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New asterinid seastars from northwest Australia, with a revised key to *Aquilonastra* species (Echinodermata: Asteroidea)

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Abstract O'Loughlin, P.M. and Bribiesca-Contreras, G. 2015. New asterinid seastars from northwest Australia, with a revised key to *Aquilonastra* species (Echinodermata: Asteroidea). *Memoirs of Museum Victoria* 73: 27–40.

The *Woodside/Western Australian Museum* Kimberley Project 2008–2015 collected four small asterinid seastar specimens from Cassini Island and Long Reef in the Kimberley region of north Western Australia. The specimens are lodged in the Western Australian Museum. They represent two new species of *Aquilonastra* O'Loughlin: *Aquilonastra alisonae* sp. nov.; *Aquilonastra cassini* sp. nov. An updated key is provided for species assigned to *Aquilonastra*, and a table distinguishing *Aquilonastra* species from the Kimberley region.

Keywords Kimberley; *Woodside/Western Australian Museum* Kimberley Project 2008–2015; *Aquilonastra*; new species; fissiparous.

Introduction

The goal of the Woodside/Western Australian Museum Kimberley Project is to generate a comprehensive understanding of the marine biodiversity of the Kimberley region of north Western Australia. Sampey *et al*. (2014) published on the history, aims, scope and methodology of this project. The WA Museum and Woodside Energy Ltd. undertook a partnership in 2008 for a six-year program to document selected marine biota of the Kimberley region. A recent publication on the echinoderms by Sampey & Marsh (2015) provides information on the historical echinoderm collections from the region.

O'Loughlin & Waters (2004) revised all of the genera of family Asterindae. Four new genera were created, and all genera diagnosed. A key to the genera was provided. New morphological characters were defined and illustrated. Amongst the new genera was *Aquilonastra* O'Loughlin (in O'Loughlin & Waters 2004). A table of all asterinid species was provided, with original and current combinations. O'Loughlin & Waters concluded that Asterinidae is a cosmopolitan family, mainly of shallow-water narrow-distribution-range genera but including some more widespread genera in deeper waters of all oceans. O'Loughlin & Rowe (2005) described an additional asterinid genus, *Ailsastra,* from the Indo-West Pacific region. Six species were assigned to *Ailsastra*, five of them new. O'Loughlin & Rowe (2006) revised the genus *Aquilonastra*. A key to the then 25 species assigned to *Aquilonastra*, and map of type localities, were provided. Subsequently two additional species of *Aquilonastra* were described: *Aquilonastra shirleyae* O'Loughlin, 2009 (100 m, Point Cloates, Western Australia); *Aquilonastra chantalae* O'Loughlin & Mackenzie, 2013 (shallows, Europa Island, Mozambique Channel). In this paper we are referring four small seastar specimens from the *Woodside Kimberley Survey 2010* to two additional new species of *Aquilonastra*. We update the key here to include *A. shirleyae*, *A. chantalae*, and the two new species described below.

Methods

The small seastar specimens were collected incidentally during an intensive search for crustacean and polychaete specimens. They were preserved immediately and directly in 90+% ethanol. No notes of live colour or photos were taken. For photography purposes the preserved specimens were allowed to partly air-dry. Photographs were taken using a Cannon 5D Mark II camera with a Cannon 65 mm macro lense. Series of photographs were taken and stacked using the Zerene Stacker software.

After assembling the whole specimen montage photographs, a ray from each of three specimens was cut off for the purpose of observing external and internal skeletal structure. The distal end of each of these three cut-off arms was cleared briefly in bleach and then washed in water. Photographs were taken to show internal skeletal structures.

Definitions and illustrations of terms

For definitions and illustrations of terms used, such as superactinal plates, superambulacral plates and splay-pointed spinelets, see O'Loughlin & Waters (2004).

Abbreviations

NMV Museum Victoria, with specimen registration number prefix F.
WAM Western Australian Museum, with registration number prefix Z.

Key (see *Remarks*) to the species assigned to *Aquilonastra* O'Loughlin (in O'Loughlin & Waters 2004) (revised from the key in O'Loughlin & Rowe 2006).

1. Typically 5 equal or subequal rays, sometimes 6 or 4; form symmetrical or near symmetrical; single conspicuous madreporite, rarely 2, very rarely 3; not fissiparous 2
— Typically 5 or more rays, up to 9, in unequal size groups; form asymmetrical; always more than 1 inconspicuous madreporite; fissiparous 20
2. Gonopores actinal (clearly evident) 3
— Gonopores abactinal (sometimes obscured) 5
3. One ray may be distinctly shorter; abactinal plates paxilliform; spinelets in dense, frequently crescentiform, clusters; spinelets pencil-like ..... *A. scobinata* (Livingstone, 1933) (SE Australia)
— Rays subequal; abactinal plates not paxilliform; spinelets not in dense clusters; spinelets not pencil-like 4
4. Abactinal plates with low rounded elevations; spinelets subpaxilliform; maximum R = 9 mm ..... *A. minor* (Hayashi, 1974) (Japan)
— Abactinal plates lacking rounded elevations; spinelets not subpaxilliform; maximum R = 15 mm ..... *A. byrneae* O'Loughlin & Rowe, 2006 (NE Australia, Mariana Is.)
5. Abactinal spinelets in uniform dense round paxilliform clusters ..... *A. rosea* (H. L. Clark, 1938) (SW Australia)
— Abactinal spinelets not in uniform dense paxilliform clusters 6
6. Abactinal pedicellariae with conspicuous toothed valves present, larger than spinelets; each oral plate with up to 10 spines 7
— If abactinal pedicellariae present, valves not larger than spinelets; each oral plate with less than 10 spines 8
7. Up to R = 23 mm; shallow concave interradial margin, rays not discrete; disc clearly defined by 5 wide interradial plates and 5 small interradial plates; spinelets long, thin, pencil-like; actinal interradial spines up to 4 per plate ..... *A. rowleyi* O'Loughlin & Rowe, 2006 (SE Africa)
— Up to R = 13 mm; form stellate, rays discrete; disc not clearly defined; spinelets columnar or conical centrally, splay-pointed distally; actinal interradial spines up to 10 per plate ..... *A. shirleyae* O'Loughlin, 2009 (WA, Point Cloates, 100 m)
8. Abactinal spinelets on rays typically differentiated on plates into apical and marginal forms; some irregularly distributed paxilliform plates 9
— Abactinal spinelets may be of variable form, but not typically differentiated on plates into apical and marginal forms; lacking any paxilliform abactinal plates 10
9. Abactinal radial plates with apical subglobose spinelets, peripheral short conical to subgranuliform spinelets; lacking pedicellariae; actinal central interradial plates each with about 3 spines ..... *A. lorioli* (Koehler, 1910) (N Indian Ocean)
— Abactinal radial plates with apical digitiform spinelets, peripheral short conical spinelets; pedicellariae frequently present; actinal central interradial plates each with about 5 spines ..... *A. coronata* (Martens, 1866) (Japan to N Australia)
10. Pedicellariae with differentiated valves in abactinal proximal interradii evident in larger specimens 11
— Lacking pedicellariae 14
11. Abactinal spinelets up to about 12 on each proximal carinal plate (at R = 20 mm) ..... *A. iranica* (Mortensen, 1940) (Persian Gulf)
— Abactinal spinelets up to about 20 and more on each proximal carinal plate (at R = 17 mm) 12
12. Abactinal proximal spinelets up to about 40 per plate; superomarginal plates each with up to about 20 spinelets (at R = 19 mm) ..... *A. batheri* (Goto, 1914) (Japan)
— Abactinal proximal spinelets up to about 20 per plate; superomarginal plates each with up to about 7 spinelets (at R = 19 mm) 13
13. Abactinal distal interradial plate spinelets splayed and overlapping adjacent plate spinelets (at R = 20 mm); actinal interradial plates each with up to 5 spines (at R = 20 mm); size up to R = 25 mm ..... *A. richmondi* O'Loughlin & Rowe, 2006 (E Africa coast, Madagascar, Mauritius)
— Abactinal distal interradial spinelets not overlapping adjacent plate spinelets if splayed; actinal interradial plates each with up to 8 spines (at R = 19 mm); size up to R = 19 mm ..... *A. watersi* O'Loughlin & Rowe, 2006 (Arabian Sea, Mauritius)
14. Abactinal spinelets sacciform, short, widely globose basally, tapered to sharply pointed apically; predominantly 2 actinal interradial spines on each plate ..... *A. halseyae* O'Loughlin & Rowe, 2006 (Maldives)

