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BIOSTRATIGRAPHIC STUDY OF THE ILAM AND GURPI FORMATIONS BASED ON PLANKTONIC FORAMINIFERA IN SE OF SHIRAZ, IRAN

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Abstract

The study of planktonic foraminifera of the Ilam and Gurpi formations at Sarvestan area (SE of Shiraz) enables me to find the most standard biozones defined in mediterranean regions, especially Tethysian domain. Seven biozones were determined. Biozones I (*Dicarinella concavata* zone) and II (*Dicarinella asymetrica* zone) belong to the Ilam Formation and indicate the Late Coniacian-Early Santonian and Middle-Late Santonian, respectively. Biozones III to VII were determined from the Gurpi Formation. Biozones III (*Globotruncanita elevata* zone), IV (*Globotruncana ventricosa* zone) and V (*Globotruncanita calcarata* zone) represent the Early, Middle and Late Campanian, respectively. Biozones VI (*Globotruncanita stuarti* zone) and VII (*Gansserina gansseri* zone) suggest the Early and Middle Maastrichtian, respectively. In the Late Maastrichtian, due to decreasing in water depth at the study area, *Abathomphalus mayaroensis* zone defined in Tethysian domain, was not recognised.

Keywords: Ilam Formation; Gurpi Formation; Upper Cretaceous; Planktonic Foraminifera; Biozonation

Introduction

The Ilam and Gurpi formations are part of the Upper Cretaceous deposits in the Zagros basin.

Deposition of the Ilam and Gurpi formations was coincident with broad marine transgression during Upper Cretaceous.

The plagic argillaceous limestone of the Ilam Formation and shale and marl of the Gurpi Formation were deposited in deep marine environment, while the nereitic carbonate of the Ilam Formation were laid down over shallower areas of the Zagros basin.

Lithologically, the Ilam Formation at the type section (E: 46° 19′ 06″, N: 33° 35′ 09″) consists of 190 meters, well bedded grey argillaceous limestones and interlayering thin beds of shale [15,22,27]. The Ilam Formation disconformabaly overlies grey shales of Surgah Formation at the type section.

The Gurpi Frormation at the type section (E: 49°13′ 47″, N: 32° 26′ 50″) is composed of 320 meters grey to

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blue marl and shale beds and occasionally thin beds of argillaceous limestones [7,15,22,27].

The Gurpi Formation overlies the Ilam Formation and is disconformably overlain by the Pabdeh Formation at the type section.

Microfauna of the Ilam and Gurpi formations were studied by Kalantary, Jalali and Zahiri [14,16-18,35]. The zonal scheme of the formations established by Wynd and then discussed by Bolz [3,34].

The main purpose of this research was to establish a biostratigraphic zonation and correlation with other universally accepted standard biozones.

Study Area and Methodology

The studied area is located 50 km to the southeast of Shiraz (Fig. 1). Fieldwork was concentrated at the Sarvestan area. With coordinations of E: 52° 51′; N: 27° 17′.

The thickness of the Ilam Formation is 50 meters and consists of well bedded argillaceous limestone with intercalation of thin beds of shale. This formation unconformably overlies limestone of the Sarvak Formation.

The thickness of the Gurpi Formation is 245 meters of grey marl, calcareous pyritic shale and argillaceous limestones. It conformably overlies the Ilam Formation and is overlain by the Tarbur Formation.

The section was studied in detail. Samples were taken almost every 2 meters. Approximately 145 samples were collected. Hard samples were studied by making thin sections. About 100 g of each dried soft sample was processed by repeated freezing and thawing until disaggregated (usually two or three cycles) in a supersaturated solution of sodium sulphate. Disaggregated sediments were washed thoroughly through a 63 μm sieve, taking care not to lose any sediment, and the residues were separated by filteration and dried overnight. Dried residues were then size sorted through sieves at haif-phi intervals from 500 μm down to 63 μm. Foraminifera were picked and studied from the residue in the 250-355 μm size fraction.

Foraminifera were studied in thin sections and electronic microscope, after particular processes had been carried out.

Foraminiferal taxonomy and nomenclature follows Leoblich and Tappan, Sliter, Hart *et al*., Longoria and VonFeldt and Georgescu [10,12,19,20,30].

Results and Discussion

Biostratigraphy

Planktonic foraminifera have proved to be vital in intercontinental biostratigraphy of the Upper Cretaceous and younger marine sequences. The value of these foraminifera for Correlation has been discussed at length by Bandy [1,2].

Planktonic foraminifera are abundance and diverse in most samples of the Ilam and Gurpi formations at the studied area. Eight genera and 24 species of planktonic forams were recognized. The zonal scheme presented here consists of 7 zones on the basis of the stratigraphic distribution of planktonic foraminifera recognized in thin sections and isolated specimens (Fig. 2).

Biozones I and II occur in the Ilam Formation and biozones III-VII are in the Gurpi Formation.

I- *Dicarinella concavata* zone

Author: Sigal [28]

Definition: Interval zone from the first appearance of *Dicarinella concavata* (Brotzen) to the first appearance of *D. asymetrica* (Sigal).

Characteristics: The dominant taxa belong to *Marginotruncana renzi* (Gandolfi), *M. sigali* (Reichel), *M. schneegansi* (Sigal), *M. coronata* (Bolli), *Dicarinella imbricata* (Mornod) and *D. primitiva* (Dalbiez).

Remarks: The last appearance of *Marginotruncana sigali*, *Dicarinella imbricata* and *D. primitiva* occurs within this zone.

Age: Late Coniacian to Early Santonian.

This biozone was recorded from W. Pacific [21,23], Atlantic realm [11,24,25], W. Tethys [32,33] and Central Tethys [9,29] mostly from the Late Coniacian-Early Santonian.

