

Biostratigraphy of the Danian/Selandian transition: A case study from Kamestan anticline section, northwest of Izeh city in Khuzestan province, Southern Iran

Hadavandkhani*, N., Sadeghi, A.

Department of Geology, Faculty of Earth Science, University of Shahid beheshti, Tehran, Iran

*n.hadavand@yahoo.com

Abstract

The planktonic foraminifera turnover across the Danian-Selandian boundary (early to late Paleocene, ~60 Ma) has been studied in the Kamestan anticline section. The studied interval span planktonic foraminifera zones P2-P3. In this section Danian-Selandian boundary is located in Pabedeh – Gurpi Formations transition. Here, the boundary of Pabeh and Gurpi Formations is a transitional one and identified by with color change of from grey shale to purple shale of Gurpi Formation to Pabdeh Formation .

Keywords: Pabeh Formation, Gurpi Formation, Danian, Selandian, Izeh, Kamestan anticline, Biostratigraphy.

Introduction

The Danian, the lower stage of the Paleocene, was introduced by Desor (1847), who named it after its type area in Denmark. It consists of chalks and a limestone overlying the Maastrichtian chalks (Sprong et al, 2009). The Selandian, introduced by Rosenkrantz (1924) and emended by Perch-Nielsen and Hansen (1981), the type area which is near Copenhagen-Denmark, lies immediately above the Danian and is the middle stage of the Paleocene (Perch-Nielsen and Hansen, 1981; Berggren et al., 1985 and 1995). The Paleogene stages were accepted by the International Subcommission on Paleogene Stratigraphy at the 28th International Geological Congress in Washington, July, 1989. In this Congress, the Selandian was placed between the Danian and Thanetian Stages of the Paleocene (Jenkins and Luterbacher, 1992; Odin and Luterbacher, 1992). In the Geological Time Scale (1999) it is accepted as the basal stage of the Upper Paleocene.

The Selandian, the second Paleocene stage, also defined in Denmark, named after the island of Sjælland. In the type region, this stage is composed of greensands, marls and clays unconformably overlying the Danian limestones (Rosenkrantz, 1924; Thomsen and Heilmann-Clausen, 1985). Because correlation of the D/S boundary with standard biostratigraphic schemes such as Berggren (1994) and Berggren et al. (1995, 2000) proposed to correlate the D/S boundary with the P2/P3 zonal boundary (~60.9 Ma).

The Global Stratotype Section and Point (GSSP) of the base of the Selandian Stage has been recently defined in Zumaia in coincidence with a prominent lithological change between the Aitzgorri Limestone Formation and the overlying Itzurun Formation (northern Spain).

Geology and Lithostratigraphy

The studied section is located in northwest of Izeh city in Khuzestan province, southern Iran (Fig. 1). In the study area, the Danian Stage is represented by the upper part of Gurpi formation and the Selandian Stage is represented by the lower part of Pabdeh formatin (Fig 2) .Here, the Gurpi Formation has 341m thickness , that is composed of Shale and Marl, and deposited through Campanian-Danian (Mahdavian,A. 2009). The Pabdeh Formation has a thickness of 548m in the Kamestan Anticline and it can be divided into 4 lithological units, including Shale(133m), Limy marl(113m), Limestone(106m) and Marly limestone(196m). Based on stratigraphic record of the planktonic and benthonic foraminifera biozones, Pabdeh Formation is Late Paleocene (Selandian) – Middle Eocene in age.