— Abactinal spinelets not widely globose basally, not tapered to a sharp point apically; predominantly > 3 actinal interradial spines on each plate 15

15. Abactinal spinelets short, thick, columnar or conical 16

— Abactinal spinelets long, subsacciform to splay-pointed 17

16. Rays long, subdigitiform; spinelets mostly spread over exposed plate surface; predominantly 6 spines per actinal interradial plate (at R = 16 mm). ..... *A. samyni* O'Loughlin & Rowe, 2006 (Arabian Sea to SE Africa, Madagascar, La Réunion)

— Rays short, strongly tapered; spinelets mostly concentrated over projecting proximal plate edge; predominantly 3 spines per actinal interradial plate (at R = 16 mm) ..... *A. marshae* O'Loughlin & Rowe, 2006 (Red Sea, Gulfs of Aqaba and Suez)

17. Rays short; lacking doubly-papulate carinal plates; spinelets not clustered into groups on plates; spinelets frequently splay-pointed 18

— Rays long, discrete; some doubly-papulate carinal plates may be present; spinelets frequently clustered into groups on plates; spinelets not splay-pointed 19

18. Rays 5; up to R = 12 mm; rays merge basally; up to 14 spinelets per abactinal plate ..... *A. oharai* O'Loughlin & Rowe, 2006 (Okinawa)

— Rays 6; up to R = 6 mm; rays with sub-acute join basally; up to 10 spinelets per abactinal plate ..... *A. alisonae* sp. nov. (north Western Australia)

19. Rays tapered; abactinal plates angled over papulae; spinelets long, thin, sub-sacciform to sacciform, tapering to fine point, rugose, subacicular; spinelets frequently projecting proximally over papulae ..... *A. cepheus* (Müller & Troschel, 1842) (Indonesia to N Australia)

— Rays digitiform; abactinal plates not angled over papulae; spinelets long, thick, conical to subsacciform, with numerous (5–6) points on distal sides and end of spinelets; spinelets not projecting proximally over papulae ..... *A. limboonkengi* (Smith, 1927) (China)

20. Actinal interradial spines predominantly 1 per plate 21

— Actinal interradial spines predominantly > 1 per plate 22

21. Up to R = 10 mm; at R = 4 mm rays 6–8; abactinal spinelets mostly granuliform; actinal interradial spines short, thick, conical to subsacciform, pointed distally ..... *A. conandae* O'Loughlin & Rowe, 2006 (Indian Ocean, Mascarene Is.)

— Up to R = 4 mm; at R = 4 mm rays 5 (smaller specimens up to 7 rays); abactinal spinelets mostly digitiform; actinal interradial spines predominantly subacciform, spinous distally ..... *A. chantalae* O'Loughlin & Mackenzie, 2013 (Mozambique Channel)

22. Spinelets of 2 distinct forms, long thick digitiform apically on upper ray and marginal plates, smaller conical below apex of plates ..... *A. corallicola* (Marsh, 1977) (NE Indian to central W Pacific Oceans)

— Spinelets of one form 23

23. Spinelets elongate, not granuliform or subgranuliform (at R = 5 mm) 24

— Spinelets truncate, small, subgranuliform or granuliform (at R = 5 mm) 27

24. Up to 8 rays; upper abactinal spinelets conical to prominently splay-pointed sacciform; pedicellariae sometimes present, valves larger than spinelets; size up to R = 12.5 mm ..... *A. anomala* (H. L. Clark, 1921) (central W Pacific)

— Up to 7 rays; upper abactinal spinelets not distinctly splay-pointed; lacking pedicellariae; size up to R = 7 mm 25

25. Oral spines 3–4 per plate; suboral spines 0–1 per plate; size up to R = 7 mm ..... *A. cassini* sp. nov. (north Western Australia)

— Oral spines 5 or 6 per plate; suboral spines 3 per plate; size up to R = 5 mm 26

26. Rays elevated; spinelets thick columnar or conical; actinal interradial spines up to 2 per plate; actinal spines bluntly pointed conical to digitiform ..... *A. colemani* O'Loughlin & Rowe, 2006 (Papua New Guinea, Indonesia)

— Rays not elevated; spinelets thin digitiform or conical with distally long spines; actinal interradial spines up to 5 per plate; actinal spines long, conical, thin, finely tapered ..... *A. doranae* O'Loughlin & Rowe, 2006 (Okinawa)

27. Size up to R = 18 mm; some central abactinal plates atypically large and irregular ..... *A. burtonii* (Gray, 1840) (Red and Arabian Seas)

— Size up to R = 9 mm; central abactinal plates not unusually large and irregular 28

28. Up to 8 rays; up to R = 7 mm; spinelets up to 16 per plate; suboral spines up to 4 per plate ..... *A. yairi* O'Loughlin & Rowe, 2006 (Red and Mediterranean Seas)

— Up to 7 rays; up to R = 9 mm; spinelets up to 10 per plate; suboral spines up to 2 per plate ..... *A. moosleitneri* O'Loughlin & Rowe, 2006 (Maldive Is.)

Remarks. We acknowledge some difficulties with the key, such as splitting the species into fissiparous and not fissiparous. We are aware, for example, that asteroids may be fissiparous when juvenile but not when adult. This is the case with the asteriid *Coscinasterias muricata* Verrill, 1867 (personal observations). Thus the slight asymmetry in the type specimens of *Aquilonastra alisonae* sp. nov. may reflect an earlier juvenile fissiparous stage. Likewise there may be difficulty in detecting the site of gonopores, or whether they are present. We judge that if they are actinal they will be readily seen, whereas abactinally they are often obscured by spinelets and amongst

papulae and an assumption has to be made about the site of their occurrence. Pedicellariae are sometimes difficult to detect, especially if the valves are undifferentiated abactinal spinelets. Judgments, such as the form of spinelets, are somewhat subjective. And the forms of some morphological characters overlap. We recommend that the key should be used in conjunction with the illustrations of *Aquilonastra* species in O'Loughlin & Rowe (2006), O'Loughlin (2009) and O'Loughlin & Mackenzie (2013).