II- *Dicarinella asymetrica* zone

Author: Postoma (*Globotruncana concavata carinata* zone) [26]

Definition: Total range zone of *Dicarinella asymetrica*

Characteristics: The dominant taxa in this zone are: *Dicarinella concavata*, *Marginotruncana coronata*, *M. schneegansi*, *Globotruncana lapparenti* Brotzen, *G. linneiana* (d' Orbigny) and *Rosita fornicata* (Plummer).

Remarks: The zone contains the last appearance of *Marginotruncana renzi*, *M. schneegansi* and the first appearance of *Globotruncana lapparenti*, *G. linneiana* and *Rosita fornicata*.

Age: Middle-Late Santonian

This zone was introduced form W. Pacific [21,23], Caribbean [11]; W. Tethys [32,33] and Central Tethys [9,29] from the Middle-Late Santonian.

III- *Globotruncanita elevata* zone

Author: Dalbiez [6]

Definition: Partial range zone from the last appearance of *Dicarinella asymetrica* to the first

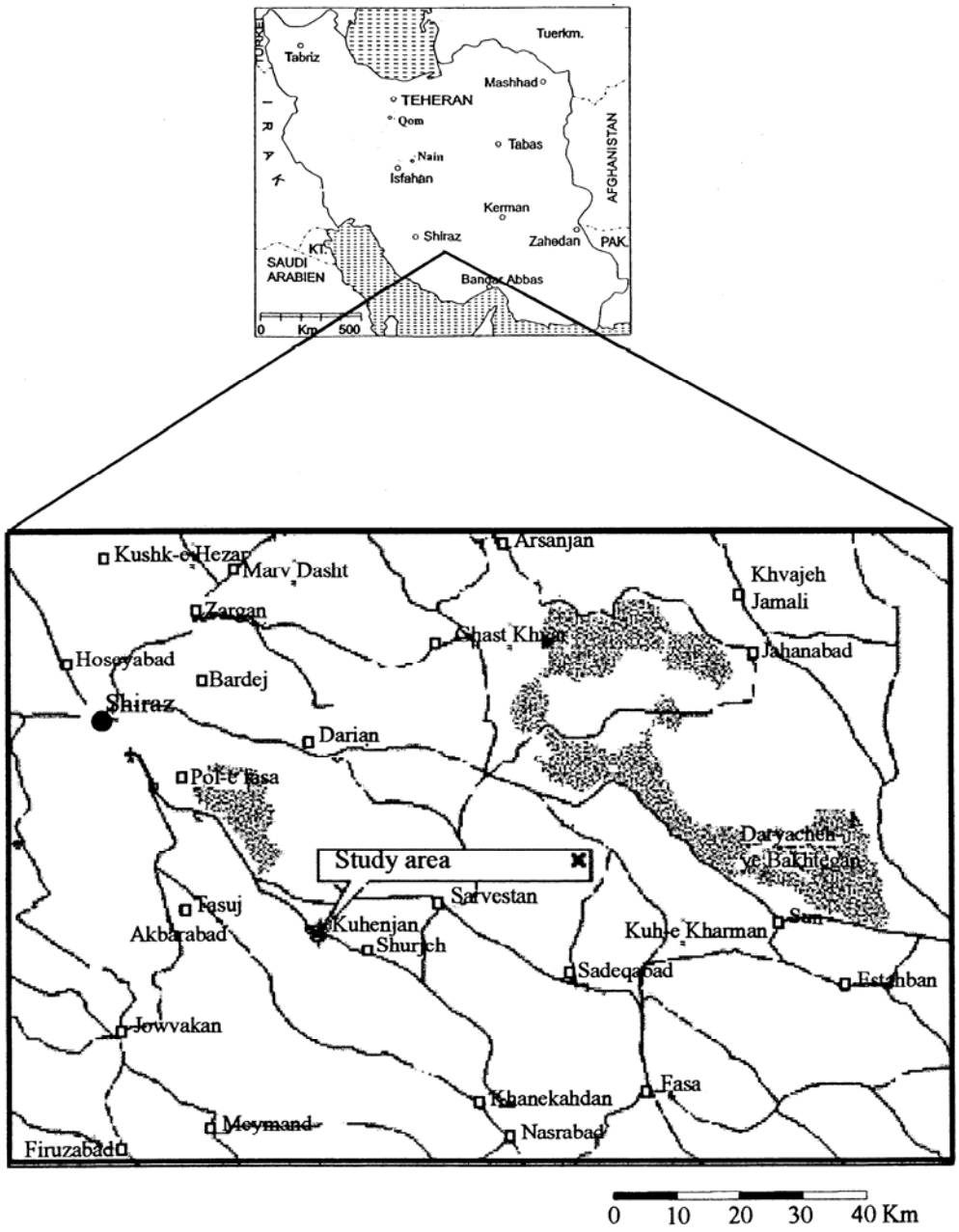

Figure 1. Locality map of studied area.

appearance of *Globotruncana ventricosa* White.

Characteristics: Whitin this zone numerous representatives of the genus *Globotruncana*: *G. lapparenti*, *G. linneiana*, *G. arca* (Cushman) and *G. bulloides* Vogler are present. *Rosita fornicata*, *Globotruncanita stuartiformis* (Dalbiez) and *Rugoglobigerina rugosa* (Plummer) are also present.

Remarks: The first appearence of *Rugoglobigerina rugosa* occurs within this zone.

Age: Early Campanian.

This zone was recorded from Caribbean [11], W. Tethys [34,35], E. Tethys [8] and Central Tethys [9,29] from the Early Campanian.

