



## ON ORBITOLINA (FORAMINIFERA) FROM THE SHYOK SUTURE ZONE, LADAKH, NW INDIA

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### ABSTRACT

The orbitolinid foraminifera from the Lower Shyok Formation, Shyok Suture Zone, Kashmir, NW India are described for the first time, and the fauna is dated as the Early to Middle Albian.

**Keywords:** *Mesorbitolina minuta*, *M. texana*, *Simplorbitolina* cf. *conulus*, *S. sp.*, Lower Shyok Formation, Shyok Suture Zone, Ladakh

### INTRODUCTION

The *Orbitolina*-bearing limestone samples collected from the lower Shyok Formation in the Shyok Suture Zone between Leh and Lake Pangon So, Ladakh, NW India have been examined by means of random thin sections (Figs. 1-4). The *Orbitolina* limestone is located at 34°06' 35"North Lat. and 78°00' 10" East Long. (Figs. 2-3). This limestone conformably overlies the conglomerate with limestone lens, which covers the sandstone with thin mudstone. They belong to the lower part of the Shyok Formation, which unconformably (?) overlies the Tsoltak Formation (Ehiro *et al.*, 2006) (Fig. 4). Reuber (1990) reported the occurrence of orbitolinid foraminifera probably from the same horizon and the same region, but not yet described. Seven thin sections of the limestone show that four species of orbitolinid foraminifera are present, all of which have been weakly deformed by tectonic stress. Genera which could be recognized are the *Mesorbitolina* and *Simplorbitolina*, and two species could be referred to *Mesorbitolina minuta* (Douglass, 1960) and *M. texana* (Roemer, 1849). Others are referred to *Simplorbitolina* cf. *conulus* Schroeder, 1965 and *S.*

sp. The orbitolinid fauna indicates Early to Middle Albian age to the limestone bed of the lower Shyok Formation.

### SYSTEMATIC DESCRIPTION

*Superfamily Orbitolinoidea* Martin, 1890

*Family Orbitolinidae* Martin, 1890

*Subfamily Orbitolininae* Martin, 1890

*Genus Mesorbitolina* Schroeder, 1962

*Mesorbitolina minuta* (Douglass)

(Pl. I, figs. 1-2, 4; Pl. II, figs. 2, 5; Pl. III, figs. 1, 3)

*Orbitolina tibetica* Cotter.- Sahni and Sastri, 1957 (parts), p. 23, pl. 3, figs. 1, 3.

*Orbitolina minuta* Douglass, 1960, p. 36-38, pl. 7, figs. 6-9, 24-25.

*Orbitolina oculata* Douglass, 1960, p. 39-41, pl. 10, figs. 13-15.

*Orbitolina gracilis* Douglass, 1960, p. 42-43, pl. 12, figs. 13-14.

*Orbitolina crassa* Douglass, 1960, p. 43-44, pl. 13, fig. 14.

*Orbitolina grossa* Douglass, 1960, p. 44-45, pl. 14, figs. 6-7.

*Orbitolina lenticularis* Blumenbach - Hofker, 1963 (parts), p. 220-230, pl. 7, figs. 16-18; pl. 8, figs. 2-6, 8-11, 14, 17; pl. 9, figs. 2-3; pl. 10, figs. 1, 4, 6; pl. 11, figs. 1-3, 5, 7-8, 10-13; pl. 12, figs. 1-3, 5, 7-8, 10-13; pl.