Table. WAM specimens of seastar species assigned to *Aquilonastra* from the Kimberley Project Area (see map in Sampey *et al*. 2014)

Taxon	**Some distinguishing species characters (See O'Loughlin & Rowe 2006)**	**Kimberley Project Area & WAM Registration**
Aq. alisonae sp. nov.	6 rays; not fissiparous; lacking pedicellariae; splay-pointed spinelets	Long Reef: WAM Z26199, WAM Z26200
Aq. anomala (H. L. Clark, 1921)	up to 8 rays; fissiparous; pedicellariae present; frequently splay-pointed spinelets	Long Reef: WAM Z6843; Ashmore Reef: WAM Z6844; Cartier Island: WAM Z6846; North Scott Reef: WAM Z6847; Mermaid Reef: WAM Z50826, WAM Z50827
Aq. cassini sp. nov.	5–6 rays; fissiparous; lacking pedicellariae; mostly conical spinelets	Cassini Island: WAM Z26198, WAM Z26201
Aq. cepheus (Müller & Troschel, 1842)	5 rays, sometimes 6 or 4; not fissiparous; spinelets subacicular, subsacciform	King Sound: WAM Z6842; Ashmore Reef: WAM Z6879, WAM Z6880, WAM Z6881, WAM Z68030, WAM Z68038; Scott Reef: WAM Z6882, WAM Z6883, WAM Z6884, WAM Z6885, WAM Z6887; Cartier Island: WAM Z6886
Aq. coronata (von Martens, 1866)	5 rays; not fissiparous; paxilliform abactinal plates; 2 forms of spinelet	Mission Bay: WAM Z6890; Admiralty Bay: WAM Z6896; Storr Island: WAM Z6897; One Arm Point: WAM Z6898, WAM Z6899; Naturalist Island: WAM Z6900; Wailgwin Island: WAM Z58338

Asterinidae Gray, 1840

Synonymy. See Clark and Downey, 1992.

Diagnosis. See Clark and Downey, 1992.

Remarks. For a recent revision of Asterinidae see O'Loughlin & Waters (2004). For the addition of a new genus *Ailsastra* see O'Loughlin & Rowe (2005).

Aquilonastra O'Loughlin, 2004 (in O'Loughlin & Waters, 2004)

Aquilonastra O'Loughlin, in O'Loughlin & Waters, 2004: 5 (key), 13–15, tables 1, 2.—O'Loughlin & Rowe, 2005: 181.—Saba & Fujita, 2006: 270.—Byrne, 2006: 244, 245, 248, 250, 251.—O'Loughlin & Rowe, 2006: 257–287.—O'Loughlin, 2009: 204, fig. 1.—O'Loughlin & Mackenzie, 2013: 177–180, figs 1, 2.

Diagnosis (from O'Loughlin & Mackenzie 2013). Rays 5, or 5–8 in fissiparous species; inter-radial margin deeply incurved, form stellate; rays discrete, broad at base, tapering, rounded distally; flat actinally, convex abactinally; abactinal plates in longitudinal series, not perpendicular to margin; papulate areas extensive; papulae predominantly single, large, in longitudinal series along sides of rays; abactinal plates with glassy convexities; abactinal spinelets and actinal spines predominantly fine, glassy, conical or sacciform or splay-pointed sacciform, in bands or tufts, numerous (10–40 per plate); actinal plates in longitudinal, sometimes oblique, series; superambulacral plates present for all of ray, sometimes for part of ray or absent in pedomorphic species; superactinal plates present.

Remarks. We have deleted the word "high" in relation to convex from the diagnosis in O'Loughlin & Mackenzie (2013) since "high" lacks clear meaning, and have replaced "not oblique" in relation to actinal plate arrangement with "sometimes oblique" to accord with our observations in this work.

Aquilonastra alisonae sp. nov.

Zoobank LSID. http://zoobank.org/urn:lsid:zoobank.org:act:727C2763-A5B6-463A-B184-94572BD2B4F5

Figures 1–4, key, table.

Material examined. Holotype. North Western Australia, Kimberley Region, *Woodside Collection Project* (Kimberley) 2008–2015, station 56/K10, Long Reef, 13.95704 S -125.71846 E, rock substrate, intertidal, coll. A. Sampey *et al*., 24 Oct 2010, WAM Z26200 (one ray abnormal; one ray cut off mid-ray and cleared).

Paratype. *Woodside Collection Project* (Kimberley) 2008–2015, station 47/K10, Long Reef, 13.81995 S -125.74942 E, rock substrate, fore reef, 6 m, coll. S. Woolley, 21 Oct 2010, WAM Z26199 (1).