IV- *Globotruncana ventricosa* zone

Author: Dalbiez [6]

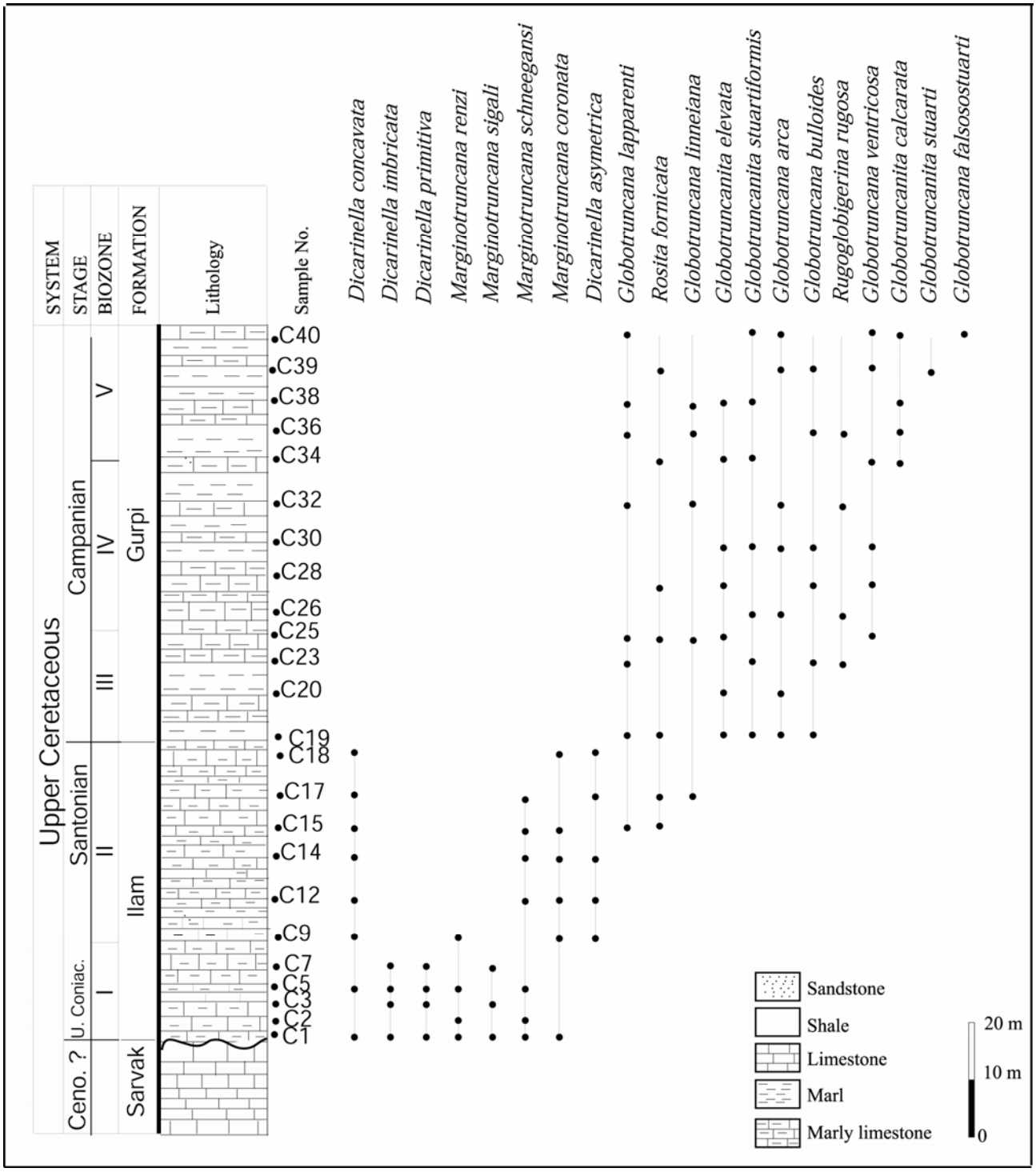

Figure 2. Distribution and planktonic foraminiferal zonation of the Ilam and Gurpi formations at Sarvestan area.

