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The first record of an isocrinid crinoid from the Tertiary of Australia

Gregory J. Milner*

Abstract

An isocrinid crinoid, tentatively assigned to *?Nielsenicrinus* sp., from the Paleogene Cardabia Calcarenite, Carnarvon Basin, Western Australia is the first record of the group in the Australian Tertiary. Foraminiferal evidence dates the crinoid as late Paleocene (mid-Thanetian, planktonic foraminiferal *Planorotalites pseudomenardii* Zone P4). The crinoid lived in an open shelf sea at 50m to 100m depth.

Introduction

Within Australia articulate crinoids of the Isocrinidae have previously been described only from Cretaceous deposits in Queensland and New South Wales (eg: Moore 1870; Jack and Etheridge 1892, Etheridge 1901, 1902). During recent stratigraphic fieldwork in Toothawarra Creek, northern Carnarvon Basin, Western Australia (latitude 22° 49' 45" S and longitude 114° 08' 30" E, Fig. 1) crinoidal remains were collected from a homogenous, soft, white, bryozoal calcarenite bed of the Wadera Member type-section, Cardabia Calcarenite (Condon *et al.* 1956; Hocking *et al.* 1987) near the contact with the underlying Boongerooda Greensand Member.

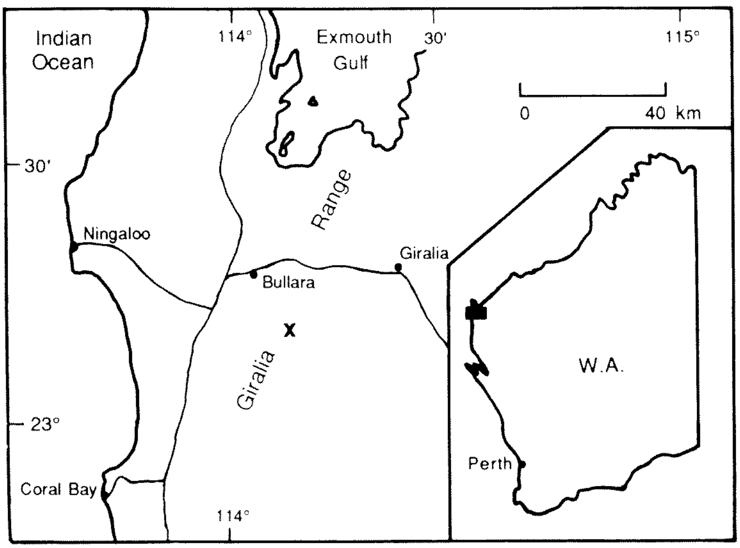

Figure 1 Locality map showing collection location as denoted by X.

*Department of Geology, the University of Western Australia, Nedlands, 6009

Many isocrinids have been assigned generic names on the basis of stem elements (Rasmussen 1961). Although reservations concerning this practice were expressed by Moore as early as 1939, and later Donovan (1984), it has continued, mainly because of the lack of diagnostic calyx or cup elements in recovered material. Other than Moore, Jeffords and Miller (1968), Roux (1977) and Donovan (1984, 1988), few detailed studies have been made assessing the taxonomic status of morphological criteria derived from crinoid columnals. Hence, until more work is done, perhaps on statistical analysis following LeMenn (1981) and Roux (1978), only tentative identifications using stem elements can be made of what are now essentially artificial morpho-genera.

Stem terminology follows Moore, Jeffords and Miller (1968), Roux (1977), Ubaghs (1978) and Webster (1974). All figured specimens in this paper (UWA 107682 - 107683) are held in the Museum Collection of the Geology Department, the University of Western Australia.

Systematics

Order Isocrinida Sieverts-Doreck 1952
Family Isocrinidae Gislen 1924
Genus *Nielsenicrinus* Rasmussen 1961
?Nielsenicrinus sp.

Description

Columnals smooth and relatively uniform in diameter (c. 3.6 — 4 mm). Internodal plates ca. 0.7 mm in height with transverse section varying between pentalobate and rounded sub-pentalobate. Suture forms a crenulate line due to symplectial articulation. Articular columnal facet petaloid, with narrow, lanceolate areolae and subguttiform floors surrounded by culmina and crenellae (Figure 2B). Crenulae vary in length between adradial and marginal areas, greatest length in radial marginal areas, diminishing towards marginal and lumen areas. Culmina few in number with 12 surrounding petaloid zones. Smooth perilumen area surrounds narrow, rounded axial canal or lumen (Figure 2C). Internodal plates number at least 10 with no complete internodal length recovered.

Nodal plates higher (1.5 times internodal height), wider, more stellate in transverse outline (Figure 2A). Nodal-infranodal articulation symplectial. Periphery on nodal distal facet slightly raised. Always five elliptical cirral sockets, occupying nearly entire lateral side of nodal. Fulcral ridge within cirral socket consists of two prominent, horizontally opposed triangular tubercles connected to outward facing elliptical cirral pore via very low, smooth lateral ridge (Figure 2D).