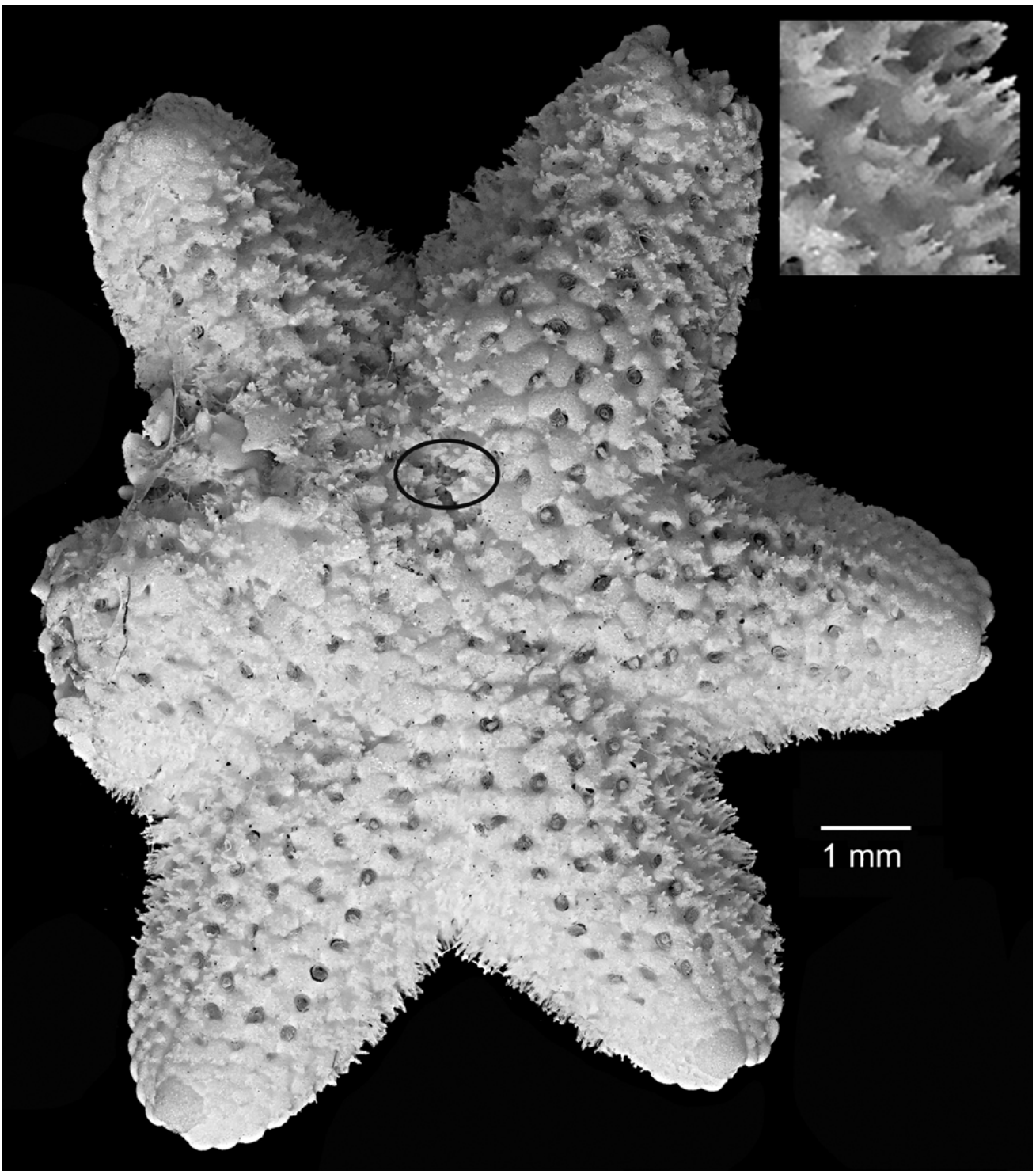

Figure 1. Montage photograph of the holotype of *Aquilonastra alisonae* sp. nov. (WAM Z26200). Abactinal view showing six subequal rays (one abnormal), abactinal plates irregular in form and arrangement, plates on upper rays singly papulate in predominantly four longitudinal series per ray. Single madreporite highlighted. Insert (upper right) with splay-pointed abactinal spinelets from the lower ray and margin.

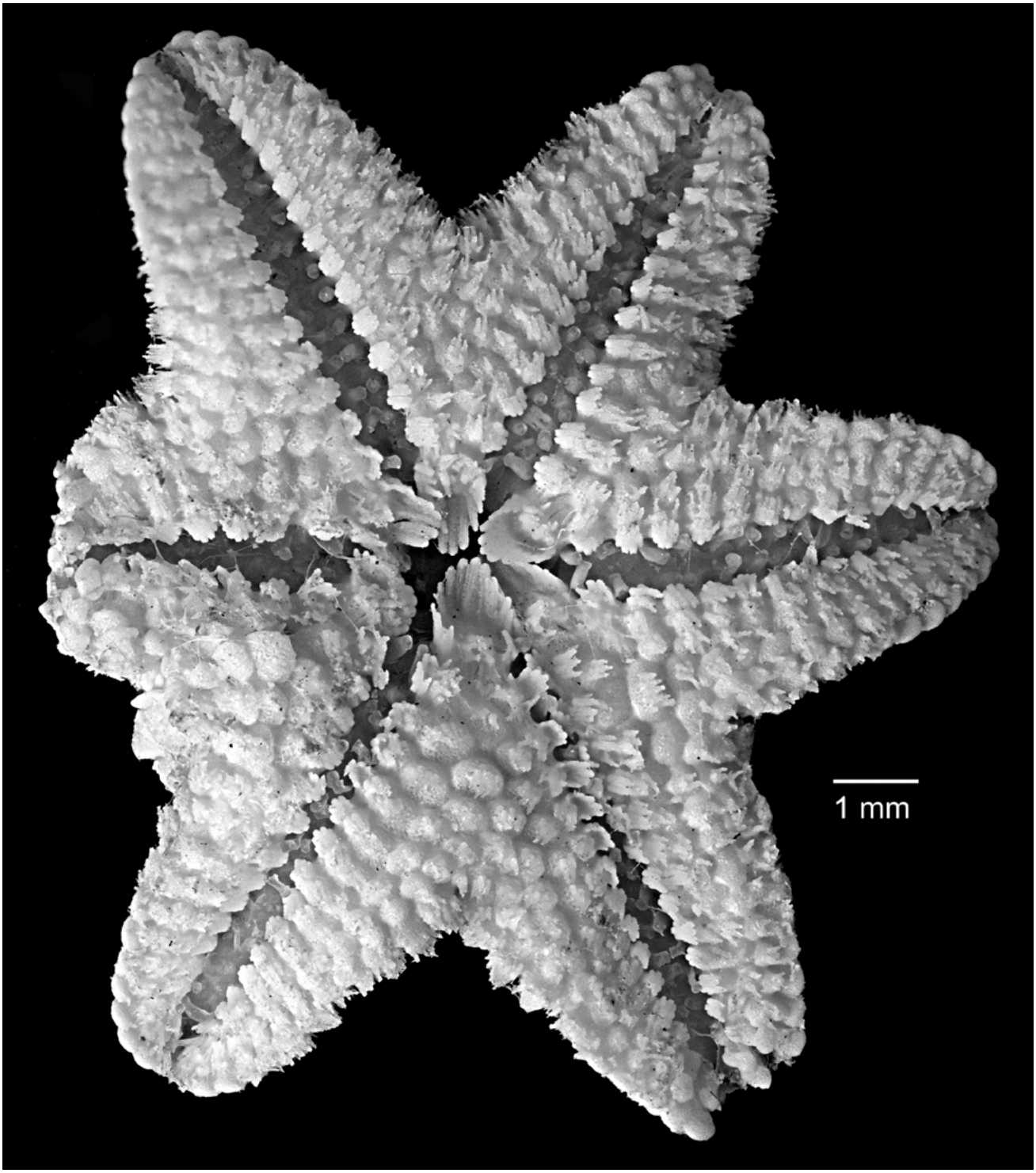

Figure 2. Montage photograph of the holotype of *Aquilonastra alisonae* sp. nov. (WAM Z26200). Actinal view showing six rays and spination and actinal plates in slightly irregular longitudinal and oblique series.

