

Notes on American fossil *Ensis* species

by

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Through the kindness of Dr. Thomas R. Waller, Smithsonian Institution, Washington (USNM), I received a collection of 28 *Ensis* samples (54 specimens/fragments) from the Miocene of Virginia, Maryland, North and South Carolina, with one sample from the Post-Pliocene.

Conrad was the first to work on the subject, describing two fossil species in 1843, *Solen directus* and *S. ensiformis*, both belonging to the genus *Ensis*. After him Dall studied Miocene material of *Ensis directus* (Conrad), supposing it to be conspecific with the Recent Atlantic form which still bears that name. As far as I can trace, very little systematical work has been done since, the identifications being almost entirely based on Conrad's views.

A close examination of the above mentioned material showed, that there are at least three species, and perhaps a fourth one; the material of the latter is still too scarce, however, for any definite conclusions. In this note I will first give a synoptical key and then descriptions of the species, followed by an enumeration of the material and a short discussion. Since the name *E. directus* (Conrad) has generally also been applied to the large, Recent Atlantic form, now *E. americanus* (Binney), I have included this latter species in the key.

For an explanation of technical terms and the synoptical key system see Van Urk (1964, 1971).

List of species

1. *Ensis americanus* (Binney) (non Gould), 1870
(*E. directus* auct., when referring to recent material, non Conrad, 1843)
2. *E. directus* (Conrad, 1843)
(*Solen directus* Conrad, 1843, non auct. when referring to recent material)
3. *E. altenensis* spec. nov.
(*Solen ensiformis* Conrad, 1843, p.p.?)
4. *E. spec.*

5. *E. ensiformis* (Conrad, 1843)
 (*Solen ensiformis* Conrad, 1843, non *E. ensiformis* J. de C. Sowerby, 1844)

KEY TO AMERICAN FOSSIL ENSIS SPECIES

The numbers refer to the species mentioned above

Shell

- | | | | | | |
|---|---------|---|---|---|---|
| 1. Breadth anteriorly | | | | | |
| a. more than 1.5 cm | 1 | — | — | — | — |
| b. up to about 1.5 cm | 1 | 2 | 3 | 4 | — |
| c. up to about 1 cm | 1 | 2 | 3 | 4 | 5 |
| 2. Curvature | | | | | |
| a. straight, hinge-region turned upwards | — | 2 | 3 | 4 | — |
| b. slightly curved | 1(juv.) | — | 3 | — | — |
| c. strongly curved | 1 | — | — | — | 5 |
| 3. Margins | | | | | |
| a. parallel | 1 | 2 | — | 4 | — |
| b. ventral margin more strongly curved than dorsal margin | — | — | 3 | — | 5 |
| 4. Anterior end | | | | | |
| a. truncate | 1 | 2 | — | — | — |
| b. rounded | — | — | 3 | 4 | 5 |
| 5. Anterior end | | | | | |
| a. faintly turned outwards | 1 | — | 3 | 4 | 5 |
| b. faintly turned inwards | — | 2 | — | — | — |
| 6. Horizontal growth-lines | | | | | |
| a. straight | — | 2 | — | — | — |
| b. slightly curved | — | 2 | — | 4 | — |
| c. strongly curved | 1 | — | 3 | — | 5 |

Hinge

- | | | | | | |
|----------------------------|---|---|---|---|---|
| 7. Horizontal teeth | | | | | |
| a. about ½ of the ligament | 1 | — | — | — | — |

b. shorter	—	2	3	4	5
8. Horizontal teeth					
a. about as long as the anterior pallial scar	1	2	—	4	5
b. shorter	—	—	3	—	—
9. Ligament					
a. about 2X the length of the anterior pallial scar	—	2	3	—	—
b. about 2½X do.	—	2	—	—	5
c. about 3X do.	1	—	—	4	—
10. Hinge					
a. terminal	1	2	—	—	—
b. subterminal	—	—	3	4	5

