

A Danian Nautiloid from Majunga, Northwest Madagascar*

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Introduction

Since the publication of several reports during 1931 through 1936 (BASSE, 1931; BESAIRIE, 1936; LAMBERT, 1933, 1936), widespread Danian in Madagascar has been recognized by subsequent authors (e.g. COLLIGNON, 1960, 1968). Indeed, Madagascar is now regarded as an important region for the Danian.

During reconnaissance survey of the paleontology of Madagascar by the National Science Museum, Tokyo in 1973 (ASAMA, 1977), KANIE collected an interesting Danian nautiloid near Majunga, in the northwestern part of the island. OBATA and KANIE jointly made a laboratory study of the specimen.

The authors wish to record here their gratitude to the following persons of the National Science Museum, who helped this study in various ways: Dr. Hiroshi UJIIÉ, who is now Professor of University of the Ryukyus, cooperated with the junior author in the field work; Mr. Yoshio OGAWA assisted us in the laboratory work; Miss. Tomoko OSHIMA typed the first draft for us. The sincere thanks extend to Dr. J. M. HANCOCK of Kings College, London, who kindly rephrased the English.

The 1973 National Science Museum Party, having been granted permission by the Malagasy Government, carried out field work, in cooperation with the Service Géologique, Direction des Mines et de l'Energie, Repoblika Malagasy. The authors are deeply indebted to Mr. RASOAMAHENINA-ANDRIAMAZOTO, Chief of the Service Géologique, who kindly made arrangements for the field work, and allowed the junior author to utilize facilities and equipment of the Service Géologique. The study was financially supported by a Grant in Aid for Overseas Scientific Survey, defrayed from the Ministry of Education, Science and Culture, Japan.

Danian in Madagascar

At present the occurrence of Danian fossils has been confirmed at several

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localities in the following areas:

1) Antonibe area (At on Fig. 1)

The calcareous strata are divided into seven formations named A to G in ascending order (COLLIGNON, 1951). The uppermost G Formation is composed of chalky limestone, 20 m in thickness and contains *Hercoglossa danica indica* SPENGLER, *H. cf. rota* BLANF., *H. madagascariensis* COLLIGNON, echinoids, corals and gastropods. Several localities (Fig. 2) yielding *Hercoglossa* were recently reported in the Antonibe area (BESAIRIE, 1976): Coupe Komajara-Marokomony (52), Ambalatsingy (53), Narinda (54), and Coupe Bepilipily-Anjavary (55).



Fig. 1. Locality map for showing the occurrence of the important Danian fossils from Madagascar. At: Antonibe area, Mj: Majunga area, So: Soalala-Mitsinjo area, Ad: Andrafiavelo area, Ij: Ianjona area, Ap: Ampanihy area.

2) Majunga area (Mj on Fig. 1)

The formation, composed of alternations of marl and chalk, outcrops at 24 km southeast of Majunga, and corresponds with F+G in the Antonibe area (BESAIRIE 1936). The locality yields abundant fossils of echinoids, lamellibranchs and serpulids such as *Linthia sindensis* DUNCAN et SLADEN, *Periaster inconstans* LAMBERT, *Modiola incomptaeformis* COLLIGNON, *Pholadomya esmarkii* NILLS, and *Venericardia beaumonti* D'ARCH. (COLLIGNON, 1951; 1960). From the same locality V. HOURCQ discovered an indeterminable fragment of *Hercoglossa* in 1954 (COLLIGNON, 1960). Later, this genus has been found at a few other localities (Fig. 2) (BESAIRIE, 1976): Coupe d'Ambenja (59), Mariarano (60) and 25 km SE point of Majunga along Route No. 4 (63).