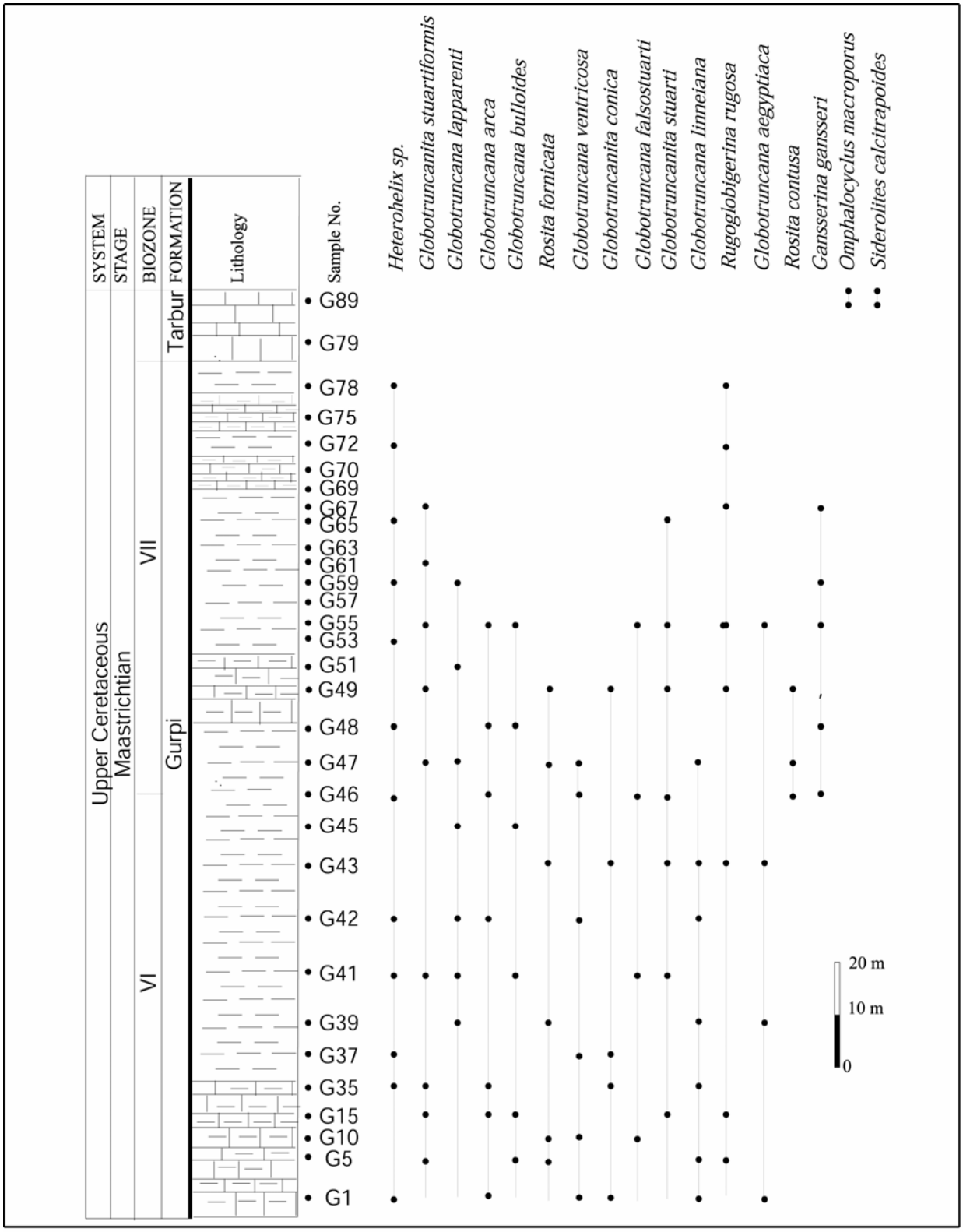

Figure 2. Continue.

Definition: Interval zone from the first appearance of *Globotruncana ventricosa* to the first appearance of *Globotruncanita calcarata* (Cushman).

Characteristics: *Globotruncana lapparenti*, *G. linneiana*, *G. arca*, *G. bulloides*, *Rosita fornicata*, *Globotruncanita elevata* (Brotzen), *Globotruncanita stuartiformis* are the most common taxa in this zone.

Age: Middle to early Late Campanian.

This zone was recorded from W. Tethys [34,35] from the Middle to early Late Campanian.

V- *Globotruncanita calcarata* zone

Author: Herm [13]

Definition: Total range zone of *Globotruncanita calcarata*

Characteristics: The dominant taxa in this zone are: *Globotruncana lapparenti*, *G. linneiana*, *G. arca*, *G. bulloides*, *G. ventricosa*, *G. falsostuarti* Sigal, *Rosita fornicata*, *Globotruncanita stuarti* (de Lapparent), *Globotruncanita stuartiformis*, *Globotruncanita elevata* and *Rugoglobigerina rugosa*.

Remarks: This zone contains the first appearance of *Globotrucanita stuarti* and *Globotruncana falsostuarti*. The last appearance of *Globotruncanita elevata* is recorded from the top of the zone.

Age: Late Campanian.

This zone was introduced from W. Pacific [21,23], Atlantic realm (Premoli-Silva and Bolli, 1973), W. Tethys [34,35] and Central Tethys [9,29] all from the Late Campanian.

VI- *Globotruncanita stuarti* zone

Definition: Partial range zone from the last appearance of *Globotruncanita calcarata* and the first appearance of *Gansserina gansseri* (Bolli).

Characteristics: The dominant taxa belong to genera *Globotruncana* (*lapparenti*, *linneiana*, *arca*, *bulloides*, *ventricosa*, *falsostuarti*, *aegyptica* Nakkady) and *Globotruncanita* (*stuartiformis*, *conica* (White)). Morever the species *Rosita fornicata* and *Rugoglobigerina rugosa* are present in this zone.

Remarks: The first appearance of *Globotruncana aegyptica* occurs within this zone.

Age: Early Maastrichtian.

This zone was recorded from E. Tethys [8] from the Lower Maastrichtian.

VII- *Gansserina gansseri* zone

Author: Bronnimann [4]

Definition: Interval zone from the first appearance of *Gansserina gansseri*. Due to decreasing in water depth and absence of deep water plankton taxa (the taxa which are vital in biozonation such as *Abathomphalus mayaroensis*) at the studied area, the upper boundary of this zone is not exactly obvious.

Remarks: The last appearance of several late Cretaceous species, such as *Globotruncana lapparenti*, *G. linneiana*, *G. arca*, *G. bulloides*, *G. ventricosa*, *G. falsostuarti*, *G. aegiptica*, *Rosita fornicata*, *Globotruncanita stuarti* and *Globotruncanita conica* occur within this zone. The first appearance of *Rosita contusa* (Cushman) is also recorded from this zone.

Age: Middle Maastrichtian.

This zone has recorded from W. Pacific [5,21,23], Atlantic realm [11,31], W. Tethys [34,35] and Central Tethys [9,29] mostly from the Middle Maastrichtian.

