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DICTYOCONUS ARABICUS HENSON (FORAMINIFERIDA) FROM THE LATE BARREMIAN OF THE LHASA BLOCK (CENTRAL TIBET)

AYMON BAUD*, ANTONIETTA CHERCHI** & ROLF SCHROEDER***

Key-words: Foraminiferida, Taxonomy, Biostratigraphy, Barremian, Central Tibet.

Riassunto. Viene segnalata per la prima volta la presenza di *Dictyoconus arabicus* Henson nell'altopiano tibetano (strada Coqen-Gerze, blocco di Lhasa, Tibet centrale). Sulla base dei principali dati noti in letteratura questa specie appare nel Barremiano superiore e si rinviene probabilmente fino all'Aptiano inferiore. Il grado di evoluzione intraspecifica degli esemplari studiati indica un'età barremiana superiore. Questa datazione permette di affermare che nel blocco di Lhasa la trasgressione cretacica si è attuata nello stesso intervallo di tempo.

Abstract. The orbitolinid foraminifer *Dictyoconus arabicus* Henson is described for the first time from the Tibetan plateau (Coqen-Gerze road, Lhasa block, Central Tibet). A discussion of the principal published data reveals that this species occurs in the Late Barremian, probably ranging to the Early Aptian. The intraspecific evolutionary degree of the studied specimens indicates a Late Barremian age. This dating leads to the conclusion that the Cretaceous marine ingression in the Lhasa block took place during the same time interval.

Introduction.

During the execution of the geotraverse through central Tibet in summer 1985, one of the authors (A.B.) was able to collect samples along the Coqen-Gerze main road (Central Tibet). This area belongs to the northern part of the Lhasa block (Fig. 1). This block, a part of the Tibetan plateau, is bounded to the north by the major Bangong-Nujiang suture zone (Fig. 2).

Whereas a lot of biostratigraphical data concerning the geology of the northern Lhasa block units, cropping out along the Lhasa-Golmud highway and in the Xainxa and Donqiao areas, have been published (Smith, 1988; Smith & Xu Juntao, 1988;

* Musée géologique, UNIL-BFSH 2, CH-1015 Lausanne, Switzerland.

** Dipartimento di Scienze della Terra dell'Università di Cagliari, via Trentino 51, I-09100 Cagliari, Italy.

*** Geologisch-Paläontologisches Institut der Johann Wolfgang Goethe-Universität, Senckenberg-Anlage 32 - 34, D-60325 Frankfurt a.M., Germany.