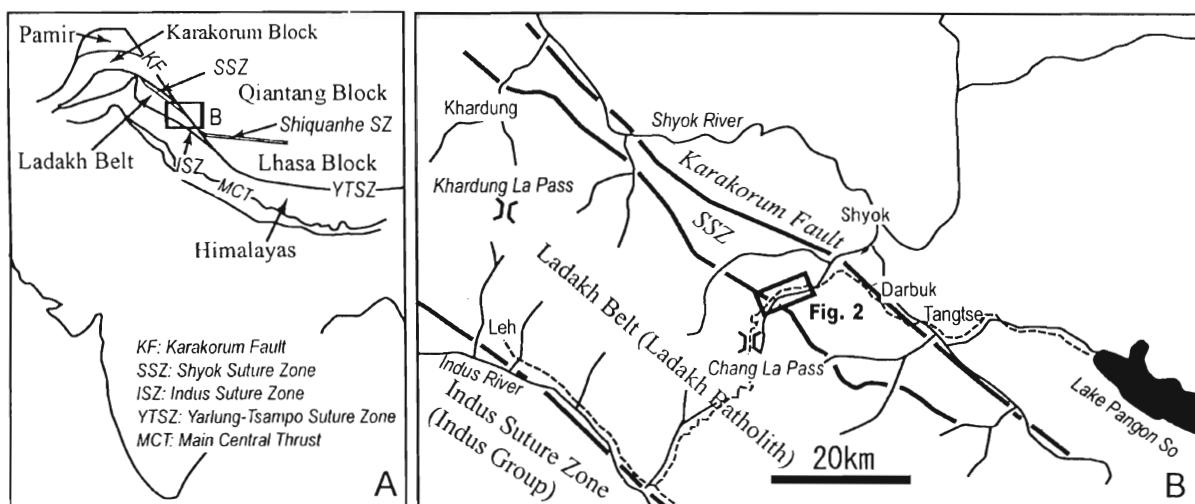


Fig. 1. Location map of the study area on a tectonic map of the Himalayas. *Orbitolina*-bearing limestone for study belongs to the Shyok Suture Zone (SSZ) (after Ehiro *et al.*, 2006).

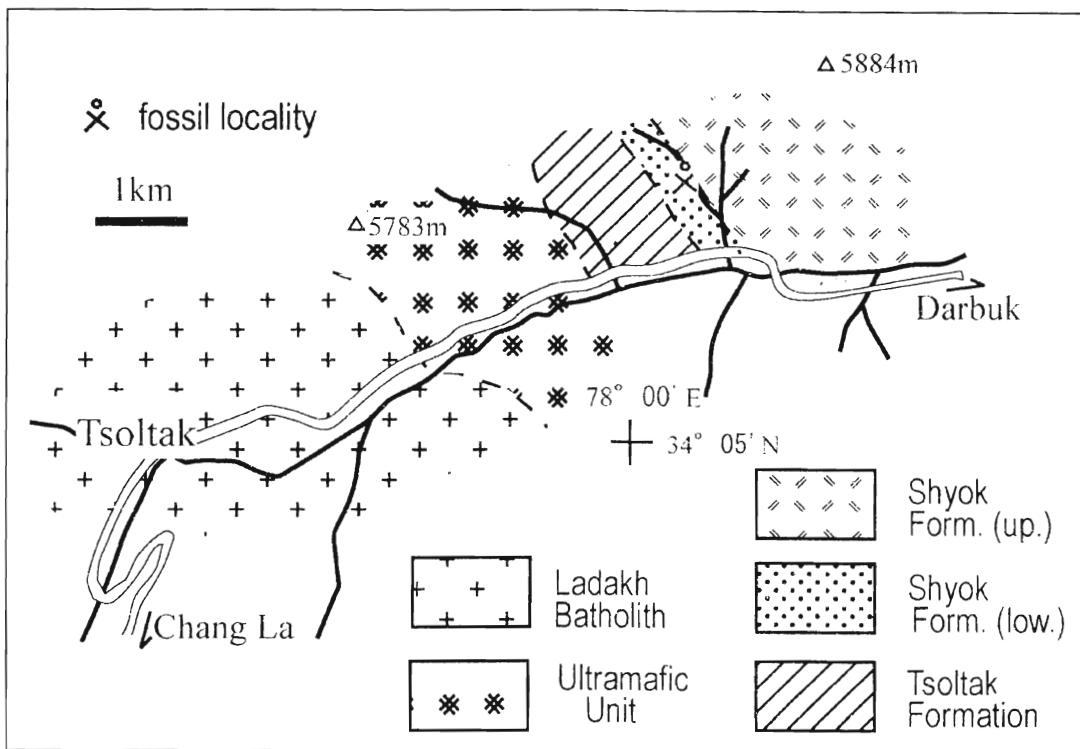


Fig. 2. Geologic outline of the study area, east of Tsoltak, Ladakh, showing the fossil locality.

