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Conopora (Stylasteridae, Hydrozoa) from the Eocene of Seymour Island

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Abstract: The first fossil stylasterid from Antarctic is reported from La Meseta Formation (Telm1: Early Eocene) of Seymour Island (Antarctic Peninsula): *Conopora mariae* sp. nov. This also is the earliest reliable fossil record of the genus *Conopora*. *Conopora mariae* differs from congeners by having much larger cyclosystems (diameter 2.5–4.5 mm). Cyclosystems of that size are exceptional among the Stylasteridae.

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Introduction

The fossil record of Stylasteridae still is relatively poor (cf. Zibrowius & Cairns 1992). Their earliest representatives were mentioned from the late Maastrichtian of Denmark (Floris 1979). Most fossil taxa are from the Tertiary: Paleocene (Denmark, Nielsen 1919, Bernecker & Weidlich 1990), Eocene (Paris Basin, Defrance 1826; Tonga, Wells 1977), Oligocene (Germany, Roemer 1863; Italy, Michelotti in Sismonda 1871), Miocene (Moravia, Reuss 1872; Spain, Barrier *et al.* 1992; New Zealand, Cairns & Grant-Mackie 1993), and rare occurrences in Plio-Pleistocene deposits (Zibrowius & Cairns 1992). Both cyclosystemate (with dactylopores surrounding gastropores) and noncyclosystemate (with gastro- and dactylopores randomly arranged) taxa co-occur in the earliest stylasterid assemblages (Cretaceous/Paleocene, Zibrowius & Voigt 1993), although the former have been considered evolutionary more advanced (Cairns 1987). Reported since the Paleocene, *Conopora* is considered one of the earliest cyclosystemate genera. However, the generic attribution of the supposedly earliest record of *Conopora* (*Conopora arborescens* Nielsen, 1919 from the Paleocene of Denmark) is doubtful (Cairns 1983; see also Zibrowius & Voigt 1993). Undoubted fossil representatives of *Conopora* include: Early Miocene (Otaian) *Conopora* sp. cf. *C. laevis* from New Zealand (Cairns & Grant-Mackie 1993), and three species of *Conopora* from the Upper Miocene of Spain (Barrier *et al.* 1992).

This paper describes a new species of *Conopora* from the Lower Eocene of Antarctica, the first fossil stylasterid from that continent and the earliest confirmed representative of the genus. The specimens of *Conopora mariae* sp. nov. were collected by Andrzej Gaździcki during the Argentine-Polish field project on Seymour Island in 1994 and are deposited at the Institute of Paleobiology of the Polish Academy of Sciences, Warszawa (abbreviation ZPAL Hz.III).

Geological setting

The stylasterids described here are from La Meseta Formation of Seymour Island (Fig. 1). The La Meseta Formation (up to 800 m thick) lies unconformably on an upper Cretaceous/ Paleocene erosional surface (Elliot & Trautman 1982, Sadler 1988) and crops out on the northern part of Seymour Island and south-west of Cross Valley. The La Meseta Formation is subdivided into seven lithofacies (Telm1–Telm7, see Sadler 1988). At fossil locality ZPAL 1, from which the stylasterids