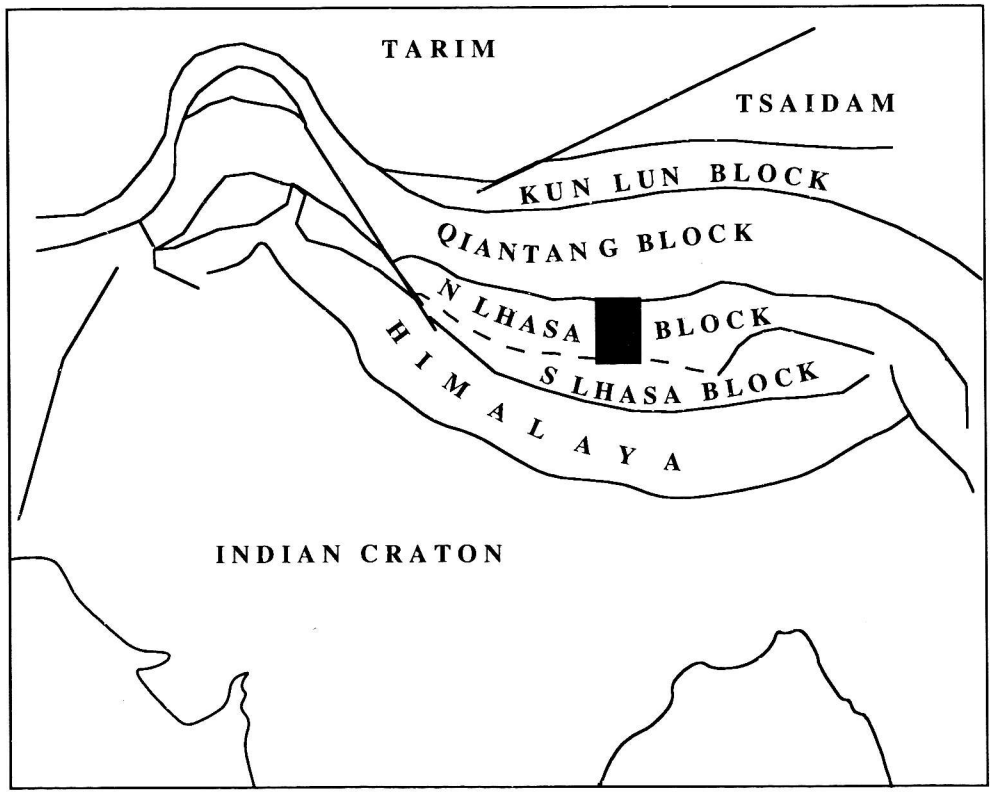

Fig. 1 - Main tectonic units and location of the Coqen-Gerze area (Fig. 2).

Girardeau et al., 1985; Marcoux et al., 1987; Baud, 1989), there is no report from the Coqen to Gerze area.

Geology.

The main geological features of the studied area are shown in Fig. 2 on the basis of the geological map of Tibet (1988) and personal observations (A.B.).

South of the Bangong-Nujiang suture zone, folded and thrusted Cretaceous Orbitolinidae-bearing limestones crop out forming an E-W oriented range. Southwest of it, the Aling Gangri mountains have about the same orientation and consist of thrusted Mesozoic rocks, mainly Cretaceous in age, with large granitic intrusions. East of the Aling Gangri mountains there is an unnamed range, about 50 km long and N-S oriented. Paleozoic black slates crop out in the central and eastern part of the unnamed range. Various lithological units, Late Jurassic to mid Cretaceous in age, are in tectonic contact with the Paleozoic slate. These units consist of Jurassic flysch, conglomerates, sandstones and stratified limestones (Zigetang Formation, Late Jurassic to

