Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae)

VI
Taxa from the Red Centre

by
Alan Solem

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CAMAENID LAND SNAILS FROM WESTERN AND CENTRAL AUSTRALIA (MOLLUSCA: PULMONATA: CAMAENIDAE)

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TAXA FROM THE RED CENTRE

ALAN SOLEM*†

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INTRODUCTION

It is generally perceived that the biota of Central Australia, perhaps better known as the Red Centre, is depauperate and marginal compared to the often quite diverse biotas of more mesic fringe areas. In concluding the seminal **Evolution of the Flora and Fauna of arid Australia** (a work in which snails were conspicuous by their absence!), Smith-White (1982: 378) stated:

> ... that the deserts, whether seasonal, sporadic or edaphic, and mosaically restricted as in the earlier Tertiary, or extensive and extreme as in the arid phases of the Quaternary, have always been surrounded by penumbras of less arid to more humid environments. These penumbras have been most important as reservoirs and sieves in the development of the arid biota. ... There is, in this volume, a consensus that the deserts themselves have rarely been centres of evolutionary episodes of speciation.

There were very few references to invertebrates in this review volume, which concentrated on plants and vertebrates. B. Main (1982: 273-283) concluded that some of older elements of mygalomorph spiders had adapted successfully to arid conditions, and P. Greenslade (1982: 271-272) stated that, for Collembola, "... there has been little or no radiation in the arid zone."

I focus on a major exception to the above pattern, the land snail family Camaenidae. It has had a major Red Centre radiation into restricted endemic genera belonging to two different subfamilies. The great majority, 83%, of these genera are confined to the Red Centre, as are all of the species. Evidence indicates that the Red Centre is not only the current Australian centre of diversity for one subfamily, but served as the source from which it colonized the south coast, Nullarbor, and mid-western coast of Western Australia.

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† Deceased 26/2/90.

The Camaenidae have a tri-continental, disjunct distribution, extending in the Old World from the foothills of the Himalayas in northern India, China, and Japan through south-east Asia, Indonesia, and New Guinea to the Solomon Islands, followed by an extensive radiation throughout most parts of Australia. Camaenids are absent from Tasmania, most of Victoria, and the humid southwestern corner of Western Australia. In the New World, extant camaenids range from Costa Rica south through the Andes of Peru, are marginal through most of Amazonia, and have radiated on both the Lesser and Greater Antilles.

Fossil camaenids are known from the Cretaceous of central China and Utah in the western United States. Both records are considerably north of current family range. This indicates that the Camaenidae are not a Gondwandic group, but of northern origin and spread. The Australian distributions of camaenids suggest that the family colonized Australia, almost certainly in several waves, after the Miocene plate contact. If it was an "Old Australian" element, then some presence in Tasmania, Victoria, and the humid southwest corner of Western Australia would be expected.

In the tropics, camaenids are primarily monsoon forest inhabitants, subjected routinely to one or more annual periods of drought during which they must aestivate to avoid fatal water loss. This preadaptation to a predictable period of total inactivity because water was not available, made extending inactivity times to accomodate the near desert conditions found on the fringes of arid Australia a trivial evolutionary change. Yet it permitted these radiations to develop. The only published evidence on camaenid reproductive patterns (Solem & Christensen, 1984) indicates that maturation and seasonality are well adjusted to a monsoon climate. The collections used in this monograph were made between mid-March and late June. Anatomical data suggest that the same basic reproductive pattern prevails in the Red Centre, but in the absence of material from other months, no firm conclusions can be drawn.

The Red Centre camaenid land snails belong to two subfamilies that cannot currently be linked by any ancestor-descendant relationship. The Sinumeloninae has its current centre of diversity in the Red Centre, with eight genera and 35 species recognized below (compared with four genera and 21 species in the Gawler-Flinders region). Only two of the genera, *Pleuroxia* Ancey, 1887 and *Sinumelon* Iredale, 1930, extend extralimitally. The Gawler-Flinders-Eastern Plains-upper Eyre Peninsula region of South Australia has 13 species of *Sinumelon*, and a few poorly known species have been described from western New South Wales (Solem, 1989a). The Flinders Ranges have three species of *Pleuroxia*, with an additional species described from the Barrier Range in New South Wales. There are two Flinders Ranges endemic sinumelonine genera, the monotypic *Micromelon* Solem, 1988 and *Lacustrelix* Iredale, 1937, with three species. Both *Pleuroxia* and *Sinumelon* are found along the Nullarbor coast, where they show limited diversity, extend through the gold fields northwest to near Geraldton, Western Australia, and then have a few derived relatives in the area between Geraldton and the North West Cape (Solem, In preparation). No species of Sinumeloninae have been found anywhere in northern Australia or along the east coast.

The second subfamily, Pleurodontinae, has a moderate radiation of genera that are confined to the Red Centre - the very speciose *Semotrachia* Iredale, 1933, *Dirutrachia* Iredale, 1937, two monotypic genera, *Vidumelon* Iredale, 1933, and *Divellomelon* Iredale, 1933 - plus the Mitchell Plateau to Carnarvon, Western Australia genus *Rhagada* Albers, 1860 (see Solem, 1985: 875-919). The closest relatives are in the Lesser Antilles (*Pleurodonte* Fischer von Waldheim, 1807).

The two radiations thus consist of restricted endemics, but this review is part of a much larger project. It is the sixth volume on the camaenid land snails of Western and central Australia. Parts I through V (Solem, 1979, 1981a, 1981b, 1984, 1985) reviewed taxa living in the Kimberley District, Western Australia and adjacent portions of the Northern Territory, recording 137 species (98 new) in 23 genera (11 new). The reports were based on materials primarily from the drier fringe areas that could be reached effectively using four-wheel drive vehicles. In the concluding part, I predicted (Solem, 1985: 976) that collecting in less accessible areas would at least double the fauna. A June 1987 helicopter collecting survey of 83 rain forest patches in the Kimberley found 94 species of camaenids, of which at least 50 are new (Solem, unpublished). A seventh and final volume will review the Nullarbor and west coast taxa. The survey of South Australian "non-Red Centre" taxa (Solem, 1992a), and work in preparation on the Arnhem Land camaenids, will essentially complete revisions of canaenids from the western two-thirds of Australia. All of these surveys are introductory, in that the distances between sampled localities usually are much greater than the typical total species range.

The present survey of Red Centre camaenids also is a first approximation. There are many obvious collecting gaps. New taxa can be found by all who use this volume to find hills or rock exposures where people have not yet looked for land snails - and go there.

The geographic limits of this review are roughly from the Jervois Range (136° 20' E), north-east of Alice Springs, Northern Territory, west to near Warburton (126° 35' E), Western Australia, and from the level of Barrow Creek (21° 32' S), Northern Territory, south to Coffin Hill, Birksgate Ranges (27° 32' S) and Oodnadatta, South Australia. This covers an area of about 1,000 km east to west and 675 km north to south. The boundaries are artificial, circumscribing places from which camaenid land snails have been collected. There are then significant geographic gaps in all directions before reaching places where more camaenids can be found. Undoubtedly the above Red Centre limits will be expanded moderately by collecting in the Davenport and Murchison Ranges to the north-east; in the scattered hills that occur between the Jervois Range and Mount Isa, Queensland; in scattered vegetation patches of the Great Victoria Desert and on the Nullarbor Plain; and in the region west of Warburton to the Newman-Wiluna-Kalgoorlie areas of Western Australia. Most places in these regions will be "snailfree", as is much of in the Red Centre. With the exception of a few species of *Sinumelon* Iredale, 1930, that can exist under bushes in open plains areas, camaenids are confined to rocky exposures. They seek shelter from the searing rays of the sun either in deep rubble of talus and boulder piles or in rocky litter under the shade of trees, especially figs.

The Red Centre land snail fauna does not consist only of camaenids. They are the only large sized taxa and dominate in species numbers. Some introduced European helicid land snails, and probably some European slugs, are well established in the gardens of Alice Springs, but, to my knowledge, only members of the native fauna have been found elsewhere. Only 14 non-camaenid species of native land snails have been recorded from the Red Centre (Solem, 1988c), compared with 43 from the Kimberley and Northern Territory above the Roper River (*Ibid.*). Half of the Red Centre non-camaenid taxa belong to the Pupillidae - *Gastrocopta deserti* Pilsbry, 1917, *G. larapinta* (Tate, 1896), *G. tatei* Pilsbry, 1917, *Pupilla (Gibbulinopsis) ficulnea* (Tate, 1894), *Pupoides ischnus* (Tate, 1894), *P. eremicolus* (Tate, 1894), and *Pupoides beltianus* (Tate, 1894). The rest are scattered among several families - Subulinidae (*Eremopeas interioris* [Tate, 1894]), Bulimulidae (*Bothriembryon spenceri* [Tate, 1894]), Helicodiscidae (*Stenopylis coarctata* [Moellendorff, 1894]), Charopidae (*Discocharopa aperta* [Moellendorff, 1888] and *Pillomena aemula* [Tate, 1894]), Punctidae (*Paralaoma retinodes* [Tate, 1894]), and Succineidae (*Succinea* spp.). Several are widely distributed in the Red Centre, but others are highly restricted in range - *Pupilla ficulnea* (2 localities), *Pupoides ischnus* (3 areas), *Bothriembryon spenceri* (3 records), *Pillomena aemula* (1 record), and *Paralaoma retinodes* (3 records).

Their biogeographic patterns are diverse. *Pupilla*, *Bothriembryon*, and *Pillomena* are northernmost records for basically south coast (*Pupilla*) or "humid corners" taxa (*Pillomena* from Victoria-New South Wales; *Bothriembryon* is diverse in Western Australia, but one Tasmanian and several Eyre Peninsula to Kangaroo Island species are relicts equivalent to the Red Centre species). *Eremopeas* ranges across northern Australia, reaching the Pilbara on the west and northern New South Wales on the east. *Gastrocopta deserti* has the greatest range of any Australian land snail, extending from Carnarvon, Western Australia east to Hughenden, Queensland and from Katherine, Northern Territory south into the Flinders Ranges. *Discocharopa* and *Stenopylis* are Indonesian taxa with extensive Australian ranges. *Succinea* and *Pupoides* range throughout Australia. *Paralaoma retinodes*, according to Frank Climo (personal communication), probably is a synonym of a "tramp species", although representing a northern record in Australia. These relicts and waifs form no congruent tracks. Their patterns are typical of the arid zone inhabitants summarized by Smith-White (1982).

The above summary of the non-camaenid land snails emphasizes the different nature of the Red Centre camaenid radiation.

PREVIOUS STUDIES

The first recorded Red Centre land snail, *Sinumelon perinflatum* (Pfeiffer, 1864: 528), was collected by Waterhouse during Stuart's expedition. The type is lost, but the name can be applied to a species from north of the MacDonnell Ranges. Bednall

(1892) described *Pleuroxia everardensis* and *Basedowena elderi* from specimens taken by members of the Elder Expedition to the northern fringes of South Australia and into Western Australia during late 1891 and early 1892. They also collected the specimens from Mt. Illbillee, Everard Ranges that later were named *Sinumelon pumilio* Iredale, 1937.

By far the most significant early collection was that by Sir Baldwin Spencer and Ralph Tate during the Horn Expedition of 1894. They departed Adelaide early in May 1894, returning in August, after some 2,000 miles of travel on camel back from Oodnadatta north through the MacDonnell Ranges and return. The specimens were kept alive until the return to Adelaide. Many camaenids were preserved and forwarded for anatomical study to Charles Hedley, a young assistant at the Australian Museum, Sydney.

Clearly there was friction between Ralph Tate, Professor of Natural History at the University of Adelaide and W. T. Bednall, Honorary Conchologist at the South Australian Museum. Bednall (1894) described *Pleuroxia adcockiana*, based on three shells collected by Robert Thornton at Tempe Downs station in 1893, on the page just before Tate (1894) provided diagnoses of 21 new species, mostly from the Horn Expedition. The expedition had only returned in August, yet this descriptive paper was read to the Royal Society of South Australia on 2 October 1894. As delicately phrased by Tate (1896: 182), this was done "Because of the risk of being anticipated in the authorship of other species collected by the Expedition".

A detailed account of the Horn Expedition material was published by Tate (1896), with an appendix of anatomical notes by Hedley (1896). These two contributions remain among the finest publications on Australian land snails. The anatomical material from this trip could not be located and is presumed to be lost.

Unfortunately, the Horn Expedition material did not receive adequate curatorial care. Specimens were widely distributed with only the location "Central Australia". For many of the more widely distributed species, this has led to much subsequent confusion. Apparently the original collection was initially split into several portions. Many of these eventually reached the South Australian Museum and the Museum of Victoria, but much specimen mixing had occurred. In establishing the original concept of species described by Tate, I have relied upon designated holotypes and specimens distributed by Horn and Tate in the 1890's, rather than on specimens still in Australian museums.

Ponsonby (1904) described *Sinumelon bednalli* from the MacDonnell Ranges, based on specimens received from Bednall. Hedley (1905) reported on materials collected by Herbert Basedow during the 1903 South Australian Government Northwest Expedition, naming *Pleuroxia radiata*, *Eximiorhagada asperrima*, and *Semotrachia basedowi*, and remarking on specimens later named by Iredale (1937b) as *Semotrachia mannensis*, *Dirutrachia mersa*, *Basedowena cottoni*, *Tatemelon musgum*, and *Tatemelon herberti*. Riddle (1915) noted a few specimens collected during the Geological Survey Expedition by Capt. S. A. White in 1914 from the Musgrave and

Everard Ranges. None of his identifications can be correct, but I could not locate his material for restudy.

There then was a long gap until the check list of Australian land snails by Iredale (1937a, 1937c, 1938), which had been preceded by an incredible orgy of generic descriptions (Iredale, 1933), including many *nomina nuda*. In a separate publication, Iredale (1937b) provided **An Annotated Check List of the Land Shells of South and Central Australia**. This summarized previous literature, and described several species that are recognized below as valid (*Sinumelon pedasum, S. expositum, S. pumilio, Basedowena cottoni, Tatemelon musgum, T. herberti, Semotrachia mannensis, S. esau, Dirutrachia mersa, Vidumelon, Divellomelon*), and several others (*Pleuroxia truca, Sinumelon impletum, S. eupesum, S. corinum, Baccalena, Fatulabia, Catellotrachia, Spernachloritis*) that are reduced to synonymy. The standard of science was low, and this publication has effectively discouraged subsequent workers. The only other report, that of Richardson (1985), was a literature compiled, useful check list of the family Camaenidae that contained no systematic innovations.

MATERIALS AND METHODS

Type and syntype examples of the previously named species were measured and studied to enable proper allocation of names, and all major Australian mollusc collections were searched for unstudied material. Mostly these consisted of bleached "bones", long dead examples bleached white by the sun, whose surface sculpture has been eroded during wet periods. These often are picked up from the ground surface by non-malacologists while involved in research on other organisms, or during vacations in the Red Centre. While helpful in providing added locality records, they often were frustrating because the characters needed for firm identification were missing.

Some preserved material was located and dissected, but these lots generally had been fixed in formalin. If still sitting in formalin, normally the shell had been reduced to a periostracal film through dissolution of the calcareous elements, and the soft parts had become rock hard, largely crystallized, and undissectable. If fixed initially in formalin and then transferred to alcohol, the shell might remain intact, but there were changes in many structures and crystallizations in some areas of the genitalia that made interpretations very difficult. The destructive effects of formalin fixation can be seen by comparing genital drawings of a formalin fixed *Granulomelon acerbum* (**Figs 269c-d**) and an ethanol fixed example (**Figs 270a-b**). These were collected in May 1977 and June 1978, respectively, and drawn by the same illustrator in 1979. The differences are in preservation, not seasonal variation in structure or illustrative technique.

Land snails should be drowned in water to which a small quantity of relaxant has been added. While I prefer to add a "pinch" of chloral hydrate to a pint of water, substituting a shredded half of the cheapest, most foul smelling, nicotine and tar ladened cigarette that is available, also is quite effective. The snails should not fill over half of the jar, which then should be filled with water, shaken to get air bubbles out of the snails, refilled with water, and sealed tightly (otherwise the snails will happily crawl away). Nearly always, specimens put in a water-filled container late one afternoon will be dead and well expanded early the next morning. Field fixation in 95% ethanol, followed by permanent preservation in 70% ethanol, produces specimens that can be dissected easily both today and a century later. The initial quantity of 95% ethanol should be at least three times the volume of the snails being preserved, or the liquid should be changed 24 hour later. In case of emergency, overproof rum, whisky, gin, or vodka (in order of suitability) can be sacrificed as a temporary preservative until full strength ethanol can be obtained. Neither methanol, which shrinks and hardens tissues selectively, nor isopropyl alcohol, which also has some peculiar effects on glandular organs, should be used in preservation.

If potable or treated ethanol is not available, then the snails should be carried live in cloth bags or small boxes until the trip is over. If their containers are "buried" in a duffle bag or food box protected from engine or sun heat, most will survive.

All of my collections were chloral hydrate relaxed and ethanol fixed in the field on a day by day basis. This was to insure that the reproductive status of the snails would be "as collected". Specimens carried alive in bags, often associated with well intended moisture supply, will activate, and may then start reproductive activity "out of season". This limits their utility in trying to work out natural patterns of reproductive seasonality.

Thus the majority of the specimens used in this study were collected and preserved specifically for this project. In order to save space and repetition, dates of collecting are not given for individual lots in the lists of material. As a courtesy to future workers interested in reproductive patterns and radular changes in respect to activity periods, the date of collection (and hence preservation) is given for each illustrated genital system and each radular example photographed.

The basic periods of collecting represented are outlined below, giving station numbers, inclusive field dates, and collectors. Note that the collecting dates only cover the period between mid-March and late June. We have no data on any July through early March changes in the reproductive system. The dates of collecting are:

STATIONS	DATES	COLLECTORS
WA-110-133	10 March 1974- 19 March 1974	A. Solem & L. Price
WA-436-452	21 May 1977- 27 May 1977	A. Solem & L. Keller

STATIONS	DATES	COLLECTORS
BJS-8-50	13 May 1977- 26 May 1977	B. J. Smith, F. & J. Aslin, Gary Wilson
(No numbered stations)	4 June 1978- 28 June 1978	F. & J. Aslin, Gary Wilson
WA-561-564	30 June 1979	A. Solem & Robyn Wilson
WA-729-769	13 April 1981- 28 April 1981	A. Solem & P. Colman
WA-847-942	4 May 1983- 29 May 1983	A. Solem, P. Colman, W. Ponder, W. Zeidler

The 1974 trip, using a conventional vehicle, was aimed at general collections; the 1977 field work, using four-wheel drive vehicles, expanded into many additional areas and involved cooperative efforts with Australian colleagues. The 1978 survey by the Aslin's again focused on expanding the areas sampled. My flying stop in 1979 focused on a particular problem species, *Granulomelon acerbum*, sp. nov. The 1981 field work was aimed at "determining limits" of genera, by surveying fringe hill systems to the point where no more snails could be located, and thus had a high number of unlisted, negative stations. The 1983 work focused on the Everard and Musgrave to Warburton Ranges area, then a transect back to Alice Springs via the Rawlinson and Petermann Ranges. The 1974 and 1978 field trips were sponsored by restricted funds from Field Museum of Natural History; the 1977, 1979, and part of the 1981 and 1983 trips were funded by the National Science Foundation. Additional support for the 1981 trip came from the Australian Museum, Sydney, while the 1983 Central Australian Expedition received funding from the National Geographic Society, Australian Museum, Sydney and the South Australian Museum, Adelaide in addition to the National Science Foundation and Field Museum.

While the above collections provide a broad geographic coverage and have greatly increased knowledge of the fauna, it must be reemphasized that many areas remain to be explored.

All material was shipped to Chicago and catalogued at Field Museum. After processing, the specimens were grouped for study. All adult shells of each species were measured, with live collected and dead examples kept separated. Means, ranges, standard deviations, and standard errors of the means were calculated for each lot of specimens. Nearly all of this tedious work was done by Temporary Technical Assistant Beth S. Morris during several periods of employment at Field Museum. As species were recognized, summaries of adult variation were compiled into tables giving the "Range of Variation", and then, where the the material warranted such summary, data were compiled on "Local Variation" in most species.

I dissected sufficient specimens to determine base line variation, and that allopatric populations had the same basic structures. During the many years of protracted study, Illustrators Linnea Lahlum, Elizabeth A. Liebman, and Marjorie M. Connors turned their considerable skills to portraying the very complex and often subtle anatomical differences and the shell illustrations that are essential aids in species identification.

Buccal masses were extracted from each dissected individual, macerated in KOH, cleaned of remaining debris by a few seconds immersion in a sonic cleaner, then mounted with rubber cement on a metal stub, coated with gold, and studied with a Cambridge S4-10 Scanning Electron Microscope (hereafter SEM). The assistance over the years of Beth S. Morris, Valerie Connor-Jackson, Patricia Johnson, and Victoria B. Huff in preparation, picture labelling, and calculating published magnifications was essential. Some species, such as *Tatemelon everardensis* (**Plate 138**), showed major alterations in tooth and jaw structure. Most species show at least minor modifications.

Mounting and labelling of the many **Figures** and **Plates** were carried out by Associate Dorothy Karall and Linnea Lahlum.

Manuscript was entered on a Toshiba T-250 microcomputer, provided by the late Frederick K. Leisch. Invaluable help in proofing the text, and in typing the final **Tables** was provided by Collection Manager Victoria B. Huff.

The systematic analysis involved neither cladistics nor phenetics. As often pointed out in this study, the Red Centre camaenid fauna consists of two very different subfamily groups. Conchological convergence between the sinumelonine genus *Montanomelon*, gen. nov., and the pleurodontine genus *Semotrachia* was so extensive that the former's affinities were not recognized until final dissection work. There are no clear polarities of structure or the unidirectional character changes developed that would permit such simplistic electronic modeling of phylogeny. Most changes in structure seem to have multiple origins.

When basic revisionary studies were completed, specimens were split among institutions for permanent deposition. As per agreement among the Malacology Curators in Australia and myself, the following depositions were made: 1) holotypes of new species were deposited in the South Australian Museum, Adelaide for species from South Australia; in the Western Australian Museum, Perth for species from Western Australia; and in the Australian Museum, Sydney for species from the Northern Territory, since they had provided considerable field support and personnel. Paratypes and non-type material were also distributed to each institution, and, where there was sufficient material, synoptic sets were provided the Queensland Museum, Brisbane, Museums of Victoria, Melbourne, and Conservation Commission of the Northern Territory. A portion of all collections were retained by Field Museum. While I decided on the actual distributions, the complex task of splitting off, labeling, invoicing, and packing the large quantity of material involved was directed by Collection Manager Margaret Baker, with the assistance of Victoria B. Huff and Beth S. Morris.

Abbreviations are used throughout the text to indicate the repository of listed specimens. They are:

AM	Australian Museum, Sydney
BMNH	British Museum (Natural History), London
FMNH	Field Museum of Natural History, Chicago
MV	Museums of Victoria
QM	Queensland Museum, Brisbane
SAM	South Australian Museum, Adelaide
WAM	Western Australian Museum, Perth

Materials thus are readily available for future Australian workers. If it is necessary to reassemble a full set for more detailed study, the original FMNH number will facilitate this effort.

To save space, directions are abbreviated hereafter as W, N, E, S, SW, SSE, etc., and states as NT (Northern Territory), SA (South Australia, and WA (Western Australia).

LIFESTYLE OF, AND FINDING, RED CENTRE LAND SNAILS

Despite the fact that they are essentially "leaky bags of water" in continual danger of death by desiccation, land snails are highly successful in semi-arid regions. By aestivating over dry periods of months or even years, they survive until rain permits brief activity periods for normal activities.

During aestivation, land snails may be found by predators or dry out from exposure to heat. Thus shelter spot selection and how it occupies this niche, are of utmost importance to individual and species survival.

One Red Centre genus, *Sinumelon* Iredale, 1930, has some species that aestivate by burrowing into the ground on the fringes of seasonal wet spots, or can live under the shelter of larger bushes. Most species of *Sinumelon* live in the litter beneath clumps of fig trees, in shaded boulder jumbles, or in smaller piles of rock talus. All *Sinumelon* are "free sealers", that is, they secrete a flexible, partly calcified sheet of mucus across the shell aperture to retard water loss.

Other genera are "rock sealers". They attach the shell aperture to a rock, log, another shell, or occasionally a leaf, and secrete a heavily calcified attachment ring between the object and shell lip. The strength of this seal is enormous: the shell may shatter during an attempt to pry or pull it off the rock! Patience is needed. Pour some water on the attached snails, then wait a few minutes. The snails will emerge from aestivation and dissolve the seal themselves. The pattern of sealing is not restricted taxonomically, as shown in the following comparative list:

GENUS	FREE SEALER	ROCK SEALER
Sinumeloninae		
Pleuroxia	X	X
Granulomelon		X
Sinumelon	X	
Basedowena		X
Minimelon	X	
Tatemelon		X
Eximiorhagada		?X
Montanomelon	X	
Pleurodontinae		
Semotrachia		X
Dirutrachia		X
Vidumelon	X	
Divellomelon	X	

On the rare occasions when a person is at a snail inhabited hill side and it rains, snails out feeding, "walking" and/or mating can be found "in the open", and collected in large numbers. They feed on bits of dead vegetation, which are blown into and may nearly fill rock crevices and boulder pile interstices. Under the normal dry conditions, one must find the shelter spots and extract the snails from them.

Any spot that is somewhat shaded from direct sunlight, has rock piles or crevices, gives shelter from predators, and has a source of dead plant matter nearby, can hold colonies of land snails in the Red Centre. Fig patches are excellent reservoirs. The fallen leaves form deep litter, which holds moisture for relatively long periods, the patches usually are sheltered from most bush fires, and often there is at least some accumulation of talus. But any shaded rock pile may hold a colony.

The first visible sign that a healthy colony exists usually is a scattering of dead snail shells on the ground below or around the patch. On climbing to the fringes of the patch, recently dead specimens can be found in the upper litter. As litter is moved, many of the micro, non-camaenid land snails will become obvious, "free sealing" live camaenids are turned up, and finally, into the rock pile and on the roots - "rock sealers" can be found. The absence of initially observed dead specimens may indicate that "no snails are there", or simply that the colony is very small and the calcium in dead shells is almost immediately recycled into the few living specimens.

In approaching a new locality, one must simply "think like a snail" and head for "snail-right shelter sites" - shade, leaves, spaces big enough for snails, but too small for predators.

In some places, an eight inch slab of rock may have more than 20 *Semotrachia* attached, or you might roll out 50 live *Sinumelon* from a cubic foot of litter beneath a fig. Before getting piggish in your enthusiasm, please remember this may be the only colony of this species. Leave snails behind to continue the colony, and repair your collecting damage to the habitat by replacing rocks and dumping back the litter you moved.

FAMILY AND SUBFAMILY UNITS

Previously, I have deliberately avoided trying to establish subfamily units or provide a clear definition for the family Camaenidae itself. I continue to avoid the latter, but study of the Australian fauna has proceeded to the point that it is possible to cluster three sets of genera into subfamily units. A majority of the northern Australian taxa are left unassigned at this time. The complexity of their relationships to Indonesian-Asian taxa is a still unsolved tangle, but patterns are emerging.

The earliest family level name with history of modern useage is the Camaenidae. This was proposed as a subfamily by Pilsbry (1895: xxxii) for his structural group, the Epiphallogona. Von Ihering (1912: 478-9) altered the limits and proposed the name Pleurodontidae for the expanded complex, in part because he considered that family names should be based upon the earliest generic name included (*Pleurodonte* Fischer von Waldheim, 1807 was described well before *Camaena* Albers, 1850). A number of more recent family level names, such as Amphidrominae Kobelt, 1902, Chloritidae Iredale, 1937, Hadridae Iredale, 1937, Papuinidae Iredale, 1938, Planispiridae Iredale, 1938, and Xanthomeloninae Iredale, 1938, have been proposed, but they do not apply to the Red Centre camaenid fauna.

Solem (1992a) redefined the Subfamily Camaeninae and assigned many Australian genera to it as part of a monograph covering the Gawler-Flinders-Eastern Plains-Eyre Peninsula taxa. In the same paper, the Subfamily Sinumeloninae was described, based upon the four genera and 21 species found within that area. The Red Centre, in contrast, has eight genera and 35 species of Sinumeloninae. Only two of these genera, *Pleuroxia* Ancey, 1887 and *Sinumelon* Iredale, 1930, but none of the species, are found in both regions. A few species of *Pleuroxia* and *Sinumelon* live on the Nullarbor fringes, in the gold fields, and near Geraldton, with some derived taxa ranging up to the North West Cape. They will be reviewed in Part VII.

The third group recognized at this time is the Subfamily Pleurodontinae (+ Rhagadidae), which includes Red Centre, Western Australian, and Neotropical taxa. Its exact limits are not definable at present, because the question of possibly including Asian-Indonesian genera requires additional studies.

So far as is known, these groups agree in basic structures of the pallial cavity, free muscle system, radula and jaw, remaining digestive tract, and the central nervous system, which suggests common ancestry. They also, at least occasionally, show striking convergences in shell structure. Two examples follow. In the Flinders Ranges of South Australia, the genera *Aslintesta* Solem, 1988 (Camaeninae) and *Micromelon* Solem, 1988 (Sinumeloninae) have evolved a *Semotrachia* Iredale, 1933 (Red Centre Pleurodontinae) shell structure to the point that they cannot be separated from each other (or *Semotrachia*) without using a microscope to examine the shell periostracal microsculpture. The Flinders Ranges genera have overlapping, but not microsympatric, distributions. Both genera are quite unlike the "typical" members of their subfamilies in shell form and structure. They are conchologically both aberrant and convergent, although their anatomical structures immediately indicate their affinities. The second example is reported below. The sinumelonine species *Montanomelon reynoldsi*, sp. nov., from the Reynolds Range, north of Alice Springs, and *M. angatjana*, sp. nov., from the Mann Ranges (**Figs 313a-f**), were assumed to be species of *Semotrachia* when collected, during initial processing, preliminary identification to genus, and final grouping for detailed study. Only when dissected, were their convergences with *Semotrachia* detected. It is thus impossible to draw up a conchological diagnosis that will differentiate all members of the three clusters.

The subfamilies differ in having distinctive mating patterns that are reflected in the terminal genital structures. In essence, the Camaeninae use an *eversible* "head wart" in pre-copulation species recognition activities, and there are only minor modifications in the terminal genitalia. Their genitalia is specialized to form and transfer a large enclosed sperm mass or spermatophore through a short, wrinkled, tubular verge directly into a basally expanded spermathecal shaft. The Pleurodontinae often have a permanently exposed cluster of specialized pustules between the ommatophores, but usually show major species recognition structures in the penis chamber and lower female tract, such as highly varied vergic structure. They retain the capability of large sperm mass transfer, but lack specialized spermathecal structures. The Sinumeloninae lack both head wart and verge, have lost (or never had) the capacity to form an enclosed sperm mass because the epiphallic region is so small, have the spermathecal head displaced to a lower position, and the species recognition structures are penis chamber and vaginal wall ridges.

Even here, there are some partial convergences, usually associated with simplifications arising from adaptation to decreasing periods of activity and increasing periods of aestivation ("desertification"). For example, the massive genitalia found in *Camaena* and the tropical Queensland genera of Camaeninae (Solem, 1992a: figs 1-11) contrast enormously with the reduced size of the genitalia in the Flinders Camaeninae (*Ibid.*, figs 15, 18, 37, 56).

The Camaeninae range from China to northern Australia and include the larger sized Queensland-New South Wales taxa from wet forest regions. It also has radiated in western New South Wales and the Gawler-Flinders-Eastern Plains-Eyre Peninsula region. They are immediately recognizable in that there is an *eversible* head wart. A short transverse slit is present between and often very slightly behind the ommatophoral bases (Solem, 1992a: figs 56c, 69b). The form of the everted wart varies greatly, especially in Indonesian and Philippine Island taxa.

Other features include the fact that the head of the spermatheca (S) reaches the base of the albumen gland (GG) or even higher (only rarely, as in *Contramelon*, it is shortened). Usually the base of the shaft is grossly enlarged, and there are longitudinal wall pilasters continuing up from the often long and slender vagina (V). The free oviduct (UV) joins the vaginal-spermathecal shaft channel at a right angle. This permits guided insertion of a sperm packet or spermatophore into the spermathecal base instead of it entering the free oviduct. The vas deferens (VD) enters the epiphallus (E) by a pore (usually through a pilaster), at the point where the channel of the usually elongated epiphallic flagellum (EF) merges directly into the epiphallus. The epiphallus (E) normally is long and coiled, entering the penis (P) through a short wrinkled verge (PV) (which rarely may be shifted in position to form a vergic papilla [VP] or an apical plug). The penis generally is long, with the verge occupying a small portion of its length. The upper walls of the penis chamber are pustulose or with corrugated ridges, while the lower part of the chamber wall has only pressure folds. In many taxa, fibrous sheets of connective tissue bind the coiled and elongated organs into a loose mass. A "protosheath" is found in some South Australian *Cupedora* (see Solem, 1992a: figs 43a-c) and some of the tropical Queensland genera, such as *Varohadra* Iredale, 1933 and *Sphaerospira* Mörch, 1867 (*Ibid.*, figs 4, 6, 7), have a penis sheath developed. The penial retractor muscle (PR), as in all camaenids, originates on the diaphragm, but its insertion is on the epiphallus, slightly to moderately above the base of the verge. The above system permits efficient formation of an enclosed sperm mass or hardened spermatophore in the epiphallic flagellum-epiphallus and then transfer of this elongated object into the vaginal-spermathecal channel.

The Sinumeloninae, whose current center of diversity lies in the Red Centre, with secondary foci in the Gawler-Flinders-Eastern Plains-upper Eyre Peninsula and then Nullarbor-gold fields-Geraldton-North West Cape areas, presents a number of fundamental differences. There is neither a head wart nor a verge. The spermathecal (S) head lies at or near the base of the prostate-uterus, rarely reaching the middle of that organ, the spermatheca and free oviduct have a near 45° angle merging, the epiphallus (E) is a very short and narrow tube, there is a very small epiphallic caecum (EC), and the main stimulatory organ is a U-shaped, crescentic, or simple longitudinal main pilaster on the wall of the penis chamber. The base of the prostate-uterus and/or the free oviduct usually is partly to completely wrapped around the slender shaft of the spermatheca. The base of the spermatheca usually is not significantly expanded. The vagina (V) normally is short, and sometimes widened. Internally, the simple longitudinal pilasters continue into both free oviduct and spermathecal shaft. The vas deferens (VD) enters laterally or basally into a short nub or finger-like epiphallic caecum (EC), but not through a pilaster. Rarely the epiphallic caecum is reduced or absent (*Tatemelon musgum* [Iredale, 1937] and *Tatemelon herberti* [Iredale, 1937], **Figs 307c, 308b**). The epiphallus (E) is short, enters the penis sheath (PS) from basally to apically, lies free inside the sheath, and may partly circle the penial retractor muscle (PR) before entering the penis apex, or may simply enter the penis lateral to the muscle insertion. In a few species the penis retractor muscle may insert upon the epiphallus inside the penis sheath, rather than directly onto the penis apex. The penis sheath varies from a thin remnant to extremely thick-walled. Inside the penis, there is at most (*Basedowena*, **Figs 302c, 303b**) a foliated pilaster or low folded ridge around the epiphallic pore. The penis chamber walls have a main pilaster (PP) that is U-shaped in most genera, becoming crescentic or longitudinal in many *Sinumelon*, usually with accessory longitudinal ridges, and often some more apically placed corrugated folds. Rarely, pustules may substitute for the latter. This system has no provision for formation of a spermatophore or enclosed sperm mass, and the spermatheca thus shows no specialization for reception of such a mass. The terminal genitalia of Sinumeloninae are much shorter than those of the Camaeninae.

The Pleurodontinae, which include the Red Centre genera *Semotrachia, Dirutrachia, Vidumelon*, and *Divellomelon*, plus the Mitchell Plateau to Carnarvon, WA genus *Rhagada* Albers, 1860, also has a Neotropical component. Many taxa have a cluster of specialized pustules located between the ommatophores. These may show species differences in both *Rhagada* (Solem, 1985: figs 228d, 229c, 231e, 232d, 233c), and *Semotrachia* (**Fig. 337**). Some taxa, *Divellomelon* and the sympatric species of *Pleurodonte* on Dominica, Lesser Antilles, have the patch reduced to absent, whereas on Grenada, Lesser Antilles, *Pleurodonta perplexa* (Pfeiffer, 1850) is the only species present and it retains a prominent patch. In other aspects the Pleurodontinae are similar to the Camaeninae. The spermathecal head (S) normally reaches to or alongside the albumen gland (GG) base, but is shortened in some species. The lower shaft normally is expanded, then tapers gradually. The free oviduct (UV) enters the spermathecal-vaginal channel at a 45° to 60° angle. The vas deferens (VD) enters the epiphallus through a special pilaster, usually around the areas of merging between the long epiphallic caecum (EC) and the epiphallus (E), which is long and with prominent wall pilasters. Generally the enlarged epiphallus is equal in diameter to the penis (P) itself, and they cannot be distinguished externally. The presence of a thin penis sheath (PS) is variable. Although long, the epiphallus normally is not coiled, and enters the penis through a highly variable verge (PV), that occupies much of the penis interior (Solem, 1985: 231d, 232c, 233b, 235b). The penis (P) often is much shorter than in the Camaeninae. The penis chamber wall sculpture is variable, often pustulose apically, then with ridges lower down, sometimes the pustules are lost. The penial retractor muscle (PR) normally inserts on the epiphallus, varying in position from well above to very near the verge base. The verge itself may be smooth or corrugated. Penis chamber wall sculpture or stimulatory devices may be present. The specialization of the vergic structure and penis chamber wall sculpture is interpreted as involving pre-copulation species recognition devices. The altered relationship of the free oviduct-spermathecal basal sizes and their angle of fusion, from that of the Camaeninae, suggests a different form of sperm mass, and thus transfer.

The genetic pools of the New World and Old World camaenids presumably have been separated for at least 80 million years, if they are, as I hypothesize, a Northern Hemisphere group originally, whose Australian radiation began with Miocene events. The presence of undoubted camaenids in the Cretaceous of both China and the western United States, and their current New World restriction to the Antilles and Costa Rice to Peru,, are the strongest evidence for this hypothesis. *Pleurodonte* is highly diverse in Jamaica and the Lesser Antilles (Wurtz, 1955: 119-129). Study of *Pleurodonte* species from the islands of Dominica and Grenada (Solem, unpublished) shows a genital system that differs from that described above in only a few minor facets. The short penis and vergic variations of *Pleurodonte* and *Rhagada* are the same. Wurtz (1955: 103) focused on the ovotestis as "a single mass of alveoli", whereas in the Australian and Indonesian taxa there are several clusters. The New World taxa have the digestive gland shorter and much wider than in the Australian taxa studied to date. This forces the ovotestis to be compressed into a shorter distance, compacting clusters. In addition, the annual periods of aestivation would be longer in the Australian monsoonal areas than in the Lesser Antilles. A longer and proportionately larger digestive gland would permit greater food storage capability, and allow the ovotestis to lengthen. The spermathecal head varies from reaching the albumen gland to lying part way up the prostate-uterus. Dominica has a far wetter climate than the Red Centre. Thus the enlarged terminal male organs found in species residing on Dominica should be viewed as equivalent to the enlarged genitalia of Queensland, as compared with Flinders Ranges, species of Camaeninae. The reduction or loss of the head wart patch in the Dominica species may reflect the presence of several sympatric species on that island. Its retention in the single species living on Grenada may indicate that it remains fully functional.

The above differences are trivial. Epiphallic wall chamber sculpture is the same, and, in taxa from both areas, this sculpture extends into the verge, and the vas deferens enters through a pilaster (Wurtz, 1955: 126). Species variations in vergic structure are parallel. The fact that shell form in the Antillean taxa resembles that of Camaeninae, not the Red Centre genera, probably is an evolutionary burden resulting from millenia of wet forest life in the Antilles.

Of these three groups, the Sinumeloninae have the most divergent structure, while the Camaeninae and Pleurodontinae have more structural elements in common. Distribution of the latter appears peripheral to the former subfamily, and they may prove to be very closely related, with the Camaeninae the derived taxon.

SYSTEMATIC REVIEW

Because of the extraordinary degree of shell convergence that exists between some members of the two subfamilies, separate keys to the genera are not provided. A highly artificial key to adults is included at the end of this report to permit generic reference of adult, reasonably fresh examples.

Australian members of the two subfamilies are easily separated:

Sinumeloninae - no head wart; no verge; head of spermatheca lying against lower to mid part of prostate-uterus; epiphallus a short thin tube, often partly circling penial retractor muscle before entering penis apex through a simple pore; epiphallic caecum short, blunt tipped; wall of penis chamber with one or more large stimulatory pilasters; penial retractor muscle inserts directly on penis apex (rarely onto epiphallus proper)

Pleurodontinae - head wart (when present) a patch of exposed tubercles; verge well developed, variable in size and shape; sperm groove lateral, exposed, rarely enclosed to form a tubular verge; head of spermatheca with a long shaft, usually reaching to or above base of albumen gland; epiphallus long, equal in diameter to penis, usually with a large tapered flagellum; epiphallus enters penis through a variable verge; walls of penis chamber with low pilasters or a large stimulator; penial retractor muscle inserts laterally on epiphallus-penis tube, near or somewhat above base of verge.

Subfamily Sinumeloninae Solem, 1988

The definition presented in Solem (1992a) is not repeated.

The Red Centre has the largest and most diverse group of Sinumeloninae. Eight genera are recognized below: *Pleuroxia* Ancey, 1887 (= *Angasella* A. Adams, 20 April 1864, not *Angasiella*, Crosse, 1 January 1864) with four species; *Granulomelon* Iredale, 1933 with four species; *Sinumelon* Iredale, 1930 with 10 species; *Basedowena* Iredale, 1937 with nine species; the monotypic *Minimelon*, gen. nov.; *Tatemelon*, gen. nov. with four species; the monotypic *Eximorhagada* Iredale, 1933; and *Montanomelon*, gen. nov., with two species (**Table 95**).

Table 95: List of taxa in the Sinumeloninae

Subfamily Sinumeloninae
  Genus *Pleuroxia* Ancey, 1887 (= *Angasella* A. Adams, 1864) (p. 1002)
    Pleuroxia adcockiana (Bednall, 1894) (p. 1009)
      (+ *clydonigera* Tate, 1894; *truca* Iredale, 1937)
    Pleuroxia everardensis (Bednall, 1892) (p. 1026)
    Pleuroxia carmeena, sp. nov. (p. 1033)
    Pleuroxia radiata (Hedley, 1905) (p. 1036)

  Genus *Granulomelon* Iredale, 1933 (p. 1040)
    Granulomelon arcigerens (Tate, 1894) (p. 1048)

Only *Pleuroxia* and *Sinumelon* occur extralimitally. Both are represented in the Nullarbor to Geraldton area of WA, in the Flinders Ranges of SA, and the Barrier Range of New South Wales. *Sinumelon* also is found in part of the Eyre Peninsula, the Gawler Range, and at scattered localities along and above the rail line from Port Augusta to Kalgoorlie. The remaining genera are restricted endemics in the Red Centre.

Condensed identification diagnoses are presented below, using a necessary combination of shell and genital features.

Pleuroxia Ancey, 1887

Shell with weak (**Plate 96**) to prominent and simple (**Fig. 259**) radial ribs, to many (**Plates 95-96**) few micropustules, low to moderately elevated spire (**Figs 257-259**), usually spiral red colour bands. Penis with U-pilaster (**Figs 260c, 262b, 263b, 264b**), variable in shape. A free sealer.

Granulomelon Iredale, 1933

Shell with large, anastomosing (**Figs 265a-f**) radial ribs (may be reduced, **Plate 103**), always with dense micropustules on spire and body whorl (**Plates 102-103**), variable red spiral colour bands. Penis with reduced U-pilaster (**Figs 267b, 268b, 270b**), very thin sheath. A rock sealer.

Sinumelon Iredale, 1930

Shell rarely with dense micropustulation (*bednalli, hullanum*, **Plates 107b-c, 108b-c**), lip thickened, aperture proportionately large (**Figs 272b, e**), colour suffusion or one red spire band present, size generally large. No foliated pilaster around epiphallic pore (**Fig. 273b**), main pilaster not U-shaped (**Figs 279b, 280b**), generally with thick-walled penis sheath through which the epiphallus enters basally to above the middle (**Figs 284a-f**). A free sealer, often buried partly in dirt.

Basedowena Iredale, 1937

Shell usually (except *squamulosa*) high spired (**Figs 292, 295, 298, 301**), densely pustulose (**Plates 121-124**), colour monochrome (except *elderi*, **Fig. 304b**). A foliated pilaster around epiphallic pore (**Figs 293b, 294b**), main pilaster U-shaped (**Figs 297b, 299b**), presence of a very thin penis sheath, epiphallus at least partly circling penial retractor muscle before entering the penis. A rock sealer.

Minimelon, gen. nov.

Shell small, narrowly umbilicated, scattered micropustules (**Plate 124e-f**), reddish suffusion stopping at periphery, lip not expanded (**Figs 304d-f**). Penis with U-pilaster (**Fig. 305d**). Radula with ectocones on central and early laterals (**Plate 125a, c**). A free sealer.

Tatemelon, gen. nov.

Shell with lowered whorl count and more rapid whorl decoiling (**Figs 306, 309**), often with simple radial ridges (**Plates 133-134**), colour monochrome. Penis with thicker sheath (**Figs 307-308, 310-311**), modified main pilaster. A rock sealer.

Eximiorhagada Iredale, 1933

Shell with keeled periphery, dense pustules, open umbilicus, simple flared lip (**Figs 312a-c**). Anatomy unknown. Probably a rock sealer.

Montanomelon, gen. nov.

Shell small, low spired, umbilicated, lip moderately expanded, little shell sculpture (**Plate 139**), monochrome colouration (**Figs 313a-f**). Penis with main pilaster split into smaller ones, vagina long, free oviduct not wrapped around spermathecal shaft (**Figs 314-315**). A free sealer.

The above notes, plus reference to the cited figures, should enable placement of a shell into a genus.

GENUS *PLEUROXIA* ANCEY, 1887 (= *ANGASELLA* A. ADAMS, 20 APRIL 1864, NOT *ANGASIELLA* CROSSE, 1 JANUARY 1864)

Angasella A. Adams, 1864 (20 April) (not *Angasiella* Crosse, 1 January 1864), IN: Angas, 1864, Proc. Zool. Soc. London, **1863**: 521 - type species: *Helix cyrtopleura* Pfeiffer, 1862 (*nomem nudum*); Clessin, 1881, Nomen. Helic. Viv., p. 181; Pilsbry, 1894, Man. Conch., (2) **9**: 113); Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Part II, Zool., pp. 188-193; Thiele, 1931, Handb. Syst. Weichtierk., **1** (2): 685; Zilch, 1960, Handb. Paläozool., **6** (2): 619.

Pleuroxia Ancey, 1887, The Conchologist's Exchange, **2** (3): 38-39 type species: *Helix cyrtopleura* Pfeiffer, 1862, substitute name for *Angasella* A. Adams, 1864 (not *Angasiella* Crosse, 1864); Iredale, 1937, South Austr. Nat., **18** (2): 46; Iredale, 1938, Austr. Zool., **9** (2): 106; Iredale, 1939, Jour. Roy. Soc. Western Aust., **25**: 54; J. B. Burch, 1976, Jour. Malac. Soc. Austr., **3** (2): 136; Richardson, 1985, Tryonia, **12**: 252-254 - list of species; Solem, 1992a, Rec. South Austr. Mus., Monogr. Ser. 2: 165.

Angasietta Iredale, 1939, Jour. Roy. Soc. Western Austr., **25**: 55 type species: *Hadra oligopleura* Tate, 1894; Richardson, 1985, Tryonia, **12**: 252.

Gantomia Iredale, 1939, Jour. Roy. Soc. Western Austr., **25**: 55 - type species: *Pleuroxia abstans* Iredale, 1939; Richardson, 1985, Tryonia, **12**: 252.

Shell medium in size, variable, adult diameters 11.5-20 mm, whorl counts 3 1/3 to 4 3/4. Spire flat (*cyrtopleura*), moderately elevated (*phillipsiana, italowiana, adcockiana, radiata*), to strongly elevated (*hinsbyi, everardensis, carmeena*), H/D ratio 0.343-0.780. Sculpture usually of prominent apical micropustules (**Plate 95a-b, d-e; Plate 96a-d**), which become replaced with widely scattered micropustules on early spire. Spire with weak and irregular (**Plate 95a, c; Plate 96a**) to very strong and regular (**Plate 95d-f; Plate 96c-d**) radial ribs, some species (*radiata*, **Plate 96c-e**) with periostracal ridglets. Body whorl rounded or slightly flattened laterally, never angulated or keeled, slightly (*cyrtopleura, radiata*) to sharply (*hinsbyi, italowiana, everardensis,* *carmeena*) descending behind lip. Umbilicus usually open, partly narrowed by reflection of columellar lip, ranging from nearly closed (*truca* form of *adcockiana, carmeena, everardensis*) or narrow (*hinsbyi, phillipsiana*) to widely open (*cyrtopleura*). Lip expansion narrower in Red Centre, greater in SA taxa. Parietal wall usually with a thick callus, rarely with raised edge (*phillipsiana*) or free lip edge (some *italowiana*). Periostracal colour light to dark brown, greenish yellow in some Red Centre populations, most (*radiata, hinsbyi, cyrtopleura, phillipsiana*) without reddish colour, some *italowiana* with reddish spire suffusion, two bright reddish spiral bands present in *adcockiana, everardensis, carmeena*.

Live specimens aestivate sealed to rocks (SA) or vary in aestivation from free sealing to rock sealing (Red Centre).

Genitalia (**Figs 260-264**) with head of spermatheca (S) lying against lower portion of prostate-uterus, exact position variable. Vagina (V) highly variable in length and diameter, prominence of internal pilasters variable. Free oviduct (UV) also variable in length. Epiphallus (E) short to long, entering penis sheath (PS) from near apex to below middle, epiphallic caecum (EC) variable in size. Penial retractor muscle (PR) long, arising from diaphragm, inserting on penis-epiphallus junction. Penis (P) from very short (*radiata*) to long (*carmeena*), usually wide, internally with variable wall sculpture. Main U-pilaster (PP) highly variable, accessory ridges also variable, corrugated folds sometimes absent.

Jaw (**Plates 97-98**) variable in rib numbers, width, presence laterally, and prominence. Central and early lateral teeth of radula (**Plates 99a-b, 100a-f, 101a,c, e**) with massive basal ridges, normal angle of elevation, cusp tip bluntly rounded, degree of curvature variable, anterior flare typical, ectoconal trace minute. Lateromarginal transition (**Plates 99c-d, 101b, d, f**) typical, rate of change variable. Marginals typical.

Type species: *Helix cyrtopleura* Pfeiffer, 1862 by original designation.

Nomenclatural matters

See discussion presented in Solem (1992a: 165).

Comparative remarks

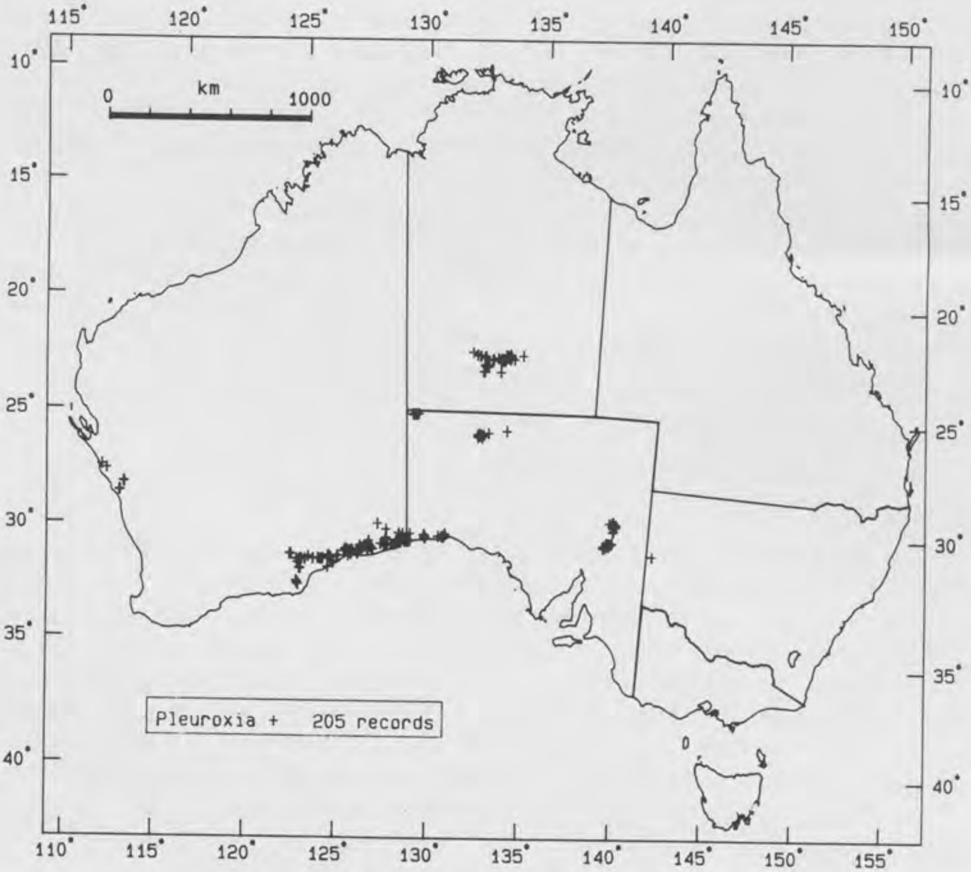
The Red Centre species differ from the SA and Nullarbor *Pleuroxia* in having simple, rather than anastomosing, radial ribs, often bright red spiral colour bands (all except *radiata*), and very narrowly expanded shell lips (except *radiata*). The most similar appearing shells, *Granulomelon arcigerens* (Tate, 1894) (**Figs 265a-c**) and *G. gilleni*, new species (**Figs 265d-f**) have very fine, often anastomosing radial ribs, dense pustulations on the spire and body whorl, a much higher spire, and strongly rounded whorls. No other Red Centre genera have the combination of two spiral colour bands and simple radial ribbing. Anatomically, the short spermatheca, U-pilaster within the penis, and very large epiphallic caecum are diagnostic.

Previous studies

Bednall (1892: 64-65) described *Pleuroxia everardensis*; Bednall (1894) described *Pleuroxia adcockiana*; Tate (1896: 188-198) reviewed species belonging to several genera under the names *Angasella* (= *Pleuroxia*) and *Thersites*; Hedley (1905) described *Pleuroxia radiata*; Riddle (1915: 771) provided a new locality record for *Pleuroxia everardensis* (as *P. adcockiana*); Iredale (1937b: 46-51) also included species from a number of genera under this name; Iredale (1938: 106-107) presented a check list; Iredale (1939: 54-57) monographed the WA species; Richardson (1985: 252-254) presented a check list; and Solem (1992a: 165-182) recently monographed species from the Flinders Ranges of SA and Barrier Ranges of NSW. Records of erroneously classified species are not included above. Only Hedley (1896: 224-225) and Solem (1992a) have provided anatomical data.

Distribution and comparative ecology

There are only four, completely allopatric, Red Centre species (**Map 2**): *Pleuroxia adcockiana* (Bednall, 1894) (+ *clydonigera* Tate, 1894 and *truca* Iredale, 1937) from the MacDonnell Ranges south to the Krichauff and James Ranges, NT; *P. everardensis*

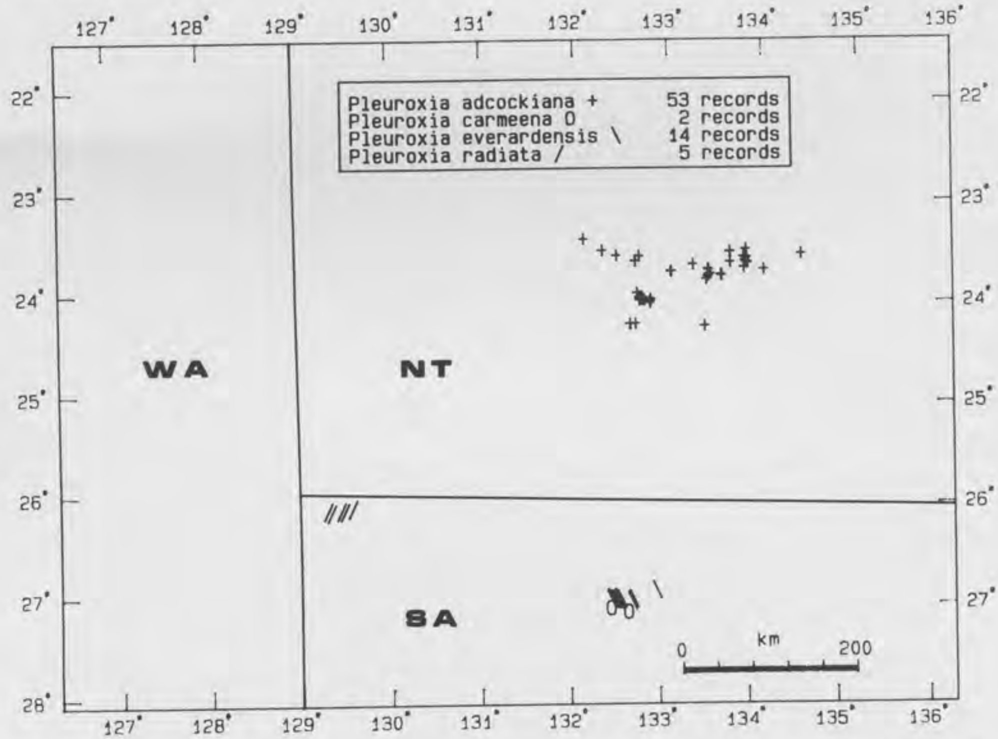


Map 1: Records of *Pleuroxia* in Australia.

(Bednall, 1892) from the central and northern parts of the Everard Ranges, SA; *P. carmeena*, new species, from the S fringes of the Everard Ranges, SA; and *P. radiata* (Hedley, 1905) from the Mann and Tomkinson Ranges, SA.

Extralimitally (**Map 1**), the Flinders Ranges of SA have three species, *P. cyrtopleura* (Pfeiffer, 1864), *P. phillipsiana* (Angas, 1873), and *P. italowieana* Solem, 1992a; *P. hinsbyi* (Gude, 1916) has been described from the Barrier Ranges, NSW; the Nullarbor coast of SA and WA has three species, *P. oligopleura* (Tate, 1894), *P. polypleura* (Tate, 1899), and *P. elfina* Iredale, 1939; and *P. abstans* Iredale, 1939 lives near Geraldton and Kalbarri National Park, coastal WA. The other taxa placed in *Pleuroxia* by Iredale (1937b, 1938) and Richardson (1985) were misclassified. They are placed elsewhere either below or in Part VII (Solem, In preparation).

The Red Centre taxa differ from most *Pleuroxia* in their pattern of aestivation. While juveniles will be found sealing to objects, nearly all adults were found loose in litter, with a thin, calcified epiphragm across the shell aperture. Quite possibly this shift relates to their use of litter under figs as the principal habitat by the Red Centre species. Since species of *Semotrachia* living at the same stations seal to rocks and wood, this may be a displacement phenomenom.



Map 2: Records of *Pleuroxia adcockiana* (Bednall, 1894), *P. carmeena*, *P. everardensis* (Bednall, 1892), and *P. radiata* (Hedley, 1905) in the Red Centre.

Discussion

Three of the four Red Centre species, *Pleuroxia adcockiana* (Bednall, 1894), *P. everardensis* (Bednall, 1892), and *P. carmeena*, have two bright spiral colour bands (**Figs 257-258**), generally reduced radial sculpture (**Plates 95-96**), very slightly expanded shell lips, and narrow umbilici, thus differing dramatically from the Flinders and Nullarbor taxa. Only *P. radiata* (Hedley, 1905) has the normal pattern of wider shell lip (**Fig. 259a-c**), prominent radial sculpture (**Plate 96c**), wider umbilicus, and uniform colour pattern.

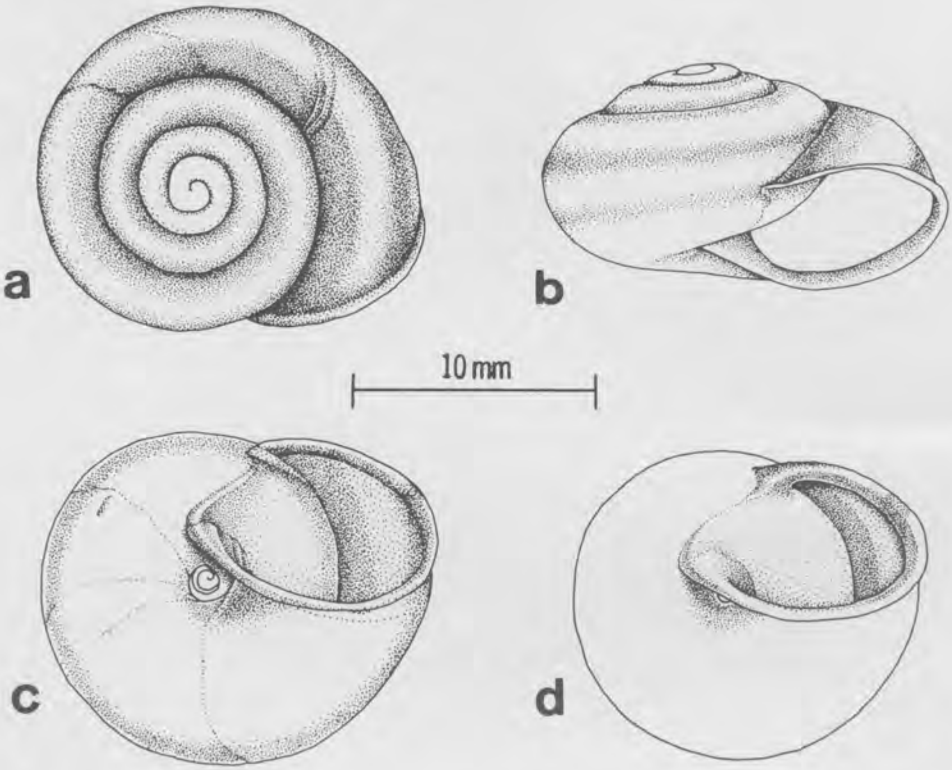


Fig. 257: Shells of *Pleuroxia adcockiana* (Bednall, 1894): (a-c) Typical form. Sta. WA-760, 2.2 km S of Glen Helen Road on Hermannsburg Road, MacDonnell Ranges, NT. FMNH 205537; (d) Form *truca*. Sta. WA-932, W bank of Ellery Creek, Krichauff Ranges, NT. FMNH 212396. Base of shell. Scale line equals 10 mm. Drawings by Linnea Lahlum.

The "free sealing" habit of these species exposes them to accidental transport by flood waters. Indeed, live examples of *Pleuroxia adcockiana* (Bednall, 1894) were collected from flood debris piles near Alice Springs in March 1974 (WA-118-9). Other examples had already dried out, but a few were still alive several weeks after the last rains.

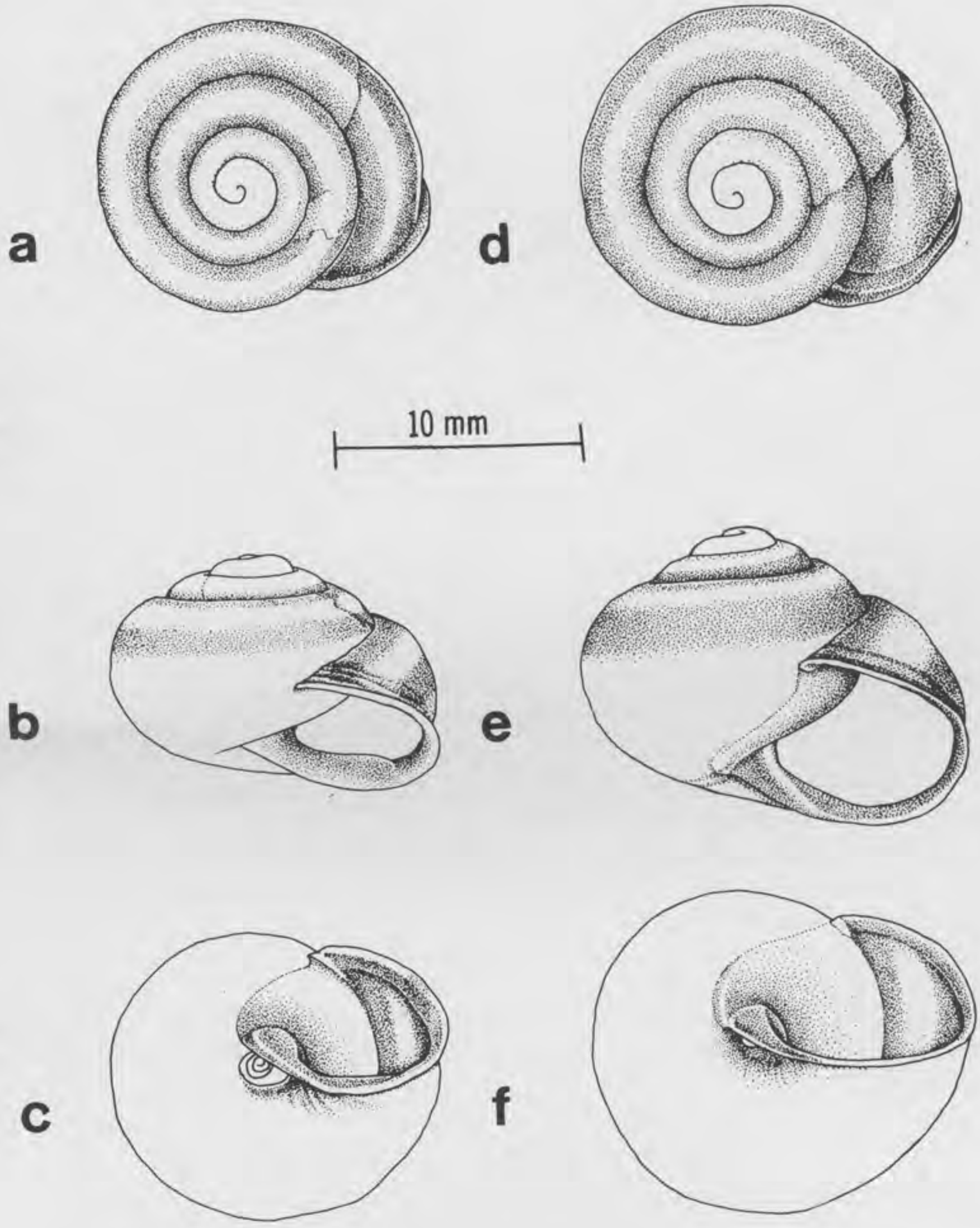


Fig. 258: Shells of *Pleuroxia everardensis* (Bednall, 1892) and *P. carmeena*, sp. nov.: (a-c) *P. everardensis*. Sta. WA-862, Mt. Illbillee, Everard Ranges, SA. FMNH 212110; (d-f) *P. carmeena*. Sta. WA-851, Mt. Carmeena, Everard Ranges, SA. Holotype. SAMD17623. Scale line equals 10 mm. Drawings by Linnea Lahlum.

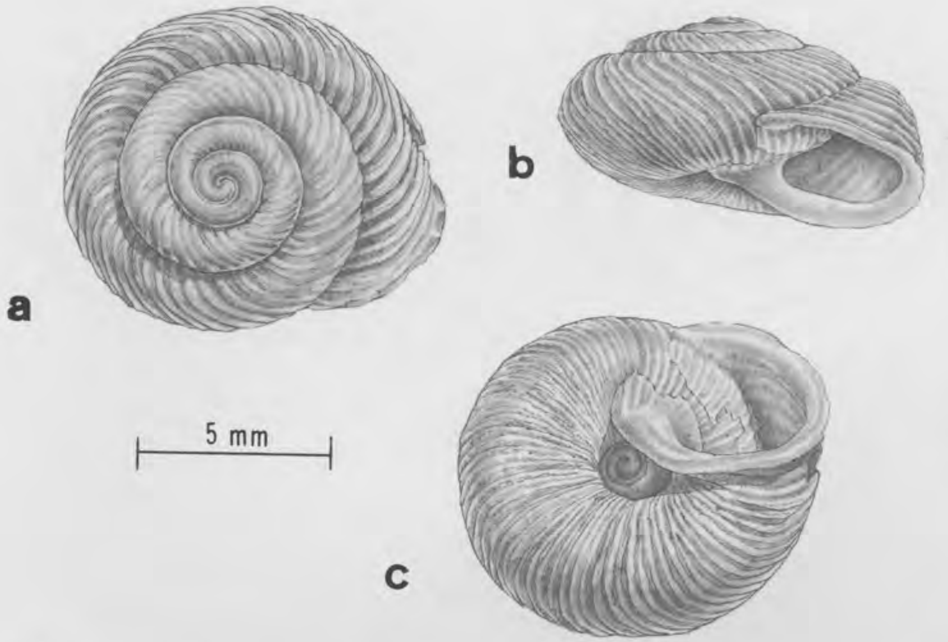


Fig. 259: Shell of *Pleuroxia radiata* (Hedley, 1905): Mt. Davies, Tomkinson Range, SA. Lectotype. AM C.19321. Scale line equals 5 mm. Drawings by Linnea Lahlum.

The above would contribute to relatively frequent gene mixing and may explain the considerable variation in shell size and sculpture found in *P. adcockiana*.

Two previously proposed species, *P. clydonigera* (Tate, 1894) and *P. truca* Iredale, 1937, are synonymized with *P. adcockiana* (Bednall, 1894). *P. clydonigera* was based on a single scalariform shell (Tate, 1896: pl. XIX, fig. 24) with heavy sculpture. A repaired injury caused the change in shape, while the sculpture is within the range seen for typical *adcockiana*. Form *truca* was based on the more narrowly umbilicated shells (**Fig. 257d**) typical of populations living in the Krichauff Ranges. Since no anatomical differences were noted, and the umbilicus does vary greatly in width, this is reduced to a form.

KEY TO THE SPECIES OF *PLEUROXIA*

1. Shell without red spiral colour bands; Mann and Tomkinson Ranges, SA ...... *Pleuroxia radiata* (Hedley, 1905) (p. 1036)
   Shell with two red spiral colour bands 2
2. Everard Ranges, SA 3
   MacDonnell Ranges S to Krichauff and James Ranges, NT *Pleuroxia adcockiana* (Bednall, 1894) (p. 1009)

3. Spire high (mean H/D ratio 0.844); umbilicus very narrow (**Fig. 258f**) ......
Pleuroxia carmeena, new species (p. 1033)

Spire less elevated (mean H/D ratio 0.731); umbilicus narrow (**Fig. 258c**)
Pleuroxia everardensis (Bednall, 1892) (p. 1026)

PLEUROXIA ADCOCKIANA (BEDNALL, 1894)
(Plates 95a-f, 97a-f, 99a-f, 100a-f; Figs 257a-d, 260a-c, 261a-b)

Hadra adcockiana Bednall, 1894, Trans. Roy. Soc. South Austr., **18**: 190, 3 figs - Tempe Downs Station, Central Australia (Mr. Robert Thornton! early in 1893).

Hadra clydonigera Tate, 1894, Trans. Roy. Soc. South Austr., **18**: 193 - Central Australia.

Thersites (Glyptorhagada) clydonigera (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 195, pl. XIX, fig. 24 - McDonnell (*sic*) Range (H. Kempe).

Thersites adcockiana (Bednall), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 196-198, pl. XIX, figs 26a, a', b, c - Ilpilla Gorge, Illamurta, Darwent River, gorges of Upper Finke, Finke River Gorge, Stuart's Pass, Painta (= Painter) Spring, Alice Springs, Maude River (Hart Range), Tempe Downs, Glen of Palms, Palm Creek, Red Centre.

Xanthomelon adcockiana (Bednall), Hedley, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 224-225, figs J-L (anatomy).

Pleuroxia adcockiana (Bednall), Iredale, 1937, South Austr. Nat., **18** (2): 49; Iredale, 1938, Austr. Zool., **9** (2): 107; Richardson, 1985, Tryonia, **12**: 253.

Pleuroxia truca Iredale, 1937, South Austr. Nat., **18** (2): 49, pl. 2, fig. 8 - Krickaueff (= Krichauff) Range, SA; Iredale, 1938, Austr. Zool., **9** (2): 107; Richardson, 1985, Tryonia, **12**: 254.

Glyptorhagada clydonigera (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 53; Iredale, 1938, Austr. Zool., **9** (2): 108; Richardson, 1985, Tryonia, **12**: 147.

Comparative remarks

Pleuroxia adcockiana (Bednall, 1894) from the MacDonnell, Krichauff, and James Ranges, NT (**Maps 2, 4**) is highly variable in size, shape, and sculpture. Generally it has a noticably lower spire (mean H/D ratio 0.641), narrower umbilicus (**Figs 257c-d**), higher whorl count (**Table 96**), and often stronger radial sculpture (**Plate 95a, d, f**) than *P. everardensis* (Bednall, 1892) from the Everard Ranges. The latter has an open umbilicus (**Fig. 258c**) and is smaller in size (**Table 96**). *P. carmeena*, new species, from the S Everard Range fringes, has a much more elevated spire (**Fig. 258e**, mean H/D ratio 0.844), and a very narrow umbilicus (**Fig. 258f**). The much smaller and widely umbilicated *P. radiata* (Hedley, 1905), from the Mann and Tomkinson Ranges (**Table 96**), has much heavier radial sculpture and lacks any trace of colour bands.

Table 96: Range of Variation in *Pleuroxia* and *Granulomelon*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
PLEUROXIA							
adcockiana (Bednall 1894)	492	9.65 (7.4-12.0)	15.04 (12.3-18.5)	0.641 (0.448-0.773)	$4\frac{1}{2}$- (4-5)	1.44 (0.1-2.5)	12.2 (6.26-28)
everardensis (Bednall, 1892)	126	9.55 (8.0-11.8)	13.07 (11.3-14.7)	0.731 (0.650-0.855)	$4\frac{1}{8}$+ ($3\frac{5}{8}$+-$4\frac{5}{8}$)	1.66 (0.5-1.9)	9.71 (6.90-28)
carmeena	8	12.70 (12.2-13.5)	15.05 (14.1-15.7)	0.844 (0.829-0.879)	$4\frac{3}{8}$+ ($4\frac{1}{8}$-$4\frac{5}{8}$-)	0.90 (0.6-1.1)	17.6 (12.2-26)
radiata (Hedley, 1905)	160	6.15 (4.9-7.8)	10.96 (9.65-12.7)	0.562 (0.475-0.651)	$4\frac{3}{8}$- ($3\frac{3}{4}$+-$4\frac{3}{4}$)	1.46 (1.0-2.2)	7.72 (5.03-11.4)
GRANULOMELON							
arcigerens (Tate, 1894)	44	9.28 (8.0-10.4)	17.43 (16.0-19.0)	0.533 (0.458-0.619)	$4\frac{3}{8}$ ($4\frac{1}{8}$+-$4\frac{5}{8}$)	3.19 (2.0-3.85)	5.57 (4.43-9.03)
gilleni	119	11.86 (9.7-14.0)	15.35 (14.0-17.1)	0.772 (0.662-0.878)	$4\frac{1}{8}$+ ($3\frac{3}{4}$-$4\frac{1}{2}$)	2.09 (1.3-2.7)	7.42 (5.70-11.7)
grandituberculatum (Tate, 1894)	142	12.28 (10.8-14.1)	15.19 (13.9-16.8)	0.809 (0.702-0.918)	$4\frac{1}{4}$+ ($3\frac{7}{8}$+-$4\frac{5}{8}$)	2.05 (1.1-2.5)	7.53 (5.74-13.3)
acerbum	401	11.67 (8.6-15.65)	14.84 (12.95-18.25)	0.786 (0.583-0.993)	$4\frac{1}{4}$- ($3\frac{7}{8}$–$4\frac{3}{4}$+)	2.17 (0.8-3.35)	7.01 (4.60-19.6)

Anatomically (**Figs 260a-c, 261a-b**), the relatively high position of the spermathecal head (S) on the prostate-uterus, short vagina (V), near apical entry of the epiphallus (E) into the penis sheath (PS), long penis (P), and simple epihallic caecum (EC) combine to separate *P. adcockiana*. The extremely long penis (**Fig. 263a**) with the mid-entry of the epiphallus (e) into the penis sheath (PS) characterizes *P. carmeena*. *P. everardensis* (**Fig. 262a**) has a short, fat penis with near apical entry of the epiphallus (E), and *P. radiata* has the vagina (V) greatly lengthened (**Fig. 264a**) and the penis very short.

Holotypes

Holotype of *Hadra adcockiana* Bednall, 1894: SAM D13763, Tempe Downs, Central Australia. Collected by Robert Thornton early in 1893. Height of shell 8.8 mm, diameter 15.0 mm, H/D ratio 0.587, whorls 4 3/8+, umbilical width 2.0 mm, D/U ratio 7.50.

Holotype of *Hadra clydonigera* Tate, 1894: SAM D13609, MacDonnell Ranges. Collected by H. Kempe. Specimen broken and thus not measurable.

Holotype of *Pleuroxia truca* Iredale, 1937: AM C.60529, Krichauff Ranges, Central Australia. Height of shell 9.9 mm, diameter 15.1 mm, H/D ratio 0.656, whorls 4 3/4, umbilical width 0.7 mm, D/U ratio 21.6.

Material studied

Northern Territory

MACDONNELL AND ADJACENT RANGES: Mt. Sonder (WA-759, NE outlier, 4 km W of Glen Helen, 4 LA, 6 DA, 13 LJ, 10 DJ, WAM 197-198.84, SAM D17682-3, FMNH 205531-2); Stokes Well (WA-933, 15 km S of Haast Bluff-Glen Helen road junction, 6 LA, 1 LJ, WAM 196.84, SAM D17681, FMNH 212398); Glen Helen (WA-113, N side opening to Finke River Gorge, 3 LA, 8 DA, 17 DJ, WAM 195.84, SAM D17680, FMNH 182483, FMNH 182390, FMNH 182658, FMNH 182083, FMNH 182161); Hermannsburg road, 2.2 km S of Glen Helen road (WA-760, 8 LA, 9 DA, 7 LJ, 6 DJ, WAM 180-1.84, SAM D17663-4, FMNH 205536-7); Ormiston Creek (WA-758, 1 LA, 12 DA, 2 LJ, 15 DJ, WAM 199.84, SAM D17684, FMNH 205525-6; Ormiston Gorge, 20 November 1976, 1 DA, MV); Ellery Gorge (WA-124, 2 LA, 7 LJ, FMNH 182630; WA-125, 6 DA, 3 LJ, FMNH 182202, FMNH 182369, FMNH 182643; WA-448, 5 LJ, FMNH 200353; WA-757, 3 DA, 3 LJ, 4 DJ, FMNH 205520-1); 71 km W of Alice Springs on Alice Springs-Hermannsburg road (9 June 1979, 3 LA, 7 LJ, AM C. 115941); Serpentine Gorge (WA-123, 1 DA, 5 LJ, 1 DJ, FMNH 182686; 8 June 1974, A. C. Beauglehole!, MV, 14 DA, 25 DJ); Stanley Chasm (WA-116, 1 DA, FMNH 182402; Lucy Serventy!, August 1957, 10 DA, 4 DJ, WAM); Spencer Gorge (Sta. 33, 4 LA, 20+ LJ, MV); Hugh River (WA-114, W bank, 3 DJ, FMNH 182079; WA-119, 3-1/3 mile N of Hugh River crossing of Stuart Highway, 4 LJ, FMNH 182213); Jay Creek (WA-115, 1 DA, FMNH 182486; WA-439, 3 DA, 2 LJ, 15 DJ, WAM 201.84, FMNH 199698-9; Sta. 41, W of Jay Creek, 9 LA, 28 LJ); Simpson's Gap (S end, 12 June 1978, 1 LJ, FMNH 198825); Sta. 40 (gap in MacDonnell Ranges ca 25 km W of Alice Springs, 2 DA, MV); Fern Gap West (WA-438, 1 DA, 2 LJ, 1 DJ, FMNH 199679-80).

ALICE SPRINGS VICINITY: Sta. 18 (20 km N of Alice Springs, 9 LA, 18 LJ, MV); Charles River crossing of Stuart Hgy (WA-118, 1.6 km N of, 1 LA, 2 DA, 1 LJ, 9 DJ, FMNH 182125, FMNH 182706, FMNH 182631); Heavitree Gap (13 DA, 13 DJ, MV F28278, MV F28280); Choritja Hill (WA-129, 8 LA, 8 DA, 23 LJ, 5 DJ, WAM 194.84, SAM D17679, FMNH 182696; WA-451, 12 DA, 1 LJ, 2 DJ, WAM 200.84, SAM D17685, FMNH 199684-5); Alice Springs Telegraph Station National Park (WA-128, 1 LA, 3 LJ, FMNH 182694); Painter Springs (WA-923, 64 LA, 13 DA, 126 LJ, 7 DJ, WAM 202-3.84, SAM D17686-7, FMNH 212333-4; 8 April 1912, 6 DA, 6 DJ, MV F28282); Wigley Waterhole, Todd River (3 LA, 10 LJ, FMNH 198820); Ross River road (WA-748, 3.7 km E of Alice Springs, 1 DA, FMNH 205480); Mt. Benstead Creek (12 May 1976, 4 DA, 4 DJ, SAM); "Bat Caves", S of Alice Springs (1 LA, 1 DA, 3 DJ, FMNH 198779-80); Undoolya Bore (1 DA, 1 DJ, MV, FMNH 198773).

HARTS RANGES: ?Maude River (3 DA, 1 DJ, MV F7608).

KRICHAUFF RANGES: Finke River (W bank, 5 km S of Hermannsburg turnoff, V. Kessner! 28 April 1987, Kessner, 6 LA; WA-764, 9.2 km in from Hermannsburg road, 1 LA, 3 DA, 2 LJ, 9 DJ, WAM 185.84, SAM D17668, FMNH 205561-2; Finke River Gorge near Hermannsburg Mission, 8 June 1979, 14 LA, 1 LJ, AM C.115857; MV 1534, 14 DA, 9 DJ); Palm Valley (WA-131, 100 yds NE Initiation Rock, 30 DA, 5 DJ, WAM 184.84, SAM D17667, FMNH 182345, FMNH 201557-8; WA-132, near old stockyard, 9 DA, 1 LJ, 2 DJ, WAM 183.84, SAM D17666, FMNH 182368, FMNH 182526; WA-440, figs near Ranger's cabin, 17 LA, 7 DA, 118 LJ, 6 DJ, WAM 182.84, WAM 189.84, SAM D17665, SAM D17672, FMNH 199668, FMNH 199672; Sta. 44, 1 km up from Ranger's cabin, 5 LA, 6 LJ, MV; WA-441, figs near Initiation Rock, 3 DA, 1 LJ, FMNH 199708, FMNH 199712; near Palm Valley Chalet ruins, 22 May 1983, 24 DA, SAM; WA-763, 13 LA, 23 DA, 2 LJ, 7 DJ, WAM 187-8.84, SAM D17670-1, FMNH 205555-6; WA-926, 2 km above campground, 1 DA, FMNH 212350; WA-928, Oasis Spring, 2 LA, 40 DA, 9 DJ, WAM 186.84, SAM D17669, FMNH 212368-9; WA-761, 0.5 km W of road end,1 DA, FMNH 205543); Glen of Palms (WA-929, 7 LA, 8 DA, 1 LJ, 8 DJ, WAM 944-5.87, SAM D17677-8, FMNH 212376-7; WA-930, junction of Ellery Creek and Finke River, 8 LA, 7 DA, 5 LJ, 9 DJ, WAM 192-3.84, SAM D17675-6, FMNH 212385-6; WA-931, Ellery Creek ca 3 km above Finke River junction, 22 LA, 8 DA, 16 LJ, 9 DJ, WAM 190-1.84, SAM D17673-4, FMNH 212387, FMNH 212388, FMNH 212389; WA-932, W bank Ellery Creek, 11 LA, 24 DA, 21 LJ, 14 DJ, WAM 178-9.84, SAM D17661-2, FMNH 212395-6).

JAMES RANGES VICINITY: Illamurta Springs Reserve (WA-942, 3 LA, 9 DA, 2 DJ, WAM 204.84, SAM D17688, FMNH 212426-7; S boundary, 6 LA, 15 LJ, WAM 205.84, SAM D17689, FMNH 198789; creek banks, 1 LA, 1 LJ, FMNH 198782).

Range

Pleuroxia adcockiana (Bednall, 1894) has been collected in the MacDonnell Ranges and outliers from Mt. Benstead Creek and the Ross River, E of Alice Springs, as far W as the Glen Helen opening to Finke River Gorge and Mt. Sonder, then S along the Finke River and Ellery Creek through the Krichauff Ranges to Tempe Downs and

Illamurta Springs Reserve, just S of the James Ranges (**Maps 2, 4**). The early record from Maude River, Harts Range requires confirmation from new collections. This may have been based on worn examples of *Granulomelon grandituberculatum* (Tate, 1894).

Diagnosis

Shell variable in size, but generally large, adult diameter 12.3-18.5 mm (mean 15.04 mm), with 4 to 5 (mean 4 1/2-) normally coiled whorls. Apex and spire moderately elevated (**Fig. 257b**), shell height 7.4-12.0 mm (mean 9.65 mm), H/D ratio 0.448-0.773 (mean 0.641). Body whorl rounded, without trace of angulation or keel. Shell apex (**Plate 95a-b**) with very dense micropustulations, becoming scarce on spire and usually absent by body whorl. Spire and body whorl with very weak (**Plate 95c**) to quite prominent rounded radial ribs (**Plate 95d, f**). Umbilicus (**Figs 257c-d**) variable, barely to narrowly open, width 0.1-2.5 mm (mean 1.44 mm), D/U ratio 6.26-28 (mean 12.2). Body whorl slightly to moderately descending behind aperture. Lip narrow, thin, rarely expanded even on columellar section, white, without trace of a ridge. Parietal wall with very thin callus. Based on 492 measured adults.

Genitalia (**Figs 260a-c, 261a-b**) with head of spermatheca (S) above base of prostate-uterus, vagina (V) very short and thick. Length of free oviduct (UV) variable. Vas deferens (VD) entering laterally on epiphallic caecum (EC). Epiphallus (E) entering penis sheath (PS) apically. Penis (P) much longer than vagina, not tapering, internally (**Fig. 260c**) with simple U-pilaster and prominent ridging around epiphallis pore.

Central and lateral teeth of radula (**Plates 99a-b, 100a-f**) with massive basal ridge, usually prominent flare, elevated cusp shaft angle, prominent ectocone. Lateromarginal transition (**Plate 99c-d**) abrupt. Jaw (**Plate 97a-f**) highly variable in number and prominence of ribs, usually with latter reduced on sides.

Discussion

The holotype of *Pleuroxia adcockiana* (Bednall, 1894) is a bleached adult with wide umbilicus, and sculpture that agrees with Form B of Tate (1896). Since Tempe Downs is located about 50 km SW of Palm Valley, the presence of the widely umbilicated form there, rather than the more narrowly umbilicated morph common in Palm Valley, Glen of Palms, and along Ellery Creek, is somewhat surprising. The holotype of *Pleuroxia truca* Iredale, 1937 has a repaired break at the 2 7/8 whorl point that changed the growth vectors, resulting in both a higher spire and narrower umbilicus. The holotype of *Hadra clydonigera* Tate, 1894 is a near scalariform, bleached shell with heavy sculpture and very faint traces of spiral banding. The unique example has been broken, and thus could not be measured, but agrees in shell features with *P. adcockiana*, once the effects of repaired breaks in the shell are discounted. All three names apply to the same anatomical grouping.

Variation is shell morphology is exceptionally large. Because of this, material from nine stations (WA-113, WA-119, WA-440, WA-759-60, WA-764, WA-923, WA-

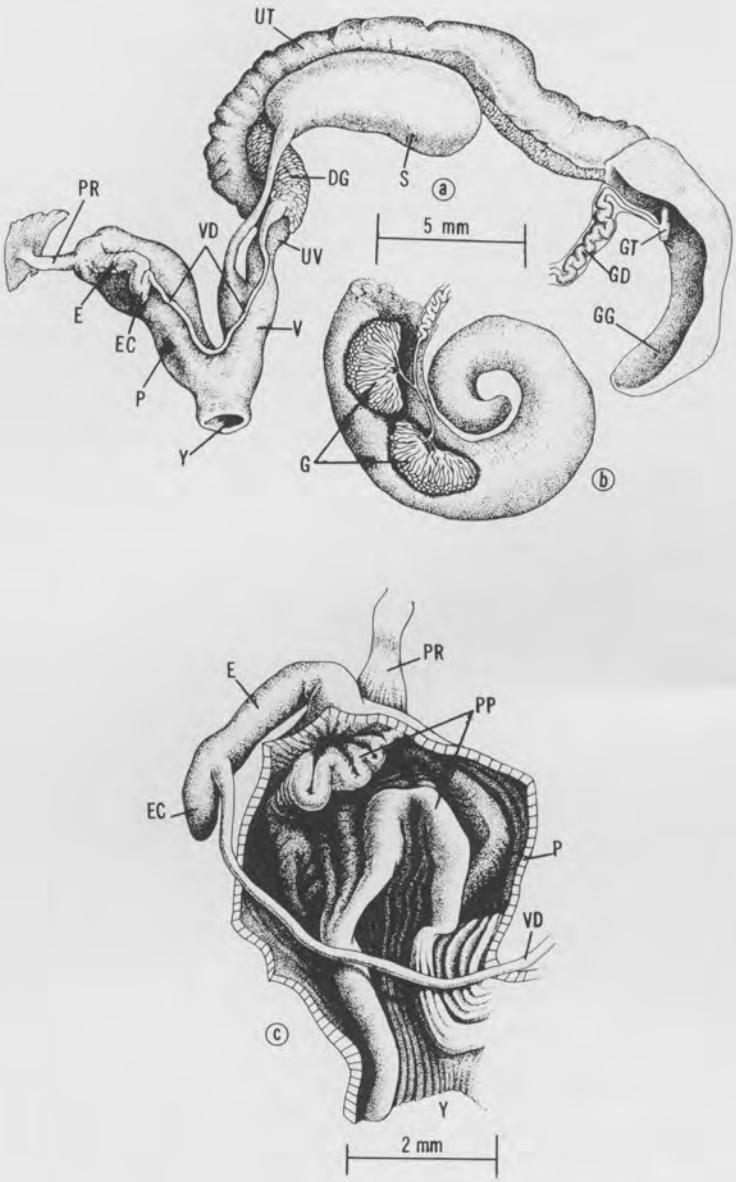


Fig. 260: Genitalia of *Pleuroxia adcockiana* (Bednall, 1894): Sta. WA-129, Choritja Hill behind St. Philipps College, Alice Springs, NT. 17 March 1974. FMNH 182696. (a) whole genitalia; (b) ovotestis (G) in active phase; (c) interior of penis. Scale lines as marked. Drawings by Elizabeth Liebman.

931, WA-942) were dissected and both radulae and jaws prepared for SEM observation. Specimens from additional stations had the neck slit open to check the size and structure of the penis. The net result was the conclusion that there is only one species of *Pleuroxia* in the NT part of the Red Centre.

Tate (1896: 196-198) gave a review of shell sculpture, colour, and shape that, unfortunately, was divorced from geography. Almost none of the land snail material collected on the Horn Expedition was distributed with precise locality data - with the exception of "single locality" species. While there are some shells in the SAM marked as the various forms recognized by Tate, no locality data is with them. It thus is necessary to "start over" in discussing variation patterns.

Size and shape differences among local populations are large (**Table 97**). There can be considerable differences within populations between live and dead adults. The Mt. Sonder outlier population at the beginning of **Table 97** is typical in the fact of difference, with live adults significantly larger, but elewhere the reverse pattern is seen with dead adults being larger (WA-760, Hermannsburg Road; WA-125, WA-757, Ellery Gorge; WA-923, Painter Springs; WA-440, Palm Valley; WA-929, Glen of Palms) and some populations show no size difference (WA-763, Palm Valley; WA-930, WA-931, WA-932, Glen of Palms).

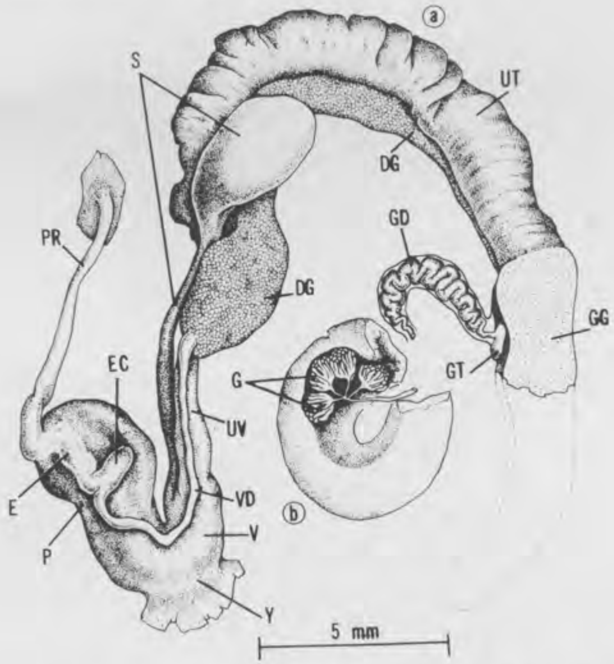


Fig. 261: Genitalia of *Pleuroxia adcockiana* (Bednall, 1894): Sta. WA-113, Glen Helen opening to Finke Gorge, MacDonnell Ranges, NT. 12 March 1974. FMNNH 182483. (a) whole genitalia; (b) ovotestis (G). Scale line equals 5 mm. Drawings by Elizabeth Liebman.

Table 97: Local Variation in *Pleuroxia adcockiana* (Bednall, 1894)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Macdonnell Ranges							
Mt. Sonder, WA-759, FMNH 205532	4L	8.93±0.160 (8.7-9.4)	15.20±0.268 (14.6-15.9)	0.587±0.004 (0.579-0.596)	$4^{1}/_{2}$- ($4^{3}/_{8}$+-$4^{1}/_{2}$)	1.70±0.082 (1.5-1.9)	8.99±0.374 (8.00-9.73)
Mt Sonder, WA-759, FMNH 2055311	6D	8.60±0.110 (8.1-8.9)	14.38±0.149 (13.9-14.8)	0.598±0.009 (0.566-0.626)	$4^{3}/_{8}$- ($4^{1}/_{4}$-$4^{3}/_{8}$+)	1.88±0.048 (1.8-2.1)	7.66±0.227 (6.71-8.22)
Glen Helen, WA-113, FMNH 182390	7D	9.86±0.462 (7.9-11.6)	15.20±0.368 (14.0-16.6)	0.648±0.025 (0.564-0.750)	$4^{5}/_{8}$ ($4^{3}/_{8}$- -5)	1.44±0.111 (1.1-1.8)	10.9±0.873 (7.78-13.7)
Stokes Well, WA-933, FMNH 212398	6D	9.80±0.202 (9.0-10.5)	15.18±0.209 (14.6-16.1)	0.646±0.011 (0.615-0.686)	$4^{1}/_{2}$ ($4^{1}/_{4}$-$4^{3}/_{4}$-)	1.43±0.049 (1.3-1.6)	10.7±0.352 (9.31-11.7)
Hermannsburg Road, WA-760, FMNH 205536	8L	9.49±0.123 (9.1-10.1)	15.29±0.230 (14.3-16.3)	0.621±0.005 (0.599-0.643)	$4^{3}/_{8}$- ($4^{1}/_{4}$- -$4^{1}/_{2}$+)	1.68±0.082 (1.4-2.0)	9.25±0.380 (8.00-10.7)
Hermansburg Road, WA-760, FMNH 205537	9D	10.16±0.096 (9.6-10.6)	16.00±0.165 (15.2-16.7)	0.635±0.008 (0.599-0.663)	$4^{1}/_{2}$+ ($4^{1}/_{4}$- -$4^{5}/_{8}$)	1.72±0.043 (1.5-1.9)	9.33±0.226 (8.44-10.6)
Ormiston Creek, WA-758, FMNH 205525	12D	8.81±0.111 (8.1-9.4)	13.83±0.113 (13.3-14.6)	0.637±0.009 (0.587-0.681)	$4^{1}/_{2}$ ($4^{3}/_{8}$-$4^{5}/_{8}$+)	1.24±0.031 (1.0-1.4)	11.2±0.297 (9.64-13.8)
Ellery Gorge, WA-125, FMNH 182369	6D	8.21±0.364 (7.5-9.95)	14.47±0.379 (13.4-15.7)	0.568±0.022 (0.510-0.659)	$4^{3}/_{8}$ ($4^{1}/_{4}$-$4^{1}/_{2}$)	1.97±0.084 (1.7-2.2)	7.41±0.311 (6.82-8.88)
Ellery Gorge, WA-757, FMNH 205520	3L	7.70±0.173 (7.4-8.0)	13.93±0.481 (13.0-14.6)	0.554±0.021 (0.521-0.592)	$4^{1}/_{4}$+ ($4^{1}/_{8}$+-$4^{3}/_{8}$-)	1.90±0.153 (1.7-2.2)	7.39±0.384 (6.64-7.89)

Table 97: Local Variation in *Pleuroxia adcockiana* (Bednall, 1894) (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Spencer Gorge, Sta.33, MV	4L	8.65±0.501 (7.8-10.1)	14.59±0.409 (13.7-15.65)	0.594±0.033 (0.530-0.687)	$4^{3}/_{8}$- $(4$-$4^{1}/_{2})$	1.85±0.275 (1.3-2.5)	8.38±1.158 (6.26-11.3)
Stanley Chasm, WAM, VIII-1957	10D	9.62±0.156 (9.0-10.4)	15.23±0.232 (14.4-16.5)	0.632±0.009 (0.588-0.684)	$4^{5}/_{8}$- $(4^{3}/_{8}$-$4^{7}/_{8})$	1.36±0.049 (1.1-1.5)	11.5±0.553 (9.60-14.8)
Jay Creek, Sta. 41, MV	6L	9.70±0.316 (8.9-10.85)	14.45±0.423 (13.35-15.8)	0.671±0.010 (0.636-0.700)	$4^{3}/_{8}$+ $(4^{1}/_{4}$-$4^{1}/_{2}$+)	1.42±0.124 (0.95-1.8)	10.6±0.999 (7.85-14.7)
Alice Springs area Heavitree Gap, MV F28280, II-1945	12D	9.61±0.220 (8.3-10.8)	15.46±0.210 (14.7-16.5)	0.622±0.012 (0.553-0.693)	$4^{3}/_{8}$+ $(4^{1}/_{8}$+-$4^{1}/_{2}$+)	1.31±0.045 (1.1-1.6)	12.0±0.424 (9.94-15.0)
20 km N of Allice Springs, Sta.18, MV	6L	9.98±0.275 (8.95-10.8)	16.08±0.362 (15.05-17.25)	0.620±0.009 (0.581-0.637)	$4^{5}/_{8}$+ $(4^{3}/_{8}$+-$4^{3}/_{4}$+)	1.64±0.091 (1.3-2.0)	9.93±0.514 (7.75-11.6)
Choritza Hill, WA-451 FMNH 199684	12D	8.52±0.194 (7.7-9.8)	13.53±0.119 (13.0-14.3)	0.629±0.011 (0.590-0.721)	$4^{1}/_{2}$+ $(4^{3}/_{8}$–$4^{7}/_{8}$-)	1.69±0.046 (1.35-1.9)	8.06±0.218 (6.87-9.63)
Painter Springs, WA-923, FMNH 212334	64L	9.08±0.065 (7.8-10.5)	14.22±0.980 (12.3-17.0)	0.639±0.004 (0.556-0.737)	$4^{3}/_{8}$- $(4$-$4^{5}/_{8}$-)	1.21±0.025 (0.8-1.9)	12.0±0.235 (7.69-17.6)
Painter Springs, WA-923, FMNH 212333	13D	9.27±0.113 (8.4-9.7)	15.12±0.161 (14.3-16.2)	0.613±0.008 (0.571-0.664)	$4^{1}/_{2}$- $(4^{1}/_{8}$+-$4^{5}/_{8}$+)	1.37±0.049 (1.1-1.7)	11.2±0.311 (9.53-13.0)
"Painta Springs", MV F28282, 8-IV-1912	6D	8.73±0.319 (7.5-9.5)	14.05±0.307 (13.3-15.1)	0.621±0.018 (0.551-0.677)	$4^{3}/_{8}$ $(4^{1}/_{4}$-$4^{1}/_{2})$	1.39±0.164 (0.9-2.1)	10.7±1.124 (6.48-14.8)
Mt Benstead Creek, SAM, 12-V-1976	4D	9.73±0.335 (8.75-10.25)	15.21±0.238 (14.6-15.7)	0.640±0.029 (0.557-0.688)	$4^{5}/_{8}$- $(4^{3}/_{8}$-$4^{3}/_{4})$	1.56±0.103 (1.3-1.75)	9.84±0.525 (8.97-11.2)

Table 97: Local Variation in *Pleuroxia adcockiana* (Bednall, 1894) (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Harts Range							
Maud River, MV F7608	3D	8.83±0.088 (8.7-9.0)	17.10±0.265 (16.6-17.5)	0.517±0.013 (0.497-0.542)	$4^{3}/_{8}$- ($4^{1}/_{4}$+-$4^{3}/_{8}$)	2.57±0.067 (2.5-2.7)	6.67±0.116 (6.48-6.88)
Krichauff Range							
Finke River, WA-764, FMNH 205562	3D	9.80±0.058 (9.7-9.9)	16.40±0.321 (15.8-16.9)	0.598±0.015 (0.574-0.627)	$4^{3}/_{8}$- ($4^{1}/_{4}$-$4^{3}/_{8}$+)	1.83±0.203 (1.5-2.2)	9.14±0.884 (7.50-10.5)
Finke River, 8-VI-1979, AM C.115857	14D	10.67±0.204 (9.3-11.9)	16.70±0.206 (15.7-18.3)	0.639±0.009 (0.589-0.711)	$4^{1}/_{2}$+ ($4^{1}/_{4}$-$4^{7}/_{8}$-)	1.36±0.037 (1.1-1.7)	12.3±0.322 (10.4-14.7)
Palm Valley,							
WA-131, FMNH 182345	29D	9.53±0.149 (8.3-11.2)	14.83±0.135 (13.4-16.3)	0.643±0.007 (0.565-0.747)	$4^{1}/_{2}$- ($4^{1}/_{4}$-$4^{7}/_{8}$)	1.37±0.037 (1.1-2.0)	11.1±0.245 (7.93-13.6)
WA-132, FMNH 182368	9D	9.76±0.220 (8.8-10.6)	15.27±0.247 (14.3-16.4)	0.639±0.011 (0.601-0.701)	$4^{1}/_{2}$+ ($4^{1}/_{4}$+-$4^{3}/_{4}$)	1.18±0.055 (1.0-1.5)	13.2±0.588 (9.80-15.2)
WA-440, FMNH 199672	17L	9.67±0.144 (8.6-10.8)	14.84±0.188 (13.9-16.3)	0.652±0.007 (0.588-0.691)	$4^{1}/_{2}$ ($4^{1}/_{4}$-$4^{3}/_{4}$)	1.16±0.029 (1.0-1.4)	12.9±0.338 (10.2-16.0)
WA-440 FMNH 199668	7D	10.09±0.308 (9.2-11.2)	15.53±0.379 (14.0-16.8)	0.650±0.014 (0.586-0.687)	$4^{5}/_{8}$ ($4^{3}/_{8}$-$4^{7}/_{8}$+)	1.17±0.052 (1.0-1.4)	13.4±0.559 (11.1-15.7)
Sta. 44, MV	5L	10.27±0.298 (9.45-10.95)	15.45±0.306 (14.8-16.4)	0.665±0.020 (0.634-0.740)	$4^{1}/_{2}$+ ($4^{1}/_{2}$-$4^{7}/_{8}$-)	1.60±0.050 (1.4-1.7)	9.95±0.042 (9.35-10.2)
Palm Valley Chalet ruins, SAM, 22-V-1983	24D	9.48±0.156 (7.9-10.9)	15.19±0.269 (12.9-18.3)	0.625±0.008 (0.521-0.685)	$4^{1}/_{2}$+ (4+-$4^{3}/_{4}$)	1.25±0.025 (1.0-1.45)	12.3±0.304 (9.93-16.0)

Table 97: Local Variation in *Pleuroxia adcockiana* (Bednall, 1894) (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-763, FMNH 205555	13L	9.96±0.219 (8.8-12.0)	15.14±0.204 (14.1-16.6)	0.658±0.010 (0.615-0.723)	$4\frac{1}{2}$ ($4\frac{1}{8}$-$4\frac{7}{8}$+)	1.26±0.074 (0.6-1.6)	12.7±1.061 (8.9-23.7)
WA-763, FMNH 205556	23D	9.92±0.176 (8.6-11.6)	15.16±0.174 (13.6-16.4)	0.654±0.009 (0.575-0.773)	$4\frac{1}{2}$+ ($4\frac{1}{4}$- $4\frac{7}{8}$+)	1.33±0.043 (1.0-1.6)	11.7±0.421 (8.69-16.1)
WA-928, FMNH 212369	40D	9.88±0.106 (8.5-11.3)	15.88±0.142 (14.2-18.5)	0.623±0.006 (0.568-0.712)	$4\frac{1}{2}$ ($4\frac{1}{8}$- $4\frac{3}{4}$+)	1.27±0.034 (0.9-1.9)	12.8±0.341 (8.20-18.2)
Glen of Palms WA-929 FMNH 212376	7L	10.41±0.323 (9.3-11.9)	15.03±0.283 (14.1-16.2)	0.693±0.015 (0.624-0.735)	$4\frac{5}{8}$- ($4\frac{1}{4}$+$4\frac{7}{8}$+)	0.91±0.108 (0.6-1.3)	18.0±2.205 (11.7-25)
WA-929, FMNH 212377	8D	10.3±0.141 (9.9-11.0)	15.45±0.292 (14.4-16.7)	0.670±0.008 (0.641-0.701)	$4\frac{5}{8}$- ($4\frac{3}{8}$- $4\frac{3}{4}$-)	1.05±0.033 (0.9-1.2)	14.8±0.592 (12.6-18.0)
WA-930, FMNH 212385	8L	10.70±0.146 (10.1-11.2)	15.49±0.184 (14.8-16.1)	0.692±0.013 (0.646-0.737)	$4\frac{5}{8}$+ ($4\frac{1}{2}$-$4\frac{3}{4}$+)	1.15±0.093 (0.8-1.6)	14.0±0.993 (9.88-18.6)
WA-930, FMNH 212386	7D	10.46±0.290 (9.3-11.5)	15.53±0.308 (14.5-16.8)	0.673±0.011 (0.636-0.710)	$4\frac{5}{8}$- ($4\frac{3}{8}$+-$4\frac{3}{4}$)	1.11±0.040 (1.0-1.3)	14.0±0.542 (12.2-16.2)
WA-931, FMNH 212389	12L	10.38±0.189 (9.2-11.2)	15.39±0.342 (13.5-17.5)	0.676±0.011 (0.629-0.763)	$4\frac{5}{8}$+ ($4\frac{1}{2}$-$4\frac{7}{8}$-)	1.08±0.045 (0.8-1.3)	14.5±0.629 (12.6-18.3)
WA-931, FMNH 212387	8D	10.39±0.259 (9.4-11.6)	15.34±0.272 (14.1-16.1)	0.678±0.015 (0.638-0.745)	$4\frac{5}{8}$+ ($4\frac{1}{2}$-$4\frac{3}{4}$+)	1.01±0.099 (0.5-1.4)	16.5±1.982 (10.5-28)
WA-932, FMNH 212395	11L	10.13±0.276 (8.3-11.2)	15.02±0.261 (13.7-16.5)	0.674±0.012 (0.593-0.720)	$4\frac{1}{2}$+ ($4\frac{1}{8}$-$4\frac{7}{8}$+)	1.03±0.083 (0.6-1.6)	15.7±1.343 (8.75-23.8)

Table 97: Local Variation in *Pleuroxia adcockiana* (Bednall, 1894) (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-932, FMNH 212396	24D	10.10±0.125 (8.8-11.1)	14.96±0.127 (13.8-16.3)	0.675±0.005 (0.620-0.731)	$5^{5}/_{8}$- ($4^{1}/_{4}$-$4^{7}/_{8}$)	1.03±0.037 (0.7-1.4)	15.0±0.570 (10.6-21.4)
James Range							
Illamurta Spring, WA-942, FMNH 212427	9D	9.40±0.295 (8.0-10.6)	14.64±0.344 (12.8-15.7)	0.641±0.008 (0.607-0.676)	$4^{1}/_{2}$- ($4^{1}/_{8}$-$4^{3}/_{4}$-)	1.56±0.065 (1.3-1.8)	9.51±0.337 (8.00-11.1)
S boundary, FMNH 199789	6L	9.73±0.291 (9.0-10.7)	15.43±0.493 (13.8-16.7)	0.631±0.011 (0.596-0.669)	$4^{3}/_{8}$+ ($4^{1}/_{8}$-$4^{7}/_{8}$+)	1.48±0.031 (1.4-1.6)	10.4±0.351 (8.94-11.1)

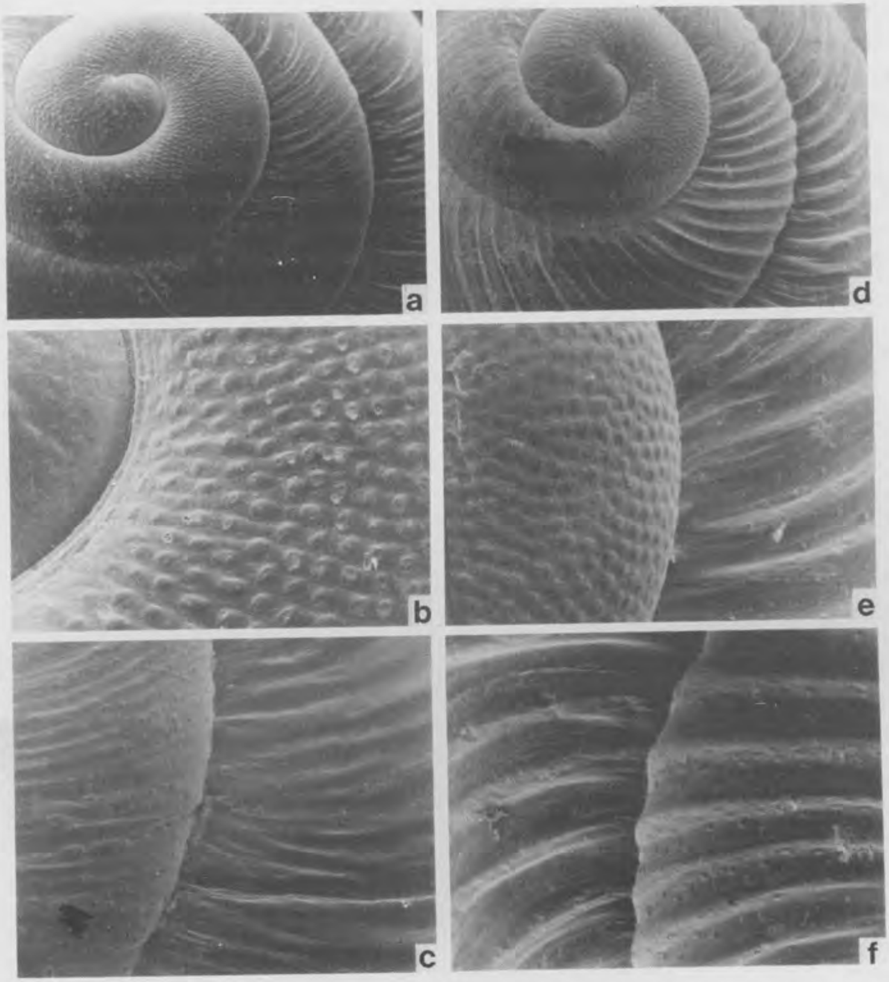


Plate 95: Shell sculpture of *Pleuroxia adcockiana* (Bednall, 1894): (a-c) Sta. WA-439, Glen Helen, MacDonnell Ranges, NT. FMNH 199699. a is apex and early spire at 16.X, b is detail of apical micropustules at 53X, c is 1st and 2nd spire whorls at 38X, showing reduced radial sculpture phase; (d-f) Sta. WA-932, Ellery Creek, Krichauff Ranges, NT. FMNH 212396. d is apex and early spire at 16.3X, e is detail of apex and 1st whorl of spire at 60X, f is 1st and second spire whorls at 43X, showing strong radial sculpture phase.

Geographically, larger and smaller diameter populations are intermingled. In general, greater shell diameter correlates with greater whorl count. Spire height, as reflected by H/D ratio, also shows dramatic changes. The three Maud River specimens have an exceptionally low spire, while those from Palm Valley and the Glen of Palms tend to be high spired and relatively large in diameter. Although Iredale (1937b) characterized the Krichauff Ranges *truca* by its narrow umbilicus and very prominent sculpture, only the Glen of Palms populations (**Table 97**) have noticably narrowed umbilici. Those from Palm Valley are more open, while the holotype from Tempe Downs and specimens from Illamurta Springs are as widely umbilicated as are those from the northern localities.

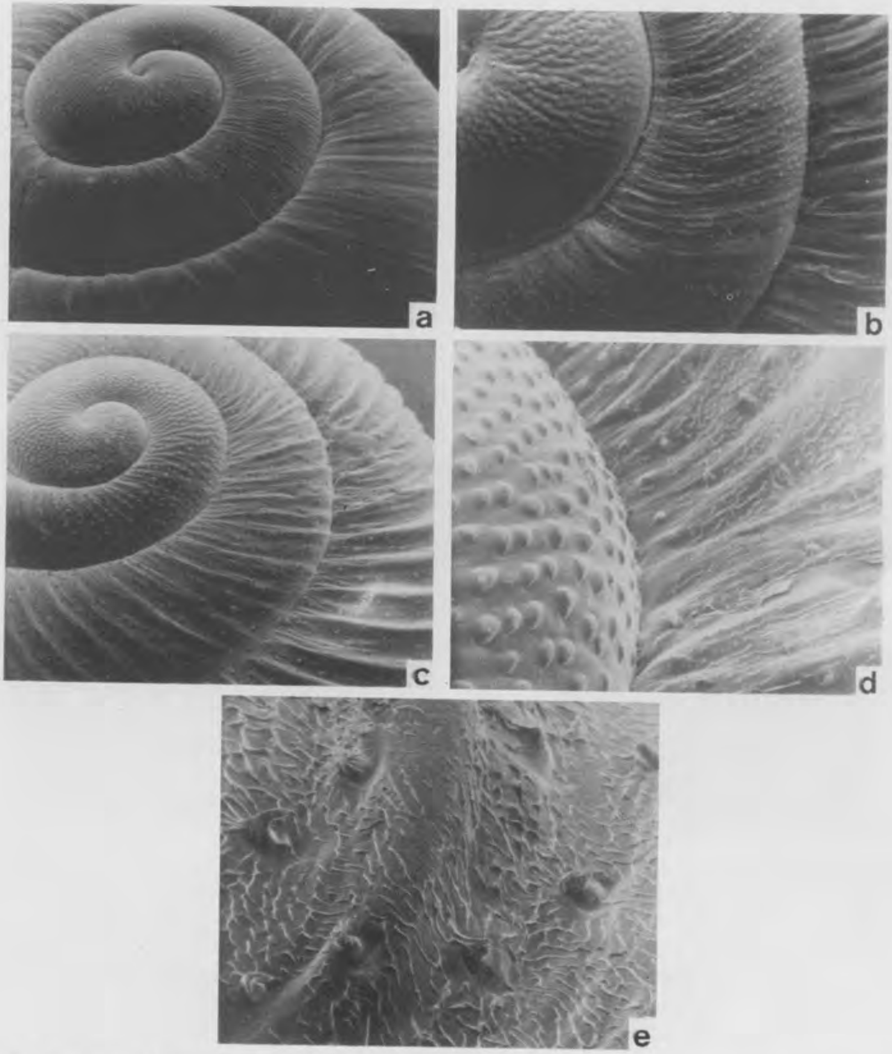


Plate 96: Shell sculpture of *Pleuroxia everardensis* (Bednall, 1892), *P. carmeena*, and *P. radiata* (Hedley, 1905): (a) *P. everardensis*. Sta. WA-938, Mt. Illbillee, Everard Ranges, SA. FMNH 212413. Apex and early spire at 16.2X; (b) *P. carmeena*. Sta. WA-851, Mt. Carmeena, Everard Ranges, SA. FMNH 212089. Apex and early spire at 24.7X; (c-e) *P. radiata*. Sta. WA-904, 22 km S of Lake Wilson, Mann Ranges, SA. FMNH 212287. c is apex and spire at 16.2X, d is detail of apical micropustules and 1st spire whorl at 80X, e is microsculpture on first whorl of spire at 145X.

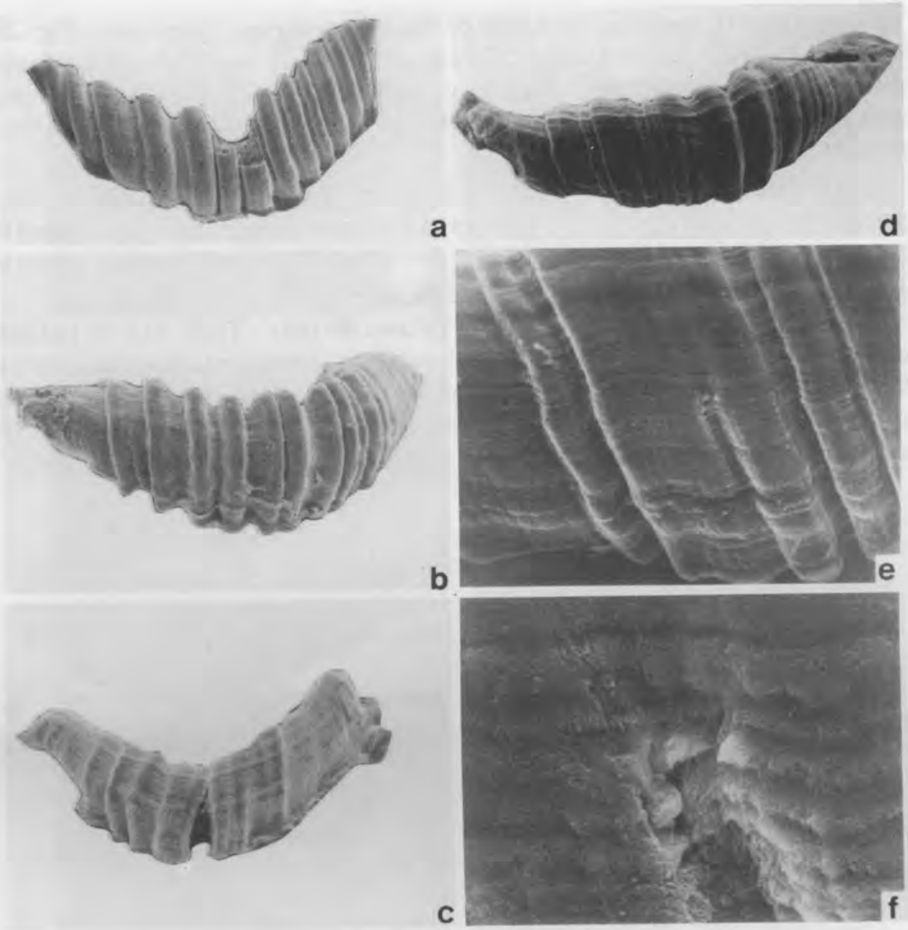


Plate 97: Jaws of *Pleuroxia adcockiana* (Bednall, 1894): (a) Sta. WA-440, Palm Valley, Krichauff Ranges, NT. 23 May 1977. FMNH 199672. Full ribbed example at 46.5X; (b) Sta. WA-923, Painter Springs, Simpson's Gap National Park, Alice Springs, NT. 20 May 1983. FMNH 212334, Dissection B. Narrow ribbed example with some lateral reduction at 58X; (c) Sta. WA-764, banks of Finke River, fringes of N Krichauff Ranges. 26 April 1981. FMNH 205561. Example with greatly reduced ribbing at 44.5X; (d-f) Sta. WA-923, Painter Springs, Simpson's Gap National Park, Alice Springs, NT. 20 May 1983. FMNH 212334, Dissection A. d is whole jaw with reduced ribbing at 43.5X, e is area on jaw where a repaired injury has resulted in fusing of two ribs at 170X, f is detail of fusion point at 840X.

The prominence of sculpture also varies greatly. Some populations, such as those from Illamurta Springs, have nearly smooth surfaced shells, most large samples from the MacDonnell Ranges show variation among individuals, ranging from heavy radial ribbing to reduced ribbing (**Plate 95a, c, d-f**). The Palm Valley-Glen of Palms examples do tend to have strong sculpture.

Except for differences in the length of the free oviduct (UV, compare **Figs 260a, 261a**), the genitalia showed no significant differences. The illustrated examples, collected in March 1974 after heavy rains, have the ovotestis (G) just beginning to shrink, whereas specimens taken in late April to late May had the ovotestis in typical dry season condition.

Jaw variation (**Plate 97**) is considerable, with number and prominence of the vertical ribs extremely different. One example from Painter Springs (**Plate 97d-f**) shows how a rib can be "lost" by injury. The growing edge of the jaw is at the top, and the sharp transition point is shown at different magnifications.

Radular tooth variation also is large (**Plates 99-100**). There can be individual tooth change that is repeated from row to row (**Plate 100e**), or a single deformed row (**Plate 100f**) of teeth produced, with the curvature of the lateral teeth cusps differing before and after the deformed row. Quite possibly the deformed row resulted from the cold shock of an overnight freeze.

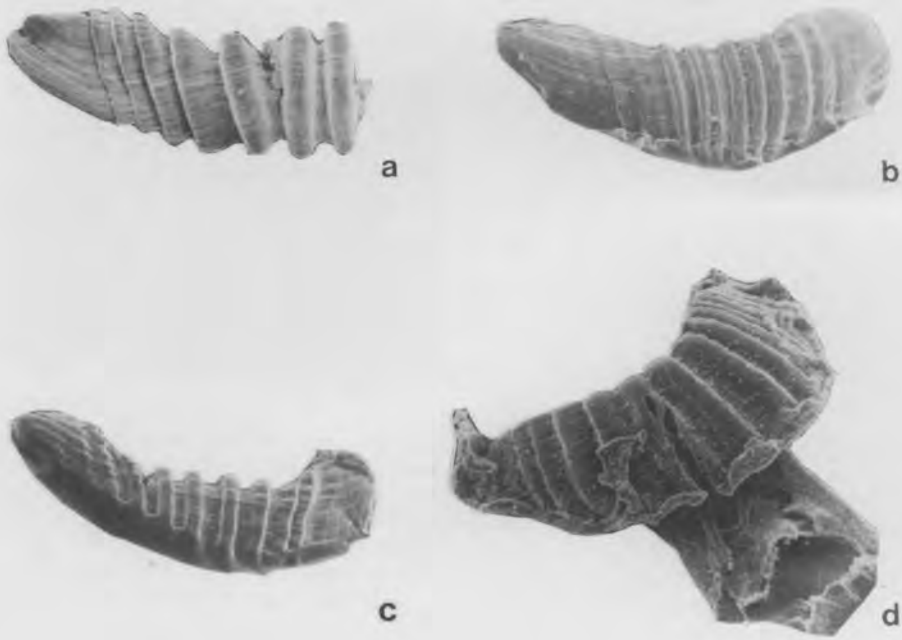


Plate 98: Jaws of *Pleuroxia everardensis* (Bednall, 1892) and *P. radiata* (Hedley, 1905): (a-c) *P. everardensis.* (a) Sta. WA-862, Mt. Illbillee, Everard Ranges, SA. 5 May 1983. FMNH 212120, Dissection A. Mixture of rib types at 58X; (b-c) Sta. WA-938, Mt. Illbillee, Everard Ranges, SA. 29 May 1983. FMNH 212414. b is from Dissection A, narrow ribbed example at 48X, c is from Dissection B, widely spaced rib example at 40X; (d) *P. radiata.* Sta. WA-905, Gosse Pile, Tomkinson Ranges, SA. 13 May 1983. FMNH 212290, Dissection A. Broad ribbed example at 82X.

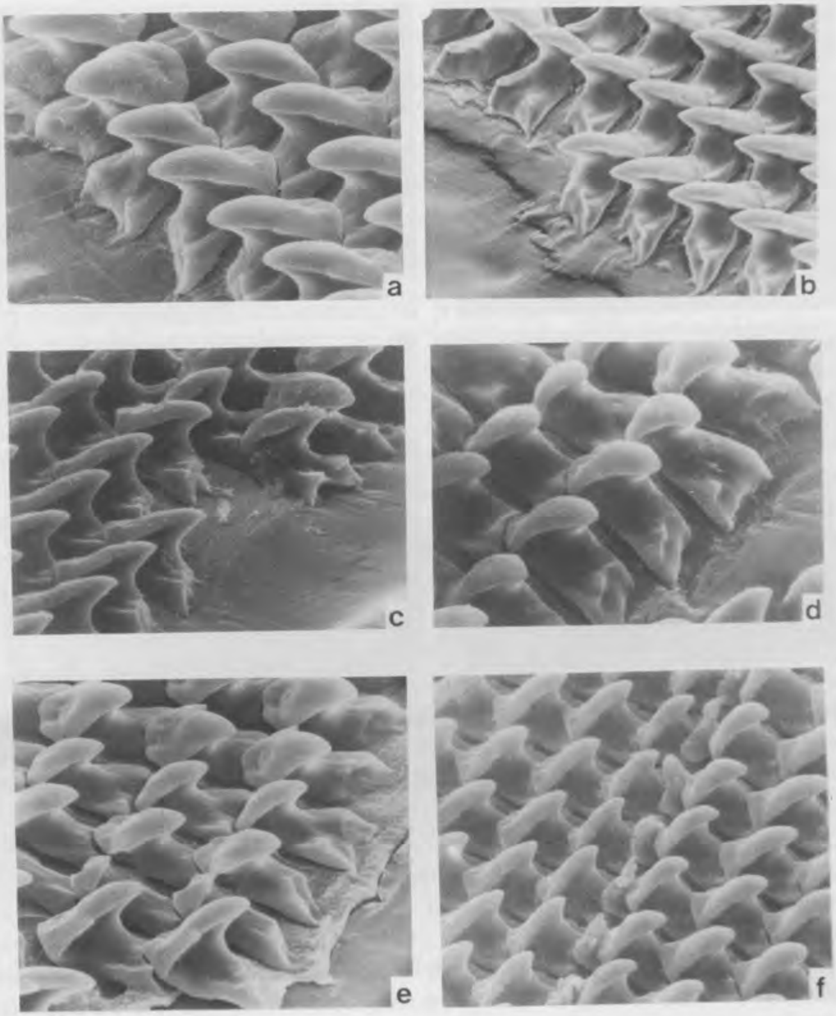


Plate 99: Radular teeth of *Pleuroxia adcockiana* (Bednall, 1894): (a) Sta. WA-440, Palm Valley, Krichauff Ranges, NT. 23 May 1977. FMNH 199672, Dissection B. Central and early laterals at 780X; (b) Sta. WA-764, Finke River bank on N frings of Krichauff Ranges, NT. 26 April 1981. FMNH 205561, Dissection A. Central and early laterals at 580X; (c) Sta. WA-759, Mt. Sonder, N of MacDonnell Ranges, NT. 25 April 1981. FMNH 205532, Dissection A. Central and early laterals at 630X; (d) Sta. WA-942, Illamurta Spring, near James Ranges, NT. 27 May 1983. FMNH 212426, Dissection A. Central and early laterals with strongly curved tips at 790X; (e) Sta. WA-129, Choritja Hill, Alice Springs, NT. 17 March 1974. FMNH 182696, Dissection E. Central and early lateral teeth with deformed 2nd laterals at 690X; (f) Sta. WA-760, N outliers of MacDonnell Ranges, NT. 25 April 1981. FMNH 206536, Dissection A. Lateral teeth with deformed row of teeth at 590X, note the change in cusp curvature from before (left) to after (right) the deformity.

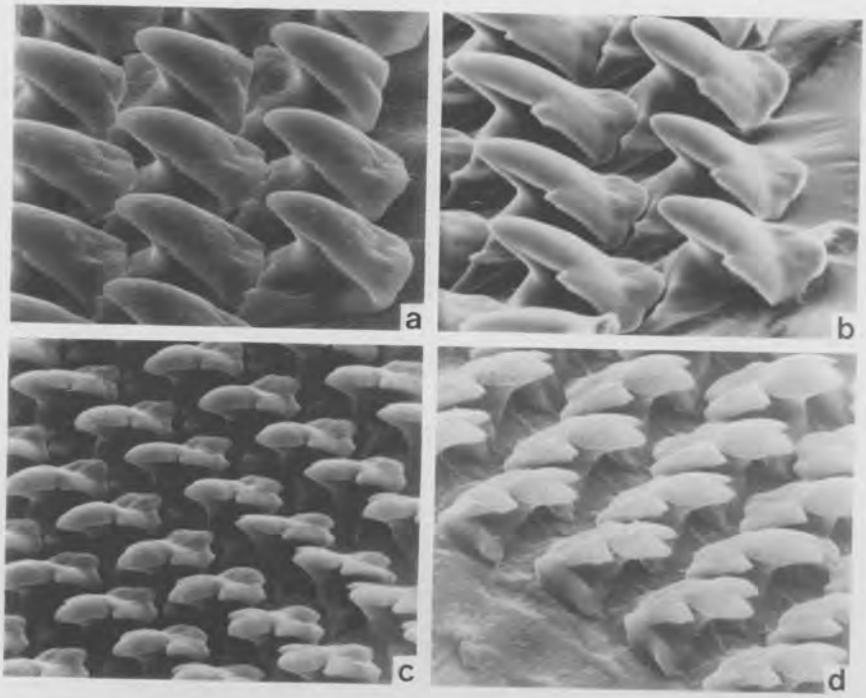


Plate 100: Radular teeth of *Pleuroxia adcockiana* (Bednall, 1894): (a) Sta. WA-440, Palm Valley, Krichauff Ranges, NT. 23 May 1977. FMNH 199672, Dissection B. Side view of central and early lateral teeth at 830X; (b) Sta. WA-764, W bank Finke River, N fringes of Krichauff Ranges, NT. 26 April 1981. FMNH 205561, Dissection A. Side view of mid laterals at 290X; (c) Sta. WA-923, Painter Springs, N edge Simpson's Gap National Park, Alice Springs, NT. 20 May 1983. FMNH 212334, Dissection A. Lateromarginal transition at 610X; (d) Sta. WA-942, Illamurta Springs, near James Ranges, NT. 27 May 1983. FMNH 212426, Dissection A. Early marginal teeth at 810X.

The data presented above and in **Table 97** are sufficient to indicate a number of possibilities for study of local variation in *Pleuroxia adcockiana*. It does get transported by flood waters and live strandees have been collected in stream debris a considerable distance from the probable colony of origin (see above). Thus occasional successful genetic mixing is almost a certainty. As one of the most common, and more widely distributed camaenids in the Red Centre, it would be a good choice for work on local variations and genetic exchange.

PLEUROXIA EVERARDENSIS (BEDNALL, 1892)
(Plates 96a, 98a-c, 101a-b; Figs 258a-c, 262a-b)

Helix (Hadra) everardensis Bednall, 1892, Trans. Roy. Soc. South Austr., **16**: 64-65, pl. I, figs 3a-c - near Illbillee Soakage, Everard Range, at an elevation of 2,000 feet, South Australia.

Hadra (Badistes) everardensis (Bednall), Pilsbry, 1893, Man. Conch., (2) **8**: 277-278, pl. 58, figs 22-24 (copies of orginal figures); Pilsbry, 1894, Man. Conch., (2) **9**: 131.

?*Xanthomelon adcockianum* Riddle, 1915 (not Bednall, 1894), Trans. Roy. Soc. South Austr., **39**: 771 - Moorilyanna Native Well, under figs, Everard Ranges.

Pleuroxia everardensis Iredale, 1937, South Austr. Nat., **18** (2): 50; Iredale, 1938, Austr. Zool., **9** (2): 107; Richardson, 1985, Tryonia, **12**: 253.

Comparative remarks

Pleuroxia everardensis (Bednall, 1892), from the north and central portions of the Everard Ranges, SA (**Map 2**), plus outliers E and SE, is of medium size (mean diameter 13.07 mm), with a strongly elevated spire (**Fig. 258b**, mean H/D ratio 0.731), narrowly open umbilicus (**Fig. 258c**), two spiral colour bands, a noticable basal lip ridge (**Fig. 258b**), and weak radial sculpture on the spire and body whorl with almost no micropustules present (**Plate 96a**). Two other species also have the spiral colour bands: *P. carmeena*, from the S Everard Ranges, is larger (mean diameter 15.05 mm) and even more elevated (**Fig. 258e**, mean H/D ratio 0.844), has a very narrow umbilicus (**Fig. 258f**), lacks any trace of the basal lip ridge, and has usually stronger radial sculpture (**Plate 96b**); *P. adcockiana* (Bednall, 1894), from the James, Krichauff, and MacDonnell Ranges in the NT, is larger (mean diameter 15.04 mm), less elevated (**Fig. 257b**, mean H/D ratio 0.641), with a much narrower to very narrow umbilicus (**Figs 257c-d**), higher whorl count (**Table 96**), and often very strong radial sculpture (**Plate 95a, d, f**). *P. radiata* (Hedley, 1905), from the Mann and Tomkinson Ranges in SA, lacks the colour bands, has a more widely reflected lip (**Figs 259a-c**), more open umbilicus, wider radial ribs (**Plate 96c-e**), is smaller (mean diameter 10.96 mm), and much less elevated (mean H/D ratio 0.562). Anatomically (**Figs 262a-b**), the vagina (V) is longer and the spermathecal head (S) is lower on the prostate-uterus than in *P. adcockiana* (**Fig. 260a**), and the penis (P) is shorter and thicker with the epiphallus (E) entering the penis sheath apically, the epiphallic caecum (EC) very large and situated about middle of penis. Internally, penis (**Fig. 262b**) with U-pilaster reduced, ridges around epiphallic pore (DP) enlarged. *P. carmeena* (**Figs 263a-b**) has a very long penis, with the epiphallus entering near the middle of the penis sheath, while *P. radiata* (**Figs 264a-b**) has an extremely long vagina, very short penis with massive U-pilaster and reduced other wall sculpture.

Holotype

SAM D13764, near Illbillee Soakage, Everard Range, at an elevation of 2,000 feet, South Australia. Collected by the Elder Expedition in 1891. Height of shell 9.9 mm, diameter 12.8 mm, H/D ratio 0.773, whorls 4 1/4, umbilical width 1.6 mm, D/U ratio 8.00.

Studied material

South Australia:

EVERARD RANGES: Mt. Illbillee (Sta. 10, S side, 14 May 1977, 3 LA, 1 LJ, MV; WA-850, valley mouth N of Victory Well, 1 LA, 11 DA, 4 LJ, 8 DJ, WAM 165.84,

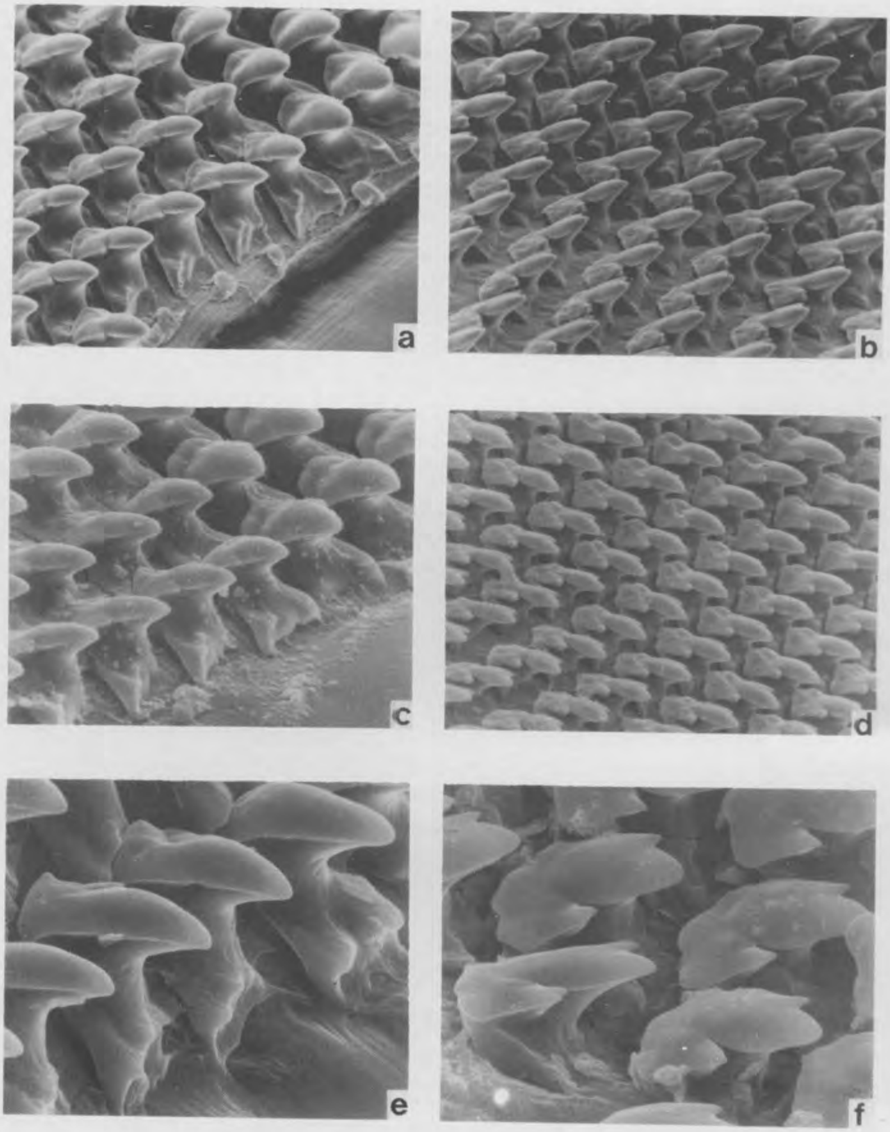


Plate 101: Radular teeth of *Pleuroxia everardensis* (Bednall, 1892), *P. carmeena*, and *P. radiata* (Hedley, 1905): (a-b) *P. everardensis*. Sta. WA-862, Victory Well, Mt. Illbillee, Everard Ranges, SA. 5 May 1983. FMNH 212120, Dissection A. a is central and early laterals at 520X, b is lateromarginal transition at 490X; (c-d) *P. carmeena*. Sta. WA-851, Mt. Carmeena, Everard Ranges, NT. 4 May 1983. FMNH 212088, Dissection A. c is laterals and early marginals at 550X, d is lateromarginal transition at 360X; (e-f) *P. radiata*. Sta. WA-905, Gosse Pile, Tomkinson Ranges, SA. 13 May 1983. FMNH 212290, Dissection B. e is central and early laterals at 1,225X, f is early marginals at 1,450X.

SAM D17638-9, FMNH 212083-4; WA-938, SW outlier of, 16 LA, 13 DA, 25 LJ, 7 DJ, WAM 164.84, WAM 171.84, SAM D17636-7, FMNH 212413-4; WA-939, valley near W end, 2 LA, 7 DA, 2 DJ, WAM 163.84, SAM D17635, FMNH 212417-8; WA-940, small outlier S of, 7 DA, 1 DJ, SAM D17634, FMNH 212419; Sta. 11, gully W of Mt. Illbillee near Victory Well, 1 LA, 1 LJ, MV; WA-862, 3.7 km W of Victory Well, 3 LA, 12 DA, 11 LJ, 12 DJ, WAM 166.84, WAM 177.84, SAM D17640, SAM D17660, FMNH 212119-20; WA-863, 2 km W of Victory Well, half way up Mt., 1 LA, 8 DA, 9 LJ, 5 DJ, WAM 170.84, SAM D17658-9, FMNH 212125-6; WA-861, 2 km W of Victory Well, 2 km up creek bed, 1 DA, FMNH 212115; WA-857, gorge mouth 4.5 km E of Victory Well, E end of Mt., 1 LA, 8 DA, 5 LJ, WAM 169.84, SAM D17657, FMNH 212103-4; WA-857A, base of creek, 5 LA, 9 LJ, WAM 168.84, SAM D17656, FMNH 212107); Robb Well (WA-854, ca 8 air km SW of, 6 DA, SAM D17655, FMNH 212094; WA-853, 6 km S of Mimili-Victory Well track junction, 2 LA, 11 DA, 8 LJ, 9 DJ, WAM 167.84, SAM D17643-4, FMNH 212092-3); 25 km E of Mimili (WA-847, hill with figs N of track, E of Everard Ranges, 2 LA, 5DA, 3 DJ, SAM D17641-2, FMNH 212071-2).

Range

Pleuroxia everardensis (Bednall, 1892) has been found on Mt. Illbillee and its outliers, Everard Ranges, SA (**Map 2**), plus apparently dwarf populations to the E: two S of Robb Well (WA-853, WA-854) and one 25 km E of Mimili (WA-847). Extension of its range northwards to the Moorilyanna Hill region is probable in view of the record by Riddle (1915).

Diagnosis

Shell of medium size, adult diameter 11.3-14.7 mm (mean 13.07 mm), with 3 5/8+ to 4 5/8 (mean 4 1/8+) normally coiled whorls. Apex and spire moderately elevated (**Fig. 258b**), shell height 8.0-11.8 mm (mean 9.55 mm), H/D ratio 0.650-0.855 (mean 0.731). Body whorl rounded, without trace of keel or angulation. Shell apex (**Plate 96a**) with dense pustulations, spire and body whorl usually with just weak, irregular growth ridges or low ribs, at most widely scattered pustulations. Umbilicus (**Fig. 258c**) narrowly open, partly closed by reflection of columellar lip, width 0.5-1.9 mm (mean 1.66 mm), D/U ratio 6.90-28 (mean 9.71). Body whorl slightly to moderately descending over last one-eighth whorl behind aperture. Lip weakly expanded, thin, basal lip raised (**Fig. 258b**) into a narrow ridge that becomes reduced in prominence in smaller sized individuals. Parietal wall with thin callus. Shell with narrow supraperipheral and subsutural spiral red colour bands. Based on 126 measured adults.

Genitalia (**Figs 262a-b**) with head of spermatheca (S) low on prostate-uterus, vagina (V) thick and of average length. Vas deferens (VD) entering long epiphallic caecum (EC) normally. Epiphallus (E) relatively thick, entering penis sheath (PS) near apically. Penis (P) short, thick, slightly longer than vagina (V), internally (**Fig. 262b**) with massive ridging at epiphallic pore, U-pilaster proportionately very large, apical connector reduced to absent.

Central and lateral teeth of radula (**Plate 101a**) with large basal ridge, somewhat enlarged anterior flare, elevated cusp shaft angle, and relatively prominent ectocone.

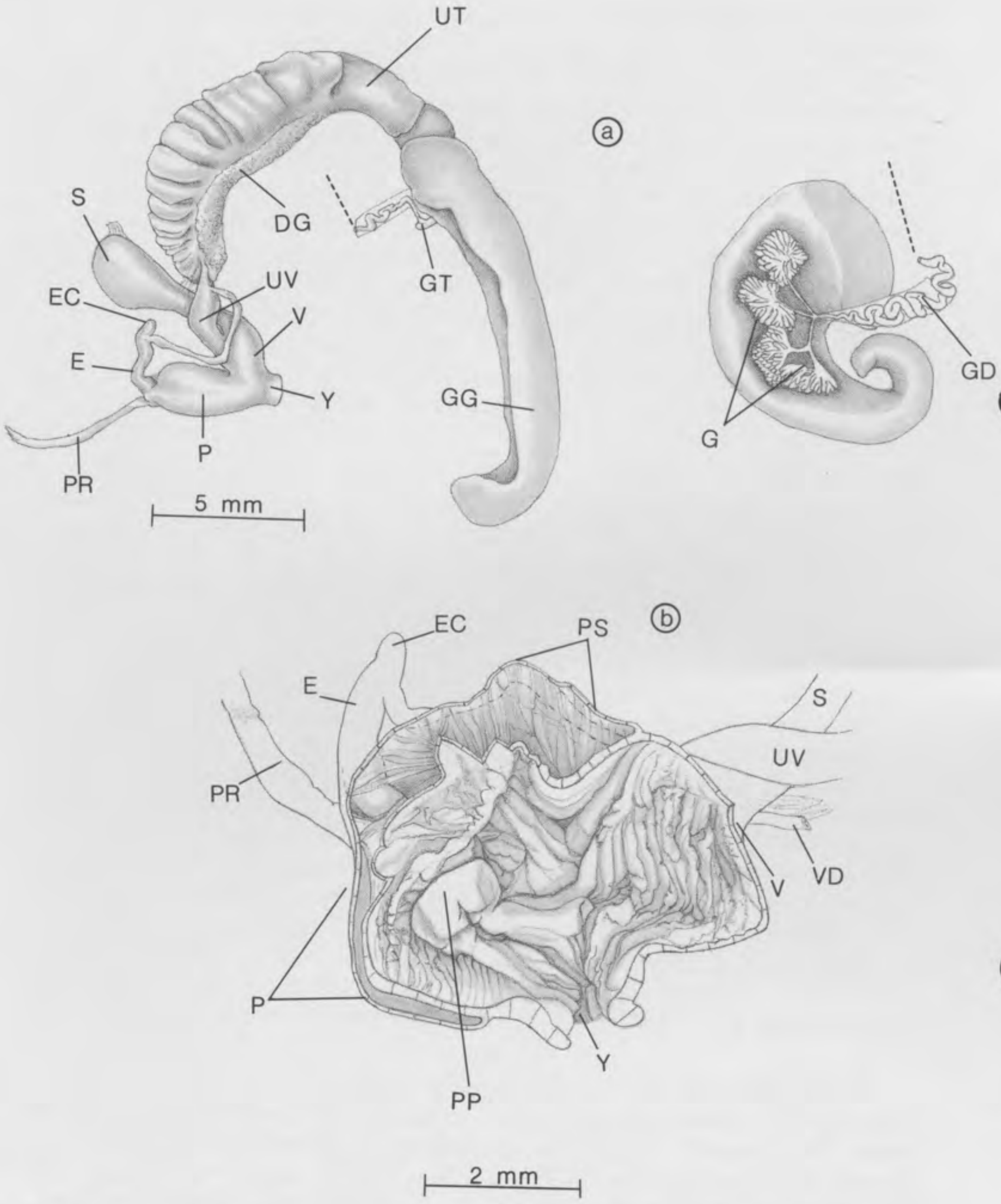


Fig. 262: Genitalia of *Pleuroxia everardensis* (Bednall, 1892): Sta. WA-938, Mt. Illbillee, Everard Ranges, SA. 29 May 1983. FMNH 212414. (a) whole genitalia, Dissection B; (b) penis interior, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

Table 98: Local Variation in *Pleuroxia everardensis* (Bednall, 1892) and *P. carmeena*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
P. everardensis (Bednall, 1892)							
Mt Illbillee,							
WA-850,	11D	9.66±0.125	13.26±0.171	0.730±0.011	$4\frac{1}{8}$+	1.43±0.074	9.53±0.491
FMNH 212084		(9.0-10.5)	(12.7-14.6)	(0.658-0.780)	($3\frac{3}{4}$-$4\frac{3}{8}$+)	(1.1-1.8)	(7.44-12.5)
WA-938,	16L	9.24±0.110	13.14±0.115	0.703±0.006	$4\frac{1}{8}$-	1.53±0.045	8.68±0.233
FMNH 212414		(8.5-10.0)	(12.0-13.9)	(0.659-0.746)	($3\frac{7}{8}$+-$4\frac{1}{2}$)	(1.2-1.9)	(6.90-10.8)
WA-938,	13D	8.92±0.102	12.67±0.126	0.704±0.006	$4\frac{1}{8}$-	1.49±0.055	8.60±0.322
FMNH 212413		(8.2-9.6)	(11.9-13.5)	(0.672-0.744)	($3\frac{7}{8}$–-$4\frac{1}{8}$+)	(1.2-1.8)	(6.80-10.3)
WA-939,	7D	9.96±0.084	13.73±0.265	0.727±0.016	$4\frac{1}{4}$	1.47±0.097	9.51±0.470
FMNH 212418		(9.6-10.2)	(12.7-14.7)	(0.673-0.772)	(4-$4\frac{1}{2}$)	(1.1-1.8)	(7.89-11.5)
WA-940,	7D	9.27±0.144	13.47±0.218	0.689±0.012	$4\frac{1}{8}$-	1.49±0.059	9.15±0.362
FMNH 212419		(8.7-9.8)	(12.8-14.3)	(0.650-0.738)	($3\frac{7}{8}$-$4\frac{1}{4}$-)	(1.3-1.7)	(8.00-10.8)
WA-862,	3L	9.67±0.067	13.23±0.240	0.731±0.017	$4\frac{1}{4}$-	1.30±0.115	10.3±0.960
FMNH 212120		(9.6-9.8)	(12.9-13.7)	(0.701-0.760)	($4\frac{1}{8}$+-$4\frac{1}{4}$)	(1.1-1.5)	(8.60-11.9)
WA-862,	12D	9.59±0.106	13.32±0.161	0.721±0.007	$4\frac{1}{8}$+	1.44±0.068	9.47±0.472
FMNH 212119		(9.0-10.5)	(12.7-14.2)	(0.674-0.752)	(4-$4\frac{3}{8}$-)	(1.0-1.9)	(7.11-12.9)
WA-863,	8D	9.03±0.170	12.50±0.169	0.722±0.014	$4\frac{1}{8}$	1.35±0.057	9.37±0.374
FMNH 212125		(8.4-9.7)	(11.9-13.2)	(0.683-0.789)	($3\frac{7}{8}$+-$4\frac{1}{4}$+)	(1.1-1.6)	(7.69-10.8)
WA-857,	8D	9.81±0.177	13.79±0.151	0.712±0.009	$4\frac{1}{8}$	1.58±0.062	8.86±0.371
FMNH 212103		(9.2-10.7)	(13.2-14.6)	(0.681-0.759)	($4\frac{1}{8}$–-$4\frac{1}{4}$)	(1.2-1.8)	(7.44-11.0)
WA-857,	5L	8.44±0.160	12.22±0.120	0.691±0.016	$3\frac{7}{8}$+	1.34±0.069	9.20±0.391
FMNH 212107		(8.0-8.8)	(12.0-12.6)	(0.661-0.733)	($3\frac{5}{8}$+-$4\frac{1}{8}$+)	(1.2-1.6)	(7.88-10.3)

Table 98: Local Variation in *Pleuroxia everardensis* (Bednall, 1892) and *P. carmeena* (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-854, FMNH 212094	6D	11.23±0.220 (10.4-11.8)	13.82±0.227 (12.8-14.5)	0.814±0.015 (0.752-0.855)	$4^{3}/_{8}$+ ($4^{3}/_{8}$– $4^{5}/_{8}$-)	0.75±0.076 (0.5-1.0)	19.4±0.980 (14.5-28)
WA-853, FMNH 212093	11D	9.89±0.148 (9.0-10.7)	12.21±0.160 (11.3-13.1)	0.810±0.007 (0.779-0.848)	$4^{3}/_{8}$+ ($4^{1}/_{4}$-$4^{5}/_{8}$-)	0.83±0.043 (0.6-1.0)	15.2±0.879 (11.0-20.8)
WA-847 FMNH 212071	5D	10.30±0.235 (9.9-11.2)	13.38±0.235 (12.5-13.8)	0.771±0.021 (0.732-0.842)	$4^{1}/_{4}$ (4-$4^{3}/_{8}$+)	1.12±0.086 (0.9-1.4)	12.2±0.821 (9.71-14.8)
P. carmeena							
Mt. Carmeena, WA-851, FMNH 212088	3L	13.03±0.418 (12.2-13.5)	15.37±0.203 (15.0-15.7)	0.848±0.017 (0.813-0.870)	$4^{3}/_{8}$ ($4^{1}/_{8}$-$4^{1}/_{2}$)	0.73±0.088 (0.6-0.9)	21.6±2.615 (17.1-26)
Thingoona, WA-855, FMNH 212096	3L	12.43±0.133 (12.3-12.7)	15.00±0.265 (14.6-15.5)	0.829±0.007 (0.819-0.842)	$4^{3}/_{8}$+ ($4^{1}/_{4}$-$4^{5}/_{8}$-)	0.97±0.120 (0.8-1.2)	16.0±2.097 (12.2-19.4)

Lateromarginal transition (**Plate 101b**) abrupt, enlargement of ectocone occurring on late laterals, endoconal development in actual transition zone. Jaw (**Plate 98a-c**) highly variable in form of ribs, but agreeing in considerable rib reduction on both side margins.

Discussion

Although I could not locate the three juvenile specimens reported by Riddle (1915: 771) from Moorilyanna Native Well (N of Mt. Illbillee), it is probable that these are examples of *Pleuroxia everardensis* (Hedley, 1905). Their supposed less elevated spire mentioned by Riddle (*loc. cit.*) would be a function of age.

All of the lots from Mt. Illbillee (**Table 98**) agree in having a narrowly open umbilicus, moderate spire elevation (mean H/D ratios of 0.689-0.731), and average 3 7/8 to 4 1/4 whorls with a mean diameter of 12.5 to 13.7 mm. Three populations (WA-853, WA-854, WA-847) from E or SE of Mt. Illbillee differ in shell diameter, proportions and umbilical width (**Table 98**). They are from under figs on more exposed and smaller rock masses than was the habitat of the Mt. Illbillee populations. They are smaller to slightly larger in diameter with 4 1/4 to 4 3/8+ mean whorl count, significantly higher spired (Mean H/D ratios 0.771-0.814) and with a significantly narrowed umbilicus. Well extended live adults were available from WA-847 and WA-853. Opening the side of the neck enabled determining that there were no penial differences from the Mt. Illbillee specimens, and thus they are classified as *P. everardensis* despite the shell variation. The reasons for the greater whorl count, which normally leads to both an increased H/D ratio and narrower umbilicus are unknown.

PLEUROXIA CARMEENA, SP. NOV.

(Plates 96b, 101c-d; Figs 258d-f, 263a-b)

Comparative remarks

Pleuroxia carmeena, new species, from the southern outlying peaks of the Everard Ranges, SA (**Map 2**) is characterized by its prominent red spiral bands, very narrow lip without any trace of a basal ridge, large size (mean diameter 15.05 mm), high spire (**Fig. 258e**, mean H/D ratio 0.844), and tiny umbilicus (**Fig 258f**, mean D/U ratio 17.6). *P. everardensis* (Bednall, 1892), from Mt. Illbillee to the north in the main Everard Ranges and then S of Robb Well and E of Mimili near the Everard Ranges, is more openly umbilicated (**Fig. 258c, Table 96**), smaller (mean diameter 13.07 mm), much less elevated (mean H/D ratio 0.731), and the basal lip has a distinct ridge (**Fig. 258b**). The Krichauff-James-McDonnell Ranges species *P. adcockiana* (Bednall, 1894) is similar in shell sculpture and colour, but differs in its much lower spire elevation (mean H/D ratio 0.641), and generally wider umbilicus. *P. radiata* (Hedley, 1905) from the Mann and Tomkinson Ranges to the W, lacks any trace of spiral banding, is much smaller in size (**Table 96**), has a widely open umbilicus (**Fig. 259c**), much stronger ribbing (**Plate 96c-e**), and prominent microsculpture on the shell spire (**Plate 96c-e**). Anatomically (**Figs 263a-b**), the very long and slender penis (P) with the epiphallus entering about the middle of the penis sheath (PS), longer vagina (V) and higher position of the spermathecal head (S) on the prostate-uterus easily separate *P. carmeena* from *P. everardensis* (**Figs 262a-b**) and *P. radiata* (**Figs 264a-b**) with their very short penes. *P. adcockiana* (**Figs 260a-c, 261a-b**) differs in its very short vagina (V) and simple structures inside the penis.

Holotype

SAM D17623, Sta. WA-851, valley on S side of Mt. Carmeena, Everard Ranges, South Australia, Australia (Everard 1:250,000 map sheet SG53-13 - 5545:6317yds). 27° 07' 54" S, 132° 25' 29" E. Collected by W. Ponder and W. Zeidler 4 May 1983. Height of shell 12.05 mm, diameter 15.15 mm, H/D ratio 0.795, whorls 4 1/4, umbilical width 0.7 mm, D/U ratio 21.6.

Paratopotypes

SAM D17624, WAM 172.84, AM, FMNH 212088-9, 2 LA, 1 DA, 14 LJ from the type locality.

Paratypes

South Australia:

EVERARD RANGES: Thingoona Hill (WA-855, outliers of, 3 LA, 1 DA, 3 DJ, SAM D17633, FMNH 212096-7).

Range

The two known localities, Mt. Carmeena and Thingoona Hill, are isolated, relatively large masses on the very south fringes of the Everard Ranges, SA (**Map 2**). They are separated by about 21 km.

Diagnosis

Shell large, diameter 14.1-15.7 mm (mean 15.05 mm), with 4 1/8 to 4 5/8- (mean 4 3/8+) normally coiled whorls. Apex and spire strongly elevated (**Fig. 258e**), shell height 12.2-13.5 mm (mean 12.70 mm), H/D ratio 0.829-0.879 (mean 0.844). Body whorl rounded, without angulation. Shell apex (**Plate 96b**) with dense pustulations, spire and body whorl with moderately prominent radial riblets, pustulations rare. Umbilicus (**Fig. 258f**) minute, nearly closed by reflection of columellar lip, width 0.6-1.1 mm (mean 0.90 mm), D/U ratio 12.2-26.1 (mean 17.6). Body whorl moderately descending behind aperture. Lip weakly expanded except umbilical portion, white, thin, basal section without knob or ridge (**Fig. 258f**). Parietal wall with very slight trace of a callus. Colour greenish yellow horn with two bright red spiral bands, a broader supraperipheral and a narrow subsutural. Based on eight measured adults.

Genitalia (**Figs 263a-b**) with head of spermatheca (S) above base of prostate-uterus, vagina (V) medium in length. Vas deferens (VD) and epiphallic caecum (EC) typical, epiphallus (E) enters middle of penis sheath (PS). Penis (P) very long, slender, internally (**Fig. 263b**) with typical sculpture.

Central and lateral teeth of radula (**Plate 101c**) with large basal ridge, moderate anterior flare, weak ectocone, and typical cusp structure. Lateromarginal transition

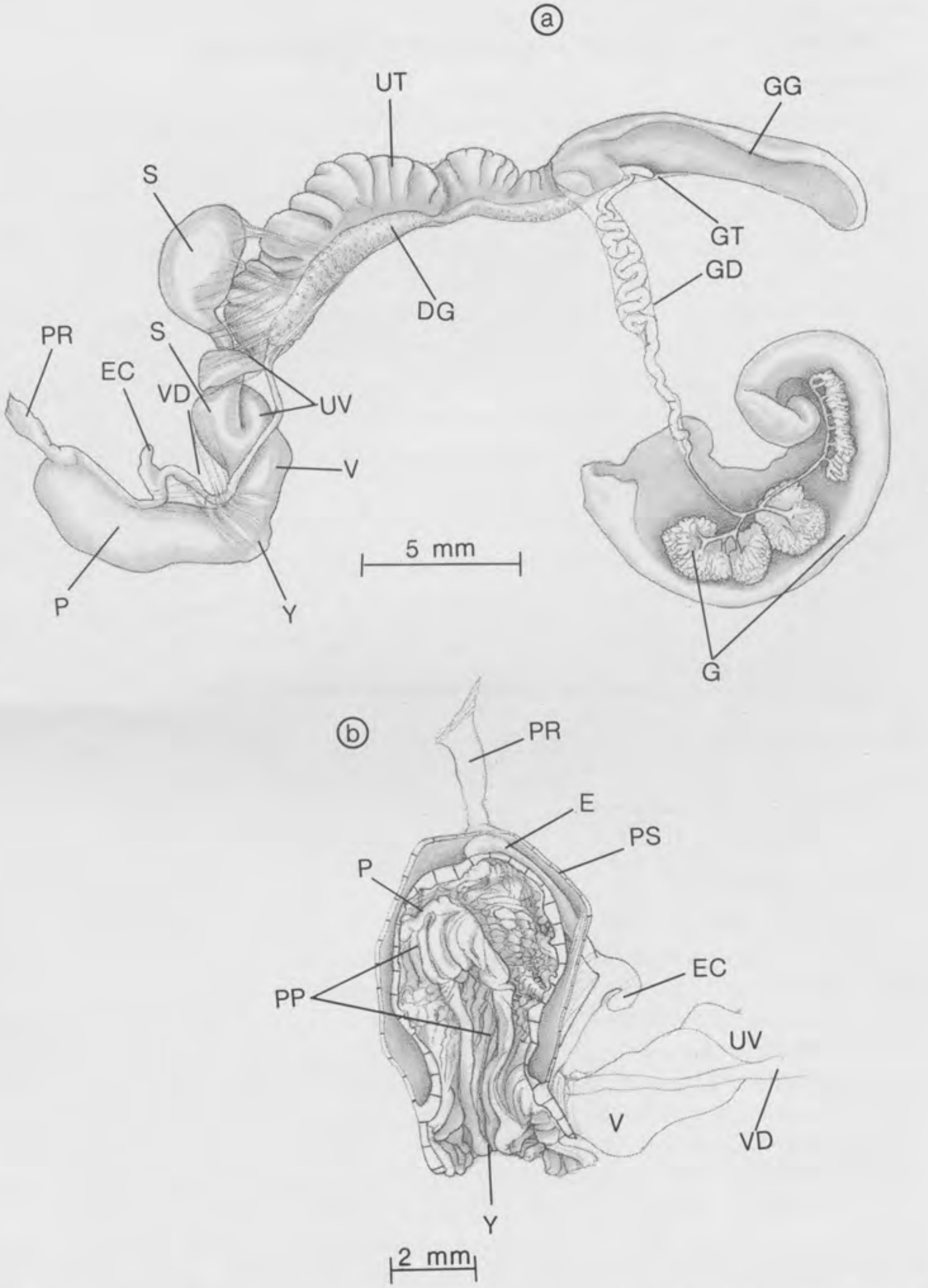


Fig. 263: Genitalia of *Pleuroxia carneema*, sp. nov.: Sta. WA-851, S side Mt. Carmeena, Everard Ranges, SA. 4 May 1983. FMNH 212088. (a) whole genitalia, Dissection B; (b) interior of penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

(**Plate 101d**) relatively gradual, ectocone enlarging on late laterals, endocone within transition zone. Jaw without unusual features, not illustrated.

Discussion

Collections in the plains areas a few km NE of Teeta Bore yielded only *Sinumelon pedasum* Iredale, 1937. Such hills as Eteamerta, Poole, Teeta, Arteinna, Etelerinna, Amoorinyinna, and Mt. Etitinna, which join Mt. Carmeena and Thingoona Hill in forming the southern edge of the Everard Ranges, have not been investigated for land snails. Collections from these areas can be expected to extend the range of *Pleuroxia carmeena* slightly. Northward extension is unlikely, since *Pleuroxia everardensis* (Bednall, 1892) inhabits the mass of Mt. Illbillee and also has been found on small hills (WA-853-4) along the track from Robb Well to Thingoona Hill.

The limited adult material from Mt. Carmeena and Thingoona Hill (**Table 98**) do not show any significant differences in size or shape.

The name *carmeena* is taken from the type locality, Mt. Carmeena on the S rim of the Everard Ranges.

PLEUROXIA RADIATA (HEDLEY, 1905)
(Plates 96c-e, 98d, 101e-f; Figs 259a-c, 264a-b)

Xanthomelon radiatum Hedley, 1905, Trans. Roy. Soc. South Austr., **29**: 163-164, pl. XXX, figs 4-6 - Mt. Davies, Tomkinson Range and Musgrave Range, Central Australia.

Pleuroxia radiata (Hedley), Iredale, 1937, South Austr. Nat., **18** (2): 49; Iredale, 1938, Austr. Zool., **9** (2): 106; Iredale, 1939, Jour. Roy. Soc. Western Austr., **25**: 57; Richardson, 1985, Tryonia, **12**: 254.

Comparative remarks

Pleuroxia radiata (Hedley, 1905), from the Tomkinson and Mann Ranges, SA (**Map 2**), is easily recognized by its small size (mean diameter 10.96 mm), low spire (**Fig. 259b**, mean H/D ratio 0.562), widely expanded lip (**Figs 259a-c**), simple and prominent radial ribs (**Plate 96c**), and absence of any spiral colour bands. The other Red Centre *Pleuroxia* are larger (**Table 96**), much higher spired (**Figs 257-258**), with two spiral colour bands, and generally much smaller umbilici. The broad and low radial ribs combined with widely (**Plate 96e**) scattered micropustulations on the spire, immediately separate *P. radiata* from any of the *Granulomelon* species with their dense pustulations (**Plates 102-103**) and very narrow to absent radial ribs on the spire and body whorl. *Pleuroxia abstans* Iredale, 1939, from the Murchiston River N of Geraldton, WA, is the most similar species, but differs in its much weaker sculpture, wider umbilicus, reduced parietal lip, and lower adult whorl count (mean 3 7/8+) (Solem, In preparation). Anatomically (**Figs 264a-b**), the very short and thick penis (P), very long vagina (V), higher position of the spermathecal head (S), and extremely large epiphallic caecum (EC) easily separate *P. radiata*. Within the penis chamber

(**Fig. 264b**), the very large U-pilaster with its greatly reduced connecting ridge, and lack of most other sculpture are equally characteristic. The other Red Centre species (**Figs 260-263**) are immediately separable by their much larger penes and short vaginae, plus different penis chamber sculpture.

Holotype

AM C.19231, Mt. Davies, Tomkinson Range, South Australia. Collected by Herbert Basedow in 1903. Height of shell 6.45 mm, diameter 12.0 mm, H/D ratio 0.538, whorls 4 1/4, umbilical width 1.4 mm, D/U ratio 8.57.

Paratypes

AM C.19231, 1 DA from the type locality.

Material studied

South Australia:

TOMKINSON RANGES: Mt. Davies outlier (WA-906, S facing hillside, 3 DA, 5 DJ, SAM D17632, FMNH 212294); Mt. Davies (H. G. Cogger! 1961, 44 DA, 8 DJ, AM C.95063); Gosse Pile (WA-905, isolated knob N of, 12 LA, 10 DA, 12 LJ, 5 DJ, WAM 176.84, SAM D17630-1, FMNH 212289-90).

MANN RANGES: Lake Wilson (WA-904, hills ca 22 km S of, W end Mann Ranges, 21 LA, 51 DA, 16 LJ, 26 DJ, WAM 173.84, WAM 175.84, SAM D17626-7, FMNH 212283, FMNH 212287; WA-903, Kapi Kunatjulda Soak, 20 km SW of Lake Wilson, 16 DA, 4 DJ, WAM 174.84, SAM D17629, FMNH 212280; WA-902, ridge 14 km S of Lake Wilson, 3 DA, 3 DJ, SAM D17628, FMNH 212277).

Range

The confirmed range of *Pleuroxia radiata* (Hedley, 1905) extends from Mt. Davies and Gosse Pile in the Tomkinson Ranges east to several areas SW of Lake Wilson in the Mann Ranges, SA (**Map 2**). Although Hedley (1905: 164) cited material from an unspecified locality in the Musgrave Ranges as this species, no specimens could be located confirming this record. The known east-west range is thus 129° 18' 18" E to 129° 34' 43" E, with a north-south range of only 26° 09' 06" S to 26° 10' 43" S, or an area of approximately 25 by 1 km.

Diagnosis

Shell small, adult diameter 9.65-12.7 mm (mean 10.96 mm), whorls 3 3/4+ to 4 3/4 (mean 4 3/8-). Spire moderately and evenly elevated (**Fig. 259b**), shell height 4.9-7.8 mm (mean 6.15 mm), H/D ratio 0.475-0.651 (mean 0.562). Body whorl rounded, without trace of keel or angulation. Shell apex (**Plate 96c-d**) with dense, crowded pustulations, which are reduced in size and widely scattered on spire and body whorl. Macrosculpture of broad, rounded, simple ribs on spire, becoming larger on body whorl, fairly widely spaced, continuing onto shell base without size reduction. Microsculpture (**Plate 96d-e**) of few pustules and periostracal ridgelets on spire and body whorl. Umbilicus (**Fig. 259c**) open, somewhat narrowed by reflection of lip, width 1.0-2.2 mm (mean 1.46 mm), D/U ratio 5.03-11.4 (mean 7.72). Body whorl not or at most slightly descending behind aperture. Lip well expanded, thickened,

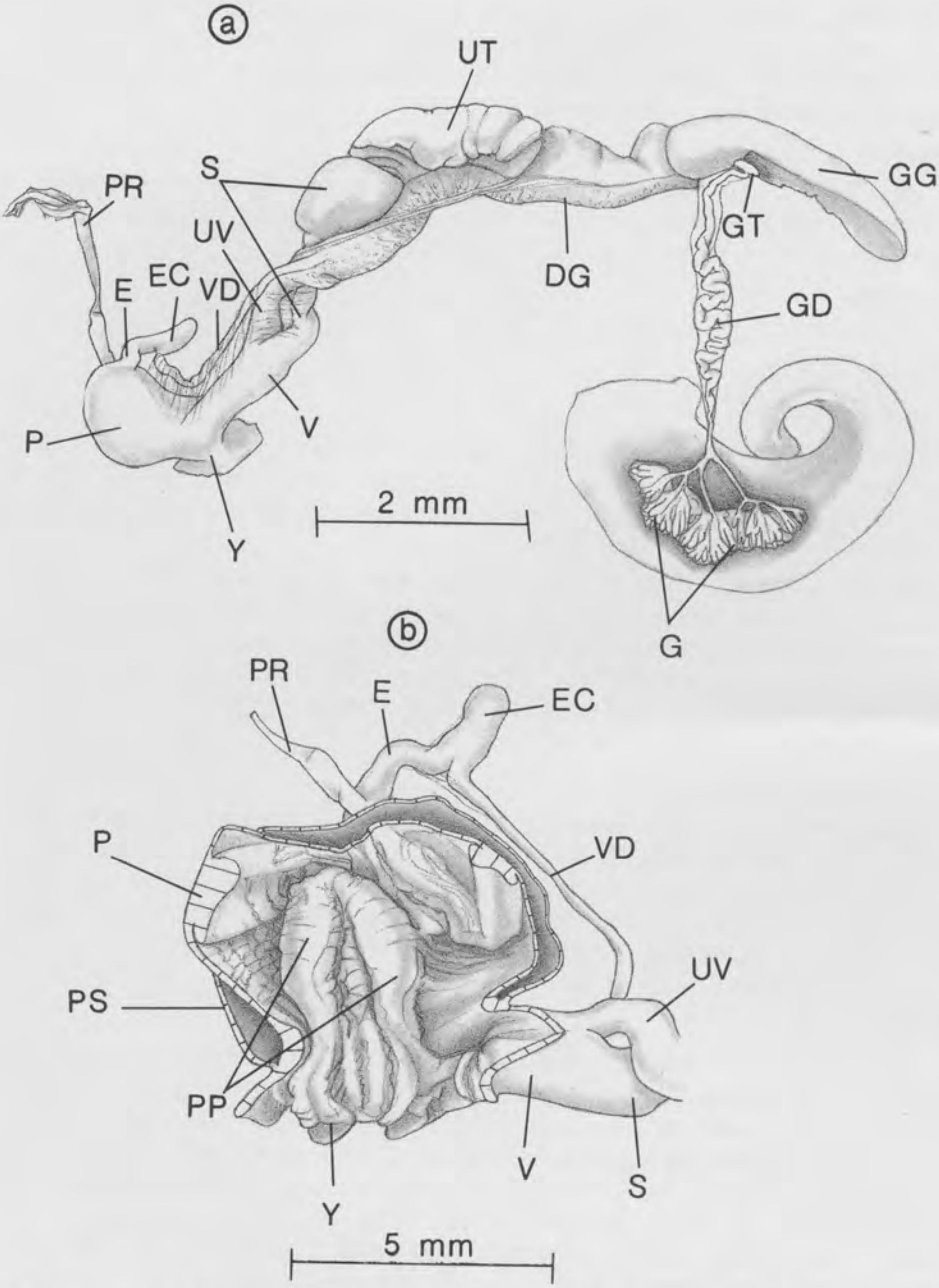


Fig. 264: Genitalia of *Pleuroxia radiata* (Hedley, 1905): Sta. WA-905, Gosse Pile, Tomkinson Range, SA. 13 May 1983. FMNH 212290. (a) whole genitalia, Dissection B; (b) interior of penis, Dissection C. Scale lines as marked. Drawings by Linnea Lahlum.

Table 99: Local Variation in *Pleuroxia radiata* (Hedley, 1905)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Tomkinson Ranges							
Mt Davies, WA-906, FMNH 212294	3D	6.00±0.252 (5.5-6.3)	11.33±0.318 (10.7-11.7)	0.529±0.008 (0.514-0.538)	$4^{1}/_{4}$- ($4^{1}/_{8}$-$4^{1}/_{4}$+)	1.60±0.000 (1.6-1.6)	7.08±0.199 (6.69-7.31)
Grosse Pile, WA-905, FMNH 212290	12L	5.81±0.130 (5.4-6.7)	10.63±0.116 (9.9-11.3)	0.547±0.011 (0.505-0.644)	$4^{1}/_{8}$- ($3^{3}/_{4}$+-$4^{3}/_{8}$-)	1.45±0.047 (1.2-1.7)	7.41±0.283 (5.94-9.42)
Grosse Pile, WA-905, FMNH 212289	10D	5.92±0.150 (5.1-6.7)	10.76±0.227 (9.7-11.8)	0.550±0.008 (0.521-0.594)	$4^{1}/_{4}$- ($4^{1}/_{8}$-$4^{3}/_{8}$+)	1.54±0.091 (1.2-2.2)	7.15±0.334 (5.27-8.67)
Mann Ranges							
22 km S of Lake Wilson, WA-904, FMNH 212283	21L	6.47±0.098 (5.5-7.1)	10.92±0.093 (10.1-11.5)	0.592±0.006 (0.545-0.651)	$4^{3}/_{8}$- (4-$4^{1}/_{2}$+)	1.34±0.050 (1.0-1.7)	8.41±0.353 (6.18-11.4)
22 km S of Lake Wilson, WA-904, FMNH 212287	51D	6.27±0.052 (5.5-7.2)	11.13±0.085 (10.0-12.7)	0.564±0.004 (0.513-0.636)	$4^{3}/_{8}$- ($4^{1}/_{8}$-$4^{3}/_{4}$)	1.50±0.016 (1.1-2.0)	7.57±0.128 (5.95-9.36)
20 km S of Lake Wilson, WA-903, FMNH 212280	16D	6.44±0.088 (5.7-7.0)	10.54±0.114 (9.8-11.4)	0.611±0.005 (0.579-0.640)	$4^{3}/_{8}$- ($4^{1}/_{8}$-$4^{1}/_{2}$)	1.16±0.27 (1.0-1.4)	9.12±0.190 (7.57-10.2)
14 km S of Lake Wilson, WA-902, FMNH 212277	3D	7.20±0.600 (6.0-7.8)	11.90±0.306 (11.3-12.3)	0.603±0.036 (0.531-0.645)	$4^{1}/_{2}$+ ($4^{3}/_{8}$-$4^{3}/_{4}$-)	1.23±0.088 (1.1-1.4)	9.73±0.659 (8.79-11.0)
Mt. Davies, AM C.95063	44D	5.85±0.052 (4.9-6.8)	10.99±0.067 (9.65-11.6)	0.532±0.004 (0.475-0.599)	$4^{3}/_{8}$- ($4^{1}/_{8}$–$4^{5}/_{8}$+)	1.57±0.031 (1.1-1.9)	7.15±0.153 (5.03-9.75)

parietal wall usually with a thick callus. Shell colour yellow-brown without any spiral red bands. Based on 160 measured adults.

Genitalia (**Figs 264a-b**) with very long vagina (V), typical free oviduct (UV), head of spermatheca (S) extending further up prostate-uterus than in other species. Vas deferens (VD) entering proportionately large epiphallic caecum (EC) at obtuse angle. Epiphallus (E) slender, entering penis sheath (PS) apically. Penis (P) very short and thick, much shorter than vagina, internally (**Fig. 264b**) with wall sculpture reduced, but arms of U-pilaster very large, upper connecting section reduced to absent.

Central and lateral teeth of radula (**Plate 101e**) with large basal ridge, moderate anterior flare, typical cusp shaft angle, blunt tip with some cusp curvature, ectocone minute. Early marginals (**Plate 101f**) with ectocone enlarged, mesocone greatly reduced, sharp endocone developed, base greatly shortened, and anterior flare nearly lost. Jaw (**Plate 98d**) with low, broad ribs continuing to side margins.

Discussion

Pleuroxia radiata (Hedley, 1905) is the smallest of the SA *Pleuroxia* and also differs in its simple ribbing. The Flinders Ranges taxa are either smooth (*italowieana*) or with anastomosing ribs and dense pustules (*cyrtopleura, phillipsiana*), and the Nullarbor taxa (*polypleura, oligopleura*) also have the dense sculpture and anastomosing major ribs. The other Red Centre taxa have three spiral colour bands, a much less expanded lip, and less prominent sculpture.

Size variation in *Pleuroxia radiata* is minor (**Table 99**). There is no obvious geographic pattern, and live examples are very slightly smaller than dead specimens.

Enough collecting has been done in both the Mann Ranges to the E and in the ranges W of the WA border to suggest that *radiata* will not be shown to have a much larger E-W distribution than has been documented here. There should be a modest N-S increase as the hills on either side of the main road are investigated for land snails.

GENUS *GRANULOMELON* IREDALE, 1933

Granulomelon Iredale, 1933, Rec. Austr. Mus., **19** (1): 51; Iredale, 1937, South Austr. Nat., **18** (2): 46; Iredale, 1938, Austr. Zool., **9** (2): 105; Burch, 1976, Jour. Malac. Soc. Austr., **3** (3): 135; Richardson, 1985, Tryonia, **12**: 150.

Shell medium in size, adult diameters 8.0-15.65 mm, whorl counts 3 7/8- to 4 3/4+. Spire either nearly flat (*arcigerens*) or strongly and evenly elevated (*gilleni, granditu-berculatum, acerbum*), H/D ratios 0.458-0.993. Apical sculpture of dense micropustulations (**Plates 102a, c, 103a, c**) that continue onto the spire and body whorl, becoming larger and ovate (*arcigenens, gilleni, grandituberculatum*, **Plates 102b, d, e, 103b**) or triangular and pointed (*acerbum*, **Plate 103e**). Spire and body whorl with sculpture of high, anastomosing radial ribs (*arcigerens, gilleni,* **Plate 102a-e, Figs 265a-f**); low ridgelets or minor ribs (*grandituberculatum*, **Plate 103a-b**); or without any radial elements (*acerbum*, **Plate 103c-d**). Body whorl rounded in high spired species, angulated in the nearly flat spired *arcigerens*, usually descending at least moderately just behind aperture. Umbilicus open, slightly narrowed by columellar lip expansion, widest in *arcigerens*. Lip expansion narrow, colour white, parietal wall usually with a free lip edge except in many *grandituberculatum*. Ground colour light greenish yellow, with prominent red spiral bands - subsutural, supraperipheral, and subperipheral in all species, latter reduced in some *gilleni* and *arcigerens*.

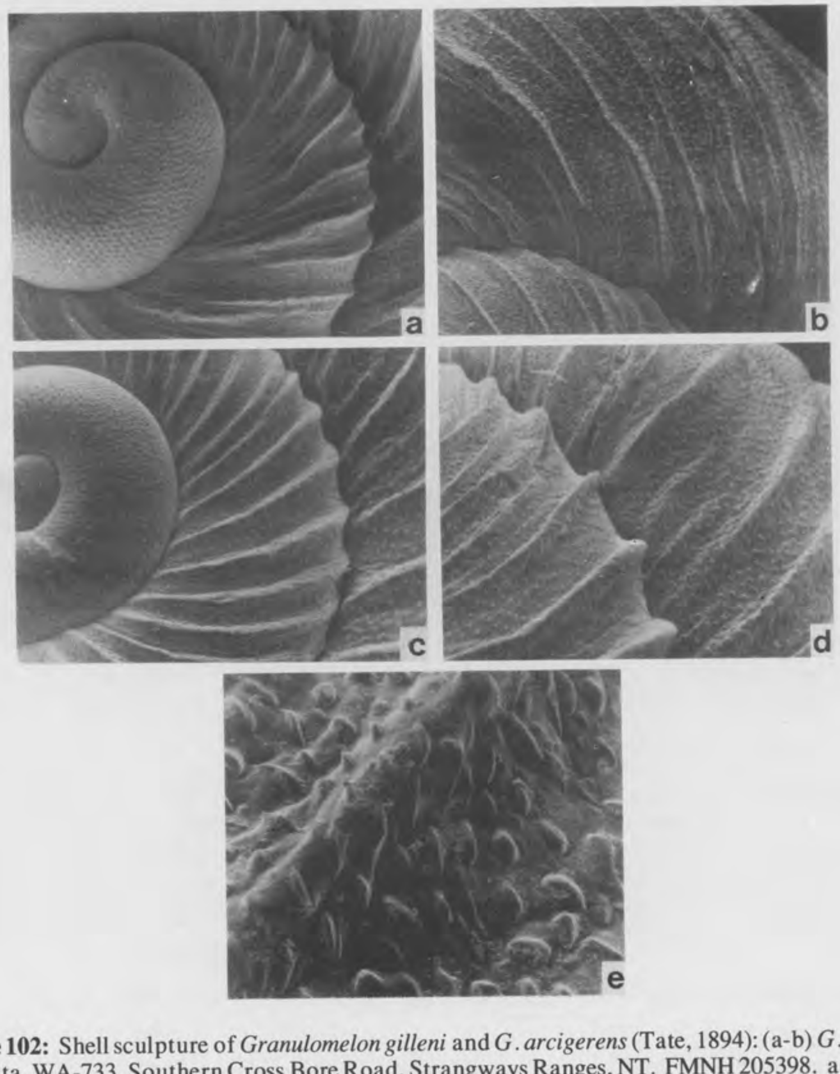


Plate 102: Shell sculpture of *Granulomelon gilleni* and *G. arcigerens* (Tate, 1894): (a-b) *G. gilleni*. Sta. WA-733, Southern Cross Bore Road, Strangways Ranges, NT. FMNH 205398. a is apex and early spire at 16.6X, b is detail of early and mid spire at 15.9X; (c-e) *G. arcigerens*. Finke Gorge, MacDonnell Ranges, NT. FMNH 219031. c is apex and early spire at 17.3X, d is lower spire and body whorl at 14.7X, e is microsculpture between two ribs on body whorl at 75X.

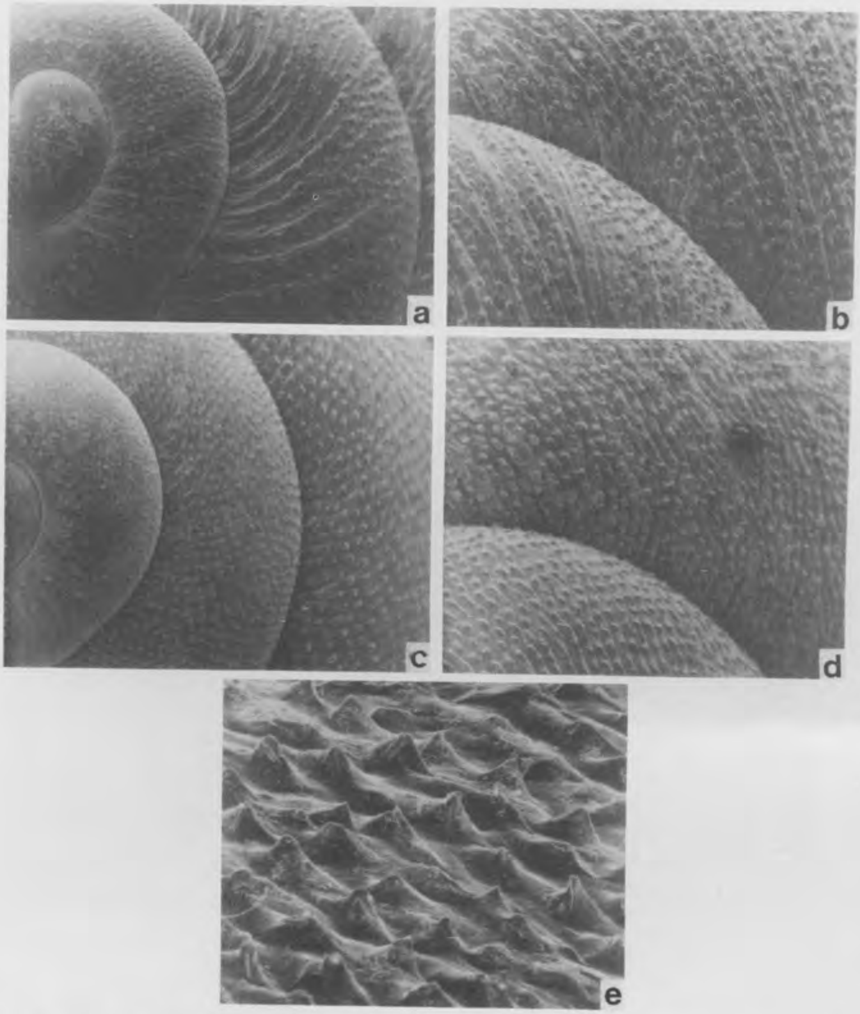


Plate 103: Shell sculpture of *Granulomelon grandituberculatum* (Tate, 1894) and *G. acerbum*: (a-b) *G. grandituberculatum*. Florence Creek, Hale River, NT. FMNH 198935. a is apex and early spire at 19.8X, b is microsculpture on lower spire and body whorl at 16.6X; (c-e) *G. acerbum*. Bitter Springs Gap, MacDonnell Ranges, NT. FMNH 198961. c is apex and early spire at 19.7X, d is detail of lower spire and body whorl at 19.8X, e is miscrosculpture on body whorl at 72X.

Live specimens aestivate sealed to large rocks, usually well above litter or dirt layer.

Genitalia (**Figs 267-271**) with modified typical Sinumeloninae structures. Penis sheath (PS) reduced to a thin membrane (omitted by accident from **Figs 267, 269-271**); penis (P) varies from short and globular (*grandituberculatum, acerbum*) to elongated (*arcigerens*, *gilleni*); U-pilaster (PP) reduced in prominence, accessory ridge area expanded, small area of corrugated folds around epiphallic pore; free oviduct (UV) sometimes (*grandituberculatum*) very long, vagina (V) ranging from short (*gilleni*) to long (*acerbum*). Head of spermatheca (S) variable in position, situated just above base of prostate-uterus (*grandituberculatum*) to reaching middle of prostate-uterus (*acerbum*, *gilleni*), shaft very slender and not wrapped around free oviduct.

Jaw (**Plate 104**) with variable rib numbers and prominence, some lateral rib reduction. Radular teeth (**Plates 105-106**) generalized, slight curve to cusp tip. Lateromarginal transition abrupt. Marginals typical. Lateral teeth 10-12, marginals 26-28 in adult specimens.

Type species: *Hadra grandituberculata* Tate, 1894 by original designation.

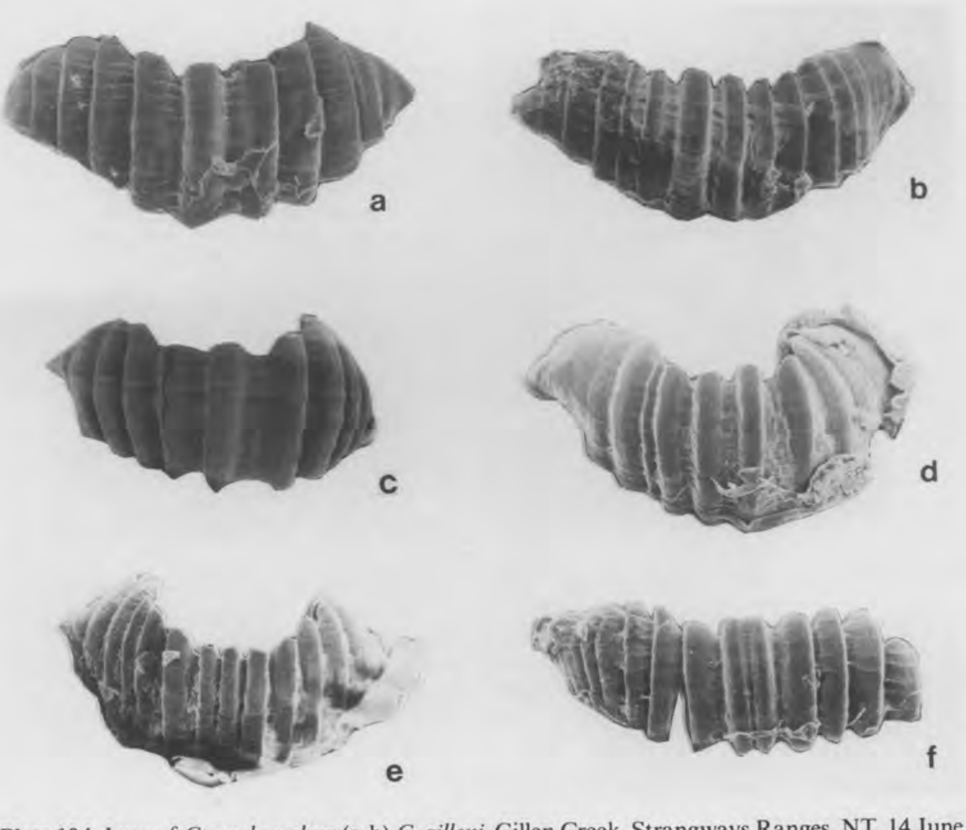


Plate 104: Jaws of *Granulomelon*: (a-b) *G. gilleni*. Gillen Creek, Strangways Ranges, NT. 14 June 1979. AM C.115785, a is Dissection A at 61X, b is Dissection B at 54X; (c) *G. grandituberculatum* (Tate, 1894). Florence Creek, Hale River, NT. 25 June 1978. FMNH 198944, Dissection B at 59X; (d-f) *G. acerbum*. (d-e) Sta. 35, Ross River, MacDonnell Ranges, NT. 21 May 1977. MV. d is at 57X, e is at 53X; (f) Bitter Springs Gap, MacDonnell Ranges, NT. 26 June 1978. FMNH 198973, Dissection A at 58X.

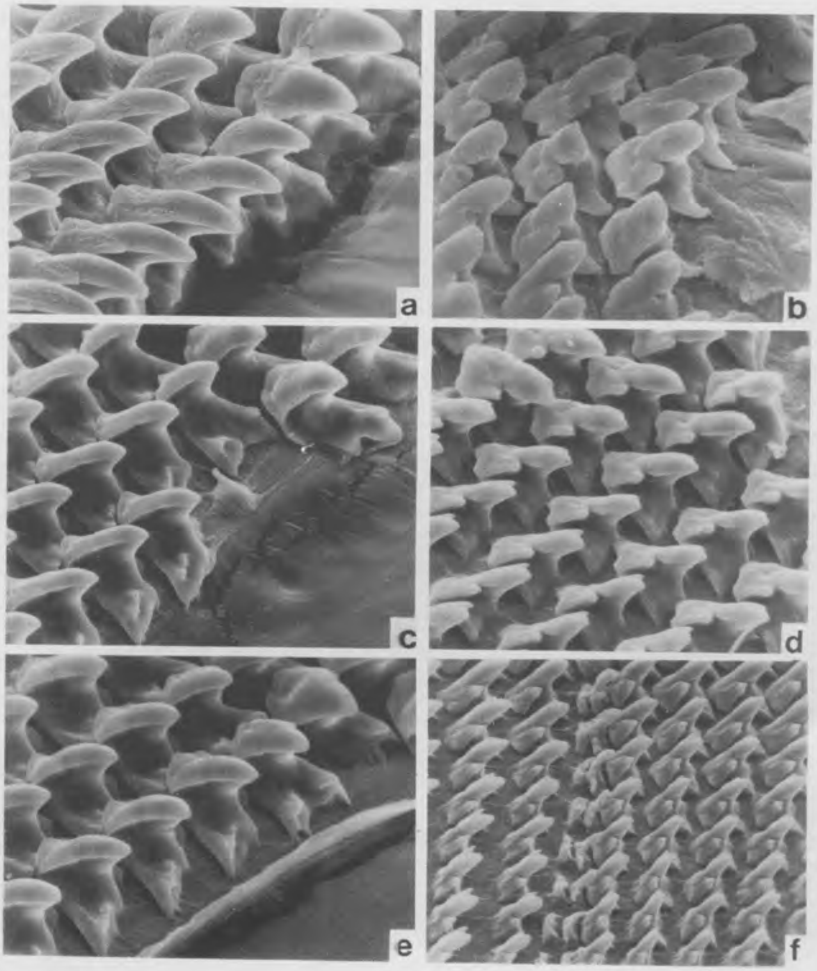


Plate 105: Radular teeth of *Granulomelon gilleni* and *G. grandituberculatum* (Tate, 1894): (a-b) *G. gilleni.* Gillen Creek, Strangways Ranges, NT. 14 June 1979. AM C.115785, Dissection B. a is central and early laterals at 710X, b is lateromarginal transition from worn area, anterior end of radula at 710X; (c-f) *G. grandituberculatum.* Florence Creek, Hale River, NT. 25 June 1978. FMNH 198944, c is Dissection A, central and early laterals at 610X, d is Dissection A, lateromarginal transition at 610X, e is Dissection B, central and early laterals at 690X, f is Dissection A, early marginals before and after deformed rows at 460X.

Comparative remarks

Granulomelon is the ecological equivalent of *Pleuroxia* as the latter genus lives in the Flinders Ranges and Nullarbor fringes, *i. e.*, a rock sealer partial to large boulders. In contrast, the Red Centre *Pleuroxia* (see above) are litter dwellers, usually under figs. The coarse sculpture of *G. argicerens* (Tate, 1894) and *G. gilleni*, sp. nov.

(**Plate 102a-f, Figs 265a-f**) agrees with that of many southern *Pleuroxia* and contrasts with Red Centre *Pleuroxia* with their weak radial sculpture (**Plates 95-96**).

Separation of *Granulomelon* as a genus is based on its altered genitalia (slender spermathecal shaft that does not wrap around the free oviduct, altered position of the spermathecal head, usually globular penis with major increase in accessory ridge area, near loss of the penis sheath), changed shell form (high spired except for *arcigerens*, generally free parietal lip, presence of three colour bands), and specialized aestivation site (large boulders rather than small rocks or wood).