13, figs. 1, 3, 5, 10, 13-14; pl. 14, fig. 12; pl. 16, figs. 2-5, 7, 14, 16. *Orbitolina (Mesorbitolina) minuta* (Douglass) - Moullade and Saint-Marc, 1975, p. 834, pl. 12, figs. 12-15; pl. 13, figs. 1-6.

**Description:** Test large, conical to high concavo-convex, with form ratio of 2.38 of diameter 3.72 mm to thickness of 1.56 mm (Pl. I, fig. 4); embryonic chambers consisting of subspherical protoconch, 208 x 200 micron in diameter and large deutoerconch, 440 micron in diameter (Pl. I, fig. 2); subembryonic chambers developed, 440 and 500 micron in diameter (Pl. I, figs. 2, 4); later chambers uniserial and discoidal, with thin marginal zone (Pl. I, figs. 1, 4; Pl. II, fig. 2; Pl. III, fig. 3), well developed radial zone (Pl. I, figs. 2, 4; Pl. III, fig. 3) and central complex zone (Pl. I, fig. 2; Pl. II, fig. 5; Pl. III, fig. 3); number of chambers, 16 per mm; wall agglutinated.

**Remarks:** The present form is assigned to *Mesorbitolina minuta* on the basis of similarity of size of protoconch diameter and subembryonic chambers with Moullade and Saint-Marc's (1975) diagram. Fossa Mancini (1928) found *Orbitolina pileus* (A-form) and *O. parma* (B-form) from Shushal near Leh, Ladakh, Jammu and Kashmir state. Hofker (1963, p. 228) regarded *O. pileus* to *O. lenticularis* form group II. *Orbitolina pileus* is similar to *O. minuta*, but is different from the latter in having large embryonic chambers and fewer number of chambers, i.e. 10 per mm, according to Sahni and Sastri (1957, p. 21). *Mesorbitolina minuta* is observed to be found in Bau 2005-99, Kalimantan (Borneo), Malaysia, and Aketo 8 and 33,

Tanohata-Cho, Miyako, Honshu, Japan (Matsumaru, 2005, MS) and Takisato (Kirigishi), Ashibetsu City, Hokkaido (Matsumaru and Furusawa, 2007, and Ladakh, India). It is thus known to have a wide geographical distribution from Kashmir, NW India to Hokkaido, Japan.

**Stratigraphic horizon:** *Orbitolina* limestone, lower Shyok Formation, Shyok Suture Zone, Ladakh.

**Geological age:** Early to Middle Albian, based on the joint occurrence with *Mesorbitolina texana* and *Simplorbitolina cf. conulus* (Moullade et al., 1985).

#### *Mesorbitolina texana* (Roemer)

(Pl. I, fig. 3; Pl. II, figs. 1, 3-4, 6; Pl. III, fig. 5)

*Orbitolina texana* (Roemer, 1849), p. 392. - Roemer, 1852, p. 86, pl. 10, figs. 7a-d.

*Orbitolina birmanica* Sahni. - Sahni and Sastri, 1957, p. 30-32, pl. 5, figs. 1-4, 6-7.

*Orbitolina texana* (Roemer). - Douglass, 1960, p. 34-36, pl. 6, figs. 1, 3-7.

*Orbitolina pervia* Douglass, 1960, p. 41-42, pl. 11, figs. 13, 15.