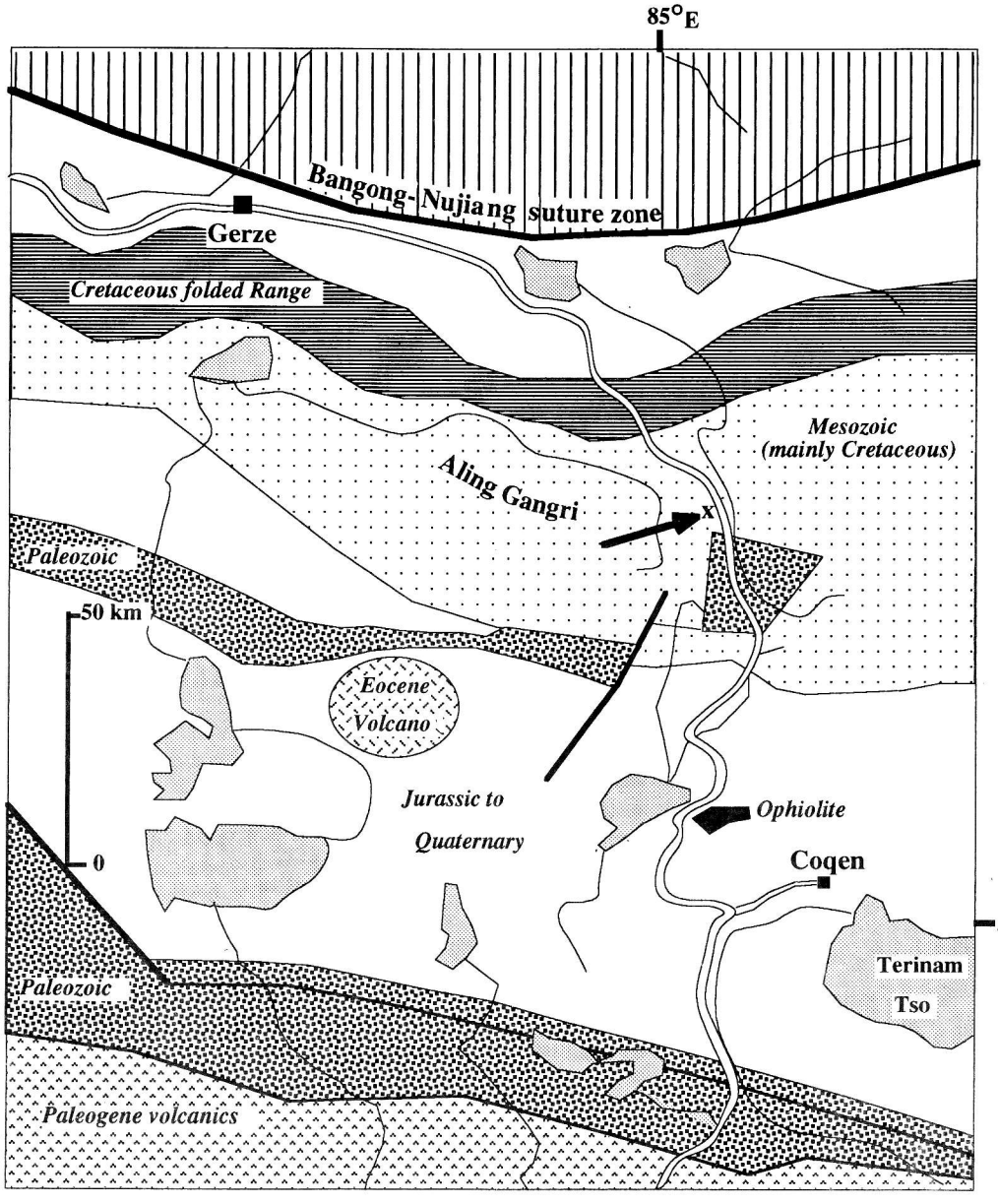

Fig. 2 - Geological sketch of the Coqen-Gerze area (Central Tibet). The arrow indicates the location of the sample with *Dictyoconus arabicus*.

Early Cretaceous), and Cretaceous red terrigenous clastics stratigraphically overlying ophiolitic rocks.

The sample we discuss here was collected on the eastern flank of the N-S unnamed range, close to the Gerze road, about 10 km along an unnamed pass (arrow in

Fig. 2). The location is 85°08'30" E, 31°39'00" N at 5100 m altitude. The beds exposed belong to the Zigetang Formation and consist of well stratified, Orbitolinidae- bearing, grey limestone, at least 200 m in thickness, with dark lava flows and ignimbrites in the middle part. The sample comes from the basal part of the section, but the contact with the underlying Paleozoic slates is not visible.

Facies and fossils of the studied sample.

The studied sample is a grainstone with aggregate grains, isolated fossil fragments and rare detrital quartz grains.

Echinoderm remains (e.g., echinoid spines) are the most frequent biogenic component. Some sponge skeletal fragments belong to two structural types. The first is documented by a single longitudinal section (Pl. 2, fig. 2) showing numerous, more or less globular spicules (0.03 mm in diameter). More frequent is the second type (Pl. 2, fig. 1) containing relatively large, kidney-shaped sterrasters (0.1-0.15 mm), also occurring as isolated elements in the sparitic matrix and within the aggregate grains. Similar sponge skeletons, consisting nearly exclusively of sterrasters, were already described by Cherchi & Schroeder (1988) from the Late Permian of Djebel Tebaga (Tunisia) (order ? Choristida Sollas) and from the Early Cretaceous of Tibet (*Pseudomillestroma reticulata* Deng, 1982).

Other biogenic components are fragments of serpulid tubes, nerineid gastropods, corals, bivalve shells, and algae (*Cayeuxia*-like forms and *Arabicodium* sp.).

Of special interest are encrusted masses of irregular micritic network becoming more orderly externally (Pl. 2, fig. 4). The inner, coarsely-meshed part of these still problematic microfossils was originally described as *Bacinella* Radoicic; the outer, relatively regular part was assigned to *Lithocodium* Elliott. The frequent co-occurrence of these two genera induced Segonzac & Marin (1973) to interpret *Bacinella* as an early ontogenetic stage of *Lithocodium*. However, according to Leinfelder et al. (1993), *Lithocodium* commonly occurs alone, directly overlying a hard substrate. Therefore, these latter authors regard again *Bacinella* and *Lithocodium* as two different organisms.