Muscle scars

11. Anterior pallial scar					
a. closer to the anterior shell-margin than the ventral pallial scar to the ventral shell-margin	1	2	—	—	—
b. at about the same distance from the a.s.m. as the v.p.s. from the v.s.m.	1	2	—	—	5
c. further from the a.s.m. than the v.p.s. from the v.s.m.	—	—	3	4	5
12. Anterior pallial scar					
a. sloping backwards	—	—	3	—	—
b. perpendicular	—	2	—	4	5
c. directed forwards	1	—	—	—	—
13. Anterior pallial scar					
a. straight	1	2	3	—	—
b. curved inwards (concave)	1	—	—	4	5
14. a. a faint but noticeable ridge/thickening parallel to the anterior pallial scar	—	—	3	—	—

	b. do. between anterior pallial scar and anterior shell margin	—	—	—	4	5
	c. not either of these two	1	2	—	—	—
15.	Ventral pallial scar					
	a. straight in its anterior part	1	2	—	4	—
	b. curved downwards (convex) in do.	1	—	3	—	5
16.	Anterior adductor scar					
	a. as long as the ligament	1	—	—	—	—
	b. slightly longer than do.	1	2	3	4?	—
	c. about 1½X as long as do.	—	—	—	—	5
17.	Foot retractor scar					
	a. before the end of the ligament	—	—	3?	—	—
	b. opposite to do.	1	2	3	—	—
	c. behind do.	—	—	—	—	5?



Fig. 1. *Ensis americanus* (Binney), young material, U.S.A., N.Y., Long Island, Long Beach, 6.VII.1962 (J.J. Bernard colln. No. 436). Slightly less than natural size. The anterior pallial scar close to the anterior shell margin is probably typical.

NOTES. Ad 4b: species 4 less so than species 3. Ad 9c: about three times or more in species 4. Ad 11a: in juvenile shell of species 1. Ad 13a: in juvenile shell of species 1. Ad 16b: in adult shell of species 1.

1. *Ensis americanus* (Binney)

fig. 1

Solen ensis var. *Americanus* Gould & Binney, 1870, edited by Binney: 42.

Solen ensis Gould, 1841, do., ed. 1: 28.

Ensis directus auct., when referring to recent material.

non: *Solen directus* Conrad, 1843.

The relation between this species and true, Miocene, *E. directus* Conrad, is discussed under the latter species.

One sample in the fossil material approaches *E. americanus*: USNM 146603, 1 fr.,¹ Heisterville, New Jersey, Post-Pliocene; as *E. directus americanus* (!).

2. *Ensis directus* (Conrad)

figs. 2, 3

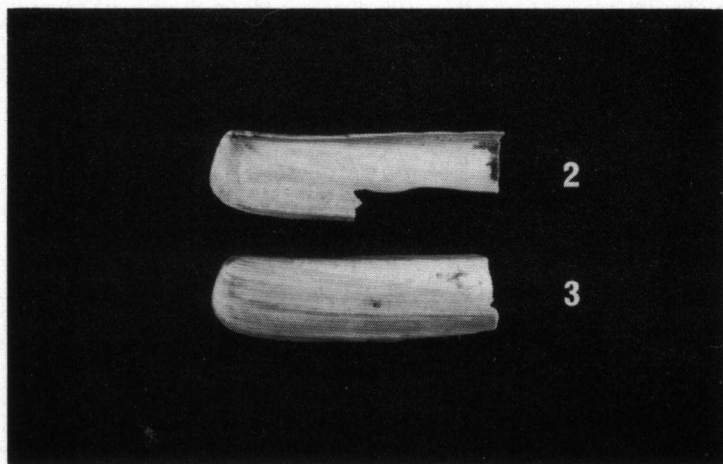
Solen directus Conrad, 1843: 325.

non: *E. directus* auct., when referring to recent material.