Remarks

Stem morphologies of *Nielsenicrinus* are not really separable from those of *Isocrinus* according to Rasmussen's (1978) descriptions. Rasmussen (1961) distinguished *Nielsenicrinus* spp. from *Isocrinus* spp. using the presence of syzygial articulation in the $IIBr_3$-$_4$ brachial, whereas *Isocrinus* spp. possessed symmorphial articulation for the

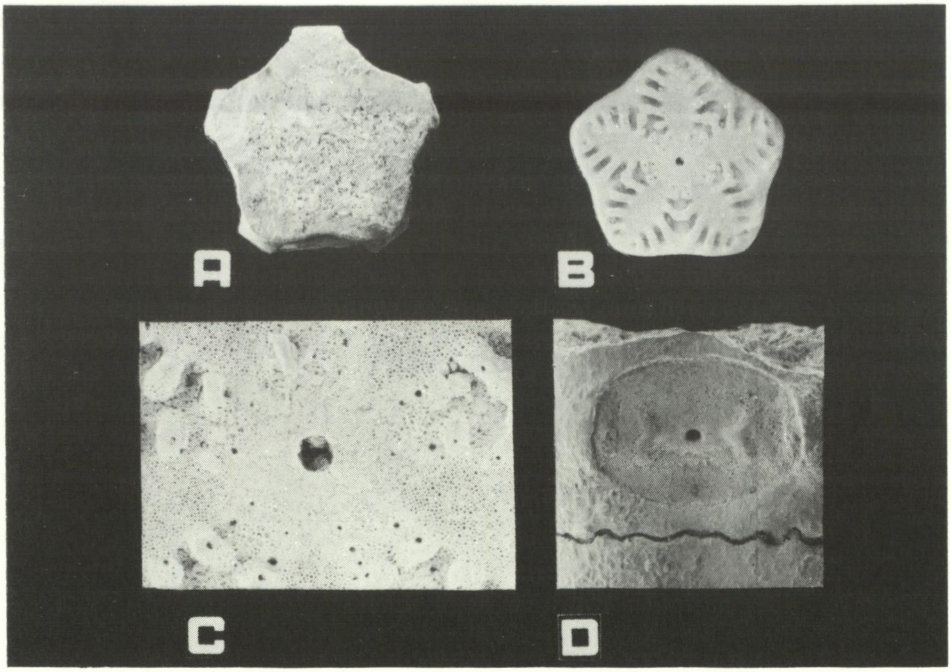

Figure 2 ?*Nielsenicrinus* sp., Late Paleocene, Wadera Member-Cardabia Calcarenite, Western Australia. (A) distal facet of nodal, x 17.2, UWA 107682. (B) proximal view of an internodal articular face, x 16.4, UWA 107683. (C) articular face of internodal, close-up of circular lumen surrounded by smooth perilumen, x 65.5, UWA 107683. (D) close-up elliptical cirral socket showing elliptical cirral pore and fulcral ridge, x 35.8, UWA 107682.

$IIBr_{3}$-$_{4}$ brachial. Since the two genera are separated by differences in calyx elements (absent in material examined), a confident generic allocation could not be made.

A lack of radial pores, common in *Isocrinus,* a relatively pentalobate columnal outline, lanceolate areolae and symplectial instead of syntosial articulation between the nodal and infranodal suggest *Nielsenicrinus* (Rasmussen 1978). Columnals of Paleogene age ascribed to *Isocrinus* sp. (Moore and Vokes 1953, Rasmussen 1961, 1978 and Klikushin 1982) tend to be more stellate in outline with broader areolae.

Examination of columnal descriptions of *Nielsenicrinus* spp. by Rasmussen (1961) show *Nielsenicrinus fionicus* Nielsen (Paleocene, Denmark) to be the most similar to the specimens from the Wadera Member. The main differences being a greater number of culimina (up to 20) and the absence of triangular tuberculations terminating the cirral fulcral ridge in *N. fionicus.*

Age and depositional environment of the crinoid

Foraminifera extracted from the calcarenite bed are used to date the crinoidal remains. The poorly preserved planktonic foraminiferal assemblage correlates with the upper part of the *Planorotalites pseudomenardii* planktonic foraminiferal (P4) Zone

(Berggren and Miller 1988) of late Paleocene (mid-Thanetian, ca. 59.8 to 58.8 Ma, according to the time-scale of Berggren *et al.* 1985).

The planktonic foraminiferal assemblage includes rare specimens of the age-diagnostic species *Planorotalites pseudomenardii* Bolli and *Acarinina mckannai* White. Other, less definitive species include abundant *Subbotina* spp. and less common *Acarinina aquiensis* Loeblich and Tappan, *Acarinina convexa* Subbotina and *Planorotalites chapmani* Parr.

Using evidence based mainly on the associated benthonic foraminiferal assemblage, which equates to the cosmopolitan Midway-type fauna described by Berggren and Aubert (1975), the calcarenite bed containing *?Nielsenicrinus* sp. was deposited in an open shelf sea at a possible depth between 50m and 100m depth. The assemblage is dominated by rotaliids, the most common being *Cibicides* spp., with less common *Alabamina midwayensis* (Brotzen), *Gavelinella danica* (Brotzen), *Gavelinella lellingensis* (Brotzen), *Cibicidoides alleni* Brotzen and *Karreria fallax* Rzehak. Bryozoans are especially abundant and the occurrence of vinicularform and lunlitiform types confirm the outer neritic bathymetry (Ryland 1970).

Modern analogs (Murray 1973; Boltovskoy and Wright 1976) show the combined presence of stenohaline planktonic foraminifera, a predominance of rotaliid-type benthonic foraminifera and an abundant macrofauna indicate normal marine salinites. A diverse calcareous benthonic fauna and homogenous, bioturbated sediments suggest aerobic conditions with dissolved oxygen levels ≥ 0.3 m/ L^{-1} (Thompson *et al.* 1985) on the sea floor and within the upper part of sedimentary deposit.

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