Foraminifera are mainly represented by the orbitolinid *Dictyoconus arabicus* Henson. Other forms are extremely rare; we have observed only some small miliolids and a fragment of an indeterminable encrusting genus.

Description of *Dictyoconus arabicus* Henson from Central Tibet.

Family *Orbitolinidae* Martin, 1889

Genus *Dictyoconus* Blanckenhorn, 1900

Dictyoconus arabicus Henson, 1948

Pl. 1, fig. 1-6; Pl. 2, fig. 3, 5

1948 *Dictyoconus arabicus* Henson, pp. 35-36, pl. 1, fig. 5-8; pl. 14, fig. 1-12.
1966 *Dictyoconus arabicus* - Hofker, p. 19, pl. 6, fig. 5, 6.
1970 *Paleodictyoconus arabicus* - Saint-Marc, p. 225, pl. 1, fig. 15.
1978 *Paleodictyoconus arabicus* - Schroeder, Cherchi, Guellal & Vila, p. 244, pl. 1, fig. 8, 9; pl. 2, fig. 9, 10.
1979 *Paleodictyoconus arabicus* - Schroeder & Cherchi, p. 575, pl. 1, fig. 3-7; pl. 2, fig. 1, 2, 4, 5.

Description. The conical tests (apical angle: 65°-75°) have a diameter of 1.5-2.0 mm and a height of 1.2-1.5 mm. The eccentric embryo is always eroded (Pl. 2, fig. 3). The chamber layers, averaging 13-14 per millimetre of the test surface, are exclusively disc-shaped and convex in growth direction; therefore, the ventral surface of tests is convex or occasionally (in adult specimens) nearly planar.

Transversal sections through the outer part of the central zone show radially directed, rudimentary partitions (Pl. 1, fig. 2), which are the prolongations of the walls of the marginal chamberlets. The inner part of the central zone, however, is characterized by the presence of vermicular or pillar-like structures (Pl. 1, fig. 6).

Each marginal chamberlet is subdivided by one horizontal (Pl. 1, fig. 3; Pl. 2, fig. 3) and one or two vertical plates (Pl. 1, fig. 2) in 4-6 subepidermal chamberlets.

Remarks. *Dictyoconus arabicus* differs from other species of this genus by the presence of interseptal pillars merging into rudimentary partitions. These latter are vermicular in the inner part and radially directed in the outer part of the central zone. Therefore, this species was attributed for the first time by Schroeder et al. (1968) to the genus *Paleodictyoconus* Moullade, 1965, which shows similar structures. However, a final decision on the systematic position of *D. arabicus* should be made after a restudy of these taxa.

Dictyoconus arabicus grades into *Rectodictyoconus giganteus* Schroeder, 1964 (Schroeder in Correia et al., 1982), which is distinguished from its direct ancestor *D. arabicus* mainly by its centrically situated embryo with a subdivided deuteroconch. Comparing additional data from the original descriptions of these two species (Henson, 1948; Schroeder, 1964), *R. giganteus* differs from *D. arabicus* furthermore:

1) by its larger test (3-4 mm in height, 4-5 mm in diameter) (*D. arabicus*: 1.7 [max. 2.0] mm in height, 2.4 [max. 3.2] mm in diameter);
2) by a relatively small number (7-8) of chambers per millimetre of the test surface (15 in *D. arabicus*, measured in axial direction);
3) by its more complex marginal zone showing 3 vertical and up to 5 horizontal plates per marginal chamberlet (*D. arabicus*: 3 vertical, but mostly 1 horizontal plate).

Unfortunately, the embryonic structures of the Tibetan specimens are always eroded. However, their tests are considerably smaller than typical *R. giganteus* and even somewhat smaller than *D. arabicus* from the type-locality. The subdivision of the marginal zone of the Tibetan material agrees well with that of *D. arabicus*. For these reasons we assign these specimens to the latter species.