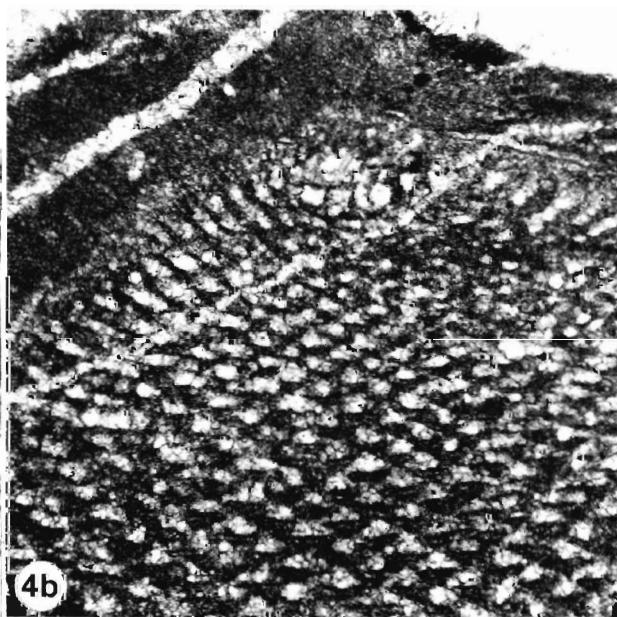
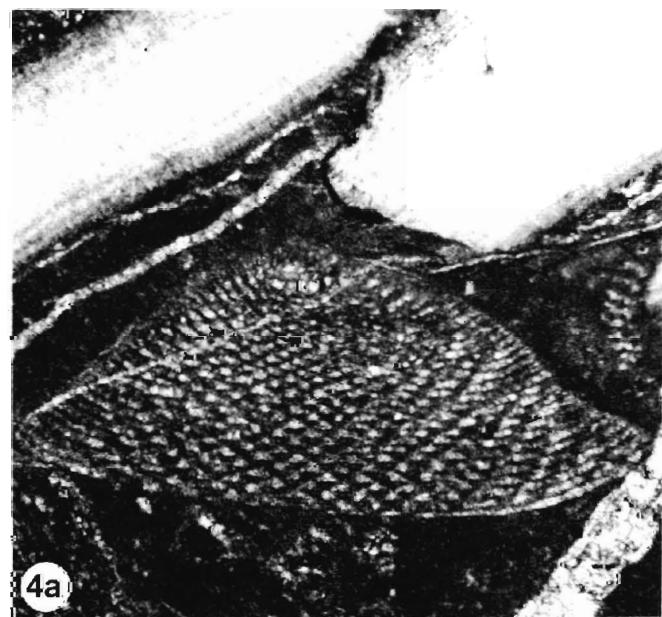
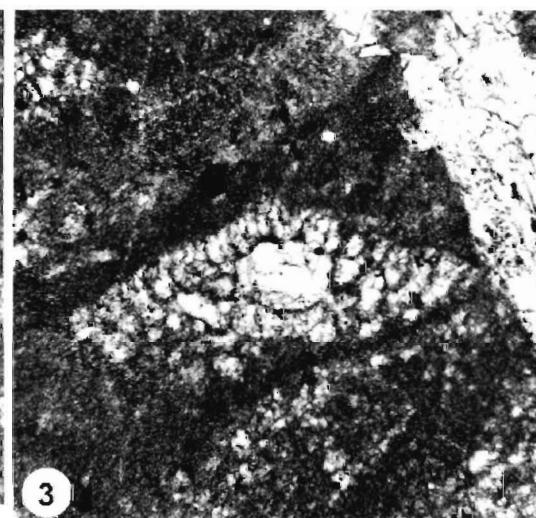
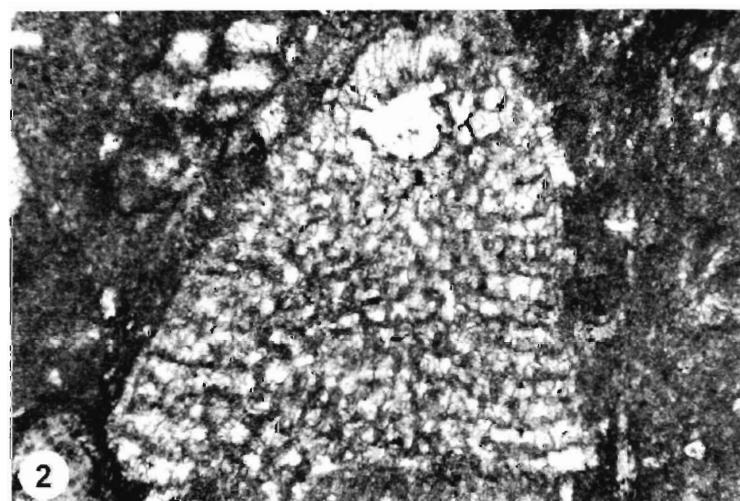
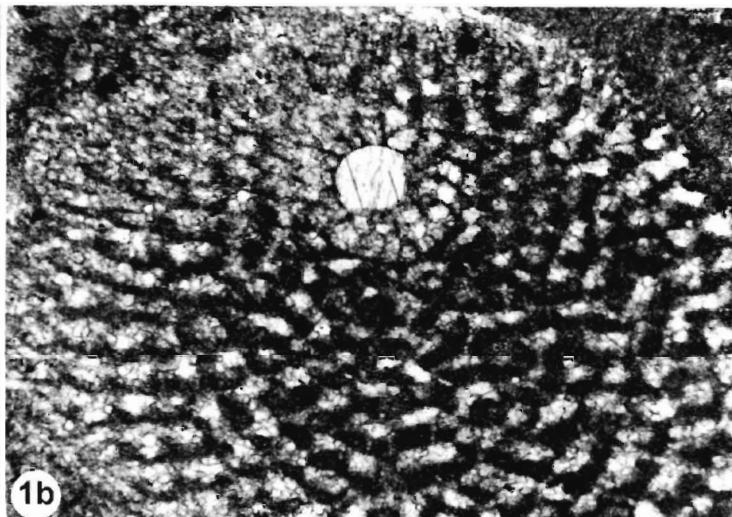
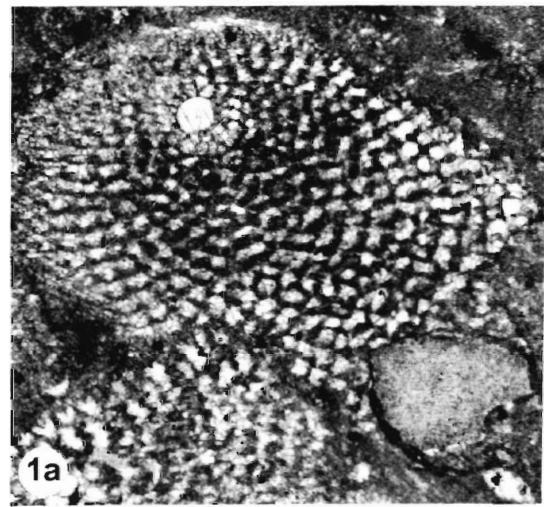
*Orbitolina lenticularis* Blumenbach - Hofker, 1963 (parts), p. 220-230, pl. 9, fig. 1; pl. 10, figs. 13-14; pl. 11, fig. 1; pl. 12, figs. 14, 17; pl. 13, figs. 2, 4, 6, 8-9; pl. 14, figs. 1, 3, 5, 7, 9-10; pl. 15, figs. 6-7; pl. 16, figs. 1, 6, 8-13, 17-18.