Shell moderately-sized, rather broad, anterior breadth of the largest fragment 1.3-1.4 cm, straight, but hinge-region turned upwards, margins parallel, anterior end truncate, faintly turned inwards, horizontal growth lines slightly curved towards the anterior end, otherwise straight or almost straight. Hinge: horizontal teeth about $\frac{1}{3}$ of the ligament, about as long as the anterior pallial scar, hinge terminal. Muscle scars: anterior pallial scar slightly closer to, or sometimes at the same distance from the anterior shell margin as the ventral pallial scar from the ventral shell margin, perpendicular, forming a right angle with the ventral pallial scar, straight or slightly curved inwards (concave) near the anterior adductor scar; ventral pallial scar straight anteriorly, anterior adductor scar short, scarcely longer than the ligament, increasing in width posteriorly, where it is about two times wider than at the top.

Ensis directus of Conrad is specifically different from the Recent Atlantic species of that name, which should be called *E. americanus* (Binney) (Van Urk, 1964: 37, also description and figure). *E. americanus* reaches about twice the length of *E. directus* (20 cm or more

1. Abbreviations: fr. = fragment(s), a. = *Ensis altenensis*, d. = *E. directus*, e. = *E. ensiformis*.



Figs. 2-3. *Ensis directus* (Conrad), U.S.A., Virginia, 2½ miles W of Suffolk; the two fragments belong to one specimen (USNM, loan form 2.XII.1969, No. 6). Natural size.

as compared to about 10 cm), it is comparatively much broader and strongly curved (*d.*: straight, hence the name), the anterior pallial scar is directed forwards (*d.*: perpendicular), the anterior adductor scar in specimens of up to about 10 cm does not reach beyond the ligament (*d.*: for a minor part only, but clearly), the horizontal teeth are longer, up to half the length of the ligament (*d.*: decidedly shorter, about $\frac{1}{3}$), and the ligament is about three times longer than the anterior pallial scar (*d.*: $2 - 2\frac{1}{2} \times$).

Compare key numbers 1 - 4 - 5 - 6 - 8 - 11 - 15.

Material. - NORTH CAROLINA: Hamilton Landing, 1 ad., USNM 24103; Williamston, 1 semi-ad., USNM 24480; Dublin County, "Natural Well", 1 ad., USNM 115065; do., Magnolia, 1 semi-ad., USNM 115066; Chowan River, 2 ($= \frac{1}{2}$) ad. (loan form 2-XII-1969, no. 2). SOUTH CAROLINA: Darlington, 1 semi-ad., USNM 145452. VIRGINIA: Chuckatuck, 1 semi-ad., USNM 24080; "Larimont", 1 semi-ad., USNM 24123; Suffolk, 1 semi-ad., USNM 24478; do., 1 juv., USNM 24479; Petersburg, 1 juv., USNM 155882 (as *E. magno-dentatus*); Suffolk, 6 ($= \frac{1}{2} + 4$) (semi-ad.) (loan form 2-XII-1969, no. 6).

USNM 25119, 1 fr. (aberrant form?) from Magnolia, North Carolina, reminds one of *Ensis* spec. (no. 4) by its strongly concave anterior pallial scar and the very long ligament; its truncate anterior

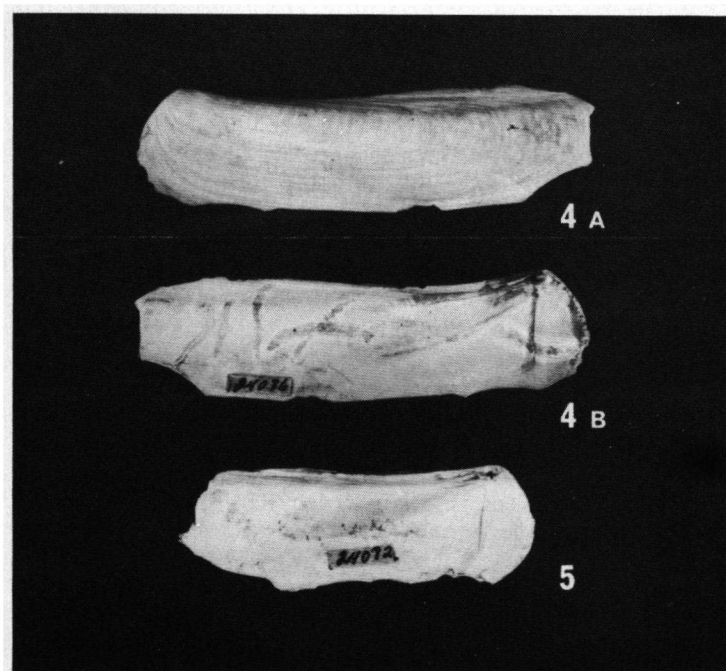
end and the straight horizontal growth-lines are those of *E. directus*. For the moment it seems advisable to defer naming this specimen.