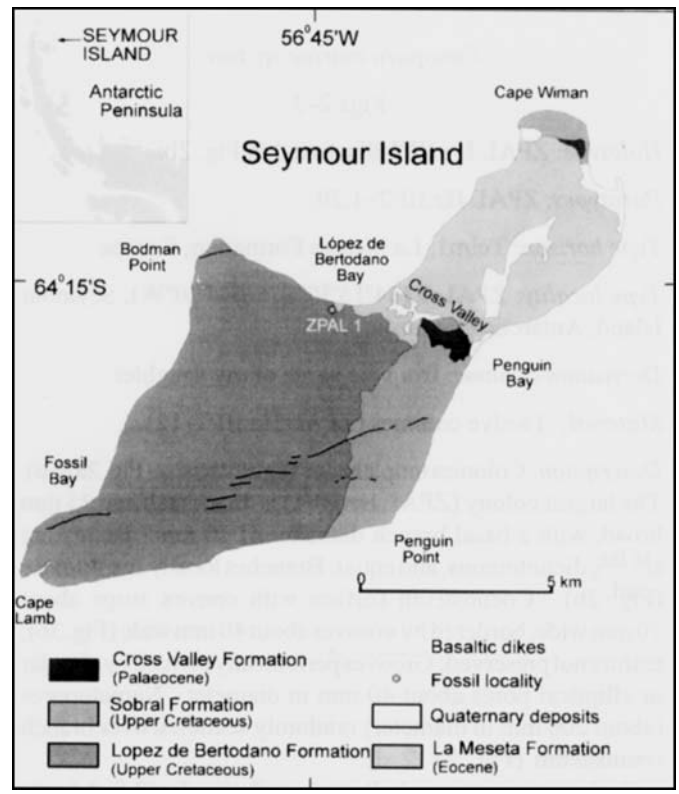

Fig. 1. Geological map of Seymour Island showing the locality (ZPAL 1) with the stylasterid fauna.

were obtained, sediments of the lowermost unit (Telm1) are exposed. Deposits interpreted as trangressive are composed of grey to red-brown limonitic sandy silstone, sandstone and sandy pebble-conglomerate with intercalations of shelly hash. A Late Early Eocene age has been suggested on the basis of dinoflagellates (Wrenn & Hart 1988, Cocozza & Clarke 1992). At locality ZPAL 1, stylasterids co-occur with abundant scleractinians (Stolarski 1996), brachiopods (Bitner 1996), bryozoans (Hara 1997), and echinoderms (Baumiller & Gaździcki 1996, Radwańska 1996). Preservation of numerous articulated brachiopod shells, complete echinoid tests with attached spines as well as articulated crowns and pinnules of crinoids testify to quick burial and lack/insignificance of the postmortem transport of the fauna from the lowermost part of La Meseta Formation at the ZPAL 1 locality.

Systematic palaeontology

Phyllum CNIDARIA Hatschek, 1888
Class HYDROZOA Owen, 1843
Family STYLASTERIDAE Gray, 1847
Subfamily STYLASTERINAE Gray, 1847
Genus *Conopora* Moseley, 1879

Diagnosis: Distinct cyclosystems. Gastropore tubes double-chambered. No gastro- and dactylostyles.

Type species: *Conopora tenuis* Moseley, 1879 (= *C. laevis* (Studer, 1878)), by monotypy.

Conopora mariae sp. nov.

Figs 2–3

Holotype: ZPAL Hz.III/1 illustrated in Fig. 2b.

Paratypes: ZPAL Hz.III/2–1.20.

Type horizon: Telm1, La Meseta Formation; Eocene

Type locality: ZPAL 1 (64°15'30"S, 56°44'20"W), Seymour Island, Antarctic Peninusla.

Derivation of name: from the name of my daughter.

Material. Twelve colonies (ZPAL Hz.III/1–12).

Description. Colonies uniplanar or slightly bushy (Fig. 2a & b). The largest colony (ZPAL Hz.III/1) is 43 mm tall and 25 mm broad, with a basal branch diameter of 10 mm. Branching sparse, dichotomous, and equal. Branches locally anostomose (Fig. 2b). Coenosteum surface with convex strips about 70 mm wide, bordered by grooves about 40 mm wide (Fig. 3b); texture not preserved. Grooves periodically pierced by circular or elliptical pores about 40 mm in diameter. Nematopores (about 200 mm in diameter) randomly scattered over branch coenosteum (Fig. 2c & d).

Cyclosystems sympodially arranged, circular (2.5–4.5 mm in diameter), ellipsoidal or slightly horseshoe shaped. The largest colony (ZPAL Hz.III/1) has 20 cyclosystems. Based on 20 well preserved cyclosystems (Fig. 4, colonies ZPAL Hz.III/1, 3–8, 10–12), there is a range of 14–24 dactylopores per cyclosystem (average = 18.3, s = 2.81, and mode 18). Dactylotomes about 0.35 mm wide, pseudosepta ranging from about 0.7–1 times dactylotome width. Gastropore tubes, about 4 mm deep, double-chambered with weak gastropore ring constriction (Fig. 3a). Upper gastropore chamber about 3 mm long, lower chamber with concave floor. Inner surfaces of the upper chamber (below dactylotome-enclosed portion) and at least part of the lower chamber has a texture of longitudinal ridges (Fig. 3d & e). Ridges are separated by grooves and are about twice as dense as pseudosepta. Cyclosystems may be overgrown in places by coenosteum, especially on proximal parts of the branches (Fig. 3c & d).