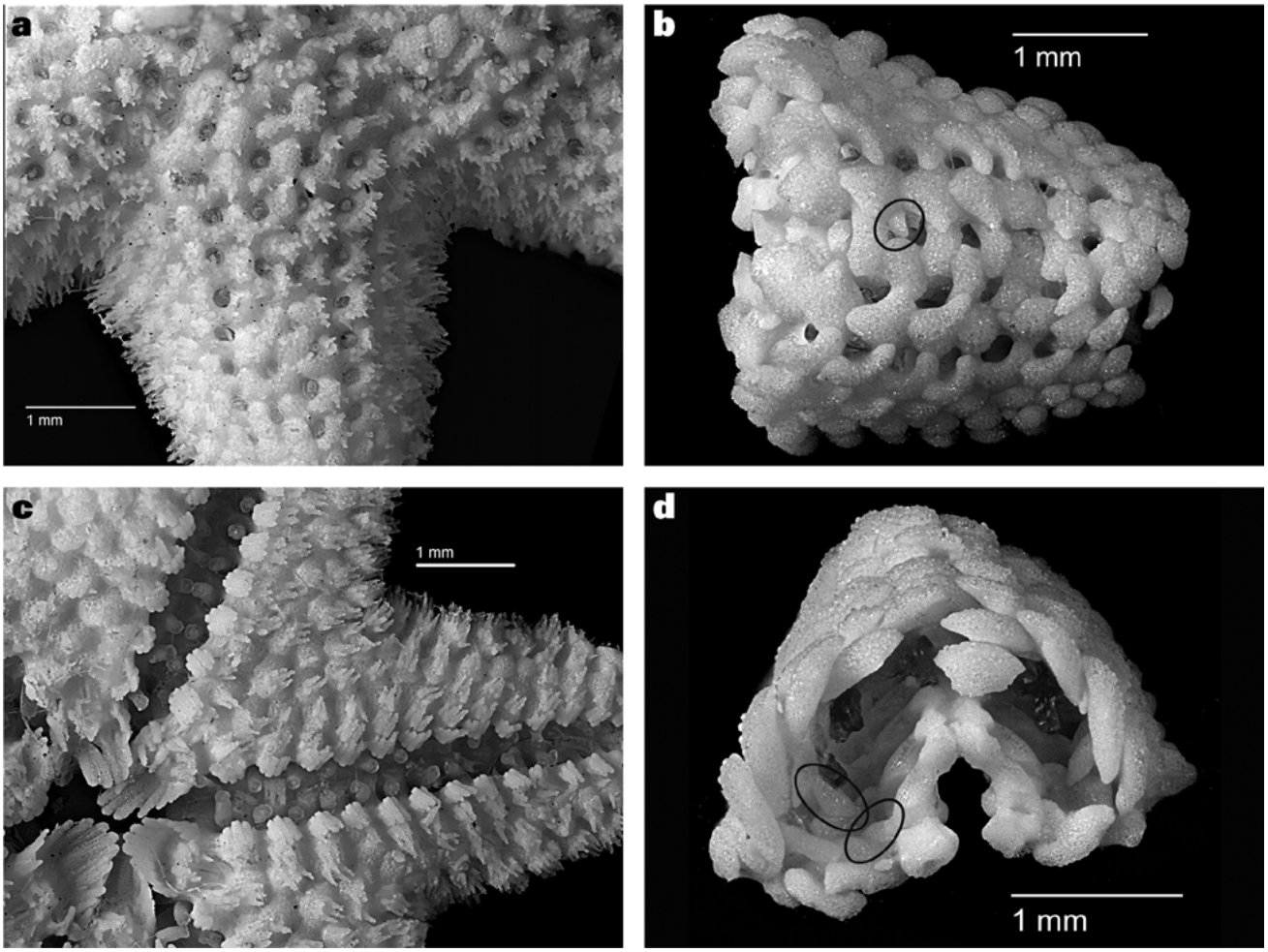

Figure 3. Montage photographs of the holotype of *Aquilonastra alisonae* sp. nov. (WAM Z26200). a, abactinal proximal view of a ray showing irregular plate forms and arrangement and predominantly splay-pointed spinelets; b, abactinal view of a distal cleared ray showing glassy convexities on plates, proximal concave indentation on some plates for a papula, and a secondary plate highlighted; c, actinal view of the oral region and proximal ray; d, view of internal skeletal structure of a cleared ray with a superactinal plate (left) and a superambulacral plate (right) highlighted.

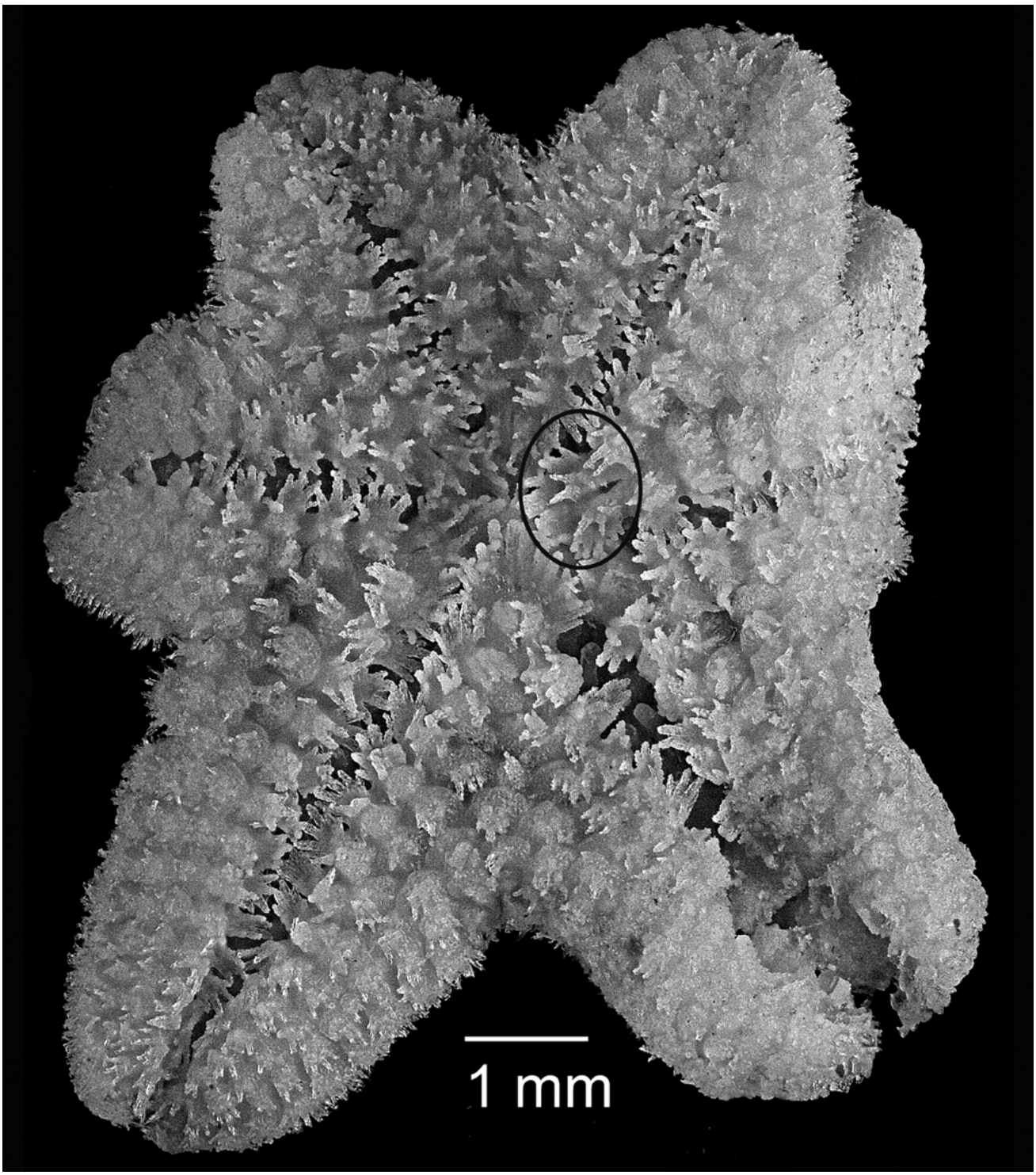

Figure 4. Montage photograph of a paratype of *Aquilonastra alisonae* sp. nov. (WAM Z26199). Actinal view showing six rays and spine forms and numbers that are similar to those of the holotype. Two oral plates highlighted, with 6 oral spines each, and four distal suboral spines each (proximal two large and distal two small).

Description. Asterinid seastar, six rays, variably slightly unequal, rays wide basally, tapered to rounded end distally, up to R = 6.2 mm, r = 3.0 mm, rays merging at bases, inter-radial junction of rays sub-acute, rays low convex abactinally, rays flat actinally, margin acute. Madreporite large, conspicuous, only one detected on holotype, above junction of bases of two rays. Not fissiparous. Disc not discretely demarcated. No abactinal or actinal gonopores detected. Pedicellariae not detected. Glassy convexities on cleared abactinal and actinal plates. Superomarginal and inferomarginal plates subequal; inferomarginal plates not projecting noticeably. Internal superambulacral and superactinal plates present.