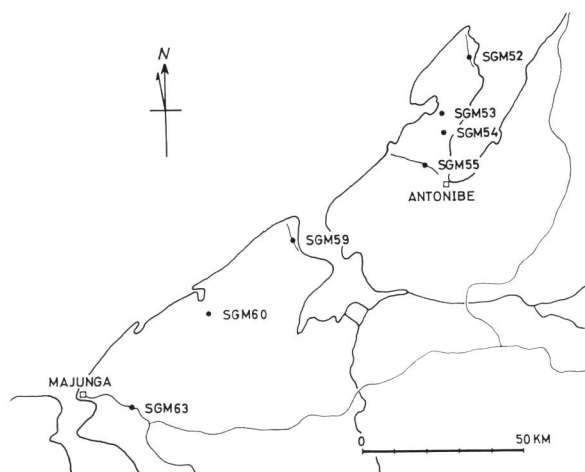


Fig. 2. Localities of the Danian *Hercoglossa* near Antonibe and Majunga, adapted from BESAIRES, 1976. SGM means the locality number of the Service Géologique of Madagascar.

3) Soalala-Mitsinjo area (So on Fig. 1)

Several fossil localities are known at Marofozano, WNW of Ananalava. The internal moulds collected by J. M. GODARD in 1957 were identified as a new species of *Acanthocardia* belonging to *A. denticulata* BAILY—*A. incompta* FORBES group by Dr. S. FRENEIX, who suggested the Campanian to Danian age (COLLIGNON, 1960).

4) Andrafiavelo area (Ad on Fig. 1)

BASSE (1931) described a few young specimens of *Hercoglossa danica indica* SPENGLER and *H. rota* (BLANFORD) from a chalky limestone of horizon 11.

5) Ianjona area (Ij on Fig. 1)

At Maharivo, 15 km south of Ianjona, *Micraster* and *Hercoglossa* beds are known in the upper part of the marly limestone (COLLIGNON, 1954). The Danian globigerinids were confirmed by J. SIGAL in the chalky limestone, and the Danian formation was estimated to be 20 m thick (COLLIGNON, 1960).

6) Ampanihy area (Ap on Fig. 1)

From samples of rocks collected in 1952 and 1957 by COLLIGNON from the Ampanihy valley, J. SIGAL distinguished globigerinid beds, 60 m above the lower Maastrichtian strata which are characterized by numerous ammonites and echinoids. The Danian formation was estimated to be 20 m thick (COLLIGNON, 1960).

The Locality of the Specimen

The specimen was collected from the chalk at loc. Mj 9-3', about 4 km ESE of Ambohizavavy in the Majunga area, on the occasion of the biostratigraphical survey along Route No. 4 (Fig. 3).