Presumed ampullae have been observed on fractured coralla, grouped around cyclosystems (Fig. 3d & e). These are internal ellipsoidal cavities up to 1 x 0.7 mm in size.

Mineralogy. Skeleton calcitic (X-ray diffraction), entirely recrystallized. It can be assumed that originally it had been aragonitic as this is the case in the extant representatives of *Conopora* (cf. Cairns & Macintyre 1992).

Remarks. Compared with known nine Recent and four fossil *Conopora* species, *C. mariae* sp. nov. has by far the largest cyclosystems, and compared with other Stylasteridae in general, it also ranges among those having the largest cyclosystems. Very large cyclosystems, about 5 mm in diameter, have been found in a Recent *Crypthelia* from New Caledonia (studied by Helmut Zibrowius). In *Conopora*, the so far largest cyclosystems (diameter up to 2.6 mm) were described from the extant *C. gigantea* Cairns, 1991. *Conopora mariae* differs from *C. gigantea* in having cyclosystems that are almost twice as large, and a larger number of dactylopores per cyclosystem (range 10–24 in *C. mariae* vs 8–13 in *C. gigantea*).

Only one fossil *Conopora* has previously been described from the Southern Hemisphere: *Conopora* sp. cf. *C. laevis* from from the Miocene of New Zealand (Cairns & Grant-Mackie 1993). Its cyclosystems are about five times smaller than those of *C. mariae*.

Conopora mariae resembles *Conopora* sp. 1 and *Conopora* sp. 2 from the late Miocene of Spain (Barrier *et al.* 1992) in overall colony shape and arrangement of cyclosystems. Cyclosystems of *C. mariae* are however, about five times larger than those of *Conopora* sp. 1 and *Conopora* sp. 2.

Compared with extant species of *Conopora*, *C. mariae* has a number of dactylopores per cyclosystem (range 14–24) similar to *C. unifacialis* Cairns, 1991 (range 14–21), *C. laevis* (Studer, 1878) (range 10–16) and *C. adeta* Cairns, 1987 (range 12–17). However, *C. mariae* differs from *C. unifacialis* in having sympodially arranged cyclosystems, and from *C. adeta* in being attached to a substratum (*C. adeta* is the only known free living stylasterid species).

Stylasterids are known for symbiotic associations with various organisms (review in Zibrowius & Cairns 1992). A particular common is association with polynoid polychaetes