3. *Ensis altenensis*, nov. spec.

figs. 4, 5

Solen ensiformis Conrad, 1843: 326, p.p.?

Description of type-specimen, USNM 24086. Shell large, broad, anterior breadth over 1.5 cm, nearly straight but the hinge-region turned upwards, ventral margin more strongly curved than the dorsal margin, anterior end rounded, faintly turned outwards, horizontal growth-lines strongly curved. Hinge: horizontal teeth about $\frac{1}{3}$ of the ligament, shorter than the anterior pallial scar, ligament about twice



Figs. 4-5. *Ensis altenensis* n. sp., type material. 4a-b, two views of holotype, U.S.A., Virginia, Suffolk (USNM No. 24086). 5, paratype, Virginia, Suffolk (USNM No. 24082). Note different connection of anterior pallial scar with ventral pallial scar in comparison to *E. ensiformis* (Conrad) in fig. 7. Natural size.

as long as the anterior pallial scar, hinge subterminal. Muscle scars: anterior pallial scar further from the anterior shell margin than the ventral pallial scar from the ventral shell margin, sloping backwards, thus diverging from the anterior shell margin downwards, straight; ventral pallial scar curved outwards (convex) anteriorly, rounded at the connection with the anterior pallial scar; parallel to the anterior pallial scar there is a faint but noticeable thickening; anterior adductor scar short, slightly longer than the ligament, about $1\frac{1}{5}x$, the ligament being about 2 cm and the scar about 2.4 cm, rapidly increasing in width posteriorly, width at the top about 0.15 cm, at the end about 0.5 cm, obliquely truncate posteriorly, foot-retractor scar opposite to the end of the ligament, but not present in the type-specimen.

Discussion: Judging from a photograph of his paratype, USNM 16306 (fig. 8), Conrad confused his *E. ensiformis* with either this species or the next form. Though there is some external resemblance to *E. ensiformis*, a number of characters mark the difference. They reveal the identity of *E. altenensis* as a good species; in fact the muscle scar pattern on the inside of the shell is of a different nature.

The shell of *E. altenensis* is straight or slightly curved (*e*: strongly curved) and proportionally much broader, the anterior pallial scar (this character occurs in only three other *Ensis* species) is sloping backwards (*e*: perpendicular), it is straight (*e*: often, if not always, curved inwards), the thickening along the anterior pallial scar, though not conspicuous, is typical, the anterior adductor scar is only slightly longer than the ligament (*e*: about $1\frac{1}{2}x$), and the ventral pallial scar is connected with the anterior pallial scar in a different way.

Compare also key numbers 1 - 8 - 11 - 12 - 13 - 14 - 16.

The species approaches *E. degrangei* Cossm. & Peyr. (see Van Urk, 1971: 17) from the Western and Central European Miocene and Pliocene in many respects. The very long horizontal teeth of the latter (about $\frac{1}{2}$ of the ligament and at least equalling the anterior pallial scar, or even the anterior shell breadth), together with the much longer anterior adductor scar (about $1\frac{1}{2}x$ the ligament) separates it invariably from *E. altenensis* and makes it necessary to distinguish between both species. See also note under the nomenclature of *E. ensiformis*.