Table 1 also shows the correlation of the proposed biostratigraphic zonation in this study with some zonal schemes from different localities. The proposed scheme most closely resembles those of Fleury, Caron and Sliter [5,9,30]. The differences are mostly in the Early Maastrichtian, especially with the zonal scheme of Caron and Sliter [5,30]. *Globotruncanella havanensis* (Voorwijk) is absent, and *Globotruncana aegyptica* is rare in the studied area. Therefore *Globotruncanella havanensis* and *Globotruncana aegyptica* zones are not recognized at this area. In the Late Maastrichtian, water depth declines and limestones of the Tarbur Formation (deposited in shallower neritic water) overlies the Gurpi Formation, therefore the recognition of *Abathomphalus mayaroensis* zone introduced from the different basin is not possible at this area.

Conclusions

(a) Eight genera and 24 species of planktonic foraminifera were identified from the Ilam and Gurpi formations at Kohanjan area in SE of Shiraz.

(b) Seven biozones including: I- *Dicarinella concavata*, II- *Dicarinella asymetrica*, III- *Globotruncanaita elevata*, IV- *Globotruncana ventricosa*, V- *Globotruncanita calcarata*, VI- *Globotruncanita stuarti* and VII- *Gansserina gansseri* were determined.

(c) Biozones I and II belong to the Ilam Formation and indicate the Uppermost Coniacian-Early Santonian and Middle-Late Santonian, respectively. Biozones III-VII were defined in the Gurpi Formation. Biozones III, IV and V represent the Early, Middle and Late Campanian, respectively. Biozones VI and VII show the Early and Middle Maastrichtian, respectively.

(d) The proposed zonal scheme most closely resembles those of Fleury, Caron and Sliter [5,9,30].

(e) Due to decreasing in water depth in the Upper Maastrichtian, *Abathomphalus mayaroensis* zone defined from the Tethysian domain but it was not recognised at the studied area.

Table 1. Correlation of the proposed biostratigraphic zonal scheme at this study with other accepted standard biozones of other parts of the world

STAGE	James and Wynd [15]	Barr (1972) Sigal [29]	Caron [5]	Sliter [30]	
m.y.	Zagros	Central Tethys	Tethys	Tethys	Sarvestan Area (1380)
65 MAASTRICHTIAN 70	*Abathomphalus mayaroensis*	*Abathomphalus mayaroensis*	*Abathomphalus mayaroensis*	*Abathomphalus mayaroensis*	
	Globotruncana stuarti + Pseudotextularia varians	*gansseri*	*Gansserina gansseri*	*Gansserina gansseri*	*Gansserina gansseri*
		stuarti + falsostuarti	*Globotruncana aegyptica*	*Globotruncana aegyptica*	*Globotruncanita stuarti*
			Globotruncana havanesis	*Globotruncana havanesis*	
CAMPANIAN 78	*Globotruncana elevata, elevata*	*calcarata*	*Globotruncanita calcarata*	*Globotruncanita calcarata*	*Globotruncanita calcarata*
		elevata + stuartiformis	*Globotruncana ventricosa*	*Globotruncana ventricosa*	*Globotruncana ventricosa*
			Globotruncanita elevata	*Globotruncanita elevate*	*Globotruncanita elevate*
SANTONIAN 82	*Globotruncana cancavata + ventricosa carinata*	*cancavata carinata*	*Dicarinella asymetrica*	*Dicarinella asymetrica*	*Dicarinella asymetrica*
CONIACIAN 86	*Globotruncana schneegansi + sigali*	*cancavata*	*Dicarinella cancavata*	*Dicarinella cancavata*	*Dicarinella cancavata*
			Dicarinella primitiva		