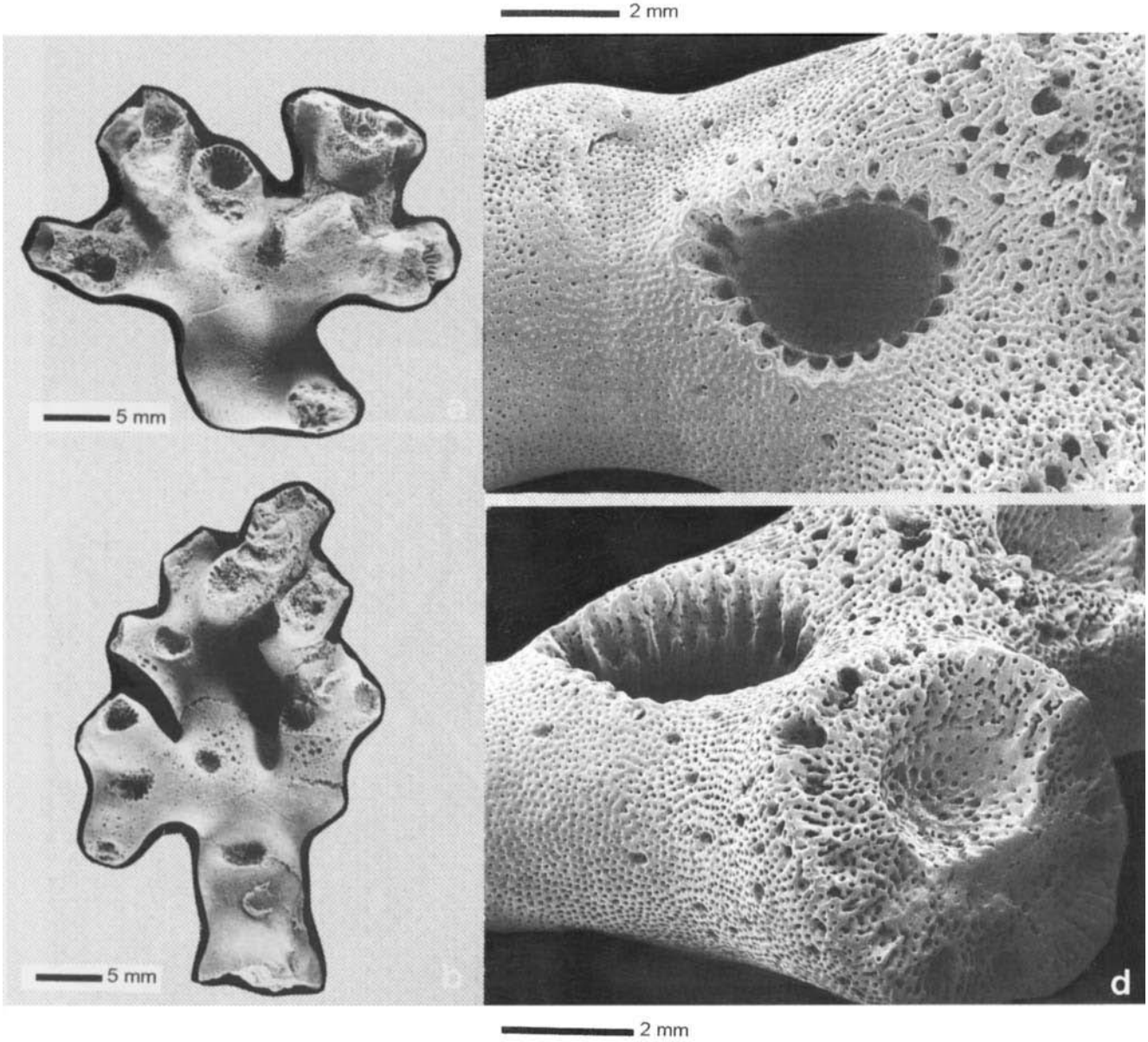

Fig. 2. *Conopora mariae* sp. nov. **a.** Bushy colony (paratype ZPAL Hz.III/2), **b.** Uniplanar colony of holotype (ZPAL Hz.III/1) with two anostomosing branches, **c-d.** Paratype (ZPAL Hz.III/3); distal view on branch with gastropore with 22 dactypores **c.** side view of the branch **d.** with nematopores (arrow) and fractured cyclosystem with preserved lower chamber of gastropore tube.

(also known for *Conopora* species), which strongly influence the corallum shape. No such traces of symbiotic organisms have been found on *C. mariae*.

Occurrence. Seymour Island, La Meseta Formation.

Remarks on environmental distribution and palaeobiogeography

In modern seas the genus *Conopora* (with nine species) is widespread throughout the Indo-Pacific and in Antarctic and subantarctic waters (Cairns 1991). All species are recorded from depths exceeding 100 m, but most of them (as with stylasterids in general) occur at depths of 200–1000 m. *Conopora verrucosa* (Studer, 1878) has the greatest depth range, 198–2355 m. Cairns (1992) argued that the occurrence of most stylasterids in deep-water and low nutrient level environments could be explained by an uncompetitiveness with fast growing, opportunistic organisms, which are typically found at shallow depth (e.g., benthic algae, heterotrophic suspension feeders). Nevertheless, some stylasterids (*Errina*, *Stylaster*) and typical deep-water species of anthipatharians and brachiopods may also occur at shallow depths (about 15 m) in New Zealand fiords (Grange *et al.* 1981, Cairns 1992). In that peculiar environment, lenses of the surface low-saline and light-absorbing waters may reduce the number of algal species (or other space competitors) and thus allow