I have pleasure to name this species in honour of my mentor, Dr. C.O. van Regteren Altena. The name "*altenensis*" has been chosen because of its natural and rhythmical flow; besides, it forms an intricate combination of malacologist and shell.

Material. — MARYLAND: St. Mary's River, 1 juv., USNM 144103; Cove Point, 7 semi-ad., (loan form 2-XII-1969, no. 1). VIRGINIA: Suffolk, 1 ad., USNM 24082; do., 1 ad., USNM 24085; do., 1 ad., holotype, USNM 24086; York River, 1 semi-ad., USNM 144274; Suffolk, 1 semi-ad., (loan form 2-XII-1969, no. 4.)

4. *Ensis* spec.
fig. 6

I have only a few fragments of this form at my disposal, one of them with the ligament and the anterior adductor scar complete. However, even this scarce material strongly suggests a separate species. The external appearance is that of a moderately-sized *E. altenensis*, while the interior characters remind one of *E. directus*, or partly also of *E. ensiformis*.

It differs from *E. directus* especially by key numbers 3 — 4 — 5 — 8 — 9 — 10 — 12, from *E. altenensis* by nos. 2 — 5 — 7 — 8 — 11 — 12 — 13 — 15, from *E. ensiformis* by nos. 1 — 2 — 3 — 9 — 15.

It is briefly characterized by its straight and rather broad shell (like *d.* and *a.*), rounded anterior end (*a, e*), which is strongly curved inwards (*e, d* slightly if at all) and lies further inside than the ventral pallial scar (*a, e*), and the straight ventral pallial scar (*d.*). A special character may be the very long ligament and, in addition, the equally long or perhaps longer anterior scar (compare key number 9).

Material. — MARYLAND: Cove Point, 3 fr., USNM (loan form 2-XII-1969, no. 1); St. Mary's River, 1 juv., USNM 2343 (ant. add. scar complete, but ventr. pall. scar invisible).

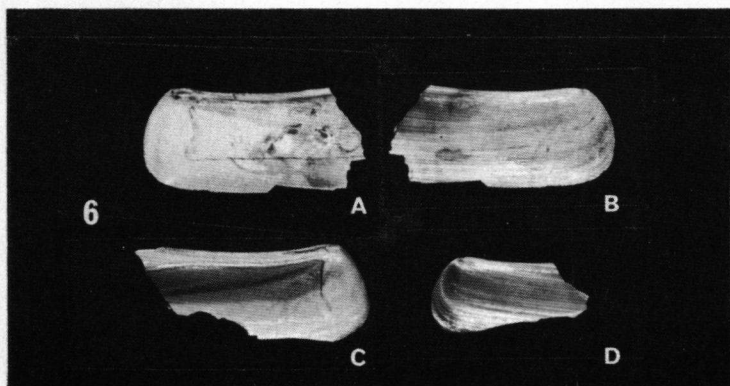


Fig. 6. *Ensis* spec., U.S.A., Maryland, Cove Point, 3 fragments of which one is depicted from both sides (a, b); ventral pallial scar slightly retouched (USNM, loan form 2.XII.1969). Natural size.

5. *Ensis ensiformis* (Conrad)
figs. 7, 8

Solen ensiformis Conrad, 1843: 326.

non: *Ensis ensiformis* J. de C. Sowerby, 1844: pl. 642 fig. 1; 1846: 77.