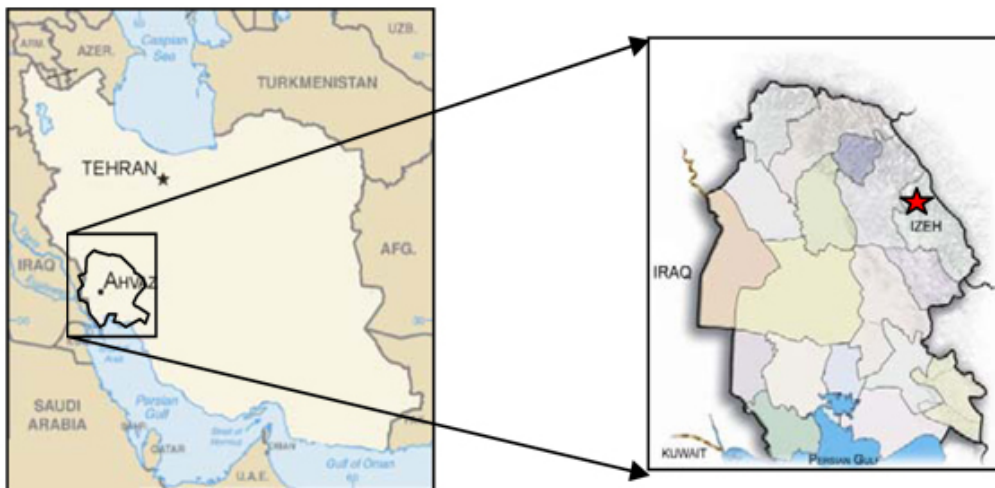


Fig 1: The location map of studied section, N-W of Izeh, Khuzestan province, Iran

Methods

For research about Danian-Selandian ,Pabdeh Formation was sampled in studied area, then the samples were soaked in water and washed through 70-120 μ m sieves. All samples were studied for foraminifer taxa by using transmit light microscope and scanning electron microscope.

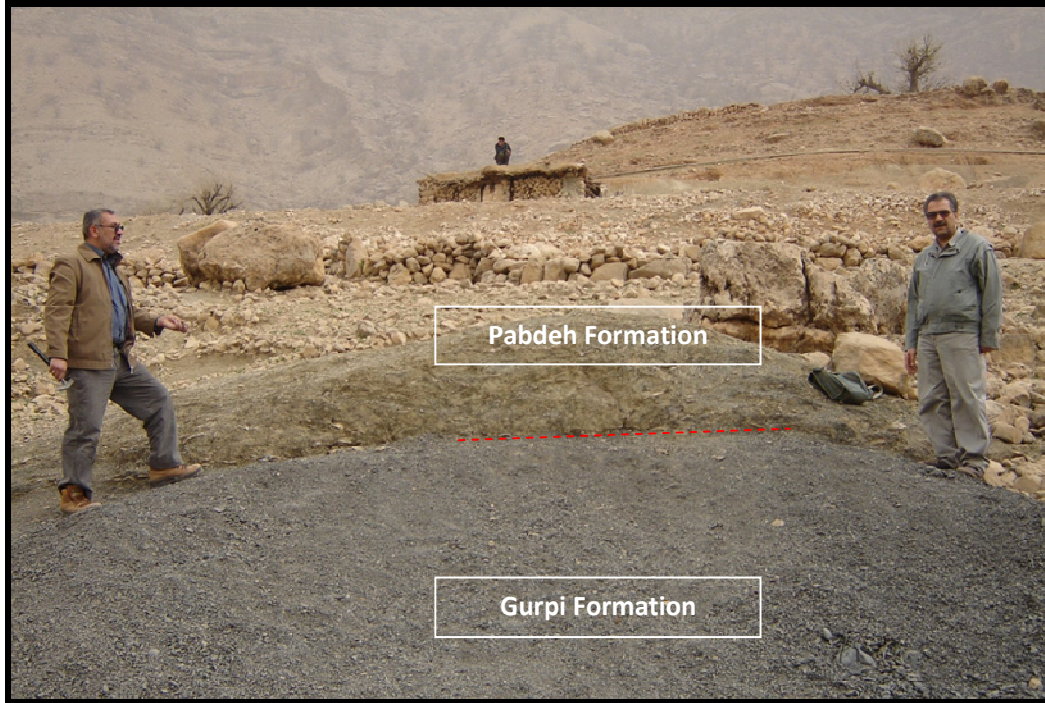


Fig 2: Boundary of Pabdeh-Gurpi formations in studied section that it was correlated with Danian-Selandian boundary.

Discussion and Biostratigraphy

Zone P2 and P3 are identified by the FAD their respective zonal marker. In the latest of Danian was accompanied with extinction of species of *Praemurica* i.e. and on the basis of appearance of representative markers of late Danian i.e. *Morozovella angulata* that it was a marker for P2 zone, also in the P2 zone the *Morozovella praeangulata* (the first species with muricate wall) was appeared and then in the Selandian and Thanetian was developed species of *Morozovella* genus (*M.angulata*, *M.apanthesma*, *M.conicotruncata*,...). In the early late Paleocene (Selandian), species of *Igorina* was appeared, such as *Igorina albeari*, *Igorina pussila* that *I.albeari* is a marker for P3 zone. In the most of world points such as Global Stratotype Section and Point (GSSP) of Danian- Selandian boundary in Denmark, Southern Tethys countries, the base of the Selandian is an unconformable, but in the Kamestan anticline section; this boundary is continuous and transitional.