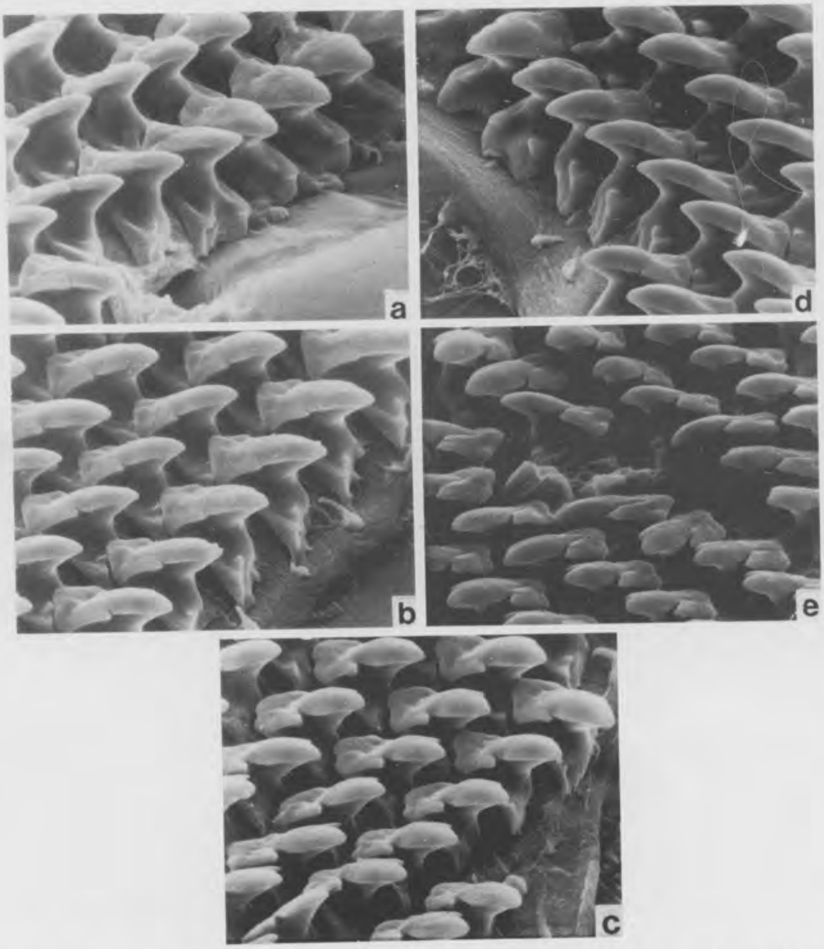


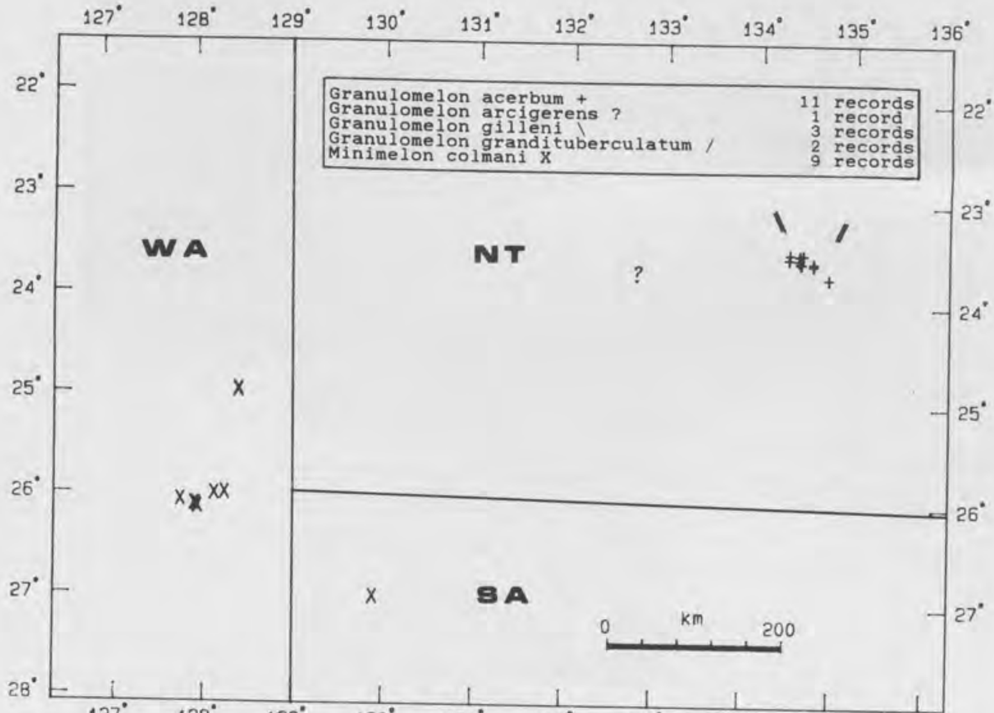
Plate 106: Radular teeth of *Granulomelon acerbum:* (a-c) Sta. 35, Ross River, MacDonnell Ranges, NT. 21 May 1977. MV. a is Dissection A, central and early laterals at 690X, b is Dissection B, mid laterals at 740X, c is Dissection B, lateromarginal transition at 740X; (d-e) Bitter Springs Gap, MacDonnell Ranges, NT. 26 June 1978. FMNH 198973, Dissection A. d is central and early laterals at 690X, e is lateromarginal transition at 570X.

Previous studies

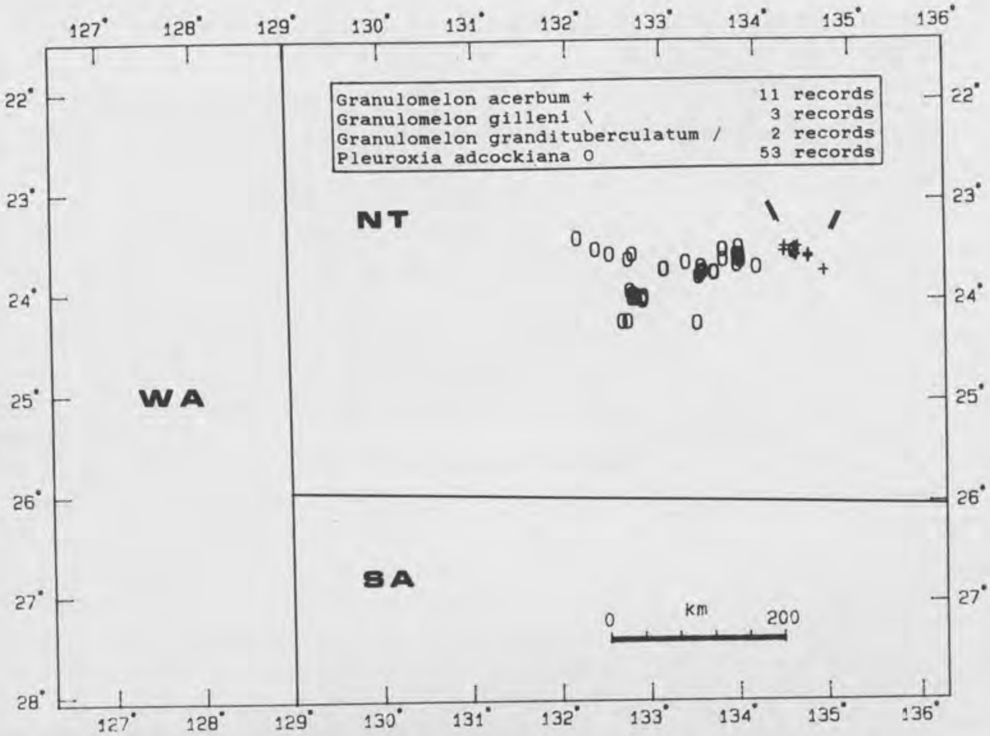
Tate (1894) described two (*arcigerens*, *grandituberculatum*) of the four species, illustrating them two years later (Tate, 1896). The former species has been consistently placed in *Pleuroxia* subsequently. Iredale (1933) gave a barely adequate diagnosis of the genus *Granulomelon* and placed the second species as its monotype. Subsequent listings by Iredale (1937b, 1938) and Richardson (1985) added no new information.

Distribution and comparative ecology

The four known species are allopatric (**Maps 3-4**), living in separate drainage systems. *G. arcigerens* (Tate, 1894) has been described from the Finke River Gorge S of Glen Helen, MacDonnell Ranges. No traces of this species, or derivatives, have been found in the Krichauff or James Ranges, through which the Finke River passes to the S before curving SE into the Simpson Desert. *G. gilleni*, sp. nov., has been collected along a tributary of Gillen Creek, Strangways Ranges, which flows NE to eventually join the Sandover River. *G. grandituberculatum* (Tate, 1894) lives on the southern outliers of the Harts Ranges, in the basin of Maud and Florence Creeks,



Map 3: Records of *Granulomelon acerbum*, *G. gilleni*, *G. grandituberculatum* (Tate, 1894), and *Minimelon colmani* in the Red Centre. The "?" indicates the probable locality for *G. arcigerens* (Tate, 1894).



Map 4: Records of *Granulomelon acerbum*, *G. gilleni*, *G. grandituberculatum* (Tate, 1894), and *Pleuroxia adcockiana* (Bednall, 1894) in the NT.

which merge and then join the Hale River which continues SE into the Simpson Desert. *G. acerbum*, sp. nov., lives in the Mt. Benstead-Ross River-Goat Camp Creek system, tributaries of the Todd River, which also flows independently into the Simpson Desert. There are no indications of past stream capture involving these seasonal stream systems.

The *Granulomelon* habit of sealing to large boulders, usually well above the dirt or litter line, makes it unlikely that they would be accidentally transported by floods. The seal to the rock is firm enough that a number of shells broke or were crushed during attempts to pry them loose from the boulders. Specimens were often locally abundant.

KEY TO THE SPECIES OF *GRANULOMELON*

1. Spire markedly elevated (**Figs 265e, 266b, e**); found E of Alice Springs 2

   Spire barely elevated (**Fig. 265b**); Finke River Gorge below Glen Helen, MacDonnell Ranges *Granulomelon arcigerens* (Tate, 1894) (p. 1048)

2. Shell with prominent radial ribs (**Figs 265d-f**); Strangways Range, NE of Alice Springs

Granulomelon gilleni, sp. nov. (p. 1053)

Shell with at most weak radial ridglets (**Plate 103a-b**) 3

3. Shell with weak radial ridgelets (**Plate 103a-b**); S side of Harts Ranges

Granulomelon grandituberculatum (Tate, 1894) (p. 1056)

Shell without any radial ridgelets (**Plate 103c-e**); MacDonnell and Fergusson Ranges

Granulomelon acerbum, sp. nov. (p. 1061)

GRANULOMELON ARCIGERENS (TATE, 1894)
(Plate 102c-e; Figs 265a-c)

Hadra arcigerens Tate, 1894, Trans. Roy. Soc. South Austr., **18**: 193 - Central Australia.

Angasella arcigerens (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 192-193, pl. XIX, figs 27a-c - on the southern slope of the escarpment, bounding Horn Valley on the south, at the Finke Gorge on its eastern side, Central Australia; Gude, 1916, Proc. Malac. Soc., London, **12**: 42 - comparison with a new species.

Xanthomelon arcigerens (Tate), Hedley, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 225, fig. M (penis complex).

Pleuroxia arcigerens (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 48; Iredale, 1938, Austr. Zool., **9** (2): 106; Cotton, 1939, South Austr. Nat., **20** (1): 4 - comparison with a new species; Richardson, 1985, Tryonia, **12**: 253.

Comparative remarks

Granulomelon arcigerens (Tate, 1894), known only from the Glen Helen gorge of the Finke River, NT (**Map 3**), differs from *G. gilleni*, sp. nov., from the SE tip of the Strangways Range, in its nearly flat spire (compare **Figs 265b, e**), wider umbilicus (**Figs 265c, f**), more widely spaced sculpture (**Figs 265a-f, Plate 102a-e**), and larger size (**Table 96**). The very narrow and irregular nature of the ribbing separates both species from any of the Red Centre *Pleuroxia*. The very high spired *Granulomelon grandituberculatum* (Tate, 1894) (**Fig. 266b**) has only traces of radial ribbing (**Plate 103a-b**). The equally high spired *G. acerbum*, sp. nov. (**Fig. 266e**) has no trace of radial ribbing (**Plate 103c-d**) on the spire and body whorl. The prominent red spiral colour bands and narrow umbilicus of *G. arcigerans* (**Figs 265b-c**) at once separate this species from the equally flat spired, but bandless and much more widely umbilicated Flinders Ranges species *Pleuroxia cyrtopleura* (Pfeiffer, 1862) (Solem, 1992a: Fig. 71) and Nullarbor fringe species *Pleuroxia oligopleura* (Tate, 1894) Solem, (In preparation). Anatomy with short, stout penis (Hedley, 1896: 225, fig M).

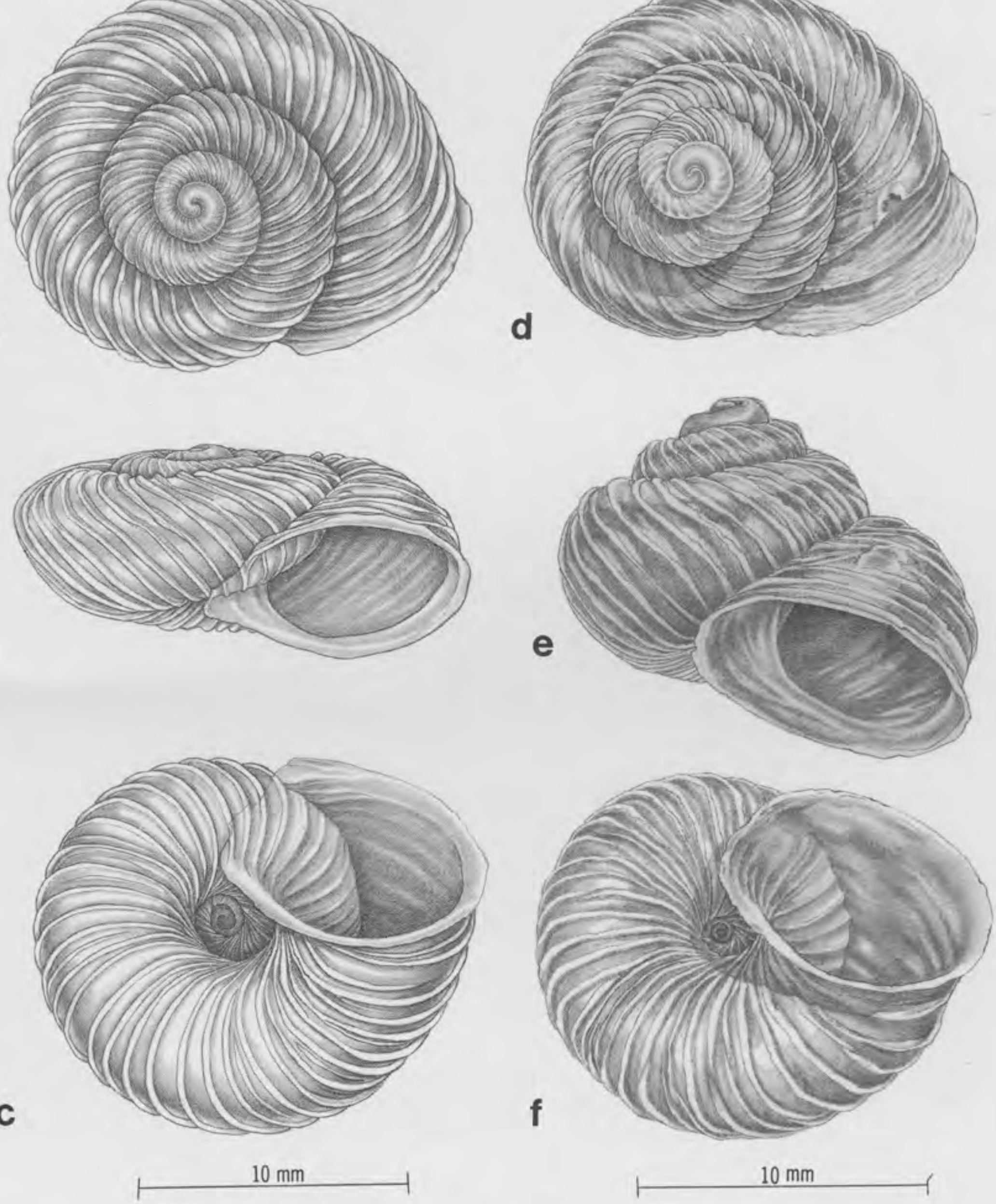


Fig. 265: Shells of *Granulomelon arcigerens* (Tate, 1894) and *G. gilleni*, sp. nov.: (a-c) *G. arcigerens*. Finke Gorge, NT. AM C.1, type lot example; (d-f) *G. gilleni*. Gillen Creek tributary, Southern Cross Bore, Strangways Range, NT. Holotype. AM C.115785. Scale lines equal 10 mm. Drawings by Linnea Lahlum.

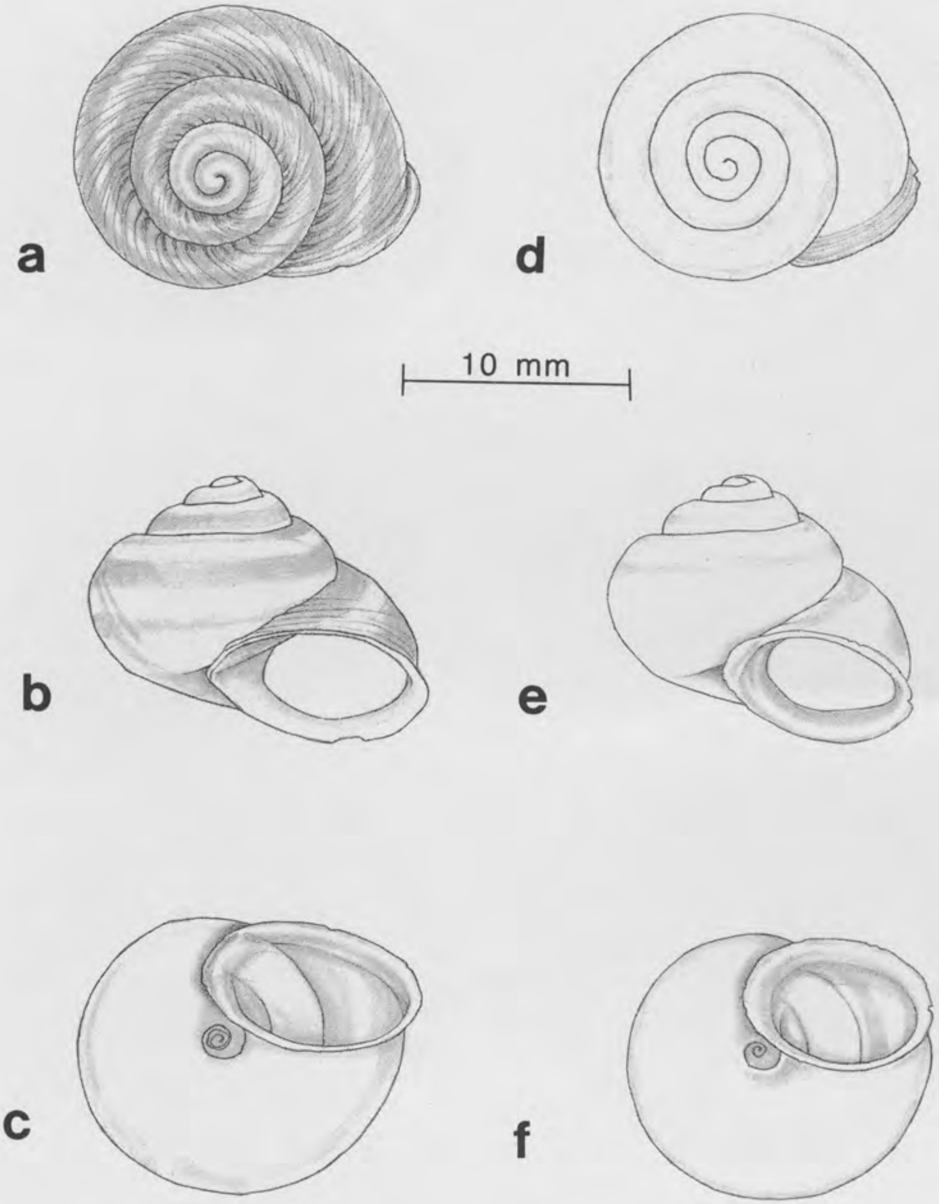


Fig. 266: Shells of *Granulomelon grandituberculatum* (Tate, 1894) and *G. acerbum*, sp. nov.: (a-c) *G. grandituberculatum*. Florence Creek, Hale River, Harts Ranges, NT. FMNH 198935; (d-f) *G. acerbum*. Paratype. Bitter Springs Gap, Ross River, MacDonnell Ranges, NT. FMNH 198961. Scale line equals 10 mm. Drawings by Linnea Lahlum.

Holotype

SAM D13605, Central Australia. Collected by the Horn Expedition. Height of shell 9.15 mm, diameter 18.3 mm, H/D ratio 0.500, whorls 4 1/2, umbilical width 3.5 mm, D/U ratio 5.23.

Type lot

Finke River (2 DA, SAM D15572); Glen Helen Gorge (11 DA, 5 DJ, SAM); "Horn Expedition" (21 DA, 8 DJ, SAM); Central Australia (1 DA, FMNH 171512); no locality (4 DA, MV F7608); Finke Gorge (1 DA, FMNH 219031, 3 DA, 1DJ, AM C.1).

Range

Only the type collection, from the Finke River Gorge south of Glen Helen, MacDonnell Ranges, NT (**Map 3**) is known.

Diagnosis

Shell large, adult diameter 16.0-19.0 mm (mean 17.43 mm), with 4 1/8+ to 4 5/8 (mean 4 3/8) normally coiled whorls. Spire flat to slightly elevated (**Fig. 265b**), shell height 8.0-10.4 mm (mean 9.28 mm), H/D ratio 0.458-0.619 (mean 0.533). At least early portion of body whorl with high, obtusely angulated periphery. Shell apex (**Plate 102c**) with dense micropustulations, becoming organized into rows, continuing onto spire and body whorl (**Plate 102c-e**) as enlarged, irregular ovate projections. Spire and body whorl (**Figs 265a-c; Plate 102c-e**) with narrow, sometimes anastomosing, irregularly spaced, very prominent radial ribs. Umbilicus (**Fig. 265c**) open, last whorl decoiling more rapidly, at most slightly narrowed by expansion of columellar lip, width 2.0-3.85 mm (mean 3.19 mm), D/U ratio 4.43-9.03 (mean 5.57). Body whorl sharply deflected just behind aperture (**Fig. 265b**). Lip narrow, thin, gradually expanded, parietal lip varying from heavy callus to raised free edge. Subsutural and supraperipheral red spiral colour bands more prominent than the subperipheral band. Based on 44 measured adults.

Anatomy basically unknown. An early illustration (Hedley, 1896: 225, fig. M) shows a penis of intermediate length, the epiphallus entering the penis sheath apically, and the vas deferens-epiphallic caecum-epiphallus junction that typifies the Sinumeloninae.

Discussion

Tate (1896: 193) reported that *Granulomelon arcigerens* was found "On the southern slope of the escarpment, bounding Horn Valley on the south, at the Finke Gorge on its eastern side. Dead shells in vast abundance, but only a few individuals taken alive beneath the large loose blocks of sandstone after a couple of hour's toil." This locality probably is some 4-5 km S of Glen Helen Tourist Camp through the Finke Gorge, located approximately at 23° 43' 30" S and 132° 40' E. My only visit to Glen Helen, March 1974, was during the wet season in an ordinary vehicle. Passage through the Finke Gorge was not practical. Collecting live material of this species thus is left to others. The minor differences in size and shape (**Table 100**) between two lots in the SAM collection, reflect differential use in exchange activity over the years.

Table 100: Local Variation in *Granulomelon arcigerens* (Tate, 1894) and *G. gilleni*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
G. arcigerens (Tate, 1894)							
Horn Expedition, SAM	21D	9.37±0.133 (8.25-10.3)	17.48±0.149 (16.4-19.0)	0.536±0.008 (0.485-0.608)	$4^{3}/_{8}+$ ($4^{1}/_{8}+-4^{5}/_{8}$)	3.20±0.099 (2.3-3.85)	5.58±0.182 (4.44-7.63)
Glen Helen Gorge, SAM	11D	9.55±0.173 (8.4-10.4)	17.09±0.217 (16.0-18.5)	0.560±0.012 (0.483-0.619)	$4^{3}/_{8}+$ ($4^{1}/_{4}--4^{5}/_{8}$)	3.22±0.103 (2.6-3.75)	5.35±0.156 (4.64-6.50)
G. gilleni							
AM C.115785	13L&D	12.75±0.194 (11.15-13.9)	15.81±0.192 (14.84-16.75)	0.806±0.010 (0.744-0.858)	$4^{3}/_{8}-$ ($4^{1}/_{8}+-4^{1}/_{2}$)	2.42±0.048 (2.1-2.7)	6.55±0.123 (5.70-7.55)
WA-734, FMNH 205409	33L	12.46±0.124 (10.8-14.0)	15.58±0.108 (14.4-17.1)	0.800±0.006 (0.745-0.860)	$4^{1}/_{4}-$ ($3^{7}/_{8}+-4^{1}/_{2}-$)	2.05±0.023 (1.8-2.3)	7.62±0.089 (6.61-8.78)
WA-734, FMNH 205410	9D	12.47±0.162 (11.7-13.1)	15.70±0.248 (14.8-17.0)	0.795±0.014 (0.753-0.878)	$4^{1}/_{4}-$ ($4-4^{3}/_{8}+$)	2.04±0.044 (1.9-2.3)	7.69±0.124 (7.23-8.25)
WA-733, FMNH 205398	35L	11.31±0.084 (9.7-12.1)	14.90±0.078 (14.0-15.8)	0.759±0.006 (0.678-0.850)	4+ ($3^{3}/_{4}-4^{1}/_{4}+$)	1.98±0.038 (1.3-2.4)	7.65±0.177 (6.33-11.7)
WA-733, FMNH 205399	29D	11.25±0.107 (10.2-12.4)	15.33±0.087 (14.6-16.3)	0.734±0.007 (0.662-0.797)	$4^{1}/_{8}-$ ($3^{3}/_{4}+-4^{1}/_{4}+$)	2.13±0.039 (1.7-2.7)	7.27±0.118 (6.04-9.18)

The only available anatomical data shows (Hedley, 1896: 225, fig. M) a penis that is intermediate in length between that of *G. acerbum* (**Figs 269a, 270a**) and *G. gilleni* (**Fig. 267a**), with apical entry of the epiphallus into the penis sheath. The internal structures of the penis and lengths of the terminal female organs are unknown.

GRANULOMELON GILLENI, SP. NOV.
(Plates 102a-b, 104a-b, 105a-b; Figs 265d-f, 267a-b)

Comparative remarks

Granulomelon gilleni, sp. nov., from near Southern Cross Bore in southeastern outliers of the Strangways Range, NT (**Maps 3-4**), is characterized by its very prominent radial sculpture (**Figs 265d-f**). The radial sculpture is greatly reduced in *G. grandituberculatum* (Tate, 1894) (**Plate 103a-b**) and absent in *G. acerbum* (**Plate 103c-e**), the other high spired species. The other species with heavy radial sculpture, *G. arcigerens* (Tate, 1894) (**Figs 265a-c**), differs in its nearly flat spire. Anatomically (**Figs 267a-b**), *G. gilleni* has the vagina (V) and free oviduct (UV) nearly equal in length, the spermathecal head (S) reaching to the middle of the prostate-uterus, and a long, slender penis (P). *G. grandituberculatum* (Tate, 1894) (**Figs 268a-b**) has a short vagina (V), very long free oviduct (UV), the spermathecal head (S) near the base of the prostate-uterus, and a very short, nearly globular penis (P). *G. acerbum* (**Figs 269-271**) also has the short penis (P), while the vagina (V) and free oviduct (UV) are moderately elongated.

Holotype

AM C.115785, tributary of Gillen Creek, S of Southern Cross Bore along track between Plenty Highway and Claraville, Strangways Range, NE of Alice Springs, Northern Territory, Australia. 23° 13' S, 134° 15' E. Collected by Phil Colman 14 June 1979. Height of holotype 13.4, diameter 16.0, H/D ratio 0.838, whorls 4 3/8, umbilical width 2.1 mm, D/U ratio 7.62.

Paratopotypes

AM C.115785, FMNH 215434, 5 LA, 5 DA, 37 DJ and embryos from the type locality.

Paratypes

Northern Territory

STRANGWAYS RANGE: Southern Cross Bore track (WA-733, 2.2 km N of The Garden Road, 35 LA, 29 DA, 12 LJ, 22 DJ, SAM D17692-3, WAM 208-9.84, AM, FMNH 205398-9; WA-734, 2.7 km N of WA-733, 33 LA, 9 DA, 31 LJ, 2 DJ, SAM D17690-1, WAM 206-7.84, AM, FMNH 205409-10).

Range

Granulomelon gilleni, new species, is known from SE outliers of the Strangways Range, just S of Southern Cross Bore, NNE of Alice Springs, NT (**Maps 3-4**). The total known range is slightly more than 5 km, but undoubtedly will be extended when collecting is done in the main part of the Strangways Range.

Diagnosis

Shell of average size, adult diameter 14.0-17.1 mm (mean 15.35 mm), with 3 3/4 to 4 1/2 (mean 4 1/8+) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 265e**), shell height 9.7-14.0 mm (mean 11.86 mm), H/D ratio 0.662-0.878 (mean 0.772). Body whorl rounded, without trace of angulation in adults. Shell apex (**Plate 102a**) with dense micropustulations in rows, continuing onto spire and body whorl as elongated pustules (**Plate 102b**). Spire and body whorl with prominent, sometimes anastomosing, rather thick radial ribs (**Figs 265d-f**). Umbilicus (**Fig. 265f**) open, columellar lip reflection partly narrowing it, width 1.3-2.7 mm (mean 2.09 mm), D/U ratio 5.70-11.7 (mean 7.42). Body whorl strongly deflected behind aperture (**Fig. 265e**). Lip thin, moderately reflected and expanded, parietal lip usually a raised free edge. Subsutural and supraperipheral red spiral colour bands prominent, subperipheral colour band reduced or absent. Based on 119 measured adults.

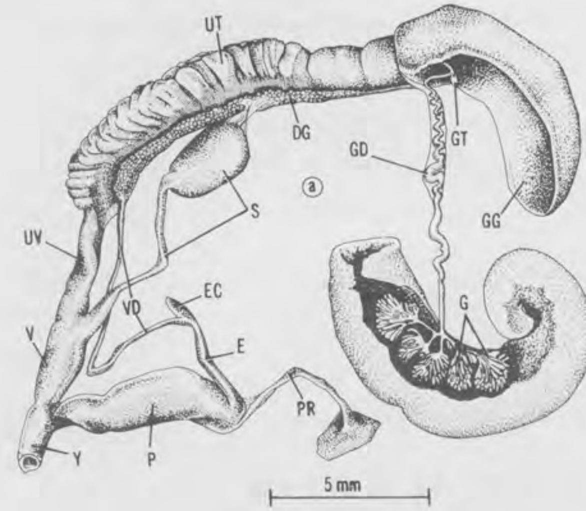
Genitalia (**Figs 267a-b**) with apical portions typical. Free oviduct (UV) and vagina (V) subequal, spermathecal (S) shaft narrow, expanded head loosely attached to prostate (DG) and uterus (UT), base lying distinctly above free oviduct origin. Vas deferens (VD) slender, entering channel of epiphallic caecum (EC) and epiphallus (E) laterally (**Fig. 267b**). Epiphallus entering extremely thin penis sheath (omitted in drawing) apically, area around epiphallic pore (EP) with few supplementary pilasters. Penial retractor muscle (PR) inserting on penis apex. Penis (P) long and relatively slender, only slightly tapering basally. Interior of figured penis (**Fig. 267b**) altered by method of preservation. Alcohol preserved specimens from other localities showed the same chamber sculpture found in *G. acerbum* (**Fig. 270b**).

Central and early lateral teeth of radula (**Plate 105a**) with small anterior flare and moderate cusp curvature, ectocone noticable on third lateral. Lateromarginal transition (**Plate 105b**) abrupt, size of ectocone very large before basal shortening started. Jaw (**Plate 104a-b**) variable in number and width of vertical ribs, which tend to be reduced on side margins.

Discussion

Granulomelon gilleni occurs abundantly in the small hills south of Southern Cross Bore, Strangways Range. Gillen Creek flows NE into Waite Creek, eventually joining the Sandover River, which floods out into open plains NE of the Dulcie and Jervois Ranges. Specimens from WA-733, which lies between the type locality and WA-734, are less elevated and smaller in size (**Table 100**) than material from either of the other localities.

A suspicious prospector of local fame, "Russian Johnny", then resident at Southern Cross Bore, convinced us that our collecting instincts had been satisfied before coming to Southern Cross Bore. Hence the many hills around the bore and just to the north remain to be sampled for snails. The range of *G. gilleni* undoubtedly will be extended. The evidence presented above of local population variation suggests that further collecting in this region will be worthwhile.



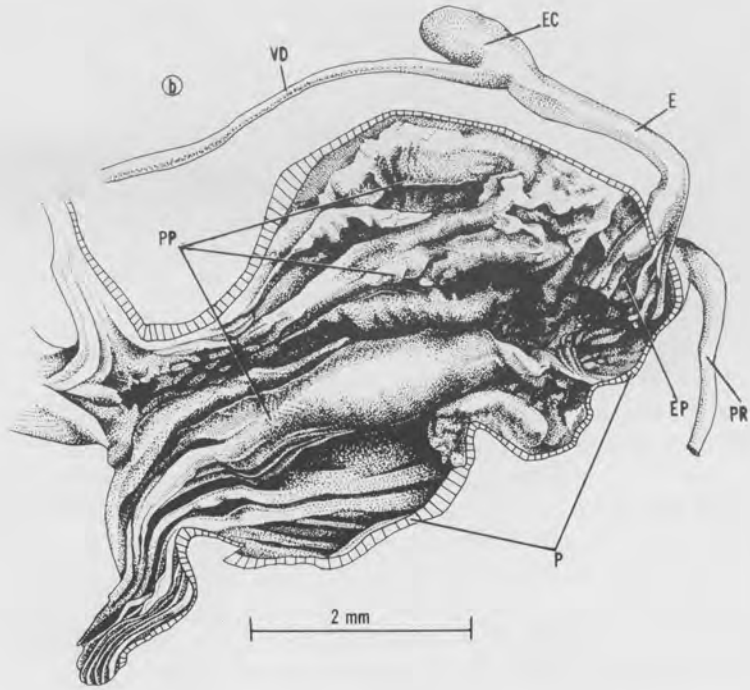


Fig. 267: Genitalia of *Granulomelon gilleni*, sp. nov.: Gillen Creek, Southern Cross Bore, Strangways Ranges, NT. 14 June 1979. AM C.115785, Dissection A. (a) whole genitalia; (b) interior of penis. Scale lines as marked. Drawings by Linnea Lahlum.

The name *gilleni* is taken from the fact that this species was collected along a tributary of Gillen Creek.

GRANULOMELON GRANDITUBERCULATUM (TATE, 1894)
(Plates 103a-b, 104c, 105c-f; Figs 266a-c, 268a-b)

Hadra grandituberculata Tate, 1894, Trans. Roy. Soc. South Austr., **18**: 193 - Central Australia.

Thersites (Badistes) grandituberculata (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 200-201, pl. XVIII, figs 11a-d - Maude (*sic*) River, Hart (*sic*) Range.

Xanthomelon grandituberculata (Tate), Hedley, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 225 (note on spermathecal duct); Ponsonby, 1904, *Proc. Malac. Soc. London*, **6**: 182, fig. 3.

Granulomelon grandituberculatum (Tate), Iredale, 1933, Rec. Austr. Mus., **19** (2): 51; Iredale, 1937, South Austr. Nat., **18** (2): 46, pl. II, fig. 16 - 20 miles SW of Harding Springs, Hart (*sic*) Range, NT (T. Hodge-Smith!); Iredale, 1937, Austr. Zool., **9**: 105; Burch, 1976, Jour. Malac. Soc. Austr., **3**: 135; Richardson, 1985, Tryonia, **12**: 150.

Comparative remarks

Granulomelon grandituberculatum (Tate, 1894), from Florence and Maud Creeks S of the Harts Ranges, NT (**Maps 3-4**), is characterized by its high spire (**Fig. 266b**) and greatly reduced radial sculpture (**Plate 103a-b**). *G. acerbum*, sp. nov., from the Bitter Creek and Ross River area of the eastern MacDonnell Ranges to the S, totally lacks radial sculpture (**Plate 103c-e**), although sharing the high spire; *G. gilleni*, new species, from the Strangways Range to the W, has very prominent radial ribs and a high spire (**Fig. 265e**); while *G. arcigerens* (Tate, 1894), from the Finke River Gorge, S of Glen Helen, western MacDonnell Ranges, has a nearly flat spire and very prominent radial ribs (**Fig. 265b**). Anatomically (**Figs 268a-b**), *G. grandituberculatum* has the free oviduct (UV) much longer than the vagina (V), the head of the spermatheca (S) lying just above the base of the prostate-uterus, and the penis (P) very short and globular in shape. *G. gilleni* (**Figs 267a-b**) has a longer penis (P), the free oviduct (UV) only slightly longer than the vagina (V), and the head of the spermatheca (S) situated further up the prostate-uterus. *G. acerbum*, sp. nov., has (**Figs 269a, 270a**) the short and globose penis with similar internal wall sculpture, but the vagina (V) is elongated and the free oviduct (UV) shortened in comparison.

Holotype

SAM D13603, Maud River, Harts Ranges, Northern Territory, Australia. Collected by the Horn Expedition. Height of shell 13.3 mm, diameter 16.3 mm, H/D ratio 0.816, whorls 4 3/8+, umbilical width 2.5 mm, D/U ratio 6.52.

Type lot

MV F28289, MV F28296, AM C.2163, AM C. 60538, SAM D15545, SAM D3152, FMNH 171514, 9 DA from the Horn Expedition,

Material studied

Northern Territory

HARTS RANGES: 20 miles SW of Harding Springs (T. Hodge-Smith!, 4 DA, AM C.107072); creek NE of Claraville, near Ignor Dam (1 LA, 1 DA, 6 LJ, 7 DJ, AM, FMNH 198911-2); 80 m E of Florence Creek, Hale River (90 LA, 39 DA, 27 LJ, 71 DJ, SAM D17694-5, WAM 210-1.84, AM, FMNH 198935, FMNH 198944).

Range

Granulomelon grandituberculatum (Tate, 1894) has been collected on the S side of the Harts Ranges from the drainage of Florence Creek and Maud Creek, NE of Alice Springs, NT (**Maps 3-4**). The "20 miles SW of Harding Springs" record could not be localized, but may be along the Hale River. The two recent collections are only four km apart and cannot be considered adequate data on which to define the species range.

Diagnosis

Shell of average size, adult diameter 13.9-16.8 mm (mean 15.19 mm), with 3 7/8+ to 4 3/4 (mean 4 1/4+) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 266b**), shell height 10.8-14.1 mm (mean 12.28 mm), H/D ratio 0.702-0.918 (mean 0.809). Body whorl evenly rounded, without trace of angulation in adults. Shell apex (**Plate 103a**) with dense micropustulations (many eroded in illustrated example). Upper spire and body whorl (**Plate 103a-b**) with enlarged micropustulations that are less prominent near suture, plus weak and irregularly spaced radial ridges that may be prominent enough to rank as ribs. Umbilicus (**Fig. 266c**) open, partly narrowed by reflection of columellar lip, width 1.1-2.5 mm (mean 2.05 mm), D/U ratio 5.74-13.3 (mean 7.53). Body whorl moderately to strongly deflected behind aperture (**Fig. 266b**). Lip thin, moderately expanded, parietal lip usually free, columellar margin moderately expanded. Subsutural, supraperipheral, and subperipheral red spiral colour bands usually prominent. Based on 142 measured adults.

Genitalia (**Figs 268a-b**) with pallial and apical portions typical. Free oviduct (UV) very long, vagina (V) slightly longer than average, head of spermatheca (S) at most slightly above base of prostate-uterus. Vas deferens (VD) slender, merging at angle with epiphallic caecum (EC, **Fig. 268a**). Epiphallus (E) entering penis sheath (PS) near apex, reflexing to enter penis chamber through enlarged pilasters (**Fig. 268b**) after receiving insertion of penial retractor muscle (PR). Penis sheath reduced to a covering membrane. Penis (P) short, globular, internally (**Fig. 268b**) with reduced U-pilaster, transverse radial ridges occupying most of chamber wall, epiphallic pore (EP) surrounded by swollen pilasters.

Central and early radular teeth (**Plate 105c, e**) variable in degree of cusp curvature, shaft angle, and size of anterior flare. Ectocone absent or very small on early

Table 101: Local Variation in *Granulomelon grandituberculatum* (Tate, 1894) and *G. acerbum*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
G. grandituberculatum (Tate, 1894)							
Florence Creek, FMNH 198944	90L	12.17±0.062 (10.8-13.8)	15.07±0.051 (14.0-16.2)	0.808±0.004 (0.732-0.918)	$4^{1}/_{4}$+ ($3^{7}/_{8}$+-$4^{5}/_{8}$)	2.01±0.023 (1.1-2.5)	7.60±0.099 (6.12-13.3)
Florence Creek, FMNH 198935	39D	12.24±0.076 (11.3-13.3)	15.16±0.083 (13.9-16.3)	0.808±0.006 (0.702-0.906)	$4^{1}/_{4}$+ ($4^{1}/_{8}$-$4^{1}/_{2}$+)	2.03±0.037 (1.6-2.5)	7.54±0.127 (6.33-9.59)
Maude River all examples	9D	13.23±0.187 (12.55-14.0)	16.26±0.178 (15.0-16.8)	0.813±0.010 (0.765-0.853)	$4^{1}/_{2}$ ($4^{1}/_{4}$-$4^{3}/_{4}$)	2.39±0.137 (1.6-2.9)	7.02±0.457 (5.74-10.1)
G. acerbum							
Bitter Springs Gap, FMNH 198961	14D	11.66±0.186 (10.3-13.5)	14.87±0.133 (13.7-15.7)	0.785±0.012 (0.701-0.888)	$4^{1}/_{4}$- (4–-$4^{3}/_{8}$)	2.04±0.051 (1.65-2.25)	7.35±0.206 (6.49-8.91)
Bitter Springs Gap, FMNH 198973	13L	12.43±0.190 (11.45-13.8)	14.96±0.155 (13.75-15.95)	0.831±0.010 (0.780-0.905)	$4^{1}/_{4}$ (4+-$4^{5}/_{8}$+)	1.98±0.088 (1.35-2.4)	7.75±0.417 (6.12-11.0)
Bitter Springs, WA-561, FMNH 204636	34L	12.13±0.139 (8.6-13.1)	15.19±0.130 (13.95-16.85)	0.799±0.009 (0.583-0.891)	$4^{3}/_{8}$- (4+-$4^{1}/_{2}$-)	2.19±0.055 (1.65-3.2)	7.07±0.155 (4.60-8.74)
Bitter Springs, WA-561, FMNH 204637	24D	11.99±0.137 (10.95-13.9)	14.99±0.144 (13.45-16.1)	0.801±0.008 (0.700-0.874)	$4^{3}/_{8}$- (4-$4^{1}/_{2}$+)	2.09±0.053 (1.65-2.75)	7.28±0.200 (5.45-9.22)
Ross River WA-748, FMNH 205481	10D	13.03±0.383 (11.75-15.65)	16.10±0.351 (13.9-18.25)	0.810±0.023 (0.731-0.993)	$4^{3}/_{8}$+ ($4^{1}/_{8}$+-$4^{3}/_{4}$+)	2.50±0.068 (2.25-2.85)	6.47±0.210 (5.80-7.58)
Sta. 35, MV	35L	11.85±0.097 (10.85-13.5)	15.28±0.098 (14.1-16.55)	0.776±0.005 (0.711-0.848)	$4^{1}/_{8}$ ($3^{7}/_{8}$–-$4^{3}/_{8}$+)	1.98±0.057 (0.8-2.5)	8.04±0.391 (5.78-19.6)

Table 101: Local Variation in *Granulomelon grandituberculatum* (Tate, 1894) and *G. acerbum* (continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-564, FMNH 204647	61L	10.90±0.076 (9.65-12.75)	14.55±0.060 (13.65-15.6)	0.749±0.005 (0.670-0.849)	$4\frac{1}{8}$ ($3\frac{7}{8}$–$4\frac{3}{8}$+)	2.42±0.036 (1.2-3.0)	6.11±0.132 (5.11-13.0)
Goat Camp Creek							
WA-743, FMNH 205454	55L	11.61±0.091 (9.95-13.1)	14.57±0.083 (12.95-15.8)	0.797±0.006 (0.682-0.924)	$4\frac{1}{8}$+ (4–$4\frac{3}{8}$+)	2.16±0.038 (1.15-2.75)	6.87±0.151 (5.30-12.8)
WA-743, FMNH 205453	52D	11.57±0.099 (10.35-13.7)	14.57±0.066 (13.5-15.55)	0.794±0.005 (0.704-0.904)	$4\frac{1}{4}$- (4–$4\frac{1}{2}$+)	2.12±0.022 (1.8-2.5)	6.90±0.68 (5.90-8.21)
WA-744, FMNH 205463	16L	11.52±0.154 (10.55-13.0)	14.41±0.193 (13.4-15.9)	0.800±0.009 (0.728-0.869)	$4\frac{1}{4}$- ($4\frac{1}{8}$–$4\frac{1}{2}$-)	2.21±0.045 (1.95-2.65)	6.56±0.128 (5.30-7.33)
WA-744, FMNH 205464	14D	11.92±0.168 (10.8-12.9)	14.98±0.168 (13.6-16.0)	0.796±0.009 (0.722-0.855)	$4\frac{1}{4}$- (4+-$4\frac{5}{8}$+)	2.28±0.50 (1.85-2.55)	6.62±0.164 5.87-8.31)
WA-746, FMNH 205468	50L	11.63±0.071 (10.45-12.65)	14.75±0.070 (13.5-16.05)	0.789±0.005 (0.712-0.891)	$4\frac{1}{8}$+ (4+-$4\frac{1}{2}$-)	1.91±0.022 (1.6-2.25)	7.77±0.096 (6.5-9.57)
WA-746, FMNH 205467	10D	11.89±0.221 (10.85-13.1)	14.86±0.199 (13.7-15.75)	0.800±0.009 (0.759-0.837)	$4\frac{3}{8}$- ($4\frac{1}{8}$-–$4\frac{5}{8}$+)	2.06±0.95 (1.5-2.35)	7.41±0.480 (6.07-10.2)
Mt. Benstead Creek, WA-752, FMNH 205499	9D	11.70±0.212 (10.75-12.65)	15.75±0.178 (14.95-16.5)	0.743±0.012 (0.679-0.781)	$4\frac{1}{4}$- (4+-$4\frac{3}{8}$-)	2.86±0.100 (2.4-3.35)	5.56±0.175 (4.83-6.41)

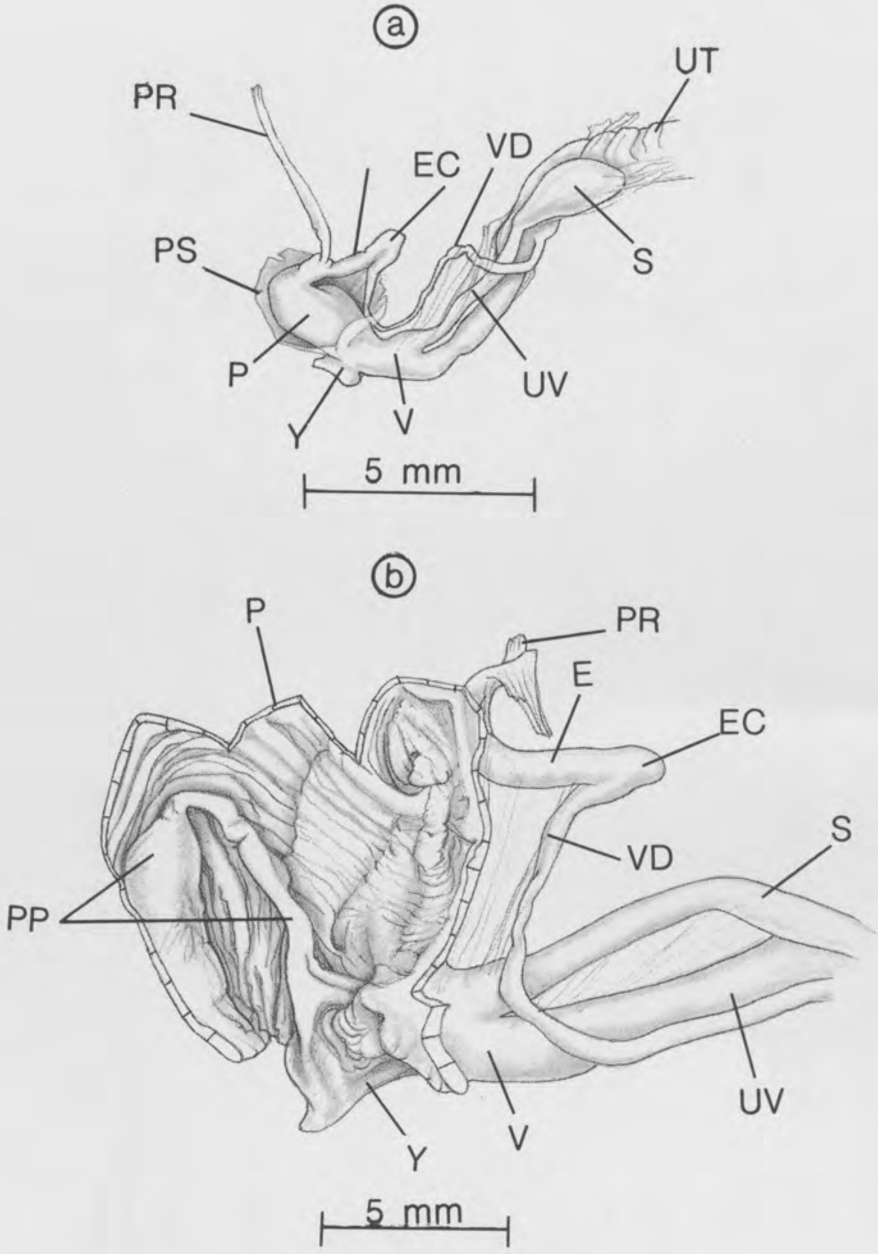


Fig. 268: Genitalia of *Granulomelon grandituberculatum* (Tate, 1894): Florence Creek, Hale River, Harts Ranges, NT. 25 June 1978. FMNH 198944. (a) terminal genitalia, Dissection C (b) interior of penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

laterals. Lateromarginal transition (**Plate 105d, f**) abrupt, major size increment of ectocone occurring on late laterals. Jaw (**Plate 104c**) without unusual features.

Discussion

Granulomelon grandituberculatum (Tate, 1894) was collected in quantity along Florence Creek on the S face of the Harts Ranges, and a very few examples were taken near Ignor Dam. Florence Creek drains the slopes of Mt. Mabel and the SW corner of Mt. Brassey, and Maud Creek starts below the SE outliers of Mt. Brassey. The creeks merge together W of Ignor Dam and then join the Hale River about 10 km to the S, which flows SE to disappear eventually into the Simpson Desert. All of the above creeks are temporary. The locality "20 miles SW of Harding Springs" probably would be near the Hale River.

The specimens of *G. grandituberculatum* had not accumulated much surface debris, and their colour bands were clearly visible. Spire and body whorl micropustulations (**Plate 103b**) were of elongated pustules, some of which tended to have one edge elevated and pointing backward from the aperture. Clear evidence of radial ridges or low ribs can be seen at optical magnifications on all unworn examples.

The above features stand in sharp contrast with *Granulomelon acerbum*, sp. nov. Almost all of these specimens had the surface coated with fine dust to the point that the colour bands were hidden. This undoubtedly resulted from the nature of the micropustulations (**Plate 103d-e**), which consist of raised triangular points, usually pointing backward from the aperture. They form highly effective "dust catchers". Sonic cleaning soon revealed the same bright colour bands found in *G. grandituberculatum*. *G. acerbum* lacks any trace of radial ridges or ribs.

The few type specimens of *G. grandituberculatum* seen (**Table 101**) agree well in shape with more recently collected material. Their slightly larger size may be an artifact of exchange procedures, with small shells sent overseas and larger examples retained in Adelaide. The live and dead specimens from Florence Creek are essentially identical in size and shape.

One radula (**Plate 105f**) showed two transverse rows of stunted teeth, which may well have been produced by the cold shock of an overnight freeze. Note that the teeth produced after (right side) the stunted rows have smaller endocones and a higher cusp shaft angle than do those teeth formed just prior to the stunted rows (left side).

GRANULOMELON ACERBUM, SP. NOV.
(Plates 103c-e, 104d-f, 106a-e; Figs 266d-f, 269a-c, 270a-b, 271a-b)

Comparative remarks

Granulomelon acerbum, sp. nov., from eastern portions of the MacDonnell Ranges, NT (**Maps 3-4**), has a high spired shell (**Fig. 266e**), rounded periphery, no trace of radial ridges or ribs (**Plate 103c-d**), and pointed micropustulations (**Plate 103e**).

These structures contrast with the radial ridglets and low ribs plus rounded micro-pustulations (**Plate 103a-b**) found in *G. grandituberculatum* (Tate, 1894) from tributaries of the Hale River, Harts Ranges, and with the prominent radial ribs (**Figs 265d-f**) of the other high spired species, *G. gilleni*, sp. nov., from the SE corner of the Strangways Ranges, NE of Alice Springs. *G. arcigerens* (Tate, 1894), from the Finke River Gorge, western MacDonnell Ranges, differs in its nearly flat spire and very prominent radial ribs (**Figs 265a-c**). The combination of bright red spiral colour bands, pointed micropustules, high spire, and free parietal lip immediately separate *G. acerbum* from any of the other Red Centre camaenid genera. Anatomically (**Figs 269a-c, 270a-b, 271a-b**), *G. acerbum* has the spermathecal head (S) partway up the prostate-uterus, the vagina (V) is relatively long, and the free oviduct (UV) somewhat longer than the vagina (V). Penis (P) short and globose, internally with typical sculpture. *G. grandituberculatum* (Tate, 1894) (**Figs 268a-b**) has the free oviduct greatly elongated. The spermathecal head is situated at the base of prostate-uterus. *G. gilleni* (**Figs 267a-b**) has a long and slender penis (P), the vagina (V) and free oviduct (UV) subequal in length, and the spermathecal head (S) reaching the middle of the prostate-uterus.

Holotype

AM C.135950, under rocks, Bitter Springs Gap, Ross River, MacDonnell Ranges, E of Alice Springs, Northern Territory. Alice Springs 1:250,000 map sheet SF53-14 - 2318:0660. 23° 32' 03" S, 134° 30' 17" E. Collected by Fred and Jan Aslin 26 June 1978. Height of shell 11.8 mm, diameter 14.7 mm, H/D ratio 0.803, whorls 4 1/8, umbilical width 2.05 mm, D/U ratio 7.17.

Paratopotypes

AM C.135951, SAM D17697-8, WAM 213-4.84, FMNH 198961, FMNH 198973, 13 LA, 13 DA, 6 LJ, 14 DJ from the type locality.

Paratypes

Northern Territory

MACDONNELL RANGES: Trephina Gorge Road (WA-751, 4.9 km from Ross River Road, AM, FMNH 205492, 2 DA); MT. BENSTEAD CREEK AREA (WA-752, 3.7 km E of Mt. Benstead Creek, SAM D17696, WAM 212.84, AM, FNMN 205499, 9 DA, 7 DJ); Bitter Springs Gap (WA-561, 6.8 km ENE from Ross River Road, SAM D17701-2, WAM 217-8.84, AM, FMNH 204636-7, 34 LA, 24 DA, 6 LJ, 22 DJ; WA-924, FMNH 212339-40, 4 LA, 4 DA, 6 LJ, 1 DJ); ROSS RIVER-N'DAHLA GORGE (WA-748, Ross River-Alice Springs Road, 3.7 km E of Alice Springs, SAM D17699, WAM 215.84, AM, FMNH 205481, 10 DA, 4 DJ; WA-564, 2.9 km S of Ross River Tourist Camp, SAM D17700, WAM 216.84, AM, FMNH 204647-8, 61 LA, 1 DA, 13 LJ, 2 DJ; Sta. 35, 300 m E of Ross River, MV, 35 LA, 6 LJ; WA-747, 3.4 km S of Ross River Tourist Camp, AM, FMNH 205474, 2 DA); GOAT CAMP CREEK (WA-743, 3.1 km N of Ross River-Box Hole Bore Road, SAM D17702-4, WAM 219-220.84, AM, FMNH 205452-4, 55 LA, 53 DA, 10 LJ, 24 DJ; WA-744, 1.3 km E of Ross River-Atnarpa Road junction, SAM D17705-6, WAM 221-2.84, AM, FMNH 205463-4, 16 LA, 14 DA, 4 DJ;

WA-746, Fergusson Range outlier, 4.4 km N of Ringwood Road, SAM D17707-8, WAM 223-4.84, AM, FMNH 205467-8, 50 LA, 10 DA, 32 LJ, 3 DJ).

Range

Granulomelon acerbum, sp. nov., has been taken in the eastern MacDonnell Ranges (**Maps 3-4**) from Trephina Gorge and Mt. Benstead Creek (ca 134° 22' E), Bitter Springs Gap area E to Ross River Resort and S through N'Dahla Gorge, then along Goat Camp Creek ESE to outliers of the Fergusson Range (ca 134° 49' E). The north-south range is on a diagonal from 23° 32' S at the NW point to 23° 46' S at the SE corner of the known range, a distance of about 52 km. No collecting has been done in the areas S of the Todd River, most of the Fergusson Range, or in the extensive hills flanking the Ross River.

Diagnosis

Shell of average size, adult diameter 12.95-18.25 mm (mean 14.84 mm), with 3 7/8- to 4 3/4+ (mean 4 1/4-) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 266e**), shell height 8.6-15.65 mm (mean 11.67 mm), H/D ratio 0.583-0.993 (mean 0.786). Body whorl rounded, without trace of angulation in adults. Shell apex (**Plate 103c**) with dense micropustulations, continuing onto spire and becoming raised triangular points (**Plate 103d-e**). Spire and body whorl without any trace of radial ridges or ribs. Umbilicus (**Fig. 266e**) open, slightly narrowed by expansion of columellar lip, width 0.8-3.35 mm (mean 2.17 mm), D/U ratio 4.60-19.6 (mean 7.01). Body whorl moderately to slightly deflected behind aperture (**Fig. 266d**). Lip thin, white, narrowly expanded, on parietal wall varying from a thick callus to free lip edge. Subsutural, supraperipheral, and subperipheral red spiral colour bands prominent. Based on 401 measured adults.

Genitalia (**Figs 269-271**) with free oviduct (UV) longer than vagina (V), head of spermatheca (S) reaching to mid point of prostate-uterus. Penis (P) short and globular, except when distorted by preservative (**Fig. 269**). Vas deferens (VD) slender, merging into epiphallic caecum (EC), which is short and broad. Epiphallus (E) short, entering apex of penis through foliated pilasters (**Figs 270b, 271a**). U-pilaster small, accessory ridges numerous and prominent, unless affected by preservative (**Fig. 270c**).

Central and early lateral teeth of radula (**Plate 106a, d**) typical. Mid laterals (**Plate 106b**) showing increase in both anterior flare and ectocone, lateromarginal transition (**Plate 106c, e**) abrupt. Jaw (**Plate 104d-f**) variable in number and width of ribs, also in degree to which side margins have reduced rib prominence.

Discussion

Granulomelon acerbum has been collected at a number of localities in the eastern MacDonnell and Fergusson Ranges. All localities are in the Ross River-Todd River drainage to the SE from the MacDonnell Ranges. It is locally common where there are creviced boulder piles available for aestivation sites. Many of the localities are roadside cliffs. Dust from passing vehicles may account, in part, for the dust covered shell surface that hides the spiral colour bands.

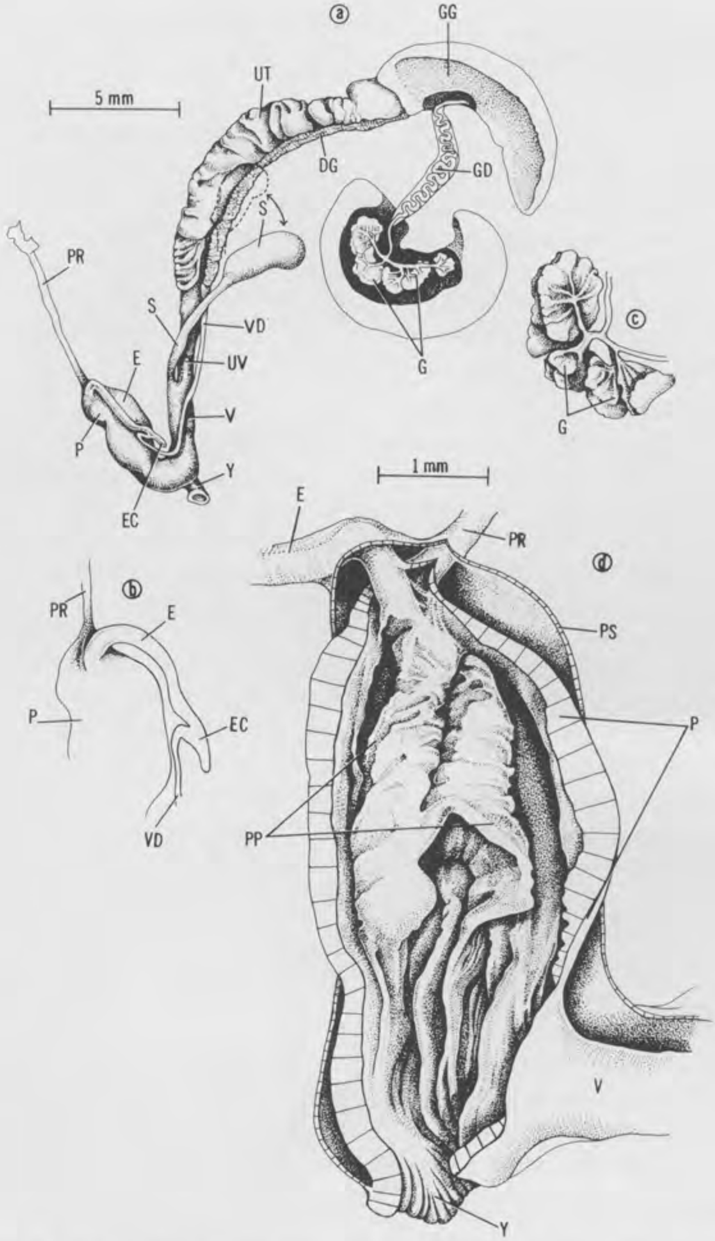
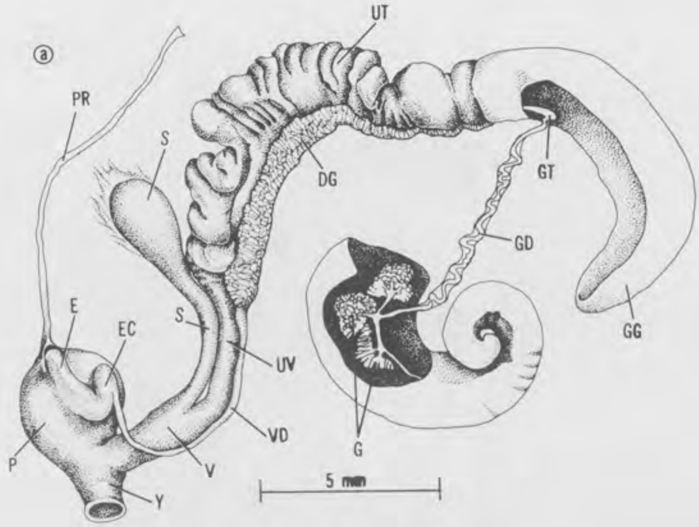


Fig. 269: Genitalia of *Granulomelon acerbum,* sp. nov.: Sta. 35, 300 m E of Ross River, N end N'Dhala Gorge, MacDonnell Ranges, NT. 21 May 1977. MV. (a) whole genitalia, Dissection A; (b) detail of penial retractor insertion, Dissection A; (c) ovotestis (formalin preservation), Dissection A; (d) penis interior (formalin preservation), Dissection B. Scale lines as marked. Drawings by Marjorie M. Connors.



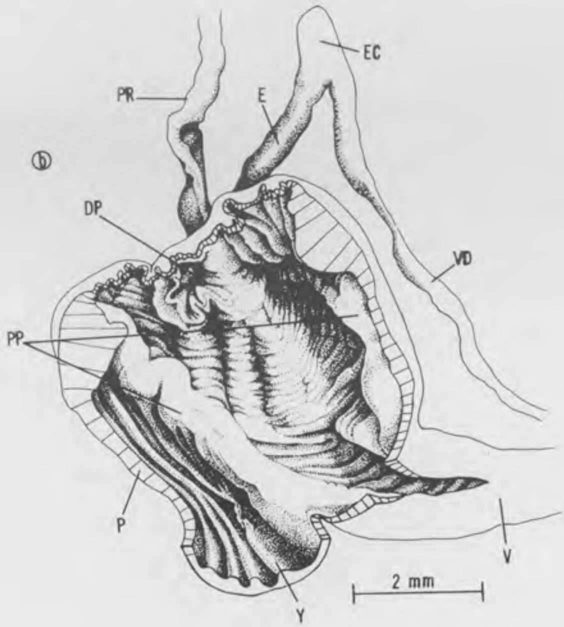


Fig. 270: Genitalia of *Granulomelon acerbum*, sp. nov.: Bitter Springs Gap, MacDonnell Ranges, NT. 26 June 1978. FMNH 198973, Dissection A. (a) whole genitalia (alcohol preservation); (b) interior of penis (alcohol preservation). Scale lines as marked. Drawings by Marjorie M. Connors.

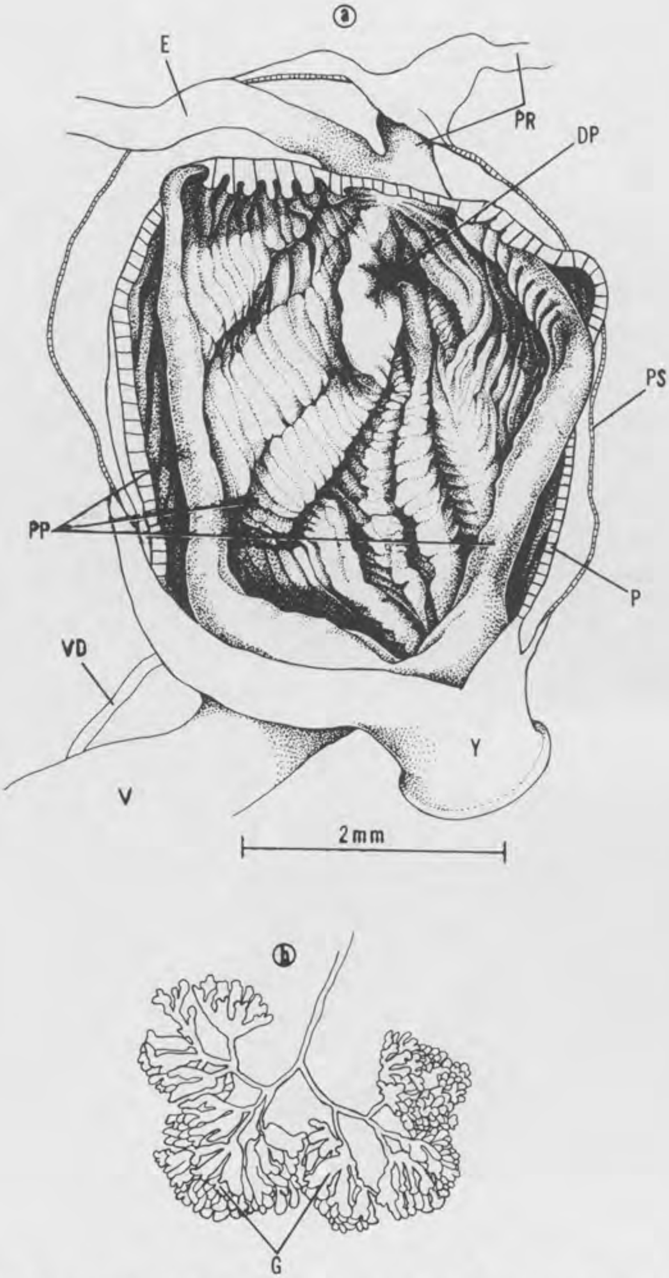


Fig. 271: Genitalia of *Granulomelon acerbum*, sp. nov.: Sta. WA-561, Bitter Springs Gap, 6.8 km ENE from Ross River Road, MacDonnell Ranges, NT. 30 June 1979. FMNH 204636, Dissection A. (a) interior of penis; (b) ovotestis. Scale line equals 2 mm. Drawings by Marjorie M. Connors.

Geographic size and shape variation is minor (**Table 101**). The specimens from Mt. Benstead Creek (WA-752) and just W of Ross River (WA-748), both southern slope exposures, are relatively large; the Goat Camp Creek populations (WA-743, WA-744, WA-746) are essentially uniform in size; live versus dead adult size varies from station to station.

Apparently significant variation is shown in the genital anatomy (**Figs 269-271**), but this relates to the method of fixation. The effects of formalin in distorting the ovotestis lobes (**Figs 269a, c**) contrasts greatly with the alcohol preserved examples (**Figs 270a, 271b**). Similarly, the formalin induced agglutination of tissue and mucoid chemicals (**Fig. 269d**) has completely altered the appearance of the penis chamber wall sculpture compared with alcohol fixed and preserved individuals (**Figs 270b, 271a**). The initial drawings of this species (**Figs 269a-d**) were done before I was aware of the extensive changes produced by even brief exposure to formalin. They are reproduced as a warning to future workers.

The name *acerbum* is taken from the occurrence of this species in Bitter Springs Gap, MacDonnell Ranges.

GENUS *SINUMELON* IREDALE, 1930
(+ *NOTOBADISTES* COTTON & GODFREY, 1932)

Sinumelon Iredale, 1930, Victorian Nat., **47** (7): 120 - type species: *Helix nullarborica* Tate, 1879; Iredale, 1937, South Austr. Nat., **18** (2): 40-46 - review of Red Centre and South Australian species; Iredale, 1938, Austr. Zool., **9** (2): 103-105 - check list of Australian species, description of some New South Wales taxa; Iredale, 1939, Jour. Roy. Soc. Western Austr., **25**: 52-54 - review and description of Western Australian species; Richardson, 1985, Tryonia, **12**: 276-278 - check list of species; Solem, 1992a, Rec. South Austr. Mus., Monogr. Ser. 2: 193-254.

Notobadistes Cotton & Godfrey, 1932, South Austr. Nat., **13** (4): 171 - type species: *Helix bitaeniata* Cox, 1868.

Shell medium to very large in size, often quite variable within a species, adult diameters 10-35 mm, whorl counts 3 3/4 to 6. Spire normally strongly elevated, only moderately in *dulcensis* and *gillensis*, never only slightly elevated or flat. Apical sculpture pustulose (**Plate 107a**) to nearly smooth (**Plate 109a, 110a**), sometimes weakly ridged (**Plate 109e**). Postapical sculpture generally with micropustulations in Flinders-Gawler taxa, but absent from all Red Centre species, except *hullanum* (**Plate 107c-d**) and *dulcensis* (**Plate 109d**). Sculpture on lower spire and body whorl (**Plates 107-110**) varying from weak to moderate growth ridges (*dulcensis, expositum*), moderate to weak radials with some incised spiral lines (*perinflatum*), moderate radials (*pedasum, musgravesi, amatensis, gillensis*), strong radials (*hullanum, pumilio*), or cancellated (*bednalli*). Body whorl always rounded, inflated, never angulated or keeled, descending behind aperture very gradually (*expositum, dulcensis*), moderately

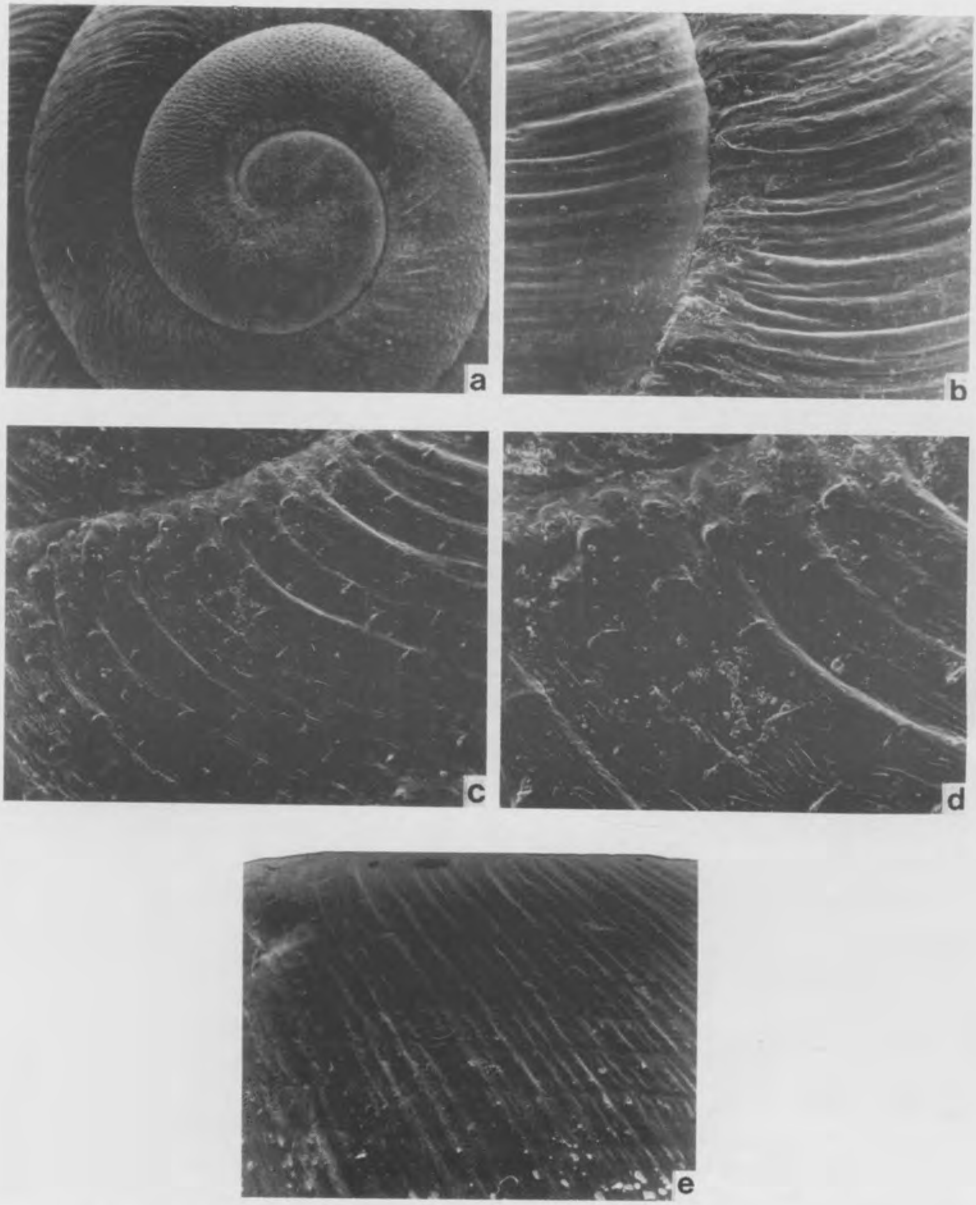


Plate 107: Shell sculpture of *Sinumelon hullanum* and *S. perinflatum* (Pfeiffer, 1846): (a-d) *S. hullanum.* WA-922, figs by Lassiter's Cave, Hull River, Petermann Ranges, NT. FMNH 212331. a is apex and spire at 17.5X, b is late spire and body whorl at 15.6X, c is mid-spire on an unworn individual at 40.5X, d is details of body whorl sculpture at 82X; (e) *S. perinflatum.* near Ambalindum Homestead, Hale River, NT. FMNH 198953. Body whorl sculpture showing incised spiral lines at 14.9X.

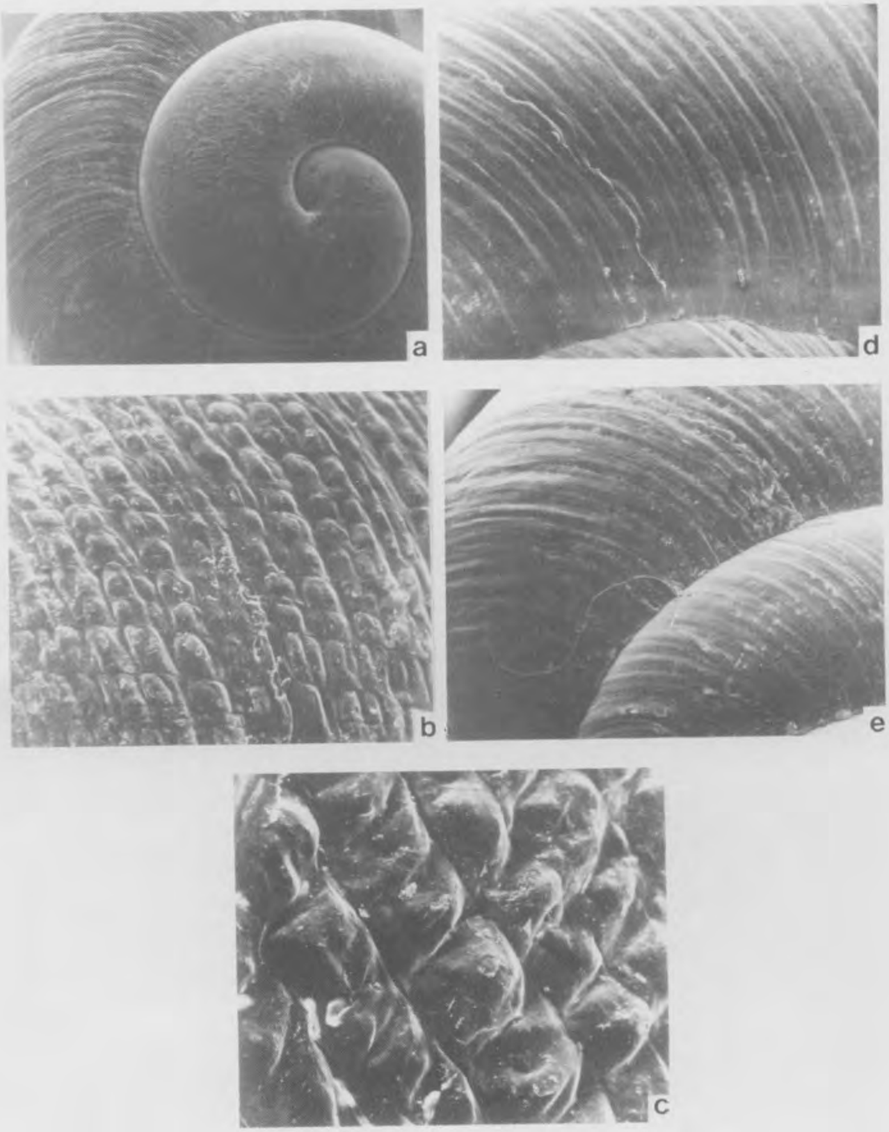


Plate 108: Shell sculpture of *Sinumelon bednalli* (Ponsonby, 1904), *S. pedasum* Iredale, 1937, and *S. musgravesi*: (a-c) *S. bednalli*. WA-128, Alice Springs Telegraph Station National Park, NT. FMNH 182692. a is apex and spire at 18.X, b is body whorl sculpture at 23.2X, c is detail of body whorl showing incised spiral lines (upper left to lower right) that produce cancellations at 56X; (d) *S. pedasum*. WA-857, Mt. Illbillee, Everard Ranges, SA. FMNH 212101. Body whorl sculpture at 18.1X; (e) *S. musgravesi*. WA-883, W of Jacky Pass Creek, Musgrave Ranges, SA. FMNH 212224. Lower spire and body whorl at 16.9X.

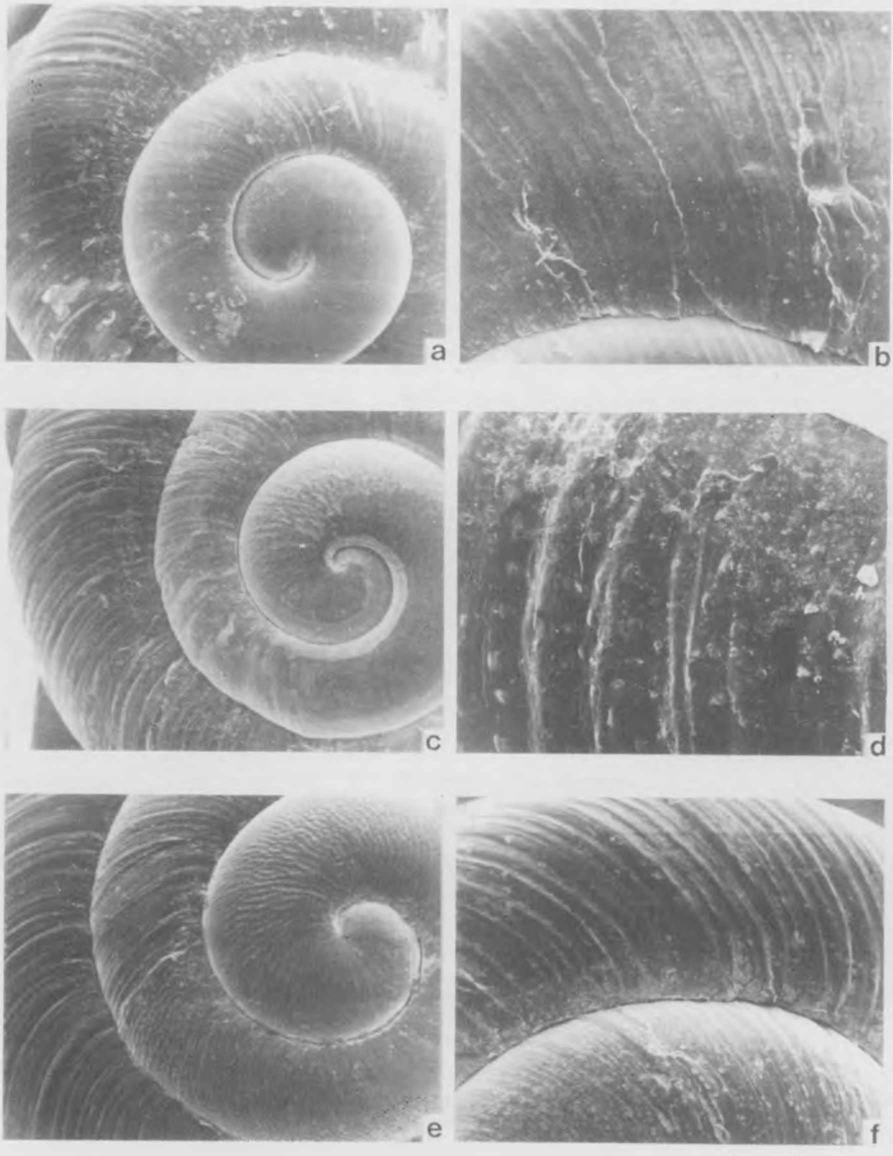


Plate 109: Shell sculpture of *Sinumelon dulcensis* and *S. amatensis*: (a-d) *S. dulcensis*. (a-b) gorge N of Old Huckitta Homestead ruins, Dulcie Range, NT. FMNH 198904. a is apex and spire at 16.3X, b is body whorl at 15.X. (c-d) WA-742, Bitter Springs Road, eastern MacDonnell Ranges, NT. FMNH 205446. c is apex and spire at 16.4X, d is detail on body whorl at 80X; (e-f) *S. amatensis*. WA-886, foothills of Mt. Morris, Musgrave Ranges, SA. FMNH 212231. e is apex and spire at 14.7X, f is lower spire and body whorl at 14.5X.

or variable (*musgravesi, gillensis, amatensis, pumilio*), to abruptly (*perinflatum, pedasum*). Umbilicus highly variable: closed (*hullanum, pedasum, pumilio*), a lateral crack (*perinflatum, hullanum*), very narrow (*musgravesi, amatensis*), or open (*bednalli, expositum, dulcensis, gillensis*). Columellar lip broadly expanded and reflected (*expositum, dulcensis, gillensis*) to relatively narrow (*pumilio, hullanum*), basal and palatal lips varying from barely (*pumilio, amatensis*) to broadly expanded (*perinflatum, bednalli, expositum*), usually white in colour, pink or reddish tints normally present in *amatensis* and rarely found in *gillensis*. Shell colour greenish-yellow, lighter in tone on shell base, a red spiral supraperipheral colour band present in most examples of *perinflatum*, often in *pedasum*, sometimes in *bednalli*. A reddish colour suffusion on the spire and body whorl may extend apically or cross the body whorl periphery and descend partly onto the shell base. It is rare in *perinflatum* and *bednalli*, weak in *pumilio*, very strong in *musgravesi, expositum, amatensis*, variable in other species.

Live adults aestivate loose in litter under spinifex or figs, more rarely in rock rubble, with a flexible, uncalcified epiphragm. Rarely they are rock sealers.

Genitalia (**Figs 273, 275-276, 279-280, 283-284, 286-287, 289-291b**) typical of Sinumeloninae. Free oviduct (UV) and shaft of spermatheca (S) twisted around each other. Head of spermatheca (S) bound to lower portion of prostate-uterus. Vagina (V) quite variable in length and diameter, very short in *gillensis*, very long in *musgravesi*, internally with narrow pilasters. Epiphallic caecum (EC) variable in size and point of vas deferens (VD) entry. Epiphallus (E) entering wall of penis sheath (PS) from near base (*dulcensis*) to above middle (*gillensis*), continuing inside wall of sheath or entering cavity, usually at least slightly coiled apically before receiving insertion of penial retractor muscle (PR) and reflexing to enter penis. Penis sheath (PS) thin to thick. Penis (P) variable in shape, short and nearly globose in *dulcensis*, long and slender in many species, expanded apically in *musgravesi*, tapering apically in *expositum* and *amatensis*. Penis chamber with wall sculpture variable. Main pilaster (PP) a simple ridge basally, often grossly expanded and foliated above (*perinflatum*), sometimes simple (*bednalli, pumilio*) or greatly reduced (*gillensis*). Accessory ridges and corrugated folds equally variable.

Jaw with very prominent vertical ridges, individually variable in width and number because of repaired injuries (**Plate 115**), becoming greatly reduced or absent on side margins. Vertical ribs substantially increased in number and very narrow in *gillensis* (**Plate 119f**). Central and lateral teeth of radula with moderate anterior flare, very high cusp shaft angle, slightly to moderately curved cusp tip, prominent basal plate support ridge, usually without trace of ectocone at least on initial laterals. Ectones becoming prominent on late laterals. Lateromarginal transition abrupt to relatively slow. Marginal teeth without unusual features.

Type species: *Helix nullarborica* Tate, 1879

Comparative remarks

The globose shell and expanded body whorl of *Sinumelon* are the most obvious features separating its species from any of the other Red Centre genera. The lack of

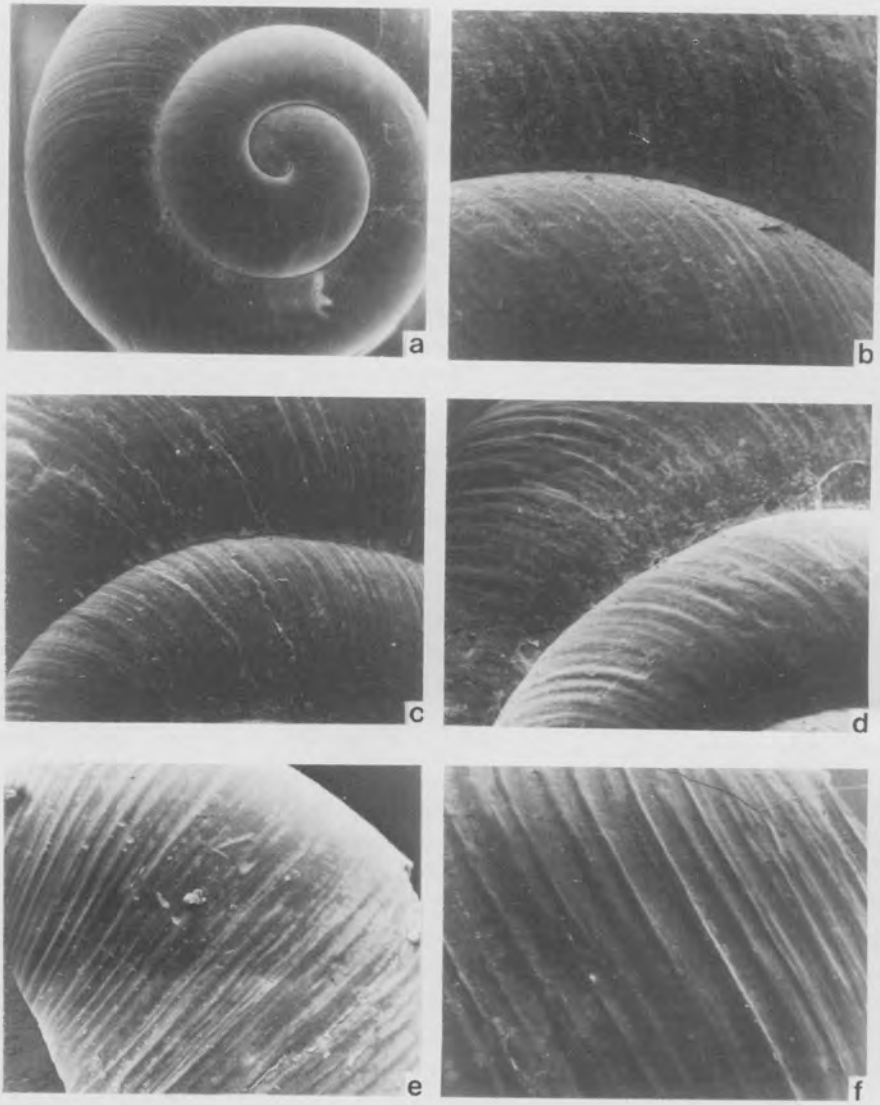


Plate 110: Shell sculpture of *Sinumelon expositum* Iredale, 1937, *S. gillensis*, and *S. pumilio* Iredale, 1937: (a-d) *S. expositum*. (a) WA-132, Initiation Rock, Palm Valley, Krichauff Ranges, NT. FMNH 201561. Apex and spire at 14.4X; (b) WA-132, Palm Valley, Krichauff Ranges, NT. FMNH 182366. Apex and spire at 18.5X; (c) WA-762, Palm Valley, Krichauff Ranges, NT. FMNH 205546. Spire and body whorl at 17.8X; (d) WA-942, Illamurta Spring, James Ranges, NT. FMNH 212423. Lower spire and body whorl at 15.1X; (e) *S. gillensis*. Paratopotype. WA-445, Reedy Rock Hole, George Gill Ranges, NT. FMNH 199688, Dissection B. Body whorl sculpture at 15.5X; (f) *Sinumelon pumilio*. WA-938, Mt. Illbillee, Everard Ranges, SA. FMNH 212416. Ribs on body whorl at 16.4X.

pustulations on the shell surface (**Plates 107-110**) contrasts sharply with the densely pustulated shells of *Basedowena* (**Plates 121-124**). The heavy radial ribbing and much lower spire of *Pleuroxia* (**Figs 257-259**), varied shell surface sculpture (**Plates 102-103**) and much less expanded whorls of *Granulomelon* are easily recognizable. The very small (mean diameter 10.93 mm) *Minimelon colmani*, sp. nov. (**Figs 304d-f**) from western sections of the Red Centre looks like a miniature *Sinumelon*, but differs in anatomy (see above), while the relatively low spired, brown coloured shells of *Basedowena* Iredale, 1937 (**Figs 292, 295, 298, 301, 304a-c**) have diverse shell sculpture (**Plates 121-124**) and many anatomical changes. No Red Centre members of the Pleurodontinae have similar shell features.

Although juvenile *Sinumelon* have been found sealed to rocks or wood upon occasion, adults of most species are "free sealers" lying loose in litter or barely below the soil surface. Examples of *S. musgravesi* and *S. amatensis* were found sealed to rocks near Mt. Morris, Musgrave Ranges (WA-886). *Minimelon colmani* and the Red Centre *Pleuroxia* also free seal, whereas *Basedowena*, *Granulomelon*, and most *Tatemelon* attach firmly to rocks and wood.

The lack of micropustulations on most, except *S. hullanum* (**Plate 107c-d**) and *S. dulcensis* (**Plate 109d**), shells of the Red Centre *Sinumelon* (**Plates 107-110**) is an obvious difference from the Gawler and Flinders Ranges species (Solem, 1992a: Plates 58-63), which, except for *S. petum* Iredale, 1937 from the Gawler Ranges, have generally dense apical pustulations that extend at least partway down the spire, although often absent from the body whorl. Red Centre species have shell sculpture (**Plates 107-110**) of variable radial ridges, rarely (**Plate 107e**) with incised spiral lines, culminating in the cancellated (**Plate 108b-c**) surface of *S. bednalli*.

Previous studies

Both Bednall (1892: 62-64) and Tate (1896: 198-200) were confused by species of this genus, lumping material from the S Flinders Ranges and the MacDonnell Ranges. Specimens with narrower or closed umbilici generally were called *S. perinflatum* (Pfeiffer, 1864), while more openly umbilicated specimens were assigned to *S. fodinalis* (Tate, 1892). The limited anatomical observations by Hedley (1889: 250-251, pl. 15; 1896: 223-4, figs G-I) on, respectively, probably *S. perinflatum* (Pfeiffer, 1864) and *S. expositum* Iredale, 1937, agree fully with the observations presented below.

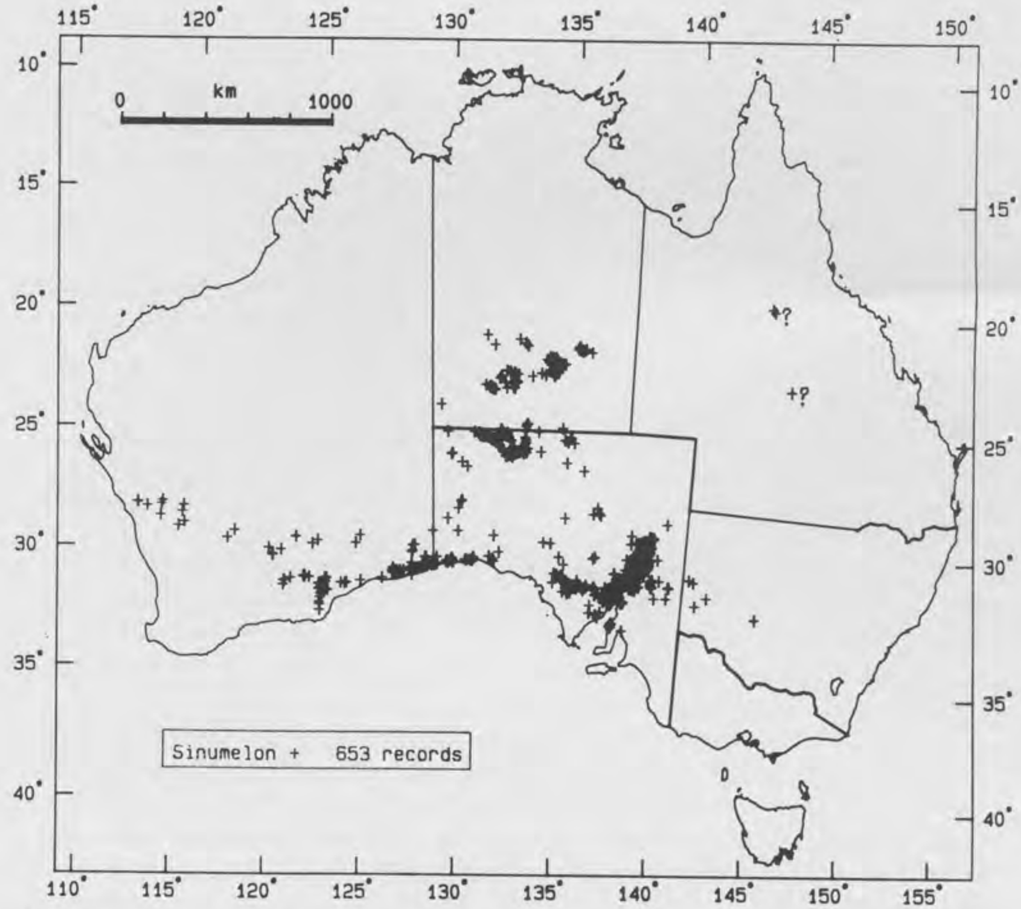
Cotton & Godfrey (1932: 171-174) included a curious mixture of species that are now assigned to *Sinumelon* and *Cupedora* Iredale, 1933 in a new genus, *Notobadistes*, whose type species, *S. bitaeniatum* (Cox, 1868), is an upper Eyre Peninsula *Sinumelon*.

Iredale (1937b: 40-46) provided a rather unique non-couplet key, named 10 new species based upon very few and worn shells, and concluded (p. 41) "The latest results tend to show that there are two distinct series occurring together and that to this fact is due the confusion which is not completely dispelled in this essay, but the way is cleared a little." A summation of these observations, plus description of some New South Wales taxa, resulted in a check list (Iredale, 1938: 103-105), followed by a revision of the Nullarbor and Western Australian taxa (Iredale, 1939: 52-54).

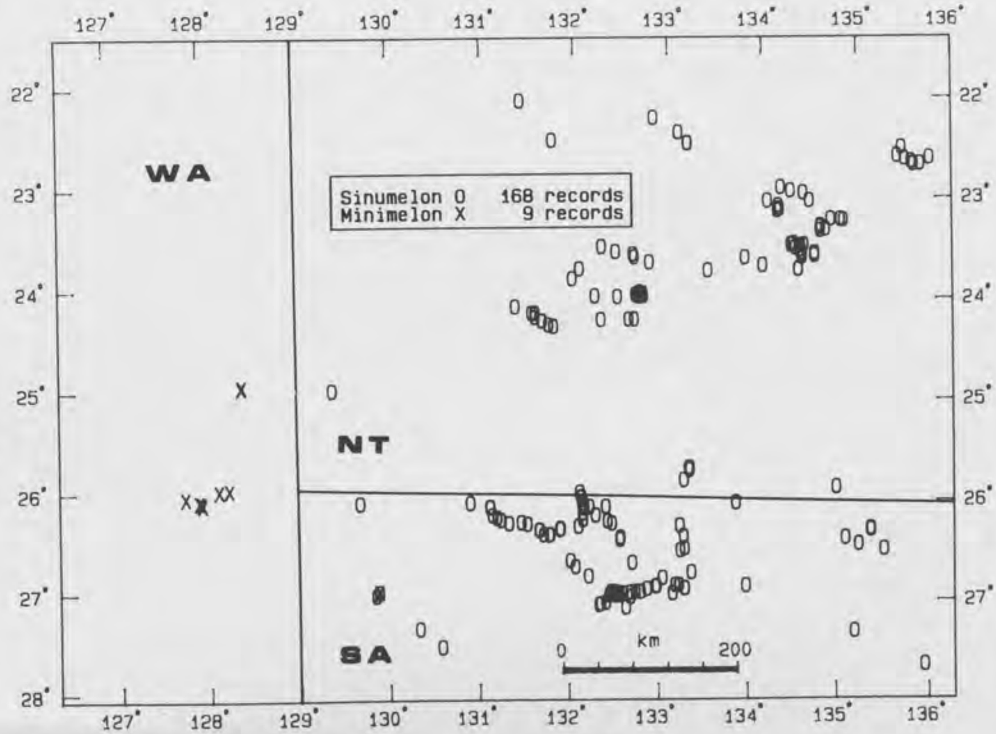
Richardson (1985: 276-278) compiled previous literature records, following listed names.

Distribution and comparative ecology

The *Sinumelon* species (**Maps 5-8**) from Lake Eyre South and Woomera along the transcontinental railroad W to Ooldea, and then S through the Gawler and Flinders Ranges into the Eyre Peninsula, have been monographed by Solem (1992a). The few records from western New South Wales and a problematic record from western Queensland also were summarized in that study. It is probable that isolated colonies of *Sinumelon* will be found in the areas between Oodnadatta and Lake Eyre South on the E, and Cheesman Peak and the Gawler Ranges on the W, providing linkage between the Red Centre and Gawler-Flinders assemblages. The few *Sinumelon*



Map 5: Records of *Sinumelon* in Australia. The W Queensland record requires confirmation by dissection and may be based on a conchologically convergent species belonging elsewhere.



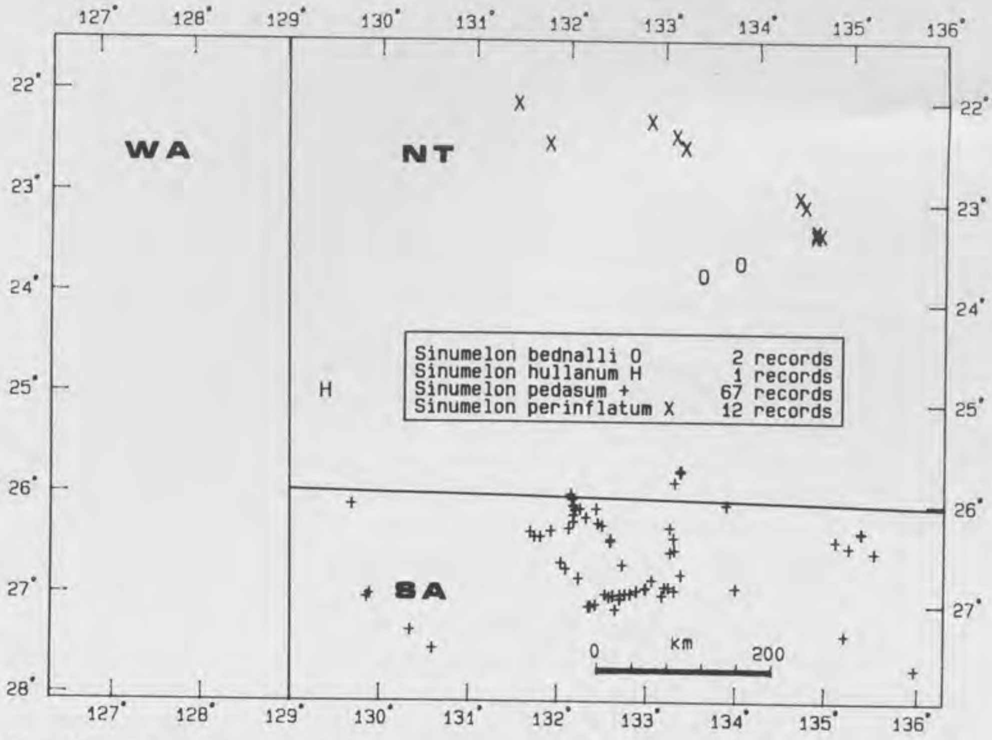
Map 6: Records of *Sinumelon* and *Minimelon* in the Red Centre.

occurring along the Nullarbor to Kalgoorlie, WA and then extending NW through the gold fields to near Geraldton, will be monographed elsewhere (Solem, in preparation).

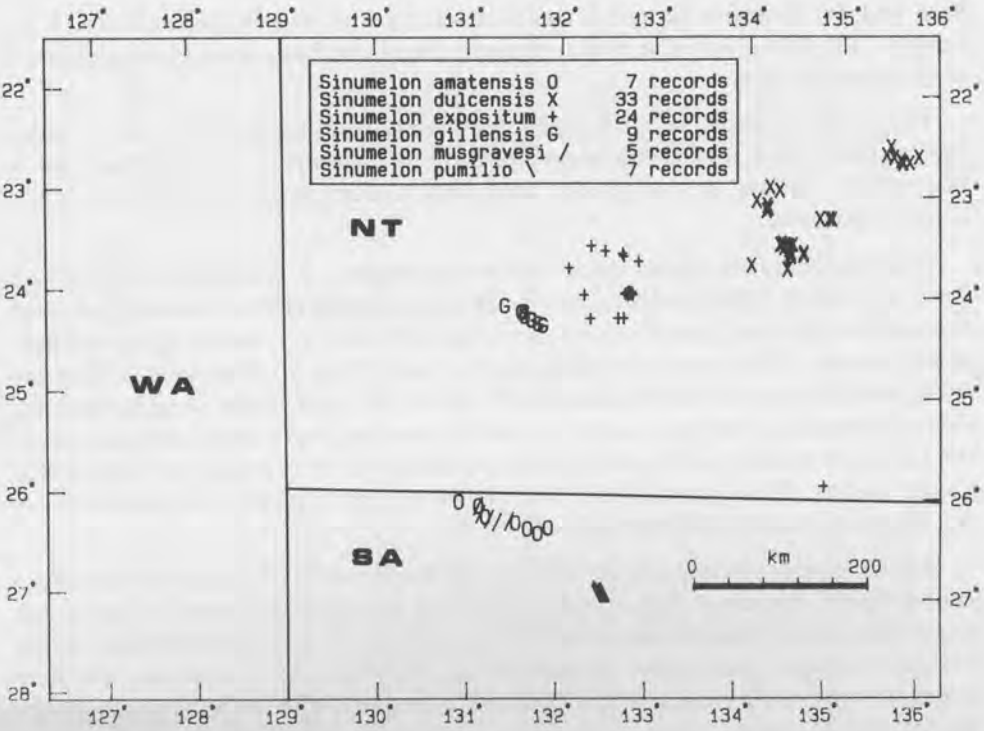
Full discussion of ecology and distribution of the genus is postponed, but a few differences between the Gawler-Flinders and Red Centre taxa are mentioned. The former taxa are almost exclusively rock associated, either in rubble or under large bushes on rocky slopes. The Red Centre species occur frequently in the litter under figs, but also have been found under spinifex or bushes on rocky stream banks, and sometimes under bushes or litter in nearly open plains. Whereas, in southern areas, the colonies of *Sinumelon* are found basically on or at the base of the hillsides, several of the Red Centre species frequently live off the main hills.

This ecological shift has resulted in differing patterns of distribution and variation. The Gawler-Flinders species are mainly allopatric and mostly are confined to the hill areas. The few examples of sympatry involve a fairly extensive area and, in general, variation in size and shape within species is moderate. In the Gawler ranges, *Sinumelon petum* Iredale, 1937 and *S. gawleri* Solem, 1992a share a wide range (Solem, 1992a: figs 127, 139), while in the Flinders Ranges there is extensive overlap between *Sinumelon godfreyi* Iredale, 1933 and *S. aversum* Iredale, 1937 (Solem, 1992a: figs 128, 132, 133). *Sinumelon remissum* Iredale, 1937 has a generally fringing distribution around the W margin of the Flinders Ranges (Solem, 1992a: fig. 130) and usually is the only *Sinumelon* present. However, in the NW part of the Flinders Ranges, *S. remissum* and *S. serlense* Iredale, 1937 become microsympatric (Solem, 1992a: fig. 136) for a short distance. *S. remissum* has been taken alive only in the NW Flinders. Whether the other records represent colonies that were still extant at the time of mid-1800 agricultural development around the Flinders or if they became extinct during the time of aboriginal habitation is unknown.

The Red Centre species are amost completely allopatric (**Maps 7-8**), and vary in range from inhabiting a 10.5 km long peak, Mt. Illbillee in the Everard Ranges (*S. pumilio*) to covering the vast area from the Birksgate Range and Cheesman Peak through the Everard and E Musgrave Ranges, SA to Kulgera, NT and SE to Dalhousie Springs and Oodnadatta, SA (*pedasum*). Six species seem to have relatively restricted range: George Gill Range, NT (*gillensis*); part of the Petermann Ranges, NT (*hullanum*); central MacDonnell Ranges, NT (*bednalli*); southern outliers of the Musgrave Ranges between Jacky Pass Creek and Mt. Morris, SA (*musgravesi*); central and eastern Musgrave Ranges, SA (*amatensis*); and Mt. Illbillee, Everard Ranges, SA (*pumilio*). They are found most commonly under figs and along stream banks in the main ranges.



Map 7: Records of *Sinumelon bednalli* (Ponsonby, 1904), *S. hullanum*, *S. pedasum* Iredale, 1937, and *S. perinflatum* (Pfeiffer, 1864) in the Red Centre.



Map 8: Records of *Sinumelon amatensis*, *S. dulcensis*, *S. expositum* Iredale, 1937, *S. gillensis*, *S. musgravesi*, and *S. pumilio* Iredale, 1937 in the Red Centre.

The other four species have more extended, but often disjunct ranges (**Maps 7-8**). *S. expositum* inhabits most of the Finke River basin, from its orgins in the foothills of Mt. Sonder and the Davenport River banks just N of the Heavitree and MacDonnell Ranges S, then S past Gosse Bluff and inhabiting the Finke River basin through the Krichauff and James Ranges, collecting tributaries from Areyonga, Palm Valley, reaching Illara Waterhole, and Illamurta Springs, and extending E to the type locality at Charlotte Waters, near where the Finke River disappears into the Simpson Desert. *S. dulcensis* somewhat parallels the range of *S. expositum* to the E. It has been collected in separate drainages: Dulcie, Jervois, and N slope of Harts Ranges, draining into the Plenty River; E margin of the Strangways Ranges into the Sandover River; S face of Harts Range and eastern MacDonnell Ranges into the Todd-Hale River system. Variation of this species in the separate drainages may be sufficient to permit eventual taxonomic recognition. *S. perinflatum* has been found in several places N of the MacDonnell Ranges - near Yuendumu and on the fringes of the Tanami Desert; Reynolds Ranges and outliers; Burt Plain; Ongeva Creek at the Plenty Highway; and Ambalindum-Claraville area of the Hale River. Possibly it may range N as far as Barrow Creek. *S. pedasum* has the widest range - as far S as Cheesman

Peak and the Birksgate Range; E to Dalhousie Springs and Oodnadatta, SA; N to Kulgera, NT; through the Everard and eastern Musgrave Ranges; and on plains just S of the Mann Ranges.

The last two species have been recorded mainly from more open areas or under figs on small rock formations away from the main ranges. *S. expositum* and *S. dulcensis*, in contrast, are rocky slope and spinifex associated, along stream and gully banks in hill areas.

Quite probably additional species will be discovered. A recent collection by Bob Read on 6 March 1986 from Mt. Lindsay, Birksgate Range (FWA) included two dead *Sinumelon* with strong radial ridging above the shell periphery, but with the shell base nearly smooth. Their small size (diameter 16.2 and 17.8 mm), high spire (H/D ratios 0.898 andd 0.910), low whorl count (4 3/4- and 4 3/4), essentially closed umbilicus, sharp descension of the body whorl behind the aperture, and almost no expansion of the basal and palatal lips combine to distinguish them from any of the named Red Centre species. While undoubtedly they represent a new species, two specimens are not adequate material for description.

Actual records of sympatry are limited. A few specimens of *S. pedasum* have been found on the fringes or just off Mt. Illbillee in the Everard Ranges, which is the known range of *S. pumilio*, but no recent microsympatric records are known. In the Musgrave ranges, about equal numbers of *S. amatensis* and *S. pedasum* have been taken from the main mass at WA-876, WA-878, and WA-879. In the foothills of Mt. Morris, SW of Amata, Musgrave Ranges, *S. amatensis* and *S. musgravesi* have been taken at WA-886. Otherwise, records are exclusively allopatric.

Size variation within species is considerable (**Tables 102-111**). Much of it seems to involve cessation of growth at a lower whorl count, thus producing smaller adult size. *S. pedasum* (**Figs 277a-f**), *S. expositum* (**Figs 282a-e**), and *S. dulcensis* (**Figs 285a-f**) demonstrate the intraspecific population size variability (**Tables 105, 107, 108**). In nearly all instances, the small sized populations can be shown to occur in areas with increased evaporation potential, and thus reduced activity time for feeding and shell growth. The range in size is much greater for the Red Centre than for the Gawler-Flinders species. This fact made preparation of a dichotomous key quite difficult.

There are no clear trends in morphology among the Red Centre species. Discussion of overall patterns of variation in *Sinumelon* is postponed until the Western Australian taxa have been reviewed.

The following key will work for reasonably fresh adult shells for which population mean measurements are available. It will not work for single specimens, or for examples whose shell shape and features have been altered in the process of repairing shell injuries. In most situations, such altered specimens or exceptional small individuals can be identified initially by reference to geographic location, then confirmed by using the **Comparative remarks** for the most probable species.

Table 102: Range of Variation in Red Centre *Sinumelon*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S.perinflatum (Pfeiffer, 1864)	237	19.46 (15.3-25.2)	22.90 (18.1-27.55)	0.849 (0.733-0.951)	5- ($4\frac{3}{8}$-$5\frac{3}{4}$)	lateral crack	
S.hullanum	16	19.38 (16.8-22.55)	21.33 (19.4-24.45)	0.908 (0.844-0.975)	$5\frac{1}{8}$- ($4\frac{7}{8}$- -$5\frac{3}{8}$)	closed or crack	
S. bednalli (Ponsonby, 1904)	137	19.51 (16.95-23.5)	22.69 (19.8-26.05)	0.861 (0.767-0.955)	$4\frac{5}{8}$+ ($4\frac{3}{8}$- -$5\frac{1}{4}$)	2.34 (1.05-3.4)	10.3 (7.02-22.7)
S. pedasum Iredale, 1937	857	21.60 (13.65-31.2)	23.98 (17.6-33.05)	0.900 (0.780-1.210)	5+ ($4\frac{1}{4}$-$5\frac{7}{8}$)	closed	
S. musgravesi	101	18.30 (13.45-21.05)	20.92 (17.05-24.3)	0.874 (0.783-0.969)	5+ ($4\frac{3}{8}$+-$5\frac{1}{2}$-)	1.12 (0.55-1.9)	19.4 (9.50-40)
S. expositum Iredale, 1937	626	15.98 (11.75-23.25)	19.24 (14.85-25.3)	0.831 (0.728-0.955)	$4\frac{3}{4}$+ ($4\frac{1}{4}$+-$5\frac{3}{8}$-)	1.83 (0.75-3.8)	11.1 (6.29-28)
S. dulcensis	559	13.62 (10.75-19.3)	16.89 (13.85-22.3)	0.806 (0.668-0.922)	$4\frac{1}{2}$+ ($4\frac{1}{8}$- -$5\frac{1}{4}$-)	1.72 (1.0-3.1)	10.1 (5.56-20)
S. gillensis	116	12.59 (9.9-15.25)	16.60 (14.4-18.7)	0.758 (0.686-0.864)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-5)	1.83 (1.2-2.85)	9.35 (6.10-15.2)
S. amatensis	81	12.68 (10.75-14.8)	14.70 (13.3-16.8)	0.863 (0.755-0.949)	$4\frac{5}{8}$ ($4\frac{3}{8}$- -$5\frac{1}{8}$-)	0.92 (0.55-1.45)	16.5 (10.7-26)
S. pumilio Iredale, 1937	52	14.53 (12.8-15.9)	15.86 (14.2-17.45)	0.915 (0.845-0.981)	$4\frac{3}{8}$- ($3\frac{3}{4}$+-$4\frac{5}{8}$-)	closed	

KEY TO THE RED CENTRE *SINUMELON*

1. Shell sculpture smooth or composed of low irregular ridgelets (**Plates 107-110**), sometimes with scattered incised spiral lines (**Plate 107e**) 2
   Shell sculpture cancellated (**Plate 108b-c**) on spire and body whorl ....
   Sinumelon bednalli (Ponsonby, 1904) (p. 1093)

2. Umbilicus narrowly (**Figs 278f, 288f**) to moderately (**Figs 281c, 282c,f, 285c, 288c**) open 3
   Umbilicus closed (**Figs 277c, 274c, 288i**) or a narrow lateral crack (**Figs 272c, f, 278f**) 7

3. Umbilicus very narrow, mean D/U ratio 15-20; spire higher (**Figs 278e, 288e**), mean H/D ratio 0.850-0.875 4
   Umbilicus more open (**Figs 281c, 282c, f, 285c**), mean D/U ratio 9-12; spire less elevated (**Figs 282b, e, 283b, 285b, d-f**), mean H/D ratio 0.750-0.840 5

4. Mean diameter about 15 mm; mean whorl count about 4 5/8
   Sinumelon amatensis sp. nov. (p. 1149)
   Mean diameter about 19-21 mm, mean whorl count about 5
   Sinumelon musgravesi sp. nov. (p. 1113)

5. George Gill Range or eastern Red Centre ranges 6
   Basin of Finke River
   Sinumelon expositum Iredale, 1937 (p. 1119)

6. George Gill Range; mean diameter 15-17 mm
   Sinumelon gillensis, sp. nov. (p. 1143)
   Dulcie and Strangways Ranges S through eastern MacDonnell Ranges ....
   Sinumelon dulcensis, sp. nov. (p. 1129)

7. Mean diameter normally over 20 mm; mean whorls 4 3/4 to 5 1/4
   8
   Mean diameter 16 mm; mean whorls 4 3/8; Mt. Illbillee, Everard Ranges
   Sinumelon pumilio Iredale, 1937) (p. 1154)

8. N of MacDonnell Ranges, between Tanami Desert and Hale River
   Sinumelon perinflatum (Pfeiffer, 1846) (p. 1081)
   Petermann and Musgrave Ranges S 9

9. Petermann Ranges, *Sinumelon hullanum*, sp nov. (p. 1088)
   Musgrave Ranges S to Cheesman Peak and Oodnadatta 10

10. S outliers of Musgrave Ranges, umbilicus sometimes slightly open ....
    Sinumelon musgravesi, sp. nov. (p. 1113)

Eastern Musgrave Ranges and Kulgera, NT and then S to Cheesman Peak and Oodnadatta

Sinumelon pedasum Iredale, 1937 (p. 1098)

SINUMELON PERINFLATUM (PFEIFFER, 1864)
(Plates 107e, 111a-f; Figs 272a-f, 273a-b)

Helix (Xanthomelon) perinflata Pfeiffer, 1864, IN: Angas, 1864, Proc. Zool. Soc., London, **1863**: 520 - citation in check list; Pilsbry, 1893, Man. Conch., (2) **8**: 282-283, pl. 58, fig. 1 - figure is of *Sinumelon pedasum* Iredale, 1937.

Helix perinflata Pfeiffer, 1864, Proc. Zool. Soc., London, **1863**: 528 - McDonnell (*sic*) Ranges, Central Australia (Waterhouse!); Cox, 1868, Monog. Austr. Land Shells, p. 45, pl. 20, fig. 2 - type specimen illustration drawn by G. F. Angas; Angas, 1876, Quat. Jour. Conch., **1**: 135 - citation in check list; ?Hedley, 1889, Proc. Roy. Soc. Queensland, **6**: 250-251, pl. 15 (genitalia) - notes on anatomy of specimens from the McDonnell (*sic*) Ranges; Pilsbry, 1890, Man. Conch., (2) **6**: 183 - copy of original description.

Thersites (Badistes) perinflata (Pfeiffer), Pilsbry, 1894, Man. Conch., (2) **9**: 131 - check list; Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zoology, pp. 198-199 - in part.

Sinumelon perinflatum (Pfeiffer), Iredale, 1937, South Austr. Nat., **18** (2): 44-45; Iredale, 1938, Austr. Zool., **9** (2): 105; Richardson, 1985, Tryonia, **12**: 277-278 - in part.

?Thersites perinflata (Pfeiffer), Clench & Archer, 1937, Jour. Conch., **21** (1): 24 - Soda Creek, 40 miles W of Barrow Creek Telegraph Station and Finke River, Glen Helen, MacDonnell Ranges, Central Australia.

Comparative remarks

Sinumelon perinflatum (Pfeiffer, 1864), found N of the MacDonnell Ranges from the Hale River at Claraville Homestead W through the Reynolds Ranges to the fringes of the Tanami Desert (**Map 7**), is characterized by its large size (mean diameter 22.90 mm), moderately elevated spire (**Figs 272b, e**, mean H/D ratio 0.849), usually narrowly open umbilicus (**Figs 272c, f**), nearly smooth to ridged shell surface with incised spiral lines (**Plate 107e**), normal presence of a red supraperipheral spiral colour band, well expanded shell lip (**Figs 272a-f**), and moderate to strong descent of the body whorl behind the aperture (**Figs 272b, e**). *S. pedasum* Iredale, 1937, from Kulgera, NT south to Oodnadatta and W through the Everard, part of the Musgrave, and Birksgate Ranges, is slightly larger (mean diameter 23.98 mm), slightly more elevated (**Figs 277b, d-f**, mean H/D ratio 0.900), normally has a closed umbilicus (**Fig. 277c**), stronger radial sculpture (**Plate 108d**), usually more abrupt descent of the body whorl (**Figs 277b, d-f**), and a less expanded shell lip (**Figs 277a-f**). The MacDonnell Ranges *S. bednalli* (Ponsonby, 1904) is immediately recognizable by its cancellated shell sculpture (**Plate 108b-c**), open umbilicus (**Fig. 274f**, mean D/U ratio 10.3), and reduced whorl count (mean whorls 4 5/8+). All other Red Centre species are much smaller, and/or have a clearly open umbilicus. Anatomically, *S. perinflatum* is unusual in that the neck and foot of the body generally are without darker markings, whereas in *S. pedasum* these areas have dark grey markings. *S. bednalli* and some populations of *S. expositum* Iredale, 1937 also generally lack this body colour. The genitalia (**Figs 273a-b**) of *S. perinflatum* are very similar to those of *S. pedasum* (**Figs 279a-b**), differing primarily in the former having enlargement of the main pilaster (PP) apically and reduced apical wall sculpture in the penis chamber. *S. bednalli* (**Figs 276a-b**) also is very similar, but has near basal entry of the epiphallus (E) into the penis sheath (PS) and reduced penis chamber wall sculpture.

Holotype

I have been unable to locate the single specimen collected by Waterhouse and used by Pfeiffer (1864) to describe this species. Although the type specimen was drawn by G. F. Angas and illustrated by Cox (1868: pl. 20, fig. 2), it could not be located in the British Museum (Natural History) collection. It is presumed to be lost.

Material studied

Northern Territory

HALE RIVER AREA: Claraville Homestead (100-200 m NE of, FMNH 198958-9, 2 LA, 1 DA, 3 LJ); Ambalindum-Claraville Road (SAM D17770, WAM 499.87, AM, FMNH 198965-6, 10 LA, 2 DA, many LJ, 1 DJ); Ambalindum Homestead (well just N of, SAM D17773, SAM D17767, WAM 495.87, WAM 502.87, AM, FMNH 198971, FMNH 198979, 36 LA, 22 LJ; main track to homestead, SAM D17771-2, WAM 500.87, WAM 501.87, AM, QM, MV, FMNH 198950, FMNH 198953, 24 LA, 8 DA, many LJ, 30 DJ).

PLENTY HIGHWAY: Ongeva Creek crossing of Plenty Highway (BJS-26, MV, 8 LA); towards Mt. Riddock, Harts Range (BJS-25, MV, 2 LA, 2 LJ).

BURT PLAIN: (MV F28283, ex Horn, 1 DA).

MACDONNELL RANGES (MV F28281, ex Petterd, Cox, 1 DA).

REYNOLDS RANGE: Prowse Gap (WA-732, ridge just W of Stuart Highway, WAM 504.87, SAM D17775, AM, QM, MV, FMNH 205393, 29 LA, 1 LJ); Reynolds Range (WA-729, N slope, 21 km W of Stuart Highway, under large figs, AM, SAM D17769, WAM 497.87, FMNH 205379-81, 7 LA, 8 DJ; WA-730, outlier of, 21.7 km W of Pine Hill Station, AM, WAM 498.87, WAM 503.87, SAM D17774, QM, MV, FMNH 205388-9, 33 LA, 3 DA, 92 LJ, 1 DJ; WA-731, Lander River drainage, 11 km NE of Lander bore, WAM 496.87, AM, FMNH 205392, 4 DA, 3 DJ).

TANAMI DESERT: 14.4 km NW of Vaughn Springs turnoff (WA-436, by large boulders on outcrop, FMNH 199707, 1 DA, 1 LJ, 1 DJ); 20 miles SW of Yuendumu (May 1967, SAM, 67 DA).

Range

Sinumelon perinflatum (Pfeiffer, 1864) has been collected from scattered NT localities in the Hale River drainage as far east as Claraville Homestead and then near

Mt. Riddock Station, Harts Range, and Ongeva Creek along the Plenty Highway (**Map 7**). An unconfirmed literature record from 40 miles W of Barrow Creek (Clench & Archer, 1937) would extend the possible range considerably to the N. It apparently is common throughout the Reynolds Range from Prowse Gap (WA-732) to the NW end (WA-729-31). Juveniles referred to this species also have been taken on the fringes of the Tanami Desert (WA-436). Adults from SW of Yuendumu also are placed here. There are no records of this species from the main Red Centre ranges. Probably *S. perinflatum* will prove to to be a species of plains and low hills,, paralleling the habitat preference of *S. pedasum* Iredale, 1937.

Diagnosis

Shell very large, adult diameter 18.1-27.55 mm (mean 22.90 mm), whorls 4 3/8 to 5 3/4 (mean 5-). Apex and spire strongly and evenly elevated (**Figs 272b,e**), shell height 15.3-25.2 mm (mean 19.46 mm), H/D ratio 0.733-0.951 (mean 0.849). Body whorl usually descending moderately to abruptly behind aperture (**Figs 272b, e**). Spire and body whorl (**Plate 107e**) with irregular low ridgelets and incised spiral lines, sometimes nearly smooth. Umbilicus usually a narrow (**Figs 272c, f**) to moderately open crack, rarely closed or too narrow to measure. Lip usually well expanded and thickened, white. Shell greenish-yellow, usually with a faint spiral red supraperiheral colour band, rarely with a reddish spire suffusion, shell base normally lighter in tone. Based on 237 measured adults.

Genitalia (**Figs 273a-b**) with medium length vagina (V), free oviduct (UV) and shaft of spermatheca (S) twisted around each other, expanded head of spermatheca starting well above base of prostate-uterus. Vas deferens (VD) joining small epiphallic caecum (EC) laterally. Entrance of epiphallus (E) into penis sheath (PS) variable in position. Penis complex slender on lower third, internally with an initially simple main pilaster (PP) that is grossly expanded and corrugated on upper section. Some pilaster foliation around epiphallic pore, much of upper chamber wall with low pustules, accessory ridges prominent.

Central and lateral teeth of radula (**Plate 111a, d, f**) with large anterior flare, high cusp angle and only weak tip curvature, rarely a faint ectoconal trace. Lateromarginal transition (**Plate 111b, e**) variable in rapidity, marginal teeth typical. Jaw (**Plate 111c**) with usual rib reduction on lateral margins.

Discussion

The name *perinflatum* has been used previously for any large, high spired, slightly umbilicated *Sinumelon* from the Red Centre, N Flinders and Gawler Ranges, and the gold field areas of WA. In large part this has reflected the quality of available material - bleached and sand-blasted subfossil examples retaining no trace of shell sculpture and colour, with only one or two examples from a locality. The record from the Finke Gorge (Clench & Archer, 1937), for example, may be based on examples of *Sinumelon expositum* Iredale, 1937.

The type, which could not be located, clearly belonged in the above category of specimen quality. The only illustration of the type (Cox, 1868: pl. 20, fig. 2) is of

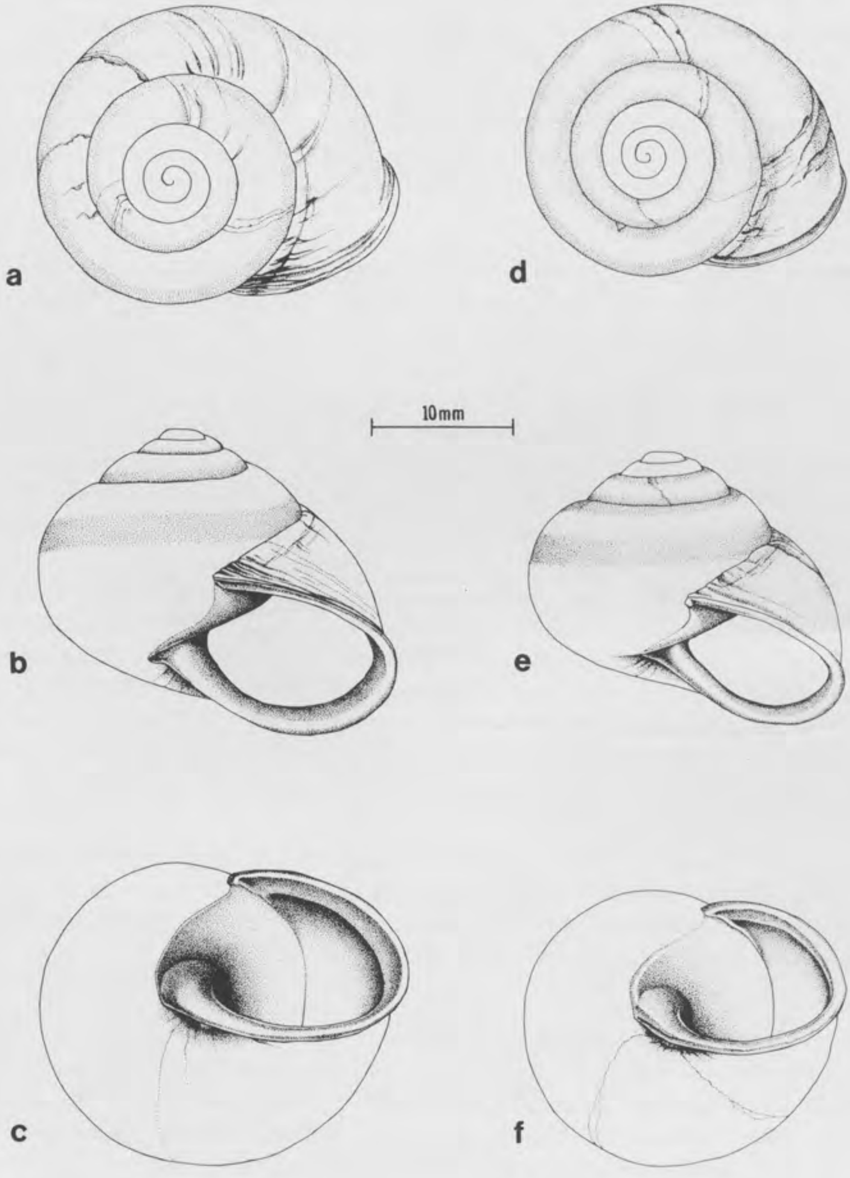


Fig. 272: Shells of *Sinumelon perinflatum* (Pfeiffer, 1864): (a-c) main track to Ambalindum Homestead, Hale River, NT. FMNH 198950; (d-f) WA-732, Prowse Gap, Reynolds Ranges, NT. FMNH 205393, Dissection B. Scale line equals 10 mm. Drawings by Linnea Lahlum.

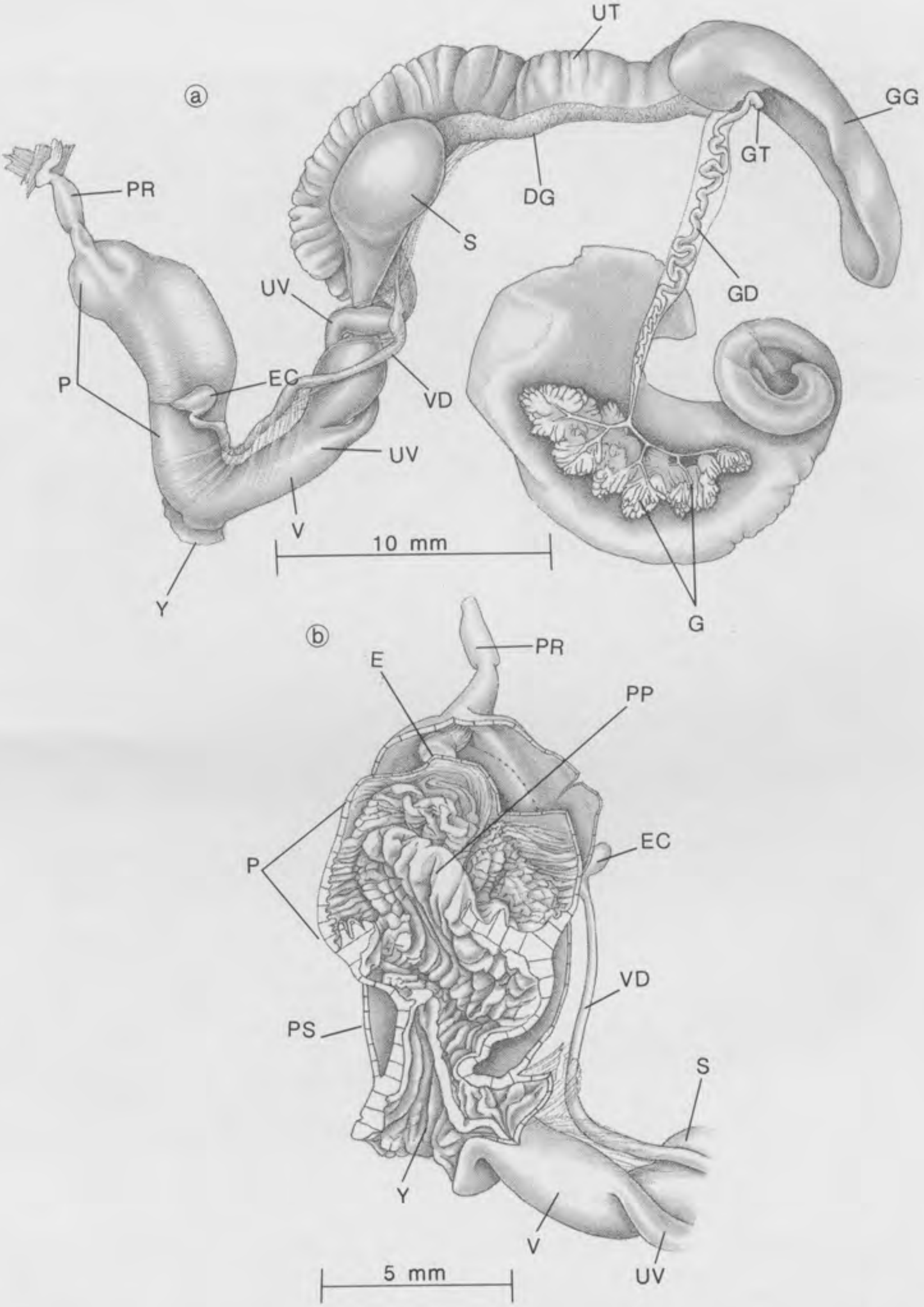


Fig. 273: Genitalia of *Sinumelon perinflatum* (Pfeiffer, 1864): WA-732, Prowse Gap, Reynolds Ranges, NT. 13 April 1981. FMNH 205393. (a) whole genitalia, Dissection A; (b) interior of penis chamber, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

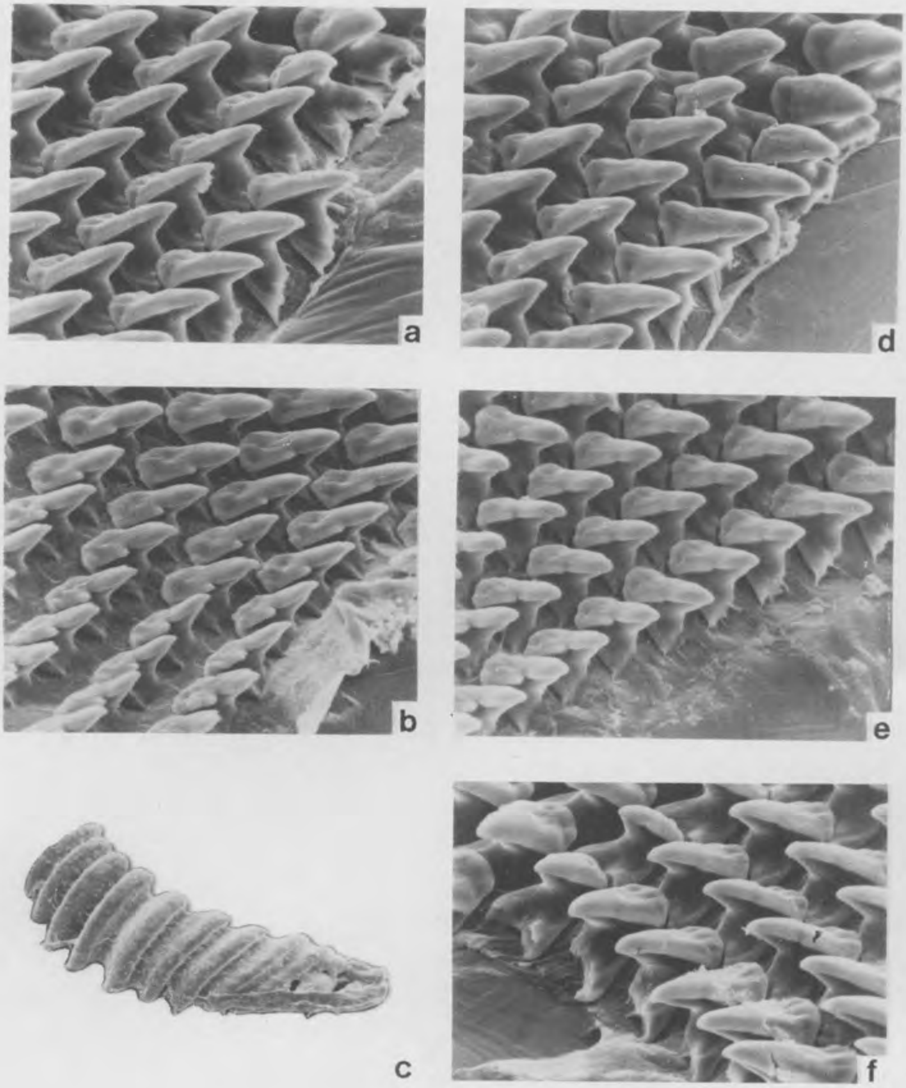


Plate 111: Radular teeth and jaw of *Sinumelon perinflatum* (Pfeiffer, 1864): (a-c) track to Ambalindum Homestead, Hale River, NE of Alice Springs, NT. 25 June 1978. FMNH 198953. a is Dissection C, central and early laterals at 395X, b is Dissection C, lateromarginal transition at 400X, c is Dissection A, jaw at 34.5X; (d-e) WA-732, Prowse Gap, Reynolds Range, NT. 13 April 1983. FMNH 205393, Dissection A. d is central and early laterals at 390X, e is lateromarginal transition at 385X; (f) track to Ambalindum Homestead, Hale River, NT. 25 June 1978. FMNH 198953, Dissection A. Central and early laterals at 405X.

Table 103: Local Variation in *Sinumelon perinflatum* (Pfeiffer, 1864)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
Hale River Area					
Ambalindum-Claraville Road, FMNH 198966	10L	20.70±0.190 (19.65-21.75)	24.39±0.375 (22.6-26.45)	0.850±0.007 (0.817-0.890	$4\frac{7}{8}$+ ($4\frac{3}{4}$+-$5\frac{1}{8}$-)
Ambalindum Hosestead, FMNH 198971	36L	21.73±0.185 (19.8-25.2)	25.08±0.191 (23.05-26.9)	0.867±0.005 (0.796-0.947)	5- ($4\frac{3}{4}$--$5\frac{3}{8}$-)
Ambalindum track, FMNH 198950	8D	22.05±0.337 (20.2-23.2)	25.11±0.364 (23.65-26.9)	0.878±0.010 (0.834-0.930)	$5\frac{1}{4}$- ($4\frac{7}{8}$+-$5\frac{3}{4}$)
Ambalindum track, FMNH 198953	24L	21.79±0.267 (20.1-24.9)	25.00±0.229 (22.55-27.45)	0.872±0.007 (0.816-0.949)	5+ ($4\frac{3}{4}$+-$5\frac{1}{4}$+)
Plenty Highway					
Ongeva Creek, BJS-26 MV	8L	18.75±0.889 (15.35-23.1)	21.33±0.838 (18.1-25.7)	0.878±0.015 (0.825-0.951)	$4\frac{7}{8}$ ($4\frac{3}{8}$-$5\frac{1}{4}$)
Reynolds Range					
Prowse Gap, WA-732, FMNH 205393	29L	18.53±0.190 (17.1-21.35)	22.42±0.184 (21.1-24.85)	0.827±0.006 (0.776-0.910)	5 ($4\frac{3}{4}$+-$5\frac{1}{4}$-)
N slope, WA-729, FMNH 205379	5D	18.20±0.226 (17.4-18.75)	21.97±0.504 (20.9-23.65)	0.830±0.020 (0.776-0.898)	$5\frac{1}{4}$- ($5\frac{1}{8}$--$5\frac{3}{8}$-)
Lander Bore, WA-731, FMNH 205389	33L	17.15±0.181 (15.3-20.2)	21.67±0.196 (19.65-24.6)	0.792±0.004 (0.733-0.859)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-$5\frac{1}{8}$-)
Lander Bore, WA-731, FMNH 205392	4D	20.50±0.543 (18.94-21.45)	23.37±0.481 (22.55-24.75)	0.877±0.020 (0.828-0.921)	$5\frac{1}{8}$ (5+-$5\frac{3}{8}$-)
20 mi SW of Yuenduma, V-67 SAM	67D	18.25±0.089 (16.8-20.45)	21.16±0.099 (19.5-23.9)	0.863±0.003 (0.808-0.905)	5- ($4\frac{5}{8}$+-$5\frac{1}{4}$-)

poor quality, but the high spire, narrow umbilical crack, and size (shell height 20 mm, diameter 23.5 mm, H/D ratio 0.851), as delineated in the original description, agree very well with the average measurements of populations assigned here (**Table 102**). No other Red Centre species comes close in size, shape, and umbilical features. Thus the name *perinflatum* is restricted to these populations from N of the MacDonnell Ranges. Literature citations given above exclude those that clearly refer to some of the other species recognized in these studies. They are allocated appropriately in this and other papers.

Shell size variation is relatively minor (**Table 103**). Specimens from the Ambalindum-Claraville area are larger in diameter and generally higher spired than those from the Reynolds Range, except for the few examples taken from Lander Bore (WA-731). The specimens taken from where Ongeva Creek crosses the Plenty Highway (BJS-26) are noticeably smaller in diameter than the Hale River examples. Dissection of examples from Ambalindum and the Reynolds Range show no indication of significant differences in genital structures. The Yuendumu specimens are small in size. Known from bleached specimens only, this population may be another example of local size reduction.

SINUMELON HULLANUM, SP. NOV.
(Plates 107a-d, 112a-f; Figs 274a-c, 275a-b)

Comparative remarks

Sinumelon hullanum, sp. nov., known only from where the Hull River passes through the Petermann Ranges (WA-922, Lassiter's Cave), NT (**Map 7**), has prominent apical pustulations (**Plate 107a**), large radial ridgelets (**Plate 107b**), and crescentic pustulations on the spire and body whorl (**Plate 107c-d**), a prominent red colour suffusion on the spire, abrupt descension of the body whorl just behind the lip (**Fig. 274b**), is medium in size (mean diameter 21.33 mm), with a high spire (**Fig. 274b**, mean H/D ratio 0.908), relatively high whorl count (mean whorls 5 1/8-), closed to nearly closed umbilicus (**Fig. 274c**), and expanded white lip (**Figs 274a-c**). *S. pedasum* Iredale, 1937, from the Birksgate, Everard, and part of the Musgrave Ranges to the S and E, is very similar in shape (**Figs 277b, e-f, 278b**, mean H/D ratio 0.900), umbilical, lip, and body whorl descension features, but, except for a few small sized populations with reduced whorl counts, is much larger (mean diameter 23.98 mm) at nearly the same whorl count (mean whorls 5+), usually has a red spiral supraperipheral colour band (some populations do have the spire suffusion), and lacks the prominent spiral shell sculpture (**Plate 108d**). *S. bednalli* (Ponsonby, 1904), from the central MacDonnell Ranges to the NE, has an open umbilicus (**Fig. 274f**, mean D/U ratio 10.3), much lower whorl count (**Fig. 274d**, mean whorls 4 5/8+), cancellated shell sculpture (**Plate 108b-c**), and a slightly lower spire (**Fig. 274e**, mean H/D ratio 0.861). *S. perinflatum* (Pfeiffer, 1864), from N of the MacDonnell Ranges between Claraville Station on the Hale River to the E and the fringes of the Tanami Desert, is larger (mean diameter 22.90 mm), has a slight umbilical crack (**Figs 272c, f**), lower spire

(**Figs 272b, e**, mean H/D ratio 0.849), and reduced shell sculpture (**Plate 107e**). All other Red Centre species lack the spiral sculpture and are either much smaller or less elevated in shell shape. Anatomically (**Figs 275a-b**), the very high insertion of the epiphallus (E) into the penial sheath (PS), large epiphallic caecum (EC), tapering upper portion of the penis complex (**Fig. 275a**), and reduced size of the penis chamber wall sculpture (**Fig. 275b**) combine with the grey markings on the neck and foot to distinguish *S. hullanum* from *S. pedasum*, *S. perinflatum*, and *S. bednalli*. The lower entry of the epiphallus (**Figs 273a, 276a, 279a**) and much more prominent penis chamber wall sculpture in the latter three species are obvious differences, while *S. perinflatum* lacks the grey markings on the neck and foot.

Holotype

AM C.135954, WA-922, under figs at entrance to Lassiter's Cave, Hull River, Petermann Ranges, Northern Territory, Australia (Petermann 1:250,000 map sheet SG52-7 - 2225:8880yds. 25° 01' 01" S, 129° 23' 28' E. Collected by the Central Australian Expedition 18 May 1983. Height of shell 19.15 mm, diameter 21.3 mm, H/D ratio 0.899, whorls 5, umbilicus a very narrow lateral crack.

Paratopotypes

AM C.135955-6, SAM D17554-5, WAM 483.87, WAM 484.87, MV, QM, FMNH 212331-2, 13 LA, 2 DA, 8 LJ, 7 DJ from the type locality.

Range

Sinumelon hullanum has been collected only from a single patch of figs at the entrance to Lassiter's Cave (WA-922) on the banks of the Petermann Ranges, NT (**Map 7**). No other collections have been made in the Petermann Ranges, so the actual range is unknown.

Diagnosis

Shell medium in size, adult diameter 19.4-24.45 mm (mean 21.33 mm), whorls 4 7/8- to 5 3/8- (mean 5 1/8). Apex and spire strongly and evenly elevated (**Fig. 274b**), shell height 16.8-22.55 mm (mean 19.38 mm), H/D ratio 0.844-0.975 (mean 0.908). Body whorl descending sharply just behind aperture (**Fig. 274b**). Apex (**Plate 107a**) densely pustulated, spire and body whorl (**Plate 107b-d**) with rather crowded radial ridgelets and crescentic pustulations. Umbilicus a very narrow lateral crack (**Fig. 274c**) to closed. Lip moderately expanded (**Figs 274a-c**), more on columellar margin, white. Shell greenish-yellow, usually with a moderate lower spire reddish suffusion that stops above periphery of body whorl. Base of shell lighter in tone. Based on 16 measured adults.

Genitalia (**Figs 275a-b**) with medium length vagina (V). Free oviduct (UV) and shaft of spermatheca (S) tightly coiled, head of spermatheca elongated. Vas deferens (VD) entering laterally on large epiphallic caecum (EC). Epiphallus (E) entering penis sheath (PS) well above middle, coiled apically. Penis complex tapering apically. Interior of penis chamber (**Fig. 275b**) with main pilaster (PP) reduced in size, upper walls with low and complex ridging.

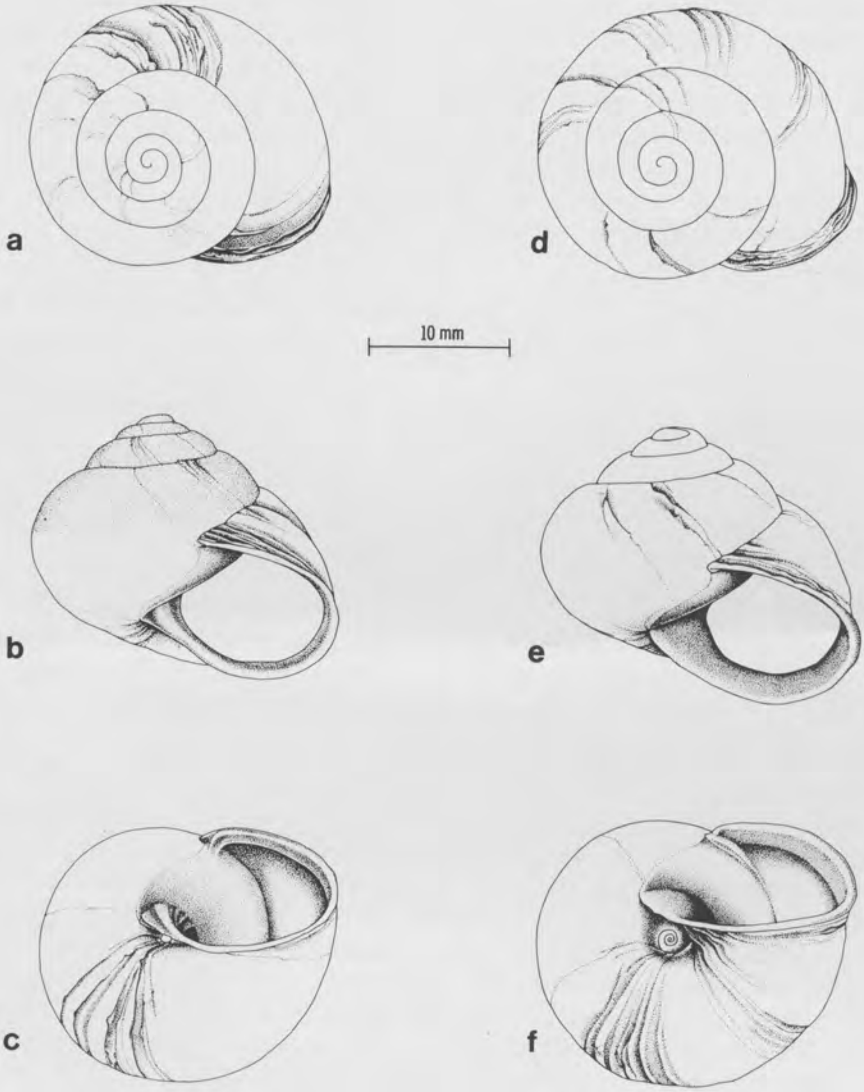


Fig. 274: Shells of *Sinumelon hullanum*, sp. nov., and *S. bednalli* (Ponsonby, 1904): (a-c) Holotype of *S. hullanum*, WA-922, Lassiter's Cave, Hull River, Petermann Ranges, NT. AM C.135954; (d-f) *S. bednalli*, WA-128, Alice Springs Telegraph Station National Park, NT. FMNH 182407. Scale line equals 10 mm. Drawings by Linnea Lahlum.

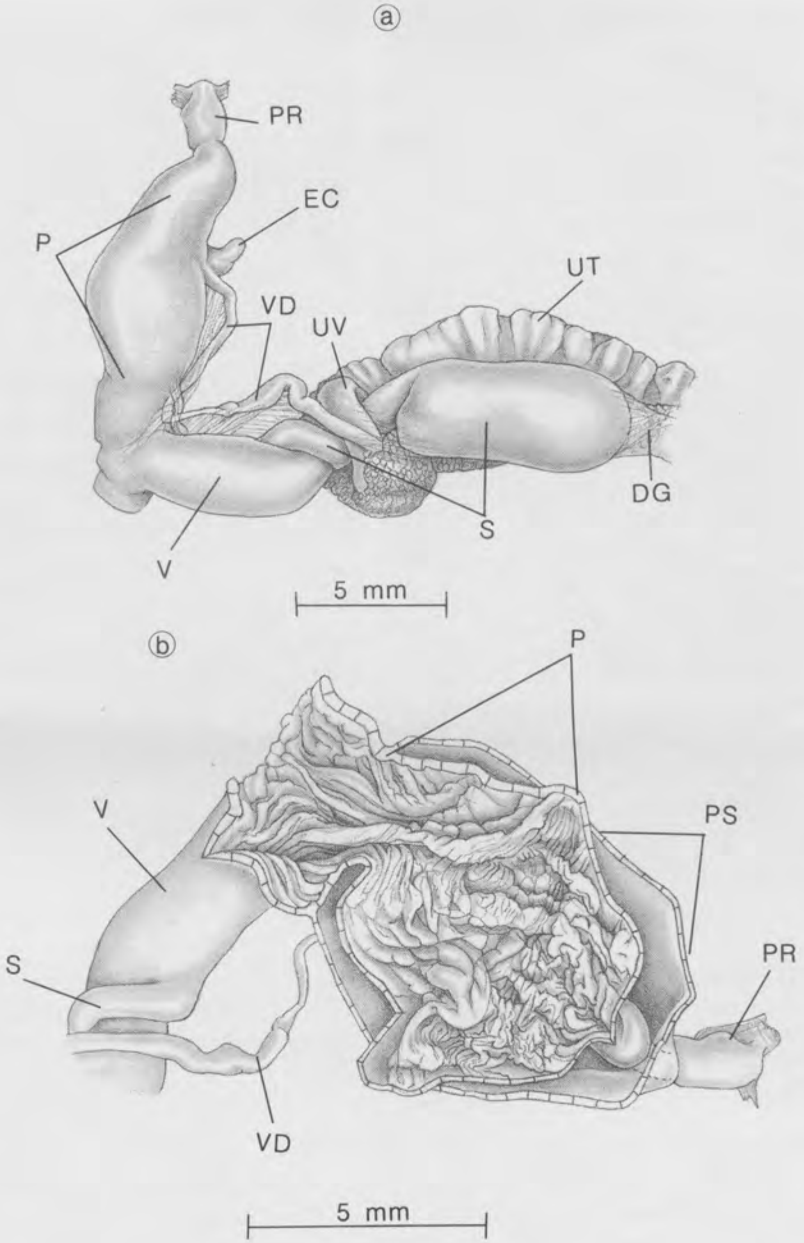


Fig. 275: Genitalia of *Sinumelon hullanum*, sp. nov.: WA-922, Lassiter's Cave, Hull River, Petermann Ranges, NT. 18 May 1983. FMNH 212332, Dissection B. (a) terminal genitalia; (b) interior of penis chamber. Scale lines as marked. Drawings by Linnea Lahlum.

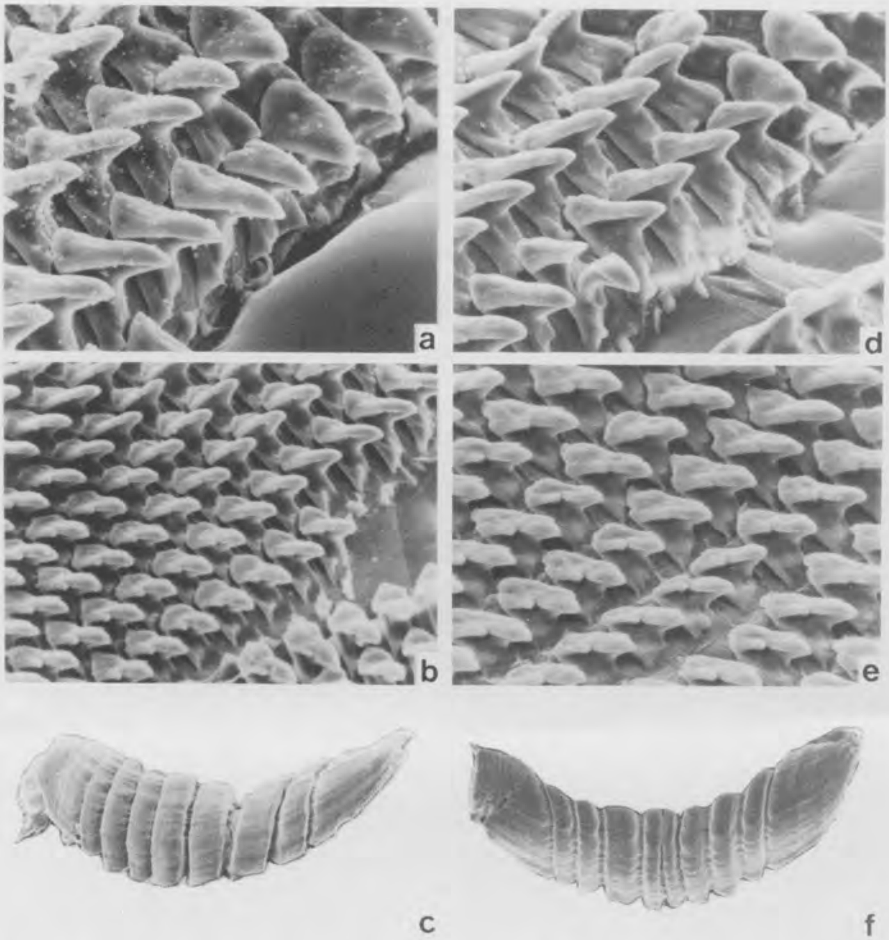


Plate 112: Radular teeth and jaw of *Sinumelon hullanum*: WA-922, Lassiter's Cave, Hull River, Petermann Ranges, NT. 18 May 1983. FMNH 212332. 18 May 1983; (a-c) Dissection A. a is central and early laterals at 465X, b is lateromarginal transition at 290X, c is jaw at 35X; (d-f) Dissection B. d is central and early laterals at 380X, e is lateromarginal transition at 370X, f is jaw at 31X.

Central and lateral teeth of radula (**Plate 112a, d**) with very high cusp angle, variable anterior flare, large basal ridge support, little cusp tip curvature, and no ectocone. Lateromarginal transition (**Plate 112b, e**) very gradual, hence number of lateral teeth increased to 20-23. Jaw (**Plate 112c, f**) with ribbing variable in width, restricted to central area, absent from sides.

Discussion

During my field work in 1983, the Docker River Community had more immediate concerns than providing guides for biologists, and we were not able to obtain their permission for more extensive collecting efforts in this area. Only the one station (WA-922) at Lassiter's Cave was sampled. While undoubtedly additional colonies will be discovered in the Petermann Ranges, this may be near the limit of *Sinumelon* distribution. Only *Baccalena* has been collected in the Schwerin Mural Crescent, WA to the W and also at Mt. Olga, NT to the E. No *Sinumelon* have been found at either place.

Despite the limited material, *S. hullanum* shows enough unusual features to merit naming. The shell sculpture is more complex than that of *S. pedasum* Iredale, 1937 and less than *S. bednalli* (Ponsonby, 1904) (compare **Plates 107-108**); the apically tapering penis complex, with reduced major penis chamber sculpture (**Figs 275a-b**), finds its counterpart in *S. gillensis* (**Figs 289a-c**) and *S. expositum* Iredale, 1937 (**Figs 283a, c**), which differ strikingly in shell size and shape (**Table 102**); and the radula (**Plate 112a-e**) is very unusual in that the number of lateral teeth is 20 to 23, whereas in the even larger sized *S. pedasum*, *S. perinflatum*, and *S. bednalli* there are only 15 to 18 laterals.

The name *hullanum* is taken from the Hull River.

SINUMELON BEDNALLI PONSONBY, 1904
(Plates 108a-c, 113a-e; Figs 274d-f, 276a-b)

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Xanthomelon bednalli Ponsonby, 1904, Proc. Malac. Soc. London, **6** (3): 182, text figs 1-2 - MacDonnell Range, Central Australia.

Sinumelon bednalli (Ponsonby), Iredale, 1937, South Austr. Nat., **18** (2): 42; Iredale, 1938, Austr. Zool., **9** (2): 103; Richardson, 1985, Tryonia, **12**: 276.

Comparative remarks

Sinumelon bednalli (Ponsonby, 1904), known from two localities in the central MacDonnell Ranges near Alice Springs, NT (**Map 7**), is immediately recognizable by its densely pustulose apex, followed by decussated spire and body whorl shell sculpture (**Plate 108a-c**). All other Red Centre *Sinumelon* have at most vague to weak radial ridglets occasionally crossed by incised spiral lines (for example **Plate 107e**). *S. bednalli* is one of the largest species, mean diameter 22.69 mm, but has a relatively low whorl count (mean 4 5/8+), and a widely open umbilicus (**Fig. 274f**, mean D/U ratio 10.3). The apex and spire are evenly elevated (**Fig. 274e**), the shell lip is broadly expanded (**Figs 274d-f**), and fresh specimens show a weak reddish supraperipheral spiral colour band. Both the more northern and eastern *Sinumelon perinflatum* (Pfeiffer, 1864) (**Figs 272a-f**) and the Kulgera-Musgrave-Everard *S. pedasum* Iredale, 1937 (**Figs 277a-f, 278a-c**) differ in having closed or nearly closed umbilici, less expanded lips, usually only radial sculptural (**Plate 107, 108d**) elements on the shell (occasionally, **Plate 107e**, with incised spiral lines), and in averaging a distinctly higher whorl count despite being only very slightly larger in size (**Table 102**). All other Red Centre species are smaller and with much reduced shell sculpture. Anatomically (**Figs 276a-b**) the low entry of the epiphallus (E) into the sheath wall, long vagina (V), and intensification of apical sculpture inside the penis chamber (**Fig. 276b**) are diagnostic. *S. perinflatum* (**Figs 273a-b**) has high entry of the epiphallus (E), a short vagina (V), and the penial wall sculpture is intensified in a different manner, while *S. pedasum* (**Figs 279a-b**) has high entry of the epiphallus (E), a long vagina (V), and develops very large accessory ridges inside the penis chamber.

Holotype

SAM D14181, MacDonnell Ranges, South Australia. Ex W. Bednall. Height of shell 19.0 mm, diameter 21.6 mm, H/D ratio 0.880, whorls 4 5/8, umbilical width 2.2 mm, D/U ratio 9.82.

Studied material

Northern Territory

MACDONNELL RANGES: Alice Springs Telegraph Station National Park (WA-128, 1 mile N of Anzac Hill turnoff, Stuart Highway, SAM D17756-7, WAM 485.87, WAM 486.87, AM, MV, QM, FMNH 182407, FMNH 182528, FMNH 182692, FMNH 182718, 85 LA, 37 DA, 13 LJ, 16 DJ); W of Jay Creek Settlement (WA-439, 3.1 km E of Glen Helen turnoff, SAM D17558, WAM 487.87, AM, FMNH 199697, FMNH 199700, 7 LA, 1 DA; BJS 41, NMV, 6 LA).

Range

Sinumelon bednalli (Ponsonby, 1904) is known from only two localities on the fringes of the MacDonnell Ranges: Alice Springs Telegraph Station to the N, and just W of Iwupataka (= Jay Creek) Settlement, to the W of Alice Springs, NT (**Map 7**). These localities are about 41 air km apart. It has not been found at several intermediate collecting stations.

Diagnosis

Shell large, adult diameter 19.8-26.05 mm (mean 22.69 mm), whorls 4 3/8- to 5 1/4 (mean 4 5/8+). Apex and spire usually strongly and evenly elevated (**Fig. 274e**), rarely rounded above, shell height 16.95-23.5 mm (mean 19.51 mm), H/D ratio 0.767-0.955 (mean 0.861). Body whorl descending slightly to strongly behind aperture. Apex (**Plate 108a**) densely pustulose, early spire with prominent radial ridgelets (**Plate 108a**), becoming cancellated on lower spire and body whorl, then continuing onto shell base (**Plate 108b-c**). Umbilicus (**Fig. 274f**) open, somehat variable, width 1.05-3.4 mm (mean 2.34 mm), D/U ratio 7.02-22.7 (mean 10.3). Lip strongly expanded and thickened (**Figs 274d-f**), white. Shell greenish-yellow, sometimes with darker zones along growth lines, base lighter in tone, fresh examples often with a faint reddish supraperipheral colour band. Based on 137 measured adults.

Genitalia (**Figs 276a-b**) typical apically, shaft of spermatheca (S) and free oviduct (UV) wrapped around each other, expanded head of spermatheca bound to base of prostate-uterus. Vagina (V) about half length of penis, tapering to atrium (Y),

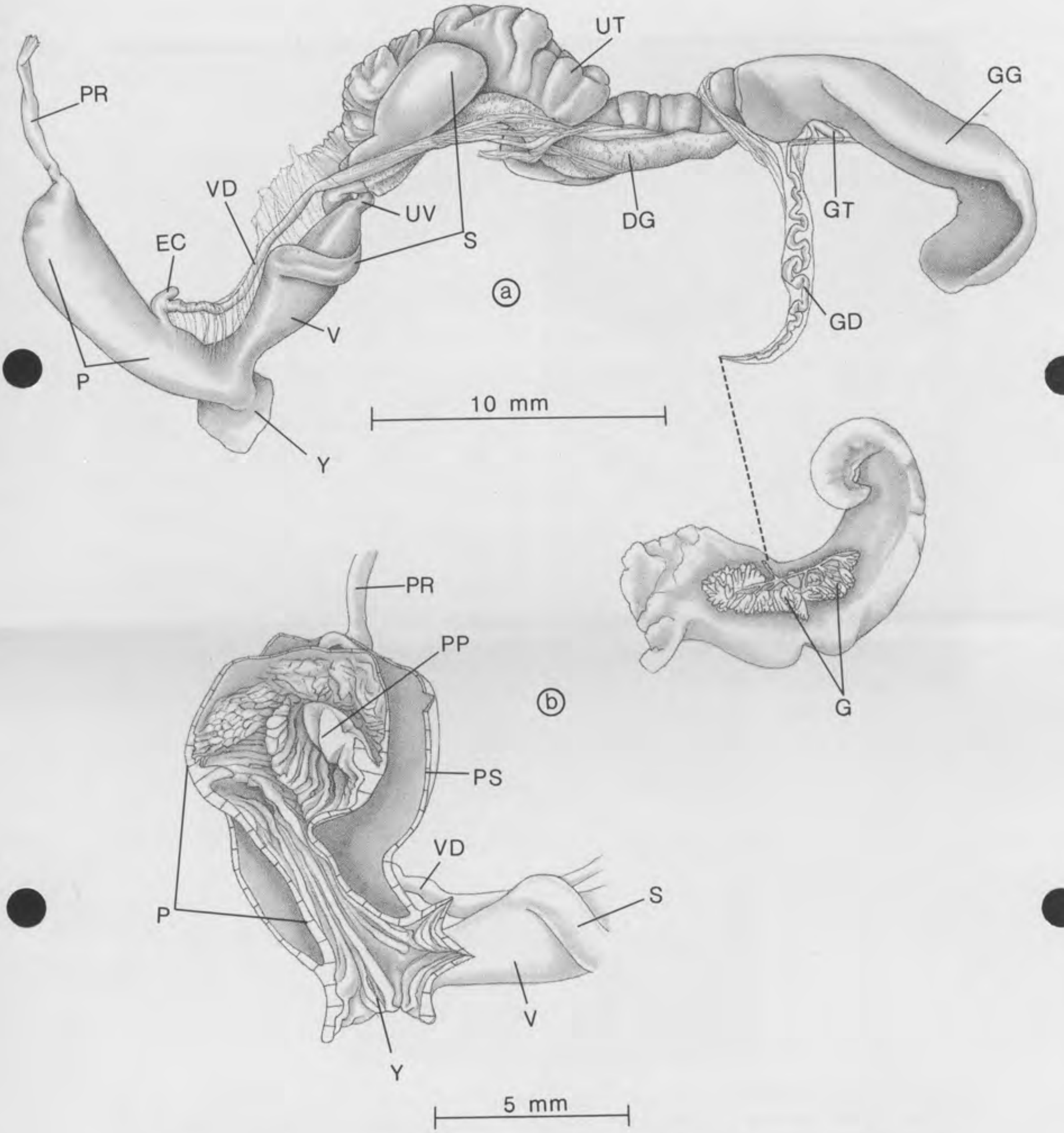


Fig. 276: Genitalia of *Sinumelon bednalli* (Ponsonby, 1904): WA-128, Alice Springs Telegraph Station National Park, NT. 18 May 1983. FMNH 212332, Dissection B. (a) whole genitalia; (b) interior of penis chamber. Scale lines as marked. Drawings by Linnea Lahlum.

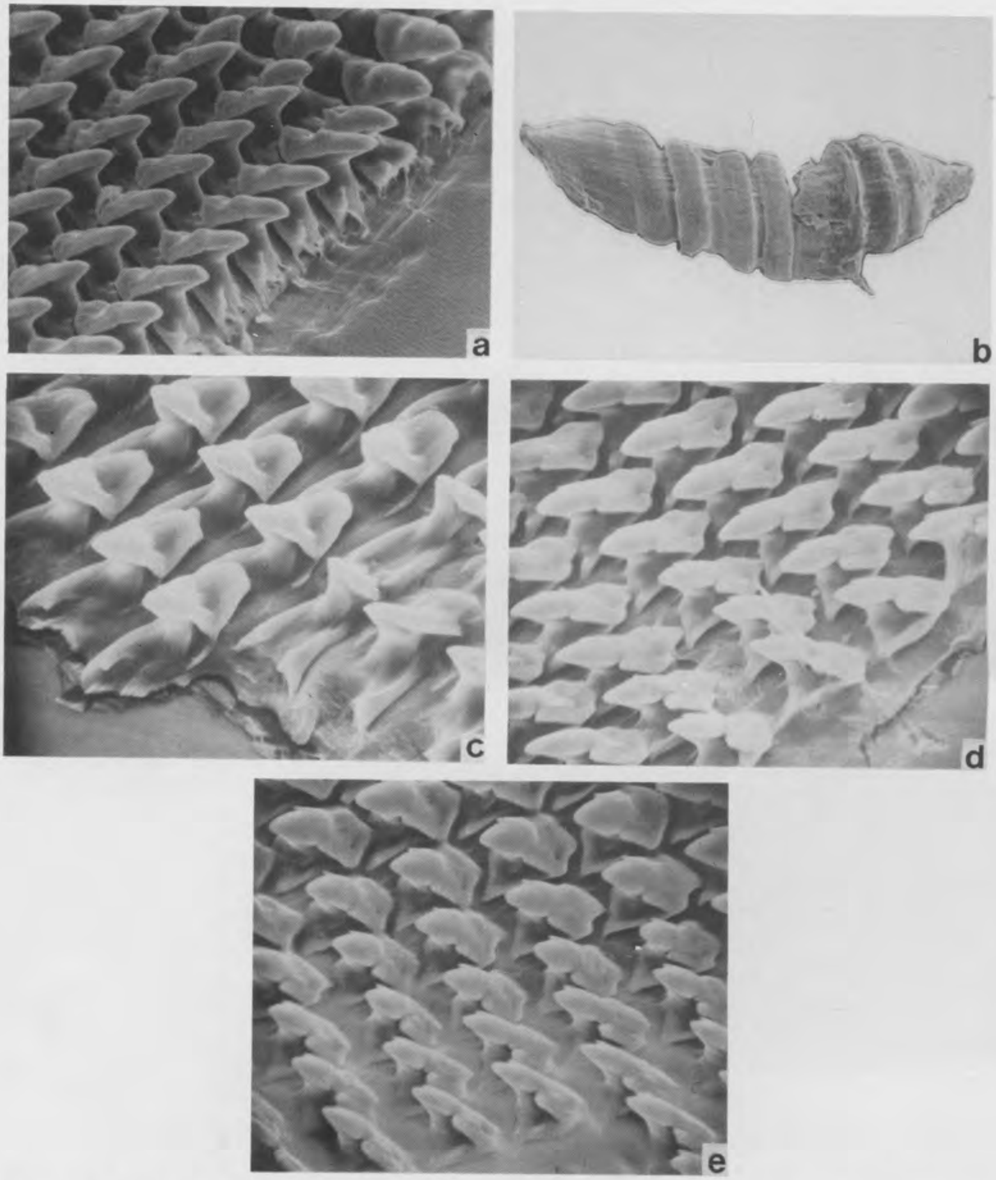


Plate 113: Radular teeth and jaw of *Sinumelon bednalli* (Ponsonby, 1904): (a-b) WA-439, W of Jay Creek Settlement, MacDonnell Ranges, NT. 22 May 1977. FMNH 199700. a is Dissection A, central and early laterals at 355X, b is Dissection B, jaw at 29.8X; (c-e) WA-128, Alice Springs Telegraph Station National Park, NT. 17 March 1974. FMNH 182528, Dissection A. c is late embryonic central and lateral teeth at 480X, d is late lateral teeth at 370X, e is early marginal teeth at 365X.

Table 104: Local Variation in *Sinumelon hullanum* and *S. bednalli* (Ponsonby, 1904)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. hullanum							
Petermann Ranges, WA-922, FMNH 212332	14L	19.54±0.438 (16.8-22.55)	21.52±0.367 (19.4-24.45)	0.907±0.008 (0.844-0.975)	$5^{1}/_{8}$- ($4^{7}/_{8}$--$5^{3}/_{8}$-)	closed	
S bednalli (Ponsonby, 1904)							
Alice Springs, WA-128, FMNH 182528	85L	19.40±0.114 (16.95-21.7)	22.64±0.131 (19.8-26.95)	0.858±0.004 (0.767-0.955)	$4^{5}/_{8}$+ ($4^{3}/_{8}$--$4^{7}/_{8}$+)	2.44±0.045 (1.15-3.4)	9.57±0.201 (7.02-19.4)
Alice Springs, WA-128, FMNH 182407	37D	19.33±0.138 (17.4-21.55)	22.57±0.133 (21.0-24.5)	0.857±0.006 (0.786-0.948)	$4^{3}/_{4}$- ($4^{1}/_{2}$--5-)	2.45±0.061 (1.65-3.15)	9.42±0.245 (7.19-13.8)
Jay Creek, BJS 41, NMV	6L	21.43±0.726 (18.5-23.5)	24.17±0.577 (21.5-25.5)	0.886±0.011 (0.860-0.922)	$4^{7}/_{8}$ ($4^{5}/_{8}$-$5^{1}/_{4}$)	1.26±0.084 (1.05-1.5)	19.5±1.053 (16.6-22.7)
Jay Creek, WA-439, FMNH 199700	7L	20.11±0.125 (19.75-20.45)	22.96±0.228 (22.05±23.55)	0.876±0.008 (0.847-0.919)	$4^{3}/_{4}$+ ($4^{3}/_{4}$- -$4^{7}/_{8}$+)	1.63±0.111 (1.15-2.0)	14.5±1.093 (11.0-19.9)

internally with very fine longitudinal pilasters. Vas deferens (VD) slender, not coiled around female organs, entering small epiphallic caecum (EC) laterally. Epiphallus (E) with very low attachment to the penis sheath (PS), bound into sheath to point just below enlargement of penis, then passing through sheath and ascending inside wall to apex where it coils and receives insertion of penial retractor muscle (PR) before reflexing to enter penis. Penis sheath very thin-walled. Penis (P) long, reaching to base of spermathecal head, enlarged on upper two-thirds, narrowed basally. Interior of penis (**Fig. 276b**) with main pilaster (PP) restricted to upper chamber, somewhat corrugated, some corrugated pilasters around epiphallic pore (EP), with moderate zone of accessory ridges. Lower portion of penis without special sculpture.

Central and early laterals (**Plate 113a**) with prominent anterior flare, high cusp angle with partly curved cusp tip, basal support ridge large, ectocone at most a faint trace. Late laterals (**Plate 113d**) with enlarged anterior flare and reduced cusp curvature. Both ectocone and endocone visible on late laterals (**Plate 113d**), early marginals (**Plate 113e**) typical. Jaw (**Plate 113b**) with ribbing reduced on sides.

Discussion

Sinumelon bednalli (Ponsonby, 1904) is locally very common. Shells from the two colonies differ (**Table 104**) slightly in size, whorl count, and umbilical size, but agree fully in sculpture and basic genital features.

Specimens collected in March 1974 had a long zone of active growth in the radula. The opportunity is taken to illustrate (**Plate 113c**) the very high cusp shaft angle and huge anterior flare found in untanned central and early lateral teeth. The examples taken in May 1981 had a much shorter zone of teeth under development, reflecting entry into aestivation by the snail. A half row count for these was 15 laterals and 40-43 marginals.

The lower spire and body whorl shell surface sculpture (**Plate 108b-c**) has been formed by strong spiral lines cutting through well defined radial ribs, and thus producing a cancellated or pustulated effect. It is the only species of *Sinumelon* with this type of shell sculpture.

SINUMELON PEDASUM IREDALE, 1937
(Plates 108d, 114a-e; Figs 277a-f, 278a-c, 279a-b)

Helix (Galaxias) perinflata Bednall, 1892 (not Pfeiffer, 1864), Trans. Royal Soc. South Austr., **16:** 62-63, pl. I, fig. 6 - In part.

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Xanthomelon perinflatum Hedley, 1905 (not Pfeiffer, 1864), Trans. Proc. Rep. Roy. Soc. South Austr., **29:** 162 - Musgrave Ranges, SA; Riddle, 1915, *Ibid.*, 39: 770-771 - Moorilyanna Native Well; Glen Ferdinand, Musgrave Ranges; Everard Ranges.

Sinumelon impletum Iredale, 1937, South Austr. Nat., **18** (2): 44, pl. I, fig. 1 - Birksgate Ranges, South Australia; Iredale, 1938, Austr. Zool., **9** (2): 105; Richardson, 1985, Tryonia, **12:** 277.

Sinumelon pedasum Iredale, 1937, South Austr. Nat., **18** (2): 44, pl. II, fig. 2 - Musgrave Ranges, South Australia; Iredale, 1938, Austr. Zool., **9** (2): 105; Richardson, 1985, Tryonia, **12:** 277.

Sinumelon eupesum Iredale, 1937, South Austr. Nat., **18** (2): 45, pl. II, fig. 1 - Musgrave Ranges, South Australia; Iredale, 1938, Austr. Zool., **9** (2): 103; Richardson, 1985, Tryonia, **12**: 276.

Sinumelon corinum Iredale, 1937, South Austr. Nat., **18** (2): 46, pl. II, fig. 5 - under figs, Mount Illbillee Soakage, Everard Ranges, South Australia; Iredale, 1938, Austr. Zool., **9** (2): 105; Richardson, 1985, Tryonia, **12:** 276.

Comparative remarks

Sinumelon pedasum Iredale, 1937, from near Oodnadatta W through the Everard, Birksgate, and part of the Musgrave Ranges, SA, then to just N of Kulgera, NT (**Map 7**), is characterized by its very large size (mean diameter 23.98 mm) and relatively low whorl count (mean 5+), closed to slightly open umbilicus (**Figs 277c-d**), relatively reduced radial sculpture (**Plate 108d**), frequent presence of a red supraperipheral spiral colour band and/or spire colour suffusion, and abrupt descension of the body whorl just behind the aperture (**Figs 277b, d-f, 278b**). *S. perinflatum* (Pfeiffer, 1864), from the Hale River area W through the Reynolds Ranges, N of the MacDonnell Ranges, NT, is slightly less elevated (**Figs 272b, e,** mean H/D rato 0.849), very narrowly umbilicated (**Figs 272c, f**), with weaker sculpture (**Plate 107e**), and the lip noticably expanded. *S. bednalli* (Ponsonby, 1904), from the MacDonnell Ranges, is slightly smaller (mean diameter 22.69 mm), has a reduced whorl count (mean 4 5/8+), an open umbilicus (**Fig. 274f**, mean D/U ratio 10.3), and cancellated shell sculpture (**Plate 108b-c**). *S. tarcoolanum* Solem (1992a: figs 82a-c), known from the transcontinental rail line between Ooldea and Tarcoola, then S to the N tips of the Gawler Ranges, SA, is very similar, but differs in its heavier shell sculpture, greater whorl count (mean 5 3/8-), and thicker shell. *S. hamiltoni* Solem (1992a: figs 82d-f), from Lake Eyre South to near Woomera and Lake Callabonna, SA, has the shell much less elevated (mean H/D ratio 0.837), a moderately expanded shell lip (Solem, 1992a: figs 82d-f), and weak shell sculpture including pustulations. Anatomically, *S. pedasum* (**Figs 279a-b**) has short terminal female genitalia, a reduced main pilaster, and expanded apical penis chamber sculpture. *S. perinflatum* (**Figs 273a-b**) is very similar, but has a much larger main pilaster (PP). *S. tarcoolanum* has (Solem, 1992a: figs 83a-b) the terminal female genitalia elongated, a thick penis, with large, simple wall sculpture. *S. hamiltoni* (Solem, 1992a: figs 84a-b) also has elongated terminal female genitalia, but the penis chamber wall sculpture is reduced in size and very complex.

Holotypes

Sinumelon impletum Iredale, 1937: SAM D14176. Birksgate Ranges, South Australia. Collected by Richard Helms in 1890. Height of shell 21.6 mm, diameter 24.4 mm, H/D ratio 0.885, whorls 5 3/8+, umbilicus a narrow lateral crack.

Sinumelon pedasum Iredale, 1937: AM C.19222. Musgrave Ranges, South Australia. Collected by Herbert Basedow. Height of shell 23.1 mm, diameter 26.4 mm, H/D ratio 0.875, whorls 5-, umbilicus nearly completely closed.

Sinumelon eupesum Iredale, 1937: AM C.60540. Musgrave Ranges, South Australia. Collected by Herbert Basedow. Height of shell 20.45 mm, diameter 24.5 mm, H/D ratio 0.835, whorls 4 3/4, umbilical width (open because of repaired break on shell) 1.8 mm, D/U ratio 13.6.

Sinumelon corinum Iredale, 1937: SAM D14178. Mount Illbillee Soakage, Everard Ranges, South Australia. Collected by Richard Helms in 1890. Height of shell 22.8 mm, diameter 26.2 mm, H/D ratio 0.870, whorls 5 1/4-, umbilicus closed.

Paratopotypes

Sinumelon impletum Iredale, 1937: SAM D14914, AM C.60517, SAM, 21 DA from the Birksgate Ranges.

Sinumelon pedasum Iredale, 1937: AM C.112623, SAM D15546, 7 DA from the type collection.

Sinumelon eupesum Iredale, 1937: AM C.15583, 1 DA from the type collection.

Sinumelon corinum Iredale, 1937: AM C.15583, AM C.112629, SAM, 9 DA from the type collection.

Studied material

Northern Territory

KULGERA AREA: 7.5 km N of (WA-767, under figs, SAM D17827, AM, WAM 549.87, FMNH 205566-7, 1 LA, 20 DA, 2 LJ, 9 DJ; BJS-15, 7 km N of Kulgera, MV, 3 LA, 1 LJ); 5.5 km N of (WA-768, SAM D17828-9, AM, WAM 550.87, WAM 551.87, FMNH 205568-9, 19 LA, 3 DA, 1 LJ, 11 DJ); 9 km SW of (WA-769, SAM D17826, AM, WAM 548.87, FMNH 205570-1, 12 LA, 17 DA, 5 LJ, 6 DJ).

South Australia

DALHOUSIE-OODNADATTA AREA: Dalhousie Springs (AM C.149592-3, 38 DA, 9 DJ); near Ilbunga Rail Station, The Stevenson, Dalhousie Springs (AM C.149596, 2 DA); Oodnadatta (30 miles NW of, SAM, 7 DA; Little Cadnapowie Spring, 34 km SE of, 28 km NNE of Mt. Dutton, SAM, 11 DA).

GRANITE DOWNS AREA: Granite Downs Station (BJS-8, 7 km WNW of homestead, MV, 3 LA, 2 LJ); NE side Stuart Highway at Marryat River Crossing, NW of Agnes Creek Station (Bob Read! 5 August 1984, FWA, 19 DA, 8 DJ); Teds Well, N of Tieyon Homestead (J. E. Johnson! 17 April 1954, SAM, 14 DA); Twin Hill, W of DeRose Hill, S of Agnes Creek (Bob Read! July 1984, FWA, 8 DA); near DeRose Hill, S of Agnes Creek Station (Bob Read! 23 September 1984, FWA, 10 DA); Eateringinna Creek, W of Agnes Creek Station (Bob Read! August 1984, FWA, 6 DA, 1 DJ); Tarcoonyinna Creek, E side Stuart Highway (SAM, 20 DA; Bob Read! 28 September 1984, FWA, 4 DA); Mengerson's Well, Granite Downs (SAM, 14 DA, 3 DJ; WA-941, 3 km W of, WAM 530.87, SAM D17802, FMNH 212422, 14 LA, 5 LJ); S of Mt. Chandler Well, Indulkana Ranges (Bob Read! 17 October 1984, FWA, 1 DA); Moorilyanna Soak (SAM, 7 DA).

EVERARD RANGE AREA: Everard Park road, 58 km W of Stuart Highway junction (BJS-9, 1 LA, 3 LJ); Mimili (25 km E of, WA-847, WAM 540.87, WAM

541.87, SAM D17818-9, AM, MV, QM, FMNH 212073-4, 11 LA, 28 DA, 25 LJ, 28 DJ; WA-848, hill S of track, 16 km E of, SAM D17820-1, WAM 542.87, WAM 543.87, AM, FMNH 212075-6, 10 LA, 10 DA, 12 LJ, 3 DJ; WA-849, hill S of track, 7.2 km E of Mimili, WAM 544.87, SAM D17822, AM, FMNH 212077-9, 1 LA, 7 DA, 2 LJ, 3 DJ); Victory Well (WA-852, 19.1 road km E of, WAM 545.87, SAM D17823, AM, FMNH 212090-1, 12 LA, 1 DA, 12 LJ, 1 DJ; WA-858, hills SW of, SAM D17807, WAM 532.87, AM, FMNH 212110-1, 10 LA, 1 DA, 4 LJ, 1 DJ); near Mimili Station gate (BJS-13 and BJS-14, MV, 1 LA, 5 LJ); Robb Well (WA-856, hill 7.7 km W of Robb Well turnoff, SAM D17816, FMNH 212099-100, 3 LA, 1 DA, 1 LJ; WA-854, 8 km SW of Robb Well, FMNH 212095, 4 DJ); Mt. Illbillee (WA-857, Mt. Illbillee, E end, FMNH 212101, 1 DA, 3DJ); 3 miles W of Chamber's Bluff (SAM, 23 DA, DJ); Mt. Carmeena (2 miles W of, SAM, 14 DA, DJ); Thingoona Hill (WA-855, outliers, under figs, FMNH 212098, 1 LJ); near Teeta Hill (WA-859, NE of Teeta Bore, SAM D17817, AM, FMNH 205832, FMNH 212112, 1 LA, 6 DA, 2 DJ; WA-860, 4.4 km NE of Teeta Bore, WAM 539.87, AM, FMNH 212113, 4 DA, 3 DJ); Fregon (waterhole 16 km S of, SAM, 1 DA, DJ; E of Fregon Mission, Bob Read! 17 October 1984, FWA, 3 DA, 1 DJ); Shirley Well, NNW Fregon Mission (SAM, 6 DA; Bob Read! 17 October 1984, FWA, 2 DA).

MUSGRAVE RANGE AREA: Kenmore Park-Mimili Road (WA-864, SAM D17811, SAM D17830, WAM 535.87, WAM 552.87, AM, QM, MV, FMNH 212128-9, 25 LA, 15 DA, 15 LJ, 6 DJ; WA-865, 6.2 km S of No. 8 Well, WAM 538.87, SAM D17814, AM, QM, MV, FMNH 212130-1, 37 LA, 5 DA, LJ, DJ; WA-866, 4.3 km S of No. 8 Well, SAM D17810, SAM D17825, WAM 547.87, AM, QM, MV, FMNH 212132-4, 33 LA, 45 LJ, 4 DJ); Kenmore Park Homestead (WA-867, side of creek just E of, SAM D17824, WAM 546.87, AM, FMNH 212135, 12 LA, 10 LJ); NW of Kenmore Park (Bob Read!, 9 November 1983, FWA, 2 DA); Tietkin's Birthday Creek, Ernabella (27 April 1957, SAM, 6 DA); Young's Well, NNE of Ernabella (SAM, 3 DA; P. C. Smith! 28 August 1978, FWA, 1 DA); Erlewanjawanja Rock Hole (SAM, 26 DA; SAM, 2 DA); Glen Ferdinand Valley (Bob Read! 11 September 1983, FWA, 1 DA, 1 DJ); Ernabella Mission (gardens, SAM, 1 DA; Ernabella, MV F7787, 2 LA); 16.9 km E of Ernabella (WA-868, WAM 533.87, SAM D17808, AM, MV, QM, FMNH 212136, FMNH 212139, 23 LA, 4 DA, 16 LJ); Wamikata Road, near Alalka turnoff (WA-869, SAM D17809, WAM 534.87, AM, FMNH 212141-2, 15 LA, 2 DA, 14 LJ, 6 DJ; WA-873, 7.3 km N of Alalka turnoff, WAM 536.87, SAM D17812, AM, MV, QM, FMNH 212161, 15 LA, 15 LJ; WA-874, 3.8 km S of Alalka turnoff, WAM 531.87, WAM 537.87, SAM D17806, SAM D17813, AM, FMNH 212162-3, 19 LA, 4 DA, 4 LJ, 3 DJ; WA-870, 9.5 km N of Alalka turnoff, SAM D17805, AM, FMNH 212147-8, 3 LA, 5 DA, 1 DJ); Mt. Cuthbert (WA-872, E outlier, N of Ernabella, SAM D17815, AM, FMNH 212156-7, 3 LA, 9 LJ, 2 DJ; WA-871, W slope of N outlier, SAM, FMNH 212153, FMNH 212155, 1 LA, 1 DA, 3 LJ, 2 DJ); Mt. Woodroffe (WA-876, rockhole area SSE of, SAM D17797-8, WAM 528.77, WAM 646.87, AM, FMNH 212174, FMNH 212188, FMNH 212192-2, 9 LA, 12 DA, 14 LJ, 9 DJ; Mt Woodroffe, 5,000 feet elevation, SAM 4 DA); NW of Mt. Woodroffe, on plains (SAM, 7 DA); 6 km E of Currie River, S side Musgrave Ranges (WA-877, 0.4 km S of Amata track, AM, SAM D17799, WAM 529.87, FMNH 212199-

200, 13 LA, 4 DA, 3 LJ); main ridge S of Mt. Woodroffe, 9.4 km E of Currie River (WA-878, E of Amata, AM, SAM D17800-1, FMNH 212203, FMNH 212205, 3 LA, 2 DA, 1 LJ, 2 DJ); Amata track, 3.7 km W of Currie River, SW of Mt. Woodroffe (WA-879, AM, FMNH 212209, FMNH 212211, 3 LA, 4 DA, 4 DJ).

MANN RANGES AREA: near windmill, plains S of Mann Ranges (WA-901, SAM D17803-4, FMNH 212274-5, 2 DA, 3 LJ).

BIRKSGATE RANGES: Mt. Lindsay (SAM, 3 DA; L. A. Smith! 1 September 1972, WAM, 1 DA, 1 DJ); Mt. Wooltarlinna (L. A. Smith! 1 September 1972, WAM, 2 DA, 2 DJ); Cheesman Peak (rock outcrops near, L. A. Smith! 2 September 1973, WAM, 5 DA, 6 DJ; 19 miles SE of, L. A. Smith! 1-2 September 1973, WAM, 7 DA, 1 DJ); Elder Expedition (near Camp #1, Richard Helms! 25 June 1891, SAM, 2 DA, 6 DJ; ca 20 miles S of Camp #4, Richard Helms! 13 June 1891, SAM, 1 DA, 1 DJ; Camp #4, Richard Helms!, SAM, 28 DA, 3 DJ; Camp #10, 3 DA).

Range

Sinumelom pedasum Iredale, 1937 ranges from near Kulgera, NT southwest to the Birksgate Ranges and Cheesman Peak on the fringes of the Great Victorian Desert, SA (**Map 7**). Known eastern limits are the Oodnadatta area and Dalhousie Springs. It is common from Granite Downs N, and has been collected under figs on small outcrops on the fringes of the Everard Ranges, but is not common on the main hills of the Everard Ranges. There are several thriving colonies in the plains and rolling hill areas between the Everard and Musgrave Ranges, such as near Fregon and Kenmore Park. In the Musgrave Ranges it is restricted to the region E of The Levenger stream (just W of Mt. Woodroffe), occurring through the main ranges to just N of Mt. Cuthbert (WA-871). There is one record from plains 10.5 km S of Katjawara Soak, Mann Ranges (WA-901), and then the Birksgate and Cheesman Peak records. *S. pedasum* has not been found in the main Mann Ranges or in the western Musgrave Ranges.

Diagnosis

Shell usually very large (some dwarfed populations known), adult diameter 17.6-33.05 mm (mean 23.98 mm), whorls 4 1/4 to 5 7/8 (mean 5+). Apex and spire strongly and evenly elevated (**Figs 277b, e, f, 278b**), shell height 13.65-31.2 mm (mean 21.60 mm), H/D ratio 0.780-1.210 (mean 0.900). Body whorl usually descending abruptly just behind aperture (**Figs 277b, e, f, 278b**). Spire and body whorl (**Plate 108d**) with irregular radial ridglets, rarely with traces of incised spiral lines. Umbilicus usually closed or a very narrow crack (**Figs 277c-d, 278c**), slightly open in smaller sized adults. Lip moderately expanded (**Figs 277a-f, 278a-c**), white. Shell greenish-yellow, often with a weak spire suffusion and a relatively inconspicuous red spiral supraperipheral colour band (**Fig. 277b**), sometimes with a dark reddish suffusion covering spire and body whorl to normal base of red spiral band (**Fig. 277f**). Base of shell lighter in tone. Based on 857 measured adults.

Genitalia (**Figs 279a-b**) typical apically, vagina (V) relatively short, tapering slightly to atrium (Y), free oviduct (UV) and shaft of spermatheca (S) coiled, expanded head of spermatheca (S) situated just above base of prostate-uterus. Vas deferens (VD) typical, joining relatively small epiphallic caecum (EC) basally. Epiphallus (E) entering relatively thick wall of penis sheath (PS) submedially to supramedially, coiled apically within sheath. Penis complex usually thickest in middle (**Fig. 279a**), tapering slightly at both ends Interior of penis chamber (**Fig. 279b**) with main pilaster (PP) high and simple in lower portion, becoming corrugated and expanded above. Supplemental wall sculpture complex.

Central and lateral teeth of radula (**Plate 114a, e-f**) with large anterior flare, high cusp shaft angle, no trace of ectocone, slight cusp tip curvature with blunt tip. Lateromarginal transition (**Plate 114b-c**) abrupt with decrease in basal plate and mesoconal size, appearance and then rapid enlargement of ectocone. Early (**Plate 114c**) and late (**Plate 114d**) marginals typical, endocone becoming prominent. Jaw (**Plate 115a-f**) with prominent vertical ribs that are lost on side margins, area of new growth typical (**Plate 115b-c**).

Discussion

Both Bednall (1892) and Tate (1896: 198-200) lumped a number of species under the name *perinflatum*. Given the great variation is size, colour, and shape found among the Red Centre to Flinders Ranges taxa, this is not surprising. Iredale (1937b: 44-46) made an attempt to correct the situation, using a dozen specimens to describe five Red Centre species. *S. pumilio* is a very well differentiated small sized species from Mt. Illbillee in the Everard Ranges. The remaining names are synonymized after study of extensive materials. In respect to the actual type specimens: *S. impletum* (Birksgate Ranges) is based on a badly injured shell, whose growth parameters were altered during repair; *S. pedasum* is typical of the Everard-Musgrave Range material; *S. eupesum* (Musgrave Ranges) was based on a teratological example, in which repair of massive injury about one-third of a whorl behind the aperture resulted in distorted growth, leaving the umbilicus narrowly open; and *S. corinum* is based on typical Everard Range examples. The name *pedasum* is used for this species, although *impletum* has line priority (both described by Iredale, 1937b: 44), because I have been able to dissect Musgrave examples. Only dead examples currently are available from the Birksgate Ranges, the type of *impletum* is an aberrant specimen, and it is possible that that Birksgate material may warrant subspecific recognition.

Except for the main mass of the eastern Musgrave Ranges, *Sinumelon pedasum* appears to be an inhabitant of isolated outcrops, usually associated with figs. It has been found even in plains areas. There are two places of microsympatry with other *Sinumelon*. On the S margin of Mt. Woodroffe in the Musgrave Ranges, *S. pedasum* and *S. amatensis* have been collected at WA-876, WA-878, and WA-879. In the Everard Ranges, two examples of *S. pedasum* were reported from "Mount Illbillee Soakage, Everard Ranges, under fig-trees, at an elevation of 2,000 feet" by Bednall (1892: 63) with "... the dwarf specimens with the vitreous appearance" (= *S. pumilio*), but in 1983 we made no microsympatric collections.

The southernmost record of *S. pedasum,* Cheesman Peak SE of the Birksgate Range, is about 470 km NW of the Ooldea record of *S. tarcoolanum* Solem, 1992a. The

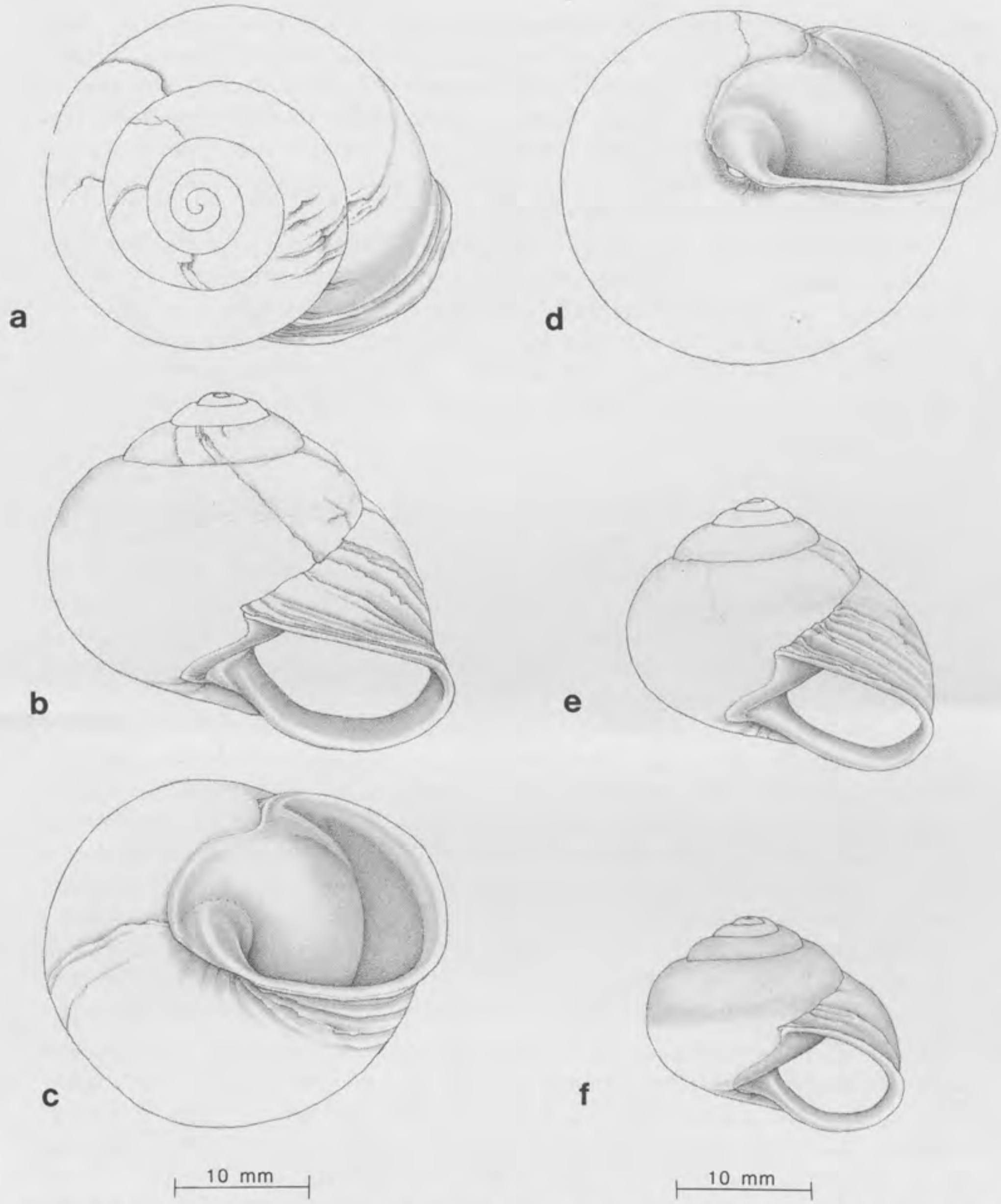


Fig. 277: Shells of *Sinumelon pedasum* Iredale, 1937: (a-c) WA-879, Amata track, 3.7 km W of Currie River, S side Musgrave Ranges, SA. FMNH 212209; (d) WA-876, SSE of Mt. Woodroffe, Musgrave Ranges, SA. FMNH 212188; (e) WA-865, 6.2 km S of No. 8 Well, Mimili-Kenmore Park Track, between Musgrave and Everard Ranges, SA. FMNH 212130; (f) WA-769, ca 9 km SW of Kulgera, NT. FMNH 205571. Scale line equals 10 mm. Drawings by Linnea Lahlum.