Abactinal surface: disc plates imbricate irregularly with those of rays; upper ray plates irregular in form, not in regular series, no carinal series of plates; most upper ray plates widely concave proximally to create papular space; single papula per papular space; rare secondary plates; 4 prominent longitudinal series of papulae across rays, short lower series of smaller papulae along rays, up to 11 papulae per series along upper ray, series along upper part of ray irregular; up to about 10 predominantly splay-pointed spinelets per abactinal plate, frequently in 2 transverse series across proximal edge and middle of plate; superomarginal plates with up to 8 splay-pointed spinelets per plate in 2 series of 5 distal and 3 proximal.

Actinal surface spines per plate: oral 6, long, thin, slightly cylindrical to spatulate; sub-oral 4–3; furrow 5, digitiform; subambulacral 4, digitiform to splay-pointed; actinal up to 7 on central plates, conical to splay-pointed; inferomarginal up to about 9, predominantly splay-pointed, frequently with 6 abactinal inferomarginal, 3 actinal inferomarginal. Actinal inter-radial plates in slightly irregular longitudinal and oblique series.

Distribution. North Western Australia, Kimberley Region, Long Reef, rock substrate, 0–6 m.

Etymology. Named for Alison Sampey, formerly of WAM, who initially collected and curated these specimens.

Remarks. The slightly irregular length of the six rays and irregular plate arrangement on disc and upper rays prompted us to think initially that this species is fissiparous. But the presence of only one conspicuous madreporite, and only slight ray length differences lead us to judge that the species is not fissiparous, at least for the size of the two type specimens. *Aquilonastra alisonae* sp. nov. is distinguished diagnostically from other *Aquilonastra* species in the key. It differs in particular from other species of *Aquilonastra* from the Kimberley region by having a combination of: six rays; predominantly splay-pointed abactinal spinelets; single madreporite; non-fissiparous habit; absence of pedicellariae. We did not observe gonopores, but they were clearly not present actinally and assume that they would be abactinal if present.

Aquilonastra cassini sp. nov.

Zoobank LSID. http://zoobank.org/urn:lsid:zoobank.org:act:EBFF184D-ADAE-4C5C-AA63-619D69B4AE4A

Figures 5–8, key, table.

Material examined. Holotype. North Western Australia, Kimberley Region, *Woodside Collection Project* (Kimberley) 2008–2015, station 37/K10, Cassini I., 13.95156S -125.624123E, rock substrate, 3 m, coll. L. Walker, 18 Oct 2010, WAM Z26198 (one ray cut off proximally and cleared).

Paratype. *Woodside Collection Project* (Kimberley) 2008–2015, station 33/K10 (see database), Cassini Island, 13.92816 S -125.623337 E, lagoon, rock substrate, 1.8 m, coll. A. Sampey *et al*., 17 Oct 2010, WAM Z26201 (1) (one ray cut off proximally and cleared).

Description. Asterinid seastar, asymmetrical, five or 6 sub-equal rays, sub-digitiform, narrow and rounded distally, slightly widened basally, up to R = 7.0 mm, r = 2.5 mm, rays merging at bases, inter-radial junction of rays sub-acute, rays low convex abactinally, rays slightly convex actinally, margin acute. Disc not discretely demarcated. Three small, inconspicuous, abactinal madreporites seen on holotype. Fissiparous. No abactinal or actinal gonopores detected. Pedicellariae not detected. Glassy convexities on cleared abactinal and actinal plates. Inferomarginal plates significantly larger than superomarginal plates; inferomarginal plates project noticeably at margin. Internal superambulacral and superactinal plates present.

Abactinal surface: disc plates imbricate irregularly with those of upper rays; upper ray plates proximal to disc irregular; lacking secondary plates; regular carinal series of plates along some upper rays only, up to 11 carinal plates per series, each carinal plate with paired deep lateral notches to create paired single papular spaces; plates on sides of rays with single papular space; single series of papulae adcarinally on rays, up to 15 per series, short lower series of smaller papulae along rays, 4 prominent longitudinal series of papulae across rays; abactinal spinelets predominantly conical; disc with 6–3 spinelets per plate, each carinal plate with cluster of 5–3 spinelets on crown of plate, adcarinal plates with up to 7 spinelets across angled plate, proximal and distal inter-radial abactinal plates with predominantly 4 spinelets, variably 6–3, conical to splay-pointed; superomarginal plates with 5–4 splay-pointed spinelets per plate.

Actinal surface spines per plate: oral 4–3, sub-oral 1–0, digitiform, slightly spatulate, with minute distal spinelets; proximal furrow 4–3, subambulacral 3–2; actinal predominantly 4, conical form with pointed distal end; inferomarginal up to about 11, predominantly splay-pointed, frequently with 2 and 6 abactinal inferomarginal groups, 3 conical actinal inferomarginals. Actinal plates in longitudinal and more noticeably oblique series.

Distribution. North Western Australia, Kimberley Region, Cassini Island, rock substrate, 1.8–3 m.

Etymology. Named *cassini* (in apposition) for the type locality, Cassini Island, in the Kimberley Region of north Western Australia.

Remarks. The subequal ray lengths of the five-rayed holotype prompted us to not think fissiparity for this species. But the presence of three small madreporites on the holotype, and irregular abactinal plate arrangement, lead us to conclude that this species is fissiparous. It differs in particular from other species of *Aquilonastra* from the Kimberley region by having a combination of: 5–6 rays; predominantly conical abactinal spinelets; up to 3 madreporites; fissiparous habit; absence of pedicellariae.