Based on Premoli Silva et al (2003), in this study the Danian- Selandian boundary is located in P2-P3 biozones (fig.3).

P2- *Praemurica uncinata* Interval Zone

Definition: Biostratigraphic interval between the FAD of *Praemurica uncinata* and the FAD of *Morozovella angulata*.

This biozone is equivalent to, *Praemurica uncinata* Lowest-occurrence Zone of Berggren & Pearson (2005) and *Morozovella uncinata* Interval Zone (Bolli, 1966).

This biozone in the studied section is beginning to uppermost of Gurpi formation and is continued to boundary with Pabdeh formation.

The associated planktonic foraminifera in this biozone in the studied section:

Chiloguembelina sp., *Subbotina triloculinoides*, *Subbotina triangularis*, *Eoglobigerina edita*, *Praemurica inconstans*, *Eoglobigerina spiralis*, *Praemurica pseudoinconstans*, *Parasubbotina pseudobulloides*, *Globanomalina compressa*, *Globanomalina imitata*, *Morozovella praeangulata*, *Globanomalina planocompressa*, *Parasubbotina variant*

Age: late early Paleocene (late Danian).

P3- *Morozovella angulata*-*Igorina pussila* Interval Zone

Definition: Biostratigraphic interval between the FAD of *Morozovella angulata* and the FAD of *Globanomalina pseudomenardii*.

This biozone is equivalent to, *Morozovella angulata* Lowest-occurrence Zone of Berggren & Pearson (2005), *Morozovella angulata*-*Globanomalina pseudomenardii* of Berggren et al (1995) and *Morozovella angulata* Zone of (Bolli, 1966).

This biozone in the studied section has 12 m thickness and it starts lowermost Pabdeh Formation and is continued to 12m of this formation.

The associated planktonic foraminifera in this biozone in the studied section:

Globanomalina compressa, *Praemurica pseudoinconstans*, *Morozovella praeangulata*, *Morozovella angulata*, *Igorina albeari*, *Igorina pussila*, *Globanomalina chapmani*

Age: early late Paleocene (Selanian)

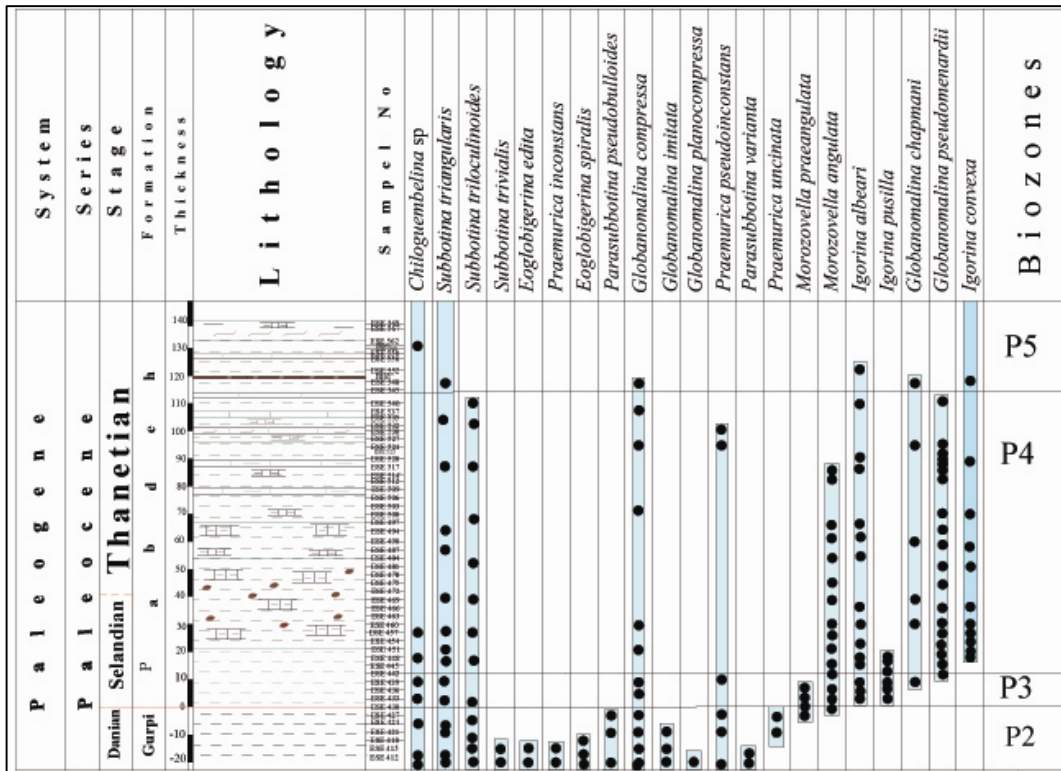


Fig 3: Distribution and planktonic foraminiferal zonation of the Danian- Selandian boundary in the Kamestan anticline section.