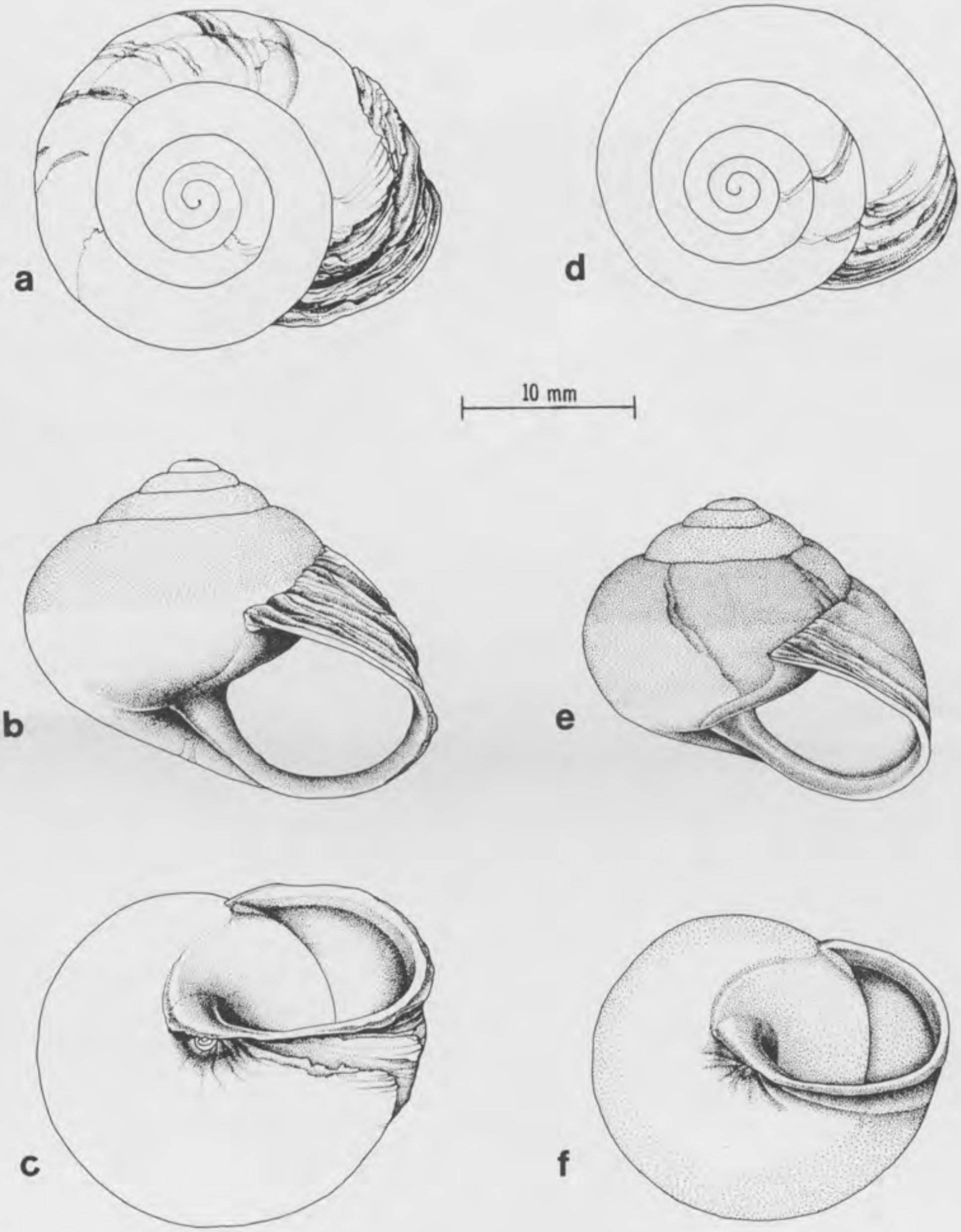


Fig. 278: Shells of *Sinumelon pedasum* Iredale, 1937 and *S. musgravesi*, sp. nov.: (a-c) *S. pedasum*, paratopotype of *Sinumelon impletum* Iredale, 1937. AM C.60517. Birksgate Ranges, SA; (d-f) Holotype of *S. musgravesi*. SAM D17728. WA-882, 13.8 km W of Jacky Pass Creek, Musgrave Ranges, SA. Scale lines equal 10 mm. Drawings by Linnea Lahlum.

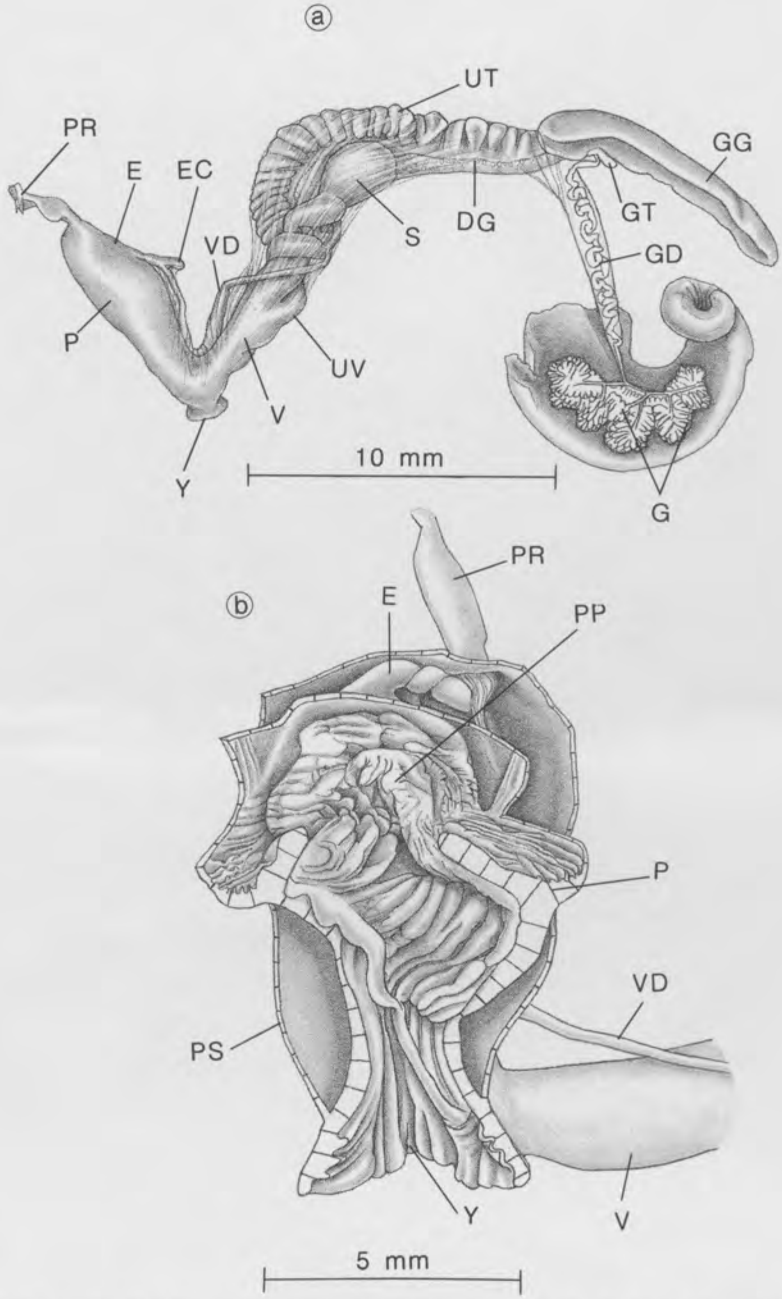


Fig. 279: Genitalia of *Sinumelon pedasum* Iredale, 1937: WA-864, hill W of Kenmore Park road, between Everard and Musgrave Ranges, SA. 6 May 1983. FMNH 212128, Dissection A. (a) whole genitalia; (b) penis interior. Scale lines as marked. Drawings by Linnea Lahlum.

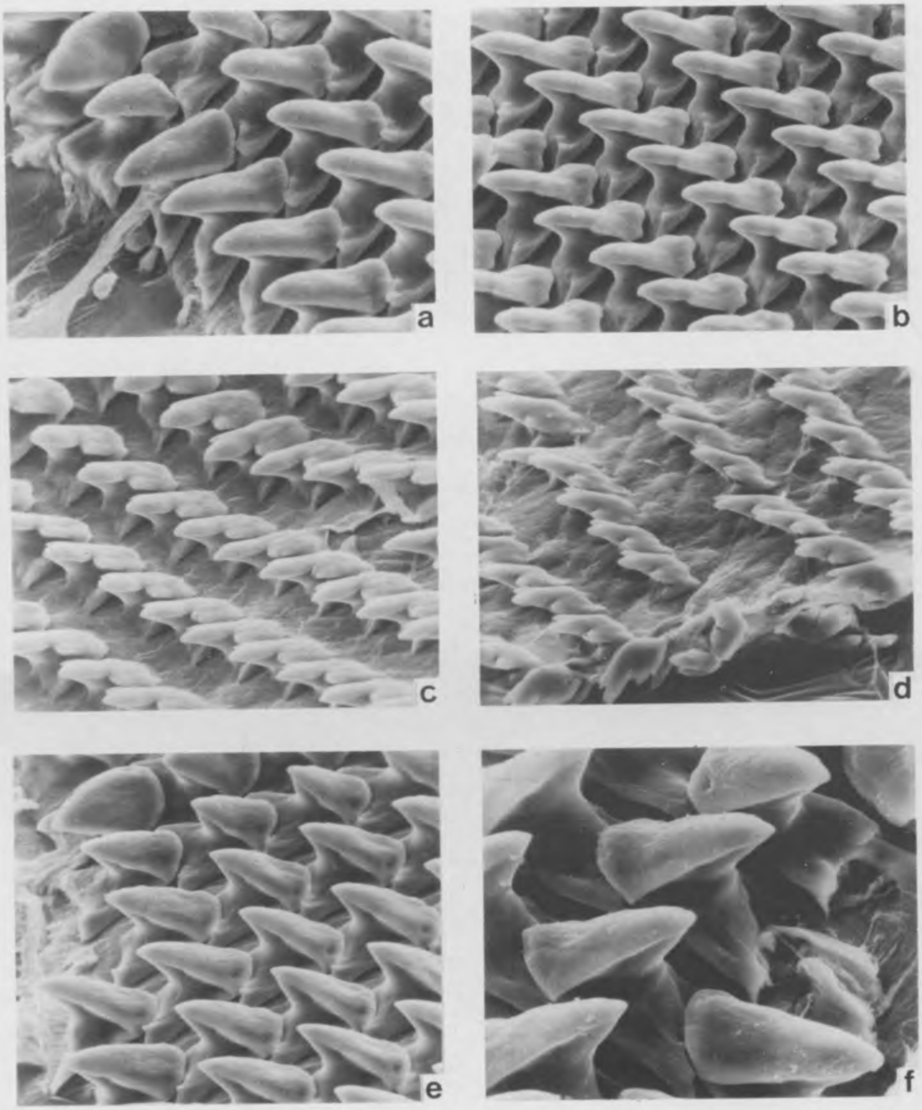


Plate 114: Radular teeth of *Sinumelon pedasum* Iredale, 1937: (a-d) WA-864, hill W of Mimili-Kenmore Park road, betw. Everard and Musgrave Ranges, SA. 6 May 1983. FMNH 212128. Dissection B. a is central and early laterals at 410X, b is lateromarginal transition at 415X, c is early marginals at 415X, d is late marginals at 410X; (e) WA-868, 16.9 km E of Ernabella, Musgrave Ranges, SA. 6 May 1983. FMNH 212139. Dissection A. central and early lateral teeth at 410X; (f) WA-768, 5.5 km N of Kulgera, NT. 28 April 1981. FMNH 205569. Dissection A. Central and first lateral teeth at 820X.

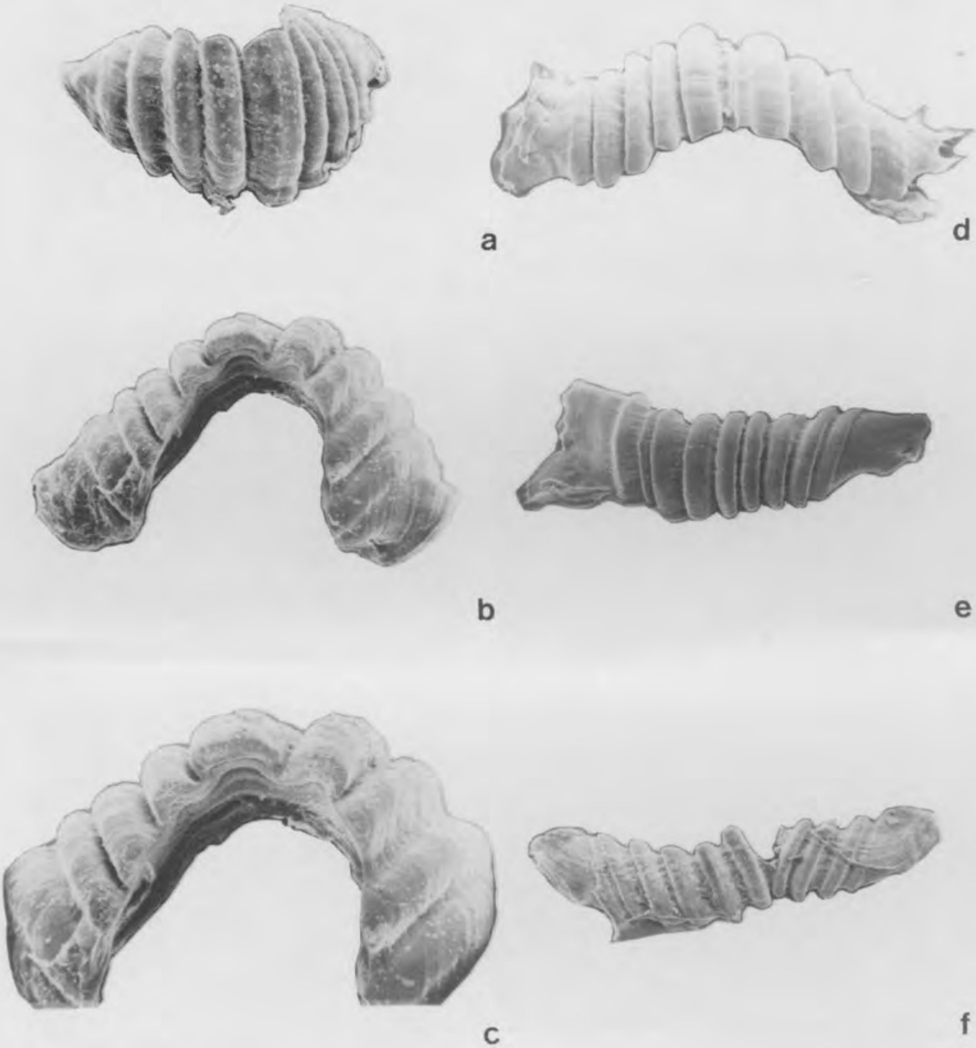


Plate 115: Jaws of *Sinumelon pedasum* Iredale, 1937: (a-c) WA-768, 5.5 km N of Kulgera, NT. 28 April 1981. FMNH 205569, Dissection A. a shows outer side at 37.5X, b shows lower edge at 45.5X, c shows detail of lower edge at 62X; (d) WA-864, hill W of Mimili-Kenmore Park Road, betw. Everard and Musgrave Ranges, SA. 6 May 1983. FMNH 212128, Dissection B. 29.5X; (e) WA-868, 16.9 km E of Ernabella, Musgrave Ranges, SA. 6 May 1983. FMNH 212139, Dissection A. 26.8X; (f) WA-858, SW of Victory Well, Everard Ranges, SA. 5 May 1983. FMNH 212111, Dissection A. 21.8X.

two species are well differentiated in anatomy, and the whorl count and sculpture differences seem constant, but it is possible that intermediates will be found. Certainly the intervening area will contain at most a few scattered patches of suitable habitat for *Sinumelon*. In the E, there is less than 200 km between the Little Cadnapowie Spring record near Oodnadatta for *S. pedasum* and the Beresford Hill record of *S. hamiltoni* that lies a little NW of Curdimurka near Lake Eyre South. Part of the area between these records may hold relict populations, but mainly subfossil material can be anticipated. Since *S. pedasum* and *S. hamiltoni* are well differentiated conchologically, such finds will enable determining the geographic area of transition.

Size variation is quite extensive (**Table 105**), with populations containing small sized specimens found at scattered localities. Near Kulgera, the small size is accompanied by a change in shell colour. Examples from WA-767 vary from having a narrow red spiral band to a modest spire suffusion and average 22.2 mm in shell diameter; those from WA-768 have a strong spire suffusion and no bands, averaging 22.1 mm in diameter; while those from WA-769 have a brightly coloured spire, and average 17.78 mm in adult size with only 4 5/8 whorls. They are the smallest individuals known, but do not differ in genital anatomy from the typical examples. Other relatively small sized shells (**Table 105**) are recorded from the camps between the Everard and Birksgate Ranges made by the Elder Expedition in 1890, the Marryat River crossing of the Stuart Highway, from Dalhousie Springs, and the low hills (WA-865-7) near Kenmore Park Homestead. These populations average 20.5-22.7 mm in diameter. A large hill somewhat further S of Kenmore Park Homestead, WA-864, had specimens averaging 23.5 to 24.5 mm in adult diameter. While a few shells in these populations show a slight spire colour suffusion, most retain the standard colouration. The small size correlates roughly with being in more exposed habitats, areas without noticable protection against rapid drying out after rains. The smaller diameter correlates with lower whorl counts, suggesting that growth has stopped earlier, rather than direct size reduction. There is no evidence of actual dwarfing, *i.e.*, diameter reduction but retaining the same number of whorls.

Populations living on the fringes of and in the main ranges, or where seasonal streams produce temporary swamps that provide longer growing periods, tend to have shells that are noticably larger in size. Most samples from the Oodnadatta, Granite Downs, and Everard Ranges areas average 23-26 mm in shell diameter (Table 105). In the main Musgrave Ranges, the shells are larger still, averaging 24-31 mm in diameter. Although specimens from the main Birksgate Ranges are relatively small, shells from Cheesman Peak, the southwesternmost recorded locality, are 26.6 and 27.7 mm in mean shell diameter, equalling the Musgrave Range and exceeding the Everard Range samples in average size.

Specimens from Kulgera, Musgrave Ranges, Kenmore Park Homestead area, and Everard Ranges were dissected. Variation in the entrance of the epiphallus (E) into the penis sheath (PS) and length of the vagina (V) was noted, but intra-populational differences were greater than any between populational changes.

Table 105: Local Variation in *Sinumelon pedasum* Iredale, 1937

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
Kulgera Area					
WA-767, FMNH 205567	20D	19.95±0.246 (17.95-22.3)	22.20±0.256 (20.05-24.4)	0.899±0.008 (0.850-0.967)	$5+$ $(4\frac{7}{8}+ - 5\frac{1}{4}+)$
WA-768, FMNH 205569	19L	20.69±0.226 (18.25-22.4)	22.11±0.186 (20.75-23.55)	0.936±0.009 (0.850-1.004)	$5-$ $(4\frac{7}{8}- - 5\frac{1}{8}-)$
WA-769, FMNH 205570	12L	15.25±0.130 (14.5-16.05)	17.77±0.219 (16.5-18.85)	0.859±0.009 (0.820-0.916)	$4\frac{5}{8}+$ $(4\frac{1}{2}+ - 4\frac{7}{8}-)$
WA-769, FMNH 205571	17D	14.82±0.185 (13.65-16.55)	17.79±0.182 (16.5-19.25)	0.833±0.006 (0.781-0.877)	$4\frac{5}{8}+$ $(4\frac{3}{8}+ - 5-)$
Dalhousie-Oodnadatta					
Dalhousie Springs, AM C. 149592	13D	18.23±0.293 (16.5-19.55)	20.86±0.250 (19.35-22.1)	0.874±0.010 (0.809-0.927)	$4\frac{3}{4}-$ $(4\frac{3}{8} - 4\frac{7}{8})$
Dalhousie Springs AM C. 149593	25D	17.57±0.241 (15.6-21.5)	20.25±0.190 (18.4-22.0)	0.868±0.007 (0.816-0.977)	$4\frac{5}{8}-$ $(4\frac{1}{4} - 5\frac{1}{4})$
30 miles NW Oodnadatta, SAM	7D	20.16±0.278 (19.3-21.25)	23.95±0.313 (22.85-25.0)	0.843±0.013 (0.782-0.885)	$5+$ $(4\frac{7}{8} - 5\frac{1}{4})$
Little Cadnapowie, SE Oodnadatta, SAM	11D	22.87±0.300 (21.4-25.0)	25.74±0.372 (24.55-28.4)	0.889±0.009 (0.864-0.948)	$5\frac{1}{8}$ $(4\frac{7}{8} - 5\frac{3}{8})$
Granite Downs					
Marryat River, Agnes Creek FWA	19D	19.33±0.279 (17.2-22.85)	21.45±0.224 (19.9-23.4)	0.901±0.009 (0.784-0.977)	$4\frac{7}{8}+$ $(4\frac{5}{8}+ - 5\frac{3}{8}+)$
Teds Well, Agnes Creek, SAM	14D	19.74±0.306 (18.1-21.65)	21.56±0.262 (20.45-23.9)	0.916±0.009 (0.879-0.994)	$5\frac{1}{8}$ $(4\frac{3}{4}+ - 5\frac{3}{8}-)$
Twin Hill, Agnes Creek, FWA	8D	22.04±0.444 (20.05-24.1)	25.03±0.451 (23.9-27.4)	0.882±0.016 (0.807-0.943)	$5\frac{1}{8}-$ $(4\frac{7}{8}- - 5\frac{3}{8}-)$
DeRose Hill, Agnes Creek, FWA	10D	22.22±0.557 (19.9-26.2)	24.97±0.373 (23.7-27.4)	0.889±0.012 (0.827-0.956)	$5\frac{1}{8}$ $(4\frac{7}{8}- - 5\frac{1}{2}+)$
Eateringinna Creek, Agnes Creek, FWA	6D	20.04±0.528 (18.2-21.5)	22.87±0.657 (21.35-24.75)	0.877±0.010 (0.852-0.920)	$5+$ $(4\frac{3}{4} - 5\frac{1}{8}+)$

Table 105: Local Variation in *Sinumelon pedasum* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
Tarcoonyinna Creek, 11-VII-85, SAM	20D	20.54±0.222 (18.8-22.25)	23.27±0.251 (21.15-25.4)	0.883±0.005 (0.840-0.917)	5- ($4^3/_4$-$5^1/_4$)
Mengerson's Well, 17-IV-54, SAM	14D	22.36±0.300 (20.8-24.25)	24.48±0.295 (22.95-26.35)	0.914±0.007 (0.849-0.948)	$5^1/_4$ (5-$5^1/_2$)
Mengerson's Well, WA-941 FMNH 212422	14L	20.98±0.231 (19.45-22.6)	23.00±0.204 (21.7-24.45)	0.912±0.006 (0.868-0.959)	$5^1/_8$ ($4^7/_8$+-$5^3/_8$-)
Moorilyanna Soak, 17-IV-54 SAM	7D	22.14±0.149 (21.4-22.6)	24.11±0.260 (22.4-25.2)	0.919±0.005 (0.873-0.991)	$5^1/_8$+ (5--$5^3/_8$)
Everard Range					
25 km E of Mimili, WA-847, FMNH 212074	11L	22.15±0.306 (20.55-23.45)	24.52±0.235 (23.4-25.6)	0.904±0.010 (0.860-0.965)	$5^1/_8$- ($4^7/_8$+-$5^1/_4$-)
25 km E of Mimili, WA-847, FMNH 212073	28D	22.58±0.167 (20.2-24.15)	25.01±0.186 (22.85-27.3)	0.903±0.005 (0.843-0.958)	$5^1/_4$- (5--$5^3/_8$+)
16 km E of Mimili, WA-848, FMNH 212075	10L	22.58±0.345 (21.25-24.6)	24.61±0.192 (23.8-25.3)	0.917±0.116 (0.870-0.989)	$5^1/_4$- (5+-$5^1/_2$)
16km E of Mimili, WA-848, FMNH 212076	10D	23.02±0.478 (20.6-25.4)	25.01±0.384 (23.1-27.1)	0.920±0.011 (0.870-0.985)	$5^1/_4$- ($5^1/_8$--$5^3/_8$+)
7.2 km E of Mimili, WA-849, FMNH 212077	7D	21.50±0.732 (18.1-24.1)	23.94±0.526 (21.65-25.6)	0.897±0.015 (0.837-0.962)	$5^1/_8$ (5+-$5^1/_4$+)
E of Victory Well, WA-852, FMNH 212091	12L	22.41±0.235 (21.45-24.25)	24.97±0.211 (23.85-26.45)	0.898±0.011 (0.848-0.945)	$5^1/_8$ (5--$5^3/_8$+)
SW of Victory Well, WA-858, FMNH 212111	10L	22.16±0.366 (20.55-24.15)	24.21±0.422 (21.7-26.1)	0.916±0.119 (0.871-0.975)	$5^1/_8$ (5--$5^1/_4$+)
Chambers Bluff, . 3 mi W of, SAM	23D	20.76±0.258 (18.8-24.5)	23.90±0.261 (22.0-26.95)	0.869±0.005 (0.830-0.918)	$5^1/_4$- (5-$5^3/_8$)
Mt. Carmeena, SAM	14D	21.85±0.227 (20.0-23.15)	25.67±0.352 (24.15-28.6)	0.853±0.013 (0.780-0.943)	$5^1/_4$- ($4^7/_8$-$5^7/_8$)
Teeta Hill, WA-859 FMNH 212112	6D	21.94±0.208 (21.3-22.7)	24.80±0.620 (22.8-26.65)	0.887±0.019 (0.820-0.935)	$5^1/_8$+ (5--$5^1/_4$+)
Shirley Well, Fregon 6-IX-54, SAM	6D	24.29±0.631 (21.8-25.85)	26.92±0.558 (24.9-28.5)	0.903±0.018 (0.845-0.968)	$5^3/_8$ ($5^1/_4$-$5^1/_2$)

Table 105: Local Variation in *Sinumelon pedasum* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
Musgrave Ranges					
Kenmore Park, WA-864 FMNH 212128	25L	21.51±0.214 (19.25-23.2)	24.52±0.217 (21.35-26.15)	0.878±0.006 (0.820-0.944)	$5\frac{1}{4}$- (5--$5\frac{1}{2}$-)
Kenmore Park, WA-864, FMNH 212129	15D	20.83±0.319 (18.45-22.8)	23.52±0.319 (20.55-25.1)	0.886±0.012 (0.802-0.997)	$5\frac{1}{4}$- (5-$5\frac{3}{8}$-)
S of No. 8 Well, WA-865, FMNH 212131	37L	19.90±0.197 (17.35-22.3)	22.34±0.177 (20..05-24.2)	0.892±0.007 (0.782-1.000)	$5\frac{1}{8}$- ($4\frac{5}{8}$+$5\frac{3}{8}$+)
WA-865, FMNH 212130	5D	19.98±0.610 (19.1-22.35)	22.27±0.434 (21.25-23.3)	0.897±0.018 (0.854-0.960)	$5\frac{1}{8}$ ($4\frac{7}{8}$+-$\frac{5}{8}$-)
WA-866, FMNH 212133	33L	18.16±0.130 (16.45-19.65)	20.53±0.106 (19.4-21.45)	0.885±0.006 (0.815-0.943)	$4\frac{7}{8}$+ ($4\frac{1}{2}$+-$5\frac{1}{8}$-)
Kenmore Park Hst., WA-867, FMNH 212135	12L	20.70±0.302 (19.35-23.25)	22.14±0.340 (20.05-23.9)	0.937±0.016 (0.865-1.050)	$4\frac{7}{8}$+ ($4\frac{3}{4}$--$5\frac{1}{8}$+)
Tietkin's Birthday Creek, SAM	6D	24.39±0.593 (23.15-26.7)	26.40±0.827 (23.6-28.9)	0.926±0.018 (0.873-1.000)	$5\frac{1}{8}$- ($4\frac{7}{8}$-$5\frac{1}{4}$)
Erlewanjawanja Waterhole, 20.VI.33, SAM	26D	26.36±0.296 (21.9-30.1)	29.80±0.356 (23.95-33.05)	0.886±0.008 (0.793-0.977)	$5\frac{1}{4}$- ($4\frac{3}{4}$-$5\frac{1}{2}$+)
E of Ernabella, WA-868, FMNH 212139	23L	22.45±0.286 (20.0-25.85)	24.06±0.216 (22.65-25.9)	0.934±0.009 (0.851-1.021)	$5\frac{1}{8}$ ($4\frac{7}{8}$+-$5\frac{3}{8}$+)
Wamikata Road, WA-869, FMNH 212141	15L	24.38±0.353 (22.25-27.25)	25.86±0.364 (24.05-28.6)	0.943±0.008 (0.898-1.011)	$5\frac{1}{8}$- (5--$5\frac{1}{4}$+)
Wamikata Road, WA-873, FMNH 212161	15L	23.50±0.266 (21.75-24.7)	25.21±0.161 (24.45-26.6)	0.933±0.011 (0.874-0.996)	$5\frac{1}{8}$+ ($4\frac{3}{4}$-$5\frac{1}{8}$+)
Alalka, WA-874, FMNH 212162	19L	24.15±0.212 (22.7-26.0)	24.85±0.246 (22.75-27.15)	0.972±0.008 (0.923-1.023)	$5\frac{1}{8}$+ ($4\frac{7}{8}$+-$5\frac{3}{4}$-)
Alalka, WA-874, FMNH 212163	4D	25.39±0.213 (24.95-25.95)	26.97±0.476 (26.1-28.35)	0.943±0.017 (0.898-0.971)	$5\frac{1}{8}$ ($5\frac{1}{8}$--$5\frac{1}{8}$+)
Wamikata Road, WA-870 FMNH 212148	5D	25.86±0.676 (24.35-28.3)	27.53±0.300 (26.8-28.2)	0.939±0.021 (0.895-1.011)	$5\frac{3}{8}$ ($5\frac{1}{8}$--$5\frac{1}{2}$+)
Mt. Woodroffe, WA-876, FMNH 212174	7L	27.34±0.513 (25.0-29.5)	30.58±0.373 (29.6-32.15)	0.895±0.016 (0.827-0.937)	$5\frac{3}{8}$- ($5\frac{1}{4}$--$5\frac{1}{2}$+)

Table 105: Local Variation in *Sinumelon pedasum* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
Mt. Woodroffe, WA-876, FMNH 212191	9D	27.71±0.620 (23.95-30.1)	30.96±0.644 (26.45-32.65)	0.895±0.010 (0.862-0.964)	$5^3/_8$- ($5^1/_8$+-$5^1/_2$-)
Plains NE Mt. Woodroffe SAM	7D	24.44±0.687 (21.15-27.2)	27.82±0.541 (25.7-29.4)	0.878±0.017 (0.813-0.946)	$5^1/_4$- ($4^7/_8$--$5^1/_2$+)
Currie River, WA-877, FMNH 212200	13L	23.51±0.278 (22.55-25.15)	27.06±0.329 (25.25-29.45)	0.869±0.008 (0.820-0.923)	$5^1/_4$+ (5--$5^1/_2$-)
Mann Ranges					
Plains S of, WA-901 FMNH 212275	2D	24.15 (24.1-24.25)	26.46 (25.8-27.15)	0.913 (0.893-0.934)	$5^1/_4$ ($5^1/_4$--$5^1/_4$+)
Birksgate Ranges					
Paratypes of S. impletum, SAM	13D	19.04±0.337 (16.7-21.6)	21.23±0.350 (18.5-23.2)	0.897±0.008 (0.849-0.936)	$4^7/_8$+ ($4^3/_4$--$5^1/_8$)
Camp #4 SAM	28D	20.01±0.171 (18.1-22.4)	21.69±0.213 (19.9-24.7)	0.924±0.008 (0.856-1.010)	$4^7/_8$ ($4^1/_2$-$5^3/_8$+)
Camp #10 SAM D.3111	3D	20.28±0.485 (19.55-21.2)	22.68±0.567 (21.55-23.3)	0.894±0.014 (0.866-0.910)	5- ($4^3/_8$+-$5^1/_4$+)
Cheesman Peak, WAM	5D	25.10±0.177 (24.55-25.65)	27.60±0.381 (26.7-28.8)	0.910±0.010 (0.891-0.944)	$5^3/_8$ ($5^1/_4$--$5^1/_2$+)
19 mi SE Cheesman Peak, WAM	5D	24.14±0.727 (22.65-26.0)	26.58±0.634 (24.9-28.1)	0.908±0.010 (0.879-0.925)	$5^3/_8$ ($5^1/_8$-$5^5/_8$+)
outcrops, Cheesman Peak, WAM	5D	25.02±0.177 (24.5-25.5)	27.70±0.387 (26.75-28.9)	0.904±0.011 (0.882-0.946)	$5^3/_8$- ($5^1/_8$+-$5^1/_2$+)

The above outline of variation is at most introductory. *Sinumelon pedasum* has perhaps the widest range of any Red Centre species, frequently is common in readily accessible habitats, and thus would be an excellent choice for study of local and geographic variation.

SINUMELON MUSGRAVESI, SP. NOV.
(Plates 108e, 116a-b; Figs 278d-f, 280a-b)

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Comparative remarks

Sinumelon musgravesi, sp. nov., from outliers off the S side of the Musgrave Ranges and foothills of Mt. Morris near Amata, SA (**Map 8**), is characterized by its medium size (mean diameter 20.92 mm, mean whorls 5+), high spire (**Fig. 278e**, mean H/D ratio 0.874), very narrow umbilicus (**Fig. 278f**, mean D/U ratio 19.4), prominent radial ridging (**Plate 108e**), reddish-green colour suffusion that extends nearly to the umbilicus, and narrowly expanded (**Figs 278d-f**) white lip. The sometime sympatric *S. amatensis* sp. nov., so far known only from the S face of main Musgrave Ranges, is much smaller (mean diameter 14.70 mm), with a reduced whorl count (mean whorls 4 5/8), has a wider umbilicus (**Fig. 288f**, mean D/U ratio 16.5), and a less expanded, often pinkish, shell lip. *S. bednalli* (Ponsonby, 1904) is larger (**Table 102**) with a lower whorl count, the umbilicus is much wider (**Fig. 274f**), and the shell has a unique cancellated shell sculpture (**Plate 108b-c**). *S. pedasum* Iredale, 1937, found in the Musgrave Ranges E of The Levenger Stream, has a closed umbilicus (**Fig. 277c**) and is larger at the same whorl count (**Tables 102, 105-106**). Anatomically (**Figs 280a-b**), *S. musgravesi* has the upper third of the penis (P) noticably expanded and a long vagina (V) in comparison with the tapered penis apex (**Fig. 290a**) and much shorter vagina found in *S. amatensis* and *S. pedasum* (**Fig. 279a**); inside the penis, *S. musgravesi* (**Fig. 280b**) has the main pilaster (PP) much lower, with apical sculpture greatly enlarged, whereas in *S. amatensis* (**Fig. 290b**) the main pilaster is very high and the apical wall sculpture greatly reduced in prominence. The other Musgrave Range species, *S. pedasum* (**Figs 279a-b**), has above midpoint entry of the epiphallus (E) into the penis sheath (PS), a short tapered vagina (V), greatly reduced main pilaster (PP) and very large accessory ridges in the penis chamber.

Holotype

SAM D18272, WA-882, under figs on small hill S of Amata track, 13.8 km W of Jacky Pass Creek, S side Musgrave Ranges, South Australia, Australia. 26° 20' 22" S, 131° 19' 03" E. Collected by Central Australian Expedition 9 May 1983. Height of holotype 18.65 mm, diameter 21.1 mm, H/D ratio 0.884, whorls 5, umbilical width 0.85 mm, D/U ratio 25.

Paratopotypes

SAM D17759-60, WAM 488.87, WAM 489.87, AM C.135964-5, MV, QM, FMNH 212221-2, 18 LA, 22 DA, 3 LJ, 3 DJ from the type locality.

Paratypes

South Australia

MUSGRAVE RANGES: Jacky Pass Creek (WA-881, 4.5 km W of, SAM D17761-2, WAM 490.87, WAM 491.87, AM C.135996-7, FMNH 212219-20, 10 LA, 15 DA, 8 LJ, 5 DJ; WA-883, 0.3 km S of Amata track, 17.4 km W of, SAM D17763-4, WAM 492.87, MV, QM, FMNH 212223-4, 16 LA, 4 DA, 7 LJ, 5 DJ); Amata track (WA-885, 15 km SSE of Amata, SAM D17765, AM, WAM 493.87, QM, MV, FMNH 212227-8, 8 DA, 5 LJ, 3 DJ); foothills of Mt. Morris (WA-886, near rock hole 2.8 km W of Amata aerodrome, SAM D17766, WAM 494.87, AM, MV, QM, FMNH 212229-30, 6 LA, 23 LJ, 2 DJ).

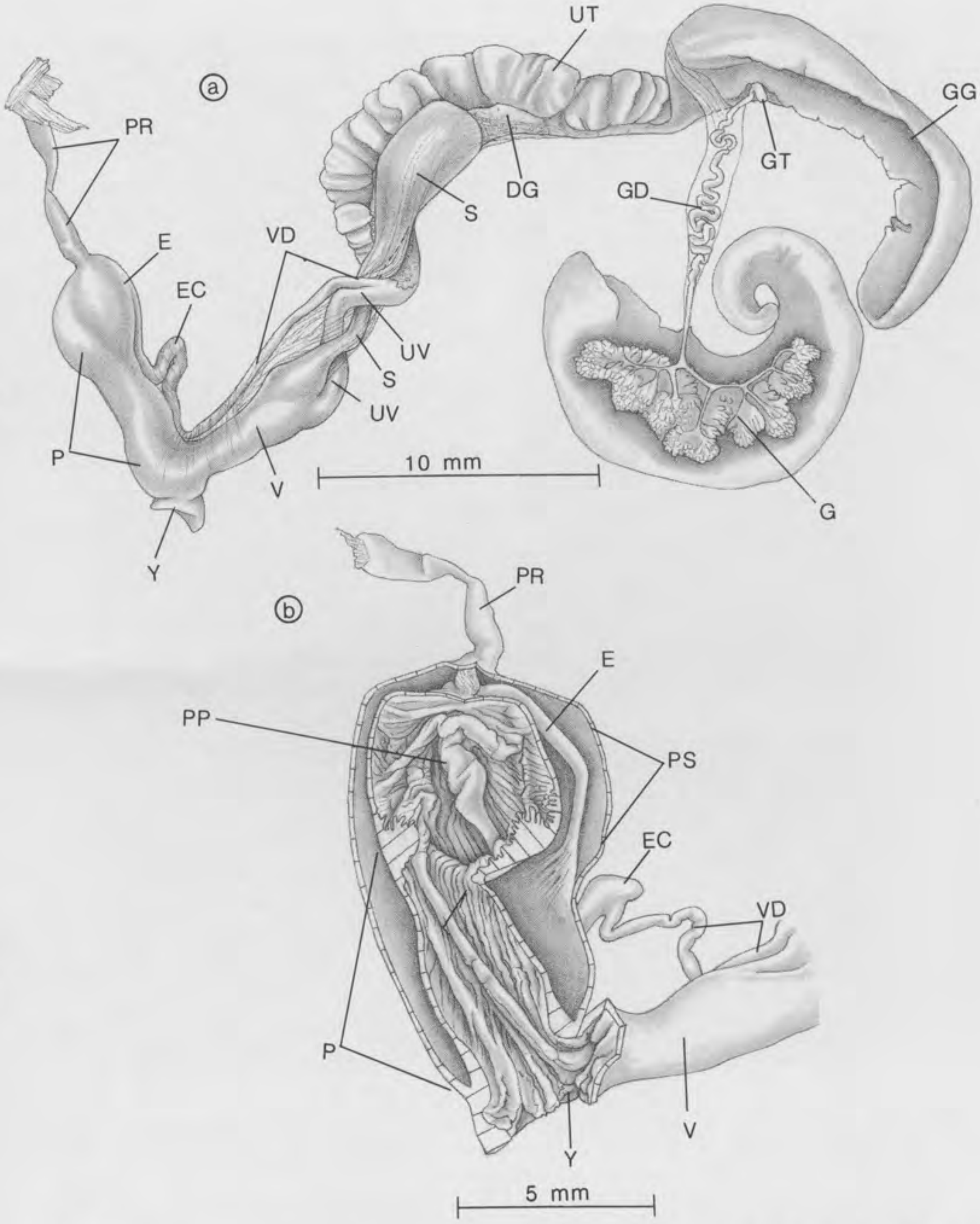


Fig. 280: Genitalia of *Sinumelon musgravesi*, sp. nov.: WA-882, 13.8 km W of Jacky Pass Creek, Musgrave Ranges, SA. 9 May 1983. FMNH 212222. (a) whole genitalia, Dissection A; (b) interior of penis, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

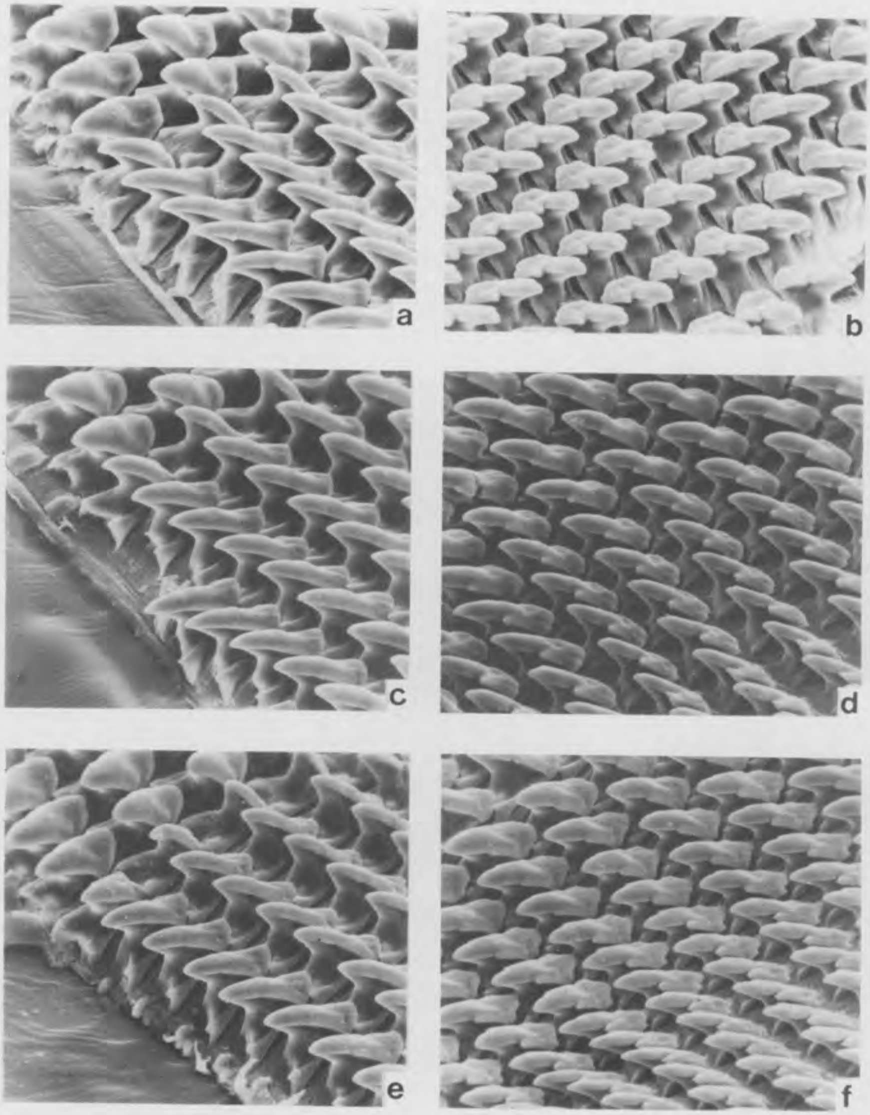


Plate 116: Radular teeth of *Sinumelon musgravesi* and *S. expositum* Iredale, 1937: (a-b) *S. musgravesi.* WA-882, W of Jacky Pass Creek, S side Musgrave Ranges, SA. 9 May 1983. FMNH 212222, Dissection A. a is central and early laterals at 370X, b is lateromarginal transition at 370X; (c-d) *S. expositum.* WA-760, Hermannsburg road, 2.2 km S of Glen Helen turnoff, W MacDonnell Ranges, NT. 25 April 1981. FMNH 205539, Dissection A. c is central and early laterals at 380X, d is lateromarginal transition at 385X; (e-f) *S. expositum.* WA-763, Palm Valley, Krichauff Ranges, NT. 26 April 1981. FMNH 205557, Dissection A. e is central and early laterals at 375X, f is lateromarginal transition at 370X.

Table 106: Local Variation in *Sinumelon musgravesi*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Musgrave Ranges WA-881 FMNH 212220	10L	19.92±0.247 (18.75-21.05)	21.86±0.223 (20.7-22.95)	0.911±0.011 (0.872-0.969)	$5^{1}/_{8}$- ($5+$-$5^{1}/_{4}$-)	1.09±0.042 (0.95-1.4)	20.4±0.712 (16.0-23.0)
WA-881, FMNH 212219	15D	19.85±0.118 (18.85-20.65)	22.21±0.176 (21.15-23.55)	0.894±0.007 (0.847-0.934)	$5^{1}/_{8}$ ($4^{3}/_{4}$+-$5^{1}/_{2}$-)	1.14±0.064 (0.85-1.75)	20.3±1.011 (12.5-25)
WA-882, FMNH 212222	18L	17.97±0.209 (16.0-20.2)	20.41±0.238 (18.15-27.8)	0.881±0.007 (0.825-0.951)	$5^{1}/_{8}$- ($4^{3}/_{4}$+-$5^{1}/_{4}$-)	0.99±0.026 (0.75-1.25)	20.9±0.604 (16.0-27)
WA-882, FMNH 212221	22D	18.58±0.194 (17.15-20.1)	20.87±0.167 (19.4-22.4)	0.890±0.006 (0.849-0.969)	$5^{1}/_{8}$ ($4^{7}/_{8}$+-$5^{1}/_{4}$+)	1.06±0.058 (0.55-1.9)	20.9±1.25 (10.9-40)
WA-883, FMNH 212223	16L	18.08±0.186 (17.0-19.75)	21.19±0.220 (20.0-23.6)	0.854±0.009 (0.808-0.938)	5- ($4^{3}/_{4}$-–$5^{1}/_{8}$+)	1.17±0.035 (0.95-1.4)	18.3±0.56 (14.5-22.2)
WA-883, FMNH 212224	4D	18.50±0.367 (17.65-19.3)	22.20±0.761 (20.75-24.3)	0.835±0.014 (0.794-0.853)	$5^{1}/_{8}$- (5 -$5^{1}/_{8}$+)	1.02±0.487 (0.9-1.1)	22.0±1.890 (19.9-27)
WA-885, FMNH 212227	8D	16.88±0.259 (15.7-17.7)	20.29±0.161 (19.65-20.85)	0.832±0.010 (0.797-0.884)	$4^{7}/_{8}$+ ($4^{5}/_{8}$-–$5^{1}/_{8}$-)	1.24±0.084 (0.95-1.75)	16.9±1.040) (11.4-21.5)
WA-886, FMNH 212229	6L	14.35±0.296 (13.45-15.65)	17.49±0.128 (17.05-17.8)	0.821±0.020 (0.783-0.920)	$4^{3}/_{4}$ ($4^{5}/_{8}$-$4^{7}/_{8}$)	1.63±0.132 (1.0-1.95)	11.17±1.160 (9.50-16.9)

Range

Sinumelon musgravesi, sp. nov., has been collected from isolated small hills on the S side of the Musgrave Ranges from just W of Jacky Pass Creek to the foothills of Mt. Morris, SW of Amata, SA (**Map 8**). The known range covers about 35 km.

Diagnosis

Shell medium in size, adult diameter 17.05-24.3 mm (mean 20.92 mm), whorls 4 3/8+ to 5 1/2- (mean 5+). Apex and spire strongly and evenly elevated (**Fig. 278e**), shell height 13.45-21.05 mm (mean 18.30 mm), H/D ratio 0.783-0.969 (mean 0.874). Body whorl descent behind aperture quite variable. Spire and body whorl (**Plate 108e**) with irregular radial ridging, sometimes faintly interrupted by short spiral lines, but never actually decussated. Sculpture continues onto shell base with slight reduction. Umbilicus (**Fig. 278f**) usually a narrow lateral crack, width 0.55-1.9 mm (mean 1.12 mm), D/U ratio 9.50-40 (mean 19.4). Lip narrow to moderately expanded (**Figs 278d-f**), wider on columellar margin, white in colour. Shell with reddish-green suffusion extending well below periphery. Based on 101 measured adults.

Genitalia (**Figs 280a-b**) with long and slender shafts of spermatheca (S) and free oviduct (UV) twisted together, head of spermatheca expanding just above base of prostate-uterus. Vagina (V) long, tapering to atrium (Y), internally with very fine pilasters. Vas deferens (VD) slender, entering large epiphallic caecum (EC) laterally. Epiphallus (E) entering wall of penis sheath (PS) submedially, free of wall shortly above midpoint, coiled apically. Wall of penis sheath (PS) average in thickness. Penis club-shaped, with strongly expanded apex, internally (**Fig. 280b**) with low main pilaster (PP) and enlarged apical sculpture.

Central and early lateral teeth (**Plate 116a**) with prominent anterior flare, massive basal support ridge, high cusp shaft angle with slight cusp curvature, and weak ectocone. Lateromarginal transition (**Plate 116b**) typical. Jaw without unusual features.

Discussion

Sinumelon musgravesi, sp. nov., has, so far, been collected only from small rock masses isolated from the S side of the main Musgrave Ranges by areas of grass plains. Material from outliers of Mt. Cuthbert (WA-971-2) that initially had been placed here on shell features, proved upon dissection to belong to *S. pedasum* Iredale, 1937 (see above). The normally more abrupt descent of the body whorl behind the aperture, somewhat wider lip, larger size, and often presence of a faint red spiral colour band in *S. pedasum* are usually sufficient to separate the two species. The dwarf populations of *S. pedasum* found in fringe habitats can cause identification difficulties.

The club-like shape of the penis, caused by the increased size of apical pilasters in the penis chamber, was confirmed in specimens from WA-881, WA-882, WA-883, and WA-886.

Shell variation was moderate (**Table 106**), showing a slight east to west reduction in H/D ratio. Material from both WA-885 and WA-886 had reduced whorl counts, and thus size, and were more widely umbilicated. The latter occurred microsympatrically with *S. amatensis*. At both stations, *Sinumelon* were found sealed to rocks, an unusual pattern for this genus.

The name *musgravesi* is taken from the Musgrave Ranges.

SINUMELON EXPOSITUM IREDALE, 1937

(Plates 110a-d, 116c-f; Figs 281a-c, 282a-f, 283a-c, 284a-f)

Thersites (Badistes) fodinalis (Tate), 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Xanthomelon fodinalis Hedley, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 223-4, figs G-I (jaw, radula, genitalia) - Palm Valley, Krichauff Ranges.

Sinumelon expositum Iredale, 1937, South Austr. Nat., **18** (2): 43, pl. II, fig 22 - Charlotte Waters, NT; Iredale, 1938, Austr. Zool., **9** (2): 103 - check list; Richardson, 1985, Tryonia, **12**: 276.

Comparative remarks

Sinumelon expositum Iredale, 1937, known from areas near the Finke River (**Map 8**) as it passes from the western MacDonnell Ranges through the Krichauff and James Ranges, is characterized by its moderately elevated spire (**Figs 281b, 282b, e**, mean H/D ratio 0.831), open umbilicus (**Fig. 281c**, mean D/U ratio 11.1), very broadly expanded white shell lip (**Figs 281-282**), normal presence of a supraperipheral reddish colour zone on the lower spire and body whorl, and relatively gradual descent of the body whorl behind the lip (**Figs 281b, 282b, e**). It is quite variable in size (**Table 107**), and the shell sculpture ranges from nearly smooth to with fairly prominent radial ridging (**Plate 110a-d**). *S. dulcenis*, sp. nov., from the Dulcie Ranges S to the eastern MacDonnell Ranges, is most similar in shell features, but is generally smaller (**Table 102**), with a lower spire and wider umbilicus. It shows major anatomical differences (**Figs 286a-c, 287a-b**), including a much shortened penis and enlarged epiphallic caecum. *S. bednalli* (Ponsonby, 1904), from the central MacDonnell Ranges, has a more widely open umbilicus (**Fig. 274f**) and cancellated shell sculpture (**Plate 108b-c**). *S. perinflatum* (Pfeiffer, 1864), which lives N of the MacDonnell Ranges from Yuendumu and the Reynolds Range E to the Hale River area, has an umbilical crack, normally a red spiral band, and moderate to sharp (**Figs 272b**) descent of the body whorl. The other large species, *S. hullanum*, sp. nov, *S. pedasum* Iredale, 1937, and *S. musgravesi*, sp. nov., have a closed umbilicus or a narrow lateral crack. Anatomically (**Figs 283a-c, 284a-f**), most populations of *S. expositum* have grey markings on the neck and foot, highly variable entrance of the epiphallus (E) into the penis sheath (PS), and a long penis (P) that is somewhat swollen medially, and has strong penis chamber wall sculpture. The conchologically very similar *S. dulcensis* (**Figs 286a, c, 287a-c**) has a short, globular penis (P), near basal entry of the epiphallus (E), and more prominent penis chamber wall sculpture.

Holotype

AM C.60531. Charlotte Waters (Telegraph Station), Northern Territory, Australia. 25° 55' S, 134° 55' E. Height of shell 16.6 mm, diameter 20.35 mm, H/D ratio 0.816, whorls 4 1/2, umbilical width 2.5 mm, D/U ratio 8.14.

Material studied

Northern Territory

MACDONNELL RANGES: Mt. Sonder (WA-759, NE outlier, FMNH 205528, 1 LA); 5 km NNW Glen Helen Tourist Camp, base of hills along Davenport River, Heavitree Range (V. Kessner! 27 April 1987, VK 11655, 4 LA); Glen Helen opening to Finke Gorge (WA-113, from stream drift, FMNH 182388, FMNH 182657, 3 DJ); Glen Helen-Hermannsburg Road (WA-760, 2.2 km S of Glen Helen turnoff, AM, WAM 512.87, SAM D17781, FMNH 205538-9, 6 LA, 8 DA, 5 DJ); 17 km E of Glen Helen (bush along Glen Helen road, V. Kessner! 27 April 1987, VK 11664, 5 LA).

GOSSE BLUFF (G. Wilson! 18 June 1978, AM, SAM D17778, WAM 507.87, FMNH 198870-1, 4 LA, 2 DA, 9 LJ, 4 DJ).

KRICHAUFF RANGES: near junction Palm Creek and Finke River (WA-132, under figs near old stockyard, AM, WAM 511.87, WAM 518.87, SAM D17780, SAM D17787, MV, QM, FMNH 182366, FMNH 182524, 13 LA, 40 DA, ? LJ, ? DJ; WA-440, figs near Ranger Cabin, AM, WAM 517.87, SAM D17786, MV, QM, FMNH 199670-1, FMNH 199673, 28 LA, 2 DA, ? LJ, ? DJ; WA-131, under figs 100 yds NE Initiation Rock, AM, WAM 523.87, WAM 524.87, SAM D17792-3, MV, QM, FMNH 182344, FMNH 182500, FMNH 201561-2, 32 LA, 170 DA, ? LJ, ? DJ; WA-441, under figs near Initiation Rock, AM, WAM 521.87, WAM 522.87, SAM D17790-1, MV, QM, FMNH 199709-10, 17 LA, 7 DA, ? LJ, ? DJ); WA-763, under spinifex, S facing slope opposite Palm Valley Chalet ruins, AM, WAM 527.87, SAM D17796, FMNH 205557-8, 17 LA, 3 DA, 13 LJ; WA-761, 0.5 km W of Palm Creek track end, AM, FMNH 205544, 4 DA; WA-762, figs on N facing slope, road end parking area, AM, WAM 510.87, WAM 526.87, SAM D17779, SAM D17795, QM, MV, FMNH 205545-6, 17 LA, 9 DA, 12 LJ, 3 DJ; WA-926, 2 km above campground, Palm Creek, AM, WAM 515.87, SAM D17784, FMNH 212346, 2 DA, 7 LJ; WA-130, Cycad Gorge, AM, FMNH 182314, FMNH 182522, 6 LA, 1 DA; WA-927, Palm Creek, AM, WAM 519.87, WAM 520.87, SAM D17788-9, FMNH 212362-3, 28 LA, 9 DA, 26 LJ, 6 DJ; WA-928, Oasis Spring, AM, FMNH 212373, 8 DA, 1 DJ; WA-443, Palm patch, Palm Creek, AM, WAM 516.87, SAM D17785, FMNH 199654, FMNH 199659, 6 LA, 1 DA, 5 LJ; WA-929, Glen of Palms, AM, FMNH 212378-9, 2 LA, 1 LJ, 2 DJ.

JAMES RANGES: Areyonga (WA-934, 0.5 km W of, AM, WAM 508.87, WAM 509.87, SAM D17777, FMNH 212402-3, 5 LA, 2 DA, 5 LJ, 1 DJ); Illara Waterhole, Tempe Downs Station, (rock ledges, AM, WAM 506.87, FMNH 198794-5, FMNH 198800, 5 LA, 3 DA, 27 LJ, 12 DJ); Illamurta Spring (WA-942, banks of, AM, WAM 513.87, WAM 514.87, SAM D17782-3, QM, MV, FMNH 212423-5, 73 LA, 30 DA, 9 LJ, 3 DJ; creek banks, Illamurta Springs Reserve, J. & F. Aslin!, 6-7 June 1978, WAM 525.87, SAM D17794, AM, QM, MV, FMNH 198781, 35 LA, 73 LJ, 2 DA, 1 DJ; S boundary of reserve, AM, WAM 505.87, SAM D17776, QM, MV, FMNH 198788, 14 DA, 43 DJ)

Range

Sinumelon expositum Iredale, 1937 ranges in the basin of the Finke River, from Mt. Sonder and the vicinity of the Finke River Gorge through the MacDonnell Ranges past Gosse Bluff, through the Krichauff and James Ranges as far S as Illara Waterhole and Illamurta Springs, and at least as far W as Areyonga, NT (**Map 8**). The type is recorded as coming from Charlotte Waters, considerably to the E and far removed from normal habitat conditions for this species.

Diagnosis

Shell quite variable in size, adult diameter 14.85-25.3 mm (mean 19.24 mm), whorls 4 1/4+ to 5 3/8- (mean 4 3/4+). Apex and spire moderately and usually evenly elevated (**Figs 281b, 282b, e**), shell height 11.75-23.25 mm (mean 15.98 mm), H/D ratio 0.728-0.955 (mean 0.831). Body whorl (**Figs 281b, 282b, e**) usually descending slightly to gradually on last part of body whorl. Sculpture highly variable (**Plate 110a-d**), less prominent in northern populations, ridging becoming almost regular in some of the southern populations (**Plate 110d**) and holotype (**Figs 281a-c**). Umbilicus narrow (**Fig. 110c**) to moderately open (**Figs 281c, 282f**), rarely a lateral crack, width 0.75-3.8 mm (mean 1.83 mm), D/U ratio 6.29-28 (mean 11.1). Lip widely expanded (**Figs 281a-c, 282a-f**), especially on columellar section, white, thickened. Shell greenish yellow, normally with strong reddish spire suffusion, extending variably onto shell base, which is lighter in tone. Sometimes colour zone narrowed to form a spiral band. Based on 626 measured adults.

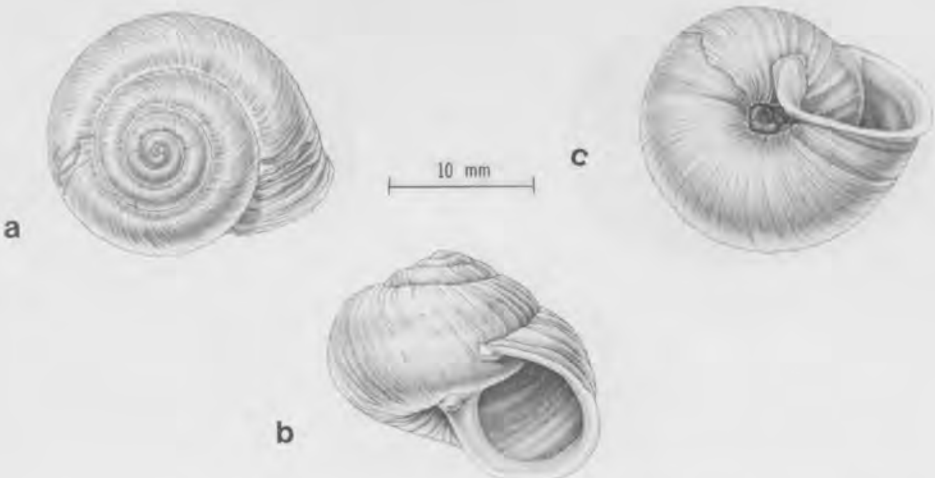


Fig. 281: Shell of *Sinumelon expositum* Iredale, 1937: Holotype. AM C.60531. Charlotte Waters (Telegraph Station), NT. Scale line equals 10 mm. Drawings by Linnea Lahlum.

Genitalia (**Figs 283a-c, 284a-f**) with relatively short vagina (V), free oviduct (UV) and shaft of spermatheca (S) intertwined, head of spermatheca just above base of prostate-uterus. Vas deferens (VD) joining small epiphallic caecum (EC) near base. Epiphallus (E) entering penis sheath from basally to medially (**Figs 284a-f**). Penis (P) long, swollen medially, chamber wall sculpture prominent and complex.

Central and lateral teeth of radula (**Plate 116c, e**) with large anterior flare, high cusp shaft angle, curved cusp tip, no trace of ectocones, large basal plate support ridge. Lateromarginal transition (**Plate 116d, f**) rapid, ectocone developing slightly before area of change. Jaw without unusual features, all examples poorly mounted.

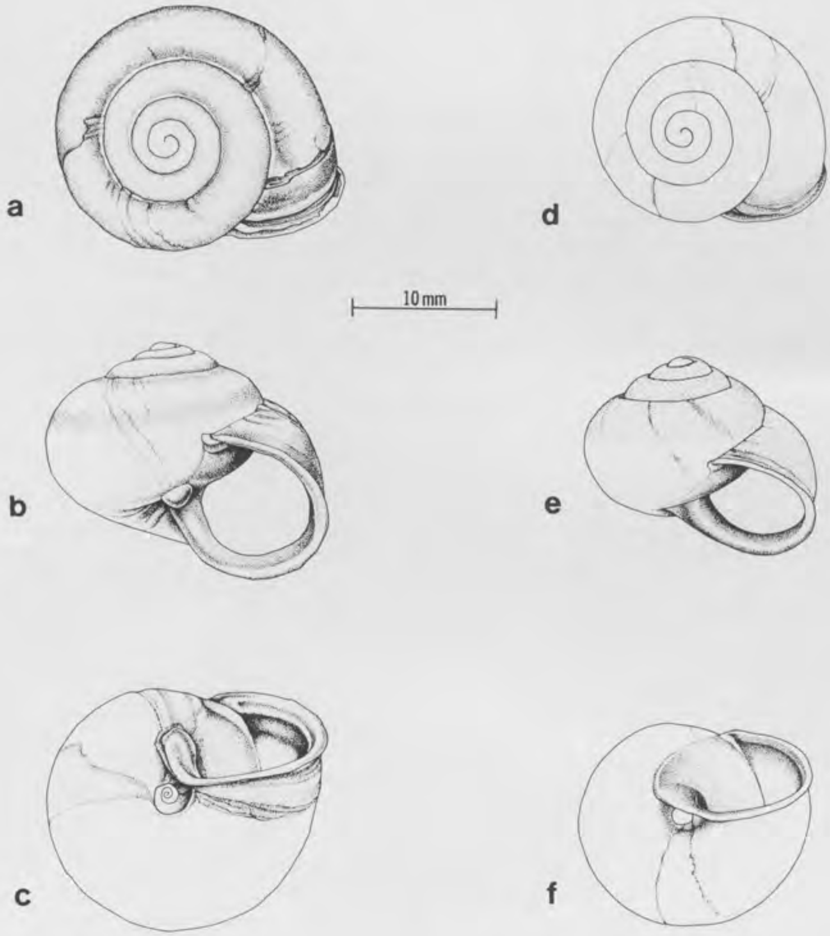


Fig. 282: Shells of *Sinumelon expositum* Iredale, 1937: (a-c) Holotype. AM C.60531. Charlotte Waters, NT; (d-f) WA-132, figs near old stockyard, Palm Valley, Krichauff Ranges, NT. FMNH 182366. Scale lines equal 10 mm. Drawings by Linnea Lahlum.

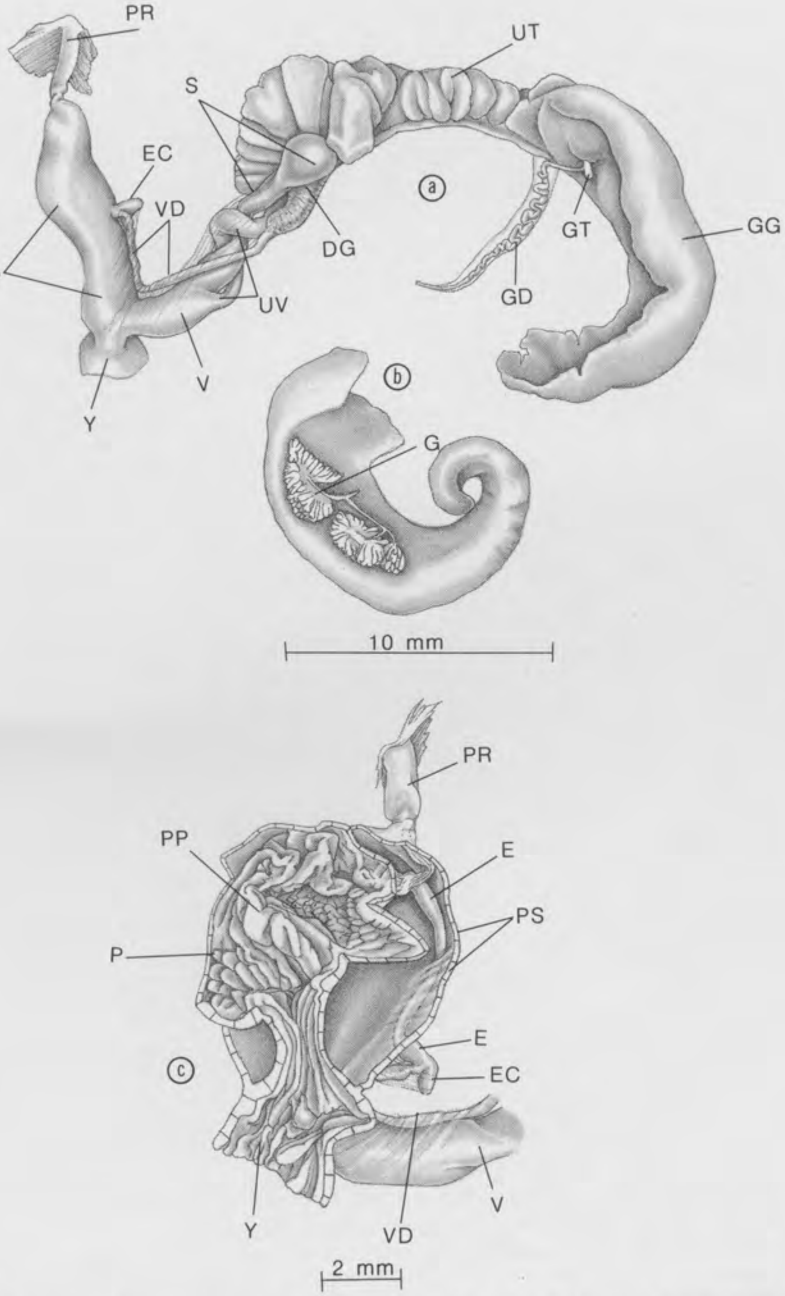


Fig. 283: Genitalia of *Sinumelon expositum* Iredale, 1937: WA-763, bank of Palm Creek opposite camp ground, Palm Valley, Krichauff Ranges, NT. FMNH 205557. (a) whole genitalia, Dissection A; (b) ovotestis, Dissection A; (c) penis interior, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

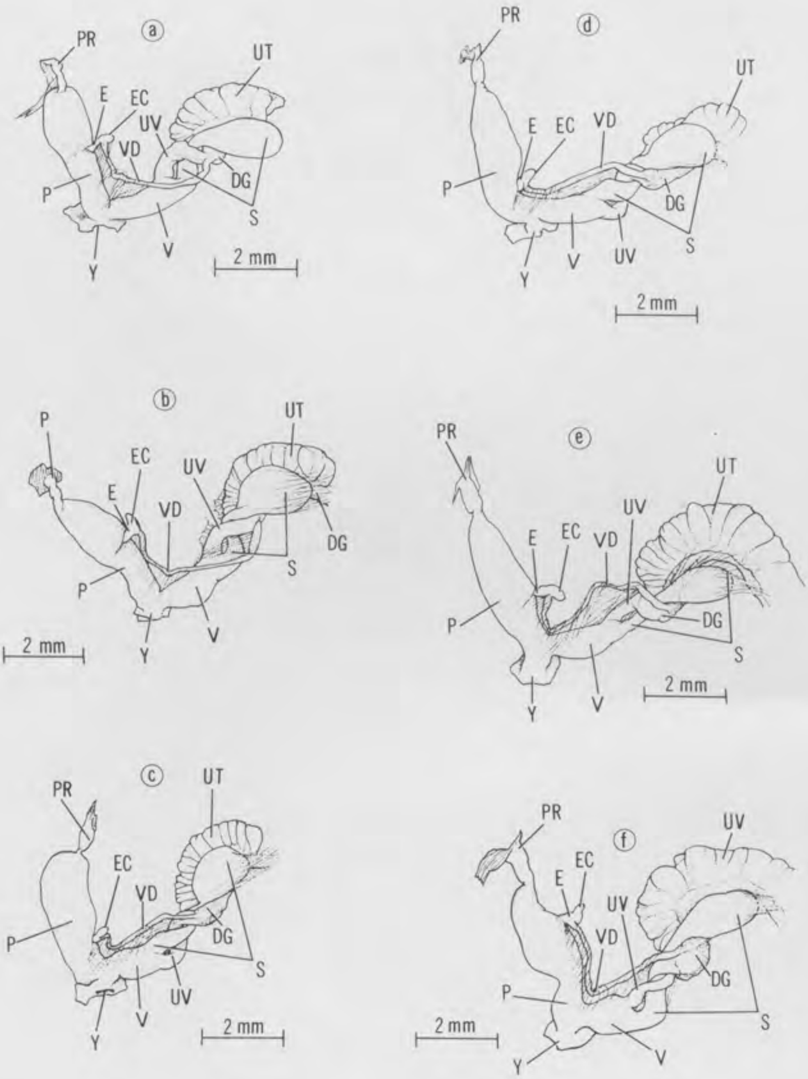


Fig. 284: Terminal genitalia variation in *Sinumelon expositum* Iredale, 1937: (a-d) WA-131, figs near Initiation Rock, Palm Valley, Krichauff Ranges, NT. 18 March 1974. FMNH 182500. Outline of terminalia showing point of epiphallic entrance and penis shape. a is Dissection A, b is Dissection C, c is Dissection E, d is Dissection D; (e) WA-763, bank of Palm Creek opposite camping area, Palm Valley, Krichauff Ranges, NT. 26 April 1981. FMNH 205557, Dissection A; (f) Wa-760, Hermannsburg Road, 2.2 km S of Glen helen turnoff, just S of MacDonnell Ranges, NT. 25 April 1981. FMNH 205539. Dissection A. Scale line equals 5 mm. Drawings by Linnea Lahlum.

Discussion

The holotype of *Sinumelon expositum* Iredale, 1937 falls well within the range of size and shape variation (**Table 102**) shown by adult specimens referred here. In addition, the spaced radial sculpture (**Figs 281a-c**) preserved on the holotype is approached by examples from Illamurta Springs in the James Ranges (WA-942, etc.). Additionally, some of these examples tend to have the colour suffusion partly reduced to form the spiral band seen in the holotype, rather than the broader spire and body whorl suffusion seen in MacDonnell and Krichauff Ranges examples. Despite the lack of recent collections from the Charlotte Waters Telegraph Station area, and thus anatomical confirmation of their identity with the MacDonnell to James Ranges material, the shell similarities are so great that I have no hesitation in using Iredale's name for this species.

There is considerable size variation (**Table 107**). The shells from Mt. Sonder, the western MacDonnell Ranges, and Gosse Bluff are large, narrowly umbilicated, and the surface of the shell is relatively smooth. Many examples have a dark colour suffusion, but others show only a trace. The specimens from Illara Waterhole and Illamurta Springs, off the James Ranges, are large, but more widely umbilicated, with stronger surface sculpture, and show reduced to absent grey markings on the neck and foot of the animal. The few Areyonga (WA-934) examples have the umbilicus slightly narrower.

In the Palm Valley area of the Krichauff Ranges, there is a size dichotomy based, apparently, upon habitat. Samples taken from under spinifex or in rock rubble of the stream banks themselves (WA-762, WA-763, WA-130, WA-927, WA-443) average more than 20 mm in diameter, 4 7/8 to 5+ whorls, and have narrow umbilici (**Table 107**). Limited material from the exposed rock rubble habitats near Oasis Spring (WA-928) are slightly smaller and share a narrowed umbilicus with specimens from WA-443. The shells from all these stations have relatively reduced surface sculpture (**Plate 110c**).

In contrast, specimens from two very small patches of figs located in open areas and away from the creek banks (WA-131, WA-132, WA-440, WA-441) are much smaller (mean diameters 16.75-17.65 mm), with reduced whorl counts (mean whorls 4 5/8- to 4 3/4-), but no change in umbilical size (**Table 107**). Their shell sculpture (**Plate 110a-b**) tends to be more prominent. The fig patches are both very small and exposed to direct sunlight. While providing shelter and food, these places would tend to dry out faster than the stream side rock rubble and spinifex sites. The smaller size of the shells is thus interpreted as resulting from decreased activity time. These populations also are unusual in that the live collected adult shells are significantly larger (difference between means is greater than the sum of the standard errors of the mean) than dead adults from the same station. This also applies to one sample from Illamurta Springs collected in 1978, but not to the Illamurta Springs sample (WA-942) collected in 1983. It is a general situation for essentially all species of Australian camaenids from areas that I have studied previously that dead adults will be slightly to significantly larger than live adults from the same station. The reversal of this

Table 107: Local Variation in *Sinumelon expositum* Iredale, 1937

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
MacDonnell Ranges							
Mt Sonder, WA-759 FMNH 205528	1L	19.70	24.60	0.800	$5\frac{1}{8}$+	1.80	13.8
5km NNW Glen Helen VK 11655	5L	18.26±0.321 (17.7-19.5)	21.80±0.287 (21.15-22.55)	0.838±0.015 (0.785-0.867)	5- ($4\frac{3}{4}$+-$5\frac{1}{4}$-)	1.35±0.219 (0.8-1.85)	8.3±1.842 (11.5-28)
Hermannsburg Road, WA-760, FMNH 205539	6L	17.280±0.424 (16.1-18.55)	21.38±0.248 (20.4-21.9)	0.808±0.015 (0.760-0.847)	5- ($4\frac{7}{8}$--$5\frac{1}{8}$+)	1.50±0.172) (1.05-2.05)	15.2±1.588 (10.2-19.8)
Hermannsburg Road, WA-760, FMNH 205538	8D	17.97±0.160 (17.3-18.5)	22.18±0.300 (21.1-23.7)	0.811±0.010 (0.774-0.859)	5- ($4\frac{7}{8}$+-5+)	1.35±2.44 (1.2-1.55)	16.6±0.576 (14.8-19.1)
17km E of Glen Helen VK 11664	4L	18.10±0.239 (17.3-18.45)	22.76±0.207 (21.3-23.8)	0.796±0.011 (0.775-0.817)	$4\frac{7}{8}$- ($4\frac{3}{4}$- -5-)	1.81±0.338 (0.9-2.35)	14.7±2.293 (9.06-25)
Gosse Bluff 2.5km E of, FMNH 198871	4L	17.39±0.263 (16.95-18.1)	21.16±0.204 (20.6.21.6)	0.822±0.007 (0.802-0.837)	$4\frac{3}{4}$+ ($4\frac{3}{4}$- -$4\frac{7}{8}$-)	1.56±0.130 (1.25-1.8)	13.8±1.088 (12.0-16.5)
Krichauff Ranges							
Palm Creek-Finke River, WA-132, FMNH 182524	13L	14.73±0.227 (13.45-16.0)	17.65±0.183 (16.65-18.45)	0.834±0.008 (0.788-0.888)	$4\frac{5}{8}$+ ($4\frac{1}{2}$-$4\frac{3}{4}$-)	1.71±0.75 (1.3-2.15)	10.5±0.395 (8.55-12.8)
Palm Creek-Finke River, WA-132 FMNH 182366	40D	14.04±0.116 (12.5-15.75)	16.98±0.130 (15.15-18.8)	0.827±0.004 (0.780-0.869)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-$4\frac{3}{4}$+)	1.70±0.049 (1.05-2.2)	10.4±0.348 (7.40-16.3)

Table 107: Local Variation in *Sinumelon expositum* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-440, FMNH 199673	26L	14.55±0.115 (13.2-16.0)	17.38±0.120 (16.15-18.65)	0.837±0.004 (0.742-0.887)	$4\frac{5}{8}$+ ($4\frac{1}{2}$- -$4\frac{7}{8}$+)	1.53±0.056 (0.95-2.05)	11.8±0.507 (8.03-18.1)
Initiation Rock, WA-131, FMNH 182500	32L	14.720.150 (13.5-16.65)	17.57±0.154 (16.2-19.8)	0.838±0.007 (0.758-0.932)	$4\frac{5}{8}$ ($4\frac{3}{8}$- -$4\frac{7}{8}$-)	1.66±0.56 (1.05-2.35)	11.0±0.435 (7.51-17.8)
Initiation Rock, WA-131, FMNH 182344	170D	13.80±0.061 (11.75-15.8)	16.75±0.068 (14.85-19.1)	0.824±0.002 (0.739-0.899)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-$4\frac{7}{8}$-)	1.56±0.019 (0.95-2.55)	11.0±0.140 (7.03-17.5)
WA-441, FMNH 199710	17L	14.71±0.198 (12.65-15.7)	17.42±0.115) (15.85-18.95)	0.845±0.006 (0.796-0.894)	$4\frac{3}{4}$- ($4\frac{1}{2}$- -5-)	1.50±0.53 (1.05-1.95)	11.8±0.396 (9.39-15.6)
WA-441, FMNH 199709	7D	14.54±0.322 (13.55-15.65)	17.52±0.446 (16.05-19.25)	0.831±0.015 (0.771-0.884)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-$4\frac{3}{4}$+)	1.60±0.107 (1.2-2.0)	11.2±0.683 (9.35-14.2)
N Bank Palm Creek, WA-763, FMNH 205557	24L	17.22±0.265 (15.0-19.6)	20.22±0.274 (17.9-22.95)	0.852±0.008 (0.771-0.951)	$4\frac{7}{8}$+ ($4\frac{5}{8}$- -$5\frac{1}{8}$-)	1.80±0.063 (1.3-2.25)	11.6±0.440 (8.66-15.6)
figs, N facing slope, WA-762, FMNH 205545	17L	18.16±0.298 (16.8-20.75)	21.75±0.324 (19.9-24.6)	0.835±0.005 (0.803-0.887)	$4\frac{7}{8}$+ ($4\frac{5}{8}$+-$5\frac{1}{4}$+)	2.20±0.065 (1.45-2.5)	10.1±0.394 (8.60-14.3)
figs, N facing slope, WA-762, FMNH 205546	9D	18.18±0.22 (17.25-19.35)	21.13±0.267 (20.95-23.05)	0.822±0.009 (0.788-0872)	$4\frac{7}{8}$+ ($4\frac{5}{8}$+-$5\frac{1}{8}$-)	2.01±0.192 (1.05-2.85)	12.0±1.361 (7.48-21.1)
Cycad Gorge, WA-130, FMNH 182522	6L	18.60±0.408 (17.05-19.5)	21.82±0.641 (19.65-24.15)	0.854±0.016 (0.799-0.907)	$5\frac{1}{8}$ ($4\frac{7}{8}$+-$5\frac{3}{8}$-)	2.16±0.154 (1.55-2.55)	10.3±0.587 (19.30-12.8)

Table 107: Local Variation in *Sinumelon expositum* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Palm Creek, WA-927, FMNH 212362	28L	17.76±0.212 (14.65-19.4)	20.61±0.183 (18.45-22.25)	0.862±0.007 (0.793-0.929)	5+ ($4\frac{5}{8}$- – $5\frac{3}{8}$-)	1.67±0.059 (1.1-2.2)	12.8±0.431 (8.80-18.0)
Palm Creek, WA-927, FMNH 212363	9D	18.06±0.333 (16.2-19.0)	21.58±0.278 (19.75-22.55)	0.838±0.014 (0.771-0.882)	5+ ($4\frac{3}{4}$+-$5\frac{1}{8}$+)	1.96±0.136 (1.35-2.8)	11.5±0.834 (7.86-15.9)
Oasis Spring, WA-928, FMNH 212373	8D	16.07±0.364 (14.55-17.95)	19.34±0.526 (17.05-21.95)	0.832±0.009 (0.794-0.880)	$4\frac{3}{4}$+ ($4\frac{1}{2}$- – $5\frac{1}{8}$-)	1.53±0.154 (1.05-2.15)	13.5±1.286 (8.41-18.7)
Palm patch, WA -443, FMNH 199659	6L	18.14±0.415 (17.1-19.4)	21.45±0.600 (19.4-23.1)	0.847±0.016 (0.791-0.897)	5- ($4\frac{7}{8}$- – 5+)	1.58±0.100 (1.4-1.9)	13.9±0.832 (10.6-15.6)
James Ranges							
Areyonga, WA-934, FMNH 212403	5L	16.24±0.503 (14.7-17.35)	19.94±0.529 (18.45-21.5)	0.815±0.020 (0.765-0.865)	$4\frac{7}{8}$+ ($4\frac{5}{8}$- – $5\frac{1}{8}$+)	1.88±0.140 (1.6-2.4)	10.8±0.611 (9.04-12.6)
Illara Waterhole, FMNH 198795	5L	14.34±0.258 (13.7-15.25)	17.39±0.324 (16.5-18.15)	0.825±0.012 (0.798-0.864)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-$4\frac{7}{8}$-)	1.77±0.101 (1.5-2.1)	9.95±0.467 (8.29-10.9)
Illara Waterhole, FMNH 198800	3D	16.33 (13.4-19.25)	19.64 (17.1-22.2)	0.827 (0.783-0.865)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-$4\frac{3}{4}$+)	1.99 (1.75-2.4)	10.2 (7.19-12.7)
Illamurta Spring, FMNH 198781	35L	18.98±0.193 (16.95-21.6)	22.51±0.166 (20.7-24.4)	0.843±0.006 (0.764-0.941)	5 ($4\frac{5}{8}$+-$5\frac{1}{4}$-)	2.31±0.086 (1.5-3.8)	10.1±0.329 (6.29-14.4)
Illamurta Spring, FMNH 198788	14D	18.22±0.372 (16.55-21.15)	22.11±0.286 (20.25-23.65)	0.824±0.011 (0.760-0.900)	5- ($4\frac{5}{8}$+-$5\frac{1}{4}$+)	2.27±0.121 (1.95-3.4)	10.0±0.434 (6.56-12.2)
Illamurta, WA-942, FMNH 212425	73L	17.39±0.124 (15.4-20.0)	21.22±0.135 (18.45-24.4)	0.820±0.004 (0.728-0.910)	5- ($4\frac{3}{8}$+-$5\frac{3}{4}$)	2.36±0.039 (1.75-3.5)	9.16±0.149 (6.84-12.2)
Illamurta, WA-942, FMNH 212423	30D	17.81±0.215 (15.5-20.35)	21.94±0.211 (20.1-24.8)	0.812±0.005 (0.761-0.857)	5 ($4\frac{5}{8}$+-$5\frac{1}{4}$)	2.36±0.087 (1.45-3.3)	9.63±0.336 (6.98-14.4)

situation in these Palm Valley fig patches thus is quite unusual. Discussion of potential reasons for this change will be presented elsewhere in a general account of patterns in camaenid shell size and shape features.

The population at WA-131 also shows an unusual amount of genital variation (**Figs 284a-d**). The entrance of the epiphallus (E) into the penis sheath (PS) is different in every individual dissected, ranging from basal (**Fig. 284b**) to medial (**Fig. 284d**) or above the middle of the penis (**Fig. 284f**) in other populations. All individuals dissected agree in the partial medial swelling of the penis complex and strong interior penis sculpture (**Fig. 283c**). The great variability shown by members of the population at WA-132 (= WA-441) requires investigation. Two things may contribute to the variability. First, the area under the figs is very small in size, and surrounded by fair expanses of rock exposures. While the population is dense, it also is small. Second, these figs would be subject to periodic inundation during floods of the Finke River spilling over into the base of Palm Creek, as well as the floods from Palm Creek itself. These floods would provide periodic recruitment of live snails washed down from upstream populations (as well as population reduction by washouts FROM the WA-132 colony), introducing genetic diversity into a small population. Allozyme study of this population might yield very interesting results.

SINUMELON DULCENSIS, SP. NOV.
(Plates 109a-d, 117a-f; Figs 285a-f, 286a-c, 287a-c)

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Comparative remarks

Sinumelon dulcensis, sp. nov., known from the Jervois and Dulcie Ranges, W fringes of the Strangeways Range, and the eastern MacDonnell Ranges, NT (**Map 8**), has a comparatively low spired (**Figs 285b, e**, mean H/D ratio 0.806), umbilicated (**Figs 285c, f**, mean D/U ratio 10.1) shell with broadly expanded lip, strong shell sculpture (**Plate 109a-d**), and a dark reddish colour suffusion on the spire and body whorl. Size and whorl count is quite variable (**Tables 102, 108**). The most similar species, *S. expositum* Iredale, 1937, whose range basically is that of the Finke River from just N of the MacDonnell Ranges at Glen Helen, S through the Krichauff and James Ranges, then E to near the former Charlotte Waters Telegraph Station, is generally larger and more elevated (**Tables 102, 107**), with a slightly higher spire (**Figs 281b, 281b, e**, mean H/D ratio 0.831), narrower umbilicus (**Figs 281c, 282c, f**, mean D/U ratio 11.1), often lighter reddish colour suffusion, and less broadly expanded shell lip in full adults (**Figs 281a-c, 282a-f**). *S. pedasum* Iredale, 1937 and *S. perinflatum* (Pfeiffer, 1864) differ in their larger size (**Table 102**), closed or very narrow (**Figs 272c, f, 277c**) umbilici, much higher spires (**Figs 272b, 277b**), and higher mean whorl counts (5+, 5- respectively). *S. bednalli* (Ponsonby, 1904), from the central MacDonnell Ranges, has very prominent cancellated shell sculpture (**Plate**

108b-c), and is much larger at the same whorl count (**Table 102**). The other small, umbilicated species, *S. gillensis*, from the George Gill Range and nearby areas, has a less elevated spire (**Fig. 288b**, mean H/D ratio 0.758), more sharply defined radial shell sculpture (**Plate 110e**), and reduced colouration. Anatomically (**Figs 286a-c, 287a-c**), *S. dulcensis* has a very short, almost globose penis (P) and short vagina V), near basal entry of the epiphallus (S) into the penis sheath (PS), and prominent penis chamber sculpture. *S. expositum* Iredale, 1937 differs most obviously (**Figs 283a, c, 284a-f**) in its long, slender penis (P) with mid entry of the epiphallus (E) and reduced internal penis chamber wall sculpture. Both *S. bednalli* (Ponsonby, 1904) (**Figs 276a-b**) and *S. pumilio* Iredale, 1937 (**Figs 291a-c**), from the Everard Ranges, have low entry of the epiphallus (E), but their long, cylindrical penes with different internal wall sculpture are diagnostic.

Holotype

AM C.135957, gorge N of Old Huckitta Homestead Ruins, Dulcie Range, NE of Alice Springs, Northern Territory, Australia. Huckitta 1:250,000 map sheet SF53-11 - 3528:1888yds. 22° 32' 14" S, 135° 31' 19" E. Collected by Fred & Jan Aslin 22 June 1978. Height of holotype 14.05 mm, diameter 17.05 mm, H/D ratio 0.824, whorls 4 5/8, umbilical width 2.0 mm, D/U ratio 7.03.

Paratopotypes

AM C.135958-9, SAM D17381-2, WAM 553.87, WAM 554.87, QM, MV, FMNH 198903-5, 30 LA, 25 DA, ? LJ, 75 DJ from the type locality.

Paratypes

Northern Territory

DULCIE RANGE AREA: Jinka Spring (WA-736, under figs, AM, SAM D17839, WAM 561.87, FMNH 205422, 4 LA, 10 LJ); Eurobra Rockhole (WA-735, under litter above flood line, AM, WAM 565.87, WAM 586.87, SAM D17843, SAM D17846, FMNH 205416-7, 4 LA, 10 DA, 7 LJ, 5 DJ; creek crossing at Eurobra Rockhole, AM, SAM D17841-2, WAM 563.87, WAM 564.87, QM, MV, FMNH 198884-5, 25 LA, 1 DA, 45 LJ, 69 DJ and broken adults; Eurobra Gorge entrance, S bank, AM, WAM 558.87, WAM 562.87, SAM D17836, SAM D17840, FMNH 198845-6, 34 LA, 10 DA, ? LJ, 33 DJ; Eurobra Gorge, under grass, AM, WAM 555.87, WAM 557.87, SAM D17833, SAM D17835, QM, MV, FMNH 198854-5, 3 LA, 14 DA, 10 LJ, 12 DJ); Old Huckitta ruins, ca 9 km SSE of, AM, WAM 556.87, WAM 569.87, SAM D17844, SAM D17847, FMNH 198892-4, 5 LA, 18 DA, ? LJ, 7 DJ); Boomerang Bore, Huckitta Station (50-100 m S of, under grass tussocks, AM, FMNH 198906, 3 LA, 5 LJ).

JERVOIS RANGE FRINGES: Mt. Thring (ca 11 km NE of, N of Plenty River, under flood debris and tussocks, AM, SAM D17853, WAM 574.87, FMNH 198876-7, 6 LA, 4 DA, 2 LJ, 2 DJ).

HARTS RANGE AREA: 2 km S of Mt. Riddock (BJS-24, under rocks and litter, MV, 2 LA, 2 LJ); Florence Creek, S side of Harts Range (watercourse of Muller Flat Dam, W of Florence Creek, AM, SAM D17838, WAM 560.87, QM, MV, FMNH 198956-7, 16 LA, ? LJ, 8 DA; 80 m E of Florence Creek, AM, FMNH 198936, FMNH

198942, 4 DJ); near Ignor Dam, on tributary of Florence Creek (AM, FMNH 198908, 1 DA, 8 DJ).

STRANGWAYS RANGE: Gillen Creek (BJS-27, banks at Plenty Highway crossing, NE of Strangways Range, MV, 4 LA, 1 LJ); Anamarra Creek Crossing, Plenty Highway (V. Kessner!, 20 April 1987, VK 11685, 5 LA); Southern Cross Bore road (WA-734, 2.7 km N of WA-733, FMNH 205406, AM, SAM D17837, WAM 559.87, FMNH 205411, 3 DA, 5 LJ, 7 DJ; WA-733, 2.2 km N of The Garden Road, FMNH 205402, 1 DA; Southern Cross Bore, G. W. Wilson! July 1981, FWA 3914, 4DA, 3 DJ).

MACDONNELL RANGES: Trephina Gorge (WA-750, creek at picnic area, FMNH 205468, 1 DA; WA-751, under large figs 4.9 km from Ross River road, AM, SAM D17854, SAM D17860, WAM 575.87, WAM 582.87, QM, MV, FMNH 205487-8, 22 LA, 61 DA, 14 LJ, 27 DJ); Bitter Springs Gap, Ross River (under rocks, AM, SAM D17858-9, WAM 580.87, WAM 581.87, MV, QM, FMNH 198964, FMNH 198972, 20 LA, 9 DA, ? LJ, 27 DJ; WA-561, 6.8 km ENE Ross River road junction, AM, SAM D17857, WAM 579.87, FMNH 204640, 7 DA, 11 DJ; WA-924, Bitter Spring, AM, WAM 578.87, SAM D17849, FMNH 212335-6, 4 LA, 9 DA, 2 LJ, 6 DJ; WA-562, 3.4 km ENE Ross River road junction, AM, WAM 570.87, SAM D17848, FMNH 204641, FMNH 204645, 6 DA, 2 LJ, 6 DJ; WA-742 [=WA-562], AM, WAM 577.87, SAM D17856, FMNH 205445-6, 3 LA, 15 DA, 5 LJ, 15 DJ; WA-749, W bank Trephina Creek, Ross River road, just W of Bitter Springs turnoff, AM, WAM 567.87, WAM D576.87, SAM D17845, SAM D17855, FMNH 205482, FMNH 205485, 10 LA, 18 DA, 1 LJ, 15 DJ); N'Dahla Gorge, Ross River (WA-748, W facing hillside 3.7 km E of Bitter Springs creek crossing, AM, SAM D17844, SAM D17861, WAM 566.87, WAM 583.87, QM, MV, FMNH 205476-7, 54 LA, 14 DA, 7 LJ, 5 DJ; WA-564, 2.9 km S of Ross River tourist camp, FMNH 204652-3, 1 LA, 1 DA, 1 DJ; BJS-37, banks of Ross River, MV, 11 LA; WA-747, W bank Ross River, 3.4 km S of Ross River Resort road, AM, SAM D17852, WAM 573.87, FMNH 205469, FMNH 205475, 3 LA, 4 DA, 2 LJ, 8 DJ; WA-563, 4.7 km S of Ross River Tourist Camp road, FMNH 204646, 2 DA); Goat Camp Creek (WA-743, 3.1 km N of Ross River-Box Hole Bore road, AM, FMNH 205455, 1 DA, 1 DJ; WA-744, 1.3 km E of Ross River-Atnarpa road junction, N of Goat Camp Creek, AM, WAM 571.87, WAM 572.87, SAM D17850-1, QM, MV, FMNH 205461-2, 15 LA, 39 DA, 9 LJ, 73 DJ); Undoolya Bore (SW of, FMNH 198778, 1 DJ).

Range

Sinumelon dulcensis, sp. nov., has been collected in the Dulcie Range and Mt. Thring just SW of the Jervois Range, the Harts Range, Gillen Creek and Southern Cross Bore road just E of the Strangways Range, and then in the eastern MacDonnell Ranges from Undoolya Bore, Trephina Gorge, Bitter Springs Gap, N'Dahla Gorge, and along Goat Camp Creek, NT (**Map 8**).

Diagnosis

Shell variable in size, adult diameter 13.85-22.3 mm (mean 16.89 mm), whorls 4 1/8- to 5 1/4- (mean 4 1/2+). Apex and spire strongly and evenly elevated (**Figs 285b, d-f**), shell height 10.75-19.3 mm (mean 13.62 mm), H/D ratio 0.668-0.922 (mean 0.806).

Body whorl usually descending at most slightly behind aperture (**Fig. 285b**). Spire and body whorl with sharply defined shell sculpture, sometimes with a few scattered pustules on body whorl (**Plate 109a-d**). Umbilicus open, only partly narrowed by broad columellar lip (**Fig. 285c**), width 1.0-3.1 mm (mean 1.72 mm), D/U ratio 5.56-20 (mean 10.1). Lip moderately expanded on palatal and basal sections, broadly expanded on columellar wall (**Figs 285a-f**), white. Shell greenish-yellow, lighter on base, northern populations generally with a light to moderate reddish colour suffusion on lower spire and body whorl above periphery, MacDonnell Range populations usually with much more intense reddish suffusion. Based on 559 measured adults.

Genitalia (**Figs 286a-c, 287a-c**) typical apically, vagina (V) short to very short, free oviduct (UV) and spermathecal shaft (S) intertwined, expanded head of spermatheca just above base of prostate-uterus. Vas deferens (VD) typical, entering large epiphallic caecum (EC) laterally. Epiphallus (E) entering penis sheath (PS) near base, becoming free of wall near top of penis (**Fig. 287c**). Penis (P) short, often nearly globular, internally (**Figs 286c, 287c**) with prominent, typical wall sculpture.

Central and lateral teeth of radula (**Plates 117a, c, e, 118a, c**) with prominent anterior flare, high cusp shaft angle, curved and pointed cusp tip, variable trace of ectocone, and prominent basal plate ridge. Lateromarginal transition (**Plate 117b, d, f**) variable in rate of change. Jaw (**Plate 118b, d-f**) with prominent radial ribs becoming reduced to absent on side margins.

Discussion

Sinumelon dulcensis is one of the few Red Centre species to show clear geographic variation. Specimens from the Dulcie Range tend to have reduced shell colour and are medium in size (**Table 108**). Those from Mt. Thring (SW of Jervois Range), eastern edge of the Strangways Range are slightly larger in size (**Table 108**) and have darker shell colour, while those from the eastern MacDonnell Ranges are noticably smaller in size (**Table 108**) and tend to have very dark colour suffusions. The holotype from Old Huckitta Homestead ruins (**Figs 285a-c**), is typical of the northern populations in size, shape, and colour. Specimens from Mt. Thring (**Fig. 285d**) and Goat Camp Creek (**Fig. 285e**) show size extremes, with a large example from Bitter Springs Gap (**Fig. 285f**) demonstrating that larger sized individuals do occur in the eastern MacDonnell Ranges. The smaller sized specimens are smaller primarily because of reduced whorl count, *i. e.*, growth stopped at a lower whorl number. An additional effect of this earlier cessation of growth is that the H/D ratio is slightly lowered in populations where the diameter is smaller.

There is considerable variation among populations within the different areas. It also is interesting that the northeastern population (WA-736, Jinka Spring), the southeastern (WA-744, Goat Camp Creek), and the westernmost with adults (WA-749, Trephina Creek) are all composed of small sized shells (**Table 108**). There generally is a significant difference in size between live and dead examples from the same populations (**Table 108**). This applies to the collections made by Fred and Jan Aslin in 1978, by Solem and Colman in 1981, and members of the Central Australian Expedition in 1983. At nearly every station, dead examples were larger in size.

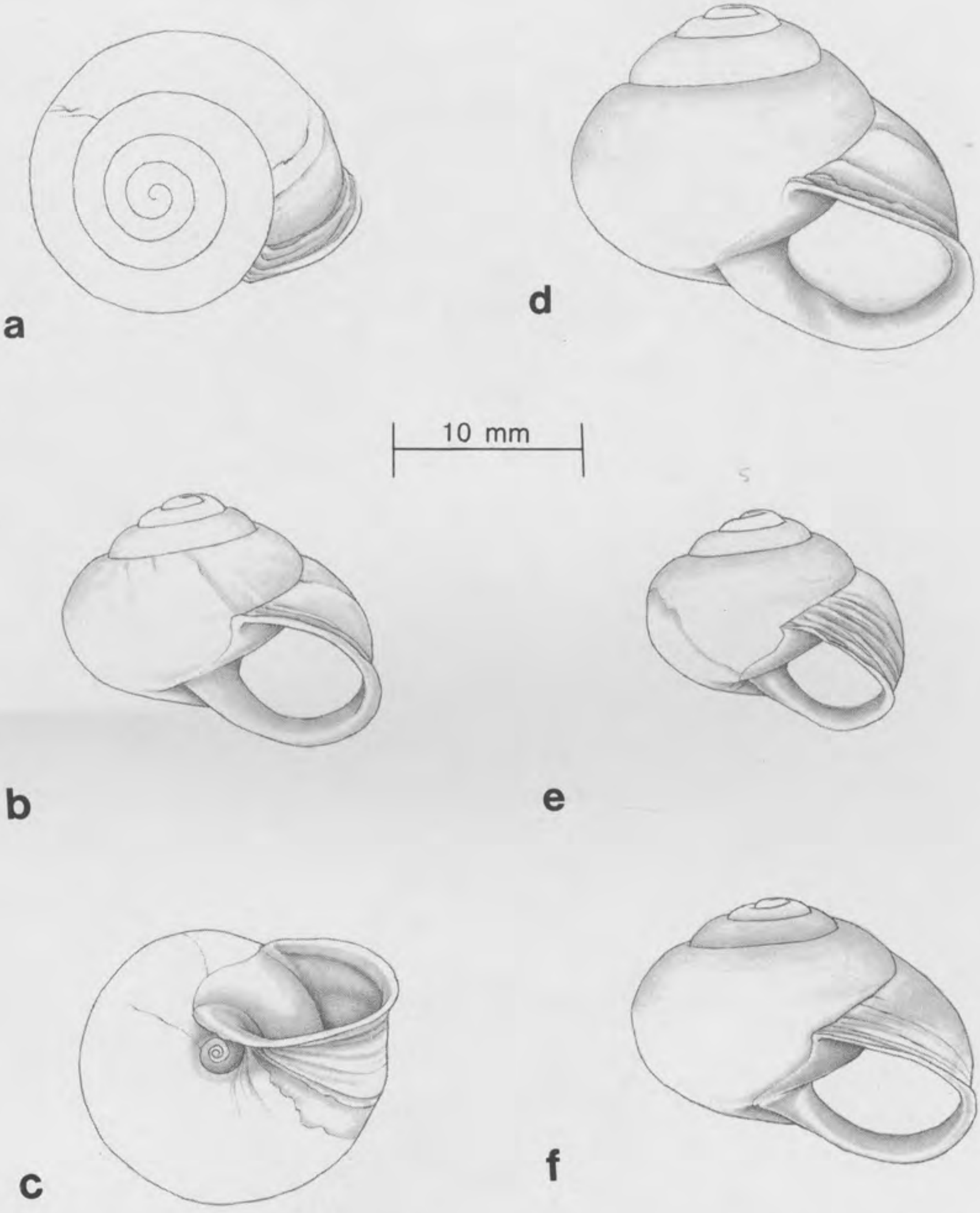


Fig. 285: Shells of *Sinumelon dulcensis*, sp. nov.: (a-c) Holotype. AM C.135957, gorge N of Old Huckitta Ruins, Dulcie Ranges, NT; (d) Mt. Thring, SW of Jervois Range, NT. Paratype. FMNH 198876; (e) WA-744, Goat Camp Creek, eastern MacDonnell Ranges, NT. FMNH 205462; (f) Bitter Springs Gap, eastern MacDonnell Ranges, NT. FMNH 198964. Scale line equals 10 mm. Drawings by Linnea Lahlum.

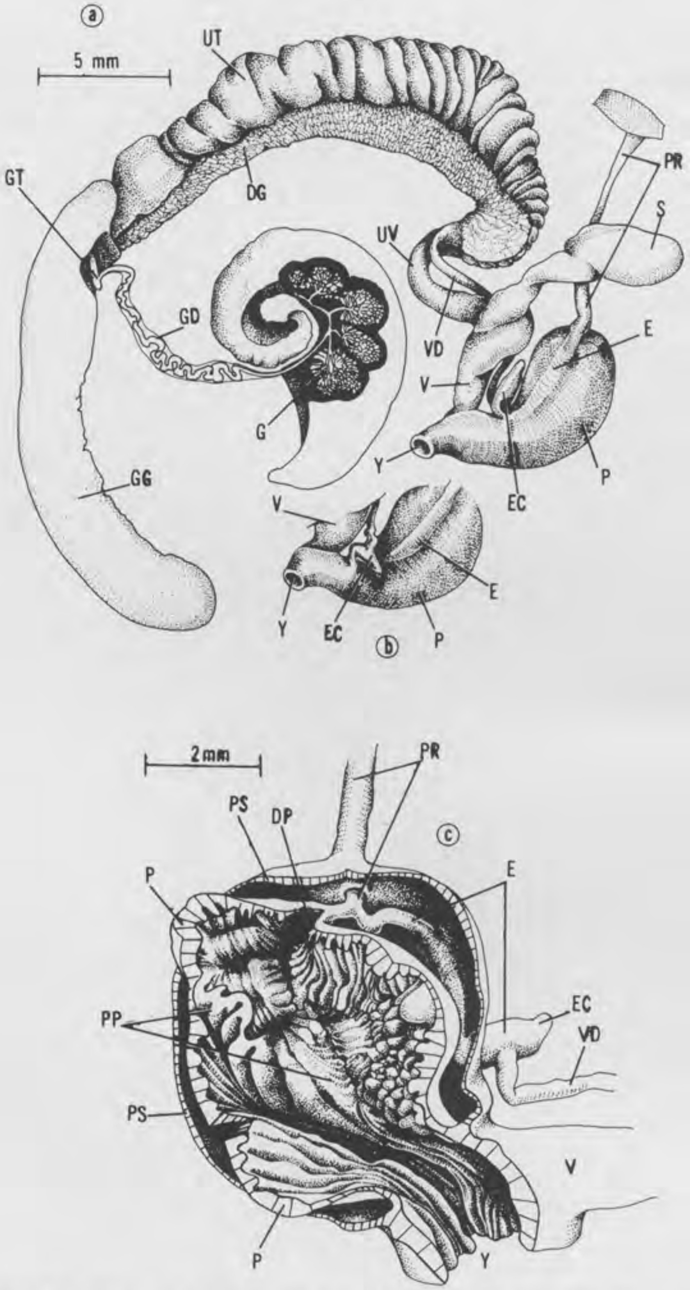


Fig. 286: Genitalia of *Sinumelon dulcensis*, sp. nov.: NE of Mt. Thring, SW of Jervois Range, NT. 20 June 1978. FMNH 198877. (a) whole genitalia, Dissection A; (b) detail of epiphallic caecum, Dissection A; (c) interior of penis, Dissection B. Scale lines as marked. Drawings by Marjorie M. Connors.

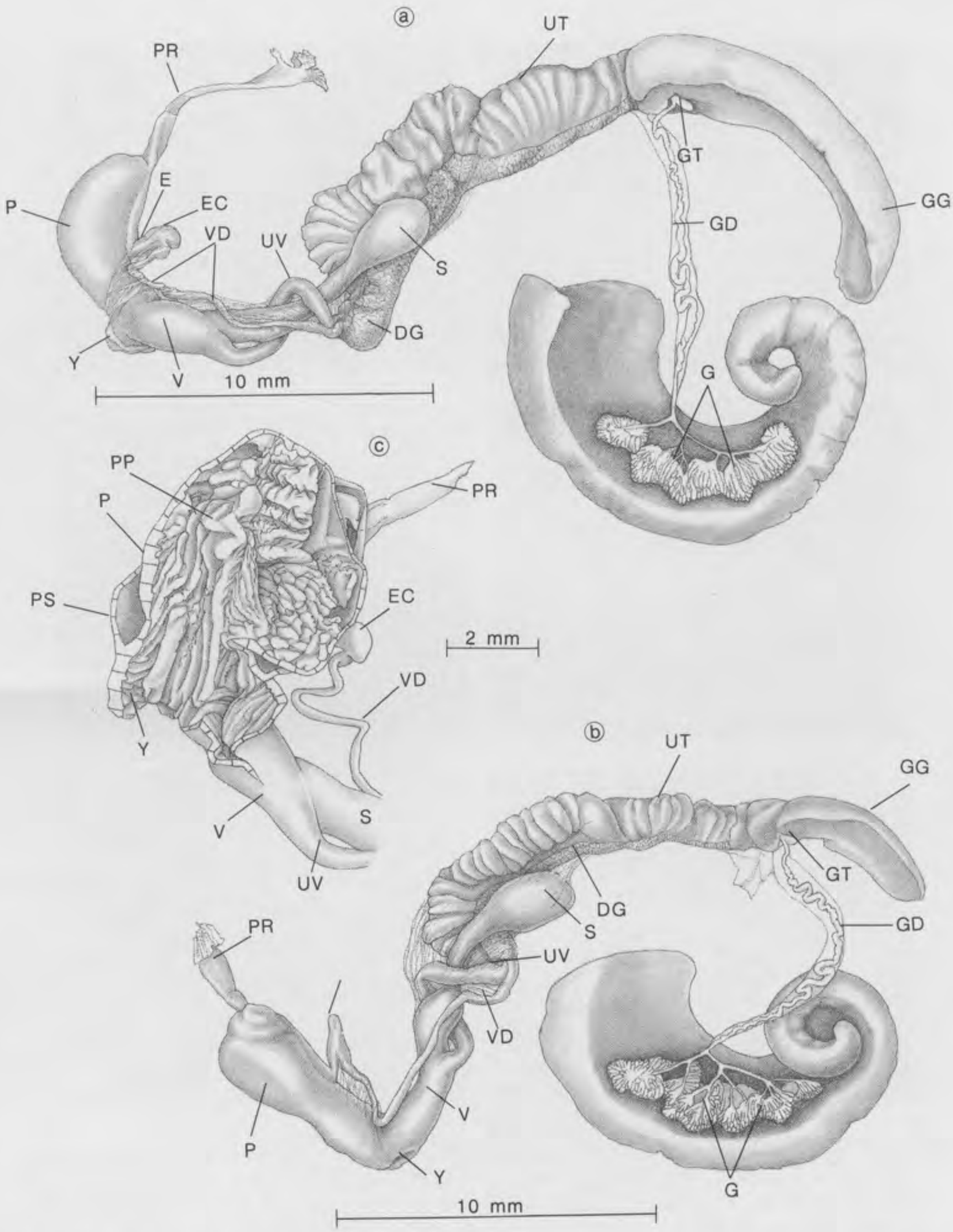


Fig. 287: Genitalia of *Sinumelon dulcensis*, sp. nov.: Gorge N of Old Huckitta Homestead ruins, Dulcie Range, NT. 22 June 1978. FMNH 198905. (a) whole genitalia of full adult, Dissection C; (b) whole genitalia of new adult, Dissection B; (c) interior of penis, Dissection C. Scale lines as marked. Drawings by Linnea Lahlum.

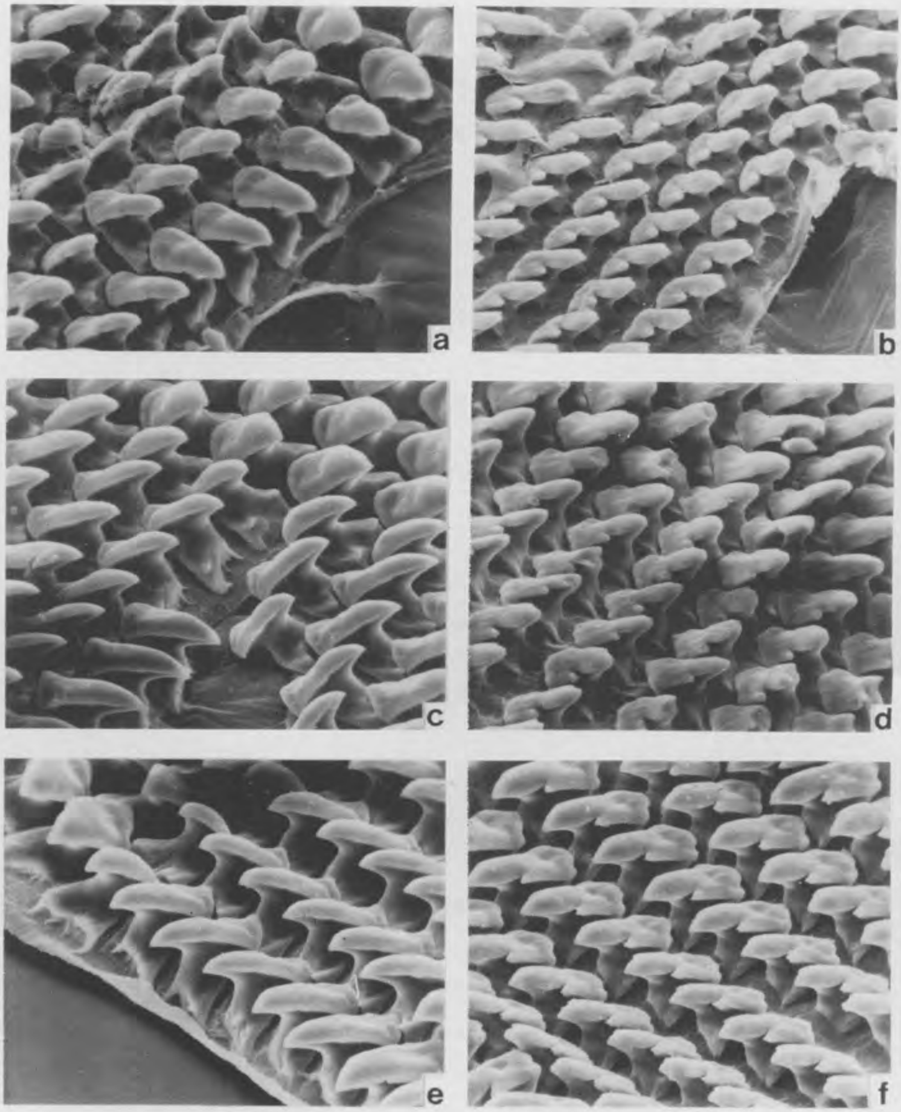


Plate 117: Radular teeth of *Sinumelon dulcensis*: (a-b) WA-744, N of Goat Camp Creek, eastern MacDonnell Ranges, NT. 23 April 1981. FMNH 205461, Dissection A. a is central and early laterals at 400X, b is lateromarginal transition at 395X; (c-d) gorge N of Old Huckitta Homestead ruins, Dulcie Range, NT. 22 June 1978. FMNH 198905. c is central and early laterals, Dissection C, 395X, d is lateromarginal transition from anterior end of radula, Dissection A, 390X; (e-f) NE of Mt. Thring, SW of Jervois Range, NT. 20 June 1978. FMNH 198877, Dissection C. e is unused central and early laterals at 395X, f is unused lateromarginal transition teeth, at 405X.

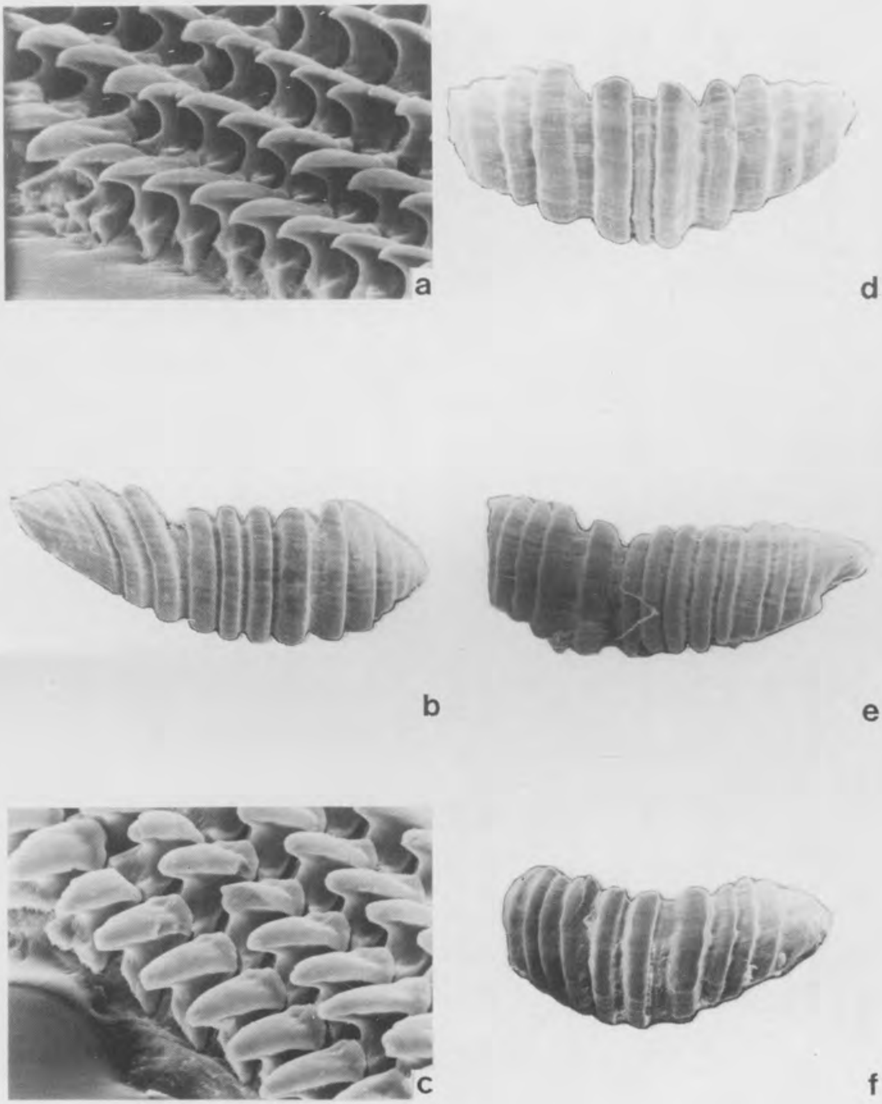


Plate 118: Radular teeth and jaw of *Sinumelon dulcensis*: (a-c) NE of Mt. Thring, SW of Jervois Range, NT. 20 June 1978. FMNH 198877. a is low angle view of central and early laterals, Dissection D, at 385X, b is jaw, Dissection C, at 36X, c is central and early laterals from worn area, Dissection C, at 380X; (d-f) gorge N of Old Huckitta Homestead ruins, Dulcie Range, NT. FMNH 198905. Jaws. d is Dissection C at 50X, e is Dissection B at 39.5X, f is Dissection A at 43.5X.

Table 108: Local Variation in *Sinumelon dulcensis*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Dulcie Range							
Jinka Spring, WA-736, FNMH 205422	4L	12.78±0.155 (12.45-13.2)	16.46±0.428 (15.25-17.3)	0.778±0.25 (0.720-0.841)	$4^{3}/_{8}$ ($4^{1}/_{4}$+-$4^{1}/_{2}$-)	2.63±0.263 (1.95-3.1)	6.41±0.547 (5.56-7.87)
Eurobra Rockhole, WA-735, FMNH 205416	4L	14.49±0.604 (12.9-15.55)	18.53±0.698 (17.1-19.8)	0.782±0.010 (0.756-0.807)	$4^{1}/_{2}$+ ($4^{3}/_{8}$+-$4^{1}/_{2}$+)	1.72±0.114 (1.45-2.0)	10.9±0.816 (8.55-12.2)
Eurobra Rockhole, WA-735, FMNH 205417	10D	14.86±0.251 (13.45-15.9)	18.50±0.284 (16.45-19.4)	0.804±0.009 (0.750-0.859)	$4^{3}/_{4}$- ($4^{1}/_{2}$+-$4^{7}/_{8}$-)	1.97±0.079 (1.55-2.4)	9.54±0.450 (7.34-11.9)
Eurobra Creek crossing, FMNH 198884	25L	14.76±0.160 (13.35-16.6)	18.04±0.168 (16.4-20.5)	0.819±0.038 (0.715-0.915)	$4^{5}/_{8}$- ($4^{3}/_{8}$–$4^{7}/_{8}$+)	1.92±0.057 (1.35-2.45)	9.59±0.282 (7.43-12.9)
Eurobra Gorge entrance, FMNH 198845	34L	14.26±0.105 (12.6-15.2)	18.07±0.131 (16.55-19.65)	0.789±0.004 (0.731-0.840)	$4^{5}/_{8}$- ($4^{3}/_{8}$-$4^{7}/_{8}$+)	1.89±0.049 (1.35-2.45)	9.77±0.265 (7.39-13.5)
Euroba Gorge entrance, FMNH 198846	10D	15.21±0.195 (10.0-14.1)	18.86±0.262 (17.35-19.85)	0.807±0.009 (0.753-0.840)	$4^{3}/_{4}$+ ($4^{1}/_{2}$+-$5^{1}/_{4}$-)	1.99±0.128 (1.45-2.75)	9.87±0.694 (7.19-13.9)
Euroba Gorge, FMNH 198855	14D	15.70±0.195 (14.3-16.7)	19.32±0.166 (17.8-20.4)	0.812±0.005 (0.764-0.831)	$4^{3}/_{4}$+ ($4^{1}/_{2}$-5-)	1.84±0.060 (1.35-2.2)	10.7±10.425 (8.85-15.0)
Old Huckitta ruins, FMNH 198905	30L	14.12±0.121 (13.05-15.45)	16.73±0.109 (15.6-17.8)	0.844±0.005 (0.791-0.922)	$4^{3}/_{4}$- ($4^{1}/_{2}$-$4^{7}/_{8}$+)	2.12±0.045 (1.6-2.7)	8.00±0.164 (6.34-10.1)
Old Huckitta ruins, FMNH 198904	26D	14.68±0.136 (13.4-16.3)	17.83±0.183 (15.8-19.95)	0.824±0.005 (0.772-0.908)	$4^{3}/_{4}$- ($4^{1}/_{2}$+-$4^{7}/_{8}$-)	2.29±0.078 (1.4-2.9)	8.01±0.300 (6.19-13.3)

Table 108: Local Variation in *Sinumelon dulcensis* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
9 km SSE Old Huckitta, FMNH 198894	5L	15.77±0.438 (14.4-17.0)	18.47±0.249 (17.5-18.95)	0.854±0.017 (0.819-0.912)	$4^{3}/_{4}$ ($4^{1}/_{2}$+-5+)	1.81±0.111 (1.5-2.05)	10.4±0.715 (9.03-12.4)
9 km SSE Old Huckitta, FMNH 198893	18D	15.00±0.211 (13.3-16.85)	18.53±0.256 (16.3-20.65)	0.810±0.005 (0.771-0.862)	$4^{3}/_{4}$- ($4^{1}/_{2}$+-$5^{1}/_{8}$+)	1.85±0.064 (1.4-2.35)	10.2±0.348 (7.93-13.1)
Boomerang Bore, Huckitta, FMNH 198906	3L	15.73 (14.8-17.1)	19.47 (18.2-20.9)	0.808 (0.794-0.817)	$4^{3}/_{4}$+ ($4^{3}/_{4}$+-$4^{7}/_{8}$-)	2.36 (1.9-2.8)	8.44 (6.85-9.64)
Jervois Range Mt Thring, FMNH 198877	6L	16.65±0.124 (16.35-17.05)	20.59±0.326 (19.6-21.9)	0.809±0.008 (0.780-0.837)	$4^{3}/_{4}$- ($4^{5}/_{8}$--$4^{7}/_{8}$+)	1.79±0.261 (1.0-2.5)	13.0±2.151 (8.79-20.0)
Mt Thring FMNH 198876	4D	16.72±0.652 (15.5-18.45)	20.13±0.502 (19.1-21.2)	0.830±013 (0.810-0.869)	$4^{5}/_{8}$+ ($4^{1}/_{4}$+-$4^{3}/_{4}$+)	2.01±0.143 (1.75-2.4)	10.1±0.542 (8.76-11.1)
Harts Range Muller Flat Dam, FMNH 198957	16L	16.77±0.208 (15.1-18.0)	19.77±0.195 (18.0-20.8)	0.848±0.007 (0.811-0.914)	$4^{3}/_{4}$- ($4^{1}/_{2}$+-$5^{1}/_{8}$+)	2.02±0.067 (1.6-2.35)	9.96±0.350 (8.14-12.5)
Strangways Range Gillen Creek, BJS-24, MV	4L	16.65±0.189 (16.4-17.2)	19.79±0.345 (19.25-20.8)	0.842±0.007 (0.827-0.862)	$4^{5}/_{8}$+ ($4^{1}/_{2}$- -$4^{7}/_{8}$-)	1.88±0.243 (1.4-2.5)	11.1±1.1.439 (7.70-13.7)
MacDonnell Ranges Trephina Gorge, WA-751, FMNH 205488	22L	11.96±0.108 (11.25-13.1)	15.17±0.147 (14.0-17.1)	0.789±0.006 (0.733-0.860)	$4^{3}/_{8}$- ($4^{1}/_{8}$- -$4^{5}/_{8}$+)	1.53±0.040 (1.1-1.75)	10.1±0.272 (8.76-13.5)

Table 108: Local Variation in *Sinumelon dulcensis* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Trephina Gorge, WA-751, FMNH 205487	61D	12.22±0.068 (10.75-13.4)	15.58±0.073 (14.4-16.95)	0.785±0.003 (0.735-0.834)	$4^{3}/_{8}$ $(4^{1}/_{8}{-}{-}4^{5}/_{8}{+})$	1.60±0.026 (1.15-2.2)	9.86±0.152 (7.65-13.6)
Bitter Springs Gap, FMNH 198972	20L	13.13±0.141 (11.7-14.5)	16.58±0.140 (15.7-17.9)	0.792±0.006 (0.737-0.829)	$4^{3}/_{8}$ $(4^{1}/_{4}{-}4^{1}/_{2}{+})$	1.56±0.047 (1.1-2.05)	10.8±0.039 (8.03-14.5)
Bitter Springs Gap, FMNH 198964	9D	13.48±0.193 (12.5-14.25)	17.46±0.239 (16.35-18.4)	0.772±0.004 (0.752-0.796)	$4^{1}/_{2}{-}$ $(4^{1}/_{8}{+}{-}4^{5}/_{8}{+})$	1.59±0.092 (1.25-2.0)	11.3±0.651 (8.80-14.3)
Bitter Springs, WA-561, FMNH 204640	7D	13.51±0.238 (12.3-14.3)	17.18±0.220 (16.4-17.85)	0.787±0.010 (0.749-0.827)	$4^{1}/_{2}{-}$ $(4^{3}/_{8}{+}{-}4^{5}/_{8}{-})$	1.72±0.051 (1.5-1.9)	10.0±0.277 (9.05-11.3)
WA-924, FMNH 212335	4L	13.97±0.390 (13.4-15.1)	16.78±0.439 (16.05-17.9)	0.832±0.004 (0.821-0.841)	$4^{5}/_{8}{+}$ $(4^{5}/_{8}{-}{-}4^{7}/_{8}{-})$	1.45±0.075 (1.35-1.65)	11.7±0.714 (9.67-13.0)
WA-924, FMNH 212336	9D	13.29±0.222 (12.0-14.5)	16.77±0.306 (15.2-18.1)	0.793±0.009 0.749-0.838)	$4^{5}/_{8}{-}$ $(4^{3}/_{8}{-}{-}5{-})$	1.52±0.075 (1.15-1.85)	11.3±0.720 (8.75-14.9)
WA-562, FMNH 204645	6D	13.50±0.293 (12.6-14.55)	16.95±0.414 (15.35-18.3)	0.797±0.013 (0.764-0.845)	$4^{1}/_{2}{-}$ $(4^{1}/_{4}{+}{-}4^{5}/_{8}{+})$	1.57±0.062 (1.35-1.75)	10.8±0.268 (10.2-11.9)
WA-742, FMNH 205446	15D	13.62±0.205 (12.25-14.8)	17.27±0.137 (15.85-18.25)	0.789±0.011 (0.727-0.863)	$4^{1}/_{2}{+}$ $(4^{1}/_{4}{+}{-}4^{7}/_{8}{+})$	1.50±0.066 (1.05-2.05)	11.8±0.541 (8.35-16.5)
Trephina Creek, WA-749, FMNH 205485	10L	12.81±0.234 (11.2-13.8)	15.47±0.169 (14.7-16.35)	0.828±0.011 (0.760-0.871)	$4^{1}/_{2}{-}$ $(4^{1}/_{4}{-}{-}4^{5}/_{8}{-})$	1.40±0.046 (1.2-1.6)	11.2±0.439 (9.61-13.3)

Table 108: Local Variation in *Sinumelon dulcensis* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Trephina Creek, WA-749, FMNH 205482	18D	12.88±0.144 (11.1-13.75)	16.09±0.133 (15.05-17.1)	0.801±0.010 (0.668-0.845)	4⅜+ (4¼+-4⅝=)	1.46±0.052 (1.05-1.75)	11.3±0.446 (9.09-15.6)
N'Dahla Gorge, WA-748, FMNH 205476	54L	12.69±0.073 (11.3-13.85)	15.62±0.073 (14.3-16.8)	0.813±0.004 (0.744-0.874)	4½- (4¼--4¾-)	1.48±0.030 (1.0-2.25)	10.8±0.216 (6.97-15.7)
WA-748 FMNH 205477	14D	12.75±0.191 (11.55-13.7)	15.58±0.231 (14.25-17.3)	0.819±0.007 (0.781-0.886)	4½- (4¼+-4⅝+)	1.38±0.073 (1.05-2.25)	11.6±0.449 (7.71-15.3)
BJS-37, MV	11L	12.43±0.278 (11.0-13.55)	15.48±0.291 (14.05-17.05)	0.803±0.009 (0.759-0.850)	4⅜- (4⅛-4⅝-)	1.43±0.051 (1.2-1.7)	11.0±0.393 (9.25-12.8)
N'Dahla Gorge, WA-747 FMNH 205475	40	13.46±0.455 (12.1-14.0)	16.87±0.159 (16.55-17.3)	0.798±0.022 (0.732-0.828)	4⅝ (4½–4¾-)	1.71±0.121 (1.45-2.0)	10.0±0.610 (8.56-11.5)
Goat Camp Creek, WA-744, FMNH 205461	15L	11.84±0.109 (11.2-12.7)	14.97±0.118 (13.85-15.6)	0.791±0.008 (0.742-0.856)	4⅜+ (4¼+-4⅝-)	1.60±0.062 (1.05-1/95)	9.54±0.367 (7.84-13.1)
Goat Camp Creek, WA-744, FMNH 205462	39D	12.11±0.077 (11.15-13.35)	15.22±0.082 (13.85-16.2)	0.796±0.005 (0.727-0.864)	4⅜ (4⅛+-4⅝-)	1.61±0.029 (1.3-2.0)	9.55±0.178 (7.48-12.0)

Despite the shell differences, anatomical structures are the same throughout the range of the species. Examples from Mt. Thring (**Figs 286a-c**), Dulcie Range (**Figs 287a-c**), and the eastern MacDonnell Ranges (WA-744, not illustrated) share the same nearly globular penis, near basal entry of the epiphallus into the penis sheath, large epiphallic caecum, and strong penis chamber sculpture. No other Red Centre *Sinumelon* has the same penis structure.

Both a fully mature specimen (**Fig. 287a**) and a "new adult" (**Fig. 287b**) from the same population are figured. They were collected 22 June 1978. Note the difference in size of the albumen gland (GG) and slenderer uterus (UT) in the new adult, but that ovotestis (G), hermaphroditic duct (GD), and prostate (DG) are essentially equivalent in size. This suggests that the "new adult" would be functional as a male in the next wet spell, and thus agrees with the maturation pattern suggested by Solem & Christensen (1984) for the Kimberley camaenids.

Unlike *Sinumelon expositum* Iredale, 1937, which has an extended range (**Map 8**) following the course of the Finke River (see above), the apparently disjunct range of *S. dulcensis* involves different drainages. The Dulcie, Jervois, and N slope of Harts Ranges localities all drain into the Plenty River; the Southern Cross Bore road and Gillen Creek records (E margin of Strangsway Range) drain N into (eventually) the Sandover River; while the eastern MacDonnell Ranges and S face of the Harts Range localities are part of the Todd-Hale River system that drains SE into the Simpson Desert. Flood water transport, and thus genetic interchange, between areas is thus unlikely.

Further study may demonstrate differentiation among the populations from these areas, but anatomically they are not separable on currently available data.

Radular preparations suggest that lateral tooth count and shell diameter may be correlated. Time for investigating this aspect was not available, but the following anecdotal information suggests obvious lines of investigation. The following fully adult shells, from different populations, have quite different numbers of lateral teeth on the radula:

Station and Area	Shell diameter	Lateral teeth/ half row
WA-744, MacDonnell Ranges	14.85 mm	11
Old Huckitta, Dulcie Ranges	17.45 mm	15
Mt. Thring, Jervois Ranges	20.15 mm	19

The situation is complicated, of course, by the fact that the shift between lateral and marginal teeth is a *transition* that may occur abruptly or more slowly. In the three specimens cited above (**Plate 117b, d, f**), the transition covers only three or four rows, so that the specimens are comparable.

The name *dulcensis* is taken from the Dulcie Range, where this species is quite abundant.

SINUMELON GILLENSIS, SP. NOV.
(Plates 110e, 119a-f; Figs 288a-c, 289a-c)

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Comparative remarks

Sinumelon gillensis, sp. nov., from the George Gill Range, NT (**Map 8**), is small in size (mean diameter 16.60 mm), low spired (**Fig. 288b**, mean H/D ratio 0.758), with an open umbilicus (**Fig. 288c**, mean D/U ratio 9.35), has a reddish-brown colour suffusion above the periphery that may extend partway to the umbilicus, and the moderately expanded shell lip is white. The shell surface has sharply defined radial ridges (**Plate 110e**). The Musgrave Range *S. amatensis*, sp. nov., is even smaller (mean diameter 14.70 mm), has a very narrow umbilicus (**Fig. 288f**, mean D/U ratio 16.5), stronger radial ridging (**Plate 109e-f**), often darker colouration that extends closer to the umbilicus, and the shell lip is narrower (**Fig. 288d-f**), often with a pink tinge. The much higher spired *S. pumilio* Iredale, 1937 (**Fig. 288h**, mean H/D ratio 0.915) also has a closed umbilicus, narrow white lip, and more prominent radial ridging (**Plate 110f**). *S. expositum* Iredale, 1937, from the James and Krichauff ranges to the N, is larger, higher spired (**Table 102**), and with less prominent shell sculpture (**Plate 110a-d**). Anatomically (**Figs 289a-c**) *S. gillensis* has a long cylindrical penis (P) with above medial attachment of the epihallus (E), short vagina (V), and a proliferation of minor sculpture within the penis chamber (**Fig. 289c**). *S. pumilio* Iredale, 1937 has near basal attachment of the epiphallus to the penis sheath (**Fig. 291a**), a much longer vagina, and retains basic penis chamber sculpture (**Fig. 291c**). *S. amatensis* (**Figs 290a-c**) has a penis that tapers apically, mid-penis sheath attachment of the epiphallus, a longer, more slender vagina, and prominent penis chamber sculpture. *S. expositum* differs most obviously in its penial chamber wall sculpture (**Fig. 283b**).

Holotype

AM C.135952, WA-445, talus under figs E of Reedy Rock Hole, George Gill Ranges, Northern Territory, Australia. 24° 17' 59" S, 131° 36' 14" E. Collected by Alan Solem and Laurel Keller 25 May 1977. Height of holotype 12.5 mm, diameter 16.7 mm, H/D ratio 0.749, whorls 4 3/4, umbilical width 1.3 mm, D/U ratio 12.8.

Paratopotypes

AM C.135953, AM C.135963, SAM D17745-6, WAM 474.87, WAM 475.87, QM, MV, FMNH 199687-8, NMV (BJS 48), 33 LA, 9 DA, 15 LJ, 5 DJ from the type locality.

Paratypes

Northern Territory

GEORGE GILL RANGES: 24 road km W of Kings Canyon (WA-936, AM, WAM 476.87, WAM 477.87, SAM D17747-8, FMNH 212404-5, 10 LA, 19 DA, 6 LJ, 10 DJ);

Kings Canyon (MV F28285, 6 DA, 2 DJ; SAM, 1 DA, 1 DJ; WA-444, W side of entrance, (AM, SAM D17749, WAM 478.87, FMNH 199681, FMNH 199689, 9 LA, 10 DA, 10 LJ, 5 DJ); Kathleen Spring (WA-446, AM, SAM D17750-1, WAM 479.87, WAM 480.87, FMNH 199693-4, 11 LA, 10 DA, many LJ, 2 DJ; BJS 49, NMV, 3 LA, 10 LJ); Bagot Spring (WA-447, 0.5 km above reed area, FMNNH 199648, 2 DA); branch of Stokes Creek (WA-937, AM, SAM D17552-3, WAM 481.87, WAM 482.87, FMNH 212406-7, 2 LA, 9 DA, 8 LJ, 11 DJ).

Range

Sinumelon gillensis, sp. nov., occurs in wetter areas throughout sampled portions of the George Gill Range, NT (**Map 8**).

Diagnosis

Shell relatively small, adult diameter 14.4-18.7 mm (mean 16.60 mm), whorls 4 1/4+ to 5 (mean 4 5/8-). Apex and spire moderately and evenly elevated (**Fig. 288b**), not rounded above, shell height 9.9-15.25 mm (mean 12.59 mm), H/D ratio 0.686-0.864 (mean 0.758). Body whorl descending moderately behind aperture. Spire and body whorl with low, irregular ribs, sometimes interrupted (**Plate 110e**), that continue onto shell base. Umbilicus (**Fig. 288c**) usually narrowly open, partly closed by reflection of columellar lip, width 1.2-2.85 mm (mean 1.83 mm), D/U ratio 6.10-15.2 (mean 9.35). Lip strongly expanded on columellar margin (**Figs 288a-c**), less basally and on palatal wall, white in colour, rarely with faint pinkish tinge. Spire greenish-yellow on base, usually with a reddish-green suffusion on spire that sometimes extends onto shell base, in other examples stops abruptly just below periphery. Based on 116 measured adults.

Genitalia (**Figs 289a-c**) with long shafts of spermatheca (S) and free oviduct (UV) wound around each other, head of spermatheca at base of prostate-uterus. Vagina (V) third to half length of penis, slightly tapering to atrium (Y), internally with very fine longitudinal pilasters. Vas deferens (VD) slender, lightly bound to terminal genitalia, entering moderately large epiphallic caecum (EC) basally. Epiphallus (E) with mid penis sheath (PS) attachment and entry, coiled apically. Penis sheath very thin-walled. Penis (P) relatively short, cylindrical, usually not reaching to base of spermathecal head. Interior of penis (**Fig. 289c**) with main pilaster partly corrugated, rest of chamber with low and complex ridging.

Central and early laterals (**Plate 119a-b, d-e**) with typical anterior flare, high cusp angle with curved and rounded tip, ectoconal presence variable. Lateromarginal transition typical. Jaw (**Plate 119c, f**) with crowded, narrow vertical ribs, reduced on side margins.

Discussion

Sinumelon gillensis, new species has been found at scattered localities along the George Gill Ranges, where dense vegetation borders permanent or near permanent springs. It also has been taken in the unnamed hills slightly NW (WA-936). Size and shape variation (**Table 109**) is minimal, considering the restricted size of the colonies.

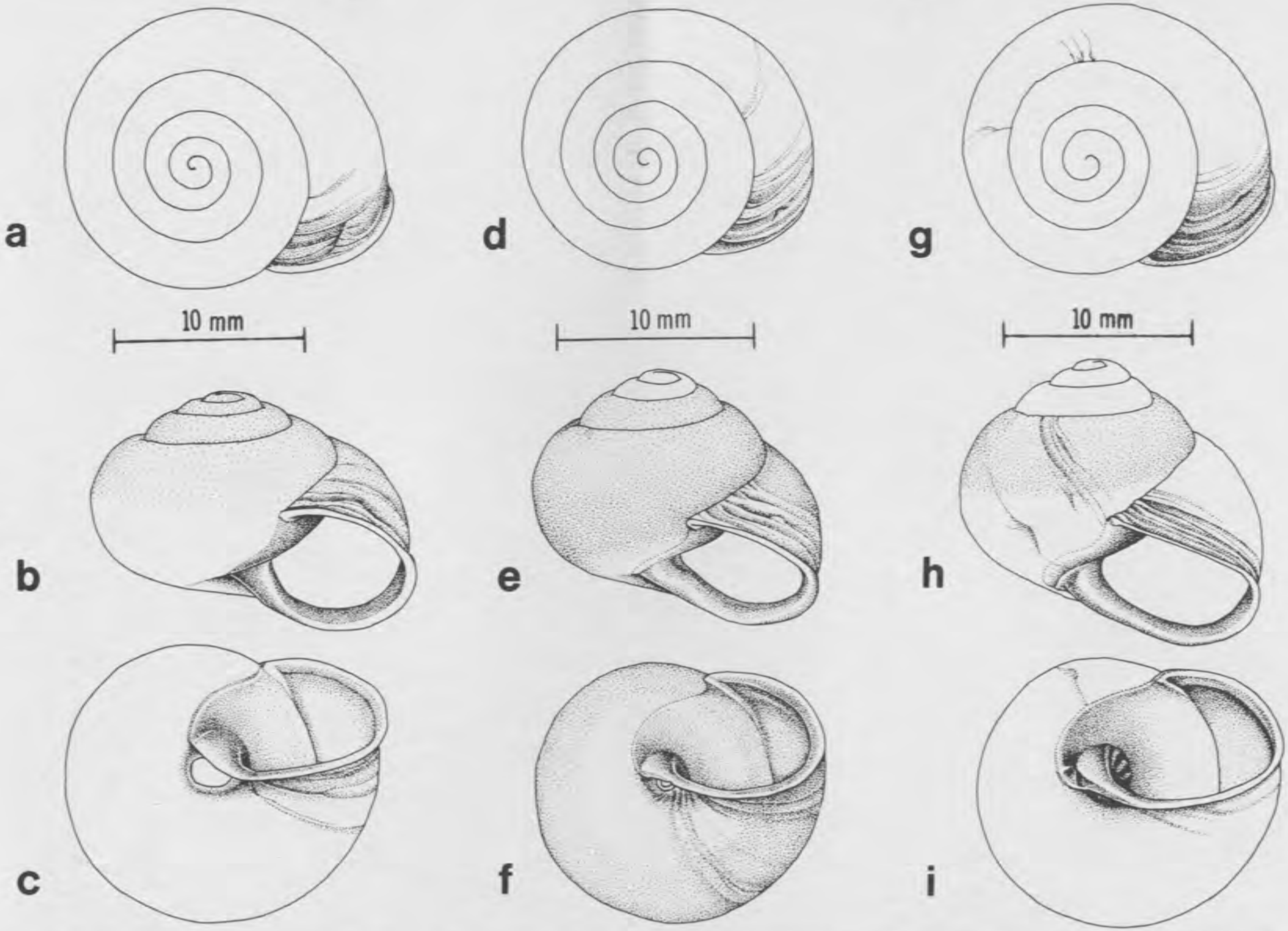


Fig. 288: Shells of *Sinumelon gillensis,* sp. nov., *S. amatensis,* sp. nov., and *S. pumilio* Iredale, 1937: (a-c) *S. gillensis.* Holotype. AM C.135952. WA-445, Reedy Rock Hole, George Gill Range, NT; (d-f) *S. amatensis,* sp. nov. Holotype. SAM D17727. WA-876, rock hole area SSE of Mt. Woodroffe, Musgrave Ranges, SA; (g-i) *S. pumilio* Iredale, 1937. WA-938, Mt. Illbillee, Everard Ranges, SA. FMNH 212415. Scale line equals 10 mm. Drawings by Linnea Lahlum.

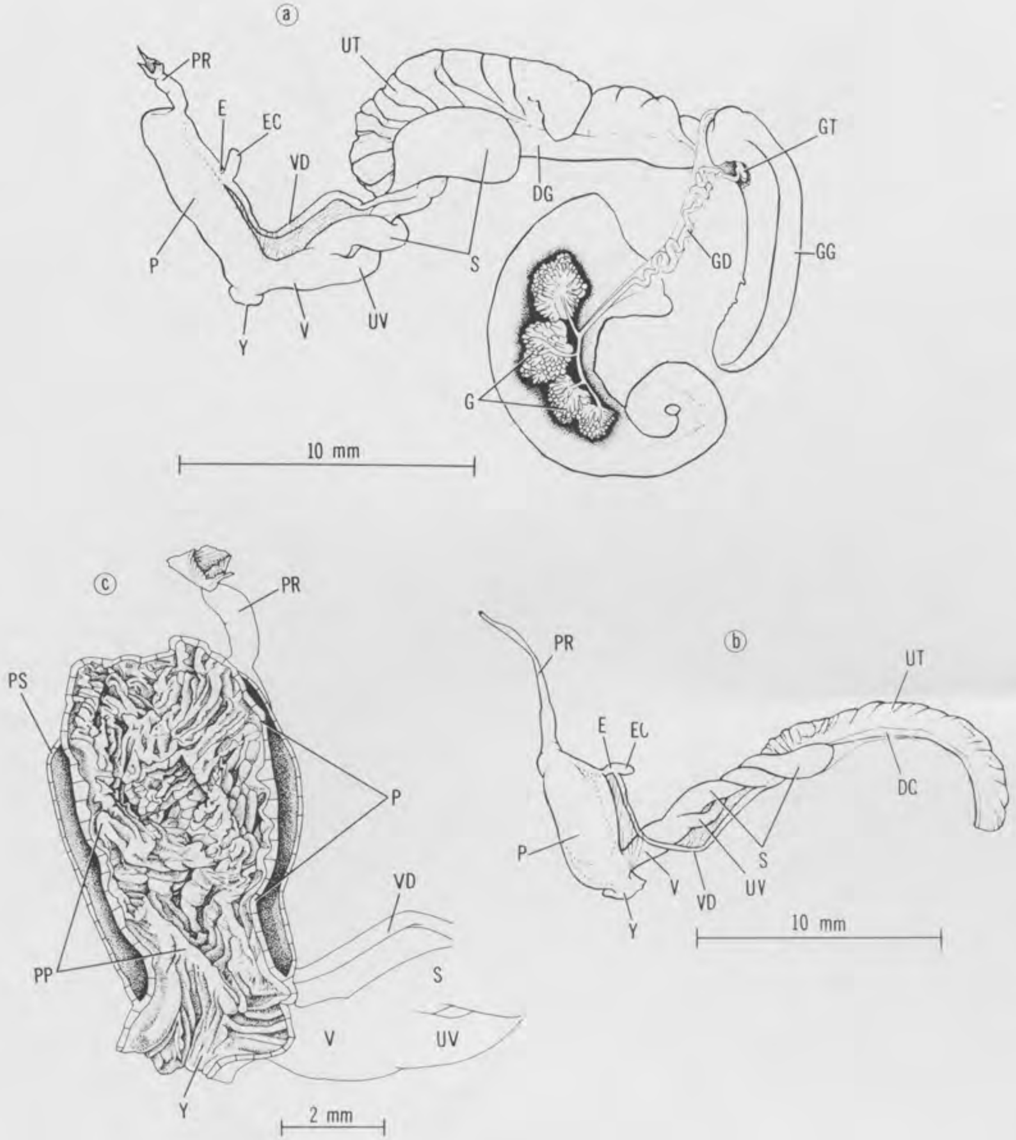


Fig. 289: Genitalia of *Sinumelon gillensis*, sp. nov.: (a) WA-936, 24 road km W of Kings Canyon, Gill Range, NT. 26 May 1983. FMNH 212404, Dissection B. whole genitalia; (b) WA-445, Reedy Rock Hole, George Gill Range, NT. 25 May 1977. FMNH 199688, Dissection A. subapical genitalia; (c) WA-936, 24 road km W of Kings Canyon, George Gill Range, NT. 26 May 1983. FMNH 212404, Dissection B. penis interior. Scale lines as marked. Drawings by Linnea Lahlum.

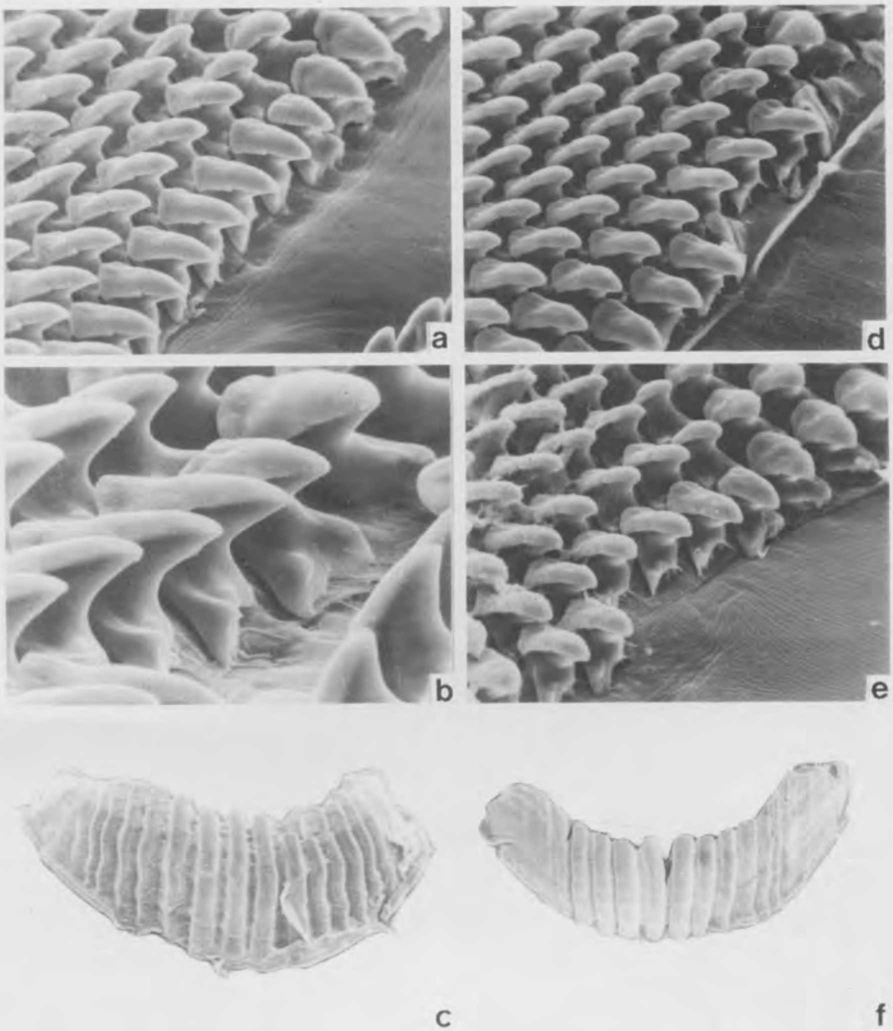


Plate 119: Radular teeth and jaw of *Sinumelon gillensis*: (a-c) WA-445, Reedy Rock Hole, George Gill Range, NT. 25 May 1977. FMNH 199688. a is Dissection B, central and early laterals at 380X, b is Dissection A, detail of central and early laterals at 760X, c is Dissection A, jaw at 53X; (d-f) WA-936, 24 road km W of Kings Canyon, George Gill Range, NT. 26 May 1983. FMNH 212404. d is Dissection A, central and early laterals at 395X, e is Dissection B, central and early laterals at 390X, f is Dissection A, jaw at 38.5X.

The jaw (**Plate 119c, f**) of *S. gillensis* is unusual in the narrow vertical ribbing, which differs from the pattern seen in all other Red Centre *Sinumelon*.

The name *gillensis* is taken from the George Gill Range.

Table 109: Local Variation in *Sinumelon gillensis*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
George Gill Range							
W of Kings Canyon, WA-936 FMNH 212405	19D	12.21±0.138 (10.85-13.15)	16.85±0.836 (15.3-18.6)	0.725±0.005 (0.691-0.787)	$4\frac{5}{8}$- ($4\frac{3}{8}$--$4\frac{7}{8}$-)	2.14±0.065 (1.65-2.85)	7.98±0.209 (6.25-9.80)
Kings Canyon, WA-444 FMNH 199681	8L	11.95±0.289 (10.5-12.7)	16.09±0.324 (14.55-17.25)	0.742±0.009 (0.700-0.783)	$4\frac{1}{2}$+ ($4\frac{1}{4}$ +-$4\frac{7}{8}$—)	1.69±0.123 (1.2-2.25)	9.89±0.844 (7.46-14.5)
Kings Canyon, WA-444 FMNH 199687	10D	12.04±0.297 (10.8-13.8)	15.90±0.366 (14.4-18.2)	0.757±0.006 (0.730-0.804)	$4\frac{5}{8}$+ ($4\frac{3}{8}$+-$4\frac{7}{8}$+)	1.74±0.123 (1.2-2.5)	9.63±0.823 (6.09-15.1)
Reedy Rock Hole, WA-445 FMNH 199688	7L	12.24±0.272 (11.3-13.5)	16.05±0.231 (15.45-17.2)	0.763±0.101 (0.724-0.801)	$4\frac{5}{8}$+ ($4\frac{1}{2}$-$4\frac{3}{4}$+)	1.70±0.093 (1.4-1.95)	9.61±0.500 (7.91-11.6)
Reedy Rock Hole, NMV 48	26L	13.57±0.145 (12.35-15.25)	17.24±0.129 (15.95-18.7)	0.787±0.006 (0.729-0.861)	$4\frac{3}{4}$ ($4\frac{1}{2}$- -5)	1.77±0.047 (1.4-2.3)	9.92±0.278 (7.13-12.5)
Kathleen Spring, WA-446 FMNH 199694	11L	12.99±0.209 (11.45-13.75)	16.58±0.241 (14.7-17.4)	0.784±0.007 (0.741-0.814)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-$4\frac{7}{8}$-)	1.69±0.053 (1.4-1.95)	9.94±0.375 (8.07-11.9)
Kathleen Spring, WA-446 FMNH 199693	10D	12.37±0.190 (11.75-13.45)	16.45±0.271 (15.45-18.25)	0.753±0.009 (0.717-0.801)	$4\frac{3}{4}$- ($4\frac{1}{2}$+-5-)	1.84±0.115 (1.2-2.4)	9.28±0.591 (7.09-12.9)
Stokes Creek, WA-937, FMNH 212406	9D	12.15—0.357 (10.9-14.3)	15.93±0.369 (15.0-18.4)	0.761±0.012 (0.705-0.840)	$4\frac{5}{8}$+ ($4\frac{3}{8}$-5-)	1.66±0.761 (1.3-2.15)	9.76±0.470 (7.53-12.8)
WNW of Areyonga, WA-935, FMNH 212404	10L	12.54±0.258 (11.5-13.55)	17.09±0.215 (16.1-18.3)	0.733±0.009 (0.696-0.771)	$4\frac{5}{8}$ ($4\frac{3}{8}$--5-)	2.18±0.088 (1.6-2.6)	7.97±0.366 (6.33-10.7)

SINUMELON AMATENSIS, SP. NOV.

(Plates 109e-f, 120e-f; Figs 288d-f, 290a-b)

Thersites (Badistes) fodinalis Tate, 1896 (not Tate, 1892), Rep. Horn Sci. Exped. Central Austr., Zool., pp. 199-200 - In part.

Comparative remarks

Sinumelon amatensis, sp. nov., from the central and western Musgrave Ranges, SA (**Map 8**), is characterized by its small size (mean diameter 14.70 mm), narrow umbilicus (**Fig. 288f**, mean D/U ratio 16.5), relatively prominent radial ribbing (**Plate 109e-f**), rather narrowly expanded shell lip (**Figs 288d-f**), which usually has a pink tinge, rather high spire (**Fig. 288e**, mean H/D ratio 0.863), and strong reddish colour suffusion that extends nearly to the umbilicus. The nearly sympatric *S. musgravesi*, sp. nov., found mainly on outliers of the same area in the Musgrave Ranges, normally is much larger (mean diameter 20.92 mm), with an increased whorl count (mean 5+), rougher and more widely spaced shell sculpture (**Plate 108e**), and has an even less expanded white shell lip. *Sinumelon pumilio* Iredale, 1937, from the Everard Ranges, is a little larger (mean diameter 15.86 mm), with a higher spire (**Fig. 288h**, mean H/D ratio 0.915), closed umbilicus (**Fig. 288i**), and a weakly expanded (**Figs 288g-i**), white shell lip. *S. gillensis*, sp. nov., from the George Gill Range, NT, is noticably larger (mean diameter 16.60 mm), with a lower spire (**Fig. 288b**, H/D ratio 0.758), more open umbilicus (**Fig. 288c**, mean D/U ratio 9.35), and moderately expanded shell lip. Anatomically (**Figs 290a-b**), *S. amatensis* is most easily recognized by the tapering upper portion of the penis complex, long spermatheca (S) and free oviduct (UV), and relatively short penis (P) and vagina (V). The internal sculpture of the penis chamber is unspecialized. The sometimes sympatric *S. musgravesi* (**Figs 280a-b**) differs most obviously in the longer vagina (V), enlarged club-like head of the penis (P), and in having the wall sculpture within the penis chamber showing a reduced main pilaster (PP) and more complicated apical ridging. *S. pumilio* (**Figs 291a-c**) has near basal attachment of the epiphallus (E) to the penis sheath (PS), enlarged main pilaster (PP), and much shorter free oviduct (UV) and spermatheca (S). *S. gillensis* (**Figs 289a-c**) has a short vagina (V), cylindrical penis (P), and the main pilaster nearly the same prominence as other wall sculpture.

Holotype

SAM D17727, WA-876, rock hole area SSE of Mt. Woodroffe, E of Amata, Musgrave Ranges, South Australia, Australia. 26° 23' 37" S, 131° 53' 03" E. Collected by the Central Australian Expedition 9 May 1983. Height of holotype 13.35 mm, diameter 14.9 mm, H/D ratio 0.896, whorls 4 3/4-, umbilical width 1.05 mm, D/U ratio 14.2.

Paratopotypes

SAM D17728-9, SAM D17738, WAM 459.87, WAM 467.87, AM C.135960, MV, QM, FMNH 212175-6, FMNH 212187, FMNH 212189, FMNH 212193, 9 LA, 35 DA, 10 LJ, 25 DJ from the type locality.

Paratypes

South Australia

MUSGRAVE RANGES: Mt. Woodroffe (WA-878, main ridge S of, 9.4 km E of Currie River, SAM D17730, WAM 461.87, AM, FMNH 212204, 2 DA, 5 DJ; WA-879, 3.7 km W of Currie River, SAM D17732, FMNH 212212, 2 DA, 3 DJ; WA-880, Amata track, 21 km W of Currie River, SAM D17733, WAM 462.87, MV, QM, AM, FMNH 212218, 10 DA, 9 DJ); Jacky Pass Creek (WA-884, 27.3 km W of, S end ridge from main range, SAM 17734-5, WAM 463.87, WAM 464.87, AM, MV, QM, FMNH 212225-6, 2 LA, 8 DA, 16 LJ, 6 DJ); Mt. Morris foothills (WA-886, rock hole area 2.8 km W of Amata aerodrome, SAM D17737, WAM 466.87, AM, FMNH 212231, 5 DA, 11 DJ); W outlier of main mass (WA-888, under figs just S of track, W of Amata, SAM D17736, WAM 465.87, AM, FMNH 212238, FMNH 215435, 7 DA, 7 LJ, 12 DJ).

Range

Sinumelom amatensis, sp. nov., has been collected along the S side of the main Musgrave Ranges, SA (**Map 8**) between 130° 53' 28" E (W of Amata) and 131° 46' 08" E (9.4 km E of the Currie River), a distance of about 95 km. All records are from the main mass itself, except for WA-886, foothills of Mt. Morris. No collections have been made along the N slopes of the Musgrave Ranges.

Diagnosis

Shell small, adult diameter 13.3-16.8 mm (mean 14.70 mm), whorls 4 3/8- to 5 1/8- (mean 4 5/8). Apex and spire moderately to strongly and evenly elevated (**Fig. 288e**), not rounded above, shell height 10.75-14.8 mm (mean 12.68 mm), H/D ratio 0.755-0.949 (mean 0.863). Body whorl descending slightly to moderately behind aperture. Spire and body whorl (**Plate 109e-f**) with irregularly and rather widely spaced, relatively prominent radial ridges that are somewhat reduced on shell base. Umbilicus (**Fig. 288f**) very narrow, sometimes reduced to a lateral crack, width 0.55-1.45 mm (mean 0.92 mm), D/U ratio 10.7-26.3 (mean 16.5). Lip narrowly expanded, more prominently on columellar margin (**Figs 288d-f**), pinkish in fresh examples. Shell greenish-yellow around umbilicus, reddish green suffusion on spire and much of body whorl. Based on 81 measured adults.

Genitalia (**Figs 290a-c**) with long shafts of spermatheca (S) and free oviduct (UV) wound around each other, head of spermatheca part way up and bound to prostate-uterus. Vagina (V) half length of penis (P), slightly tapering to atrium (Y), internally with fine pilasters. Vas deferens (VD) slender, entering laterally into prominent epiphallic caecum (EC). Epiphallus (E) entering wall of penis sheath above middle, passing out of wall subapically, coiled apically. Penis sheath (PS) relatively thick. Penis (P) tapering apically (**Fig. 290a**), internally (**Fig. 290c**) with high, slender main pilaster (PP) becoming corrugated above, wall sculpture typical and prominent.

Central and early laterals (**Plate 120e**) with prominent anterior flare, high cusp shaft angle, curved cusp tip, prominent basal plate ridge, and small ectocone. Lateromarginal transition typical. Jaw (**Plate 120f**) with ribs reduced laterally.

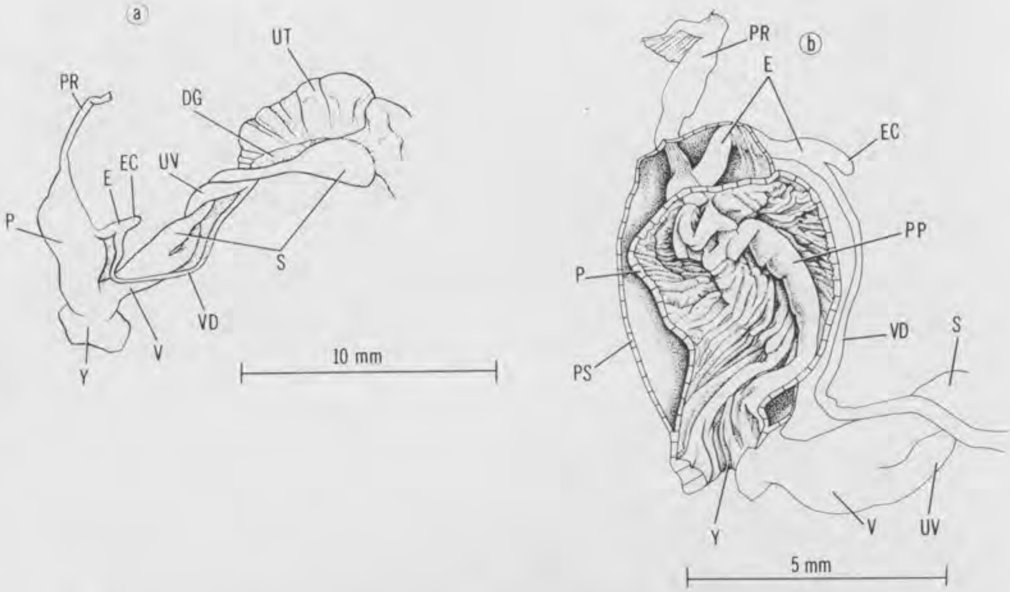


Fig. 290: Genitalia of *Sinumelon amatensis*, sp. nov.: WA-876, rock hole area SSE of Mt. Woodroffe, E of Amata, Musgrave Ranges, SA. 8 May 1983. FMNH 212193. (a) terminal genitalia, Dissection A; (b) penis interior, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

Discussion

Sinumelon amatensis, sp. nov., has been collected from the main mass of the Musgrave Ranges, but not from isolated outliers to the S, which are inhabited by *Sinumelon musgravesi*, sp. nov. Both species have been taken from foothills near Mt. Morris (WA-886), but only *S. musgravesi* was found alive at that station. At the time of initial collecting, sampling was deliberately directed at either well vegetated main mass areas or small outlying hills with fig trees providing shelter sites. The Mt. Morris collection was made from a scruffy patch of plants and rocks which other members of the Central Australia Expedition were investigating a nearby pond for freshwater molluscs. The two species may have a number of microsympatric records in such "second class" habitats.

Size variation (**Table 110**) is minor. There may be some geographic variation, with the westernmost populations (WA-884, WA-888) slightly larger. The Mt. Morris foothills population (WA-886), which is between the above localities and involves microsympatry with the larger *S. musgravesi*, has the *amatensis* shells smaller and less elevated. This may indicate some interactions with *S. musgravesi*, but the specimen numbers involved are too small for firm conclusions to be drawn at this time.

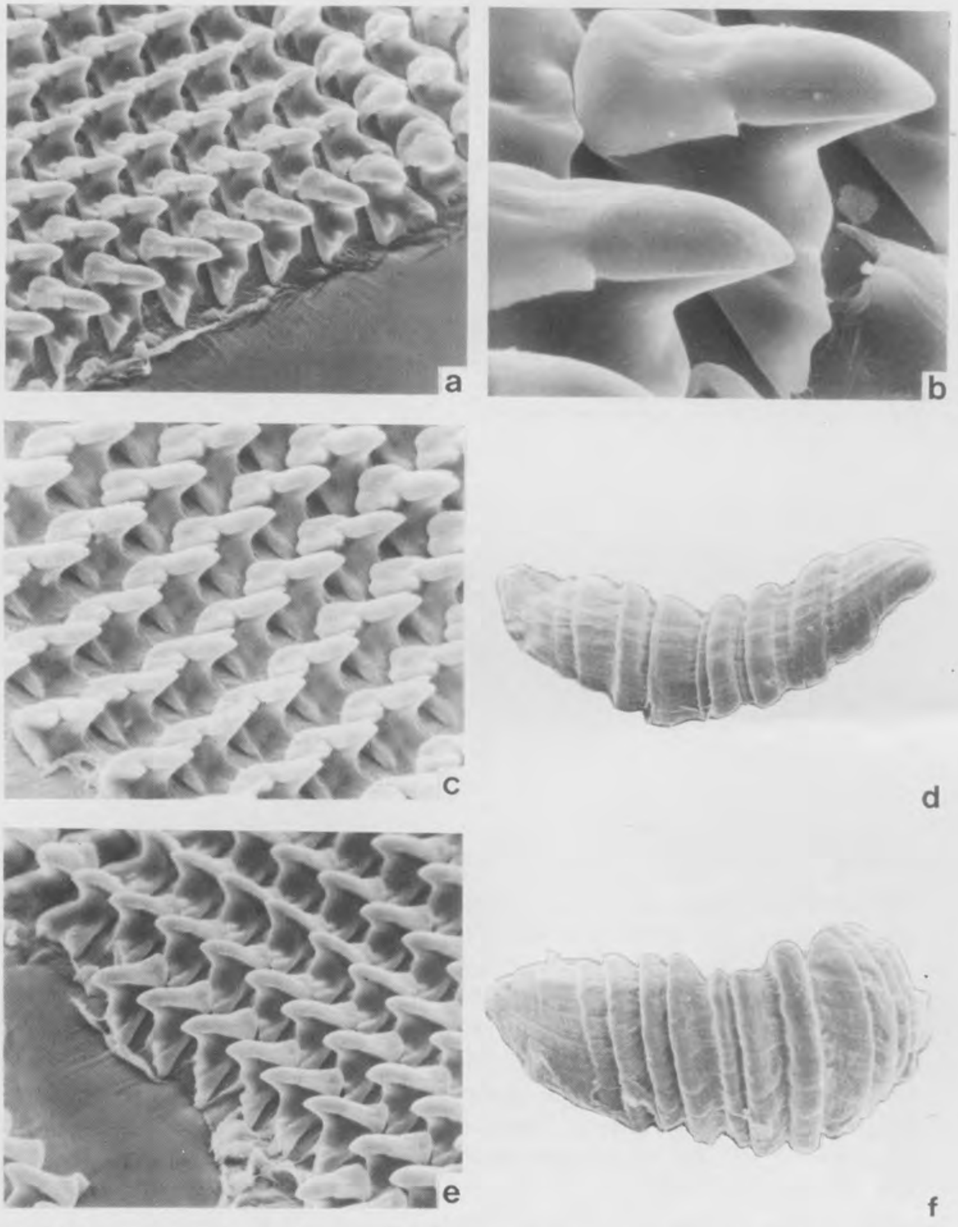


Plate 120: Radular teeth and jaw of *Sinumelon pumilio* Iredale, 1937 and *S. amatensis*: (a-d) *S. pumilio*. WA-850, Mt. Illbillee, Everard Ranges, SA. 4 May 1983. FMNH 212081. a is Dissection A, central and early lateral teeth at 360X, b is Dissection C, second lateral tooth at 1,500X, c is Dissection C, lateromarginal transition at 530X, d is Dissection B, jaw at 39.5X; (e-f) *S. amatensis*. WA-876, SSE of Mt. Woodroffe, Musgrave Ranges, SA. 9 May 1983. FMNH 212193, Dissection B. e is central and early laterals at 375X, f is jaw at 65X.

Table 110: Local Variation in *Sinumelon amatensis*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Musgrave Ranges							
WA-876, FMNH 212193	8L	12.26±0.068 (12.0-12.6)	14.29±0.126 (13.9-14.95)	0.859±0.010 (0.815-0.903)	$4^{5}/_{8}$- ($4^{3}/_{8}$+-$4^{7}/_{8}$+)	0.93±0.054 (0.75-1.25)	15.7±0.901 (11.1-19.9)
WA-876, FMNH 212189	18D	12.68±0.127 (11.85-13.7)	14.54±0.137 (13.3-15.6)	0.873±0.009 (0.805-0.949)	$4^{5}/_{8}$+ ($4^{1}/_{2}$--$5^{1}/_{8}$-)	0.96±0.032 (0.75-1.25)	15.4±1.930 (12.0-18.3)
WA-876, FMNH 212176	18D	12.57±0.116 (11.8-13.65)	14.23±0.131 (13.3-15.3)	0.883±0.007 (0.825-0.920)	$4^{3}/_{4}$- ($4^{1}/_{2}$--5)	0.95±0.037 (0.7-1.25)	15.5±0.668 (10.7-21.0)
WA-880, FMNH 212218	10D	12.40±0.144 (11.45-13.0)	14.36±0.177 (13.65-15.45)	0.864±0.011 (0.822-0.925)	$4^{5}/_{8}$- ($4^{3}/_{8}$--$4^{7}/_{8}$+)	0.85±0.051 (0.65-1.1)	17.3±0.893 (13.8-21.0)
WA-884, FMNH 212225	8D	13.61±0.273 (12.5-14.8)	15.87±0.653 (14.75-16.7)	0.858±0.008 (0.831-0.902)	$4^{3}/_{4}$- ($4^{1}/_{2}$+-$5^{1}/_{8}$-)	0.83±0.075 (0.55-1.2)	20.0±1.600 (13.9-26)
WA-886, FMNH 212231	5D	11.47±0.209 (10.75-11.9)	14.62±0.138 (14.1-14.95)	0.785±0.012 (0.755-0.815)	$4^{1}/_{2}$+ ($4^{3}/_{8}$-$4^{3}/_{4}$-)	0.96±0.062 (0.8-1.1)	15.5±1.080 (13.4-18.7)
WA-888, FMNH 212238	7D	13.86±0.203 (13.35-14.55)	16.10±0.231 (15.25-16.8)	0.861±0.009 (0.818-0.890)	$4^{3}/_{8}$+ ($4^{3}/_{8}$--$4^{1}/_{2}$+)	0.95±0.088 (0.7-1.45)	17.7±1.368 (11.5-23.0)

The difference in penis shape - tapering apex in *S. amatensis* (**Fig. 290a**) and club-shaped apex in *S. musgravesi* (**Fig. 280a**) - is consistent through all populations for which live adults were available. It reflects major differences in size of the apical penis wall sculpture, and would serve as a species recognition mechanism.

The name *amatensis* honours the Amata community.

SINUMELON PUMILIO IREDALE, 1937
(**Plates 110f, 120a-d; Figs 288g-i, 291a-c**)

Helix (Galaxias) perinflata Bednall, 1892 (not Pfeiffer, 1864), Trans. Roy. Soc. South Austr., **16** (1): 62-63 (partly) - Mt. Illbillee Soakage, Everard Range, SA, under fig-trees, at an elevation of 2,000 feet.

Sinumelon pumilio Iredale, 1937, South Austr. Nat., **18** (2): 45-46, pl. II, fig. 11 - Mount Illbillee Soakage, Everard Range, SA; Iredale, 1938, Austr. Zool., **9** (2): 105.

Sinumelon pumilis (*sic*), Richardson, 1985, Tryonia, **12**: 278 - misspelling in check list.

Comparative remarks

Sinumelon pumilio Iredale, 1937, from Mount Illbillee, Everard Ranges, SA (**Map 8**), is characterized by its small size (mean diameter 15.86 mm), very high spire (**Fig. 288h**, mean H/D ratio 0.915), low whorl count (mean 4 3/8-), reduction of the umbilicus to a lateral crack (**Fig. 288i**), and presence of fairly prominent radial ridging (**Plate 110f**) that usually continues below the periphery with little diminution. The greenish brown colouration with little spire suffusion, and sometimes change in colour intensity on different parts of the body whorl are unusual, while the thin, little expanded, and white lip contrast with some of the other smaller species. The Musgrave Range *S. amatensis* is smaller (mean diameter 14.70 mm), with a slightly lower spire (**Fig. 288e**, mean H/D ratio 0.863), increased whorl count (mean 4 5/8), and narrow umbilicus (**Fig. 288f**, mean D/U ratio 16.5). Its shell sculpture (**Plate 109e-f**) is weaker and tends to be more reduced below the periphery, the shell colour is a darker reddish brown that extends well below the periphery to a yellow zone around the umbilicus, and the lip is slightly broader and in live collected or fresh examples shows a faint pink tone. *S. gillensis* from the George Gill Range, NT has the umbilicus much more widely open (**Fig. 288c**) and a lower spire (**Fig. 288b**, mean H/D ratio 0.758), plus a broadly expanded shell lip (**Figs 288a-c**). *S. dulcensis*, from the MacDonnell to Dulcie Ranges, is almost identical in diameter and whorl count (**Table 102**), but has a lower spire and much wider umbilicus (**Figs 285a-f**), equivalent sculpture, and a much wider lip. The somewhat larger *S. expositum* Iredale, 1937, from the MacDonnell to Krichauff Ranges, mean diameter 19.24 mm, has an open umbilicus and broadly expanded lip (**Figs 281, 282**), plus reduced shell sculpture. Anatomically (**Figs 291a-c**), *S. pumilio* is immediately recognizable by it long, cylindrical penis, having the epiphallus enter the penis sheath (PS) just above the peni-oviducal angle then coiled near the penis sheath apex before receiving insertion of the penial retractor muscle and then reflexing to enter the penis (P). Internally (**Fig. 291c**), the penis chamber has typical wall sculpture. The Musgrave Range *S. amatensis* differs in its much shorter penis (**Fig. 290a-b**) with tapering upper section and reduced internal wall sculpture, plus the epiphallic caecum being situated near the middle of the penis, rather than near the base.

Holotype

SAM D14177, Mt. Illbillee soakage, under figs at 2,000 feet elevation, Everard Ranges, South Australia. Collected during the Elder Exploring Expedition. Height of shell 15.15 mm, diameter 15.45 mm, H/D ratio 0.981, whorls 4 1/2+, umbilicus a very narrow lateral crack.

Paratopotype

AM C.60500, 1 DA from the type locality.

Studied material

South Australia

EVERARD RANGES: base of creek, E end Mt. Illbillee (WA-857a, SAM D17739, WAM 468.87, AM, FMNH 212108-9, 3 LA, 2 DA, 2 LJ, 1 DJ; 2 km E of Victory Well, ca 2 km up crook on Mt. Illbillie (WA-861, FMNH 212114, 1 DJ); valley mouth N of Victory Well, Mt. Illbillee (WA-850, 7 LA, 5 DA, 29 LJ, 19 DJ, SAM D17740-2, WAM 468.87, WAM 470.87, WAM 471.87, AM, FMNH 212081, FMNH 212085-6); creek bed 3.7 km W of Victory Well, Mt. Illbillee (WA-862, 1 LJ, 1 DJ, FMNH 212121-2); small outlier S of Mt. Illbillee (WA-940, 1 DJ, FMNH 212420); SW outlier of Mt. Illbillee (WA-938, 12 LA, 8 DA, 35 LJ, 20 DJ, SAM D17743-4, WAM 472.87, WAM 473.87, FMNH 212415-6); granite outcrop N of track (BJS-12, MV, 1 LA).

Range

Sinumelon pumilio Iredale, 1937 has been found only on the mass of Mt. Illbillee and its immediate outliers, Everard Ranges, SA (**Map 8**). The known linear range is about 10.5 km.

Diagnosis

Shell very small, adult diameter 14.2-17.45 mm (mean 15.86 mm), whorls 3 3/4+ to 4 5/8- (mean 4 3/8-). Apex and spire strongly elevated (**Fig. 288h**), sometimes slightly rounded above, shell height 12.8-15.9 mm (mean 14.53 mm), H/D ratio 0.845-0.981 (mean 0.915). Body whorl descending moderately behind aperture (**Figs 288g-i**). Spire (**Plate 110f**) and body whorl with weak and irregular radial ribs that continue onto base of shell with little reduction in prominence. Umbilicus (**Fig. 288i**) a very narrow lateral crack. Lip only slightly expanded, white. Shell greenish-yellow, sometimes slight reddish tone above periphery, base sometimes lighter in tone. Based on 52 measured adults.

Genitalia (**Figs 291a-c**) typical apically, shaft of spermatheca (S) and free oviduct (UV) wrapped around each other, expanded head of spermatheca bound to base of prostate-uterus. Vagina (V) more than half length of penis, relatively thick. Vas deferens (VD) slender, entering epiphallic caecum (EC) just above peni-oviducal

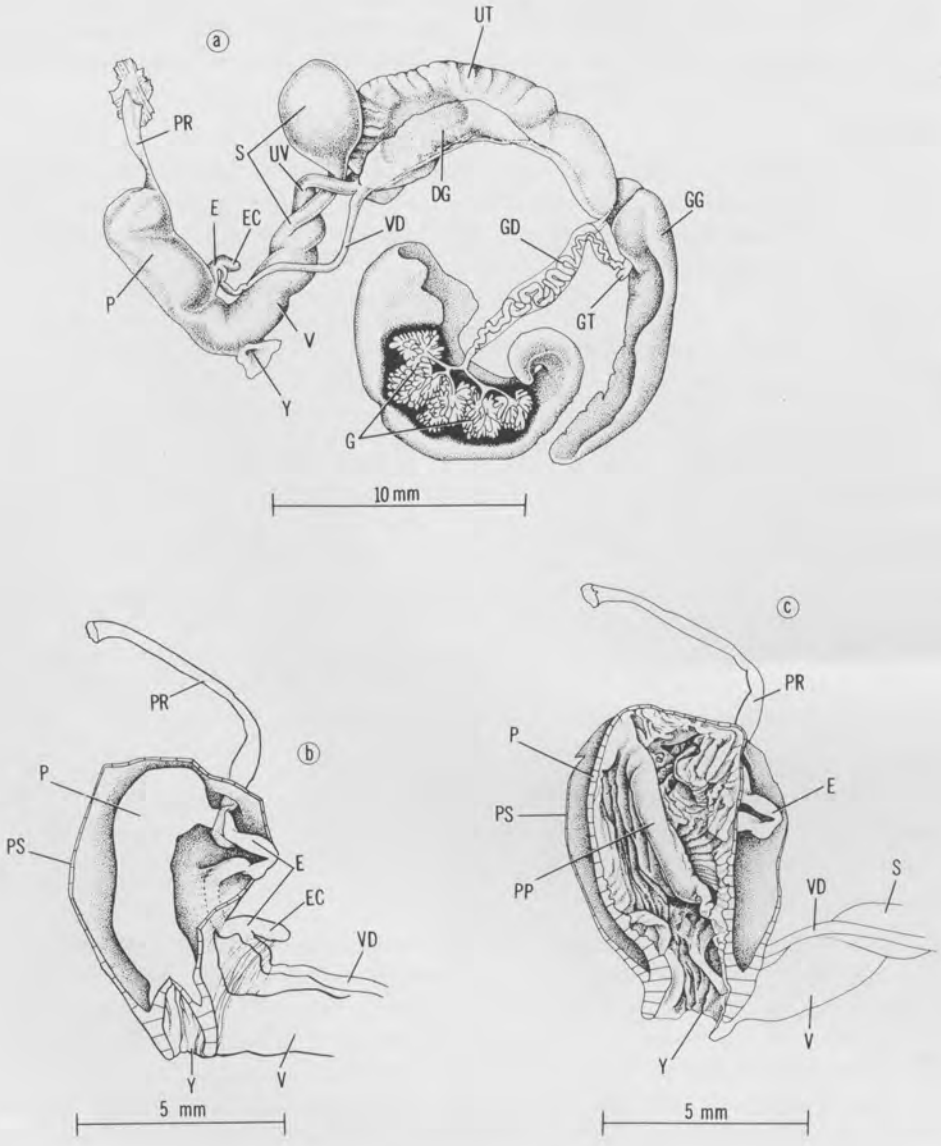


Fig. 291: Genitalia of *Sinumelon pumilio* Iredale, 1937: WA-938, Mt. Illbillee, Everard Ranges, SA. 29 May 1983. FMNH 212416. (a) whole genitalia, Dissection B; (b) penis sheath opened, Dissection A; (c) interior of penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

angle. Epiphallus (E) attached to wall of penis sheath just above peni-oviducal angle, entering sheath medially and coiled apically (**Fig. 291b**) inside thick-walled penis sheath (PS). Penis (P), long, cylindrical, large in diameter, not tapering. Interior of penis (**Fig. 291c**) with prominent, simple main pilaster (PP), cluster of corrugated pilasters around epiphallic pore (EP), and moderate zone of accessory ridges.

Central and lateral radular teeth (**Plate 120a-b**) with average anterior flare, high cusp shaft angle, strong basal support ridge, and weak ectocone. Lateromarginal transition (**Plate 120c**) typical. Jaw (**Plate 120d**) with variable central ribbing, reduced to absent on sides.

Discussion

Sinumelon pumilio Iredale, 1937 is known from only a few adult specimens. Their size range (**Table 111**) is relatively small. Dead adults were slightly larger than live adults.

Because of its simple, high spired shell, confusion with other species can be expected. The large, cylindrical penis with near basal attachment of the epiphallus into the penis sheath readily separates *S. pumilio* from the other Red Centre Sinumeloninae.

Table 111: Local Variation in *Sinumelon pumilio* (Iredale, 1939)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
Mt Illbillee					
WA-850, FMNH 212081	13L	13.86±0.183 (13.15-15.7)	15.38±0.181 (14.2-16.9)	0.901±0.009 (0.845-0.963)	$4^1/_4$ ($3^1/_8$–$4^1/_2$-)
WA-850, FMNH 212085	7L	14.64±0.412 (12.8-15.8)	15.99±0.296 (14.6-16.75)	0.915±0.013 (0.877-0.950)	$4^3/_8$ ($4^1/_4$+-$4^1/_2$+)
WA-850, FMNH 212086	5D	14.75±0.172 (14.15-15.25)	16.12±0.263 (15.25-16.9)	0.915±0.004 (0.901-0.929)	$4^3/_8$ ($4^1/_4$+-$4^1/_2$-)
WA-938, FMNH 212416	12L	14.73±0.151 (13.85-15.35)	16.06±0.153 (15.4-16.95)	0.918±0.008 (0.881-0.964)	$4^3/_8$+ ($4^1/_4$–-$4^1/_2$+)
WA-938, FMNH 212415	8D	15.07±0.169 (14.55-15.90)	16.29±0.197 (15.75-17.45)	0.925±0.008 (0.892-0.969)	$4^3/_8$+ ($4^1/_4$+-$4^5/_8$-)

GENUS *BASEDOWENA* IREDALE, 1937

Baccalena Iredale, 1937, South Austr. Nat., **18** (2): 50 - type species *Hadra squamulosa* Tate, 1894, a subgenus of *Pleuroxia*; Iredale, 1938, Austr. Zool., **9** (2): 107 - raised to generic level in a check list.

Fatulabia Iredale, 1937, South Austr. Nat., **18** (2): 51 - type species *Helix (Hadra) elderi* Bednall, 1892, a subgenus of *Pleuroxia*; Iredale, 1938, Austr. Zool., **9** (2): 107-108 - raised to generic level in a check list; Richardson, 1985, Tryonia, **12**: 127-128 - check list citation.

Basedowena Iredale, 1937, South Austr. Nat., **18** (2): 51-52 - type species *Basedowena cottoni* Iredale, 1937; Iredale, 1938, Austr. Zool., **9** (2): 105-106 - check list citation; Richardson, 1985, Tryonia, **12**: 61 - check list citation.

Bacculena (*sic*) Richardson, 1985, Tryonia, **12**: 55-56 - spelling error in check list citation.

Shell medium to large in size (**Table 112**), adult diameters 12.65-26.75 mm, whorl count 4+ to 5 1/2+. Spire moderately (*squamulosa, cognata, katjawarana, elderi*) to very strongly (*olgana, cottoni, gigantea, vulgata, papulankutjana*) and evenly elevated, H/D ratio 0.588-1.080. Apical sculpture (**Plates 121-123, 124a-d**) of dense pustules, often becoming elongated, reduced in *papulankutjana*. Spire and body whorl normally with dense pustules, varying from simple (*cottoni, gigantea, vulgata*) to curved (*squamulosa, olgana*), greatly reduced on lower spire and body whorl in *papulantkutjana* and *elderi*. Supplementary radial ridgelets present in many species, never reaching prominence of ribs. Body whorl rounded, never angulated, descending moderately to sharply just behind aperture. Umbilicus variable, open in *squamulosa* and *katjawarana*, narrow in *cognata*, varying from narrow to closed in *elderi*, a narrow crack in *olgana, gigantea*, and *vulgata*, closed in both *cottoni* and *papulankutjana*. Palatal and basal lips very narrow in *squamulosa*, well expanded in other species, columellar lip usually more expanded and/or partly rolled over umbilical crack. Parietal wall with variable callus, most prominent in *katjawarana* and *papulankutjana*. Shell colour various shades of brownish-yellow, continuing well onto shell base, with a lighter zone near umbilicus. Lip white, except for brown in the columellar area of *papulankutjana*, which also has darkest coloured shell. Two narrow red spiral colour bands present in *elderi*.

Live specimens aestivate sealed to rocks or (rarely) other shells in all species observed, pattern in *elderi* unknown.

Genitalia (**Figs 293-294, 296-297, 299-300, 302-303**) with head of spermatheca (S) expanded, lying against and loosely bound to prostate-uterus, position varying from basal (*katjawarana*) to medial (*cognata*). Shaft of spermatheca variable in diameter and length. Vagina (V) short to long, usually expanded basally, internally with fine (*cognata*) to very large (*papulankutjana*) longitudinal pilasters. Free oviduct (UV) usually partly wound around shaft of spermatheca, degree of coiling variable. Epiphallus (E) short to medium in length, entering penis sheath (PS) and partly circling columellar retractor muscle (PR) before entering penis (P). Epiphallic

Table 112: Range of Variation in *Basedowena*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
BASEDOWENA							
squamulosa (Tate, 1894)	102	9.65 (8.2-11.4)	14.81 (12.65-17.55)	0.652 (0.588-0.717)	$4^{5}/_{8}$ ($4^{1}/_{4}$+-5)	1.97 (1.45-2.45)	7.60 (5.92-10.0)
cognata	30	12.96 (11.25-14.65)	16.09 (14.0-18.1)	0.806 (0.753-0.873)	$4^{5}/_{8}$+ ($4^{3}/_{8}$+-5-)	1.08 (0.7-1.45)	15.3 (10.8-21.0)
olgana	34	15.95 (13.15-17.4)	17.52 (15.55-18.7)	0.910 (0.844-0.982)	$4^{7}/_{8}$ ($4^{5}/_{8}$--$5^{1}/_{4}$+)	crack	
cottoni (Iredale, 1937)	116	17.45 (13.5-20.65)	18.82 (15.35-21.5)	0.927 (0.835-1.010)	5+ ($4^{1}/_{2}$+-$5^{1}/_{2}$)	crack	
gigantea	137	20.19 (16.05-26.55)	21.64 (17.7-26.75)	0.932 (0.804-1.080)	$5^{1}/_{8}$ ($4^{1}/_{8}$+-$5^{1}/_{2}$+)	crack	
katjawarana	39	13.24 (11.9-14.5)	16.21 (14.9-17.5)	0.817 (0.755-0.884)	$4^{7}/_{8}$+ ($4^{3}/_{8}$+-$5^{1}/_{4}$-)	1.75 (1.2-2.4)	9.44 (6.86-13.3)
vulgata	388	17.81 (13.9-21.0)	19.08 (15.9-22.5)	0.934 (0.798-1.050)	5 (4+-$5^{3}/_{8}$+)	crack	
papulankutjanma	138	12.62 (10.4-16.2)	15.39 (13.85-17.7)	0.831 (0.734-0.970)	$4^{7}/_{8}$- ($4^{1}/_{2}$-$5^{1}/_{4}$-)	closed	
elderi (Bednall, 1892)	33	12.86 (11.7-14.7)	16.63 (15.85-17.65)	0.774 0.701-0.919)	$4^{7}/_{8}$ ($4^{3}/_{8}$-$5^{1}/_{4}$)	narrow to closed	

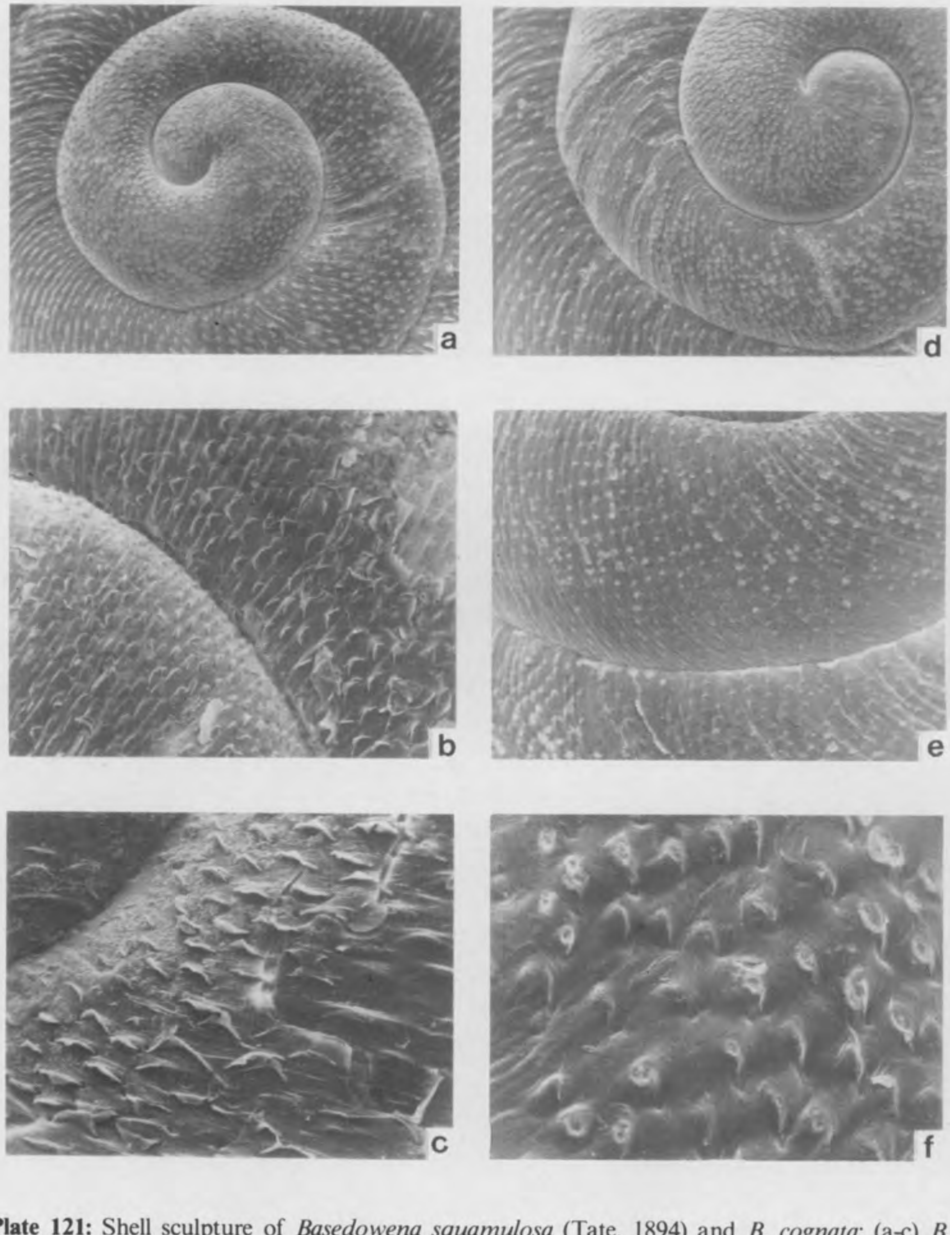


Plate 121: Shell sculpture of *Basedowena squamulosa* (Tate, 1894) and *B. cognata*: (a-c) *B. squamulosa*. WA-130, Cycad Gorge, Palm Valley, Krichauff Ranges, NT. FMNH 182523, Dissection B. a is apex and early spire at 19.2X, b is detail of late spire and body whorl at 18.6X, c is detail of periostracal sculpture at 46.5X; (d-f) *B. cognata*. WA-919, Schwerin Mural Crescent, W of Docker River, WA. FMNH 212325. d is apex and early spire at 20.7X, e is late spire and body whorl at 19X, f is detail of relatively unworn spot on body whorl at 80X.

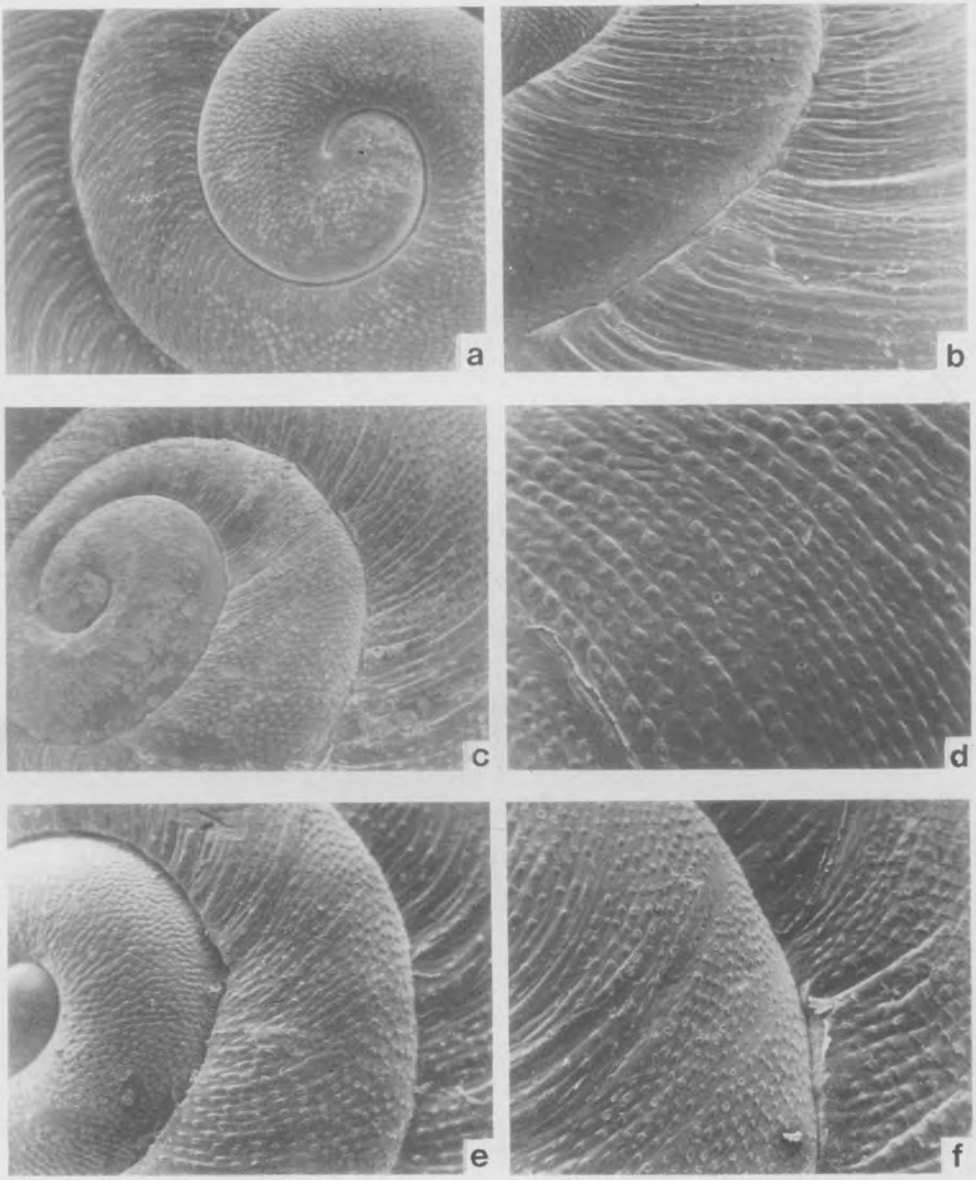


Plate 122: Shell sculpture in *Basedowena cognata, B. olgana*, and *B. cottoni* Iredale, 1937: (a-b) *B. cognata.* WA-922, Lassiter's Cave, Petermann Ranges, NT. FMNH 212330. a is apex and early spire at 21X, b is late spire and body whorl at 16.7X; (c-d) *B. olgana.* WA-452, Valley of the Winds, Mt. Olga, NT. FMNH 199674, Dissection A. c is apex and spire at 15.9X, d is sculpture on body whorl at 17X; (e-f) *B. cottoni.* WA-892, behind Angatja Homestead, Mann Ranges, SA. FMNH 212248, Dissection B. e is apex and spire at 23.9X, f is lower spire and body whorl at 22.1X.

caecum (EC) small to proportionately large, receiving vas deferens (VD) laterally. Penial retractor muscle short to long, arising on diaphragm, inserting onto penis head. Penis sheath (PS) very thin. Penis (P) varying from globose (*olgana*, *cottoni*) to elongated (*gigantea*, *katjawarana*), internally with a variously modified, U-shaped main pilaster, and an unusual foliated pilaster that surrounds the epiphallic pore (EP). Rarely accessory ridges developed on wall of penis chamber.