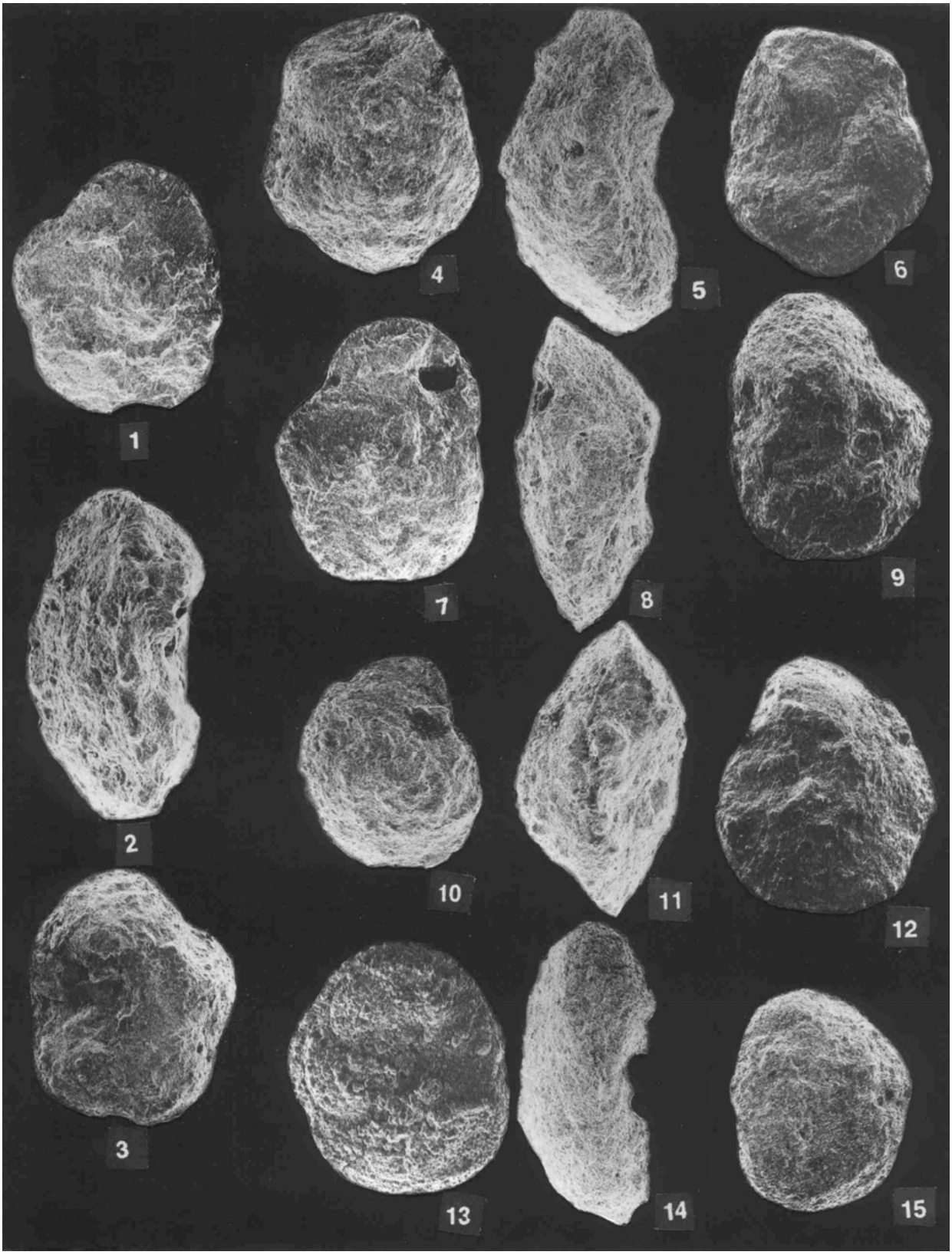

Plate 1.

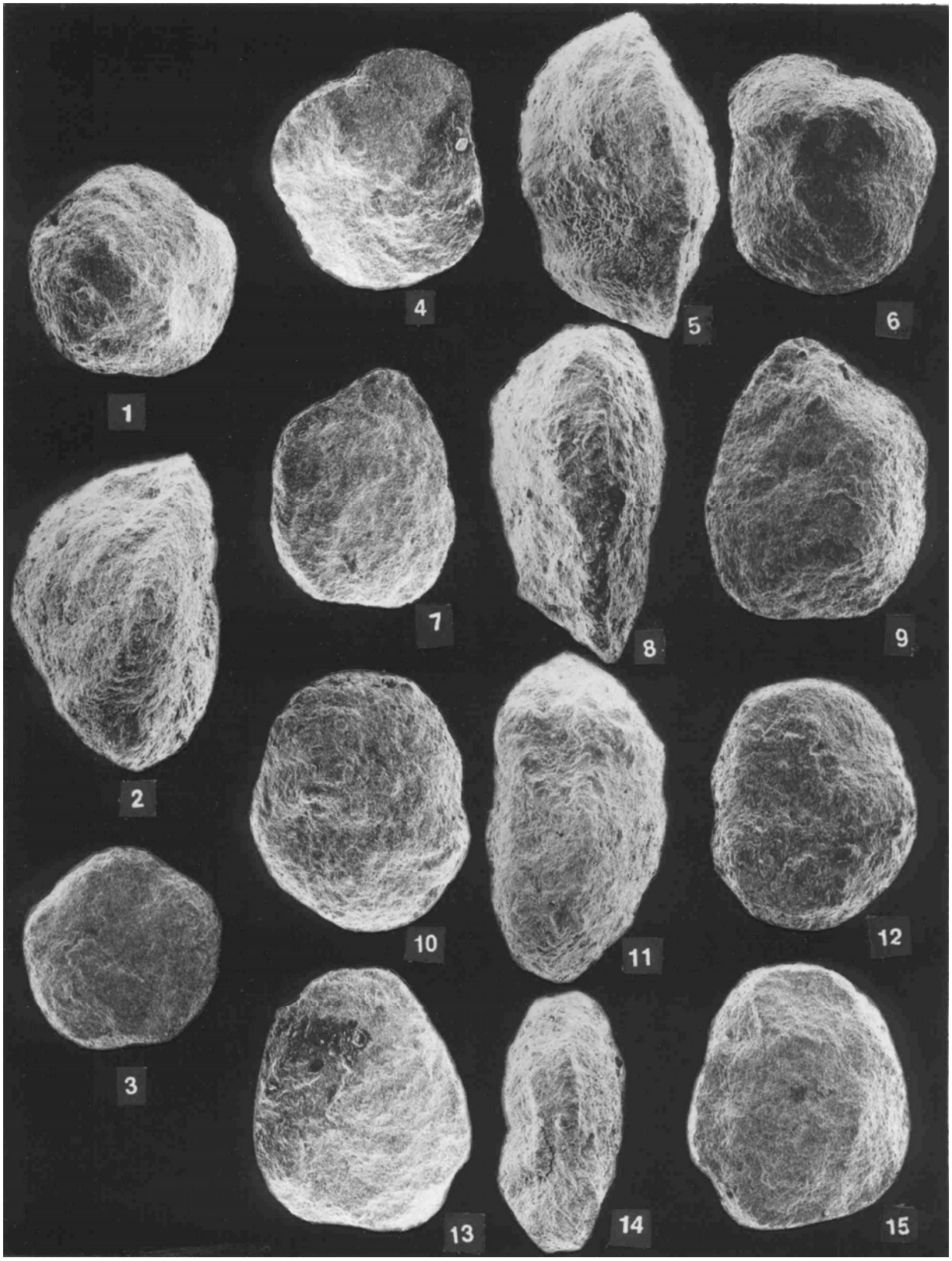

Plate 2.