*Orbitolina (Mesorbitolina) texana* (Roemer). - Moullade and Saint-Marc, 1975, p. 834-835, pl. 3, figs. 8-13; pl. 14, figs. 1-2.

#### EXPLANATION OF PLATE I

- 1-2,4. *Mesorbitolina minuta* (Douglass)
  1. Tangential section. 1a. x 25, 1b. x 45.
  2. Axial section. x 45.

4. Oblique section. 4a. x 25, 4b. x 45.
3. *Mesorbitolina texana* (Roemer)
  - Axial section. x 45.



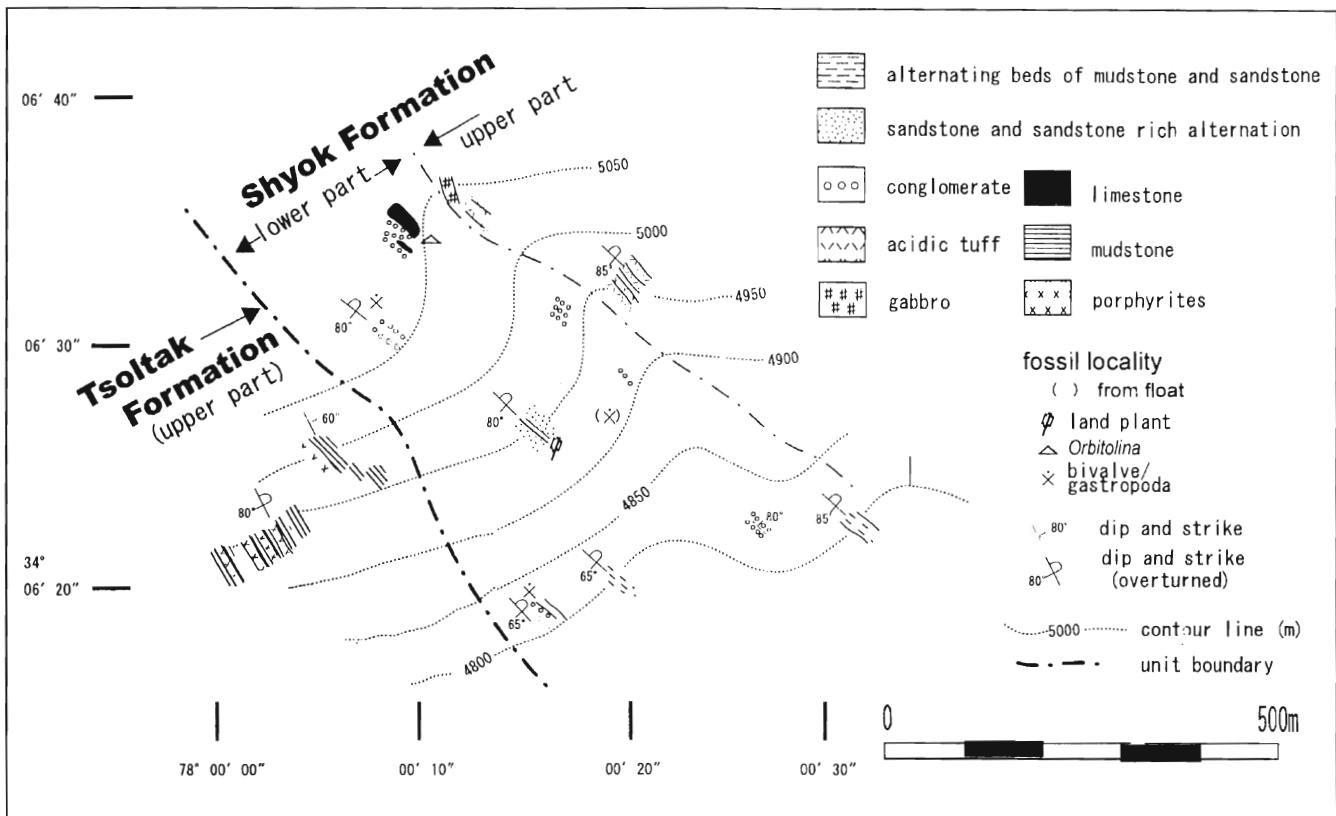


Fig. 3. Route map along the left bank slope of the Shyok derivative River about 8 km to the northeast of Tsoltak (Ehiro *et al.*, 2006).

**Description:** Test large, concavo-convex, with form ratio of 2.36 of diameter 5.20 mm to thickness of 2.20 mm (Pl. II, fig. 3) and form ratio of 2.54 of diameter of 9.33 mm to thickness of 3.68 mm (Pl. III, fig. 5); embryonic chambers consisting of subspherical protoconch, 288 x 200 micron in diameter and large deutoerconch, 680 micron in diameter (Pl. I, fig.3); subembryonic chambers developed, 660 micron in diameter; later chambers uniserial and discoidal, with thin marginal zone, well developed radial zone and central complex zone (Pl. II, figs. 1, 3-4, 6); number of chambers 11 to 13 per mm; wall agglutinated.

**Remarks:** The present form is assigned to *Mesorbitolina texana*, based on the similarity of size of protoconch and subembryonic chambers with Moullade and Saint-Marc's (1975) diagram.

**Stratigraphic horizon:** *Orbitolina* limestone, lower Shyok Formation, Shyok Suture Zone, Ladakh.

**Geological age:** Early to Middle Albian.

**Subfamily Dictyoconinae** Moullade, 1965

**Genus *Simplorbitolina*** Ciry and Rat, 1953

*Simplorbitolina* cf. *conulus* Schroeder, 1965

(Pl. III, figs. 2, 4.)