Description of specimen USNM no. 24075. Shell small, about 7.5 cm long, slender, anterior breadth about 1 cm, strongly curved, ventral margin more strongly so than dorsal margin, anterior end rounded, faintly turned outwards, horizontal growth-lines strongly curved. Hinge: horizontal teeth about $\frac{2}{5}$ of ligament, slightly shorter than the anterior pallial scar, ligament about $2\frac{1}{2}$ x the anterior pallial scar, hinge subterminal. Muscle scars: further from the anterior shell margin than the ventral pallial scar from the ventral shell margin, perpendicular, forming a right angle with the ventral pallial scar, curved inwards (concave); ventral pallial scar curved outwards (convex), a faint thickening halfway anterior pallial scar and anterior shell margin, anterior adductor scar moderately long, about $1\frac{1}{2}$ x the



Fig. 7. *Ensis ensiformis* (Conrad), adult valve, U.S.A., Virginia, Yorktown (USNM No. 24075), cf. fig. 5. Natural size. Photographs figs. 1-7: B. Kieft, Leiden.

ligament, increasing in width posteriorly, where it is about $2\frac{1}{2}$ x wider than at the top, foot-retractor scar before (?) the end of the ligament, posterior adductor scar at less than its own length from the pallial sinus.

Dr. Th.R. Waller kindly sent to me a photograph of Conrad's holotype (USNM 16506, "Type"), which is reproduced here (fig. 8). Even though the anterior end is damaged and the muscle scars are not visible, one immediately notices the striking resemblance to the right valve USNM 24075 (fig. 7) described here.

I am less certain about the identity of Conrad's paratype USNM 16306 (fig. 8). It is not the same species as his holotype, but may belong to either *E. altenensis*, or species no. 4. The conclusion is, that Conrad apparently confused two forms, but there is no doubt as to the specific identity of the type.

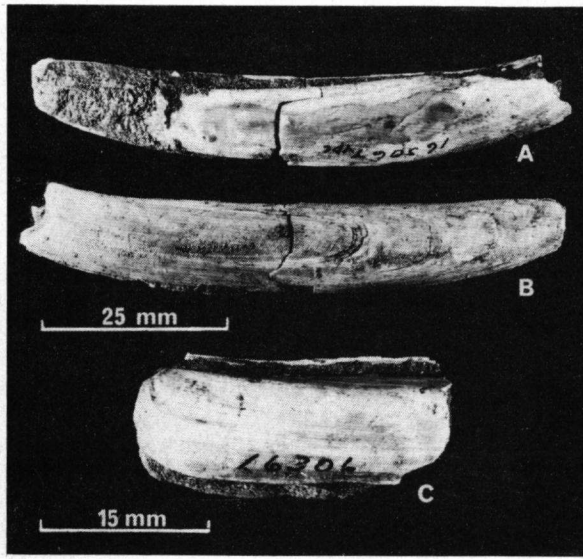


Fig. 8. *Ensis ensiformis* (Conrad), type material; a-b, holotype, USNM No. 16506; c, paratype, USNM No. 16306. Photographs courtesy United States National Museum.

E. ensiformis J. de C. Sowerby non Conrad is specifically different from *E. ensiformis* (Conrad) and, since it is preoccupied by the latter, should be called *E. waltoniensis* (Van Urk, 1971: 16). Referring to this paper, the note that American *E. ensiformis* may be confused with *E. degrangei*, should be corrected: I wrote this, when still considering *E. altenensis* to be the true *E. ensiformis* of Conrad. See also discussion under *E. altenensis*.

Material. — MARYLAND: St. Mary's River, 1 semi-ad., USNM 11863. VIRGINIA: Yorktown, 1 ad., right valve with posterior end slightly damaged, USNM 24075; do., 1 semi-ad., USNM 144812; Sycamore, 3 juv.-semi-ad., (loan form 2-XII-1969, no. 5).

I am greatly indebted to Dr. Th.R. Waller, Smithsonian Institution, Washington, for providing me with the material, the photographs of Conrad's types, and in general for giving me every kind of assistance. I would also like to thank Mr. B. Kieft, Leiden, who prepared the other photographs in such a skilful way.

Request

For a revision of American Atlantic *Ensis* I will be pleased to receive material of *Ensis minor megistus* Pilsbry & McGintey, and of so-called *Ensis directus* from south of Cape Hatteras either for the Leiden Museum, on loan, or in exchange for European material. If anyone could supply me with such material, I would be very grateful.

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