Age of the sample.

From all taxa mentioned above only *Dictyoconus arabicus* is age-diagnostic.

This species was first described by Henson (1948) from the "Barremian?" of the Qatar peninsula (Arabia), where it occurs together with "*Orbitolina discoidea* var. *delicata*" Henson (= *Palorbitolina lenticularis*; see Schroeder, 1963) and *Choffatella decipiens*. Although the presence of *P. lenticularis* excludes an Early Barremian age, this latter species ranges up to the early Late Aptian, thus an Early Aptian age of the type-material of *D. arabicus* is possible.

In the western Mediterranean region, *D. arabicus* was recorded by Schroeder et al. (1978) from various localities of the Constantine region (northeastern Algeria). There, the species always occurs with *Palorbitolina lenticularis*, and in one instance (Gramont & Lombard, 1967) with numerous Barremian cephalopods. It was therefore dated by Schroeder et al. (1978) as latest Barremian.

In Lebanon, *D. arabicus* was reported by Saint-Marc (1970) (the specimen figured by that author on pl. 1, fig. 15 shows a somewhat eccentric embryo) from the lower half of the so-called "Falaise de Blanche". This formation contains in its uppermost part *Praeorbitolina wienandsi* Schroeder (erroneously determined as "*Mesorbitolina lotzei*" by Saint-Marc), a characteristic species of the late Early Aptian. It is therefore possible that *D. arabicus* ranges up into the Aptian.

Schroeder & Cherchi (1979) described *Dictyoconus arabicus* occurring together with *Palorbitolina lenticularis* from the Grand Banks continental rise, northwestern Atlantic (DSDP Leg 43, Site 384). The overlap of the stratigraphical ranges of the two species suggests a Late Barremian to Early Aptian age. The same age was proposed for *D. arabicus* from Eastern Algarve (Southern Portugal), where this species occurs together with relatively primitive palorbitolinas (Correia et al., 1982).

All these data indicate that *Dictyoconus arabicus* is certainly of Late Barremian age, but it is safe to assume that this species can range as high as the Lower Aptian. The relatively low intraspecific evolutionary degree of the Tibetan specimens, described in this paper, suggests a Late Barremian age.

Dictyoconus arabicus was also reported from several other localities of the Tethyan realm; however, the citations listed below are either not accompanied by figures or the figured specimens do not show the characteristic structures allowing a reliable differentiation from *Rectodictyoconus giganteus*.

The lower part of the Urgonian of the Ukrainian Carpathians (Marmorosch Klippen zone), passing laterally into Upper Barremian marls with *Barremites strettostoma* (Chernov & Yanin, 1979), contains *Dictyoconus arabicus* and/or *Rectodictyoconus giganteus*, which were previously described as "*Paleodictyoconus* cf. *cuvillieri* (Foury)" by Chernov et al. (1980) and later revised by Peybernès et al. (1988). Unfortunately, the revision made by Peybernès et al. (1988) is not accompanied by figures, and the specimens figured by Chernov et al. (1980) do not show the characteristic structures that allow a specific determination.

Peybernès et al. (1988) reported "*Dictyoconus* gr. *arabicus-balcanicus*" (the latter species being a synonym of *D. arabicus*) from the Urgonian of the Dziroula massif (Georgia), which is overlain at Gorecka by glauconitic marly limestones with Late Barremian ammonites. The same authors also mentioned "*Palorbitolina lenticularis, Dictyoconus* gr. *arabicus-balcanicus, D. giganteus, Paleodictyoconus cuvillieri*" from the Urgonian of Alikulishagi (Azerbaidjan).

In Central Iran (region of Esfahan) "*Dictyoconus arabicus*" was cited and figured by Seyed-Emami et al. (1971) (oblique section: pl. 3, fig. 3) from the "Lower *Orbitolina* limestone", which contains also "*Orbitolina lenticularis*". This limestone is underlain by yellow dolomites with *Matheronites* (= *Hemihoplites*) *soulieri* (Matheron) indicating a Late Barremian age, and is followed by "*Orbitolina*"-bearing shales and marls with *Prodeshayesites tenuicostatus* (Koenen), *P. bodei* (Koenen), and *Deshayesites* cf. *deshayesi* (d'Orbigny), indicating an Early Aptian age. The "Lower *Orbitolina* limestone" was regarded by Seyed-Emami et al. (1971) as Late Barremian in age (however, "Upper Barremian-Lower Aptian" in the caption).