Jaw (**Plates 127f, 128c, e, 130c, f, 131f, 132d**) with prominent vertical ribs that usually are absent from the lateral margins, rib numbers and width reduced and widened in *vulgata* and *gigantea*, more numerous and narrower in *cognata*. Central and lateral teeth of radula variable among species: very high shaft angle with strongly curved and bluntly rounded tips in *squamulosa*, less so in *papulankutjana* and *cognata*, partly in *cottoni*, very little tip curvature in *vulgata* and *gigantea*. Lateromarginal transition usually abrupt.

Type species: *Basedowena cottoni* Iredale, 1937 by original designation.

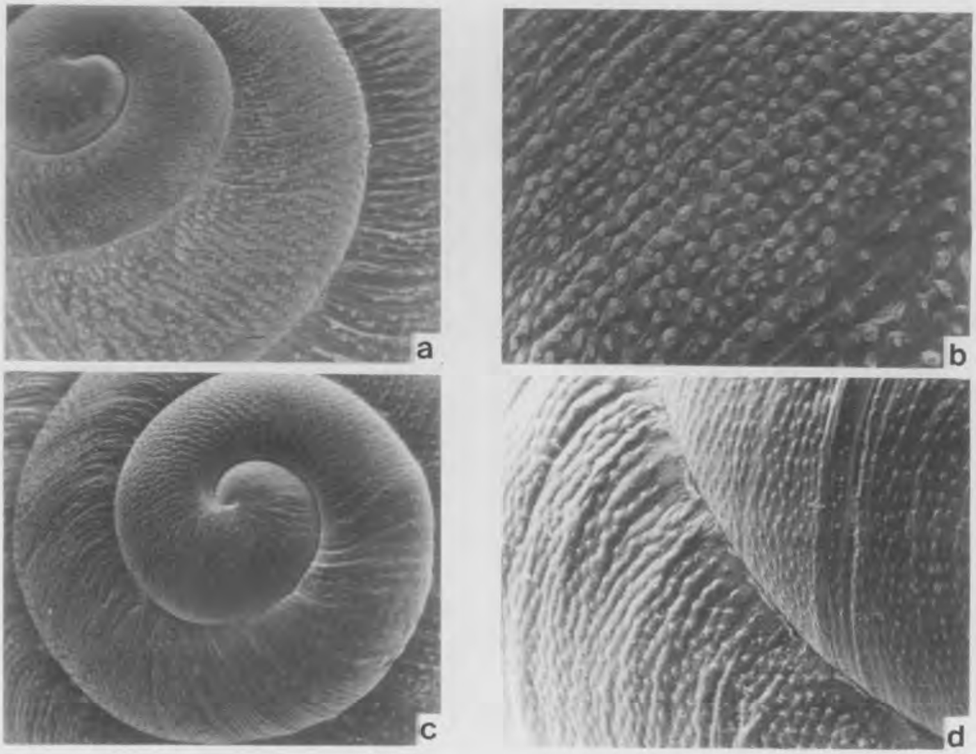


Plate 123: Shell sculpture of *Basedowena gigantea* and *B. vulgata*: (a-b) *B. gigantea*. WA-898, Katjawara Soak, SW end of Mann Ranges, SA. FMNH 212264, Dissection A. a is apex and early spire at 15.7X, b is area on body whorl at 15.8X; (c-d) *B. vulgata*. WA-902, 14 km S of Lake Wilson, Mann Ranges, SA. FMNH 212278. c is apex and early spire at 17.3X, d is lower spire at 21.1X.

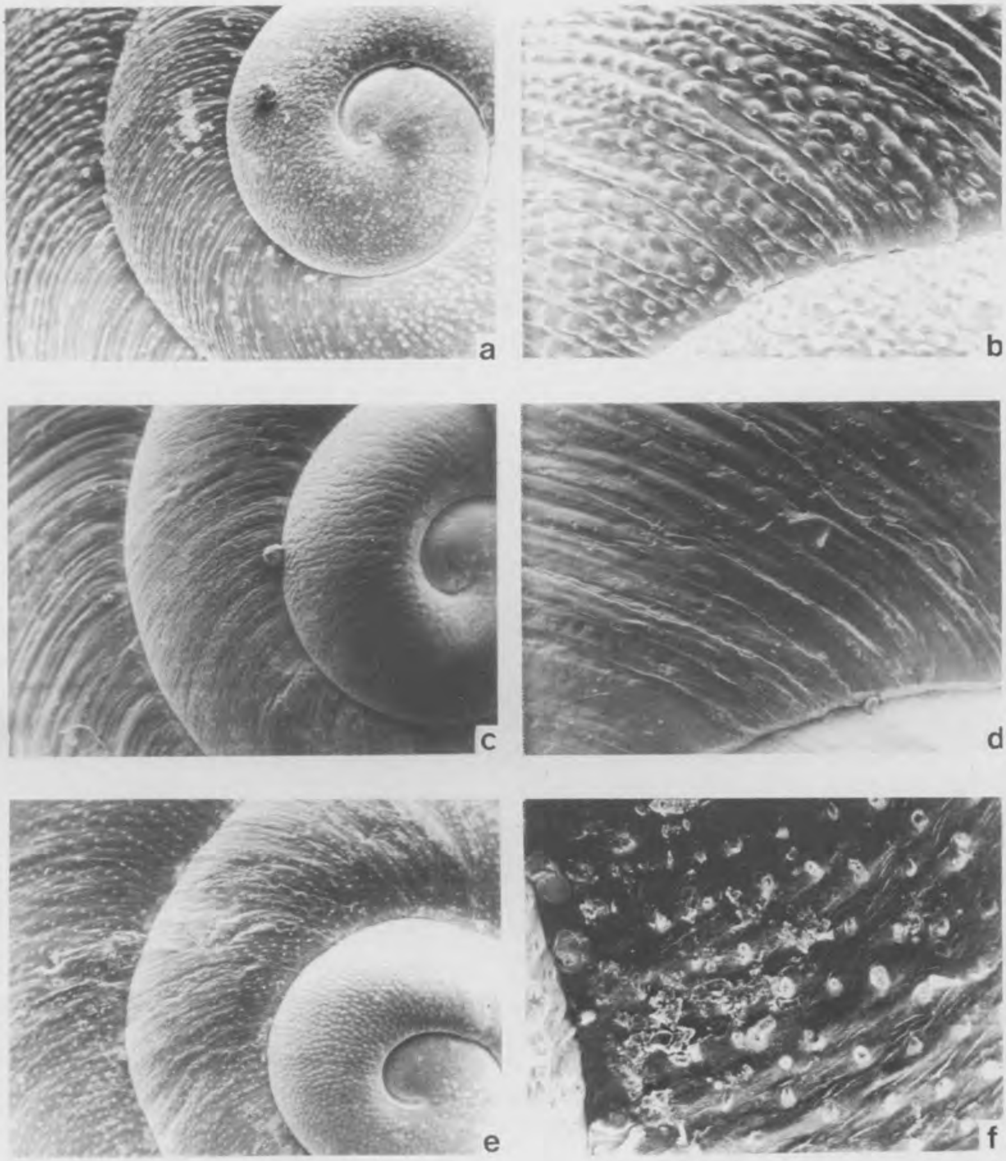


Plate 124: Shell sculpture of *Basedowena katjawarana*, *B. papulankutjana*, and *Minimelon colmani*: (a-b) *B. katjawarana.* WA-898, Katjawara Soak, SW end of Mann Ranges, SA. FMNH 212262. a is apex and early spire at 18.9X, b is late spire and body whorl at 19.3X; (c-d) *B. papulankutjana.* WA-911, Blackstone Range, WA. FMNH 212317. c is apex and spire at 19.9X, d is late spire and body whorl at 18.9X; (e-f) *M. colmani.* WA-916, NE tip Barrow Range, E of Warburton, WA. FMNH 212317. e is apex and spire at 72X, f is body whorl detail at 16.8X.

Nomenclatural matters

Both *Baccalena* Iredale, 1937 and *Fatulabia* Iredale, 1937 have page or line priority, respectively, over *Basedowena* Iredale, 1937. However, as first revisor, I have chosen to utilize the latter name for this genus. *Basedowena* was by far the best described of the three names, *B. cottoni* Iredale, 1937 is a much more typical species in shell and anatomical structures, whereas *B. squamulosa* (Tate, 1894), the type of *Baccalena*, is perhaps the most specialized, and *B. elderi* (Bednall, 1892), the type of *Fatulabia*, which has somewhat unusual shell features, has not yet been dissected. If either of the latter two species are found to differ sufficiently for renewed generic separation, then the generic names based upon them can be revived, leaving the bulk of species within *Basedowena*. It thus will contribute to eventual nomenclatural stability by having *Basedowena* cover the entire complex.

Comparative remarks

The very high spire, general presence of dense pustules on at least the early spire, if not extending down to the body whorl, simple lip expansion, presence of at most a weak parietal callus and not a free parietal lip, absence of major radial ribs, and generally monochrome colouration (except *B. elderi* [Bednall, 1892]) are the main shell features of *Basedowena*. Anatomically, the development of a large foliated pilaster around the epiphallic pore, retention of a U-shaped main pilaster, pattern of the epiphallus partly circling the penial retractor muscle before entering the penis, and very thin penis sheath are the key characters of *Basedowena*. The aestivation pattern of species sealing to rocks (except *B. squamulosa* [Tate, 1894]) is shared with *Granulomelon* Iredale, 1933 and *Tatemelon*, gen. nov., whereas the Red Centre *Pleuroxia* Ancey, 1887, *Sinumelon* Iredale, 1930, and *Minimelon*, gen. nov., are free sealers.

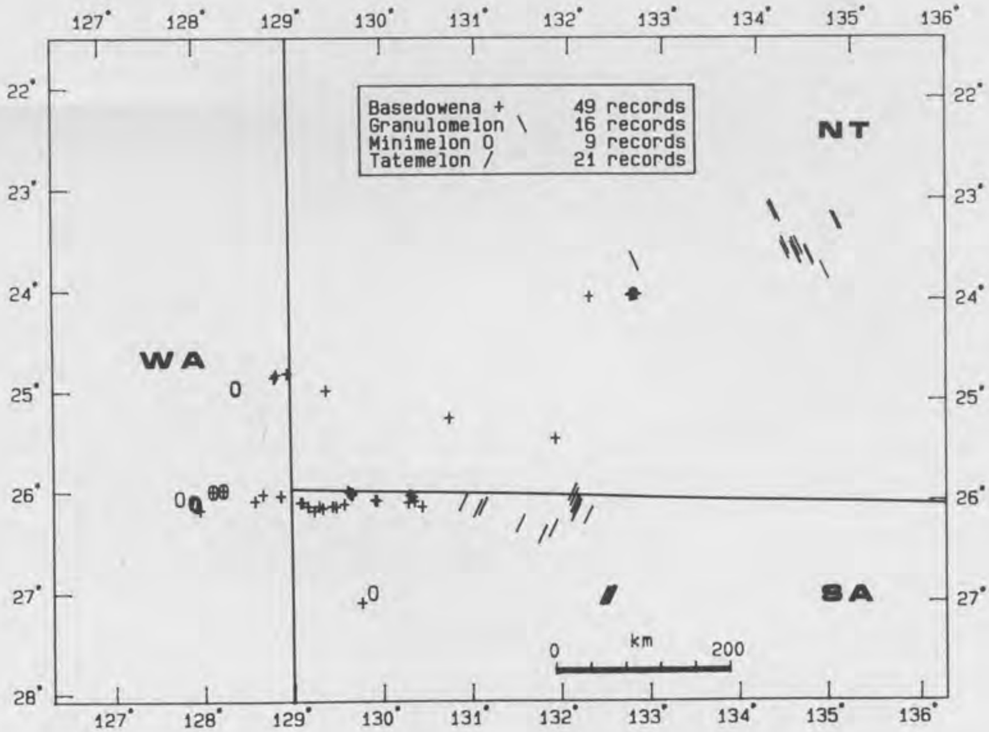
Previous studies

Bednall (1892: 65-66) described *Basedowena elderi* from the Birksgate Range; Tate (1894: 193; 1896: 193-194) described and illustrated the shell of *B. squamulosa* from Palm Valley, Krichauff Ranges; and Hedley (1896: 225) gave a note on penis structure in *B. squamulosa*. Riddle (1915) used the name *squamulosa* for specimens from just N of the Everard Ranges that probably belong to *Tatemelon everardensis* (see below). The actual specimens could not be located and restudied. Iredale (1937b: 51-52) described new subgenera of *Pleuroxia* for *squamulosa* (*Baccalena*) and *elderi* (*Fatulabia*), then named *Basedowena cottoni*, which now is known to live in the eastern portion of the Mann Ranges, as a new species and genus. Iredale (1938: 105-108), in a check list, treated *Baccalena, Fatulabia*, and *Basedowena* as full genera, keeping *Baccalena* and *Basedowena* monotypic, but adding *Tatemelon musga* Iredale, 1937 from the Musgrave Ranges, *Sinumelon wilpenensis* (Tate, 1894) from the Flinders Ranges, and *Pleuroxia hinsbyi* (Gude, 1916) from the Barrier Range of New South Wales to *Fatulabia*. Richardson (1985) accepted Iredale's last rankings in a family check list.

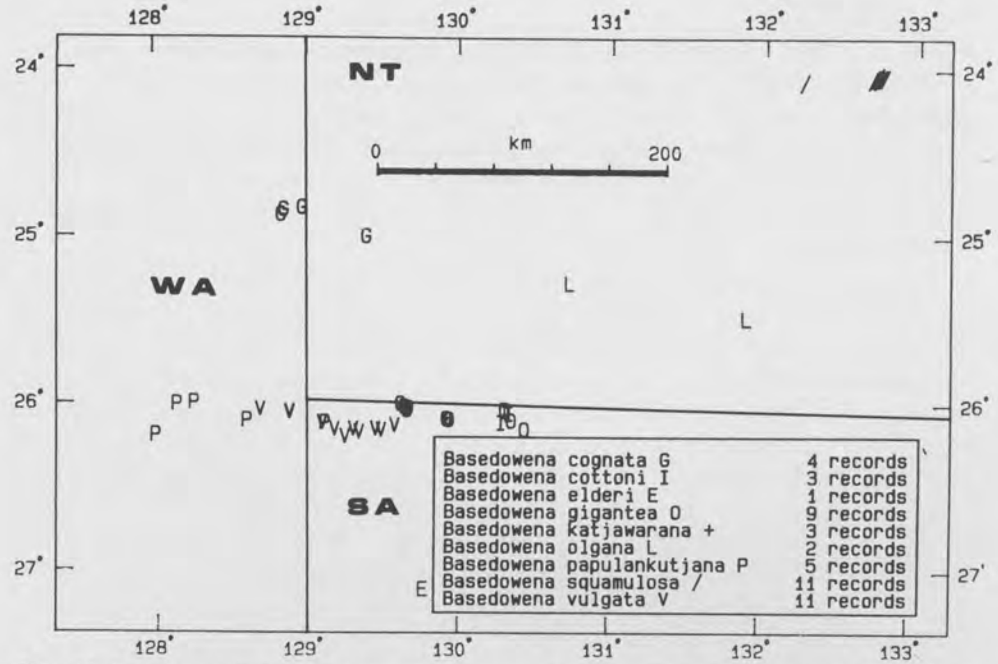
Distribution and comparative ecology

Basedowena is restricted to the Red Centre (**Maps 9-11**) and the nine species recognized here have mostly allopatric ranges. Only *B. gigantea* and *B. katjawarana* have been taken microsympatrically in the southwestern Mann Ranges (WA-896, WA-898, WA-899). In the Musgrave and Everard Ranges, *Basedowena* seems to be replaced by *Tatemelon*. In the Birksgate Ranges it overlaps with *Sinumelon pedasum* Iredale, 1937 and probably *Minimelon colmani*, sp. nov. In the Mann and Tomkinson Ranges there is partial overlap of *Basedowena* with *Pleuroxia radiata* (Hedley, 1905), and in the Blackstone and Cavenagh Ranges there is some sympatry with *Minimelon colmani* again.

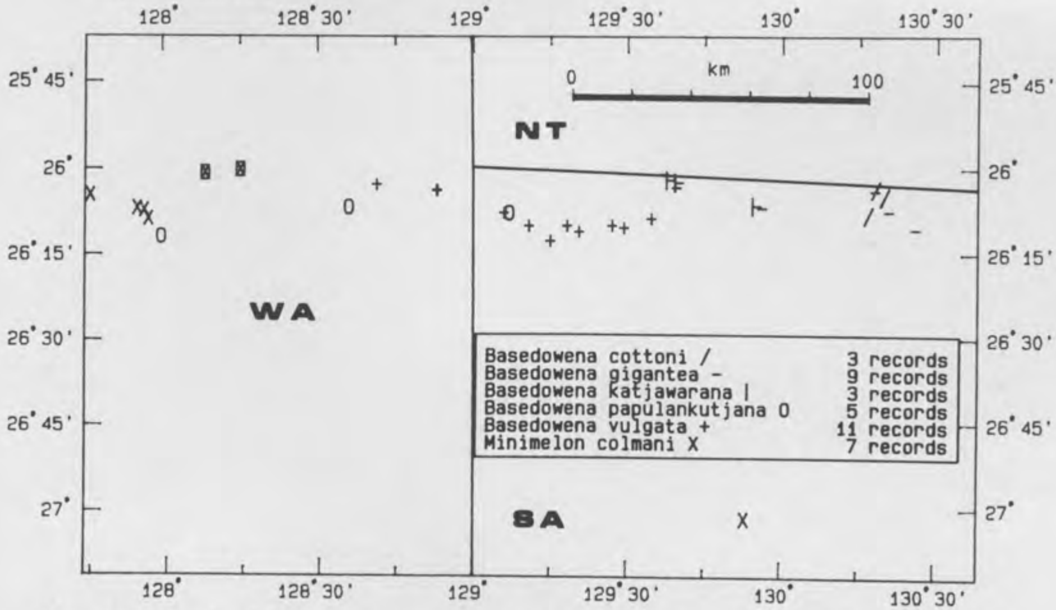
Basedowena squamulosa (Tate, 1894) from the Krichauff and James Ranges has the northernmost range, followed by *B. cognata*, sp. nov., from the Schwerin Mural Crescent in WA and the Petermann Ranges in the NT, and *B. olgana*, sp. nov., from Mt. Olga and Mt. Conner. The Mann Ranges have maximum species diversity, with *B. cottoni* Iredale, 1937 inhabiting the eastern part of the main mass, *B. gigantea* living mainly on southern outliers, and *B. katjawarana* known from the south-central and south-western fringes of the main mass. *B. vulgata* lives in the Tomkinson Range of SA and Hinckley Range of WA, then is replaced to the W in the Blackstone, Bell Rock, and Cavenagh Ranges by *B. papulankutjana*. The southernmost species is *B. elderi* (Bednall, 1892) from the Birksgate Ranges.



Map 9: Records of *Basedowena*, *Granulomelon*, *Minimelon*, and *Tatemelon* in the Red Centre.



Map 10: Records of *Basedowena cognata*, *B. cottoni* Iredale, 1937, *B. elderi* (Bednall, 1892), *B. gigantea*, *B. katjawarana*, *B. olgana*, *B. papulankutjana*, *B. squamulosa* (Tate, 1894), and *B. vulgata* in the Red Centre.



Map 11: Records of *Basedowena cottoni* Iredale, 1937, *B. gigantea*, *B. katjawarana*, *B. papulankutjana*, *B. vulgata*, and *Minimelon colmani* in the Red Centre.

B. squamulosa (Tate, 1894), from Palm Valley, is different in that it aestivates free in the litter, while all other species that I have collected are rock sealers. The aestivation strategy of *B. elderi* (Bednall, 1892) is unknown. The rock sealers frequently are extremely abundant locally, but the total area of a colony may be very small. One hundred thirty-six specimens of *B. vulgata*, 83 of them adult, were taken under one large boulder at WA-908A in the Hinckley Range. Populations in the Mann and Tomkinson Ranges generally were large, and the type lot of *B. elderi* also contained many specimens. The comparatively small numbers (**Table 112**) collected of the northern species, *B. cognata*, *B. olgana*, and *B. squamulosa*, probably reflect actual reduction in abundance levels, as equivalent collecting time produced fewer specimens.

Discussion

The peripheral species show the unusual shell features, while those in the central part of the range have a relatively uniform shell structure. Indeed, during the 1983 field work in the Red Centre, the Mt. Olga-Mann-Tomkinson species were assumed to be one species - except for the small, low spired, and noticably umbilicated *B. katjawarana*. The four similar species, *P. olgana*, *P. cottoni*, *P. giganta* and *P. vulgata*, are readily differentiated by dissection, as the terminal genitalia show major differences.

The westernmost species, *B. papulankutjana*, has lost most of the pustulose sculpture (**Plate 124c-d**), is dark in colour, and with a low spire. *B. elderi* (Bednall, 1892), the southernmost species, has lost the pustules on the body whorl (**Plate 126c**), has two red spiral bands, a low spire, and the umbilicus varying from narrowly open to closed. The northernmost species, *B. squamulosa* (Tate, 1894), has very prominent curved pustules (**Plate 121b-c**), a very low spire, almost no lip expansion, and a wide umbilicus.

In contrast, the large central area species *B. olgana*, *B. cottoni*, *B. gigantea*, and *B. vulgata*, agree in having a very high spire (**Table 112**), well expanded lip, brownish-yellow monochrome colour, prominent spire, closed or nearly closed umbilici (**Figs 295, 298**), and prominent body whorl pustulations (**Plates 122c-f, 123**).

The single new character in the terminal genitalia involves the formation of the foliated pilaster around the epiphallic pore. This structure can be derived from the corrugated folds found around the epiphallic pore in many *Sinumelon* Iredale, 1930 and *Granulomelon* Iredale, 1933, but is much more developed than in any species of these genera. The pattern of the epiphallus partly circling the penial retractor muscle is shared with both *Tatemelon* and *Minimelon*, plus the Flinders Ranges *Pleuroxia* (Solem, 1992a: figs 74-76). This feature is greatly reduced to absent in the Red Centre *Pleuroxia* and is absent in both *Granulomelon* and Red Centre *Sinumelon.*

Most changes in the genitalia of *Basedowena* are in the penis and vagina. They involve primarily size, proportion, and position shifts of the U-shaped main pilaster and the foliated pilaster. The U-pilaster may have one arm reduced (*B. olgana*, **Fig. 296e**), the cross-connection greatly enlarged (*B. papulankutjana*, **Fig. 303b**), a lateral

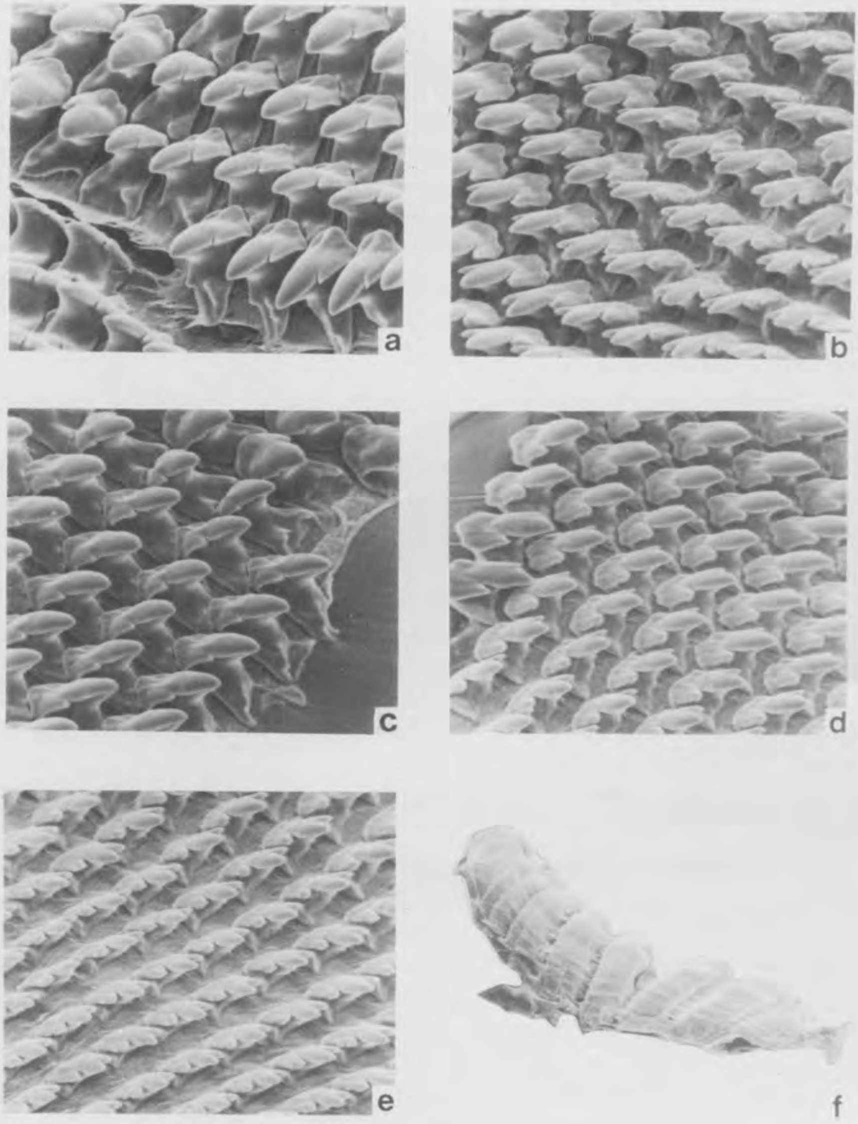


Plate 125: Radular teeth of *Minimelon colmani*: (a-b) Sta. WA-917, Glen Cumming, Mt. Russell, Rawlinson Ranges, WA. 16 May 1983. FMNH 212319, Dissection B. a is central and early laterals at 610X, b is lateromarginal transition at 620X; (c-e) Sta. WA-916, Barrow Ranges, NT. 14 May 1983. FMNH 212318, Dissection A. c is central and early laterals at 570X, d is lateromarginal transition at 580X, e is mid marginals at 590X; (f) Sta. WA-916, Barrow Ranges, NT. 14 May 1983. FMNH 212318, Dissection B. Jaw at 88X.

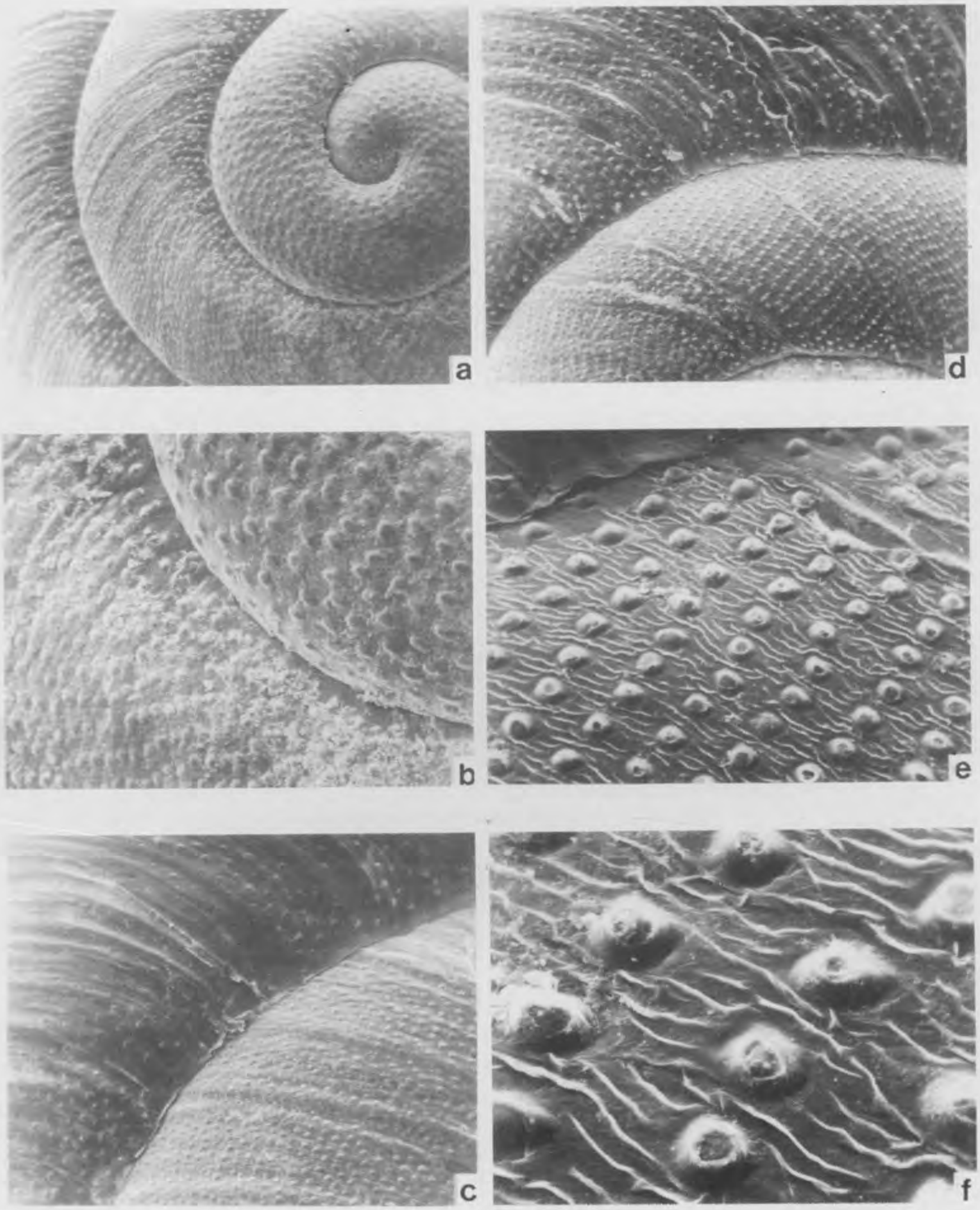


Plate 126: Shell sculpture of *Basedowena elderi* (Bednall, 1892): Birksgate Range, SA. Paratype. FMNH 208706, ex SAM. (a) apex and upper spire at 20.2X; (b) detail of apex (upper right) and upper spire (lower left) at 50X; (c) lower spire and body whorl at 20X; (d) apex to mid-spire at 21.1X; (e) mid-spire pustules in uninterrupted growth area at 100X; (f) detail of mid-spire pustules and periostracal ridgelets at 305X.

pocket developed (*B. vulgata*, **Fig. 300b**), an extension upward from the cross-arm present (*B. katjawarana*, **Fig. 302b**), or the pilaster itself narrowed significantly (*B. gigantea*, **Fig. 299b**). The foliated pilaster varies from very thin and expanded (*B. katjawarana*, **Fig. 302b**), to massive and pillow-like (*B. olgana*, **Fig. 296e**), or short and compacted (*B. cognata*, **Fig. 294b**). Normally, the foliated pilaster is located apicad of the main pilaster, but in both *B. olgana* (**Fig. 296e**) and *B. squamulosa* (**Fig. 293b**) it lies lateral to the main pilaster. Often there is no room for other wall sculpture because the two pilasters are so large.

The vagina normally is wide at its base, internally with very fine (*B. cognata*, **Fig. 294b**) to large (*B. papulankutjana*, **Fig. 303b**) longitudinal pilasters. Its length is generally short, becoming longer in *B. katjawarana* (**Fig. 302a**) and *B. cottoni* (**Fig. 297a**), and very short in both *B. vulgata* (**Fig. 300a**) and *B. squamulosa* (**Fig. 293a**).

The above changes, combined with the simple penis length shift from the globose shape in *B. cottoni* (**Fig. 297a**) and *B. cognata* (**Fig. 294a**) to the very elongated form found in *B. gigantea* (**Fig. 299a**) and *B. katjawarana* (**Fig. 302a**), are sufficient to separate the species. Because they represent basically size, shape, and position shifts, with few novelties in structure, it is not possible to decide on polarity of character change. The added side pocket to the main pilaster of *B. vulgata* (**Fig. 300b**) is unique among known species, but there is no indication of which species has a pilaster that could be immediately ancestral to this. Any of the main pilasters seen in the various species could have produced this by simple splitting, but none of them show any indication of this event. Most of the changes probably relate to "species recognition" interactions with sympatric Sinumeloninae, introducing another complicating factor.

Radular and jaw variation was moderate. *B. squamulosa* (Tate, 1894) has the most altered radula (**Plates 127a-e, 132e**). The cusp shaft angle is greatly elevated, the cusp tip is broadly rounded and grossly curved, with the anterior flare greatly reduced. This closely approaches the situation in the Napier Range *Westraltrachia* Iredale, 1933 (see Solem, 1984), where members of that genus have adapted to scrapping algal-fungal films, although a sympatric genus, *Amplirhagada* Iredale, 1933, retains a generalized feeding habit. Other species have less sharply curved tips, while *B. gigantea* and *B. vulgata* (**Plates 130d-e, 131a-c**) show almost no trace of cusp tip curving. Variation in jaw ribbing seems within normal limits, although *B. cognata* (**Plate 128c, e**) have the ribs narrower and more numerous. The radulae and jaws of *Basedowena* showed one significant difference from those of the other Red Centre Sinumeloninae. Although the others showed numerous instances of deformed rows of teeth, presumably caused by "cold shock", and variable width jaw ribs, presumably caused by repaired injury, not a single deformed row was seen on any radula of *Basedowena* that was examined, and only rarely did there seem to be jaw rib variation. This may result from the aestivation habit of *Basedowena* species. The massive boulders to which they seal would retain heat well, and cool off slowly enough that the "cold shock" might not occur. The free sealing *B. squamulosa* (Tate, 1894), from the Krichauff and James Ranges, has been collected mainly in the litter at the base of cliffs or large boulder piles, and thus would receive similar temperature buffering.

The pattern of rock sealing, effectively enough that some specimens are broken in the attempt to pull them off, restricts colonies to areas of talus or piled rock with spaces that do not fill up after rains or with blown dust. Thus colonies will tend to be scattered, small in size, and well isolated from each other. Free sealers would be more likely to be washed away by a flood and thus have the potential to establish a new colony. Hence the short ranges of the *Basedowena* species probably relate, in large part, to the above factors.

The following key will work for fully adult, relatively unworn examples, but not for juveniles or very worn adults. Size variation (**Table 112**) within the *olgana-cottoni-gigantea-vulgata* complex is extensive. While a key to fully mature adult examples can be constructed, using umbilical and shell sculpture features, the umbilical features are variable in subadults and new adults. Thus the key uses geography, not shell features. These four species are primarily distinguished by genital anatomy (see below).

KEY TO THE SPECIES OF *BASEDOWENA*

1. Shell without red spiral colour bands; various shades of yellow-brown, a lighter tone around umbilicus 2

   Shell with two narrow red spiral colour bands; Birksgate Ranges, SA ....

   Basedowena elderi (Bednall, 1892) (p. 1215)

2. Shell with prominent micro-pustules on spire and body whorl (**Plates 121-123, 124a-b**) 3

   Shell with pustules lost on lower spire and body whorl (**Plate 124d**); colour dark; Cavenagh to Blackstone Ranges, WA

   Basedowena papulankutjana, sp. no. (p. 1211)

3. Umbilicus narrowly open (**Figs 292c, f, 301c**) 4

   Umbilicus at most a narrow lateral crack (**Figs 295c, f, 298c, f**) 6

4. Spire more elevated (**Figs 292e, 301b**), mean H/D ratios 0.800 or above; pustules on shell ovate (**Plate 122b, 124b**); Mann Ranges, SA, Schwerin Mural Crescent, WA, or Petermann Ranges, NT 5

   Spire less elevated (**Fig. 292b**), mean H/D ratio about 0.650; pustules on shell curved (**Plate 121b-c**); Krichauff or James Ranges, NT ....

   Basedowena squamulosa (Tate, 1894) (p. 1172)

5. Mean D/U ratio about 9.50; Mann Ranges in SA

   Basedowena katjawarana, sp. nov. (p. 1205)

Mean D/U ratio about 15; Schwerin Mural Crescent in WA or Petermann Ranges in NT

Basedowena cognata, sp. nov. (p. 1180)

6. Mann or Tomkinson Ranges in SA or Hinckley Range in WA 7
   Mt. Olga or Mt. Conner, NT

   Basedowena olgana, sp. nov. (p. 1184)

7. Umbilicus a narrow crack (**Fig. 298c, f**), if closed, not angled; mostly outliers on S side of Mann Ranges or W in Tomkinson and Hinckley Ranges 8
   Umbilical closure angled (**Fig. 295f**); E end of main mass, Mann Ranges ....

   Basedowena cottoni Iredale, 1937 (p. 1188)

8. S side of Mann Ranges .... *Basedowena gigantea*, sp. nov. (p. 1192)
   Tomkinson or Hinckley Ranges .... *Basedowena vulgata*, sp. no. (p. 1200)

BASEDOWENA SQUAMULOSA (TATE, 1894)
(Plates 121a-c, 127a-f, 132e; Figs 292a-c, 293a-b)

Hadra squamulosa Tate, 1894, Trans. Proc. Rep. Roy. Soc. South Austr., **17**: 193 - Central Australia.

Chloritis squamulosa (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 193-194, pl. 118, figs 10a-c - under rock ledges, Palm Creek and its tributaries, Krichauff Ranges, NT.

Chloritis ophioderma Tate, 1896, Rep. Horn Exped. Central Austr., Zool., p. 194 - possible substitute name for *squamulosa* if that name should be preoccupied.

Xanthomelon squamulosa (Tate), Hedley, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 225 - note on penis structure.

Pleuroxia (Baccalena) squamulosa (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 50 - describes *Baccalena* as a new subgenus.

Baccalena squamulosa (Tate), Iredale, 1938, Austr. Zool., **9** (2): 107 - check list citation; Burch, 1976, Jour. Malac. Soc. Australia, **3**: 135 - generic check list; Richardson, 1985, Tryonia, **12**: 55-56.

Comparative remarks

Basedowena squamulosa (Tate, 1894), which ranges from Palm Valley W to Areyonga, NT (**Map 10**), generally is confused with *Semotrachia* because of its relatively low spire (**Fig. 292b**, mean H/D ratio 0.652), wide umbilicus (**Fig. 292c**, mean D/U ratio 7.60), brownish colour, and micro-rugose surface at optical inspection. It differs most obviously in the narrowly expanded shell lip (**Figs 292a-c**), and in having the shell microsculpture of curved microridges (**Plate 121a-c**) rather than setae as in many *Semotrachia*. Most *Basedowena* differ in having micro shell sculpture of shortened pustulose ridges (**Plates 121d-f, 122-123, 124a-d**), a much higher spire (**Figs 292e, 295b, e, 298b, e, 301b, e**), and nearly closed umbilicus (**Figs 295c, f, 298c, f, 301f**). The only other umbilicated species, *B. cognata* and *B. katjawarana*, have much higher spires (**Figs 292e, 301b**) and their umbilici are much narrower (**Table 112, Figs 292f, 301c**). *Tatemelon musgum* (Iredale, 1937) and *T. herberti* (Iredale, 1937), from the Musgrave Ranges, SA, have a postapical sculpture of radial ridges (**Plate 133a-d**) or calcareous pustules surrounded by periostracal ridgelets (*Tatemelon everardensis*, **Plate 134c-f**). Anatomically (**Figs 293a-b**), *B. squamulosa* has a very short vagina (V) and free oviduct (UV), the spermatheca (S) partly winds around the free oviduct, the epiphallic caecum (EC) is medium in size, with the epiphallus (E) entering the sheath medially. The penis (P) is large, swollen apically, and with a thin sheath (PS). Inside the penis chamber (**Fig. 293b**), there is a prominent U-pilaster, and then a large foliated pilaster around the epiphallic pore that is set lateral to the main pilaster. The lateral position of the foliated pilaster is shared with *B. olgana* (**Fig. 296e**), which differs in its short globose penis with the epiphallus entering apically. In other *Basedowena*, the foliated pilaster lies ABOVE the main pilaster (**Figs. 294b, 299b, 300b, 302b, 303b**).

Holotype

SAM D13608, Krichauff Range, Northern Territory. Collected by the Horn Expedition. Height of shell 9.9 mm, diameter 15.2 mm, H/D ratio 0.651, whorls 4 3/8+, umbilical width 2.15 mm, D/U ratio 7.07.

Paratopotypes

SAM D15553, SAM D15558, NMV, FMNH 88258, 11 DA, 2 DJ from the type locality.

Studied material

Northern Territory:

KRICHAUFF RANGES: Palm Valley (SAM, 12 DA); Palm Creek (8 June 1979, AM C.45854, 5 LA, 5 LJ); Cycad Gorge, Palm Valley (WA-130, WA-442, FMNH 182375, FMNH 182523, FMNH 182650, FMNH 199664, 8 LA, 6 DA, 4 LJ, 1 DJ); Palm Creek banks, 2 km upstream from campground (WA-926, WA-926A-B, WAM 613.87, SAM D17893, AM, QM, FMNH 212344, FMNH 212347, FMNH 212354-5, FMNH 212358-9, 14 LA, 14 DA, 19 LJ, 4 DJ); Palm Creek near Cycad Gorge (WA-927, SAM D17892, WAM 612.87, AM, QM, MV, FMNH 212366-7, 2 LA, 19 DA, 1 LJ, 2 DJ); 0.5 km W of road end, Palm Valley (WA-761, AM, FMNH 205541, 5 DA, 1 LJ, 4 DJ); under figs on N facing slope at road end (WA-762, AM, FMNH 205549, 7 DA, 3 DJ); Glen of Palms, 1.65 km W of Cycad Gorge (WA-443, FMNH 199656, 1 DA, 3DJ).

JAMES RANGE: Areyonga (WA-934, 0.5 km W of, AM, FMNH 212400-1, 5 LA, 2 LJ, 1 DA).

Range

Basedowena squamulosa (Tate, 1894) is known from Palm Valley in the Krichauff Ranges, and then from near Areyonga in the James Ranges, NT (**Map 10**).

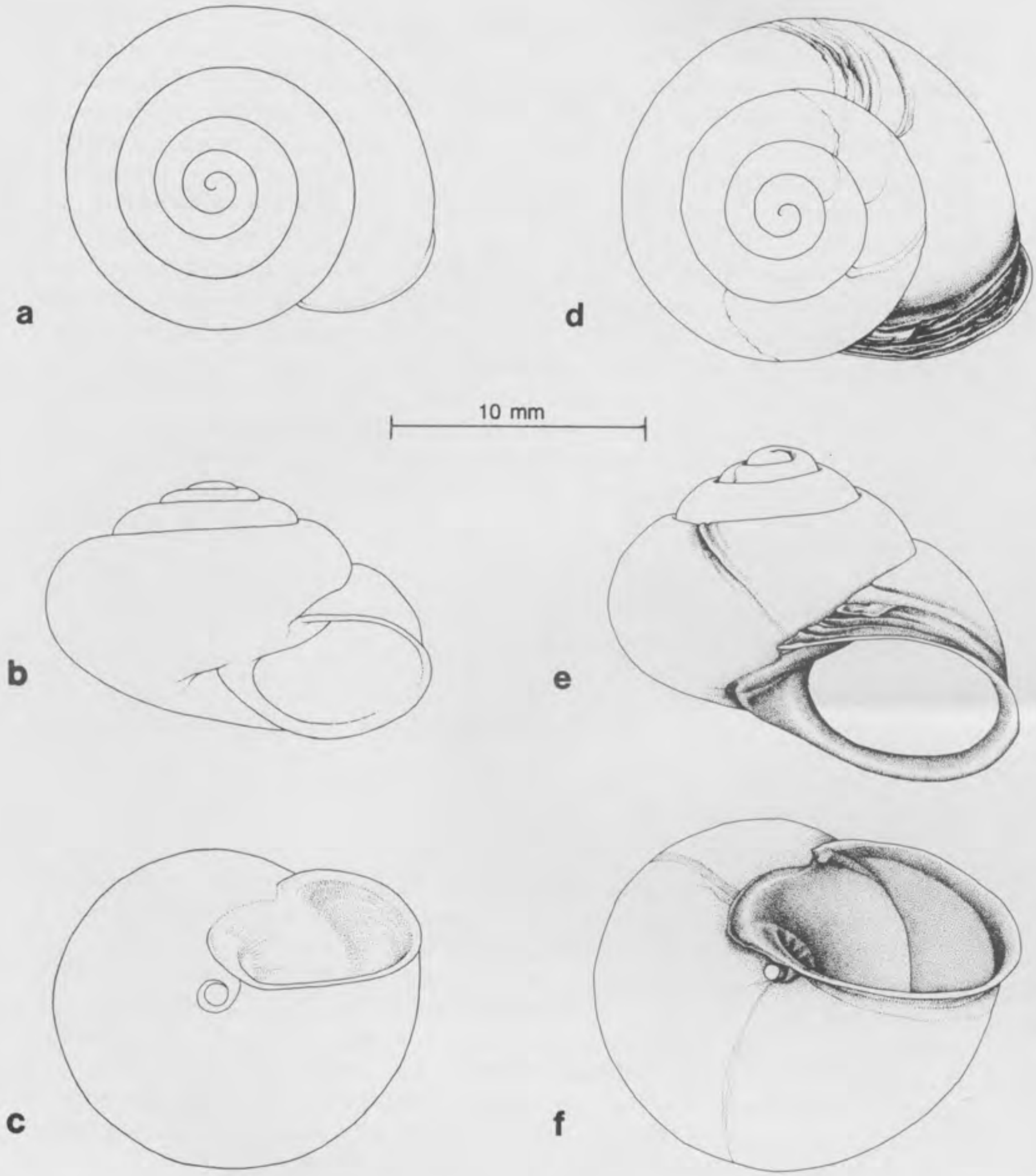


Fig. 292: Shells of *Basedowena squamulosa* (Tate, 1894) and *B. cognata*, sp. nov.: (a-c) *B. squamulosa*, paratype of *Hadra squamulosa* Tate, 1894. MV. Palm Creek, Krichauff Ranges, NT; (d-f) Holotype of *Basedowena cognata*, sp. nov. WAM 584.87. WA-920, NE tip Schwerin Mural Crescent, W of Docker River, WA. Scale lines equal 10 mm. Drawings by Elizabeth A. Liebman (a-c) and Linnea Lahlum (d-f).

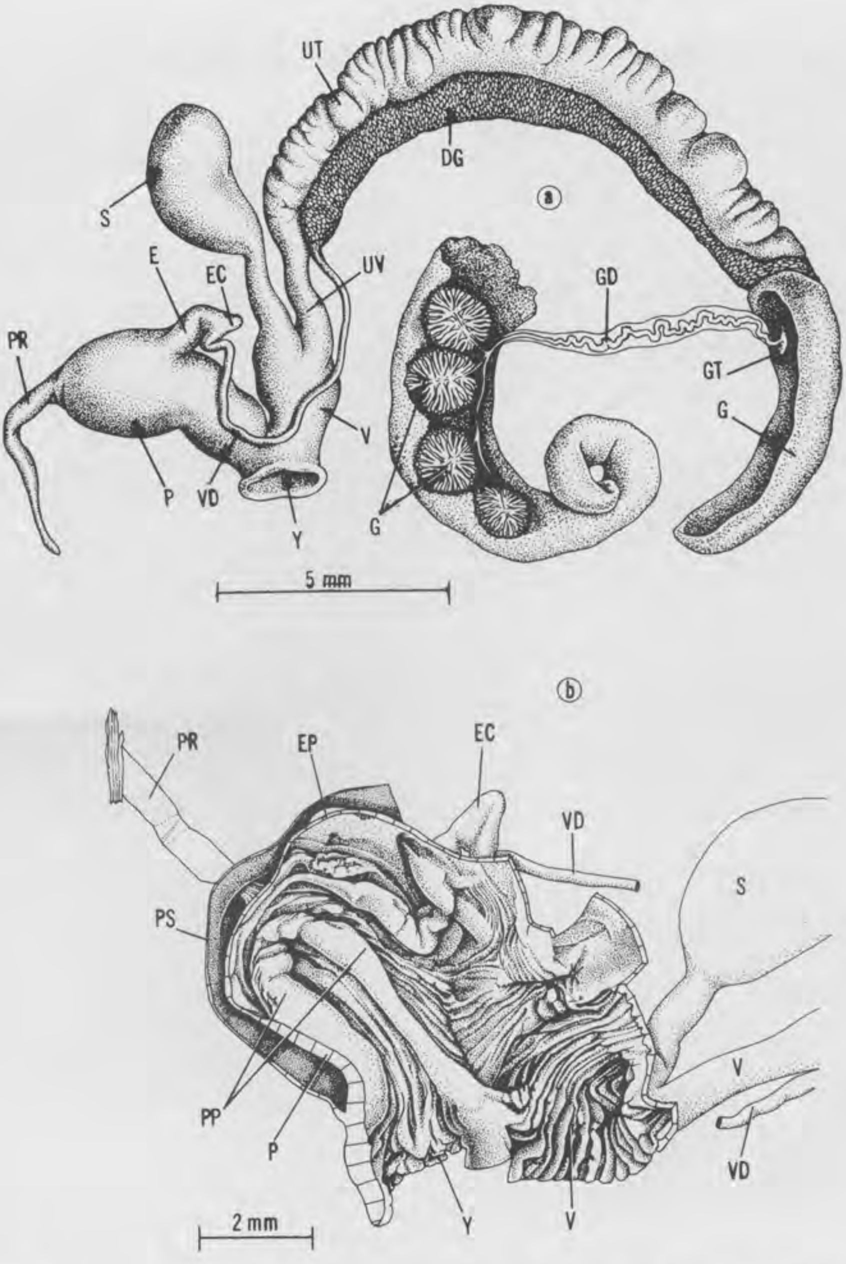


Fig. 293: Genitalia of *Basedowena squamulosa* (Tate, 1894): WA-130, Cycad Gorge, Palm Valley, Krichauff Ranges, NT. 12 March 1974. FMNH 182523, Dissection A. (a) whole genitalia; (b) interior of penis and vagina. Scale lines as marked. Drawings by Elizabeth A. Liebman (a) and Linnea Lahlum (b).

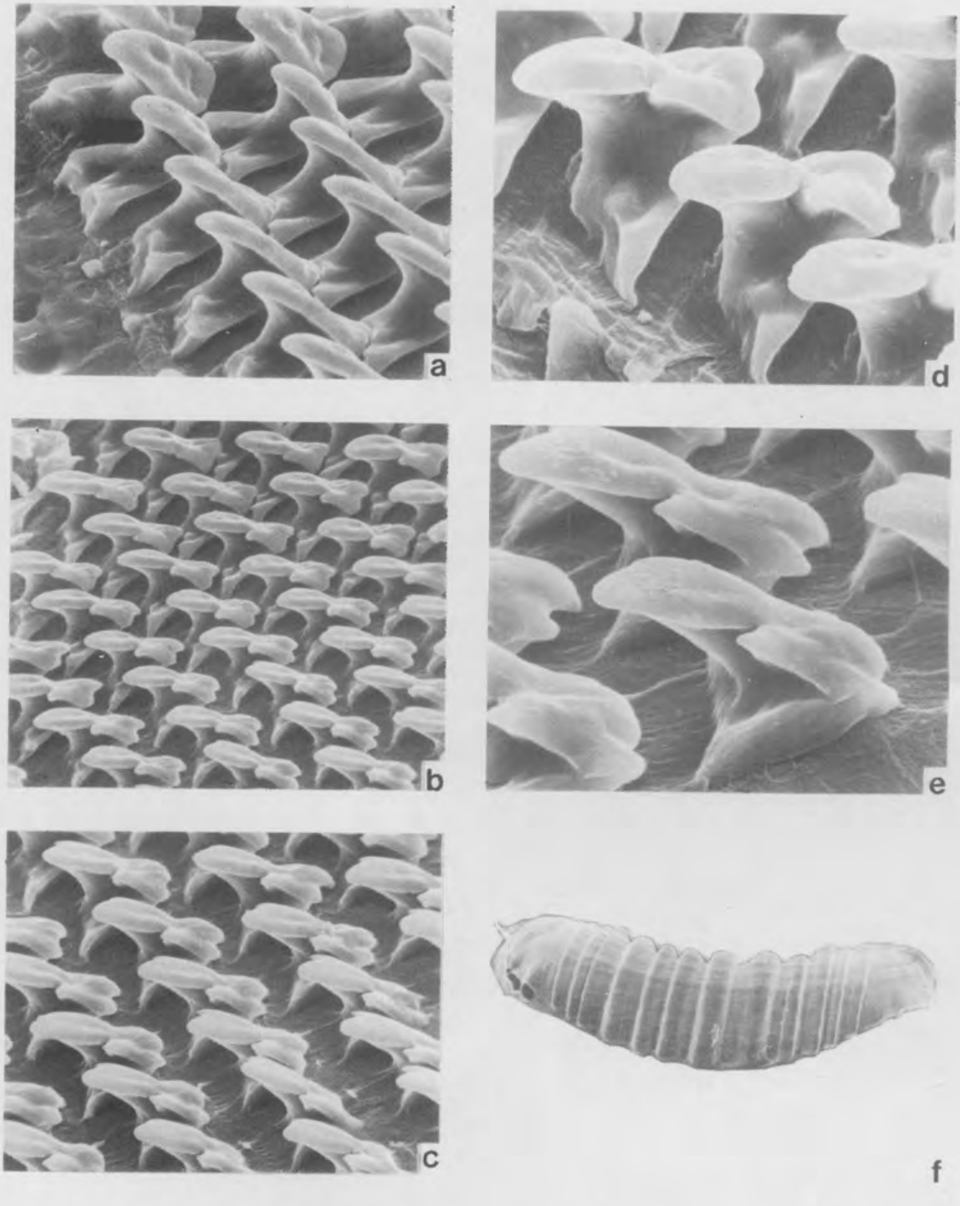


Plate 127: Radular teeth and jaw of *Basedowena squamulosa* (Tate, 1894): WA-130, Cycad Gorge, Palm Valley, Krichauff Ranges, NT. FMNH 182523. (a-d) Dissection A. a is central and early laterals at 760X, b is lateromarginal transition at 570X, c is detail of early marginals at 750X, d is 7th and 8th laterals at 1,500X; (e-f) Dissection B. e is early marginals at 1,525X, f is jaw at 51X.

Table 113: Local Variation in *Basedowena squamulosa* (Tate, 1894), *B. cognata*, *B. olgana* and *B. cottoni* Iredale, 1937.

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
B. squamulosa (Tate, 1894)							
WA-130, FMNH 182523	8L	9.75±0.261 (8.4-11.0)	14.88±0.190 (14.25-15.65)	0.655±0.013 (0.591-0.709)	$4\frac{5}{8}$ ($4\frac{3}{8}$-$4\frac{3}{4}$+)	1.83±0.048 (1.55-2.0)	8.18±0.214 (7.38-9.34)
WA-926B, FMNH 212358	12L	9.42±0.245 (8.2-11.15)	14.46±0.229 (13.15-15.75)	0.651±0.010 (0.593-0.707)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-5-)	1.95±0.057 (1.6-2.25)	7.45±0.183 (6.23-8.32)
WA-927, FMNH 212366	19D	9.82±0.107 (9.1-10.55)	14.85±0.190 (13.25-16.4)	0.662±0.007 (0.614-0.712)	$4\frac{5}{8}$+ ($4\frac{1}{2}$- -$4\frac{7}{8}$+)	1.97±0.060 (1.45-2.3)	7.66±0.241 (6.08-10.0)
WA-762 FMNH 205549	7D	9.70±0.213 (9.0-10.6)	15.56±0.353 (14.65-16.7)	0.623±0.009 (0.596-0.665)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-$4\frac{3}{4}$-)	2.08±0.070 (1.85-2.35)	7.54±.263 (6.66-8.36)
WA-926 FMNH 212347	7D	9.64±0.103 (9.35-10.15)	14.55±0.244 (13.55-15.45)	0.664±0.011 (0.621-0.706)	$4\frac{5}{8}$+ ($4\frac{1}{2}$+-$4\frac{3}{4}$-)	1.99±0.051 (1.85-2.2)	7.31±0.172 (6.73-8.10)
WA-934 FMNH 212400	5L	8.98±0.329 (8.2-10.2)	13.75±0.328 (12.65-14.55)	0.653±0.013 (0.624-0.702)	$4\frac{1}{2}$- ($4\frac{1}{4}$+-$4\frac{1}{2}$+)	2.01±0.140 (1.7-2.45)	6.93±0.356 (5.95-8.06)
B. cognata							
WA-992, FMNH 212330	5D	12.96±0.125 (12.6-13.2)	15.84±0.238 (15.1-16.4)	0.819±0.011 (0.777-0.840)	$4\frac{5}{8}$+ ($4\frac{1}{2}$+-$4\frac{3}{4}$+)	0.94±0.075 (0.7-1.2)	17.3±1.240 (13.9-21.8)
WA-992, FMNH 212329	4L	14.04±0.227 (13.6-14.65)	16.96±0.238 (16.3-17.3)	0.828±0.007 (0.813-0.845)	$4\frac{7}{8}$ ($4\frac{5}{8}$+-5-)	1.05±0.088 (0.85-1.3)	16.4±1.380 (13.5-20.1)
WA-919, FMNH 212325	6D	12.16±0.126 (11.8-12.55)	15.65±0.192 (15.1-16.45)	0.778±0.012 (0.753-0.831)	$4\frac{5}{8}$- ($4\frac{3}{8}$+-$4\frac{7}{8}$-)	1.15±0.076 (1.0-1.45)	13.9±0.941 (10.8-16.8)
WA-919 FMNH 212324	4L	12.40±0.155 (12.15-12.85)	15.27±0.506 (14.0-16.45)	0.814±0.022 (0.780-0.873)	$4\frac{1}{2}$ ($4\frac{3}{8}$+-$4\frac{1}{2}$+)	1.10±0.057 (1.0-1.25)	14.0±0.597 (12.9-15.1)
WA-920, FMNH 212327	10L	13.39±0.187 (12.7-14.3)	16.57±0.224 (16.0-18.1)	0.808±0.007 (0.775-0.854)	$4\frac{5}{8}$+ ($4\frac{1}{2}$+-$4\frac{7}{8}$-)	1.09±0.052 (0.85-1.35)	15.5±0.783 (12.2-19.6)

Table 113: Local Variation in *Basedowena squamulosa* (Tate, 1894), *B. cognata*, *B. olgana* and *B. cottoni* Iredale, 1937. (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
B. olgana							
Mt Olga, WA-452 FMNH 199674	14L	15.72±0.128 (15.05-16.5)	17.24±0.196 (15.95-18.5)	0.912±0.007 (0.875-0.959)	$4^7/_8$+ ($4^5/_8$+-5+)	closed	
Mt Olga, 1-VII-61, AM C 112675	5D	16.79±0.218 (16.05-17.4)	17.80±0.266 (17.0-18.5)	0.944±0.020 (0.868-0.982)	5- ($4^3/_4$+-$5^1/_4$+)	crack	
Mt Connor, 12-III-67, WAM	11D	16.26±0.117 (15.4-16.85)	17.96±0.180 (17.2-18.7)	0.906±0.009 (0.858-0.954)	$4^7/_8$-) ($4^3/_4$-5)	crack	
B. cottoni Iredale, 1937							
WA-891, FMNH 212244	5D	19.09±0.473 (18.1-20.65)	20.30±0.353 (19.3-21.5)	0.941±0.017 (0.915-1.008)	$5^1/_8$ (5-$5^3/_8$-)	closed	
WA-892, FMNH 212248	31L	16.74±0.136 (15.35-18.05)	18.51±0.139 (16.7-19.9)	0.905±0.007 (0.836-0.991)	5+ ($4^3/_4$+-$5^1/_4$-)	closed	
WA-892, FMNH 212247	12D	17.25±0.183 (16.2-18.2)	18.65±0.223 (17.65-20.3)	0.926±0.007 (0.880-0.977)	$5^1/_8$- ($4^7/_8$+-$5^1/_4$+)	closed	
Piltardi Rockhole, 21-VII-63, WAM	15D	18.80±0.164 (17.65-19.85)	19.78±0.185 (18.3-21.0)	0.951±0.008 (0.889-0.990)	$5^1/_8$- ($4^7/_8$-$5^1/_4$+)	closed	
Piltardi Rockhole, 13-VI-61, AM C.112670	8D	16.91±0.689 (13.5-20.15)	18.27±0.617 (15.35-21.3)	0.925±0.014 (0.848-0.963)	5 ($4^1/_2$+-$5^1/_4$)	closed	
6 km S of Angatja, 11-V-83 SAM	17D	17.76±0.274 (15.5-19.9)	18.95±0.255 (16.85-20.9)	0.937±0.007 (0.883-0.979)	5+ ($4^3/_4$-$5^1/_2$)	closed	
near Angatja, 11—V-83 SAM	23D	17.17±0.215 (15.3-20.5)	18.43±0.192 (16.6-21.05)	0.932±0.006 (0.881-1.003)	5- ($4^3/_4$-5)	closed	

Diagnosis

Shell small, adult diameter 12.65-17.55 mm (mean 14.81 mm), with 4 1/4+ to 5 (mean 4 5/8) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 292b**), shell height 8.2-11.4 mm (mean 9.65 mm), H/D ratio 0.588-0.717 (mean 0.652). Body whorl rounded, without angulation. Shell apex (**Plate 121a**) with crowded pustules that become elongated on spire (**Plate 121b-c**) and body whorl, developing curved periostracal extensions. No trace of ridges or ribbing. Umbilicus (**Fig. 292c**) narrow, regularly decoiling, only slightly narrowed by reflection of columellar lip, width 1.45-2.45 mm (mean 1.97 mm), D/U ratio 5.92-10.0 (mean 7.60). Body whorl descending slightly to moderately over last eighth whorl behind aperture. Lip weakly expanded on palatal and basal margins, slightly more expanded on columellar margin. Older examples with lip thickened internally, parietal wall with modest callus. Shell colour yellow-brown above, lighter in tone around umbilicus. Based on 102 measured adults.

Genitalia (**Figs 293a-b**) with head of spermatheca (S) slightly above base of prostate-uterus, base of shaft thick. Vagina (V) very short, wide. Free oviduct (UV) short, partly wound around shaft of spermatheca. Vas deferens (VD) typical, epiphallic caecum (EC) intermediate in size, epiphallus (E) entering penis sheath (PS) near middle, free of wall to apex where it receives insertion of penial retractor muscle. Penis (P) elongated, swollen apically, sheath (PS) very thin. Penis chamber with simple U-shaped main pilaster (PP), a large, laterally positioned, foliated pilaster around epiphallic pore, no other major sculpture present.

Central and lateral teeth of radula (**Plates 127a, 132e**) with massive basal support ridge, short and raised anterior flare, very high cusp shaft angle, cusp tip very strongly curved and bluntly rounded. Late laterals (**Plate 127d**) retain rounded cusp tip. Lateromarginal transition (**Plate 127b-c**) marked by abrupt appearance of ectocone and shortening of basal plate. Early marginals (**Plate 127e**) with sharper cusp tip and weak endocone. Jaw (**Plate 127f**) typical, vertical ribs reduced laterally.

Discussion

Basedowena squamulosa (Tate, 1894) is a free sealer found in litter, thus differing from the other members of the genus. It also is unusual because of the relatively low spire, wider umbilicus, and sculpture of elongated pustules. Tate (1896: pl. 18, fig. 10c) gave a good impression of the shell sculpture, which is distinctive. *B. squamulosa* is relatively common in Palm Valley, both in talus and under figs. The one colony (WA-934) from near Areyonga does not differ in genital anatomy, or in the unusual curved and rounded cusps of the lateral randular teeth (**Plates 127a, 132e**). Some specimens in the MV that were "collected by Prof. Spencer during Horn Expedition" are labeled Finke George, Palm Creek, Central Australia. While it is possible that this species may inhabit Finke Gorge in the MacDonnell Ranges to the north, no modern records exist and this record is not accepted.

Few collections contained enough adult specimens for statistical analysis (**Table 113**). The specimens from WA-762 are slightly larger and less elevated, while the

Areyonga shells (WA-934) are slightly smaller in both diameter and whorl count. The differences are statistically significant, but there are no obvious habitat differences which could account for the variation.

BASEDOWENA COGNATA, SP. NOV.

(Plates 121d-f, 122a-b, 128a-e; Figs 292d-f, 294a-c)

Comparative remarks

Basedowena cognata, sp. nov., from the Schwerin Mural Crescent and Mt. Sargood in WA and the Petermann Ranges in the NT (**Map 10**), has a moderately elevated spire (**Fig. 292e**, mean H/D ratio 0.806), very narrow umbilicus (**Fig. 292f**, mean D/U ratio 15.3), the pustulose shell sculpture greatly reduced, although retaining traces of the curved pustules seen in *B. squamulosa* (Tate, 1894) on the body whorl (**Plate 121d-f**), and shows traces of radial ridging on most specimens (**Plate 122a-b**). *B. squamulosa* (Tate, 1894) has a lower spire (**Fig. 292b**) and wider umbilicus (**Fig. 292c**), less expanded shell lip (**Figs 292a-c**), less body whorl descent (**Fig. 292b**), and much more prominent shell sculpture of curved pustules (**Plate 121a-c**). The only other umbilicated species, *B. katjawarana*, sp. nov., is similar in size and shape (**Table 112, Figs. 301a-c**), but differs obviously in its much more prominent pustulose shell sculpture (**Plate 124a-b**) and absence of radial ridging. All other *Basedowena* have much higher spires and a closed or nearly closed umbilicus. Anatomically (**Figs 294a-c**), *B. cognata* has a rather short penis (P) that tapers apically, a large epiphallic caecum (EC), the epiphallus (E) enters the thin penis sheath (PS) near the apex, and typical insertion of the penial retractor muscle (PR) at the epiphallus-penis junction. The penis chamber (**Fig. 294b**) has a short and simple U-shaped main pilaster (PP), the thick foliated pilaster around the epiphallic pore lies directly above the apex of the U-pilaster, and there are accessory wall pilasters developed. *B. katjawarana* (**Figs 302a-d**) agrees in the near apical entry of the epiphallus (E), and in having the foliated pilaster above the U-pilaster apex, but differs most obviously in its much longer penis (P) and vagina (V). Both *B. olgana*, sp. nov., and *B. cottoni* Iredale, 1937 have short, globose penes with different interior details. *B. squamulosa* (Tate, 1894) differs in having the foliated pilaster lateral to the U-pilaster (**Fig. 293b**).

Holotype

WAM 584.87, WA-920, NE tip of Schwerin Mural Crescent, W of Docker River Community, Western Australia, Australia (Rawlinson 1:250,000 map sheet SG52-2 - 1625:9065yds). 24° 51' 25" S, 128° 51' 01" E. Collected by A. Solem and P. Colman 17 May 1983. Height of shell 13.6 mm, diameter 16.2 mm, H/D ratio 0.840, whorls 4 5/8, umbilical width 1.25 mm, D/U ratio 13.0.

Paratopotypes

WAM 588.87, SAM D17868, AM, QM, FMNH 212326-7, 9 LA, 2 LJ, 1 DJ from the type locality.

Paratypes

Western Australia

SCHWERIN MURAL CRESCENT: SE tip (WA-919, WAM 590.87, WAM 591.87, SAM D17870-1, AM, QM, MV, FMNH 212324-5, 4 LA, 6 DA, 1 LJ, 5 DJ); SW corner of Mt. Sargood (WA-921, AM, FMNH 212328, 1 LA, 2 LJ).

24°20'S
128°31'E

Northern Territory

PETERMANN RANGES: under figs by Lassiter's Cave, Hull River (WA-922, WAM 589.87, SAM D17869, AM, MV, QM, FMNH 212329-30, 4 LA, 5 DA, 3 LJ, 3 DJ).

Range

Basedowena cognata, sp. nov., is known from the SE tip of the Schwerin Mural Crescent in WA to as far E as Lassiter's Cave on the Hull River in the Petermann Ranges, NT (**Map 10**). Only the one collecting stop has been made in the Petermann Ranges, so that its actual distribution there is unknown. Several hill systems to the N of these localities potentially may have extant populations.

Diagnosis

Shell relatively small, diameter 14.0-18.1 mm (mean 16.09 mm), with 4 3/8+ to 5- (mean 4 5/8+) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 292e**), shell height 11.25-14.65 mm (mean 12.96 mm), H/D ratio 0.753-0.873 (mean 0.806). Body whorl rounded, without angulation. Shell apex (**Plates 121d, 122a**) with fine, elongated pustules. Pustules reduced on spire and body whorl (**Plates 121e-f, 122b**), some populations with irregular radial ridges appearing on spire and body whorl (**Plate 122b**). Remnant pustules retaining traces of curvature (**Plate 121f**). Umbilicus (**Fig. 292f**) very narrow, partly covered by reflection of columellar lip, width 0.7-1.45 mm (mean 1.08 mm), D/U ratio 10.8-21.6 (mean 15.3). Body whorl descending moderately just behind aperture. Lip thin, narrowly expanded on palatal and basal margins, more expanded on columellar region. Parietal callus variable. Shell colour light yellow-brown above and well below periphery, much lighter near umbilicus. Based on 30 measured adults.

Genitalia (**Figs 294a-c**) with vagina (V) half length of penis, slightly expanded medially, free oviduct (UV) partly wound around shaft of spermatheca (S), whose head extends half way up prostate-uterus. Vas deferens (VD) slender, epiphallic caecum (EC) prominent, epiphallus (E) entering very thin penis sheath (PS) apically and circling penial retractor muscle (PR) before entering penis (P). Penial retractor muscle inserting partly on epiphallus, partly on penis apex. Penis (P) of medium length, slightly tapering apically, internally (**Fig. 294b**) with short U-shaped main pilaster (PP), compact foliated pilaster around epiphallic pore (EP) located directly above main pilaster. Some accessory ridges on wall of penis chamber. Vagina with very narrow wall pilasters.

Central and lateral teeth of radula (**Plate 128a, d**) with large basal support ridge, prominent anterior flare, normal cusp shaft angle, cusp top slightly curved and sharp

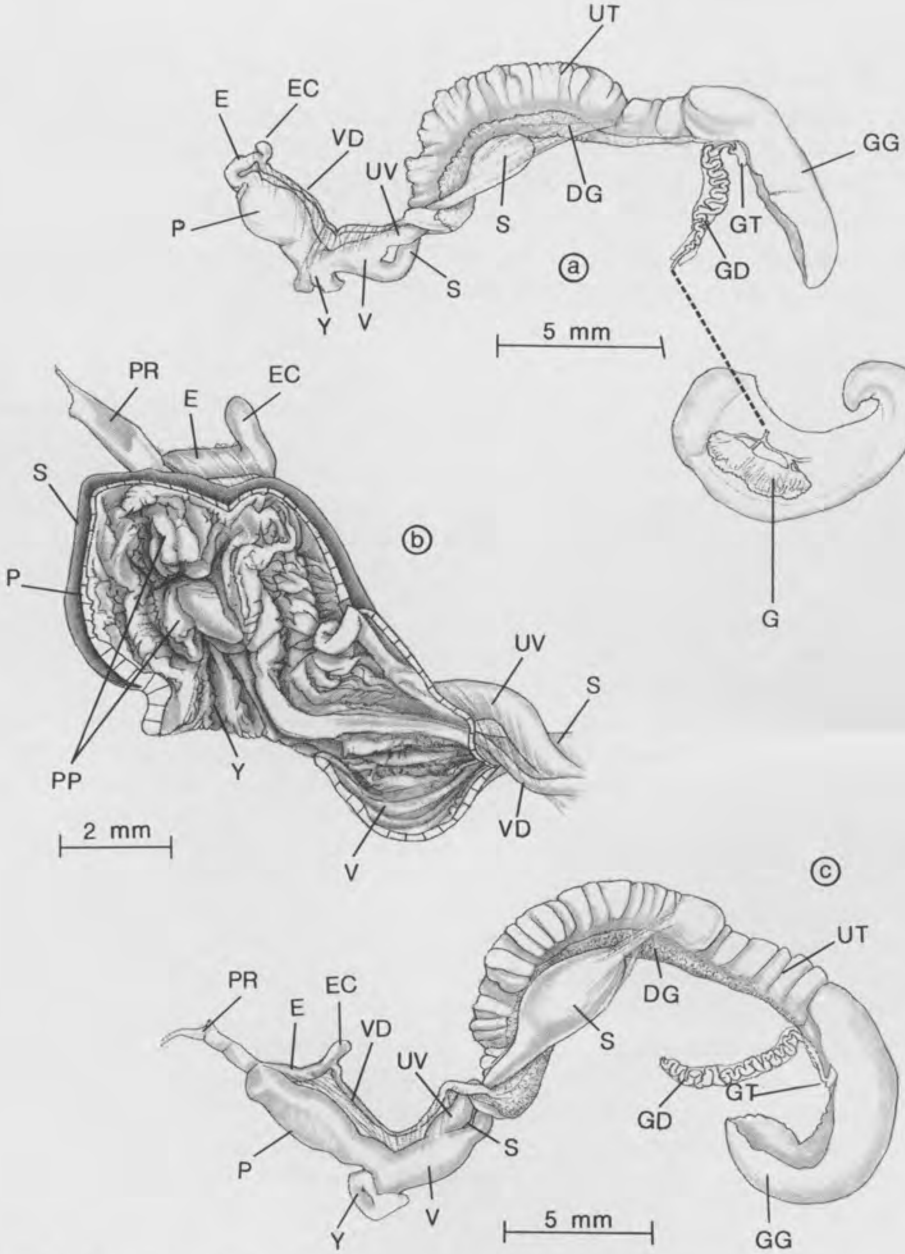


Fig. 294: Genitalia of *Basedowena cognata*, sp. nov.: (a-b) WA-920, NE tip Schwerin Mural Cresent, WA. 17 May 1983. FMNH 212327. a is whole genitalia, Dissection B. b is penis interior, Dissection A; (c) WA-922, Lassiter's Cave, Hull River, Petermann Ranges, NT. 18 May 1983. FMNH 212329, Dissection A. Whole genitalia. Scale lines as marked. Drawings by Linnea Lahlum.

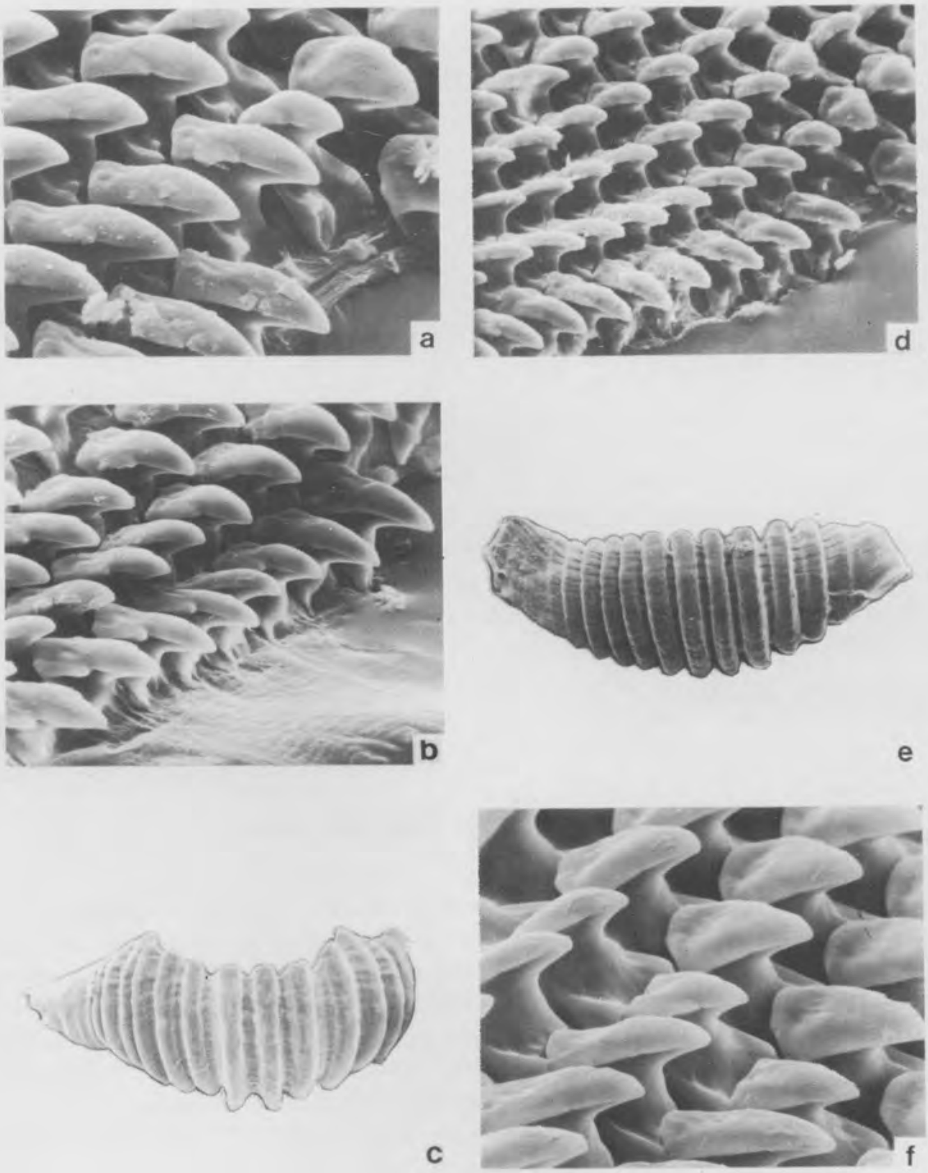


Plate 128: Radular teeth and jaw of *Basedowena cognata* and *B. olgana*: (a-c) *B. cognata*. WA-922, Lassiter's Cave, Hull River, Petermann Ranges, NT. 18 May 1983. FMNH 212329, Dissection A. a is central and early laterals at 550X, b is lateromarginal transition at 540X, c is jaw at 54X; (d-e) *B. cognata*. WA-920, NE tip of Schwerin Mural Crescent, WA. 17 May 1983. FMNH 212327, Dissection A. d is central and early laterals at 365X, e is jaw at 48X; (f) *B. olgana*. WA-452, Valley of the Winds, Mt. Olga, NT. 27 May 1977. FMNH 199674, Dissection B. Central and early laterals at 750X.

tipped. Late laterals and lateromarginal transition (**Plate 128b**) showing abrupt appearance of ectocone and reduction of basal plate, but anterior flare and cusp shape on late laterals typical. Jaw (**Plate 128c, e**) with narrow vertical ribs, reduced to absent on margins.

Discussion

Basedowena cognata, sp. nov., is a rock sealer that has been found in limited quantity in the drainage of Rebecca Creek at the eastern end of the Schwerin Mural Cresent and outliers of Mt. Sargood in WA, and then at Lassiter's Cave on the Hull River, Petermann Ranges, NT. The aerial distance between these population clusters is about 59 km. No attempt at collecting has been made in the Anne Range, Bloods Range, or Walter James Range to the N, or the nearer Ilyaralona and Piultarana Ranges than lie just NE of the main Petermann Ranges. The western part of the Schwerin Mural Crescent also is unsampled territory, although Mount Russell in the Rawlinson Ranges yielded only *Minimelon colmani* (see above). It is quite probable that the range of *B. cognata* will be considerably extended by further field work.

Size and shape variation (**Table 113**) is moderate and without clear pattern. Dissection showed (**Figs 294a, c**) that the Petermann Range (WA-922) specimens had the penis longer and narrower than in a Schwerin Mural Crescent population (WA-920). The difference is less than that seen between other species, and thus they are maintained under one name.

The name *cognata*, meaning similar, was selected because this species shows affinities with a number of other *Basedowena*.

BASEDOWENA OLGANA, SP. NOV.
(Plates 122c-d, 128f; Figs 295a-c, 296a-e)

Comparative remarks

Basedowena olgana, sp. nov., from Mt. Olga and Mt. Conner, NT (**Map 10**), is a medium sized species (mean diameter 17.52 mm), with high spire (**Fig. 295b**, mean H/D ratio 0.904), closed umbilicus (**Fig. 295c**), and a micro sculpture of very dense, prominent pustules (**Plate 122c-d**) that almost appear cancellated as in *Sinumelon bednalli* (Ponsonby, 1904) (**Plate 108b-c**), narrowly expanded lip, and strong descent of the body whorl. *B. cottoni* Iredale, 1937, from the eastern Mann Ranges, is very similar in size and shape (**Table 112, Figs 295d-f**), but differs in having a much more expanded shell lip, different umbilical closure, and the shell sculpture (**Plate 122e-f**) is reduced in prominence. Both *B. vulgata*, sp. nov., and *B. gigantea*, sp. nov., from the Mann to Tomkinson Ranges, are larger (**Table 112**) and with reduced shell sculpture (**Plate 123a-d**). The species with distinctly open umbilici (**Figs 292c, f, 301c**), *B. squamulosa* (Tate, 1894), *B. cognata*, and *B. katjawarana*, also have much lower spires. Both *B. papulankutjana*, sp nov., and *B. elderi* (Bednall, 1892) are smaller and much lower spired. Anatomically (**Figs 296a-e**), the globose penis (P) with apical entry of the epiphallus (E), and position of the foliated pilaster LATERAL to the main pilaster (PP) readily separate *B. olgana*. All other species, except

B. squamulosa (Tate, 1894) (**Fig. 293b**), have the foliated pilaster directly ABOVE the main pilaster.

Holotype

AM C.135968, WA-452, rock pile just W of waterfall base at entrance to Valley of the Winds, Mt. Olga, Northern Territory, Australia. approximately 25o 18' S, 130o 44' E. Collected by A. Solem 27 May 1977. Height of shell 15.45 mm, diameter 16.9 mm, H/D ratio 0.914, whorls 4 7/8, umbilicus a slight lateral crack.

Paratopotypes

AM C.135969, WAM 587.87, SAM D17867, QM, FMNH 199674, 13 LA, 8 LJ from the type locality.

Paratypes

Northern Territory

MOUNT OLGA (September 1948, MV F6953, 3 LA, 1 LJ; MV F20696, 1 DA; AM C.112675, H. Cogger!, 1 July 1961, 5 DA, 6 DJ).

MOUNT CONNER (WAM, W. H. Butler!, 12 March 1967, 11 DA, 1 DJ).

Range

The only localities for *Basedowena olgana* are Mt. Olga and Mt. Conner, near Ayers Rock, NT (**Map 10**).

Diagnosis

Shell of medium size, diameter 15.55-18.7 mm (mean 17.52 mm), with 4 5/8- to 5 1/4+ (mean 4 7/8) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 295b**), shell height 13.15-17.4 mm (mean 15.95 mm), H/D ratio 0.844-0.982 (mean 0.910). Body whorl rounded, without angulation. Shell apex (**Plate 122c**) usually worn, showing traces of fine pustules. Lower spire and body whorl (**Plate 122d**) with large pustules, sometimes giving a near cancellated effect. Some areas with radial growth ridgelets. Umbilicus (**Fig. 295c**) at most a tiny lateral crack, closure caused by rolled columellar lip. Body whorl descending sharply just behind aperture. Lip narrowly expanded on palatal and basal margins, rolled over umbilicus on columellar margin. Parietal callus thin, except near columellar lip. Colour very light greenish-yellow-brown, lighter in tone around umbilicus. Based on 34 measured adults.

Genitalia (**Figs 296a-e**) with vagina (V) short and swollen, free oviduct (UV) and short shaft of spermatheca (S) wound around each other, head of spermatheca extending one-third of way up prostate-uterus. Vas deferens (VD) slender, entering large epiphallic caecum (EC) laterally. Epiphallus (E) wrapped around penial retractor muscle, entering penis sheath apically, then into penis apex. Penis retractor muscle (PR) inserting on penis-epiphallus junction. Penis (P) globose, with very thin sheath (PS). Penis chamber with main pilaster (PP) unevenly U-shaped (incorrectly shown in **Fig. 296e**), one arm ascending into vagina. Reduced second arm of U-pilaster hidden under edge of huge foliated pilaster around epiphallic pore (DP). Accessory ridges present on chamber wall.

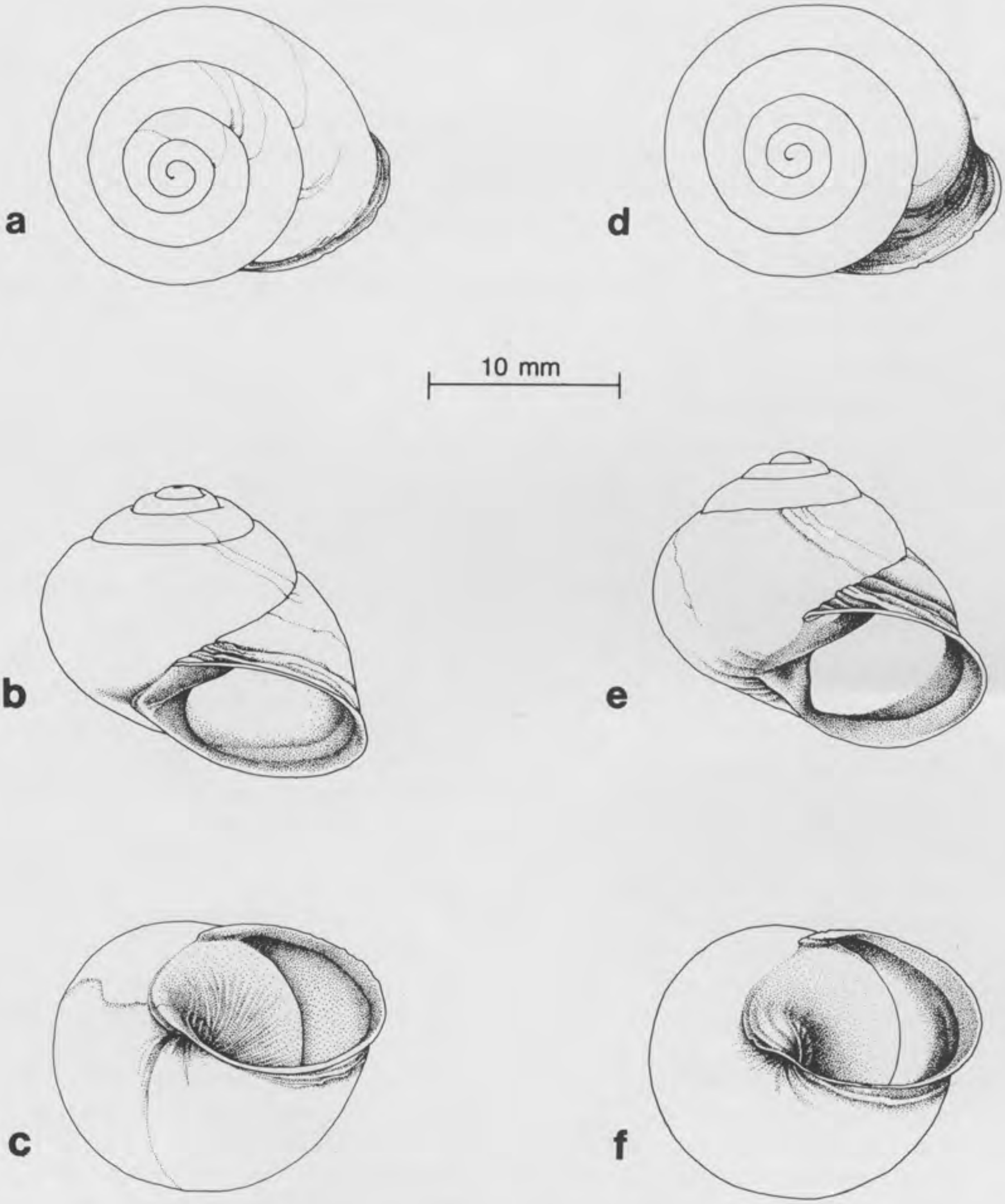


Fig. 295: Shells of *Basedowena olgana*, sp. nov., and *B. cottoni* Iredale, 1937: (a-c) Holotype of *B. olgana*. AM C.135968. WA-452, Valley of the Winds, Mt. Olga, NT; (d-f) Holotype of *Basedowena cottoni* Iredale, 1937. AM C.19223. Musgrave Ranges (error), SA. Scale lines equal 10 mm. Drawings by Linnea Lahlum.

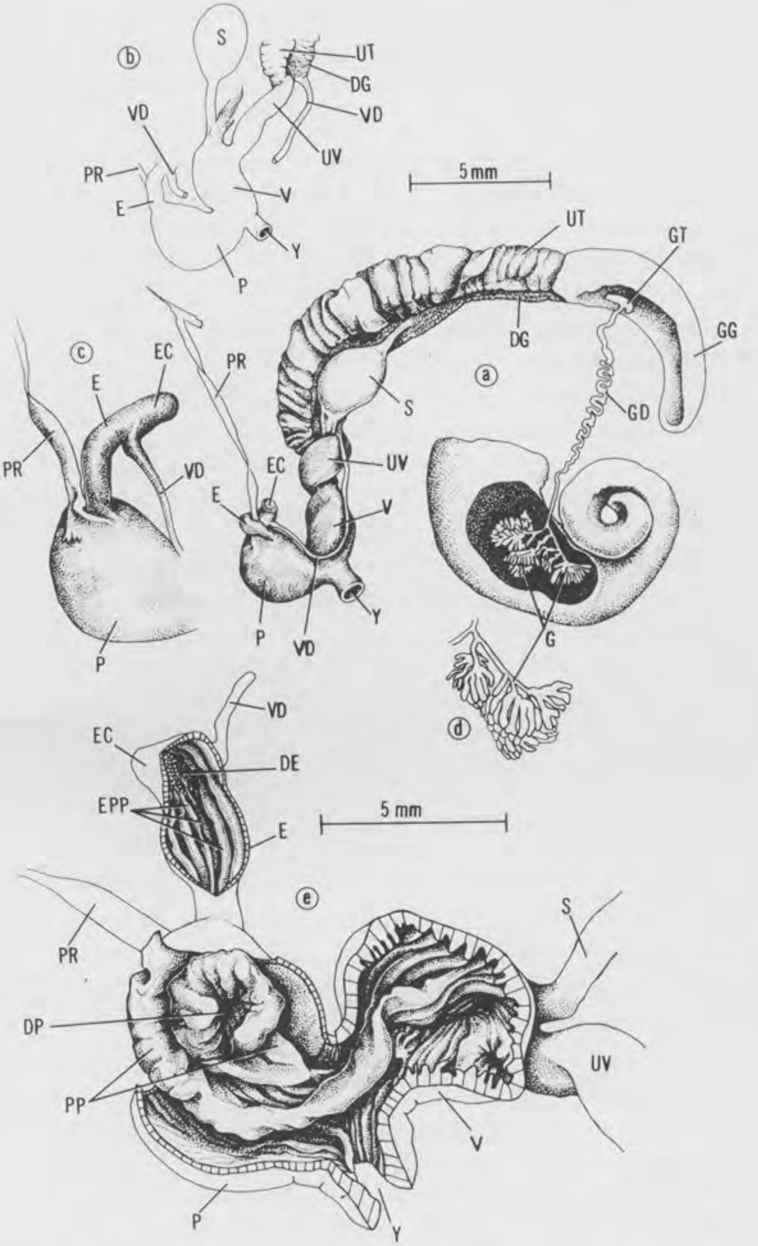


Fig. 296: Genitalia of *Basedowena olgana*, sp. nov.: WA-452, base of waterfall, Valley of the Winds, Mt. Olga, NT. 27 May 1977. FMNH 199674, Dissection A. (a) whole genitalia; (b) origins and insertions of organs in lower genital tracts; (c) detail of terminal male organs; (d) lobes of ovotestis; (e) interior of penis complex and vagina. Scale lines as marked. Drawings by Marjorie M. Connors.

Central and lateral teeth of radula (**Plate 128f**) with large basal support ridge, normal anterior flare, typical cusp shaft angle, cusp tip slightly curved and with a sharp point. Lateromarginal transition and jaw without unusual features.

Discussion

Basedowena olgana is a geographically isolated species of *Basedowena*. Nothing similar has been found in the George Gill Range to the N or the Musgrave-Everard Ranges complex to the SE. It may live in talus on the perimeter of Ayers Rock, which lies between the two known localities, Mt. Conner and Mt. Olga, but no land snail collections from Ayers Rock are known to me.

The heavy pustulose sculpture is more prominent than in other species of the genus. *B. cottoni* Iredale, 1937 also has a globose penis, but in that species the foliated pilaster lies above the main pilaster (**Figs 297a-b**).

Size and shape variation (**Table 113**) is moderate. The earlier lots from Mt. Olga were not further localized. They differ is size and proportions from the 1977 specimens. It is improbable that they came from the population that I sampled (WA-452), so no data are available on possible allochronic variation. The Mt. Conner specimens do not differ significantly from the Mt. Olga shells.

Initial study of this species was carried out in the late 1970's, before I really understood the patterns of genital variation in the Sinumeloninae. Thus both Illustrator Marjorie M. Connors and I missed the reduced arm of the U-pilaster beneath the raised edge of the foliated pilaster. It was not considered necessary to redraw this figure, as other features are clearly shown.

The name *olgana* is taken from Mt. Olga, where most of the known specimens have been collected.

BASEDOWENA COTTONI IREDALE, 1937
(Plates 122e-f, 129a-d; Figs 295d-f, 297a-b)

Basedowena cottoni Iredale, 1937, South Austr. Nat., **18** (2): 51-52, pl. II, fig. 24 - Musgrave Ranges (error) (H. Basedow!); Iredale, 1938, Austr. Zool., **9** (2): 105-106; Richardson, 1985, Tryonia, **12**: 61.

Comparative remarks

Basedowena cottoni Iredale, 1937, from the E end of the Mann Ranges, SA (**Maps 10-11**), is a large (mean diameter 18.82 mm), very high spired species (**Fig. 295e**, mean H/D ratio 0.927), with typical pustules on the spire and body whorl (**Plate 122e-f**). The umbilical closure (**Fig. 295f**) has an unusual angulation that differentiates it from *B. olgana* (**Fig. 295c**). The somewhat (*B. vulgata*) to much (*B. gigantea*) larger Mann to Tomkinson Range species are basically identical in shape (**Table 112**), but have more prominent pustules (**Plate 123a-d**) and a tendency towards formation of radial ridgelets on the lower spire and body whorl. They also lack the columellar angulation. The umbilicated taxa, *B. squamulosa* (Tate, 1894), *B. cognata*, sp. nov., and

B. katjawarana, sp. nov., have much lower spires and are smaller in size. Both *B. papulankutjana*, sp. nov., from the Blackstone Range, and *B. elderi* (Bednall, 1892), from the Birksgate Range, are smaller and lower spired, with almost total loss of the pustules (former, **Plate 124d**) or with red spiral colour bands (latter, **Fig. 304b**). Anatomically (**Figs 297a-b**), the vagina (V) is equal in length to the globose penis (P), the foliated pilaster is situated above the U-shaped main pilaster (PP), and the spermathecal head (S) lies well up the prostate-uterus. The only other species with a globose penis, *B. olgana* (**Fig. 296e**), has the massive foliated pilaster LATERAL to, rather than above, the U-pilaster. The conchologically similar *P. vulgata* and *P. gigantea* have moderately to very elongated penes (**Figs 299a, 300a**) as the most obvious difference.

Holotype

AM C.19223, Musgrave Ranges (error), South Australia. Collected by Herbert Basedow. Type locality here corrected to E end of Mann Ranges, South Australia. Height of shell 16.65 mm, diameter 18.05 mm, H/D ratio 0.922, whorls 5-, umbilicus closed by reflection of columellar lip.

Paratopotypes

AM C.19223, SAM D.14913, 4 DA, 4 DJ from the type collection.

Studied material

South Australia

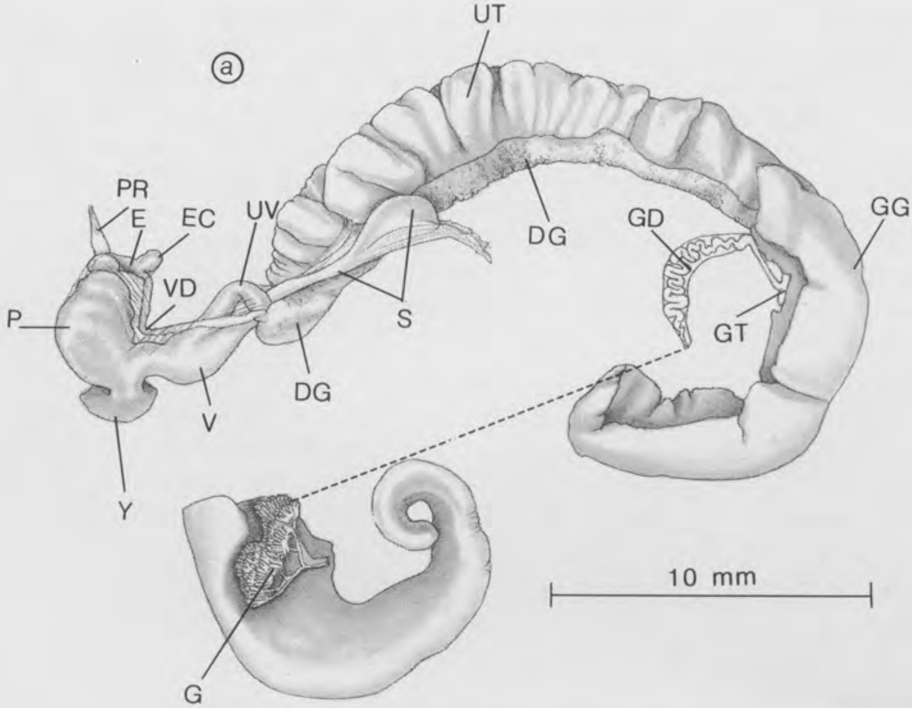
MANN RANGES: Piltardi area (Day Gully, N. Tindale!, 24 May 1957, SAM, 1 DA); Piltardi Rockhole (H. Cogger!, 13 June 1961, AM C.112670, 8 DA, 3 DJ; G. M. Storr!, 21 July 1963, WAM, 15 DA; WA-895, slopes around rockhole, AM, WAM 599.87, SAM D17878, FMNH 212254-5, 1 DA, 12 LJ); Angatja (6 km S of, W. Zeidler!, 11 May 1983, SAM, 17 DA, 4 DJ; WA-891, figs on N facing slope 1.7 km from Angatja fence, WAM 598.87, SAM D18265, AM, FMNH 212243-4, 2 LA, 5 DA, 3 LJ, 12 DJ; WA-892, rockhole 0.5 km above Angatja homestead, WAM 596.87, WAM 297.87, SAM D18268, AM, MV, QM, FMNH 212247-8, 31 LA, 12 DA, 14 LJ, 16 DJ; small stream near Angatja, W. Zeidler!, 11 May 1983, SAM).

Range

Basedowena cottoni Iredale, 1937 has been collected from the E end of the Mann Ranges, SA (**Maps 10-11**), between Angatja Rockhole and Piltardi Rockhole on the main mass of the range. Outliers to the SE have yielded *Basedowena gigantea*, sp. nov. Most of the Mann Range remains uncollected, so the exact area occupied by *B. cottoni* is unknown.

Diagnosis

Shell fairly large, adult diameter 15.35-21.5 mm (mean 18.82 mm), with 4 1/2+ to 5 1/2 (mean 5+) normally coiled whorls. Apex and spire very strongly elevated (**Fig. 295e**), shell height 13.5-20.65 mm (mean 17.45 mm), H/D ratio 0.835-1.010 (mean 0.927). Body whorl rounded, without angulation. Shell apex (**Plate 122e**) with crowded and elongated pustules, lower spire and body whorl (**Plate 122f**) with typical



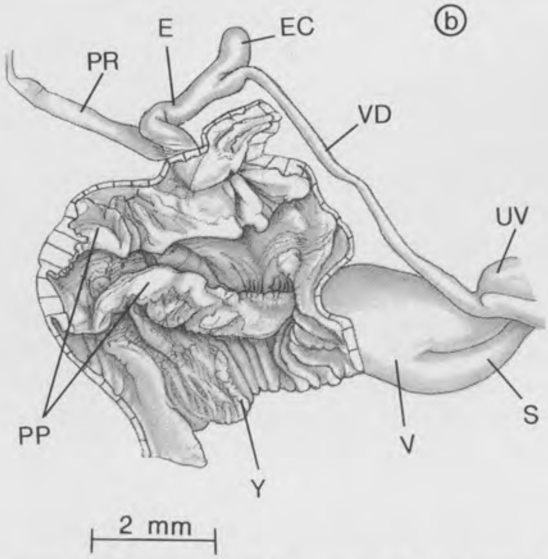


Fig. 297: Genitalia of *Basedowena cottoni* (Iredale, 1937): WA-892, rockhole above Angatja homestead, E end of Mann Ranges, SA. 11 May 1983. FMNH 212248. (a) whole genitalia, Dissection B; (b) interior of penis and vagina, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

pustules, relatively widely spaced, and occasional patches of weak radial ridgelets. Umbilicus closed or at most a slight lateral crack, caused by reflection of the columellar lip (**Fig. 295f**). Body whorl descending sharply just behind aperture. Lip well expanded on palatal and basal margins, columellar lip rolled over umbilical crack. Parietal wall with at most a weak callus. Shell colour yellow-brown on spire and most of base, lighter in tone around umbilicus. Based on 116 measured adults.

Genitalia (**Figs 297a-b**) with vagina (V) equal in length to globular penis, expanded apically, free oviduct (UV) short, partly wound around narrow shaft of spermatheca (S), which becomes wider apically. Head of spermatheca extends more than half way up prostate-uterus. Vas deferens (VD) very slender, entering laterally on large epiphallic caecum (EC). Epiphallus (E) proportionately long, entering very thin penis sheath (PS) apically after circling penial retractor muscle (PR) and then entering penis (P) at point where penial retractor muscle attaches. Penis short, nearly globular. Internally (**Fig. 297b**) with large U-shaped main pilaster (PP), with one arm reduced and apical portion both crenulated and flattened. Reduced arm extends up partly under massive foliated pilaster that surrounds epiphallic pore. A few accessory ridges on wall opposite U-pilaster. Vagina initially with larger folds extending up from atrium (Y), soon changing to extremely narrow ridges.

Central and lateral teeth of radula (**Plate 129a, c**) with massive basal support ridge, small anterior flare, high cusp shaft angle, and very slight cusp curvature to the bluntly pointed cusp tip. Late laterals (**Plate 129b, d**) with larger anterior flare, cusp tip blunter, ectocone appearing abruptly and with short lateromarginal transition zone. Jaw typical.

Discussion

Basedowena cottoni Iredale, 1937, described as coming from the Musgrave Ranges, was based upon a few dead and relatively worn examples. No specimens of *Basedowena* have been found in the Musgrave Ranges, where it appears to be replaced by *Tatemelon*. Initially I had thought that the name could be used for the Mt. Olga populations, but the differences in sculpture, shell shape, and umbilical closure were significant. In size, sculpture, and umbilical closure the holotype matches exactly the populations from the eastern tip of the Mann Ranges that have the nearly globular penis. Iredale (1937b: 52) mentioned that "a larger dead shell measures 24 mm. by 23 mm." Other examples from the type lot (SAM D14913) are also very large. I suspect that these large individuals, all of which are quite worn, probably are examples of *Basedowena gigantea*, collected from the outlying rock masses or after being washed down onto the intermediate plains areas. Thus I have deleted them from the summary of variation given above.

Local variation (**Plate 113**) is moderate. The allochronic collections from Piltardi Rockhole differ significantly in size, and there are equivalent differences among the Angatja populations.

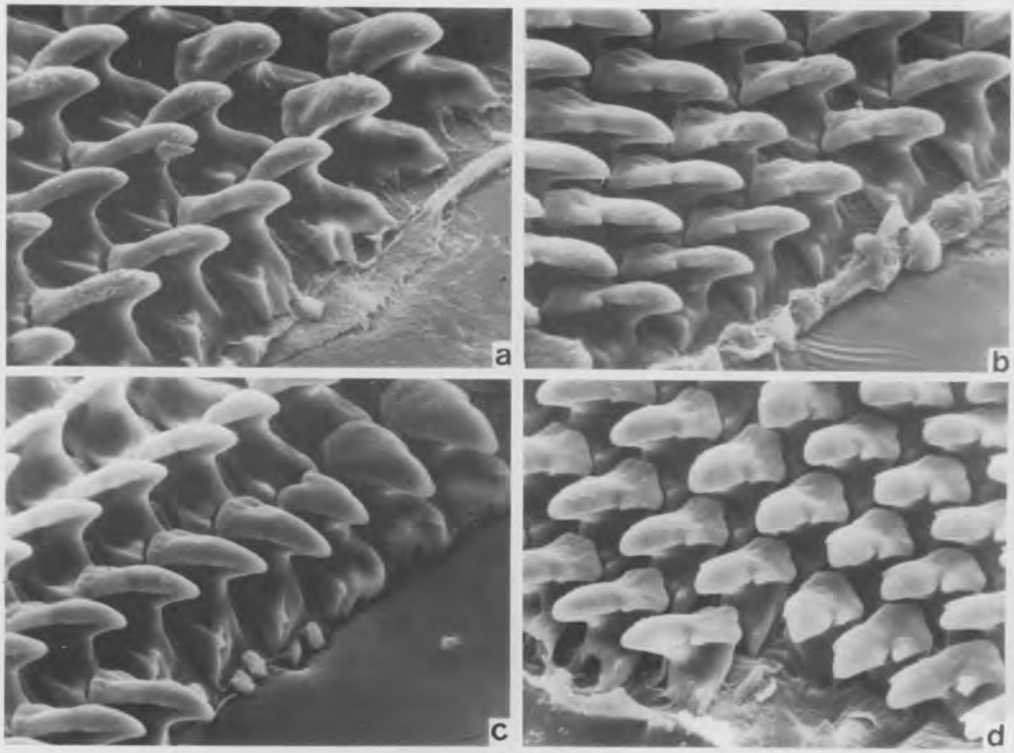


Plate 129: Radular teeth of *Basedowena cottoni* Iredale, 1937: (a-b) WA-891, 1.7 km from Angatja homestead, Mann Ranges, SA. 11 May 1983. FMNH 212243, Dissection A. a is central and early laterals at 520X, b is lateromarginal transition at 530X; (c-d) WA-892, 0.5 km above Angatja homestead, Mann Ranges, SA. 11 May 1983. FMNH 212248, Dissection A. c is central and laterals at 495X, d is lateromarginal transition at 530X.

BASEDOWENA GIGANTEA, SP. NOV.

(Plates 123a-b, 130d-f, 131a-c; Figs 298a-c, 299a-c)

Comparative remarks

Basedowena gigantea, sp. nov., known from the S side of the Mann Ranges (**Maps 10-11**) between Njungunja Rockhole (WA-890) at the eastern end to Lake Wilson (WA-897) near the western tip,is the largest species (mean diameter 21.64 mm) of *Basedowena*. It has a very high spire (**Fig. 298b**, mean H/D ratio 0.932), the umbilicus is reduced to a lateral crack (**Fig. 298c**) or closed, and the microsculpture consists of dense pustules (**Plate 123a-b**). The most similar species, *B. vulgata*, sp. nov., which ranges through the Tomkinson Ranges, SA and Hinckley Ranges, WA, is slightly smaller (mean diameter 19.08 mm), tends to have the umbilicus closed more often, and the microsculpture is less prominent (**Plate 123c-d**). In shape and colour the shells are essentially identical. *B. cottoni* Iredale, 1937, known from the main mass at the eastern end of the Mann Ranges, is the same size as *B. vulgata*, but the peculiar pattern of umbilical closure (**Fig. 295f**), reduced size of the pustules (**Plate 122e-f**), and lessened frequency of radial ridgelets are the main shell differences. The remaining taxa either have an open umbilicus, (*B. squamulosa* (Tate, 1894), *B. cognata*, sp. nov., and *B. katjawarana*, sp. nov.); reduced sculpture (**Plate 124c-d**) and a lower spire (mean H/D ratio 0.831) (*B. papulankutjana*); a much lower spire (mean H/D ratio 0.774) and red spiral colour bands (*B. elderi* [Bednall, 1892]); or are much smaller (mean diameter 17.52 mm) and with a narrowly expanded shell lip (**Figs 295a-c**) (*B. olgana*). Anatomically (**Figs 299a-c**) the long and slender penis (P) with swollen apex, long free oviduct (UV), low position of the spermathecal head (S), and narrow main pilaster (PP) that is well below the foliated pilaster in the penis chamber, are diagnostic. *B. cottoni* to the N has an almost globose penis (**Figs 297a-b**) that equals the vagina in length, while the large U-pilaster and foliated pilaster are jammed together, completely filling the penis chamber. *B. vulgata* to the W differs most obviously in its medium length penis (P) that tapers apically, combined with the unusual side pocket of the main pilaster and the foliated pilaster touching the top of the U-pilaster (**Figs 300a-c**). *B. olgana* also differs in its very short, globular penis and altered penis chamber pilaster structures (**Figs 296a-e**).

Holotype

SAM D17862, WA-898, Katjawara Soak, SW end of Mann Ranges, South Australia, Australia (Mann 1:250,000 map sheet SG52-11 - 254:764yds). 26° 02' 43" S, 129° 40' 03" E. Collected by the Central Australian Expedition 12 May 1983. Height of shell 22.5 mm, diameter 23.7 mm, H/D ratio 0.949, whorls 5 1/8-, umbilicus a narrow lateral crack.

Paratopotypes

SAM D17894, WAM 614.87, AM, QM, FMNH 212261, FMNH 212264, 3 LA, 9 DA, 1 LJ, 5 DJ from the type locality.

Paratypes

South Australia

MANN RANGES: Njungunja Rockhole (WA-890, under figs, SAM D17899-900, WAM 618.87, WAM 619.87, AM, QM, MV, FMNH 212241-2, 38 LA, 5 DA, 22 LJ, 13 DJ); E tip of Mann Range (WA-889, 10.2 road km from Angatja fence, SAM D17901, FMNH 212240, 1 DA, 6 DJ); S tip of Mann Range (WA-893, under figs on outlying rock exposures S of track, just W of Piltardi Rockhole Creek, SAM D17902, WAM 620.87, AM, FMNH 212249-51, 14 LA, 1 DA, 13 LJ, 2 DJ); 2.3 km E of Pakiwandi Creek (WA-894, S fringes Mann Range, SAM D17896, FMNH 212252-3, 3 LA, 2 DA, 2 LJ, 1 DJ); W side of Pakiwandi Creek Valley (WA-896, under fig, AM, FMNH 219032, FMNH 212256, 3 LA, 2 DA, 3 LJ, 1 DJ); outlier at SW end of Mann Range (WA-900, under figs, FMNH 212271-2, 2 LA, 1 DA, 3 LJ, 3 DJ); ridge of Mann Range 2.8 km W of Katjawara Soak (WA-899, under figs, SAM D17895, WAM 615.87, AM, QM, MV, FMNH 212266, FMNH 212269, 12 LA, 5 DA, 14 LJ, 3 DJ); small bluff at NE corner of Lake Wilson (WA-897, SW corner Mann Ranges, SAM D17897-8, WAM

616.87, WAM 617.87, AM, QM, MV, FMNH 212258, FMNH 212260, 18 LA, 20 DA, 14 LJ, 25 DJ); outlier at SW end of range (WA-900, AM, FMNH 212271-2, 2 LA, 2 DA, 3 LJ, 2 DJ).

Range

All known localities for *Basedowena gigantea*, sp. nov., are from isolated outliers or the tips of the Mann Ranges, SA (**Maps 10-11**) between Njungunja Rockhole on the E and Lake Wilson on the W. The few main mass inland localities have yielded only *B. cottoni* Iredale, 1937 at the eastern end, or *B. katjawarana*, sp. nov., in the central portion (WA-896) or western end (WA-898), where the latter has been taken microsympatrically with *B. gigantea*. There are no collecting records from the peaks or the N side of the Mann Ranges. Hence delineation of actual ranges is not possible.

Diagnosis

Shell very large, adult diameter 17.7-26.75 mm (mean 21.64 mm), with 4 1/8+ to 5 1/2+ (mean 5 1/8) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 298b**), shell height 16.05-26.55 mm (mean 20.19 mm), H/D ratio 0.804-1.080 (mean 0.932). Body whorl rounded, without trace of angulation. Shell apex (**Plate 123a**) with dense pustulations that become elongated near beginning of spire, body whorl and spire (**Plate 123b**) with large, crowded pustules often surmounting variable radial ridgelets. Umbilicus normally a slight lateral crack (**Fig. 298c**), partly closed by reflection of columellar lip. Body whorl descending moderately to sharply just behind aperture. Lip strongly expanded on palatal and basal margins, columellar lip expansion greater, with some thickening and considerable reflection over umbilicus. Parietal wall with a weak callus. Shell colour brownish yellow to brown, lighter around umbilicus. Based on 137 measured adults.

Genitalia (**Figs 299a-c**) with vagina (V) short, moderately swollen, free oviduct (UV) long and slender, partly wound around shaft of spermatheca (S). Latter tapers from base to head, which lies next to prostate-uterus base. Vas deferens (VD) slender, entering prominent epiphallic caecum (EC) laterally. Epiphallus (E) long, entering thin penis sheath (PS) at apex, after partly circling penial retractor muscle (PR). Penis (P) elongated, usually with apex swollen. Internally (**Figs 299b-c**) with main pilaster (PP) narrowed to a V-shape, a section of simple wall pilasters between main pilaster apex and beginning of foliated pilaster around epiphallic pore. Rest of penis chamber walls with simple longitudinal folds.

Central and lateral teeth of radula (**Plates 130d, 131a-b**) with massive basal support ridge, small anterior flare, high cusp shaft angle, slight to almost no cusp curvature to pointed tip. Lateromarginal transition (**Plate 130e, 131c**) typical. Jaw (**Plate 130f**) with most of lateral margins without vertical ribs.

Discussion

Basedowena gigantea, sp. nov., has been collected microsympatrically with *B. katjawarana*, sp. nov., at stations WA-896 and WA-898. Only dead examples of *gigantea* were collected at the former station. Dissection of specimens from WA-890,

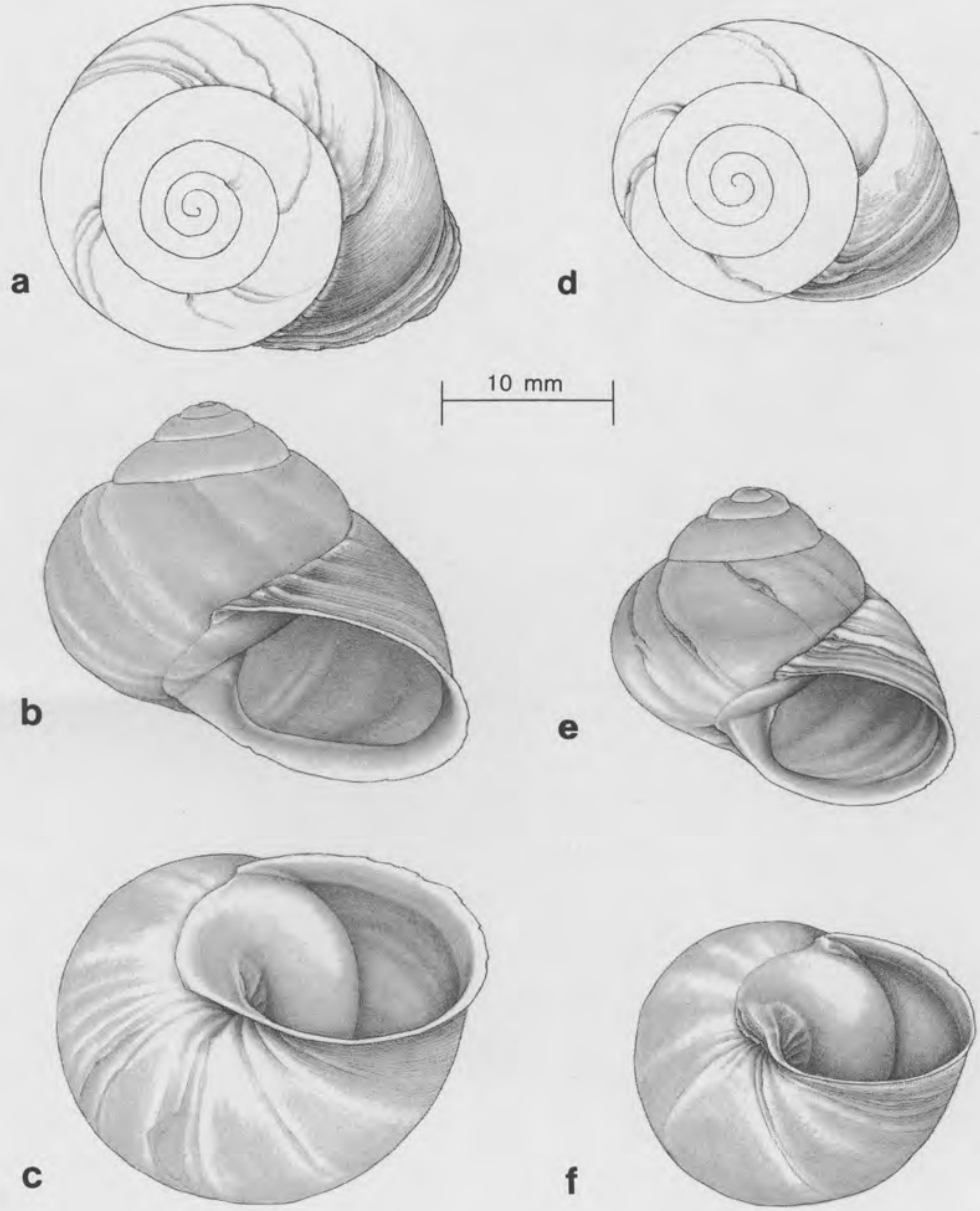


Fig. 298: Shells of *Basedowena gigantea*, sp. nov., and *B. vulgata*, sp. nov.: (a-c) Holotype of *B. gigantea*. SAM D17862. WA-898, Katjawara Soak, SW end of Mann Ranges, SA; (d-f) Holotype of *B. vulgata*. SAM D17863. WA-906, outlier of Mt. Davies, Tomkinson Ranges, SA. Scale line equals 10 mm. Drawings by Linnea Lahlum.

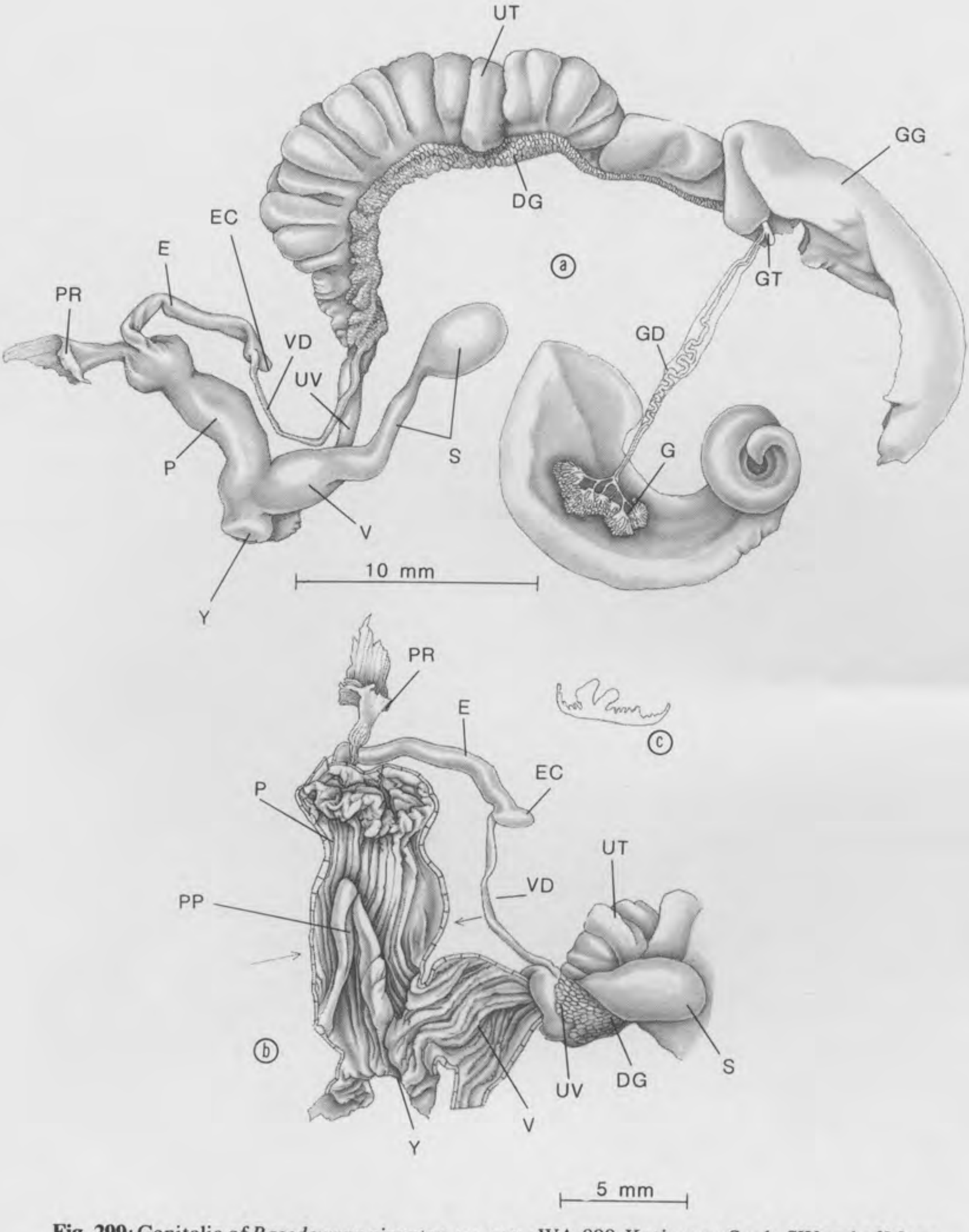


Fig. 299: Genitalia of *Basedowena gigantea*, sp. nov.: WA-898, Katjawara Soak, SW end of Mann Ranges, SA. 12 May 1983. FMNH 212264. (a) whole genitalia, Dissection B; (b) interior of penis complex, Dissection A; (c) cross-section through main pilaster (PP). Scale lines as marked. Drawings by Linnea Lahlum.

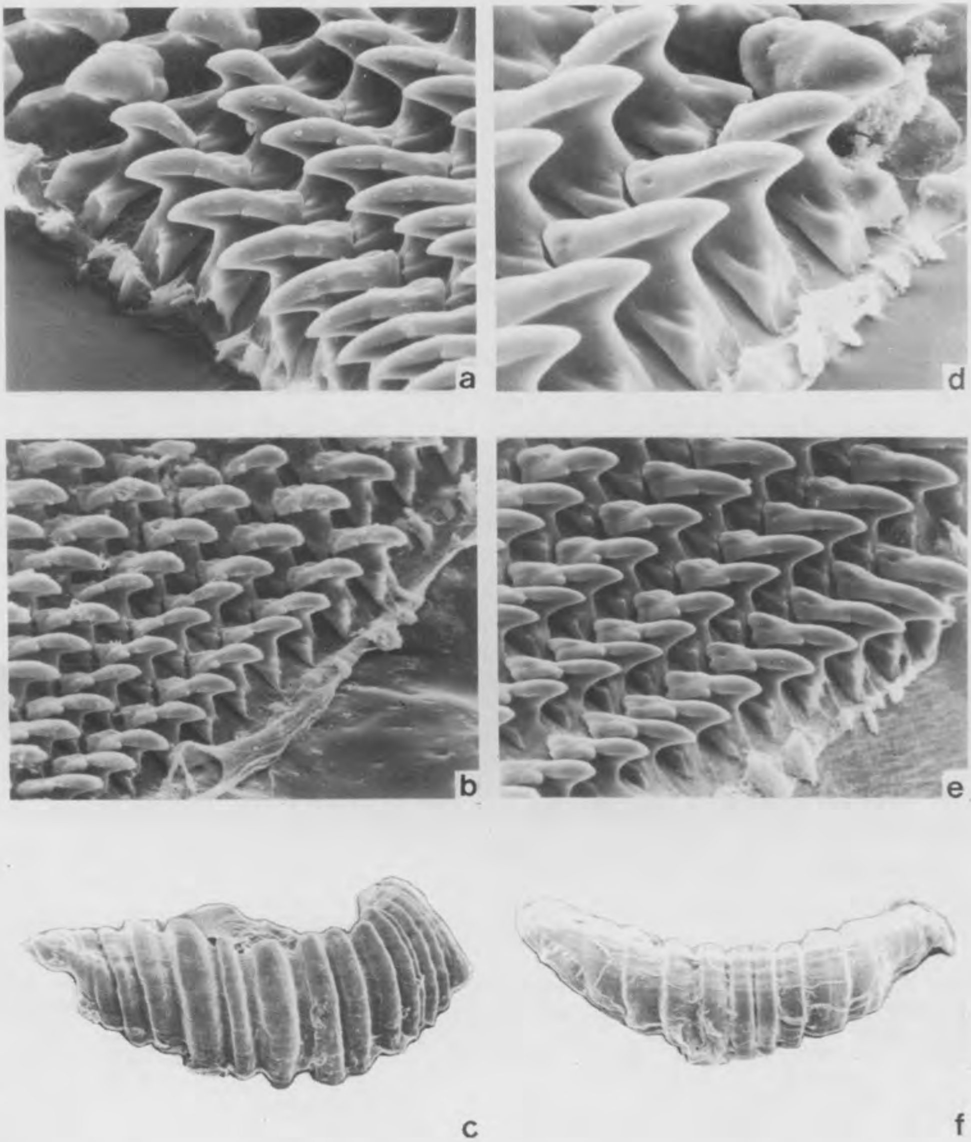


Plate 130: Radular teeth and jaw of sympatric examples of *Basedowena katjawarana* and *B. gigantea*: (a-c) *B. katjawarana*. WA-898, Katjawara Soak, SW end of Mann Ranges, SA. 12 May 1983. FMNH 212263, Dissection B. a is central and laterals at 610X, b is lateromarginal transition at 370X, c is jaw at 58X; (d-f) *B. gigantea*. WA-898, Katjawara Soak, SE end of Mann Ranges, WA. 12 May 1983. FMNH 212264, Dissection A. d is central and early laterals at 610X, e is lateromarginal transition at 370X, f is jaw at 31.5X.

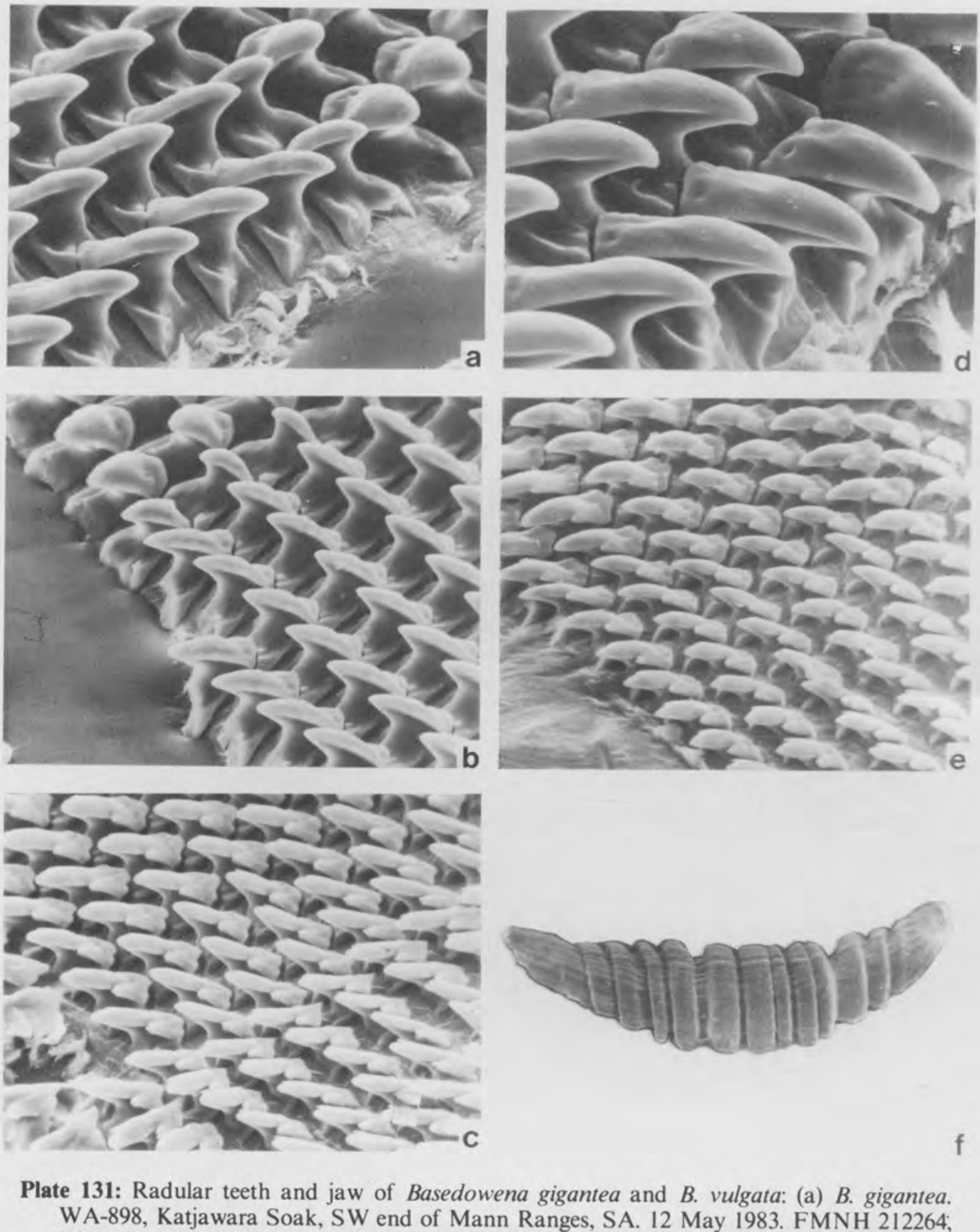


Plate 131: Radular teeth and jaw of *Basedowena gigantea* and *B. vulgata*: (a) *B. gigantea*. WA-898, Katjawara Soak, SW end of Mann Ranges, SA. 12 May 1983. FMNH 212264; Dissection B. central and early laterals at 465X; (b-c) *B. gigantea*. WA-890, Njungunga Rockhole, SE tip of Mann Ranges, SA. 11 May 1983. FMNH 212242, Dissection A. b is central and early laterals at 365X, c is lateromarginal transition at 365X; (d-f) *B. vulgata*. WA-906, Mt. Davies, Tomkinson Range, SA. 13 May 1983. FMNH 212292, Dissection A. d is central and early laterals at 670X, e is lateromarginal transition at 345X, f is jaw at 37X.

WA-893, WA-894, WA-898, WA-900, WA-899, and WA-897 showed a nearly uniform penis structure. Examples from WA-890, the isolated Njungunja Rockhole, had the penis noticably shorter, but with the same internal structure. Shells from this station also were noticably smaller (mean diameters 19.17 and 18.46 mm) and with low (mean 5) whorl count (**Table 114**). There was no indication that the penis was more elongated at WA-898, the only point of sympatry with another species.

There may be minor differences in radular teeth between specimens from populations where *B. gigantea* is the only species present (WA-890), and where it is sympatric with *B. katjawarana* (WA-898). Early lateral teeth from the latter station (**Plates 130d, 131a**) have a slightly higher cusp shaft angle, less cusp tip curvature, a less prominent anterior flare, and a more massive basal support ridge than in material from the former station (**Plate 131b**). Time did not permit study of sufficient specimens for statistical analysis, but this would be a worthwhile project for investigation. The differences in rate of lateromarginal transition (compare **Plates 130e, 131c**) are within observed limits of populational variation. Differences between the cutting teeth of *B. gigantea* and *B. katjawarana* discussed below.

Table 114: Local Variation in *Basedownea gigantea*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
WA-890, FMNH 212242	38L	17.51±0.109 (16.45-19.4)	19.17±0.103 (17.7-20.4)	0.914±0.005 (0.855-0.986)	5 (4½+-5⅛+)
WA-890, FMNH 212241	5D	17.06±0.437 (16.4-18.75)	18.46±0.255 (17.95-19.4)	0.923±0.011 (0.901-0.966)	5 (4⅞--5⅛-)
WA-893, FMNH 212249	14L	18.60±0.202 (17.05-19.55)	20.25±0.277 (18.4-22.05)	0.920±0.008 (0.863-0.960)	5+ (4¾+-5⅛+)
WA-897, FMNH 212260	18L	22.81±0.327 (20.75-26.55)	24.09±0.256 (21.4-26.35)	0.947±0.008 (0.905-1.026)	5¼ (5+-5½+)
WA-897, FMNH 212258	20D	23.10±0.279 (20.65-25.15)	24.20±0.285 (22.3-26.75)	0.955±0.010 (0.889-1.086)	5¼ (5⅛--5⅜+)
WA-898 FMNH 212261	10D	21.54±0.375 (20.1-23.95)	22.63±0.359 (20.95-24.25)	0.953±0.012 (0.897-1.018)	5¼ (5⅛--5⅜+)
WA-899 FMNH 212269	12L	21.83±0.302 (20.3-23.55)	22.99±0.223 (22.15-24.25)	0.950±0.010 (0.896-1.032)	5¼- (5⅛+-5½-)
WA-899 FMNH 212266	5D	21.28±0.452 (19.95-22.55)	23.27±0.703 (20.6-24.55)	0.916±0.015 (0.890-0.968)	5¼+ (5¼--5⅜+)

The smallest examples, from the isolated Njungunya Rockhole (WA-890), have been discussed above. Specimens from WA-893, situated on a southeastern outlier of the Mann Ranges, were intermediate in size (mean diameter 20.25 mm) and whorl count (mean 5+). The limited material from WA-894 and WA-896 averaged 19.95 mm in diameter, with 5 1/8- whorls. Specimens from Katjawara Soak, at the foot of the Mann Range (WA-898), and near Lake Wilson (WA-897, WA-899) were very large (**Table 114**).

The above documented apparent size increase from E to W needs confirmation by additional field work. The smaller sized shells to the E came from small and isolated rock masses, where small size would be anticipated. The intermediate sized examples from the Pakiwandi Creek area were from "main mass" areas, while the larger sized individuals from the W were taken near a soak and Lake Wilson, areas that, at least occasionally, would remain moist for significant periods, permitting growth to a large size. Until more collections have been made from the main mass and N side of the Mann Ranges, interpretation of this variation should be left open. The apparent geographic cline may simply reflect differences in local ecology and biased collecting effort.

The name *gigantea* refers to the very large size of the shell in this species.

BASEDOWENA VULGATA, SP. NOV.
(Plates 123c-d, 131d-f; Figs 298d-f, 300a-c)

Comparative remarks

Basedowena vulgata, sp. nov., from the Tomkinson Ranges, SA and Hinckley Range, WA (**Maps 10-11**), is slightly smaller (**Table 112**) and with weaker pustules (**Plate 123**) than *B. gigantea*, sp. nov., from the Mann Ranges. In addition, the umbilicus normally differs in that specimens of *B. vulgata* (**Fig. 298f**) tend to have it closed, while examples of *B. gigantea* (**Fig. 298c**) tend more to having it narrowly open. *B. cottoni* Iredale, 1937, from the eastern Mann Ranges, is essentially identical in size and shape (**Table 112**), but has a very unusual angled closure of the umbilicus (**Fig. 295f**) and noticably reduced microsculpture (**Plate 122e-f**). *B. olgana*, sp. nov., from Mt. Olga and Mt. Conner, is slightly smaller (**Table 112**) and has very large microsculpture (**Plate 122d**). The smaller (**Table 112**), umbilicated species, *B. squamulosa* (Tate, 1894), *B. cognata*, sp. nov., and *B. katjawarana*, sp. nov., also have much lower spires. *B. papulankutjana*, sp. nov., from the Blackstone Range, has essentially lost its pustulations (**Plate 124c-d**) and is much smaller, while *B. elderi* (Bednall, 1892), from the Birksgate Range, is small and has red spiral colour bands. Anatomically (**Figs 300a-c**), *B. vulgata* has a very short vagina (V), the free oviduct (UV) and spermathecal shaft (S) wind around each other, and the penis (P) varies in shape from near globose to moderately elongated and swollen above. The penis chamber has a short U-pilaster with a prominent lateral pocket (**Fig. 300b**), and, directly above it, a massive foliated pilaster around the epiphallic pore. *B. gigantea* differs most obviously in its very long and slender penis with swollen apex (**Fig.**

299a), reduction of the main pilaster to a slender V-form (**Fig. 299b**), and clear separation of the foliated and main pilasters by an area of chamber wall. *B. olgana* (**Figs 296a-e**) has a globose penis with the foliated pilaster lateral to the U-pilaster, while *B. cottoni* (**Figs 297a-b**) has a relatively long vagina, a globose penis, and the main pilaster lacks the side pocket found in *B. vulgata*.

Holotype

SAM D17863, WA-906, S facing hillside on outlier of Mt. Davies, Tomkinson Ranges, South Australia, Australia (Mann 1:250,000 map sheet SG52-11 - ca 215:748yds). 26° 10' 19" S, 129° 18' 18" E. Collected by the Central Australian Expedition 13 May 1983. Height of shell 18.85 mm, diameter 19.3 mm, H/D ratio 0.977, whorls 4 3/4-, umbilicus closed by reflection of columellar lip.

Paratopotypes

SAM D17884-5, WAM 605.87, WAM 606.87, AM, QM, MV, FMNH 212292-3, 31 LA, 6 DA, 6 LJ, 4 DJ from the type locality.

Paratypes

South Australia

TOMKINSON RANGES: E outlier of Tomkinson Range (WA-902, under figs on high, isolated ridge 14 road km S of Lake Wilson, SAM D17889, WAM 610.87, AM, QM, MV, FMNH 212278-9, 16 LA, 4 DA, 70 LJ, 11 DJ); rocks by Kapi Kunatjulda Soak (WA-903, 20 km SW of Lake Wilson, SAM D17888, WAM 609.87, AM, QM, MV, FMNH 212281-2, 66 LA, 22 LJ, 9 DA, 5 DJ); hills ca 22 km SW of Lake Wilson (WA-904, under figs, SAM D17886, WAM 607.87, AM, QM, MV, FMNH 212284-5, 37 LA, 1 DA, 25 LJ, 5 DJ); N of Gosse Pile (WA-905, under figs on isolated knob, SAM D17890, WAM 611.87, AM, QM, MV, FMNH 212288, FMNH 212291, 7 LA, 7 DA, 18 LJ, 6 DJ); 4.1 km E of Pipalyatuara (= Mount Davies Camp) (WA-907, under isolated fig on N facing slope, SAM D17891, AM, FMNH 212295-6, 2 LA, 4 DA, 3 DJ); 5 miles NW of Mt. Davies Camp (27 August 1969, WAM, 2 DA); Mt. Davies (AM, 4 DA, 1 DJ); 26 miles NW of Mt. Davies (29 August 1972, WAM, 13 DA, 4 DJ).

Western Australia

HINCKLEY RANGE: N edge of Hinckley Range (WA-908, W of Wingelinna, WAM 608.87, SAM D17887, AM, QM, MV, FMNH 212297-8, 42 LA, 1 DA, 26 LJ, 3 DJ; WA-908A, under one boulder, 0.5 km E, SAM D17882-3, WAM 603.87, WAM 604.87, AM, QM, MV, FMNH 212299-300, 83 LA, 11 DA, 53 LJ, 11 DJ); W end of Hinckley Range (WA-909, under rocks at top of hill, WAM 602.87, SAM D17881, AM, QM, MV, FMNH 212301, 23 LA, 9 LJ).

Range

Basedowena vulgata, sp. nov., has been found (**Maps 10-11**) from the easternmost outliers of the Tomkinson Range in SA (WA-902, 129° 34' 43" E) to the western end of the Hinckley Range in WA (WA-909, 128° 41' 24" E), a linear distance of about 90 km. No collections have been made in such nearby areas as the Michael Hills to the S, or from Mt. Aloysius just to the W. Nor are any snails recorded from the scattered

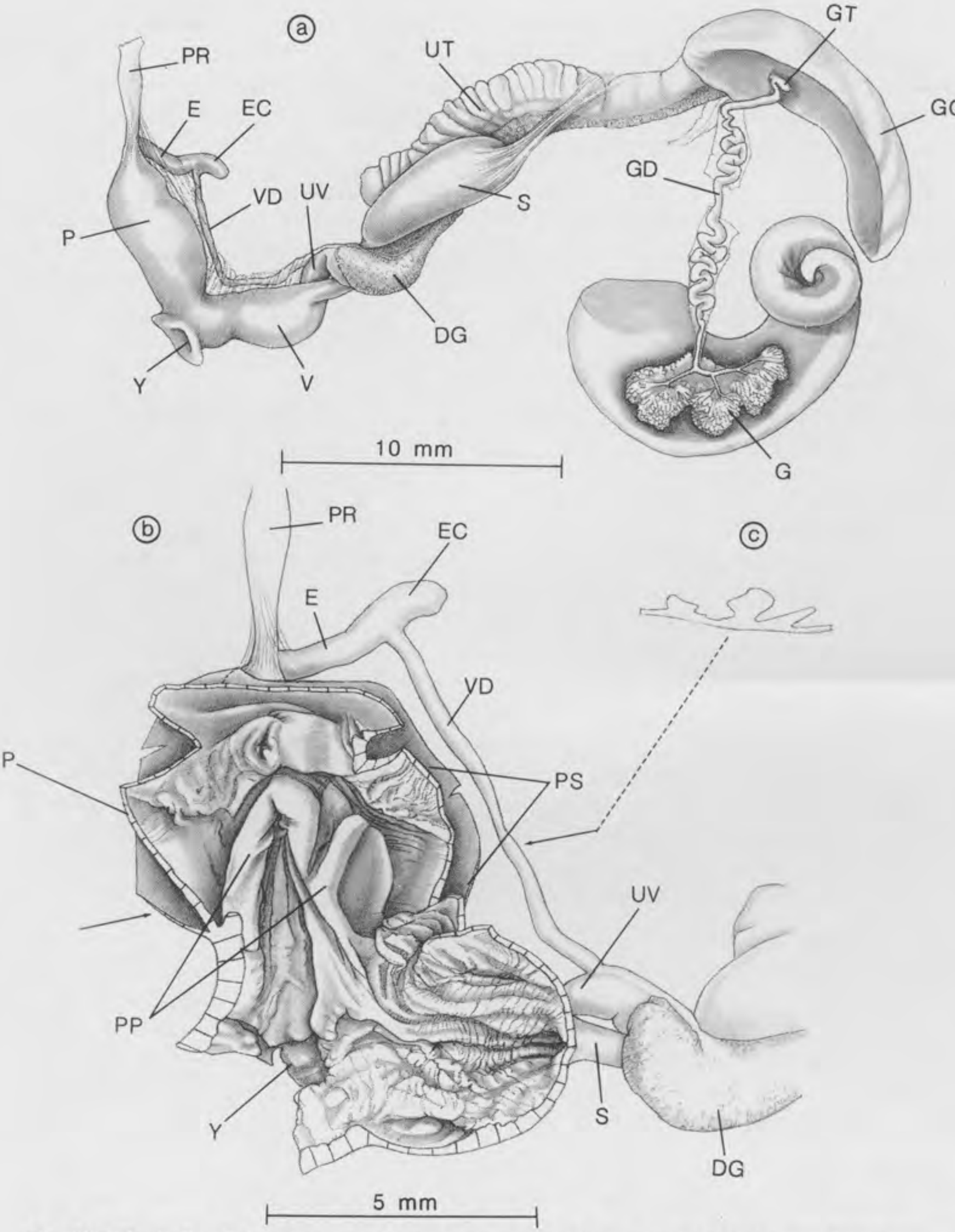


Fig. 300: Genitalia of *Basedowena vulgata*, sp. nov.: WA-906, outlier of Mt. Davies, Tomkinson Ranges, SA. 13 May 1983. FMNH 212292. (a) whole genitalia, Dissection B; (b) interior of penis and vagina, Dissection A; (c) cross-section through main pilaster (PP). Scale lines as marked. Drawings by Linnea Lahlum.

hills to the N (Murray Range, Morgan Range, Amy Giles Rocks, Mount Fanny, Mount Daisy Bates, Mt. Gosse, etc.). Thus the width of the range for this species is unknown.

Diagnosis

Shell large, adult diameter 15.9-22.5 mm (mean 19.08 mm), with 4+ to 5 3/8+ (mean 5) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 298d-f**), shell height 13.9-21.0 mm (mean 17.81 mm), H/D ratio 0.798-1.050 (mean 0.934). Body whorl rounded, without trace of angulation. Shell apex (**Plate 123c**) with low pustulations, becoming reduced on lower portion. Spire and body whorl (**Plate 123d**) with prominent micropustulations, often on top of irregular radial ridglets. Umbilicus usually closed by reflection of the columellar lip (**Fig. 298f**), or a very narrow lateral crack. Body whorl descending moderately to sharply behind aperture. Lip moderately to strongly expanded on palatal and basal margins, more sharply reflected and thickened on columellar margin. Parietal wall with thin callus. Shell colour brownish, lighter around umbilical area. Based on 388 measured adults.

Genitalia (**Figs 300a-c**) with very short vagina (V), lower part of spermathecal shaft enlarged, free oviduct (UV) and base of prostate-uterus wound around narrowed portion of spermathecal shaft. Head of spermatheca (S) starting above prostate-uterus base, extending well past middle. Vas deferens slender, entering large epiphallic caecum (EC) laterally. Epiphallus (E) relatively short, partly circling penial retractor muscle (PR) before passing through very thin penis sheath (PS) and entering penis next to muscle insertion. Penis (P) short to medium in length, near globose to tapering, wider apically. Penis chamber (**Fig. 300b-c**) with large U-shaped main pilaster (PP) narrowed and a big side pocket pilaster situated laterally. Foliated pilaster around epiphallic pore shortened in length, squeezed apically to circle apex of chamber. Few traces of longitudinal accessory ridges because of space limitations. Vagina (V) with prominent wall pilasters.

Central and lateral teeth of radula (**Plate 131d**) with massive basal plate support ridge, small anterior flare, normal cusp shaft angle, slight cusp tip curvature and bluntly pointed tip. Late laterals (**Plate 131e**) with enlarged anterior flare, lateromarginal transition typical. Jaw (**Plate 131f**) with prominent vertical ribs, absent from lateral margins.

Discussion

The conchological differences among *Basedowena olgana*, sp. nov., *B. cottoni* Iredale, 1937, *B. gigantea*, sp. nov., and *B. vulgata*, sp. nov., are trivial and observable only in fresh, fully grown adult specimens. New adults of *B. gigantea* and *B. vulgata*, for example, can show very similar umbilical shell features to those of *B. cottoni*. The anatomical differences are, in contrast, striking. They show no indication of intergradation. Both *B. cottoni* and *B. olgana* have globose penes: in *cottoni* the foliated pilaster lies ABOVE the main pilaster (**Fig. 297b**), while in *olgana* the foliated pilaster is LATERAL to the main pilaster (**Fig. 296e**). *B. vulgata* has a unique structure, the lateral pocket to the main pilaster (**Figs 300b-c**), with the penis itself

Table 115: Local Variation in *Basedowena vulgata*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height (in mm)	Shell Diameter (in mm)	H/D Ratio	Whorls
WA-902, FMNH 212279	16L	16.71±0.216 (14.85-17.75)	17.95±0.214 (16.85-19.75)	0.932±0.009 (0.849-0.991)	$4^{7}/_{8}$+ ($4^{3}/_{4}$-$5^{1}/_{8}$-)
WA-903, FMNH 212282	66L	17.63±0.096 (15.7-19.0)	18.39±0.075 (16.95-19.65)	0.959±0.004 (0.876-1.049)	5- ($4^{5}/_{8}$--$5^{1}/_{8}$+)
WA-903, FMNH 212281	9D	18.10±0.257 (17.1-19.15)	18.97±0.202 (18.15-20.05)	0.954±0.007 (0.917-0.984)	5 ($4^{7}/_{8}$+-$5^{1}/_{8}$+)
WA-904, FMNH 212284	37L	18.82±0.153 (17.5-20.85)	19.69±0.120 (18.3-22.5)	0.956±0.005 (0.900-1.033)	5+ ($4^{7}/_{8}$--$5^{1}/_{4}$+)
WA-905, FMNH 212291	7L	18.92±0.344 (18.1-20.85)	19.64±0.332 (18.3-20.9)	0.963±0.009 (0.926-0.998)	$4^{7}/_{8}$+ ($4^{3}/_{4}$--$5^{1}/_{8}$-)
WA-905, FMNH 212288	7D	19.23±0.264 (18.15-20.5)	20.14±0.204 (19.5-21.15)	0.954±0.007 (0.929-0.982)	5 ($4^{7}/_{8}$--$5^{1}/_{4}$-)
WA-906, FMNH 212292	32L	19.19±0.162 (16.7-21.0)	19.91±0.144 (18.1-22.25)	0.964±0.006 (0.902-1.048)	5 ($4^{3}/_{4}$+-$5^{1}/_{8}$+)
WA-906, FMNH 212293	6D	18.95±0.281 (18.3-20.0)	19.69±0.315 (18.55-20.7)	0.963±0.012 (0.914-0.987)	5- ($4^{3}/_{4}$--$5^{1}/_{8}$-)
WA-908, FMNH 212297	42L	17.56±0.108 (16.0-19.15)	19.27±0.113 (18.0-20.95)	0.912±0.005 (0.848-0.978)	5+ ($4^{3}/_{4}$--$5^{1}/_{4}$+)
WA-908A, FMNH 212300	83L	17.25±0.081 (15.4-19.15)	19.14±0.070 (17.55-20.5)	0.901±0.004 (0.798-0.980)	5 ($4^{3}/_{4}$--$5^{1}/_{4}$-)
WA-908A, FMNH 212299	11D	17.21±0.275 (15.6-18.55)	19.45±0.243 (18.1-20.3)	0.885±0.013 (0.817-0.962)	$5^{1}/_{8}$- ($4^{7}/_{8}$+-$5^{1}/_{4}$+)
WA-909 FMNH 212301	23L	17.81±0.184 (16.3-19.4)	19.2±0.156 (17.15-20.6)	0.928±0.010 (0.856-1.017)	$5^{1}/_{8}$ (5--$5^{3}/_{8}$+)
Mann Ranges, 21-VII-63, WAM	12D	18.59±0.186 (17.5-19.9)	19.67±0.178 (16.7-21.6)	0.948±0.013 (0.898-1.048)	$4^{7}/_{8}$+ ($4^{7}/_{8}$--5+)
Hinckley Ranges, 29-VIII-72, WAM	13D	18.35±0.207 (17.25-20.25)	19.38±0.198 (18.4-21.0)	0.948±0.008 (0.888-1.000)	5- ($4^{3}/_{4}$+-$5^{1}/_{4}$)

ranging from short and nearly globose to moderately elongated. *B. gigantea* is immediately recognizable by its long and slender penis, expanded apically, the U-pilaster narrowed to a V-shape, and distinct separation of the main and foliated pilasters by a section of chamber wall (**Figs 299a-c**).

Most populations of *Basedowena vulgata* had a mean diameter in the 19-20 mm size range (**Table 115**). The easternmost samples (WA-902-3), from outliers of the Tomkinson Ranges, were slightly smaller in size and whorl count. This probably reflects dryer local habitat and thus minor dwarfing.

The name *vulgata*, meaning common, refers to both the generally great local abundance of this species and the fairly extensive known linear range.

BASEDOWENA KATJAWARANA, SP. NOV.

(Plates 124a-b, 130a-c; Figs 301a-c, 302a-d)

Diagnosis

Basedowena katjawarana, sp. nov., from the central and W portions of the Mann Ranges, SA (**Maps 10-11**), is immediately recognizable by its small size (mean diameter 16.21 mm), low spire (**Fig. 301b**, H/D ratio 0.817), and narrowly open umbilicus (**Fig. 301c**, mean D/U ratio 9.44). The sometimes sympatric *B. gigantea*, sp. nov., is much larger (mean diameter 21.64 mm), has a very high spire (**Fig. 298b**, mean H/D ratio 0.932), and the umbilicus is at most a lateral crack (**Fig. 298c**). The only other umbilicated species are readily separated: *B. cognata*, sp. nov., from the Schwerin Mural Crescent, WA and Petermann Ranges, NT, has greatly reduced micropustulations (compare **Plate 122a-b, 124a-b**) and a slightly lower whorl count; *B. squamulosa* (Tate, 1894), from the Krichauff and James Ranges, NT, has a very low spire (**Fig. 292b**, mean H/D ratio 0.652), a much wider umbilicus (**Fig. 292c**, mean D/U ratio 7.60), almost no expansion of the palatal and basal lips, and a microsculpture of curved pustules (**Plate 121b-c**); *B. elderi* (Bednall, 1892), from the Birksgate Range, SA, has red spiral colour bands (**Figs 304a-c**) and only weak traces of micropustulations on the lower spire and body whorl (**Plate 126c**). The other species have very high spires and closed or nearly closed umbilici. Anatomically (**Figs 302a-c**), *B. katjawarana* has a relatively long vagina (V), the long penis (P) tapers apically, and the wall sculpture of the penis chamber shows two specializations: the U-shaped main pilaster has a high apical extension that reaches the foliated pilaster, and the foliated pilaster around the epiphallic pore is relatively thin. The only other species with elongated penis, *B. gigantea*, has the penis expanded apically (**Fig. 299a**), the main pilaster is simple and narrowed to a V-shape, there is a section of chamber wall between the foliated pilaster and the main pilaster (**Fig. 299b**), and the foliated pilaster itself is thickened and complexly folded. Other species have much shortened penial complexes.

Holotype

SAM D17864, WA-898, under figs at Katjawarana Soak, SW end of Mann Ranges, South Australia, Australia (Mann 1:250,000 map sheet SG52-11 - 254:764yds).

26° 02' 43" S, 129° 40' 03" E. Collected by the Central Australian Expedition 12 May 1983. Height of shell 13.15 mm, diameter 16.05 mm, H/D ratio 0.819, whorls 4 5/8+, umbilical width 1.65 mm, D/U ratio 9.73.

Paratopotypes

SAM D17872-3, WAM 592.87, AM, FMNH 212262-3, 3 LA, 5 DA, 4 DJ from the type locality.

Paratypes

South Australia

MANN RANGES: Pakiwandi Creek Valley (WA-896, under fig on W side, SAM D17876, WAM 595.87, AM, FMNH 212257, 3 DA, 4 DJ); ridge of Mann Range (WA-899, 2.8 km W of Katjawara Soak, under figs, SAM D17876-7, WAM 593.87, WAM 594.87, AM, QM, MV, FMNH 212267-8, 21 LA, 6 DA, 9 LJ, 6 DJ).

Range

Basedowena katjawarana, sp. nov., has been found on the S side of the Mann Ranges, SA (**Maps 10-11**) in the valley of Pakiwandi Creek and the vicinity of Katjawara Soak. The former is in the middle of the Mann Ranges, the latter near the SW corner. The localities are less than 30 km apart. All collections were from edges of the main mass, not from outlying, isolated outcrops. In the absence of collections from the peaks and north slopes of the Mann Ranges, the true extent of its range will remain unknown.

Diagnosis

Shell fairly small, adult diameter 14.9-17.5 mm (mean 16.21 mm), with 4 3/8+ to 5 1/4- (mean 4 7/8+) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 301b**), shell height 11.9-14.5 mm (mean 13.24 mm), H/D ratio 0.755-0.884 (mean 0.817). Body whorl rounded, without trace of angulation. Shell apex (**Plate 124a**) with fine, elongated pustules. Spire and body whorl (**Plate 124b**) with very prominent pustules along irregular radial ridgelets. Umbilicus narrowly open (**Fig. 301c**), not decoiling, partly narrowed by reflection of columellar lip, width 1.2-2.4 mm (medan 1.75 mm), D/U ratio 6.86-13.3 (mean 9.44). Body whorl descending moderately just behind aperture. Lip broadly expanded on palatal and basal margins, columellar lip edge partly rolled. Parietal wall narrow because of aperture descension, some specimens with a raised callus edge. Shell colour yellow-brown, lighter on base. Based on 39 measured adults.

Genitalia (**Figs 302a-d**) with medium length and relatively slender vagina (V), free oviduct (UV) and shaft of spermatheca partly wound around each other, head of spermatheca (S) against base of prostate-uterus. Vas deferens (VD) slender, entering large epiphallic caecum (EC) laterally. Epiphallus (E) fairly short, partly circling penial retractor muscle (PR) before passing through thin penis sheath (PS) and then entering penis next to attachment point of muscle. Penis (P), long, slender, tapering apically. Penis chamber with the high (**Fig. 302d**) main pilaster (PP) having a modified U-shape, with a high apical extension reaching to base of foliated pilaster. Walls

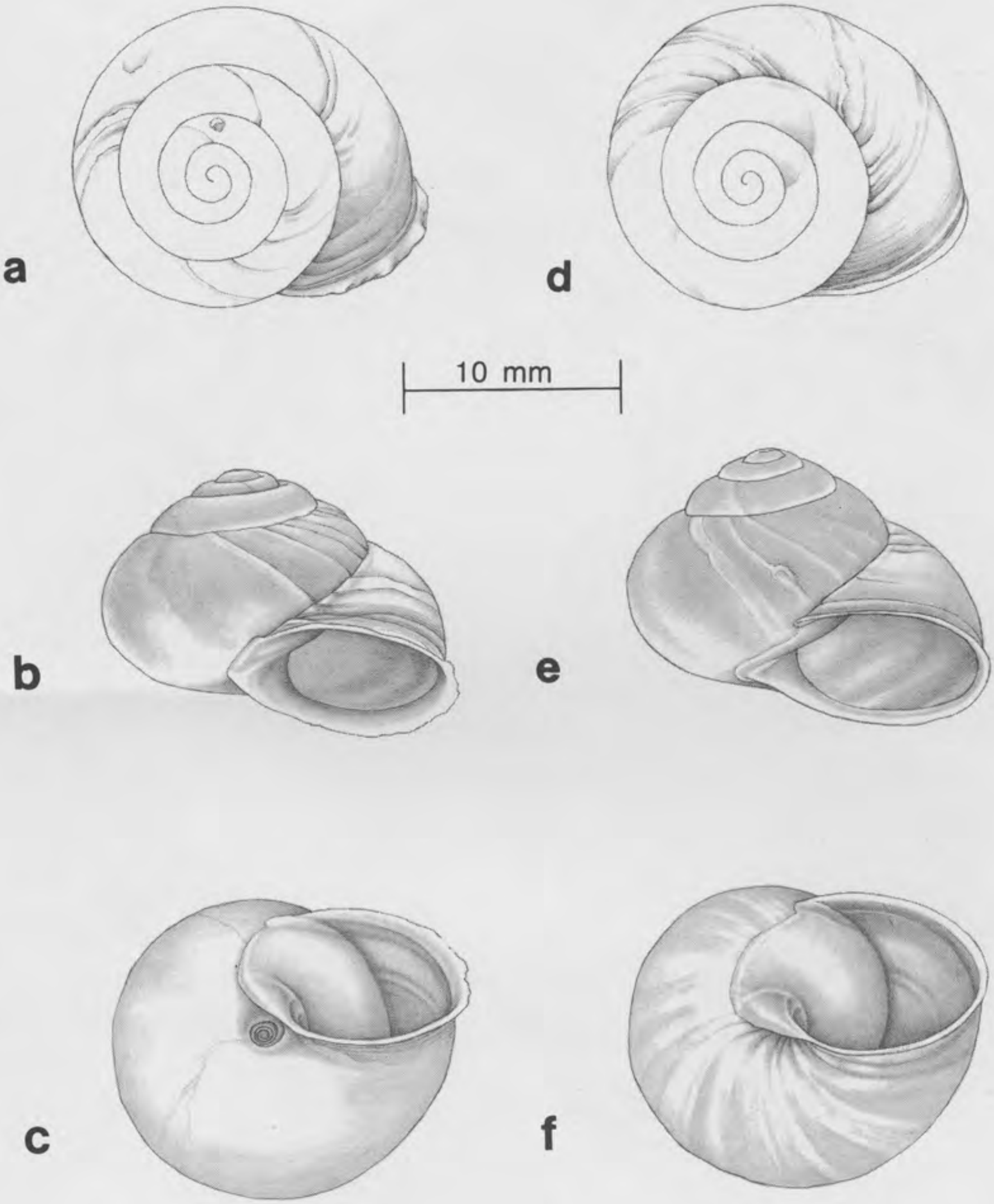


Fig. 301: Shells of *Basedowena katjawarana*, sp. nov., and *B. papulankutjana*, sp. nov.: (a-c) *B. katjawarana*. Holotype. SAM D17864. WA-898, Katjawara Soak, SW end of Mann Ranges, SA; (d-f) *B. papulankutjana*. Holotype. WAM 585.87. WA-910, N side Blackstone Range, 2 km W of Papulankutja Village, WA. Scale line equals 10 mm. Drawings by Linnea Lahlum.

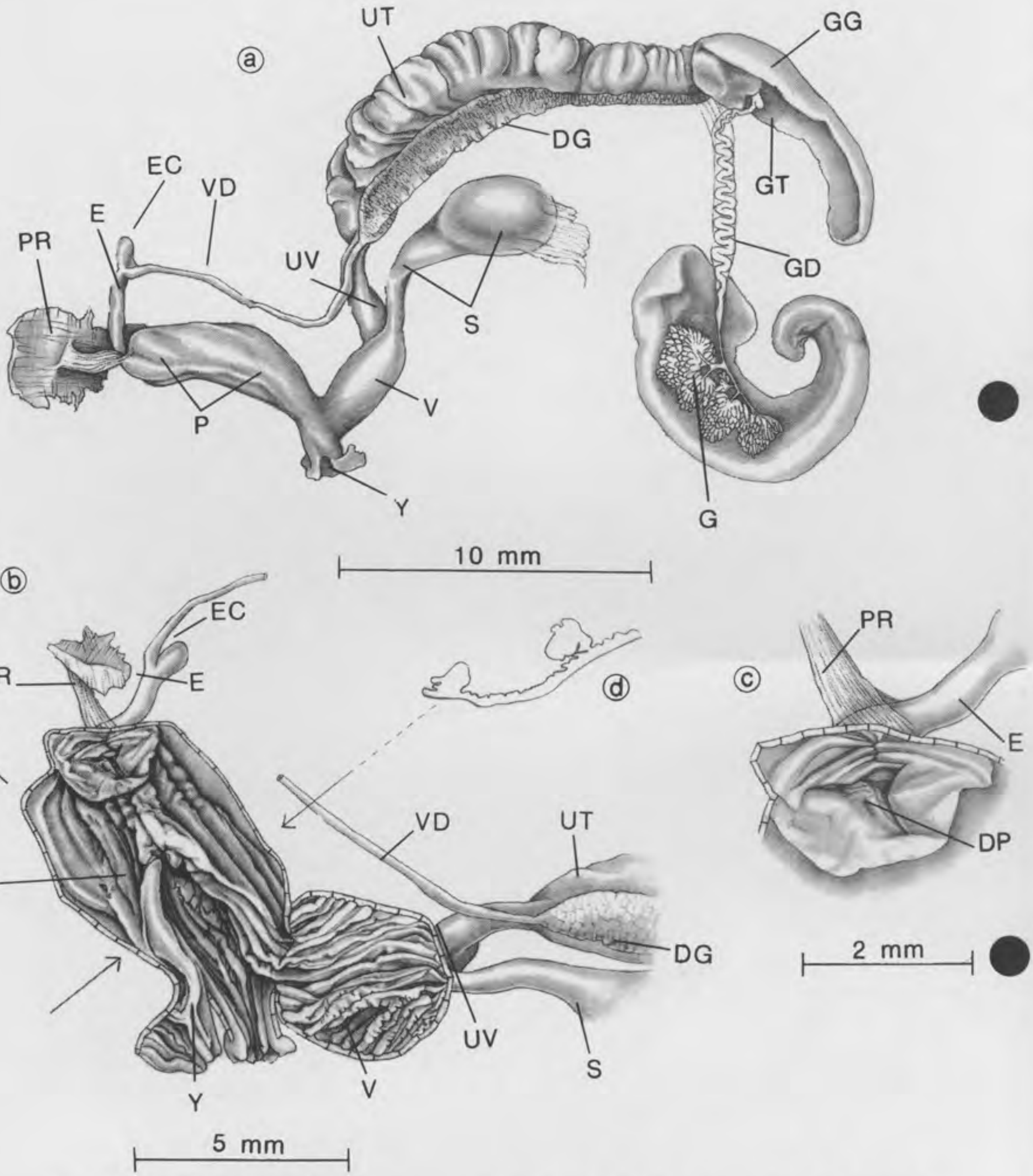


Fig. 302: Genitalia of *Basedowena katjawarana*, sp. nov.: WA-898, Katjawara Soak, SW end of Mann Ranges, SA. 12 May 1983. FMNH 212263, Dissection A. (a) whole genitalia; (b) interior of penis and vagina; (c) detail of epiphallic pore; (d) cross-section through main pilaster (PP). Scale lines as marked. Drawings by Linnea Lahlum.

Table 116: Local Variation in *Basedowena katjawarana*, *B. papulnakutjana*, and *B. elderi* (Bednall, 1892)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
B. katjawarana							
WA-896, FMNH 212257	3D	12.96±0.427 (12.25-13.75)	16.31±0.323 (16.0-16.95)	0.795±0.033 (0.758-0.860)	5 ($4^{7}/_{8}$-$5^{1}/_{8}$-)	1.45±0.127 (1.2-1.6)	11.4±0.976 (10.2-13.3)
WA-898, FMNH 212263	4L	13.54±0.234 (12.95-14.0)	16.20±0.216 (15.6-16.65)	0.836±0.024 (0.778-0.884)	$4^{3}/_{4}$- ($4^{3}/_{8}$+-$5^{1}/_{8}$-)	1.62±0.101 (1.35-1.85)	10.1±0.695 (8.93-12.0)
WA-898A, FMNH 212262	5D	12.86±0.438 (11.9-14.5)	16.22±0.337 (15.65-17.5)	0.792±0.013 (0.762-0.829)	$4^{7}/_{8}$- ($4^{3}/_{4}$--$5^{1}/_{8}$-)	2.03±0.155 (1.5-2.3)	8.17±0.637 (6.86-10.4)
WA-899, FMNH 212268	21L	13.40±0.078 (12.55-14.0)	16.40±0.081 (15.45-17.1)	0.816±0.006 (0.755-0.878)	$4^{7}/_{8}$+ ($4^{5}/_{8}$--$5^{1}/_{8}$+)	1.78±0.055 (1.25-2.4)	9.35±0.263 (6.96-12.6)
WA-899, FMNH 212267	6D	12.93±0.217 (12.25-13.6)	15.52±0.218 (14.9-16.2)	0.833±0.013 (0.768-0.861)	5- ($4^{7}/_{8}$--$5^{1}/_{4}$-)	1.67±0.074 (1.4-1.85)	9.41±0.481 (8.37-11.1)
B. papulankutjana							
WA-910, FMNH 212303	15D	12.34±0.158 (11.5-13.85)	15.23±0.178 (14.2-16.5)	0.810±0.008 (0.759-0.871)	$4^{3}/_{4}$ ($4^{5}/_{8}$--5-)		
WA-911, FMNH 212305	56D	12.31±0.095 (10.4-13.7)	15.48±0.091 (14.0-16.85)	0.795±0.004 (0.734-0.847)	$4^{3}/_{4}$ ($4^{1}/_{2}$--5+)		
NW Mt. Davies airstrip, WAM 602.79	49D	13.07±0.089 (11.95-14.3)	15.12±0.086 (13.85-16.9)	0.865±0.005 (0.779-0.941)	$4^{7}/_{8}$+ ($4^{5}/_{8}$+-$5^{1}/_{4}$-)		

Table 116: Local Variation in *Basedowena katjawarana*, *B. papulnakutjana*, and *B. elderi* (Bednall, 1892) (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
NW end Bell Rock Range, WAM 607.79	5D	13.78±0.119 (13.45-13.8)	15.81±0.163 (15.3-15.8)	0.872±0.005 (0.858-0.885)	$4^7/_8$- ($4^3/_4$- -5-)
Fort Mueller, Cavanagh Range, WAM 601.79	8D	15.14±0.338 (13.7-16.2)	16.61±0.225 (15.75-17.7)	0.912±0.017 (0.821-0.970)	$4^7/_8$ ($4^1/_2$- -$5^1/_8$)
B. elderi (Bednall, 1892)					
Birksgate Range, SAM D3135	27D	12.91±0.147 (11.7-14.7)	16.62±0.099 (15.6-17.4)	0.777±0.009 (0.701-0.919)	$4^7/_8$ ($4^3/_8$-$5^1/_4$)

with prominent longitudinal ridges. Foliated pilaster thin, expanded, circling epiphallis pore (**Figs 302b-c**). Vagina (V) with prominent longitudinal ridges.

Central and lateral teeth of radula (**Plate 130a**) with massive basal support ridge, prominent anterior flare, normal cusp shaft angle, curved cusp top to bluntly pointed tip. Late laterals (**Plate 130b**) with minute ectocone, lateromarginal transition typical. Jaw (**Plate 130c**) with variable width vertical ribs extending nearly to lateral margins.

Discussion

The limited numbers of specimens taken at most stations (**Table 116**), prevent any analysis of local variation in *Basedowena katjawarana*.

Probably this species will have an extended range on the main mass of the Mann Ranges, replacing the outlier occupant, *B. gigantea*, a very large sized species. It would thus be approximately equivalent to the situation found in the Musgrave Range *Sinumelon*, where the small sized species, *S. amatensis*, sp. nov., lives on the main mass, sometimes with *S. pedasum* Iredale, 1937, and an intermediate sized species, *S. musgravesi*, sp. nov., is found on outlying rock exposures that harbour patches of figs.

Both *B. gigantea* and *B. katjawarana* have been collected microsympatrically at WA-896, WA-898, and WA-899. The radular teeth and jaws of both species from WA-898 are shown on **Plate 130**. The magnifications of the radular photographs are the same so that the relative size of the teeth is obvious. Since the shell of *B. gigantea* from which the radula was extracted is 22.9 mm in diameter, compared with the 16.2 mm diameter of the *B. katjawarana* specimen, the larger teeth of the former would be expected. The significant fact is that the teeth differ obviously in cusp shaft angle, cusp tip curvature, and degree of cusp tip sharpness. The differences in anterior flare and size of the basal support ridge follow from the other changes. These differences are enough to suggest the possibility of dietary specialization between these species. No direct evidence of this is available at present, but the changes are suggestive.

The name *katjawarana* is taken from its type locality.

BASEDOWENA PAPULANKUTJANA, SP. NOV.

(Plates 124c-d, 132a-d; Figs 301d-f, 303a-b)

Comparative remarks

Basedowena papulankutjana, sp. nov., from the Blackstone, Bell Rock, and Cavenagh Ranges in WA (**Maps 10-11**), is small in size (mean diameter 15.39 mm), with a moderately elevated spire (**Fig. 301e**, mean H/D ratio 0.831), closed umbilicus (**Fig. 301f**), greatly reduced microsculpture (**Plate 124d**), and with weak radial ridging. The absence of spiral red bands separates it from the similar sized *B. elderi* (Bednall, 1892) from the Birksgate Range. *B. katjawarana*, sp. nov., from the Mann Ranges, *B. cognata*, sp. nov., from the Schwerin Mural Crescent in WA and Petermann Ranges in the NT, plus *B. squamulosa* (Tate, 1894), from the Krichauff and James Ranges, NT, are similar in size (**Table 112**), but have open umbilici and much stronger microsculpture. The remaining species are much larger in size and with much more elevated spires (**Table 112**). Anatomically (**Figs 303a-b**), the very short vagina (V) and the massive cross portion of the U-shaped main pilaster (PP) are the diagnostic features. The penis (P) is short, but not globose, thus being easily separable from both *B. cottoni* Iredale, 1939 and *B. olgana*, sp. nov., both of which have globose shaped penes. *B. cognata* is most similar in penis shape, but differs in many details of structure.

Holotype

WAM 585.87, WA-910, 2 km W of Papulankutja Village (= Blackstone Community after a move to a new location), N side of Blackstone Range, Western Australia, Australia (Cooper 1:250,000 map sheet SG52-10 - 168:760yds). 26° 04' 04" S, 128° 53' 06" E. Collected by the Central Australian Expedition 13 May 1983. Height of shell 13.55 mm, diameter 15.95 mm, H/D ratio 0.850, whorls 4 7/8-, umbilicus reduced to a minute lateral crack.

Paratopotypes

WAM 600.87, SAM D17879, AM, FMNH 212302-3, FMNH 212305, 2 LA, 8 DA, 9 DJ from the type locality.

Paratypes

Western Australia

BLACKSTONE RANGE (22 July 1963, WAM 606.79, 3 DA; 15 July 1977, WAM 315.80, 6 DA, 1 DJ): 2 km into pass through range (WA-911, bluffs on E side, SAM D17880, WAM 601.87, AM, QM, MV, FMNH 212306, FMNH 219033, 5 LA, 56 DA, 7 LJ, 26 DJ); 4 miles NW (?) of Mt. Davies airstrip (WAM 602.79, 49 DA).

BELL ROCK RANGE: NW end (1966, WAM 607.79, 5 DA).

CAVENAGH RANGE: Fort Mueller (1966, WAM 601.79, 8 DA).

Range

Basedowena papulankutjana, sp. nov., has been collected in the Cavenagh, Bell Rock, and Blackstone Ranges of WA (**Maps 10-11**). The first two records are based on dead examples only and need to be confirmed by study of live collected specimens.

Diagnosis

Shell small, adult diameter 13.85-17.7 mm (mean 15.39 mm), with 4 1/2 to 5 1/4- (mean 4 7/8-) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 301e**), shell height 10.4-16.2 mm (mean 12.62 mm), H/D ratio 0.734-0.970 (mean 0.831). Body whorl rounded, without angulation. Shell apex (**Plate 124c**) with low, anastomosing wrinkles, spire and body whorl (**Plate 124d**) with scattered pustules and prominent ridgelets on spire, becoming much reduced on body whorl. Umbilicus (**Fig. 301f**) at most a minute lateral crack, covered by reflection of columellar lip. Body whorl descending moderately just behind aperture. Lip at most narrowly expanded on palatal and basal margins, columellar section expanded to cover umbilicus and thickened. Parietal wall narrow, often with thickened callus present. Shell a darker yellow brown in tone, lighter on shell base, with a colour patch present on columellar lip. Based on 138 measured adults.

Genitalia (**Figs 303a-b**) with short expanded vagina (V). Slender free oviduct (UV) partly wound around slender shaft of spermatheca (S). Head of spermatheca begins expansion at base of prostate-uterus, extends partway up. Vas deferens (VD) slender, entering laterally on prominent epiphallic caecum (EC). Epiphallus (E) short, partly circling penial retractor muscle (PR) before entering very thin penis sheath (PS) and then into penis itself through epiphallic pore (EP). Penis (P) short, expanded above, internally (**Fig. 303b**) with U-shaped main pilaster (PP) having slender vertical ridges connected apically by greatly enlarged and thickened cross-portion. Foliated pilaster around epiphallic pore thick and complexly folded, short. No space left for accessory wall sculpture. Vagina (V) with few very large wall pilasters.

Central and early lateral teeth of radula (**Plate 132a, c**) with massive basal support ridge, prominent anterior flare, normal cusp shaft angle, slightly curved cusp top to blunt cusp tip. Lateromarginal transition (**Plate 132b**) typical. Jaw (**Plate 132d**) with prominent vertical ribs that are absent from lateral margins.

Discussion

Basedowena papulankutjana, sp. nov., has been collected sympatrically with *Minimelon colmani*, sp. nov., in the Blackstone Range, and both species are recorded, but not sympatrically, in the Cavenagh Ranges. Most records consist of very worn examples, with limited live examples taken in the Blackstone Range (WA-910, WA-911). Local variation in shell shape (**Table 116**) is marked, with the Blackstone Range material having a much lower spire. It is quite possible that the Bell Rock Range and

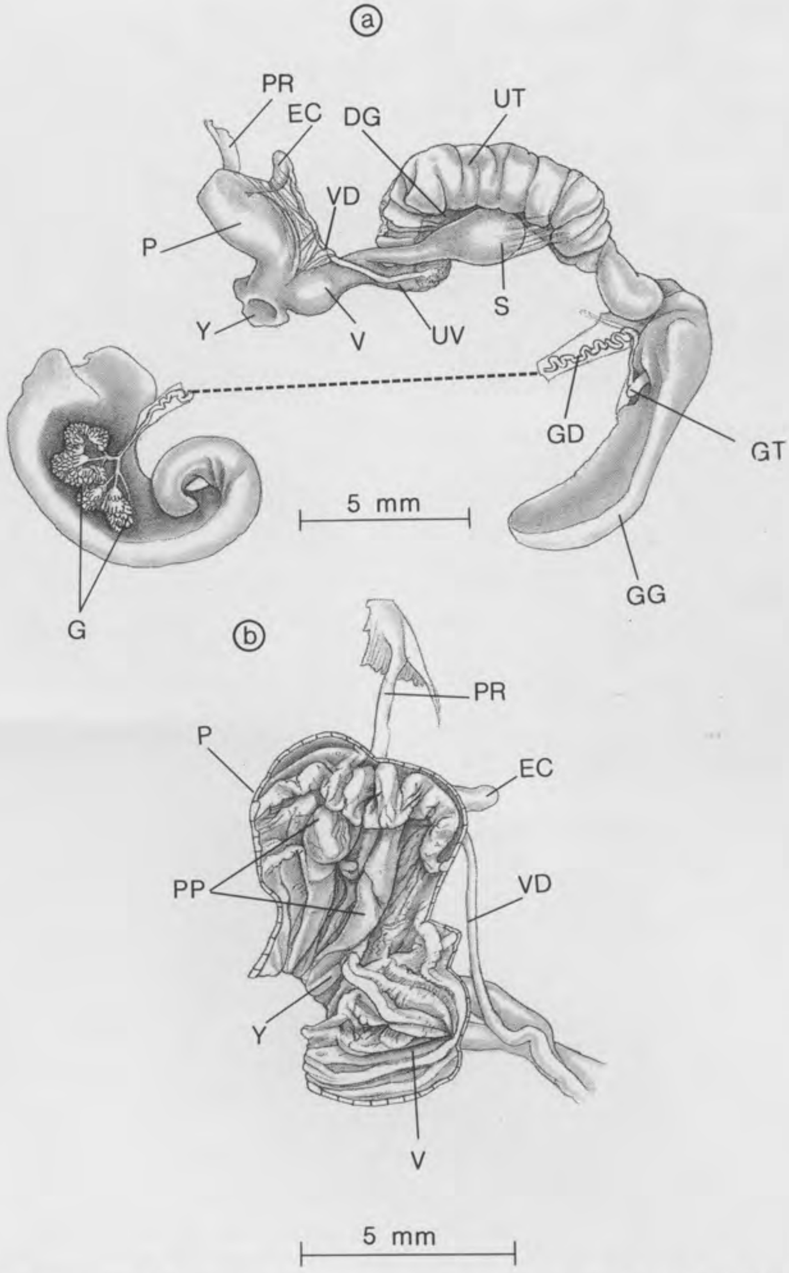


Fig. 303: Genitalia of *Basedowena papulankutjana*, sp. nov.: (a) WA-910, N side Blackstone Range, 2 km W of Papulankutja Village, WA. 13 May 1983. FMNH 212302, Dissection A. whole genitalia; (b) WA-911, pass through Blackstone Range, WA. 13 May 1983. FMNH 219033. Dissection A. interior of penis and vagina. Scale lines as marked. Drawings by Linnea Lahlum.

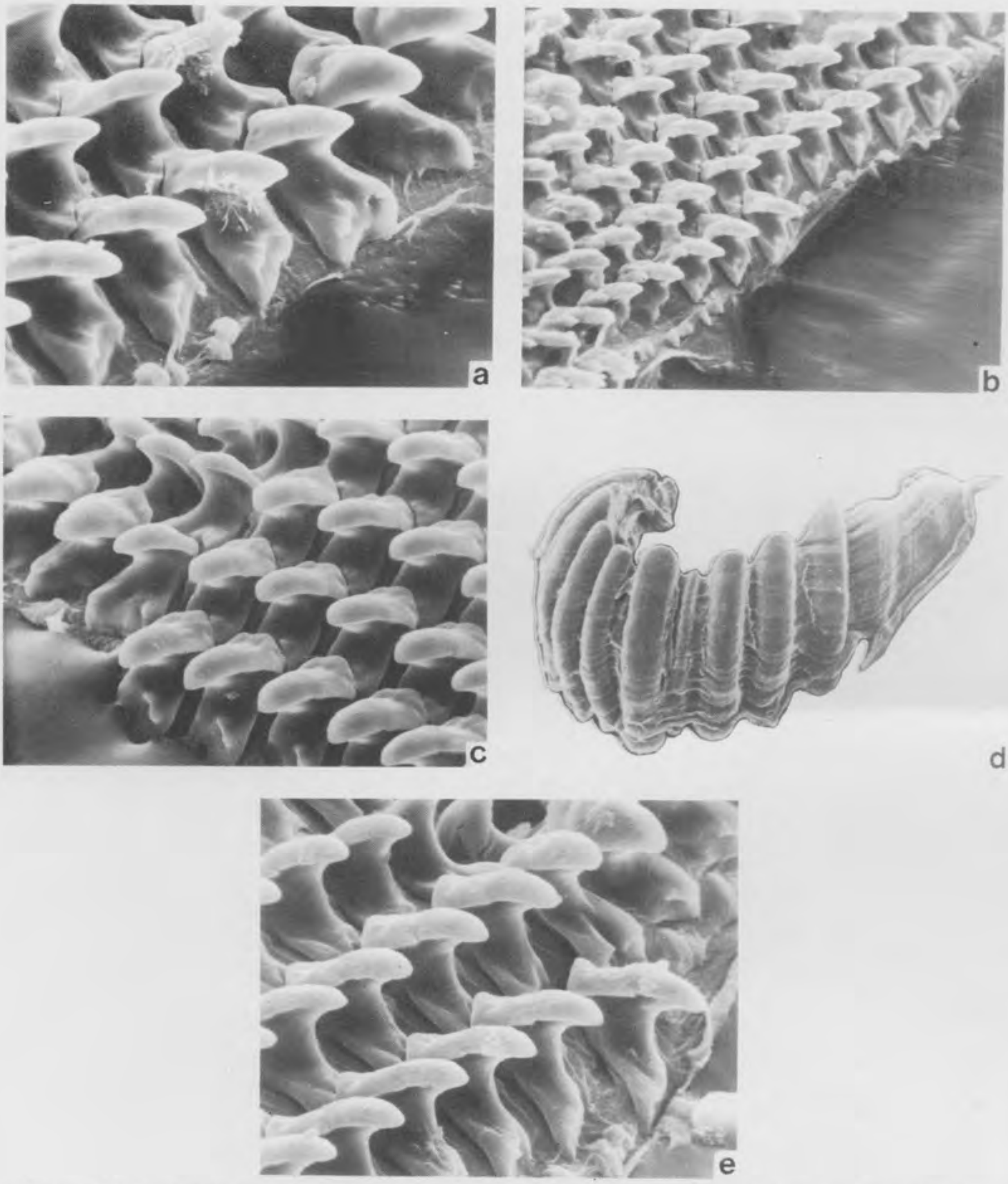


Plate 132: Radular teeth and jaw of *Basedowena papulankutjana* and *B. squamulosa* (Tate, 1894): (a-b) *B. papulankutjana.* WA-911, pass through Blackstone Range, WA. 13 May 1983. FMNH 212306, Dissection A. a is central and early laterals at 660X, b is lateromarginal transition at 340X; (c-d) *B. papulankutjana.* WA-910, N side of Blackstone Range, WA. 13 May 1983. FMNH 212302, Dissection A. c is central and early laterals at 550X, d is jaw at 64X; (e) *B. squamulosa.* WA-934, near Areyonga, James Range, NT. 26 May 1983. FMNH 212400, Dissection A. Central and early laterals at 710X.

Cavenagh Range populations will prove separable when live collected material can be studied, but available specimens had best be kept under one name.

The name *papulankutjana* honors the local community.

BASEDOWENA ELDERI (BEDNALL, 1892)
(Plate 126a-f; Figs 304a-c)

Helix (Hadra) elderi Bednall, 1892, Trans. Proc. Rep. Roy. Soc. South Austr., **16**: 65-66, pl. I, figs 2a-c (shell), 4 (jaw), 5 (radular teeth) - under fig-trees amongst granite boulders, Birksgate Range, Central Australia; Pilsbry, 1893, Man. Conch., (2) **8**: 278-279, pl. 58, figs 5-7 (copy of original description and figures).

Thersites (Badistes) elderi (Bednall), Pilsbry, 1894, Man. Conch., (2) **9**: 131 - check list citation.

Pleuroxia (Fatulabia) elderi (Bednall), Iredale, 1937, South Austr. Nat., **18** (2): 51.

Fatulabia elderi (Bednall), Iredale, 1938, Austr. Zool., **9** (2): 107 - check list citation; Richardson, 1985, Tryonia, **12**: 127 - check list citation.

Comparative remarks

Basedowena elderi (Bednall, 1892), described from the Birksgate Range, SA (**Map 10**), is a relatively small species (mean diameter 16.63 mm), with comparatively low spire (**Fig. 304b**, mean H/D ratio 0.774), moderately flared lip (**Figs 304a-c**), and shell microsculpture of dense pustules on the apex and early spire, becoming absent on lower spire and body whorl (**Plate 126a-f**). It is immediately recognizable by its two red spiral colour bands (**Fig. 304b**), since no other *Basedowena* have this feature. The presence of prominent radial ribs and much lower spire in such taxa as *Granulomelon arcigerens* (Tate, 1892) (**Figs 265a-c**), *Pleuroxia adcockiana* (Bednall, 1892) (**Figs 257a-d**), and in the higher spired *G. gilleni*, sp. nov. (**Figs 265d-f**), immediately separate them. The lack of micropustules and presence of weak radial ribs in *Pleuroxia everardensis* (Bednall, 1892) and *P. carmeena*, sp. nov., from the Everard Ranges differentiate those species, while *G. grandituberculatum* (Tate, 1894) and *Granulomelon acerbum*, sp. nov., which have greatly reduced or lost, respectively, radial ribbing, differ in having the parietal lip usually complete and free of the wall. Anatomy unknown.

Holotype

SAM D13762, under fig-trees amongst granite rocks, Birksgate Range, South Australia. Collected by the Elder Expedition. Height of shell 12.75 mm, diameter 16.85 mm, H/D 0.757, whorls 4 7/8-, umbilical width 1.3 mm, D/U ratio 13.0.

Paratopotypes

SAM D3135, SAM D15574, AM C.60520, FMNH 208706, 32 DA, 23 DJ from the type collection.

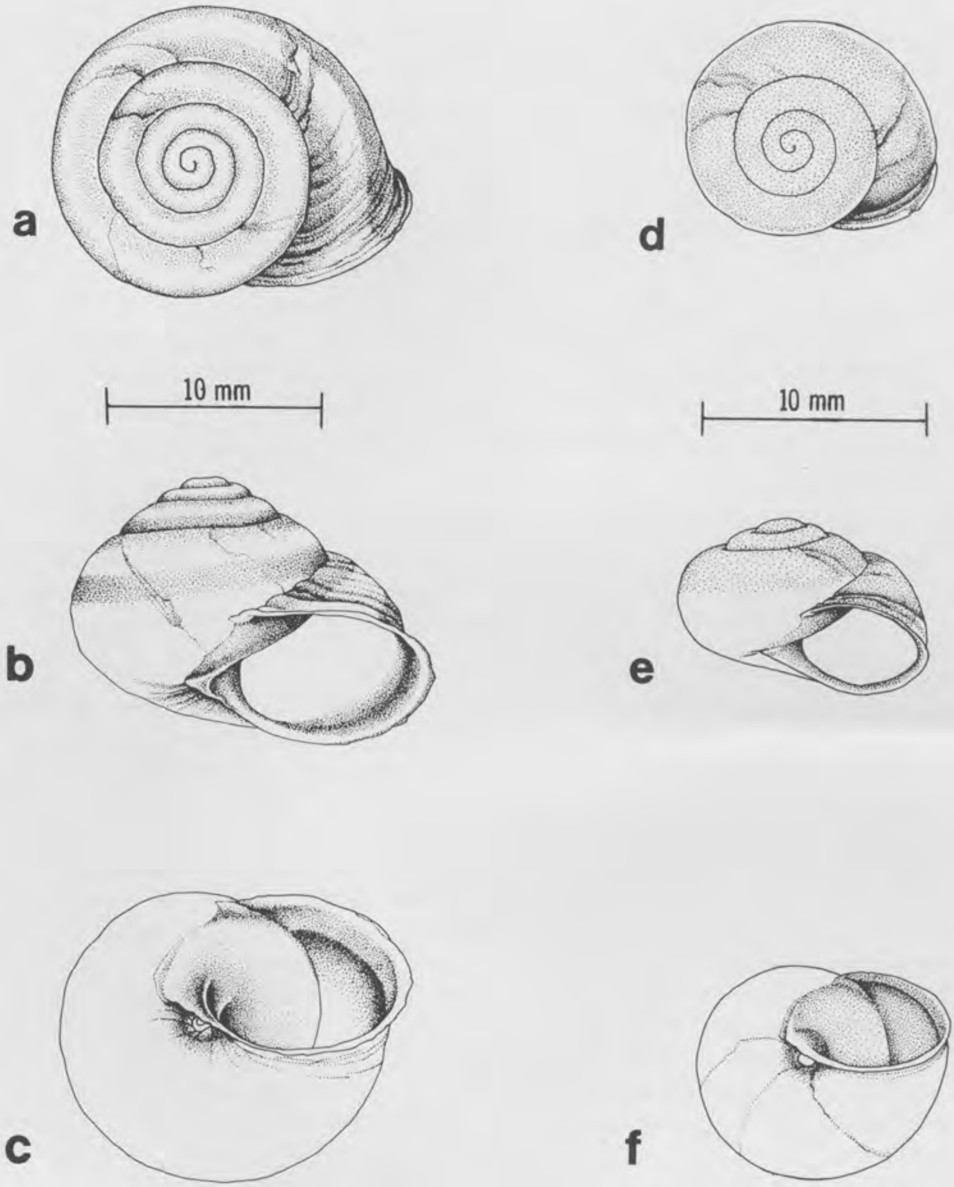


Fig. 304: Shells of *Basedowena elderi* (Bednall, 1892) and *Minimelon colman*, sp. nov.: (a-c) Paratype of *Helix (Hadra) elderi* Bednall, 1892. Birksgate Ranges, SA. AM C.60520; (d-f) Holotype of *Minimelon colmani*, sp. nov. WAM 586.87. WA-916, NE tip Barrow Range, E of Warburton, WA. Scale line equals 10 mm. Drawings by Linnea Lahlum.

Range

Basedowena elderi (Bednall, 1892) was found in the Birksgate Range, SA (**Map 10**) by the Elder Expedition in 1891 and has not been collected subsequently. Unfortunately, no exact locality was cited.

Diagnosis

Shell relatively small, adult diameter 15.85-17.65 mm (mean 16.63 mm), with 4 3/8 to 5 1/4 (mean 4 7/8) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 304b**), shell height 11.7-14.7 mm (mean 12.86 mm), H/D ratio 0.701-0.919 (mean 0.774). Body whorl rounded, without angulation. Shell apex (**Plate 126a-b**) with rather widely spaced, round to ovate pustules. Spire (**Plate 126a-c**) initially with very dense pustules, becoming more widely spaced on mid-spire and nearly absent on body whorl (**Plate 126a-d**). In areas of uninterrupted growth (**Plate 126d-f**), the pustules are arranged in diagonal rows, partly eroded above, with short, irregular periostracal ridgelets inbetween. Umbilicus varying from narrowly open (87 %) to a slight lateral crack (13 %). Body whorl descending moderately to sharply just behind aperture. Lip expanded on palatal and basal margins, partly rolled on columellar margin to narrow umbilicus. Parietal callus thin. Colour light yellow-brown, with narrow supraperipheral and subsutural red spiral bands. Based on 33 measured adults.

Anatomy unknown.

Discussion

The presence of red spiral bands in *Basedowena elderi* (Bednall, 1892) suggests *Pleuroxia* or *Granulomelon*, but the microsculpture (**Plate 126**), form of the shell lip, and size are closer to *Basedowena*. Only collection and study of live material will permit settling the question of affinities.

No evidence as to whether this is a free sealer or a rock sealer is available, since at some point in time the specimens had been thoroughly cleaned, removing any trace of eiphragms from the apertures. Only one set (**Table 116**) contained enough material for analysis of local variation. It showed a typical pattern.

GENUS *MINIMELON*, GEN. NOV.

Shell small, adult diameters 9.0-13.7 mm, whorl count 3 3/4 to 4 3/4. Spire strongly elevated, H/D ratios 0.620-0.827. Apical sculpture (**Plate 124e**) of dense pustules, spire and body whorl (**Plate 124e-f**) with more widely spaced pustules, weak and irregular radial swellings, and fine periostracal ridgelets. Body whorl rounded, descending slightly to moderately behind aperture (**Fig. 304e**). Umbilicus varying from nearly closed to narrowly open (**Fig. 304f**). Palatal and basal lips thickened internally, at most very slightly expanded, columellar lip narrow, partly reflected over umbilicus. Parietal wall with moderate callus. Shell colour greenish-yellow, base lighter, often with a red suffusion on spire and body whorl that stops abruptly at periphery. Lip white.

Live specimens free seal in litter or talus.

Genitalia (**Figs 305a-d**) fairly generalized. Terminal female organs with short vagina (V), enlarged free oviduct (UV), latter and lower portion of prostate-uterus partly wrapped around shaft of spermatheca (S). Expanded spermathecal head part way up prostate-uterus. Vas deferens (VD) typical, epiphallic caecum (EC) proportionately large. Epiphallus (E) short, entering thin penis sheath subapically, partly circling penial retractor muscle (PR). Penis (P) of medium length, swollen medially, internally (**Fig. 305d**) with U-shaped main pilaster (PP) having a massive cross arm. Epiphallic pore (EP) surrounded by a corrugated pilaster. Accessory longitudinal pilasters on chamber wall.

Jaw (**Plate 125f**) normal, vertical ribs reduced on lateral margins. Central tooth and early laterals (**Plate 125a, c**) with distinct ectocones, large anterior flare, and massive basal support ridge. Cusp shaft angle, top curvature, and bluntly pointed tip normal. Endocone appears on late laterals (**Plate 125b, d**), enlarges rapidly after abrupt lateromarginal transition. Marginal teeth typical.

Type species: *Minimelon colmani*, gen. nov., sp. nov., by original designation.

Comparative remarks

The reduced size of the shell, lack of lip expansion but presence of lip thickening, and unusual colour suffusion that stops at the shell periphery easily separate the free sealing *Minimelon* from the much larger (**Tables 112, 117**) species of *Basedowena* Iredale, 1937 and *Tatemelon* from the Schwerin Mural Crescent and Blackstone Ranges E through the Krichauff and Everard Ranges. They tend to have very well expanded, but not thickened, shell lips, monochrome colouration that gradually lightens near the umbilicus, and are rock sealers.

The genitalia of *Minimelon* (**Fig. 305**) and *Basedowena* (**Figs 293-294, 296-297, 299-300, 302-303**) are very similar. It is quite possible that they are very closely related. The retention of a U-shaped main pilaster, prominent pilaster around the epiphallic pore, very thin penis sheath, partial circling of the penial retractor muscle by the epiphallus, and short vagina are shared characters. *Sinumelon* Iredale, 1930 (**Figs 273, 275-276, 279-280, 283-287, 289-291**) lacks the U-pilaster in Red Centre species, has a very thick penis sheath, and very different epiphallic entry patterns.

The jaw (**Plate 125f**) of *Minimelon* is without unusual features, but the development of an ectocone on the central and early lateral teeth (**Plate 125a, c**). is very unusual.

The shell features and radular changes are the main reasons for placing *Minimelon colmani* as a separate genus. They are very different from the patterns seen in other Red Centre genera.