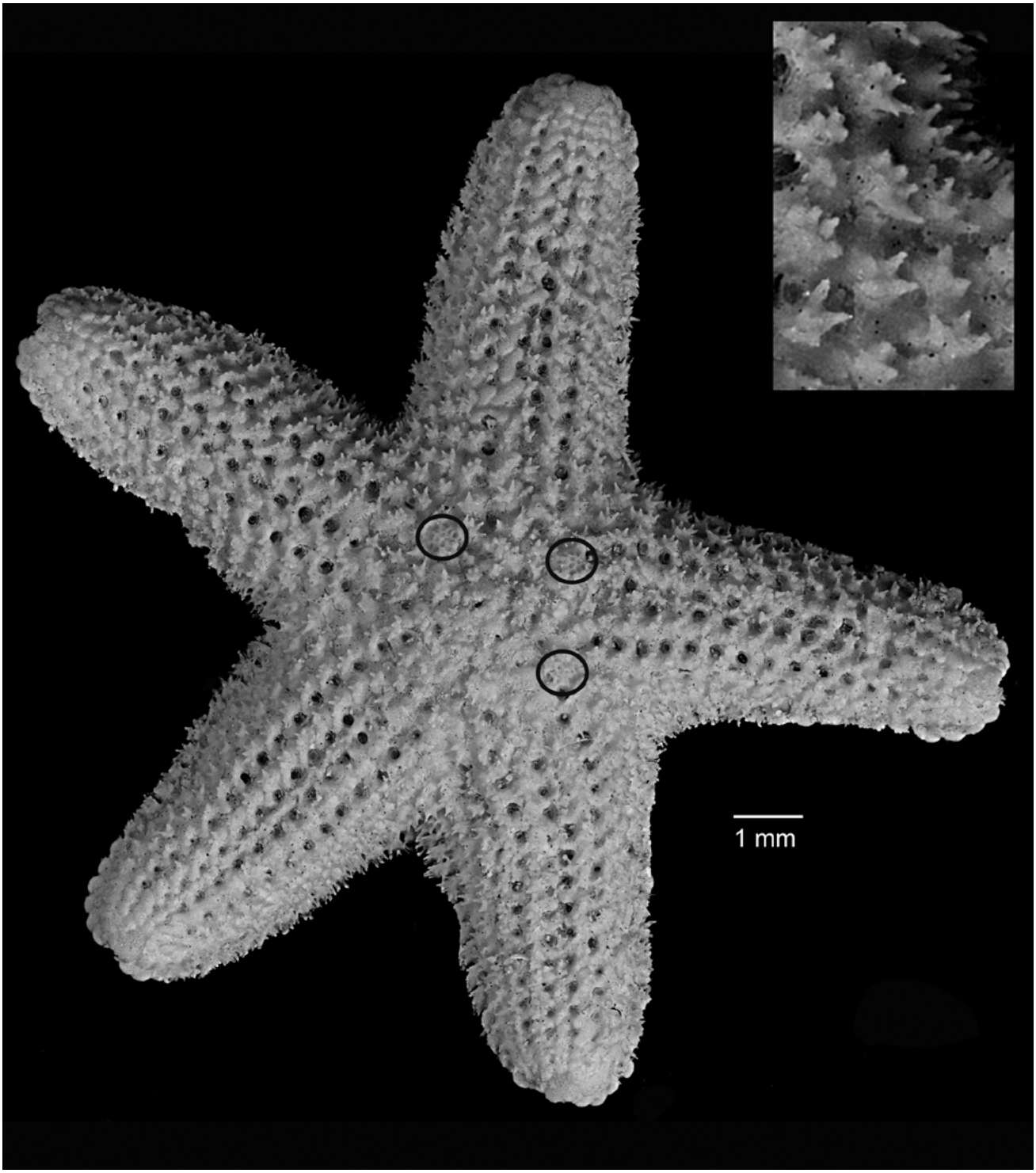

Figure 5. Montage photograph of the holotype of *Aquilonastra cassini* sp. nov. (WAM Z26198). Abactinal view showing five subequal rays; long carinal series on bottom left ray; disc not discretely delineated; three small madreporites highlighted. Insert (upper right) with predominantly conical spinelets from an abactinal lower ray and margin. The fine black spots on the specimen are contaminating grit.

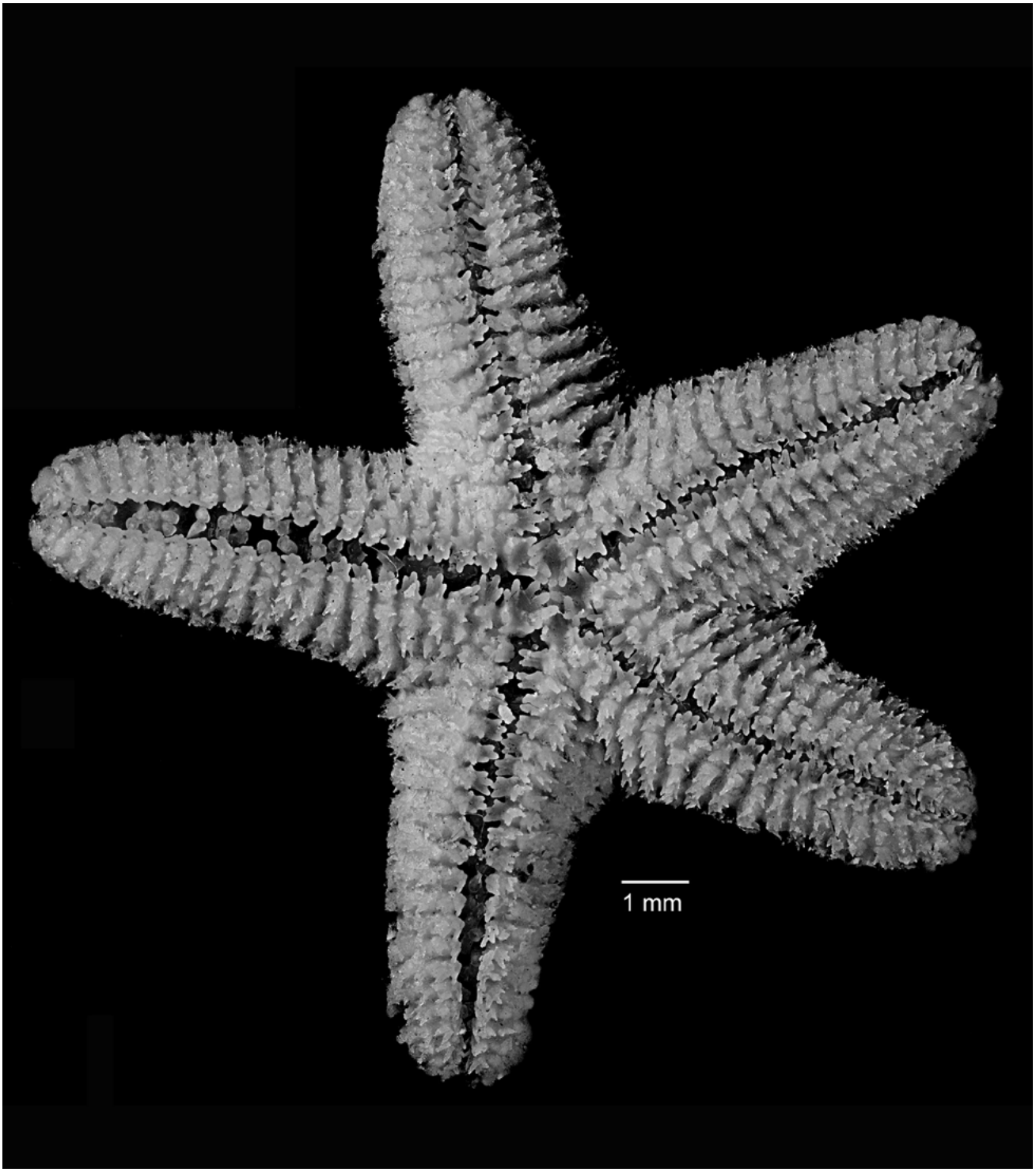

Figure 6. Montage photograph of the holotype of *Aquilonastra cassini* sp. nov. (WAM Z26198). Actinal view showing the oblique and longitudinal arrangement of the actinal plates, and the actinal spination.