The authors give a columnar section of the surveyed area and show a kind of

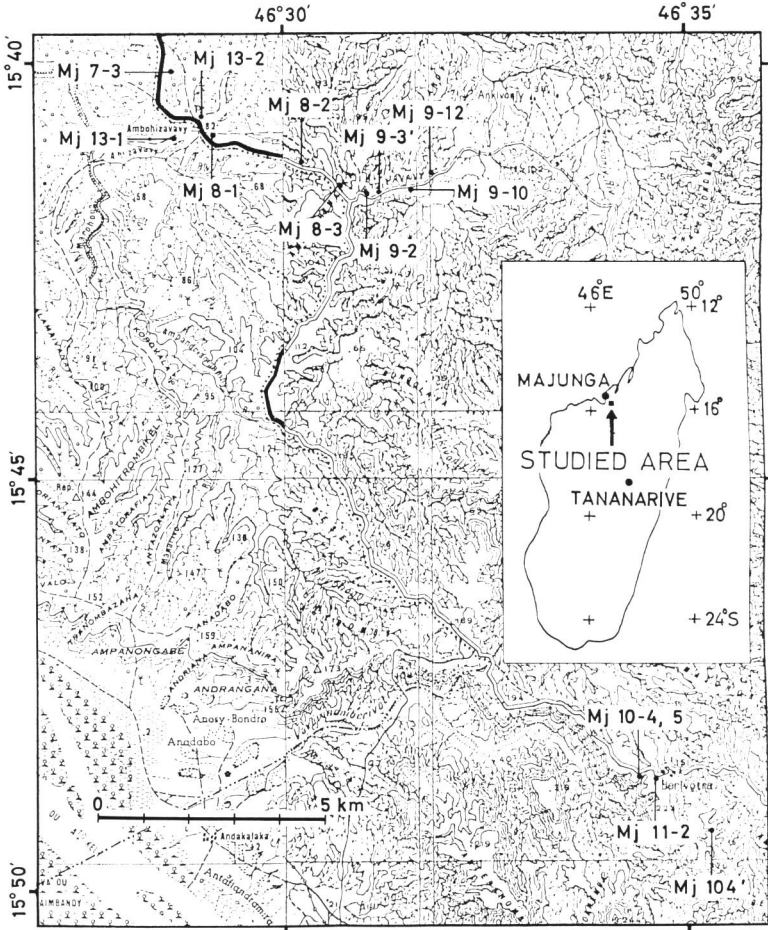


Fig. 3. Route map near Ambohitravavy, showing the surveyed localities in the 1973 and 1975 Paleontological Expeditions by the National Science Museum, Tokyo.

frequency diagram of the occurrence of the invertebrate fossils (Fig. 4). The relative abundance based on counts of the taxa is outlined for each locality. The stratigraphic position of each locality corresponds with the horizon in the columnar section on the right hand side.

The area surveyed was too small to decide the scope of formations and members, or the amount of change in the litho-facies, so the authors have generally used the divisions of BESAIKIE (1972). The essential stratigraphic facts, including both litho-facies and fossil occurrences, are outlined in Fig. 4.

From this figure it will be seen that: (1) the specimen of *Hercoglossa* was obtained from the lower part of Danian; (2) the number of echinoids in the Danian

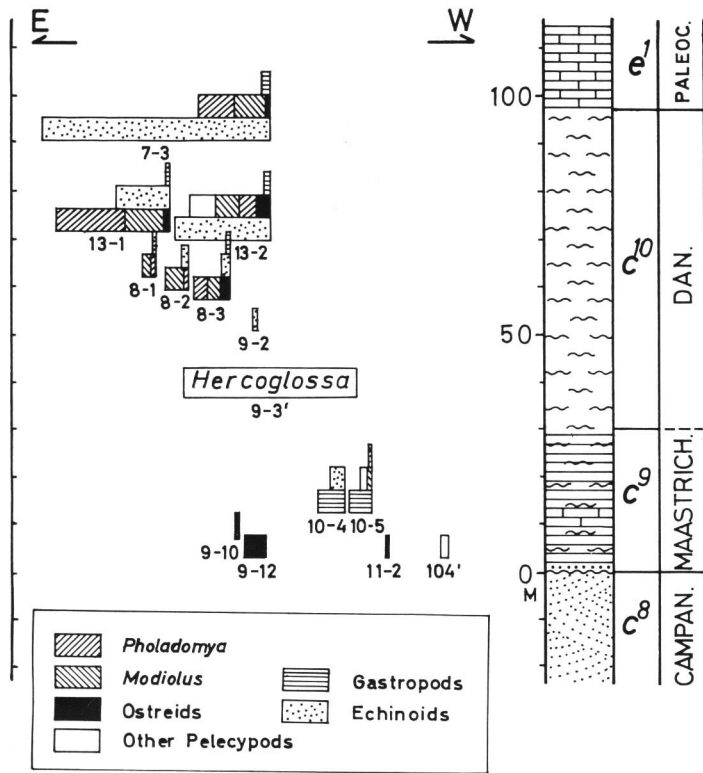


Fig. 4. Columnar section of the Upper Cretaceous to Lower Tertiary, showing the occurrence of invertebrate fossils. The specimen of *Hercoglossa* was obtained from loc. Mj. 9-3' in the lower part of the Danian chalk.

formation increases upwards; (3) ostreids predominate in the lower Maastrichtian and the gastropods in the middle.

