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Notes on North Sea Basin Cainozoic echinoderms, Part 3. Pliocene gorgonocephalid ophiuroids from borehole IJsselmuiden-1 (Overijssel, The Netherlands)

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A few disarticulated brittlestar vertebrae recovered from strata assigned to the Oosterhout Formation (Upper North Sea Group, Pliocene), penetrated in the borehole IJsselmuiden-1, are assigned to the Gorgonocephalidae on the basis of vertebral shape and arm branching. This is the first fossil record of this group from the North Sea Basin.

KEY WORDS: Echinodermata, Ophiuroidea, Gorgonocephalidae, Pliocene, North Sea Basin, The Netherlands.

Introduction

Figure 1. Map of the Netherlands, showing location of borehole IJsselmuiden-1.

Dissociated vertebral ossicles of gorgonocephalid ophiuroids are recorded for the first time from Pliocene deposits of the North Sea Basin. The material originates from hand-picked sieve residues of borehole IJsselmuiden-1 (Figure 1), stemming from a depth between 242.5 and 247 m. Fossil assemblages from the 189-c. 330 m interval in this well may be assigned to the Oosterhout Formation (Gaemers, 1986). This unit correlates with the Lillo Formation in the Antwerp-Kallo area (north-western Belgium); it is dated as (Late Miocene-) Pliocene on foraminiferal evidence (Doppert *et al.*, 1979; Doppert, 1980; TNO-NITG, Afdeling Geo-Infrastructuur, 2003).

Although only a handful of disarticulated vertebrae are available, attribution to the Gorgonocephalidae is beyond doubt based on vertebral shape and the presence of a 'branching vertebra'. Previous records of fossil gorgonocephalids have recently been discussed by Kroh (2003). Extant representatives are found in a large variety of habitats, ranging from the subpolar to tropical climate zones (Döderlein, 1927; Mortensen, 1933; Baker, 1980; Hendler *et al.*, 1995), yet the fossil record of this group is very poor. This is a pattern shown by most groups of ophiuroids and may be explained by the fact that the great majority of fossil brittlestars are preserved as disarticulated ossicles only, which are easily overlooked in the field. Although such ossicles may be recovered from and are locally abundant in bulk samples, these remains have rarely been studied in great detail. Although there is a considerable body of literature on Cainozoic echinoderm faunas from the North Sea Basin (see, *e.g.*, Janssen, 1972; Jagt, 1991, and references therein), there are no previous records of gorgonocephalids from this area.