Result

Biozones P2 and P3 were identified according to Premoli Silva et al (2003) and on the basis of extinction of representative markers of late Danian i.e. *Praemurica uncinata* and appearance of representative markers of early Selandian i.e. *Igorina albeari* . Unlike of many sections in world wide such as Global Stratotype Section and Point (GSSP) of Danian- Selandian boundary in Denmark and Southern Tethys countries e.i. Egypt and Tunisia that Danian- Selandian boundary is unconformable , here this boundary is continuous and comformable.

Plate 1

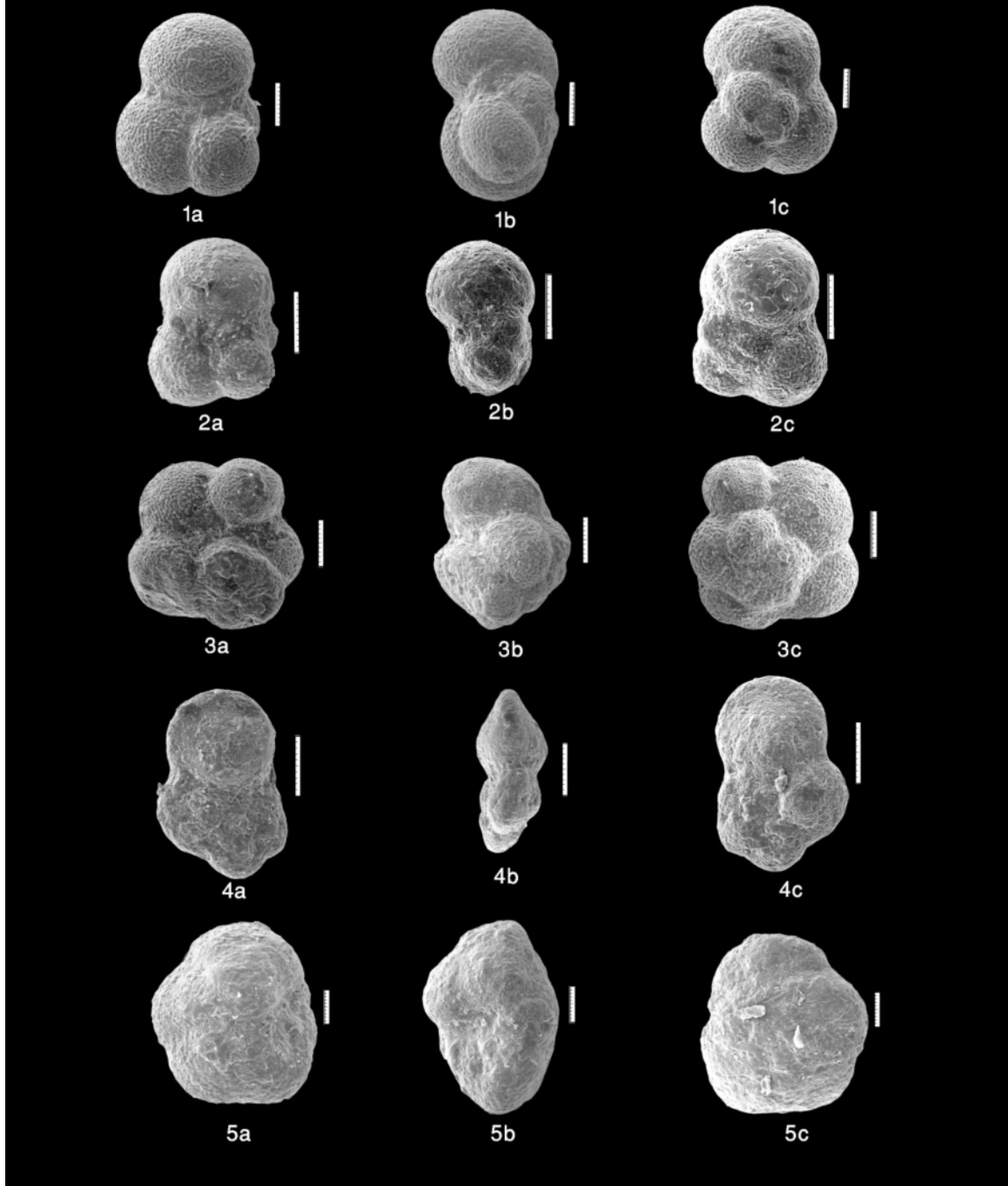


Plate 1: 1a –1c: *Parasubbotina pseudobulloides* Plummer, 1926 2a –2c: *Subbotina triloculinoides* Plummer, 1926 3a –3c: *Eoglobigerina spiralis* Bolli, 1957 4a-4c: *Globanomalina chapmani* Parr, 1938 5a-5c: *Morozovella angulata* White, 1928, Scale bar represent 100µm.