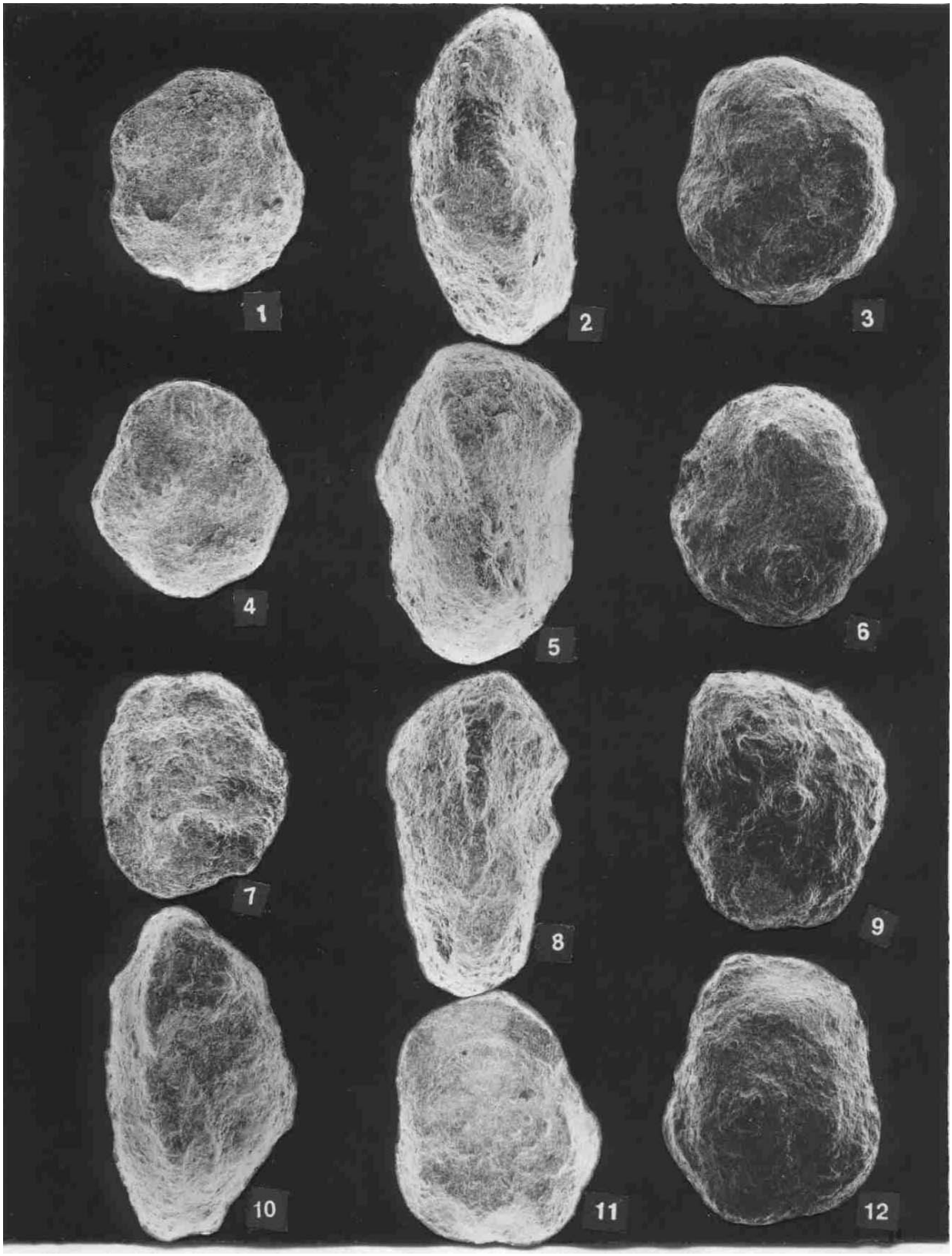

Plate 3.