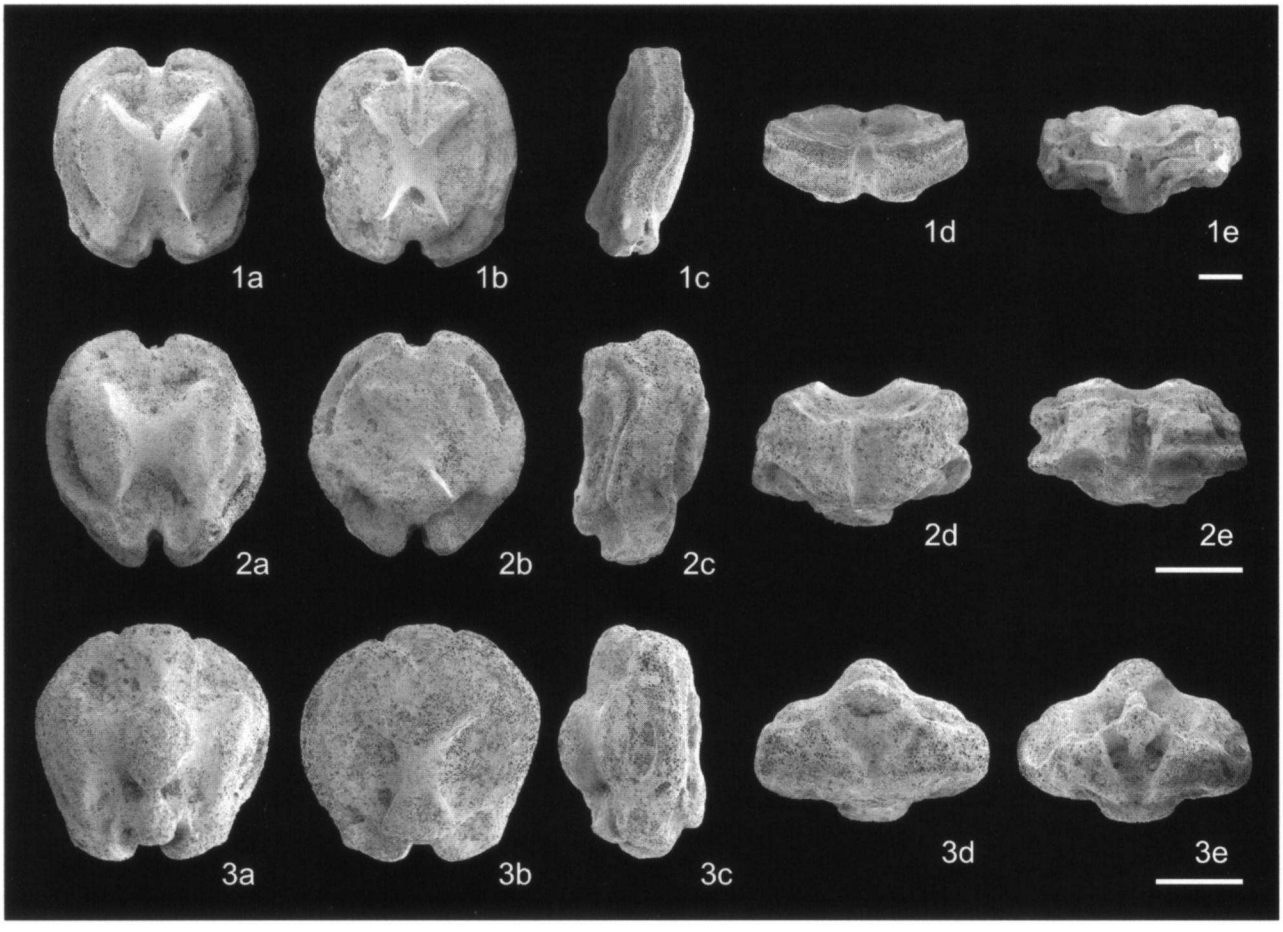

Figure 2. Indeterminate gorgonocephalid vertebrae (NHMM 2003 193) from borehole IJsselmuiden-1, the Netherlands, depth 242.5-247 m, Oosterhout Formation (Pliocene); 1, 2 – 'normal' vertebrae; 3 – 'branching' vertebra, in distal (a), proximal (b), lateral (c), dorsal (d) and ventral (e) views, respectively. Scale bars equal 1 mm.

The material described here is deposited in the collections of the Natuurhistorisch Museum Maastricht (NHMM).

Description and discussion

Class Ophiuroidea Gray, 1840
Order Euryalina Lamarck, 1816
Family Gorgonocephalidae Ljungman, 1867

Indeterminate gorgonocephalids (Figure 2)

Material — Seven disarticulated vertebrae (NHMM 2003 193), including a single 'branching vertebra'. Although this cannot be demonstrated beyond doubt, these vertebrae are here considered to be conspecific.

Description — 'Normal' vertebrae (Figure 2/1, 2) range between 2 and c. 4.5 mm in diameter, and show the characteristic hourglass-shaped streptospondylous articulation of euryaline ophiuroids. In lateral view, the larger (proximal) vertebrae are rather narrow and slightly sinuous; the lateral furrow between the proximal and distal insertion areas is rather narrow and shows no traces of ornament, although the material is quite well preserved. The aboral groove is U- to V-shaped, the oral groove U-shaped. The oral fossae are moderately large and not well differentiated from the remaining ossicle surface. Proximal vertebrae (Figure 2/1a-e) are rectangular with rounded corners in proximal/distal view; median ones are oval (vertically elongated) in outline (Figure 2/2a-e).
The single 'branching vertebra' available is similar in size and shape to median 'normal' vertebrae (Figure 2/3a-e). The distal face, however, has two inclined articulation surfaces in contrast to only one in the latter. The two articulation surfaces are subequal in size and the vertebra is symmetrical in distal view.

Discussion — Attribution of the present material to the Gorgonocephalidae is beyond doubt. This is based on vertebral shape and the presence of 'branching' vertebrae, since the latter occur only in two post-Palaeozoic families of the suborder Euryalina, namely the Gorgonocephalidae and Euryalidae (formerly Trichasteridae). Euryalids, however, can definitely be excluded since in these the ventral furrow is closed by a 'bridge-like' structure in all but the most proximal vertebrae (Mortensen, 1933, pp. 3, 4; compare also Kroh, 2004), whereas the present vertebra all show an open ventral furrow.