Systematic Description

Family *Hercoglossidae* SPATH, 1927
 Genus *Hercoglossa* CONRAD, 1866

Type species-*Nautilus orbiculatus* TUOMEY, 1856, from the Paleocene of Alabama, designated by HYATT, 1883. Neotype of the species was designated by MILLER and THOMPSON in 1933.

Remarks-A comprehensive generic diagnosis was provided by MILLER(1947, p. 50). The relationship between *Hercoglossa* and other genera was discussed by KUMMEL (1956, p. 459).

According to KUMMEL's list (1956, p. 461) the genus *Hercoglossa* seems to be persistent, ranging from Cretaceous to Eocene, and composed of numerous species

from various parts of the world. The occurrence of the Cretaceous species, however, is still poorly known because COLLIGNON (1968) in his revision of the occurrence of Madagascar species, listed the Danian cephalopods from Madagascar as: *Hercoglossa danica indica* SPENGLER, *H. cf. rota* BLANFORD, *H. harrisi* MILLER et THOMAS, *H. madagascariensis* COLLIGNON and *Eutrephoceras desertorum* ZITTEL. Furthermore, as KUMMEL (1956, p. 460) pointed out in detail, any interpretation of the occurrence of two species from the early Cretaceous, i.e., *Hercoglossa (?) ricordeanus* (D'ORBIGNY) and *H. (?) forbesianus* (BLANFORD), can only be tentative pending discovery of new material.

Hercoglossa majungaensis sp. nov.

Pl. 1, fig. 1; Pl. 2, fig. 1a, b; Text-figs. 5, 6.

Material.—Holotype, NSM.PM 9360, a fairly well preserved, large internal mould, with most of the body chamber preserved. The holotype was sent back to the Service Géologique, Tananarive in Madagascar. No other example is available.

Specific diagnosis.—whorl fairly compressed, having a narrowly rounded venter and gently convergent flanks; umbilicus very small and deep; surface nearly smooth; septa rather crowded, showing sutures of *H. danica* type.

Description of the holotype.—The specimen has the following dimensions in millimeters:

stage	Diameter	Height	Breadth	B/H	Umbilicus
A: Last part of the preserved whorl	c. 380 (100)	c. 250 (0.66)	c. 170 (0.45)	0.68	c. 8 (0.02)
B: 1/4 whorl earlier than A	c. 340 (100)	c. 230 (0.68)	c. 150 (0.44)	0.65	
C: 1/2 whorl earlier than A	c. 250 (100)	c. 140 (0.56)	c. 100 (0.40)	0.71	

If the living chamber were completely preserved, the shell would be extremely large, presumably more than 400 mm in diameter.

The shell is nautiliconic and subdiscoidal, being ovoid in outline. The whorl is only moderately inflated, as illustrated by the frontal and ventral views (Text-fig. 5-1,3). The venter is narrowly but evenly rounded; the flanks are very broadly rounded; the umbilical shoulder is broad and gently rounded, passing to a steep umbilical wall. The maximum breadth is at about one quarter of the way up the side. The ratio of height to breadth of the whorl is 100:68. The umbilicus is not closed on the internal mould, but is extremely narrow, occupying approximately 2 percent of the diameter. The surface of the shell is smooth on the internal mould; it is not possible to detect any faint elevations, depressions or lines.

Several septa are visible where the whorl is 14 cm to 18 cm in height. They are crowded. It might be suggested that the specimen represents the gerontic stage. The suture is illustrated in Text-figs. 5, 6 and Plate 1. The suture has a broad rounded