Plate 2

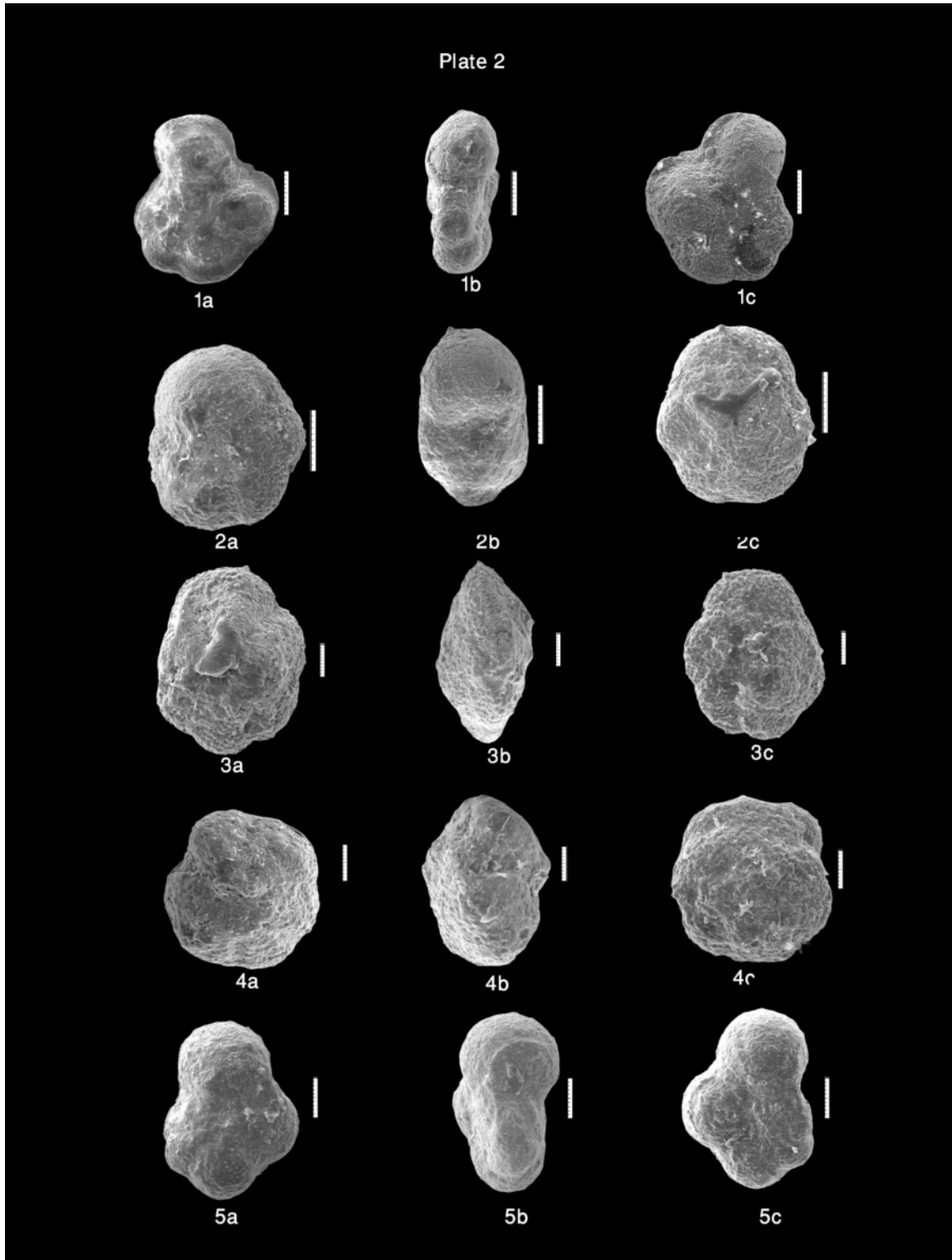


Plate 2: 1a-1c: *Globanomalina compressa* Plummer, 1926 2a-2c: *Morozovella praeangulata* Blow, 1979 3a-3c: *Igorina albeari* Cushman and Bermudez, 1949 4a-4c: *Igorina pusilla* Bolli, 1957 5a-5c: *Praemurica uncinata* Bolli, 1957, Scale bar represent 100 μ m.

Plate 3

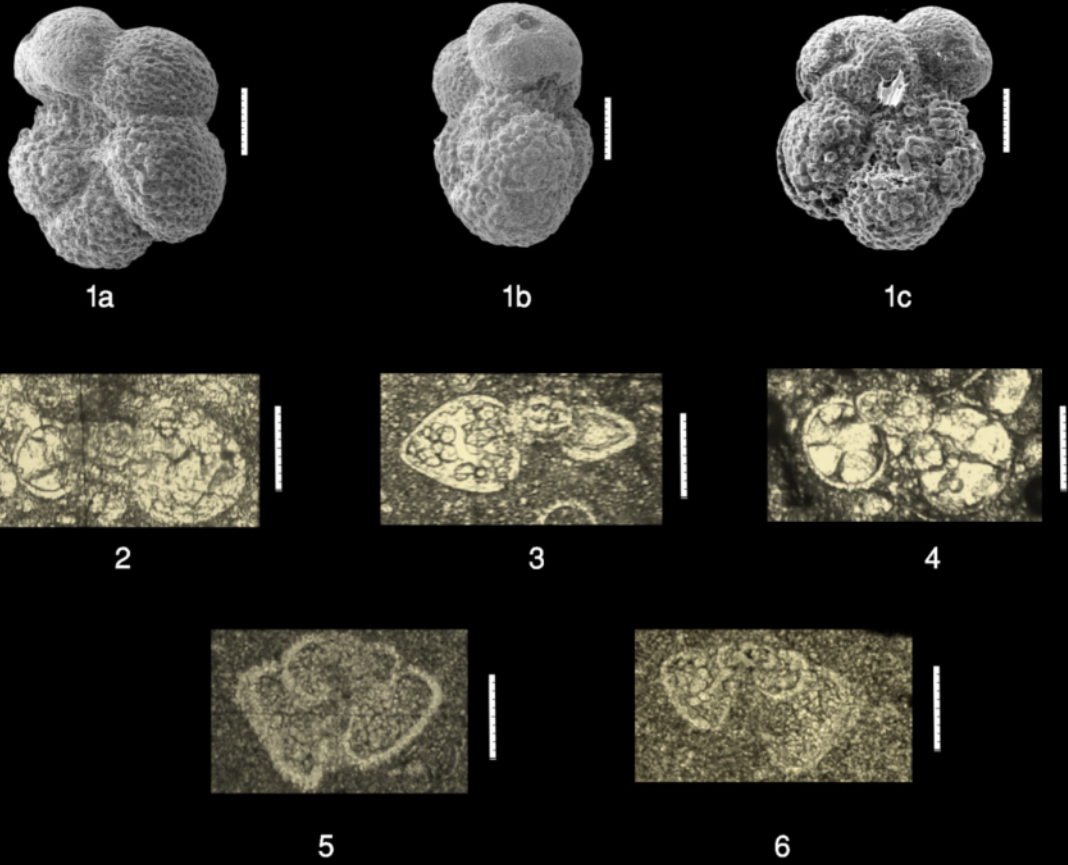


Plate 3: 1a-1c: *Praemurica inconstans* Subbotina, 1953 2a-2c: *Globanomalina compressa* Plummer, 1926 3a-3c: *Globanomalina chapmani* Parr, 1938 4a-4c: *Subbotina triloculinoides* Plummer, 1926 5a-5c: *Morozovella angulata* White, 1928 6a-6c: *Morozovella apantesma* Loeblich and Tappan, 1957, Scale bar represent 100 μ m.

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