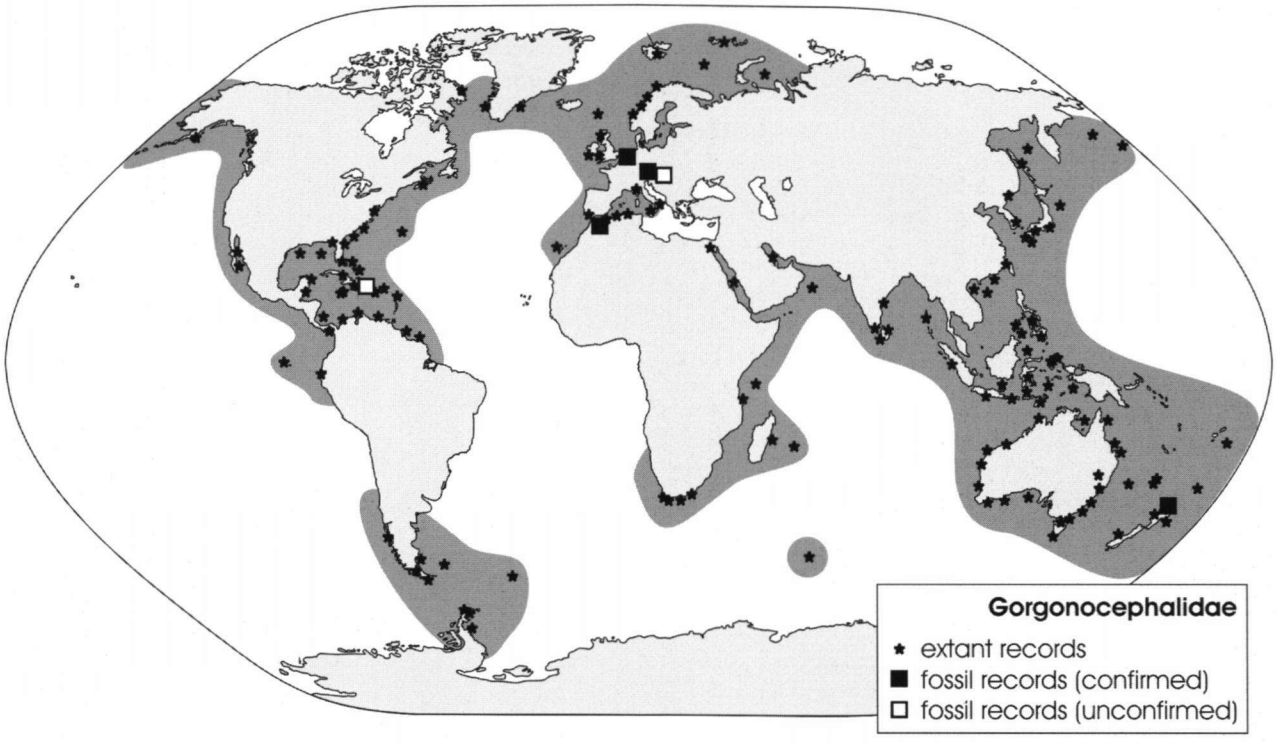

Figure 3. Distribution of extant Gorgonocephalidae and localities from which fossil material has been recorded to date (compiled after Döderlein, 1911, 1927, 1930; Mortensen, 1933; Baker, 1980; Hendler *et al.*, 1995; Liao & Clark, 1995; Rowe & Gates, 1995; Donovan & Paul, 1998; Kroh, 2003). The absence of Recent gorgonocephalids along large portions of the coasts of South America and West Africa may in part reflect lack of sampling rather than true absence.

A generic or even specific identification of such ossicles is possible (compare Kroh, 2003), but for this abundant, well-preserved material including disc ossicles (*e.g.*, oral plates), is required.

At present, four species of the genus *Gorgonocephalus (G. arcticus, G. caputmedusae, G. eucnemis and G. lamarcki*) occur in the North Atlantic (see Döderlein, 1911; Hansson, 1998). The fossil vertebrae studied here are indeed closely similar to those of extant North Atlantic *Gorgonocephalus*, but for a definite assignment, both additional fossil material and more data on ossicles of extant taxa are needed.

Despite the low taxonomic resolution that can be achieved studying such isolated ossicles it is still worthwhile to report their presence. Consequent employment of disarticulated echinoderm material in large scale studies can supplement data obtained from whole specimens and has been shown to yield valuable results already (*e.g.* Jagt, 2000; Kroh, 2005, submitted).

Comparison of the present-day distribution pattern (Figure 3) of the gorgonocephalids with their fossil record suggests a Western-Tethyan origin of the group. Their modern diversity hotspot - the Indo-Malayan-Region - in contrast, has not yielded any such fossils up to date. Interestingly a closely similar pattern is seen in Euryalids (Kroh, 2004) and many other invertebrate groups. Further research is needed to reveal whether this reflects a sampling bias (due to more intense research in the Mediterranean area) or a true pattern. Another striking feature of the modern distribution of the gorgonocephalids is their occurrence in three apparently disjunct areas. It is, however, likely that the lack of reports from large parts of the South American and West African coasts is due to our incomplete knowledge of the marine fauna of these areas rather than an absence of these animals.

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