Distribution and comparative ecology

Minimelon is the westernmost Red Centre camaenid (**Maps 6, 11**). Details of its known distribution are discussed below. There is a substantial geographic gap between Warburton and the Wiluna-Kalgoorlie axis from which no camaenids have

Table 117: Range of Variation in *Minimelon*, *Tatemelon* and *Eximiorhagada*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
MINIMELON							
colmani	398	7.90 (5.85-9.9)	10.96 (9.0-13.7)	0.719 (0.620-0.827)	$4^{1}/_{4}$ ($3^{3}/_{4}$–$4^{3}/_{4}$)	0.66 (0.45-1.4)	17.9 (7.00-38)
TATEMELON							
musgum (Iredale, 1937)	266	12.83 (10.9-15.7)	18.75 (15.9-22.2)	0.685 (0.612-0.782)	$4^{1}/_{2}$- ($4^{1}/_{8}$+-5-)	1.19 (0.7-2.50)	16.7 (8.12-24.3)
herberti (Iredale, 1937)	124	12.78 (11.0-15.4)	20.86 (18.7-23.65)	0.613 (0.527-0.727)	$4^{1}/_{2}$+ ($4^{3}/_{8}$- $4^{7}/_{8}$-)	1.61 (0.7-2.5)	13.8 (8.85-28)
inexpectatum	19	13.81 (12.5-14.9)	17.22 (16.15-18.0)	0.802 (0.750-0.862)	$4^{1}/_{2}$+ ($4^{3}/_{8}$- -$4^{3}/_{4}$+)	1.43 (1.0-2.05)	12.4 (8.53-17.3)
everardensis	16	11.08 (10.4-12.0)	17.84 (16.6-18.85)	0.621 (0.589-0.653)	$4^{1}/_{8}$+ ($3^{3}/_{4}$-$4^{1}/_{4}$+)	2.34 (1.5-2.8)	7.84 (6.01-11.6)
EXIMIORHADADA							
asperrima (Hedley, 1905)	1	10.0	19.60	0.510	$4^{1}/_{8}$-	1.75	11.2

been recorded. From Kalgoorlie and Norseman S to the coast, and then E between basically the railroad and coast to near Ceduna, SA, there are numerous records of *Sinumelon* Iredale, 1930 and *Pleuroxia* Ancey, 1887. A few records of *Sinumelon* exist from slightly N of the rail line, but these are from considerably to the E and involve Gawler Range taxa (Solem, 1992a). The inland range of *Sinumelon* undoubtedly will be extended by field work, but I am doubtful that camaenids will be discovered in most of the areas between Warburton, Laverton, and Wiluna.

Minimelon is a free sealer found in litter or talus, whereas the nearest Red Centre camaenids, species of *Basedowena*, are rock sealers.

Discussion

The most similar extralimital species to *Minimelon colmani* is a currently undescribed taxon that will be reviewed in Part VII. It is a free sealing species recorded from a few localities in WA between Mt. Deans, Norseman, and the Fraser Range, some 100 km to the E.

Since only the genotype is known, further comments are given in the species account.

MINIMELON COLMANI, SP. NOV.

(Plates 124e-f, 125a-f; Figs 304d-f, 305a-d)

Comparative remarks

Minimelon colmani, sp. nov., from the Rawlinson, Warburton, Barrow, Cavenagh, and Blackstone Ranges in WA and Birksgate Ranges in SA (**Maps 6, 11**), is the smallest of the Red Centre Sinumeloninae (mean diameter 10.96 mm), with a reduced whorl count (mean 4 1/4). The spire is moderately elevated (**Fig. 304e**, mean H/D ratio 0.719), umbilicus nearly closed (**Fig. 304f**), lip thickened, but almost not expanded, except on columellar section (**Figs 304d-f**). Apex densely pustulated, spire and body whorl with widely spaced pustules and irregular radial growth ridges (**Plate 124e-f**). Spire often with bright reddish suffusion that extends only to periphery. The absence of a expanded lip, small size and reduced whorl count, plus the colour zone, effectively separate *M. colmani* from any of the *Basedowena* Iredale, 1937 or *Tatemelon*, gen. nov., found in the Blackstone and other ranges E through the James, Musgrave, and Everard Ranges. Species of *Sinumelon* Iredale, 1930 are much larger (**Table 102**), with only *S. amatensis* from the Musgrave Ranges overlapping it in size. *S. amatensis* differs obviously in its much higher spire and whorl count (**Figs 288d-f**), greatly inflated body whorl, absence of pustulose sculpture on the spire and body whorl, and pinkish colour of the shell lip. Anatomically (**Figs 305a-d**), *M. colmani* has a short, rather wide vagina (V), the free oviduct (UV) and lower part of the prostate-uterus are wrapped around the spermathecal shaft, with the enlarged spermathecal head (S) situated against lower part of prostate-uterus. Epiphallic caecum (EC) large, short epiphallus (E) circling penial retractor muscle (PR) after passing through very thin penis sheath (PS) to enter penis apex. Internally (**Fig. 305d**), penis with a large U-shaped main pilaster (PP), the crossarm massive. Epiphallic pore (EP) surrounded by a circular, folded pilaster. The latter is a reduced equivalent of the foliated pilaster found in *Basedowena* species (for example, **Figs 299b, 302b**). The central and lateral radular teeth of *M. colmani* (**Plate 125a, c**) have a very large ectocone developed, thus differing from all other known Red Centre Sinumeloninae.

Holotype

WAM 586.87, Station WA-916, NE tip of Barrow Range, E of Warburton, Western Australia, Australia (Talbott 1:250,000 map sheet SG52-9 - 564:763yds). ca 26° 03' S, 127° 30" E. Collected by Alan Solem and Phil Colman 14 May 1983. Height of shell 8.45 mm, diameter 10.25 mm, H/D ratio 0.820, whorls 4 1/8, umbilical width 0.9 mm, D/U ratio 11.4.

Paratopotypes

WAM 639.87, WAM 640.87, SAM D18017-8, AM C.135970, C.136039, MV, QM, FMNH 212317-8, 30 LA, 20 DA, 21 LJ, 13 DJ from the type locality.

Paratypes

Western Australia

RAWLINSON RANGES: Mt. Russell (WA-918, near mouth of Glen Gerald, E end of Rawlinson Ranges, WAM 643.87, AM, SAM D18021, FMNH 212322-3, 1 LA, 11 DA, 4 DJ; WA-917, near mouth of Glen Cumming, E end Rawlinson Ranges, WAM 652.87, WAM 653.87, SAM D18030-1, AM, MV, QM, FMNH 212319-20, 13 LA, 44 DA, 34 LJ, 71 DJ, FMNH 212319-20).

JAMESON RANGE: open country NE of (Bob Read!, 2 November 1983, 25o 45' S, 127o 45' E, FWA, 1 DA, 2 DJ).

WARBURTON RANGES: (H. Hackett!, 10 DA, 32 DJ, SAM).

CAVENAGH RANGES (D. L. Serventy!, 18 August 1965, WAM 604.79, 17 DA, 6 DJ; R. L. Serventy!, 7 July 1963, WAM 605.79, 14 DA; G. M. Storr!, 7 July 1963, WAM 606.79, 2 DA): Bilbring Waterhole (WA-915, S of Lightening Rock, WAM 644.87, SAM D18022, AM, QM, MV, FMNH 212315-6, 21 LA, 2 DA, 12 LJ); Linton Bore (WA-914, 1 km SE of, NW tip of Range, WAM 648.87, WAM 649.87, SAM D18026-7, AM, MV, QM, FMNH 212312-3, 10 LA, 42 DA, 17 LJ, 14 DJ; central area (WA-913, WAM 647.87, SAM D18025, AM, FMNH 212311, 10 DA, 12 DJ); Fort Welcome Spring (WA-912, NW of, WAM 641.87, WAM 642.87, SAM D18019-20, AM, QM, MV, FMNH 212308-10, 6 LA, 81 DA, 24 LJ, 36 DJ).

BLACKSTONE RANGES (WAM 315.80, 8 DA): in pass through range (WA-911, E side bluffs, WAM 650.87, WAM 651.87, SAM D18028-9, AM, QM, MV, FMNH 212306-7, 5 LA, 39 DA, 7 LJ, 41 DJ); Papulankutja Village (WA-910, 2 km W of village, WAM 645.87, WAM 646.87, SAM D18023-4, AM, QM, MV, FMNH 212304, 14 DA).

South Australia

BIRKSGATE RANGE: Mt. Lindsay (Bob Read!, 6 March 1986, FWA, 2 DA).

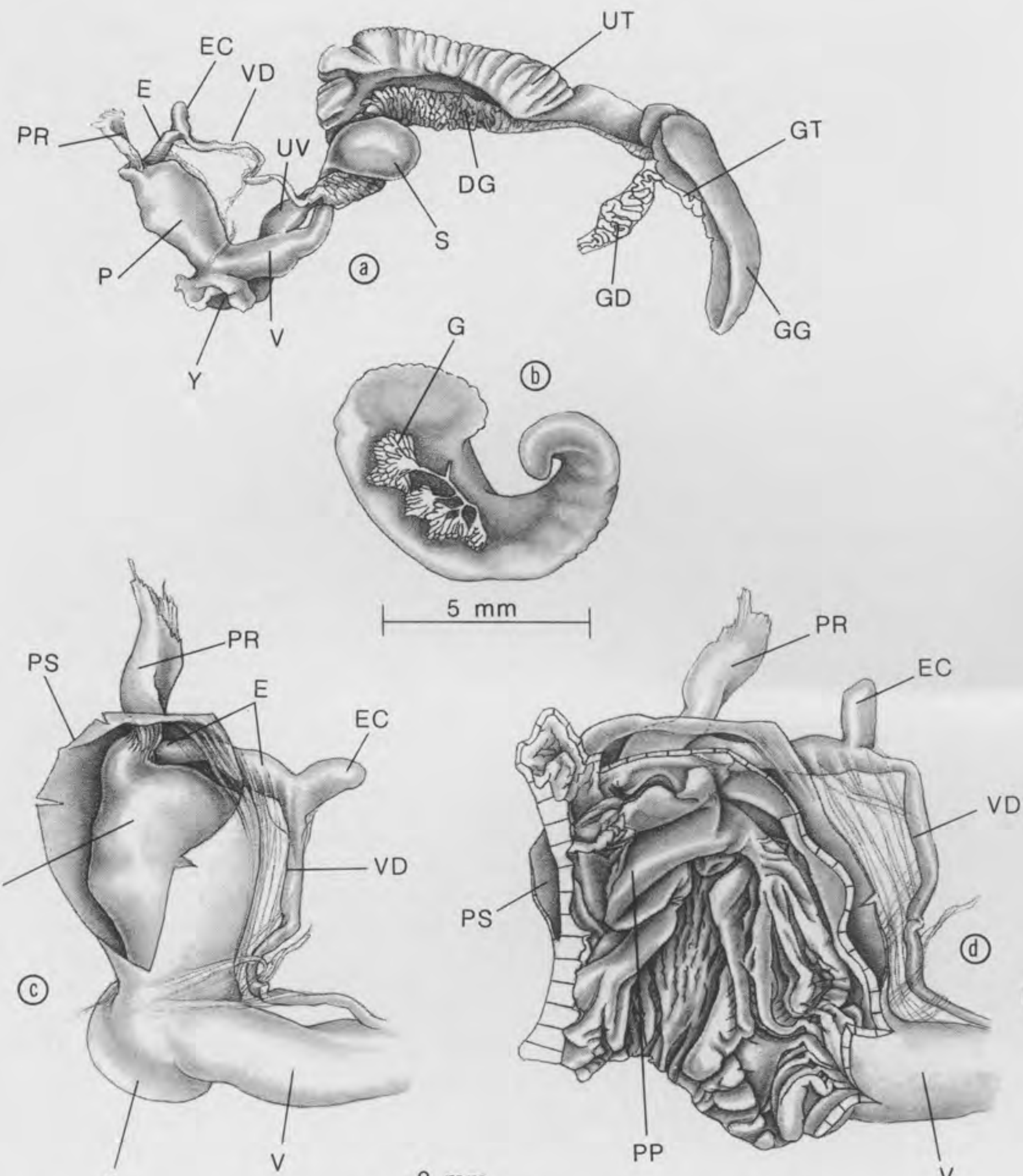


Fig. 305: Genitalia of *Minimelon colmani*, sp. nov.: WA-916, NE tip Barrow Range, E of Warburton, WA. 14 May 1983. FMNH 212318. (a) whole genitalia, Dissection B; (b) ovotestis, Dissection B; (c) penis sheath (PS) opened, Dissection D; (d) interior of penis and lower vagina, Dissection D. Scale lines as marked. Drawings by Linnea Lahlum.

Range

Minimelon colmani, sp. nov., has been found (**Maps 6, 11**) in the area from the E tip of the Rawlinson Ranges (WA-917-8) (24° 58' 51' S) to the southern tier of the Warburton, Barrow, Cavenagh, and Blackstone Ranges (26° 00' 24" S to 26° 08' 53" S), a distance of about 140 km (if the unlocalized Warburton Range record is correct). Much of the intervening area probably is snail-free country. The east-west known range is 126° 40' E to 128° 25' E in the southern tier, a total distance of about 155 km. The only localities in the Rawlinson Ranges are clustered between 128° 24' 26" E to 128° 24' 39" E. Thus the actual northern range remains to be determined.

Diagnosis

Shell small, adult diameter 9.0-13.7 mm (mean 10.96 mm), with 3 3/4 to 4 3/4 (mean 4 1/4) normally coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 304e**), shell height 5.85-9.9 mm (mean 7.90 mm), H/D ratio 0.612-0.782 (mean 0.685). Body whorl rounded, without trace of angulation. Shell apex (**Plate 124e**) densely pustulated, spire and body whorl (**Plate 124e-f**) with much more widely scattered pustules, irregular radial swellings, and some periostracal ridgelets. Umbilicus (**Fig. 304f**) nearly closed, width 0.45-1.4 mm (mean 0.66 mm), D/U ratio 7.00-38 (mean 17.9). Body whorl descending slightly to moderately just behind aperture. Lip sometimes thickened on palatal and basal walls, rarely very slightly expanded, columellar margin weakly expanded and slightly narrowing umbilicus (**Fig. 304f**). Parietal wall with weak to moderate callus. Colour variable, ground colour greenish-yellow, many populations with most individuals having a red suffusion on spire and body whorl that stops abruptly at periphery. Shell base lighter in tone. Based on 398 measured adults.

Genitalia (**Figs 305a-d**) with very short vagina (V), internally with normal pilasters. Shaft of spermatheca (S) tapering from base, head bound to prostate-uterus above its base. Free oviduct (UV) proportionately wide, it and base of prostate-uterus wound around spermathecal shaft. Vas deferens (VD) slender, loosely bound to adjacent tubes (**Fig. 305c**), entering large epiphallic caecum (EC) basally. Epiphallus (E) short, entering very thin walled penis sheath (PS) subapically (**Fig. 305c**), partly circling penial retractor muscle (PR) before entering penis apex. Penial retractor muscle (PR) attached partly to penis apex and partly to epiphallus. Penis (P) fairly short, slightly swollen medially. Internally (**Fig. 305d**) with large U-shaped main pilaster (PP), whose cross arm is massive. Epiphallic pore (EP) surrounded by a short folded pilaster. Chamber wall with numerous narrow longitudinal pilasters.

Central and early lateral teeth of radula (**Plate 125a, c**) with massive basal support ridge, large anterior flare, large ectocone on both central and laterals, normal cusp shaft angle with slight top curvature to bluntly pointed tip. Late laterals (**Plate 125b, d**) with enlarged anterior flare, very large ectocone, and noticable endocone. Lateromarginal transition (**Plate 125b, d**) abrupt, with major size increase of endocone and rapid basal plate shortening. Marginal teeth (**Plate 125e**) typical. Jaw (**Plate 125f**) with relatively wide medial vertical ribs, absent from lateral margins.

Table 118: Local Variation in *Minimelon colmani*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Rawlinson Ranges							
Glen Gerald, WA-918, FMNH 212322	11D	8.20±0.180 (7.1-8.9)	11.30±0.159 (10.3-12.2)	0.725±0.010 (0.682-0.774)	$4^{1}/_{4}+$ ($4^{1}/_{8}-4^{3}/_{8}+$)	0.56±0.045 (0.3-0.8)	22.0±2.527 (13.4-38)
Glen Cumming, WA-917, FMNH 212319	13L	7.05±0.145 (6.3-8.3)	10.06±0.162 (9.3-11.3)	0.701±0.006 (0.663-0.735)	4+ ($3^{3}/_{4}+-4^{3}/_{8}+$)	0.69±0.042 (0.5-0.9)	15.2±0.927 (11.1-21.0)
Glen Cumming, WA-917 FMNH 212320	44D	7.51±0.077 (6.3-8.7)	10.81±0.086 (9.6-12.2)	0.694±0.004 (0.624-0.738)	$4^{1}/_{8}+$ ($3^{3}/_{4}+-4^{1}/_{2}$)	0.59±0.027 (0.3-0.9)	20.6±1.187 (12.2-38)
Warburton Ranges							
SAM	7D	9.38±0.167 (8.7-9.9)	12.99±0.088 (12.6-13.25)	0.722±0.012 (0.681-0.761)	$4^{1}/_{4}+$ ($4^{1}/_{4}-4^{3}/_{8}+$)	0.92±0.042 (0.75-1.05)	14.3±0.736 (12.5-18.1)
Barrow Range							
NE tip, WA-916, FMNH 212318	30L	8.38±0.065 (7.75-9.05)	11.23±0.083 (10.1-12.15)	0.747±0.005 (0.683-0.827)	$4^{3}/_{8}+$ ($3^{7}/_{8}-4^{5}/_{8}+$)	0.97±0.022 (0.75-1.25)	11.7±0.244 (8.85-14.9)
NE tip, WA-916, FMNH 212317	21D	8.58±0.123 (7.1-9.7)	11.59±0.094 (11.0-12.9)	0.740±0.008 (0.634-0.811)	4+ ($3^{7}/_{8}+-4^{1}/_{4}$)	0.85±0.025 (0.7-1.1)	13.9±0.416 (11.0-17.3)
Cavenagh Range							
Bilbring, WA-915, FMNH 212316	21L	8.36-0.058 (8.0-8.9)	11.68±0.083 (11.0-12.5)	0.716±0.004 (0.683-0.750)	$4^{1}/_{4}-$ ($4-4^{3}/_{8}+$)	0.73±0.022 (0.5-0.9)	16.2±0.524 (12.6-23.2)
Linton Bore, WA-914, FMNH 212313	10L	7.49±0.107 (7.1-8.2)	10.09±0.148 (9.4-10.7)	0.743±0.010 (0.692-0.792)	$4^{1}/_{4}-$ ($4-4^{1}/_{2}-$)	0.53±0.37 (0.4-0.7)	19.9±1.403 (14.7-25)

Table 118: Local Variation in *Minimelon colmani* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Linton Bore, WA-914, FMNH 212312	42D	7.88±0.086 (6.6-9.3)	10.90±0.107 (9.0-12.5)	0.723±0.005 (0.663-0.795)	$4^1/_4$ ($3^3/_4$-$4^5/_8$+)	0.59±0.025 (0.3-1.0)	20.±0.931 (11.8-37)
central, WA-913, FMNH 212311	10D	7.49±0.214 (6.5-8.8)	10.67±0.167 (9.8-11.4)	0.701±0.013 (0.633-0.772)	$4^1/_4$- ($3^7/_8$+-$4^1/_2$)	0.57±0.047 (0.4-0.9)	19.8±1.532 (11.9-29)
Fort Welcome, WA-912, FMNH 212310	6L	7.83-0.306 (6.9-8.6)	10.90±0.337 (9.4-11.6)	0.719±0.016 (0.667-0.768)	$4^1/_4$ ($3^7/_8$+-$4^1/_2$)	0.57±0.049 (0.4-0.7)	20.2±2.259 (15.0-29)
Fort Welcome, WA-912, FMNH 212308	81D	8.16±0.059 (6.9-9.4)	11.27±0.059 (9.8-12.6)	0.724±0.004 (0.651-0.825)	$4^3/_8$- ($3^7/_8$+-$4^3/_4$)	0.47±0.019 (0.1-0.9)	28±1.494 (12.8-98)
Blackstone Range							
pass, WA-911, FMNH 212306	9L	7.23±0.196 (6.5-8.3)	10.13±0.255 (9.2-11.2)	0.714±0.008 (0.676-0.753)	$4^1/_8$- ($3^7/_8$+-$4^1/_2$)	0.88±0.057 (0.5-1.0)	12.2±1.342 (9.20-21.6)
pass, WA-911, FMNH 212307	39D	7.19±0.078 (6.4-8.2)	10.21±0.084 (9.0-11.2)	0.704±0.006 (0.660-0.804)	$4^1/_8$+ (4-$4^3/_8$)	0.69±0.034 (0.3-1.4)	16.3±0.929 (7.0-36)
Papulankutja, WA-910, FMNH 212304	4D	7.15±0.185 (6.7-7.5)	10.33±0.221 (9.9-10.8)	0.692±0.008 (0.670-0.707)	$4^1/_8$+ ($4^1/_8$–$4^3/_8$-)	0.85±0.126 (0.6-1.2)	12.8±1.616 (8.83-16.7)

Discussion

Minimelon colmani, sp. nov., lives in shaded litter as a free sealer, and has not been collected sealed to rocks or other snails. It is common under fig clusters, and has been taken in talus both in the Cavenagh and Rawlinson Ranges. The only record from open country, NE of the Jameson Range, suggests that this species may survive, at least for some years, in areas of plains lying between the Rawlinson and line of southern ranges that provide most of the current records.

It is presently impossible to circumscribe its inhabited range accurately. Three 1983 stops in the Warburton Ranges during the Central Australian Expedition were negative for land snails, although there is an unlocalized Warburton Range record in SAM. The area W of Warburton to Wiluna and Laverton never has been visited by a malacologist. While maps suggest that the presence of *Minimelon colmani* in this area is unlikely, isolated colonies may be present. The eastern range limits seem better defined. *Basedowena cognata*, sp. nov., has been taken in the Schwerin Mural Crescent, WA, without recording *M. colmani*. Both *Minimelon colmani* and *Basedowena papulankutjana*, sp. nov., occur microsympatrically (WA-910-1) in the Blackstone Range, but in the Hinckley and Tomkinson Ranges, only *Basedowena vulgata*, sp. nov., and *Pleuroxia radiata* (Hedley, 1905) are found. *Basedowena elderi* (Bednall, 1892), *Minimelon colmani*, *Sinumelon pedasum* Iredale, 1937, and an undescribed species of *Sinumelon* have been collected in the Birksgate Range. *Minimelon* is absent from the larger ranges further E (Mann, Musgrave, Everard, Petermann, etc.). Undoubtedly it will be found in the various small ranges lying both N and S of the Warburton-Blackstone axis. The northern range limit is unknown. In 1983 we were locally refused permission to collect in the main Rawlinson Ranges and the Dixon Ranges. Our efforts were restricted to near Mt. Russell (WA-917-8).

Variation in size and shape (**Table 118**) is substantial, especially in regard to umbilical size. Dissection of examples from the Rawlinson and Barrow Ranges failed to find any significant genital differences. Quite possibly there is a species complex involved, but determination of this must be left to others.

The name *colmani* is in honour of Phil Colman of the Australian Museum, Sydney, companion on several field trips, and indefatigable proselytizer of mollusc collecting effort. Together we collected most of the above material during the Central Australian Expedition of 1983. He requested that this species by "his". So be it.

GENUS *TATEMELON*, GEN. NOV.

Shell medium to large in size, adult diameters 15.9-23.65 mm, whorl count 3 3/4 to 5-. Spire moderately (*herberti*, *everardensis*), strongly (*musgum*), or very strongly (*inexpectatum*) and evenly elevated, H/D ratio 0.527-0.862. Apical sculpture (**Plates 133-134**) of dense pustules, often worn off. Spire and body whorl densely pustulose and without radial ribbing (*everardensis*), or with prominent crowded radial ridges (*musgum*, *herberti*) that may be greatly reduced (*inexpectatum*). Body whorl rounded, without trace of angulation, descending moderately (*everardensis*, *inexpectatum*) to very sharply (*musgum*, *herberti*) over last part of body whorl. Umbilicus open in *everardensis*, narrow in *inexpectatum* and *herberti*, very narrow to almost closed in *musgum*. Palatal and basal lips narrow in *everardensis*, moderately expanded in *inexpectatum*, well expanded in *musgum* and *herberti*. Columellar lip narrow in *everardensis*, moderately expanded in *inexpectatum*, broadly expanded and nearly closing umbilicus in remaining species. Parietal wall narrow, a noticable callus only in *musgum* and *herberti*. Shell colour brown, varying individually, often lighter on shell base. Lip white, no colour bands present.

Live specimens aestivate sealed to rocks or other snail shells.

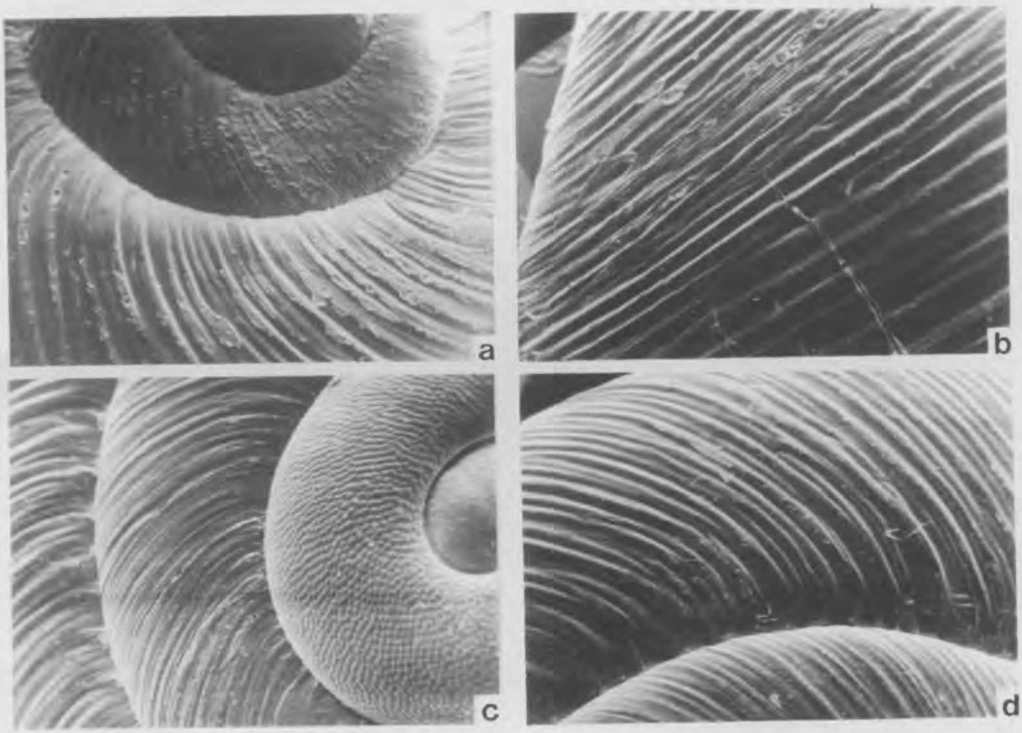


Plate 133: Shell sculpture of *Tatemelon musgum* (Iredale, 1937) and *T. herberti* (Iredale, 1937): (a-b) *T. musgum*. WA-675, Alalka Gorge, nr. Ernabella, Musgrave Ranges, SA. FMNH 212173, Dissection B. a is apex and early spire at 14.9X, b is detail of body whorl at 15.7X; (c-d) *T. herberti*. WA-876, SSE of Mt. Woodroffe, E of Amata, Musgrave Ranges, SA. FMNH 212190. c is apex and early spire at 17.8X, d is detail on body whorl at 16.6X.

Genitalia (**Figs 307-308, 310-311**) with variable structure. Vagina (V) short and slender (*herberti*), short and swollen (*musgum*, *everardensis*), or very long and slender (*inexpectatum*), internally with typical longitudinal pilasters. Spermatheca (S) with expanded head bound to lower part of prostate-uterus, shaft long and slender in

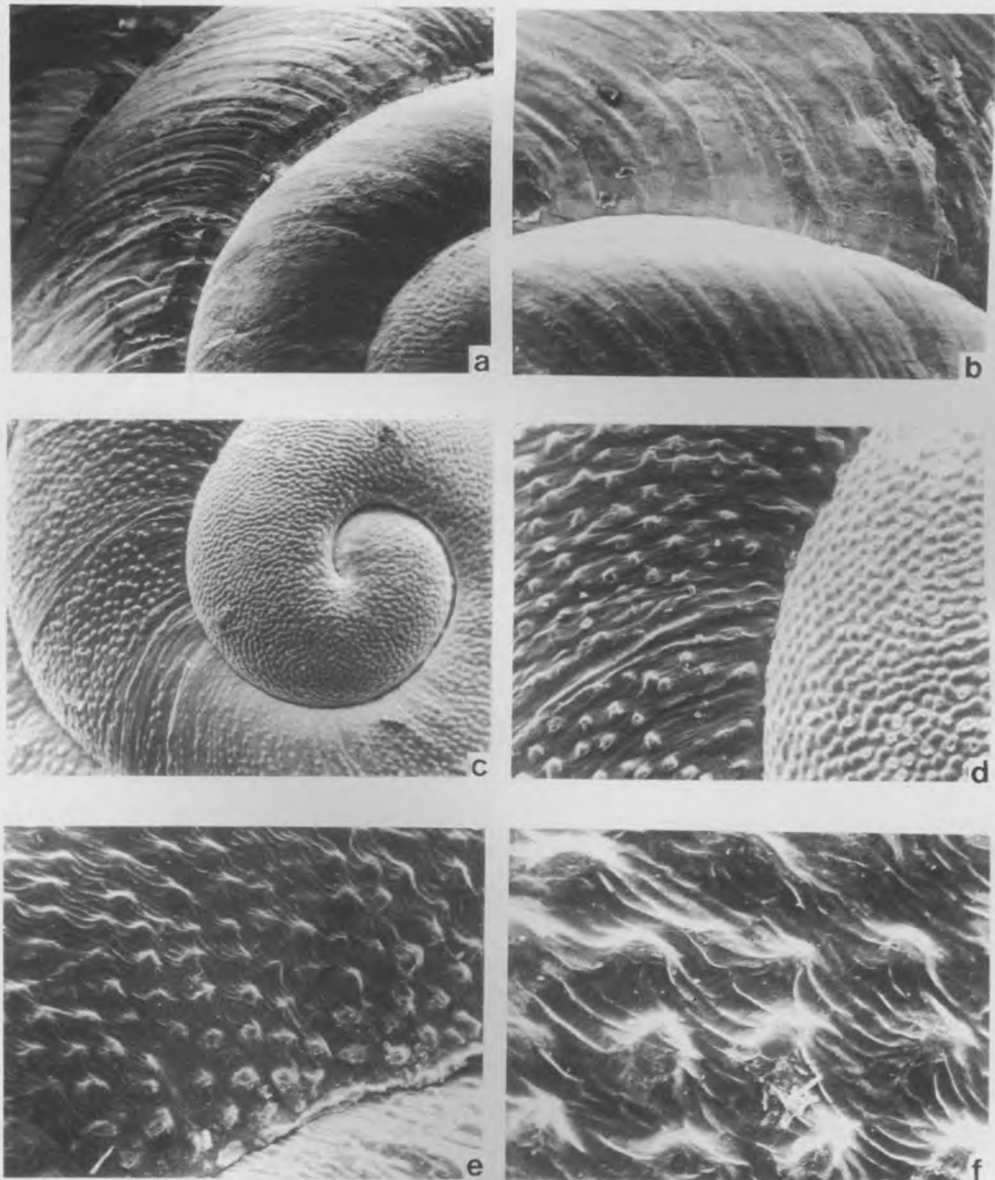


Plate 134: Shell sculpture of *Tatemelon inexpectatum* and *T. everardensis*: (a-b) *T. inexpectatum*. WA-887, S outlier of Mt. Morris, nr. Amata, Musgrave Ranges, SA. FMNH 212236, Dissection A. a is apex and early spire at 18.6X, b is lower spire and body whorl at 17.4X; (c-f) *T. everardensis*. WA-850, Mt. Illbillee, N of Victory Well, Everard Ranges, SA. FMNH 212080. c is apex and early spire at 17.7X, d is detail of late apex and early spire at 44X, e is detail on body whorl at 44.5X, f is detail of body whorl pustules at 89X.

everardensis, short and slender in *inexpectatum*, base of shaft swollen in *musgum* and *herberti*. Free oviduct (UV) wound around spermathecal shaft, except in *inexpectatum* where both free oviduct and spermatheca are very short because of vaginal elongation. Vas deferens (VD) enters normal epiphallic caecum (EC) partway up penis in *inexpectatum* and *everardensis*. Epiphallus (E) then enters very thin walled penis sheath (PS) apically or subapically, and at least partly circles penial retractor muscle (PR) before entering head of penis (*everardensis*) or epiphallus (*inexpectatum*). In both *musgum* and *herberti* the vas deferens enters the very thick walled penis sheath just above peni-oviducal angle, lies free in sheath cavity to near mid-point where it either joins remnant of epiphallic caecum (*herberti*) or increases in diameter (*musgum*) to form epiphallus, which then coils apically and enters penis apex next to insertion of penial retractor muscle after partly circling it. Epiphallus thus shortened in *everardensis*, long in other species. Penis (P) short and globose (*musgum*), of medium length and enlarged diameter (*everardensis, herberti*), or very long and slender (*inexpectatum*). Epiphallic pore (EP) apical, surrounded by enlarged wall pustules (*everardensis*) or a series of very low and indistinct folds (other species). Main pilaster (PP) U-shaped with one arm reduced (*everardensis*), a simple long ridge with specialized head (*inexpectatum*), or a grossly enlarged ridge occupying most of chamber with narrow cross corrugations and a median groove extending partway down pilaster (*herberti*) or with larger cross corrugations and the median groove extending entire length of main pilaster (*musgum*). Penis chamber wall with some accessory ridges basally and prominent wall pustules above (*everardensis*), many simple ridges (*inexpectatum*), or almost no accessory sculpture present (*herberti, musgum*).

Jaw (**Plates 135d, 136b, f, 137d, 138f**) with medially located vertical ribs that are few and very wide in *everardensis*, prominent but widely spaced in *inexpectatum*, rather wide in *herberti*, and typical in *musgum*. Ribs reduced or absent from lateral margins in all species. Central and lateral teeth of radula generalized in *musgum* (**Plate 135a, c, e**), with elevated cusp shaft angle and blunter tip in *herberti* (**Plate 136a, c, e**), elevated cusp shaft angle with curved top and pointed tip in *inexpectatum* (**Plate 137a**), and greatly modified in *everardensis* (**Plate 138a, e**) with shortened basal plate, nearly vertical cusp shaft angle, cusp top curved nearly 90° to broadly rounded scraping tip. Lateromarginal transition abrupt, somewhat modified in *everardensis* because of lateral cusp shift, faint ectoconal trace on early laterals in *musgum*. Marginal teeth without unusual features.

Type species: *Pleuroxia musga* Iredale, 1937 by original designation.

Comparative remarks

The pattern of more rapid whorl width increment and concomitant reduced adult whorl count, rounded shell periphery, densely pustulose shell apex, simple shell lip, general presence of crowded radial ridges (except in *everardensis*), moderate spire elevation, and monochrome colouration are the main features of *Tatemelon*, which is restricted to the Everard and Musgrave Ranges. Its ecological and morphological replacement to the N and W, *Basedowena* Iredale, 1937, retains normal whorl coiling, tends to a much more elevated spire (except *B. squamulosa* [Tate, 1894] from the Krichauff and James Ranges, NT, **Fig. 292b**), has dense pustulations on both apex and spire (reduced on lower spire in *B. papulankutjana* and *B. elderi* [Bednall, 1892], **Plates 124d, 126c-d**), but shares monochrome colouration and relatively simple shell lip. *Granulomelon* Iredale, 1933 generally has prominent and widely spaced radial ribs plus pustules (reduced to only pustules in *G. acerbum*, **Plate 103e**), and three red spiral colour bands. All three genera, *Tatemelon, Basedowena*, and *Granulomelon*, are rock sealers, generally found attached to large boulders. *Sinumelon* Iredale, 1930, Red Centre *Pleuroxia* Ancey, 1887, and *Minimelon*, gen. nov., are, in contrast, free sealers.

Previous studies

Hedley (1905) and Riddle (1915) recorded, but did not describe, specimens of *Tatemelon*, while Iredale (1937b: 50-53) named *T. musgum* and *T. herberti*. Iredale (1938: 107) shifted generic position of the former species. In all, specimens have been assigned previously to *Xanthomelon, Pleuroxia, Glyptorhagada, Chloritis*, and *Fatulabia*, members of several subfamilies. Richardson (1985), in his check list of the Camaenidae, followed Iredale's last set of generic allocations. The only anatomical note, Hedley (1905: 162-163) on the terminal genitalia of *T. herberti*, accurately rendered the basic features.

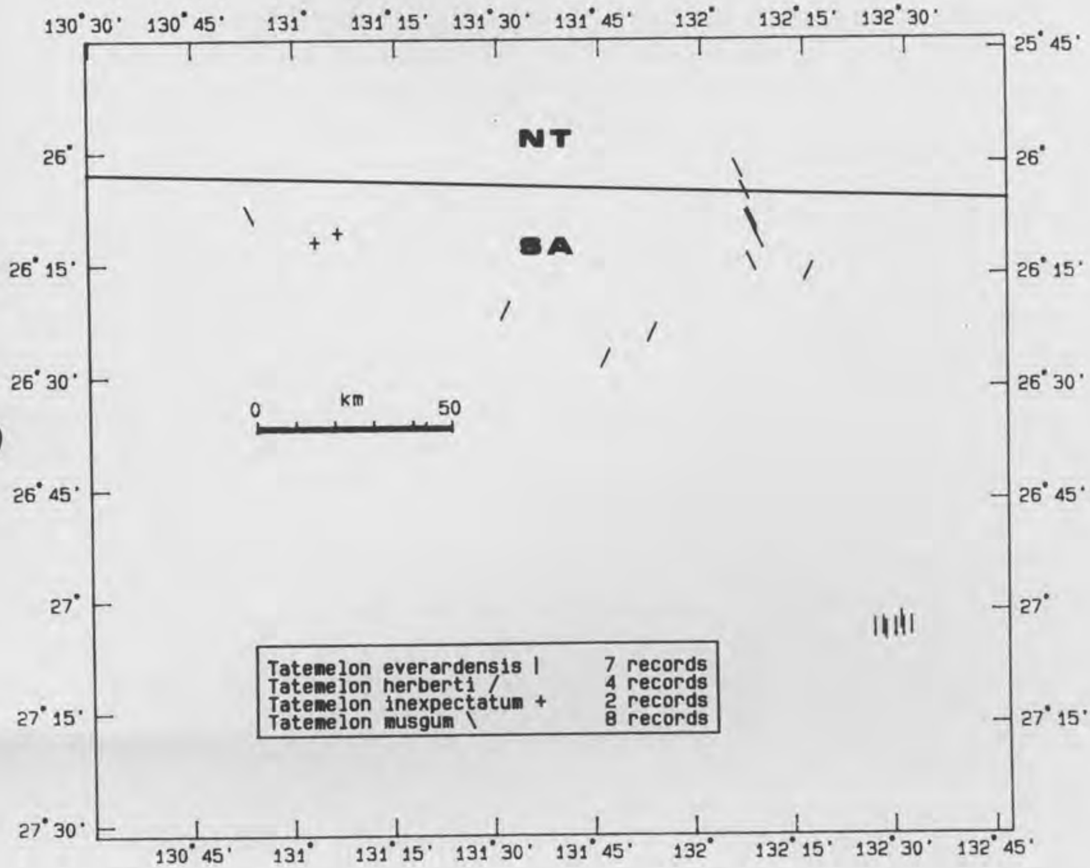
Distribution and comparative ecology

Tatemelon is restricted to the Everard and Musgrave Ranges, SA (**Maps 9, 12**). *T. everardensis*, sp. nov., has been collected only from Mt. Illbillee and its outliers, Everard Ranges, although most other peaks have not been surveyed adequately for land snails. The other three species are restricted to the Musgrave Ranges, where they are allopatric. *T. inexpectatum* has been found only on outliers of Mt. Morris, SW of Amata; *T. musgum* (Iredale, 1937) is common between Ernabella and Mt. Cuthbert in the main mass of the eastern Musgraves, and then has been taken disjunctly at the SW tip of the Musgraves, W of Amata. *T. herberti* (Iredale, 1937) also has a disjunct range, with several records from the south-central main mass from the basin of The Officer west to Jacky Pass Creek, then an isolated record in the SE outliers of the Musgraves between Kenmore Park and Ernabella.

All of the species are rock sealers. The Musgrave Range species are abundant locally, found sealed to boulders in shaded talus areas of limited extent. *T. everardensis* is, in contrast, a rare species that has not been found anywhere in quantity.

Discussion

Tatemelon shows a greater range of variation than any other genus of the Sinumeloninae. An Iredalean solution would have been to scatter the four species into three genera, leaving only *musgum* and *herberti* as congeneric. I suspect, however, that additional field work in the Musgrave and Everard Ranges will discover more species, and that these may, at least in part, fill the currently large morphologic gaps.



Map 12: Records of *Tatemelon everardensis*, *T. herberti* (Iredale, 1937), *T. inexpectatum*, and *T. musgum* (Iredale, 1937) in the Red Centre.

T. everardensis is unusual in its retention of pustules and absence of radial ridges on the shell, and in the great structural alteration of the central and lateral radular teeth (**Plate 138a, e**). The widening seen in the vertical ribs on the jaw (**Plate 138f**), and the reduction in rib number, is linked with the radular changes as an adaptation for scraping rock surfaces for food, rather than tearing up free pieces of dead vegetation. In contrast to these obvious specializations, the genitalia of *T. everardensis* are the most generalized (**Figs 311a-b**) of the four species: retention of the large epiphallic caecum, subapical passage of the epiphallus through a very thin penis sheath, circling of the penial retractor muscle by the epiphallus before it enters the penis apex, presence of positive chamber wall sculpture (pustules) around the epiphallic pore, the U-shaped main pilaster (even with one arm significantly reduced), and short vagina which is swollen in size - all are features that can be found, or nearly duplicated, in other genera of Red Centre Sinumeloninae. Except for the pattern of shell growth and shape outlined above, plus the restriction of structure around the epiphallic pore to pustules, rather than the foliated pilaster found in *Basedowena* Iredale, 1937 (**Figs 293b, 294b, 296e, 297b, 299b, 300b, 302b, 303b**) or the large folds seen in many *Sinumelon* Iredale, 1930 (**Figs 273b, 275b, 276b, 279b**), the genitalia of *T. everardensis* is generalized Sinumeloninae, while the other *Tatemelon* show significant specializations.

Tatemelon inexpectatum has one specialized shell feature, its secondary reduction in ridging (**Plate 134b**), has the radular laterals somewhat curved on top (but not to an unusual extent), and both the penis and vagina have become very elongated and slender. The simple latter change has had a number of consequences - shifting attachment of the penial retractor muscle to the epiphallus rather than the penis apex; probably compressing a U-shaped main pilaster into a single ridge (although with specialized apex); reducing penial wall chamber sculpture around the epiphallic pore, although retaining many longitudinal pilasters lower in the chamber; narrowing the vaginal base; shortening both the free oviduct and the spermatheca, which changed their relationship to companion U-curves rather than wrapping around each other; and lengthening the epiphallus. Both *Sinumelon amatensis*, sp. nov., and *S. musgravesi*, sp nov., have been found microsympatrically with *T. inexpectatum* at WA-886, but it was the only camaenid collected at WA-887. While the above genital elongations are striking in appearance, they suggest "species recognition" alterations, rather than fundamental evolutionary change.

Tatemelon musgum and *T. herberti* share most features. The shells differ very slightly in size and shape. Indeed, if the genital differences were not constant, I probably would have ranked these populations as belonging to one variable species. Both the jaw and the radular teeth are generalized. The two species do show both additive and reductive genital changes. The development of a thick penis sheath with the vas deferens entering near the base, near loss (*herberti*) to loss (*musgum*) of the epiphallic caecum, loss of penis chamber wall sculpture around the epiphallic pore, and change to a single massive main pilaster within the penis, are shared specializations. The facts that *herberti* has base of the vagina and spermatheca slender, while in *musgum* they are broad at the base; that the penis is shorter and often globose in *musgum*, but longer and expended above in *herberti*; and that the main pilaster in *herberti* has narrow cross corrugations and a medial groove extending part way down the pilaster, while in *musgum* the cross corrugations are much wider and the medial groove extends the length of the penis, again suggest "species recognition" differences, not fundamental alterations.

Thus the four species show individual, sometimes dramatic, specializations in structures. As indicated above, some of these seem minor, but others are more basic. The loss of the epiphallic caecum, and change in spatial relationships among vas deferens, penis sheath, epiphallus, and penial retractor muscle seen in *T. musgum* and *T. herberti* are unique among the Red Centre Sinumeloninae.

The pattern of rock sealing, as in *Basedowena* (see above), would tend to limit both colony size and successful dispersal of specimens. The disjunct distributions for *T. musgum* and *T. herberti* suggest that at least occasionally dispersal is successful.

The name *Tatemelon* has been chosen to honour Ralph Tate, whose field efforts during the Horn Expedition provided the first significant land snail collection from the Red Centre, and whose report on this material (Tate, 1896) ranks as one of the finest studies ever published on Australian land snails.

The following key is based upon adult examples.

KEY TO THE SPECIES OF *TATEMELON*

1. Shell with weak to prominent radial ridges on the spire and body whorl (**Plates 133b, d, 134b**) 2

   Shell with dense pustules, but no radial ridges, on the spire and body whorl (**Plate 134d-f**)

   Tatemelon everardensis, sp. nov. (p. 1250)

2. Radial ridges prominent on body whorl (**Plate 133b, d**) 3

   Radial ridges reduced (**Plate 134b**); Mt. Morris area

   Tatemelon inexpectatum, sp. nov. (p. 1245)

3. Shell larger (mean diameter 20.86 mm), spire lower (**Fig. 306e**, mean H/D ratio 0.613)

   Tatemelon herberti (Iredale, 1937) (p. 1241)

   Shell smaller (mean diameter 18.75 mm), spire higher (**Fig. 306b**, mean H/D ratio 0.685)

   Tatemelon musgum (Iredale, 1937) (p. 1233)

TATEMELON MUSGUM (IREDALE, 1937)
(Plates 133a-b, 135a-f; Figs 306a-c, 307a-c)

Xanthomelon wilpenensis Hedley, 1905 (not Tate, 1894), Trans. Proc. Rep. Roy. Soc. South Austr., **29**: 163 - Musgrave Ranges.

Pleuroxia musga Iredale, 1937, South Aust. Nat., **18** (2): 50-51, pl. 2, fig. 3 - Musgrave Ranges, SA

Fatulabia musga (Iredale), Iredale, 1938, Austr. Zool., **9** (2): 107 - check list citation; Richardson, 1985, Tryonia, **12**: 127 - check list citation.

Comparative remarks

Tatemelon musgum (Iredale, 1937), from the E and W ends of the Musgrave Ranges, SA (**Map 12**), is fairly large in size (mean diameter 18.75 mm), has a strongly elevated spire (**Fig. 306b**, mean H/D ratio 0.685), extremely narrow umbilicus (**Fig. 306c**, mean D/U ratio 16.7), broadly expanded lip (**Figs 306a-c**) whose columellar portion nearly closes the umbilicus, and a medium to dark brownish-yellow colour, somewhat lighter in tone on shell base. The apex (**Plate 133a**) is densely pustulated, but the spire and body whorl (**Plate 133a-b**) have crowded radial ridges and lack micropustules. *T. herberti* (Iredale, 1937), from the SE outliers and the main south-central mass of the Musgrave Ranges, has the same sculpture (**Plate 133c-d**), lip, and colour, but differs in its larger size (mean diameter 20.86 mm), lower spire (**Fig. 306e**, mean H/D ratio 0.613), and slightly wider umbilicus (mean D/U ratio 13.8). *T. inexpectatum*, sp. nov., is similar in size and shape (**Table 117**), but differs most obviously in the narrow lip (**Figs 309a-c**), and great reduction in the radial sculpture on the spire and body whorl (**Plate 134a-b**). *T. everardensis*, sp. nov., from Mt. Illbillee, Everard Ranges, has dense pustules on the spire and body whorl (**Plate 134c-f**), but no radial ridges, a much lower spire and wider umbilicus (**Figs 309e-f, Table**). All species of *Basedowena* Iredale, 1937 and *Sinumelon* Iredale, 1937 from the Red Centre are immediately differentiated in their absence of equivalent radial ridging.

Lectotype

AM C.19830, Musgrave Ranges, Central Australia. Collected by H. Basedow. Height of shell 14.2 mm, diameter 18.8 mm, H/D ratio 0.785, whorls 4 1/2, umbilical width 1.05 mm, D/U ratio 17.9.

Paratypes

AM C.19380, SAM D14911, 2 DA from the type collection.

Studied material

South Australia

MUSGRAVE RANGES: Ernabella area (WA-874, 3.8 km S of Alalka turnoff, SAM D18016, WAM 638.87, AM, QM, MV, FMNH 212164-5, 66 LA, 2 DA, 50 LJ, 1 DJ; WA-875, Alalka Gorge above campground, SAM D18007-8, WAM 631.87, WAM 632.87, AM, FMNH 212172-3, 9 LA, 10 DA, 2 LJ, 4 DJ; WA-869, Wamikata Road, 1.8 km N of Alalka turnoff, SAM D18009-10, WAM 633.87, WAM 634.87, AM, MV, QM, FMNH 212140, FMNH 212146, 89 LA, 19 DA, 108 LJ, 14 DJ; WA-870, Wamikata Road, 9.5 km B of Alalka turnoff, SAM D18015, WAM 637.87, AM, QM, FMNH 212149-50, 16 LA, 3 DA, 5 LJ; WA-873, NE facing slope 7.3 km N of Alalka turnoff, Wamikata Road, SAM D18011, FMNH 212159-60, 3 LA, 3 DA, 5 LJ; WA-872, E outlier of Mt. Cuthbert, N of Ernabella, SAM D18014, FMNH 212158, 2 LA, 5 LJ; WA-871, W slope of N outlier of Mt. Cuthbert, SAM D18012-3, WAM 635.87, WAM 636.87, AM, QM, MV, FMNH 212154, FMNH 212663, 11 LA, 13 DA, 8 LJ, 6 DJ); western end of Musgrave Ranges (WA-888, under figs just S of track, W of Amata, SAM D18006, WAM 630.87, AM, QM, FMNH 212237, FMNH 212239, 17 LA, 3 DA, 24 LJ, 6 DJ); Erliwunyawunya (H. Cogger!, 1961, AM C.112640, 8 DA).

Range

Tatemelon musgum (Iredale, 1937) is a common species at the E end of the main mass of the Musgrave Ranges, SA (**Map 12**), extending from near Ernabella N past Mt. Cuthbert (WA-869 through WA-875), and then recurrs at the southwestern tip of the Musgraves (WA-888), W of Amata. On the S side of the central mass of the Musgraves and on the southeastern outliers, it is replaced by *T. herberti* (Iredale, 1937). On the outliers of Mt. Morris, SW of Amata (WA-886-7), it is replaced by *T. inexpectatum*.

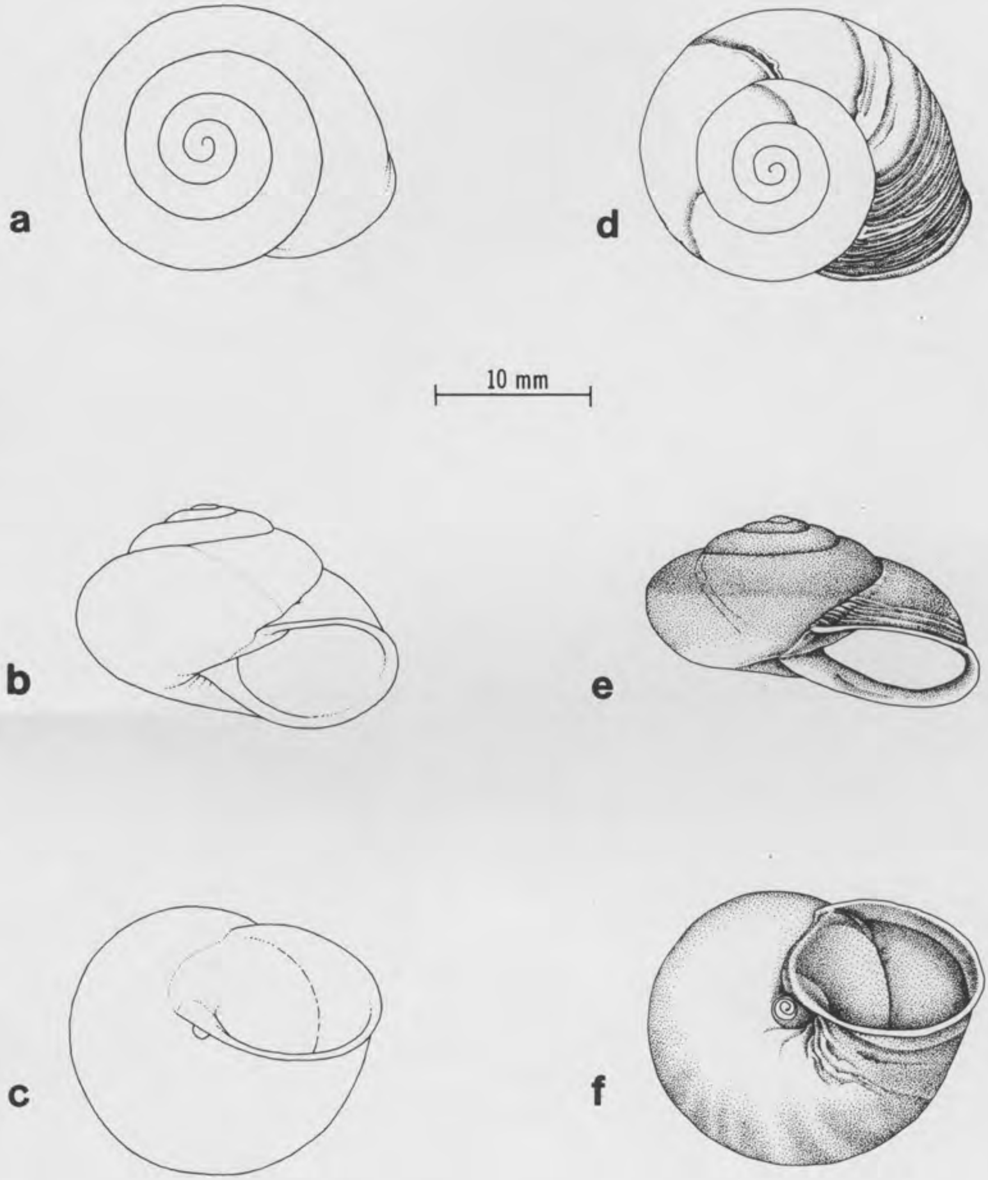


Fig. 306: Shells of *Tatemelon musgum* (Iredale, 1937) and *T. herberti* (Iredale, 1937): (a-c) Paratype of *Pleuroxia musga* Iredale, 1937. AM C.19830. Musgrave Ranges, SA; (d-f) *T. herberti*. WA-868, 16.9 km E of Ernabella, Musgrave Ranges, SA. .FMNH 212138, Dissection A. Scale line equals 10 mm. Drawings by Elizabeth Liebman (a-c) and Linnea Lahlum (d-f).

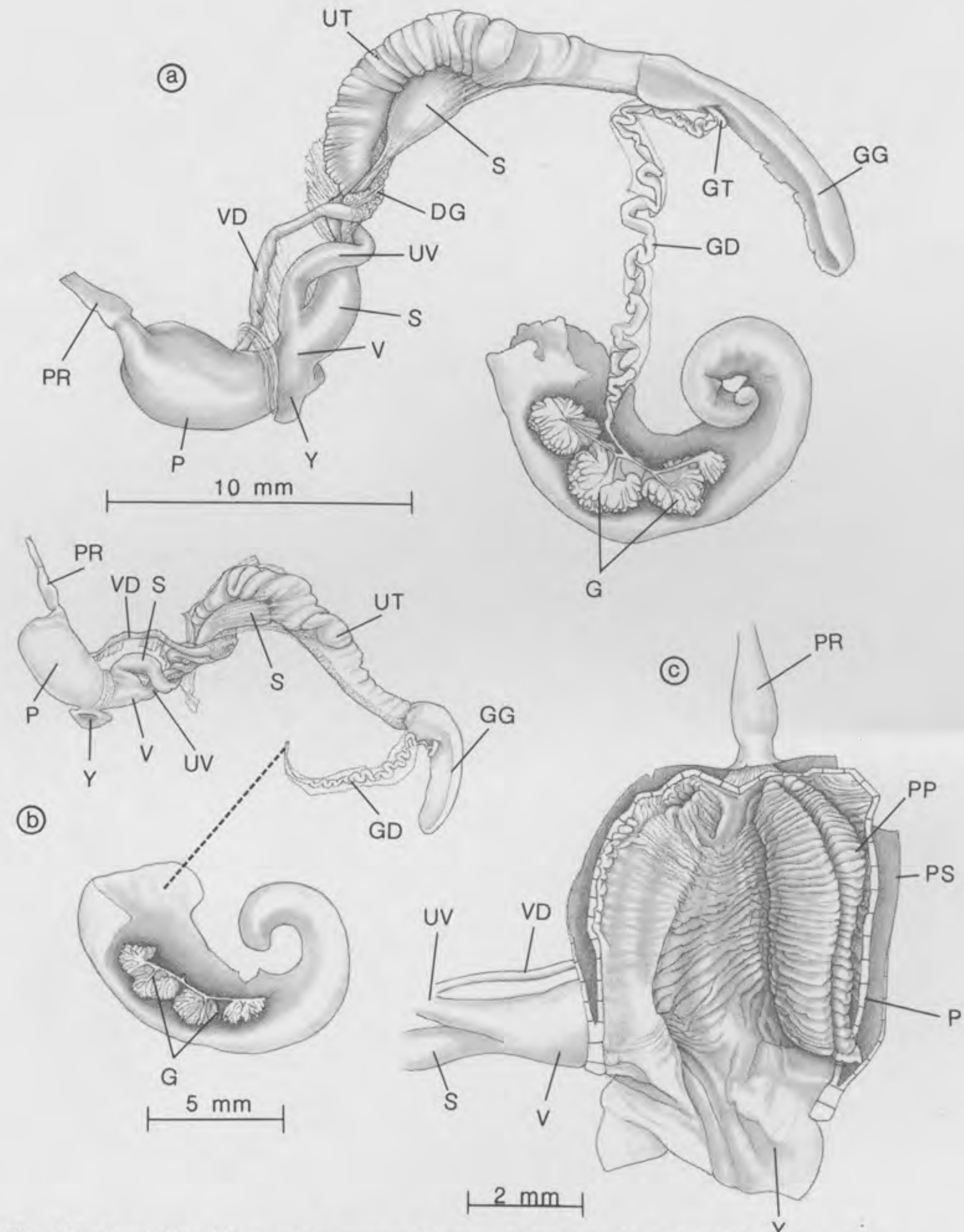


Fig. 307: Genitalia of *Tatemelon musgum* (Iredale, 1937): (a) WA-875, Alalka Gorge, Musgrave Ranges, SA. 1 May 1983. FMNH 212173, Dissection B. whole genitalia; (b) WA-888, outliers W of Amata, Musgrave Ranges, SA. 10 May 1983. FMNH 212239, Dissection B. new adult genitalia; (c) WA-869, Wamikata Road, N of Alalka turnoff, Musgrave Ranges, SA. 7 May 1983. FMNH 212146, Dissection A. interior of penis. Scale lines as marked. Drawings by Linnea Lahlum.

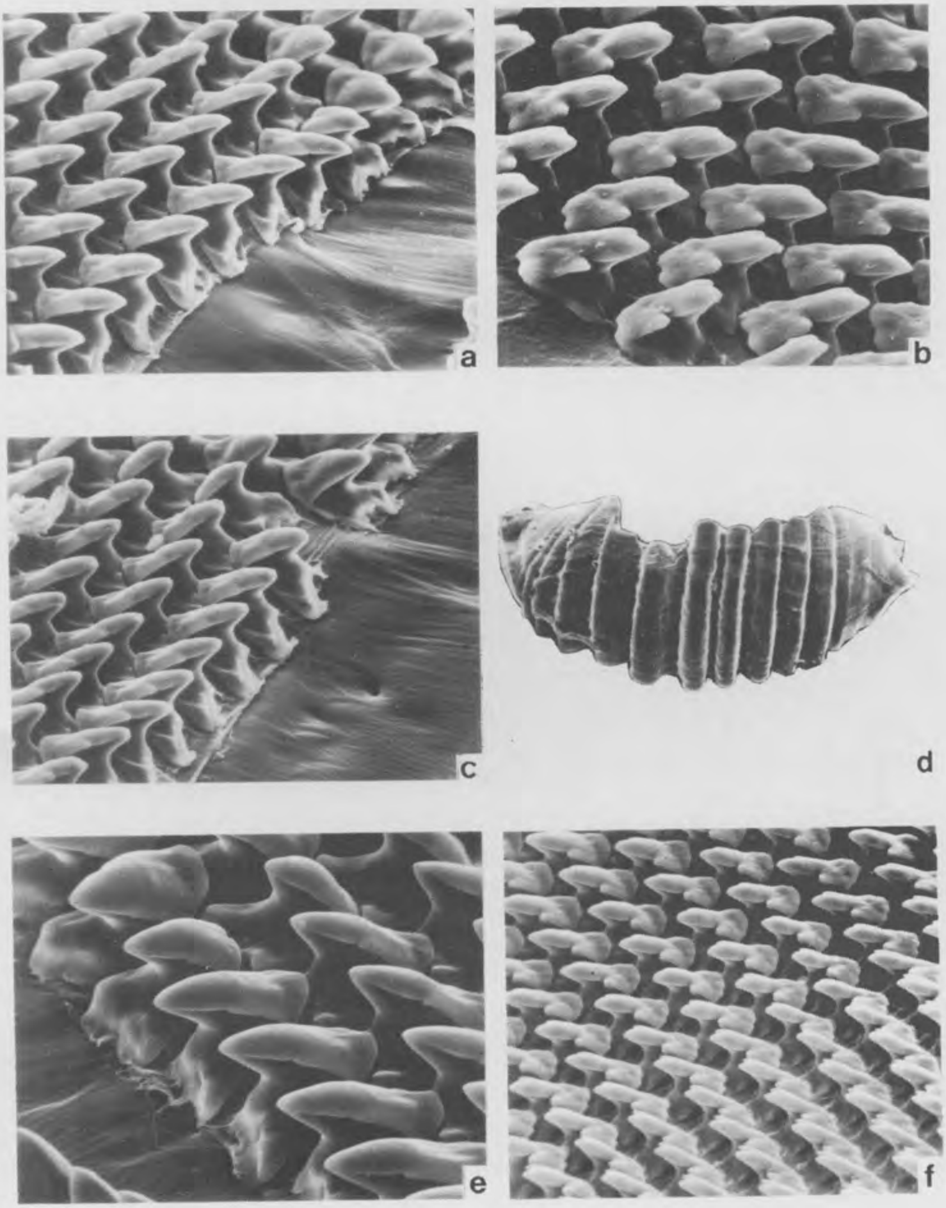


Plate 135: Radular teeth and jaw of *Tatemelon musgum* (Iredale, 1937): (a-d) WA-888, W end Musgrave Ranges, SA. 10 May 1983. FMNH 212239. a is central and early laterals at 365X, Dissection A, b is lateromarginal transition at 540X, Dissection A, c is partly worn central and early laterals at 370X, Dissection B, d is jaw at 52X, Dissection B; (e-f) WA-875, Alalka Gorge, near Ernabella, Musgrave Ranges, SA. 7 May 1983. FMNH 212173, Dissection A, e is central and early laterals at 600X, f is lateromarginal transition at 345X.

Table 119: Local Variation in *Tatemelon*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
T. musgum (Iredale, 1937)							
WA-874, FMNH 212165	66L	13.46±0.088 (12.25-15.7)	19.59±0.097 (18.05-22.2)	0.687±0.004 (0.618-0.746)	$4^{5}/_{8}$- ($4^{3}/_{8}$+-$4^{7}/_{8}$-)	1.18±0.026 (0.8-1.8)	17.0±0.336 (10.5-24.3)
WA-875, FMNH 212173	9L	13.96±0.198 (13.05-14.9)	20.08±0.244 (19.1-21.3)	0.696±0.010 (0.643-0.737)	$4^{1}/_{2}$+ ($4^{1}/_{4}$+-$4^{3}/_{4}$-)	1.25±0.085 (1.0-1.65)	16.7±1.079 (12.5-20.7)
WA-875, FMNH 212172	10D	13.79-0.279 (12.7-15.3)	20.30±0.205 (18.8-21.2)	0.679±0.011 (0.640-0.748)	$4^{5}/_{8}$- ($4^{3}/_{8}$+-$4^{7}/_{8}$+)	1.06±0.047 (0.9-1.4)	19.3±0.701 (14.9-22.7)
WA-869, FMNH 212146	89L	12.51±0.056 (11.45-13.95)	18.19±0.055 (16.8-19.4)	0.688±0.003 (0.623-0.779)	$4^{3}/_{8}$+ ($4^{1}/_{8}$+-$4^{5}/_{8}$-)	1.00±0.010 (0.7-1.4)	18.4±0.198 (13.1-24.2)
WA-869, FMNH 212140	19D	12.28±0.157 (11.05-13.9)	18.38±0.159 (17.3-19.45)	0.669±0.009 (0.612-0.782)	$4^{3}/_{8}$- ($4^{1}/_{4}$+-$4^{1}/_{2}$-)	1.07±0.040 (0.9-1.55)	17.5±0.532 (12.4-21.0)
WA-870, FMNH 212149	16L	12.92±0.133 (11.95-13.85)	18.61±0.163 (17.45-20.1)	0.695±0.006 (0.646-0.748)	$4^{3}/_{8}$+ ($4^{1}/_{4}$+-$4^{1}/_{2}$+)	1.02±0.018 (0.9-1.2)	18.4±0.337 (15.8-20.7)
WA-871, FMNH 212663	11L	13.09±0.184 (12.05-14.35)	19.20±0.144 (18.35-19.75)	0.682±0.007 (0.646-0.740)	$4^{5}/_{8}$- ($4^{1}/_{2}$--5-)	1.91±0.106 (1.3-2.25)	10.5±0.703 (8.25-15.1)
WA-871, FMNH 212154	13D	12.93±0.115 (12.35-13.6)	19.52±0.220 (18.1-20.85)	0.663±0.008 (0.617-0.715)	$4^{1}/_{2}$+ ($4^{3}/_{8}$-$4^{3}/_{4}$-)	2.16±0.070 (1.55-2.5)	9.18±0.344 (8.12-12.7)
WA-888, FMNH 212239	17L	11.54±0.114 (10.9-12.45)	16.79±0.123 (16.2-17.9)	0.687±0.007 (0.638-0.727)	$4^{3}/_{8}$- ($4^{1}/_{8}$+-$4^{1}/_{2}$+)	1.36±0.048 (1.05-1.75)	12.6±0.469 (9.41-15.7)

Table 119: Local Variation in *Tatemelon* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
T. herberti (Iredale, 1937)							
WA-868, FMNH 212138	16L	13.00±0.137 (11.85-13.65)	21.99±0.168 (20.5-22.9)	0.592±0.007 (0.551-0.656)	$4\frac{1}{2}$+ ($4\frac{3}{8}$- $-4\frac{3}{4}$)	2.01±0.067 (1.5-2.45)	11.1±0.431 (8.85-15.3)
WA-868, FMNH 212137	31D	11.98±0.109 (11.0-13.4)	21.26±0.132 (20.2-23.65)	0.563±0.004 (0.527-0.607)	$4\frac{1}{2}$+ ($4\frac{3}{8}$+$-4\frac{3}{4}$)	1.95±0.040 (1.5-2.3)	11.0±0.266 (9.04-14.4)
WA-876, FMNH 212194	24L	13.15±0.153 (12.05-14.6)	20.27±0.147 (19.1-22.25)	0.648±0.006 (0.598-0.708)	$4\frac{1}{2}$ ($4\frac{3}{8}$- $-4\frac{7}{8}$-)	1.35±0.057 (1.0-2.0)	15.6±0.585 (9.60-20.0)
WA-876, FMNH 212190	34D	13.14±0.142 (11.1-15.4)	20.59±0.145 (19.2-22.55)	0.638±0.005 (0.578-0.683)	$4\frac{1}{2}$ ($4\frac{3}{8}$+$-4\frac{3}{4}$+)	1.40±0.056 (0.7-2.1)	15.6±0.755 (9.69-28)
WA-878, FMNH 212206	5L	12.60±0.321 (11.9-13.5)	20.21±0.286 (19.5-21.15)	0.623±0.010 (0.604-0.662)	$4\frac{1}{2}$- ($4\frac{3}{8}$+$-4\frac{1}{2}$+)	1.31±0.96 (1.05-1.55)	15.7±1.127 (13.2-19.2)
T. inexpectatum							
WA-886, FMNH 212232	7D	14.12±0.160 (13.3-14.55)	17.56±0.146 (17.0-18.0)	0.804±0.013 (0.751-0.845)	$41/_{2}$+ ($4\frac{3}{8}$+$-4\frac{3}{4}$+)	1.60±0.124 (1.2-2.05)	11.4±0.851 (8.53-14.0)
WA-887, FMNH 212236	9L	13.66±0.229 (12.9-14.9)	16.90±0.144 (16.15-17.5)	0.808±0.011 (0.766-0.862)	$4\frac{1}{2}$+ ($4\frac{3}{8}$+$-4\frac{5}{8}$)	1.34±0.072 (1.0-1.7)	13.0±0.800 (9.56-17.3)
T. everardensis							
WA-861, FMNH 212116	5L	10.91±0.190 (10.6-11.6)	17.26±0.255 (16.6-18.15)	0.632±0.007 (0.609-0.647)	$4\frac{1}{8}$ ($3\frac{3}{4}$-$4\frac{1}{4}$+)	2.20±0.269 (1.5-2.75)	8.41±1.13 (6.39-11.6)

Diagnosis

Shell relatively large, adult diameter 15.9-22.2 mm (mean 18.75 mm), with 4 1/8+ to 5- (mean 4 1/2-) rather loosely coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 306b**), shell height 10.9-15.7 mm (mean 12.83 mm), H/D ratio 0.612-0.782 (mean 0.685). Body whorl rounded, without trace of angulation. Shell apex (**Plate 133a**) normally worn nearly smooth, juveniles showing typical dense pustulations, spire and body whorl (**Plate 133a-b**) with prominent, crowded radial ridges, no pustulations. Umbilicus (**Fig. 306c**) very narrow, nearly closed by reflection of columellar lip, width 0.7-2.5 mm (mean 1.19 mm), D/U ratio 8.12-24.3 (mean 16.7). Body whorl descending sharply over last eighth whorl. Lip broadly expanded on palatal and basal margins, strongly curved over umbilicus (**Figs 306a-c**). Parietal wall narrow, with a moderate callus. Shell color brown to yellow-brown, somewhat lighter near umbilicus. Based on 266 measured adults.

Genitalia (**Figs 307a-c**) with vagina (V) very short, swollen, internally with typical wall pilasters. Base of spermatheca (S) well expanded, narrowed shaft section short, free oviduct (UV) wrapped around it. Vas deferens (VD) partly kinked on descending arm, entering thick walled penis sheath (PS) just above base, free inside sheath, expanding into epiphallus (E) near top, but no trace of epiphallic caecum (EC). Epiphallus circles penial retractor muscle (PR), which inserts on head of penis right next to epiphallic entrance into penis through a circle of very low ridges. Penis (P) generally very short, often nearly globose, internally (**Fig. 307c**) with a huge main pilaster (PP) having large cross corrugations and a median groove its entire length.

Central and early lateral teeth of radula (**Plate 135a, c, e**) with prominent basal support ridge, large anterior flare, standard cusp shaft angle, only slight top curvature to pointed cusp tip, and often a very faint trace of an ectocone. Late laterals (**Plate 135b, f**) with enlarged anterior flare and prominent ectocone. Lateromarginal transition abrupt, marginal teeth typical. Jaw (**Plate 135d**) with average width vertical ribs in center, lateral margins smooth.

Discussion

Tatemelon musgum (Iredale, 1937) shows considerable size and shape variation (**Table 119**). Populations from just N of Ernabella (WA-874, WA-875) average largest in both diameter and whorl count, and also have a narrow umbilicus. Populations from WA-869, WA-870, and WA-873 average less in both diameter and whorl count, but also retain the very small umbilicus. The Mt. Cuthbert populations, WA-871-2, are larger in diameter and whorl count, but also have the umbilicus distinctly more open. Finally, the isolated population from the western tip of the Musgrave Ranges (WA-888) has a smaller average diameter and the umbilicus is intermediate in size.

Dissection of individuals from all populations with extended adult animals showed that the unusual main pilaster (PP) within the penis is shared, although penis length may vary from population to population.

The colonies we located always were quite circumscribed in area, with specimens restricted to large rock talus or outcrops with good tree cover. Thus gene flow among populations probably is quite restricted, and variation would be expected.

TATEMELON HERBERTI (IREDALE, 1937)
(Plates 133c-d, 136a-f; Figs 306d-f, 308a-b)

Xanthomelon clydonigerum Hedley, 1905 (not Tate, 1894), Trans. Proc. Rep. Roy. Soc. South Austr., **29**: 162-163, text fig. (terminal genitalia), pl. XXX, figs 10-12 - Musgrave Ranges.

Glyptorhagada herberti Iredale, 1937, South Austr. Nat., **18** (2): 53, pl. II, fig. 19; Iredale, 1938, Austr. Zool., **9** (2): 108 - check list citation; Richardson, 1985, Tryonia, **12**: 147 - check list citation.

Comparative remarks

Tatemelon herberti (Iredale, 1937), from the E and south-central portions of the Musgrave Ranges, SA (**Map 12**) has a moderately elevated spire (**Fig. 306e**, mean H/D ratio 0.613), very narrow umbilicus (**Fig. 306f**, mean D/U ratio 13.8), well expanded lip, and post-apical sculpture of crowded radial ridges (**Plate 133c-d**). The same sculpture is found on *T. musgum* (Iredale, 1937), also from the Musgrave ranges, but that species has a much higher spire (**Fig. 306b**, mean H/D ratio 0.685), narrower umbilicus (**Fig. 306c**, mean D/U ratio 16.7), and is somewhat smaller (**Table 117**). *T. inexpectatum*, sp. nov., from Mt. Morris, Musgrave Ranges, has a higher spire (**Fig. 309b**, mean H/D ratio 0.802), and the radial ridges on the spire and body whorl are greatly reduced in prominence (**Plate 134a-b**). *T. everardensis*, sp. nov., from the Everard Ranges, is readily separable by its lack of radial ridges, presence of dense pustulations on the spire and body whorl (**Plate 134e-f**), wider umbilicus, and reduced whorl count (**Table 117**). No species of *Sinumelon* Iredale, 1930 or *Basedowena* Iredale, 1937 have equivalent radial ridging. Anatomically (**Figs 308a-b**), *T. herberti* has the vagina (V) very short and slender, the vas deferens (VD) enters the thick penis sheath (PS) shortly above the penis (P) base, there is a remnant epiphallic caecum present on the epiphallus (E) inside the penis sheath cavity, and the medium length penis (P) internally (**Plate 308b**) has a single huge main pilaster (PP) that has narrow cross corrugations and a deep groove extending part way down from the penis apex. *T. musgum* differs (**Figs 307a, c**) in that the penis (P) is much shorter, often globose in shape, the main pilaster has wider corrugations, and the groove extends the length of the main pilaster. The long vagina (V) and penis (P) of *T. inexpectatum* (**Figs 310a-c**) are obvious differences, while *T. everardensis* (**Figs 311a-b**) has a prominent epiphallic caecum (EC) outside of the penis sheath (PS), and the penis has a U-shaped main pilaster without cross corrugations. The absence of a protruding epiphallic caecum and the presence of the huge corrugated pilaster in *T. herberti* immediately separate it from any of the other Red Centre Sinumeloninae genera.

Holotype

AM C.19229, Musgrave Ranges, Central Australia. Collected by Herbert Basedow. Height of shell 15.5 mm, diameter 22.65 mm, H/D ratio 0.684, whorls 4 7/8+, umbilical width 1.55 mm, D/U ratio 14.6.

Paratypes

SAM D14623, Glen Ferdinand, Musgrave Ranges, SA, 1 DJ.

Studied material

South Australia

MUSGRAVE RANGES: 16.9 km E of Ernabella (WA-868, hill N of road, SAM D17903-4, WAM 621.87, WAM 622.87, AM, QM, MV, FMNH 212137-8, 16 LA, 31 DA, 8 LJ, 3 DJ); 9.4 km E of Currie River, S of Mt. Woodroffe (WA-878, main ridge, E of Amata, SAM D17907, SAM D17909, WAM 625.87, AM, FMNH 212206-7, 5 LA, 3 DA, 10 LJ, 8 DJ); rockhole area SSE of Mt. Woodroffe (WA-876, SAM D17905-6, WAM 623.87, WAM 624.87, AM, QM, MV, FMNH 212184-6, FMNH 212190, FMNH 212194, 25 LA, 40 DA, 29 LJ, 27 DJ); 21 km W of Currie River, Amata track (WA-880, large rocky gulch, SAM D17908, AM, FMNH 212217, 4 DA, 4 DJ).

Range

Tatemelon herberti (Iredale, 1937) has a disjunct distribution. It has been taken once in the SE outlying hills of the Musgrave Ranges, SA (**Map 12**) between Kenmore Park and Ernabella (WA-868), and then along the S face of the main mass of the Musgrave Ranges in The Officer drainage and just E of Jacky Pass Creek.

Diagnosis

Shell large, adult diameter 18.7-23.65 mm (mean 20.86 mm), with 4 3/8- to 4 7/8- (mean 4 1/2+) rather loosely coiled whorls. Apex and spire moderately and evenly elevated, not rounded above (**Fig. 306e**), shell height 11.0-15.4 mm (mean 12.78 mm), H/D ratio 0.527-0.727 (mean 0.613). Body whorl rounded, without trace of angulation. Shell apex (**Plate 133c**) with dense pustulations. Spire and body whorl (**Plate 133c-d**) with low, crowded radial ridges, no trace of pustulations. Umbilicus (**Fig. 306f**) very narrow, partly closed by reflection of columellar lip, width 0.7-2.5 mm (mean 1.61 mm), D/U ratio 8.85-28.5 (mean 13.8). Body whorl descending sharply over last eighth whorl. Lip thin, moderately expanded on palatal and basal margins, more strongly on columellar margin. Parietal wall narrow, with medium callus. Shell colour yellow-brown, lighter around umbilicus. Based on 124 measured adults.

Genitalia (**Figs 308a-b**) with vagina (V) very short and slender. Spermatheca (S) with swollen base, part of shaft narrowed. Free oviduct (UV) long, wrapped around spermathecal shaft. Head of spermatheca at base of prostate-uterus. Vas deferens (VD) slender, entering thick walled penis sheath (PS) about one-eighth up from penis base, free in sheath cavity, expanding into epiphallus about halfway up with remnant bits of epiphallic caecum (EC) visible. Epiphallus (E) long, circling penial retractor muscle (PR) before entering penis apex through very low ridges. Penial retractor muscle inserts on head of penis beside epiphallus entry. Penis (P) of medium length,

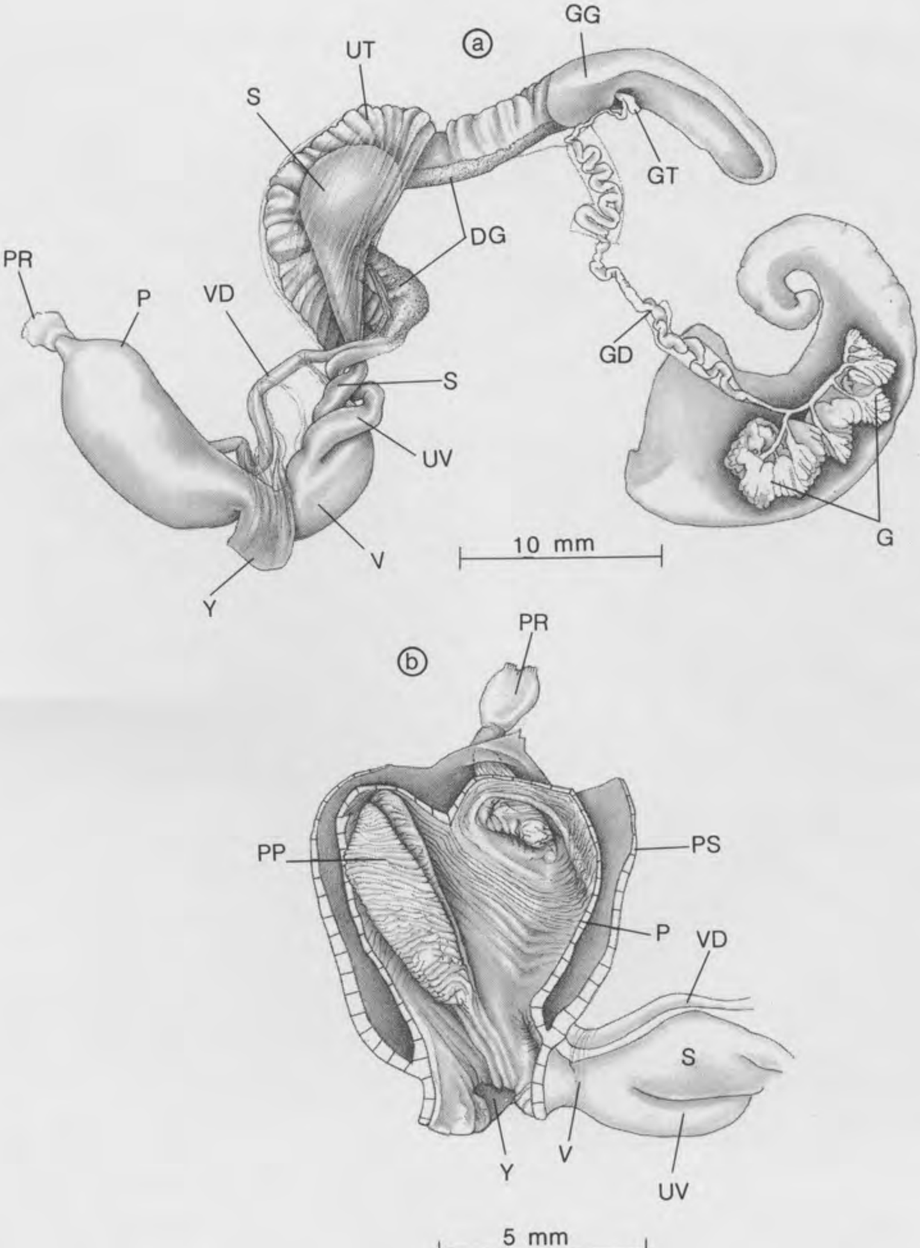


Fig. 308: Genitalia of *Tatemelon herberti* (Iredale, 1937): WA-868, 16.9 km E of Ernabella, Musgrave Ranges, SA. 6 May 1983. FMNH 212138. (a) whole genitalia, Dissection B; (b) interior of penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

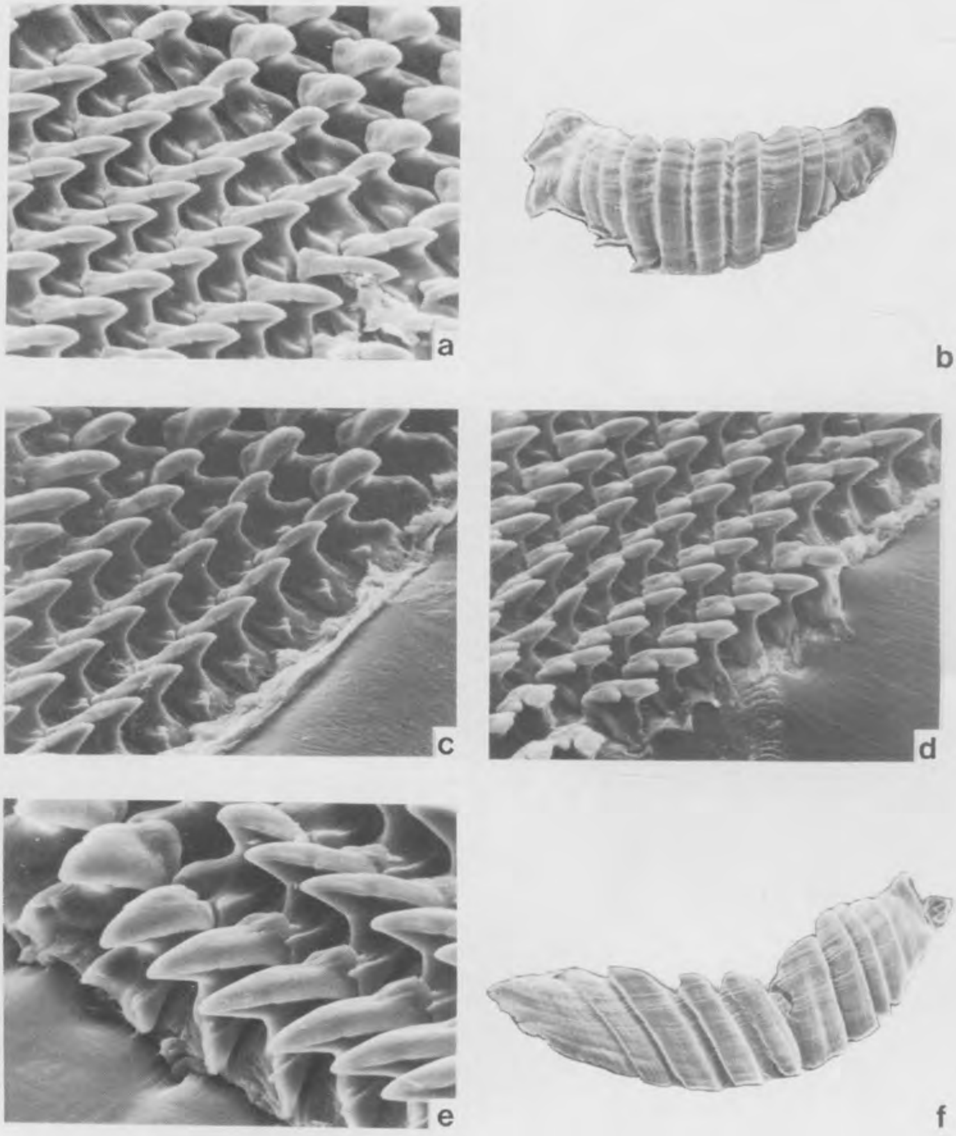


Plate 136: Radular teeth and jaw of *Tatemelon herberti* (Iredale, 1937): (a-b) WA-878, S of Mt. Woodroffe, Musgrave Ranges, SA. 8 May 1983. FMNH 212206, Dissection A. a is central and early laterals at 355X, b is jaw at 38X; (c-f) WA-868, E of Ernabella Mission, Musgrave Ranges, SA. 6 May 1983. FMNH 212138. c is central and early laterals at 360X, Dissection A, d is lateromarginal transition at 350X, Dissection A, e is central and early laterals at 540X, Dissection B, f is jaw at 36.5X, Dissection A.

thick, internally (**Fig. 308b**) with a single huge pilaster (PP) that fills most of cavity. Pilaster with very narrow cross corrugations and a medial groove extending from top of pilaster to near mid-point. Just above atrium (Y), main pilaster narrows and splits into simple longitudinal wall pilasters. No other penis chamber sculpture.

Central and lateral teeth of radula (**Plate 136a, c, e**) with massive basal support ridge, small anterior flare, about 60o cusp shaft angle, only slight cusp top curvature to bluntly pointed cusp tip. Late laterals (**Plate 136d**) with enlarged anterior flare and prominent ectocone, lateromarginal transition abrupt. Marginals typical. Jaw (**Plate 136b, f**) with a few, rather wide, vertical ribs, reduced or absent from lateral margins.

Discussion

Tatemelon herberti (Iredale, 1937) was erroneously referred in its original description to the Flinders Range-Eastern Plains-Eyre Peninsula-Kangaroo Island genus *Glyptorhagada* Pilsbry, 1890. That genus is a locally evolved member of the subfamily Camaeninae, totally unrelated in anatomy and biogeography to the Sinumeloninae (Solem, 1988c).

The several populations show minor size and shape differences (**Table 119**). The disjunct easternmost examples (WA-868) are more widely umbilicated and with a slightly lower spire, whereas the material from WA-876 and WA-878 are essentially identical. The holotype agrees more with the latter populations in size and shape, but it is premature to offer a restricted type locality.

TATEMELON INEXPECTATUM, SP. NOV.
(Plates 134a-b, 137a-d; Figs 309a-c, 310a-b)

Comparative remarks

Tatemelon inexpectatum, sp. nov., from foothills of Mt. Morris, SW of Amata, Musgrave Ranges, SA (**Map 12**), is smaller than the other known *Tatemelon*, has a strongly elevated spire (**Fig. 309b**, mean H/D ratio 0.802), very narrow umbilicus (**Fig. 309c**, mean D/U ratio 12.4), narrowly expanded lip, is dark brownish-yellow in colour with slightly lighter basal tone, has remnants of radial ridges on the spire and body whorl (**Plate 134a-b**), but no pustules, although the apex is densely pustulated. *T. everardensis*, sp. nov., from Mt. Illbillee, Everard Ranges, has a much lower spire and wider umbilicus (**Table 117, Figs. 309e-f**), dense micropustulations on the spire and body whorl (**Plate 134e-f**), and no trace of radial ridges. *T. musgum* (Iredale, 1937), from the Musgrave Ranges, is very narrowly umbilicated and has a lower spire (**Figs 306b-c**, mean H/D ratio 0.685), plus a spire and body whorl sculpture of crowded radial ridges (**Plate 133a-b**). The large *T. herberti* (Iredale, 1937), from the Musgrave Ranges, has a significantly lower spire (**Fig. 306e**) and sculpture of crowded radial ribs (**Plate 133c-d**). The much more expanded body whorl and thickened lip of all Musgrave Range species of *Sinumelon* Iredale, 1930 immediately differentiate them from *T. inexpectatum*. Anatomically (**Figs 310a-b**), *T. inexpectatum* is distinguished by its very long and slender vagina (V), very short spermatheca (S) and free oviduct (UV), long epiphallus (E), and long, slender penis (P) which has the main pilaster (PP) a single ridge with specialized apex and many accessory wall pilasters. Both *T. musgum* and *T. herberti* differ in the presence of a massive main pilaster in the penis, which has narrow cross corrugations and a partial groove (*herberti*, **Fig. 308b**) or wider cross corrugations with a continuous groove (*musgum*, **Fig. 307c**).

Holotype

SAM D17865, WA-887, under figs on S outlier of Mt. Morris, SW of Amata, Musgrave Ranges, South Australia, Australia (Woodroffe 1:250,000 map sheet SG52-12 - 406:746yds). 26° 11' 53" S, 131° 03' 09" E. Collected by the Central Australian Expedition 10 May 1983. Height of shell 14.25 mm, diameter 17.8 mm, H/D ratio 0.801, whorls 4 1/2-, umbilical width 1.1 mm, D/U ratio 16.2.

Paratopotypes

SAM D18001, WAM 626.87, AM, QM, MV, FMNH 212235-6, 8 LA, 3 DA, 7 LJ, 6 DJ from the type locality.

Paratypes

South Australia

MUSGRAVE RANGES: rockhole 2.8 km W of Amata aerodrome, Mt. Morris foothills (WA-886, SAM D18002, WAM 627.87, AM, FMNH 212232, 7 DA, 8 DJ).

Range

Tatemelon inexpectatum is known from outliers of Mt. Morris, SW of Amata, western Musgrave Ranges, SA (**Map 12**). To the W, it is replaced by a disjunct population of *T. musgum* (Iredale, 1937) (WA-888), while near Jacky Pass Creek to the E, the first record of *T. herberti* (Iredale, 1937) is known. There is thus a significant collecting gap from which no material of *Tatemelon* are known. Until these intervening areas are sampled, and the northern slopes of the Musgrave Ranges are collected, the exact distribution will remain unknown.

Diagnosis

Shell of medium size, adult diameter 16.15-18.0 mm (mean 17.22 mm), with 4 3/8- to 4 3/4+ (mean 4 1/2+) rather widely coiled whorls. Apex and spire strongly and evenly elevated (**Fig. 309b**), shell height 12.5-14.9 mm (mean 13.81 mm), H/D ratio 0.750-0.862 (mean 0.802). Body whorl rounded, without trace of angulation. Shell apex (**Plate 134a**) with dense micropustules. Upper spire (**Plate 134a**) with traces of pustules, changing to weak radial ridges, that become reduced in prominence on lower spire and body whorl (**Plate 134b**). Umbilicus (**Fig. 309c**) very narrow, partly covered by columellar lip reflection, width 1.0-2.05 mm (mean 1.43 mm), D/U ratio 8.53-17.3 (mean 12.4). Body whorl descending strongly over last eighth whorl. Lip thin, moderately expanded on palatal and basal margins, more strongly on columellar margin. Parietal wall narrow, with a thin callus. Shell colour brownish-yellow, lighter near umbilicus. Based on 19 measured adults.

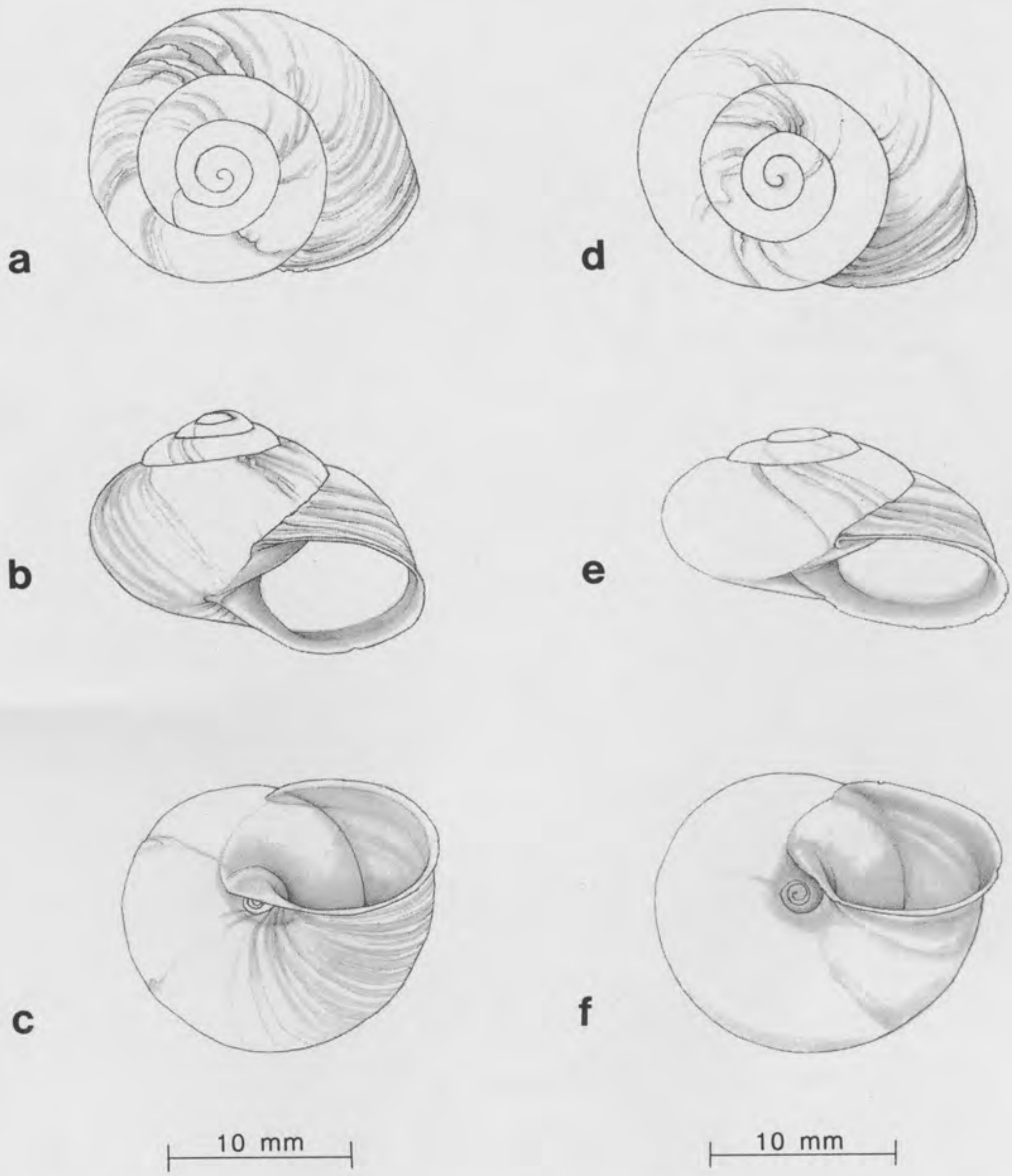


Fig. 309: Shells of *Tatemelon inexpectatum*, sp. nov., and *T. everardensis*, sp. nov.: (a-c) Holotype of *T. inexpectatum*. SAM D17865. WA-887, under figs on S outlier of Mt Morris, near amata, W Musgrave Ranges, SA; (d-f) Holotype of *T. everardensis*. SAM D17866. WA-850, valley mouth N of Victory Well, Mt. Illbillee, Everard Ranges, SA. Scale line equals 10 mm. Drawings by Linnea Lahlum.

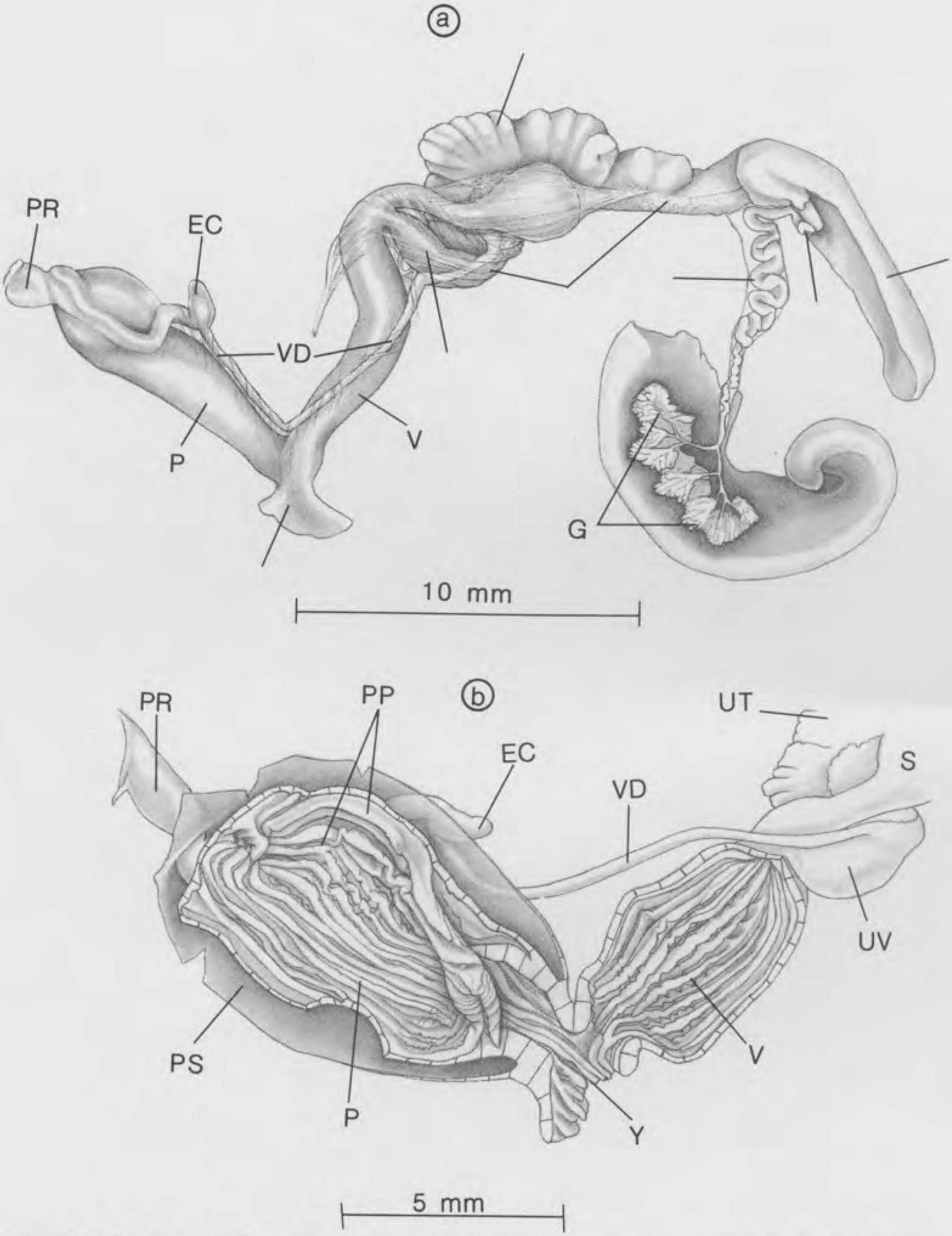


Fig. 310: Genitalia of *Tatemelon inexpectatum*, sp. nov.: WA-887, S outlier of Mt. Morris, near Amata, Musgrave Ranges, SA. 10 May 1983. FMNH 212236. (a) whole genitalia, Dissection A; (b) interior of penis and vagina, Dissection C. Scale lines as marked. Drawing by Linnea Lahlum.

Genitalia (**Figs 310a-b**) with vagina (V) very long and slender, internally with typical pilasters. Spermathecal shaft (S) and free oviduct (UV) very short, U-coiled. Head of spermatheca ovate to circular, starting at base of prostate-uterus. Vas deferens (VD) slender, entering laterally into epiphallic caecum (EC), which lies near base of penis. Epiphallus (E) long, entering thin penis sheath (PS) well below top, coiled inside sheath, entering head of penis through cluster of low ridges. Penial retractor muscle (PR) attaches to epiphallus. Penis (P) long and slender, internally (**Fig. 310b**) with main pilaster (PP) an elongated ridge with specialized apex. Wall of penis chamber with many narrow accessory pilasters.

Central and early lateral teeth of radula (**Plate 137a**) with prominent basal support ridge, typical anterior flare, elevated cusp shaft angle with curved top to sharply pointed tip. Early laterals (**Plate 137c**) show curvature and cusp tip clearly. Late laterals (**Plate 137b**) with enlarged anterior flare, lowered cusp shaft angle, more strongly curved top, and faint trace of ectocone. Lateromarginal transition (**Plate 137b**) abrupt, marginals typical. Jaw (**Plate 137d**) with prominent, rather widely spaced vertical ribs, reduced to absent on lateral margins.

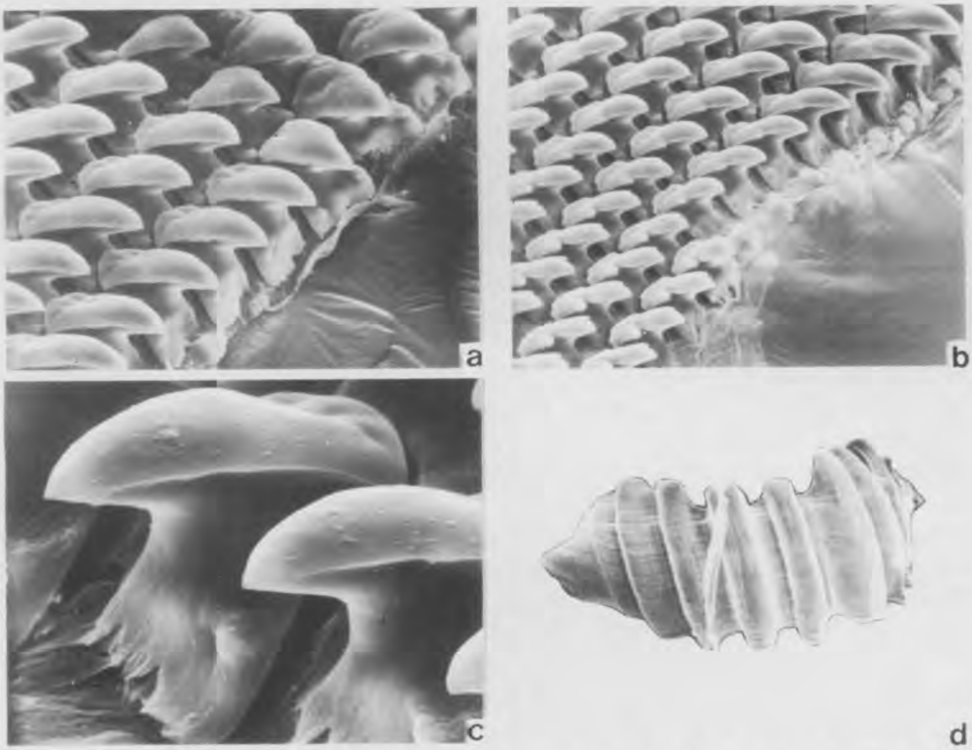


Plate 137: Radular teeth and jaw of *Tatemelon inexpectatum*: WA-887, S outlier of Mt. Morris, Musgrave Ranges, WA. 10 May 1983. FMNH 212236: (a-c) Dissection B. a is central and early laterals at 440X, b is lateromarginal transition at 335X, c is 3rd lateral at 1,375X; (d) Dissection A. Jaw at 48X.

Discussion

The greatly increased length of the vagina and penis in *Tatemelon inexpectatum* combine with the great reduction in shell sculpture on the spire and body whorl to differentiate it from the other Musgrave Range species. The general appearance of the shell is similar to *Basedowena*, but the genital anatomy readily separates members of the latter genus.

Size differences between the two known populations are significant (**Table 119**) in respect to height and diameter, but proportions and whorl count are the same. The actual difference is similar to that found elsewhere between live and dead examples from the same population, so no importance can be attached to this observation.

The name *inexpectatum* refers to our surprise in collecting this species after leaving Amata and starting towards the Mann Ranges.

TATEMELON EVERARDENSIS, SP. NOV.
(Plates 134c-f, 138a-f; Figs 309d-f, 311a-b)

?*Chloritis squamulosa* Riddle, 1915 (not Tate, 1894), Trans. Roy. Soc. South Austr., **39**: 771 - under fig trees at Moorilyanna Native Well, near Moorilyanna Hill, NW of Indulkana Range, SA.

Comparative remarks

Tatemelon everardensis, sp. nov., known only from Mt. Illbillee in the Everard Ranges, SA (**Map 12**), has a moderately elevated spire (**Fig. 309e**, mean H/D ratio 0.621), narrowly open umbilicus (**Fig. 309f**, mean D/U ratio 7.84), narrowly expanded lip, is light brown in colour with a slightly lighter base, lacks radial ridging on the shell, and has a microsculpture of dense circular pustules (**Plate 134c-f**) on both spire and body whorl. The Musgrave Range species of *Tatemelon* all differ in their sculpture of radial ridges, strong and very crowded in both *T. musgum* (Iredale, 1937) (**Plate 133a-b**) and *T. herberti* (Iredale, 1937) (**Plate 133c-d**), greatly reduced in *T. inexpectatum*, sp. nov. (**Plate 134a-b**). *Basedowena squamulosa* (Tate, 1894), from the Krichauff and James Ranges, is similar in shape and umbilical size (**Table 112**), but averages a half whorl more (compare **Fig. 292a** of *squamulosa* and **Fig. 309d** of *everardensis*), has much less lip expansion (**Figs 292a-c**), and the micropustules are curved (**Plate 121a-c**). The other umbilicated species, *Basedowena cognata* and *B. katjawarana*, both have greatly increased whorl counts and are much more elevated (**Table 112**). Anatomically (**Figs 311a-b**), *T. everardensis* has a prominent epiphallic caecum (EC), short epiphallus (E), very thin penis sheath (PS), medium length penis (P) that internally has a U-shaped main pilaster (PP) with one arm greatly reduced, and the upper half with prominent wall pilasters that are somewhat enlarged around the epiphallic pore. *T. inexpectatum* differs most obviously (**Figs 310a-b**) in its very long and slender vagina (V), long epiphallus (E) that enters the penis sheath well below apex, slender penis (P) with a single main pilaster (PP) that has a specialized apex, and presence of many longitudinal wall pilasters. *T. musgum* (**Figs 307a-c**) has lost the epiphallic caecum completely, the epiphallus (E) enters near the base of the very thick penis sheath (PS), and there is a very short penis (P) that contains a huge main pilaster (PP) with wide cross corrugations and a central groove down its whole length. *T. herberti* (**Figs 308a-b**) has the epiphallus (E) enter near the base of the very thick penis sheath (PS), a remnant of the epiphallic caecum (EC) is present inside the very thick walled penis sheath (PS), the penis (P) is of medium length, internally with a huge main pilaster (PP) that has very narrow cross corrugations and a groove extending only partway down the middle. Species of *Basedowena* differ in their foliated pilaster around the epiphallic pore and general presence of an equal armed U-pilaster (except *B. olgana*, sp. nov., **Fig. 296e**).

Holotype

SAM D17866, WA-850, ca 2 km up valley that is 2 km E of Victory Well, Mt. Illbillee, Everard Ranges, South Australia, Australia (Everard 1: 250,000 map sheet SG53-13 - 565:644yds). 27° 08' 35" S, 132° 31' 12" E. Height of shell 12.05 mm, diameter 18.95 mm, H/D ratio 0.636, whorls 4 1/8-, umbilical width 2.3 mm, D/U ratio 8.24.

Paratopotypes

WAM 628.87, AM, FMNH 212080, FMNH 212082, FMNH 212087, 3 DA, 1 LJ, 7 DJ from the type locality.

Paratypes

South Australia

EVERARD RANGES: Mt. Illbillee (WA-857, mouth of gorge at E end, 4.5 km E of Victory Well, SAM D18003, FMNH 212102, 3 DA, 1 DJ; WA-857A, base of creek, AM, FMNH 212106, 2 LA, 1 LJ; WA-861, 2 km E of Victory Well, ca 2 km up creek, WAM 628.87, AM, QM, FMNH 212116, 5 LA, 1 LJ; WA-863, half way up Mt. Illbillee, 2 km W of Victory Well, FMNH 212123-4, 1 LJ, 2 DJ; WA-862, up creek bed 3.7 km W of Victory Well, SAM D18004, AM, FMNH 212117-8, 1 LA, 1 DA, 5 LJ, 2 DJ; WA-940, small outlier just S of Mt. Illbillee, SAM D18005, FMNH 212421, 1 DA, 2 DJ).

Range

Tatemelon everardensis has been collected only from Mt. Illbillee, Everard Ranges, SA (**Map 12**). Probably this is the species that Riddle (1915: 771) reported from Moorilyanna Native Well, but this record requires confirmation.

Diagnosis

Shell of medium size, adult diameter 16.6-18.85 mm (mean 17.84 mm), with 3 3/4 to 4 1/4+ (mean 4 1/8+) rather widely decoiling whorls. Apex and spire moderately and evenly elevated (**Fig. 309e**), shell height 10.4-12.0 (mean 11.08 mm), H/D ratio 0.589-0.653 (mean 0.621). Body whorl rounded, without angulation. Shell apex (**Plate 134c-d**) with dense, sometimes elongated micropustulations. Upper spire (**Plate 134d**) with pustulations much more widely spaced, continuing onto body whorl with short, irregular periostracal ridgelets reaching up sides of pustules and extending along surface between pustules. No large radial ridges present. Umbilicus (**Fig. 309f**) narrow, little change in decoiling, slightly narrowed by columellar lip

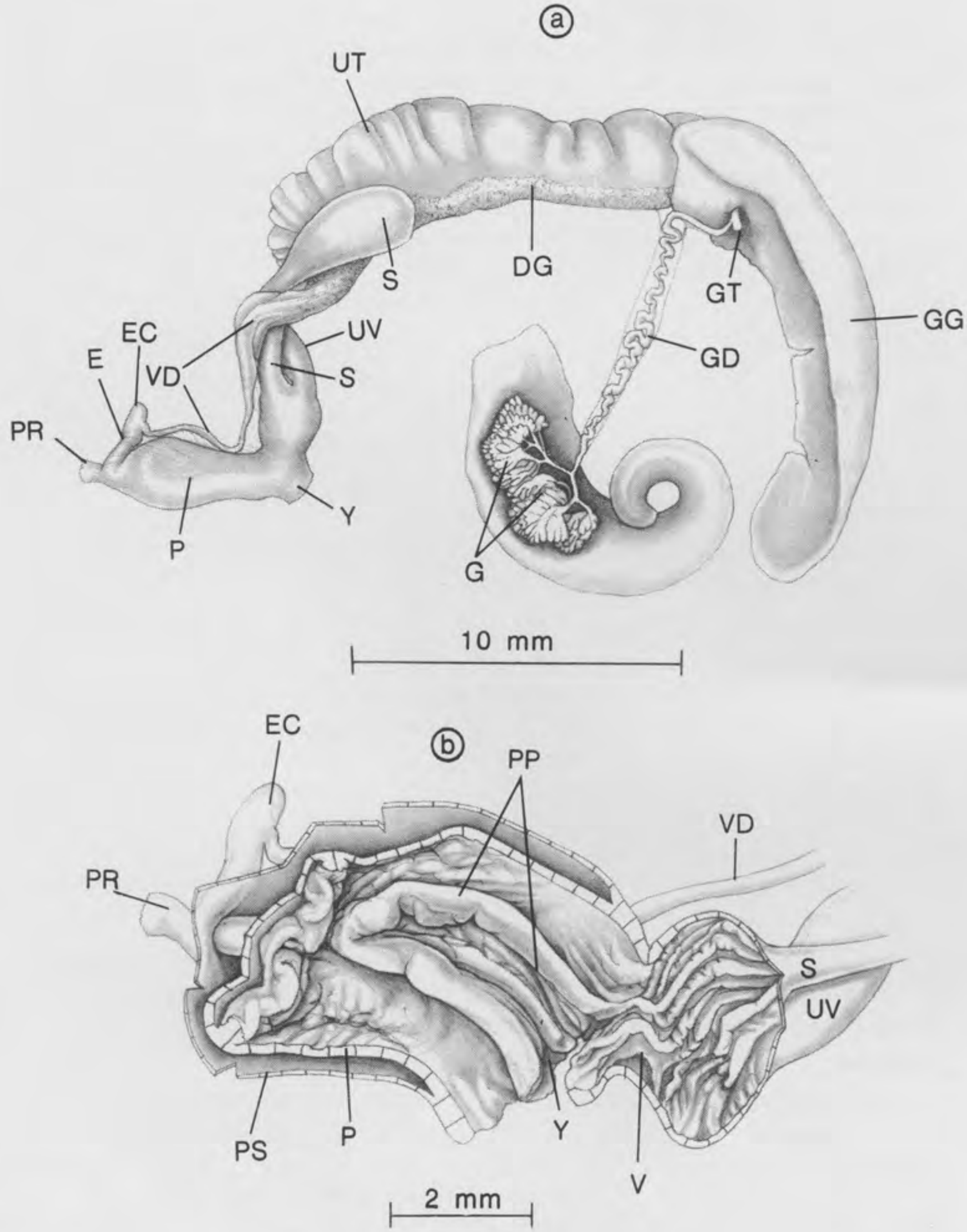


Fig. 311: Genitalia of *Tatemelon everardensis*, sp. nov.: WA-861, Mt. Illbillee, 2 km E of Victory Well, Musgrave Ranges, SA. 5 May 1983. FMNH 212116, Dissection A. (a) whole genitalia; (b) interior of penis. Scale lines as marked. Drawings by Linnea Lahlum.

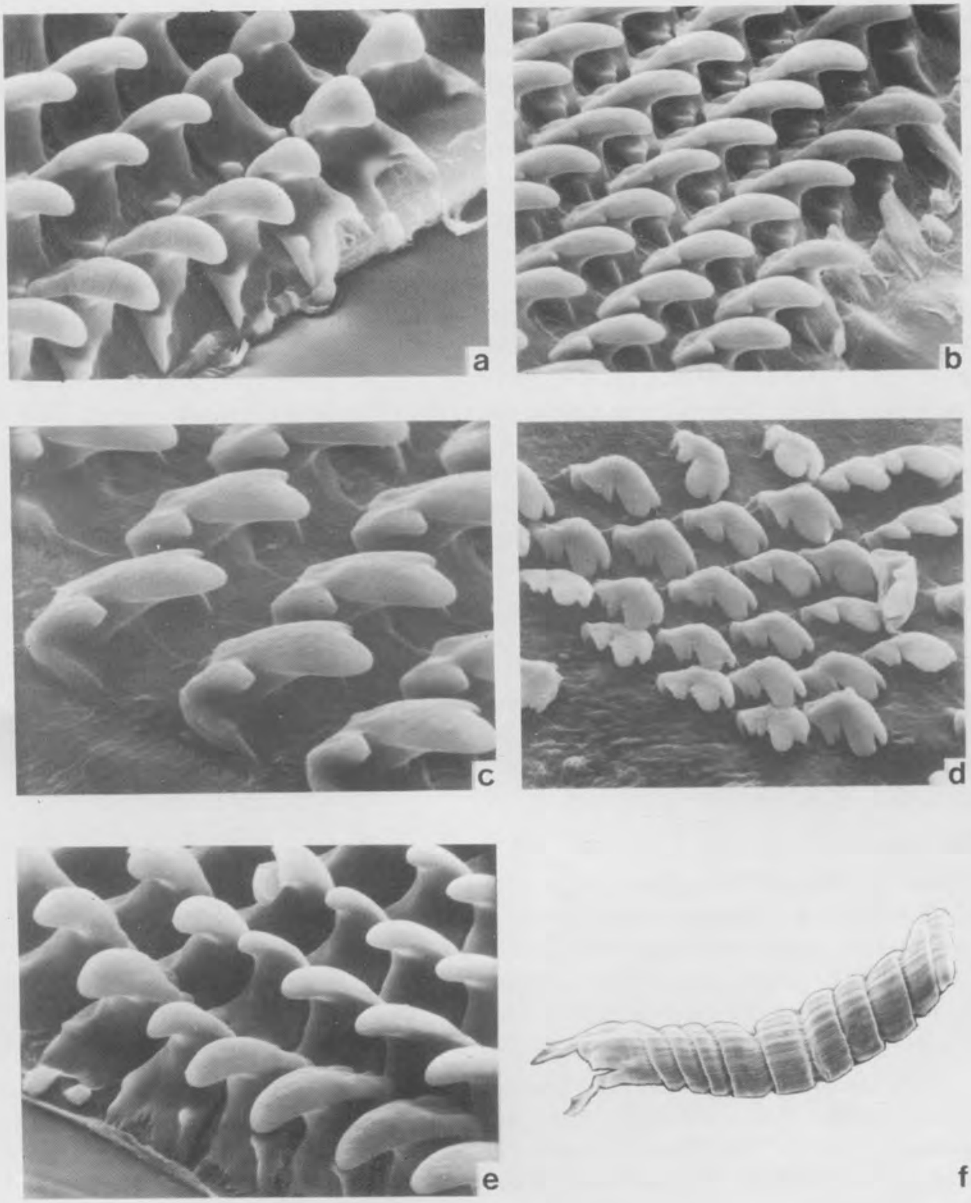


Plate 138: Radular teeth and jaw of *Tatemelon everardensis*: WA-861, 2 km E of Victory Well, Mt. Illbillee, Everard Ranges, SA. 5 May 1983. FMNH 212116: (a-d) Dissection A. a is central and early laterals at 670X, b is lateromarginal transition at 680X, c is early marginals at 1,150X, d is outer marginals at 690X; (e-f) Dissection B. e is central and early laterals at 680X. f is jaw at 50X.

expansion, width 1.5-2.8 mm (mean 2.34 mm), D/U ratio 6.01-11.6 (mean 7.84). Body whorl descending moderately over last eighth whorl. Lip thin, modestly expanded on palatal and basal margins, slightly more expanded on columellar section. Parietal wall narrow, with a thin callus. Shell colour light yellow-brown, slightly lighter in tone on shell base. Based on 16 measured adults.

Genitalia (**Figs 311a-b**) with vagina (V) very short, swollen basally, internally with typical longitudinal pilasters. Spermatheca (S) and free oviduct (UV) both slender, wrapped around each other, head of spermatheca against base of prostate-uterus. Vas deferens (VD) typical, entering laterally into base of prominent epiphallic caecum (EC). Epiphallus (E) short, entering very thin penis sheath (PS) subapically, coiled inside of sheath and partly circling penial retractor muscle before entering penis apex. Penial retractor muscle (PR) inserting on penis apex next to entry of epiphallus. Penis (P) medium in length, internally (**Fig. 311b**) with a U-shaped main pilaster (PP), with one arm reduced in length. Upper third of chamber with prominent wall pustules that become enlarged apically when surrounding epiphallic pore. Few accessory ridges on walls of lower penis chamber.

Central and lateral teeth of radula (**Plate 138a, e**) greatly modified. Basal plate short with very large support ridge, anterior flare essentially absent, cusp shaft angle initially nearly vertical, cusp top strongly curved to broadly rounded tip. Late laterals (**Plate 138b**) with lower cusp shaft angle, larger anterior flare. Ectocone appears during lateromarginal transition, rapidly becomes prominent. Early marginal teeth (**Plate 138c**) showing endocone, retaining some of cusp shaft curvature from lateral field. Outer marginals (**Plate 138d**) typical. Jaw (**Plate 138f**) narrow, with few generally very wide vertical ribs that are reduced to absent on lateral margins.

Discussion

Riddle (1915: 771) reported a single live specimen from Moorilyanna Native Well as *Chloritis* (= *Basedowena*) *squamulosa*. The reported size of this specimen, shell height 9 mm, diameter 17 mm, H/D ratio 0.529, is below that recorded for adults of *T. everardensis* (**Table 117**). If this specimen was subadult, and Riddle thus confused the juvenile lip of this shell with the adult lip of *B. squamulosa*, then my interpretation of this record may be correct.

The radular teeth of *Tatemelon everardensis* (**Plate 138a-e**) are modified to a much greater extent, but in the same basic direction, as are the teeth of *Basedowena squamulosa* (Tate, 1894) (**Plate 127a-e**). The former have reached the "film scraper" structure found in the Napier Range *Westraltrachia commoda* Solem (1984: 465, pl. 35c) and other members of that genus from Windjana Gorge to the NW tip of the ranges. *B. squamulosa*, in contrast, is only partly modified, equivalent to such taxa as *Westraltrachia* from E of Windjana Gorge in the Napier Range through the Oscar, Pillara, and Laidlaw Ranges to the E (Solem, 1984: 474-479, pls 44-49).

Only limited adult material was collected of *T. everardensis*. One sample did contain five adults (**Table 119**).

All live examples were collected while aestivating sealed to rocks.

The name *everardensis* refers to the range in which this species lives.

GENUS *EXIMIORHAGADA* IREDALE, 1933

Eximiorhagada Iredale, 1933, Rec. Austr. Mus., **19** (1): 51 - type species *Xanthomelon asperrimum* Hedley, 1905 by original designation (proposed as a subgenus); Iredale, 1937, South Austr. Nat., **18** (2): 52 - listed as a synonym of *Glyptorhagada* Pilsbry, 1890; Iredale, 1938, Austr. Zool., **9** (2): 108 - check list citation; Richardson, 1985, Tryonia, **12**: 146 - check list citation.

Shell medium in size, adult diameter 15.4-19.6 mm, whorl count 4 to 4 1/8-. Spire slightly to moderately elevated (**Fig. 312b**), H/D ratios 0.435-0.510. Apical sculpture of dense micropustules, spire and body whorl (**Fig. 312a**) with large pustules that are usually elongated to ovate, plus a microsculpture of radial ridgelets. Body whorl with a strongly protruded, knife-edge keel, descending sharply just behind aperture (**Fig. 312b**). Umbilicus narrow (**Fig. 312c**), barely decoiling, partly closed by reflection of columellar lip, width 1.75-2.4 mm, D/U ratio 6.42-11.2. Palatal and basal lips thin, gradually expanded, upper portion of columellar lip more broadly expanded over umbilicus (**Figs 312a-c**). Parietal wall narrow, with a callus edge that almost covers pustules on preceeding whorl. Shell colour unknown.

Aestivation strategy unknown. Anatomy unknown.

Type species: *Xanthomelon asperrimum* Hedley, 1905 by original designation.

Nomenclatural matters

Eximiorhagada Iredale, 1933 was proposed as a subgenus of *Glyptorhagada*. A short comparision with *Glyptorhagada* Pilsbry, 1890 and the pleurodontid genus *Divellomelon* Iredale, 1933 is marginally sufficient to validate the name. Subsequently, Iredale (1937b, 1938) synonymized it with *Glyptorhagada*. The name thus is available for use.

Comparative remarks

Eximiorhagada differs from all other Red Centre species in having the protruded knife-edge keel (**Fig. 312b**), extremely large pustules (**Figs 312a-c**), and microsculpture of calcified radial ridgelets. The ridgelets are too small for portrayal in the illustrations, and the types could not be coated for SEM photography. While the ridgelets resemble those of *Tatemelon everardensis* (**Plate 134e-f**), they are calfified and thus may only be analogous. Especially on the shell base (**Fig. 312c**), the pustules are arranged in rows. The pattern of whorl increment (**Fig. 312a**) is closest to that of *Tatemelon* (**Figs 306a, d, 309a, d**); the lip expansion, ignoring the effect of the keel, resembles that of the narrowly umbilicated *Basedowena* such as *B. cognata*, sp. nov. (**Figs 292d-f**) or *B. katjawarana* (**Figs 301a-c**); the pattern of umbilical shape agrees with the above *Basedowena* and *Tatemelon* (**Figs 292f, 301c, 306f, 309c, f**). The keeled South Australian species of *Glyptorhagada* Pilsbry, 1890 from the Flinders Range, Eastern Plains, and Kangaroo Island (Solem, 1988c: figs 48a-h, 50a-f, 57a-c) have a sculpture of anastomosing radial ribs (not pustules), closed or cracked umbilici (not open), thickened (not expanded) shell lip, and increased whorl count with much tighter coiling of the whorls. The general appearance of *Eximiorhagada* and *Glyptorhagada* is much the same, but details of structure are quite different.

Distribution and comparative ecology

Eximiorhagada asperrima (Hedley, 1905) was described from the Mann Ranges without precise locality. It has not been collected subsequently. When a copy of the original line drawings were shown to members of the Angatja Community in 1983, several of the older women said it was seen in caves during the wet season. Quite possibly this indicates that it is a rock sealing fissure or cave roof species, equivalent to the Kimberley genus *Kimboraga* Solem (1985: 818-846).

Discussion

The shell features cited above suggest that *Eximiorhagada asperrima* (Hedley, 1905) probably is a member of the Sinumeloninae. The keel and pustules readily separate it from any of the other Red Centre taxa. Thus I am using Iredale's name and ranking it as a genus. Its similarities to *Glyptorhagada* Pilsbry, 1890 are superficial and convergent.

Until new collections can be made, and the anatomy studied, there can be only speculation as to its affinities. I will not be surprised if it is found to be a close relative of *Tatemelon*, gen. nov.

EXIMIORHAGADA ASPERRIMA (HEDLEY, 1905)

(Figs 312a-c)

Xanthomelon asperrimum Hedley, 1905, Trans. Proc. Rep. Roy. Soc. South Austr., **29**: 164, figs - Mann Ranges, SA.

Glyptorhagada asperrima (Hedley), Iredale, 1937, South Austr. Nat., **18** (2): 54; Iredale, 1938, Austr. Zool., **9** (2): 109 - citation in check list; Richardson, 1985, Tryonia, **12**: 147.

Comparative remarks

Eximiorhagada asperrima (Hedley, 1905), from the Mann Ranges, is a medium sized species (diameter about 20 mm) characterized by a protruded knife-edge keel (**Fig. 312b**), sculpture of very large pustules (**Figs 312a-c**), narrowly open umbilicus, and expanded lip. No other Red Centre species has an equivalent keel, while species with strongly angulated peripheries, such as the pleurodontid taxa *Vidumelon wattii* (Tate, 1894) (**Figs 361d-f**) and *Divellomelon hillieri* (E. A. Smith, 1910) (**Figs 266a-c**), have an increased number of very tightly coiled whorls and a nearly smooth shell surface. *Glyptorhagada* (Pilsbry, 1890) has tighter whorl coiling, sculpture of anastomosing radial ribs, and a nearly closed umbilicus (see Solem, 1992a). The anatomy of *Eximiorhagada asperrima* is unknown.

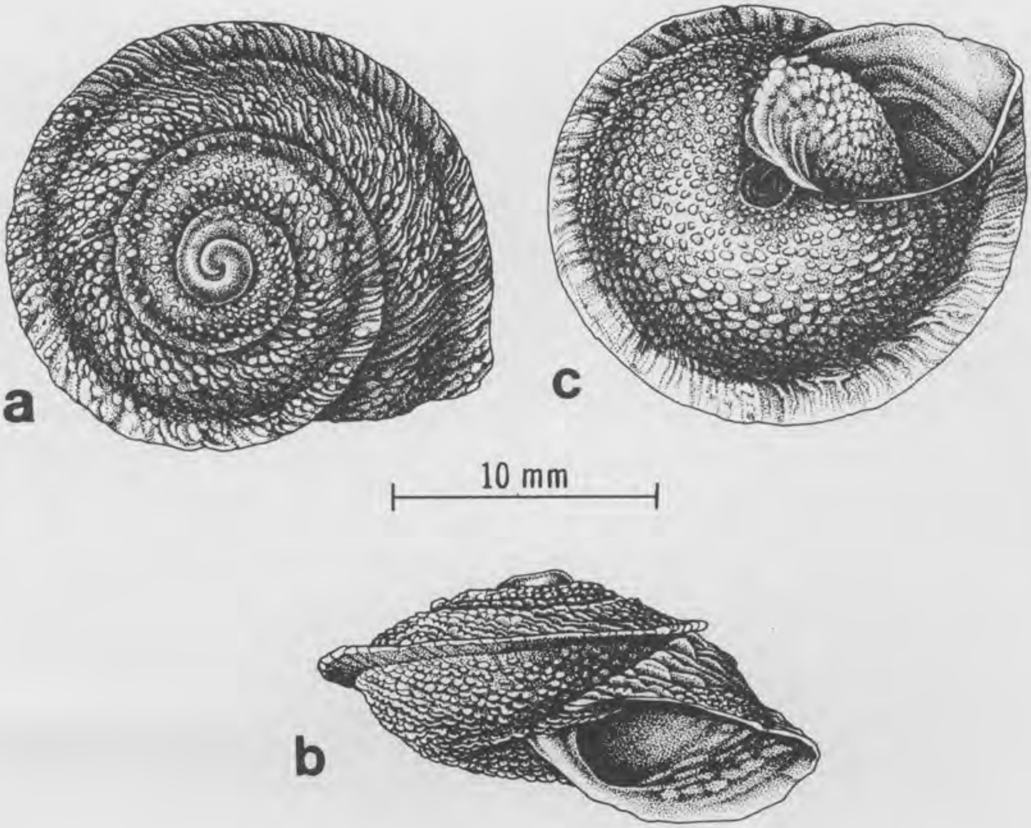


Fig. 312: Shell of *Eximiorhagada asperrima* (Hedley, 1905): Lectotype of *Xanthomelon asperrimum* Hedley, 1905. Mann Ranges, SA. AM C.19228. Scale line equals 10 mm. Drawings by Linnea Lahlum.

Lectotype

AM C.19228, Mann Ranges, South Australia. Collected by Herbert Basedow 17 June 1903. Height of shell 10.0 mm, diameter 19.6 mm, H/D ratio 0.510, whorls 4 1/8-, umbilical width 1.75 mm, D/U ratio 11.2.

Syntypes

AM C.19228, 1 DA, 3 DJ from the type locality.

Range

Mann Ranges, SA.

Diagnosis

Same as generic description.

Discussion

The type specimens of *Eximiorhagada asperrima* (Hedley, 1905) are bleached "bones", with no trace of colour remaining. Sculpture on the upper part of the last half whorl is mostly eroded from the lectotype, although the shell base sculpture is intact.

This is one of only two Red Centre camaenids that has not been recollected during this project. *Basedowena elderi* (Bednall, 1892) from the Birksgate Range and *Eximiorhagada asperrima* from the Mann Range remain as elusive goals for both biologists and collectors.

GENUS *MONTANOMELON*, GEN. NOV.

Shell very small, adult diameters 7.0-12.75 mm, whorl count 3 1/2- to 4 7/8-. Apex and spire slightly (**Fig. 313e**) to moderately (**Fig. 313b**) elevated, H/D ratios 0.365-0.680. Apical sculpture (**Plate 139a, d**) of ovate pustules, variable in spacing. Postapical sculpture of dense and prominent (*angatjana*, **Plate 139d-f**) to low and scattered (*reynoldsi*, **Plate 139a-c**) plus variably prominent irregular radial ridglets. Body whorl rounded, without trace of angulation, descending slightly (*reynoldsi*, **Fig. 313b**) to moderately (*angatjana*, **Fig. 313e**) behind aperture. Umbilicus open (**Fig. 313c**) to widely open (**Fig. 313f**), last whorl decoiling more rapidly, D/U ratios 2.84-9.79. Palatal and basal lips sharply reflected, moderately expanded, usually thickened internally, columellar lip slightly wider and covering portion of umbilicus. Parietal wall with at most a thin callus. Shell colour brownish, no colour bands or suffusions, base lighter. Lip white.

Live specimens seal free in litter or talus.

Genitalia (**Figs 314-315**) simplified. Vagina (V) medium to long, free oviduct (UV) short, spermatheca (S) short, shaft lying alongside free oviduct and base of prostate-uterus. Epiphallic caeum (EC) prominent, epiphallus (E) medium to short, entering penis sheath (PS) apically, partly circling penial retractor muscle (PR) before entering apex of penis (P). Penis sheath (PS) very thin. Penis (P) cylindrical, internally with fragmented longitudinal pilasters, a low ridge to low foliated pilaster around epiphallic pore.

Jaw (**Plates 140c, 141c, f**) with prominent vertical ribs in middle, reduced on margins. Central and early lateral teeth (**Plates 140a, 140d, 141a, 141d**) with small (*reynoldsi*) to large (*angatjana*) ectocone present, cusp shaft typical, cusp top curved and bluntly tipped. Lateromarginal and marginal teeth typical.

Type species: *Montanomelon reynoldsi* gen. nov., sp. nov., by original designation.

Comparative remarks

The small diameter, widely open umbilicus, and large micropustulations found in both species led to confusion with *Semotrachia*. *Montanomelon* (Sinumeloninae) and *Semotrachia* (Pleurodontinae) are convergent in the same way that the Flinders Range

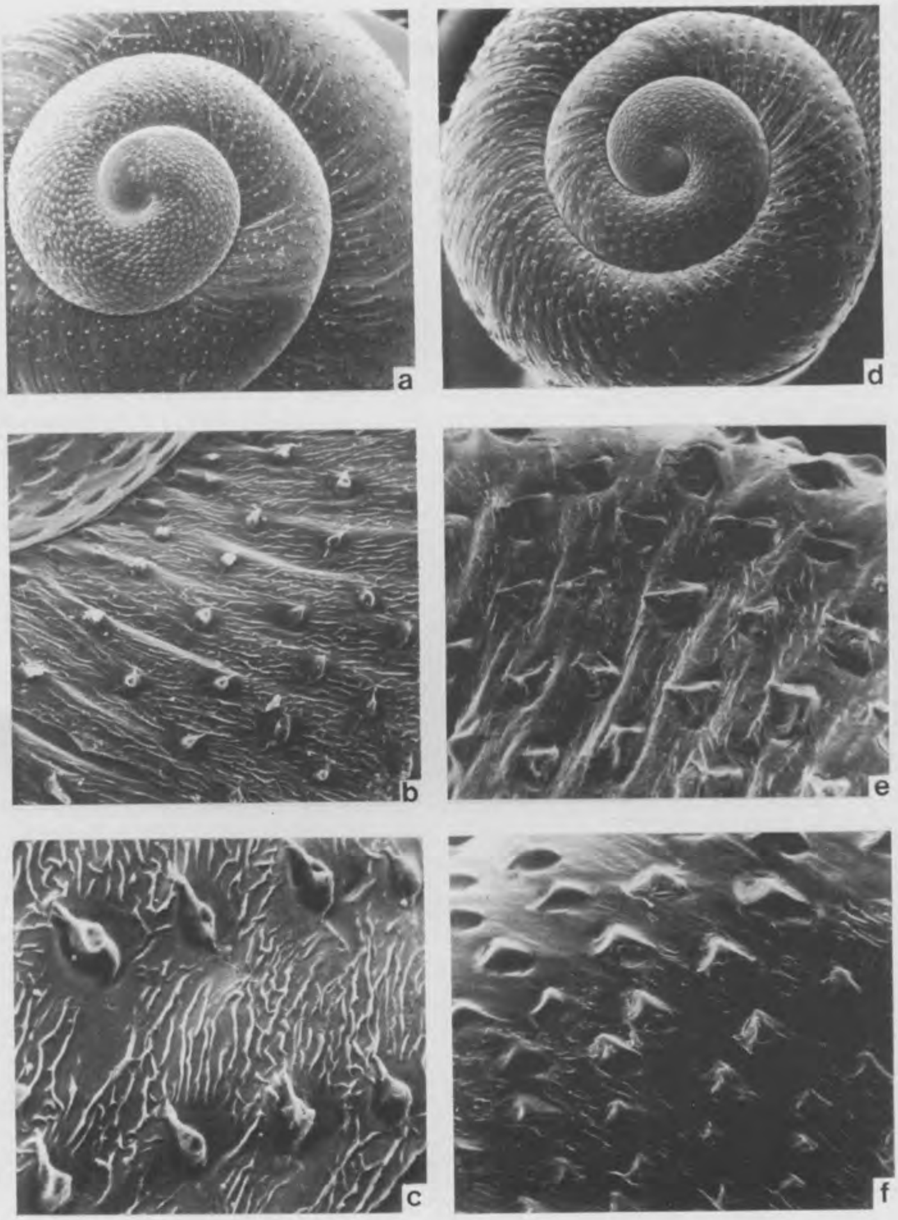


Plate 139: Shell sculpture of *Montanomelon reynoldsi* and *M. angatjana*: (a-c) *M. reynoldsi*. WA-729, N slope of Reynolds Range, S of Ti Tree, NT. FMNH 205377. a is apex and early spire at 19.2X, b is detail of apex and early spire at 95X, c is detail of lower spire sculpture at 230X; (d-f) *M. angatjana*. WA-892, near Angatja homestead, E end of Mann Ranges, SA. FMNH 212245. d is apex and early spire at 18.3X, e is sculpture on third whorl at 90X, f is third whorl sculpture at 63X.

Aslintesta (Camaeninae) and *Micromelon* (Sinumeloninae) (Solem, 1992a) are convergent. The wider lip and usual periostracal setae of *Semotrachia* are the most obvious shell differences. *Minimelon* from WA is similar in size, but has a nearly closed umbilicus, often a strong color suffusion, and much less prominent microsculpture. No other Red Centre Sinumeloninae species is similar in size and structure.

The genitalia (**Figs 314-315**) of *Montanomelon* are distinctive in that the free oviduct and spermathecal shaft are not wrapped around each other, the epiphallus enters the penis sheath apically, and the wall sculpture of the penis chamber is fragmented, with no trace of a U-pilaster remaining.

The jaw (**Plates 140c, 141c, f**) is without unusual features. The radula is unusual in the development of an ectocone on the early laterals (**Plates 140a, d, 141a, d**).

The shell size, shape and sculpture, presence of ectocones on the lateral teeth of the radula, fragmented wall sculpture in the penis chamber, and the lack of wrapping around by the free oviduct and spermathecal shaft are the main features suggesting generic separation of *Montanomelon*.

Distribution and comparative ecology

Montanomelon reynoldsi, sp. nov., has a modest range in the Reynolds Range, N of Alice Springs, NT, while *M. angatjana* has been collected near Angatja homestead at the E end of the Mann Ranges, SA (**Map 14**). It is quite probable that additional species will be discovered. Both species are free sealers, which contrasts with the rock or wood sealing habits of the conchologically convergent genus *Semotrachia*.

Discussion

The similarity of shells, when viewed with the eye or at low optical magnifications, is such that *Montanomelon* was confused with *Semotrachia* until the last stages of this project.

The name *Montanomelon* refers to its habitat in both the Mann and Reynolds Ranges, plus its belonging to the Sinumeloninae.

KEY TO THE SPECIES OF *MONTANOMELON*

1. Shell with narrower umbilicus (**Fig. 313c**; shell height over 5 mm; Reynolds Ranges, NT

   Montanomelon reynoldsi, sp. nov. (p. 1260)

   Shell with wider umbilicus (**Fig. 313f**); shell height less than 3.25 mm; Mann Ranges, SA

   Montanomelon angatjana, sp. nov. (p. 1265)

MONTANOMELON REYNOLDSI, SP. NOV.

(Plates 139a-c, 140a-f, 141a-c; Figs 313a-c, 314a-c)

Comparative remarks

Montanomelon reynoldsi, sp. nov., from the Reynolds Range and its outliers, NNW of Alice Springs, NT (**Maps 14-15**), differs (**Figs 313a-d**) from *M. angatjana*, sp. nov., collected near Angatja Homestead, Mann Ranges, SA, in being much larger (mean diameters 10.89, 7.36 mm), with a much more elevated spire (means H/D ratios 0.553, 0.394), higher whorl count (means 4 3/8, 3 5/8+), and narrower umbilicus (mean D/U ratios 5.37, 3.18). The much less crowded and smaller pustules and weaker radial ridges on the post apical whorls in *M. reynoldsi* compared with *M. angatjana* (**Plate 139a-f**) also separate the two species. *Semotrachia* overlaps in size and shape, but the normal presence of periostracal setae, more broadly flared and expanded lip, frequent presence of a raised parietal lip edge separate most species easily. Anatomically (**Figs 314a-c**), *M. reynoldsi* has both the vagina (V) and epiphallus (E) much longer than in *M. angatjana* (**Fig. 315a**) and its penis chamber sculpture is less fragmented (compare **Figs 314b** and **315b**).

Holotype

AM C.135971, WA-729, under large fig trees on rocky slope, N slope of Reynolds Range, 21.0 road km W of Stuart Highway, S of Ti Tree, Northern Territory, Australia (Napperby 1:250,000 map sheet SF 53-9 - 640:199yds). 22° 26' 44.5" S, 133° 07' 52" E. Collected by A. Solem and P. Colman 13 April 1981. Height of holotype 5.95 mm, diameter 10.7 mm, H/D ratio 0.551, whorls 4 1/2-, umbilical width 2.3 mm, D/U ratio 4.65.

Paratopotypes

AM C.136032-3, WAM 745.87, WAM 746.87, SAM D18128-9, MV, QM, FMNH 205376-8, 60 LA, 80 DA, 13 LJ, 26 DJ from the type locality.

Paratypes

Northern Territory

REYNOLDS RANGE: Prowse Gap (WA-732, ridge just N of Stuart Highway, under dead spinifex below figs on crest, 10.8 km N of Aileron, AM C.136034, WAM 946.87, SAM D18130, FMNH 205394-5, 6 LA, 7 DA, 7 DJ; outlier of Reynolds Range, 21.7 km W of Pine Hill Station, SW of Ti Tree (WA-730, under figs, FMNH 205390, 1 LA, 1 LJ); Blackhill Creek drainage (WA-731, 11.0 km NE of Lander Bore, SW of Ti Tree, FMNH 205391, 1 DA, 1 DJ).

Range

Montanomelon reynoldsi, sp. nov., has been collected along the N slope of the Reynolds Range, NT (**Map 15**) from Prowse Gap NW to N of Lander Bore, a distance of about 72 km. It probably extends further N in the Lander River drainage and can be expected to be located on the S slope and outlying hills of the Reynolds Range.

Diagnosis

Shell small, adult diameter 9.55-12.77 mm (mean 10.89 mm), with 4 1/8- to 4 7/8- (mean 4 3/8) normally coiled whorls. Apex and spire moderately and evenly elevated (**Fig. 313b**), shell height 5.1-8.7 mm (mean 5.03 mm), H/D ratio 0.486-0.680 (mean 0.553). Body whorl rounded, without trace of angulation. Shell apex (**Plate 139a**) densely pustulated, spire and body whorl (**Plate 139b-c**) with much more widely scattered fine pustules plus scattered weak radial ridgelets. Umbilicus (**Fig. 313c**) open,

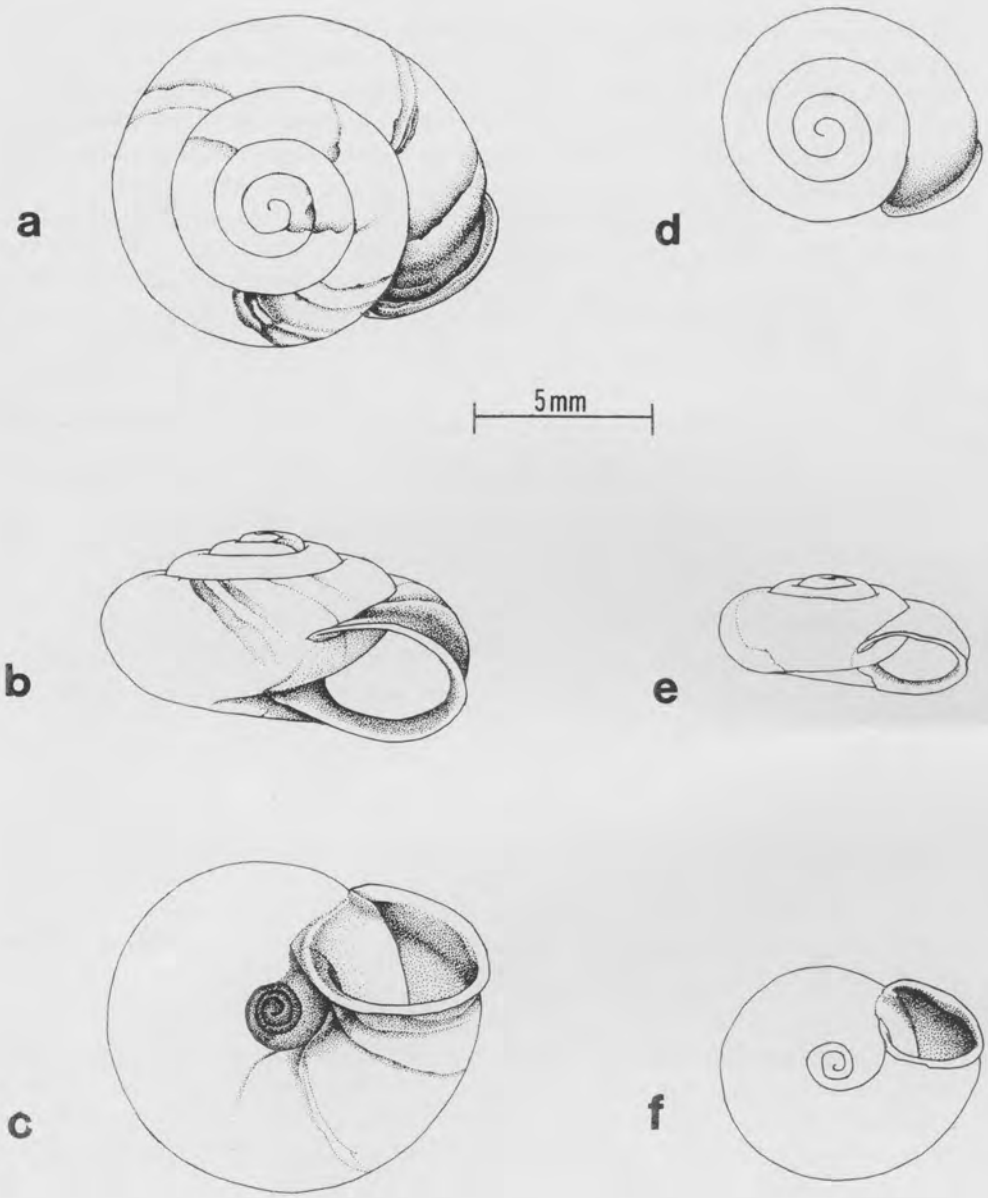


Fig. 313: Shells of *Montanomelon reynoldsi*, sp. nov., and *M. angatjana*, sp. nov.: (a-c) Holotype of *M. reynoldsi*. AM C.135971. WA-729, under figs on N slope of Reynolds Range, S of Ti Tree, NT; (d-f) Holotype of *M. angatjana*. SAM D18032. WA-892, near Angatja homestead, E end Mann Ranges, SA. Scale line equals 5 mm. Drawings by Linnea Lahlum.

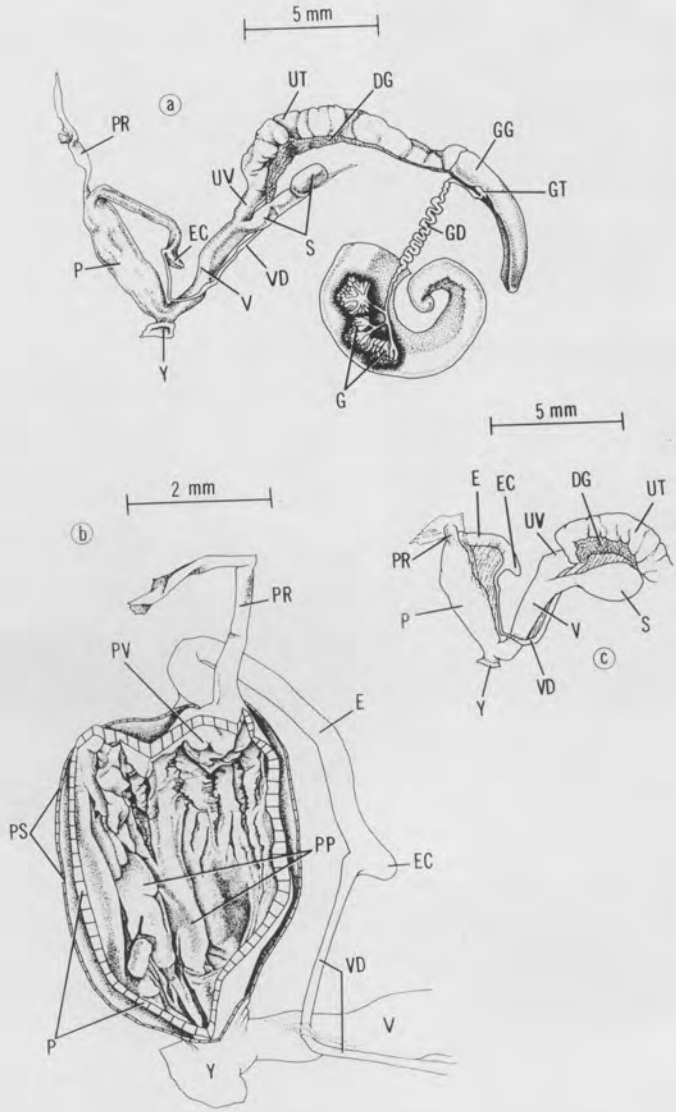


Fig 314: Genitalia of *Montanomelon reynoldsi*, sp. nov.: (a-b) WA-729, N slope of Reynolds Range, S of Ti Tree, NT. 13 April 1981. FMNH 205379. Dissection B. a is whole genitalia. b is penis interior; (c) WA-732, Prowse Gap, Reynolds Range, NT. 13 April 1981. HMNH 205394, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

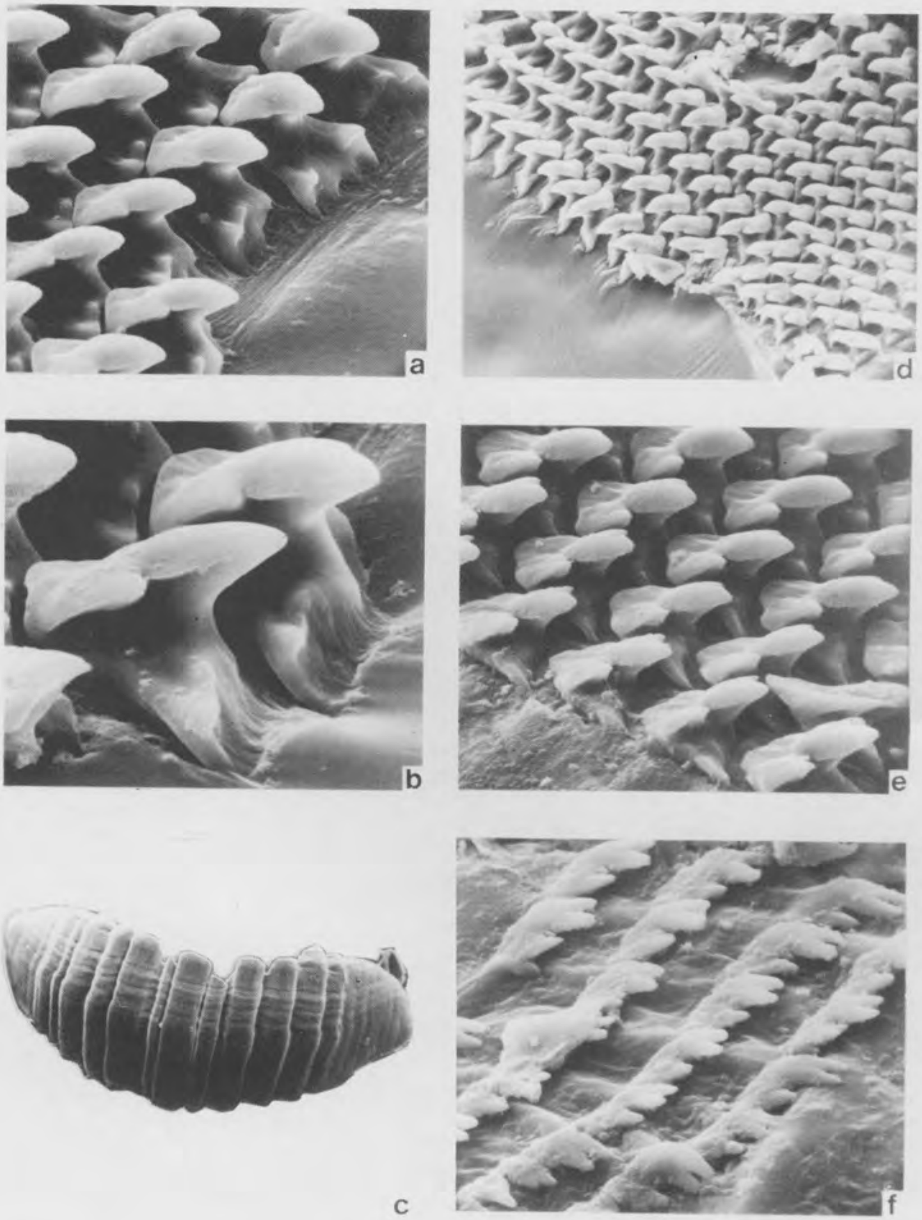


Plate 140: Radular teeth and jaw of *Montanomelon reynoldsi*: WA-729, N slope Reynolds Range, S of Ti Tree, NT. 13 April 1981. FMNH 205378. (a-c) Dissection B. a is central and early laterals at 880X, b is 6th and 7th laterals at 1,750X, c is jaw at 81X. (d-f) Dissection A. d is part row at 325X, e is lateromarginal transition at 890X, f is outermost marginals at 880X.

slightly and regularly decoiling until body whorl, width 1.15-2.6 mm (mean 2.07 mm), D/U ratio 4.02-9.79 (mean 5.37). Body whorl usually descending only slightly behind aperture. Lip abruptly expanded (**Figs 313a-c**), narrow, often thickened internally, slightly more expanded on columellar margin. Parietal wall with at most a very thin callus. Colour brownish, without colour bands or suffusion, shell base lighter. Based on 157 measured adults.

Genitalia (**Figs 314a-c**) with long vagina (V). Free oviduct (UV) short, not wrapped around spermathecal shaft. Spermatheca (S) short, expanded head reaching partway up prostate-uterus. Vas deferens (VD) slender, entering laterally on epiphallus junction. Epiphallic caecum (EC) prominent, blunt tipped. Epiphallus (E) medium in length, entering penis sheath (PS) apically and partly circling penial retractor muscle (PR) before entering penis apex. Penis sheath (PS) thin. Penis (P) equal in length to sheath, internally (**Fig. 314b**) with numerous wall pilasters, two somewhat enlarged, with a small foliated pilaster around epiphallic pore.

Central and early lateral teeth of radula (**Plates 140a, 140d, 141a**) with large basal support ridge, small anterior flare, small ectocone present, cusp shaft angle typical, cusp tip moderately curved with bluntly rounded tip. Lateromarginal transition (**Plate 140d-e, 141b**) marked by massive increase in ectoconal size, appearance of small endocone, decrease in mesoconal size, basal plate and anterior flare reduction. Early and outer marginals (**Plate 140e-f**) typical. Jaw (**Plate 140c, 141c**) with prominent central ribs, margins with ribs reduced or lost.

Discussion

Montanomelon reynoldsi, sp. nov., has been found at several localities on the N side of the Reynolds Ranges. The populations differ slightly in size and shape (**Table 122**), but show no other shell differences. The terminal genitalia of specimens from Prowse Gap (WA-732, **Fig. 314c**) have the vagina (V) and epiphallus (E) shorter than in specimens from WA-729 (**Fig. 114a**), but agree in penis chamber sculpture.

The name *reynoldsi* is taken from the range in which this species was first collected.

MONTANOMELON ANGATJANA, SP. NOV.
(Plates 139d-f, 141d-f; Figs 313d-f, 315a-b)

Comparative remarks

Montanomelon angatjana, sp. nov., from near Angatja Homestead, E end of Mann Ranges, SA (**Map 17**), is small (mean diameter 7.36 mm), with a weakly elevated spire (**Fig. 313e**, mean H/D ratio 0.394), low whorl count (**Fig. 313d**, mean 3 5/8+), and a widely open umbilicus (**Fig. 313f**). *M. reynoldsi*, sp. nov., from the Reynolds Range, NNW of Alice Springs, NT, is larger (mean diameter 10.89 mm), has a raised spire (**Fig. 313b**, mean H/D ratio 0.553), higher whorl count (**Fig. 313a**, mean 4 3/8), and a much narrower umbilicus (**Fig. 313c**, mean D/U ratio 5.37). Both species have prominent apical microsculpture (**Plate 139a, d**). On the spire and body whorl, the sculpture is denser and larger in *angatjana* (**Plate 139d-f**), reduced and scattered in *reynoldsi* (**Plate**

139a-c). Most species of *Semotrachia*, some of which overlap in size and shape, differ in having more broadly expanded shell lips and a complex shell microsculpture with periostracal setal projections. All Red Centre Sinumeloninae are much larger in size and have higher whorl counts. Anatomically (**Figs 315a-b**) the shortened vagina (V), swollen base of the spermatheca (S), very short epiphallus (E), and very fragmented penial chamber wall sculpture are the main features separating *angatjana* from *reynoldsi* (**Figs 314a-c**).

Holotype

SAM D18032, WA-892, rockhole area ca 0.5 km above Angatja Homestead, E end of Mann Ranges, South Australia, Australia (Mann 1:250,000 map sheet SG 52-11 - 324:762yds). 26°03'40"S, 130°18'23"E. Collected by the Central Australian Expedition 11 May 1983. Height of holotype 3.3 mm, diameter 7.2 mm, H/D ratio 0.458 whorls 3 5/8, umbilical width 2.4 mm, D/U ratio 3.00.

Paratopotypes

SAM D18131-2, AM C.136035-6, WAM 747.87, WAM 748.87, MV, QM, FMNH 212245-6, 22 LA, 19 DA, 15 LJ, 4 DJ from the type locality.

Range

Montanomelon angatjana, sp. nov., has been collected once, from a rock hole near Angatja Homestead, E end of Mann Ranges, SA (**Map 17**).

Diagnosis

Shell very small, adult diameter 7.0-7.8 mm (mean 7.36 mm), with 3 1/2- to 4+ (mean 3 5/8+) normally coiled whorls. Apex and spire slightly and evenly elevated (**Fig. 313e**), shell height 2.7-3.2 mm (mean 2.90 mm), H/D ratio 0.365-0.416 (mean 0.394). Body whorl rounded, without angulation. Shell apex (**Plate 139d**) with evenly spaced ovate micropustules. Spire and body whorl (**Plate 139d-f**) with dense, prominent pustules and irregular, relatively prominent radial ridges. Umbilicus widely open, last whorl decoiling much more rapidly (**Fig. 313f**), width 2.05-2.7 mm (mean 2.32 mm), D/U ratio 2.84-3.56 (mean 3.18). Lip abruptly and narrowly expanded, more so on columellar margin. Parietal wall with weak callus. Colour brownish-yellow, base lighter in tone, no trace of colour bands or suffusions. Based on 42 measured adults.

Genitalia (**Figs 315a-b**) with short vagina (V) and free oviduct, base of spermatheca (S) expanded, shaft short, lying alongside free oviduct and then head against base of prostate-uterus. Vas deferens (VD) simple, entering laterally on epiphallic caecum (EC) base. Epiphallus (E) short, entering thin penis sheath (PS) near apex, partly circling penial retractor muscle (PR, **Fig. 315b**) before etering (P) through a very low ridge. Penis (P) equal in length to sheath, chamber wall with fragmnented longitudinal pilaster, one pilaster continuing into vagina.

Central tooth of radula (**Plate 141d**) with very weak ectocones, early laterals with very large ectocone, large basal support ridge, small anterior flare, elevated cusp shaft angle, curved cusp top, with blunt pointed cusp tip. Lateromarginal transition (**Plate 141e**) typical. Jaw (**Plate 141f**) with large central vertical ribs, sides with ribs reduced to absent.

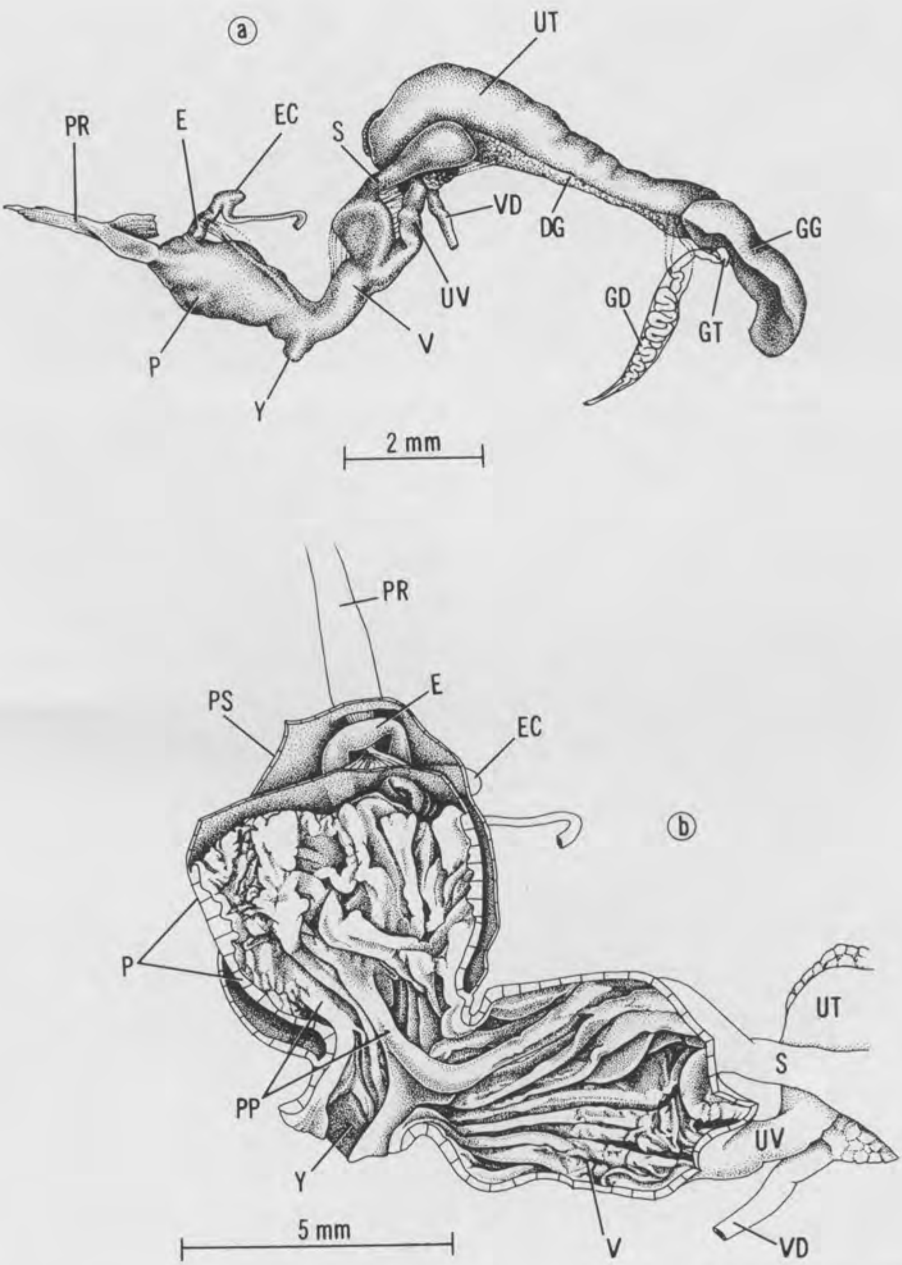


Fig. 315: Genitalia of *Montanomelon angatjana*, sp. nov.: WA-892, near Angatja homestead. E end Mann Ranges, SA. 11 May 1983. FMNH 212246, Dissection B. (a) subapical genitalia; (b) interior of penis and vagina. Scale lines as marked. Drawings by Linnea Lahlum.

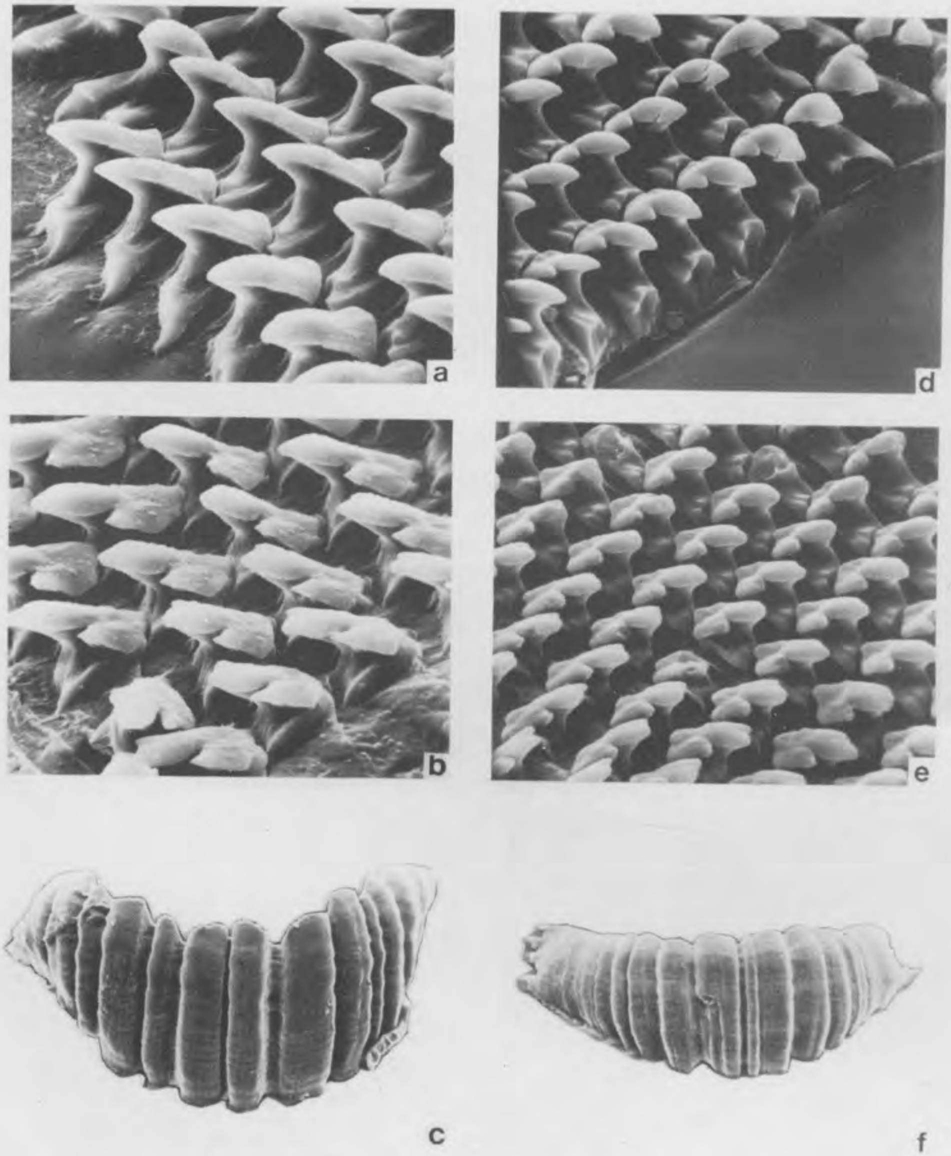


Plate 141: Radular teeth and jaw of *Montanomelon reynoldsi* and *M. angatjana*: (a-c) *M. reynoldsi.* WA-732, Prowse Gap, Reynolds Range, NT. 13 April 1982. FMNH 205394, Dissection A. a is central and early laterals at 780X, b is lateromarginal transition at 880X, c is jaw at 90X; (d-f) *Montanomelon angatjana.* WA-892, near Angatja Homestead, E end of Mann Ranges, SA. 11 May 1983. FMNH 212246, Dissection A. d is central and early laterals at 840X, e is lateromarginal transition near anterior end of radula (note worn and broken teeth) at 1,075X, f is jaw (note damaged center rib) at 110X.

Discussion

The name *angatjana* is taken from that of the nearby homestead, in appreciation of courtesies extended by Lee Brady during our field work in this area.

Subfamily Pleurodontinae Von Ihering, 1912

Shell highly variable in size, shape, and colour. Microsculpture, if present, normally of fine pustulations on apex, spire and body whorl often with periostracal setae, usually with a minute to prominent calcareous base. Micro ridging common on shell, development of larger ribs or ridges highly unusual. Body whorl varying from rounded to sharply angulated to keeled. Aperture often strongly deflected behind lip, which may or many not have raised knobs present. Colour highly variable.

Head of animal with exposed patch of stimulatory pustules between to slightly behind ommatophores, frequently reduced to absent when taxa are sympatric. Spermathecal head (S) normally reaching to base of albumen gland (GG), secondarily shortened in many species. Lower portion of shaft expanded, then tapers to junction with free oviduct (UV) to form vagina (V). Free oviduct usually short, narrower than spermatheca, entering it at 45° to 60° angle. Vas deferens (VD) entering epiphallus (E) through a specialized ridge or pilaster. Epiphallic caecum (EC) rarely absent, varying from very long and tapered to a barely noticable remnant. Penial retractor muscle (PR) originating on diaphragm, inserting, unless secondarily altered, on epiphallus about one-third to one-half distance from penis apex to vas deferens entrance. Penis (P) generally rather short, with or without a well developed penis sheath (PS), walls of penis chamber with simple longitudinal pilasters or complex rugose sculpture, occasionally with secondary stimulatory organs developed. Verge (PV) highly variable: almost always a rolled structure with thin to thick walls, a lateral sperm groove varying from present only at apex to running entire length of a long verge; rarely formed into a closed tube.

Epiphragm calcified. Aestivation strategy variable, with some taxa free sealers in litter or crevices, others seal to rock or wood.

Radular teeth variable, a few species modified for scraping from rock surfaces. Jaw generalized.

Four genera of Pleurodontinae inhabit the Red Centre, and the SE Kimberley to Carnarvon genus *Rhagada* Albers, 1860 (see Solem, 1985: 875-919, pls 89-92, figs 222-235) also belongs to this subfamily. *Pleurodonte* Fischer von Waldheim, 1808, and probably several other Antillean genera, have the same basic genital structure. It is quite probable that a number of Indonesian to SE Asian taxa also belong here, but not enough is known about their anatomical structure to permit subfamily assignment at this time. At the present time, no other Australian genera are included, pending detailed anatomical studies.

Typical species of the Western Australian genus *Rhagada* are readily recognized by their globose shape, spiral red or orange colour bands, closed or nearly closed umbilicus, smooth to radially ribbed shell, the spermatheca (S) drastically shortened (often by coiling), and the penial retractor muscle (PR) inserting just above the penis apex (see Solem, 1985).

Two of the Red Centre genera, *Vidumelon* Iredale, 1937 and *Divellomelon* Iredale, 1937, are monotypic. *Dirutrachia* Iredale, 1933 has only three described species at present, but more may be discovered. In contrast, *Semotrachia* Iredale, 1933 has 25 species reviewed below (**Table 120**). The actual number of species could come close to being doubled. These genera are readily separated on both shell and anatomical features:

Semotrachia Iredale, 1933: shell with widely open umbilicus, last whorl decoiling more rapidly; mean whorl counts 3 1/2 to 4 7/8+, size variable (mean diameters 5.41-17.07 mm); lip strongly reflected, usually without basal knob; body whorl usually descending abruptly behind aperture; microsculpture of periostracal setae that are highly variable among species in spacing, size, and basal structure, often surmounting microscopic calcareous pustules; colour monochrome. Genitalia with spermatheca head (S) reaching base of albumen gland (GG); epiphallic caecum (EC) absent to longer than penis (P); penis (P) without a sheath; verge (PV) from a small knob to cylindical to a thin-walled sheet of tissue. Radular teeth sometimes modified for rock scraping.

Dirutrachia Iredale, 1937: shell narrowly umbilicated, decoiling only slightly; mean whorl counts 4 1/2+ to 5 1/8+, increased because of larger size (mean diameters 13.90-17.43 mm); lip less reflected, with a prominent lip knob; body whorl descending abruptly behind lip; microsculpture highly varied; colour monochrome. Genitalia with spermathecal head (S) reaching base of albumen gland (GG); a penis sheath (PS) present or a fibrous network joining penis (P) and epiphallus (E); verge (PV) small, simple. Radular teeth modified for rock scraping (**Plates 172-173**).

Vidumelon Iredale, 1937: umbilicus nearly closed; shell with increased whorl count (mean 6 3/4) and tighter whorl coiling, without size increase (mean diameter 10.89 mm); lip only slightly reflected and little expanded; body whorl descending slightly behind lip; microsculpture of fine setae; colour monochrome. Genitalia (**Figs 365a-c**) with head of spermatheca (S) not reaching base of albumen gland (GG); penis sheath (PS) well developed; verge (PV) a closed tube. Radular teeth generalized (**Plate 175**).

Divellomelon Iredale, 1937: umbilicus closed; whorl count increased (mean 5 3/4+), coiling normal, size very large (mean diameter 17.70 mm); shell with keeled periphery, elevated spire; lip little expanded; body whorl very slightly descending behind aperture; shell surface without microsculpture; narrow red spiral colour bands present. Genitalia (**Figs 367a-b**) with head of spermatheca (S) reaching base of albumen gland (GG); penis sheath (PS) thin walled; verge (PV) short, walls of penis chamber with very complex sculpture. Radular teeth (**Plate 176**) highly modified for rock scraping.

The above synopses, or the artifical key presented below (p. 1454), should permit assignment of any Red Centre pleurodontid species to a genus.

Table 120: List of taxa in the Pleurodontinae

Subfamily Pleurodontinae
- Genus *Semotrachia* Iredale, 1933 (p. 1271)
  - *Semotrachia jinkana*, sp. nov. (p. 1287)
  - *Semotrachia huckittana*, sp. nov. (p. 1293)
  - *Semotrachia hortulana*, sp. nov. (p. 1295)
  - *Semotrachia strangwayana*, sp. nov. (p. 1303)
  - *Semotrachia setigera* (Tate, 1894) (p. 1307)
  - *Semotrachia rossana*, sp. nov. (p. 1322)
  - *Semotrachia bensteadana*, sp. nov. (p. 1329)
  - *Semotrachia jessieana*, sp. nov. (p. 1332)
  - *Semotrachia emilia*, sp. nov. (p. 1339)
  - *Semotrachia euzyga* (Tate, 1894) (p. 1340)
  - *Semotrachia caupona*, sp. nov. (p. 1348)
  - *Semotrachia runutjirbana*, sp. nov. (p. 1351)
  - *Semotrachia felixiana*, sp. nov. (p. 1355)
  - *Semotrachia winneckeana* (Tate, 1894) (p. 1358)
  - *Semotrachia elleryi*, sp. nov. (p. 1364)
  - *Semotrachia esau* Iredale, 1937 (p. 1369)
  - *Semotrachia illarana*, sp. nov. (p. 1382)
  - *Semotrachia hughana*, sp. nov. (p. 1386)
  - *Semotrachia bagoti*, sp. nov. (p. 1392)
  - *Semotrachia minuta*, sp. nov. (p. 1395)
  - *Semotrachia illbilleeana*, sp. nov. (p. 1401)
  - *Semotrachia basedowi* (Hedley, 1905) (p. 1403)
  - *Semotrachia mannensis* Iredale, 1937 (p. 1407)
  - *Semotrachia plana*, sp. nov. (p. 1417)
  - *Semotrachia discoidea*, sp. nov. (p. 1413)
- Genus *Dirutrachia* Iredale, 1937 (p. 1420)
  - *Dirutrachia sublevata* (Tate, 1894) (p. 1424)
  - *Dirutrachia mersa* Iredale, 1937 (p. 1430)
  - *Dirutrachia ponderi*, sp. nov. (p. 1438)
- Genus *Vidumelon* Iredale, 1933 (p. 1439)
  - *Vidumelon wattii* (Tate, 1894) (p. 1441)
- Genus *Divellomelon* Iredale, 1937 (p. 1445)
  - *Divellomelon hillieri* (E.A. Smith, 1910) (p. 1447)

GENUS *SEMOTRACHIA* IREDALE, 1933 (+ *CATELLOTRACHIA* IREDALE, 1933 AND *SPERNACHLORITIS* IREDALE, 1933)

Semotrachia Iredale, 1933, Rec. Aust. Mus., **19** (1): 51 - type species: *Thersites basedowi* Hedley, 1905; Iredale, 1937, S. Aust. Nat., **18** (2): 35-39 - review and description of species; Iredale, 1938, Aust. Zool., **9** (2): 89-90 - check list of species; Burch, 1976, J. Malac. Soc. Aust., **3** (3-4): 136, 147 - citation in generic check list; Richardson, 1985, Tryonia, **12**: 274-275 - check list.

Catellotrachia Iredale, 1933, Rec. Aust. Mus., **19** (1): 52 - proposed as a subgenus, type species: *Hadra winneckeana* Tate, 1894; Iredale, 1937, S. Aust. Nat., **18** (2): 36 - listed as a "subgroup" of *Semotrachia*; Iredale, 1937, Aust. Zool., **9** (2): 89 - listed as a synonym of *Semotrachia*; Burch, 1976, J. Malac. Soc. Aust., **3** (3-4): 136, 147 - listed as synonym of *Semotrachia*; Richardson, 1985, Tryonia, **12**: 274 - listed as a synonym of *Semotrachia*.

Spernachloritis Iredale, 1933, Rec. Aust. Mus., **19** (1): 52 - proposed as a subgenus, type species: *Hadra setigera* Tate, 1894; Iredale, 1937, S. Aust. Nat., **18** (2): 36 - listed as a "subgroup" of *Semotrachia*; Iredale, 1937, Aust. Zool., **9** (2): 89 - listed as a synonym of *Semotrachia*; Burch, 1976, J. Malac. Soc. Aust., **3** (3-4): 136, 147 - listed as synonym of *Semotrachia*; Richardson, 1985, Tryonia, **12**: 274 - listed as a synonym of *Semotrachia*.

Shell very small to medium in size, sometimes quite variable within a species, adult diameters 4.9-18.8 mm, whorl counts 3 1/4+ to 5 3/4-. Spire flat (*discoidea, plana*) to moderately elevated (*setigera, esau*), usually slightly and evenly elevated, H/D ratios 0.274 (*discoidea*) to 0.661 (*setigera*). Apical sculpture variable, diagonal ridgelets in *minuta, illbilleana, discoidea*, and *plana*, scattered to dense, round to elongated pustules in others. Spire and body whorl with underlying calcareous sculpture of small to very large (*huckittana*) pustules and or ridgelets, plus scattered to very closely spaced periostracal setae that surmount the pustules. Reduced to very prominent micro ridging, that lacks any calcareous base, present on shell surface between setae. Body whorl rounded, weakly shouldered, strongly shouldered, or angulated (*basedowi*), abruptly descending behind lip except in species with very angulated periphery or secondarily reduced in size. Umbilicus moderately to very widely open, last whorl decoiling much more rapidly, variable within populations, width 1.5 (*winneckeana*) to 4.85 mm (*setigera*), D/U ratio 2.42 (*winneckeana*) to 7.30 (*setigera*). Lip sharply reflected, often with a posterior sulcus, slightly to moderately expanded, at most slightly narrowing umbilicus. Parietal wall often narrowed by pattern of lip insertion, about half of species with parietal lip reduced to a thin to thick callus, half of species with parietal lip continuous and free of parietal wall. Rarely a trace of a basal lip knob found in some specimens. Colour yellow-brown, varying in shade. Lip white.

Live adults usually aestivate sealed to rocks or wood, rarely found free in litter. Often abundant in rocky litter under figs, much scarcer in open areas.

Genitalia with head of spermatheca (S) reaching just to base of albumen gland (GG). Ovotestis (G) multi-clumped, hermaproditic duct (GD) tightly coiled, talon (GT) small. Prostate (DG) and uterus (UT) typical. Free oviduct (UV) normally very short, occasionally longer, entering vaginal-spermathecal channel at 45° to 60° angle. Vagina (V) variable in length, internally with simple longitudinal pilasters. Vas deferens (VD) entering epiphallus (E) through a low ridge or pilaster. Epiphallic caecum (EC) rarely absent (*rossana, bensteadana*), usually small, greatly enlarged in most W MacDonnell Range species. Epiphallus (E) usually longer than penis (altered in microsympatric situations), variable in length. Penial retractor muscle (PR) inserting on epiphallus, usually about one-third of way from verge base to entrance of vas deferens, in some species near verge base. Penis (P) short to long. Penis chamber wall sculpture variable, simple longitudinal ridges (*huckittana*), fine pustules (*emilia*), corrugated ridges (*elleryi*), or rugose surface (*discoidea*). Verge (PV) from very long and cylindrical with sperm groove extending to tip (*illarana*) to wider than long (*euzyga*), surface smooth, rugose, or corrugated. Some species with a sheet-like verge (*jinkana, discoidea*). An accessory foliated pilaster (FP) developed in *discoidea* and *plana*.

Jaw normally with prominent vertical ribs that extend at least partway to margins. Central and lateral radular teeth usually somewhat modified in terms of cusp shaft angle and cusp curvature, extremely modified in *basedowi* to form a scraping tooth. Outer laterals with enlarged anterior flare, increased ectoconal size, and reduced cusp shaft angle. Lateromarginal transition and marginal teeth without unusual features.

Type species: *Thersites basedowi* Hedley, 1905

Comparative remarks

The low spire, open umbilicus in which the last whorl decoils distinctly more rapidly, generally strongly deflected aperture with sharply reflected and moderately expanded lip, the presence of periostracal setae (often eroded in adults), and monochrome shell colour (lighter on shell base), combine to separate *Semotrachia* species from most other Red Centre genera. Species of the sinumelonine genus *Montanomelon* are strikingly convergent with *Semotrachia*, differing conchologically primarily in the lack of periostracal setae (**Plate 139d-f**) and in having the lip less strongly deflected. The monotypic genera *Vidumelon* (**Fig. 361e**) and *Divellomelon* (**Fig. 366c**) differ immediately in their tiny to almost closed umbilici, the tightly coiled and increased whorl number of the former, and the protruded peripheral keel (**Figs 366a-b**) and red spiral colour bands (**Figs 366a-b**) of the latter. The three species of *Dirutrachia* have narrower umbilici (**Figs 361c, 362c, f**) that are noticably narrowed by the columellar lip reflection, and the basal lip has a prominent elongated (**Figs 361b, 362b**) or triangular (**Fig. 362e**) knob. A few *Semotrachia*, such as some examples of *S. winneckeana* (Tate, 1894), have a low and recessed basal lip knob, but this never is as prominent as in the *Dirutrachia*.

None of the other Red Centre genera can be confused with *Semotrachia*. Extralimital taxa that have the same shell appearance include *Minimelon*, gen. nov. (Sinumeloninae) and *Aslintesta* Solem, 1992a (Camaeninae) from the Flinders Ranges (see Solem, 1992a: figs 68a-f, pls 44, 46) and *Setobaudinia* Iredale, 1933 from the Kimberley and NT above the Roper River (see Solem, 1985: 711-775). The former differ in details of shell microsculpture, the latter most obviously in its indented upper parietal lip, increased whorl count, and the simple basal lip swelling.

Anatomically, *Semotrachia* lacks any trace of a penis sheath (PS), which is present in *Dirutrachia sublevata* (**Fig. 363c**), *Vidumelon wattii* (**Fig. 365b**), and *Divellomelon* *hillieri* (**Fig. 367c**), but absent in *Dirutrachia mersa* (**Fig. 364c**). The network of fibers that bind together the epiphallus and penis in *D. mersa* are an effective substitute to presence of a penis sheath. They find their equivalent in the much heavier fibers that bind together the epiphallus and penis of *Semotrachia winneckeana* (Tate, 1894) (**Figs 342a-b**). These conditions are convergent, since the nature and orientation of the fibers are extremely different in the two taxa. The presence of a small to large verge that either has a lateral sperm groove (**Fig. 348b**) or is a partly rolled, thin walled structure (**Fig. 358**) is characteristic, and immediately distinguishes all *Semotrachia* from any of the Sinumeloninae, all of which lack a verge or vergic papilla.

Previous studies

Tate (1894, 1896) provided the first descriptions and illustrations of Red Centre species now referred to *Semotrachia*, placing *S. setigera* (+ *papillosa*), *S. euzyga*, and *S. winneckeana* first (Tate, 1894) in *Hadra*, together with a number of other taxa, and then (Tate, 1896) in *Angasella* (= *Pleuroxia*) together with *Granulomelon arcigerens* (Tate, 1894), a sinumelonid species.

Hedley (1905) described *S. basedowi* from the Musgrave Ranges and noted a specimen from the Mann Ranges that Iredale (1937b: 37) subsequently named *S. mannensis*.

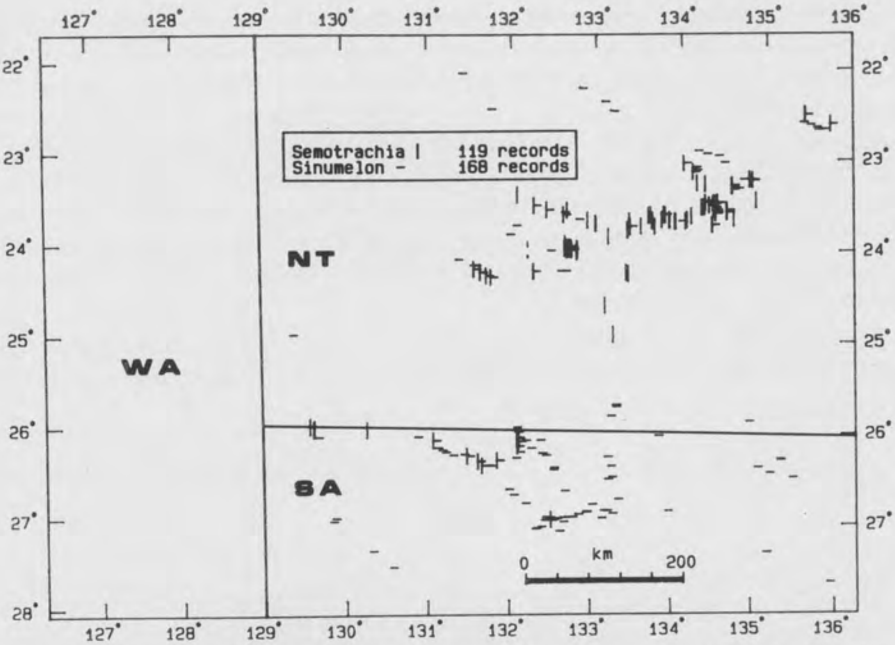
The generic separation (Iredale, 1933: 51) was followed by a species level review (Iredale, 1937b: 35-39) that included description of *S. esau* from the Krichauff Ranges. Iredale recognized a curious assortment of species: *Semotrachia setigera* (Tate, 1894) (+ *papillosa* Tate, 1894), *S. euzyga* (Tate, 1894), *S. winneckeana* (Tate, 1894), *S. basedowi* (Hedley, 1905), *S. esau* Iredale, 1937, then *Dirutrachia mersa* (Iredale, 1937), the sinumelonid *Lacustrelix eyrei* (H. Adams & Angas, 1876) from the N Flinders Ranges, SA, and the mislabelled example of the helicid species from the European Alps, *Helicigona (Chilostoma) intermedium* (Ferussac, 1821), that had been described as *Helix subsecta* Tate, 1879. The next year, Iredale (1938: 89-91) elevated *Dirutrachia* Iredale, 1937 and *Lacustrelix* Iredale, 1937 to generic rank.

The only previous anatomical information was provided by Hedley (1896: 222-223, figs D-F), who gave accurate data on the jaw, radula, and genitalia of *Semotrachia esau* Iredale, 1937.

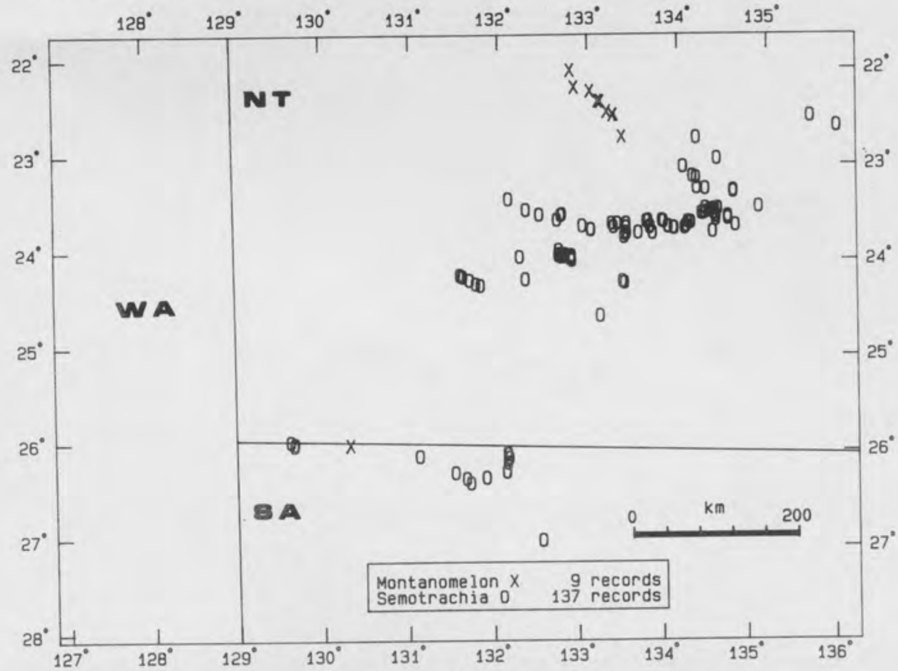
Distribution and comparative ecology

Semotrachia is restricted to the Red Centre, with species found from the Dulcie Range in the NE to the Mann Ranges in the SW and the Everard Ranges in the S (**Map 14**). Frequently they are sympatric with species of *Sinumelon* (**Map 13**), but the latter genus has a much wider range elsewhere in Australia (**Map 5**) and also locally. *Semotrachia* aestivates sealed to rocks or wood, while *Sinumelon* is a free sealer that often lives under spinifex or bushes, habitats from which *Semotrachia* normally is absent.

This difference in aestivation strategy and local ecology has led to major differences in distribution patterns and range size. Four *Sinumelon* species (*S. pedasum*, *S.*



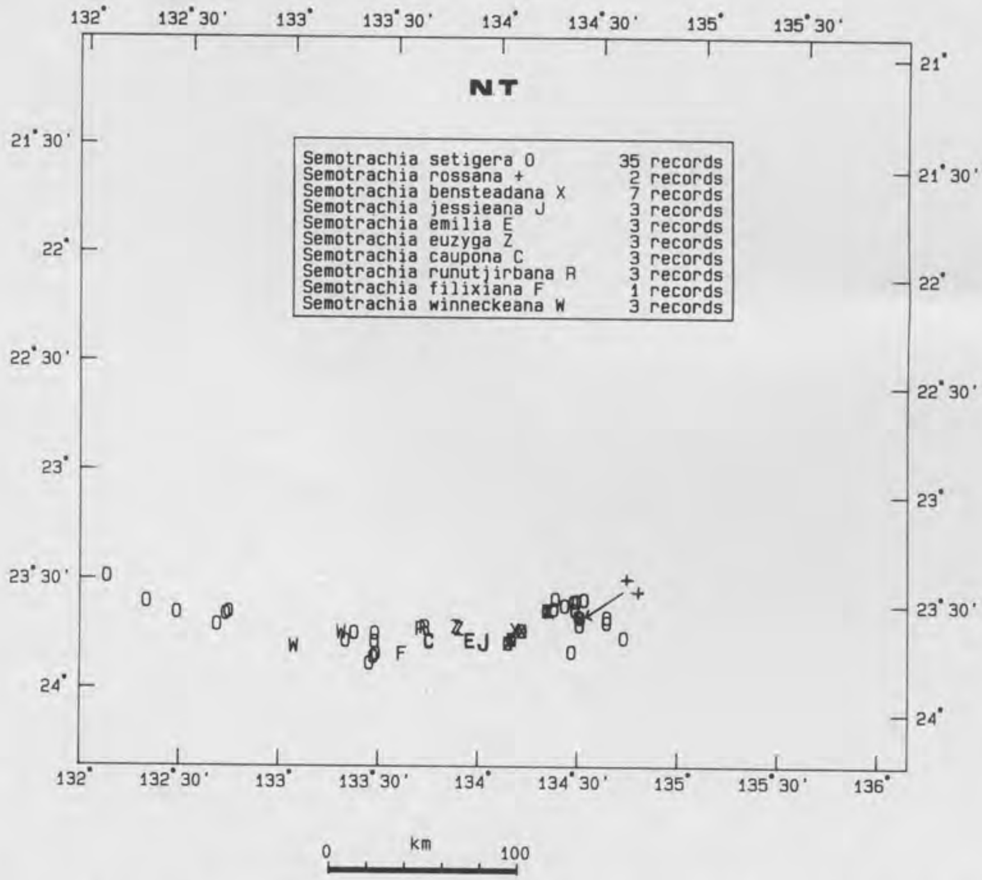
Map 13: Comparative distribution of *Semotrachia* and *Sinumelon* in the Red Centre.



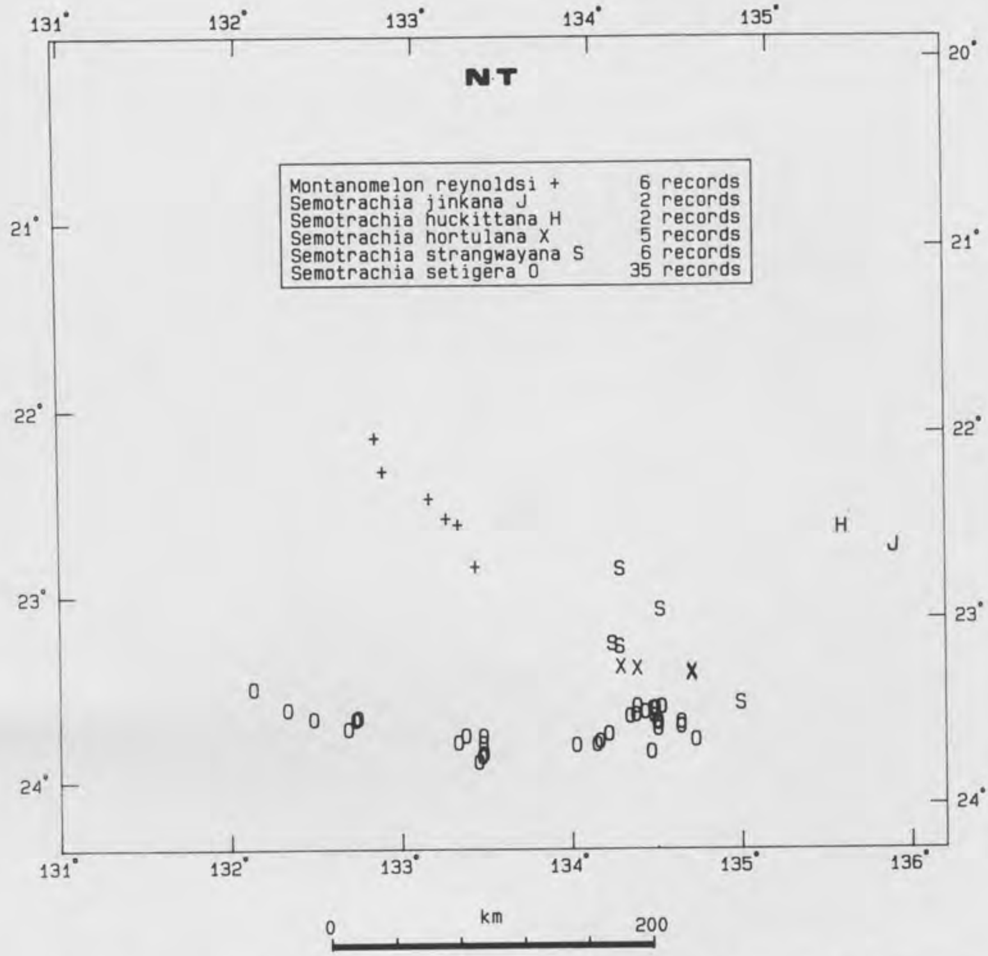
Map 14: All records of *Semotrachia* and *Montanomelon* in the Red Centre.

perinflatum, *S. dulcensis*, *S. expositum*, **Maps 7-8**) have extended distributions, involving more than one set of mountain ranges, while six species are basically restricted to a single hill system (see also pp. 992 above). In contrast, of the 25 *Semotrachia* species recognized below, only *S. setigera* (Tate, 1894) (**Maps 15-16**), which has a wide disjunct distribution in the MacDonnell Ranges, *S. elleryi* (**Map 17**) from the MacDonnell and Krichauff Ranges, and *S. esau* Iredale, 1937 (**Map 17**) from the Krichauff Ranges and Palmer River, have moderately extended ranges. Most of the other 22 species have been collected from single gaps or gorges, and at most have single hill system records. It is anticipated that a number of additional *Semotrachia* species remain to be described (see below).