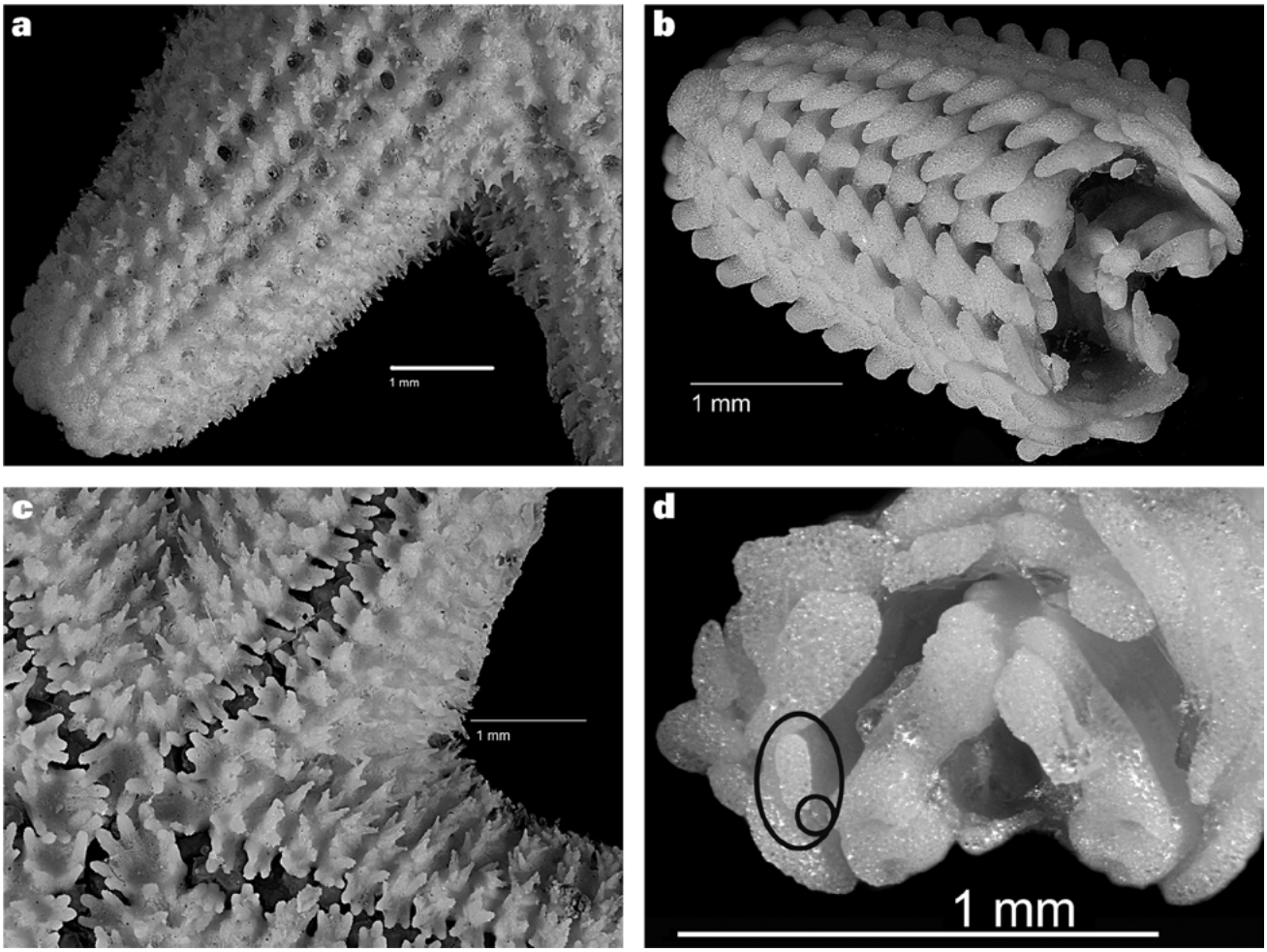

Figure 7. a–c, montage photographs of the holotype of *Aquilonastra cassini* sp. nov. (WAM Z26198). a, abactinal view of a ray showing a long carinal series of plates along the upper ray; b, abactinal view of a distal cleared ray showing the doubly papulate carinal series of plates, absence of secondary plates, and projecting inferomarginal plates; c, actinal view of the oral region and a proximal ray; d, montage photograph of a cleared distal ray of the paratype of *Aquilonastra cassini* sp. nov. (WAM Z26201). d, view of the internal skeletal structure of a ray with a superactinal plate (highlighted left) and probably an incipient minute superambulacral plate (highlighted within).

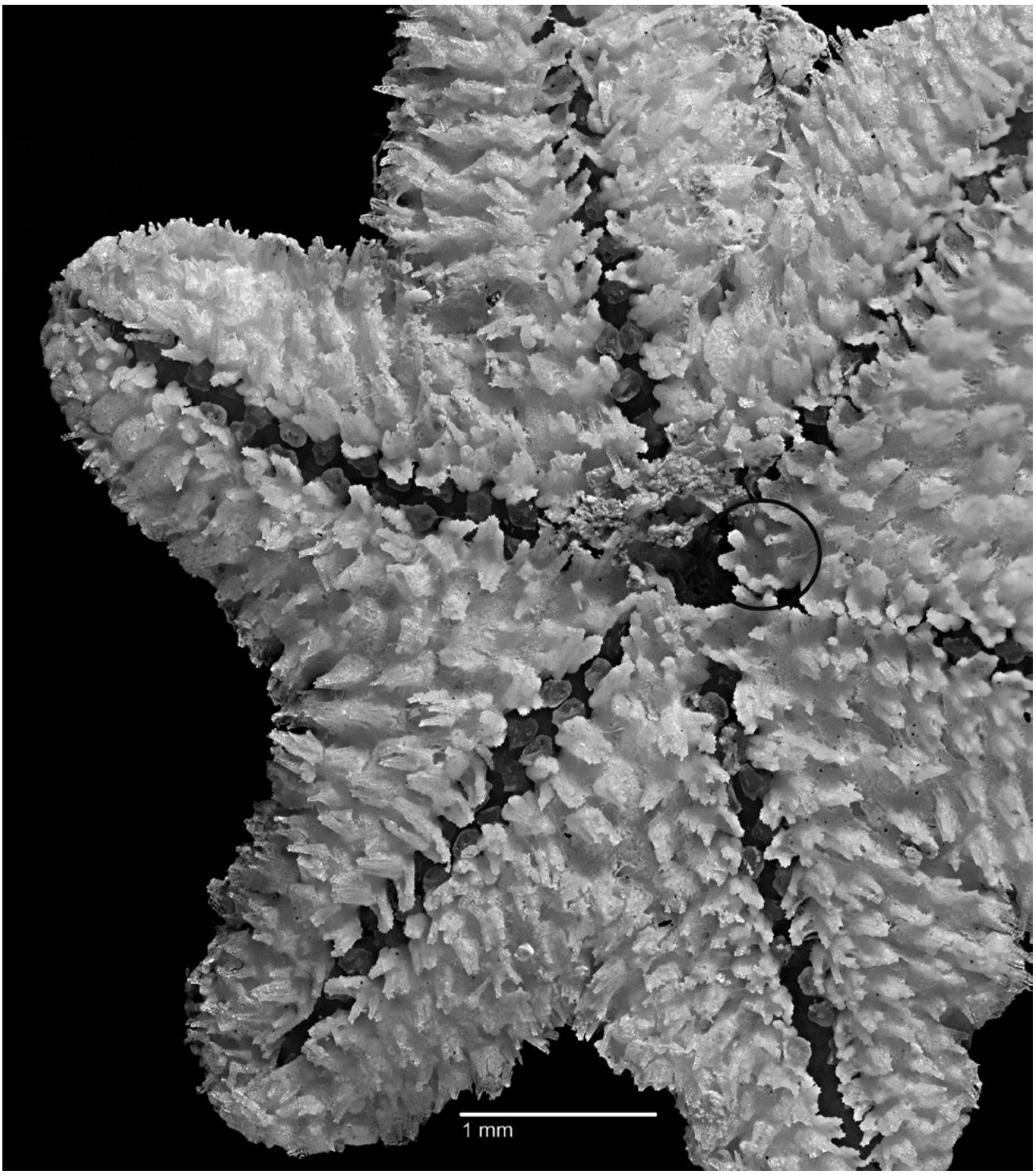

Figure 8. Montage photograph of the paratype of *Aquilonastra cassini* sp. nov. (WAM Z26201). Actinal view with pair of oral plates highlighted and showing three oral and single suboral spines, all spines with minute distal spinelets.

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