**Description:** Test high conical, with form ratio of 0.98 of

diameter of 4.00 mm to height of 4.08 mm; embryonic chambers at the apex not visible; chambers, uniserial and discoidal, increasing in diameter and divided into three zones: marginal zone, radial zone and reticulate central zone; marginal zone, subdivided by short vertical partitions and mostly lack horizontal partitions; cylindrical chamber passages, anastomose and form reticulate central zone.

**Remarks:** The present form is similar to *Orbitolina simplex* (Henson) reported by Hofker (1966, pl. 14-16), in its form ratio, though no embryonic chambers are observed. As Hofker's *O. simplex* is a synonym of *Simplorbitolina conulus* Schroeder, 1965, the present form is assigned to *Simplorbitolina* cf. *conulus*.

**Stratigraphic horizon:** *Orbitolina* limestone, lower Shyok Formation, Shyok Suture Zone, Ladakh.

**Geological age:** Early to Middle Albian.

*Simplorbitolina* sp.

(Pl. III, fig. 6)

**Description:** Test small, high conical, with pointed apex, and with form ratio of 0.55 of diameter of 1.44 mm to height of 2.64 mm; proloculus and neopionic chambers not visible; adult chamber layers uniserially and rectilinearly arranged, and chambers divided into marginal, radial and reticulate central

## EXPLANATION OF PLATE II

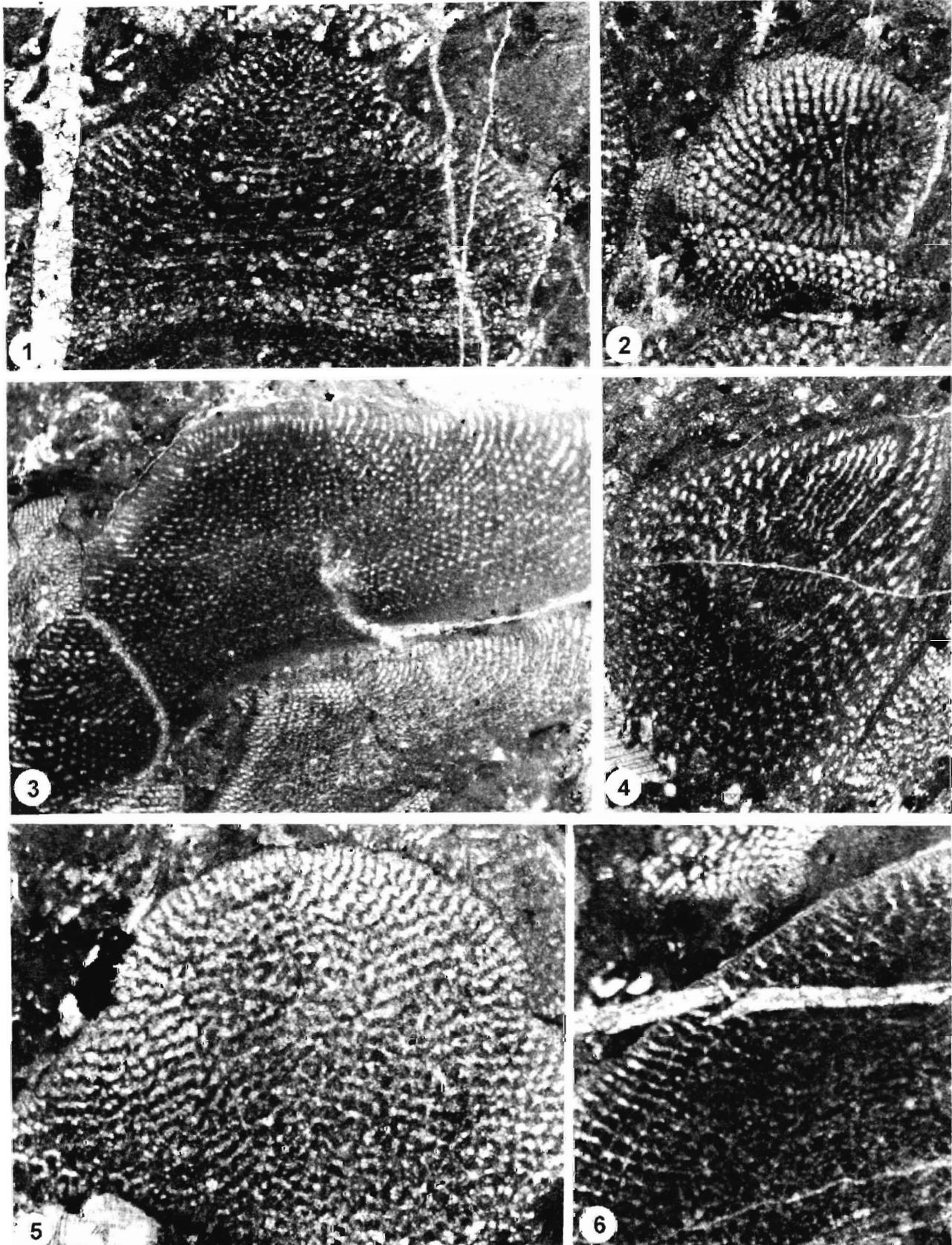
1, 3, 4, 6. *Mesorbitolina texana* (Rocmer)