Sympatry among species of *Semotrachia* is limited. In the eastern MacDonnell Ranges (**Map 16**), *S. setigera* (Tate, 1894) occurs with *S. rossana* along the Ross River

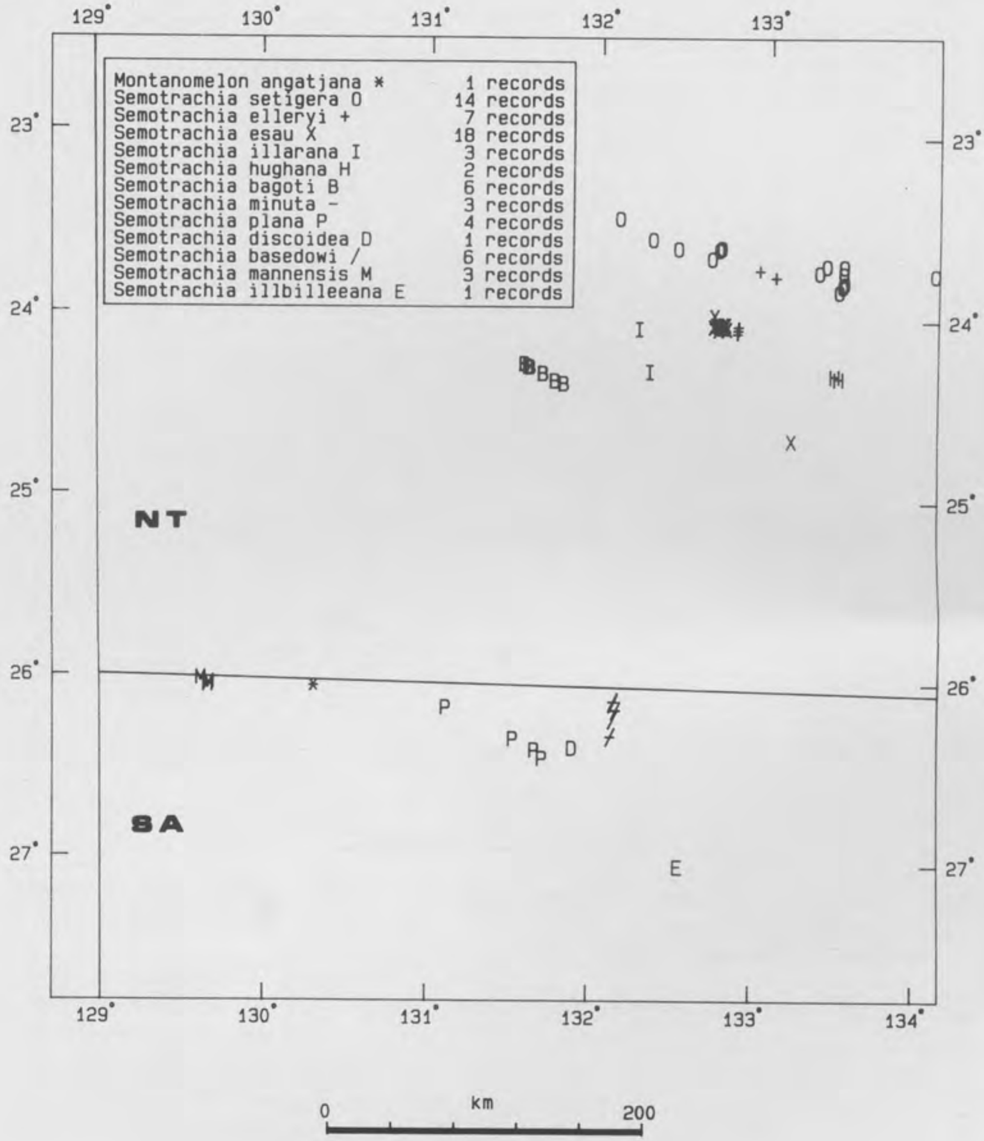


Map 15: Records of *Montanomelon reynoldsi*, northern and MacDonnell Range *Semotrachia*: *S. jinkana*, *S. huckittana*, *S. hortulana*, *S. strangwayana*, and *S. setigera* (Tate, 1894).



Map 16: Records of MacDonnell Range *Semotrachia*: *S. setigera* (Tate, 1894), *S. rossana*, *S.bensteadana*, *S. jessieana*, *S. emilia*, *S. euzyga* (Tate, 1894), *S. caupona*, *S. runutjirbana*, *S. filixiana*, and *S. winneckeana* (Tate, 1894).

banks and *S. bensteadana* usually is found with *setigera* throughout its 28 km range - Undoolya Gap E to Mt. Benstead Creek. At Ellery Creek Big Hole, Heavitree Ranges, *S. winneckeana* (Tate, 1894) and *S. elleryi* have been collected in the same patch of figs. In the Musgrave Ranges, *S. basedowi* (Hedley, 1905) and *S. minuta* (**Map 17**) have been found together at three stations. The difference in size between sympatric species varies. *S. setigera* at WA-747 has a mean diameter of 14.24 mm, compared with 11.98 mm for *S. rossana*; *S. bensteadana* has local population mean diameters of 9.03-10.28 mm, compared with 13.84-15.33 mm means for *S. setigera* at the same stations. *S. elleryi* has a mean diameter of 11.38 mm at WA-125 compared with 6.13 mm mean diameter for *S. winneckeana*, while *S. minuta* from 5 km S of Ernabella averaged 5.34



Map 17: Records of *Montanomelon angatjana* and southern species of *Semotrachia*: *S. setigera* (Tate, 1894), *S. elleryi*, *S. esau* Iredale, 1937), *S. illarana*, *S. hughana*, *S. bagoti*, *S. minuta*, *S. plana*, *S. discoidea*, *S. basedowi* (Hedley, 1905), *S. mannensis* Iredale, 1937, and *S. illbilleeana*.

Table 121: Range of Variation in *Montanomelon* and nothern area *Semotrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
MONTANOMELON							
reynoldsi	349	6.39 (5.1-9.3)	11.02 (9.1-14.1)	0.579 (0.486-0.683)	$4^{3}/_{8}$ (4--$4^{7}/_{8}$)	2.02 (1.15-2.7)	5.52 (3.70-9.79)
angatjana	42	2.89 (2.7-3.2)	7.36 (7.0-7.8)	0.394 (0.365-0.416)	$3^{3}/_{8}$ ($3^{1}/_{2}$-- 4+)	2.32 (2.1-2.7)	3.18 (2.84-3.56)
SEMOTRACHIA							
jinkana	40	3.93 (3.3-4.85)	8.13 (7.3-8.85)	0.483 (0.408-0.589)	4- ($3^{3}/_{4}$-$4^{1}/_{8}$+)	2.43 (2.0-2.8)	3.35 (2.86-3.90)
huckittana	26	3.58 (3.3-4.1)	8.98 (7.7-10.1)	0.399 (0.373-0.445)	4+ ($3^{3}/_{4}$+-$4^{1}/_{8}$+)	2.48 (2.05-2.9)	3.65 (3.12-4.20)
hortulana	74	6.90 (5.85-7.75)	13.73 (12.7-15.1)	0.503 (0.440-0.600)	$4^{7}/_{8}$+ ($4^{5}/_{8}$- -$5^{1}/_{4}$)	3.52 (2.65-4.45)	3.94 (3.25-5.05)
strangwayana	122	6.97 (6.0-8.1)	13.13 (12.0-14.7)	0.530 (0.474-0.617)	$4^{7}/_{8}$ ($4^{5}/_{8}$-$5^{1}/_{4}$+)	3.26 (1.7-4.1)	4.09 (3.00-7.08)

mm in diameter and *S. basedowi* 16.16 mm. Clearly there is no simple pattern of size ratios for microsympatric species.

Discussion

The general similarity in appearance of the known *Semotrachia* is deceiving. Many characters vary significantly, sometimes with geographic coherence, more often with a mosaic pattern. The features are discussed initially in the order that they are covered in the **Diagnoses**, then in respect to sympatric interactions. After a brief commentary on some probable new species for which the available material is inadequate for description, this section concludes with a highly artificial key.

Mean shell diameter and whorl count, with the exception of *Semotrachia basedowi* (Hedley, 1905), which has a sharply angulated periphery (**Fig. 355b**) that increases its diameter considerably, are in basic accord, and the pattern of spire elevation and relative umbilical width often are linked - the higher the whorl count, the greater the diameter; the higher the spire, the greater the H/D ratio and, usually, the narrower the umbilicus. The selected examples below indicate that the linkage is less than perfect. Data in **Tables 121-129** demonstrate there is considerable intrapopulational variation. The following few examples show the pattern of size increment:

	Diameter in mm	Whorls Elevation	Spire	H/D	D/U
S. minuta	5.41	3 1/2	slight	0.387	3.04
S. winneckeana	5.99	3 3/4-	flat	0.392	2.90
S. illbilleeana	6.49	3 5/8	flat	0.382	3.86
S. illarana	7.69	3 7/8	slight	0.418	3.68
S. jinkana	8.13	4-	moderate	0.483	3.35
S. bensteadana	9.71	4+	slight	0.398	3.10
S. filixiana	10.30	4 1/4-	moderate	0.447	3.50
S. emilia	11.97	4 3/8+	flat	0.387	3.22
S. esau	11.92	4 3/4	moderate	0.526	3.87
S. hortulana	13.73	4 7/8+	moderate	0.503	3.94
S. basedowi	17.07	4 1/4-	moderate	0.508	4.52

The umbilici all show the characteristic pattern of the last whorl decoiling more rapidly (**Figs 334c, f**). Species with narrower umbilici have the last whorl decoiling reduced (**Fig. 355c**), those with wider umbilici have the rate of decoiling increased (**Fig. 328f**). The same last whorl decoiling pattern is found in some species of *Lacustrelix* Iredale, 1937 from the Flinders Ranges (Solem, 1992a: figs 77-78).

Presumably as an adaptation relating to their aestivation strategy of sealing to rock or wood surfaces, the body whorl descension is abrupt in nearly all species. The second typical adaptation of a rock sealer, having the parietal lip continuous across and free of the parietal wall (**Figs 328b, 328e, 331b, 331e, 334e, 338e, 341b, 343b, 349b, 352b, 355b**), occurs geographically. In essentially all of the species from the central portions of the MacDonnell Ranges, plus *S. hughana* from the James Ranges, plus *S. minuta* and *S. basedowi* from the Musgrave Ranges, SA, the lip is continuous and free. *S. runutjirbana* from the Runutjirba Range, is variable in this feature. In contrast, all northern species, *S. jinkana*, *S. huckittana*, *S. hortulana*, and *S. strangwayana*; *S. setigera* from the eastern and western MacDonnell Ranges; *S. esau* from the Krichauff and James Ranges; *S. illarana* from Tempe Downs; *S. bagoti* from the George Gill Ranges; *S. mannensis* from the Mann Ranges; *S. discoidea* and *S. plana* from the Musgrave Ranges; and *S. illbilleeana* from the Everard Ranges - all have the parietal lip reduced to a callus, which may be thin or thick. This is not a size associated phenomenon, since the 11 species with a free lip are 5.41-17.07 mm (mean 10.74 mm) in diameter, and the 12 species with a parietal callus are 6.49-13.73 mm (mean 10.91 mm).

Apical sculpture was misinterpreted by Iredale (1933: 51-52) in his description of generic units, with a worn apex considered to be smooth, and intrusive periostracal setae assumed to be primitively apical. In actuality, all *Semotrachia* have pustulose apices. The pustules vary in shape from round to elongated, from dense to scattered, and in two species (*S. rossana*, *S. bensteadana*) it seems to consist (**Plates 148a-b, d-e**) of complex elements. In the Musgrave and Everard Ranges, several species, *S. minuta* (**Plate 164b**), *S. illbilleeana* (**Plate 164c**), *S. discoidea* (**Plate 167e**), and *S. plana* (**Plate 166a**), have part of the apex with diagonal radial ridges, some of which may be broken up into elongated pustules.

Microsculpture on the spire and body whorl consists of both periostracal and calcareous elements. The periostracal elements consist of setae and low micro ridglets (**Plate 146e**). There is considerable variation in the size, spacing, and bases of the setae, and in the degree of ridgelet development (see **Plates 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 161, 163, 164, 166, 167**). The setae will be long in the sutural area and on the periphery of the body whorl, shorter on the spire and upper surface of the body whorl. Partly this is because of erosion as the snail crawls through the rocky litter, partly because they start out shorter. The only significant variation in setal shape is in *S. illbilleeana* (**Plate 164c-e**) from the Everard Ranges, where the setae are spatulate.

The calcareous microsculpture can consist of pustules or micro ridges. The former often form the base to which a seta is attached (**Plate 161e**). In a few species these pustules become grossly enlarged (*S. huckittana* from the Dulcie Range, **Plate 142d, f**, and many of the Musgrave-Everard species, **Plates 164, 166, 167**). The latter also tend to have micro ridgelets developed (**Plate 167**).

Body colour is highly variable within populations, although most species will have grey markings on at least the head and neck. Land snail species with reduced colour often live in deep fissures or huge talus piles, and the lack of colour is assumed to be correlated with life in darkness. It is interesting that the only species of *Semotrachia* that are dark grey in body colour, *S. winneckeana* (Tate, 1894) and *S. minuta*, are among the very smallest species.

Genital variation is substantial, partly correlated with microsympatric occurrences, and difficult to interpret. *S. rossana* (**Figs 329a-b**) and *S. bensteadana* (**Figs 330a-b**), each of which overlaps with *S. setigera* in the eastern MacDonnell Ranges, are the only species to have completely lost the epiphallic caecum (EC). The epiphallic caecum in *S. setigera* (**Figs 324-326**) is small. In contrast, *S. euzyga*, *S. runutjirbana*, *S. filixiana*, *S. elleryi*, *S. illarana*, and *S. hughana* have very large epiphallic caeca.

Insertion of the penial retractor muscle (PR) normally is about one-third of the distance from the verge (PV) base to the entrance of the vas deferens (VD) into the epiphallus (E). In *S. rossana* (**Figs 329a-b**), *S. euzyga* (**Figs 335a-d**), and *S. plana* (**Figs 360a-b**), the muscle attaches close to the verge base. These are independent changes, since in *S. rossana* the epiphallus has shrunken to a fraction of its normal length although the penis is long, displacing the muscle; in *S. euzyga* both the penis and the lower part of the epiphallus have been shortened; and in *S. plana* the epiphallus is partly shortened.

Discussion of the penis chamber wall sculpture is deferred. It varies from simple to rugose or corrugated, but some of the figured material was fixed in formalin. As noted above with the illustrations of *Granulomelon acerbum* (**Figs 269-270**), this makes a tremendous difference in the appearance of the chamber wall.

The verge (PV) is quite variable in size and structure. In *S. euzyga* (**Figs. 335b-c**) it is wider than long, while in *S. winneckeana* (**Fig. 342b**) and *S. illarana* (**Figs 348a-b**) it is a very long and cylinder shaped. In the former, the sperm groove extends less than a quarter of its length, while in the latter, the sperm groove reaches almost to the verge tip. Most species have the verge intermediate in size, but its shape, length, surface appearance in preservation, sperm groove prominence, and degree of tapering vary significantly. I have not been able to detect correlated variations that would suggest monophyly. A few species do have a significantly different verge. In *S. jinkana* (**Fig. 317c**) from the Dulcie Range, plus *S. basedowi* (**Fig. 356b**) and *S. discoidea* (**Fig. 358**) from the Musgrave Ranges, the verge is a folded sheet of thin tissue, rather than the thick walled organ found in other species.

A new structure, the foliated pilaster (FP), is found in both *S. discoidea* (**Fig. 358**) and *S. plana* (**Fig. 360b**). This is a high, tightly rolled sheet of tissue that is attached longitudinally to the lower part of the penis chamber and functions as a stimulator. In three other species, *S. basedowi* (**Fig. 356b**) and *S. minuta* (**Fig. 353b**) from the Musgrave Ranges, and *S. rossana* (**Fig. 329b**) from the E MacDonnell Ranges, there are low structures at the base of penis chamber that could be interpreted as remnants of or the "embryo" to the foliated pilaster.

There is not a simple correlation between verge type and accessory organ:

Species	Verge and sperm groove	Basal ridges	Foliated pilaster
S. jinkana	sheet verge	0	0
S. rossana	short cylinder, groove to tip	+	0
S. minuta	long cylinder, groove to tip	+	0
S. basedowi	sheet verge	+	0
S. discoidea	sheet verge	0	+
S. plana	tapered cylinder, groove to tip	0	+

As mentioned above (p. 1276), few species are sympatric. *S. rossana* and *S. bensteadana* are sequentially sumpatric with *S. setigera* in the eastern MacDonnell Ranges. The absence of the epiphallic caecum in both of the first two species and their very distinctive verges (**Figs 329b, 330b**) compared with the verge of *S. setigera* (**Fig. 325**), can be attributed to sympatric interactions. The extremely long verge and simple penis chamber wall pilasters of *S. winneckeana* (**Fig. 342b**) from Ellery Creek Big Hole, Heavitree Range, contrast with the extremely short verge and corrugated wall pilasters found in the sympatric *S. elleryi* (**Fig. 344c**). In the Musgrave Range near Ernabella, *S. minuta* (**Fig. 353b**) has a long verge with a smooth surface and complex penis chamber wall sculpure, while the microsympatric and much larger *S. basedowi* (**Fig. 356b**) has a proportionately smaller (but actually larger) verge in a longer penis with much more prominent penis chamber wall sculpture. The genital differences between sympatric species are thus obvious.

While 25 species are reviewed below, this may represent about half of the extant diversity levels. Many gorges in the MacDonnell-Heavitree-Chewings Ranges area remain to be surveyed for land snails. In view of the many short range species already found between Mt. Benstead Creek in the E MacDonnells and Simpson Gap, W MacDonnells, more can be anticipated. Material from Standley Chasm (K 11712) is placed with *S. winneckeana*, but probably is new; specimens from Kings Canyon, George Gill Range (K 11709) are much smaller than *S. bagoti*, nearly flat spired, and with a free parietal lip; and two collections have been made near Areyonga (WA-934, FMNH 212399 and K 11727) of an intermediate sized shell with very dense setae, a nearly flat spire, and the parietal lip a thin callus. Ellis Troughton in 1952 (AM C.112699) collected from "Palm Valley Creek, 12 miles from Hermannsburg Mission" two dead examples of a large species with rugose shell sculpture, a free parietal lip, nearly flat spire, and strongly shouldered body whorl. It has not been found subsequently. None of the above probable new species could be dissected. Without anatomical data they cannot be named.

Two additional species have been dissected, but are represented by very limited material. One (*S.* new species 1) is from Pine Gap Road on the S fringes of the MacDonnell Ranges (WA-120, FMNH 182637). It has a very long, thick based epiphallic caecum, short penis with rough surfaced verge, and rugose penis chamber wall sculpture. The shell is fairly large and with large, very closely spaced setae. Another small species (*S.* new species 2) was collected near the S end of Serpentine Gorge, Heavitree Range (WA-123, FMNH 182685). The penis is long, with a small verge, the penial retractor muscle inserts just above the verge base, and the epiphallic caecum is very small and slender. The shell is flat spired, the parietal lip is barely free of the wall, and the setae are short and very closely spaced.

While the available data suggest that several of the above are undescribed species, the material are not sufficient for naming. I choose instead to call attention to their presence as a hint and challenge to collectors.

The following key is the only one in this series to be based upon genital structures. It thus will work only for live collected adults, and requires not only dissecting out the entire genitalia, but also opening the penis chamber so that the verge structure and the penis chamber wall sculpture can be observed. The latter structure is severely altered by formalin fixation. All retracted specimens will be very difficult to dissect, but the shell differences often are subtle and size variation among populations is quite substantial. Even with use of mostly genital structures, two species, *Semotrachia winneckeana* (Tate, 1894) and *S. runutjirbana*, had to be included twice because of variation. If you have only dead examples available, then forget using this key. Measure the adult examples, and compare this data against measurements of the geographically nearest taxa. If they differ substantially, as indicated above, they probably will be another new species.

KEY TO THE SPECIES OF *SEMOTRACHIA*

1. Parietal lip continuous and free of parietal wall (**Figs 328b, 331b, e**) 2
   Parietal lip a thin to thick callus, not free of parietal wall (**Figs 316b, e, 323b, e, 343e**) 14

2. Mean shell diameter less than 7 mm 3
   Mean shell diameter more than 7 mm 4

3. Musgrave Ranges; spire elevated (**Fig. 352b**); mean diameter 5.4 mm *Semotrachia minuta*, sp. nov. (p. 1395)
   Chewings and Heavitree Ranges; spire nearly flat (**Figs 341b, e**); mean diameter 6 mm .... *Semotrachia winneckeana* (Tate, 1894) (p. 1358)

4. Mean diameter less than 13 mm; body whorl rounded or shouldered, not angulated; NT 5
   Mean diameter 16-17 mm; body whorl sharply angulated; Musgrave Ranges, SA *Semotrachia basedowi* (Hedley, 1905) (p. 1403)

5. Epiphallic caecum (EC) absent 6
Epiphallic caecum (EC) present 7

6. Epiphallus (E) and verge (PV) short (**Figs 329a-b**); Ross River
Semotrachia rossana, sp. nov. (p. 1322)

Epiphallus (E) long, verge cylindrical (**Figs 330a-b**); Mount Benstead Creek W to Undoolya Gap, MacDonnell Ranges
Semotrachia bensteadana, sp. nov. (p. 1329)

7. Penis chamber wall with pustulose sculpture (**Figs 333a-b**) 8
Penis chamber wall with simple or corrugated longitudinal ridging (**Figs 335b, 340c, 342b**) 9

8. Penis (P) short and wide (**Fig. 333b**); Jessie Gap, MacDonnell Ranges ....
Semotrachia jessieana, sp. nov. (p. 1332)

Penis (P) long and cylindrical, tapering (**Fig. 333a**); Emily Gap, MacDonnell Ranges
Semotrachia emilia, sp. nov. (p. 1339)

9. Epiphallic caecum (EC) very short and inconspicuous (**Figs 336a, c**); Temple Bar Gap, W MacDonnell Ranges
Semotrachia caupona, sp. nov. (p. 1348)

Epiphallic caecum (EC) prominent (**Figs 339a, 340a, c**) 10

10. Verge (PV) much longer than wide (**Figs 339a, 340c, 344c, 350b**) 11
Verge (PV) wider than long (**Fig. 335b**); penis (P) short; Alice Springs ....
Semotrachia euzygra (Tate, 1894) (p. 1340)

11. Epiphallic caecum (EC) equal in length to penis, slightly tapering (**Figs 339a-b**); Runutjirba Range
Semotrachia runutjirbana, sp. nov. (p. 1351)

Epiphallic caecum (EC) much shorter than penis (**Figs 340c, 344c, 350b**) .. 12

12. Penis chamber wall with simple longitudinal folds (**Figs 340c, 350b**) 13
Penis chamber walls with corrugated pilasters below (**Fig. 344c**); basin of Ellery Creek in MacDonnell and Krichauff Ranges ....
Semotrachia elleryi, sp. nov. (p. 1364)

13. Verge (PV) tapering, rugose; Fenn Gap West, MacDonnell Ranges
Semotrachia filixiana, sp. nov. (p. 1355)

Verge (PV) cylindrical, smooth; Hugh River near James Range
Semotrachia hughana, sp. nov. (p. 1386)

14. Mean diameter less than 9.4 mm 15
Mean diameter more than 9.7 mm 19

15. Periostracal setae with simple shafts 16
Periostracal setae with spatulate shafts (**Plate 164c-e**); Everard Ranges
Semotrachia illbilleeana, sp. nov. (p. 1401)

16. Heavy fibers binding epiphallus (E) to penis (P) (**Figs 342a-b**) ....
Semotrachia winneckeana (Tate, 1894) (p. 1358)
Epiphallus not bound to penis (**Figs 317a, 318a, 347a**) 17

17. Verge (PV) cylindrical (**Figs 318b, 348a-b**) with lateral sperm groove 18
Verge (PV) a wide, thin sheet folded within penis (**Fig. 317c**) ....
Semotrachia jinkana, sp. nov. (p. 1287)

18. Verge (PV) less than one-third length of penis (**Fig. 318c**); Huckitta Range ...
Semotrachia huckittana, sp. nov. (p. 1293)
Verge (PV) more than two-thirds length of penis (**Figs 347b-c**); Tempe Downs, NT
Semotrachia illarana, sp. nov. (p. 1382)

19. Shell periphery strongly shouldered to angulated (**Figs 359b, 359e**); Musgrave Ranges 20
Shell periphery rounded or at most weakly shouldered (**Figs 323b, e**) 21

20. Verge (PV) overlaps foliated pilaster (**Fig. 358a**); shell larger (mean diameter 13.25 mm); spire nearly flat (**Fig. 359e**, mean H/D ratio 0.303); Mt. Woodroffe, Musgrave Ranges ...... *Semotrachia discoidea*, sp. nov. (p. 1413)
Verge (PV) not overlapping foliated pilaster (**Fig. 360b**); shell smaller (mean diameter 10.7 mm), shell periphery less shouldered (**Fig. 359b**, mean H/D ratio 0.403); western Musgrave Ranges ...... *Semotrachia plana*, sp. nov. (p. 1417)

21. Species living in the NT 22
Mann Ranges, SA
Semotrachia mannensis Iredale, 1937 (p. 1407)

22. Epiphallic caecum (EC) much shorter than penis (**Figs 320a, b, 321a, 326a, d, g, 345a, b, 351b**) 23
Epiphallic caecum (EC) longer than penis (**Figs 339a-b**); Runutjirba Range
Semotrachia runutjirbana, sp. nov. (p. 1351)

23. Krichauff to George Gill Ranges, NT 24
MacDonnell Ranges N to Harts and Strangways Ranges 25

24. Krichauff Ranges .... *Semotrachia esau* Iredale, 1937 (p. 1369)
George Gill Ranges .... *Semotrachia bagoti*, sp. nov. (p. 1392)

25. Harts to Strangways Ranges, Hale River basin 26
E and W MacDonnell Ranges
Semotrachia setigera (Tate, 1894) (p. 1307)

26. Hale River basin, N of MacDonnell Ranges, NT
Semotrachia hortulana, sp. nov. (p. 1295)
Strangways Range to Hart Ranges, NT
Semotrachia strangwayana, sp. nov. (p. 1303)

SEMOTRACHIA JINKANA, SP. NOV.
(Plates 142a-c, 143a-c; Figs 316a-c, 317a-c)

Comparative remarks

Semotrachia jinkana, sp. nov., known only from Jinka Spring, Dulcie Range, NT, is a relatively small species (mean diameter 8.13 mm), with moderately elevated spire (**Fig. 316**, mean H/D ratio 0.483), wide umbilicus (**Fig. 316c**, mean D/U ratio 3.35), relatively simple shell microsculpture and prominent setae (**Plate 142a-c**), and the parietal wall has a very thick callus with slightly raised edge (**Fig. 316b**). *S. bensteadana* (**Figs 328d-f**) and *S. euzyga* (Tate, 1894) (**Figs 334a-c**) are similar in size and umbilicus, but are much more depressed (mean H/D ratios 0.395-0.398), and their parietal lips are completely free of the parietal wall. The neighbouring *S. huckittana* has the same lip and umbilical structure as in *S. jinkana*, but is easily separated by its much lower spire (**Fig. 316e**), slightly larger size (mean diameter 8.98 mm), and very prominent microsculpture on the spire and body whorl (**Plate 142d, f**). *S. illarana*, from Illara Waterhole, near Tempe Downs, is closest in size and shape, but the parietal wall has only a thin callus (**Fig. 341e**). Anatomically (**Figs 317a-c**), *S. jinkana* has the epiphallus (E), penis (P), and vagina (P) relatively short and thick, and the epiphallic caecum (EC) is small and slender. The penis chamber (**Fig. 317c**) has rugose wall sculpture on the upper portion, and the verge (PV) is a multi-folded, thin, wide sheet with the sperm groove running only partway to the tip. *S. huckittana* (**Figs 318a-c**) has the terminal genitalia longer and slenderer, no rugose wall sculpture in the penis chamber, and a typical subcylindrical verge (PV). *S. bensteadeana* (**Fig. 330a**) lacks the epiphallic caecum (EC), *S. euzyga* (**Figs 335a-d**) has the epiphallic caecum greatly enlarged, but the rest of the male genitalia reduced in size, and *S. illarana* (**Figs 347-348**) has the penis very short, a very long and slender verge, lacks penis chamber wall sculpture, and the epiphallic caecum (EC) is very slender.

Holotype

AM C.135972, WA-736, under fig trees, Jinka Spring, Dulcie Range, NE of Alice Springs, Northern Territory, Australia (Huckitta 1:250,000 map sheet SF 53-11 - 3805:1780yds). 22° 37′40″S, 135° 49′22″E. Collected by Alan Solem and Phil Colman

17 April 1981. Height of holotype 3.8 mm, diameter 8.00 mm, H/D ratio 0.475, whorls 4+, umbilical width 2.5 mm, D/U ratio 3.20.

Paratopotypes

AM C.135987-8, SAM D18038, WAM 655.87, WAM 656.87, MV, QM, FMNH 205420-1, 14 LA, 15 LJ from the type locality; 21 April 1987, V. Kessner!, K 11760, 69 DA, 1 DJ.

Range

The only known colony is from a small patch of figs below Jinka Spring, Dulcie Range, NT.

Diagnosis

Shell relatively small, adult diameter 7.3-8.85 mm (mean 8.13 mm), whorls 3 3/4 to 4 1/8+ (mean 4-). Apex and spire moderately and evenly elevated (**Fig. 316b**), shell height 3.3-4.85 mm (mean 3.93 mm), H/D ratio 0.408-0.589 (mean 0.483). Body whorl (**Fig. 316b**) weakly shouldered above, strongly descending just behind lip. Apex (**Plate 142a-b**) initially with crowded pustules, becoming irregular in shape later. Spire and body whorl (**Plate 142a, c**) with high, long based setae in sutures, setal length reduced or eroded elsewhere, typical irregular micro ridgelets. Umbilicus (**Fig. 316c**) wide, last whorl decoiling more rapidly, width 2.0-2.8 mm (mean 2.43 mm), D/U ratio 2.86-3.90 (mean 3.35). Lip sharply reflected and moderately expanded, white, continued across parietal wall as a heavy callus, rarely just barely free of wall. Shell dark yellow-brown, lighter on base. Based on 40 measured adults.

Genitalia (**Figs 317a-c**) with vagina (V) and free oviduct (UV) short and thick. Epiphallic caecum (EC) very slender, small. Epiphallus (E) short and thick, internally with simple ridges. Penis (P) short, expanded apically. Penis chamber with rugose upper wall. Verge (PV) broad, very thin, multi-folded, sperm groove reduced, not reaching tip.

Central and lateral teeth of radula (**Plate 143a**) with small anterior flare, noticable ectocone, strongly curved cusp tip. Late laterals with rapidly enlarging anterior flare and ectocone (**Plate 143b**). Lateromarginal transition and marginals without unusual features. Jaw (**Plate 143c**) with prominent vertical ribs except where altered by injury.

Discussion

Semotrachia jinkana, sp. nov., is the easternmost known species of the genus. It is quite possible that isolated colonies of other species will be found between the Dulcie Range and Mt. Isa, Queensland.

While the shell structure is simple, the highly modified verge has its greatest similarity in form to the accessory stimulator found in the Musgrave Range *Semotrachia* (**Figs 356, 358, 360**). The only camaenid recorded microsympatrically is *Sinumelon dulcensis*, sp. nov., so that species interactions cannot be invoked as having led to the evolution of this unusual verge.

The name *jinkana* is taken from the name of the spring by which this species lives.

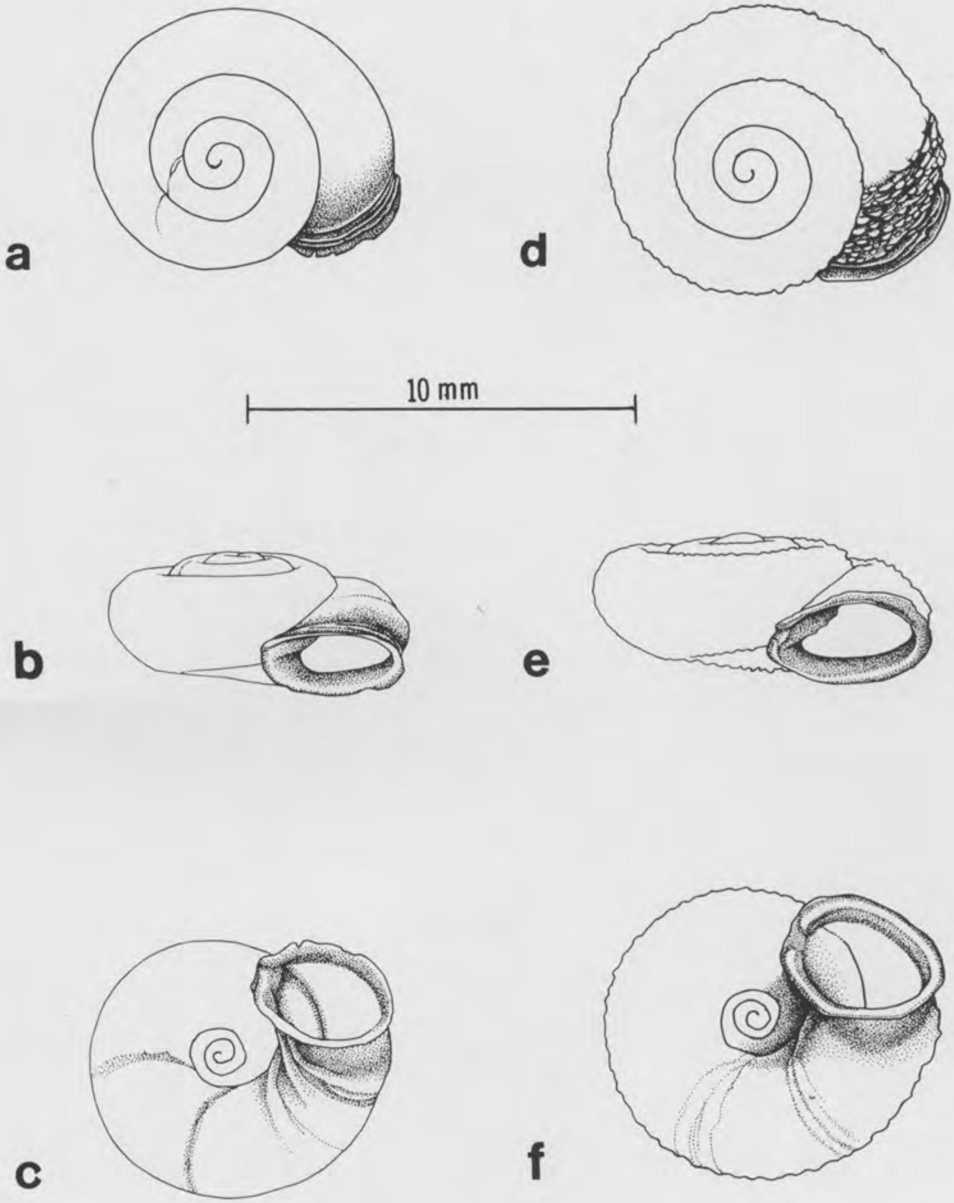


Fig. 316: Shells of *Semotrachia jinkana*, sp. nov., and *S. huckittana*, sp. nov.: (a-c) Holotype of *S. jinkana*, WA-736, Jinka Spring, Dulcie Range, NT. AM C.135972; (d-f) Holotype of *S. huckittana*, gorge N of Old Huckitta Homestead ruins, Dulcie Ranges, NT. AM C.135973. Scale line equals 10 mm. Drawings by Linnea Lahlum.

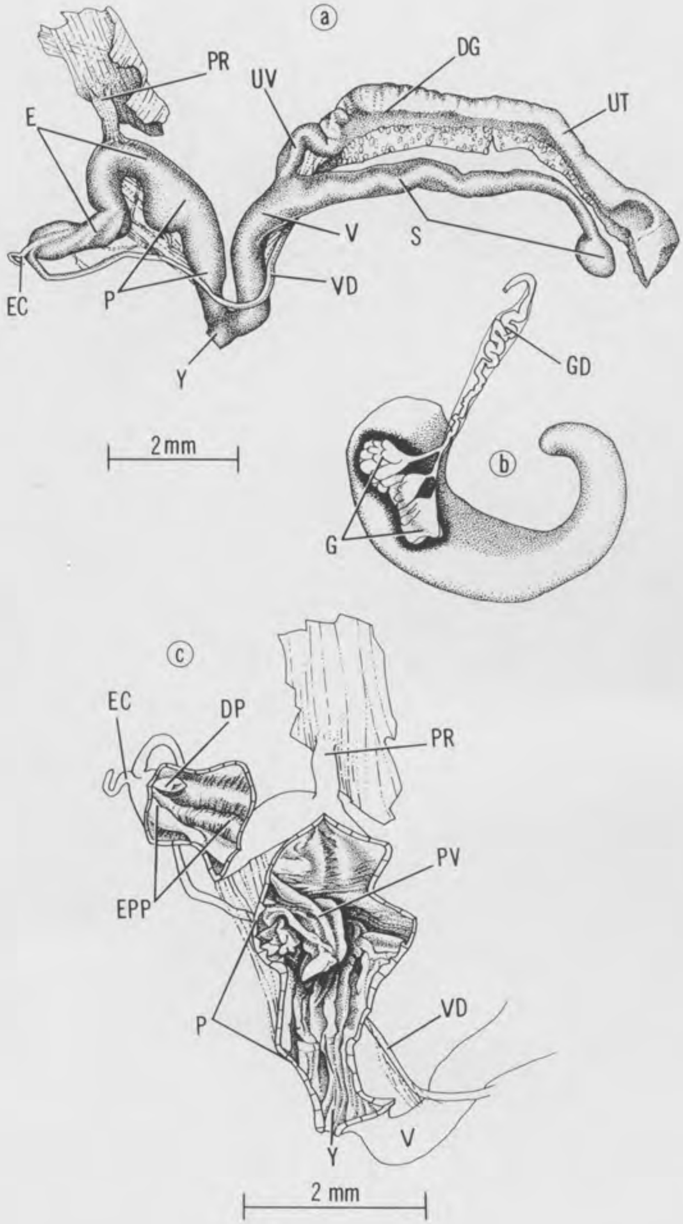


Fig. 317: Genitalia of *Semotrachia jinkana*, sp. nov.: WA-736, Jinka Spring, Dulcie Range, NT. 17 April 1981. FMNH 205421, Dissection A. (a) whole genitalia; (b) ovotestis and hermaphroditic duct; (c) interior of epiphallus and penis. Scale lines as marked. Drawings by Linnea Lahlum.

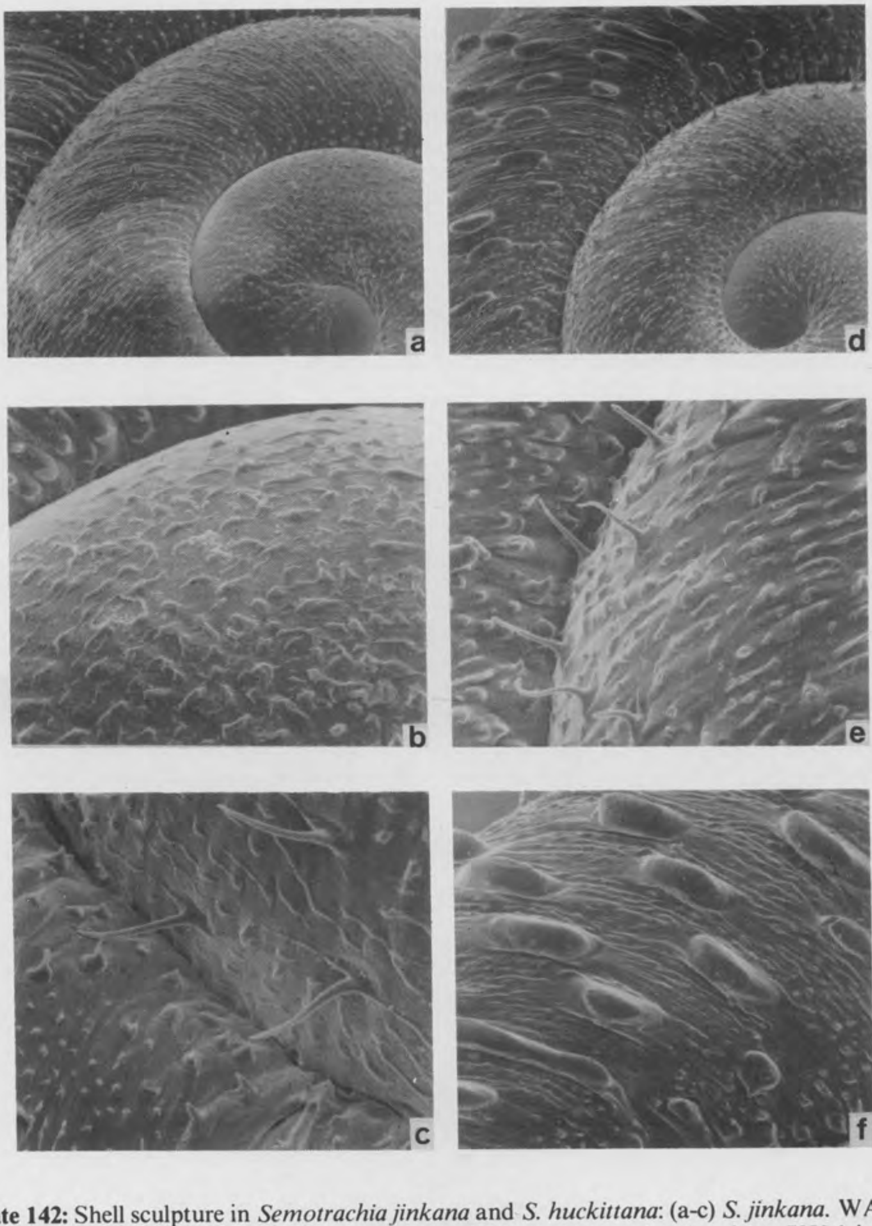


Plate 142: Shell sculpture in *Semotrachia jinkana* and *S. huckittana*: (a-c) *S. jinkana*. WA-736, Jinka Spring, Dulcie Range, N. T. FMNH 205421. a is apex and early spire at 79X, b is detail of apex at 150X, c is setae on lower spire and body whorl at 165X; (d-f) *S. huckittana*. near Old Huckitta Homestead ruins, Dulcie Range, NT. FMNH 198903. d is apex and early spire at 41.5X, e is detail of setae on lower spire at 125X, f is detail of elongated pustules on body whorl at 79X.

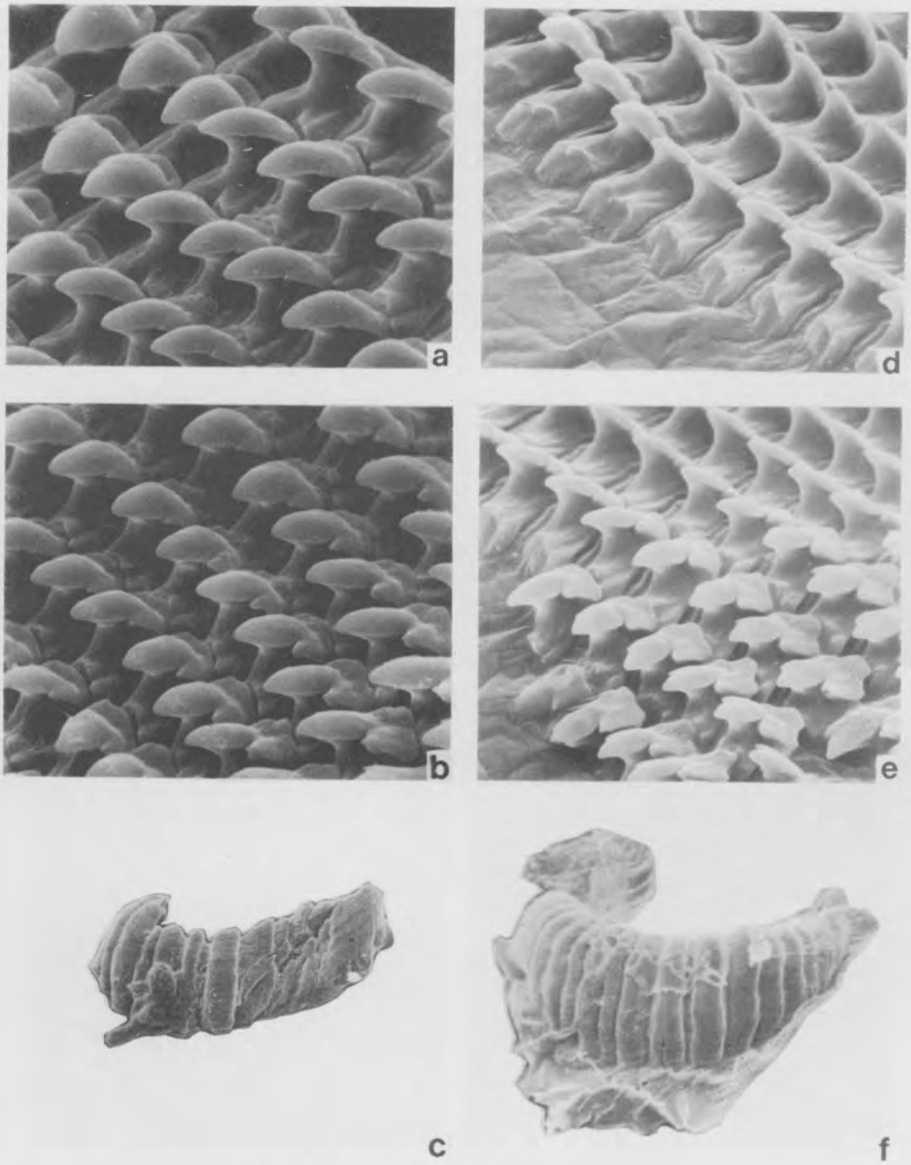


Plate 143: Radular teeth and jaw of *Semotrachia jinkana* and *S. huckittana*: (a-c) *S. jinkana*. WA-736, Jinka Spring, Dulcie Range, NT. 17 April 1981. FMNH 205421, Dissection A. a is central and early laterals at 950X, b is lateromarginal transition at 940X, c is jaw with partly repaired injury at 82X; (d-f) *S. huckittana*. near Old Huckitta Homestead ruins, Dulcie Range, NT. 22 June 1978. FMNH 198902. d is Dissection A, central and early laterals at 780X, e is Dissection A, lateromarginal transition at 780X, f is Dissection B, jaw at 115X.

SEMOTRACHIA HUCKITTANA, SP. NOV.
(Plates 142d-f, 143d-f; Figs 316d-f, 318a-c)

Comparative remarks

Semotrachia huckittana, sp. nov., from near Old Huckitta Homestead ruins, Dulcie Range, NT, is a relatively small species (mean diameter 8.98 mm), with low spire (**Fig. 316e**, mean H/D ratio 0.399), typical umbilicus (**Fig. 316f**, mean D/U ratio 3.65), specialized shell microsculpture (**Plate 142d, f**) of raised very elongated pustules on spire and body whorl, setae restricted to sutural areas (**Plate 142e**), parietal lip thin, at most barely free of wall (**Fig. 316e**). The other species of similar size, *S. jinkana* - also from the Dulcie Range, *S. bensteadeana* and *S. euzyga* from the MacDonnell Ranges, and *S. illarana* from Tempe Downs Station near the James Range, all lack the prominent shell sculpture and differ in details of size, shape, and lip features. Anatomically, *S. huckittana* (**Figs 318a-c**) has the vagina (V), penis (P), and epiphallus (E) long and slender, epiphallic caecum (EC) small and slender, verge (PV) short and conical with lateral sperm groove, wall sculpture inside penis chamber of low ridges. *S. jinkana* (**Fig. 317c**) differs most obviously in the very wide and thin verge. *S. bensteadeana* (**Fig. 330a**) lacks the epiphallic flagellum, and *S. euzyga* (**335a-d**) has the penis complex very much shortened, with greatly reduced verge (PV). *S. illarana* (**Figs 347-348**) has a shortened penis and greatly elongated verge.

Holotype

AM C.135973, under moist rocks in gorge N of Old Huckitta Homestead ruins, Dulcie Range, NE of Alice Springs, Northern Territory, Australia (Huckitta 1:250,000 map sheet SF53-11 - 3528:1888yds). 22° 32' 14" S, 135° 31' 19" E. Collected by Fred and Jan Aslin 22 June 1978. Height of holotype 4.0 mm, diameter 8.9 mm, H/D ratio 0.449, whorls 4, umbilical width 2.5 mm, D/U ratio 3.56.

Paratopotypes

AM C.135989-90, SAM D18039, WAM 657.87, QM, MV, FMNH 198902-3, 23 LA, 2 DA, 40 LJ, 11 DJ from the type locality.

Range

Known only from the one collection near Old Huckitta Homestead ruins, Dulcie Ranges, NT.

Diagnosis

Shell relatively small, adult diameter 7.7-10.1 mm (mean 8.89 mm), whorls 3 3/4+ to 4 1/8+ (mean 4+). Apex and spire slightly elevated (**Fig. 316e**), shell height 3.3-4.1 mm (mean 3.58 mm), H/D ratio 0.373-0.445 (mean 0.399). Body whorl (**Fig. 316e**) moderately shouldered above, descending normally behind lip. Apex (**Plate 142d**) initially with crowded pustules, becoming longer and lower. Typical setae (**Plate 142d-e**) present in spire sutures, lower spire and body whorl (**Plate 142d, f**) with large, elongated pustulose ridges following lines of growth. Umbilicus (**Fig. 316f**) typical, last whorl decoiling somewhat more rapidly, width 2.05-2.9 mm (mean 2.48 mm), D/U ratio 3.12-4.20 (mean 3.65). Lip sharply reflected and moderately expanded, continued across parietal wall as heavy callus, rarely slightly free of wall. Colour dark yellow-brown, lighter on base. Based on 26 measured adults.

Genitalia (**Figs 318a-c**) with terminal organs long and slender, epiphallic caecum (EC) short and very slender. Walls of penis chamber and epiphallus with low round ridges, no corrugated or rugose sculpture. Verge (PV) short, cylindrical, with lateral sperm groove.

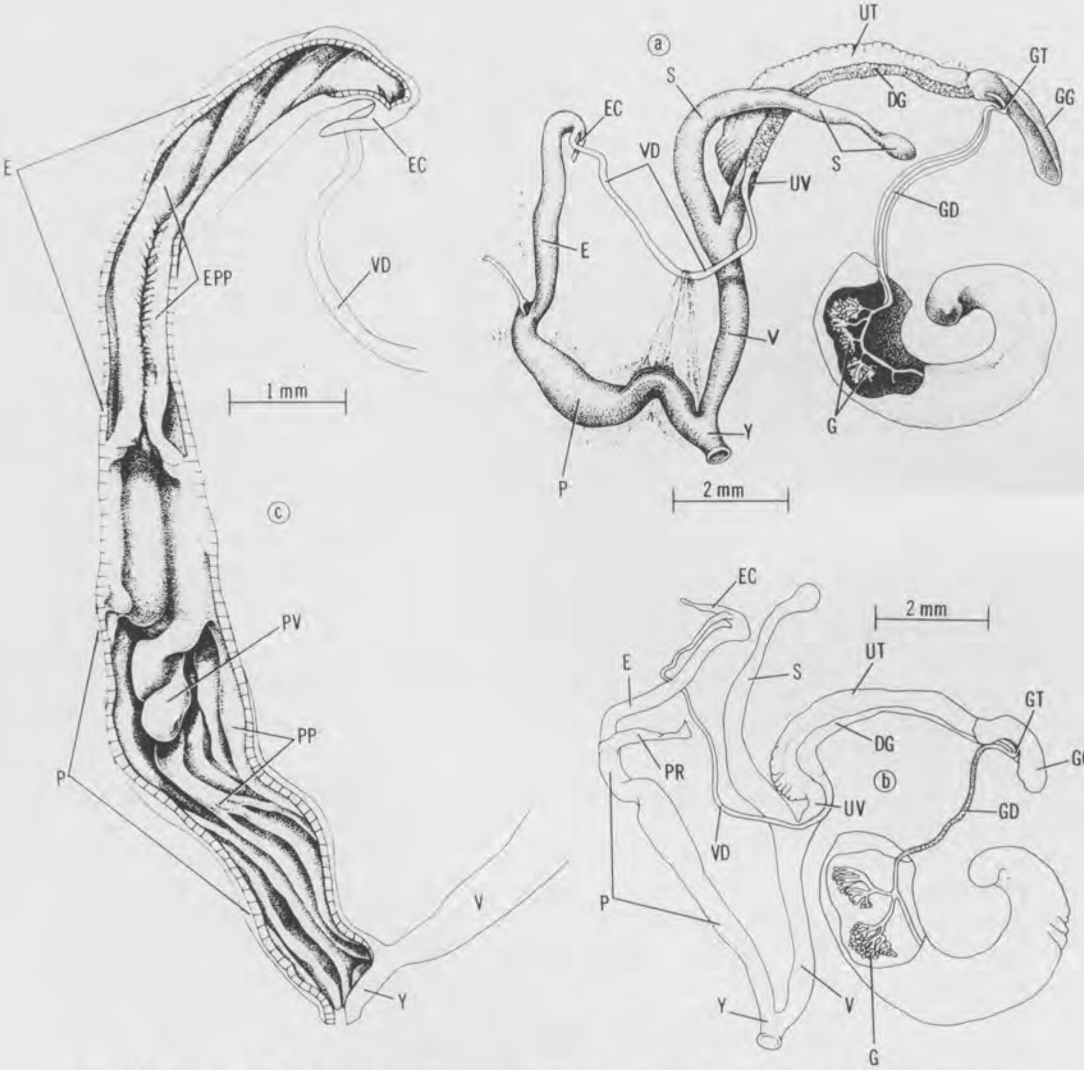


Fig. 318: Genitalia of *Semotrachia huckittana*, sp. nov.: gorge N of Old Huckitta Homestead, Dulcie Range, NT. 22 June 1978. FMNH 198902. (a) whole genitalia, Dissection A; (b) whole genitalia of new adult, Dissection B; (c) interior of epiphallus and penis, Dissection A. Scale lines as marked. Drawings by Marjorie M. Connors.

Central and lateral teeth of radula (**Plate 143d**) with slight anterior flare, high cusp shaft angle, slight cusp tip curvature, moderate ectocone. Late laterals (**Plate 143e**) with enlarged anterior flare and ectocone, endocone appearing, and shortening of basal plate. Marginals typical. Jaw (**Plate 143f**) with prominent radial ribs continuing to margins.

Discussion

Illustrations of both a new adult (**Fig. 318b**) and a "third wet season" adult (**Fig. 318a**) are presented. Note that the ovotestes (G) are comparable in size, but that the hermaphroditic duct (GD), albumen gland (GG), talon (GT), prostate (DG), and uterus (UT) of the new adult are distinctly smaller in size, although collected on the same date. These differences are the same demonstrated for "new adult" Kimberley taxa by Solem & Christensen (1984).

The elongated pustules on the spire and body whorl (**Plate 142d, f**) are calcareous. They appear to have the same structure as smaller pustules found in the Musgrave Range taxa (**Plates 166-167**).

The name *huckittana* is taken from the name of the former homestead near the type locality.

SEMOTRACHIA HORTULANA, SP. NOV.

(Plates 144a-b, 145a-c; Figs 319a-c, 320, 337f)

Comparative remarks

Semotrachia hortulana, from part of the Hale River basin, NT, is a large species (mean diameter 13.73 mm) with typical shape and umbilicus (**Figs 319a-c**), but the periostracal setae are more crowded and with longer bases than those of *S. strangwayana* (**Plate 144c-d**) or *S. setigera* (Tate, 1894) (**Plate 146b, c, e**), the other species of similar size and shape. Other *Semotrachia* are much smaller or differ in shape and sculpture. Anatomically, *S. hortulana* (**Figs 320a-c**) has a short vagina (V), large epiphallic caecum (EC), and reduced penis chamber wall sculpture; in *S. strangwayana* (**Figs 321a, 322a-b**) the vagina is much longer, the epiphallic caecum is reduced in size, and the penis chamber has complex wall sculpture; and in *S. setigera* (**Figs 324-327**) the vagina is even longer, the epiphallic caecum is more prominent, and the penis chamber sculpture is reduced to very few low ridges. The verge (PV) is proportionately larger in *S. hortulana* (**Fig. 320c**) and *S. strangwayana* (**Figs 322a-b**), somewhat smaller in *S. setigera* (**Figs 325, 327**). In radular tooth structure, the few examined specimens of *S. hortulana* (**Plate 145a**) agreed in that the early lateral teeth have a larger anterior flare and lower cusp shaft angle than specimens of *S. strangwayana* (**Plate 145d**), while examples of *S. setigera* (**Plate 147a, d**) are closer in form to *S. hortulana*.

Holotype

AM C.135974, WA-737, S facing slope of Mt. Bartlett foothills, 8.7 km SW of The Garden Homestead, NE of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 4345:74195yds). 23° 19' 52" S, 134° 21' 23" E. Collected

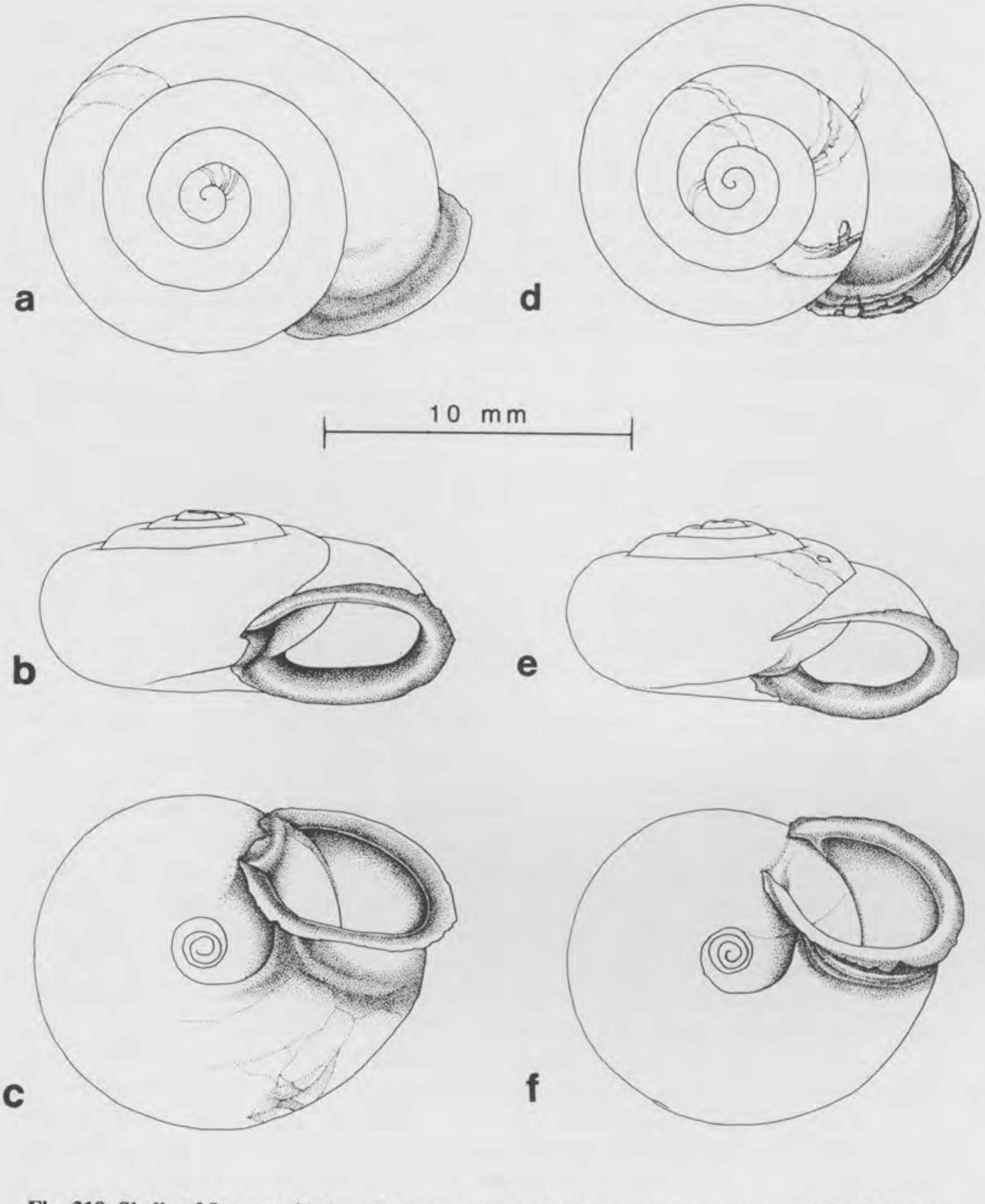


Fig. 319: Shells of *Semotrachia hortulana*, sp. nov., and *S. strangwayana*, sp. nov.: (a-c) Holotype of *S. hortulana*, WA-737, Mt. Barlett foothills, SW of The Garden homestead, NE of Alice Springs, NT. AM C.135974; (d-f) Holotype of *S. strangwayana*, WA-734, Southern Cross Bore road, Strangways Range, NT. AM C.135975. Scale line equals 10 mm. Drawings by Linnea Lahlum.

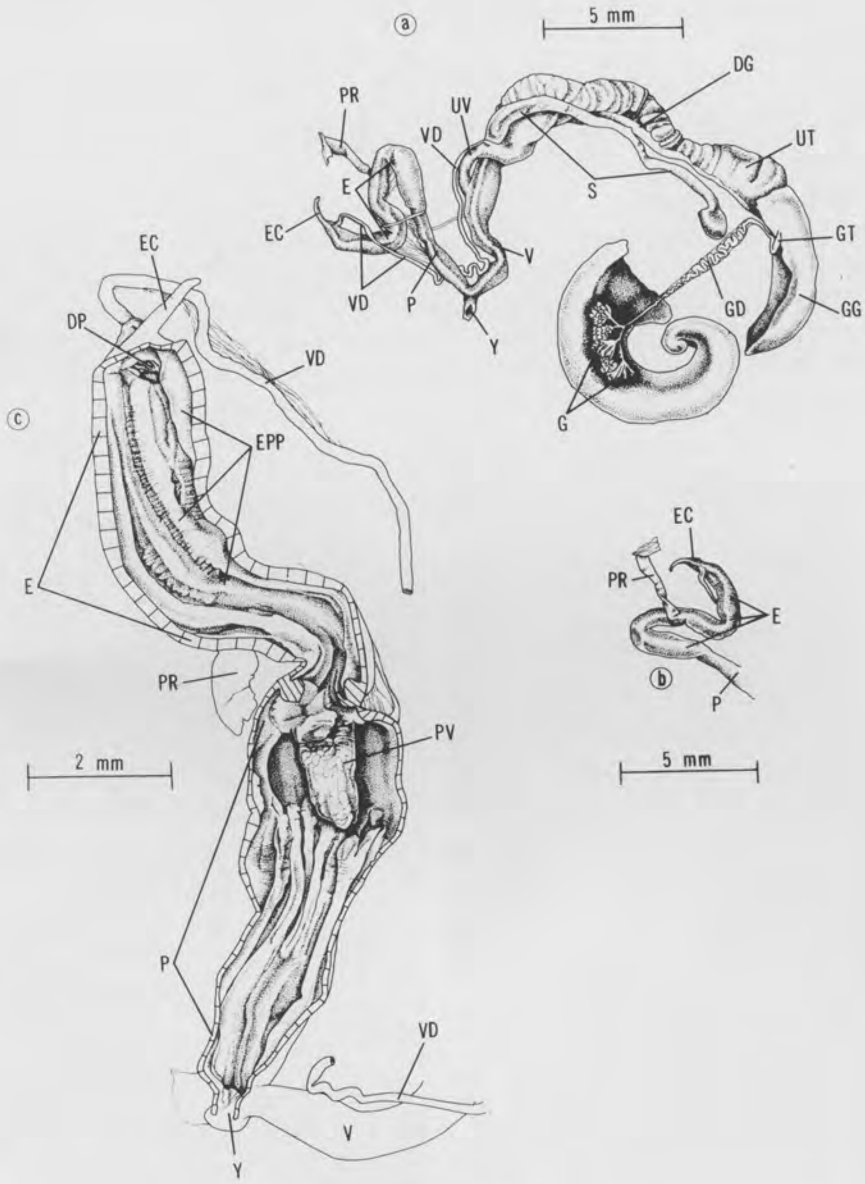


Fig. 320: Genitalia of *Semotrachia hortulana*, sp. nov.: WA-737, Mt. Bartlett foothills, NE of Alice Springs, NT. 19 April 1981. FMNH 205424. (a) whole genitalia, Dissection A; (b) detail of epiphallus, Dissection A; (c) interior of epiphallus and penis, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

by Alan Solem and Phil Colman 19 April 1981. Height of holotype 6.9 mm, diameter 14.05 mm, H/D ratio 0.476, whorls 4 5/8+, umbilical width 3.35 mm, D/U ratio 4.19.

Paratopotypes

AM C.135992-3, SAM D18041-2, WAM 659.87, WAM 660.87, MV, QM, FMNH 205423-5, 8 LA, 13 DA, 5 LJ, 21 DJ from the type locality.

Paratypes

Northern Territory

HALE RIVER AREA: near 9 mile yard, E of The Garden (WA-738, 10.6 km W of WA-737, AM C.135991, SAM D18040, WAM 658.87, MV, QM, FMHN 205429-30, 46 LA, 3 DA, 3 LJ, 3 DJ); 30 km W of Claraville Station, Garden Road, 22 April 1987, V. Kessner!, K 11747, 2 DA; main track to Ambalindum Homestead (FMNH 198948, FMNH 198951, 1 LA, 1 dead broken); well N of Ambalindum Homestead (AM C., FMNH 198969-70, 1 LA, 1 DA, 2 LJ).

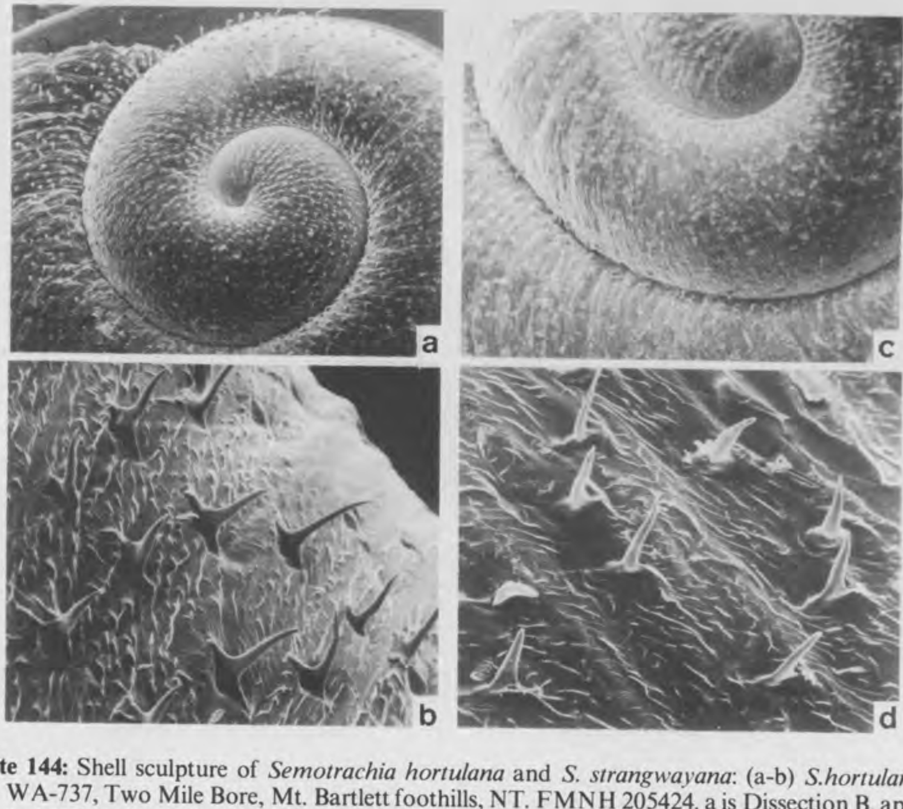


Plate 144: Shell sculpture of *Semotrachia hortulana* and *S. strangwayana*: (a-b) *S.hortulana*. WA-737, Two Mile Bore, Mt. Bartlett foothills, NT. FMNH 205424. a is Dissection B, apex and early spire at 31X, b is Dissection A, setae on body whorl at 77X; (c-d) *S. strangwayana*. WA-734, Southern Cross Bore Road, Strangways Range, NT. c is apex and spire at 43.5X, d is setae on body whorl at 79X.

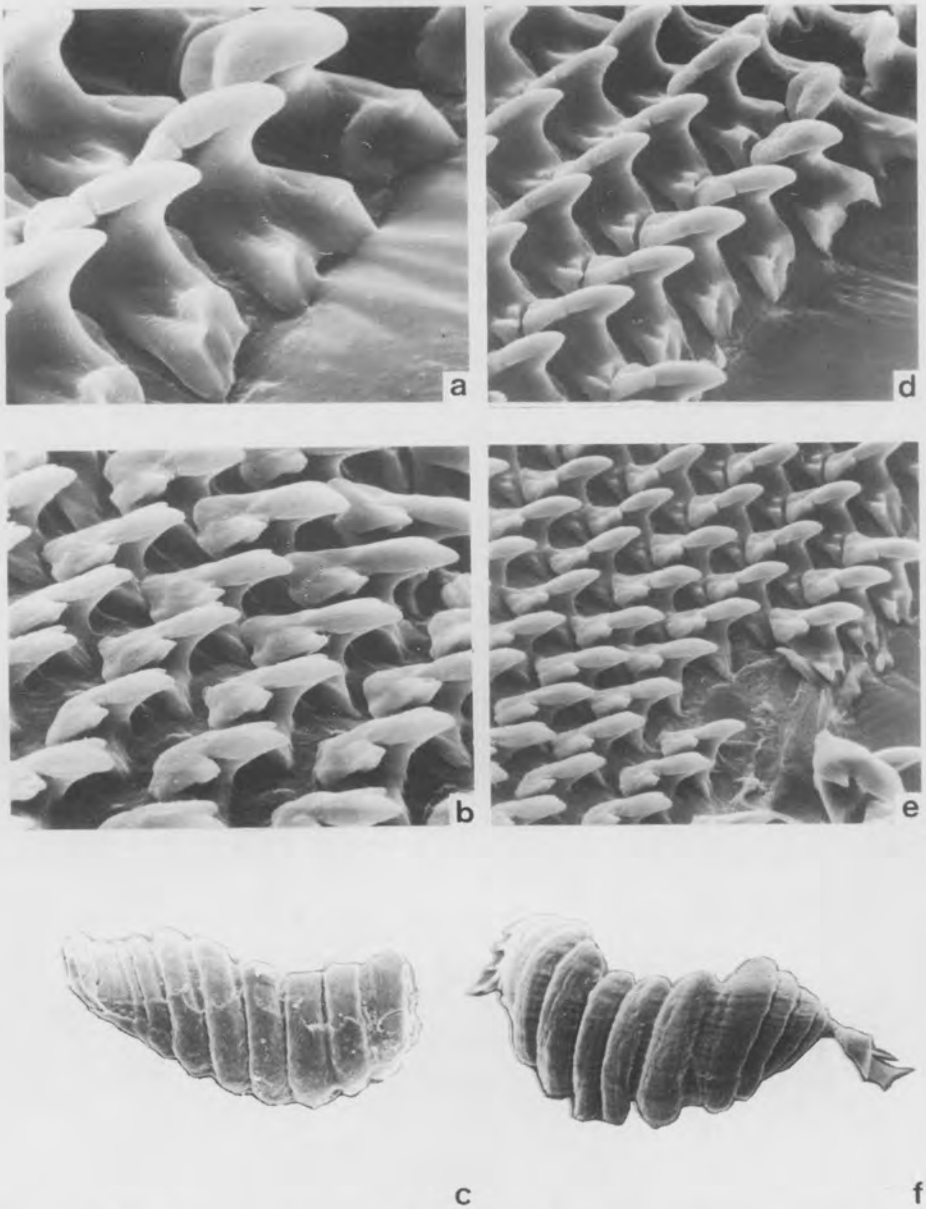


Plate 145: Radular teeth and jaw of *Semotrachia hortulana* and *S. strangwayana*: (a-c) *S. hortulana*. WA-738, Mt. Bartlett Foothills, NT. FMNH 205430, Dissection A. a is central and earliest laterals at 1,350X, b is lateromarginal transition at 910X, c is jaw at 83X; (d-f) *S. strangwayana*. WA-734, Southern Cross Bore Road, Strangways Range, NT. FMNH 205404. 14 April 1981. d is Dissection A, central and early lateral teeth at 760X, e is Dissection A, lateromarginal transition at 570X, f is Dissection B, jaw at 75X.

Table 122: Local Variation in *Montanomelon* and nothern area *Semotrachia*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
M. reynoldsi							
WA-729, FMNH 205378	60L	5.70±0.042 (5.1-6.35)	10.79±0.061 (9.9-11.8)	0.529±0.003 (0.486-0.578)	$4^3/_8$- ($41/_4$--$4^3/_4$-)	2.02±0.022 (1.4-2.4)	5.39±0.079 (4.47-8.38)
WA-729, FMNH 205376	80D	6.19±0.046 (5.2-7.2)	10.95±0.056 (9.75-12.1)	0.565±0.002 (0.515-0.612)	$4^3/_8$ ($4^1/_8$+-$4^3/_4$-)	2.15±0.032 (1.2-2.6)	5.21±0.121 (4.02-9.79)
WA-732, FMNH 205394	6L	6.28±0.264 (5.85-7.5)	10.92±0.351 (10.1-12.6)	0.575±0.010 (0.549-0.607)	$4^1/_2$ ($4^3/_8$+-$4^7/_8$-)	1.87±0.067 (1.6-2.05)	5.86±0.244 (5.23-6.71)
WA-732, FMNH 205395	7D	6.09±0.116 (5.6-6.45)	10.62±0.194 (9.55-11.15)	0.574±0.005 (0.557-0.589)	$4^1/_4$ ($4^1/_8$- -$4^3/_8$+)	1.86±0.132 (1.15-2.25)	5.95±0.611 (4.75-9.54)
Yundurbungu Hills, K11762	15D	8.69±0.107 (8.0-9.3)	13.71±0.110 (12.8-14.1)	0.634±0.006 (0.598-0.662)	$4^5/_8$+ ($4^3/_8$-$4^7/_8$)	2.17±0.059 (1.75-2.55)	6.39-0.189 (5.49-8.06)
Mt. Finnis K11764	45D	7.17±0.050 (6.2-8.2)	12.07±0.066 (11.05-12.9)	0.594±0.004 (0.549-0.656)	$4^1/_2$+ ($4^1/_4$-$4^7/_8$)	2.18±0.033 (1.7-2.7)	5.58-0.088 (4.61-7.18)
Prowse Gap, K11767	53D	6.77±0.056 (5.75-7.65)	10.88±0.068 (9.1-11.8)	0.622±0.004 (0.553-0.683)	$4^3/_8$ ($4^1/_8$-$4^5/_8$)	1.80±0.024 (1.4-2.2)	6.1±0.085 (4.14-7.71)
Native Gap, K11761	37D	5.98±0.063 (5.1-6.8)	10.14±0.068 (9.25-10.95)	0.589±0.006 (0.521-0.674)	$4^1/_4$ (4--$4^1/_2$+)	2.02±0.034 (1.5-2.5)	5.07±0.095 (3.70-6.41)
White Hill, K11763	42D	5.98±0.065 (5.2-7.3)	10.38±0.080 (9.1-12.2)	0.576±0.005 (0.514-0.648)	$4^3/_8$- ($4^1/_8$-$4^5/_8$)	1.95±0.029 (1.6-2.3)	5.36±0.083 (4.41-6.78)

Table 122: Local Variation in *Montanomelon* and nothern area *Semotrachia* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
M. angatjana							
WA-892 FMNH 212246	22L	2.91±0.025 (2.7-3.2)	7.38±0.049 (7.0-7.8)	0.395±0.002 (0.365-0.413)	$3\frac{5}{8}$+ ($3\frac{1}{2}$- -$3\frac{7}{8}$+)	2.34±0.032 (2.1-2.7)	3.17±0.038 (2.84-3.56)
S. jinkana							
WA-736, FMNH 205420	15D	3.60±0.052 (3.3-4.05)	8.22±0.082 (7.8-8.8)	0.439±0.006 (0.408-0.493)	4 ($3\frac{7}{8}$+-$4\frac{1}{8}$+)	2.40±0.045 (2.0-2.65)	3.44±0.052 (3.20-3.90)
Jinka Spring, K11760	25D	4.12±0.067 (3.4-4.85)	8.08±0.086 (7.3-8.85)	0.510±0.008 (0.432-0.589)	4- ($3\frac{3}{4}$-$4\frac{1}{8}$)	2.45±0.034 (2.1-2.8)	3.30±0.040 (2.86-3.71)
S. huckittana							
Old Huckitta Hstd, FMNH 198902	24L	3.58±0.040 (3.3-4.1)	8.96±0.092 (7.7-10.1)	0.400±0.004 (0.373-0.445)	4 ($3\frac{3}{4}$+-$4\frac{1}{8}$+)	2.45±0.048 (2.05-2.8)	3.68±0.064 (3.12-4.20)
S. hortulana							
WA-738, FMNH 205430	46L	6.79±0.065 (5.85-7.75)	13.60±0.081 (12.7-14.7)	0.500±0.004 (0.440-0.601)	$4\frac{7}{8}$ ($4\frac{5}{8}$- -$5\frac{1}{8}$-)	3.61±0.055 (2.85-4.35)	3.80±0.050 (3.25-4.53)
WA-737, FMNH 205424	8L	7.10±0.121 (6.7-7.6)	13.98±0.129 (13.25-14.4)	0.508±0.010 (0.476-0.551)	5+ ($4\frac{7}{8}$+-$5\frac{1}{4}$)	3.23±0.088 (2.95-3.6)	4.35±0.113 (3.92-4.76)
WA-737, FMNH 205423	14D	7.15±0.086 (6.7-7.7)	13.92±0.125 (13.15-14.6)	0.514±0.005 (0.475-0.550)	5- ($4\frac{5}{8}$+-$5\frac{1}{8}$-)	3.43±0.096 (2.65-4.0)	4.09±0.104 (3.64-5.05)

Table 122: Local Variation in *Montanomelon* and nothern area *Semotrachia* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. strangwayana							
WA-734, FMNH 205404	23L	6.61±0.096 (6.0-7.6)	12.61±0.073 (12.0-13.3)	0.524±0.006 (0.481-0.617)	$4^{7}/_{8}+$ ($4^{5}/_{8}+-5^{1}/_{8}+$)	2.85±0.081 (1.7-3.45)	4.52±0.164 (3.68-7.08)
WA-734, FMNH 205405	7D	6.68±0.124 (6.15-7.1)	12.96±0.196 (12.05-13.6)	0.516±0.009 (0.482-0.555)	$4^{7}/_{8}+$ ($4^{3}/_{4}--5+$)	3.09±0.141 (2.6-3.5)	4.23±0.149 (3.79-4.71)
Mt. Riddock, BJS-24, MV	6L	6.97±0.132 (6.5-7.4)	13.43±0.180 (12.85-13.9)	0.519±0.009 (0.505-0.564)	5+ ($5--5^{1}/_{8}-$)	3.07±0.086 (2.9-3.5)	4.38±0.107 (3.97-4.63)
Gillen Creek trib., AM C.115784	4D	6.86±0.299 (6.25-7.5)	13.71±0.359 (13.1-14.65)	0.499±0.010 (0.474-0.521)	$5^{1}/_{8}-$ ($4^{7}/_{8}+-5^{1}/_{4}-$)	3.72±0.135 (3.45-4.1)	3.68±0.058 (3.58-3.82)
Gillen Creek crossing, K11766	39D	7.30±0.060 (6.5-8.0)	13.42±0.096 (12.1-14.7)	0.544±0.004 (0.494-0.594)	$4^{7}/_{8}$ ($4^{5}/_{8}-5^{1}/_{4}-$)	3.37±0.046 (2.85-4.0)	4.01±0.057 (3.45-4.79)
Anamarra Creek crossing, K11768	30D	6.98±0.074 (6.4-8.1)	13.30±0.085 (12.3-14.1)	0.525±0.005 (0.474-0.586)	$4^{7}/_{8}-$ ($4^{5}/_{8}-5+$)	3.31±0.044 (2.75-3.65)	4.04±0.056 (3.59-5.05)
Ongewa Crk at Plenty Hwy, K11765	12D	6.82±0.086 (6.3-7.3)	12.75±0.133 (12.0-13.4)	0.535±0.003 (0.516-0.561)	$4^{7}/_{8}$ ($4^{5}/_{8}-5+$)	3.57±0.072 (3.05-4.0)	3.59±0.084 (3.00-4.20)

Range

Semotrachia hortulana, sp. nov., has been collected in the south-central portion of the Hale River basin, from Ambalindum Homestead to just W of Mt. Bartlett near 9 Mile Yard, N of the MacDonnell Ranges, NT. The known localities range over 43 km.

Diagnosis

Shell very large, adult diameter 12.7-15.1 mm (mean 13.73 mm), whorls 4 5/8- to 5 1/4 (mean 4 7/8+). Apex and spire moderately elevated (**Fig. 319b**), shell height 5.85-7.75 mm (mean 6.9 mm), H/D ratio 0.440-0.600 (mean 0.503). Body whorl (**Fig. 319b**) evenly rounded, descending relatively gradually over last portion of body whorl. Apex (**Plate 144a**) densely pustulose, rather closely spaced periostracal setae with long bases (**Plate 144a-b**) generally distributed over shell surface. Umbilicus (**Fig. 319c**) average, last whorl decoiling slightly more rapidly, width 2.65-4.45 mm (mean 3.26 mm), D/U ratio 3.25-5.05 (mean 3.94). Lip sharply reflected and moderately expanded, white, not continuous across parietal wall in new adults, a thickened callus edge on parietal wall in older individuals. Shell dark yellow-brown, lighter on base. Based on 74 measured adults.

Genitalia (**Figs 320a-c**) with a relatively short vagina (V). Epiphallic caecum (EC) prominent, thickened basally. Epiphallus (E) equal in length to penis (P). Upper portion of penis chamber without sculpture, lower section with simple longitudinal ridges. Verge (PV) long, wrinkled, with lateral sperm groove.

Central and lateral teeth of radula (**Plate 145a**) with moderate anterior flare, normal cusp shaft angle, ectocone and basal support ridge prominent. Lateromarginal transition and jaw (**Plate 145b-c**) without unusual features.

Discussion

Semotrachia hortulana, sp. nov., has been collected at only a few localities in the Hale River drainage (**Map 15**). The limited material shows only minor size and shape variation (**Table 122**). The exact relationships among *hortulana-strangwaysana-setigera* remain to be determined. Certainly they are one of the few apparently closely related species.

The name *hortulana* refers to the type locality landmark, The Garden.

SEMOTRACHIA STRANGWAYANA, SP. NOV.

(Plates 144c-d, 145d-f; Figs 319d-f, 321a, 322a-b)

Comparative remarks

Semotrachia strangwayana, sp. nov., from the E end of the Strangways Range to near Mt. Riddock, Harts Range, NT, is a large species (mean diameter 13.13 mm) with elevated spire (**Fig. 319e**, mean H/D ratio 0.530), plus setae (**Plate 144d**) more widely spaced and with shorter bases than in *S. hortulana* (**Plate 144b**) or *S. setigera* (Tate, 1894) (**Plate 146e**). The only other species of similar size, *S. discoidea* from the Musgrave Ranges, has a much lower spire (**Fig. 359e**) and H/D ratio (mean 0.303), angulated periphery, and a microsculpture of prominent pustules (**Plate 167f**). Anatomically, *S. strangwayana* (**Figs 321a, 322a-b**) has a relatively long vagina (V), epiphallic caecum (EC) very slender, epiphallus (E) distinctly longer than the penis (P), sculpture on walls of penis chamber complex, and verge (PV) tapering with a very prominent sperm groove. *S. hortulana* (**Figs 320a-c**) has a much shorter vagina, thicker epiphallic caecum, reduced penis chamber wall sculpture, and a more cylindrical penis. *S. setigera* (**Figs 324-327**) has a longer vagina, more prominent epiphallic caecum, comparatively short penis, variable verge, and greatly reduced penis chamber wall sculpture.

Holotype

AM C.135975, WA-734, isolated peak 0.5 km W of track, Southern Cross Bore Road, 2.7 km N of WA-733, Strangways Ranges, NE of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 190:360 yds). 23° 12' 07" S, 134° 12' 29" E. Collected by Alan Solem and Phil Colman 14 April 1981. Height of holotype 6.9 mm, diameter 13.1 mm, H/D ratio 0.527, whorls 4 3/4+, umbilical width 3.5 mm, D/U ratio 3.74.

Paratopotypes

AM C.135994-5, SAM D18043-4, WAM 661.87, WAM 662.87, QM, MV, FMNH 205404-5, 23 LA, 6 DA, 15 LJ, 13 DJ from the type locality; 20 April 1987, V. Kessner!, K 11737, 38 DA, 2 DJ.

Paratypes

Northern Territory

STRANGWAYS RANGE: tributary of Gillen Creek (P. H. Colman!, 14 June 1979, AM C.115784, 1 LA, 4 DA, 1 LJ, 5 DJ); Ongewa Creek crossing of Plenty Highway, 20 April 1987, V. Kessner!, K 11765, 13 DA, 5 DJ; Anamarra Creek crossing, Plenty Highway, 20 April 1987, K 11768, 30 DA; Gillen Creek crossing, Plenty Highway, 20 April 1987, V. Kessner!, K 11766, 39 DA.

HARTS RANGE: 2 km S of Mt. Riddock (BJS-24, MV, 6 LA, 1 LJ); Ruby Gap (AM C.115789, 1 DA).

Range

Semotrachia strangwayana, sp. nov., has been collected from near Southern Cross Bore at the E end of the Strangways Range to a little S of Mt. Riddock Homestead, Harts Range, NT. These localities are about 49 km apart.

Diagnosis

Shell very large, adult diameter 12.0-14.7 mm (mean 13.13 mm), whorls 4 5/8 to 5 1/4+ (mean 4 7/8). Apex and spire moderately elevated (**Fig. 319e**), shell height 6.0-8.1 mm (mean 6.97 mm), H/D ratio 0.474-0.617 (mean 0.530). Body whorl (**Fig. 319e**) evenly rounded, descending moderately over last portion of body whorl. Apex (**Plate 144c**) with crowded pustules, setae on spire and body whorl rather widely spaced (**Plate 144d**). Umbilicus (**Fig. 319f**) typical, last whorl decoiling more rapidly, width 1.7-4.1 mm (mean 3.26 mm), D/U ratio 3.00-7.08 (mean 4.09). Lip sharply reflected and moderately expanded, not continuous across parietal wall. Shell yellow-brown, lighter on base. Based on 122 measured adults.

Genitalia (**Figs 321a, 322a-b**) with long vagina (V), very short free oviduct (UV). Epiphallic caecum (EC) very slender. Epiphallus (E) much longer than penis (P). Walls of penis chamber with complex sculpture. Verge (PV) tapered, with very prominent lateral sperm groove.

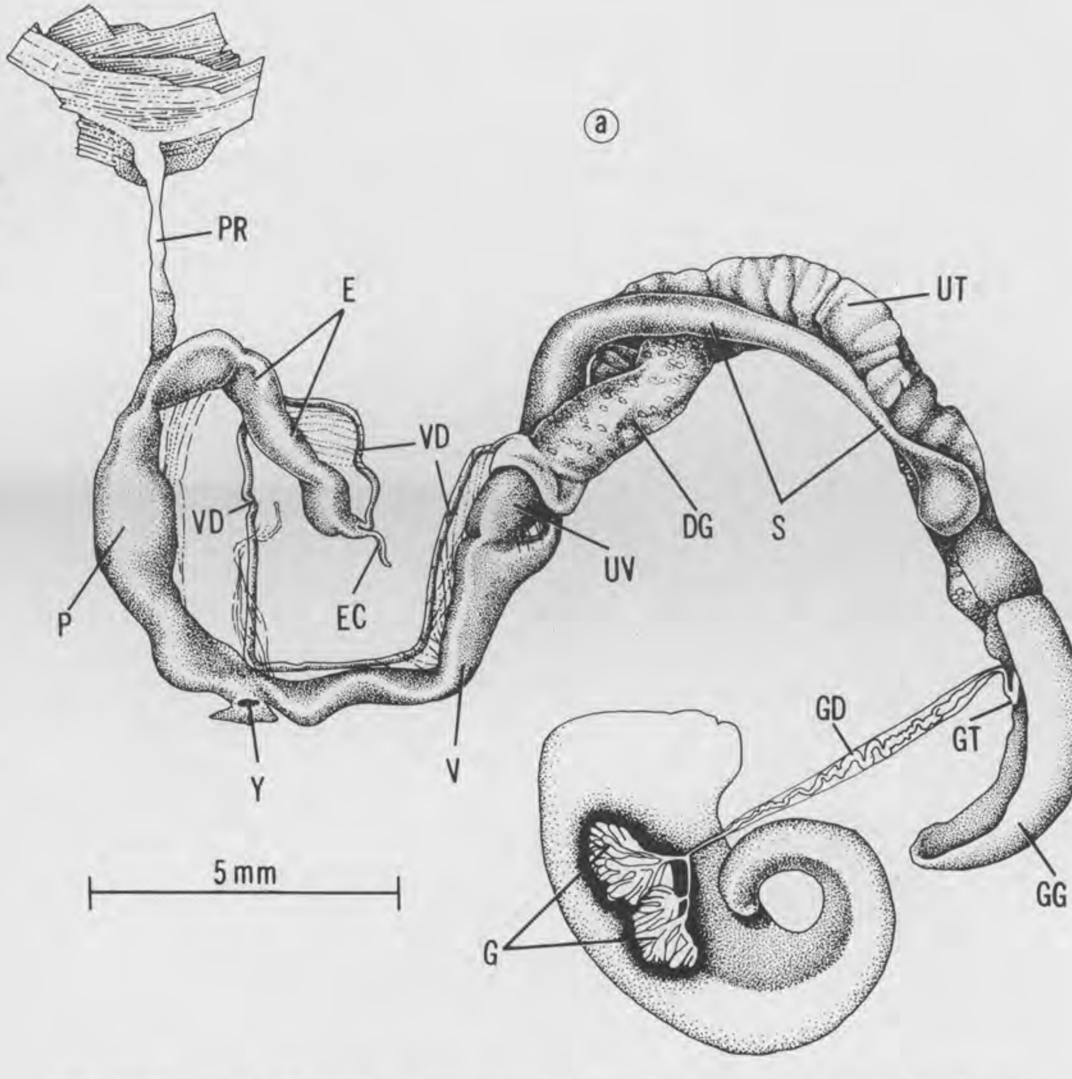


Fig. 321: Genitalia of *Semotrachia strangwayana*, sp. nov.: WA-734, Southern Cross Bore road, Strangways Range, NT. 14 April 1981. FMNH 205404, Dissection A. (a) whole genitalia. Scale line equals 2 mm. Drawing by Linnea Lahlum.

Central and lateral teeth of radula (**Plate 145d**) with small anterior flare, elevated cusp shaft angle, weakly curved cusp tip, small ectocone, and short basal plate. Late laterals (**Plate 145e**) with somewhat enlarged anterior flare and greatly enlarged ectocone, lateromarginal transition abrupt. Jaw (**Plate 145f**) typical.

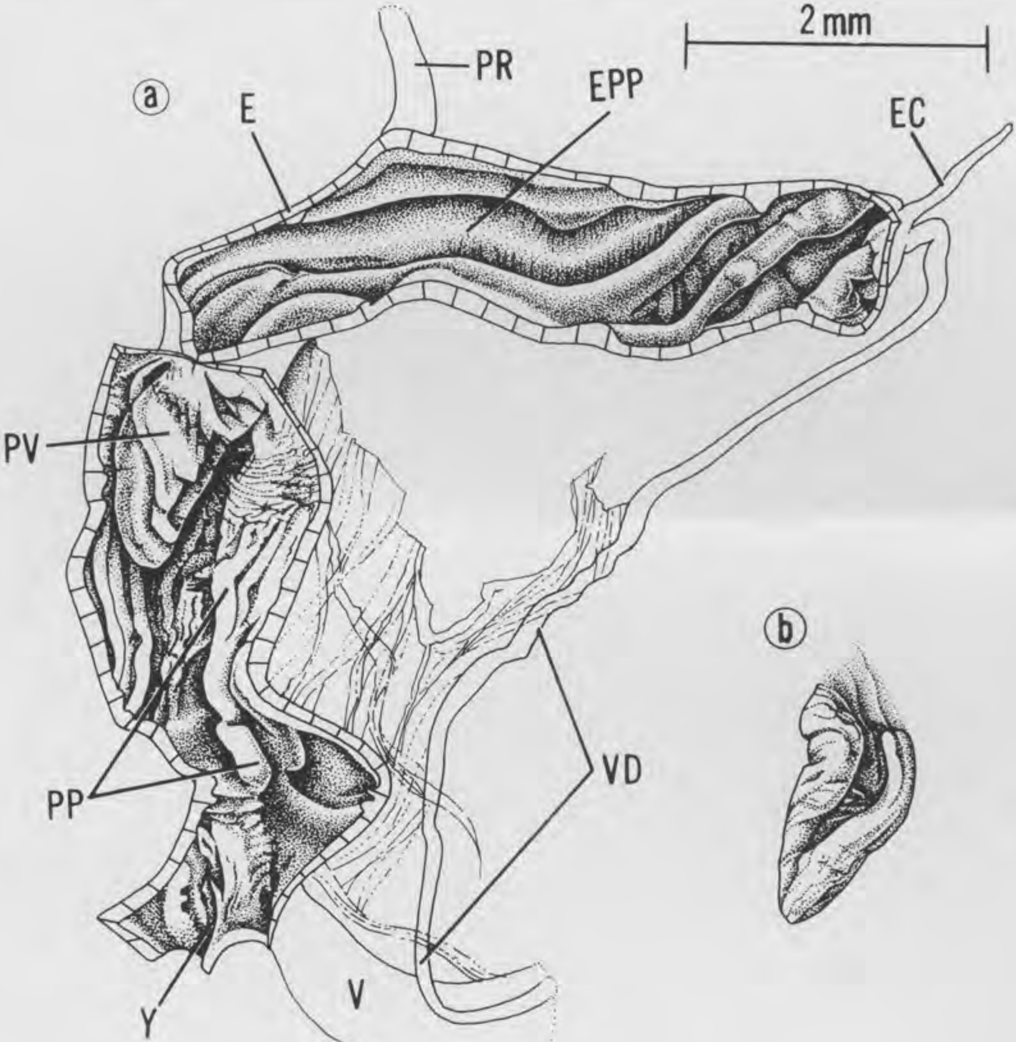


Fig. 322: Genitalia of *Semotrachia strangwayana*, sp. nov.: WA-734, Southern Cross Bore road, Strangways Range, NT. 14 April 1981. FMNH 205404, Dissection B. (a) interior of epiphallus and penis; (b) detail of verge. Scale lines as marked. Drawings by Linnea Lahlum.

Discussion

Examples from several populations were dissected without finding any significant differences. Shell size and shape (**Table 122**) does differ among populations. In general, the creek crossing material was larger (except Ongewa Creek), while the type collection was from a promontory on a hillside, which would dry out more quickly. Hence its reduced size.

The name *strangwayana* honors an intriguing looking set of hills that have yet to be explored properly for land snails.

SEMOTRACHIA SETIGERA (TATE, 1894)

(Plates 146a-f, 147a-f; Figs 323a-f, 324a-b, 325a, 326a-g, 337c)

Hadra setigera Tate, 1894, Trans. Roy. Soc. South Austr., **18**: 194 - Central Australia.

Hadra papillosa Tate, 1894, Trans. Roy. Soc. South Austr., **18**: 194 - Central Australia.

Angasella setigera (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 189-190, pl. XVII, figs 6a-d - many localities listed (In part).

Angasella larapinta Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 190 - substitute species name if the need should arise.

Angasella papillosa (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 191-192, pl. 18, figs 9a-c - No locality (Rev. H. Kempe!).

Semotrachia setigera (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 38; Iredale, 1938, Austr. Zool., **9** (2): 90 - check list citation; Richardson, 1985, Tryonia, **12**: 275 - check list citation.

Semotrachia papillosa (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 38; Iredale, 1938, Austr. Zool., **9** (2): 90; Richardson, 1985, Tryonia, **12**: 275.

Comparative remarks

Semotrachia setigera (Tate, 1894), from the E MacDonnell Ranges as far W as Undoolya Gap and then in the W MacDonnell Ranges from Standley Chasm for at least 140 km to the W, is a large species (mean diameter 13.49 mm) with elevated spire (**Figs 323b, e**, mean D/U ratio 0.518) and typical umbilicus (**Figs 323c, f**, mean D/U ratio 4.06). The periostracal setae are fairly crowded and with short bases (**Plate 146b, e, f**) compared to the similar species *S. hortulana* (**Plate 144b**) and *S. strangwayana* (**Plate 144d**). The round periphery, large size, and raised spire easily separate it from any of the other MacDonnell Range species. Anatomically, *S. setigera* (**Figs 324-327**) has a long vagina (V), prominent epiphallic caecum (EC), reduced sculpture on the penis chamber wall, and the verge (PV) is relatively short and with a very prominent sperm groove. *S. strangwayana* (**Figs 321a, 322a-b**) has a shorter vagina, smaller epiphallic caecum, complex penis chamber wall sculpture, and the verge is proportionately larger.

Type Specimens

Holotype of *Hadra setigera* Tate, 1894: SAM D13597. Central Australia. Height of holotype 6.6 mm, diameter 13.6 mm, H/D ratio 0.485, whorls 4 3/4, umbilical width 4.0 mm, D/U ratio 3.40.

Paratypes of *Hadra setigera* Tate, 1894: SAM D15576. MacDonnell Ranges, Central Australia.

Holotype of *Hadra papillosa* Tate, 1894: SAM D13599. MacDonnell Ranges, Australia. Height of holotype 9.05 mm, diameter 14.1 mm, H/D ratio 0.642, whorls 5 1/8, umbilical width 3.5 mm, D/U ratio 4.03.

Paratypes of *Hadra papillosa* Tate, 1894: SAM D15550. MacDonnell Ranges (Rev. H. Kempe!). Height of paratypes 8.4 and 7.0 mm, diameter 11.9 and 12.4 mm, H/D ratio 0.706 amd 0.565, whorls 5 and 4 3/4, umbilical width 2.15 and 2.9 mm, D/U ratio 5.53 and 4.28.

All the specimens of *papillosa* are fire bleached bones that show no trace of periostracal shell sculpture. The holotype and first paratype of *Hadra papillosa* are elevated because of repaired shell injuries. The greater surface rugosity of the *papillosa* shells is matched by numerous individuals collected in recent years. If the results of repaired injuries are ignored, the second paratype of *papillosa* and the holotype of *setigera* agree very well in both size and shape. The specimens of *setigera* were collected dead, but retain widely spaced setae. The paratypes agree with *papillosa* in the appressed parietal lip with a recessed callus ridge; the holotype has the lip freee, but is a "new adult".

Studied material

Northern Territory

EASTERN MACDONNELL RANGES: Goat Camp Creek (WA-745, 6.3 km E of Box Hole Bore, AM, SAM D18076, WAM 696.87, FMNH 205466, 4 DA, 16 DJ; WA-744, 1.3 km E of Ross River-Atnarpa Road junction, AM, SAM D18075, WAM 694.87, WAM 695.87, QM, MV, FMNH 205459-60, 5 LA, 29 DA, 6 DJ; WA-743, Atnarpa Road, 3.1 km N of Ross River-Box Hole Bore road junction, AM, SAM D18073-4, WAM 692.87, WAM 693.87, FMNH 205456-7, 8 LA, 16 DA, 2 DJ); banks of Ross River (BJS 35, MV, 5 LA; WA-747, W bank, 3.4 km S of Ross River Resort turnoff, AM C., SAM D, WAM, FMNH 205470, FMNH 205472, 5 LA, 11 DA, 7 DJ; WA-748, W facing hillside, 3.7 km E of Bitter Springs Creek crossing, Ross River-Alice Springs road, AM, SAM D18070-1, WAM 689.87, WAM 690.87, MV, QM, FMNH 205478-9, 22 LA, 21 DA, 1 LJ, 1 DJ); Bitter Springs Gap (A-4, SAM D18068-9, WAM 687.87, WAM 688.87, QM, MV, FMNH 198963, FMNH 198978, 13 LA, 12 DA, 1 LJ, 7 DJ; WA-924, Bitter Spring, AM, SAM D18066-7, WAM 685.87, WAM 686.87, QM, MV, FMNH 212337-8, 4 LA, 24 DA, 6 LJ, 9 DJ; WA-562, WA-742, 3.4 km ENE of Ross River Resort road turnoff, AM, SAM D18064-5, WAM 682.87, WAM 683.87, WAM 684.87, QM, MV, FMNH 204643-4, FMNH 205444, FMNH 205451, 5 LA, 62 DA, 5 LJ, 28 DJ; Ross River, BJS 37, MV, 5 LA; WA-561, 6.8 km ENE of Ross River Resort road turnoff, AM, SAM D18063, WAM 681.87, FMNH 204638-9, 1 LA, 14 DA, 9 DJ); Trephina Gorge area (WA-751, Trephina

Gorge road, 4.9 km from Ross River road, AM, SAM D18061-2, WAM 679.87, WAM 680.87, FMNH 205489-90, 7 LA, 13 DA, 1 LJ, 1 DJ); Trephina Creek (WA-749, W bank, N of Ross River road, AM, SAM D18057, WAM 675.87, FMNH 205483-4, 5 DA); Mount Benstead Creek (WA-752, S facing slope, Alice Springs-Ross River road, 3.7 km E of creek crossing, AM, SAM D18058-60, WAM 676.87, WAM 677.87, WAM 678.87, MV, QM, FMNH 205495, FMNH 205497-8, 9 LA, 22 DA, 1 LJ, 10 DJ; 3.7 km NE Mt. Benstead Creek crossing, 26 April 1987, V. Kessner!, K 11749, 7 DA; crossing, under fig, 25 April 1987, V. Kessner!, K 11748, 15 DA; WA-741, N bank of creek, FMNH 205442, 1 DA); 10.5 km SW of Mt. Benstead Creek crossing, 25 April 1987, V. Kessner!, K 11739, 33 DA; Corroborree Rock (WA-112, rubble at base, AM, SAM D18056, WAM 674.87, FMNH 182713, FMNH 182107, FMNH 182215, FMNH 182241, FMNH 182341, 14 DA, 5 LJ, 20 DJ; 25 April 1987, V. Kessner!, K 11755, 2 DA, 1 DJ); Undoolya Gap area (WA-740, pass through MacDonnell Ranges ca 3.7 km ENE of Undoolya Gap, AM, SAM D18055, WAM 673.87, FMNH 205433-4, 1 LA, 15 DA, 1 DJ; WA-739, outlier ESE of Undoolya Gap, AM, SAM D18054, WAM 672.87, FMNH 205432, 7 DA, 3 DJ).

WESTERN MACDONNELL RANGES: Standley Chasm, Chewings Range (WA-116, S end, 4.8 miles in from highway, FMNH 182403, 1 DA); Standley Chasm (26 April 1987, K 11734, 47 DA, 6 DJ); Stuart Pass, 8 km NW of Glen Helen Road, S of Chewing Range (26 April 1987, V. Kessner!, K 11720, 20 DA, 6 DJ); Stuart Pass near Paisley Bluff, Chewings Range (26 April 1987, K 11716, 3 DA); banks of Jay Creek, MacDonnell Ranges (WA-439, W bank, AM, SAM D18045, SAM D18049, WAM 663.87, WAM 667.87, QM, MV, FMNH 199695-6, 32 LA, 16 DA, 5 LJ, 18 DJ; 1 km W of Jay Creek, 27 April 1987, V. Kessner!, K 11742, 4 DA; WA-115, near highway, AM, SAM D18050, WAM 668.87, FMNH 182485, 4 LA, 11 LJ); Hugh River banks (WA-114, SW of Jay Creek, FMNH 182078, 1 DA, 1 DJ); Chalet Ridge, Larapinta Highway, 25 km E of Glen Helen (27 April 1987, V. Kessner!, K 11735, 42 DA); Ormiston Gorge (near park entrance, 27 April 1987, V. Kessner!, K 11740, 32 DA); Ormiston Creek (WA-758, 0.8 km S of waterhole, W bank, under figs, AM, SAM D18051, SAM D18053, WAM 669.87, WAM 671.87, QM, MV, FMNH 205523-4, 28 LA, 18 DA, 14 LJ, 13 DJ; E side of first waterhole, 27 April 1987, V. Kessner!, K 11718, 25 DA); Glen Helen opening to Finke Gorge (WA-113, stream drift, AM, SAM D18046-8, WAM 664.87, WAM 665.87, WAM 666.87, QM, MV, FMNH 182154, FMNH 182484, FMNH 189391-2, 13 LA, 37 DA, 6 LJ, 28 DJ); outlier of Mt. Sonder (WA-759, 4 km NW of Glen Helen tourist camp, FMNH 205529, 3 LA); 5 km NNW Glen Helen (17 April 1987, V. Kessner!, K 11746, 14 DA); upper Davenport River drainage (WA-760, N outliers of MacDonnell Ranges, AM, SAM D18052, WAM 670.87, FMNH 205534-5, 15 LA, 4 DA, 4 LJ); Stokes Well, Arumbera River (WA-933, 15 km S of Haast Bluff-Glen Helen road junction, N of MacDonnell Ranges, AM, FMNH 212397, 6 LA, 1 LJ).

Range

Semotrachia setigera (Tate, 1894), as revised here, has a disjunct distribution in the MacDonnell Ranges. It has been collected to the E of Alice Springs from the valley of Goat Camp Creek (WA-745, 134°43'E), just N of the Fergusson Range and W of Giles Creek, to near Undoolya Gap (WA-739, 134°08'40"E), an aerial distance of 52 km

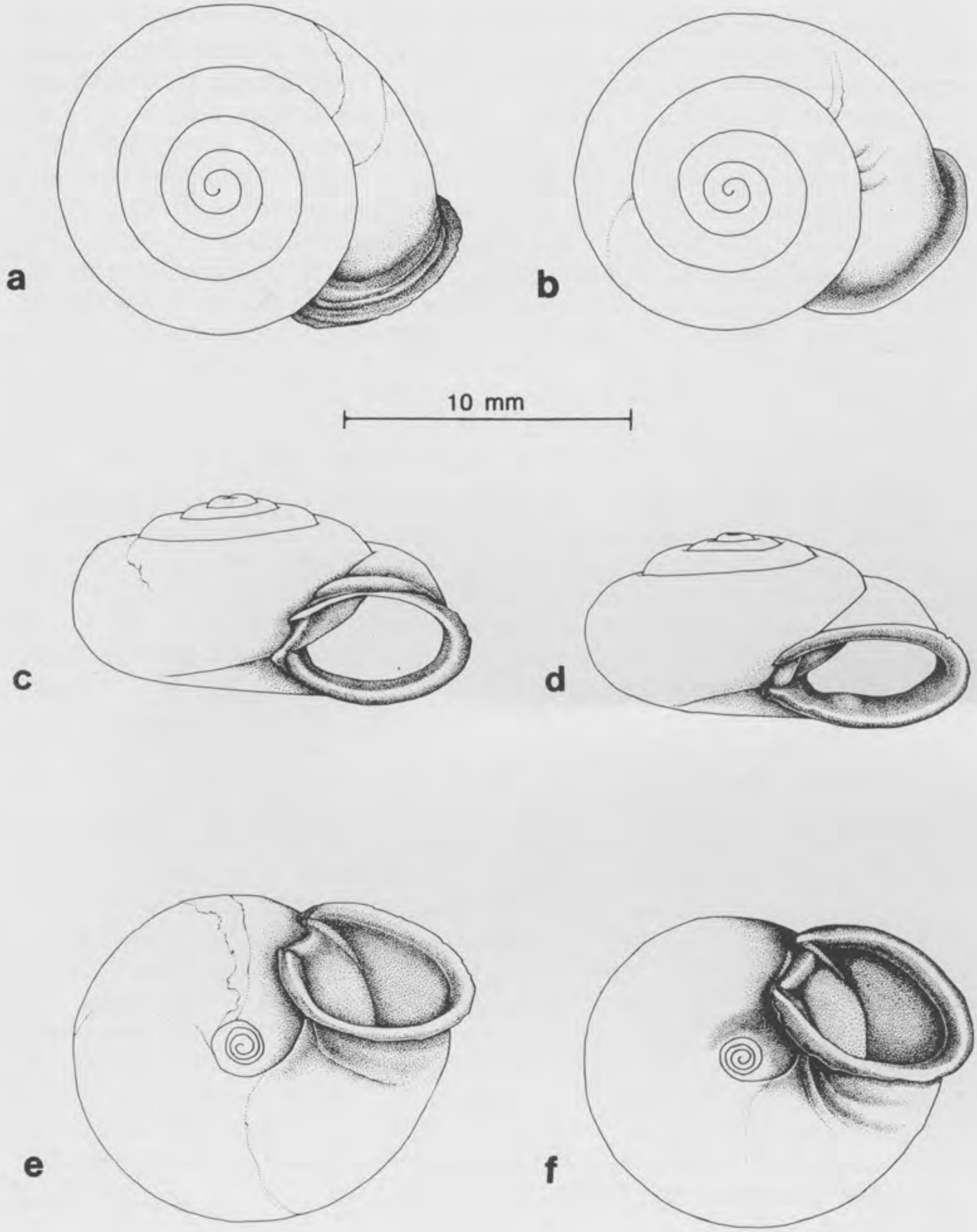


Fig. 323: Shells of *Semotrachia setigera* (Tate, 1894): (a-c) MacDonnell Ranges, NT. Horn Expedition; (d-f) WA-439, W of Jay Creek, MacDonnell Ranges, NT. FMNH 199695. Scale line equals 10 mm. Drawings by Linnea Lahlum.

station to station. The actual range, which follows the U-shaped arc of the MacDonnell Ranges, is significantly longer (ca 70 km). A second area to the W of Alice Springs extends from Standley Chasm (WA-116, 133° 29' E) WNW to at least as far as Stokes Well (WA-933, 132° 07' E), an aerial distance of about 140 km along the relatively narrow MacDonnell, Heavitree, and Chewings Ranges. The western section is not continuous, since at Ellery Creek Big Hole it is replaced by both *S. elleryi*, sp. nov., and *S. winneckeana* (Tate, 1894). In Serpentine Gorge it is replaced by a much smaller unnamed species.

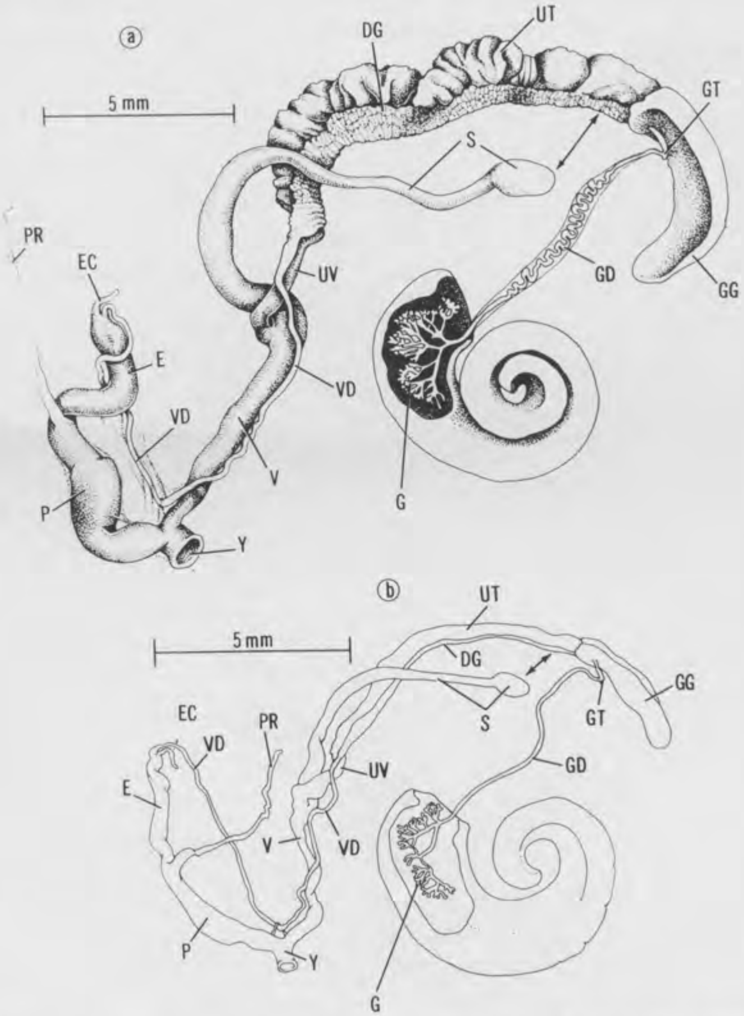


Fig. 324: Genitalia of *Semotrachia setigera* (Tate, 1894): Bitter Springs Gap, E MacDonnell Ranges, NT. 26 June 1978. FMNH 198978. (a) adult genitalia, Dissection A; (b) new adult genitalia, Dissection B. Scale lines equal 5 mm. Drawings by Marjorie M. Connors.

Diagnosis

Shell variable in size, usually quite large, adult diameter 10.2-16.7 mm (mean 13.49 mm), whorls 3 7/8- to 5 3/4- (mean 4 7/8). Apex and spire elevated (**Figs 323b, e**), shell height 4.0-9.45 mm (mean 7.01 mm), H/D ratio 0. 377-0.654 (mean 0.518). Body whorl (**Figs 323b, e**) descending moderately to abruptly over last part of whorl. Apex (**Plate 146a, c-d**) densely pustulose. Spire and body whorl (**Plate 146 a-c, e-f**) with short based, rather widely spaced setae, plus a variable set of growth line ridgelets. Umbilicus (**Figs 323c, f**) typical, width 2.05-4.85 mm (mean 3.36 mm), D/U ratio 2.79-7.30 (mean 4.06). Lip strongly reflected and variably expanded, white, continued on parietal wall as a raised callus ridge, never free of parietal wall. Shell yellow-brown, lighter on base. Based on 573 measured adults.

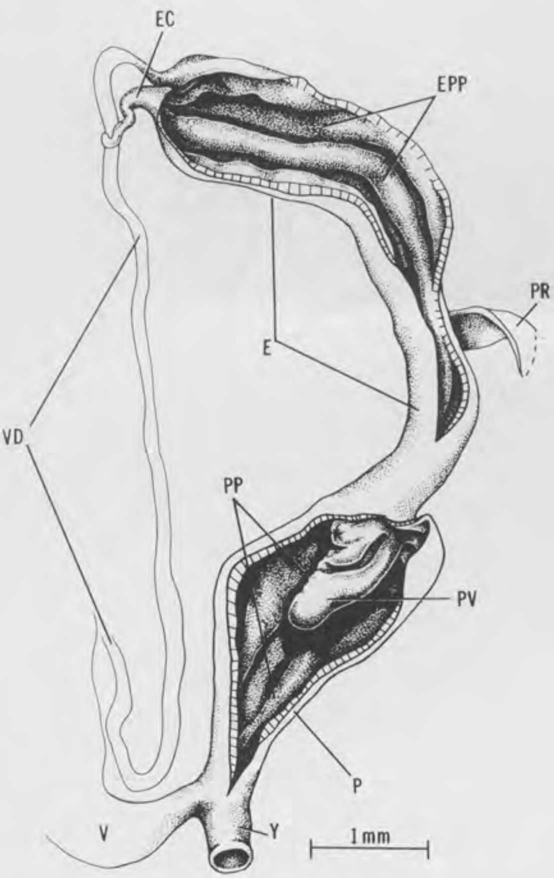


Fig. 325: Genitalia of *Semotrachia setigera* (Tate, 1894): Bitter Springs Gap, E MacDonnell Ranges, NT. 26 June 1978. FMNH 198978, Dissection A. Interior of epiphallus and penis. Scale line equals 1 mm. Drawings by Marjorie M. Connors.

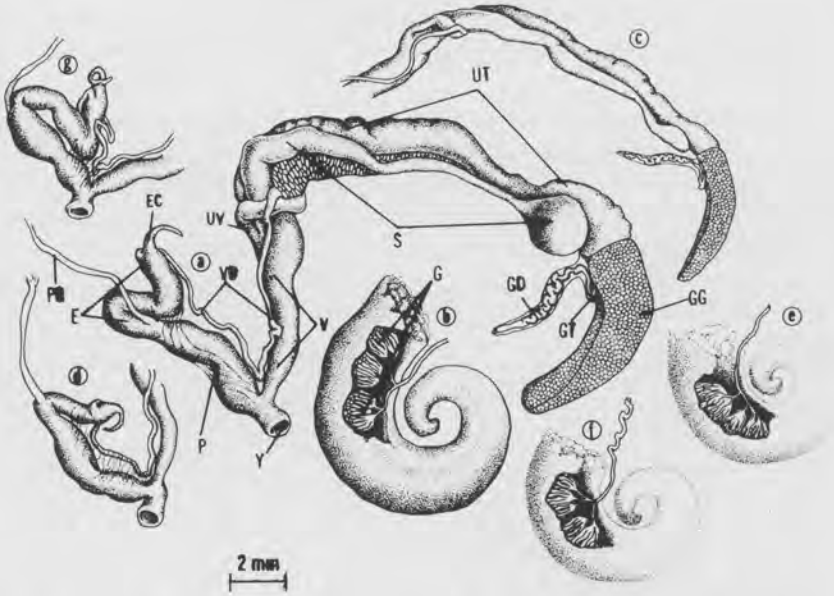


Fig. 326: Genitalia of *Semotrachia setigera* (Tate, 1894): WA-115, banks of Jay Creek, W MacDonnell Ranges, NT. 13 March 1974. FMNH 182485. (a) adult genitalia, Dissection C; (b) adult ovotestis, Dissection C; (c) new adult genitalia, Dissection A; (d) terminal genitalia of new adult, Dissection A; (e) ovotestis of new adult, Dissection A; (f) ovotestis of full adult, Dissection B; (g) terminal genitalia of adult, Dissection B. Scale line equals 10 mm. Drawings by Elizabeth A. Liebman.

Genitalia (**Figs 324-327**) with long vagina (V) and medium length free oviduct (UV). Epiphallic caecum (EC) very slender. Epiphallus (E) much longer than penis (P). Walls of penis chamber with simple, large ridges. Verge (PV) tapering from wide base, sperm groove very prominent.

Central and lateral teeth of radula (**Plate 147a, d**) with small anterior flare, normal cusp shaft angle, prominent ectocone, large basal support ridge, and bluntly rounded cusp tip. Late laterals and lateromarginal transition typical (**Plate 147e**). Early (**Plate 147f**) and outer (**Plate 147f**) marginals typical. Jaw (**Plate 147c**) with prominent, crowded vertical ribs.

Discussion

On the basis of both anatomy (**Figs 324-326**) and shell variation (**Tables 123-124**), I could find no consistent differences among the eastern and western populations. Hence they are kept as a single species. If further research does demonstrate geographic differences, then it would make sense to restrict the name *setigera* to the western MacDonnell Ranges populations and to use the name *papillosa* for the eastern assemblage. Many shells in the latter populations do have the rougher surface sculpture of the *papillosa* types, whereas more of the western shells tend to have the finer radial ridglets seen in the *setigera* type. These are tendencies, not consistent differences.

Much detailed study remains to be accomplished. The samples from Standley Chasm and Stuart Pass (**Table 124**) are very small and with a lower spire. Dissection may result in discovery that they are a different species. Unfortunately, Adelaide River rodents munched the live collected material on V. Kessner's porch before it was preserved. The westernmost examples, WA-933 from above Stokes Well, Arumbera River, also are small, very high spired, and rather narrowly umbilicated (**Table 124**), but dissection showed that they have the typical *setigera* anatomy.

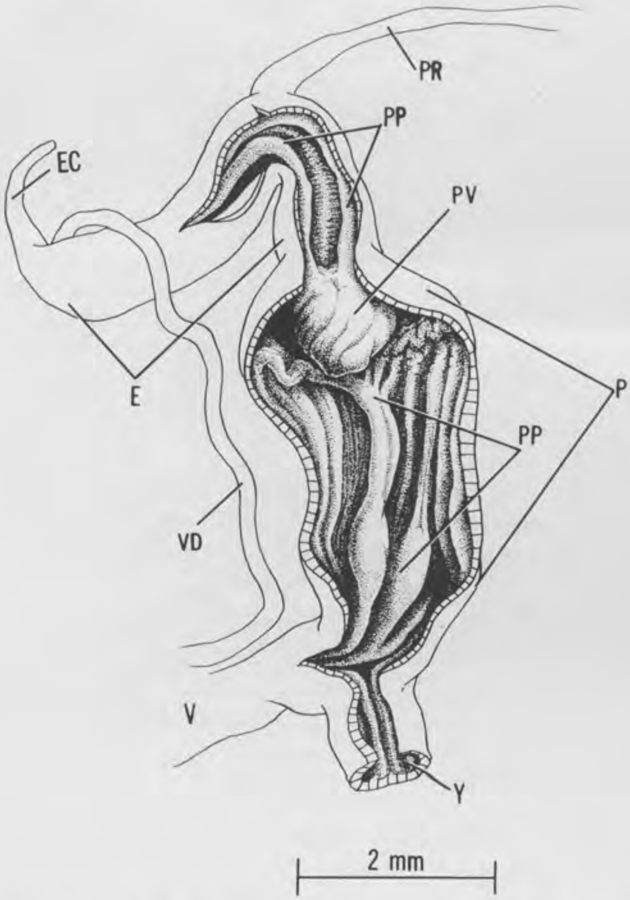


Fig. 327: Penis interior of *Semotrachia setigera* (Tate, 1894): WA-115, banks of Jay Creek, W MacDonnell Ranges, NT. 13 March 1974. FMNH 182485, Dissection A. Scale line equals 2 mm. Drawing by Elizabeth A. Liebman.

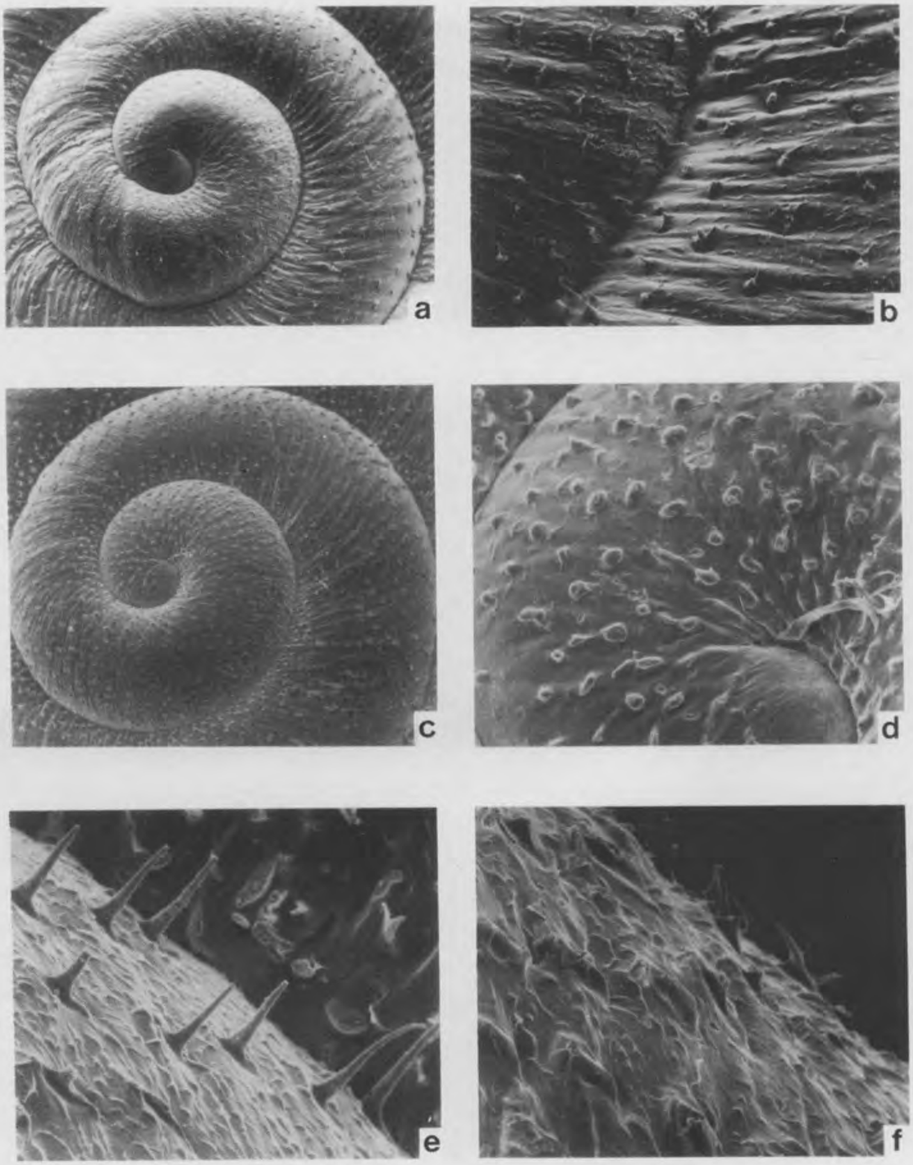


Plate 146: Shell sculpture of *Semotrachia setigera* (Tate, 1896): (a-b) WA-113, Glen Helen entrance to Finke Gorge, W MacDonnell Ranges, NT. FMNH 182484. a is apex and early spire at 27.1X, b is setae on lower spire at 76X; (c-f) WA-742, Bitter Springs Road, E MacDonnell Ranges, NT. FMNH 205444. c is apex and early spire at 25.7X, d is detail of apex at 105X, e is setae on beginning of body whorl at 93X, f is setal remnants on periphery of body whorl at 85X.

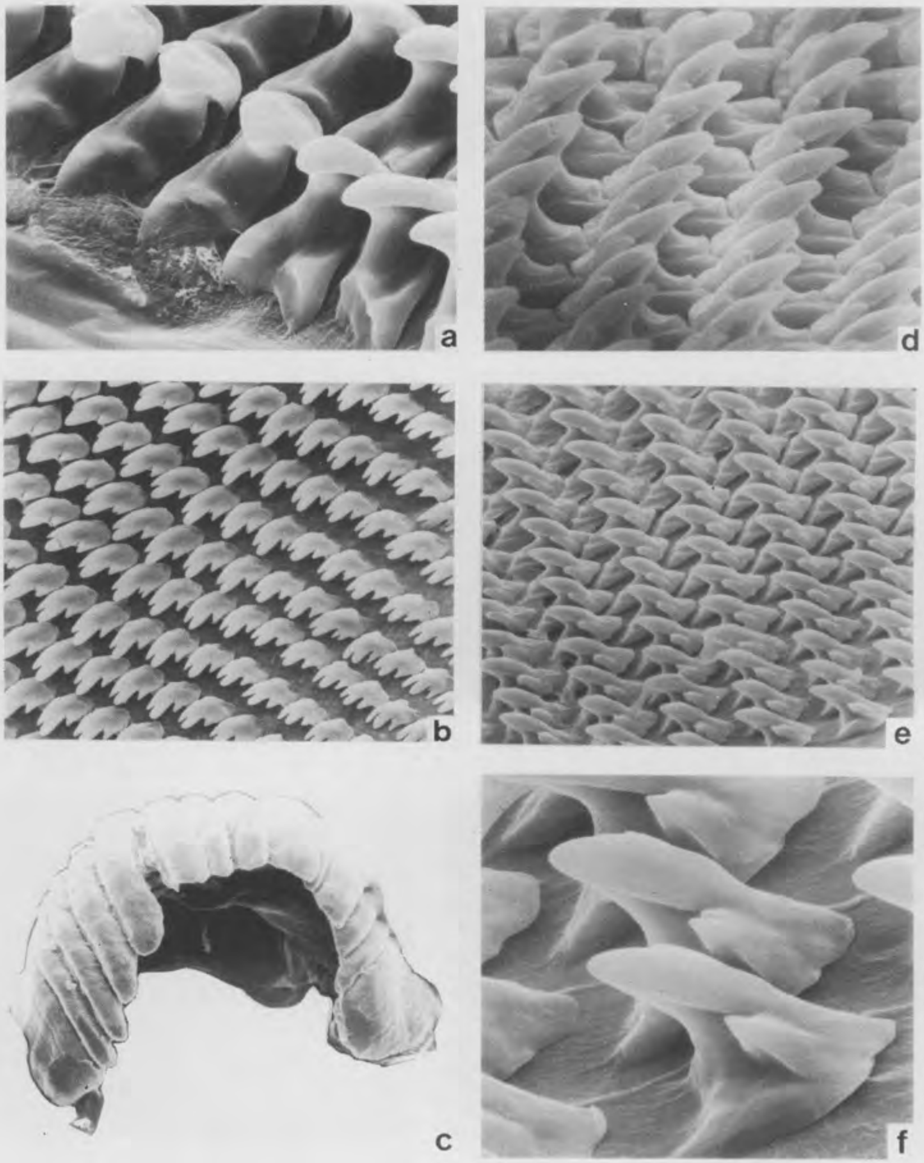


Plate 147: Radular teeth and jaw of *Semotrachia setigera* (Tate, 1896): (a-c) WA-113, Glen Helen opening to Finke Gorge, W MacDonnell Ranges, NT. 12 March 1974. FMNH 182484. a is Dissection D, central and early lateral teeth at 1,000X, b is Dissection D, mid and late marginal teeth at 385X, c is Dissection E, jaw at 110X; (d) Bitter Springs Gap, E MacDonnell Ranges, NT. FMNH 198978, Dissection A. Central and lateral teeth in side view at 740X; (e-f) WA-115, banks of Jay Creek, W MacDonnell Ranges, NT. 13 March 1974. FMNH 182485, Dissection C. e is lateromarginal transition at 390X, f is early marginal teeth at 1,600X.

Table 123: Range of Variation in MacDonnell and Heavitree Ranges species of *Semotrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. setigera (Tate, 1894)	573	7.01 (4.0-9.45)	13.49 (10.2-16.7)	0.518 (0.377-0.654)	$4^{7}/_{8}$ ($3^{7}/_{8}$--$5^{3}/_{4}$-)	3.36 (2.05-4.85)	4.06 (2.79-7.30)
S. rossana	12	5.02 (4.7-5.7)	11.56 (10.9-12.45)	0.435 (0.395-0.487)	$4^{1}/_{8}$ (4+-$4^{1}/_{4}$)	3.44 (2.95-4.1)	3.38 (3.03-3.81)
S. bensteadana	128	3.86 (3.25-4.55)	9.71 (8.45-10.95)	0.398 (0.342-0.438)	4+ ($3^{5}/_{8}$+-$4^{1}/_{4}$+)	3.15 (2.4-4.0)	3.10 (2.62-3.85)
S. jessieana	149	4.30 (3.75-4.7)	11.39 (10.5-12.3)	0.378 (0.338-0.422)	$4^{3}/_{8}$ ($4^{1}/_{8}$- -$4^{3}/_{4}$+)	3.42 (2.8-4.05)	3.34 (2.87-4.13)
S. emilia	95	4.63 (3.8-5.85)	11.97 (10.85-13.05)	0.387 (0.329-0.484)	$4^{3}/_{8}$+ ($4^{1}/_{8}$-$4^{3}/_{4}$-)	3.74 (3.2-4.5)	3.22 (2.79-3.76)
S. euzyga (Tate, 1894)	112	3.14 (2.35-3.9)	7.97 (7.1-8.95)	0.395 (0.281-0.463)	$3^{7}/_{8}$- ($3^{1}/_{2}$-$4^{1}/_{4}$+)	2.57 (1.9-3.5)	3.24 (2.44-4.06)
S. caupona	238	4.17 (3.5-5.4)	10.29 (9.1-11.3)	0.405 (0.361-0.480)	$4^{1}/_{4}$- (4+-$4^{1}/_{2}$-)	3.21 (2.3-3.9)	3.22 (2.69-4.47)
S. runutjirbana	45	4.34 (3.6-5.1)	10.25 (8.6-11.75)	0.423 (0.356-0.490)	$4^{1}/_{4}$+ ($3^{7}/_{8}$-$4^{5}/_{8}$)	3.37 (2.55-3.9)	3.05 (2.67-4.10)
S. filixiana	39	4.60 (4.15-5.45)	10.30 (9.2-11.5)	0.447 (0.413-0.493)	$4^{1}/_{4}$- ($3^{7}/_{8}$+-$4^{3}/_{8}$-)	2.95 (2.55-3.35)	3.50 (3.13-4.00)
S. winneckeana (Tate, 1894)	12	2.34 (2.2-2.45)	5.99 (5.4-6.6)	0.392 (0.346-0.444)	$3^{3}/_{4}$- ($3^{3}/_{8}$-$3^{7}/_{8}$+)	2.10 (1.5-2.65)	2.90 (2.42-3.60)

Table 124: Local Variation in *Semotrachia setigera* (Tate, 1894)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-745 FMNH 205466	4D	8.35±0.154 (8.8-8.05)	14.34±0.183 (14.75-13.95)	0.583±0.018 (0.533-0.629)	$5\frac{1}{8}$ ($4\frac{7}{8}$+-$5\frac{1}{4}$-)	2.86±0.130 (2.5-3.1)	5.04±0.211 (5.66-4.72)
WA-744, FMNH 205460	5L	7.49±0.208 (6.85-8.05)	13.50±0.327 (12.8-14.7)	0.555±0.009 (0.526-0.009)	$4\frac{5}{8}$ ($4\frac{3}{4}$- -$5\frac{1}{8}$-)	3.02±0.153 (2.75-3.6)	4.49±0.130 (4.08-4.82)
WA-744, FMNH 205459	29D	7.51±0.096 (6.5-8.5)	13.38±0.149 (11.6-14.9)	0.561±0.005 (0.522-0.625)	5 ($4\frac{3}{4}$+-$5\frac{1}{4}$-)	3.04±0.058 (2.35-3.65)	4.43±0.068 (3.72-5.37)
WA-743, FMNH 205456	8L	7.07±0.171 (6.45-7.65)	13.31±0.249 (14.15-12.1)	0.531±0.009 (0.494-0.558)	$4\frac{7}{8}$ ($4\frac{3}{4}$-5+)	3.19±0.094 (2.8-3.6)	4.19±0.080 (3.84-4.42)
WA-743, FMNH 205457	16D	7.07±0.145 (6.2-8.5)	13.08±0.205 (11.7-15.0)	0.540±0.005 (0.510-0.570)	5- ($4\frac{5}{8}$+-$5\frac{3}{8}$-)	3.11±0.091 (2.4-3.75)	4.23±0.086 (3.58-4.97)
WA-747, FMNH 205470	5L	7.62±0.208 (7.2-8.3)	14.09±0.210 (13.5-14.6)	0.541±0.008 (0.527-0.570)	5+ ($4\frac{7}{8}$+-$5\frac{1}{8}$-)	2.97±0.065 (2.85-3.2)	4.75±0.061 (4.54-4.88)
WA-747, FMNH 205472	11D	8.08±0.209 (7.05-9.45)	14.24±0.153 (13.35-15.1)	0.567±0.012 (0.510-0.625)	5 ($4\frac{7}{8}$- -$5\frac{1}{8}$+)	2.76±0.106 (2.1-3.3)	5.23±0.169 (4.49-6.38)
WA-748, FMNH 205479	22L	7.49±0.115 (6.45-8.9)	13.84±0.122 (12.85-15.0)	0.541±0.006 (0.485-0.612)	5 ($4\frac{3}{4}$- -$4\frac{1}{8}$+)	3.22±0.054 (2.9-3.85)	4.32±0.074 (3.70-4.92)

Table 124: Local Variation in *Semotrachia setigera* (Tate, 1894) (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-748,	21D	7.52±0.101	13.94±0.124	0.540±0.007	5-	3.50±0.064	4.00±0.053
FMNH 205478		(6.8-8.5)	(13.0-15.0)	(0.462-0.582)	($4\frac{1}{8}$- -$5\frac{1}{8}$+)	(2.95-3.95)	(3.62-4.41)
Bitter Springs Gap,	13L	7.01±0.092	14.21±0.099	0.493±0.004	$4\frac{7}{8}$+	3.38±0.060	4.21±0.085
FMNH 198978		(6.55-7.5)	(13.6-14.85)	(0.472-0.514)	($4\frac{3}{4}$-5+)	(2.95-3.75)	(3.74-4.87)
Bitter Springs Gap,	12D	6.92±0.109	14.31±0.110	0.483±0.005	$4\frac{7}{8}$+	3.88±0.058	3.69±0.053
FMNH 198963		(6.5-7.75)	(13.5-14.8)	(0.461-0.523)	($4\frac{1}{2}$+-$5\frac{1}{8}$-)	(3.6-4.2)	(3.48-4.00)
WA-562,	5L	6.82±0.136	13.91±0.366	0.491±0.005	5-	3.28±0.127	4.25±0.120
FMNH 204643		(6.5-7.15)	(12.9-15.1)	(0.473-0.503)	($4\frac{7}{8}$+-$5\frac{1}{8}$-)	(3:1-3.75)	(3.83-4.47)
WA-562,	20D	7.33±0.100	14.03±0.155	0.523±0.007	$5\frac{1}{8}$-	3.55±0.065	3.97±0.075
FMNH 204644		(6.5-8.5)	(12.9-15.5)	(0.481-0.597)	($4\frac{7}{8}$+-$5\frac{3}{4}$)	(3.1-4.2)	(3.38-4.48)
WA-742,	42D	7.54±0.086	14.11±0.110	0.534±0.005	5	3.40±0.065	4.20±0.073
FMNH 205444		(6.7-9.0)	(13.2-16.7)	(0.473-0.606)	($4\frac{3}{4}$+-$5\frac{1}{8}$+)	(2.4-4.85)	(3.45-5.72)
WA-924,	24D	7.54±0.105	14.34±0.144	0.525±0.005	5+	3.48±0.066	4.14±0.059
FMNH 212337		(6.6-8.5)	(13.1-15.55)	(0.473-0.565)	($4\frac{7}{8}$+-$5\frac{1}{4}$-)	(2.95-4.05)	(3.60-4.77)
WA-561,	14D	7.51±0.088	14.40±0.149	0.523±0.011	5+	3.71±0.090	3.90±0.236
FMNH 204638		(7.0-8.15)	(13.1-15.5)	(0.450-0.622)	($4\frac{3}{4}$+-$5\frac{1}{4}$-)	(3.0-4.35)	(3.48-4.39)

Table 124: Local Variation in *Semotrachia setigera* (Tate, 1894) (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-751, FMNH 205489	7L	7.78±0.157 (7.35-8.5)	14.55±0.172 (14.1-15.3)	0.535±0.008 (0.507-0.573)	5 (5--$5^1/_8$-)	3.65±0.105 (3.25-3.9)	4.01±0.112 (3.65-4.37)
WA-751, FMNH 205490	13D	7.83±0.134 (7.15-8.7)	14.98±0.208 (13.85-16.3)	0.523±0.007 (0.488-0.564)	5 ($4^3/_4$-$5^1/_8$+)	3.39±0.110 (2.8-3.95)	4.47±0.143 (3.66-5.58)
WA-752, FMNH 205495	9L	7.34-0.138 (6.5-8.05)	14.17±0.224 (13.0-15.3)	0.518±0.011 (0.488-0.583)	5- ($4^7/_8$--5+)	3.49±0.126 (2.9-4.3)	4.08±0.081 (3.55-4.46)
WA-752, FMNH 205498	17D	7.55±0.095 (6.8-8.2)	14.37±0.150 (13.1-15.25)	0.525±0.004 (0.496-0.564)	5- ($4^7/_8$- -$5^1/_8$+)	3.48±0.081 (3.05-4.3)	4.15±0.084 (3.56-4.74)
WA-752, FMNH 205497	5D	4.75±0.160 (4.4-5.3)	10.53±0.162 (10.2-11.1)	0.451±0.008 (0.433-0.478)	4 ($3^7/_8$--$4^1/_8$-)	3.42±0.147 (3.2-4.0)	3.09±0.085 (2.79-3.30)
WA-112, FMNH 182341	13D	8.09±0.166 (7.4-9.2)	15.33±0.206 (14.2-16.7)	0.527±0.006 (0.496-0.564)	$5^1/_8$+ ($4^7/_8$+-$5^3/_8$-)	3.45±0.084 (3.1-3.95)	4.47±0.119 (3.74-5.13)
WA-740, FMNH 205433	15D	7.39±0.100 (6.65-8.3)	13.84±0.158 (12.8-14.8)	0.534±0.007 (0.496-0.598)	5 ($4^7/_8$+-$5^1/_8$-)	3.52±0.078 (3.0-4.0)	3.95±0.086 (3.58-4.70)
WA-739, FMNH 205432	7D	7.38±0.115 (7.0-7.9)	14.25±0.213 (13.4-14.95)	0.518±0.005 (0.497-0.536)	5- ($4^7/_8$+-5+)	3.80±0.169 (3.2-4.4)	3.78±0.137 (3.34-4.47)
WA-439 FMNH 199696	32L	6.80±0.093 (5.4-8.25)	13.35±0.110 (12.15-14.65)	0.509±0.005 (0.445-0.568)	$4^7/_8$+ ($4^1/_2$+-$5^1/_4$)	3.15±0.062 (2.6-4.15)	4.28±0.078 (3.08-4.83)

Table 124: Local Variation in *Semotrachia setigera* (Tate, 1894) (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-439, FMNH 199695	16D	7.27±0.089 (6.6-7.7)	13.45±0.008 (12.55-14.2)	0.541±0.008 (0.497-0.600)	5- ($4^3/_4$--$5^1/_8$-)	3.16±0.088 (2.65-3.8)	4.29±0.099 (3.77-4.98)
WA-758, FMNH 205524	28L	7.30±0.071 (6.7-8.2)	13.86±0.084 (12.95-14.7)	0.527±0.005 (0.477-0.578)	5- ($4^3/_4$-$5^1/_8$+)	3.54±0.068 (2.95-4.25)	3.94±0.066 (3.31-4.53)
WA-113, FMNH 182484	13L	6.47±0.092 (5.8-7.0)	13.62±0.129 (12.9-14.5)	0.475±0.008 (0.430-0.530)	$4^3/_4$+ ($4^5/_8$+-$4^7/_8$+)	3.66±0.064 (3.35-4.05)	3.74±0.072 (3.30-4.20)
WA-113, FMNH 182392	17D	6.49±0.106 (5.8-7.25)	13.54±0.143 (12.7-14.85)	0.479±0.007 (0.436-0.529)	$4^7/_8$- ($4^1/_2$+-$5^1/_4$-)	3.72±0.098 (3.0-4.4)	3.68±0.085 (3.24-4.43)
WA-113, FMNH 182391	20D	7.19±0.140 (6.35-8.75)	13.14±0.220 (11.35-14.95)	0.547±0.007 (0.493-0.610)	5- ($4^5/_8$+-$5^1/_4$+)	3.10±0.065 (2.6-3.8)	4.26±0.080 (3.43-4.83)
WA-933, FMNH 212397	6L	6.77±0.241 (6.0-7.7)	12.26±0.200 (11.8-13.0)	0.554±0.025 (0.461-0.654)	$4^3/_4$+ ($4^5/_8$+-5-)	2.85±-0.087 (2.45-3.1)	4.31±0.116 (4.00-4.80)
Standley Chasm, K11734	46D	5.19±0.052 (4.4-6.4)	11.27±0.068 (10.25-12.45)	0.461±0.004 (0.400-0.533)	$4^3/_8$+ ($4^1/_8$-$4^3/_4$-)	3.46±0.018 (2.8-4.0)	3.27±0.042 (2.82-4.10)
Stuart Pass, K11720	20D	4.86±0.068 (4.4-5.55)	10.89±0.073 (10.4-11.45)	0.446±0.006 (0.407-0.500)	$4^3/_8$ ($4^1/_4$--$4^1/_2$)	3.33±0.043 (3.1-3.8)	3.27±0.035 (2.97-3.55)

SEMOTRACHIA ROSSANA, SP. NOV.
(Plates 148a-c, 149a-d; Figs 328a-c, 329a-b)

Comparative remarks

Semotrachia rossana, sp. nov., known the banks of the Ross River, S of Ross River Resort road, E MacDonnell Ranges, NT, is a medium sized species (mean diameter 11.56 mm), with relatively low spire (**Fig. 328b**, mean H/D ratio 0.435), low whorl count (mean 4 1/8), wide umbilicus (**Fig. 328c**, mean D/U ratio 3.38), complex apical sculpture, spire and body whorl with crowded, long based setae (**Plate 148a-c**), and the parietal lip is free of the parietal wall (**Figs 328b-c**). *S. bensteadana*, from slightly further W in the E MacDonnell Ranges, is much smaller (mean diameter 9.71 mm), with a narrower whorl profile (**Fig. 328e**), even more reduced whorl count (mean 4+), and much less crowded sculpture (**Plate 148d, f**). *S. jessieana* and *S. emilia* are similar in size (**Table 123**), but have much lower H/D ratios (means 0.378, 0.387) and higher whorl counts (means 4 3/8, 4 3/8+). The sometimes sympatric *S. setigera* (Tate, 1894) differs obviously (**Figs 323?-?**) by its greater size (mean diameter 13.49 mm), much higher whorl profile (mean H/D ratio 0.518), increased whorl count (mean 4 7/8) and in having the parietal wall without a free lip edge. Anatomically, *S. rossana* (**Figs 329a-b**) has a long vagina (V) and penis (P), but the epihallus (E) is grossly shortened, the epiphallic caecum absent, the penis chamber wall with complex corrugated sculpture, and the verge (PV) is short with a very large sperm groove. *S. setigera* (**Figs 324-327**) has the epiphallus much longer, the epiphallic caecum (EC) present, simple wall sculpture within the penis chamber, and a more elongated verge. *S. bensteadana* (**Figs 330a-b**) also has lost the epiphallic caecum, but retains a longer epiphallus, has simple wall sculpture within the penis chamber, and a long cylindrical verge.

Holotype

AM C.135976, WA-747, W bank of Ross River, 3.4 km S of Ross River Resort turnoff, S fringes of MacDonnell Ranges, E of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 480:880yds). 23° 36' 52" S, 134° 28' 50" E. Collected by Alan Solem and Phil Colman 24 April 1981. Height of holotype 5.65 mm, diameter 11.8 mm, H/D ratio 0.479, whorls 4 1/8+, umbilical width 3.8 mm, D/U ratio 3.11.

Paratopotypes

AM C.136010, SAM D18098, FMNH 205471, FMNH 205473, 1 LA, 3 DA from the type locality.

Paratypes

Northern Territory

ROSS RIVER: Banks of Ross River, 2.9 km S of Ross River Resort road turnoff (WA-564, E of Alice Springs, WAM 715.87, MV, FMNH 204650-1, 4 LA, 3 DA, 1 DJ).

Range

Semotrachia rossana, sp. nov., has been collected, once (WA-747) in company with *S. setigera* (Tate, 1894), from two stations along the Ross River, downstream from the

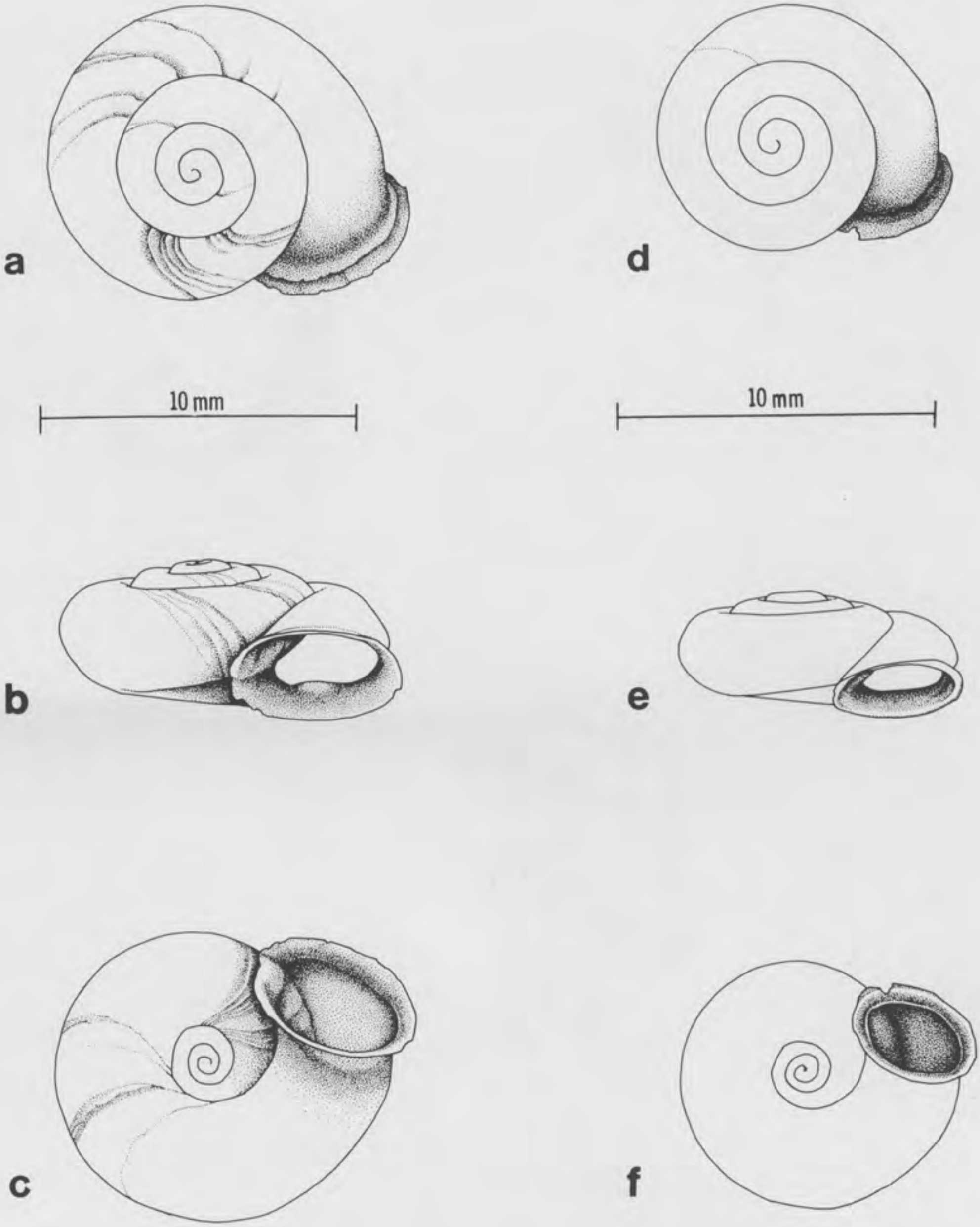


Fig. 328: Shells of *Semotrachia rossana*, sp. nov., and *S. bensteadana*, sp. nov.: (a-c) Holotype of *S. rossana*. WA-747, Ross River, S fringes of E MacDonnell Ranges, NT. AM C.135976; (d-f) Holotype of *S. bensteadana*. WA-740, E MacDonnell Ranges, ENE of Undoolya Gap, NT. AM C.135977. Scale lines equals 10 mm. Drawings by Linnea Lahlum.

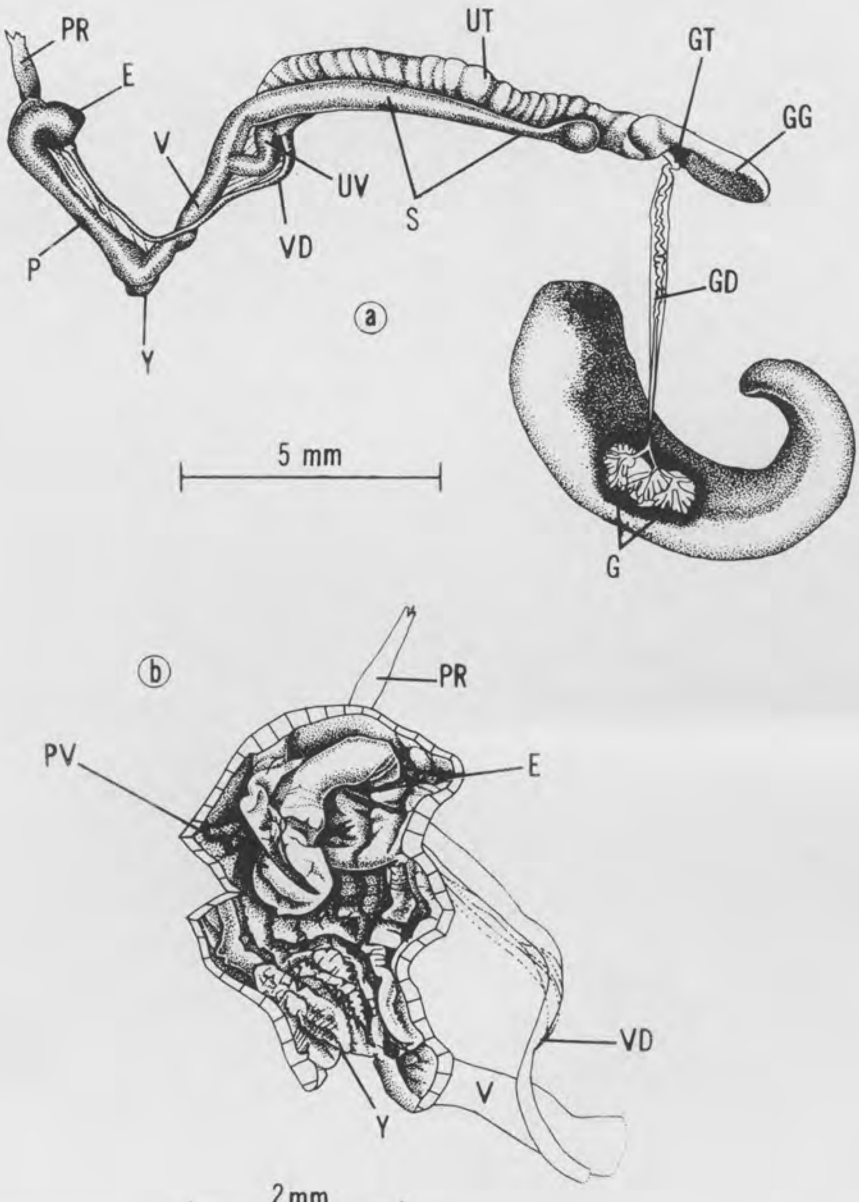


Fig. 329: Genitalia of *Semotrachia rossana*, sp. nov.: WA-564, Ross River banks, 2.9 km S of Ross River Resort turnoff, E MacDonnell Ranges, NT. 30 June 1979. FMNH 204561. (a) genitalia of new adult, Dissection A; (b) interior of epiphallus and penis, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

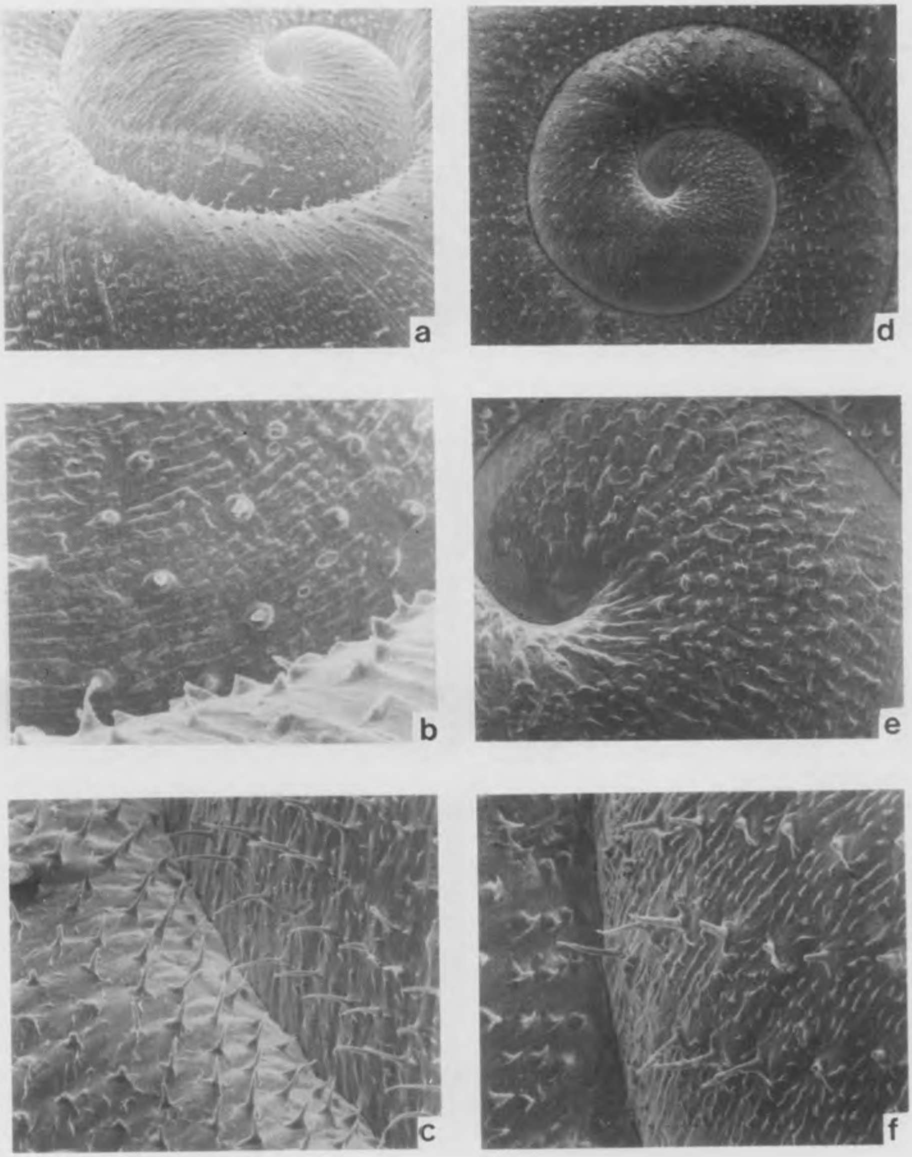


Plate 148: Shell sculpture of *Semotrachia rossana* and *S. bensteadana*: (a-c) *S. rossana*. WA-564, banks of Ross River, E MacDonnell Ranges, NT. FMNH 204560. a is apex and early spire at 45X, b is detail of late apex at 180X, c is setae on lower spire and body whorl at 89X; (d-f) *S. bensteadana*. WA-111, Mt. Benstead Creek, E MacDonnell Ranges, NT. FMNH 182089. d is apex and spire at 27.6X, e is detail of apex at 93X, f is setae on lower spire and body whorl at 115X.

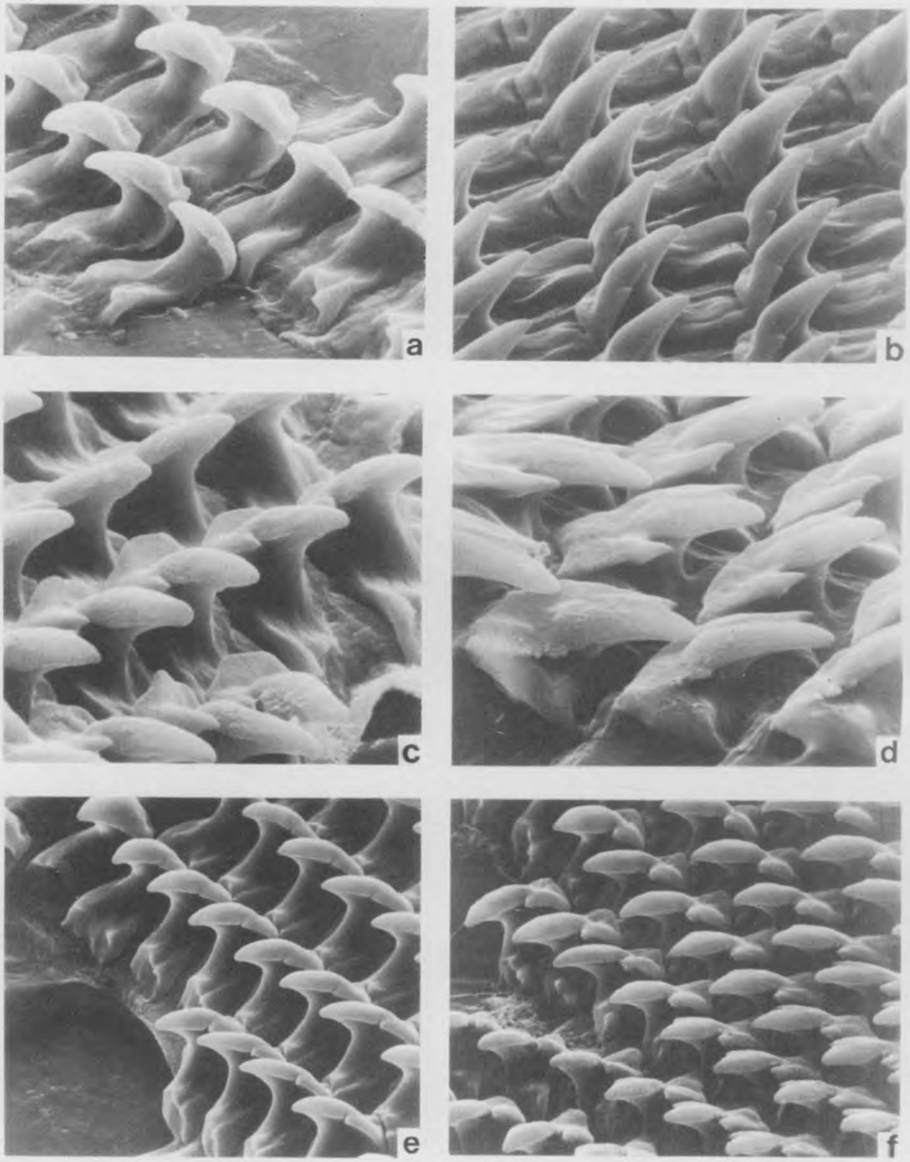


Plate 149: Radular teeth of *Semotrachia rossana* and *S. bensteadana*: (a-d) *S. rossana*. WA-564, W bank Ross River, E MacDonnell Ranges, NT. 30 June 1979. FMNH 204651, Dissection B. a is central and early laterals at 1,125X, b is side view of central and early laterals at 1,175X, c is late lateral teeth at 1,575X, d is early marginal teeth at 1,600X; (e-f) *S. bensteadana*. WA-740, pass through E MacDonnell Ranges, NT. 22 April 1981. FMNH 204535, Dissection B. e is central and early laterals at 820X, f is lateromarginal transition at 830X.

Table 125: Local Variation in *Semotrachia rossana*, *S. bensteadana*, *S. jessieana*, and *S. emilia*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. rossana							
WA-564, FMNH 204651	4L	4.85±0.072 (4.75-5.05)	11.42±0.137 (11.1-11.75)	0.425±0.111 (0.405-0.457)	$4\frac{1}{8}$+ ($4\frac{1}{8}$–$4\frac{1}{4}$-)	3.55±0.087 (3.35-3.75)	3.22±0.042 (3.13-3.31)
WA-747 FMNH 205473	4D	5.10±0.101 (4.9-5.4)	11.98±0.165 (11.2-12.45)	0.426±0.013 (0.395-0.459)	$4\frac{1}{8}$ (4+$4\frac{1}{8}$+)	3.66±0.190 (3.2-4.1)	3.30±0.156 (3.03-3.75)
S. bensteadana							
WA-741, FMNH 205440	5D	4.21-0.047 (4.1-4.4)	10.28±0.107 (10.05-10.65)	0.409±0.001 (0.406-0.411)	$4\frac{1}{8}$ ($4\frac{1}{8}$–$4\frac{1}{8}$+)	3.36±0.085 (3.1-3.55)	3.07±0.172 (2.85-3.28)
WA-740, FMNH 205435	15L	3.82±0.057 (3.4-4.1)	9.32±0.098 (8.7-10.05)	0.410±0.004 (0.385-0.437)	4- ($3\frac{3}{4}$–$4\frac{1}{8}$-)	2.95±0.062 (2.4-3.3)	3.17±0.052 (2.90-3.63)
WA-740, FMNH 205436	29D	3.92±0.030 (3.65-4.2)	9.73±0.080 (8.7-10.4)	0.403±0.004 (0.369-0.438)	4 (4--$4\frac{1}{8}$+)	3.13±0.044 (2.7-3.6)	3.12±0.040 (2.62-3.48)
WA—739, FMNH 205431	6D	3.60±0.089 (3.4-4.0)	9.03±0.171 (8.45-9.65)	0.399±0.005 (0.382-0.414)	$3\frac{7}{8}$+ ($3\frac{5}{8}$+-$4\frac{1}{8}$-)	2.81±0.054 (2.6-3.0)	3.21±0.040 (3.07-3.35)
WA-111, FMNH 182089	10D	3.83-0.047 (3.6-4.1)	10.07±0.137 (9.0-10.6)	0.382±0.008 (0.342-0.430)	$4\frac{1}{8}$ ($3\frac{3}{4}$+-$4\frac{1}{4}$+)	3.44±0.088 (3.0-3.8)	2.94±0.048 (2.70-3.19)
WA-112, FMNH 182342	30D	3.67±0.037 (3.25-4.0)	9.31±0.064 (8.75-10.01)	0.395±0.004 (0.351-0.435)	$4\frac{1}{8}$ ($3\frac{3}{4}$+-$4\frac{1}{4}$)	2.85±0.038 (2.45-3.3)	3.28±0.040 (2.87-3.85)

Table 125: Local Variation in *Semotrachia rossana*, *S. bensteadana*, *S. jessieana*, and *S. emilia* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Mt. Benstead Creek, AM C. 115766	32L&D	4.00±0.042 (3.6-4.5)	10.15±0.090 (9.1-10.95)	0.394±0.003 (0.353-0.426)	$4^{1}/_{8}$- ($3^{7}/_{8}$- -$4^{1}/_{4}$-)	3.49±0.041 (3.05-4.0)	2.91±0.025 (2.69-3.22)
S. jessieana							
WA-925, FMNH 212342	19L	4.31±0.043 (4.0-4.6)	11.25±0.086 (10.75-12.15)	0.383±0.004 (0.354-0.417)	$4^{3}/_{8}$+ ($4^{1}/_{4}$+-$4^{5}/_{8}$+)	3.47±0.047 (3.0-3.85)	3.25±0.034 (3.01-3.63)
WA-925, FMNH 212341	11D	4.28-0.053 (4.1-4.7)	11.29±0.118 (10.65-11.9)	0.379±0.004 (0.366-0.409)	$4^{3}/_{8}$ ($4^{1}/_{4}$- -$4^{3}/_{4}$+)	3.54±0.070 (3.25-3.9)	3.19±0.058 (2.87-3.48)
WA-127, FMNH 182683	79L	4.35±0.029 (3.9-5.4)	11.48±0.050 (10.6-12.8)	0.379±0.002 (0.342-0.422)	$4^{3}/_{8}$ ($4^{1}/_{8}$+-$4^{5}/_{8}$-)	3.34±0.028 (2.8-3.8)	3.45±0.026 (2.94-4.13)
WA-753, FMNH 205501	12D	4.19±0.063 (3.85-4.51)	11.05±0.099 (10.55-11.6)	0.379±0.004 (0.353-0.405)	$4^{1}/_{4}$+ ($4^{1}/_{8}$- -$4^{1}/_{2}$+)	3.46±0.065 (2.95-3.8)	3.21±0.055 (2.92-3.58)
WA-449, FMNH 199660	20L	4.25±0.045 (3.9-4.5)	11.57±0.109 (10.5-12.3)	0.368±0.003 (0.344-0.394)	$4^{3}/_{8}$ ($4^{1}/_{8}$- -$4^{3}/_{4}$-)	3.64±0.067 (3.0-4.05)	3.19±0.043 (2.93-3.63)
S. emilia							
WA-122, FMNH 182684	7L	4.45±0.065 (4.25-4.7)	11.94±0.091 (11.6-12.2)	0.373±0.007 (0.349-0.395)	$4^{1}/_{2}$- ($4^{1}/_{4}$-$4^{1}/_{2}$+)	3.72±0.066 (3.4-3.9)	3.21±0.049 (3.04-3.38)
WA-450, FMNH 199666	14L	4.69±0.057 (4.35-5.05)	12.21±0.134 (11.5-13.05)	0.385±0.004 (0.361-0.410)	$4^{1}/_{2}$ ($4^{3}/_{8}$+-$4^{5}/_{8}$+)	3.75±0.092 (3.25-4.5)	3.27±0.061 (2.82-3.58)
WA-754, FMNH 205505	70D	4.62±0.034 (3.8-5.3)	11.92±0.048 (11.85-12.7)	0.388±0.003 (0.329-0.443)	$4^{3}/_{8}$+ ($4^{1}/_{8}$- -$4^{3}/_{4}$-)	3.73±0.028 (3.2-4.3)	3.21±0.021 (2.79-3.76)

Ross River Resort, E of Alice Springs, NT. The stations (WA-564, WA-747) are only 0.5 km apart. This species may well extend westwards into the N'Dahla Gorge area.

Diagnosis

Shell of medium size, adult diameter 10.9-12.45 mm (mean 11.56 mm), whorls 4+ to 4 1/4 (mean 4 1/8). Apex and spire slightly and evenly elevated (**Fig. 328b**), shell height 4.7-5.7 mm (mean 5.02 mm), H/D ratio 0.395-0.487 (mean 0.435). Body whorl narrow, somewhat shouldered, strongly descending just behind lip (**Fig. 328b**). Apex (**Plate 148a-b**) with altered sculpture, pustules scattered and with setae, various short sprial and longitudinal ridgelets. Spire and body whorl (**Plate 148a, c**) with crowded, short base setae, micro ridging reduced to absent. Umbilicus (**Fig. 328c**) wide, last whorl decoiling more rapidly, width 2.95-4.1 mm (mean 3.44 mm), D/U ratio 3.03-3.81 (mean 3.38). Lip sharp reflected and moderately expanded, free and elevated across parietal wall. Shell yellow-brown, lighter on base. Based on 12 measured adults.

Genitalia (**Figs 329a-b**) with long vagina (V) and penis (P). Epiphallic caecum reduced to swelling at head of much shortened epiphallus (E). Walls of penis chamber rugose. Verge (PV) short, with very prominent sperm groove.

Central and lateral teeth of radula (**Plate 149a-b**) with small anterior flare, high cusp shaft angle, prominent ectocone, curved cusp tip, massive basal support ridge. Late laterals (**Plate 149c**) with enlarged anterior flare, reduced cusp shaft angle, decreased cusp tip curvature, and enlarged ectocone. Endocone appears just before lateromarginal transition (**Plate 149d**). Jaw without unusual features.

Discussion

The two known colonies of *Semotrachia rossana* are from the S fringes of the E MacDonnell Ranges along the banks of the Ross River above N'Dahla Gorge. Collecting to the west may result in a considerable expansion of its 0.5 km recorded range. The populations differ only slightly in size (**Table 125**).

The loss of the epiphallic caecum (EC), which is shared with *S. bensteadana*, is very unusual for the Pleurodontinae, but provides an easily observable distinction from *Semotrachia setigera* (Tate, 1894), which sometimes is sympatric with both species.

The name *rossana* is taken from the Ross River.

SEMOTRACHIA BENSTEADANA, SP. NOV.

(Plates 148d-f, 149 e-f; Figs 328d-f, 330a-b, 337b)

Comparative remarks

Semotrachia bensteadana, sp. nov., which lives in the E MacDonnell Ranges between Mt. Benstead Creek and Undoolya Gap, is a relatively small species (mean diameter 9.71 mm), with low spire (**Fig. 328e**, mean H/D ratio 0.398), reduced whorl count (mean 4+), very wide umbilicus (**Fig. 328f**, mean D/U ratio 3.10), rather widely scattered and long based setae (**Plate 148d-f**), and the continuous parietal lip is elevated well above the parietal wall. *S. rossana*, from the Ross River to the E, is much larger (mean diameter 11.56 mm) and more elevated (**Fig. 328b**, mean H/D ratio 0.435), with much denser setae (**Plate 148a-c**). *S. jessieana* and *S. emilia* to the W in the MacDonnell Ranges, are larger and with increased whorl count (**Table 123**), while the other gap dwellers to the W differ in details of shape and size (**Table 123**). Anatomically, *S. bensteadana* (**Figs 330a-b**) has a very long penis (P) and medium length vagina (V), retains a short epiphallus (E), but has completely lost the epiphallic caecum, has a greatly reduced penis chamber wall sculpture and a long cyclindrical verge (PV). *S. rossana* (**Figs 329a-b**) also has lost the epiphallic caecum, but differs in the greater reduction of the epiphallus, rugose penis chamber wall sculpture, and very different verge. The sympatric *S. setigera* (**Figs 324-327**) has a shorter, tapering verge, simple penis chamber wall sculpture, a much longer epiphallus, and a prominent epiphallic caecum (EC). The papillose penis chamber wall sculpture, short epiphallic caecum, and short penes of *S. jessieana* and *S. emilia* (**Figs 332-333**) readily differentiate those species.

Holotype

AM C.135977, WA-740, narrow pass through MacDonnell Ranges, 0.9 km N of main road, ENE of Undoolya Gap, MacDonnell Ranges, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 140:760yds). 23° 43' 40" S, 134° 08' 59" E. Collected by Alan Solem and Phil Colman 22 April 1981. Height of holotype 4.2 mm, diameter 9.55 mm, H/D ratio 0.440, whorls 4 1/8-, umbilical width 3.2 mm, D/U ratio 2.98.

Paratopotypes

AM C.136011-2, SAM D18099-100, WAM716.87, WAM 717.87, MV, QM, FMNH 205435-6, 15 LA, 29 DA, 11 DJ from the type locality.

Paratypes

Northern Territory

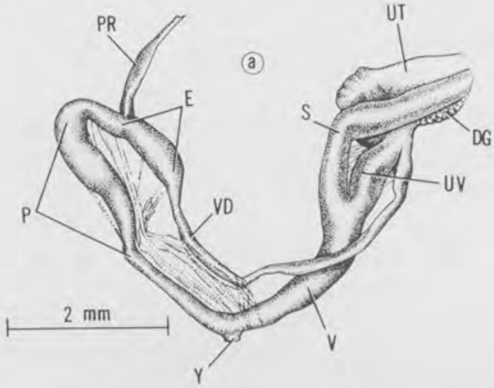
MACDONNELL RANGES: Mt. Benstead Creek (AM C.115766, 3 LA, 29 DA, 4 DJ; WA-741, N bank, N of main road, FMNH 205440, 5 DA, 1 DJ; WA-111, S bank, AM C.136015, SAM D18102, WAM 720.87, QM, FMNH 182089, FMNH 182656, 11 DA, 4 DJ); Corroborree Rock (WA-112, rubble at base, AM C.136014, SAM D18101, WAM 719.87, QM, MV, FMNH 182342, 30 DA, 9 DJ; 25 April 1987, V. Kessner!, K 11729, 2 DA, 1 DJ); Red Range Well track (25 April 1987, V. Kessner!, K 11730, 4 DA); near Undoolya Gap (WA-739, under figs on MacDonnell Range outlier, AM C.136013, WAM 718.87, FMNH 205431, 6 DA, 6 DJ).

Range

Semotrachia bensteadana, sp. nov., has been found in the eastern MacDonnell Ranges from the banks of Mount Benstead Creek (134°20'E) to near Undoolya Gap (134°08'E), a distance of about 28 km. At nearly all stations it is sympatric with *Semotrachia setigera* (Tate, 1894).

Diagnosis

Shell relatively small, adult diameter 8.45-10.95 mm (mean 9.71 mm), whorls 3 5/8+ to 4 1/4+ (mean 4+). Apex and spire flat to slightly and evenly elevated (**Fig. 328e**), shell height 3.25-4.55 mm (mean 3.86 mm), H/D ratio 0.342-0.438 (mean 0.398). Body whorl (**Fig. 328e**) rounded to weakly shouldered, descending abruptly behind lip. Apex (**Plate 148d-e**) with complex microsculpture, spire and body whorl (**Plate 148d, f**) with low, rather widely spaced setae and some micro ridging. Umbilicus wide (**Fig. 328f**), last whorl decoiling more rapidly, width 2.4-4.0 mm (mean 3.15 mm), D/U ratio 2.62-3.85 (mean 3.10). Lip sharply reflected and strongly expanded, continuous across and free of parietal wall. Shell yellow-brown, lighter in tone on base. Based on 128 measured adults.



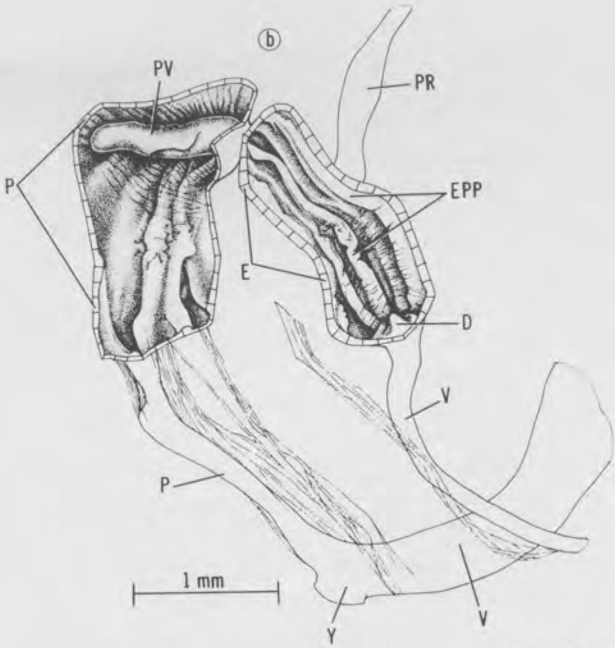


Fig. 330: Genitalia of *Semotrachia bensteadana*, sp. nov.: WA-740, E MacDonnell Ranges, ENE of Undoolya Gap, NT. 22 April 1981. FMNH 205435, Dissection B. (a) terminal genitalia; (b) interior of epiphallus and penis. Scale lines as marked. Drawings by Linnea Lahlum.

Genitalia (**Figs 330a-b**) with medium length vagina (V) and short free oviduct (UV). Epiphallus (E) short with tapered apex, internal sculpture of low ridges, epiphallic caecum completely lost. Penis very long, slender except for apical area. Penis chamber with low pilasters only, some circular sculpture at level of verge (PV), which is cylindrical, blunt-tipped, and with reduced sperm groove.

Central and lateral teeth of radula (**Plate 149e**) with greatly reduced anterior flare, very high cusp shaft angle, prominent ectocone, strongly curved cusp tip, shortened basal plate. Late laterals (**Plate 149f**) with enlarged anterior flare, reduced cusp shaft angle and cusp curvature, and small endocone. Lateromarginal transition (**Plate 149f**) and marginals typical. Jaw without unusual features.

Discussion

Unfortunately most of the available material for *Semotrachia bensteadana* was collected dead. The anatomical data is thus limited to WA-740. The differences from neighbouring species and the microsympatric *S. setigera* (Tate, 1894) are major, and have been discussed above. Size and whorl count variation is considerable among populations (**Table 125**), and also between live and dead examples from the same colony (WA-740). In view of this extensive shell variation, the genital anatomy of all populations should be studied to determine if this is a single species or a complex of species. The shell differences among the populations are the same order of magnitude (**Table 123**) as those between *S. jessieana* and *S. emilia* from further W in the MacDonnell Ranges, which do show major anatomical differentiation.

The name *bensteadana* is taken the Mount Benstead Creek, which forms the known northeastern limit of this species.

SEMOTRACHIA JESSIEANA, SP. NOV.

(Plates 150a-c; Figs 331a-c, 332a-c, 333b)

Comparative remarks

Semotrachia jessieana, sp. nov., from Jessie Gap, E MacDonnell Ranges, NT, is a medium sized species (mean diameter 11.39 mm), with nearly flat spire (**Fig. 331b**, mean H/D ratio 0.378), typical whorl count (mean 4 3/8), typical umbilicus (**Fig. 331c**, mean D/U ratio 3.34), microsculpture of relatively widely spaced setae with long bases (**Plate 150a-c**), and the parietal lip is continuous and free (**Fig. 331c**). *S. emilia*, from the neighbouring Emily Gap, is a little larger (mean diameter 11.97 mm), and has much more closely spaced setae (**Plate 150d-f**), but is very similar in appearance and shape. *S. rossana*, from banks of the Ross River to the E, is similar in size, but has a more elevated spire (**Fig. 328b**, mean H/D ratio 0. 435), reduced whorl count (mean 4 1/8), and much more crowded setae (**Plate 148a, c**). The Western MacDonnell Ranges species are distinctly smaller in size (**Table 123**). Anatomically, *S. jessieana* (**Figs 332a-c, 333b**) has a long vagina (V), the epiphallic caecum (EC) reduced to a small protrusion, the head of the epiphallus (E) expanded, the penis chamber walls with a combination of pustules and rounded longitudinal ridges, and the verge (PV) short and wide. *S. emilia* (**Figs 332d, 333a**) has similar epiphallic structures, but the penis chamber wall sculpture consists only of pustules and the verge is long and slightly tapering. *S. euzyga* (Tate, 1894), from the Alice Springs area, has the penis and epiphallus shortened, but the epiphallus is increased in size, the penis chamber wall sculpture consists of only longitudinal rounded ridges, and the verge is very short and wide (**Figs 335a-d**).

Holotype

AM C.135978, WA-753, under figs on S side of Jessie Gap, MacDonnell Ranges, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 3990:7372yds). 23° 45' 02" S, 134° 00' 31" E. Collected by Alan Solem and Phil Colman 24 April 1981. Height of holotype 4.5 mm, diameter 11.4 mm, H/D ratio 0.395, whorls 4 3/8, umbilical width 3.4 mm, D/U ratio 3.35.

Paratopotypes

AM C.136016, SAM D18103, WAM 721.87, FMNH 205501-2, 5 LA, 11 DA, 3 LJ, 9 DJ from the type collection.

Paratypes

Northern Territory

MACDONNELL RANGES: Jessie Gap (WA-127, WA-449, WA-925, AM C.136017-8, SAM D18104-5, WAM 722.87, WAM 723.87, QM, MV, FMNH 182660, FMNH 182683, FMNH 182211, FMNH 199660, FMNH 212341-2, 118 LA, 14 DA, 53 LJ, 4 DJ; 24 April 1987, V. Kessner!, K 11719, many DA).

Range

Semotrachia jessienana, sp. nov., has been collected only from Jessie Gap, MacDonnell Ranges, E of Alice Springs, NT.

Diagnosis

Shell medium in size, adult diameter 10.5-12.3 mm (mean 11.39 mm), whorls 4 1/8- to 4 3/4+ (mean 4 3/8). Apex and spire flat or at most slightly elevated (**Fig. 331b**), shell height 3.8-5.85 mm (mean 4.63 mm), H/D ratio 0.329-0.484 (mean 0.387). Body whorl (**Fig. 331b**) weakly shouldered, descending abruptly just behind lip. Apex (**Plate 150a**) with scattered projecting pustules and setae, spire and body whorl (**Plate 150b-c**) with closely spaced long base setae, plus scattered micro ridglets. Umbilicus (**Fig. 331c**) typical, width 2.8-4.05 mm (mean 3.42 mm), D/U ratio 2.87-4.13 (mean 3.34). Lip sharply reflected and moderately expanded, continuous across and free of parietal wall. Shell dark yellow-brown, lighter on base. Based on 149 measured adults.

Genitalia (**Figs 332a-c, 333b**) with long vagina (V) and very short free oviduct (UV). Epiphallic caecum (EC) a short stub. Epiphallus (E) with expanded head, internally with simple ridges. Penis (P) relatively short, walls of chamber with pustules and rounded longitudinal ridges. Verge (PV) short, wide, sperm groove reduced in size.

Central and lateral teeth of radula (**Plate 151a-b**) with large ectocone, high cusp shaft angle, moderate anterior flare, and weakly curved cusp tip. Early marginals (**Plate 151c**) with prominent ectocone. Outer marginals and lateromarginal transition typical. Jaw without unusual features.

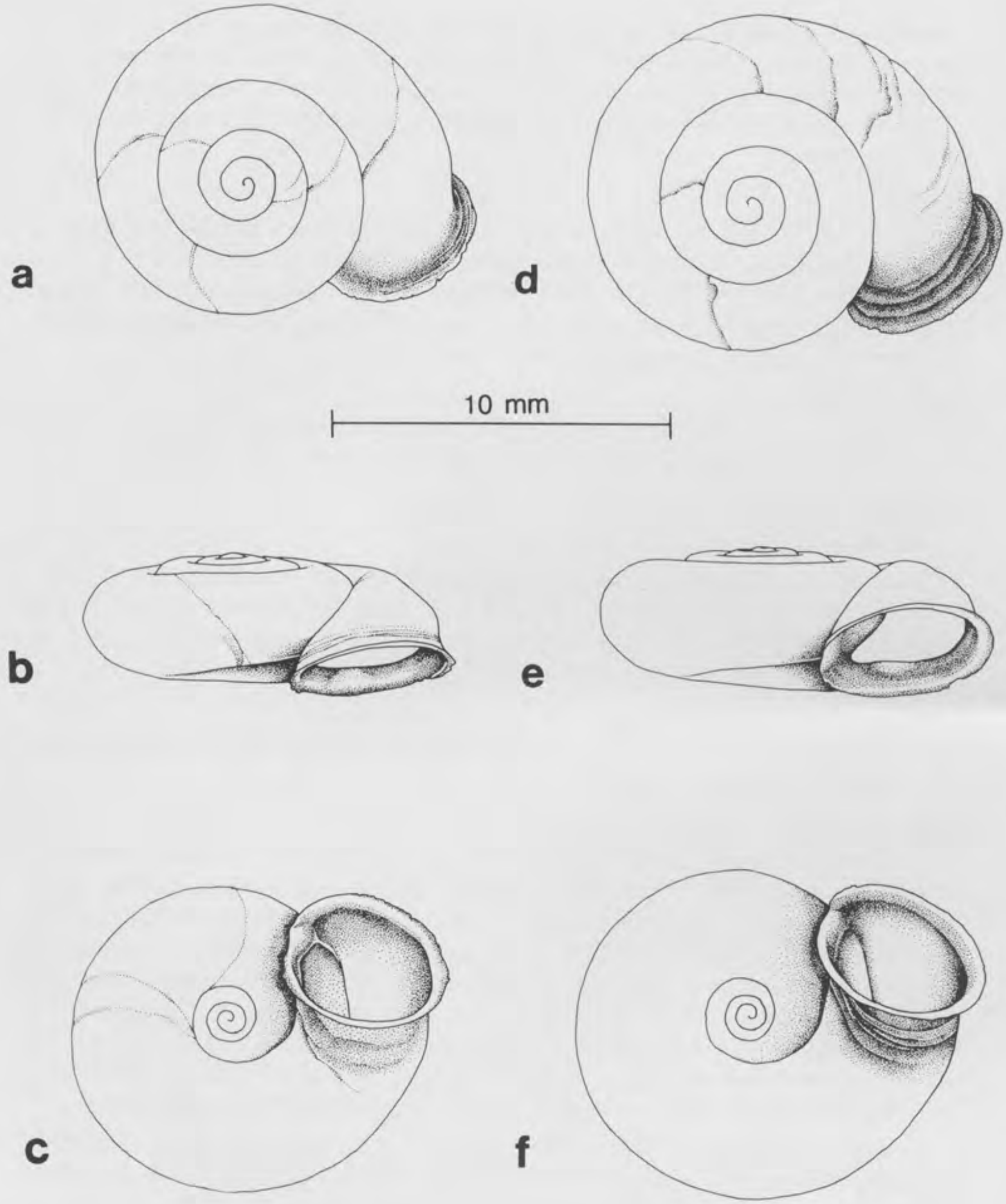


Fig. 331: Shells of *Semotrachia jessieana*, sp. nov., and *S. emilia*, sp. nov.: (a-c) Holotype of *S. jessieana*. WA-753, Jessie Gap, E MacDonnell Ranges, NT. AM C.135978; (d-f) Holotype of *S. emilia*. WA-754, Emily Gap, E MacDonnell Ranges, NT. AM C.135979. Scale line equals 10 mm. Drawings by Linnea Lahlum.

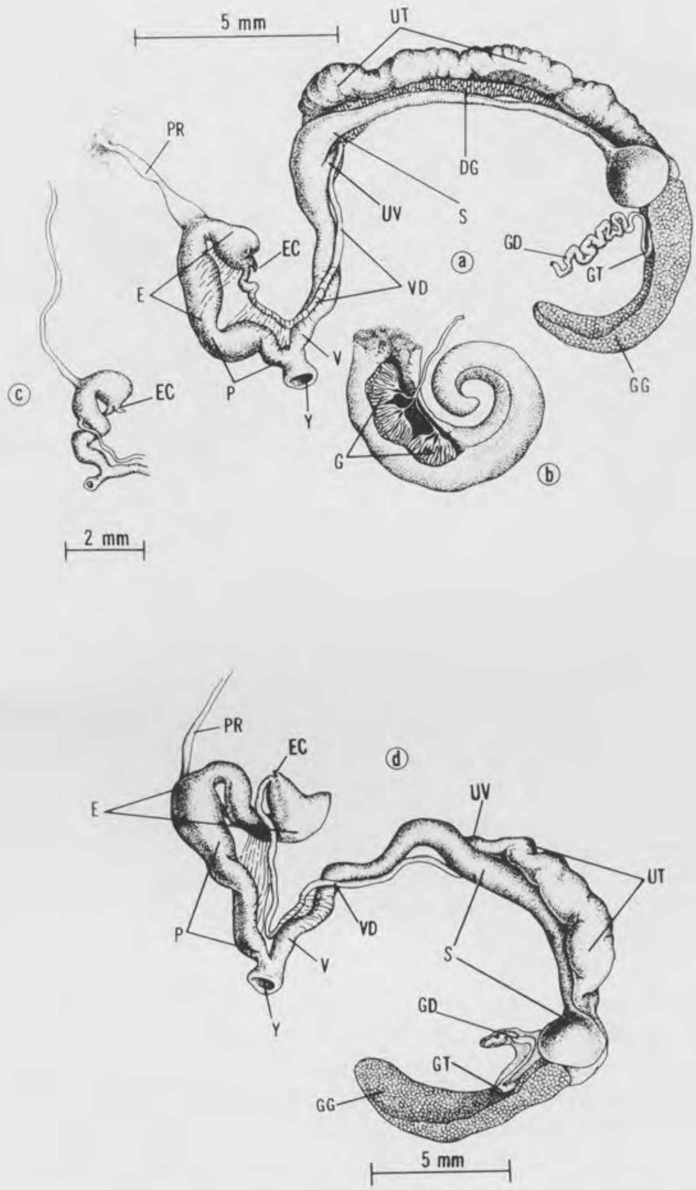


Fig. 332: Whole genitalia of *Semotrachia jessieana*, sp. nov., and *S. emilia*, sp. nov.: (a-c) *S. jessieana*. WA-127, Jessie Gap, E MacDonnell Ranges, NT. 15 March 1974. FMNH 182623. a is whole genitalia, Dissection D; b is adult ovotestis, Dissection D; c is new adult terminal genitalia, Dissection A; (d) adult genitalia of *S. emilia*. WA-122, Emily Gap, E MacDonnell Ranges, NT. 15 March 1974. FMNH 182684, Dissection B. Scale lines equal 2 mm. Drawings by Elizabeth A. Liebman.

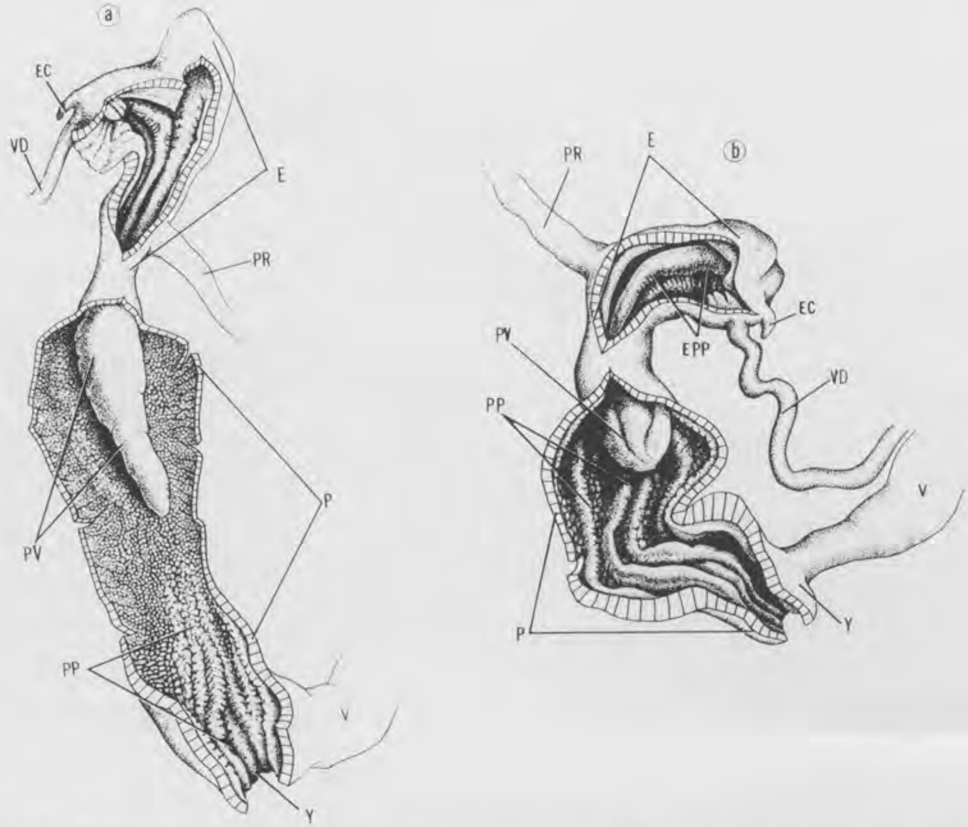


Fig. 333: Penis interior of *Semotrachia emilia*, sp. nov., and *S. jessieana*, sp. nov.: (a) *S. emilia*. WA-122, Emily Gap, E MacDonnell Ranges, NT. 15 March 1974. FMNH 182684, Dissection B; (b) *S. jessieana*. WA-127, Jessie Gap, E MacDonnell Ranges, NT. 15 March 1974. FMNH 182623, Dissection D. Scale lines equal 2 mm. Drawings by Elizabeth A. Liebman.

Discussion

All samples of *Semotrachia jessieana*, sp. nov., were taken aestivating on small rocks in litter under the same small patch of figs. The variation in diameter and whorl count (**Table 125**) is thus allochronic, rather than microgeographic. The spread of samples is March 1974 (WA-127), late May 1977 (WA-449), late April 1981 (WA-753), and late May 1983 (WA-925). The essential identity of shell size for the live and dead examples from WA-925 probably reflects the fact that this population inhabits well shaded rubble by the side of a near permanent pool. The litter at the base of the figs gains moisture from seepage and thus is a highly favourable habitat. Despite this, allochronic shell variation exists.