The orbitolinid foraminifera described by Mamontova (1961) as *Dictyoconus walnutensis* (Carsey) and *Dictyoconus arabicus* from the "Lower Barremian" of Kopet-Dag (Turkmenistan) probably belong to the latter species (Schroeder & Cherchi, 1979), which is likewise present in the Iranian part of these mountains (personal observations).

In Central Afghanistan, beds containing *D. arabicus* have been reported from the region of Taiwara (Farah Rud basin), where they are overlain by pink limestones with *Praeorbitolina* sp. and *Rectodictyoconus giganteus* (Montenat et al., 1982); the latter association was already recorded from the same area by Schroeder & de Lapparent (1967).

Eastward of Afghanistan, *Dictyoconus arabicus* was unknown till now. Its occurrence in the Coqen-Gerze area (Lhasa block) is the first documentation of this species in the entire Himalayan region.

Several authors (Girardeau et al., 1985; Marcoux et al., 1987) have studied the Mesozoic series of the Lhasa block in the region of Xainxa, which is situated east of Coqen-Gerze area. There, the sequence begins with a continental clastic member (less than 500 m thick), which is overlain by several hundred metres thick Orbitolinidae-bearing limestones. According to Marcoux et al. (1987), the lowermost part of these limestones (basal part of "unit A") contains *Palorbitolina lenticularis* (Blumenbach), *Praeorbitolina* sp. and one section of *Orbitolina* (*Mesorbitolina*) *texana* (Roemer). A similar faunal association was reported by the same authors from the Daqin area (about 180 km southeast of Xainxa): *Palorbitolina lenticularis, Praeorbitolina cormyi* Schroeder and *Orbitolina* (*Mesorbitolina*) *texana parva* Douglass. These two associations indicate an age close to the Early/Late Aptian boundary.

However, the occurrence of relatively primitive *Dictyoconus arabicus* from the Coqen-Gerze area suggests that the Cretaceous marine ingression in the Lhasa block (at least in some regions) was already taking place during the Late Barremian or even

somewhat earlier. This latter statement is also supported by the discovery of "*Eopalorbitolina*" near Baingoin, approx. 130 km northwest of Lhasa (det. J. Whittaker and M. Simmons in Smith & Xu Juntao, 1988, p. 91, pl. 1, fig. 8). *Eopalorbitolina* is actually regarded as a synonym of *Valserina* (Schroeder, 1993); this genus represents the direct ancestral group of the palorbitolinas, the latter being frequently associated with *Dictyoconus arabicus*.