1, 3. Axial sections. x 25.

4, 6. Oblique sections. x 25.

2, 5. *Mesorbitolina minuta* (Douglass)

Tangential sections. x 25.



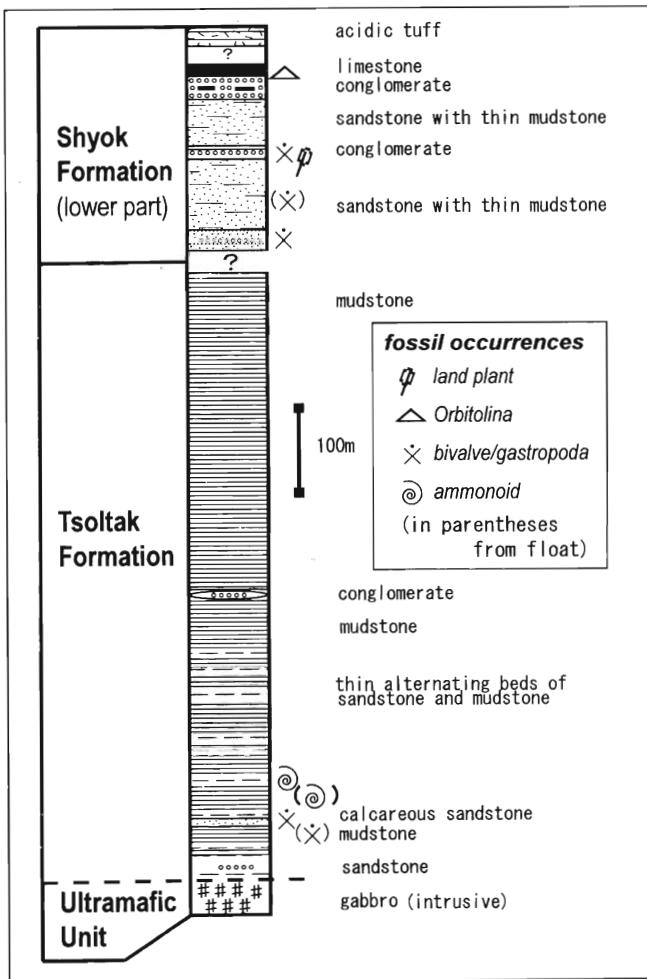


Fig. 4. Generalized columnar section of the Tsoltak Formation and the lower part of the Shyok Formation (Ehiro *et al.*, 2006).

zones; marginal zone subdivided by short vertical plates only and lack horizontal plates.

**Remarks:** The present form is rare in occurrence, and hence detailed observation on its morphological features cannot be made.

**Stratigraphic horizon:** *Orbitolina* limestone, lower Shyok Formation, Shyok Suture Zone, Ladakh.

**Geological age:** Early to Middle Albian.

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## EXPLANATION OF PLATE III

1, 3. *Mesorbitolina minuta* (Douglass)

1. Tangential section. x 12., 3. Axial section. x 12.

2, 4. *Simplorbitolina cf. conulus* Schroeder

Tangential sections. x 12.

5. *Mesorbitolina texana* (Roemer)

Axial section. x 12.

6. *Simplorbitolina* sp.

Tangential section. x 25.