A wet period survey of the MacDonnell Ranges between Jessie Gap and Emily Gap to determine if *Semotrachia* is extant in the intervening thin and unshaded rock rubble, which species inhabits which area, if there is hybridization, and exactly where the

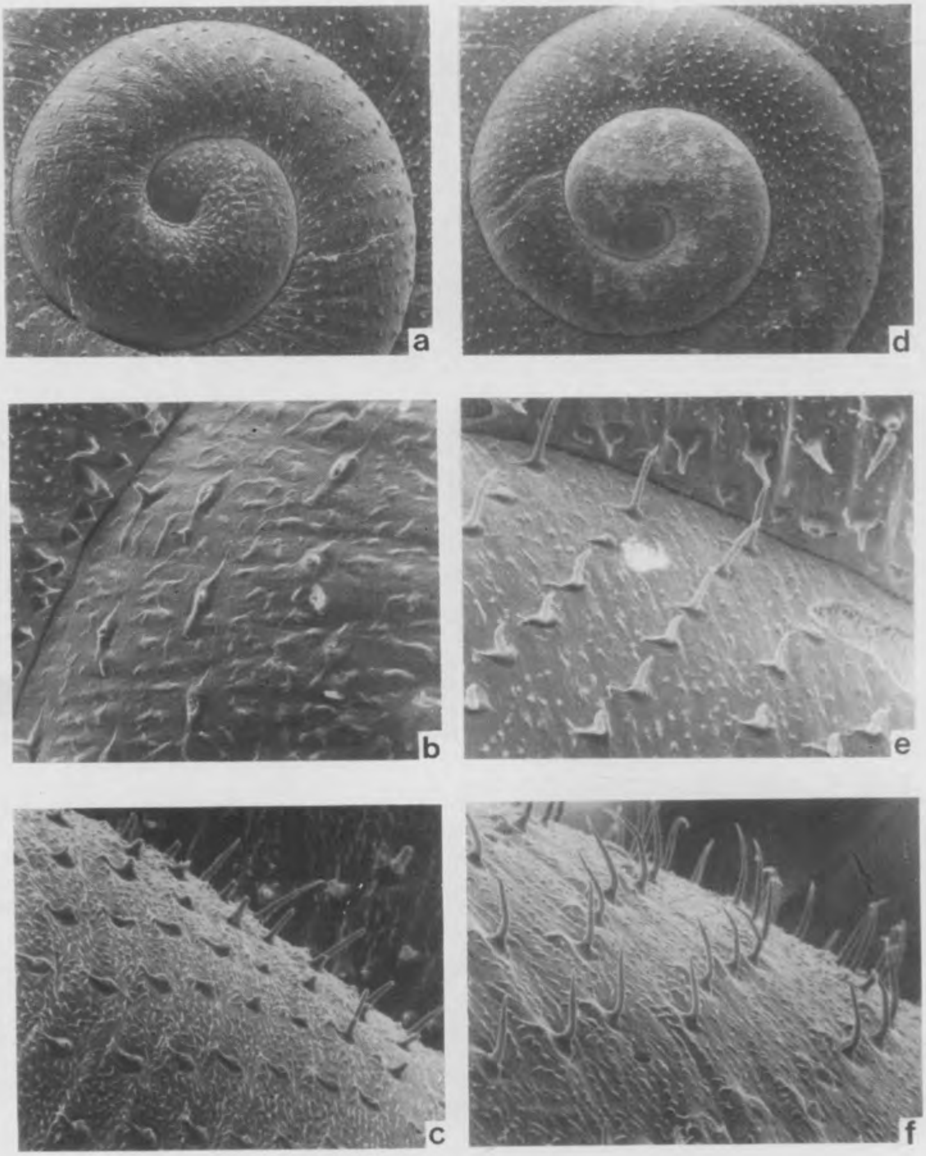


Plate 150: Shell sculpture of *Semotrachia jessiana* and *S. emilia*: (a-c) *S. jessieana*. WA-753, Jessie Gap, E MacDonnell Ranges, NT. FMNH 205501. a is apex and early spire at 28.7X, b is detail of upper spire at 130X, c is setae on lower spire at 105X; (d-f) *S. emilia*. WA-122, Emily Gap, E MacDonnell Ranges, NT. FMNH 182684. d is apex and early spire at 21.1X, e is setae on upper spire at 135X, f is setae on body whorl at 83X.

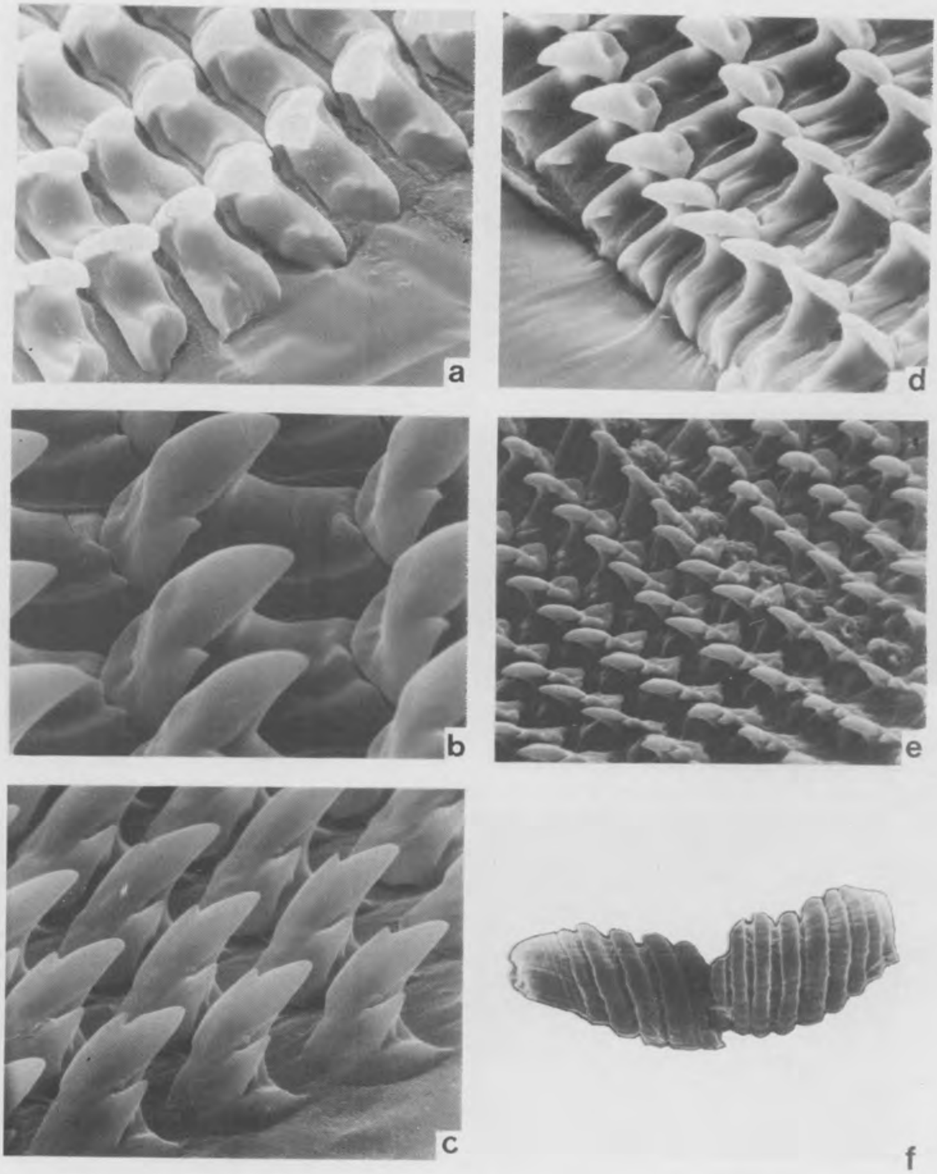


Plate 151: Radular teeth and jaw of *Semotrachia jessieana* and *S. emilia*: (a-c) *S. jessieana*. WA-127, S side Jessie Gap, E MacDonnell Ranges, NT. 17 March 1974. FMNH 182683, Dissection D. a is central and early lateral teeth at 860X, b is side view of early lateral teeth at 1,675X, c is early marginal teeth at 1,200X; (d-f) *S. emilia*. WA-450, Emily Gap, E MacDonnell Ranges, NT. 26 May 1977. FMNH 199666, Dissection A. d is central and early laterals at 760X, e is lateromarginal transition at 610X, f is jaw at 72X.

transition between *jessieana* and *emilia* occurs, would be a quite worthwhile project for a local naturalist.

The name *jessieana* is taken from the gap in which it lives.

SEMOTRACHIA EMILIA, SP. NOV.
(Plates 150d-f, 151d-f; Figs 331d-f, 332d, 333a)

Comparative remarks

Semotrachia emilia, sp. nov., from Emily Gap, E MacDonnell Ranges, NT, is a medium large species (mean diameter 11.97 mm), with flat or barely elevated spire (**Fig. 331e**, mean H/D ratio 0.387), typical whorl count (mean 4 3/8+) and umbilicus (**Fig. 331f**, mean D/U ratio 3.22), microsculpture of crowded, relatively long base setae (**Plate 150d-f**), and the parietal lip continous and free (**Fig. 331f**). *S. jessieana*, from the next gap E (Jessie Gap), is slightly smaller (mean diameter 11.39 mm) and has the setae more widely spaced (**Plate 150a-c**). *S. rossana*, from the Ross River, has a reduced whorl count (mean 4 1/8), is much more elevated (**Fig. 328b**, mean H/D ratio 0.435), and has very crowded setae (**Plate 148c**). Anatomically, *S. emilia* (**Figs 332d, 333a**) has a very long vagina (V), the epiphallic caecum (EC) reduced to a nub, the head of the epiphallus (E) greatly expanded, the penis chamber walls with very fine pustules, and the verge (PV) is long and tapering. *S. jessieana* (**Figs 332a-c, 333b**) differs most obviously in its short, very wide verge (PV) and the combination of rounded longitudinal ridges and larger pustules on the penis chamber walls. *S. euzyga* (Tate, 1894) (**Figs 335a-d**) has the entire penis complex shortened, a very prominent epiphallic caecum (EC), simple penis chamber wall sculpture, and an even shorter and wider verge (PV).

Holotype

AM C.135979, WA-754, figs on S side of Emily Gap, MacDonnell Ranges, E of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 383:7374yds). 23° 44' 30" S, 133° 56' 34" E. Collected by Alan Solem and Phil Colman 24 April 1981. Height of holotype 4.8 mm, diameter 12.25 mm, H/D ratio 0.392, whorls 4 1/2, umbilical width 4.0 mm, D/U ratio 3.06.

Paratopotypes

AM C.136019, SAM D18106, WAM 724.87, QM, MV, FMNH 205503-6, 2 LA, 71 DA, 2 LJ, 16 DJ from the type collection; 24 April 1987, V. Kessner!, K 11736, many DA.

Paratypes

Northern Territory

MACDONNELL RANGES: Emily Gap (WA-122, WA-450, figs on S side, AM C.136020, SAM D18107, WAM 725.87, FMNH 182684, FMNH 199666, 21 LA, 17 LJ).

Range

Semotrachia emilia, sp. nov., has been collected only from Emily Gap, MacDonnell Ranges, NT.

Diagnosis

Shell medium to large, adult diameter 10.85-13.05 mm (mean 11.97 mm), whorls 4 1/8- to 4 3/4- (mean 4 3/8+). Apex and spire almost flat (**Fig. 331e**), shell height 3.8-5.85 mm (mean 4.63 mm), H/D ratio 0.329-0.484 (mean 0.387). Body whorl (**Fig. 331e**) rounded to weakly shouldered, abruptly deflected just behind lip. Apex (**Plate 150d**) with typical sculpture, spire and body whorl (**Plate 150e-f**) with crowded long base setae and moderate micro ridging. Umbilicus (**Fig. 331f**) with last whorl decoiling more rapidly, width 3.2-4.5 mm (mean 3.74 mm), D/U ratio 2.79-3.76 (mean 3.22). Lip sharply reflected and moderately expanded, continuous across and free of parietal wall. Shell dark yellow-brown, lighter on base. Based on 95 measured adults.

Genitalia (**Figs 332d, 333a**) with very long vagina (V) and very short free oviduct (UV). Head of epiphallus (E) greatly expanded, epiphallic caecum (EC) a tiny remnant. Head of penis (P) swollen. Walls of penis chamber with fine pustules above, trace of longitudinal ridges basally. Verge (PV) long, tapering, sperm groove reduced in size.

Central and lateral teeth of radula (**Plate 151d**) with long base, prominent anterior flare, very high cusp shaft angle, small ectocone, only slight cusp tip curvature. Late laterals and lateromarginal transition typical (**Plate 151e**). Marginals and jaw (**Plate 151f**) without unusual features.

Discussion

Semotrachia emilia, sp. nov., aestivates attached to small rock slabs in a small patch of figs at Emily Gap, MacDonnell Ranges. It is less abundant than is *S. jessieana* from Jessie Gap just to the E. Thus less material is available to document allochronic variation (**Table 125**). The patterns may be the same.

The radula of a specimen collected 26 May 1977 (**Plate 151e**) shows an interesting temporary malformation to the late lateral teeth. A row of "blobs", probably produced by a freeze, was followed by a formation of a part row of laterals (**Plate 151e**, upper left) with near vertical cusp shaft angle and strongly curved cusp tip. This was followed (left) by teeth conforming to the "pre-shock" pattern. The single altered row shows the pattern found in some of the Musgrave taxa with altered feeding.

The name *emilia* is taken from the type locality.

SEMOTRACHIA EUZYGA (TATE, 1894)

(Plates 152a-b, 153a-c; Figs 334a-c, 335a-d, 337a)

Hadra euzyga Tate, 1894, Trans. Royal Soc. South Austr., **18**: 194 - Central Australia.

Angasella euzyga (Tate), Tate, 1896, Rep. Horn Sci. Exped., Central Austr., Zool., pp. 191-192, pl. XVII, figs 7a- - Alice Springs, Central Australia.

Semotrachia euzyga (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 37; Iredale, 1938, Austr. Zool., **9** (2): 90 - check list citation; Richardson, 1985, Tryonia, **12**: 275 - check list citation.

Comparative remarks

Semotrachia euzyga (Tate, 1894), known only from the Alice Springs area, NT, is small (mean diameter 7.97 mm), with slightly elevated spire (**Fig. 334b**, mean H/D ratio 0.395, reduced whorl count (mean 3 7/8-), typical umbilicus (**Fig. 334c**, mean D/U ratio 3.24), microsculpture of a few widely spaced short base setae and very dense micro ridging (**Plate 152a-b**), and the parietal lip continuous across and free of parietal wall (**Fig. 334c**). *S. emilia*, from Emily Gap to the E, is much larger (mean diameter 11.97 mm) and has dense long base setae with reduced micro ridging (**Plate 150d-f**). *S. jessieana*, from further E at Jessie Gap, also is much larger (mean diameter 11.39 mm), and has very long base setae with reduced micro ridging (**Plate 150a-c**). *S. caupona*, from Temple Bar Gap (= Honeymoon Gap) to the W, is much larger (mean diameter 10.33 mm), and has very dense medium base setae with reduced micro ridging (**Plate 152c-d**). Anatomically, *S. euzyga* (**Figs 335a-d**) has an extremely large and gradually tapering epiphallic caecum (EC), the entire penis complex is shortened, the penis chamber wall has comparatively simple longitudinal ridges, and the verge is very short and broad. Both *S. jessieana* (**Figs 332a-c, 333b**) and *S. emilia* (**Figs 332d, 333a**) have the epiphallic caecum reduced to a nub, the head of the epiphallus swollen, the penis chamber wall at least partly pustulose, and very different verges. *S. caupona* (**Figs 336a-c**) also has an extremely small epiphallic caecum, longer verge, and simple penis chamber wall sculpture. Species found further west tend to have elongated, but only slightly tapering, epiphallic caeca.

Holotype

SAM D13596, Alice Springs Telegraph Station, Northern Territory, Australia. ca 23° 41' S, 133° 53' E. Height of holotype 3.9 mm, diameter 8.45 mm, H/D ratio 0.462, whorls 4-, umbilical width 2.55 mm, D/U ratio 3.31. Collected when recently dead, moderate ridging visible amidst heavy surface deposits.

Paratypes

SAM D15548, FMNH 88248, 5 DA from the type locality.

Material studied

Northern Territory

ALICE SPRINGS: Choritza Hill (WA-129, WA-451, behind St. Philipps College, AM, SAM D18109-10, WAM 727.87, WAM 728.87, QM, MV, FMNH 182689, FMNH 199682-3, 31 LA, 15 DA, 5 LJ, 21 DJ); Alice Springs Telegraph Station National Park (WA-128, park fringes, E bank bluffs of Todd River, AM, SAM D18108, WAM 726.87, QM, MV, FMNH 182693, FMNH 182717, FMNH 182203, FMNH 200776, FMNH 201549, 37 LA, 19 DA, 24 LJ, 7 DJ).

Range

Semotrachia euzyga (Tate, 1894) has been collected from the banks of the Todd River near the S fringes of the Telegraph Station National Park and under figs on Choritza Hill, Alice Springs. The two localities are less than 2 km apart.

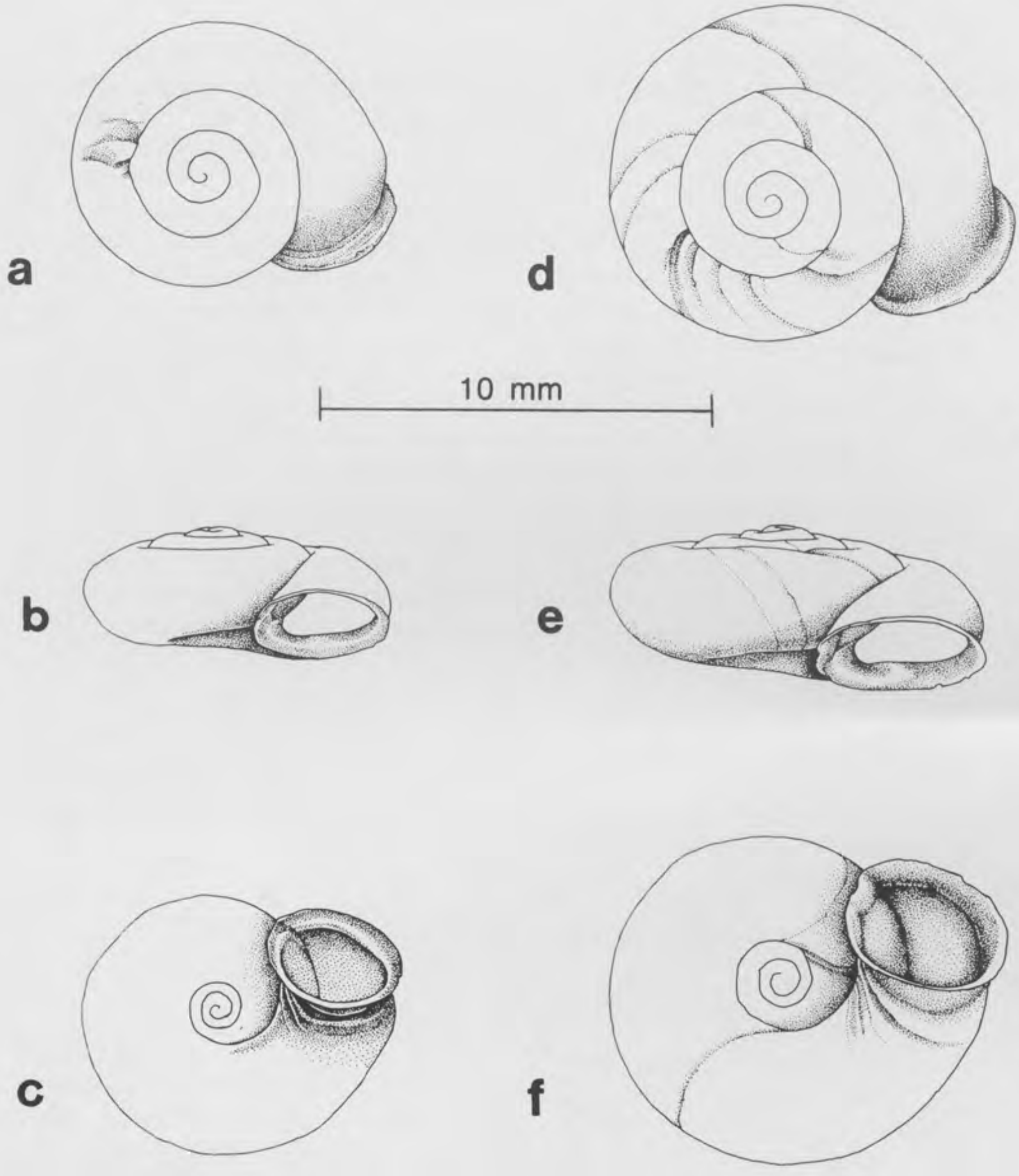


Fig. 334: Shells of *Semotrachia euzyga* (Tate, 1894) and *S. caupona*, sp. nov.: (a-c) Paratype of *Hadra euzyga* Tate, 1894. Central Australia. MV F30071. Horn Expedition; (d-f) Holotype of *S. caupona*. WA-133, Temple Bar Gap (= Honeymoon Gap), W MacDonnell Ranges, NT. AM C.135980. Scale lines equal 10 mm. Drawings by Elizabeth A. Liebman (a-c) and Linnea Lahlum (d-f).

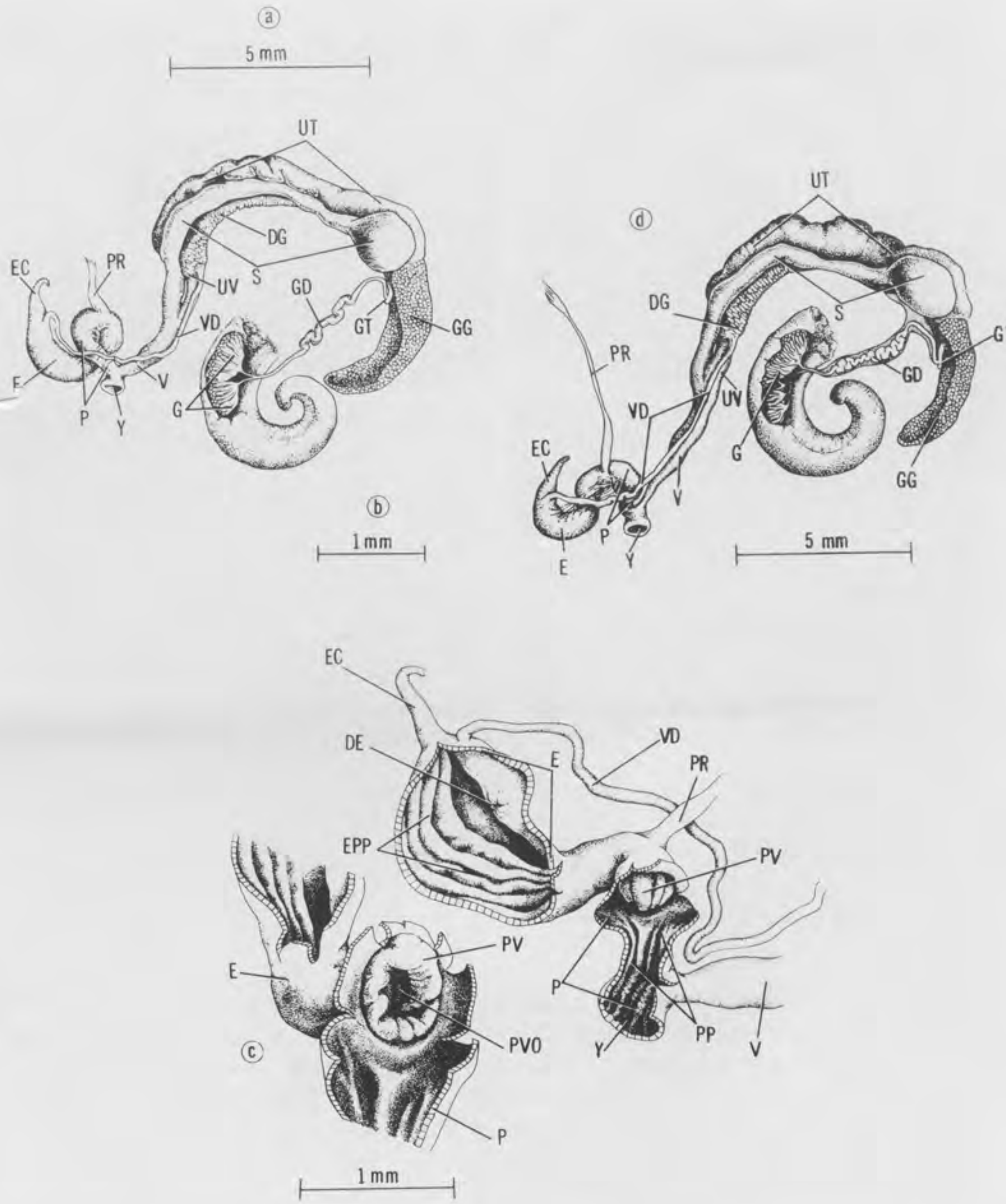


Fig. 335: Genitalia of *Semotrachia euzyga* (Tate, 1894): (a-c) WA-129, Choritja Hill, behind St. Philipps College, Alice Springs, NT. 17 March 1974. FMNH 182689, Dissection A, a is whole genitalia, b is interior of penis and epiphallus, c is detail of verge; (d) WA-128, Alice Springs Telegraph Station National Park, Alice Springs, NT. 17 March 1974. FMNH 182693, Dissection C. whole genitalia. Scale lines as marked. Drawings by Elizabeth A. Liebman.

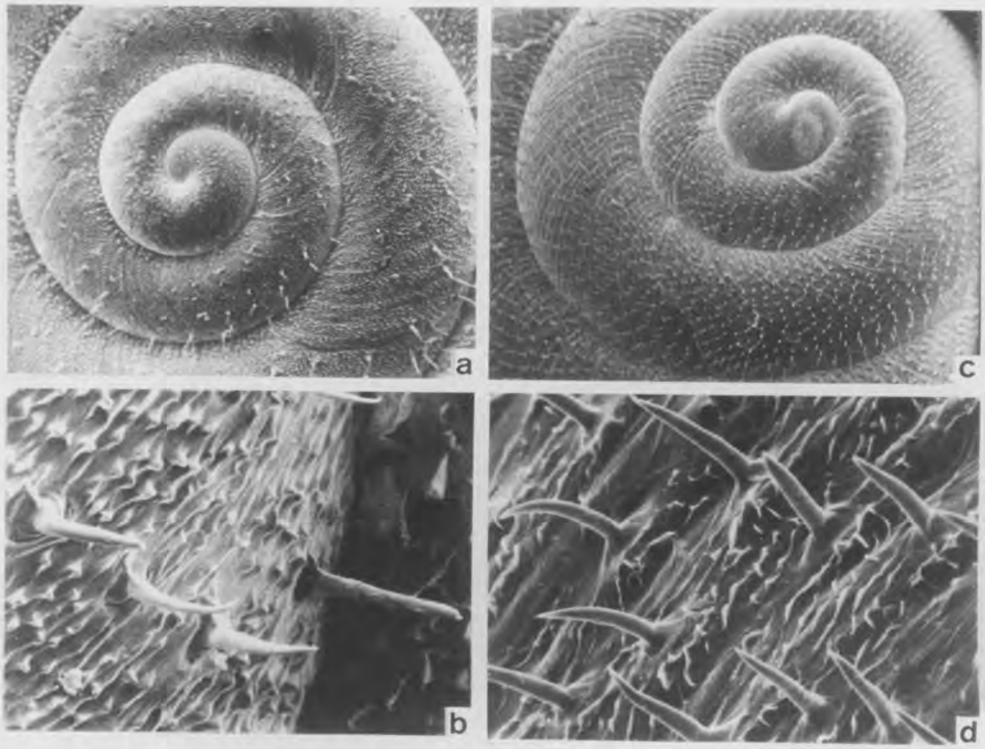


Plate 152: Shell sculpture of *Semotrachia euzyga* (Tate, 1894) and *S. caupona*: (a-b) *S. euzyga*. WA-129, Choritza Hill, Alice Springs, NT. FMNH 182689. a is apex and spire at 16.4X, b is setae on late spire at 16.2X; (c-d) *S. caupona*. WA-133, Temple Bar Gap, W MacDonnell Ranges, NT. FMNH 182502. c is apex and spire at 16.3X, d is setae on body whorl at 160X.

Diagnosis

Shell small, adult diameter 7.1-8.95 mm (mean 7.97 mm), whorls 3 1/2- to 4 1/4+ (mean 3 7/8-). Apex and spire slightly elevated (**Fig. 334b**), shell height 2.35-3.9 mm (mean 3.14 mm), H/D ratio 0.281-0.463 (mean 0.395). Body whorl (**Fig. 334b**) weakly shouldered, descending abruptly just behind lip. Apex (**Plate 152a**) with scattered pustules, spire and body whorl (**Plate 152a-b**) with widely spaced medium base setae and well developed micro ridging. Umbilicus (**Fig. 334c**) typical, width 1.9-3.5 mm (mean 2.57 mm), D/U ratio 2.44-4.06 (mean 3.24). Lip sharply reflected and modestly expanded, continuous across and free of parietal wall. Colour yellow-brown, lighter on base. Based on 112 measured adults.

Genitalia (**Figs 335a-d**) with variable length vagina (V), free oviduct (UV) short. Epiphallic caecum (EC) very large, tapering from wide base. Penis (P) very short. Walls of penis chamber with low longitudinal ridges. Verge (PV) wider than long, sperm groove very prominent.

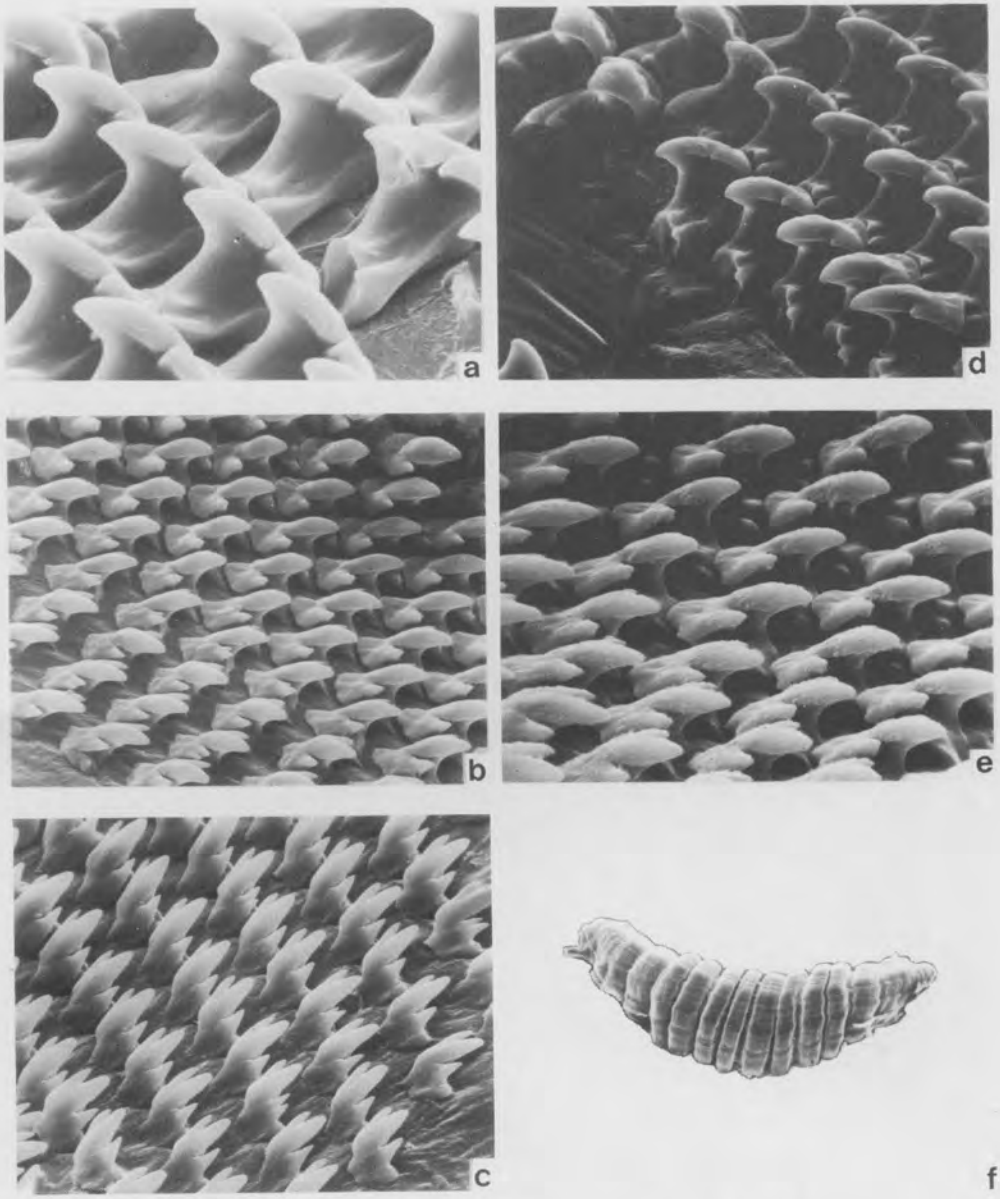


Plate 153: Radular teeth and jaw of *Semotrachia euzyga* (Tate, 1894) and *S. caupona*: (a-c) *S. euzyga*. WA-129, Choritza Hill, Alice Springs, NT. 17 March 1974. FMNH 182689. a is Dissection D, central and early lateral teeth at 1,325X, b is Dissection C, lateromarginal transition at 620X, c is Dissection C, mid-marginal teeth at 680X; (d-f) *S. caupona*. WA-133, Temple Bar Gap, W MacDonnell Ranges, NT. FMNH 182502, Dissection F. d is central and early laterals at 750X, e is lateromarginal transition at 880X, f is jaw at 74X.

Table 126: Local Variation in *Semotrachia euzyga* (Tate, 1894), *S. caupona, S. runutjirbana, S. filixiana* and *S. winneckeana* (Tate, 1894)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. euzyga (Tate, 1894)							
WA-128 FMNH 182693	34L	3.12±0.027 (2.85-3.4)	8.03±0.074 (7.25-8.9)	0.390±0.004 (0.329-0.434)	$3\frac{3}{4}$+ ($3\frac{5}{8}$+-$4\frac{1}{8}$-)	2.42±0.042 (1.9-3.05)	3.34±0.053 (2.67-4.06)
WA-128, FMNH 182693	16D	3.01±0.038 (2.8-3.4)	7.83±0.112 (7.25-8.95)	0.385±0.004 (0.357-0.412)	$3\frac{3}{4}$ ($3\frac{5}{8}$–-4-)	2.48±0.058 (2.15-2.95)	3.18±0.053 (2.80-3.47)
WA-129, FMNH 182689	31D&L	3.20±0.027 (2.9-3.5)	8.02±0.071 (7.2-8.9)	0.400±0.003 (0.368-0.441)	$3\frac{3}{4}$ ($3\frac{1}{2}$–-4+)	2.43±0.047 (2.0-3.5)	3.32±0.048 (2.53-4.01)
WA-451, FMNH 199682	15D	3.09±0.070 (2.35-3.45)	7.96±0.124 (7.1-8.5)	0.389±0.008 (0.281-0.434)	$4\frac{1}{8}$+ ($3\frac{3}{4}$+-$4\frac{1}{4}$+)	2.51±0.061 (2.1-2.8)	3.18±0.063 (2.81-3.8)
S. caupona							
WA-133, FMNH 182502a	47L	4.16±0.034 (3.5-4.65)	10.21±0.054 (9.55-10.85)	0.408±0.003 (0.362-0.455)	$4\frac{1}{4}$ (4+-$4\frac{3}{8}$+)	3.00±0.036 (2.3-3.5)	3.42±0.037 (3.00-4.47)
WA-133, FMNH 182502	22D	4.06±0.061 (3.65-4.9)	10.20±01.05 (9.1-11.2)	0.398±0.004 (0.371-0.451)	$4\frac{1}{4}$ (4+-$4\frac{3}{8}$+)	3.19±0.045 (2.8-3.6)	3.21±0.045 (2.69-3.55)
WA-437, FMNH 199677	64L	4.22±0.032 (3.8-4.9)	10.43±0.044 (9.6-11.2)	0.405±0.003 (0.374-0.480)	$4\frac{1}{4}$- ($4\frac{1}{8}$-$4\frac{1}{2}$-)	3.34±0.026 (3.0-3.9)	3.13±0.022 (2.70-3.60)

Table 126: Local Variation in *Semotrachia euzyga* (Tate, 1894), *S. caupona, S. runutjirbana, S. filixiana* and *S. winneckeana* (Tate, 1894) (Cont)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-437, FMNH 199675	9D	4.41±0.090 (4.0-4.8)	10.56±0.119 (10.2-11.2)	0.418±0.009 (0.391-0.466)	$4^{1}/_{4}$- ($4^{1}/_{8}$-$4^{1}/_{2}$-)	3.3±0.062 (3.1-3.7)	3.21±0.038 (3.01-3.36)
WA-755, FMNH 205509	18L	4.11±0.049 (3.75-4.4)	10.15±0.097 (9.3-10.95)	0.405±0.004 (0.382-0.440)	$4^{1}/_{4}$- ($4^{1}/_{8}$- -$4^{1}/_{4}$+)	3.19±0.051 (2.6-3.5)	3.19±0.044 (2.97-3.58)
WA-755, FMNH 205510	77D	4.14±0.062 (3.85-5.4)	10.24±0.042 (9.4-11.3)	0.404±0.006 (0.361-0.480)	$4^{1}/_{8}$+ (4+-$4^{3}/_{8}$-)	3.23±0.027 (2.6-3.8)	3.18±0.019 (2.79-3.61)
S. runutjirbana							
WA-756, FMNH 205513	16L	3.87±0.057 (3.6-4.35)	10.07±0.123 (8.6-10.7)	0.385±0.005 (0.356-0.417)	$4^{1}/_{4}$- 4–$4^{3}/_{8}$+)	3.35±0.076 (2.7-3.8)	3.02±0.056 (2.67-3.48)
Simpson Gap, K11723	27D	4.62±0.056 (4.2-5.1)	10.28±0.083 (8.9-11.1)	0.449±0.005 (0.413-0.490)	$4^{1}/_{4}$+ ($3^{7}/_{8}$-$4^{5}/_{8}$)	3.38±0.062 (2.55-3.8)	3.06±0.057 (2.69-4.10)
S. filixiana							
WA-438, FMNH 199678	39L	4.60±0.041 (4.15-5.45)	10.30±0.083 (9.2-11.5)	0.447±0.003 (0.413-0.493)	$4^{1}/_{4}$- ($3^{7}/_{8}$+-$4^{3}/_{8}$-)	2.95±0.033 (2.55-3.35)	3.50±0.032 (3.13-4.00)
S. winneckeana (Tate, 1894)							
WA-125, FMNH 182204	4D	2.33±0.042 (2.25-2.4)	6.13±0.151 (5.85-6.55)	0.381±0.015 (0.346-0.411)	$3^{5}/_{8}$+ ($3^{1}/_{2}$+-$3^{3}/_{4}$+)	2.33±0.125 (1.85-2.65)	2.84±0.145 (2.47-3.17)

Central and lateral teeth of radula (**Plate 153a**) with average anterior flare and cusp shaft angle, prominent ectocone, curved cusp tip, and typical basal plate. Latero-marginal transition abrupt and typical (**Plate 153b**). Outer marginal teeth (**Plate 153c**) typical. Jaw without unusual features.

Discussion

Semotrachia euzyga (Tate, 1894) has been confirmed from only two localities, Choritza Hill (WA-129) and the Alice Springs Telegraph Station National Park (WA-128). At the former station, the vagina (V) is much shorter than at the latter (**Figs 335a, d**), but otherwise the genitalia agree in structure. The populations are well isolated, and small in size. Thus the presence of such a difference is not surprising.

No shape or size differences were found (**Table 126**) between the two populations, and the difference in size between live and dead adults collected from the Telegraph Station population in 1974 is not statistically significant.

SEMOTRACHIA CAUPONA, SP. NOV.

(Plates 152c-d, 153d-f; Figs 334d-f, 336a-c)

Comparative remarks

Semotrachia caupona, sp. nov., from Temple Bar Gap, W MacDonnell Ranges, NT, is smaller than average (mean diameter 10.29 mm), with a slightly elevated spire (**Fig. 334e**, mean H/D ratio 0.405), average whorl count (mean 4 1/4+), typical umbilicus (**Fig. 334f**, mean D/U ratio 3.22), microsculpture of very dense medium base setae and some micro ridging (**Plate 152c-d**), and the parietal lip is continuous across and free of the parietal wall. *S. euzyga* (Tate, 1894), from Alice Springs, is much smaller (mean diameter 7.97 mm), with a reduced whorl count (mean 3 7/8-), and has more widely spaced setae and much stronger micro ridging (**Plate 152a-b**). Both *S. runutjirbana*, from Simpsons Gap, Runutjirba Range, and *S. filixiana*, from Fenn Gap West, MacDonnell Ranges are very similar in size and shape (**Table 123**), but differ in having much more widely spaced setae and projecting micropustules, plus considerable anatomical differences (see below). Both *S. jessieana* and *S. emilia*, from just E of Heavitree Gap in the MacDonnell Ranges, are larger, with a lower spire (**Table 123**), and have quite different anatomy. Anatomically, *S. caupona* (**Figs 336a-c**) has a medium length vagina (V), the epiphallic caecum (EC) is reduced to a vestage, the epiphallus (E) is shortened with altered penial retractor muscle (PR) insertion, the penis chamber walls have low longitudinal ridges, and the verge (PV) is elongate-oval in shape. *S. euzyga* (**Figs 335a-d**) has a very large, gradually tapering epiphallic caecum (EC), the verge is wider than long, and the penis is greatly shortened. *S. runutjirbana* (**Fig. 339a**) and *S. filixana* (**Fig. 340a**) both have very long and slightly tapering epiphallic caeca.

Holotype

AM C.135980, WA-133, under large patch of figs at SW corner of Temple Bar Gap (= Honeymoon Gap), MacDonnell Ranges, Northern Territory, Australia (Alice

Springs 1:250,000 map sheet SF 53-14 - 3720:7373yds). 23° 45' S, 133° 44' E. Collected by Alan Solem and Laurie Price 19 March 1974. Height of holotype 4.4 mm, diameter 10.3 mm, H/D ratio 0.427, whorls 4 1/4, umbilical width 3.45 mm, D/U ratio 2.99.

Paratopotypes

AM C., SAM D, WAM, QM, MV, FMNH 182502, 47 LA, 21 DA, 6 LJ, 5 DJ from the type collection.

Paratypes

Northern Territory

MACDONNELL RANGES: Temple Bar Gap (WA-437, WA-755, AM C.136021-3, SAM D18111-3, WAM 729.87, WAM 730.87, WAM 731.87, QM, MV, FMNH 199675, FMNH 199677, FMNH 205509-11, 82 LA, 88 DA, 44 LJ, 21 DJ; 26 April 1987, V. Kessner!, K 11714, many DA).

Range

All collections of *Semotrachia caupona*, sp. nov., have been made from a large patch of figs at the SW corner of Temple Bar (= Honeymoon) Gap, MacDonnell Ranges, W of Alice Springs, NT.

Diagnosis

Shell average in size, adult diameter 9.1-11.3 mm (mean 10.29 mm), whorls 4+ to 4 1/2- (mean 4 1/4-). Apex and spire slightly elevated (**Fig. 334e**), shell height 3.5-5.4 mm (mean 4.17 mm), H/D ratio 0.361-0.480 (mean 0.405). Body whorl (**Fig. 334e**) weakly shouldered, descending abruptly just behind lip. Apex (**Plate 152c**) with scattered pustules and ridgelets, spire and body whorl (**Plate 152c-d**) with very dense medium base setae and moderate micro ridging. Umbilicus (**Fig. 334f**) typical, width 2.3-3.9 mm (mean 3.21 mm), D/U ratio 2.69-4.47 (mean 3.22). Lip sharply reflected and narrowly expanded, continuous across and free of parietal wall. Shell yellow-brown, lighter on base. Based on 238 measured adults.

Genitalia (**Figs 336a-c**) with medium length vagina (V), free oviduct (UV) short. Epiphallic caecum (EC) a short remnant. Epiphallus (E) with head tapering, internally with simple pilasters, very short. Penial retractor muscle (PR) inserted just above penis apex. Walls of penis chamber with low, longitudinal folds. Verge (PV) elongate-ovate with typical sperm groove.

Central and lateral teeth of radula (**Plate 153d**) with large ectocone, massive basal plate support ridge, moderate anterior flare, average cusp shaft angle, moderate cusp tip curvature, and blunt cusp tip. Lateromarginal transition (**Plate 153e**) typical. Marginals and jaw (**Plate 153f**) without unusual features.

Discussion

Semotrachia caupona, sp. nov., has been collected only from under a large fig at the SW corner of Temple Bar Gap. The 1974 shells (WA-133, **Table 126**) are significantly smaller than those collected in 1977 (WA-437) and 1981 (WA-755). The differences between live and dead adults for each year are not statistically significant.

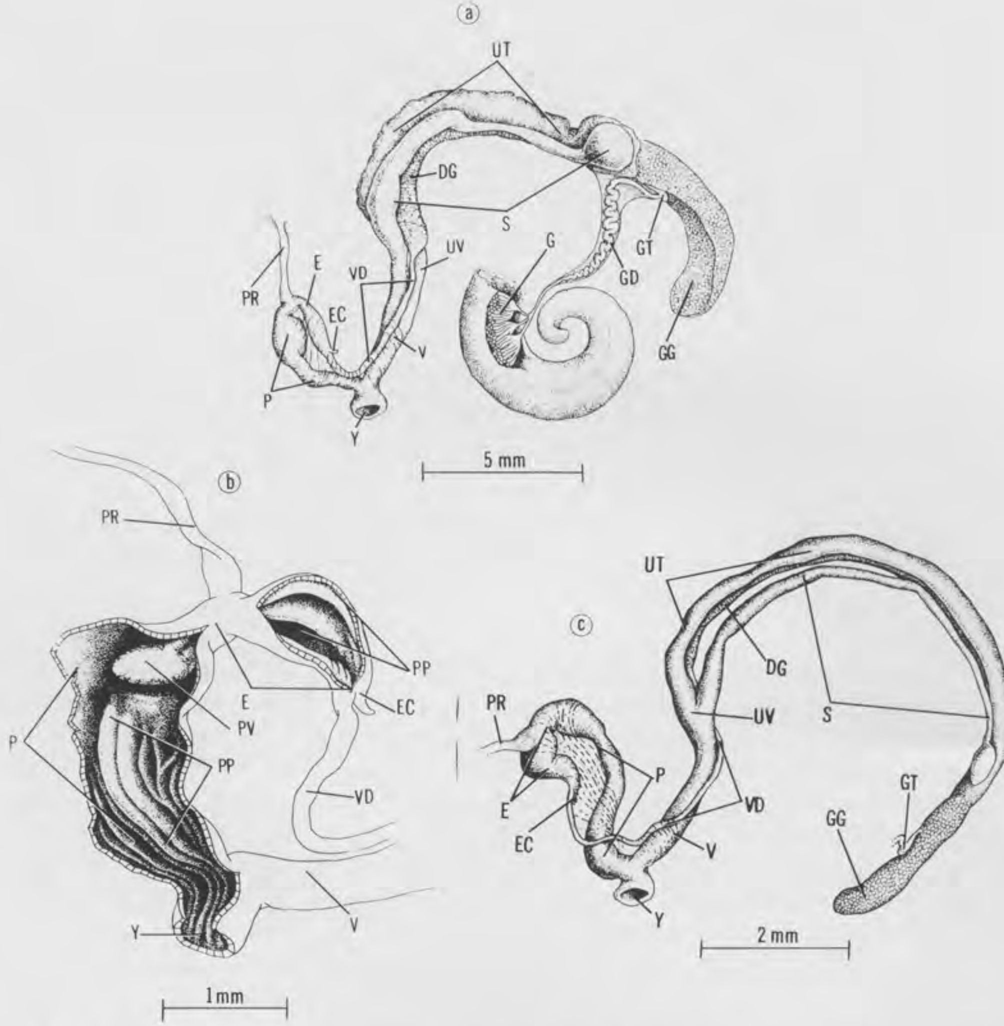


Fig. 336: Genitalia of *Semotrachia caupona*, sp. nov.: WA-133, Temple Bar Gap, MacDonnell Ranges, W of Alice Springs, NT. 19 March 1974. FMNH 182502. (a) is whole genitalia of full adult, Dissection D; (b) is interior of penis and epiphallus, Dissection D; (c) is whole genitalia of new adult, Dissection B. Scale lines as marked. Drawings by Elizabeth A. Liebman.

Semotrachia caupona is unusual anatomically in that the insertion of the penial retractor muscle (PR, **Fig. 336c**) is now just above the penis apex. Normally it inserts along the mid-portion of the epiphallus (E), but the drastic shortening of that organ in *S. caupona* has resulted in a changed position.

The name *caupona*, from the latin for bar or tavern, celebrates the change in name of the type locality and addition of a different "bar" to the scenery.

SEMOTRACHIA RUNUTJIRBANA, SP. NOV.
(Plates 154a-b, 155a-b; Figs 338a-c, 339a-b)

Comparative remarks

Semotrachia runutjirbana, sp. nov., from Simpsons Gap, Runutjirba Range, NT, is smaller than average (mean diameter 10.25 mm), with a moderately elevated spire (**Fig. 338b**, mean H/D ratio 0.423), typical whorl count (mean 4 1/4+), wide umbilicus (**Fig. 338c**, mean D/U ratio 3.05), microsculpture of rather widely spaced setae and micro-pustules (**Plate 154b**), and the parietal lip is elevated from the parietal wall (**Fig. 338b**). Both *S. caupona* from Honeymoon Gap to the S and *S. filixiana* from Fenn Gap West to the SW are nearly identical in size, but differ (**Table 123**) in degree of spire elevation, umbilical size, and details of sculpture (**Plate 152c-d, 154c-d**). *S. bensteadana*, from Undoolya Gap to Mt. Benstead Creek, E MacDonnell Ranges, is slightly smaller in size (**Table 123**), but otherwise shows only minor sculptural differences (**Plate 148d-f**). Anatomically, *S. runutjirbana* (**Figs 339a-b**) differs most obviously in having the epiphallic caecum (EC) greatly enlarged and longer than the epiphallus (E), reduced penis chamber wall sculpture, and a long, nearly cylindrical verge (PV). *S. felixiana* (**Figs 340a-c**) has a much shorter epiphallic caecum and verge. In *S. caupona* (**Fig. 336a**), *S. emilia* (**Fig. 332d**), and *S. jessieana* (**Fig. 332a**) the epiphallic caecum is reduced to a tiny nub, while in *S. bensteadana* the epiphallic caecum is completely lost. Many other structures differ, but this is the most obvious feature distinguishing these taxa.

Holotype

AM C.135981, WA-756, on rocks, W side of Simpsons Gap, Runutjirba Range, W of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 3690:7381yds). 23° 40' 50" S, 133° 42' 51" E. Collected by Alan Solem and Phil Colman 25 April 1981. Height of holotype 4.2 mm, diameter 10.45 mm, H/D ratio 0.410, whorls 4 1/4-, umbilical width 3.7 mm, D/U ratio 2.82.

Paratopotypes

AM C.136024, SAM D18114, WAM 732.87, FMNH 205513, 16 LA, 7 LJ from the type locality.

Paratypes

Northern Territory

RUNUTJIRBA RANGE: Simpsons Gap (FMNH 198827, FMNH 198980, 2 DA, 12 DJ; SW corner, 26 April 1987, V. Kessner!, K 11723, 27 DA, 1 DJ).

Range

Semotrachia runutjirbana, sp nov., has been collected only in Simpsons Gap, Runutjirba Range, W of Alice Springs, NT.

Diagnosis

Shell average in size, adult diameter 8.6-11.75 mm (mean 10.25 mm), whorls 3 7/8 to 4 5/8 (mean 4 1/4+). Apex and spire moderately elevated (**Fig. 338b**), shell height 3.5-5.4 mm (mean 4.17 mm), H/D ratio 0.361-0.480 (mean 0.405). Body whorl (**Fig.**

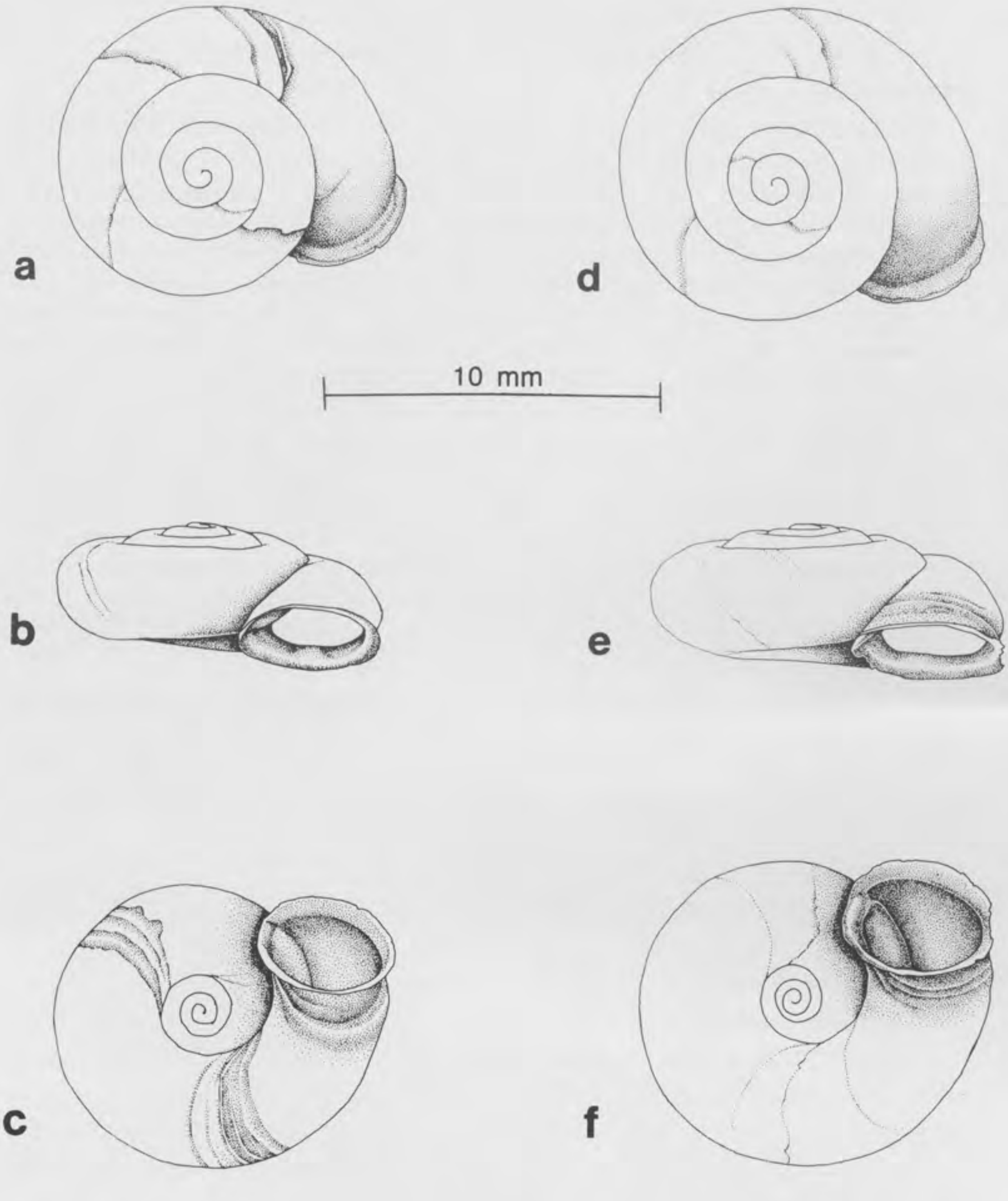


Fig. 338: Shells of *Semotrachia runutjirbana*, sp. nov., and *S. filixana*, sp. nov.: (a-c) Holotype of *S. runutjirbana*. WA-756, Simpsons Gap, Runutjirba Range, W of Alice Springs, NT. AM C.135981; (d-f) Holotype of *S. filixana*. WA-438, Fenn Gap West, W MacDonnell Ranges, NT. AM C.135982. Scale line equals 10 mm. Drawings by Linnea Lahlum.

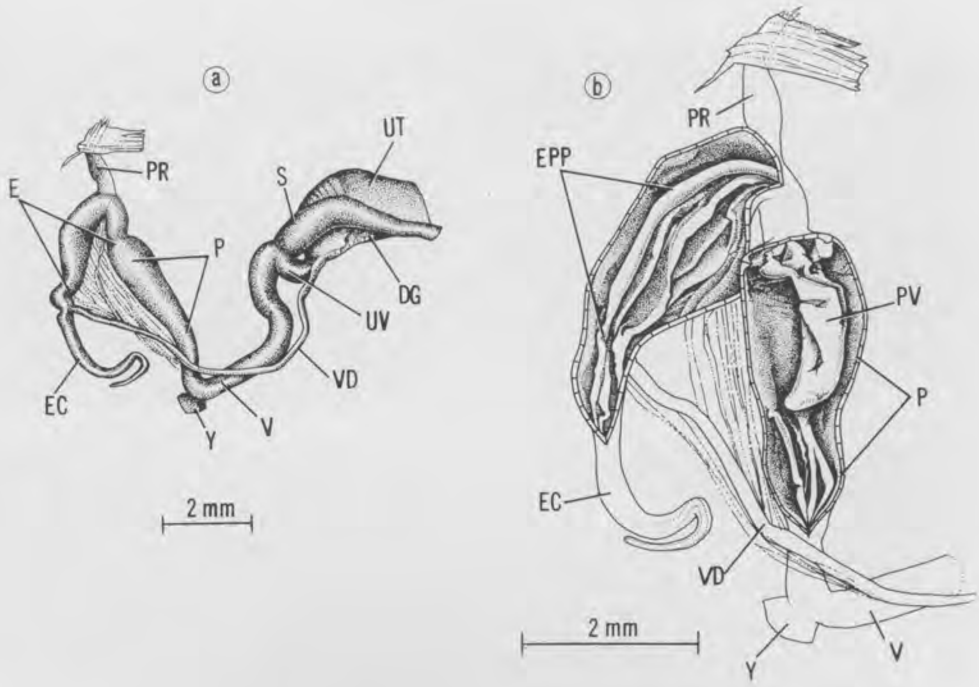


Fig. 339: Genitalia of *Semotrachia runutjirbana*, sp. nov.: WA-756, Simpsons Gap, Runutjirbana Range, W of Alice Springs, NT. FMNH 205513. (a) whole genitalia, Dissection A; (b) interior of epiphallus and penis, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

338b) rounded to weakly shouldered, deflected abruptly just behind lip. Apex (**Plate 154a**) eroded in available material, spire and body whorl (**Plate 154b**) with widely spaced short base setae and micro pustules. Umbilicus (**Fig. 338c**) wide, last whorl decoiling much more rapidly, width 2.55-3.9 mm (mean 3.37), D/U ratio 2.67-4.10 (mean 3.05). Lip sharply reflected and moderately expanded, narrowly free of parietal wall but less expanded there. Shell yellow-brown, lighter on base. Based on 45 measured adults.

Genitalia (**Figs 339a-b**) with medium length to long vagina (V), free oviduct (UV) short. Epiphallic caecum (EC) longer then epiphallus (E), only slightly tapering. Epiphallus (E) with simple internal pilasters, slightly shorter than penis (P). Walls of penis chamber with a few simple ridges. Verge (PV) more than half length of penis, subcylindrical, with prominent sperm groove.

Central and lateral teeth of radula (**Plate 155a**) with prominent anterior flare, massive basal support ridge, average cusp shaft angle, large ectocone, and moderate cusp tip curvature. Laterals and marginals typical. Jaw (**Plate 155b**) without unusual features.

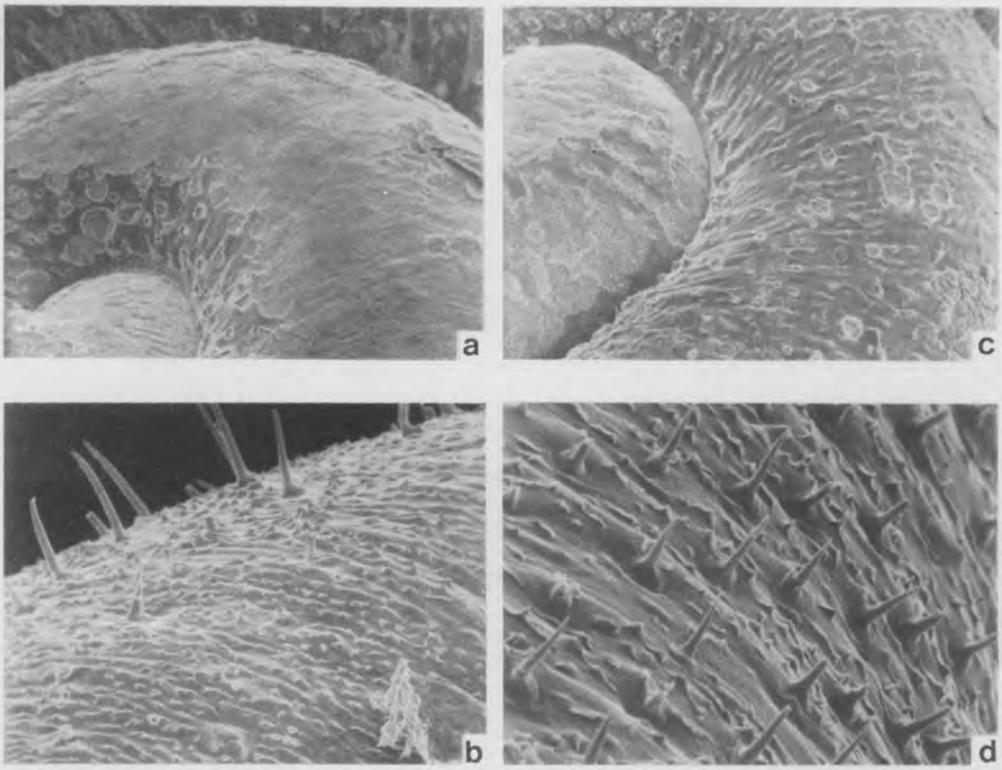


Plate 154: Shell sculpture of *Semotrachia runutjirbana* and *S. filixiana*: (a-b) *S. runutjirbana*. WA-756, Simpsons Gap, Runutjirba Ranges, W of Alice Springs, NT. FMNH 205513. a is apex at 84X, b is setae on body whorl at 52X; (c-d) *S. filixiana*. WA-438, Fenn Gap West, W MacDonnell Ranges, NT. FMNH 199678. c is apex and early spire at 75X, d is setae on body whorl at 83X.

Discussion

Semotrachia runutjirbana, sp. nov., has proportionately the largest epiphallic caecum (EC, **Fig. 339a**) of any known Australian species of Pleurodontinae. *S. filixiana* (**Fig. 340a**) and *S. elleryi* (**Fig. 344a**) also have this structure enlarged, but not to the same extent.

The recorded difference in shell height and H/D ratio between the two samples listed in **Table 126** probably are artifacts of measuring technique, with K 11723 measured by a different person than the rest of *Semotrachia* samples.

The name *runutjirbana* is taken from the aboriginal name for the range of hills in which this species lives.

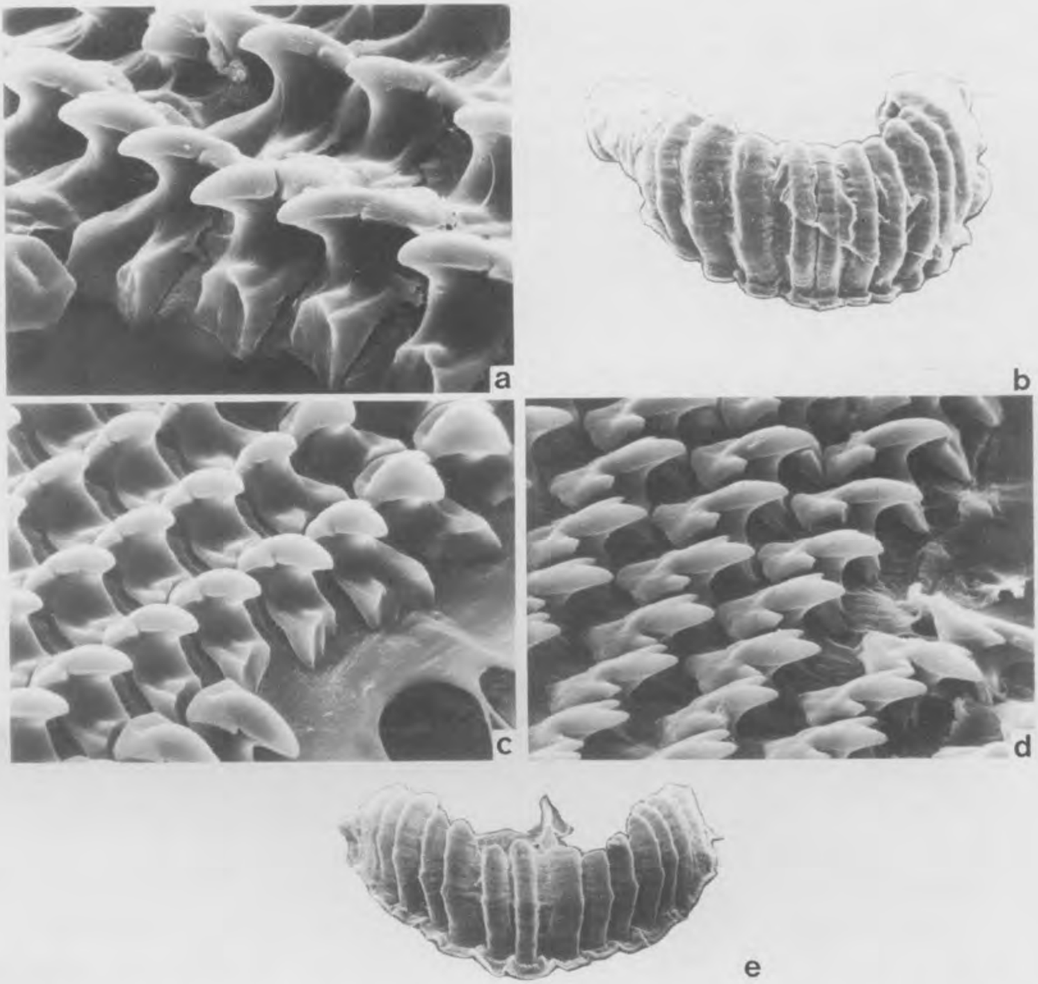


Plate 155: Radular teeth and jaw of *Semotrachia runutjirbana* and *S. filixiana*: (a-b) *S. runutjirbana*. WA-756, Simpsons Gap, Runutjirba Ranges, W of Alice Springs, NT. 25 April 1981. FMNH 205513, Dissection A. a is central and early laterals at 1,125X, b is jaw at 105X; (c-e) *S. filixiana*. WA-438, Fenn Gap West, W MacDonnell Ranges, NT. 22 May 1977. FMNH 199678, Dissection B. c is central and early laterals at 750X, d is lateromarginal transition at 760X, e is jaw at 79X.

SEMOTRACHIA FILIXIANA, SP. NOV.
(Plates 154c-d, 155c-e; Figs 338d-f, 340a-c)

Comparative remarks

Semotrachia filixiana, sp. nov., from Fenn Pass West, W MacDonnell Ranges, NT, is a medium sized species (mean diameter 10.30 mm), with moderately elevated spire

(**Fig. 338e**, mean H/D ratio 0.447), normal whorl count (mean 4 1/4-), slightly narrowed umbilicus (**Fig. 338f**, mean D/U ratio 3.50), microsculpture (**Plate 154d**) of closely spaced medium base setae with moderate micro ridging, and the parietal lip free of the parietal wall (**Fig. 338e**). *S. runutjirbana* from Simpsons Gap and *S. caupona* from Temple Bar Gap, MacDonnell Ranges are identical in size (**Table 123**), but differ in spire height (**Figs 334e, 338b**) and details of shell sculpture (**Plate 152c-d, 154b**). Other species differ in size and sculpture. Most of the differences are found in the terminal genitalia. Anatomically, *S. filixiana* (**Figs 340a-c**) has a medium length vagina (V), the epiphallic caecum (EC) is long, gradually tapering, and about half the length of the epiphallus, the penis chamber wall sculpture is complex, and the verge (PV) is short and subcylindrical. *S. elleryi* (**Fig. 344a**) has a long vagina (V), larger epiphallic caecum (EC), partly rugose penis chamber wall sculpture, and a smaller verge (PV). *S. runutjirbana* (**Figs 339a-b**) has an even longer epiphallic caecum (EC) and much larger verge. All other *Semotrachia* have the epiphallic caecum much smaller.

Holotype

AM C.135982, WA-438, Fenn Gap West, MacDonnell Ranges, W of Alice Springs, Northern Territory, Australia (Alice Springs 1:250,000 map sheet SF 53-14 - 1335:0321yds). 23° 48' 10" S, 133° 36' 40" E. Collected by Alan Solem, Laurel Keller, Fred and Jan Aslin, Brian J. Smith 22 May 1977. Height of holotype 4.7 mm, diameter 11.2 mm, H/D ratio 0.420, whorls 4 1/2, umbilical width 3.5 mm, D/U ratio 3.20.

Paratopotypes

AM C.136025, SAM D18115, WAM 733.87, QM, MV, FMNH 199678, 38 LA, 7 LJ from the type locality.

Range

Semotrachia filixiana, sp. nov., has been collected only once, at Fenn Gap West, MacDonnell Ranges, W of Alice Springs, NT.

Diagnosis

Shell medium in size, adult diameter 9.2-11.5 mm (mean 10.30 mm), whorls 3 7/8+ to 4 3/8- (mean 4 1/4-). Apex and spire moderately elevated (**Fig. 338e**), shell height 4.15-5.45 mm (mean 4.60 mm), H/D ratio 0.413-0.493 (mean 0.447). Body whorl (**Fig. 338e**) weakly shouldered to rounded, descending abruptly just behind lip. Apex (**Plate 154c**) typical, spire and body whorl (**Plate 154d**) with closely spaced medium base setae and moderate micro ridging. Umbilicus (**Fig. 338f**) slightly narrowed, width 2.55-3.35 mm (mean 2.95 mm), D/U ratio 3.13-4.00 (mean 3.50). Lip sharply reflected, modestly expanded, well free of parietal wall. Shell yellow-brown, lighter on base. Based on 39 measured adults.

Genitalia (**Figs 340a-c**) with medium length vagina (V) and short free oviduct (UV). Epiphallic caecum (EC) long and gradually tapering, about half length of epiphallus (E). Penial retractor muscle (PR) inserts on epiphallus (E) well above penis apex. Penis (P) relatively short, verge (PV) short, subcylindrical, with prominent sperm groove.

Central and lateral teeth of radula (**Plate 155c**) with small anterior flare, typical cusp shaft angle, strongly curved cusp tip, large ectocone, and massive basal support

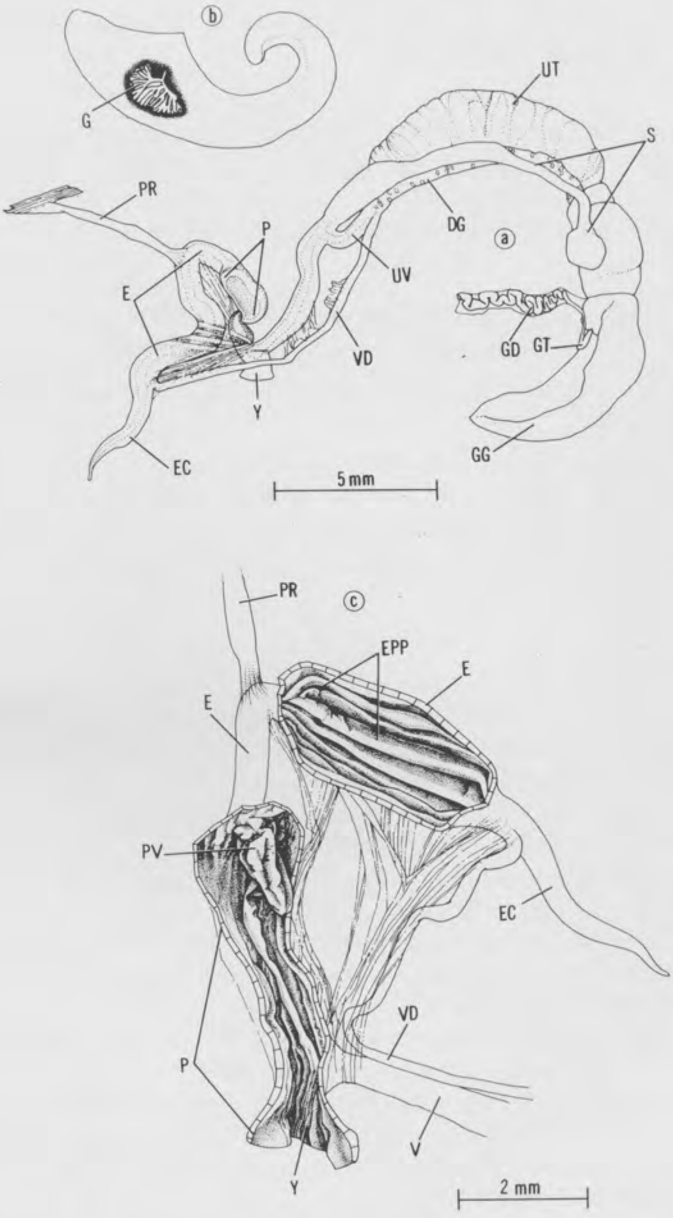


Fig. 340: Genitalia of *Semotrachia filixana*, sp. nov.: WA-438, Fenn Gap West, W MacDonnell Ranges, NT. 22 May 1977. FMNH 199678. (a) whole genitalia, Dissection B; (b) part of ovotestis, Dissection B; (c) interior of epiphallus and penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

ridge. Late laterals (**Plate 155d**) with enlarged anterior flare and ectocone, reduced cusp shaft angle and cusp curvature. Lateromarginal transition (**Plate 155d**) abrupt and typical. Jaw (**Plate 155e**) typical.

Discussion

A sweat and dirt smudged field map led me to interpret the name of the locality mistakenly as "Fern Gap West". The name *filixiana*, from the Latin for a fern, was chosen before a last minute unsmudged map check revealed my error. It has been retained to point out the need to continually check for errors.

SEMOTRACHIA WINNECKEANA (TATE, 1894)
(Plates 156a-e, 157a-b; Figs 341a-f, 342a-b)

Hadra winneckeana Tate, 1894, Trans. Royal Soc. South Austr., **17**: 194 - Central Australia.

Angasella winneckeana (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 191, pl. XVIII, figs 8a-c - Spencer Gorge by Brinkley Bluff, Central Australia.

Semotrachia winneckeana (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 37; Iredale, 1938, Austr. Zool., **9** (2): 90 - check list citation; Richardson, 1985, Tryonia, **12**: 275 - check list citation.

Comparative remarks

Semotrachia winneckeana (Tate, 1894), collected at Spencer Gorge, Chewings Range and Ellery Creek Big Hole, Heavitree Range, is very small in size (mean diameter 5.99 mm), with flat to at most slightly elevated spire (**Figs 341b, e**, mean H/D ratio 0.392), reduced whorl count (mean 3 3/4-), microsculpture (**Plate 156b-c, e**) of a few short base setae and projecting pustules, with parietal wall having only a thin callus (Ellery Creek Big Hole, **Figs 341e-f**) or lip continuous and free of parietal wall (Chewings Range, **Figs 341b-c**). The only two species of similar size, *S. minuta* from near Ernabella, Musgrave Ranges and *S. illbilleeana* from Mt. Illbillee, Everard Ranges, show obvious differences. *S. minuta* is smaller (mean diameter 5.41 mm) with fewer whorls (mean 3 1/2), has diagonally ridged apical sculpture and radial rugose spire sculpture (**Plate 164a-b**), plus the parietal lip is always continuous and free of the parietal wall (**Fig. 352b**). *S. illbilleeana* is noticably larger (mean diameter 6.49 mm) at the same whorl count (mean 3 5/8), has very dense, spatulate setae (**Plate 164e**), and the parietal lip is appressed to the parietal wall (**Figs 352e-f**). *S. jinkana* and *S. huckittana* from the Dulcie Range, NE of Alice Springs, average more than 8 mm in diameter and have different shell sculpture (**Plate 142**), while *S. illarana* from Tempe Downs Station, James Range, averages 7.69 mm in diameter and has very dense long base setae (**Plate 160e**). Anatomically, *S. winneckeana* (**Figs 342a-b**) has the most distinctive anatomy of any *Semotrachia*: the very short vagina (V), very small epiphallic flagellum (EF), and extremely long and slender verge (PV) with the sperm groove restricted to near its apex, are joined by a unique feature, the mass of fibers binding the epiphallus to the lower penis chamber. The latter feature immediately separates *S. winneckeana* from all other known species.

Holotype

SAM D13595, Spencer Gorge by Brinkley Bluff, Chewings Range, Northern Territory, Australia. 23° 43' S, 133° 18' E. Collected by the Horn Expedition in 1891. Height of holotype 2.45 mm, diameter 6.0 mm, H/D ratio 0.408, whorls 3 1/2+, umbilical width 1.8 mm, D/U ratio 3.33.

Paratopotypes

SAM D15573, FMNH 88251, 4 DA from the type collection.

Material studied

Northern Territory

HEAVITREE RANGE: Ellery Creek Big Hole (WA-125, WA-757, under figs on E side of gorge, FMNH 182204, FMNH 182722, AM C.136026, SAM D18116, WAM 734.87, FMNH 182371, FMNH 205514-5, 7 DA, 20 LA, 2 DJ; K 11711, 30 DA, 4 DJ).

Range

Semotrachia winneckeana (Tate, 1894) was described from Spencer Gorge, Chewings Range in the upper Hugh River drainage. The only other material assigned here is from Ellery Creek Big Hole, Heavitree Range (23° 47' 11" S, 133° 03' 48" E) which lies in the mid-drainage of Ellery Creek, a tributary of the Finke River. The two localities are about 28 air km apart. At the latter station it is microsympatric with *S. elleryi*, sp. nov.

Diagnosis

Shell very small, adult diameter 5.4-6.6 mm (mean 5.99 mm), whorls 3 3/8 to 3 7/8- (mean 3 3/4-). Apex flat or at most slightly elevated (**Figs 341b, e**), shell height 2.2-2.45 mm (mean 2.34 mm), H/D ratio 0.346-0.444 (mean 0.392). Body whorl (**Figs 341b, e**) weakly shouldered, descending gradually to moderately on last part of body whorl. Apex (**Plate 156a, d**) with dense pustules and weak ridges, spire and body whorl (**Plate 156a-e**) with a few short base setae and prominent micropustulations. Umbilicus (**Figs 341c, f**) wide, last whorl decoiling more rapidly, width 1.5-2.65 mm (mean 2.10 mm), D/U ratio 2.42-3.60 (mean 2.90). Lip sharply reflected and moderately expanded, reduced to a thin callus on parietal wall (Ellery Creek Big Hole) or continuous and free of parietal wall (Chewings Range, **Figs 431b-c, e-f**). Shell dark yellow-brown, base lighter. Based on 12 measured adults.

Genitalia (**Figs 342a-b**) with very short vagina (V) and free oviduct (UV). Epiphallic caecum (EC) short, finger-shaped. Epiphallus (E) slender, much shorter than penis (P), short penial retractor muscle (PR) inserting one-third distance from penis apex. Epiphallus tightly bound to penis by a row of heavy fibers. Penis chamber wall sculpture of simple longitudinal ridges. Verge (PV) very long, cylindrical, not tapering, sperm groove confined to upper quarter.

Central and lateral teeth of radula (**Plate 157a**) with anterior flare greatly reduced to absent, shortened basal plate, average cusp shaft angle, strongly curved cusp tip, and very prominent ectocone. Outermost laterals (**Plate 157b**) with enlarged ectocone but

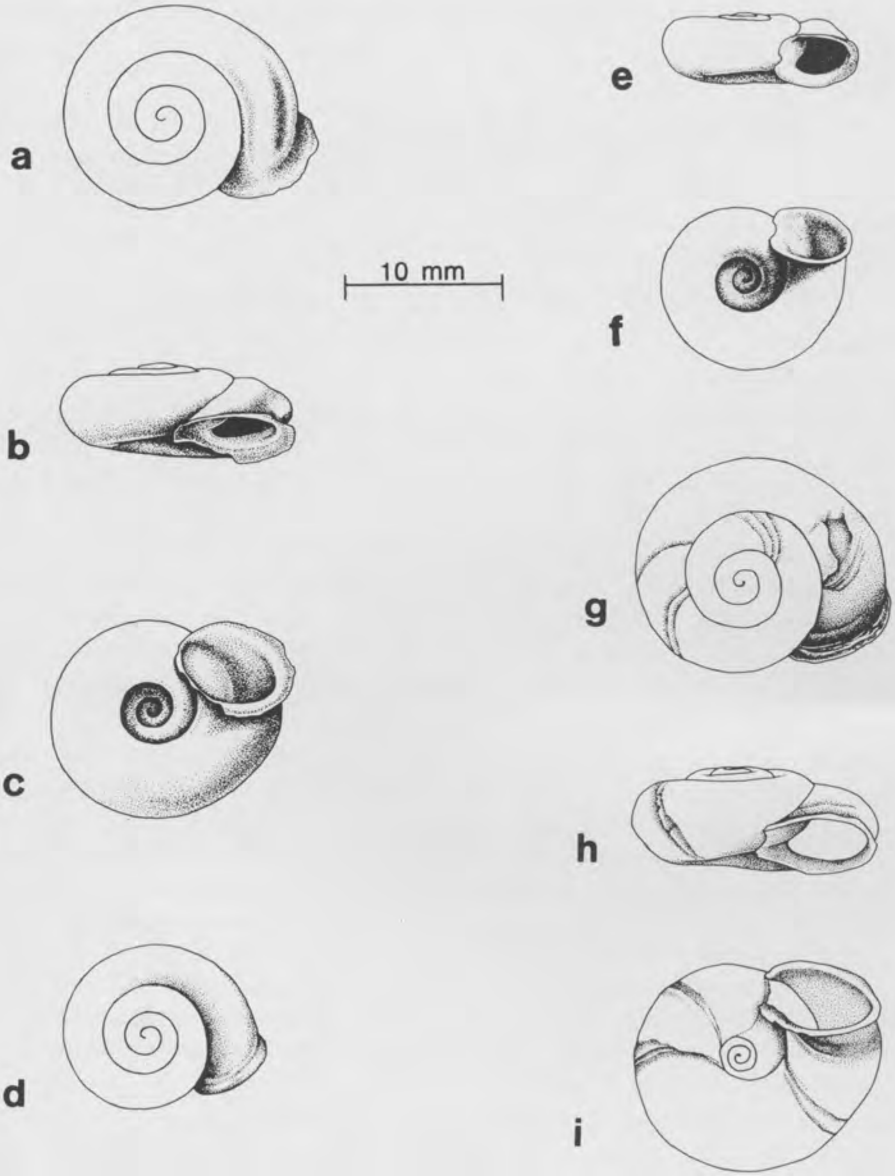


Fig. 341: Shells of *Semotrachia winneckeana* (Tate, 1894) and *S. illarana*, sp. nov.: (a-c) Paratype of *Hadra winneckeana* Tate, 1894. Spencer Gorge by Brinkley Bluff, Chewings Range, NT. MV F26900; (d-f) *Semotrachia winneckeana* (Tate, 1894). WA-125, Ellery Big Hole, MacDonnell Ranges, NT. FMNH 182204; (g-i) Holotype of *S. illarana*. Illarra Waterhole, NW of Tempe Downs homestead, S of James Range, NT. AM C.135984. Scale lines as marked. Drawing by Elizabeth A. Liebman (a-f) and Linnea Lahlum (g-i).

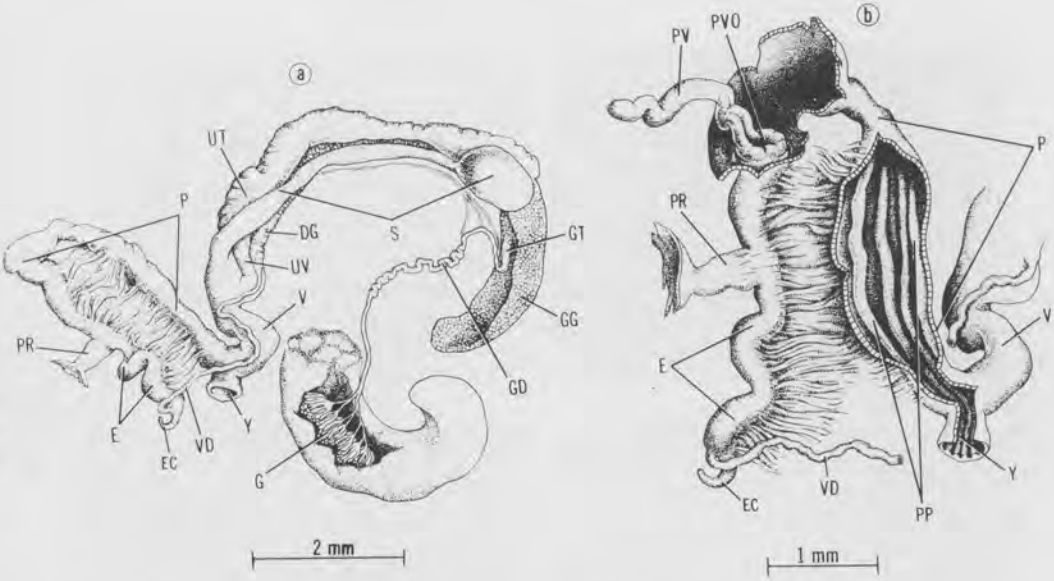


Fig. 342: Genitalia of *Semotrachia winneckeana* (Tate, 1894): WA-125, Ellery Big Hole, Heavitree Range, NT. 16 March 1974. FMNH 182204. (a) whole genitalia, Dissection A; (b) interior of epiphallus and penis, Dissection B. Scale lines as marked. Drawings by Elizabeth A. Liebman.

almost no anterior flare, retaining strong cusp tip curvature. Lateromarginal transition (**Plate 157b**) abrupt. Jaw without unusual features.

Discussion

The types of *Hadra winneckeana* have the parietal lip free and continuous. There sometimes is a low recessed basal ridge, very similar to that found in *Dirutrachia sublevata* (Tate, 1894) (**Fig. 361b**), but deeper and lower. It is most prominent in the holotype, weak in one paratype, absent in the other paratypes. The Ellery Creek Big Hole examples have the parietal lip reduced to a thin callus (**Figs 341e-f**). Shell size, shape, and microsculpture (**Plate 156**) of the few known specimens are very similar, and thus they are united under this name. I will not be in the least surprised if dissection of the Spencer Gorge population reveals that they are distinct species.

The Ellery Creek Big Hole examples of *Semotrachia winneckeana* (Tate, 1894) have a very distinctive genital structure (**Figs 342a-b**), with the fibers binding the epiphallus (E) to the penis (P) representing a new structure in the Red Centre Pleurodontinae. Live material of the Spencer Gorge populations has not been recollected. Its genital structure, and thus identity, remains to be determined.

Some recently collected (26 April 1987) dead shells from Standley Chasm (23° 43' S, 133° 28' E), about 14 km E of Spencer Gorge agree in size and shell lip. They may indicate either a range extension or represent yet another species.

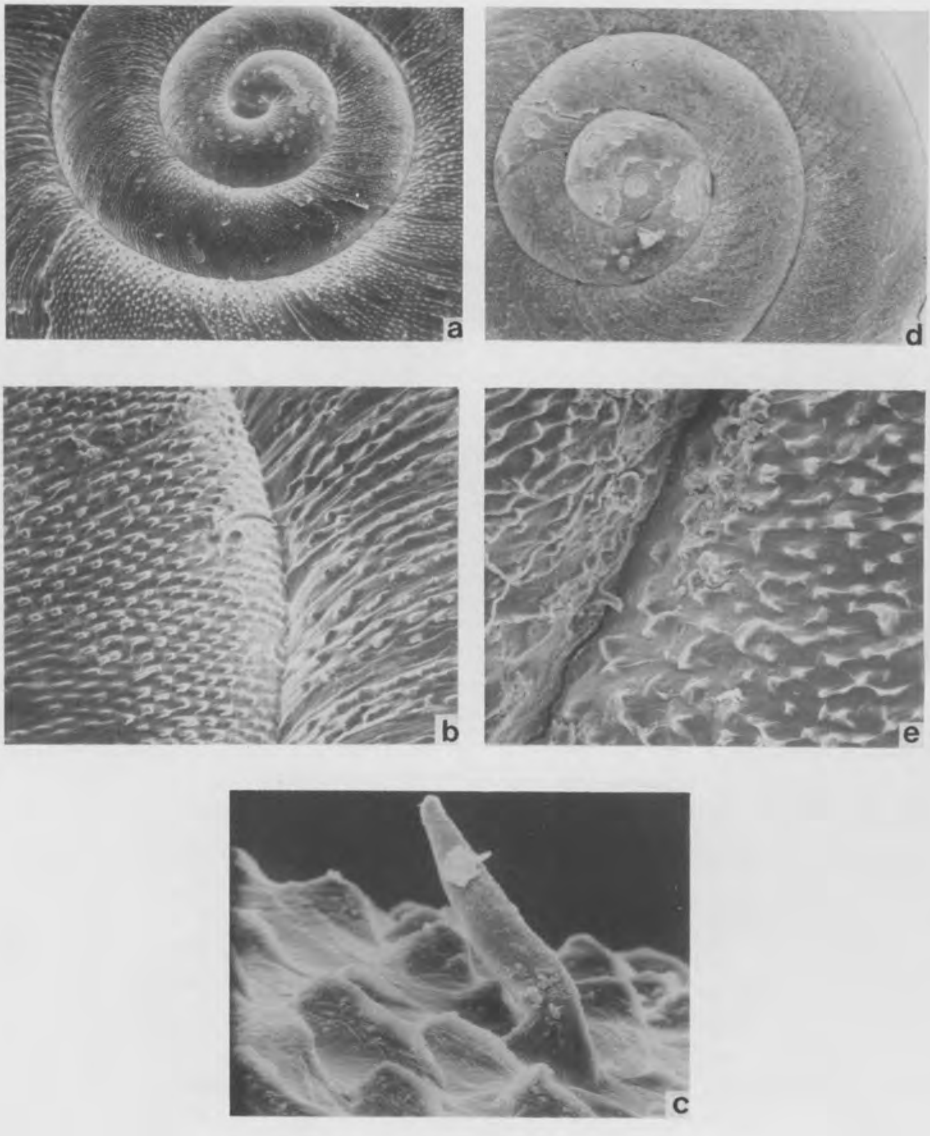


Plate 156: Shell sculpture of *Semotrachia winneckeana* (Tate, 1894): (a-b) WA-757, Ellery Creek Big Hole, Heavitree Range, W of Alice Springs, NT. FMNH 205514. a is apex and spire at 20.1X, b is microsculpture and seta on lower spire at 76X; (c) WA-125, Ellery Creek Big Hole, Heavitree Range, NT. FMNH 182204. Seta and microsculpture on body whorl at 345X; (d-e) Central Australia. Type lot. FMNH 88255. d is top of shell at 15.9X, e is microsculpture on lower spire and body whorl at 160X.

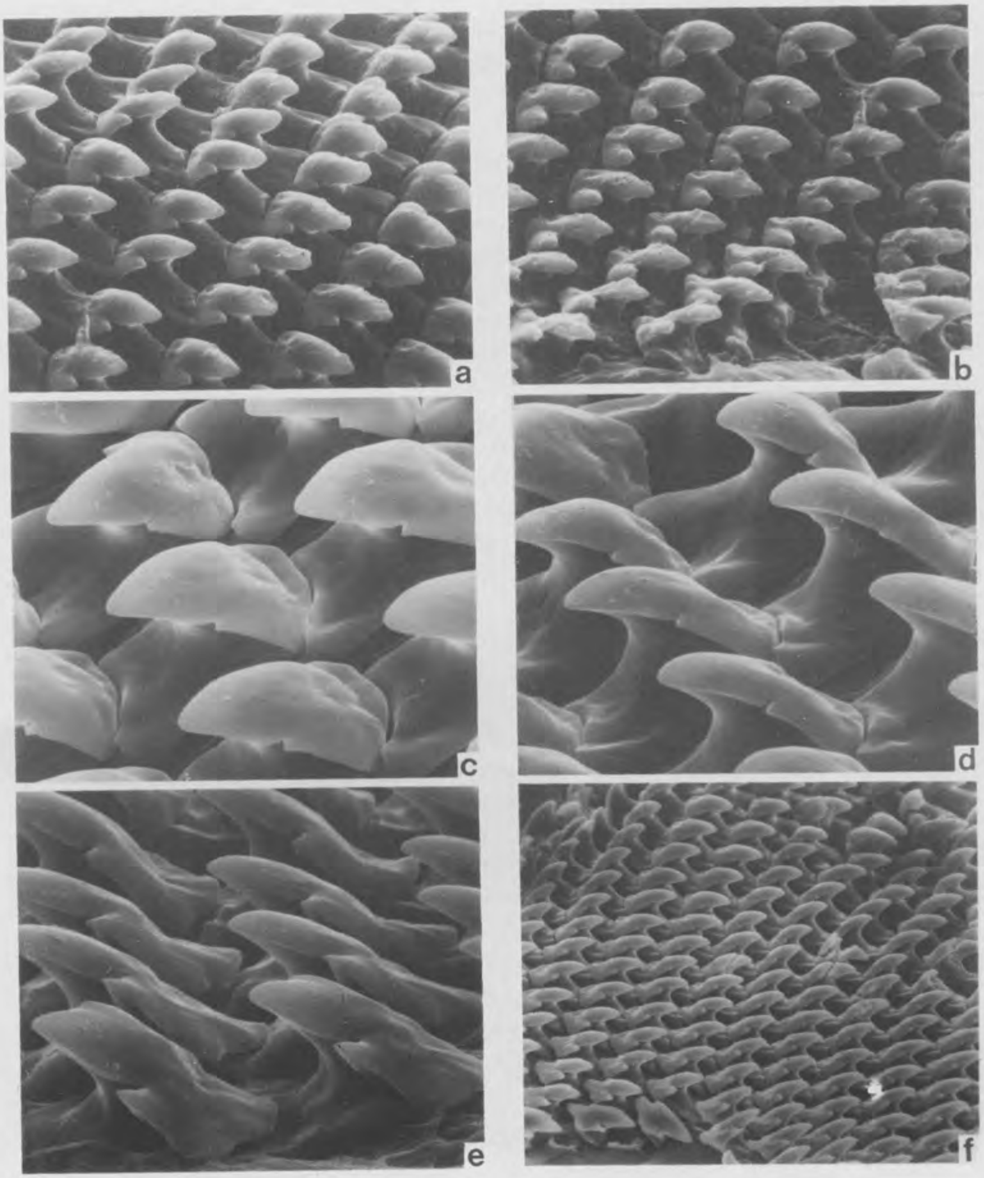


Plate 157: Radular teeth and jaw of *Semotrachia winneckeana* (Tate, 1894) and *S. elleryi*: (a-b) *S. winneckeana*. WA-125, Ellery Creek Big Hole, Heavitree Range, NT. 16 March 1974. FMNH 182204, Dissection A. a. is central and laterals at 840X, b is lateromarginal transition at 850X; (c-e) *S. elleryi*. WA-125, Ellery Creek Big Hole, Heavitree Range, NT. FMNH 182644, Dissection E. c is central and early laterals from higher angle at 1,350X, d is central and early laterals from normal viewing angle at 1,400X, e is lateromarginal transition in side view at 1,400X; (f) *S. elleryi*. WA-125, Ellery Creek Big Hole, Heavitree Range, NT. 16 March 1974. FMNH 182644, Dissection D. Entire lateral field at 345X.

SEMOTRACHIA ELLERYI, SP. NOV.
(Plates 157c-e, 158a-c; Figs 343a-c, 344a-c)

Comparative remarks

Semotrachia elleryi, sp. nov., from the basin of Ellery Creek between Serpentine Gorge in the Heavitree Range and the Finke River-Ellery Creek junction in the Krichauff Range, NT, is a medium sized species (mean diameter 11.41 mm), with slightly to moderately elevated spire (**Fig. 343b**, mean H/D ratio 0.432), normal whorl count (mean 4 3/8), typical umbilicus (**Fig. 343c**, mean D/U ratio 3.36), microsculpture (**Plate 158a-c**) of rather widely spaced long base setae and micro ridging, parietal lip normally free of wall (**Figs 343b-c**), sometimes almost appressed to it. The Krichauff Range *S. esau* Iredale, 1937 is slightly larger (mean diameter 11.92 mm), with a much more elevated spire (**Fig. 343e**, mean H/D ratio 0.526), increased whorl count (mean 4 3/4), narrower umbilicus (**Fig. 343f**, mean D/U ratio 3.87), microsculpture (**Plate 158d-f**) of much more crowded, smaller medium base setae, and the parietal lip varies from a thick callus to barely free of parietal wall. *S. hughana*, from fringes of the James Range, is slightly smaller (mean diameter 11.07 mm), and has a microsculpture (**Plate 161b-c**) of even more widely spaced short base setae. *S. bagoti*, from the George Gill Range, is a little smaller (mean diameter 11.16 mm), much more elevated (**Fig. 349e**, mean H/D ratio 0.506), and has a microsculpture (**Plate 163b-c**) of very crowded setae with massive bases. Of the MacDonnell Range species (**Table 123**), only *S. rossana*, from the Ross River, comes close in size and shape, but differs in its microsculpture (**Plate 148b-c**) of very dense setae and reduced micro ridging. Anatomically, *S. elleryi* (**Figs 344a-c**) has a long vagina (V), large epiphallic caecum (EC) that tapers apically, slender penis(P), penis chamber walls with corrugated ridges below, simple longitudinal ridges above, and verge (PV) short with prominent sperm groove. *S. esau* (**Figs 345a-c, 346**) has a much smaller epiphallic caecum, there is corrugated wall sculpture in the upper portion of the penis chamber, and the verge is large, wider, with a heavily wrinkled surface and a rather small sperm groove. *S. hughana* (**Figs 350a-b**) has a short vagina, medium length epiphallic caecum, simple penis chamber wall sculpture, and a medium sized, cylindrical verge with only weak wrinkling on the surface. Both *S. runutjirbana* (**Figs 339a-b**) and *S. filixiana* (**Figs 340a-c**) have longer, more slender epiphallic caeca and different vergic structure.

Holotype

AM C.135983, WA-124, talus at cliff base of E side of S end, Ellery Creek Big Hole, Heavitree Range, W of Alice Springs, Northern Territory, Australia (Hermannsburg 1:250,000 map sheet SF 53-13 - 631:036yds). 23° 47' 11" S, 133° 03' 48" E. Collected by Alan Solem and Laurie Price 16 March 1974. Height of holotype 5.4 mm, diameter 12.4 mm, H/D ratio 0.435, whorls 4 3/8, umbilical width 3.8 mm, D/U ratio 3.26.

Paratopotypes

AM C.136027, SAM D18117, WAM 735.87, FMNH 182629, FMNH 182628, 8 LA, 5 LJ from the type collection.

Paratypes

Northern Territory

HEAVITREE RANGE: Ellery Creek Big Hole (WA-125, WA-757, patch of figs high on cliff, AM C.136028-9, SAM D18118-9, WAM 736.87, WAM 737.87, QM, MV, FMNH 182644, FMNH 205516-7, 50 LA, 1 DA, 9 LJ, 1 DJ; 27 April 1987, V. Kessner!, K 11724, 4 DA); Serpentine Gorge (MV, 14 DA, 12 DJ).

KRICHAUFF RANGES: banks of Ellery Creek, N of Finke River junction (WA-932, under large figs on W bank, AM C.136030, FMNH 212393-4, 6 LA, 1 DA, 1 LJ, 4 DJ; WA-931, under figs on W bank, ca 3 km N of Finke River junction, SAM D, WAM, FMNH 212390-1, 9 LA, 3 DA, 1 DJ; WA-930, figs at junction of Ellery Creek and Finke River, AM C.136031, QM, FMNH 212381-4, 8 LA, 4 DA, 15 LJ, 6 DJ); 0.5 km SE of Finke River-Ellery Creek junction (29 April 1987, V. Kessner!, K 11722, 16 DA).

Range

Semotrachia elleryi, sp. nov., has been collected at three different places: Serpentine Gorge (23° 45' S, 132° 58' E) and Ellery Creek Big Hole (23° 47' S, 133° 04' E) in the Heavitree Range, W of Alice Springs; and further S where Ellery Creek enters the Krichauff Range to join the Finke River (24° 03' 36" S to 24° 05' 54" S). All are in the Ellery Creek basin. The first two localities are about 10.5 km apart on an E-W axis; the straight line distance from Ellery Creek Big Hole to the Finke River junction in the Krichauff Ranges is about 40 km.

Diagnosis

Shell medium in size, adult diameter 10.1-13.15 mm (mean 11.41 mm), whorls 4+ to 4 3/4+ (mean 4 3/8). Apex and spire slightly to moderately elevated (**Fig. 343b**), shell height 4.1-6.6 mm (mean 4.92 mm), H/D ratio 0. 373-0.526 (mean 0.432). Body whorl (**Fig. 343b**) weakly shouldered, descending abruptly just behind lip. Apex (**Plate 158a**) with elongated dense pustules, spire and body whorl (**Plate 158b-c**) with rather widely spaced, long base setae and prominent microridging. Umbilicus (**Fig. 343c**) typical, last whorl decoiling more rapidly, width 2.5-4.15 mm (mean 3.42 mm), D/U ratio 2.82-4.38 (mean 3.36). Lip sharply reflected and moderately expanded, usually (**Figs 343b-c**) free of parietal wall, sometimes appressed and forming a thick callus. Shell colour yellow-brown, base lighter. Based on 120 measured adults.

Genitalia (**Figs 344a-c**) with long vagina (V) and very short free oviduct (UV). Epiphallic caecum (EC) very long, thick at base, tapering only on last portion. Epiphallus (E) longer than penis (P). Wall sculpture of penis chamber consists of corrugated ridges below, simple pilasters above. Verge (PV) very short, tapering to bluntly rounded tip, sperm groove prominent.

Central and lateral teeth of radula (**Plate 157c-d, f**) with very small anterior flare, normal cusp shaft angle, large ectocone, strongly curved cusp tip. Late laterals (**Plate 157f**) with greatly enlarged anterior flare and reduced cusp tip curvature. Lateromarginal transition (**Plate 157e**) abrupt and typical. Jaw without unusual features.

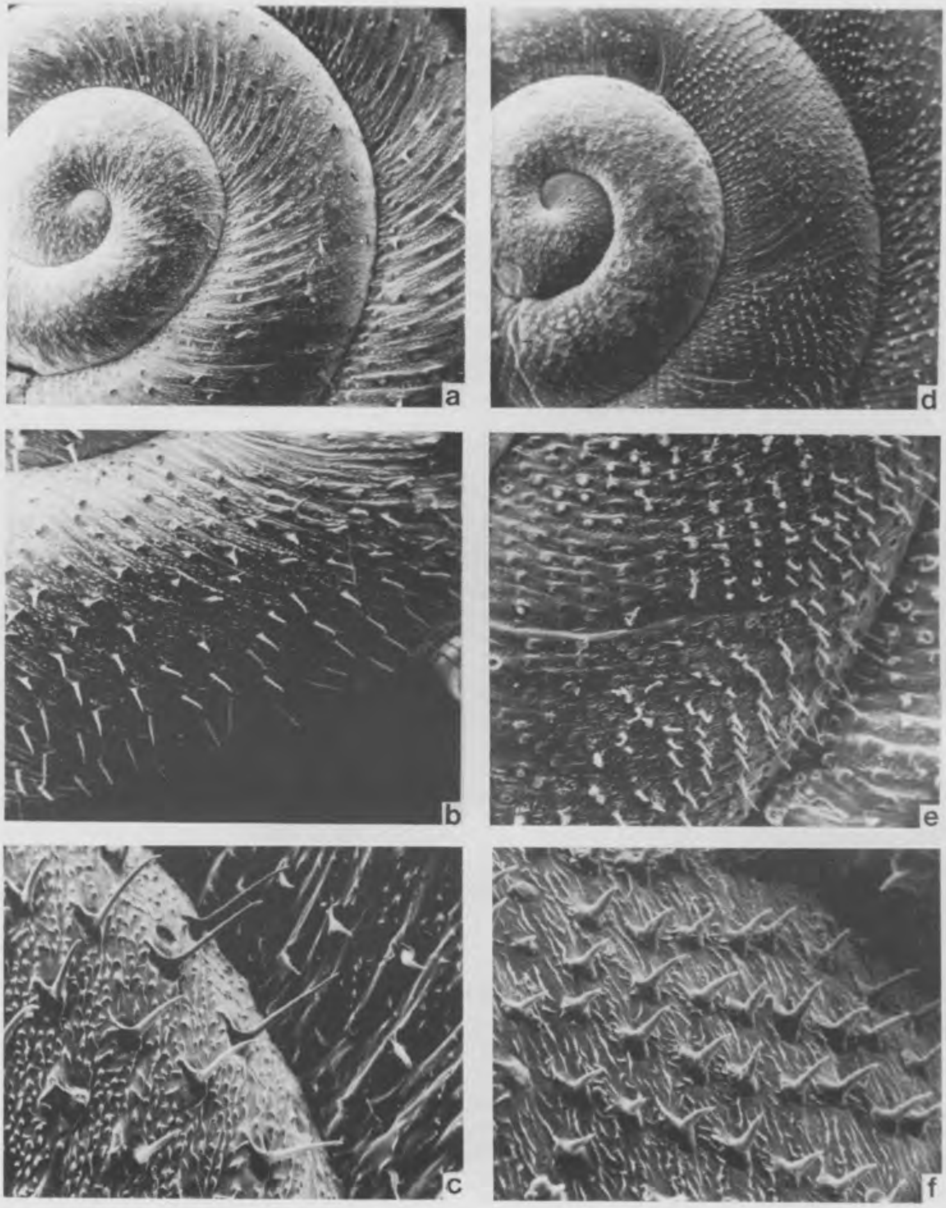


Plate 158: Shell sculpture of *Semotrachia elleryi* and *S. esau* Iredale, 1937: (a-c) *S. elleryi.* WA-930, junction of Ellery Creek and Finke River, Krichauff Ranges, NT. FMNH 212384. a is apex and spire at 21.1X, b is setae on body whorl at 20.9X, c is setae on lower spire at 51X; (d-f) *S. esau.* WA-443, Glen of Palms, Finke Gorge National Park, Krichauff Ranges, NT. FMNH 199657. d is apex and spire at 21X, e is pustules and setae on mid-spire at 53X, f is detail of setae on mid-spire at 100X.

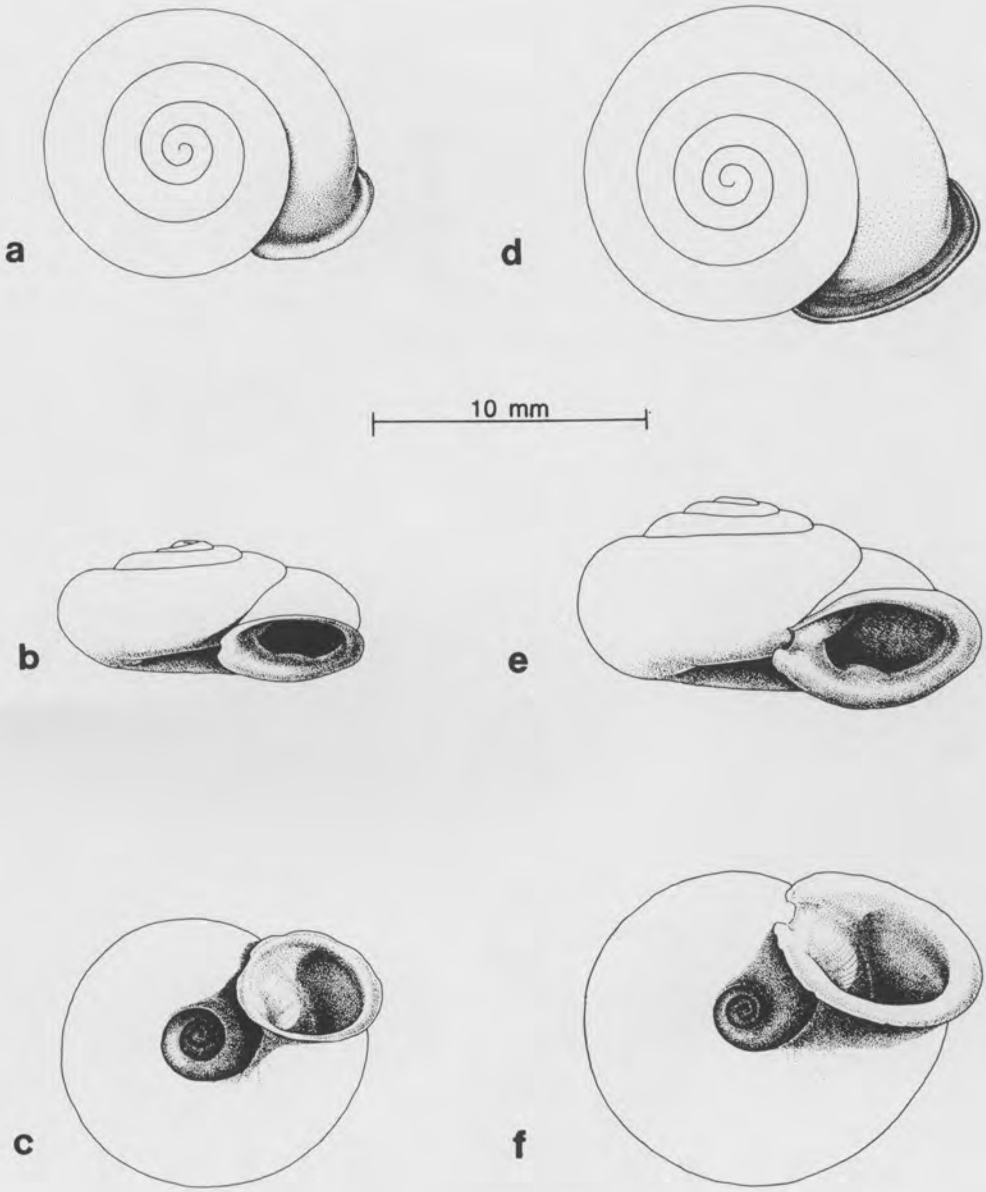


Fig. 343: Shells of *Semotrachia elleryi*, sp. nov., and *S. esau* Iredale, 1937: (a-c) Paratype of *S. elleryi*. WA-125, Ellery Creek Big Hole, Heavitree Range, NT. FMNH 182644; (d-f) *S. esau* (Iredale, 1937). WA-131, near Initiation Rock, Palm Valley, Krichauff Ranges, NT. FMNH 182501. Scale lines as marked. Drawings by Elizabeth A. Liebman.

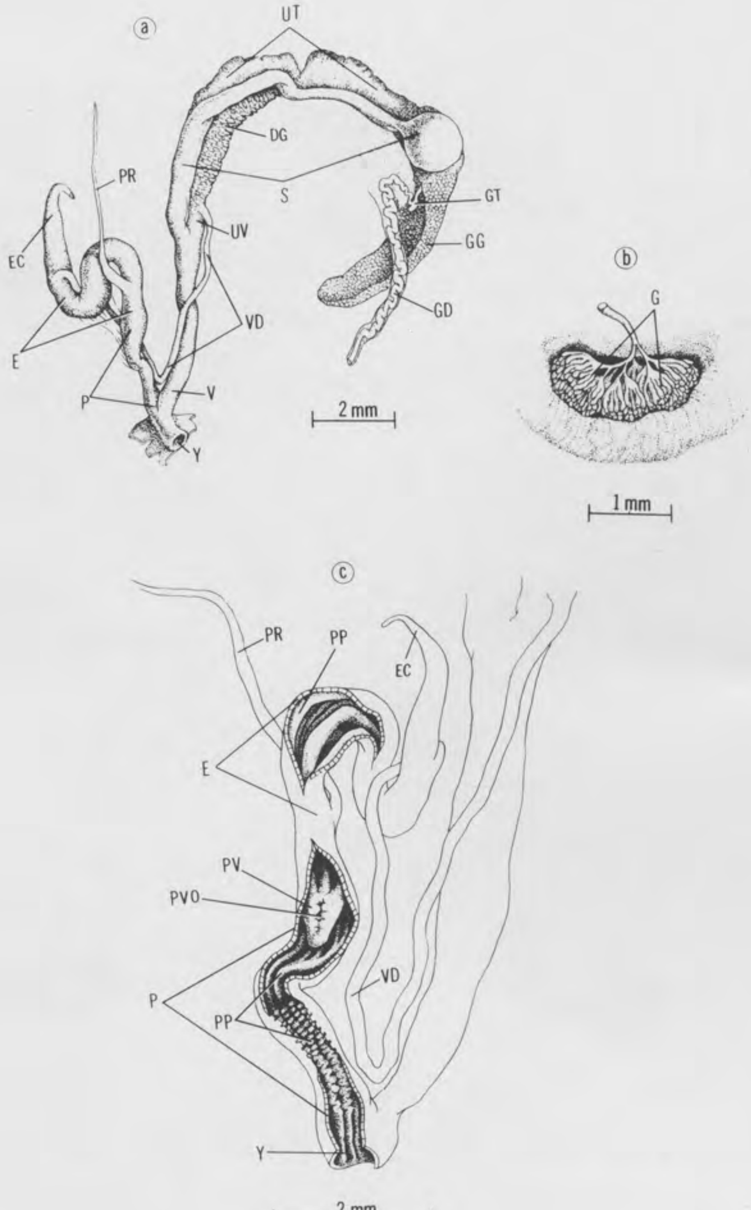


Fig. 344: Genitalia of *Semotrachia elleryi*, sp. nov.: WA-125, Ellery Big Hole, Heavitree Range, NT. 16 March 1974. FMNH 182644, Dissection A. (a) whole genitalia; (b) ovotestis; (c) interior of epiphallus and penis. Scale lines as marked. Drawings by Elizabeth A. Liebman.

Discussion

There is only one collection of land snails available from the Finke River banks in the Krichauff Ranges below its junction with Ellery Creek, and that is from only 0.5 km S. The shells agree with *S. elleryi*, suggesting that it replaces the Palm Creek *S. esau*.

The specimens of *Semotrachia elleryi* from the actual junction of Ellery Creek and the Finke River (WA-930, **Table 128**) are slightly smaller in size that those from further upstream, but agree with Kessner's 1987 collections. Samples from Serpentine Gorge and Ellery Creek Big Hole (WA-124-5, WA-757) have a lower mean H/D ratio (0.403-0.412) than do those from the Krichauff Ranges (means 0.457-0.483, **Table 128**). No genital differences were detected in dissected material from the two areas.

The name *elleryi* is taken from Ellery Creek, which extends throughout the known range of this species.

SEMOTRACHIA ESAU IREDALE, 1937

(Plates 158d-f, 159a-f, 161d-e; Figs 343d-f, 345a-c, 346)

Angasella setigera Hedley, 1896 (not Tate, 1894), Rep. Horn Sci. Exped. Central Austr., Zool., p. 222, figs D-F - jaw, radula, genitalia.

Semotrachia esau Iredale, 1937, South Austr. Nat., **18** (2): 38, pl. I, fig. 11 - Krichauff Range, Central Australia; Iredale, 1938, Austr. Zool., **9** (2): 90 -check list citation; Richardson, 1985, Tryonia, **12**: 274 - check list citation.

Comparative remarks

Semotrachia esau Iredale, 1937, from Palm Creek and the Finke River in the Krichauff Ranges, plus an isolated probable record near the Palmer River, is larger than average (mean diameter 11.92 mm), with a moderately elevated spire (**Fig. 343e**, mean H/D ratio 0.526), increased whorl count (mean 4 3/4), slightly narrowed umbilicus (**Fig. 343f**, mean D/U ratio 3.87), microsculpture (**Plates 158e-f, 161e**) of densely crowded long base setae and moderate micro ridging, and the parietal wall has a thin to very thick callus (**Figs 343e-f**) that rarely is slightly free. *S. elleryi*, from the basin of Ellery Creek, Krichauff Ranges N to Serpentine Gorge, is smaller (mean diameter 11.41 mm), much less elevated (**Fig. 343b**, mean H/D ratio 0.432), with normal whorl count (mean 4 3/8), microsculpture (**Plate 158b-c**) that is much more widely spaced, and the parietal lip normally is continuous and free of the parietal wall. *S. hughana*, from the James Range, is smaller (mean diameter 11.07 mm), much less elevated (**Fig. 349b**, mean H/D ratio 0.465), with much more widely spaced microsculpture (**Plate 161b-c**), and the parietal lip is free of the parietal wall. *S. bagoti*, from the George Gill Range, is smaller (mean diameter 11.07 mm), and with a lower whorl count (mean 4 1/2+). The MacDonnell Range species of similar size (**Table 123**) have fewer whorls and a much more depressed shape. Anatomically, *S. esau* (**Figs 345a-c, 346a**) has a very small tapering epiphallic caecum (EC), corrugated penis chamber wall sculpture, and a medium sized verge (PV) with wrinkled surface. *S. elleryi* (**Figs344a-**

c) has a much larger epiphallic caecum and a much smaller verge. *S. hughana* (**Figs 350a-b**) has a much larger epiphallic flagellum, simple penis chamber wall sculpture, and the verge has a nearly smooth surface.

Holotype

SAM D15538, Krichauff Ranges, Central Australia. Collected by the Horn Expedition. Height of holotype 7.0 mm, diameter 12.6 mm, H/D ratio 0.556, whorls 4 3/4, umbilical width 3.35 mm, D/U ratio 3.76. This is a fairly recently dead specimen in which the parietal lip is not raised, but appressed to the parietal wall, with a raised callus ridge behind the edge. There is crowded radial ribbing and most of the setae are missing.

Paratypes

AM C.112597, AM C.115772, AM C.115858, AM C.115856, SAM D15559, 10 DA from the type collection.

Material studied

Northern Territory

KRICHAUFF RANGES: Finke River (MV F5402, 4 DA, 3 DJ); W bank Finke River (WA-764, 9.2 km in from Hermannsburg road, FMNH 205560, FMNH 205563, 2 LA, 1 LJ, 2 DJ); Palm Valley (WA-762, under figs at N facing slope, road end parking area, FMNH 205547-8, 4 LA, 10 DA, 1 LJ, 3 DJ; WA-763, S facing bank, under spinifex, opposite Palm Valley Chalet ruins, AM, SAM D18121-2, WAM 739.87, WAM 740.87, QM, MV, FMNH 205553-4, 30 LA, 47 DA, 5 DJ; WA-443, 1.65 km W of Cycad Gorge, FMNH 199657-8, 2 LA, 8 LJ, 1 DJ; WA-130, WA-442, Cycad Gorge, FMNH 182649, FMNH 182376, FMNH 199663, 5 DA, 1 DJ; WA-131, WA-441, under figs 100 m NE of Initiation Rock, AM, SAM D18123, SAM D18125, WAM 741.87, WAM 742.87, QM, MV, FMNH 182127, FMNH 182346-7, FMNH 182501, FMNH 182708-9, FMNH 201563-4, FMNH 199711, FMNH 199713, 9 LA, 79 DA, 10 LJ, 62 DJ; WA-132, WA-440, under figs near Ranger cabin, AM, SAM D18126, WAM 743.87, FMNH 182367, FMNH 182525, FMNH 199667, FMNH 199669, 7 LA, 17 DA, 3 LJ, 2 DJ; WA-926, 2 km upstream from campground, AM, FMNH 212348, FMNH 212351, FMNH 212356-7, 17 LA, 7 DA, 2 LJ, 2 DJ; WA-927, banks of Palm Creek, AM, SAM D18124, FMNH 212365, 11 DA, 5 DJ; WA-928, Oasis Spring, Palm Creek tributary, FMNH 212372, 1 DA; WA-929, Glen of Palms, Finke River, FMNH 212374-5, 8 LA, 3 DA, 1 LJ, 5 DJ).

PALMER RIVER: small ridge just W of Stuart Highway, 10.3 km N of Palmer River (WA-766, under figs, AM, SAM D18127, WAM 744.87, QM, MV, FMNH 205565, 37 LA, 14 LJ); W of Stuart Highway, 10 km S of Kings Canyon Road (7 May 1987, V. Kessner!, K 11753, 2 DA, 2 DJ).

Range

Semotrachia esau Iredale, 1937 has been collected along the Finke River and Palm Creek in the Krichauff Ranges, and then from a single isolated locality in the Palmer River drainage. The area known to be inhabited in the Krichauff Ranges is about 8.3 km east to west and only 7.5 km north to south. The Palmer River colony is located approximately 78 air km to the SE.

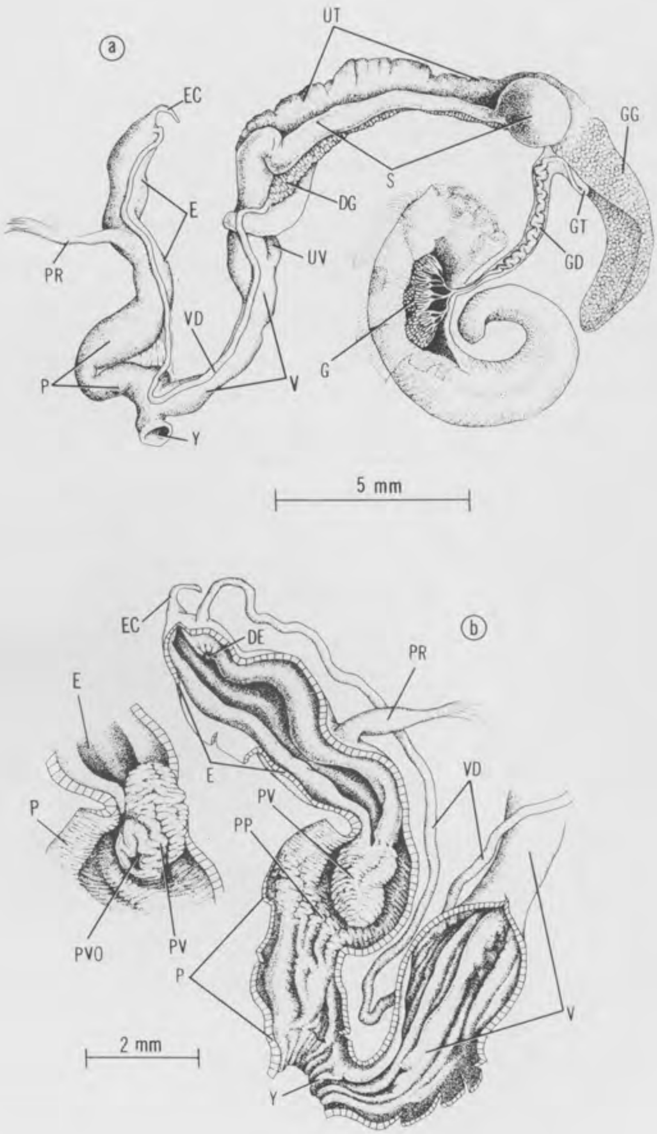


Fig. 345: Genitalia of *Semotrachia esau* (Iredale, 1937): WA-131, near Initiation Rock, Palm Valley, Krichauff Ranges, NT. 18 March 1974. FMNH 182501, Dissection C. (a) whole genitalia; (b) interior of epiphallus, penis, and vagina; (c) detail of verge. Scale lines as marked. Drawings by Elizabeth A. Liebman.

Diagnosis

Shell variable in size, usually relatively large, adult diameter 8.65-14.6 mm (mean 11.92 mm), whorls 4+ to 5 3/8- (mean 4 3/4). Apex and spire evenly elevated (**Fig. 343e**), shell height 4.0-8.5 mm (mean 6.30 mm), H/D ratio 0.401-0.661 (mean 0.526). Body whorl (**Fig. 343e**) rounded or at most weakly shouldered, descending abruptly just behind lip. Apex (**Plates 158d, 161d**) generally eroded, spire and body whorl (**Plates 158e-f, 161e**) with dense setae having massive bases and extensive to moderate micro ridging. Umbilicus (**Fig. 343f**) narrow, last whorl decoiling more rapidly, width 2.05-4.15 mm (mean 3.11 mm), D/U ratio 3.01-5.62 (mean 3.87). Lip sharply reflected and moderately to strongly expanded, a thin to very thick callus on parietal wall (**Figs 343e-f**), rarely weakly elevated from wall. Shell dark yellow-brown, base lighter in tone. Based on 342 measured adults.

Genitalia (**Figs 345a-c, 346a**) with variable length vagina (V), very short free oviduct (UV). Epiphallic caecum (EC) short, tapering at base. Epiphallus (E) slightly longer than penis (P), internally with simple pilasters. Penis chamber walls with corrugated ridging apically, becoming simple in lower portion. Verge (PV) large, tip rounded, surface wrinkled, sperm groove restricted to upper end.

Central and lateral teeth of radula (**Plate 159a-b**) with very small anterior flare, short basal plate, normal cusp shaft angle, curved cusp tip, and small ectocone. Late laterals with enlarged anterior flare and ectocone. Mid-marginals (**Plate 159d**) and outer marginals (**Plate 159e**) typical. Jaw (**Plate 159f**) without unusual features.

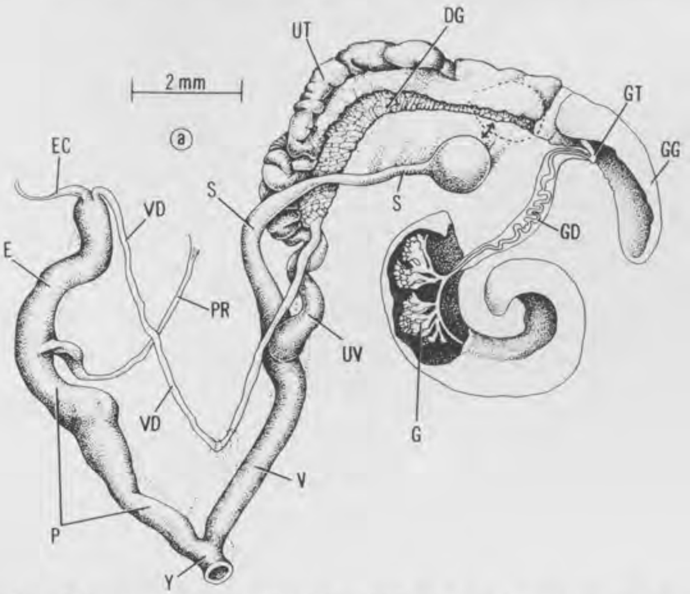


Fig. 346: Genitalia of *Semotrachia esau* (Iredale, 1937): WA-132, near junction of Palm Creek with Finke River, Palm Valley, Krichauff Ranges, NT. 18 March 1974. FMNH 182525, Dissection A. Whole genitalia. Scale line equals 2 mm. Drawing by Elizabeth A. Liebman.

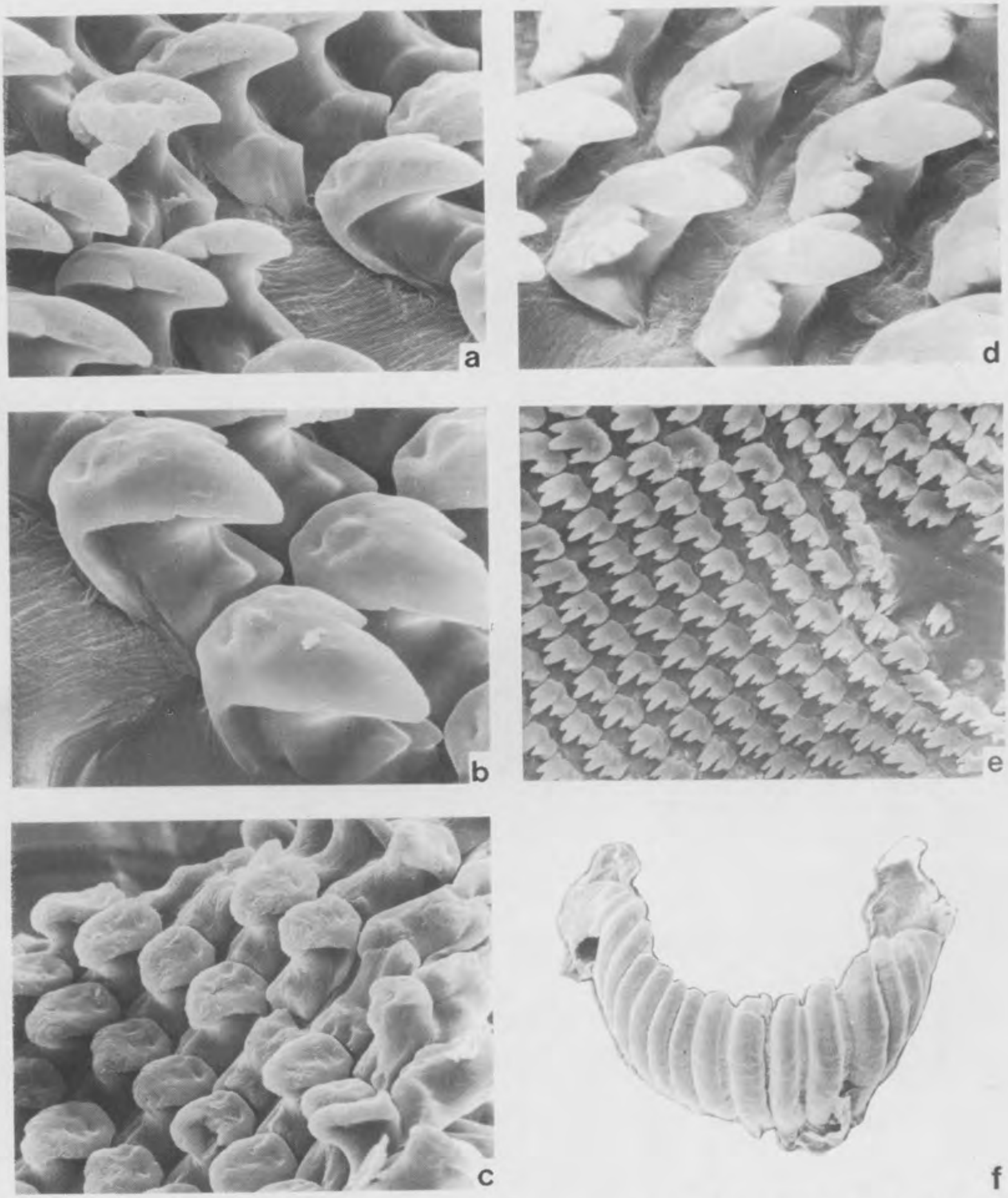


Plate 159: Radular teeth and jaw of *Semotrachia esau* Iredale, 1937: (a-f) WA-131, figs NE of Initiation Rock, Palm Creek, Krichauff Ranges, NT. 18 March 1984. FMNH 182501. a is Dissection B, central and early lateral teeth at 1,025X, b is Dissection B, details of 1st and 2nd laterals at 1,350X, c is Dissection D, worn lateral teeth at 670X, d is Dissection E, mid-marginal teeth at 1,350X, e is Dissection D, outer marginals at 360X, f is Dissection A, jaw at 75X.

Table 127: Range of Variation in southern species of *Semotrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. elleryi	120	4.92 (4.1-6.6)	11.41 (10.11-13.15)	0.432 (0.373-0.526)	$4\frac{3}{8}$ (4+-$4\frac{3}{4}$+)	3.42 (2.5-4.15)	3.36 (2.82-4.38)
S. esau Iredale, 1937	342	6.30 (4.0-8.5)	11.92 (8.65-14.6)	0.526 (0.401-0.661	$4\frac{3}{4}$ (4+-$5\frac{3}{8}$-)	3.11 (2.05-4.15)	3.87 (3.01-5.62)
S. illarana	14	3.21 (3.1-3.4)	7.69 (7.25-8.15)	0.418 (0.398-0.432)	$3\frac{7}{8}$ ($3\frac{3}{4}$-4+)	2.10 (1.85-2.4)	3.68 (3.24-4.12)
S. aff. illarana	11	4.16 (3.6-4.7)	8.57 (7.5-9.25)	0.485 (0.434-0.530)	$4\frac{1}{8}$- ($3\frac{7}{8}$-$4\frac{1}{4}$-)	2.65 (2.3-3.1)	3.25 (2.94-3.57)
S. hughana	14	5.15 (4.7-5.65)	11.07 (10.35-11.6)	0.465 (0.441-0.448)	$4\frac{3}{8}$- ($4\frac{1}{4}$– -$4\frac{1}{2}$+)	3.20 (2.9-3.65)	3.47 (3.11-3.88)
S. bagoti	150	5.65 (4.2-7.1)	11.16 (9.15-12.7)	0.506 (0.432-0.603)	$4\frac{1}{2}$+ ($4\frac{1}{8}$+-5)	3.05 (1.8-3.9)	3.69 (3.09-5.36)
S. minuta	36	2.09 (1.8-2.55)	5.41 (4.9-6.6)	0.387 (0.334-0.442)	$3\frac{1}{2}$ ($3\frac{1}{4}$+-$3\frac{7}{8}$+)	1.81 (1.35-2.2)	3.04 (2.52-4.06)
S. illbilleeana	15	2.48 (2.3-2.65)	6.49 (6.1-6.85)	0.382 (0.352-0.404)	$3\frac{5}{8}$ ($3\frac{3}{8}$+-$3\frac{3}{4}$+)	1.72 (1.2-2.3)	3.86 (2.86-5.17)

Table 127: Range of Variation in southern species of *Semotrachia* (Continued)

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. plana	20	4.28 (3.4-5.0)	10.68 (9.5-12.1)	0.403 (0.324-0.521)	$4^{1}/_{8}$ (4--$4^{3}/_{8}+$)	2.92 (2.35-3.95)	3.69 (3.04-4.33)
S. discoidea	36	4.02 (3.5-4.8)	13.27 (12.2-14.3)	0.303 (0.274-0.387)	$4^{1}/_{4}+$ (4-$4^{1}/_{2}-$)	3.61 (3.15-4.1)	3.70 (3.17-4.18)
S. basedowi (Hedley, 1905)	25	6.19 (5.0-7.9)	17.07 (15.0-18.8)	0.362 (0.319-0.429)	$4^{1}/_{4}-$ ($3^{3}/_{4}$-$4^{5}/_{8}-$)	3.81 (3.1-4.75)	4.52 (3.67-5.93)
S. mannensis Iredale, 1937	4	5.91 (5.6-6.35)	12.28 (11.45-13.75)	0.484 (0.411-0.537)	$4^{3}/_{8}$ ($4^{3}/_{8}$--$4^{3}/_{8}+$)	2.67 (2.2-3.75)	4.74 (3.67-5.15)

Table 128: Local Variation in *Semotrachia elleryi* and *S. esau* Iredale, 1937

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. elleryi							
WA-757, FMNH 205517	14L	4.60±0.053 (4.25-4.95)	11.39±0.135 (10.35-12.2)	0.405±0.004 (0.383-0.436)	$4\frac{1}{4}$+ ($4\frac{1}{8}$+-$4\frac{1}{2}$-)	3.57±0.091 (2.7-4.15)	3.21±0.073 (2.91-3.83)
Serpentine Gorge, NMV FWA2296	14D	4.60±0.066 (4.15-5.0)	11.18±0.121 (10.38-12.1)	0.412±0.005 (0.385-0.446)	$4\frac{3}{8}$ ($4\frac{1}{4}$-$4\frac{5}{8}$)	3.27±0.078 (2.85-3.9)	3.43±0.057 (3.08-3.77)
WA-124, FMNH 182629	8L	4.74±0.099 (4.35-5.25)	11.79±0.200 (10.8-12.4)	0.403±0.009 (0.373-0.448)	$4\frac{3}{8}$ ($4\frac{1}{4}$+-$4\frac{1}{2}$+)	3.49±0.075 (3.1-3.7)	3.38±0.038 (3.23-3.51)
WA-125, FMNH 182644	36L	4.67±0.043 (4.1-5.25)	11.38±0.050 (10.7-11.95)	0.411±0.004 (0.376-0.466)	$4\frac{3}{8}$ ($4\frac{1}{8}$+-$4\frac{5}{8}$-)	3.43±0.036 (3.05-3.8)	3.33±0.033 (2.97-3.78)
WA-930, FMNH 212384	8L	4.97±0.082 (4.7-5.4)	10.87±0.155 (10.1-11.5)	0.457±0.009 (0.432-0.491)	$4\frac{1}{4}$ ($4\frac{1}{8}$+-$4\frac{3}{8}$-)	3.21±0.083 (2.9-3.5)	3.40±0.072 (3.17-3.70)
WA-931, FMNH 212390	9L	5.58±0.098 (5.15-5.95)	12.10±0.236 (11.0-13.15)	0.462±0.010 (0.428-0.526)	$4\frac{5}{8}$- ($4\frac{1}{4}$+-$4\frac{3}{4}$+)	3.42±0.113 (2.9-3.9)	3.56±0.083 (3.18-3.98)
WA-932, FMNH 212394	6L	5.45±0.106 (5.15-5.8)	11.85±0.211 (10.9-12.4)	0.460±0.007 (0.439-0.485)	$4\frac{1}{2}$ ($4\frac{1}{4}$– $4\frac{5}{8}$+)	3.44±0.157 (2.95-3.75)	3.47±0.138 (3.14-4.06)
Finke River, K11722	16D	5.41±0.055 (5.0-5.7)	11.22±0.098 (10.6-11.8)	0.483±0.005 (0.452-0.514)	$4\frac{1}{4}$ (4+-$4\frac{3}{8}$+)	3.51±0.058 (3.1-3.9)	3.20±0.045 (2.92-3.48)

Table 128: Local Variation in *Semotrachia elleryi* and *S. esau* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. esau Iredale, 1937							
WA-762, FMNH 205548	10D	5.95±0.154 (5.05-6.6)	11.98±0.253 (10.8-13.2)	0.497±0.011 (0.436-0.557)	$4^{5}/_{8}$+ ($4^{1}/_{2}$+-$4^{7}/_{8}$+)	3.15±0.094 (2.7-3.6)	3.83±0.107 (3.25-4.44)
WA-763, FMNH 205553	30L	7.05±0.104 (6.15-8.5)	12.64±0.119 (11.2-14.4)	0.558±0.006 (0.498-0.661)	5- ($4^{1}/_{2}$+-$5^{1}/_{4}$-)	3.21±0.076 (2.35-4.0)	3.99±0.078 (3.13-4.90)
WA-763, FMNH 205554	47D	7.06±0.070 (6.1-8.1)	12.55±0.106 (11.15-13.9)	0.563±0.004 (0.508-0.643)	5- ($5^{1}/_{8}$+-$4^{1}/_{2}$+)	3.23±0.050 (2.55-3.85)	3.92±0.053 (3.38-4.80)
WA-132, FMNH 182501	16D	6.95±0.077 (6.05-7.15)	13.04±0.117 (12.2-13.8)	0.533±0.005 (0.462-0.540)	$4^{7}/_{8}$ ($4^{5}/_{8}$+-5+)	3.29±0.066 (2.75-3.6)	3.99±0.083 (3.82-4.47)
WA-131, FMNH 182346	58D	6.49±0.057 (5.65-7.8)	11.63±0.064 (10.6-13.3)	0.558±0.004 (0.489-0.625)	$4^{5}/_{8}$+ ($4^{3}/_{8}$+-5+)	2.88±0.040 (2.05-3.45)	4.08±0.058 (3.36-5.62)
WA-440, FMNH 199669	5L	6.45±0.207 (5.9-7.15)	13.09±0.258 (12.4-13.7)	0.492±0.012 (0.463-0.521)	$4^{7}/_{8}$+ ($4^{3}/_{4}$+-5-)	3.60±0.156 (3.2-3.95)	3.66±0.090 (3.46-3.87)
WA-441, FMNH 199713	16D	6.32±0.071 (5.7-6.75)	11.69±0.107 (10.7-12.25)	0.541±0.005 (0.491-0.566)	$4^{3}/_{4}$+ ($4^{1}/_{2}$+-5+)	3.14±0.063 (2.8-3.6)	3.74±0.064 (3.25-4.23)

Table 128: Local Variation in *Semotrachia elleryi* and *S. esau* Iredale, 1937 (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
Palm Valley, AM C.115860	14L	6.46±0.122 (5.8-7.3)	12.08±0.147 (11.05-12.8)	0.535±0.008 (0.478-0.583)	$4^{7}/_{8}$+ ($4^{5}/_{8}$--$5^{3}/_{8}$-)	3.21±0.099 (2.55-3.7)	3.80±0.110 (3.14-4.70)
WA-929, FMNH 212375	8L	6.65±0.156 (6.15-7.35)	12.45±0.174 (11.9-13.4)	0.535±0.012 (0.503-0.609)	5- ($4^{3}/_{4}$+-$5^{1}/_{8}$-)	3.22±0.137 (2.4-3.6)	3.91±0.160 (3.47-4.95)
WA-926b, FMNH 212357	13L	4.39±0.067 (4.1-4.85)	9.70±0.167 (8.65-10.6)	0.454±0.008 (0.404-0.492)	$4^{1}/_{2}$- ($4^{1}/_{4}$--$4^{7}/_{8}$+)	2.67±0.076 (2.2-3.15)	3.65±0.060 (3.36-4.21)
WA-927, FMNH 212365	11D	5.00±0.128 (4.3-5.65)	10.34±0.238 (9.3-11.7)	0.483±0.005 (0.453-0.504)	$4^{1}/_{2}$ ($4^{1}/_{4}$+-$4^{3}/_{4}$-)	2.80±0.109 (2.25-3.5)	3.72±0.096 (3.18-4.15)

Table 129: Local Variation in southern species of *Semotrachia*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
S. illarana							
Illara Waterhole,	12L	3.22±0.030	7.72±0.083	0.418±0.003	$3\frac{7}{8}$-	2.07±0.039	3.74±0.069
FMNH 198792		(3.1-3.4)	(7.3-8.15)	(0.398-0.432)	($3\frac{3}{4}$-4)	(1.85-2.25)	(3.46-4.12)
S. aff. illarana							
Areyonga, 30-IV-87	11D	4.16±0.119	8.57±0.158	0.485±0.009	$4\frac{1}{8}$-	2.65±0.082	3.25±0.071
K11727		(3.6-4.7)	(7.5-9.25)	(0.434-0.530)	($3\frac{7}{8}$-$4\frac{1}{4}$-)	(2.3-3.1)	(2.93-3.57)
S. hughana							
WA-765,	14L	5.15±0.070	11.07±0.101	0.465±0.005	$4\frac{3}{8}$-	3.20±0.057	3.47±0.051
FMNH 205564		(4.7-5.65)	(10.35-11.6)	(0.441-0.488)	($4\frac{1}{4}$-$4\frac{1}{2}$+)	(2.9-3.65)	(3.11-3.88)
S. aff. esau							
WA-766,	37L	5.21±0.034	10.98±0.047	0.474±0.002	$4\frac{1}{4}$+	2.94±0.034	3.74±0.036
FMNH 205565		(4.9-5.65)	(10.3-11.6)	(0.447-0.507)	($4\frac{1}{8}$--$4\frac{1}{2}$-)	(2.5-3.35)	(3.31-4.15)
S. bagoti							
WA-937,	19L	4.65±0.056	10.15±0.075	0.458±0.005	$4\frac{3}{8}$+	2.58±0.067	3.99±0.110
FMNH 212410		(4.25-5.0)	(9.15-10.5)	(0.432-0.492)	($4\frac{1}{4}$+-$4\frac{5}{8}$+)	(1.8-3.1)	(3.25-5.36)
WA-937,	10D	4.75±0.118	10.15±0.122	0.467±0.010	$4\frac{3}{8}$+	2.71±0.051	3.75±0.065
FMNH 212411		(4.2-5.3)	(9.5-10.85)	(0.434-0.528)	($4\frac{1}{8}$+-$4\frac{5}{8}$+)	(2.5-2.95)	(3.48-4.09)
WA-445,	16L	5.39±0.064	11.49±0.124	0.470±0.004	41/2	3.28±0.074	3.52±0.062
FMNH 199689		(5.0-5.85)	(10.7-12.5)	(0.446-0.506)	($4\frac{3}{8}$- $4\frac{3}{4}$-)	(2.9-3.9)	(3.15-3.92)
WA-446,	21L	5.45±0.061	11.38±0.118	0.479±0.005	$4\frac{1}{2}$+	3.05±0.068	3.76±0.069
FMNH 199691		(4.95-6.1)	(10.7-12.7)	(0.447-0.535)	($4\frac{3}{8}$+-$4\frac{3}{4}$-)	(2.35-3.75)	(3.25-4.64)
WA-446,	6D	5.67±0.074	11.33±0.147	0.500±0.003	$4\frac{3}{4}$-	3.31±0.071	3.43±0.074
FMNH 199692		(5.4-5.9)	(10.95-11.8)	(0.492-0.511)	$4\frac{5}{8}$+-$4\frac{3}{4}$-)	(3.05-3.55)	(3.15-3.60)

Table 129: Local Variation in southern species of *Semotrachia* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-447, FMNH 199650	5L	5.71±0.077 (5.5-5.95)	11.62±0.237 (10.85-12.2)	0.493±0.016 (0.452-0.550)	$4\frac{5}{8}$+ ($4\frac{1}{2}$+-$4\frac{7}{8}$+)	2.97±0.058 (2.75-3.1)	3.92±0.087 (3.62-4.11)
Penny Springs K11757	16D	6.27±0.105 (5.5-7.0)	11.28±0.117 (10.65-12.2)	0.556±0.008 (0.500-0.603)	$4\frac{5}{8}$- ($4\frac{3}{8}$-$4\frac{3}{4}$)	2.98±0.067 (2.5-3.4)	3.81±0.076 (3.35-4.30)
Reedy Creek waterhole, K11759	52D	6.17±0.048 (5.5-7.1)	11.40±0.064 (10.7-12.6)	0.542±0.004 (0.474-0.590)	$4\frac{1}{2}$+ ($4\frac{3}{8}$-5)	3.18±0.033 (2.75-3.7)	3.60±0.027 (3.26-4.03)
S. minuta							
WA-875, FMNH 212168	4L	2.30±0.162 (1.8-2.55)	5.83±0.341 (4.95-6.6)	0.394±0.11 (0.369-0.423)	$3\frac{3}{4}$- ($3\frac{1}{2}$--$3\frac{7}{8}$+)	1.70±0.135 (1.45-1.95)	3.49±0.338 (2.57-4.03)
WA-869, FMNH 212143	23L	2.01±0.024 (1.8-2.2)	5.36±0.048 (4.9-6.0)	0.376±0.005 (0.334-0.416)	$3\frac{1}{2}$ $3\frac{1}{4}$+-$3\frac{3}{4}$-)	1.80±0.045 (1.35-2.2)	3.03±0.086 (2.52-4.06)
Ernabella, K11710	9D	2.20±0.025 (2.1-2.3)	5.34±0.033 (5.2-5.5)	0.412±0.006 (0.389-0.442)	$3\frac{1}{2}$- ($3\frac{1}{4}$+-$3\frac{1}{2}$+)	1.87±0.033 (1.7-2.0)	2.86±0.051 (2.65-3.18)
S. plana							
WA-886, FMNH 212233	6D	4.17±0.173 (3.7-4.95)	10.55±0.367 (9.5-11.9)	0.398±0.025 (0.345-0.521)	$4\frac{1}{8}$ (4+-$4\frac{1}{8}$+)	2.86±0.131 (2.5-3.3)	3.70±0.061 (3.52-3.89)
Amata Rockhole, K11713	8D	4.58±0.083 (4.3-5.0)	10.64±0.108 (10.35-11.15)	0.431±0.009 (0.399-0.481)	$4\frac{1}{8}$ (4-$4\frac{1}{8}$)	2.86±0.049 (2.65-3.05)	3.73±0.070 (3.44-3.93)
S. discoidea							
WA-876, FMNH 212180	24L	4.01±0.057 (3.5-4.7)	13.29±0.090 (12.5-14.3)	0.032±0.004 (0.274-0.355)	$4\frac{1}{4}$ (4-$4\frac{1}{2}$-)	3.55±0.050 (3.15-4.1)	3.76±0.055 (3.17-4.18)

Table 129: Local Variation in southern species of *Semotrachia* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
WA-876, FMNH 212181	6D	4.09±0.173 (3.6-4.8)	12.98±0.220 (12.2-13.55)	0.315±0.015 (0.289-0.387)	$4^{3}/_{8}$- ($4^{1}/_{8}$+-$4^{3}/_{8}$+)	3.67±0.100 (3.35-4.0)	3.55±0.108 (3.28-4.06)
S. basedowi (Hedley, 1905)							
WA-874, FMNH 212167	7L	6.23±0.184 (5.35-6.9)	17.53±0.317 (16.35-18.5)	0.355±0.008 (0.319-0.380)	$4^{1}/_{4}$ ($4^{1}/_{8}$+-$4^{3}/_{8}$+)	4.32±0.114 (4.0-4.75)	4.07±0.099 (3.67-4.40)
Ernabella, K11773	6D	5.52±0.180 (5.0-6.3)	16.16±0.425 (15.0-17.6)	0.342±0.006 (0.324-0.365)	4+ ($3^{3}/_{4}$-$4^{1}/_{4}$+)	3.52±0.140 (3.1-4.0)	4.61±0.123 (4.16-5.00)
S. mannensis Iredale, 1937							
WA-898, FMNH 212265	2D	5.98±0.378 (5.6-6.35)	11.64±0.205 (11.45-11.85)	0.537±0.024 (0.489-0.537)	$4^{3}/_{8}$ ($4^{3}/_{8}$–-$4^{3}/_{8}$+)	2.26±0.040 (2.2-2.3)	5.15±0.000 (5.15-5.15)
S. illbilleeana							
WA-857, FMNH 212105	15L	2.48±0.024 (2.3-2.65)	6.49±0.059 (6.1-6.85)	0.382±0.004 (0.352-0.404)	$3^{5}/_{8}$ ($3^{3}/_{8}$+-$3^{3}/_{4}$+)	1.72±0.069 (1.2-2.3)	3.86±0.148 (2.86-5.17)

Discussion

Semotrachia esau Iredale, 1937 is a quite variable species in size, with mean diameters ranging from 9.7-13.04 mm (**Table 128**). The two populations with smallest sized adults (WA-926b, WA-927) were from less sheltered habitats above the main gorge of Palm Creek. The have reduced whorl counts (means 4 1/2, 4 1/2-), but in sculpture and anatomy showed no differences from larger sized individuals from "better" habitats along Palm Creek and the Finke River.

An isolated population near the Palmer River (WA-766) is tentatively classified here on the basis of anatomy. Its reduced H/D ratio and whorl count (**Table 129**) differs from the main Palm Creek-Finke River samples, but agrees well with the smaller sized samples mentioned in the previous paragraph. If it is correctly identified as *S. esau*, the origin of this colony probably resulted by accidental transport during an exceptional flooding of the Finke River. The area between the Finke and the Palmer River is subject to at least occasional inundation by severe floods. More collecting in this area is needed.

The complex variation within Palm Valley and along the Finke River will be analyzed elsewhere and compared with variation found in other camaenids from this region.

SEMOTRACHIA ILLARANA, SP. NOV.

(Plate 160a-e; Figs 341d-f, 347a, 348a-b)

Comparative remarks

Semotrachia illarana, sp. nov., from Illara Waterhole, Tempe Downs station, NT, is small (mean diameter 7.69 mm), with a slightly elevated spire (**Fig. 341e**, mean H/D ratio 0.418), low whorl count (mean 3 7/8), microsculpture (**Plate 160d-e**) of extremely dense long base setae plus prominent microridging, and narrow parietal wall with a thin callus. It is nearest in size to the Alice Springs *S. euzyga* (Tate, 1894) (**Table 123**), but that species has only a few widely scattered short base setae (**Plate 152a-b**) and its parietal lip is continuous and free of the parietal wall (**Fig. 334c**). The Dulcie Range *S. jinkana* is a little larger, with a much higher spire, and is more widely umbilicated (**Table 121**), plus having fewer, larger, and much more widely spaced setae. *S. huckittana*, also from the Dulcie Range, is larger (**Table 121**), but differs most obviously in its sculpture of very large elongated pustules on the spire and body whorl (**Plate 142e-f**). Anatomically, *S. illarana* (**Figs 347a, 348a-b**) has a medium length vagina (V), long free oviduct (UV), medium length and very slender epiphallic caecum (EC), epiphallus (E) twice as long as the shortened penis (P), wall sculpture essentially absent from penis chamber, and verge (PV) very long, cylindrical, with sperm groove extending almost its entire length. Of neighbouring species, *S. hughana* (**Figs 350a-b**) and *S. elleryi* (**Figs 344a-c**) have much larger and thicker based epiphallic caeca, while *S. esau* Iredale, 1937 (**Figs 345a-c, 346a**) has a much smaller epiphallic caecum and its verge is much shorter and wider with a wrinkled surface.

Holotype

AM C.135984, Illara Waterhole, NW of Tempe Downs Station, S of James Ranges, Northern Territory, Australia (Henbury 1:250,000 map sheet SG 53-1 - 5502:9716yds). 24° 18' 58" S, 132° 19' 17" E. Collected by Fred and Jan Aslin 7 June 1978. Height of holotype 3.5 mm, diameter 8.2 mm, H/D ratio 0.427, whorls 3 7/8-, umbilical width 2.35 mm, D/U ratio 3.49.

Paratopotypes

AM C.136002, SAM D18093, WAM 710.87, QM, MV, FMNH 198792-3, 12 LA, 2 DA, 15 LJ, 4 DJ.

Other material

JAMES RANGE: Areyonga (WA-934, gully 0.5 km W of, FMNH 212399, 1 LA; leaf litter under fig, 30 April 1987, Kessner 11727, 11 dead adults).

Range

Semotrachia illarana, sp. nov., has only been collected at Illara Waterhole, S of the James Ranges, NT. The Areyonga population probably is a distinct species.

Diagnosis

Shell small, adult diameter 7.25-8.15 mm (mean 7.69 mm), whorls 3 3/4 to 4+ (mean 3 7/8). Apex slightly elevated (**Fig. 341h**), shell height 3.1-3.4 mm (mean 3.21 mm), H/D ratio 0.398-0.432 (mean 0.418). Body whorl (**Fig. 341h-i**) rounded, descending

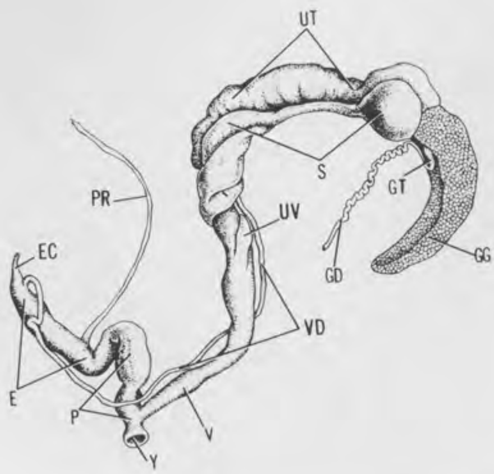


Fig. 347: Whole genitalia of *Semotrachia illarana*, sp. nov.: Illara Waterhole, Tempe Downs station, SW of Alice Springs, NT. 7 June 1978. FMNH 198792, Dissection A. Scale line equals 2 mm. Drawing by Marjorie M. Connors.

moderately to abruptly just behind lip. Apex (**Plate 160d**) with dense pustules, spire and body whorl (**Plate 160d-e**) with very dense long base setae and prominent micro ridging. Umbilicus (**Fig. 341i**) typical, width 1.85-2.4 mm (mean 2.10 mm), D/U ratio 3.24-4.12 (mean 3.68). Lip sharply deflected and moderately expanded, becoming a thin callus on parietal wall (**Figs 341h-i**). Colour yellow-brown, base lighter. Based on 14 measured adults.

Genitalia (**Figs 347a, 348a-b**) with medium length vagina (V) and long free oviduct (UV). Epiphallic caecum (EC) medium in length and very slender. Epiphallus (E) much longer than penis (P), both without significant wall chamber sculpture. Verge (PV) three-quarters length of penis, cylindrical, not tapering, smooth surfaced, with sperm groove (**Fig. 347b**) extending nearly entire length.

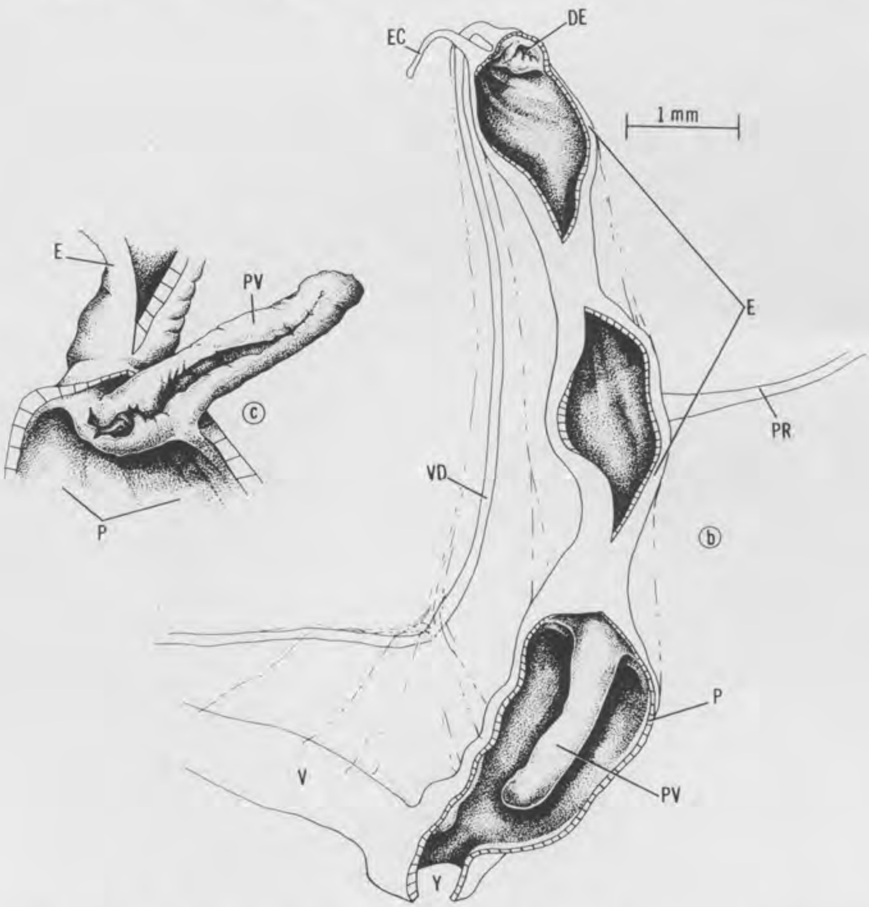


Fig. 348: Genitalia of *Semotrachia illarana*, sp. nov.: Illara Waterhole, Tempe Downs station, SW of Alice Springs, NT. 7 June 1978. FMNH 198792, Dissection B. (a) interior of epiphallus and penis; (b) detail of verge. Scale lines as marked. Drawings by Marjorie M. Connors.

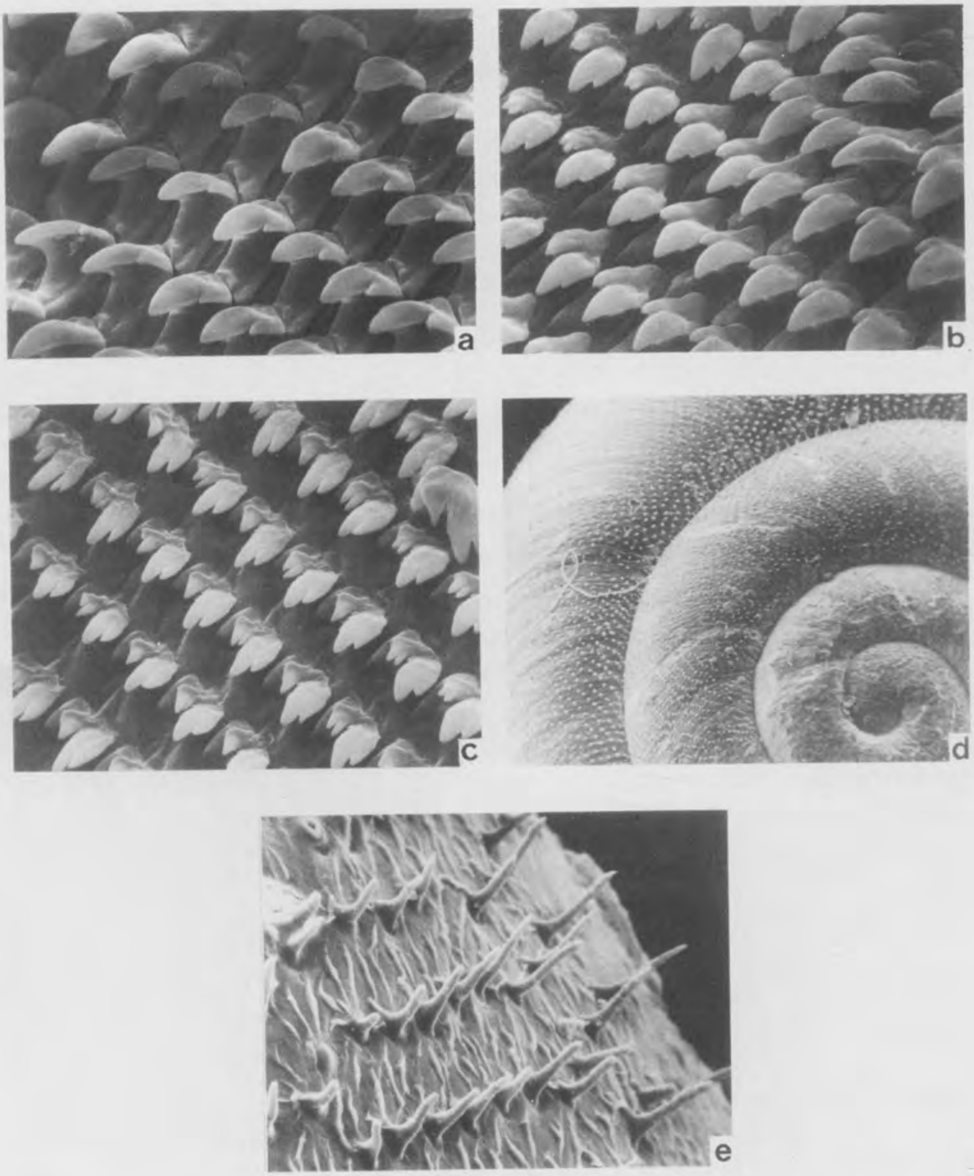


Plate 160: Shell sculpture and radular teeth of *Semotrachia illarana*: (a-c) near Illara Waterhole, Tempe Downs, NT. 7 June 1978. FMNH 198792, Dissection A. a is central and laterals at 720X, b is lateromarginal transition at 730X, c is marginals at 730X; (d-e) Illara Waterhole, Tempe Downs, NT. FMNH 198793. d is apex and spire at 20.2X, e is setae on body whorl at 205X.

Central and lateral teeth of radula (**Plate 160a**) with small anterior flare, typical cusp shaft angle, curved cusp tip, and very prominent ectocone. Late laterals (**Plate 160b**) with greatly enlarged anterior flare and ectocone, transition to marginals abrupt, marked by appearance of endocone. Marginals (**Plate 160c**) in one specimen with unusually prominent ectoconal splitting. Jaw without unusual features.

Discussion

Semotrachia illarana, sp. nov., has only been confirmed from Illara Waterhole, Tempe Downs station, on a tributary of the Palmer River, NT. A single live adult and several dead examples of a very similar morph have been collected near Areyonga about 28 km to the NNW. These specimens are listed above and their measurements included in **Table 127** because they are very close to *S. illarana* in shell shape and sculpture. The radulae are similar and the epiphallic caeca are the same. But the Areyonga shells are large and the single adult has a verge that is like that of *S. esau* (**Figs 345b-c**) rather than the verge found in *S. illarana* (**Fig. 348a-b**). The Areyonga population probably is a distinct species, but too little material is available for description.

The name *illarana* is taken from the type locality.

SEMOTRACHIA HUGHANA, SP. NOV.

(Plates 161a-c, 162a-c; Figs 349a-c, 350a-b)

Comparative remarks

Semotrachia hughana, sp. nov., from the Hugh River, S of the James Ranges, NT, is medium sized (mean diameter 11.07 mm), with a moderately elevated spire (**Fig. 349b**, mean H/D ratio 0.465), typical whorl count and umbilicus, microsculpture of widely spaced medium base setae and micro ridging (**Plate 161b-c**), parietal lip free of wall (**Figs 349b-c**). The lack of a free parietal lip and different microsculpture immediately separate *S. esau* Iredale, 1937 (**Figs 343e-f, Plate 161d-e**) and *S. illarana* (**Figs 341h-i, Plate 160d-e**), while *S. bagoti* from the George Gill Range also lacks the free parietal lip (**Figs 349e-f**) and the shell microsculpture is very dense with massive bases to the setae (**Plate 163a-b**). Anatomically, *S. hughana* (**Figs 350a-b**) has a medium length vagina (V), very large and tapering epiphallic caecum (EC), long slender penis, simple longitudinal pilasters on the penis chamber wall, and an elongated verge (PV) with broad rounded tip, little surface ridging, and typical sperm groove. *S. illarana* (**Figs 348a-b**) differs obviously in its short penis and very long verge. *S. esau* (**Figs 345-346**) has a much shorter epiphallic caecum and elongate-ovate verge with wrinkled surface. *S. elleryi* has a much larger epiphallic caecum and very small verge, and *S. bagoti* (**Figs 351a-c**) has a very small epiphallic caecum, complex penis chamber wall sculpture, and a short, broad, wrinkled verge.

Holotype

AM C.135985, WA-765, 4.7 km N of Hugh River crossing, W of Stuart Highway, James Ranges, Northern Territory, Australia (Henbury 1:250,000 map sheet SG 53-1

- 6730:9695yds). 24° 19' 49" S, 133° 27' 44" E. Collected by Alan Solem and Phil Colman 27 April 1981. Height of holotype 5.5 diameter 11.1 mm, H/D ratio 0.495, whorls 4 3/8, umbilical width 3.4 mm, D/U ratio 3.26.

Paratopotypes

AM C.136003, SAM D18094, WAM 711.87, QM, MV, FMNH 205564, 13 LA, 7 LJ from the type locality.

Paratypes

Northern Territory

JAMES RANGE: 3 miles N of Hugh River crossing, Old Stuart Highway (WA-119, FMNH 182712, 3 DA).

Range

Semotrachia hughana, sp. nov., has only been collected from the two localities on the fringes of the James Ranges, NT. No land snail collections have been made between there and the Ellery Creek-Finke River junction, about 71 km to the WNW. Hence the actual range of *S. hughana* is unknown.

Diagnosis

Shell medium in size, adult diameter 10.35-11.6 mm (mean 11.07 mm), whorls 4 1/4- to 4 1/2+ (mean 4 3/8-). Apex and spire slightly elevated (**Fig. 349b**), shell height 4.7-5.65 mm (mean 5.15 mm), H/D ratio 0.441-0.488 (mean 0.465). Body whorl (**Fig. 349b**) rounded, descending abruptly just behind lip. Apex (**Plate 161a**) with dense pustules, spire and body whorl (**Plate 161b-c**) with widely spaced long base setae and prominent micro ridging. Umbilicus (**Fig. 349c**) typical, width 2.9-3.65 mm (mean 3.20 mm), D/U ratio 3.11-3.88 (mean 3.47). Lip sharply reflected and moderately expanded, usually continuous and narrowly free of parietal wall (**Figs 349b-c**). Shell yellow-brown, base lighter. Based on 14 measured adults.

Genitalia (**Figs 350a-b**) with a medium length vagina (V) and short free oviduct (UV). Epiphallic caecum (EC) large, gradually tapering. Epiphallus (E) slightly longer than penis (P). Penis chamber wall sculpture simple. Verge (PV) medium in length, not tapering, tip rounded, surface at most slightly wrinkled, sperm groove prominent.

Central and lateral teeth of radula (**Plate 162a**) with small anterior flare, very high cusp shaft angle, curved cusp tip, and very large ectocone. Late laterals (**Plate 162b**) with enlarged anterior flare and ectocone, cusp shaft angle and cusp curvature reduced. Lateromarginal transition and marginals without unusual features. Jaw (**Plate 162c**) with narrow vertical ribs that are greatly reduced on the sides.

Discussion

Semotrachia hughana, sp. nov., has been collected along the Old Stuart Highway just N of the Hugh River crossing. It probably has a more extended geographic range.

The name *hughana* refers to the nearby Hugh River.

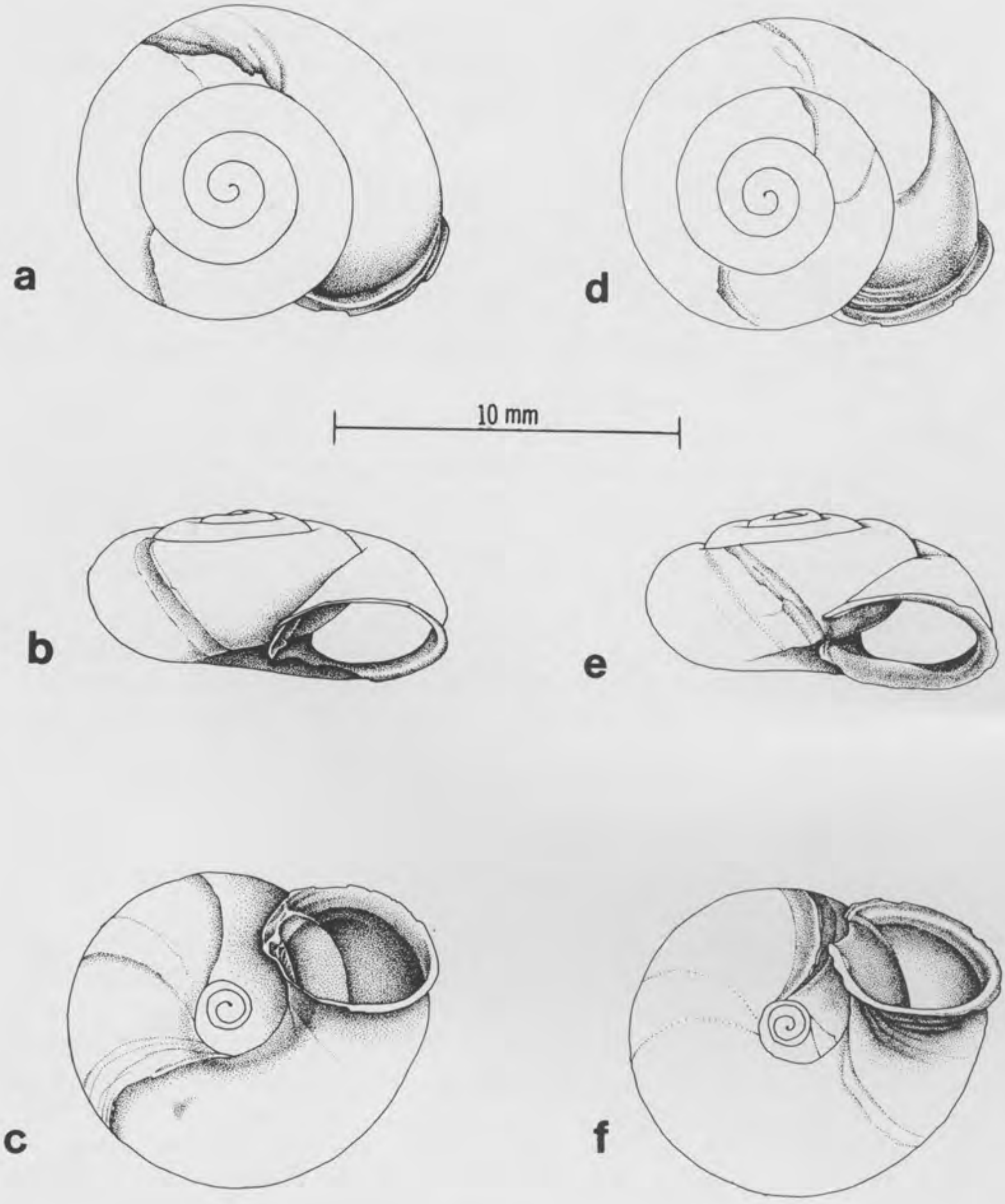


Fig. 349: Shells of *Semotrachia hughana*, sp. nov., and *S. bagoti*, sp. nov.: (a-c) Holotype of *S. hughana*. WA-765, 4.7 km N of old Stuart Highway crossing of Hugh River, James Ranges, NT. AM C.135985; (d-f) Holotype of *S. bagoti*. WA-445, Reedy Rockhole, George Gill Range, NT. AM C.135986. Scale line equals 10 mm. Drawings by Linnea Lahlum.

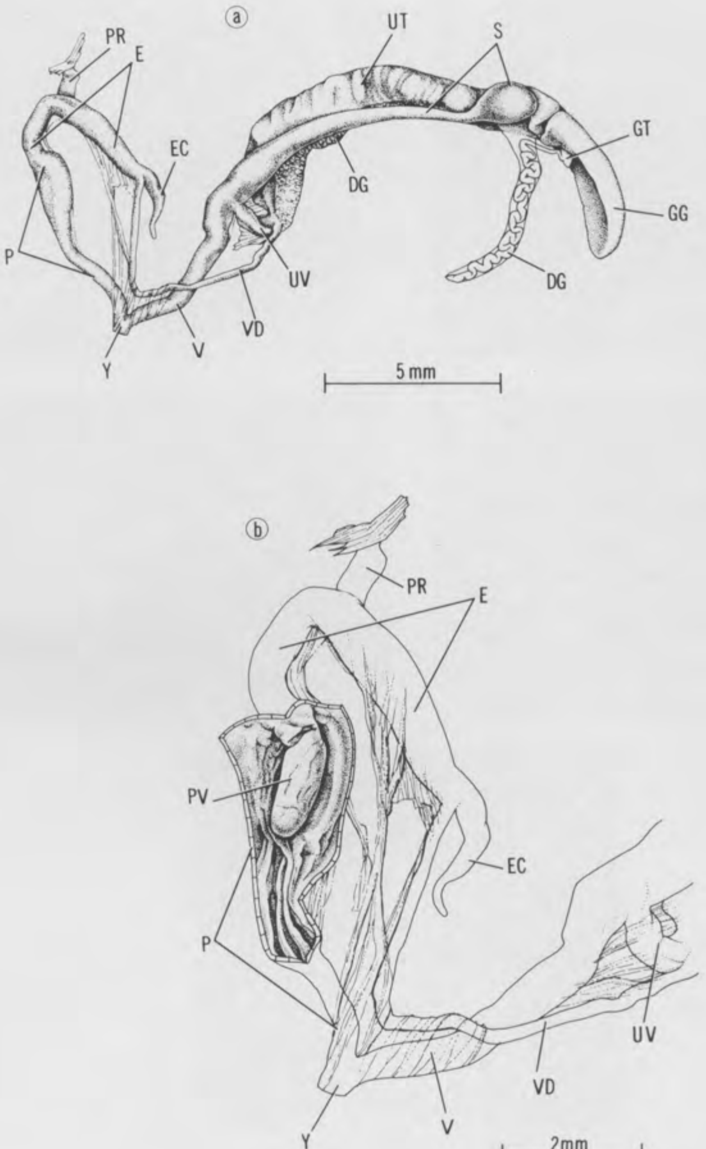


Fig. 350: Genitalia of *Semotrachia hughana*, sp. nov.: WA-765, 4.7 km N of Old Stuart Highway crossing of Hugh River, James Ranges, NT. 27 April 1981. FMNH 205564, Dissection A. (a) whole genitalia; (b) interior of penis. Scale lines as marked. Drawings by Linnea Lahlum.

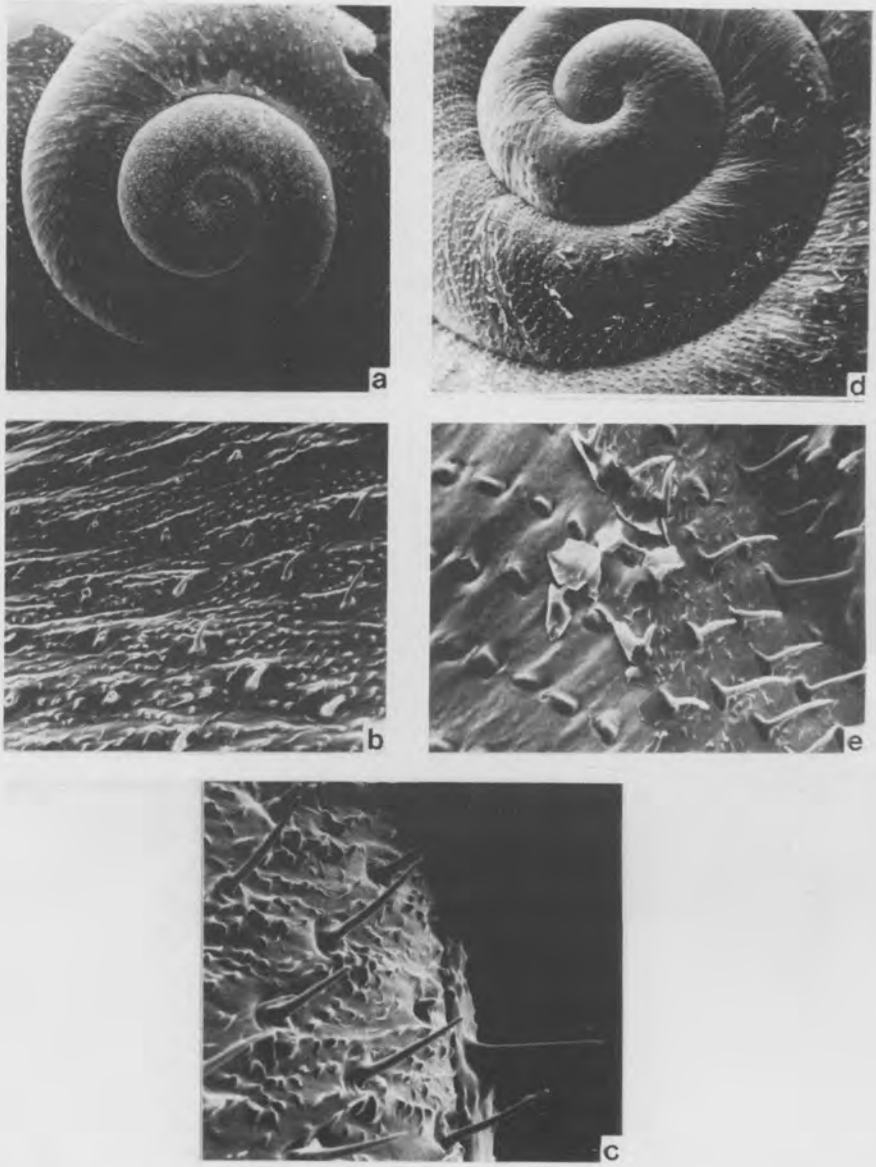


Plate 161: Shell sculpture of *Semotrachia hughana* and *S. esau* Iredale, 1937: (a-c) *S. hughana.* WA-765, James Ranges, NT. FMNH 205564. a is apex and spire at 19.9X, b is setae on body whorl at 53X, c is undamaged setae on body whorl at 93X; (d-e) *S. esau.* WA-766, 10 km N of Palmer River, NT. FMNH 205565. d is apex and spire, part with periostracum eroded at 22.7X, e is detail of periostracal erosion showing relationship between periostracal setae and underlying calcareous pustules at 110X.

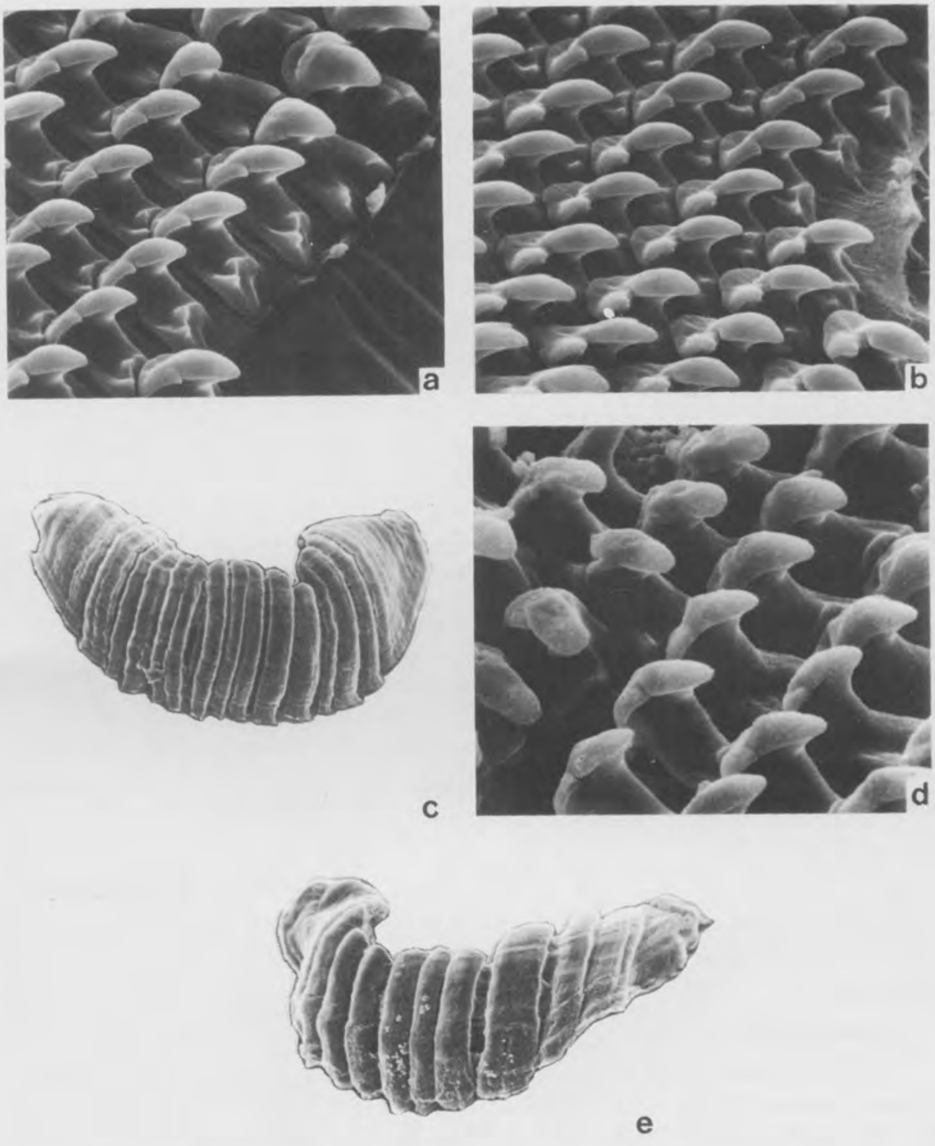


Plate 162: Radular teeth and jaw of *Semotrachia hughana* and *S. esau* Iredale, 1937: (a-c) *S. hughana.* WA-765, James Ranges, NT. 27 April 1981. FMNH 205564, Dissection A. a is central and laterals at 820X, b is lateromarginal transition at 830X, c is jaw at 100X; (d-e) *S. esau.* WA-766, 10 km N of Palmer River, NT. 27 April 1984. FMNH 205565, Dissection A. d is central and laterals at 1,075X, e is jaw at 110X.

SEMOTRACHIA BAGOTI, SP. NOV.
(Plates 163a-f; Figs 349d-f, 351a-c)

Comparative remarks

Semotrachia bagoti, sp. nov., from the George Gill Range E of Kings Canyon, NT, is medium sized (mean diameter 11.16 mm), with elevated spire (**Fig. 349e**, mean H/D ratio 0.506), slightly increased whorl count (mean 4 1/2+), typical umbilicus (mean D/U ratio 3.69), microsculpture (**Plate 163a-b**) of closely spaced setae with massives bases, parietal lip reduced to a thin callus (**Figs 349e-f**). *S. hughana*, from the Hugh River, has the spire less elevated (**Fig. 349b**, mean H/D ratio 0.465), widely spaced medium base setae (**Plate 161a-b**), and the parietal lip free of the parietal wall (**Figs 349b-c**). The Krichauff Range *S. esau* Iredale, 1937 is larger (mean diameter 11.92 mm), has slightly more whorls (mean 4 3/4), but very similar microsculpture (**Plate 158d-f**). Anatomically, *S. bagoti* (**Figs 351a-c**) has a long vagina (V) and medium length free oviduct (UV), small, finger-shaped epiphallic caecum (EC), epiphallus (E) and penis (P) about equal in length, penis chamber wall sculpture partly corrugated and complex, verge (PV) ovate with wrinkled surface and prominent sperm groove. *S. hughana* (**Figs 350a-b**) has a much shorter vagina and free oviduct, large epiphallic caecum, much simpler penis chamber wall sculpture, and the verge is cyclindrical with blunt tip. *S. esau* (**Figs 345a-c, 346**) has a similar verge and penis chamber wall sculpture, but the much larger, tapering epiphallic caecum is an obvious difference.

Holotype

AM C.135986, WA-445, talus under figs just E of Reedy Rockhole, Gill Ranges, Northern Territory, Australia (Lake Amadeus 1:250,000 map sheet SG 52-4-467:976yds). 24° 18' S, 131° 36' E. Collected by Alan Solem and Laurel Keller 25 May 1977. Height of holotype 5.7 mm, diameter 11.05 mm, H/D ratio 0.516, whorls 4 3/8+, umbilical width 3.2 mm, D/U ratio 3.45.

Paratopotypes

AM C.136004-5, SAM D18095, WAM 712.87, QM, MV, FMNH 199689-90, 15 LA, 3 DA, 5 LJ, 4 DJ from the type locality; 1 May 1987, V. Kessner!, K 11759, 52 DA, 1 DJ.

Paratypes

Northern Territory

GEORGE GILL RANGE: Penny Springs (1 May 1987, V. Kessner!, K 11757, 16 DA); Kathleen Spring (WA-446, under figs, AM C.136006-7, SAM D18096, WAM 713.87, QM, MV, FMNH 199691-2, 21 LA, 6 DA, 15 LJ, 8 DJ); Bagot Spring (WA-447, E slope 0.5 km above reed area, AM C.136008, FMNH 199649-50, FMNH 200480, 5 LA, 2 DA, 7 LJ, 2 DJ); branch of Stokes Creek (WA-937, under rocks, AM C.136009, SAM D18097, WAM 714.87, QM, MV, FMNH 212409-11, 19 LA, 10 DA, 14 LJ, 5 DJ).

Range

Semotrachia bagoti, sp. nov., has been collected along the S face of the George Gill Range, NT between Penny Springs and Bagot Spring, a distance of about 26 km. The

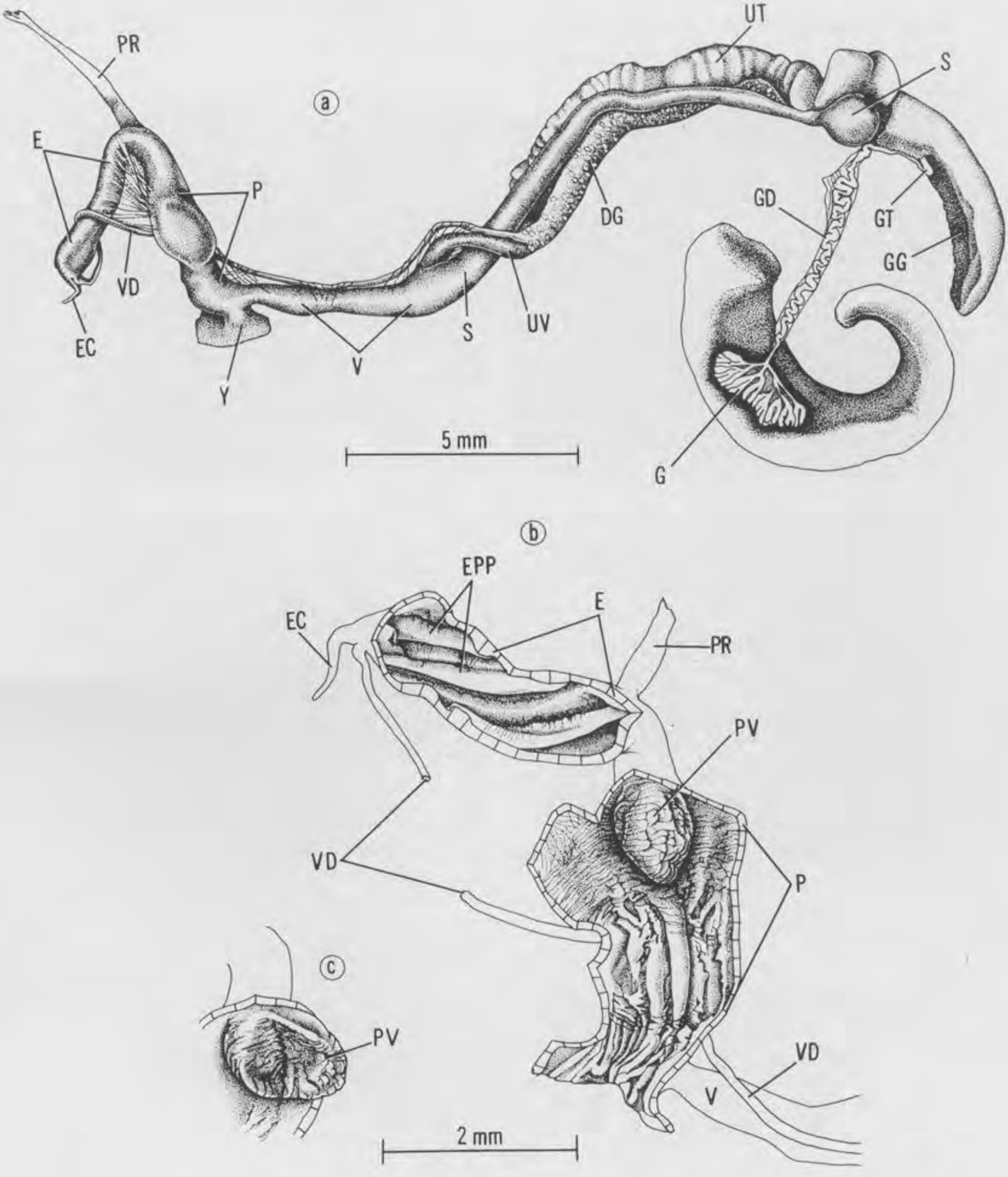


Fig. 351: Genitalia of *Semotrachia bagoti*, sp. nov.: (a) WA-445, Reedy Rockhole, George Gill Range, NT. 25 May 1977. FMNH 199689, Dissection B. whole genitalia; (b-c) WA-937, Stokes Creek, George Gill Range, NT. 27 May 1983. FMNH 212410, Dissection A. b is interior of penis and epiphallus. c is detail of verge. Scale lines as marked. Drawings by Linnea Lahlum.

limited material from Kings Canyon appears to be a distinct species, but until it can be dissected, description is premature (see below).

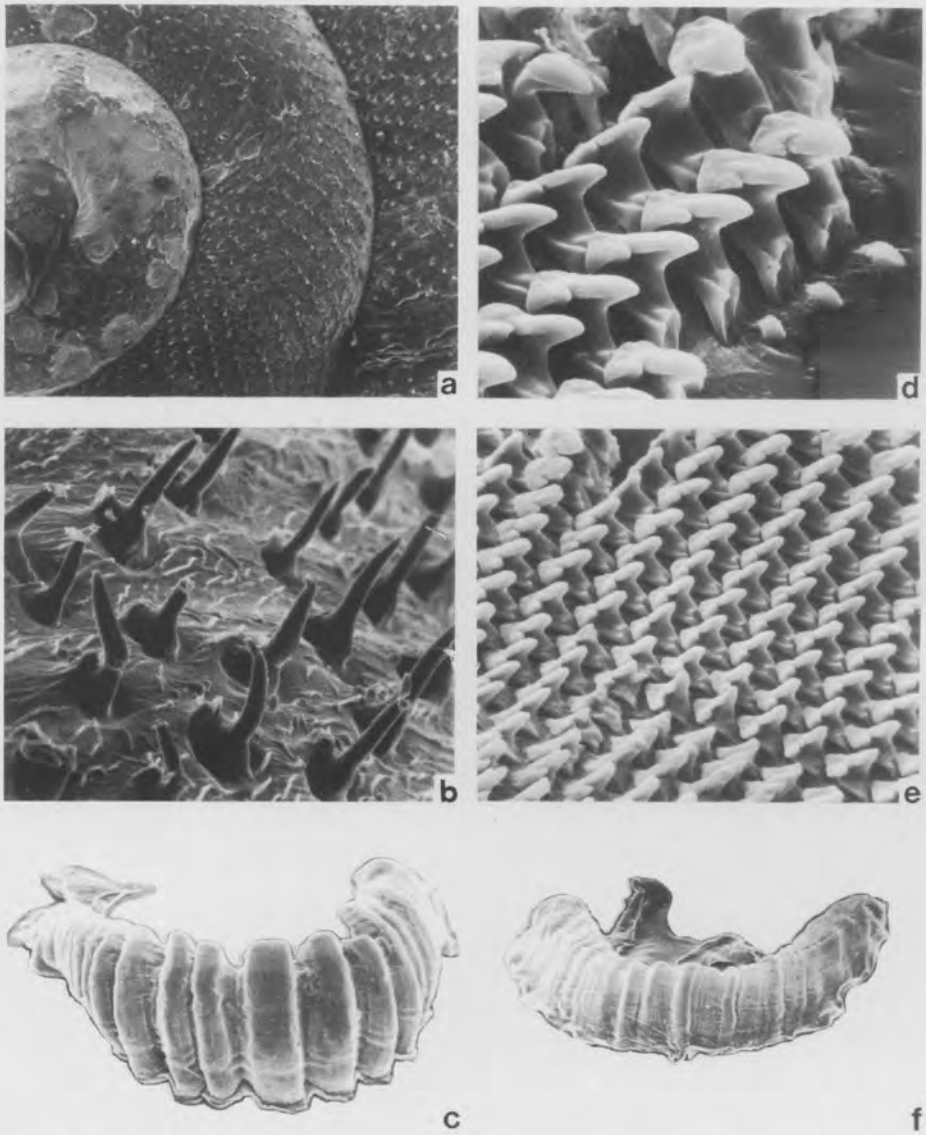


Plate 163: Shell sculpture, radular teeth, and jaw of *Semotrachia bagoti*: (a-b) WA-937, Stokes Creek, George Gill Range, NT. FMNH 212410. a is apex and spire at 30X, b is setae on body whorl at 180X; (c-f) WA-446, Kathleen Spring, George Gill Range, NT. 25 May 1977. FMNH 199691. c is Dissection B, jaw at 105X, d-f are Dissection A, d is central and early laterals at 870X, e is lateromarginal transition at 425X, f is jaw at 77X.

Diagnosis

Shell medium in size, adult diameter 9.15-12.7 mm (mean 11.16 mm), whorls 4 1/8+ to 5 (mean 4 1/2+). Apex and spire elevated (**Fig. 349e**), shell height 4.2-7.1 mm (mean 5.65 mm), H/D ratio 0.432-0.603 (mean 0.506). Body whorl (**Fig. 349e**) rounded, descending abruptly just behind lip. Apex (**Plate 163a**) with large pustules, spire and body whorl (**Plate 163a-b**) with short, closely spaced setae with massive bases and prominent micro ridging. Umbilicus (**Fig. 349f**) typical, width 1.8-3.9 mm (mean 3.05 mm), D/U ratio 3.11-3.88 (mean 3.69). Lip sharply reflected and moderately expanded, parietal section narrow, with at most a modest callus (**Figs 349e-f**). Shell colour yellow-brown, base lighter. Based on 150 measured adults.

Genitalia (**Figs 351a-c**) with long vagina (V) and moderately long free oviduct (UV). Epiphallic caecum (EC) short, slender, only slightly tapering. Epiphallus (E) equal in length to penis (P). Wall sculpture of penis chamber corrugated above and below. Verge (PV) almost ovate in shape, surface wrinkled, sperm groove prominent.

Central and lateral teeth of radula (**Plate 163d**) with moderate anterior flare, normal cusp shaft angle, very slight cusp tip curvature, large ectocone, relatively short basal plate. Late laterals (**Plate 163e**) with enlarged anterior flare and ectocone, slightly higher cusp shaft angle. Lateromarginal transition (**Plate 163e**) abrupt. Jaw (**Plate 163c, f**) variable in ribbing.

Discussion

Semotrachia bagoti, sp. nov., shows some size variation (**Table 129**), with the Stokes Creek (WA-937) samples being smaller than the remaining samples. The increased shell height and H/D ratio for the 1987 samples from Penny Spring (K11757) and Reedy Creek (K11759) are an artifact of measuring technique. The whorl count and shell diameter are not affected.

Only one sample has been taken in Kings Canyon (K11709, under figs near waterhole). The shells are 6.5-7.3 mm in diameter, with about 3 7/8 whorls, a wide umbilicus, a microsculpture of short base, widely spaced setae, and the parietal lip is free of the wall. No preserved specimens are available. Although clearly not assignable to any of the species defined in this report, description is premature in the absence of any anatomical data.

Collecting in the George Gill Range to date has been limited to the S side canyons and creek gorges. No collections have been made in adjacent range areas.

The name *bagoti* comes from Bagot Spring.

SEMOTRACHIA MINUTA, SP. NOV.