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PLATE 1

Dictyoconus arabicus Henson, 1948

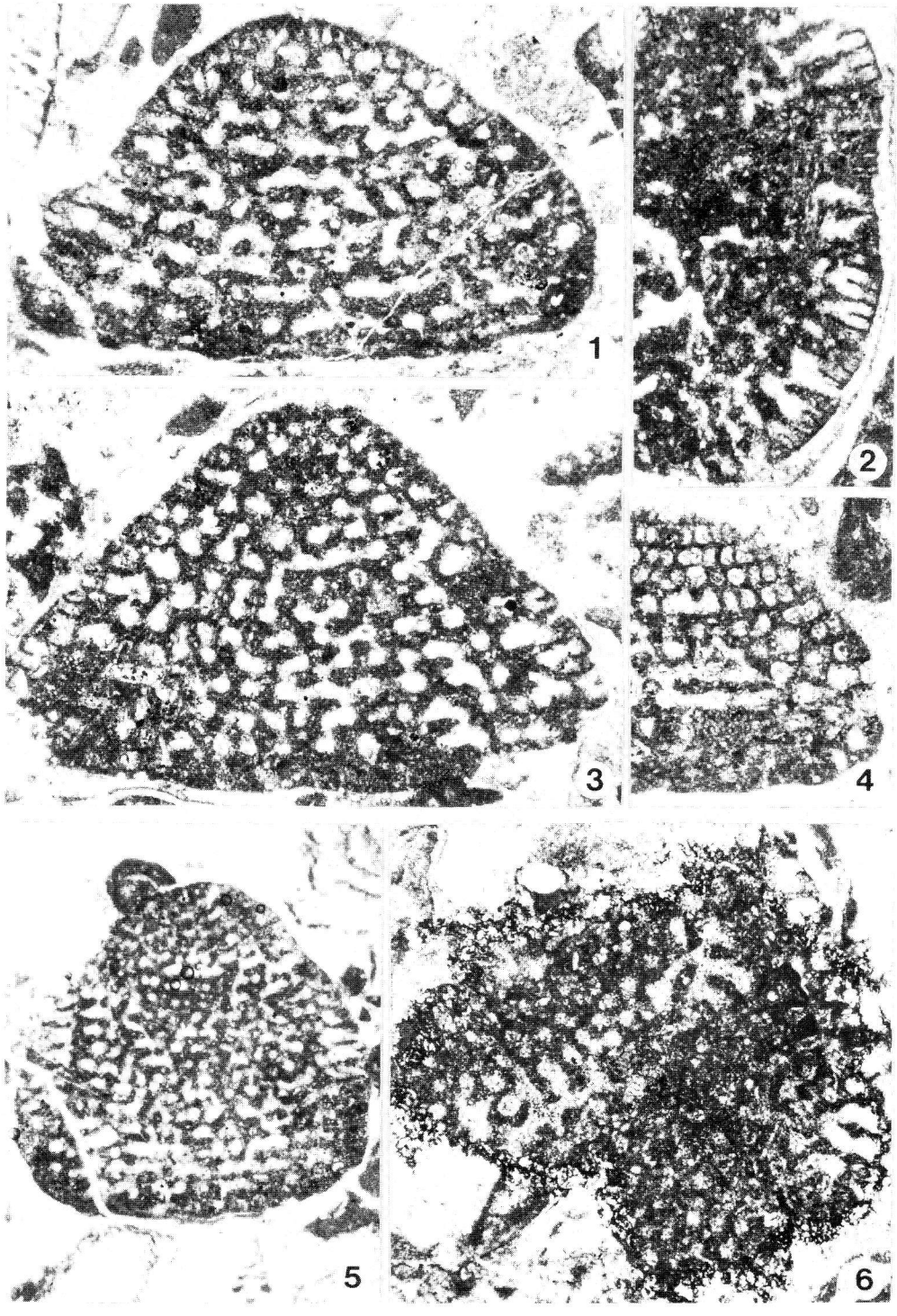
Fig. 1 - Vertical section. 203/6 (x 50).
Fig. 2 - Transversal section (detail) showing the marginal zone with vertical subepidermal plates and a part of the central zone with some rudimentary developed radial partitions. 203/8 (x 50).
Fig. 3 - Subaxial section. 203/7 (x 50).
Fig. 4 - Oblique tangential section showing in the upper part the subdivision of marginal chamberlets by vertical subepidermal plates. 203/8 (x 50).
Fig. 5 - Oblique subaxial section. 203/4 (x 35).
Fig. 6 - Transversal section showing within the central zone vermicular partitions and numerous orifices (white points) piercing the septa. 203/4 (x 50).

Coqen-Gerze main road (Central Tibet). Late Barremian.

PLATE 2

Fig. 1 - Transversal section through a sponge fragment showing numerous reniform spicules. 203/1 (x 50).
Fig. 2 - Longitudinal section through a sponge fragment showing numerous sterrasters in the left part. 203/7 (x 40).
Fig. 3 - *Dictyoconus arabicus* Henson, 1948. Axial section. 203/6 (x 50).
Fig. 4 - *Lithocodium-Bacinella* association. 203/6 (x 30).
Fig. 5 - *Dictyoconus arabicus* Henson, 1948. Vertical section. 203/7 (x 50).