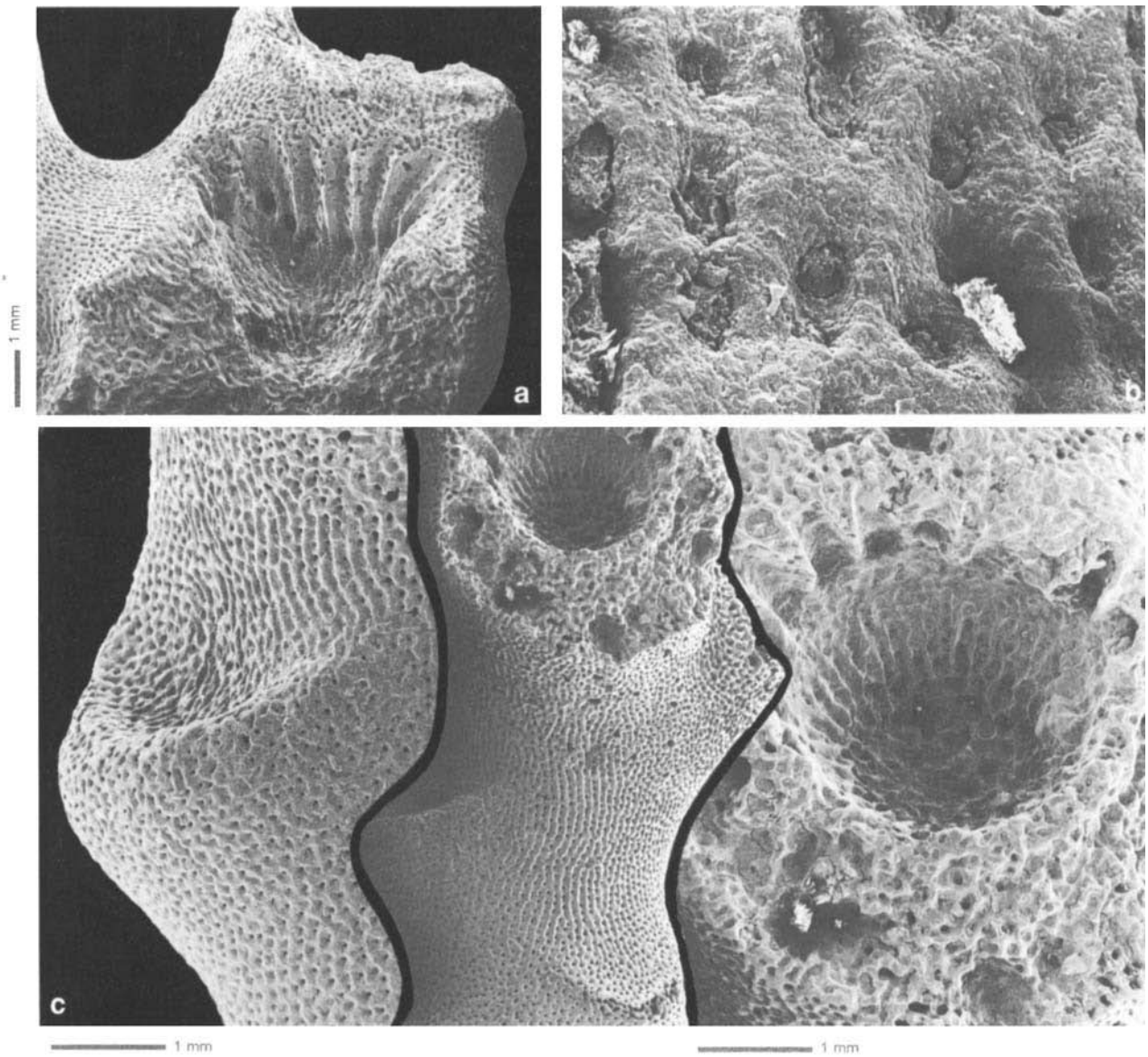

Fig. 3. *Conopora mariae* sp. nov. **a-b.** Paratype (ZPAL Hz.III/5). **a.** Longitudinal section of a gastropore tube illustrating double chambers. **b.** Coenosteal strips and grooves pierced by small pores. **c-e.** Paratype (ZPAL Hz.III/4) with some cyclosystems completely overgrown by coenosteum (**c** - enlargement). Cavities disclosed on erroded part of the branch (arrow) may represent internal ampullae which surround cyclosystem (**e** - enlargement).

settlement of stylasterid larvae at lesser depths than normal (Cairns 1992).