(Plates 164a-b, 165a; Figs 337d, 352a-c, 353a-b)

Comparative remarks

Semotrachia minuta, sp. nov., from near Ernabella, Musgrave Ranges, SA, is the smallest known *Semotrachia* (mean diameter 5.41 mm), with modestly elevated spire (**Fig. 352b**, mean H/D ratio 0.387), greatly reduced whorl count (mean 3 1/2) wide umbilicus (**Fig. 352c**, mean D/U ratio 3.04), microsculpture (**Plate 164a-b**) of diagonal partial to complete ridges on the apex, scattered pustules on spire and body whorl plus micro-pustules, juveniles with widely spaced, short base setae, parietal lip continuous and well free of parietal wall. *S. illbilleeana* from the Everard Ranges (**Figs 352d-f**) is considerable larger and more narrowly umbilicated (**Table 127**), the microsculpture (**Plate 164c-e**) consists of closely spaced spatulate setae, and the parietal lip is reduced to a thin to thick callus (**Figs 352e-f**). *S. winneckeana* (Tate, 1894), from the Chewings and Heavitree Ranges is larger (mean diameter 5.99 mm), with much weaker sculpture. All other *Semotrachia* average more than 7.5 mm in diameter. Anatomically, *S. minuta* (**Figs 353a-b**) has a long and slender vagina (V), the epiphallic caecum (EC) is small and finger-shaped, the epiphallus (E) is more than twice the length of the penis (P), the penis chamber wall sculpture is corrugated above and enlarged basally, the verge is very long, cylindrical, with sperm groove extending nearly the entire length. *S. illbilleeana* (**Figs 354a-b**) has a much enlarged epiphallic caecum, smaller penis and verge, and less complex penis chamber wall sculpture. *S. winneckeana* (**Figs 342a-b**) is immediately differentiated by the very short vagina and massive set of fibers binding the epiphallus to the penis. The other Musgrave Range species differ immediately in their foliated verge and accessory vergic structure (**Figs 356-358, 360**).

Holotype

SAM D18033, WA-869, Wamikata Road, 1.8 km N of Alalka turnoff, near Ernabella, 1 km E of track, Musgrave Ranges, South Australia (Alberga 1:250,000 map sheet SG 53-9 - 526:747yds). 26° 10' 59" S, 132° 08' 52" E. Collected by the Central Australian Expedition. 7 May 1983. Height of holotype 2.5 mm, diameter 5.1 mm, H/D ratio 0.490, whorls 3 1/2, umbilical width 1.35 mm, D/U ratio 3.78.

Paratopotypes

SAM D18084, AM C.135966, WAM 703.87, QM, MV, FMNH 212143, 22 LA, 4 LJ from the type locality.

Paratypes

South Australia

MUSGRAVE RANGES: Alalka Gorge (WA-875, above campground, near Ernabella, SAM D18085, AM C.135997, WAM 704.87, FMNH 212168, 4 LA, 7 LJ); 5 km S of Ernabella (6 May 1987, V. Kessner!, K11710, 9 DA).

Range

Semotrachia minuta, sp. nov., has been collected from three localities near Ernabella in the eastern Musgrave Ranges, SA. The stations are only 18 km apart. At all localities it is sympatric with *S. basedowi* (Hedley, 1905).

Diagnosis

Shell very small, adult diameter 4.9-6.6 mm (mean 5.41 mm), whorls 3 1/4+ to 3 7/8+ (mean 3 1/2). Apex and spire slightly elevated (**Fig. 352b**), shell height 1.8-2.55 mm (mean 2.09 mm), H/D ratio 0.334-0.442 (mean 0.387). Body whorl (**Fig. 352b**) shouldered, descending abruptly behind lip. Apex (**Plate 164a**) with scattered pustules

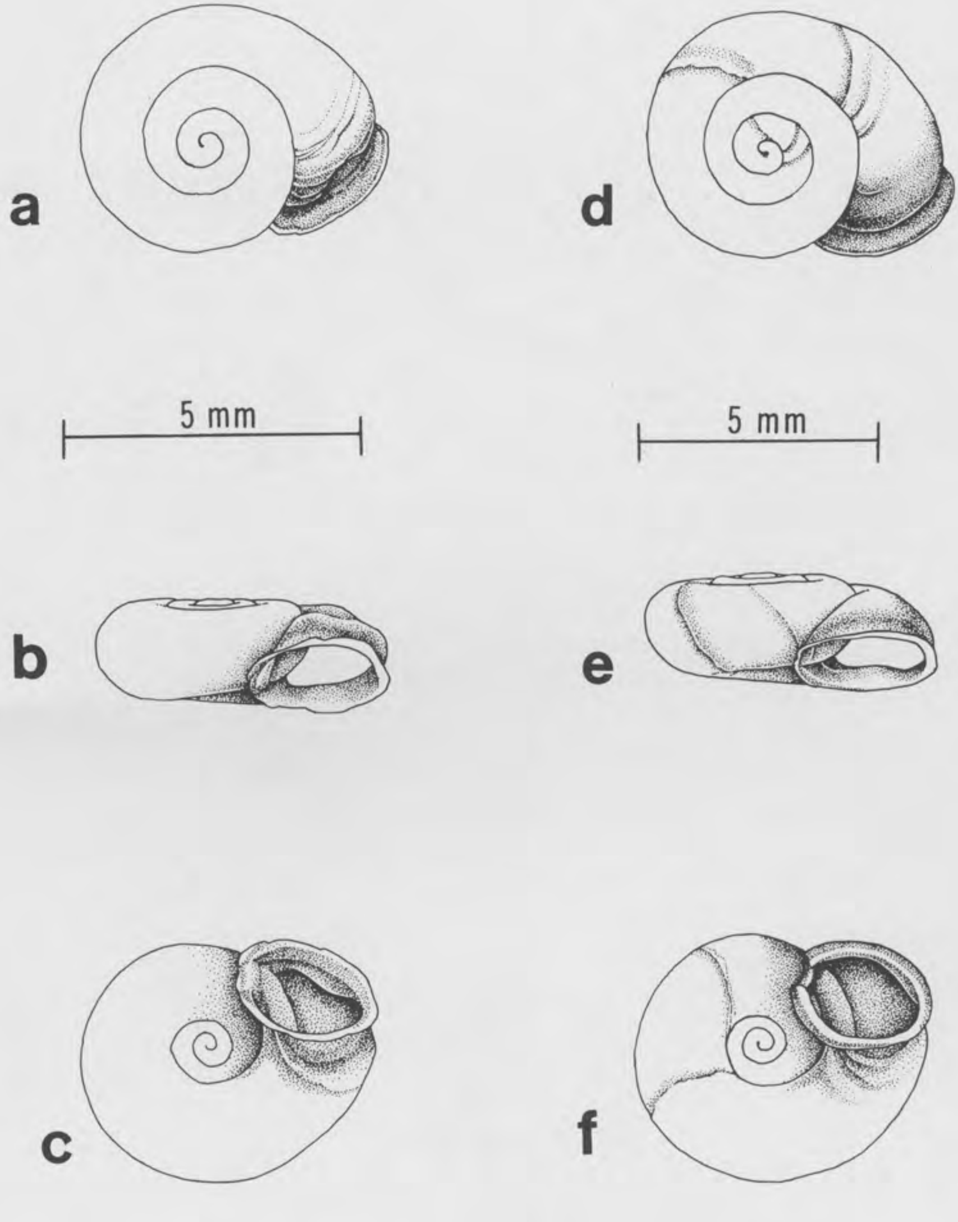


Fig. 352: Shells of *Semotrachia minuta*, sp. nov., and *S. illbilleana*, sp. nov.: (a-c) Holotype of *S. minuta*. WA-869, Wamikata Road, near Ernabella, Musgrave Ranges, SA. SAM D18033; (d-f) Holotype of *S. illbilleeana*. WA-857, gorge 4.5 km E of Victory Well, E end Mt. Illbillee, Everard Ranges, SA. SAM D18036. Scale line equals 10 mm. Drawings by Linnea Lahlum.

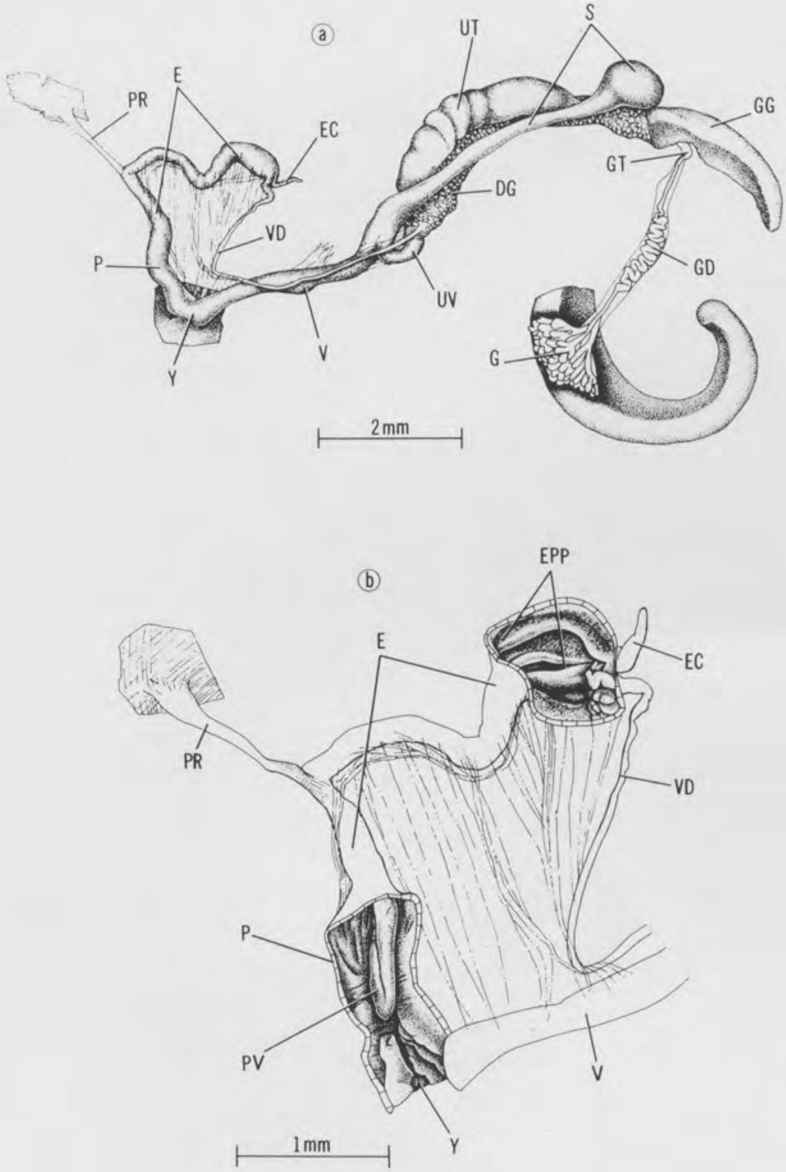


Fig. 353: Genitalia of *Semotrachia minuta*, sp. nov.: WA-869, Wamikata Road near Ernabella, Musgrave Ranges, SA. 7 May 1983. FMNH 212143, Dissection A. (a) whole genitalia; (b) interior of epiphallus and penis. Scale lines as marked. Drawings by Linnea Lahlum.

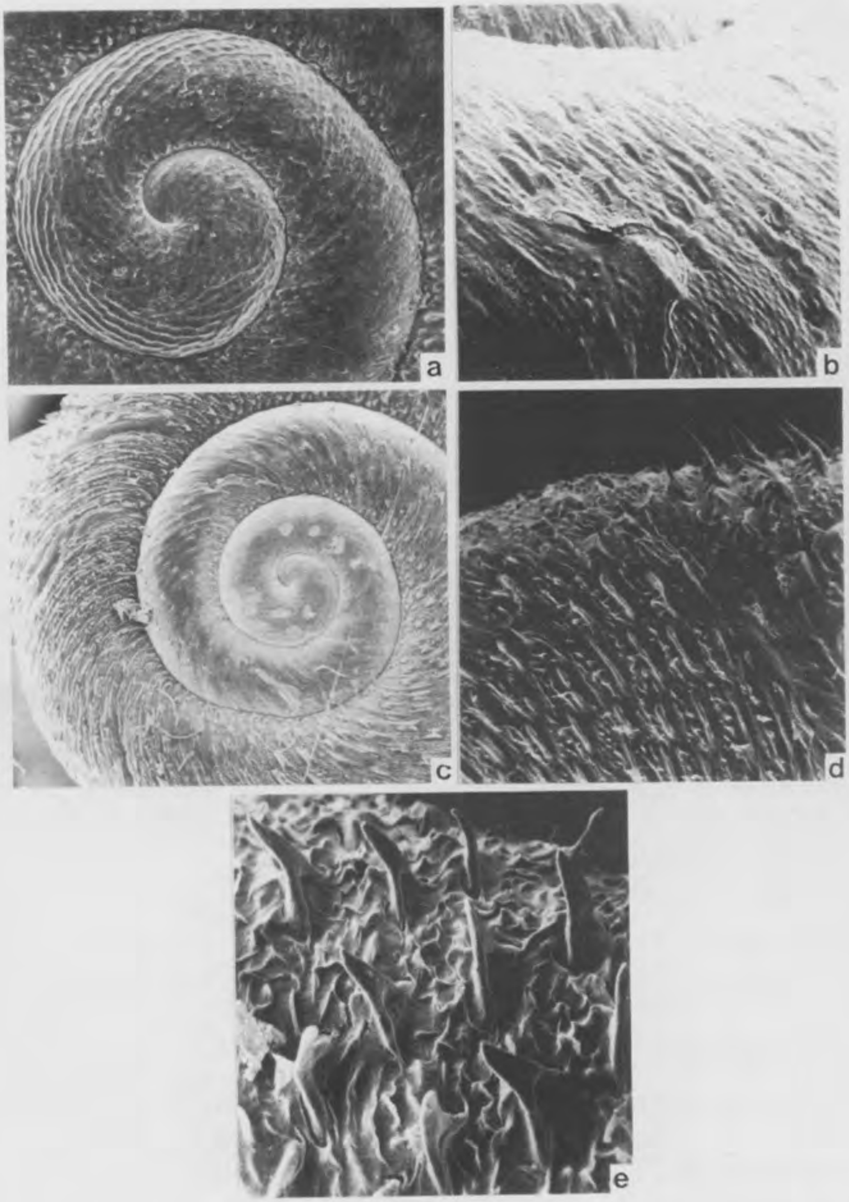


Plate 164: Shell sculpture of *Semotrachia minuta* and *S. illbilleeana*: (a-b) *S. minuta*. WA-869, near Ernabella, Musgrave Ranges, SA. FMNH 212143. a is apex as 45X, b is body whorl at 52X; (c-e) *S. illbilleeana*. WA-857, Mt. Illbillee, Everard Ranges, SA. FMNH 212105. c is apex and spire at 17.5X, d is body whorl at 49X, e is detail of setae on body whorl at 105X.

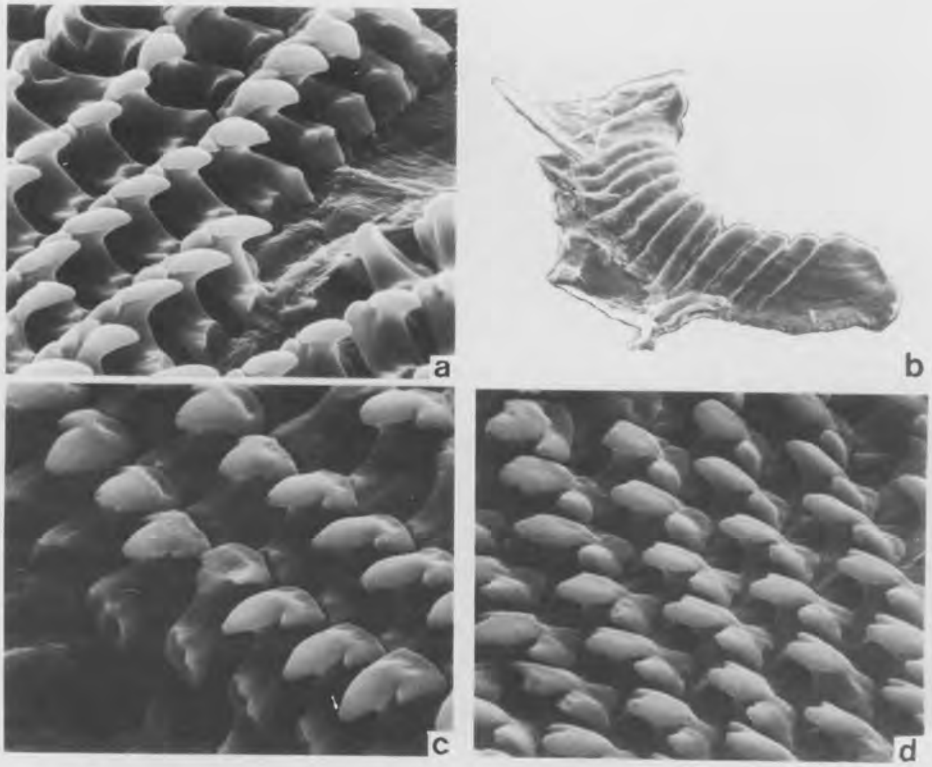


Plate 165: Radular teeth and jaw of *Semotrachia minuta* and *S. illbilleeana*: (a) *S. minuta*. WA-869, near Ernabella, Musgrave Ranges, SA. 7 May 1983. FMNH 212143, Dissection B. central and laterals at 1,275X; (b-d) *S. illbilleeana*. WA-857, Mt. Illbillee, Everard Ranges, SA. 5 May 1983. FMNH 212105, Dissection B. b is jaw at 130X, c is central and laterals at 1,225X, d is lateromarginal transition at 1,200X.

and ridglets on later portion, initially with diagonal ridges that later break up into elongated pustules. Spire and body whorl (**Plate 164b**) with low, short vertical ridglets and prominent pustules, wisely spaced setae observed only on juveniles. Umbilicus (**Fig. 352c**) widely open, last whorl decoiling much more rapidly, width 1.35-2.2 mm (mean 1.81 mm), D/U ratio 2.52-4.06 (mean 3.04). Lip sharply reflected and well expanded, parietal portion continuous and well free of parietal wall. Colour dark yellow-brown, base somewhat lighter. Based on 36 measured adults.

Genitalia (**Figs 353a-b**) with long vagina (V) and medium length free oviduct (UV). Epiphallic caecum (EC) average in length, slender. Epiphallus (E) much longer than penis (P). Wall chamber sculpture of penis corrugated above, thickened below. Verge (PV) long, slender, smooth surfaced, sperm groove extending nearly entire length.

Central and lateral teeth of radula (**Plate 165a**) with small anterior flare, elevated cusp shaft angle, strong cusp tip curvature, very large ectocone, and typical basal plate.

Lateromarginal teeth and marginals not observed because of preparation problems. Jaw without unusual features.

Discussion

Semotrachia minuta, sp. nov., always has been collected microsympatrically with *S. basedowi* (Hedley, 1905). The low number of individuals in two of the three samples summarized in **Table 129** prevent any comments on size variation.

The name *minuta* recognizes the very small size of the shell in this species.

SEMOTRACHIA ILLBILLEEANA, SP. NOV.
(Plates 164c-e, 165b-d; Figs 352d-f, 354a-b)

Comparative remarks

Semotrachia illbilleeana, sp. nov., from Mt. Illbillee, Everard Ranges, SA, is very small (mean diameter 6.49 mm), with a flat to slightly elevated spire (**Fig. 352e**, mean H/D ratio 0.382), greatly reduced whorl count (mean 3 5/8), typical umbilicus (**Fig. 352f**, mean D/U ratio 3.86), microsculpture (**Plate 164c-e**) of growth line pustules and spatulate crowded setae, parietal lip apressed to wall or a thin callus. The Musgrave Range *S. minuta* (**Figs 352a-c**) is much smaller and more widely umbilicated (**Table 127**), lacks the spatulate setae, and has the parietal lip continuous and free of the parietal wall. *S. winneckeana* (**Figs 341a-f**) is smaller and much more widely umbilicated (**Table 123**), and has different microsculpture (**Plate 156b-c, e**). Anatomically, *S. illbilleeana* (**Figs 354a-b**) has a long vagina (V) and short free oviduct (UV), the epiphallic caecum (EC) is proportionatly large with a wide base from which it tapers rapidly, the penis chamber wall sculpture is corrugated below, and the verge (PV) is short, broad, wrinkled and with a prominent sperm groove. *S. minuta* (**Figs 353a-b**) has a smaller epiphallic caecum and much longer verge. The other Musgrave Range species have a much larger verge and the foliated accessory organ.

Holotype

SAM D18036, WA-857, mouth of gorge 4.5 km E of Victory Well, E end of Mt. Illbillee, Everard Ranges, South Australia, Australia (Everard 1:250,000 map sheet SG 53-13 - 568:643yds). 27° 02' 26" S, 132° 32' 43" E. Collected by Central Australian Expedition 5 May 1983. Height of holotype 2.45 mm, diameter 6.6 mm, H/D ratio 0.371, whorls 3 1/2, umbilical width 2.15 mm, D/U ratio 3.07.

Paratopotypes

AM C.135998, SAM D18086, WAM 705.87, QM, MV, FMNH 212105, 14 LA, 14 LJ from the type locality.

Range

Semotrachia illbilleeana, sp. nov., has only been collected at the one station, a gorge on the S side of Mt. Illbillee, 4.5 km E of Victory Well, Everard Ranges, SA.

Diagnosis

Shell small, adult diameter 6.1-6.85 mm (mean 6.49 mm), whorls 3 3/8+ to 3 3/4+ (mean 3 5/8). Apex and spire flat to slightly elevated (**Fig. 352e**), shell height 2.3-2.65

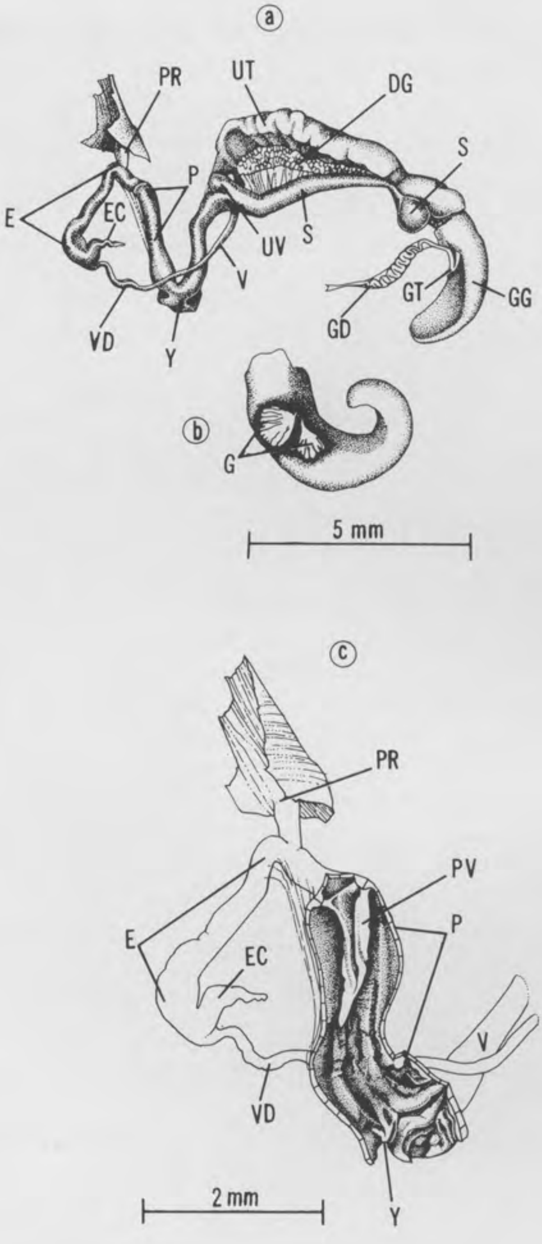


Fig. 354: Genitalia of *Semotrachia illbilleeana*, sp. nov.: WA-857, gorge 4.5 km E of Victory Well, E end Mt. Illbillee, Everard Ranges, SA. 5 May 1983. FMNH 212105. (a) whole genitalia, Dissection B; (b) interior of epiphallus and penis, Dissection A. Scale lines as marked. Drawings by Linnea Lahlum.

mm (mean 2.48 mm), H/D ratio 0.352-0.404 (mean 0.382). Body whorl (**Fig. 352e**) weakly shouldered, descending abruptly just behind lip. Apex (**Plate 164c**) with same sculpture as in *S. minuta* (**Plate 164a**). Spire and body whorl (**Plate 164c-e**) with prominent growth line pustules and micro ridging, setae spatulate and very dense, usually eroded. Umbilicus (**Fig. 352e**) relatively narrow, last whorl decoiling more rapidly, width 1.2-2.3 mm (mean 1.72 mm), D/U ratio 2.86-5.17 (mean 3.86). Lip sharply reflected and strongly expanded (**Figs 352e-f**), parietal section a thin to thick callus. Colour dark yellow-brown, base lighter. Based on 15 measured adults.

Genitalia (**Figs 354a-b**) with long and slender vagina (V), free oviduct (UV) short. Epiphallic caecum (EC) proportionately large, wide at base then tapering rapidly. Epiphallus (E) several times as long as penis (P). Wall chamber sculpture of penis corrugated below. Verge (PV) short, wide, wrinkled, with prominent sperm groove.

Central and lateral teeth of radula (**Plate 165c**) with prominent anterior flare, long base, typical cusp shaft angle, sharply curved cusp tip, and very large ectocone. Late laterals (**Plate 165d**) with very large anterior flare and huge ectocone, endocone starting to appear, mesosonal tip bluntly rounded. Lateromarginal transition (**Plate 165d**) and marginals typical. Jaw (**Plate 165b**) with ribs absent from side margins.

Discussion

Semotrachia illbilleeana, sp. nov., shares the unusual apical sculpture with the Musgrave Range *S. minuta* (see **Plate 164a, c**), but differs from all other *Semotrachia* in having spatulate setae (**Plate 164d-e**), which also occur in *Dirutrachia sublevata* (**Plate 170b-c**) from the Hart Ranges, NT. Otherwise the most similar setae are found in two species from N of the Roper River, NT - *Setobaudinia anatispretia* Solem, 1985 and *S. victoriana* Solem, 1985 (see Solem, 1985b: 722-723, plates 68b-f, 69a-b). These similarities appear to be convergent, since the genitalia of *Semotrachia* and *Setobaudinia* show significant differences.

The name *illbilleeana* honors the mountain in the Everard Range from which so many restricted range taxa are described in this report.

SEMOTRACHIA BASEDOWI (HEDLEY, 1905)

(Plates 167a-b, 169a-f; Figs 355a-c, 356a-b)

Thersites basedowi Hedley, 1905, Trans. Roy. Soc. South Austr., **29**: 161-162 - Musgrave Ranges (H. Basedow!).

Semotrachia basedowi (Hedley), Iredale, 1937, South Austr. Nat., **18** (2): 37; Iredale, 1938, Austr. Zool., **9** (2): 89 - check list citation; Richardson, 1985, Tryonia, **12**: 274 - check list citation.

Comparative remarks

Semotrachia basedowi (Hedley, 1905), from the E end of the Musgrave Ranges, SA, is by far the largest species (mean diameter 17.07 mm), with an at most slightly elevated spire (**Fig. 355b**, mean H/D ratio 0.362), near typical whorl count (mean 4 1/4-), narrowed umbilicus (**Fig. 355c**, mean D/U ratio 4.52), microsculpture (**Plate 167a-b**) of small ovate pustules and moderate micro ridging, shell lip (**Figs 355b-c**) sharply reflected and strongly expanded, parietal lip continuous and elevated well free of parietal wall. *S. discoidea* (**Figs 359d-f**), from near Mt. Woodroffe, Musgrave Ranges, is smaller (mean diameter 13.27 mm), much more depressed (mean H/D ratio 0.303), more widely umbilicated (mean D/U ratio 3.70), has sharp pointed, rather than elongated, pustules (**Plate 167f**), and the parietal lip is reduced to a callus. *S. plana* (**Figs 359a-c**), from the Currie River to Amata, Musgrave Ranges, is much smaller (mean diameter 10.68 mm), more elevated (mean H/D ratio 0.403), and more widely umbilicated (mean D/U ratio 3.69). *S. mannensis* Iredale, 1937 (**Figs 355d-e**), from the Mann Ranges, is much smaller (mean diameter 12.28 mm), much more elevated (mean H/D ratio 0.484), and even more narrowly umbilicated (mean D/U ratio 4.74). It also lacks the pustulose microsculpture (**Plate 167c-d**). Anatomically, *S. basedowi* (**Figs 356a-b**) has a long vagina (V) and medium length free oviduct (UV), a very long epiphallic caecum (EC) that tapers gradually, the epiphallus (E) twice the length of the penis (P), wall sculpture of penis chamber finely rugose, verge (PV) long and folded, with sperm groove extending to tip, and remnant of foliated pilaster situated as a low ridge at base of penis chamber. *S. discoidea* (**Figs 357a-b, 358**) has a shorter vagina and epiphallic caecum, the penis is shorter and extends partly alongside the very large foliated pilaster (FP), which is much larger than the verge. *S. plana* (**Figs 360a-b**) has the vagina and verge short, the foliated pilaster large. No other *Semotrachia* is known to have the foliated pilaster.

Holotype

AM C.19226, Musgrave Ranges, South Australia. Collected by Herbert Basedow. Height of holotype 6.5 mm, diameter 18.65 mm, H/D ratio 0.349, whorls 4 1/4, umbilical width 3.55 mm, D/U ratio 5.25.

Paratypes

South Australia

MUSGRAVE RANGES: Glen Ferdinand (SAM D.14908, 2 DA).

Material studied

South Australia

MUSGRAVE RANGES: Alalka Gorge (WA-875, above campground, SAM D18089, WAM 707.87, AM, FMNH 212169-70, 1 LA, 3 DA, 1 LJ, 3 DJ); Ernabella road (WA-874, 3.8 km S of Alalka turnoff, AM, SAM D18090, WAM 708.87, FMNH 212166-7, 7 LA, 15 LJ, 1 DJ); Wamikata road (WA-870, W side, 9.5 km N of Alalka turnoff, QM, FMNH 212151-2, 4 LA, 1 DA; WA-869, 1.8 km N of Alalka turnoff, SAM D18088, FMNH 212144-5, 1 DA, 2 LJ, 3 DJ); 5 km S of Ernabella (6 May 1987, V. Kessner!, K 11773-4, 6 DA, 6 DJ).

Range

Semotrachia basedowi (Hedley, 1905) has been collected from a few localities near Ernabella in the eastern Musgrave Ranges, SA. The northernmost locality (WA-870) is only 15 km N of the southernmost (5 km S of Ernabella). At three stations, WA-869, WA-875, 5 km S of Ernabella, it is sympatric with *S. minuta*, sp. nov.

Diagnosis

Shell very large, adult diameter 15.0-18.8 mm (mean 17.07 mm), whorls 3 3/4 to 4 5/8- (mean 4 1/4-). Apex and spire modestly elevated (**Fig. 355b**), shell height 5.0-7.9 mm (mean 5.99 mm), H/D ratio 0.489-0.537 (mean 0.508). Body whorl (**Fig. 355b**) angulated slightly above middle, descending abruptly just behind lip. Apex (**Plate 167a**) with small elongated pustules, spire and body whorl (**Plate 167a-b**) with small, elongated pustules along growth lines, plus moderate micro ridging. Umbilicus (**Fig. 355c**) narrow, last whorl decoiling more rapidly, width 3.1-4.75 mm (mean 3.81 mm), D/U ratio 3.67-5.93 (mean 4.52). Lip sharply reflected and strongly expanded (**Figs 355b-c**), parietal portion continuous and well free of parietal wall. Shell colour yellow-brown, base lighter. Based on 25 measured adults.

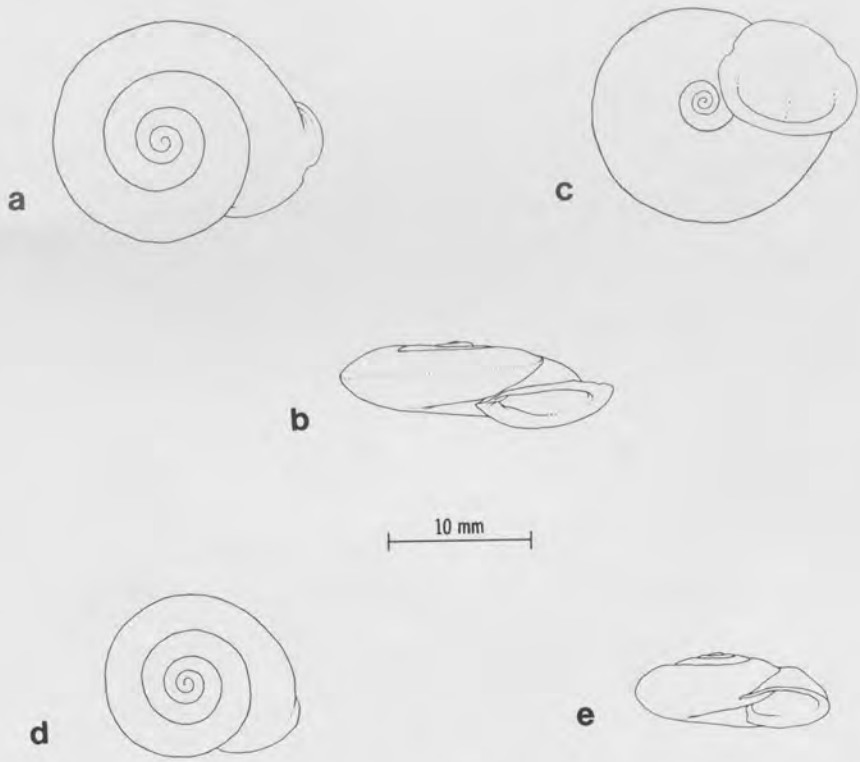


Fig. 355: Shells of *Semotrachia basedowi* (Hedley, 1905) and *S. mannensis* Iredale, 1937: (a-c) Holotype of *Thersites basedowi* Hedley, 1905. Musgrave Ranges, SA. AM C.19226; (d-e) Holotype of *Semotrachia basedowi mannensis* Iredale, 1937. Mann Ranges, SA. AM C.19227. Scale line equals 10 mm. Drawings by Elizabeth A. Liebman.

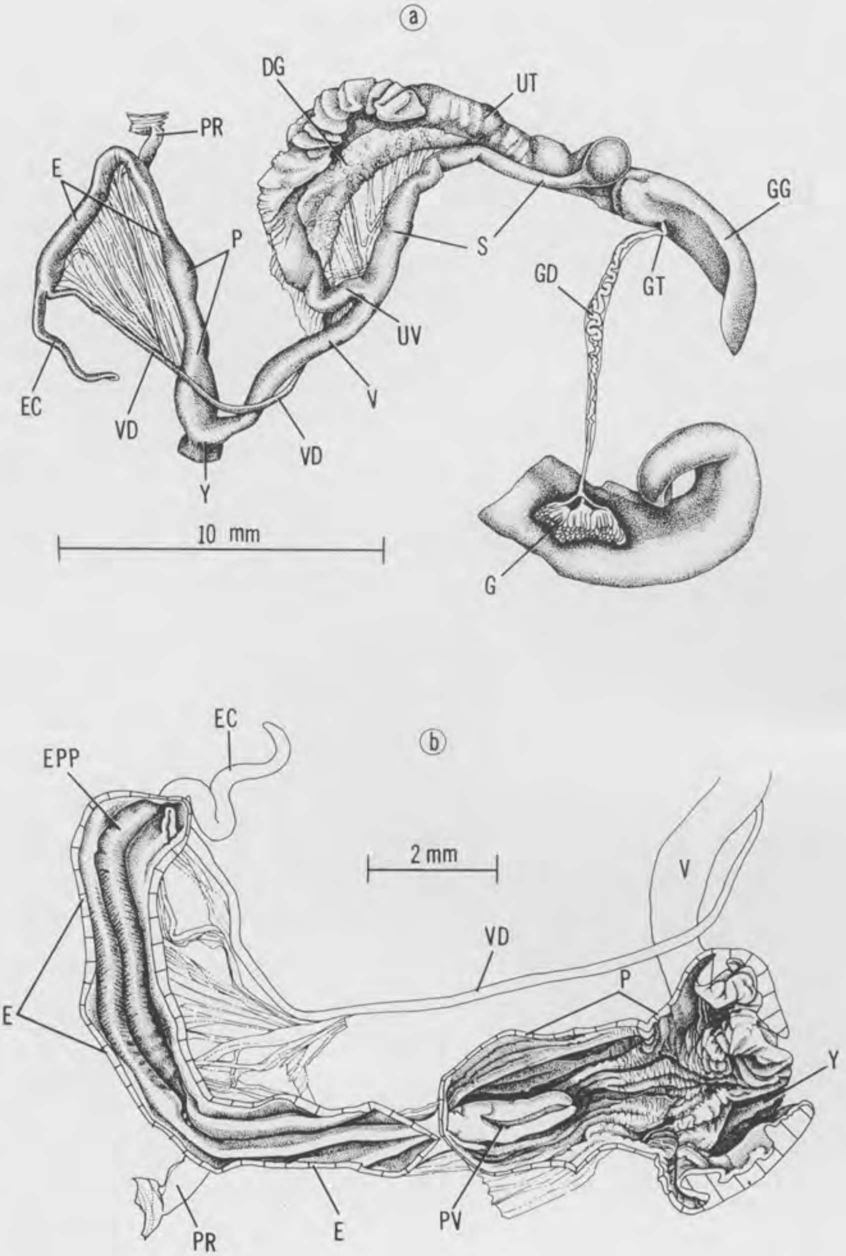


Fig. 356: Genitalia of *Semotrachia basedowi* (Hedley, 1905): WA-870, Wamikata Road near Ernabella, Musgrave Ranges, SA. 5 May 1983. FMNH 212151. (a) whole genitalia, Dissection A; (b) interior of epiphallus and penis, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

Genitalia (**Figs 356a-b**) with long vagina (V) and medium length free oviduct (UV). Epiphallic caecum (EC) very long, gradually tapering. Epiphallus (E) twice as long as penis (P), interior wall sculpture simple. Penial retractor muscle (PR) inserting below middle of epiphallus. Penis long, wall chamber sculpture finely rugose. Verge (PV) long, folded to a subcylindrical shape with a very deep sperm groove, rounded tip of penis well short of foliated pilaster remnant, which occupies base of penis chamber and is very low and short.

Central and lateral teeth of radula (**Plate 169a**) without anterior flare, near vertical cusp shaft angle, very strongly curved and rounded cusp tip, short basal plate, no ectocone. Early laterals (**Plate 169b**) also without ectocone, greatly altered basal plate. Lateromarginal transition (**Plate 169c**) abrupt, marked by appearance of ectocone and small anterior flare. Early marginals (**Plate 169d**) marked by appearance of small endocone, marked change in cusp shaft angle and cusp tip curvature, and increased size of ectocone. Outer marginals (**Plate 169e**) typical. Jaw (**Plate 169f**) with height of vertical ribs reduced, ribs absent from sides.

Discussion

Semotrachia basedowi (Hedley, 1905) is not only by far the largest species in the genus, but has the most modified radula and jaw (**Plate 169**). This undoubtedly relates to the number of camaenid species that are microsympatric in this part of the Musgrave Ranges - *Semotrachia basedowi* (Hedley, 1905), *Semotrachia minuta*, *Sinumelon pedasum* Iredale, 1937, and *Tatemelon musgum* (Iredale, 1937). None of the other species show significant radular alteration.

Within the Musgrave Ranges, there is an orderly replacement of *Semotrachia* species from E to W. Both *S. basedowi* (Hedley, 1905) and *S. minuta* have been found near Ernabella in the eastern area; *S. discoidea* has been collected once in the S foothills of Mt. Woodroffe; it is relaced on an outlier (WA-877) and then W to Mt. Morris near Amata by *S. plana*. In the Mann Ranges further to the W, the convergent *Montanomelon angatjana* has been collected on the E tip, while the still undissected *Semotrachia mannensis* Iredale, 1937 has been collected near the W tip, providing the westernmost record for *Semotrachia*.

Semotrachia basedowi was named after Herbert Basedow, collector of so many land snail species during the era of interior exploration.

SEMOTRACHIA MANNENSIS IREDALE, 1937
(Plate 167c-d; Figs 355d-e)

Thersites basedowi Hedley, 1905, Trans. Roy. Soc. South Austr., **29**: 162 - Mann Ranges.

Semotrachia basedowi mannensis Iredale, 1937, South Austr. Nat., **18** (2): 27, pl. II, fig. 18 - Mann Ranges.

Semotrachia mannensis Iredale, Iredale, 1938, Austr. Zool., **9** (2): 90 - check list citation; Richardson, 1985, Tryonia, **12**: 275 - check list citation.

Comparative remarks

Semotrachia mannensis Iredale, 1937, from the SW Mann Ranges, SA, is medium sized (mean diameter 12.28 mm), with a slightly elevated apex and spire (**Fig. 355e**, mean H/D ratio 0.484), normal whorl count (mean 4 3/8), rather narrow umbilicus (mean D/U ratio 4.74), rounded body whorl, microsculpture (**Plate 167c-d**) of rather widely spaced setae and moderate micro ridging, parietal lip a thin callus. *S. plana*, from the western Musgrave Ranges, is smaller (mean diameter 10.68 mm), with a shouldered body whorl and much lower spire (mean H/D ratio 0.403). *S. discoidea* from Mt. Woodroffe, Musgrave Ranges, is larger (mean diameter 13.27 mm), with a flat spire (**Fig. 359e**, mean H/D ratio 0.303), strongly shouldered body whorl, and has a microsculpture of crowded, sharp pointed pustules (**Plate 167f**). *S. basedowi* (Hedley, 1905), from the eastern Musgrave Ranges, is extremely large (mean diameter 17.07 mm), with an angulated periphery (**Fig. 355b**), and the parietal lip free of the parietal wall (**Figs 355b-c**). Anatomy unknown.

Holotype

AM C.19227, Mann Ranges, South Australia. Collected by Herbert Basedow. Height of holotype 5.65 mm, diameter 13.75 mm, H/D ratio 0.411, whorls 4 3/8+, umbilical width 3.75mm, D/U ratio 3.67.

Studied material

South Australia

MANN RANGES: Katjawara Soak (WA-898, SW end of Mann Ranges, SAM D18092, FMNH 212265, 2 DA, 1 DJ); Lake Wilson (WA-897, small bluff at NE corner, FMNH 212259, 1 DA); outlier at SW end of Mann Ranges (WA-900, FMNH 212270, 1 DJ).

Range

Semotrachia mannensis Iredale, 1937 has confirmed locality records only from Lake Wilson and Katjawara Soak at the W end of the Mann Ranges, SA. The two stations are only 5.3 km apart.

Diagnosis

Shell medium in size, adult diameter 11.45-13.75 mm (mean 12.28 mm), whorls 4 3/8- to 4 3/8+ (mean 4 3/8). Apex and spire slightly and evenly elevated (**Fig. 355d**), shell height 5.6-6.35 mm (mean 5.91 mm), H/D ratio 0.411-0.537 (mean 0.484). Body whorl rounded (**Fig. 355e**), descending moderately behind lip. Apex (**Plate 167c**) with crowded pustules, spire and body whorl (**Plate 167c-d**) with widely spaced setae and moderate micro ridging. Umbilicus variable, width 2.2-3.75 mm (mean 2.67 mm), D/U ratio 3.67-5.15 (mean 4.74). Lip sharply reflected, modestly expanded (**Figs 355d-e**), reduced to thin callus on parietal wall. Shell colour dark yellow-brown, base lighter. Based on 4 measured adults.

Anatomy unknown.

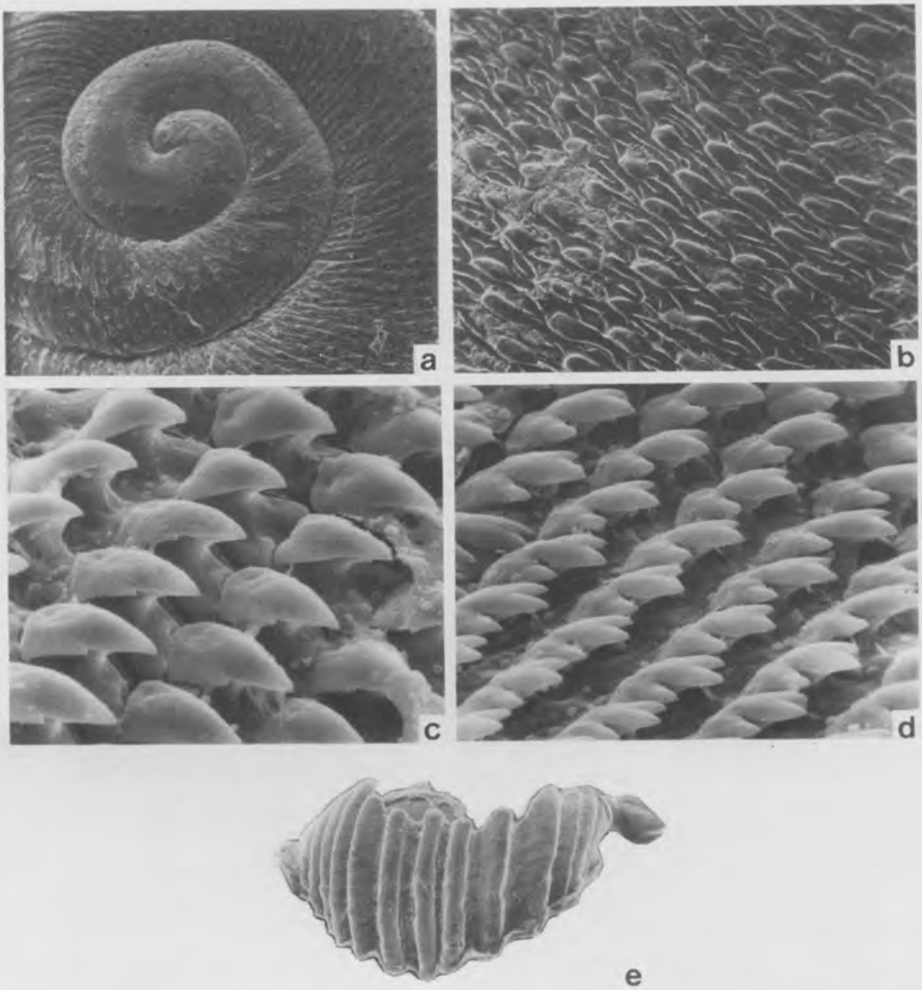


Plate 166: Shell sculpture, radular teeth, and jaw of *Semotrachia plana*: (a-c) WA-876, SW of Mt. Woodroffe, Musgrave Ranges, SA. 8 May 1983. FMNH 212210, Dissection A. a is apex and spire at 20.7X, b is microsculpture on lower spire at 55X, c is central and laterals at 820X, d is marginals at 840X, e is jaw at 79X.

Discussion

Semotrachia mannensis Iredale, 1937 was based originally on a bleached, very worn specimen without exact locality data. The 1983 Mann Range field work produced a few adult examples from the SW end of the Mann Ranges that are significantly smaller, with a greater H/D ratio, and narrower umbilicus (**Table 129**) than the type example (see holotype above). Probably two different species are represented, but in the absence of anatomical material, I prefer to lump them together, especially as the type lacks precise locality data.

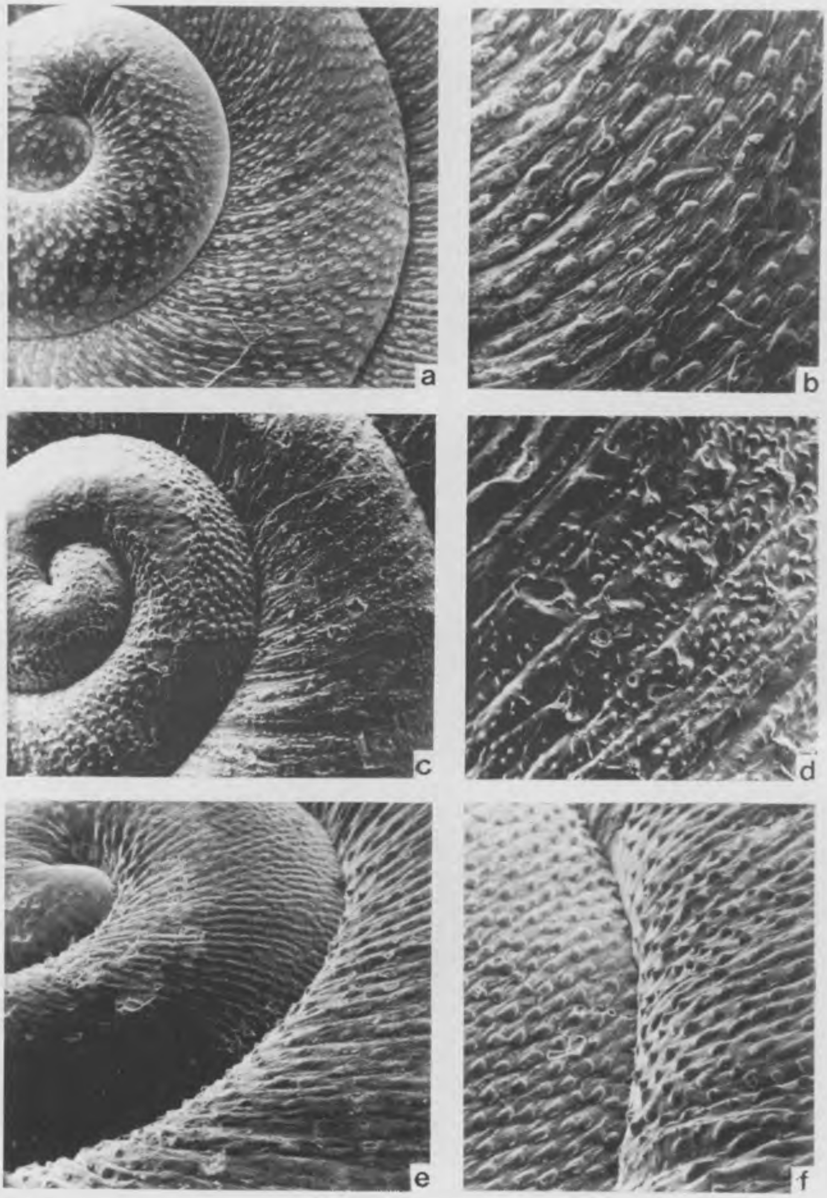


Plate 167: Shell sculpture of *Semotrachia basedowi* (Hedley, 1905), *S. mannensis* Iredale, 1937, and *S. discoidea*: (a-b) *S. basedowi*. WA-869, near Ernabella, Musgrave Ranges, SA. FMNH 212145. a is apex and spire at 21.6X, b is detail of body whorl sculpture at 18.3X; (c-d) *S. mannensis*. WA-897, Lake Wilson, Mann Ranges, SA. FMNH 212259. c is apex and spire at 23.9X, d is microsculpture on body whorl at 58X; (e-f) *S. discoidea*. WA-876, SSE of Mt. Woodroffe, Musgrave Ranges, SA. FMNH 212181. e is apex and spire at 51X, f is lower spire and body whorl at 51X.

Whether or not the Mann Range populations will have the very unusual foliated pilaster found in the Musgrave Range species is unknown, and cannot be predicted from the available shell data.

Although originally described as a subspecies of *Semotrachia basedowi* (Hedley, 1905), the very different shell shape (**Figs 355a-e**) and microsculpture (**Plate 167a-d**) of *S. mannensis* suggest species level differences.

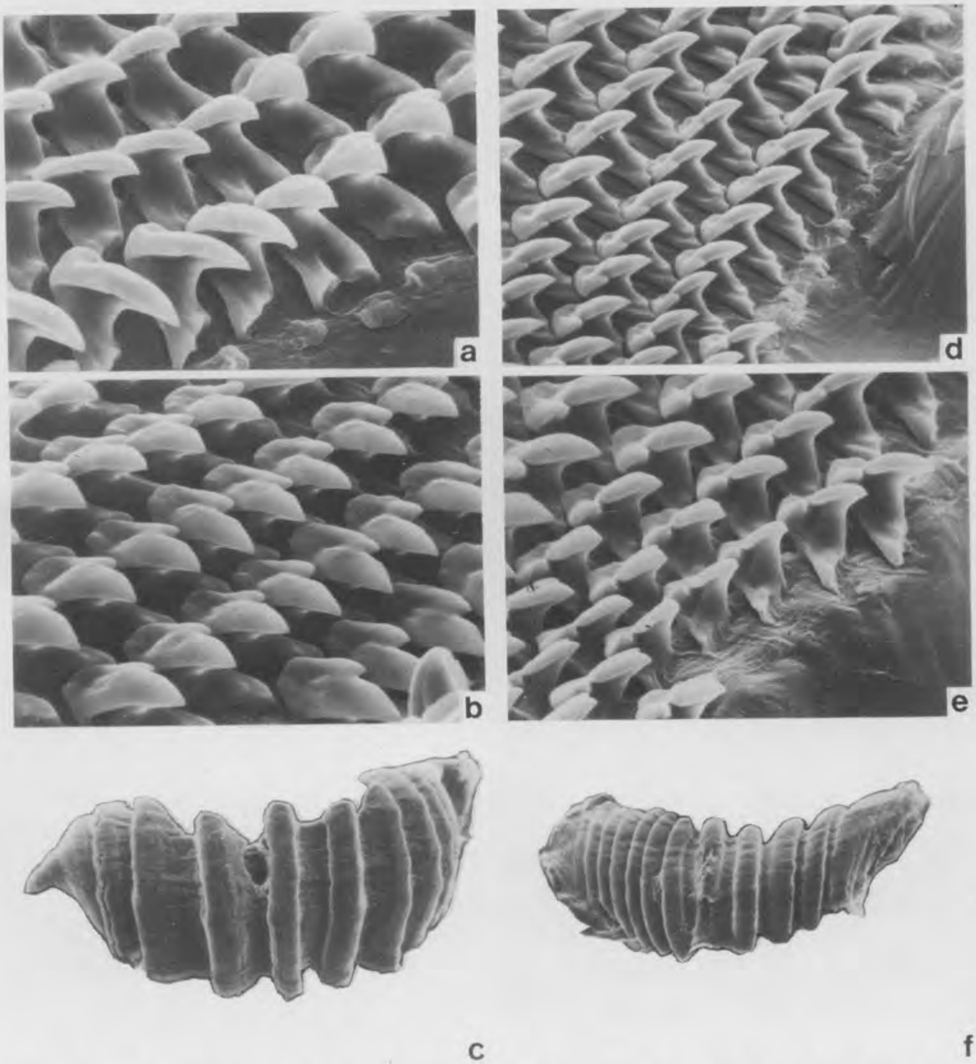


Plate 168: Radular teeth and jaw of *Semotrachia discoidea*: WA-876, SSE Mt. Woodroffe, Musgrave Ranges, SA. 8 May 1983. FMNH 212180. (a-c) Dissection A. a is central and laterals at 760X, b is lateromarginal transition at 780X, c is jaw at 115X. (d-f) Dissection B. d is central and laterals at 520X, e is lateromarginal transition at 750X, f is jaw at 78X.

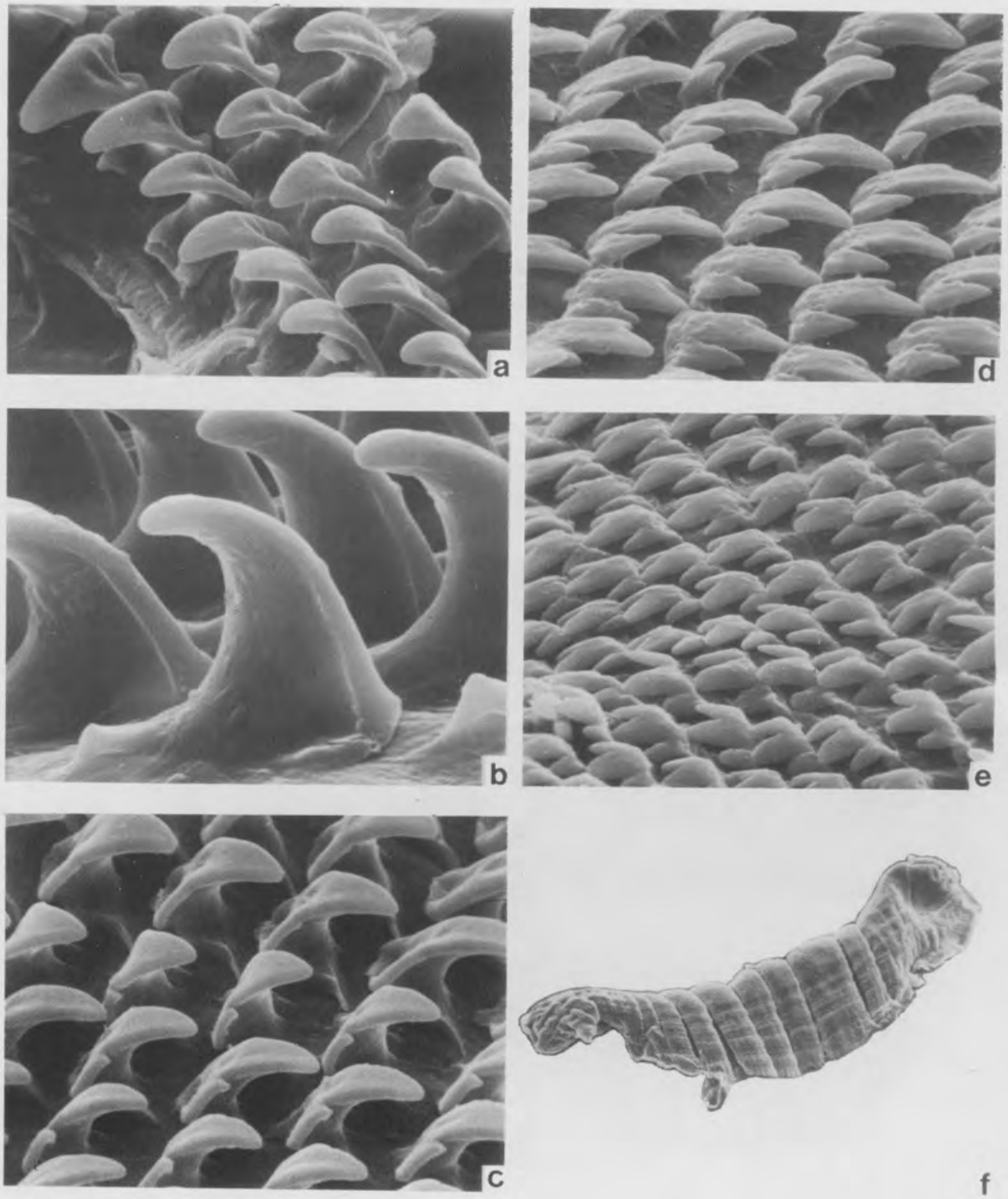


Plate 169: Radular teeth and jaw of *Semotrachia basedowi* (Hedley, 1905): (a-f) WA-870, near Ernabella, Musgrave Ranges, SA. 7 May 1983. FMNH 212151, Dissection A. a is central and laterals from a high angle at 730X, b is detail of laterals at 1,800X, c is late laterals at 1,000X, d is early marginals at 1,000X, e is outer marginals at 725X, f is jaw at 65X.

SEMOTRACHIA DISCOIDEA, SP. NOV.
(Plates 167e-f, 168a-f; Figs 337e, 357a-b, 358a, 359d-f)

Comparative remarks

Semotrachia discoidea, sp. nov., from near Mt. Woodroffe, Musgrave Ranges, is a very large species (mean diameter 13.27 mm), with flat or barely elevated spire (**Fig. 359e**, mean H/D ratio 0.303), normal whorl count (mean 4 1/4+), strongly shouldered body whorl (**Fig. 359e**), typical umbilicus (mean D/U ratio 3.70), microsculpture (**Plate 167e-f**) of dense, pointed pustules, and parietal lip reduced to a thin callus. *S. basedowi* (Hedley, 1905), from near Ernabella, Musgrave Ranges, is larger, more narrowly umbilicated, higher spired (**Table 127**), with angulated body whorl (**Fig. 355b**), spire and body whorl with elongated pustules (**Plate 167a-b**), and the parietal lip well free of the parietal wall. *S. plana*, from the western part of the Musgrave Ranges, is much smaller (mean diameter 10.68 mm), more elevated (mean H/D ratio 0.403), with a less strongly shouldered body whorl, microsculpture of smooth pustules, and the parietal lip reduced to a thin callus. The Mann Range species, *S. mannensis* Iredale, 1937, has a rounded periphery (**Fig. 355e**), elevated spire (mean H/D ratio 0.484), and narrowed umbilicus (mean D/U ratio 4.74). Anatomically, *S. discoidea* (**Figs 357a-b, 358a**) has a long vagina (V) and short free oviduct (UV). The epiphallic caecum (EC) is large and gradually tapers. The epiphallus (E) is more than twice the length of the penis (P), which is relatively short. Wall sculpture of penis chamber rugose. Verge (PV) relatively short, tapering, folded into cylindrical form, extending half way along foliated pilaster (FP), which is large, situated above base of penis, and tightly coiled. *S. basedowi* (**Figs 356a-b**) has a very long epiphallic caecum and much longer penis, the verge is longer, but does not extend to upper end of the small foliated pilaster remnant. *S. plana* (**Figs 360a-b**) has a shorter epiphallic caecum, vagina and penis, the verge is shorter than the foliated pilaster, and is more cyclindrical than in the other Musgrave species.

Holotype

SAM D18035, WA-876, sealed to rocks, rock hole area SSE of Mt. Woodroffe, E of Amata, Musgrave Ranges, South Australia, Australia (Woodroffe SG 52-12 - 4795:7220yds). 26° 23' 37" S, 131° 53' 03" E. Collected by Central Australian Expedition 8 May 1983. Height of holotype 4.0 mm, diameter 13.45 mm, H/D ratio 0.207, whorls 4 1/2, umbilical width 3.5 mm, D/U ratio 3.84.

Paratopotypes

SAM D18091, AM C.136001, WAM 709.87, QM, MV, FMNH 212179-81, FMNH 212197-8, 28 LA, 7 DA, 3 LJ from the type locality.

Range

Semotrachia discoidea, sp. nov., has only been collected from one locality, near Mt. Woodroffe, Musgrave Ranges, SA.

Diagnosis

Shell very large, adult diameter 12.2-14.3 mm (mean 13.27 mm), whorls 4 to 4 1/2- (mean 4 1/4+). Apex and spire flat to at most slightly elevated (**Fig. 359e**), shell height

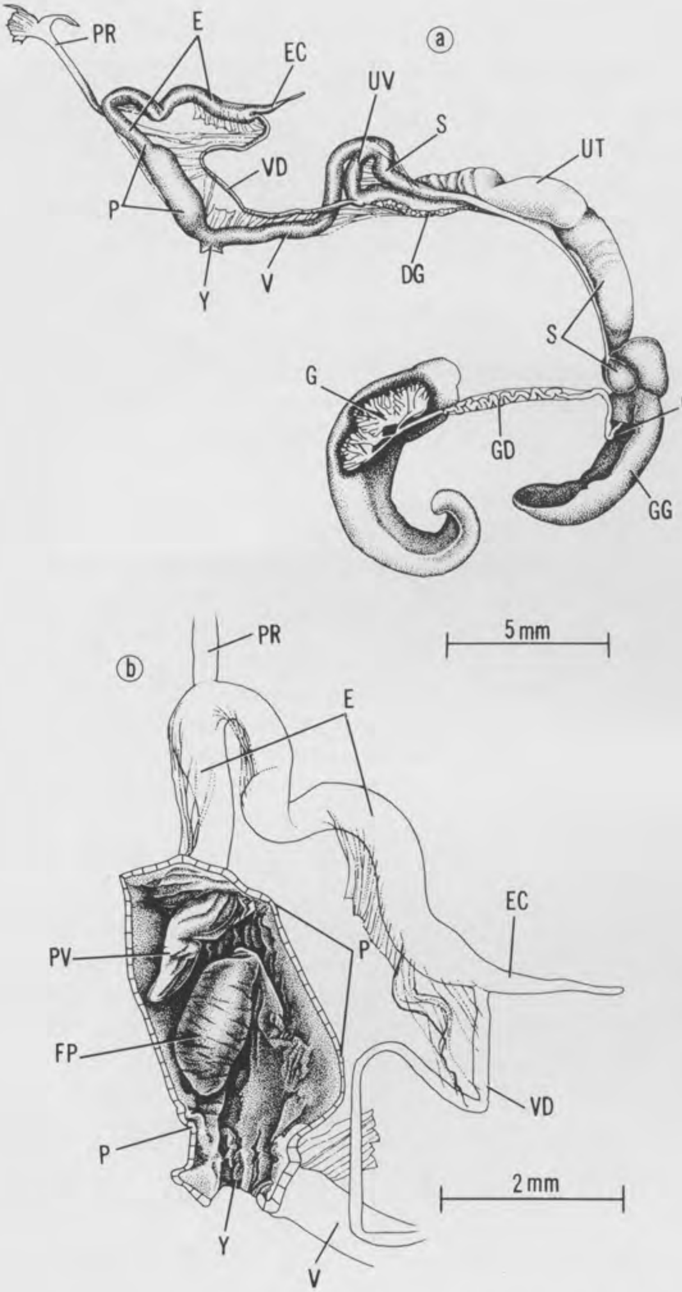


Fig. 357: Genitalia of *Semotrachia discoidea*, sp. nov.: WA-876, SSE Mt. Woodroffe, E of Amata, Musgrave Ranges, SA. 8 May 1983. FMNH 212180, Dissection A. (a) whole genitalia; (b) interior of penis. Scale lines as marked. Drawings by Linnea Lahlum.

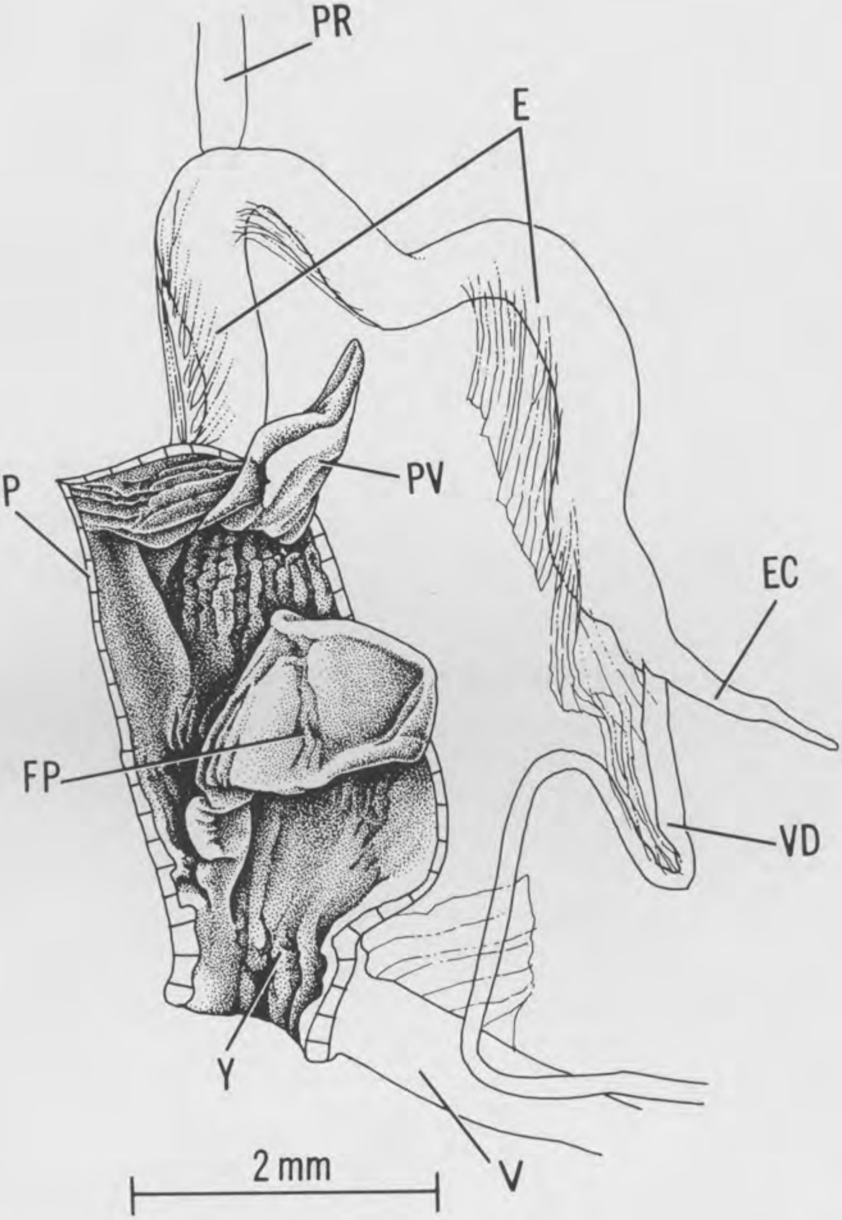


Fig. 358: Penis interior of *Semotrachia discoidea*, sp. nov.: WA-876, SSE Mt. Woodroffe, E of Amata, Musgrave Ranges, SA. 8 May 1983. FMNH 212180, Dissection A. Scale line equals 2 mm. Drawing by Linnea Lahlum.

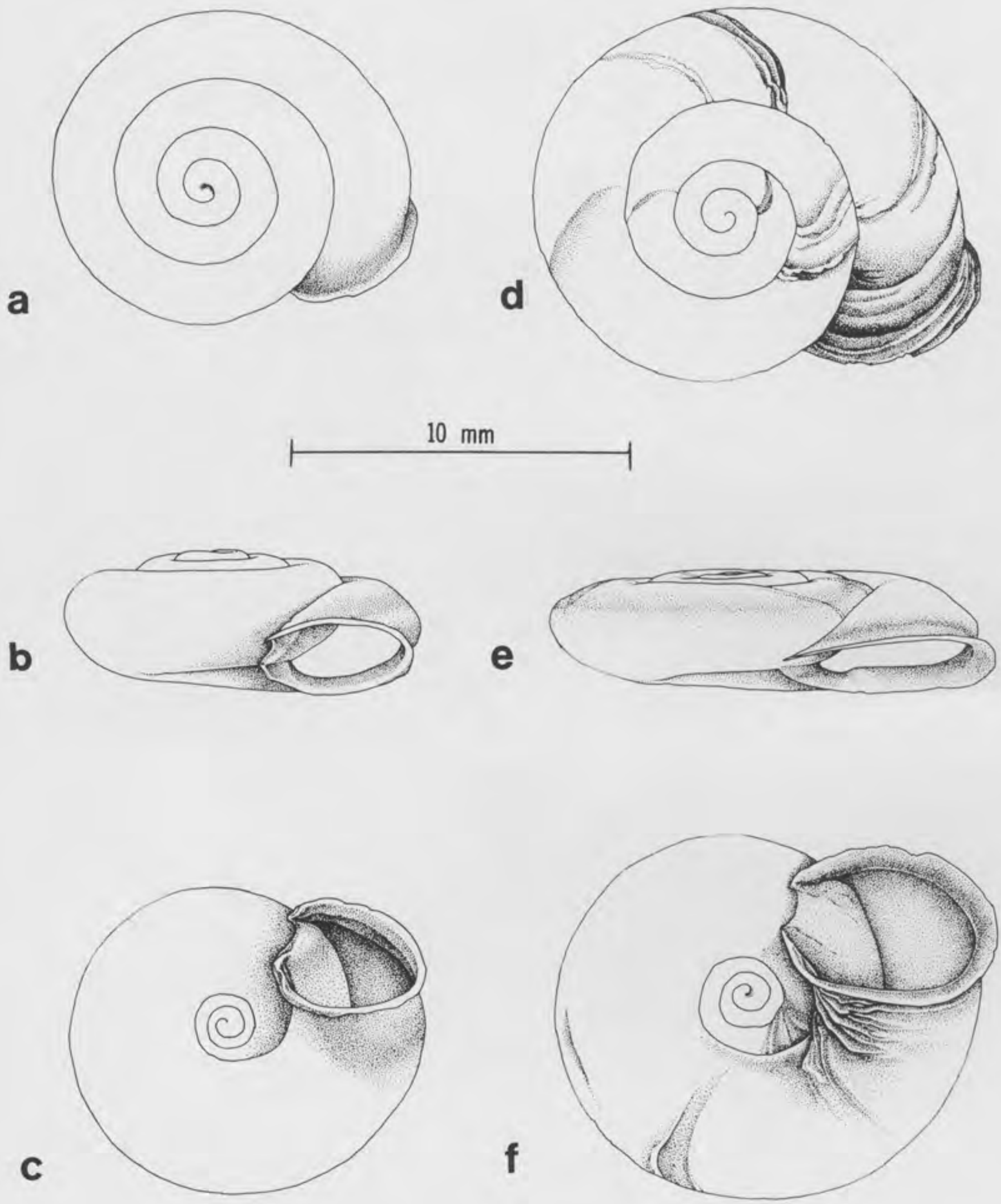


Fig. 359: Shells of *Semotrachia plana*, sp. nov., and *S. discoidea*, sp. nov.: (a-c) Holotype of *S. plana*. WA-866, Mt. Morris foothills, Musgrave Ranges, SA. SAM D18034; (d-f) Holotype of *S. discoidea*. WA-876, SSE Mt. Woodroffe, E of Amata, Musgrave Ranges, SA. SAM D18035. Scale line equals 10 mm. Drawings by Linnea Lahlum.

3.5-4.8 mm (mean 4.02 mm), H/D ratio 0.319-0.429 (mean 0.303). Body whorl (**Fig. 359e**) strongly shouldered above, descending moderately over last portion of body whorl. Apex (**Plate 167e**) with elongated pustules sometimes joining into low ridgelets, spire and body whorl (**Plate 167e-f**) with closely spaced pointed pustules. Umbilicus (**Fig. 359f**) typical, last whorl decoiling more rapidly, width 3.15-4.1 mm (mean 3.61 mm), D/U ratio 3.17-4.18 (mean 3.70). Lip sharply deflected, moderately expanded, reduced to callus on parietal wall (**Figs 359e-f**). Shell colour yellow-brown, base lighter. Based on 36 measured adults.

Genitalia (**Figs 357a-b, 358a**) with long vagina (V) and short free oviduct (UV). Epiphallic caecum (EC) long, gradually tapering. Epiphallus (E) more than twice length of penis (P), internally with simple ridges. Insertion of penial retractor muscle (PR) on lower quarter of epiphallus. Penis chamber wall sculpture rugose. Verge (PV) of medium length, folded into a tapering cylinder, shorter than and extending past apex of the large foliated pilaster (FP), which is tightly coiled.

Central and lateral teeth of radula (**Plate 168a, d**) with prominent anterior flare, long base, normal cusp shaft angle with modest curvature to the sharp cusp tip, ectocone initially very small. Late laterals (**Plate 168b, d**) with enlarged anterior flare, reduced cusp tip curvature, and greatly enlarged ectocone. Lateromarginal transition (**Plate 168e**) typical, marked by endoconal appearance, basal and mesoconal cusp shortening, and ectoconal enlargment. Jaw (**Plate 168c, f**) with highly variable number of vertical ribs.

Discussion

Semotrachia discoidea, sp. nov., has the flattest shell of any Red Centre species. It also is distinguished by the large size of the verge (PV) and foliated pilaster (FP) in relation to the length of the penis. There was no significant difference between live and dead adults at the type locality (**Table 129**).

The name *discoidea* refers to the extremely flattened shell of this species.

SEMOTRACHIA PLANA, SP. NOV.

(Plate 166a-e; Figs 359a-c, 360a-b)

Comparative remarks

Semotrachia plana, sp. nov., from the Musgrave Ranges between Amata and the Currie River, SA, is medium sized (mean diameter 10.68 mm), with flat to very slightly elevated spire (**Fig. 359b**, mean H/D ratio 0.403), reduced whorl count (mean 4 1/8), typical umbilicus (**Fig. 359c**, mean D/U ratio 3.69), microsculpture (**Plate 166a-b**) of dense elongated pustules and prominent micro ridging (setae observed only in live collected juveniles), parietal lip reduced to a callus. *S. discoidea* (**Figs 359d-f**), found so far only near Mt. Woodroffe, Musgrave Ranges, is much larger (mean diameter 13.27 mm), flatter (mean H/D ratio 0.303), and has sharp pointed pustules (**Plate 167f**). *S. basedowi* (Hedley, 1905) (**Figs 355a-c**), from the E part of the Musgrave Ranges, is much larger (mean diameter 17.07 mm), with a lower H/D ratio (mean 0.362), and the parietal lip is continuous and at least slightly free of the parietal wall. Anatomically, *S. plana* (**Figs 360a-b**) has a relatively short vagina (V) and medium length free oviduct (UV). The epiphallic caecum (EC) is long and tapers gradually from a relative wide base. The verge (PV) is short, tapering gradually, smooth surfaced, with a prominent sperm groove, and the foliated pilaster (FP) is large. *S. discoidea* (**Figs 357a-b, 358**) has a longer vagina, penis, and foliated pilaster, plus the penis chamber wall has corrugated ridging. *S. basedowi* (**Figs 356a-b**) has a very long epiphallic caecum, the verge longer and less tapered, and the foliated pilaster is reduced to a remnant. No other *Semotrachia* have the foliated pilaster.

Holotype

SAM D18034, WA-886, rock hole area 2.8 km W of Amata aerodrome, Mt. Morris foothills, Musgrave Ranges, South Australia, Australia (Woodroffe 1:250,000 map sheet SG 52-12 - 912:748yds). 26° 10' 39" S, 131° 06' 31" E. Collected by Central Australian Expedition 10 May 1983. Height of holotype 4.55 mm, diameter 10.95 mm, H/D ratio 0.416, whorls 4 1/4, umbilical width 3.0mm, D/U ratio 3.65.

Paratopotypes

SAM D18087, AM C.136000, QM, FMNH 212233-4, 5 DA, 2 LJ, 1 DJ from the type locality; 3 May 1987, V. Kessner!, K 11713, 8 DA, 5 DJ.

Paratypes

South Australia

MUSGRAVE RANGES: Currie River (WA-877, ca 6 km E of, under figs on rock outcrop 0.4 km S of track, AM C.135999, FMNH 212201-2, 2 DA, 1 LJ, 1 DJ; WA-879, 3.7 km W of Currie River on Amata track, FMNH 212210, 2 LA; WA-880, large rocky gulch 21 km W of Currie River on Amata track, WAM 706.87, FMNH 212216, 2 DA).

Range

Semotrachia plana has been collected from, scattered localities on the S side of the Musgrave Ranges, SA from 6 km E of the Currie River (WA-877, 131 ° 42' 09" E) to near the Amata aerodrome (WA-886, 131° 06' 31" E). The aerial distance between these stations is about 69 km. Three of the station, WA-879, WA-880, and WA-886, are on foothills of the main mass, while WA-877 is on an isolated southern outlier. *S. discoidea*, sp. nov., has been collected on the main mass (WA-876) about 6.5 km N of WA-877.

Diagnosis

Shell medium in size, adult diameter 9.5-12.1 mm (mean 10.68 mm), whorls 4- to 4 3/4+ (mean 4 1/8). Apex and spire very slightly elevated (**Fig. 359b**), shell height 3.4-5.0 mm (mean 4.28 mm), H/D ratio 0.324-0.521 (mean 0.403). Body whorl (**Fig. 359b**) shouldered above, descending abruptly behind lip. Apex (**Plate 166a**) with pustules and weakly anastomosing ridgelets, spire and body whorl (**Plate 166a-b**) with raised elongated pustules oriented along growth lines and prominent micro ridging. Umbilicus (**Fig. 359c**) with last whorl decoiling more rapidly, typical, width 2.35-3.95 mm (mean 2.92 mm), D/U ratio 3.04-4.33 (mean 3.69). Lip sharply reflected, narrowly expanded, reduced on parietal wall to a thin callus (**Figs 359b-c**). Shell colour yellow-brown, base lighter. Based on 20 measured adults.

Genitalia (**Figs 360a-b**) with medium length vagina (V) and short free oviduct (UV). Epiphallic caecum (EC) long, slender, wider at base. Epiphallus (E) slightly longer than penis (P), insertion of penial retractor muscle (PR) on epiphallus just above penis apex. Wall sculpture in penis chamber reduced. Verge (PV) tapering gradually from wider base to pointed tip, about half length of foliated pilaster (FP). Sperm groove prominent. Foliated pilaster occupying lower two thirds of penis chamber, rolled tightly.

Central and lateral teeth of radula (**Plate 166c**) with small anterior flare, short base, normal cusp shaft angle, strongly curved and sharp pointed cusp tip, and small ectocone. Lateromarginal transition and marginals (**Plate 166d**) typical. Jaw (**Plate 166e**) without unusual features.

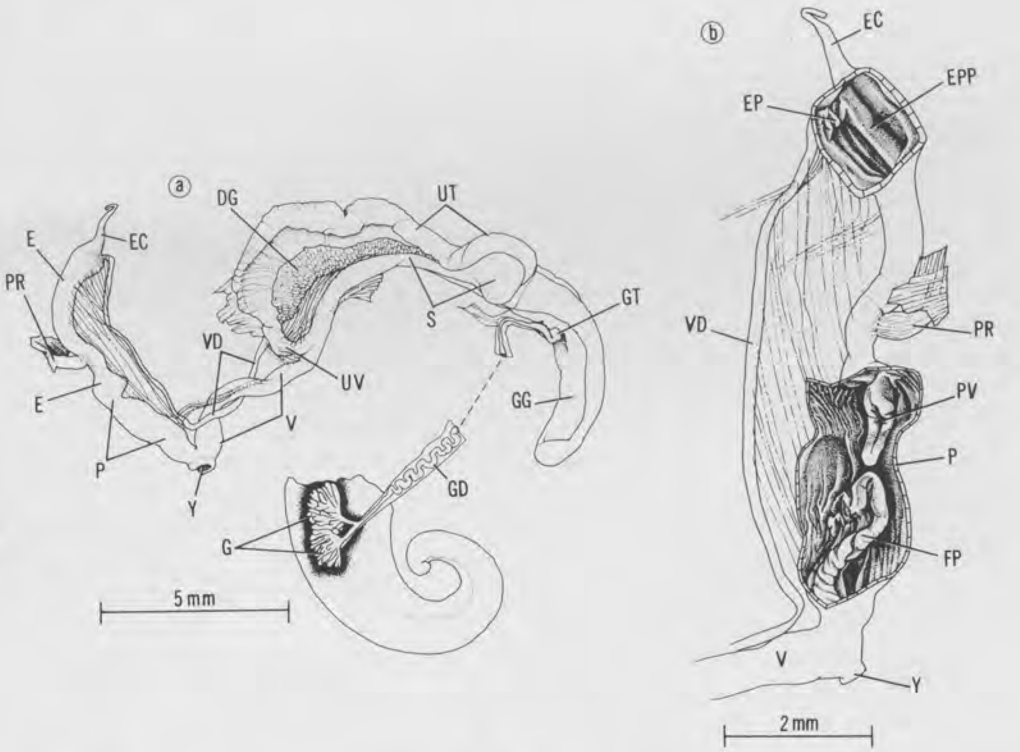


Fig. 360: Genitalia of *Semotrachia plana*, sp. nov.: WA-879, 3.7 km W of Currie River on Amata track, S side Musgrave Ranges, SA. 8 May 1983. FMNH 212210, Dissection A. (a) whole genitalia; (b) interior of epiphallus and penis. Scale lines as marked. Drawings by Linnea Lahlum.

Discussion

Semotrachia plana, sp. nov., is a species whose aestivation site eluded us during 1983 field work. Only two live adults and three live juveniles plus 10 dead adults were taken at four stations. Most of the adults were badly worn and probably had been washed downhill from their actual habitat. Vince Kessner collected eight dead adults and five dead juveniles from the type locality in 1987. The two samples from WA-886 (**Table 129**) do not differ significantly, the shell height difference resulting from measurement technique variation.

The name *plana* refers to the very low spire of this species.

GENUS *DIRUTRACHIA* IREDALE, 1937

Dirutrachia Iredale, 1937, South Austr. Nat., **18** (2): 36 - type species *Hadra sublevata* Tate, 1894, as a subgenus of *Semotrachia*; Iredale, 1937, Austr. Zool., **9** (1): 90-91 - raised to generic rank and *Semotrachia mersa* Iredale, 1937 added; Burch, 1976, Jour. Malac. Soc. Australia, **3** (3): 135 - citation in check list; Richardson, 1985, Tryonia, **12**: 120 - citation in check list.

Shell relatively small to medium in size, adult diameters 13.0-19.3 mm, whorl counts 4 1/8+ to 5 1/2-. Spire moderately and usually evenly elevated, H/D ratios 0.419-0.588. Apical sculpture variable, generally of dense pustules that become elongated on lower portion (**Plate 170a, d**), less crowded in *mersa* (**Plate 171a**). Spire and body whorl with minute periostracal setal projections that are spade shaped when unworn (*sublevata*, **Plate 170 b-c**) and with irregular microridglets in between; with even finer reduced setal projections and an overlay of widely scattered calcareous pustules (*mersa*, **Plate 171a-d**); or with large, more crowded calcareous pustules (*ponderi*, **Plate 170d-f**). Body whorl slightly angulated (*sublevata*, **Fig. 361b**), moderately angulated (*ponderi*, **Fig. 362e**), or sharply angulated (*mersa*, **Fig. 362b**), descending abruptly just behind lip. Umbilicus open, narrow, only slightly decoiling, slightly narrowed by lip reflection. Lip sharply reflected, narrowly to moderately expanded, thickened internally, with a prominent lip knob on basal lip that is low and elongated (*sublevata*, *ponderi*, **Figs 361b, 362e**) or higher and triangular (*mersa*, **Fig. 362b**). Parietal wall with moderate to thick callus, sometimes raised, never with a free lip. Shell colour yellow-brown, lighter on base, without spiral colour bands.

Live specimens aestivate as free sealers in crevices or litter with a sheet of calcified mucus secreted across the aperture.

Genitalia (**Figs 363-364**) with head of spermatheca (S) reaching base of albumen gland (GG). Free oviduct (UV) long, U-folded or kinked, vagina (V) very short (*sublevata*, **Fig. 363a**) to long (*mersa*, **Fig. 364a**). Vas deferens (VD) slender, lightly bound by fibers to rest of terminal genitalia, entering either directly into epiphallus (*mersa*, **Fig. 364a**) or at junction of epiphallus (E) and epiphallic caecum (EC, *sublevata*, **Fig. 363a**). Epiphallic caecum large, blunt tipped. Epiphallus (E) long, with varied internal wall sculpture, joined by epiphallic caecum prior to insertion of penial retractor muscle (PR), entering penis (P) through a verge (PV). Penis sheath (PS) well

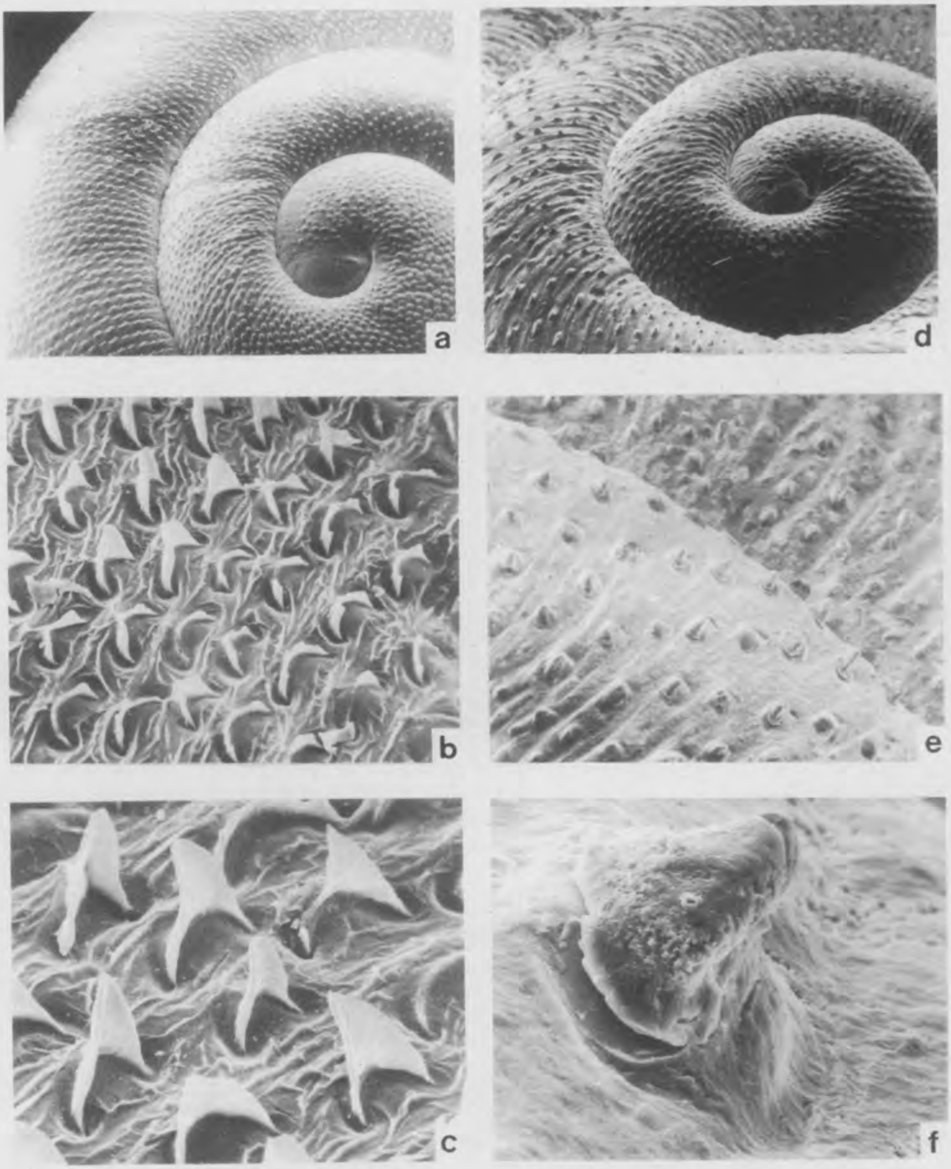


Plate 170: Shell sculpture of *Dirutrachia sublevata* (Tate, 1894) and *D. ponderi*: (a-c) *D. sublevata*. near Florence Creek, Hale River, NT. FMNH 198939. a is apex and spire at 19.6X, b is setae on mid-spire at 185X, c is detail of mid-spire setae at 185X; (d-f) *S. ponderi*. WA-863, Mt. Illbillee, Everard Ranges, SA. Holotype. SAM D18037, d is apex and spire at 20.3X, e is microsculpture on mid-spire at 47X, f is detail of mid-spire pustule at 490X.

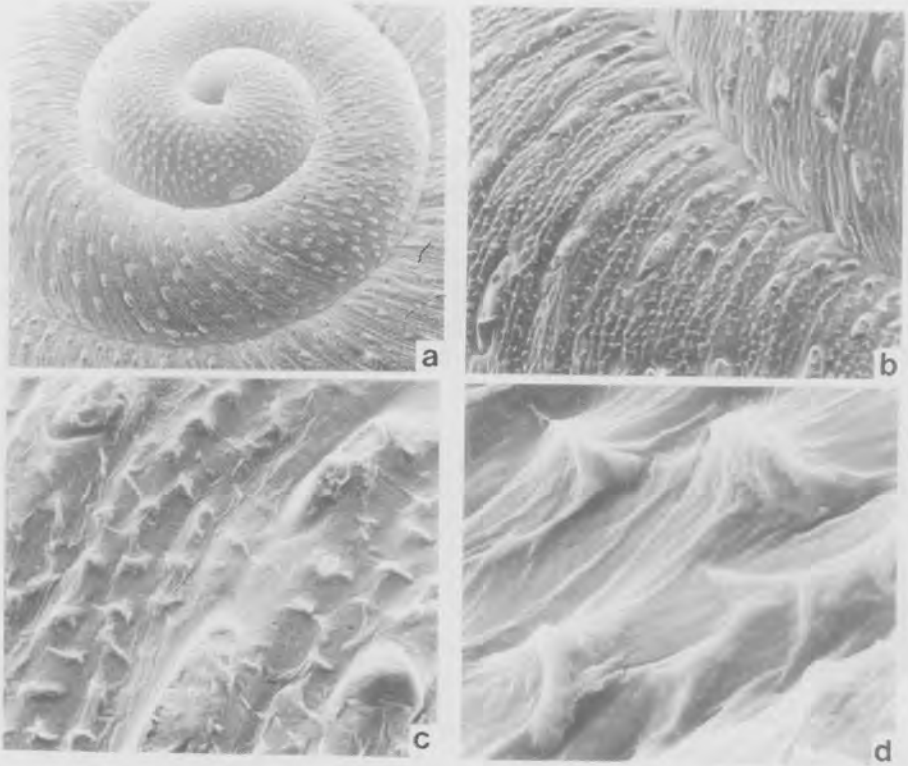


Plate 171: Shell sculpture of *Dirutrachia mersa* (Iredale, 1937): WA-876, SSE of Mt. Woodroffe, Musgrave Ranges, SA. FMNH 212183. (a) apex and spire at 20.2X; (b) microsculpture on mid-spire at 200X; (c) detail of mid-spire microsculpture at 200X; (d) detail of mid-spire pustules at 950X.

developed in *sublevata* (**Fig. 363c**), starting at point of penial retractor insertion, continuing to atrium (Y), or reduced to fibers (*mersa*, **Fig. 364c**). Penis chamber with thicker walls, longitudinal corrugated to simple ridges. Verge (PV) very short and tubercular (*sublevata*, **Figs 363c-d**) or small and tapering (*mersa*, **Figs 364c-d**), with a lateral sperm groove. Atrium (Y) very short. Head with very small patch of specialized pustules between and just behind ommatophores.

Jaw with prominent (*sublevata*, **Plate 172f**) to reduced (*mersa*, **Plate 173f**) medial ribs, lateral portions with ribs reduced to absent. Central and early lateral teeth (**Plates 172a-b, 173a-b**) modified. Basal plates shortened, anterior flare (**Plate 172b**) essentially lost, basal support ridge large with a sharp point, cusp shaft angle elevated to over 70°, cusp tip strongly curved and bluntly rounded. Lateromarginal transition abrupt (**Plates 172c, 173 c**), marked by reappearance of anterior flare, development of ectocone, drastically reduced cusp shaft angle, loss of basal support ridge and shortening of basal plate, then appearance of endocone. Marginals (**Plates 172d-e, 173d**) without unusual features.

Type species: *Hadra sublevata* Tate, 1894 by original designation.

Comparative remarks

Dirutrachia differs from both *Vidumelon* Iredale, 1933 and *Divellomelon* Iredale, 1933 in possessing a prominent knob on the basal lip, its shell sculpture of complex setae and calcareous pustules, open umbilicus that barely decoils, strongly expanded and thickened lip, and moderately to weakly angulated shell periphery. *Dirutrachia* and *Divellomelon* share the same basic alteration of the central and lateral teeth, although in the latter genus (**Plate 176a-d**) the cusp tip is not as strongly curved and is much more broadly rounded (compare **Plate 172a-b**). Genital structures are basically the same, allowing for sympatric interactions. All three genera appear to be free sealers, in contrast to the rock or wood sealing habit of *Semotrachia* Iredale, 1933. Differences from the latter genus have been outlined above.

Previous studies

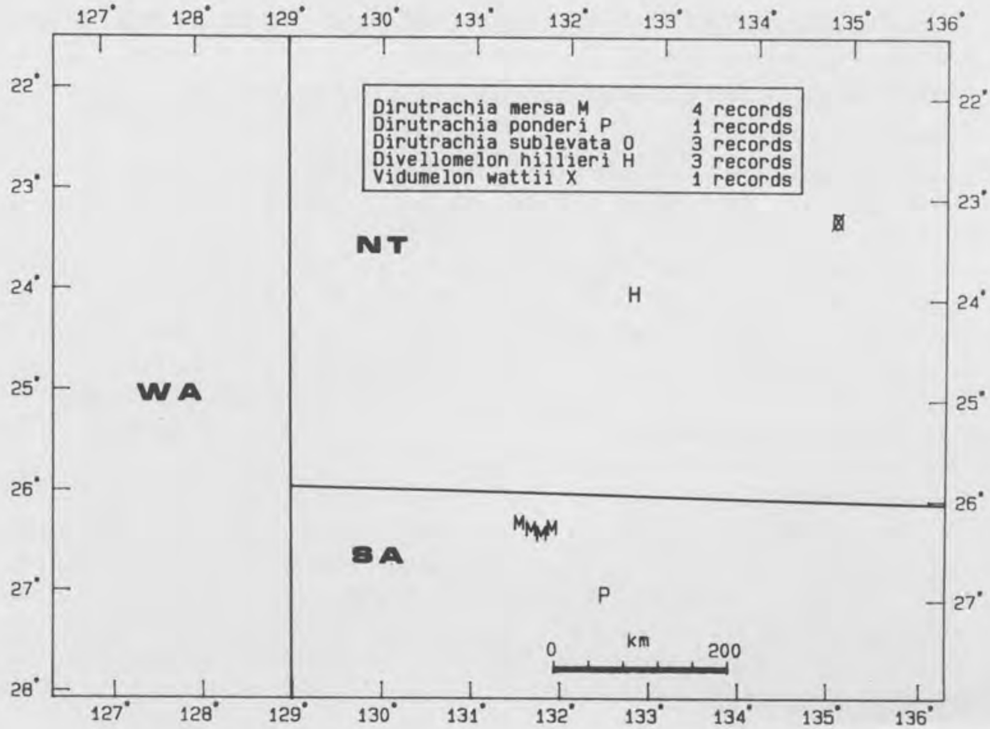
Tate (1894) described *Hadra sublevata* from Horn Expedition material, and Hedley (1905) mistakenly applied the name to material from the Musgrave Ranges that Iredale (1937) subsequently named *Semotrachia mersa*. The name *Dirutrachia* was proposed by Iredale (1937b: 36) as a subgenus of *Semotrachia*, including only the type species, and then almost immediately (Iredale, 1937c: 90-91) elevated to generic rank without comment, and with *D. mersa* (Iredale, 1937) added. Check list mentions by Burch (1976) and Richardson (1985: 120) are the only additional citations.

Distribution and comparative ecology

Dirutrachia sublevata (Tate, 1894) has been collected near Maud Creek and Florence Creek on the S side of the Harts Range, NT, a little N of the Hale River (**Map 18**). It was scarce in rock rubble. *S. mersa* (Iredale, 1937) is known from a small section along the S side of the Musgrave Ranges, SA (**Map 18**), where it has been collected in low numbers from crevices and litter under figs in rocky areas. *D. ponderi*, sp. nov., is based on a single dead example from Mt. Illbillee, Everards Ranges, SA (**Map 18**). Its ecology is unknown. All live adult examples were free sealers, but a few juveniles were found sealed to rocks.

It is quite possible that additional species will be discovered by more comprehensive collecting in the Red Centre. The ranges of the three known species are quite small, and the species are found more in crevices than the traditionally examined litter directly under figs.

The three known species do show one clear pattern of directional change, from the spade-shaped periostracal setae in *D. sublevata* (Tate, 1894) from the Harts Ranges, NT (**Plate 170a-c**), to the reduced setae and scattered pustules in *D. mersa* (Iredale, 1937) from the Musgrave Ranges, SA (**Plate 171a-d**), to the large and more crowded pustules in *D. ponderi*, sp. nov., from the Everard Ranges, SA (**Plate 170d-f**). The elongated basal lip knob is found in *sublevata* and *ponderi*, while a triangular knob is found in the geographically intermediate *mersa*.



Map 18: Records of *Dirutrachia mersa* (Iredale, 1937), ***D. ponderi, D. sublevata*** (Tate, 1894), *Divellomelon hillieri* (E. A. Smith, 1894), and *Vidumelon wattii* (Tate, 1894) in the Red Centre.

KEY TO THE SPECIES OF *DIRUTRACHIA*

1. Basal lip of shell with an elongated, low knob (**Figs 361b, 362e**) 2

   Basal lip of shell with a high, triangular knob (**Fig. 362b**)

   Dirutrachia mersa (Iredale, 1937) (p. 1430)

2. Microsculpture of large calcareous pustules (**Plate 170e-f**); Everard Ranges, SA

   Dirutrachia ponderi, sp. nov. (p. 1438)

   Microsculpture of very small, spade-shaped periostracal setae (**Plate 170b-c**); Harts Ranges, NT

   Dirutrachia sublevata (Tate, 1894) (p. 1424)

DIRUTRACHIA SUBLEVATA (TATE, 1894)
(**Plates 170a-c, 172a-f; Figs 361a-c, 363a-d**)

Hadra sublevata Tate, 1894, Trans. Royal Soc. South Austr., **18**: 192 - Central Australia.

Thersites sublevata (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., p. 196, pl. XVII, figs 5a-b - Hart (*sic*) Ranges.

Semotrachia sublevata (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 38 - check list citation.

Dirutrachia sublevata (Tate), Iredale, 1938, Austr. Zool., **9** (2): 90 - check list citation.

Dirutrachia sublaevata (*sic*) Richardson, 1985 (not Tate, 1894), Tryonia, **12**: 120 - check list citation.

Comparative remarks

Dirutrachia sublevata (Tate, 1894), from the S side of the Harts Ranges, NT (**Map 18**), is of average size (mean diameter 14.66 mm), has a low whorl count (mean 4 1/2+), shell microsculpture of dense, spade-shaped periostral setae and irregular microridgelets between (**Plate 170a-c**), and a weak to prominent, slightly recessed, elongated lip knob. The shell periphery is weakly and obtusely angulated (**Fig. 361b**). This contrasts with the stronger angulation (**Fig. 362e**) and shell sculpture of dense calcareous pustules (**Plate 170e-f**) in *D. ponderi* from the Everard Ranges, and stronger angulation (**Fig. 362b**) plus shell microsculpture of greatly reduced periostracal setae and scattered calcareous pustules (**Plate 171b-c**) in *D. mersa* (Iredale, 1937) from the Musgrave Ranges. *Vidumelon wattii* (Tate, 1894), which is sympatric with *D. sublevata* in the Harts Ranges, has much tighter whorl coiling (**Fig. 361d**), a minute umbilicus (**Fig. 361f**), periostracal microsculpture of simple setae (**Plate 174b**), and lacks any trace of a lip knob. *Divellomelon hillieri* (E. A. Smith, 1894), from Palm Valley, Krichauff Ranges, has an acutely angulated periphery (**Fig. 366b**), spiral colour bands, a nearly closed umbilicus, nearly smooth shell surface (**Plate 174c-d**), and is larger in size with an increased whorl count (**Table 130**). It also has no trace of a lip knob. Anatomically (**Figs 367a-d**), the very short vagina (V), near tubercular verge (PV) with lateral groove, well developed penis sheath (PS), and complex sculpture inside the male organs contrast with the much longer vaginae and verges in both *D. mersa* (**Figs 364a-d**) and *Vidumelon wattii* (**Figs 365a-c**).

Holotype

SAM D13598, Harts Range, Northern Territory. Collected by the Horn Expedition. Height of holotype 8.6 mm, diameter 16.6 mm, H/D ratio 0.518, whorls 4 7/8-, umbilical width 1.8 mm, D/U ratio 9.22.

Paratopotypes

SAM D15557, AM C.60511, AM C.2168, SAM, MV F28292, 18 DA from the type collection.

Studied material

Northern Territory

HARTS RANGE: Florence Creek (80 m E of, 25 June 1978, AM, WAM 697.87, SAM D18077, MV, QM, FMNH 198939-40, FMNH 198943, 4 LA, 26 DA, 2 LJ, 42 DJ; 22 April 1987, V. Kessner!, K 11785, 16 DA); creek NE of Claraville (24 June 1978, AM, SAM D18078, WAM 698.87, FMNH 198909, 6 DA, 4 DJ).

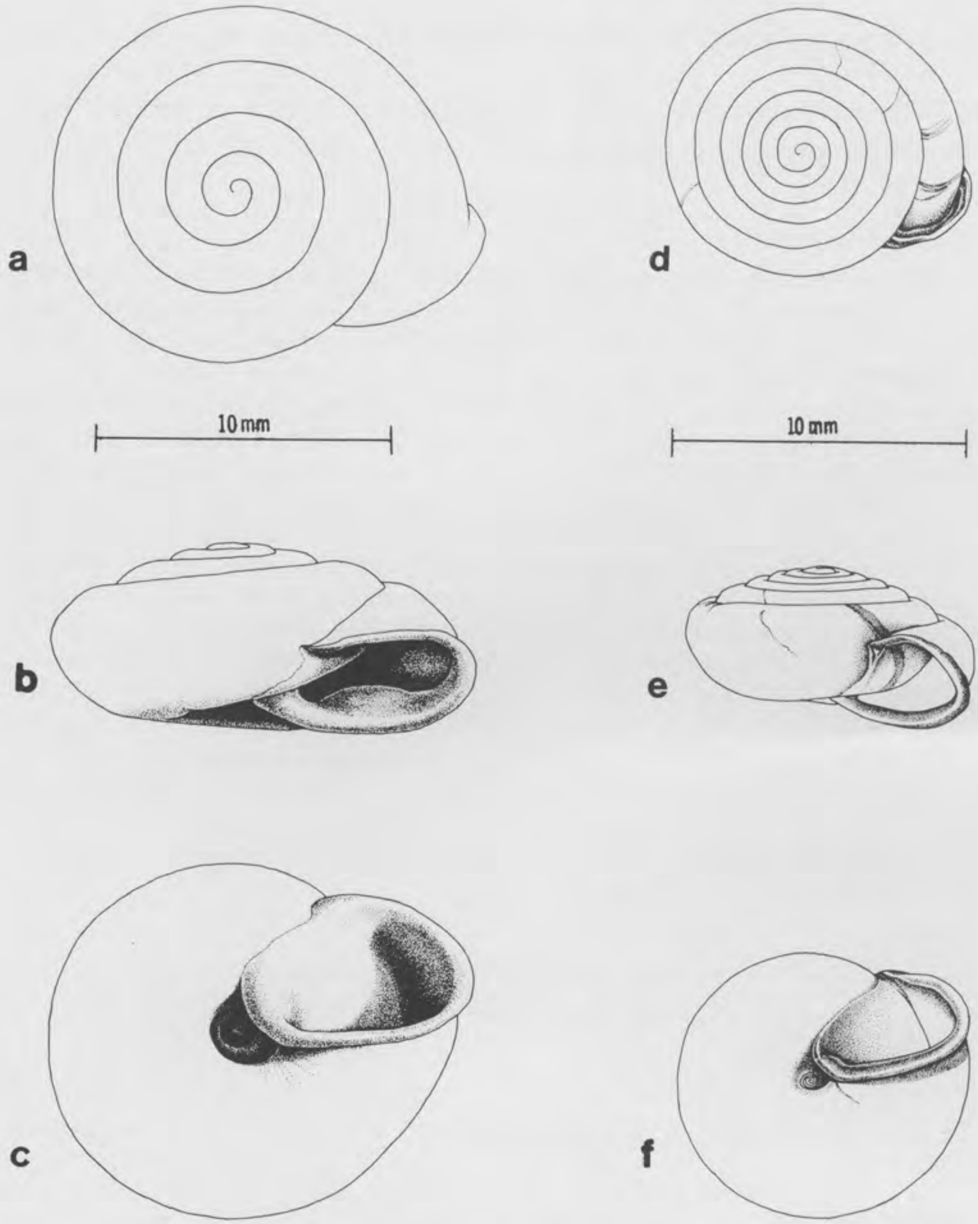


Fig. 361: Shells of *Dirutrachia sublevata* (Tate, 1894) and *Vidumelon wattii* (Tate, 1894): (a-c) Paratype of *Hadra sublevata* Tate, 1894. Hart Ranges, NT. Horn Expedition. FMNH 171525; (d-f) Paratype of *Hadra wattii* Tate, 1894. Maude River, Hart Ranges, NT. Horn Expedition. FMNH 171513. Scale line equals 10 mm. Drawing by Elizabeth A. Liebman (a-c) and Linnea Lahlum (d-f).

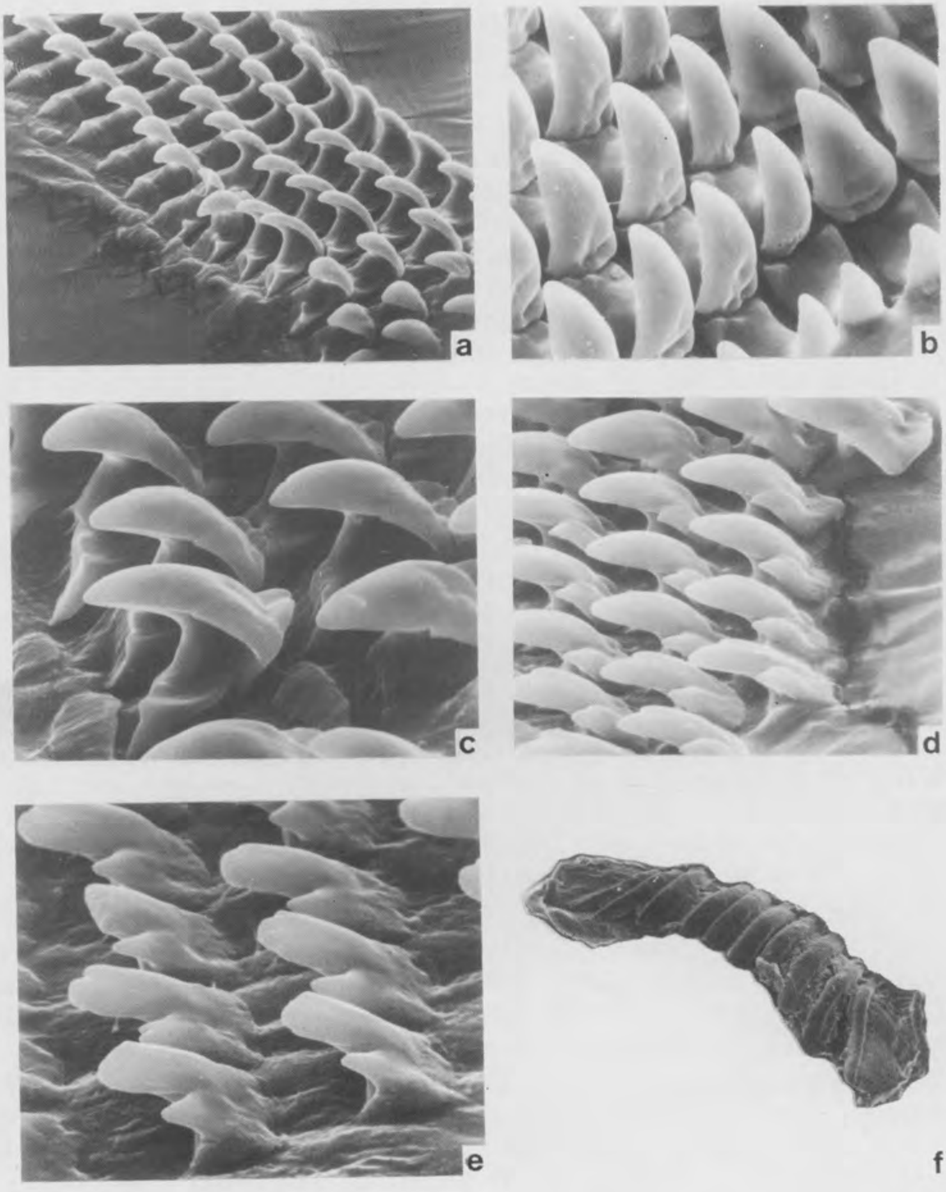


Plate 172: Radular teeth and jaw of *Dirutrachia sublevata* (Tate, 1894): near Florence Creek, Hale River, NT. 25 June 1978. FMNH 198940, Dissection A. (a) central and early laterals at 455X; (b) front view of central and early laterals at 885X; (c) late laterals at 1,300X; (d) lateromarginal transition at 910X; (e) marginals at 1,350X; (f) jaw at 68X.

Range

Dirutrachia sublevata (Tate, 1894) has been recorded only from the basins of Maud and Florence Creeks on the S side of the Harts Ranges, NT (**Map 18**). The total species range is much less than 5 km.

Diagnosis

Shell average in size, adult diameter 13.0-16.6 mm (mean 14.66 mm), whorls 4 1/4 to 5 1/4+ (mean 4 1/2+). Apex and spire moderately elevated (**Fig. 361b**), shell height 5.7-9.2 mm (mean 7.04 mm), H/D ratio 0.419-0.508 (mean 0.480). Body whorl (**Fig. 361b**) obtusely angulated, rounded, descending moderately to sharply just behind lip. Apex (**Plate 170a**) with crowded pustules that become slightly elongated on lower part. Spire and body whorl (**Plate 170b-c**) with very fine and dense spade-shaped periostracal extensions. Umbilicus (**Fig. 361c**) narrow, regularly decoiling, slightly narrowed by lip refection, width 1.1-3.6 mm (mean 1.90 mm), D/U ratio 3.76-12.5 (mean 7.98). Lip sharply reflected and moderately expanded, thickened internally, white, usually with elongated basal lip knob that is very slightly recessed (**Fig. 361b**). No external depression on lip beneath knob. Parietal wall with thick callus. Shell yellow-brown, lighter on base, no colour bands. Based on 76 measured adults.

Genitalia (**Figs 363a-d**) with very short vagina (V) and penis (P), verge (PV) short and tubercular in shape, sperm groove lateral. Epiphallic caecum (EC) long and blunt tipped. Penis sheath well developed. Wall sculpture of male system complex (**Fig. 363c**).

Central and lateral teeth of radula (**Plate 172a-b**) modified, with shortened basal plate, sharp tipped basal support ridge, anterior flare lost (**Plate 172b**), cusp shaft angle nearly vertical, cusp sharply curved, tip blunt. Lateromarginal transition abrupt (**Plate 172c**), with reappearance of anterior flare, appearance of a weak ectocone, loss of basal support ridge, reduction in cusp shaft angle, shortening of basal plates, and reduction in cusp tip curvature. Early (**Plate 172d**) and midmarginal (**Plate 172e**) teeth normal. Jaw (**Plate 172f**) with lateral reductions of vertical ribs.

Discussion

The holotype of *Dirutrachia sublevata* (Tate, 1894) retains the periostracum. The basal ridge is low and long, slightly recessed, without any trace of an external gutter. The lip is narrowly expanded, thickened, partly reflected over the umbilicus, and the body whorl descends abruptly just behind the lip.

So far, all confirmed records for *Dirutrachia sublevata* (Tate, 1894) are from the drainages of Maud and Florence creeks on the S side of the Harts Ranges, N of the Hale River. The variation in height between two Florence Creek samples (**Table 130**) probably is an artifact resulting from differences in the angle at which the shell is held when measuring height.

At the Florence Creek site, Fred and Jan Aslin in 1978 observed that *Vidumelon wattii* (Tate, 1894) was common in leaf litter and occasionally present under rocks, while *Dirutrachia sublevata* (Tate, 1894) was collected in soil under rocks or from crevices deep in rock piles.

Table 130: Range of Variation in speciies of *Dirutrachia*, *Vidumelon*, and *Divellomelon*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
DIRUTRACHIA							
D. sublevata (Tate, 1894)	76	7.04 (5.7-9.2)	14.66 (13.0-16.6)	0.480 (0.419-0.588)	$4\frac{1}{2}$+ ($4\frac{1}{4}$–$5\frac{1}{4}$+)	1.90 (1.1-3.6)	7.98 (3.76-12.5)
D. mersa Iredale, 1937	43	7.99 (7.1-9.2)	17.43 (15.9-19.3)	0.458 (0.421-0.508)	$5\frac{1}{8}$+ ($4\frac{1}{8}$+-$5\frac{1}{2}$-)	2.28 (1.7-2.85)	7.76 (5.70-11.3)
D. ponderi	1	6.45	13.90	0.464	$4\frac{5}{8}$	2.10	6.62
VIDUMELON							
V. wattii (Tate, 1894)	46	5.55 (4.85-6.6)	10.89 (10.25-12.2)	0.510 (0.467-0.595)	$6\frac{3}{4}$ ($6\frac{1}{8}$–$7\frac{1}{4}$-)	1.01 (0.7-1.25)	10.87 (8.34-15.4)
DIVELLOMELON							
D. hillieri (E.A. Smith, 1910)	26	7.67 (6.5-8.5)	17.70 (16.3-18.6)	0.434 (0.388-0.473)	$5\frac{3}{4}$+ ($5\frac{3}{8}$-$6\frac{1}{8}$+)	0.490 (closed-1.1)	25 (16.8-44)

DIRUTRACHIA MERSA IREDALE, 1937

(Plates 171a-d, 173a-f; Figs 362a-c, 364a-d)

Xanthomelon sublevatum Hedley, 1905 (not Tate, 1894), Trans. Royal Soc. South Austr., **29**: 162, pl. xxx, figs 7-9 - Musgrave Ranges, South Australia.

Semotrachia mersa Iredale, 1937, South Austr. Nat., **18** (2): 38, pl. II, fig. 9 - Musgrave Ranges, South Australia.

Dirutrachia mersa (Iredale), Iredale, 1938, Austr. Zool., **9** (2): 91 - check list citation; Richardson, 1985, Tryonia, **12**: 120 - check list citation.

Comparative remarks

Dirutrachia mersa (Iredale, 1937), from the S side of the central Musgrave Ranges, SA (**Map 18**), is a large species (mean diameter 17.43 mm) with increased whorl count (mean 5 1/8+), a shell microsculpture of very small periostracal setae and scattered calcareous pustules (**Plate 171a-d**), and a large triangular lip knob (**Fig. 362b**). Its shell periphery is acutely to obtusely angulated. In *D. ponderi* (**Fig. 362e**) from the Everard Ranges the periphery is obtusely angulated, while in *B. sublevata* (Tate, 1894) (**Fig. 361b**) from the Harts Range it is barely angulated. Both of the latter species have an elongated, rather than triangular, lip knob (**Figs 361b, 362e**), and the shell sculpture is much more prominent (**Plate 170a-f**). *Vidumelon wattii* (Tate, 1894), also from the Harts Ranges, has very tight whorl coiling, a minute umbilicus, lacks the lip knob, and has shell microsculpture of simple setae (**Plate 174a-b**). *Divellomelon hillieri* (E. A. Smith, 1894), from Palm Valley, Krichauff Ranges, has an acutely angulated periphery (**Fig. 366b**), spiral colour bands, a minute to nearly closed umbilicus (**Fig. 366c**), shell microsculpture of weak radial ridgelets (**Plate 174c-d**), and lacks a lip knob. Anatomically (**Figs. 364a-d**), the long vagina (V), tapering verge, and absence of a penis sheath in *D. mersa*, contrast with the short vagina, very short verge, and well developed penis sheath found in *D. sublevata*. *Vidumelon wattii* (**Figs 365a-c**) has an even longer vagina, the verge has become a closed tube within a quite short penis, and the penis sheath is prominent. *Divellomelon hillieri* (**Figs 367a-d**) has the vagina very short, a small grooved verge, the wall sculpture within the penis chamber slightly altered, and a well developed penis sheath.

Holotype

AM C.19225, Musgrave Ranges, South Australia, Australia. Collected by Herbert Basedow. Height of holotype 7.0 mm, diameter 15.4 mm, H/D ratio 0.455, whorls 4 3/4, umbilical width 2.0 mm, D/U ratio 7.70.

Studied material

South Australia

MUSGRAVE RANGES: Erliwunyawunya (H. Cogger, H. Hughes, R. Mackay!, 1961, AM C.95065, 9 DA); Mt. Woodroffe at 5,000' elevation (SAM, 1 DA); main ridge, S of Mt. Woodroffe, 9.4 km E of Currie River (WA-878, FMNH 212208, 1 DA, 2 DJ); rockhole area SSE of Mt. Woodroffe (WA-876, SAM D18079, AM, WAM 699.87, MV, QM, FMNH 212182-3, FMNH 212195-6, 5 LA, 17 DA, 4 LJ, 12 DJ); Amata track, 3.7

km W of Currie River, SW of Mt. Woodroffe (WA-879, FMNH 212213, 1 DA, 4 DJ); Amata track, 21 km W of Currie River (WA-880, large rocky gulch, FMNH 212214-5, 1 LA, 8 DA, 3 DJ).

Range

The known range of *Dirutrachia mersa* (Iredale, 1937) extends a short distance along the S side of the Musgrave Ranges, SA (**Map 18**) - for about 27 km from almost directly S of Mt. Woodroffe (WA-878) to the area between Levenger Creek and Jacky Pass (WA-880). This probably will be extended in both directions by additional collecting.

Diagnosis

Shell large, moderately variable in size, adult diameter 15.9-19.25 mm (mean 17.43 mm), whorls 4 1/8+ to 5 1/2- (mean 5 1/8+). Apex and spire moderately and evenly elevated (**Fig. 362b**), shell height 7.1-9.2 mm (mean 7.99 mm), H/D ratio 0.421-0.508 (mean 0.458). Body whorl (**Fig. 362b**) acutely to obtusely angulated, bluntly rounded, descending sharply just behind lip. Apex (**Plate 171a**) with prominent, rather widely spaced pustules. Spire and body whorl (**Plate 171a-d**) with low, irregular radial growth ridgelets, very fine periostracal-calcareous setal projections and scattered calcareous pustules on the spire. Umbilicus (**Fig. 362c**) narrow, regularly decoiling, only slightly narrowed by columellar lip, width 1.7-2.85 mm (mean 2.28 mm), D/U ratio 5.70-11.3 (mean 7.76). Lip sharply reflected and moderately to broadly expanded (**Figs 362a-c**), only slightly narrowing umbilicus, white, with a rather high, triangular knob on basal section just inside aperture. Rarely any trace of a depression on the outside shell behind the knob, but upper palatal wall sometimes with weak elongated depression. Parietal wall with thin to thick callus edge. Shell yellow-brown, lighter on base, without trace of spiral bands. Based on 43 measured adults.

Genitalia (**Figs 364a-d**) with long vagina (V), free oviduct (UV) kinked. Ovotestis (**Fig. 364b**, G) elongated. Male genitalia slender, epiphallic flagellum (EF) long and blunt tipped. Penis (P) short, internally (**Fig. 364c**) with typical wall sculpture, verge (PV) short, slightly tapered, typical rolled pattern with lateral end of groove (**Fig. 364d**). Penis sheath absent.

Central and lateral teeth of radula (**Plate 173a-b**) highly modified. Basal plate shortened, support ridge high and with sharp point, anterior flare absent until lateromarginal transition (**Plate 173c**). Cusp shaft angle more than 70°, approaching right angle condition near middle of radula, cusp tip very sharply curved, rounded. Ectocone absent until lateromarginal transition (**Plate 173c**), becoming large at end of three row transition. Marginal teeth (**Plate 173c-d**) with reduced cusp shaft angle, rapidly enlarging ectocone, prominent endocone, mesocone remaining blunt. Jaw (**Plate 173f**) with prominence of radial ribs reduced medially, margins mostly smooth.

Discussion

The holotype is a long dead "bone" and retains no trace of periostracal sculpture. The parietal callus is thick, and there is the high triangular knob just behind the shell lip, but with no external invagination present.

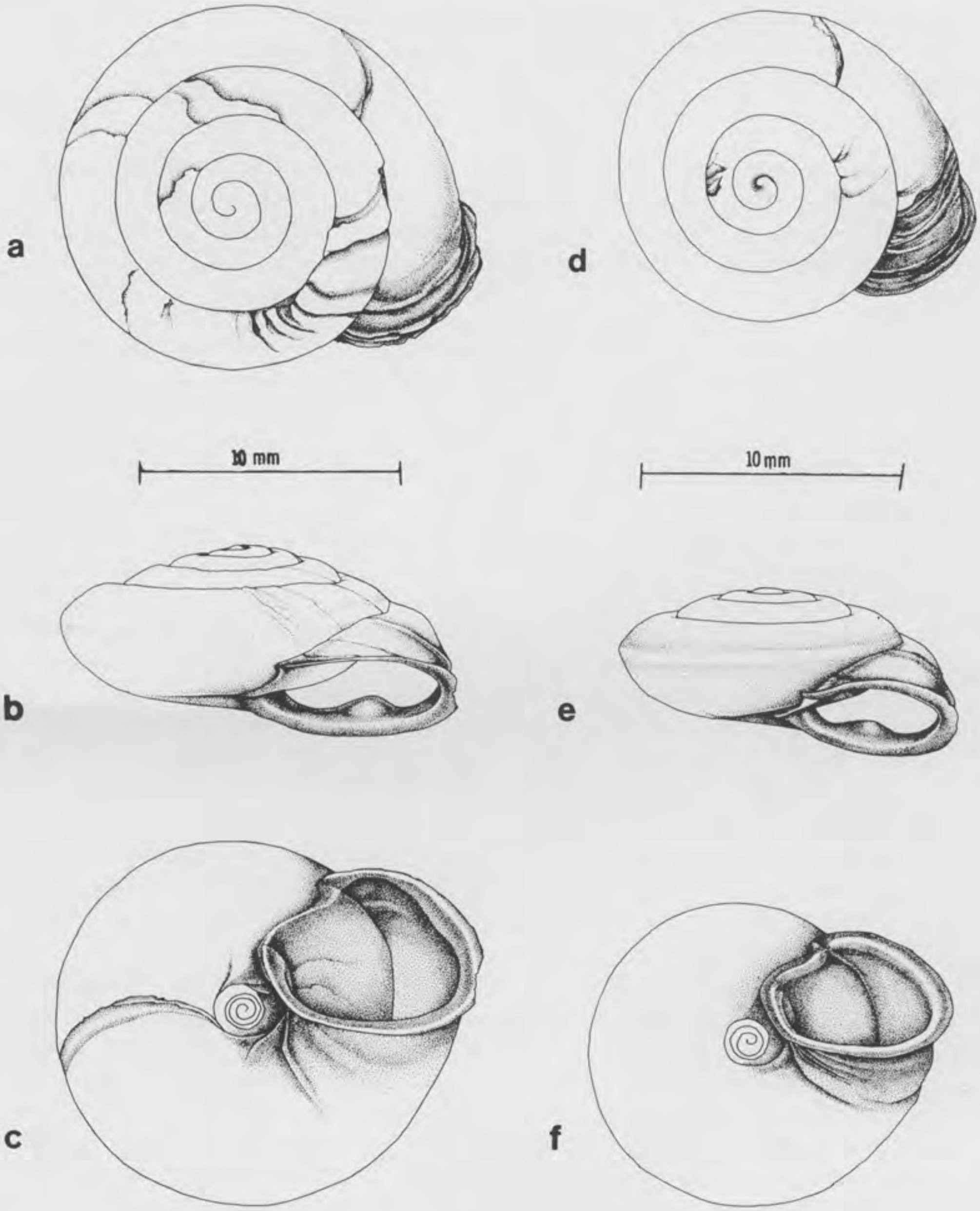


Fig. 362: Shells of *Dirutrachia mersa* (Iredale, 1937) and *Dirutrachia ponderi*, sp. nov.: (a-c) *D. mersa*. WA-878, S of Mt. Woodroffe, Musgrave Ranges, SA. FMNH 212208; (d-f) Holotype of *D. ponderi*. WA-863, Mt. Illbillee, Everard Ranges, SA. SAM D18037. Scale line equals 10 mm. Drawings by Linnea Lahlum.

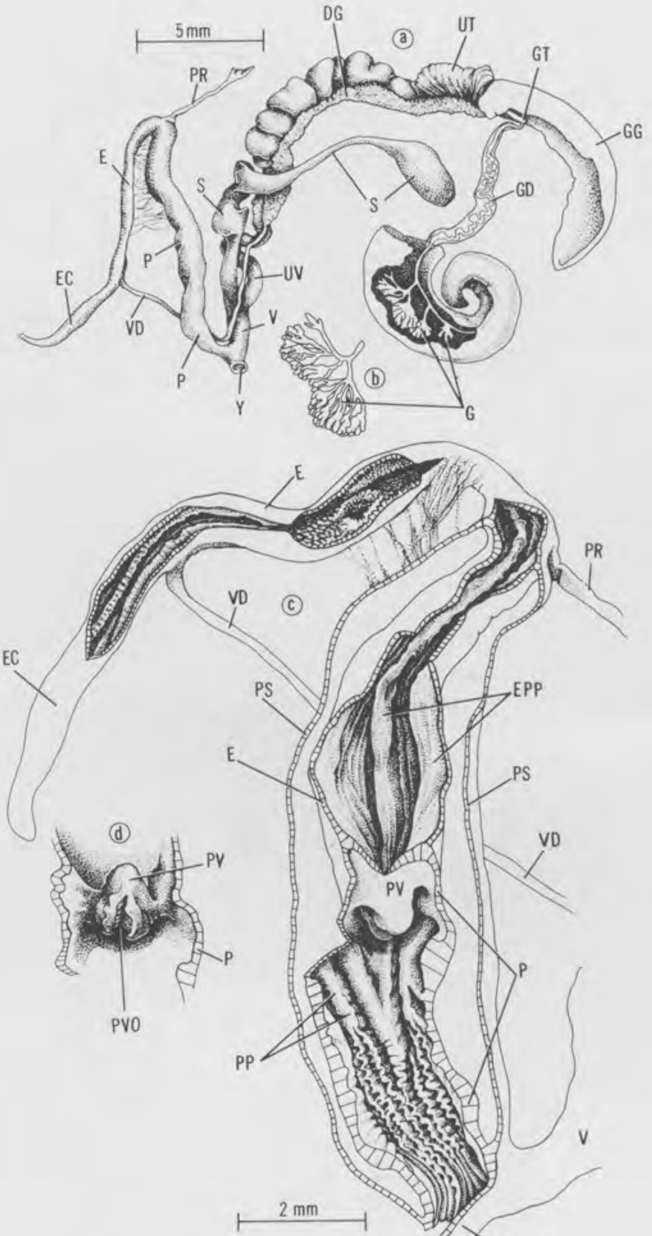


Fig. 363: Genitalia of *Dirutrachia sublevata* (Tate, 1894): 80 m E of Florence Creek, Hale River, S of Harts Ranges, NT. 25 June 1978. FMNH 198940, Dissection A. (a) whole genitalia; (b) detail of ovotestis; (c) interior of penis complex; (d) detail of verge. Scale lines as marked. Drawings by Marjorie M. Connors.

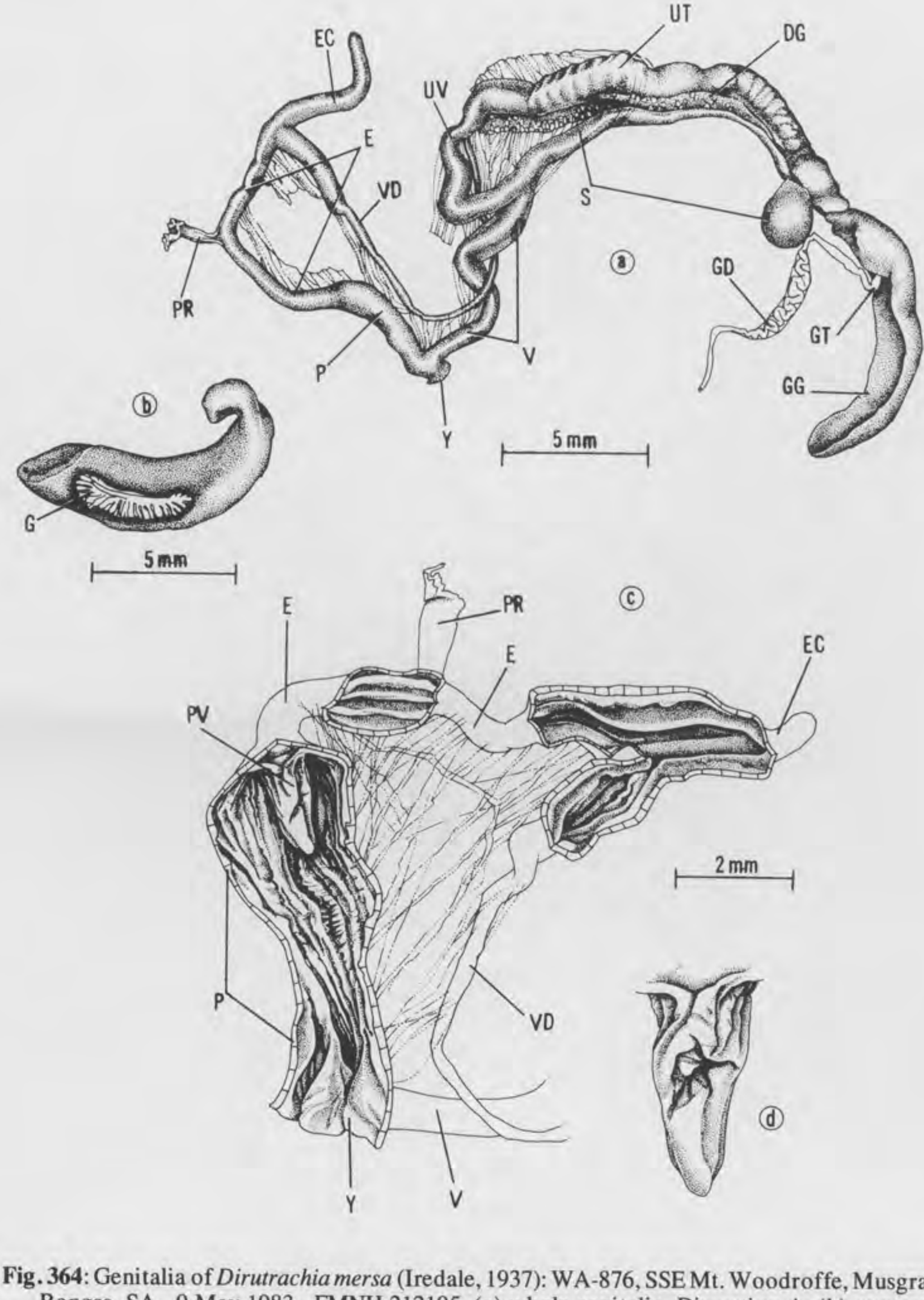


Fig. 364: Genitalia of *Dirutrachia mersa* (Iredale, 1937): WA-876, SSE Mt. Woodroffe, Musgrave Ranges, SA. 9 May 1983. FMNH 212195. (a) whole genitalia, Dissection A; (b) ovotestis, Dissection A; (c) interior of penis complex, Dissection B; (d) detail of verge, Dissection B. Scale lines as marked. Drawings by Linnea Lahlum.

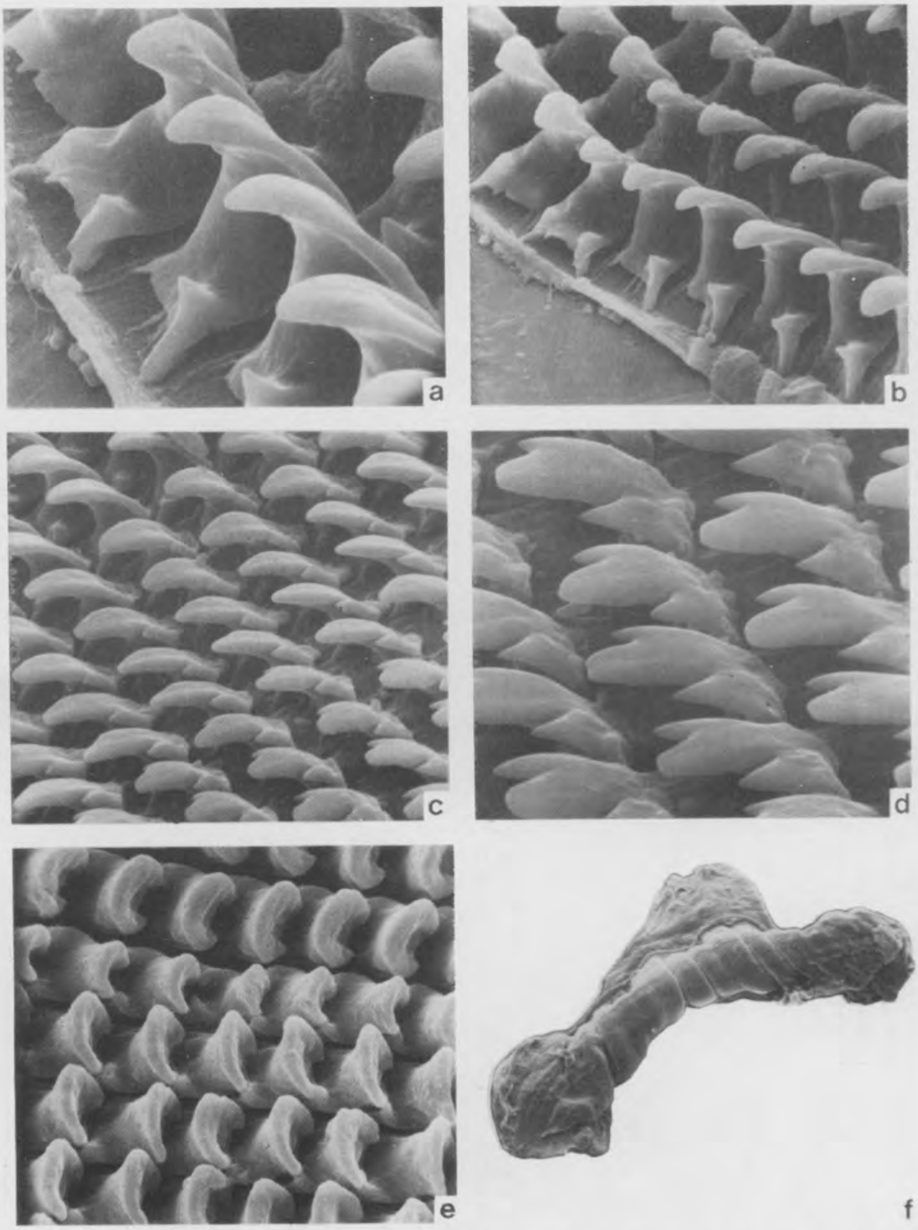


Plate 173: Radular teeth and jaw of *Dirutrachia mersa* Iredale, 1937: WA-876, SSE of Mt. Woodroffe, Musgrave Ranges, SA. 9 May 1983. FMNH 212195, Dissection A. (a) central and 1st laterals at 1,500X; (b) central and early laterals at 750X; (c) lateromarginal transition at 750X; (d) marginals at 1,475X; (e) worn central and laterals at 770X; (f) jaw at 71X.

Table 131: Local Variation in speciies of *Dirutrachia*, *Vidumelon*, and *Divellomelon*

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
D. sublevata (Tate, 1894)							
Florence Creek, K11785	16D	7.21±0.105 (6.5-7.8)	14.42±0.199 (13.0-15.5)	0.500±0.003 (0.484-0.531)	$4^1/_2+$ $(4^1/_4--4^7/_8)$	1.77±0.039 (1.5-2.0)	8.19±0.218 (6.95-9.81)
80 mi E Florence Crk, FMNH 198939	26D	6.73±0.064 (6.15-7.55)	14.50±0.082 (13.75-15.3)	0.464±0.004 (0.419-0.508)	$4^1/_2$ $(4^3/_8+-4^7/_8-)$	1.89±0.064 (1.2-2.5)	7.93±0.309 (5.93-12.5)
creek NE of Claraville, FMNH 198909	6D	6.78±0.288 (5.7-7.7)	14.47±0.362 (13.0-15.4)	0.468±0.009 (0.440-0.500)	$4^1/_2$ $(4^3/_8+-4^5/_8-)$	2.01-0.106 (1.7-2.4)	7.33±0.505 (5.99-8.97)
D. mersa Iredale, 1937							
WA-876, FMNH 212196	10D	8.03±0.181 (7.3-9.2)	17.41±0.301 (15.9-18.9)	0.461±0.007 (0.421-0.486)	5- $(4^1/_8+-5^3/_8+)$	2.27±0.093 (1.85-2.85)	7.78±0.308 (5.70-9.14)
WA-876, FMNH 212183	7D	7.68±0.195 (7.1-8.35)	17.52±0.324 (16.4-18.75)	0.438±0.004 (0.421-0.450)	$5^1/_4$ $(5^1/_8--5^1/_2-)$	2.35±0.058 (2.15-2.5)	7.49±0.214 (6.95-8.67)
WA-880, FMNH 212215	8D	7.83±0.117 (7.35-8.3)	17.65±0.153 (17.2-18.4)	0.443±0.006 (0.421-0.465)	$5^1/_4-$ $(5^1/_8+-5^1/_4+)$	2.33±0.073 (1.95-2.65)	7.63±0.286 (6.46-9.17)
Erliwunyawunya, AM C.95065	9D	8.11±0.175 (7.5-8.8)	17.12±0.202 (16.3-18.1)	0.474±0.009 (0.428-0.508)	$5^1/_4$ $(5^1/_8--5^1/_2-)$	2.35±0.102 (1.8-2.7)	7.38±0.334 (6.15-8.95)

Table 131: Local Variation in speciies of *Dirutrachia*, *Vidumelon*, and *Divellomelon* (Continued)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
V. watti (Tate, 1894)							
Hart Ranges & Maud River AMS C.2173 + AMS	6D	5.42±0.094 (4.85-5.8)	10.66±0.074 (10.25-10.9)	0.508±0.006 (0.473-0.532)	$6\frac{3}{4}$ ($6\frac{5}{8}$-7-)	0.93±0.037 (0.75-1.15)	11.7±0.474 (8.91-14.0)
Florence Creek, K11770	16D	5.84±0.109 (5.4-6.6)	11.09±0.141 (10.3-12.2)	0.527±0.007 (0.488-0.595)	$6\frac{3}{4}$+ ($6\frac{3}{8}$-$7\frac{1}{4}$-)	1.02±0.035 (0.7-1.25)	11.0±0.366 (9.52-15.4)
80 m E Florence Creek, FMNH 198941	21L	5.40±0-.049 (5.0-5.8)	10.85±0.074 (10.4-11.65)	0.498±0.004 (0.467-0.534)	$6\frac{3}{4}$- ($6\frac{1}{8}$–$7\frac{1}{8}$+)	1.03±0.019 (0.8-1.25)	10.5±0.204 (8.65-13.2)
D. hillieri (E.A. Smith, 1910)							
Hermannsburg, BMNH, 1909	6D	7.47±0.115 (7.0-7.85)	17.80±0.338 (16.6-18.5)	0.420±0.004 (0.408-0.432)	$5\frac{3}{4}$- ($5\frac{1}{2}$-$5\frac{7}{8}$)	0.84±0.055 (0.7-1.10)	21.5±1.241 (16.8-25)
3 km W Palm Valley, K11769	5D	7.88±0.078 (7.65-8.1)	17.66±0.271 (17.0-18.5)	0.447±0.007 (0.432-0.471)	$5\frac{7}{8}$+ ($5\frac{3}{4}$+-6)		

Tooth wear is extreme (**Plate 173e**), characterized by even erosion of the central and lateral teeth, rather than tooth fracture by chipping, as is seen in most worn helicoid radulae. The specimens were collected 9 May 1983, less than two months after a torrential downpour over the whole Red Centre, and the animal thus undoubtedly had enjoyed a protracted period of feeding.

Local variation (**Table 131**) in size and shape is minor. At none of the localities was this species abundant. The few live examples were free sealed and taken from rock crevices or from litter under figs growing on rock outcrops.

DIRUTRACHIA PONDERI, SP. NOV.

(Plates 170d-f; Figs 362d-f)

Comparative remarks

Dirutrachia ponderi, sp. nov., collected once from mid-elevations on Mt. Illbillee, Everard Ranges, SA (**Map 18**), has an elongated lip knob (**Fig. 362e**), is smaller (diameter 13.9 mm), has a reduced whorl count (4 5/8), and much more prominent pustules (**Plate 170d-f**), compared with *D. mersa* (Iredale, 1937) from the Musgrave Ranges. The latter also has a triangular lip knob and scattered calcareous pustulations on the spire (**Plate 171b**). *D. sublevata* (Tate, 1894) from the Harts Ranges, NT (**Map 18**) has the shell periphery at most very weakly angulated, and the shell microsculpture consists only of dense spade-shaped periostracal setae (**Plate 170c**). It is very similar (see **Table 131**) in size, shape, whorl count, and lip knob. *Vidumelon wattii* (Tate, 1894), also from the Harts Ranges, has the more numerous whorls (mean 6 3/4) that are very tightly coiled (**Fig. 361d**), a minute umbilicus (**Fig. 361f**), no trace of a lip knob, and shell microsculpture of simple periostracal setae (**Plate 174b**). *Divellomelon hillieri* (E. A. Smith, 1910), from Palm Valley, Krichauff Ranges, NT (**Map 18**) has an acutely keeled periphery, spiral colour bands (**Figs 366a-c**), a minute or nearly closed umbilicus, lacks the lip knob, and is much larger in size (**Table 130**). The anatomy of *D. ponderi* is unknown.

Holotype

SAM D18037, WA-863, half way up S side of Mt. Illbillee, 2 km W of Victory Well, Everard Ranges, South Australia, Australia (Everard 1:250,000 map sheet SG 53-13 - 561:642yds). 27° 03' 06" S, 132° 28' 57" E. Collected by Wolfgang Zeidler and Winston Ponder. 5 May 1983. Height of holotype 6.45 mm, diameter 13.9 mm, H/D ratio 0.464, whorls 4 5/8, umbilical width 2.1 mm, D/U ratio 6.62.

Range

Dirutrachia ponderi, sp. nov., is known from one specimen collected on the mid-slopes of Mt. Illbillee, Everard Ranges, SA (**Map 18**).

Diagnosis

Shell relatively small, adult diameter 13.9 mm, whorls 4 5/8. Apex and spire moderately elevated (**Fig. 362e**), shell height 6.45 mm, H/D ratio 0.464. Body whorl descending abruptly just behind lip (**Fig. 362e**), periphery obtusely angulated. Apex

(**Plate 170d**) with prominent pustules, changing to low and irregular radial ridges surmounted at intervals by crescentic pustules on spire and body whorl (**Plate 170e-f**), reduced in prominence below periphery. Umbilicus narrow (**Fig. 362f**), regularly decoiling, slightly narrowed by lip reflection, width 2.1 mm, D/U ratio 6.62. Lip sharply reflected, moderately expanded, white, with a prominent elongated knob just inside basal lip (**Fig. 362e**), no trace of indentation behind lip. Parietal wall with moderate callus. Remnant color suggests that the shell was brownish-yellow. Based on one adult specimen.

Anatomy unknown.

Discussion

The very strong surface sculpture (**Plate 170d-f**), small size with reduced whorl count (**Table 130**), and obtusely angulated periphery characterize *Dirutrachia ponderi*. In lip knob form it is more similar to *D. sublevata* (Tate, 1894) from the Harts Ranges than it is to *D. mersa* (Iredale, 1937) from the nearby Musgrave Ranges, although the latter has shell microsculpture that is intermediate in composition.

Dirutrachia ponderi is dedicated to Winston Ponder, Curator at the Australian Museum, Sydney, who, together with Wolfgang Zeidler, Curator at the South Australian Museum, Adelaide collected this species while in search of freshwater snails.

GENUS *VIDUMELON* IREDALE, 1933

Vidumelon Iredale, 1933, Rec. Austr. Mus., **19** (1): 51 - type species *Hadra wattii* Tate, 1894; Iredale, 1937, South Austr. Nat., **18** (2): 39; Iredale, 1938, Austr. Zool., **9** (1): 91; Burch, 1976, Jour. Malac. Soc. Austr., **3** (3): 136 - check list citation; Richardson, 1985, Tryonia, **12**: 313 - check list citation.

Shell small, adult diameter 10.25-12.2 mm, with 6 1/8- to 7 1/4- very tightly coiled whorls. Apex and spire only slightly elevated, H/D ratios 0.467-0.595. Apical sculpture reduced initially, with low scattered pustules on lower portion (**Plate 174a**). Spire and body whorl above periphery with very dense periostracal setae (**Plate 174a-b**), each with a long basal support, plus low and irregular periostracal ridgelets in between. Sculpture greatly reduced below periphery, absent from shell base. Body whorl at most obtusely angulated high on whorl, only gradually descending behind lip (**Fig. 361e**). Umbilicus open, very narrow, barely decoiling. Lip sharply reflected, slightly expanded, little thickened internally, white, barely narrowing umbilicus (**Fig. 361f**). Shell colour dark brownish-yellow, lighter on shell base.

Live specimens aestivate free sealing in litter.

Genitalia (**Figs 365a-c**) with head of spermatheca (S) stopping well short of albumen gland (GG) base, lower portion of shaft expanded. Free oviduct (UV) short, not folded. Vagina (V) long and slender. Vas deferens (VD) partly bound to other genitalia with fibers, entering (DE) junction of epiphallus (E) and epiphallic caecum

(EC) through a low pilaster. Epiphallic caecum long and tapering apically. Epiphallus with complex internal wall sculpture. Penial retractor muscle (PR) inserting on epiphallus at point where thin walled penis sheath (PS) begins. Walls of penis (P) thick, with low pilaster folds. Verge (PV) tubular (**Fig. 365c**), internally ridged, with near terminal pore. Atrium very short. Head with very small patch of specialized pustules between and just behind ommatophores.

Jaw (**Plate 175d**) with widely spaced, prominent vertical ribs medially, reduced on margins. Central and early lateral teeth (**Plate 175a, c**) with large basal support ridge, small anterior flare, normal cusp shaft angle, weak ectocone on early laterals, cusp tip moderately curved and blunt. Lateromarginal transition (**Plate 175b**) typical and abrupt, early marginals typical.

Type species: *Hadra wattii* Tate, 1894 by original designation.

Comparative remarks

Vidumelon is most easily recognized by its low spire (**Fig. 361e**) and increased number of very tightly coiled whorls (mean 6 3/4, **Fig. 361d**) compared with the much larger *Divellomelon hillieri* (E. A. Smith, 1910) (mean 5 3/4+, **Figs 366a-c**). The barely expanded lip (**Figs 361e-f**) and lack of a basal lip knob immediately distinguishes it from any of the *Dirutrachia* Iredale, 1937, which also differ in basic shell microsculpture (**Plates 170-171**). The periostracal microsculpture (**Plate 174a-b**) of *Vidumelon* is basically the same as in many *Semotrachia* Iredale, 1933, except that the setal bases often are shorter in the latter. The more expanded shell lip, widely open umbilicus, and lower whorl counts of *Semotrachia* (**Tables 121-129**) easily separate them. The most unusual anatomical feature of *Vidumelon* is the formation of a tubular verge (PV, **Fig. 365c**) with near terminal pore. This, combined with the very long vagina (V, **Fig. 365a**) and simplified penis chamber wall sculpture (**Fig. 365b**) contrast with the very short tubercular verge with lateral sperm groove (PV, **Figs 363c-d**), short vagina (V, **Fig. 363a**), and more complex penis chamber wall sculpture (PP, **Fig. 363c**) in the sympatric *Dirutrachia sublevata* (Tate, 1894). I interpret these differences as representing species recognition differences between these sympatric taxa. The failure of the spermathecal head (S) to reach the albumen gland base in *Vidumelon* (**Fig. 365a**) probably correlates with the greatly increased number of whorls and differential growth rates of the organs in this zone of the animal.

Previous studies

Tate (1894, 1896) described and illustrated *Vidumelon wattii* from Horn Expedition materials. The generic name *Vidumelon* was proposed by Iredale (1933). Subsequent check list mentions by Iredale (1937b, 1938), Burch (1976), and Richardson (1985) complete the literature records. In recent years, it has been collected by Fred and Jan Aslin in 1978 and Vince Kessner in 1987.

Distribution and comparative ecology

Vidumelon wattii (Tate, 1894) has been collected along Maude and Florence Creeks on the S side of the Harts Ranges, NT (**Map 18**). Both creeks are seasonal tributaries of the Hale River. All live examples were found free sealing in leaf litter, with a few taken under rocks.

VIDUMELON WATTII (TATE, 1894)
(Plates 174a-b, 175a-d; Figs 361d-f, 365a-c)

Hadra wattii Tate, 1894, Trans. Royal Soc. South Austr., **18**: 192 - Central Australia.

Thersites (Badistes?) wattii (Tate), Tate, 1896, Rep. Horn Sci. Exped. Central Austr., Zool., pp. 201-202, pl. XVIII, figs 12a-c - Maud River, in the Hart (*sic*) Range, east of Alice Springs.

Vidumelon wattii (Tate), Iredale, 1937, South Austr. Nat., **18** (2): 39, pl. II, fig. 6 - check list citation; Iredale, 1938, Austr. Zool., **9** (2): 91 - check list citation; Richardson, 1985, Tryonia, **12**: 313 - check list citation.

Comparative remarks

Vidumelon wattii (Tate, 1894), from the S side of the Harts Ranges, NT (**Map 18**), is small (mean diameter 10.89 mm), with many (mean 6 3/4) very tightly coiled whorls (**Fig. 361d**), and a very small umbilicus (**Fig. 361f**, mean D/U 10.9). The postapical shell microsculpture consists of dense periostracal setae with elongated bases (**Plate 174a-b**). The shell periphery (**Fig. 361e**) is somewhat flattened, with a weak shoulder above, the lip is narrow, and there is a weak callus on the palatal wall. The sympatric *Dirutrachia sublevata* (Tate, 1894) is much larger (mean diameter 14.66 mm), with fewer (mean 4 1/2+) normally coiled whorls (**Fig. 361a**), and a wider umbilicus (**Fig. 361c**, mean D/U ratio 7.98). The postapical shell microsculpture consists of larger spade-shaped periostracal setae (**Plate 170a-c**) with U-shaped bases. The shell periphery is more angulated, the lip is much more expanded, and the body whorl descends sharply behind the lip. *Divellomelon hillieri* (E. A. Smith, 1910), from the Krichauff Ranges, is much larger (mean diameter 17.70 mm), with fewer (mean 5 3/4+) and less tightly coiled (**Fig. 366a**) whorls, and an even narrower umbilicus (**Fig. 366c**, mean D/U ratio 25.5). The postapical shell sculpture consists of vague radial ridgelets only (**Plate 174c-d**). The shell periphery is protruded (**Fig. 366b**) and acutely angulated, and the lip is more expanded. The much reduced whorl counts (**Tables 121-129**), wider umbilici, and strongly reflected lips easily separate all species of *Semotrachia* Iredale, 1933 from *Vidumelon*. Anatomically (**Figs 365a-c**), the very long vagina (V), simple penial chamber wall sculpture, and the verge (PV) consisting of a closed tube with near terminal pore easily distinguish *Vidumelon wattii* from the sympatric *Dirutrachia sublevata*, *Divellomelon*, and any of the northern *Semotrachia*. In retaining generalized lateral radular teeth (**Plate 175a, c**), *Vidumelon wattii* differs greatly from both *Dirutrachia* (**Plates 172a-b, 173a-b**) and *Divellomelon* (**Plate 176a-d**), in which the teeth are greatly modified.

Holotype

SAM D13601, Maud River, Hart (*sic*) Ranges, Northern Territory, Australia. Collected by the Horn Expedition. Height of holotype 5.8 mm, diameter 10.8 mm, H/

D ratio 0.537, whorls 6 7/8-, umbilical width 0.8 mm, D/U ratio 13.5. A live collected example.

Paratopotypes

AM C.2173, AM, WAM 701.87, SAM D18082, QM, MV, FMNH 171513, MV F28287, 8 DA, 3 DJ from the type locality.

Studied material

Northern Territory

HARTS RANGE: Florence Creek (80 m E of, FMNH 198941, 23 LA, 26 LJ; 22 April 1987, V. Kessner!, K 11770, 16 DA).

Range

Vidumelon wattii (Tate, 1894) has been collected from Florence and Maud Creeks on the S side of the Harts Ranges, NT (**Map 18**). The total range probably is 5-10 km maximum, depending how far into the Harts Ranges the populations extend.

Diagnosis

Shell small, adult diameter 10.25-12.2 mm (mean 10.89 mm), whorls 6 1/8- to 7 1/4- (mean 6 3/4). Apex and spire slightly and evenly elevated (**Fig. 361e**), shell height 4.85-6.6 mm (mean 5.55 mm), H/D ratio 0.467-0.595 (mean 0.510). Body whorl (**Fig. 361e**) somewhat flattened laterally, at most slightly shouldered above, not or at most slightly descending behind lip. Apex (**Plate 174a**) initially nearly smooth, then with often elongated pustules. Spire and body whorl (**Plate 174a-b**) with densely spaced simple setae that have elongated bases and are organized in diagonal rows. Umbilicus (**Fig. 361f**) open, very narrow, last whorl decoiling more rapidly, width 0.7-1.25 mm (mean 1.01 mm), D/U ratio 8.34-15.4 (mean 10.9). Lip narrowly expanded, with rolled edge, no trace of lip knob (**Figs 361e**). Parietal wall with very thin callus. Shell brownish-yellow, somewhat lighter on shell base, no colour bands. Based on 46 measured adults.

Genitalia (**Fig. 365a-c**) with very long vagina (V), short free oviduct (UV), spermatheca (S) with expanded base, but head not reaching albumen gland base (GG). Epiphallic caecum (EC) long, with slender tip. Epiphallus typical. Penis sheath (PS) thin walled. Penis (P) short, wall sculpture with low simple ridges. Verge (PV, **Figs 365b-c**) tubular, with near terminal pore.

Central and lateral teeth of radula (**Plate 175a, c**) with large basal support ridge, moderate anterior flare, weak ectocone developed after first few laterals, cusp shaft angle typical, curved and rather blunt cusp tip typical. Lateromarginal transition (**Plate 175b**) abrupt, typical. Early marginals and jaw (**Plate 175d**) without unusual features.

Discussion

Vidumelon wattii (Tate, 1894) is one of the most distinctive species of Red Centre camaenids. Its low spire, tight whorl coiling, narrow umbilicus, and narrow lip (**Figs 361d-f**) are very different from any of the Sinumeloninae or other Pleurodontinae, and, combined with its small size (**Table 130**), are diagnostic.

Fig. 365: Genitalia of *Vidumelon wattii* (Tate, 1894): 80 m E of Florence Creek, Hale River, Hart Ranges, NT. 25 June 1978. FMNH 198941. (a) whole genitalia, Dissection A; (b) interior of penis complex, Dissection B; (c) detail of verge tip, Dissection B. Scale lines as marked. Drawings by Marjorie M. Connors.

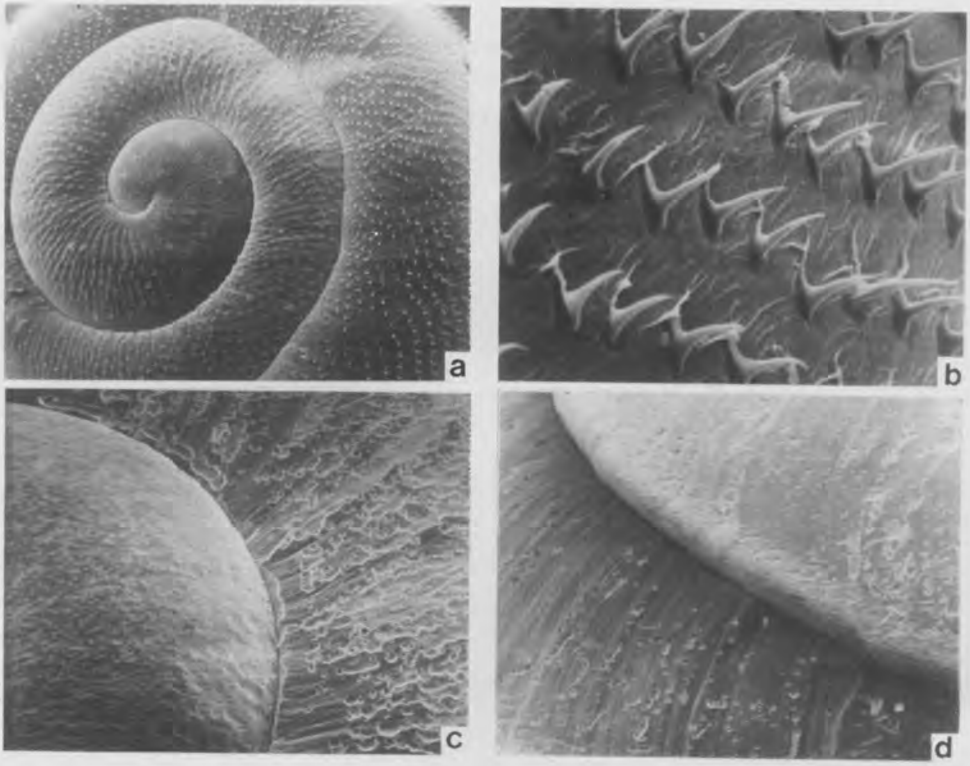


Plate 174: Shell sculpture of *Vidumelon wattii* (Tate, 1894) and *Divellomelon hillieri* (E. A. Smith, 1910): (a-b) *V. wattii.* near Florence Creek, Hale River, NT. FMNH 198941. a is apex and spire at 29.2X, b is setae on mid-spire at 295X; (c-d) *D. hillieri.* WA-926b, Palm Valley, Krichauff Ranges, NT. FMNH 212360. c is apex and early spire at 43X, d is mid-spire showing peripheral keel at 27X.

The genital differences from the microsympatric *Dirutrachia sublevata* (Tate, 1894) (see **Comparative remarks** above), especially the differences in verge (PV) and vaginal (V) lengths (compare **Figs 363, 365**), suggest that *Vidumelon* and *Dirutrachia* are closely related, despite the obvious shell differences. These differences approach the pattern seen in sympatric congeners. The fact that the head of the spermatheca (S, **Fig. 365a**) does not reach to the base of the albumen gland (GG) in *Vidumelon* probably is a result of the increase in shell whorl count and narrowing of the whorl cross section in this species. Whether this was caused by differential lengthening of the prostate-uterus and spermathecal shaft, or the relative descension of the spermathecal head was caused by its being "squeezed out" from the gland base is unknown.

In 1978, Fred and Jan Aslin found the *Vidumelon wattii* was common in leaf litter and relatively scarce under rocks. At the same station, specimens of *Dirutrachia sublevata* (Tate, 1894) were found in soil under rocks and from crevices deep in rock piles. This suggests habitat specialization for the two species, and correlates with the different tooth structures - *Vidumelon* (**Plate 175a-c**) having the teeth of a generalized eater of dead plant matter, while *Dirutrachia sublevata* (**Plate 172a-e**) has the tooth structure associated with scraping rock surfaces.

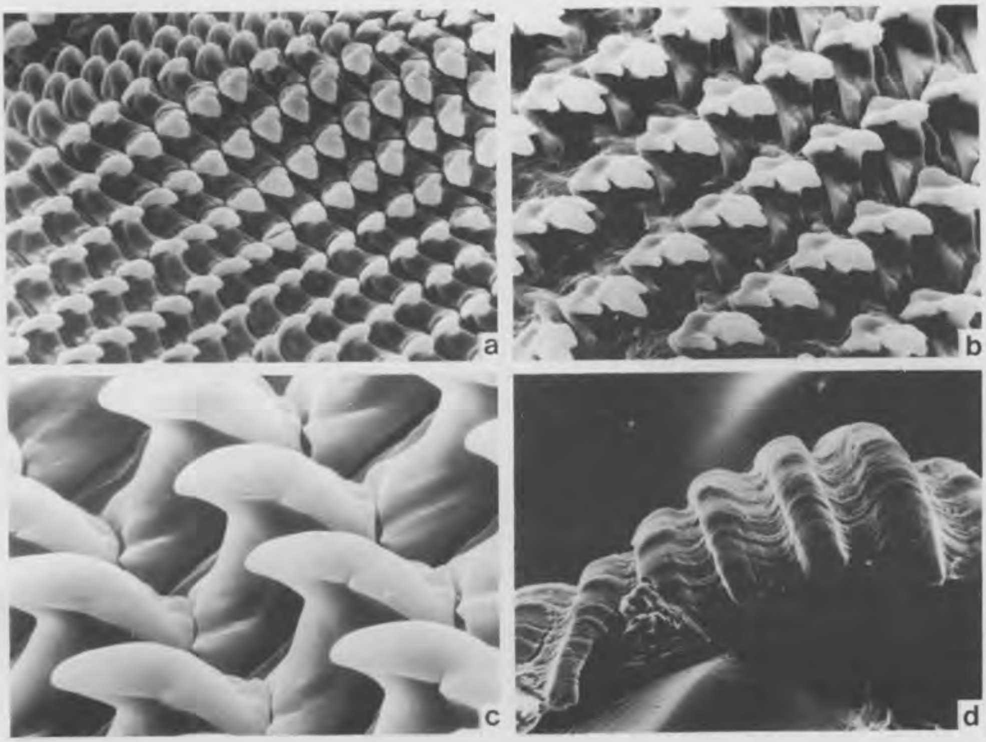


Plate 175: Radular teeth and jaw of *Vidumelon wattii* (Tate, 1894): near Florence Creek, Hale River, NT. 25 June 1978. FMNH 198941, Dissection A. (a) high angle rear view of centrals and laterals at 365X; (b) medium angle rear-lateral view of lateromarginal transition at 770X; (c) early laterals at 1,350X; (d) jaw at 150X.

GENUS *DIVELLOMELON* IREDALE, 1933

Divellomelon Iredale, 1933, Rec. Austr. Mus., **19** (1): 51 - type species *Thersites (Glyptorhagada) hillieri* E. A. Smith, 1910; Iredale, 1937, South Austr. Nat., **18** (2): 54-55; Iredale, 1938, Austr. Zool., **9** (1): 109 - check list citation; Burch, 1976, Jour. Malac. Soc. Austr., **3** (3): 135 - check list citation; Richardson, 1985, Tryonia, **12**: 122-123 - check list citation.

Shell large, adult diameter 16.3-18.6 mm, with 5 3/8 to 6 1/8+ fairly narrow whorls. Apex and spire moderately elevated, H/D ratios 0.388-0.473. Apex (**Plate 174c**) worn in available material, spire and body whorl (**Plate 174c-d**) with low and irregular radial ridgelets, no microsculpture observed. Body whorl acutely angulated (**Fig. 366b**), with thread-like keel, not descending behind lip. Umbilicus (**Fig. 366c**) closed to minute. Lip narrowly expanded and rolled, thickened internally. Parietal wall with variable callus. Shell light yellow-brown, base much lighter, narrow peripheral and subsutural red spiral colour bands in live collected examples.

Live specimens probably aestivate free sealed in litter and deep rock fissures.

Genitalia (**Figs 367a-d**) with head of spermatheca (S) reaching base of albumen gland (GG), free oviduct (UV) short and folded, vagina (V) short and relatively thick. Epiphallic caecum (EC) long and finger-like. Epiphallus (E), penis chamber walls, and vagina with complex microsculpture. Penial retractor muscle (PR) inserting onto epiphallus at point where thin walled penis sheath (PS) begins. Penis (P) short, verge (PV) short and with lateral sperm groove (**Fig 367d**). Atrium (Y) very short. Head with small patch of specialized pustules between and just behind ommatophores.

Jaw (**Plate 176e**) with prominent vertical ribs medially, reduced on lateral margins. Central and early lateral teeth (**Plate 176c-d**) with high basal support ridge, greatly reduced anterior flare, close to vertical cusp shaft angle, cusp tip moderately to strongly curved and usually broadly rounded. Ectocone not present until after lateromarginal transition (**Plate 176a-b**), which is relatively gradual. Late laterals with enlarged anterior flare (**Plate 176a-b**). Early marginals with broad mesocone.

Type species: *Thersites (Glyptorhagada) hillieri* E. A. Smith, 1910 by original designation.

Comparative remarks

Divellomelon immediately differs from other Red Centre taxa in it combination of nearly closed umbilicus, protruded keel, low spire (**Figs 366a-c**), and lack of prominent microsculpture (**Plate 174c-d**). The pattern of lip thickening is the same as in *Vidumelon, Sinumelon,* and *Montanomelon* (**Figs 313a-f**), and very different from that found in *Semotrachia* and *Dirutrachia* (**Figs 323a-f, 361a-c, 362a-f**). Anatomically (**Figs 367 a-d**), the thickness and complex internal wall sculpture of the vagina (V), relatively short epiphallic caecum and penis (P), small verge (PV), and highly modified radular teeth (**Plate 176a-d**) separate *Divellomelon* from *Semotrachia* Iredale, 1933 and *Vidumelon* Iredale, 1933, which have generalized radular teeth.

Kimberley and NT genera such as *Prototrachia* Solem, 1984 and *Ordtrachia* Solem, 1984 have the same general shell appearance, but have open umbilici, prominent shell microsculpture, and very different genital anatomy and radular structure (Solem, 1984: 647-670, 681-693, plts 60-63).

Previous studies

Divellomelon hillieri (E. A. Smith, 1910) was described from drift material collected near Hermannsburg, NT. The generic name was provided by Iredale (1933: 51) with only vague descriptive notes that were then slightly expanded by Iredale (1937b: 54-55). The only subsequent mentions are check list citations by Iredale (1938: 109), Burch (1976: 135), and Richardson (1985: 122-123).

Distribution and comparative ecology

Divellomelon hillieri (E. A. Smith, 1910) has been collected recently only from rock rubble and litter at the bottom of deep vertical fissures in a cliff face in Palm Valley, Krichauff Ranges, NT (**Map 18**). The original collection, cited as "from the neighbourhood of Hermannsburg, South Central Australia" (E. A. Smith, 1910: 26), consists of bleached "stream drift" examples. Probably they originated from the same colony.

Both Vince Kessner and I have found a few live individuals in rocky litter at the base of fissures within a few weeks of heavy rains. They had thin epiphragms secreted across the aperture and were free in the substrate. Undoubtedly the main colony lives deep within the fissured cliff, and these were stray examples. A few dead and bleached examples (AM) were collected "under figs, N side of Palm Valley" by D. McMichael in September 1958.

The colony occupies considerably less than 0.5 km of cliff face.

DIVELLOMELON HILLIERI (E. A. SMITH, 1910)
(Plates 174c-d, 176a-e; Figs 366a-c, 367a-d)

Thersites (Glyptorhagada) hillieri E. A. Smith, 1910, Proc. Malac. Soc. London, **9** (1): 26, 2 figs - Hermannsburg, Central Australia.

Divellomelon hillieri (E. A. Smith), Iredale, 1937, South Austr. Nat., **18** (2): 55, pl. II, fig. 23 - check list citation: Iredale, 1938, Austr. Zool., **9** (2): 109 - check list citation; Richardson, 1985, Tryonia, **12**: 122-123 - check list citation.

Comparative remarks

Divellomelon hillieri (E. A. Smith, 1910), from a small section of cliff face, Palm Valley, Krichauff Ranges, NT (**Map 18**), is a relatively large species (mean diameter 17.70 mm) with increased whorl count (mean 5 3/4+), but is most readily characterized by its acutely angulated periphery with thread-like keel (**Fig. 366b**), lack of shell microsculpture (**Plate 174c-d**), nearly closed umbilicus (**Fig. 366c**), very narrow lip, and peripheral colour zones (**Figs 366a-c**). Other Red Centre taxa with angulated peripheries, such as *Semotrachia basedowi* (Hedley, 1905) (**Figs 355a-c**) and *Dirutrachia mersa* (Iredale, 1937) (**Figs 362a-c**), have complex shell microsculpture and open to widely open umbilici. The Flinders Range *Contramelon howardi* (Angas, 1869) (Solem, 1989a: figs 58a-c) is similar in appearance and general lack of shell sculpture, but has an open umbilicus, more expanded shell lip, fewer whorls, and much more prominent colour bands. The E Kimberley *Ordtrachia grandis* Solem (1984: 663, figs 171a-c, plt. 56a-c) is very similar in size and shape, but has fewer whorls, an open umbilicus, more expanded lip, and prominent shell microsculpture. The absence of a shell lip knob immediately distinguishes *Divellomelon hillieri* from any of the Red Centre *Dirutrachia* (**Figs 361a-c, 362a-f**). Anatomically (**Figs 367a-d**), the short and thick vagina (V) with complex wall sculpture, short penis (P) and small verge (PV) are diagnostic. The modified central and lateral teeth of the radula (**Plate 176c-d**) agree with the pattern in *Dirutrachia* (**Plates 172-173**) and differ sharply from the generalized teeth that are characteristic of *Vidumelon* (**Plate 175a, c**) and most *Semotrachia*.

Holotype

British Museum (Natural History) 1909.10.23.1. From the neighbourhood of Hermannsburg, South Central Australia. Collected by H. J. Hillier. Height of holotype 7.5 mm, diameter 17.8 mm, H/D ratio 0421., whorls 5 5/8, umbilical width 0.7 mm, D/U ratio 25.4. A worn and bleached example.

Paratopotypes

British Museum (Natural History) 1909.10.23.2-7, AM, AM C.31494, WAM 111.50, SAM D14912, 11 DA, 1 DJ from the type collection.

Studied material

Northern Territory

KRICHAUFF RANGES: Palm Valley (under figs on N side, 12-13 September 1958, AM, 2 DA, 1 DJ; WA-926a-b, 2.5 km above campground in rock crevices, AM, SAM D18083, WAM 702.87, FMNH 212349, FMNH 212352-3, FMNH 212360; 6 LA, 1 DA, 4 LJ; 3 km W of camping ground, 28 April 1987, V. Kessner!, Kessner 11769, 5 DA).

Range

Divellomelon hillieri (E. A. Smith, 1910) is known from a small area of cliffs in Palm Valley, Krichauff Ranges, NT (**Map 18**).

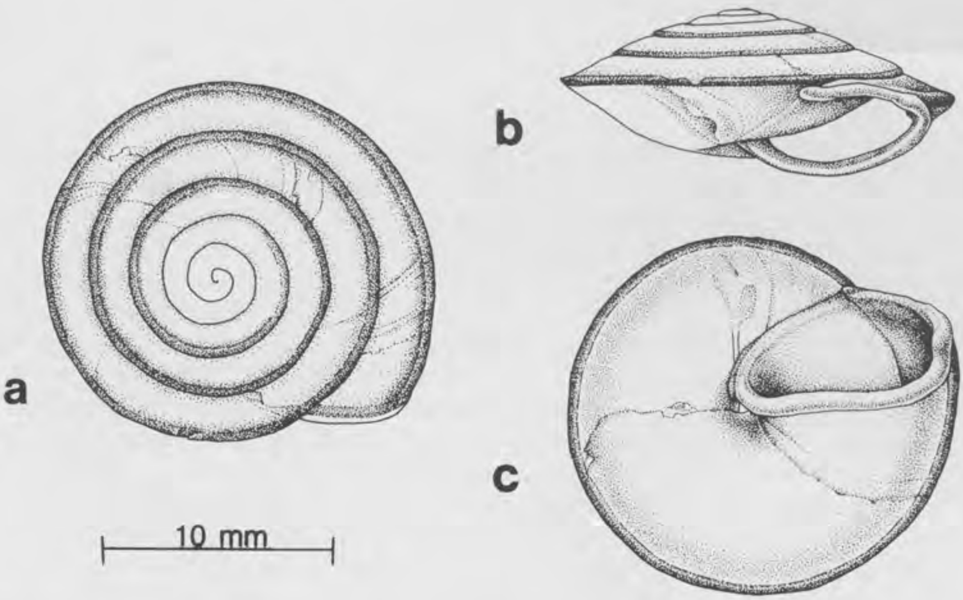


Fig. 366: Shell of *Divellomelon hillieri* (E. A. Smith, 1910): Holotype of *Thersites (Glyptorhagada) hillieri* E. A. Smith, 1910. Neighbourhood of Hermannsburg, NT. BMNH 1909.10.23.1. Scale line equals 10 mm. Drawings by Linnea Lahlum.

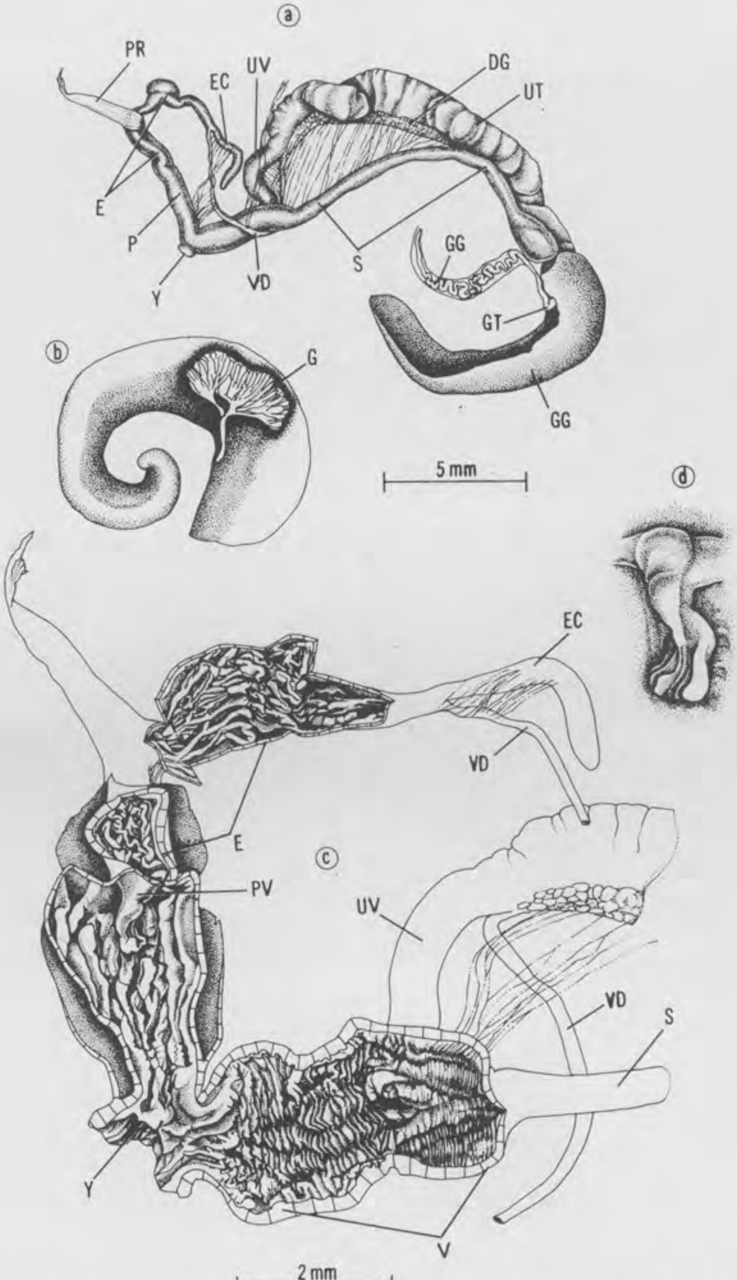


Fig. 367: Genitalia of *Divellomelon hillieri* (E. A. Smith, 1910): WA-926B, Palm Valley, Krichauff Ranges, NT. 22 May 1983. FMNH 212360, Dissection A. (a) whole genitalia; (b) ovotestis; (c) interior of penis complex; (d) detail of verge. Scale lines as marked. Drawings by Linnea Lahlum.

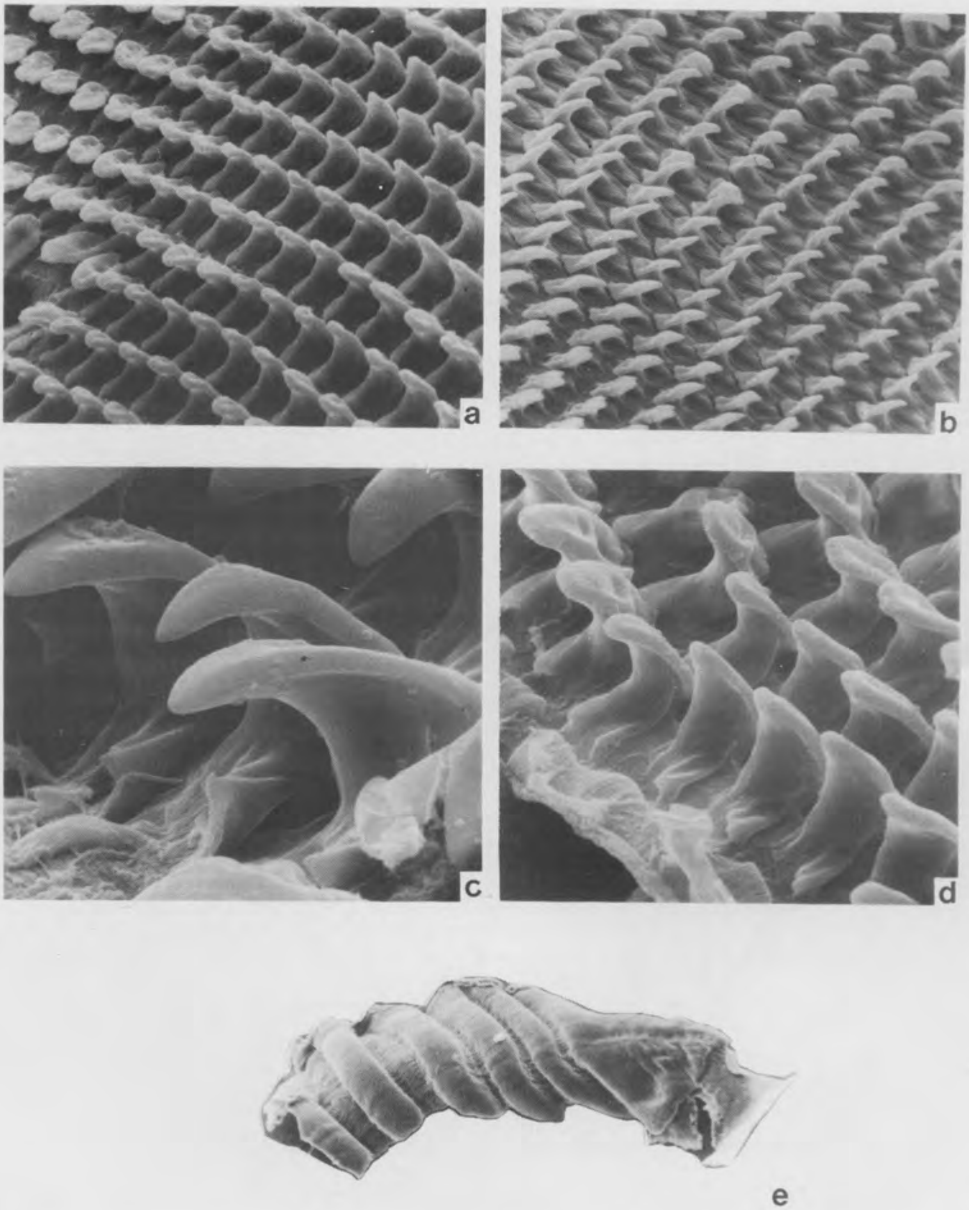


Plate 176: Radular teeth and jaw of *Divellomelon hillieri* (E. A. Smith, 1910): WA-926b, Palm Valley, Krichauff Ranges, NT. 22 May 1983. FMNH 212360, Dissection A. (a) lateromarginal transition at 395X; (b) part row of new teeth at 405X; (c) early laterals at 1,625X; (d) central and laterals at 790X; (e) jaw at 120X.

Diagnosis

Shell large, adult diameter 16.3-18.6 mm (mean 17.70 mm), whorls 5 3/8 to 6 1/8+ (mean 5 3/4+). Apex and spire slightly to moderately and evenly elevated (**Fig. 366b**), shell height 6.5-8.5 mm (mean 7.67 mm), H/D ratio 0.388-0.473 (mean 0.434). Whorls flattened above and below acutely angulated periphery (**Fig. 366b**), which has a thread-like keel (**Plate 174d**), body whorl not descending behind lip. Apical sculpture unknown because of shell wear, spire and body whorl (**Plate 174c-d**) with low and irregular, vague radial riblets. Umbilicus minute to closed (**Fig. 366c**), width when open 0.42-1.1 mm (mean 0.76 mm), D/U ratio 16.8-44 (mean 25). Lip slightly expanded, thickened internally, with rolled edge, no trace of lip knob. Parietal wall with very thin callus. Shell light yellow-brown above periphery, almost white on base, peripheral area with spiral red colour zone, also a subsutural red colour zone. Based on 26 measured adults.

Genitalia (**Figs 367a-d**) with vagina (V) short and thick, free oviduct (UV) folded, spermatheca (S) with head reaching base of albumen gland (GG). Epiphallic caecum (EC) long, finger-shaped. Epiphallus (E), penis chamber, and vaginal walls with fine complex sculpture. Penial retractor muscle (PR) inserting on epiphallus at point where thin walled penis sheath (PS) originates. Penis (P) short. Verge (PV) slender, with lateral sperm groove.

Central and early lateral teeth of radula (**Plate 176c-d**) with shortened basal plates, prominent basal support ridge, greatly reduced anterior flare, very high cusp shaft angle, cusp tip moderately curved and broadly rounded. Late laterals (**Plate 176a-b**) with reduced cusp tip curvature and cusp shaft angle, enlarged anterior flare. Lateromarginal transition typical. Early marginals (**Plate 176a-b**) developing small side cusps, but mesocone wider than usual. Jaw (**Plate 176e**) with large vertical ribs medially, lost on sides.

Discussion

Divellomelon hillieri (E. A. Smith, 1894) probably is restricted to the fissured cliff area in Palm Valley. The animal is yellowish-white, without any darker markings on head and neck, which often is characteristic of species inhabiting such areas.

The red spiral bands on the periphery and below the suture are unusual in the Australian Pleurodontinae. Size variation (**Table 131**) is minimal.

PATTERNS OF DISTRIBUTION AND AREA DIVERSITY

Use of the term biogeography implies that the phylogeny of the group under review is understood and that hypotheses concerning the dispersal/vicariation origins of species and genera can be presented. This situation does not prevail for the taxa reviewed in this monograph. Hence the section heading mentioning "distribution" and "area diversity".

The Sinumeloninae are restricted to central and southern Australia, with no known affinities to either northern Australian or Indonesian-SE Asian taxa. The most diverse sinumelonid genus, *Sinumelon*, does range extralimitally from the New South Wales Barrier Ranges W through South Australia, up to the Western Australian town of Geraldton. Derived genera (**Part VII**) extend the subfamily range up the west coast to the North West Cape. Otherwise the distribution of *Sinumelon* (**Map 5**) nearly coincides with the subfamily range. A second genus, *Pleuroxia*, as here defined, occupies disjunct portions of the above range (**Map 1**), but the possibility exists that the species assigned to *Pleuroxia* are independently derived and merely convergent. The remaining six genera are restricted to portions of the Red Centre (**Maps 3, 4, 9, 14**). They have not yet been linked to any non-Red Centre taxa. Indeed, the Red Centre has more genera (8) and species (35) of Sinumeloninae than anywhere else.

The Pleurodontinae stand even more isolated. While the Western Australian Kimberley to Carnarvon genus *Rhagada* and the Antillean genus *Pleurodonte* are placed in the same subfamily, available data does not permit assigning ancestor-descendent roles among the Red Centre and two extralimital genera. The four Red Centre genera are restricted endemics. It is probable that some of the Queensland to Solomon Island camaenid genera will be shown to belong to the Pleurodontinae, and a number of Philippine Island taxa have the same head wart structure. These remain to be studied, and, at present, the Red Centre genera must be considered of un-linked status.

Within the Red Centre, only three genera show wide distribution: *Sinumelon, Pleuroxia,* and *Semotrachia. Sinumelon* (**Maps 5-8**) extends from Vaughn Springs, Reynolds Range, and Dulcie Range in the N, to the Birksgate and Everard Ranges in the S, as far E as Charlotte Waters, as far W as the Mann Ranges, and then in scattered colonies through the desert to the Gawler and Flinders Ranges in SA and the Nullarbor region in WA and SA. *Pleuroxia* (**Maps 1-2**) has one species (*P. adcockiana*) in the MacDonnell to Krichauff Ranges, two in the Everard Ranges (*P. everardensis, P. carmeena*), and one in the Mann and Tomkinson Ranges (*P. radiata*). The disjunctions are real, since many collections have been made in intervening areas. *Semotrachia* (**Maps 14-17**) has a less extended range than that of *Sinumelon* (see **Map 13**), probably because of the difference in aestivation strategy - *Sinumelon* "free seals" and can live under bushes or spinifix in open plains, whereas *Semotrachia* seals to a rock or piece of wood, and thus is not found (except as rare flood strandees) away from talus or figs.

Pleuroxia has four, strictly allopatric, species with modest individual distributions; *Sinumelon* has at least ten species, four (**Maps 7-8**) with fairly extended ranges (*S. expositum, S. dulcensis, S. perinflatum, S. pedasum*), and six with more restricted distributions (*S. gillensis*, George Gill Range; *S. hullanum*, Petermann Range; *S. bednalli*, central MacDonnell Range and fringes; *S. musgravesi* and *S. amatensis*, different parts of the S Musgrave Ranges; and *S. pumilio*, Mt. Illbillee, Everard Ranges. Microsympatry is rare: *S. pedasum* and *S. ilbilleeana* may overlap on Mt. Illbillee, Everard Ranges; *S. amatensis* and *S. pedasum* do live together in the S Musgrave Ranges; and *S. musgravesi* and *S. amatensis* have been collected together once near Amata, Musgrave Ranges.

Most of the 25 recognized species of *Semotrachia* (**Maps 14-17**) have very limited ranges. *S. setigera* is found throughout much of the eastern and western MacDonnell

Ranges, but is absent (**Map 16**) from the area between Undoolya Gap, E of Alice Springs, and Standley Chasm in the Chewings Range, W of Alice Springs, a distance of about 65 km. *S. elleryi* (**Map 17**) inhabits the basin of Ellery Creek from the Heavitree Range S to the Finke River-Ellery Creek junction in the Krichauff Ranges. *S. strangwayana* (**Map 15**) extends from the Harts Ranges W to the Strangways Range, a distance of about 49 km, and its neighbour, *S. hortulana* (**Map 15**) has been recorded from localities 43 km apart. Microsympatry is limited, with *S. elleryi* and *S. winneckeana* at Ellery Creek Big Hole, Heavitree Range; *S. rossana* and *S. setigera* along the Ross River; *S. bensteadana* and *S. setigera* occur together in the MacDonnell Ranges between Mt. Benstead Creek and near Undoolya Gap (**Map 16**); plus *S. basedowi* and *S. minuta* near Ernabella in the Musgrave Ranges. Limited material of several undescribed species of *Semotrachia* has been seen (p. 1276). I have no doubt that the number of species may double, but the new taxa will be more short range species, perhaps restricted to a single gap or gorge.

The other genera with more than one species have limited area ranges. Three species of *Granulomelon* (**Maps 3, 4, 9**) range allopatrically from the Harts and Strangways Ranges S through Bitter Spring Gap, MacDonnell Ranges; a fourth species, probably lives in the Finke Gorge S of Glen Helen (see "?" on **Map 3**). *Granulomelon* is allopatric to *Pleuroxia adcockiana* (**Map 4**). *Basedowena* (**Maps 9-11**) lives in the Krichauff and James Ranges (*B. squamulosa*); Mt. connor and Mt. Olga (*B. olgana*); and Schwerin Mural Crescent through the Petermann Ranges (*B. cognata*) in the northern tier of ranges. It is not found in the Musgrave or Everard Ranges, but a series of species extend from the Mann Ranges W to the Cavenagh Ranges in WA. An isolated species, *B. elderi* (**Map 10**) has been recorded from the Birksgate Range. The only microsympatric records for *Basedowena* are from the SW Mann Ranges and involve *B. gigantea* and *B. katjawarana*. *Tatemelon* (**Maps 9, 12**) has four allopatric species in the Musgrave and Everard Ranges. *Dirutrachia* (**Map 18**) has three scattered short range species: *D. sublevata* in the Harts Range; *D. mersa* in the Musgraves; and *D. ponderi* in the Everard Ranges. The two species of *Montanomelon* have an equally split range (**Map 14**), with *M. reynoldsi* recorded from several places in the Reynolds Range, NW of Alice Springs and *M. angatjana* from one locality in the Mann Ranges. Of the monotypic genera, only *Minimelon* (**Maps 3, 6, 9, 11**) has a moderate range. It seems to replace *Sinumelon* in the drier ranges W of the Mann Range, and overlaps in several places with *Basedowena* (**Map 11**). *Eximiorhagada asperrima* (Hedley, 1905) (**Figs 312a-c**) was described from the Mann Ranges, without precise locality, and has not been collected subsequently; *Divellomelon hillieri* (**Map 18**) is known from Palm Valley, Krichauff Ranges; and *Vidumelon wattii* (**Map 18**) lives in the Maud-Florence Creek area of the Harts Ranges.

The above facts can be easily summarized: little sympatry between (and never among) congeric species; most species and genera have restricted ranges; several genera show widely disjunct ranges within the Red Centre; and only two genera, *Sinumelon* and *Pleuroxia*, range outside of the Red Centre.

A fuller analysis of local diversity will be presented elsewhere, including comparative data from the Kimberley, west coast of Western Australia, and the Flinders Ranges of South Australia. Here it is desirable to point out that in several areas, three to five species of camaenids manage to exist microsympatrically. Evidence for feeding specialization exists in their altered radular tooth structure (see individual species accounts). This is part of a general pattern in the semi-arid to arid zone camaenids that will be summarized elsewhere.

In the Florence Creek area on the S slope of the Harts Ranges, *Dirutrachia sublevata*, *Vidumelon wattii*, *Sinumelon dulcensis*, and *Granulomelon grandituberculatum* have been collected together. Slightly to the S, in the Bitter Springs Gap area of the MacDonnell Ranges, *Granulomelon acerbum*, *Semotrachia setigera*, and *Sinumelon dulcensis* live in the same rock piles. In Palm Valley, Krichauff Ranges it is possible that *Semotrachia esau*, *Sinumelon expositum*, *Pleuroxia adcockiana*, *Basedowena squamulosa*, and *Divellomelon hillieri* live in the same rubble heaps. In the Musgrave Ranges, near Ernabella, *Semotrachia basedowi*, *S. minuta*, *Tatemelon herberti*, *Dirutrachia mersa*, and *Sinumelon pedasum* have been collected from the same patch of figs. On Mt. Illbillee in the Everard Ranges, *Dirutrachia ponderi*, *Pleuroxia everardensis*, *Semotrachia illbilleeana*, and *Tatemelon everardensis* probably are microsympatric.

On the fringes of the Red Centre, such as the Dulcie Range and near Vaughn Springs on the N, Rawlinson and Warburton ranges on the W in WA, and SE to Charlotte Waters, only single species can be found. The southern Birksgate and Everard Ranges are good snail habitat, bordered on the S by basically unihabitable desert, and thus diversity drops abruptly from some to none.

Until more details of distribution and data on phylogenetic affinities of the many species are available, it is not possible to model the origin of the above distributions. It seems clear the periodic catastropic floods that occur in the Red Centre have been effective in transporting live snails down stream to establish new colonies, but the origin of disjunctions in such genera as *Montanomelon* and *Dirutrachia* will require a much more sophisticated explanation.

KEY TO THE GENERA OF RED CENTRE CAMAENIDAE

The following key will work for most adult specimens with colour and surface sculpture remaining. It will not work for juveniles or worn examples. Several taxa are entered twice because of structural variation.

KEY TO THE GENERA

1. Umbilicus widely open, last whorl decoiling more rapidly (**Figs 313, 316**) 2
   Umbilicus narrow to closed, never widely open 3

2. Live or newly dead examples with periostracal setae
   Semotrachia Iredale, 1933
   Live or newly dead examples without periostracal setae
   Montanonmelon, gen. nov.

3. Umbilicus narrowly open, if closed, then keel absent 4
Umbilicus closed; shell keeled; red spiral colour bands near keel (**Figs 366a-c**)
Divellomelon hillieri (E. A. Smith, 1910)

4. Whorls normally coiled (**Fig. 361a**) 5
Whorls very tightly coiled, whorl count increased (**Fig. 361d**)
Vidumelon wattii (Tate, 1894)

5. Basal lip without protrusion 6
Basal lip with elongated or triangular knob present (**Figs 361b, 362b, e**) ....
Dirutrachia Iredale, 1937

6. Shell with prominent radial ribs 7
Shell without prominent radial ribs 10

7. Ribs anastomosing (**Figs 265a-f**)
some *Granulomelon* Iredale, 1937

Ribs not anastomosing 8

8. Red spiral colour bands present above periphery
most *Pleuroxia* Ancey, 1887

Red spiral colour bands absent 9

9. Musgrave Ranges, SA .... *Tatemelon*, gen. nov.
Mann and Tomkinson Ranges .... *Pleuroxia radiata* (Hedley, 1905)

10. Shell with dense, small to large pustules over spire and body whorl 11
Shell with at most scattered small pustules on spire 14

11. Body whorl rounded or at most weakly shouldered .... 12.
Body whorl obtusely angulated or keeled 13

12. Harts Ranges and E MacDonnell Ranges
some *Granulomelon* Iredale, 1937

Mann and Birksgate Ranges, SA and W to Cavenagh Ranges, WA
Basedowena Iredale, 1937

13. Shell with protruded keel; pustules large (**Fig. 312b**);
Mann Ranges, SA ....*Eximiorhagada asperrima* (Hedley, 1905)
Shell with angulated periphery; pustules smaller (**Plate 134c-f**) ....
Tatemelon everardensis, sp. nov.

14. Diameter 9-13.7 mm; Birksgate Ranges, SA and then Blackstone Ranges W to Warburton Ranges and N to Rawlinson Ranges in WA

Minimelon, gen. nov.

Diameter 10-35 mm; in Birkgate Range over 18 mm; Birksgate and Mann Ranges E to Charlotte Waters, N to Vaughn Springs and Dulcie Range ....

Sinumelon Iredale, 1947

SUMMARY

This monograph reviews 65 species in 10 genera and two subfamilies. Three of the genera, *Tatemelon*, *Minimelon*, and *Montanomelon*, and 39 of the species are new. Many additional species will be discovered, especially in the genus *Semotrachia*, and it will be surprising if additional limited range genera are not collected.

Because of the large number of taxa involved, and the massive need for illustration of radular variation, space for discussions of general morphological patterns was not available. They will be presented elsewhere.

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