Coqen-Gerze main road (Central Tibet). Late Barremian.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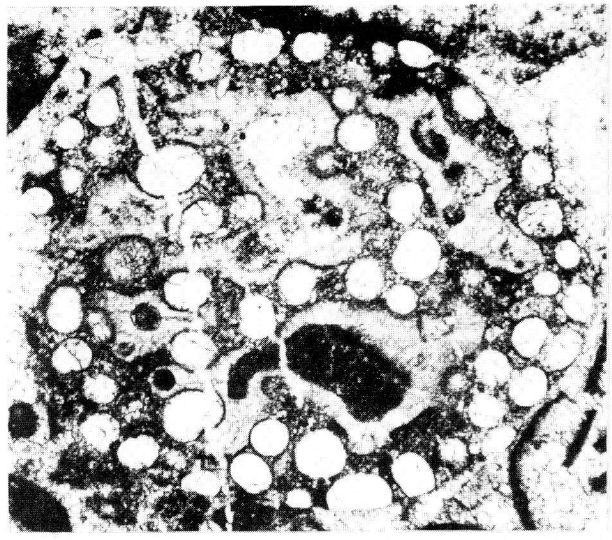

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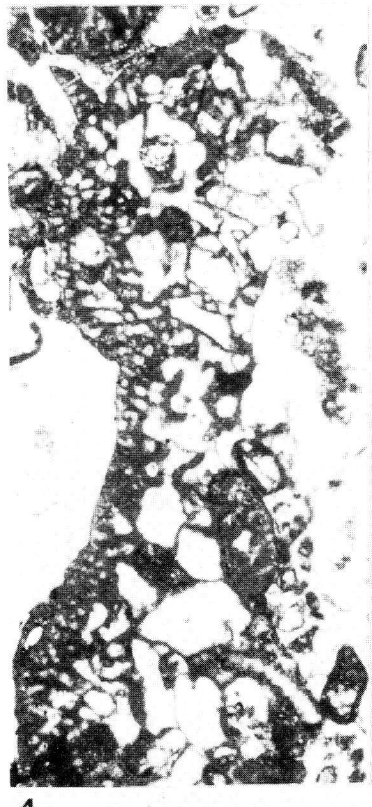

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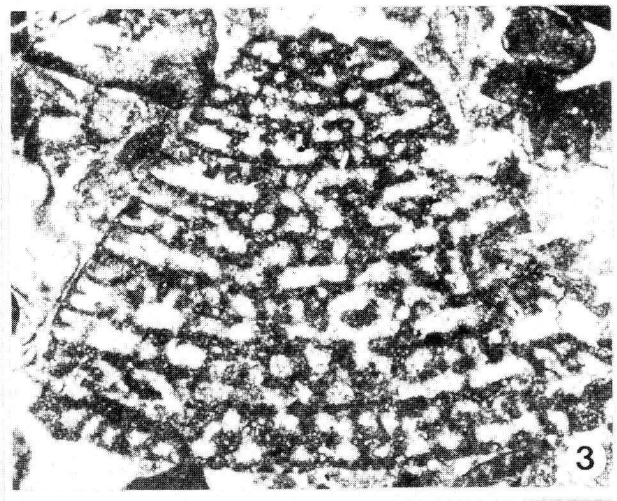

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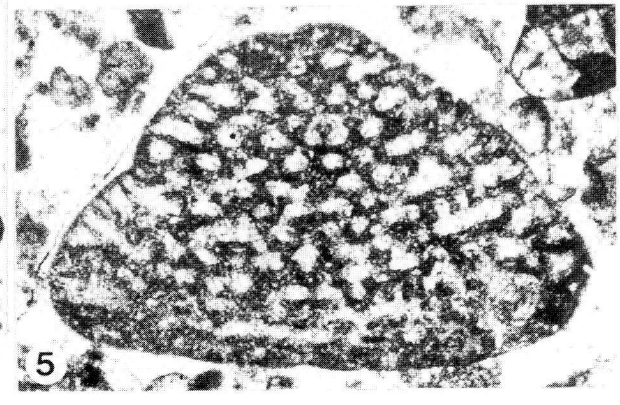

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