Bathymetric estimations for the fossil assemblage of the Telm1 unit of the La Meseta Formation based on scleractinians and brachiopods suggest palaeodepths of the order of 100 m (Stolarski 1996, Bitner 1996). Reference to present-day records of *Conopora* in general does not contradict this interpretation. By contrast, some other palaeoecological interpretations and sedimentological data (presence of wavy bedding, climbing-ripple lamination) would imply much shallower depositional conditions for the lowermost units of La Meseta Formation (Stilwell & Zinsmeister 1992, Baumiller & Gazdzicki 1996). This cannot be ruled out by the record of fossil *Conopora* as a whole, especially when recalling the situation of the New Zealand fiord environment.

The records of fossil stylasterids (and of *Conopora* in particular) are to patchy to permit detailed palaeobiogeographic analysis. However, some general comments can be make on geographic distribution of fossil and extanct *Conopora*. Its earliest record, *Conopora* mariae sp. nov. is from Seymour Island (present report). Stratigraphically and geographically nearest to this finding is *Conopora* sp. cf. *C. laevis* from the Early Miocene of New Zealand (Cairns & Grant-Mackie 1993). Today, the New Zealand region (including Norfolk,

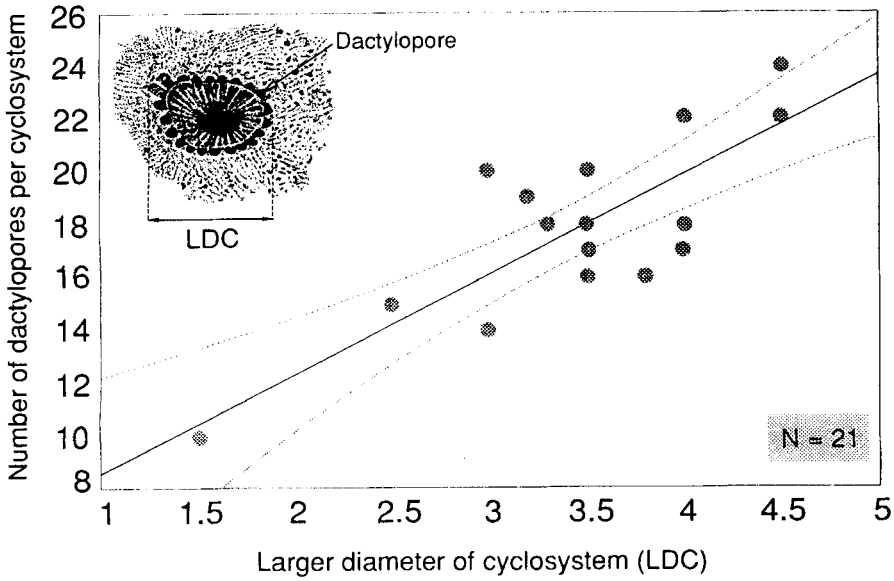

Fig. 4. Scattergram of larger diameter of cyclosystems *versus* number of dactylopores per cyclosystem in *Conopora mariae* sp. nov. Correlation $r = 0.77$. Also plotted are regression lines for 95% confidence.

Kermadec, and Macquarie Ridges) has the highest *Conopora* (and stylasterid as a whole) species diversity: six of nine known extant species of *Conopora* have been described from that region. Thus, there are reasons to believe that *Conopora* originated on the Southern Hemisphere. Interesting exception to southern distribution of *Conopora* are three species reported from the Late Miocene of Spain (Barrier *et al.* 1992). To discuss the possible dispersal routes of *Conopora* in Cenozoic (? through the Tethys before its Miocene closing) we need, however, much more fossil evidence.

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