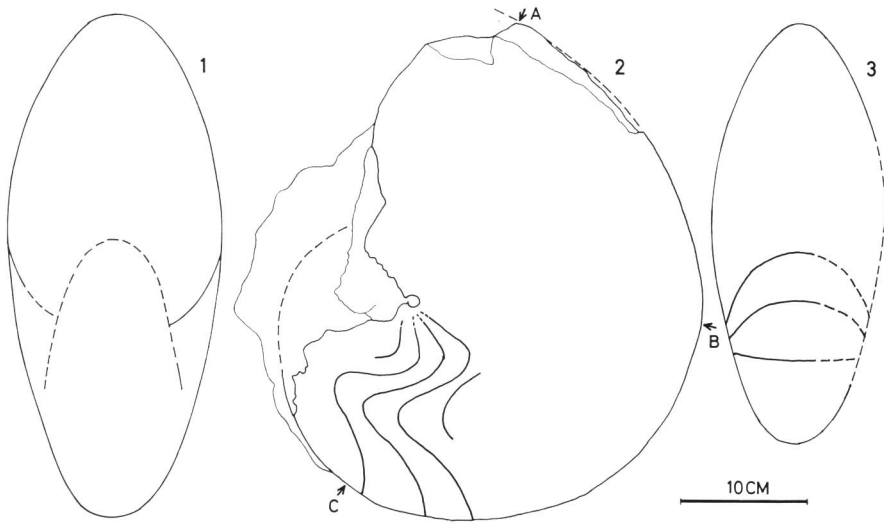


Fig. 5. *Hercoglossa majungaensis*, sp. nov. from loc. Mj 9-3' in the Majunga area. Frontal (1), lateral (2), and ventral (3) views of the holotype. A, B and C indicate the measured point of the shell diameter.

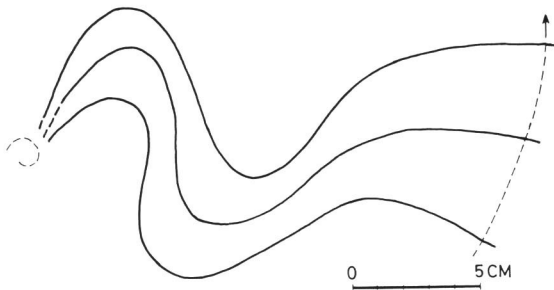


Fig. 6. Suture-lines of *Hercoglossa majungaensis*, sp. nov. from loc. Mj. 9-3' in the Majunga area.

ventral saddle, deep rounded lateral lobe and high rounded lateral saddle. The internal suture is not exposed. The character of the siphuncle is uncertain, because the exposed last section is that of the living chamber.

Remarks.—As only a single specimen is available, the extent of variation is regrettably unknown.

Comparison and affinity.—This species is certainly assignable to *Hercoglossa* in its nautilonic shell form, smooth surface and distinct suture-line. It is, however, clearly distinguished from *H. orbiculata* (TUOMEY), the type-species, from the Paleocene of Alaska, in its much compressed and slender type of whorl. In the latter species the venter is broader, the umbilical shoulder is much exaggerated and the ventral saddle is narrower than in the former.

Hercoglossa danica (SCHLOTHEIM) (RAVN, 1902, p. 242) is regarded as the most important index of the Danian age. The present species is allied to it in its similar type of suture, but distinguished from that species in its convergent flanks, narrower venter and greater height.

H. danica indica (SPENGLER) (COLLIGNON, 1951, p. 127) from the Danian of Madagascar shows a subglobular shell; it has a more depressed whorl, broader venter and a much exaggerated umbilical shoulder compared with the present species.

The present species is clearly distinguished from *H. madagascariensis* COLLIGNON (1951, p. 130), another Danian species from Madagascar, in its compressed whorl and narrower venter, moderate umbilical shoulder and wider lateral lobe.

Occurrence.—see the description in the preceding chapter.

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Explanation of Plates**Plate 1**

Hercoglossa majungaensis sp. nov., $\times 1/3$

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Lateral view of the holotype from loc. Mj 9-3', Majunga area.

Plate 2

Hercoglossa majungaensis sp. nov., $\times 1/3$.

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Frontal (a) and ventral (b) views of the holotype from loc. Mj 9-3', Majunga area.