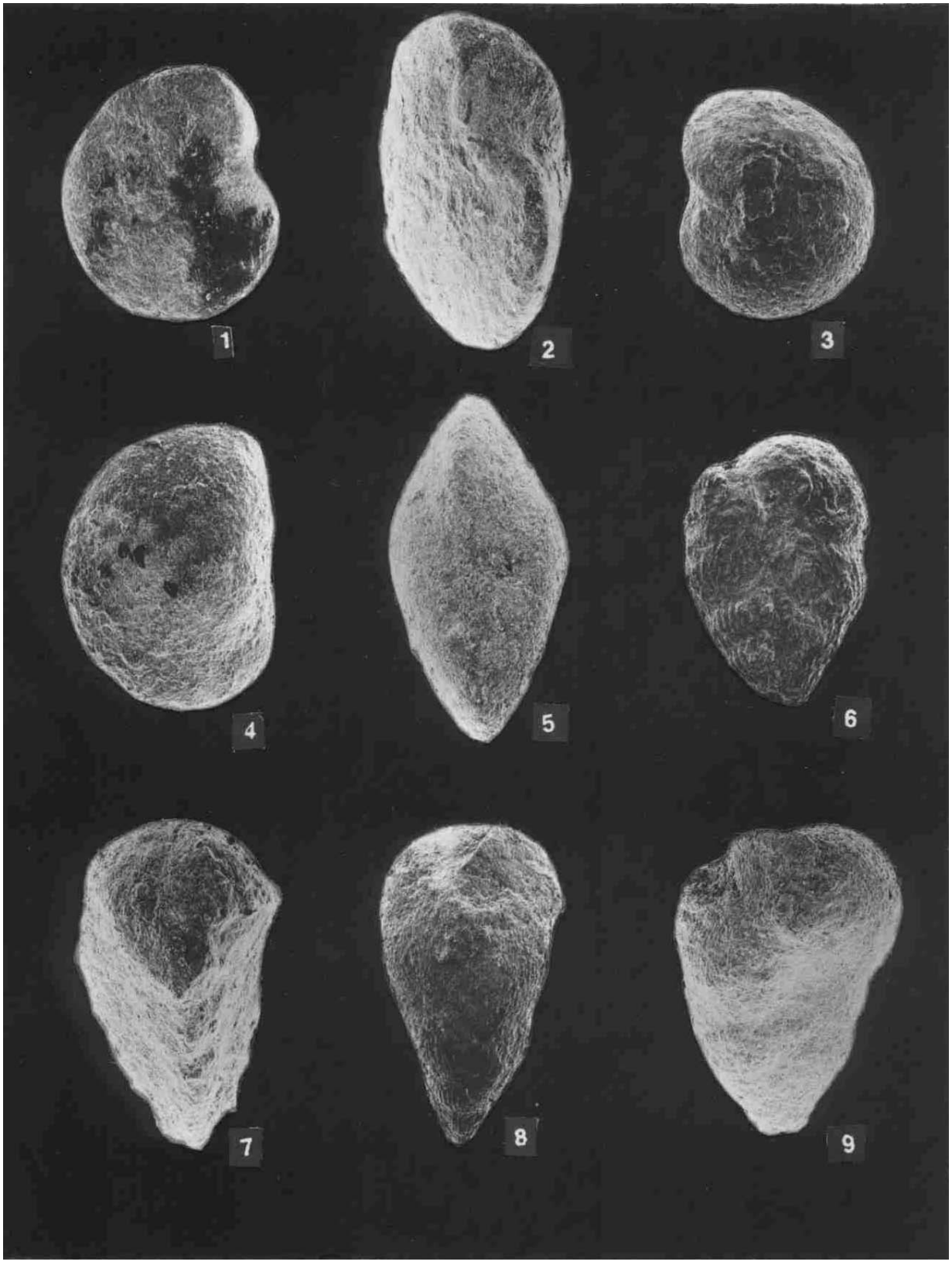

Plate 4.

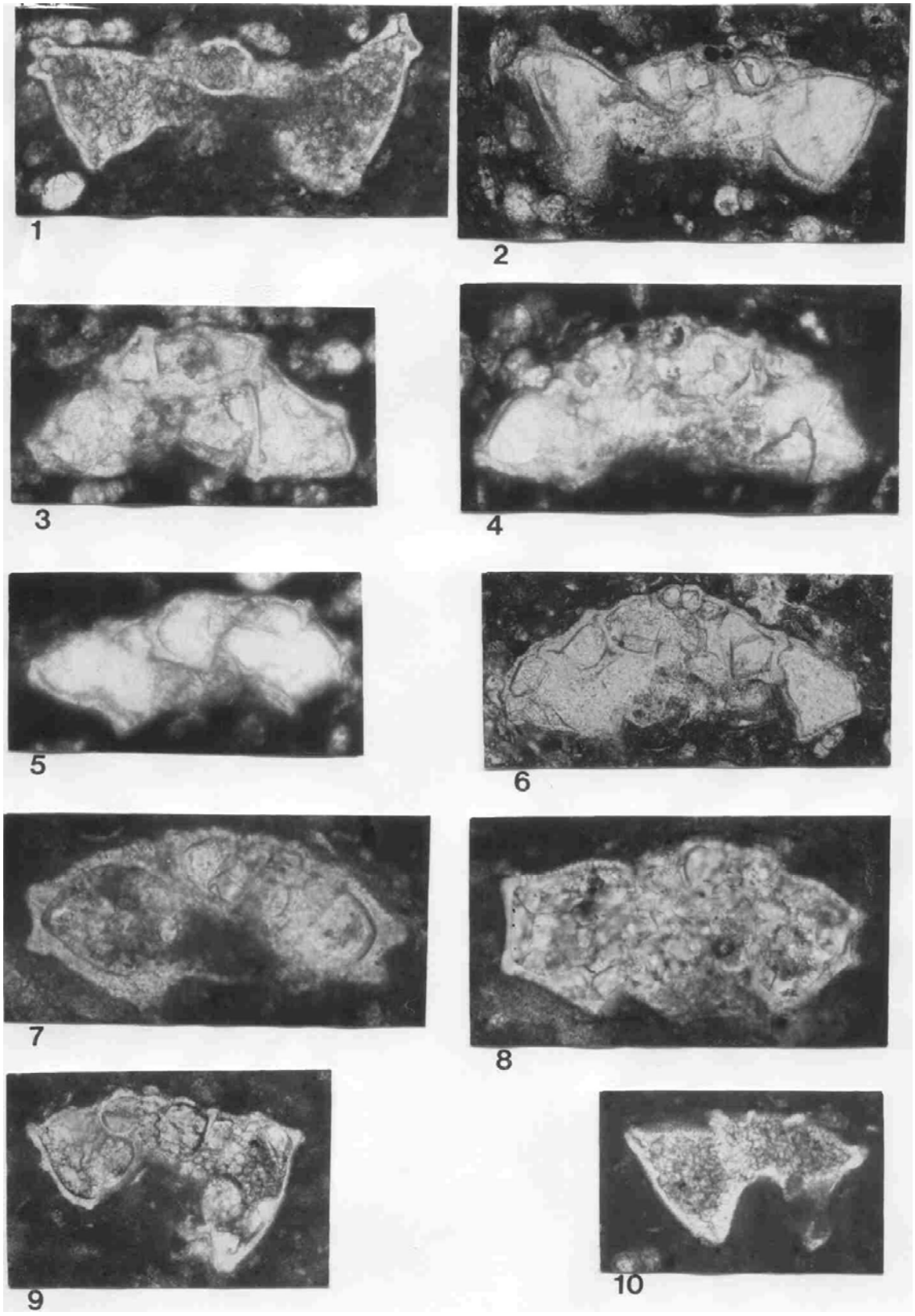

Plate 5.

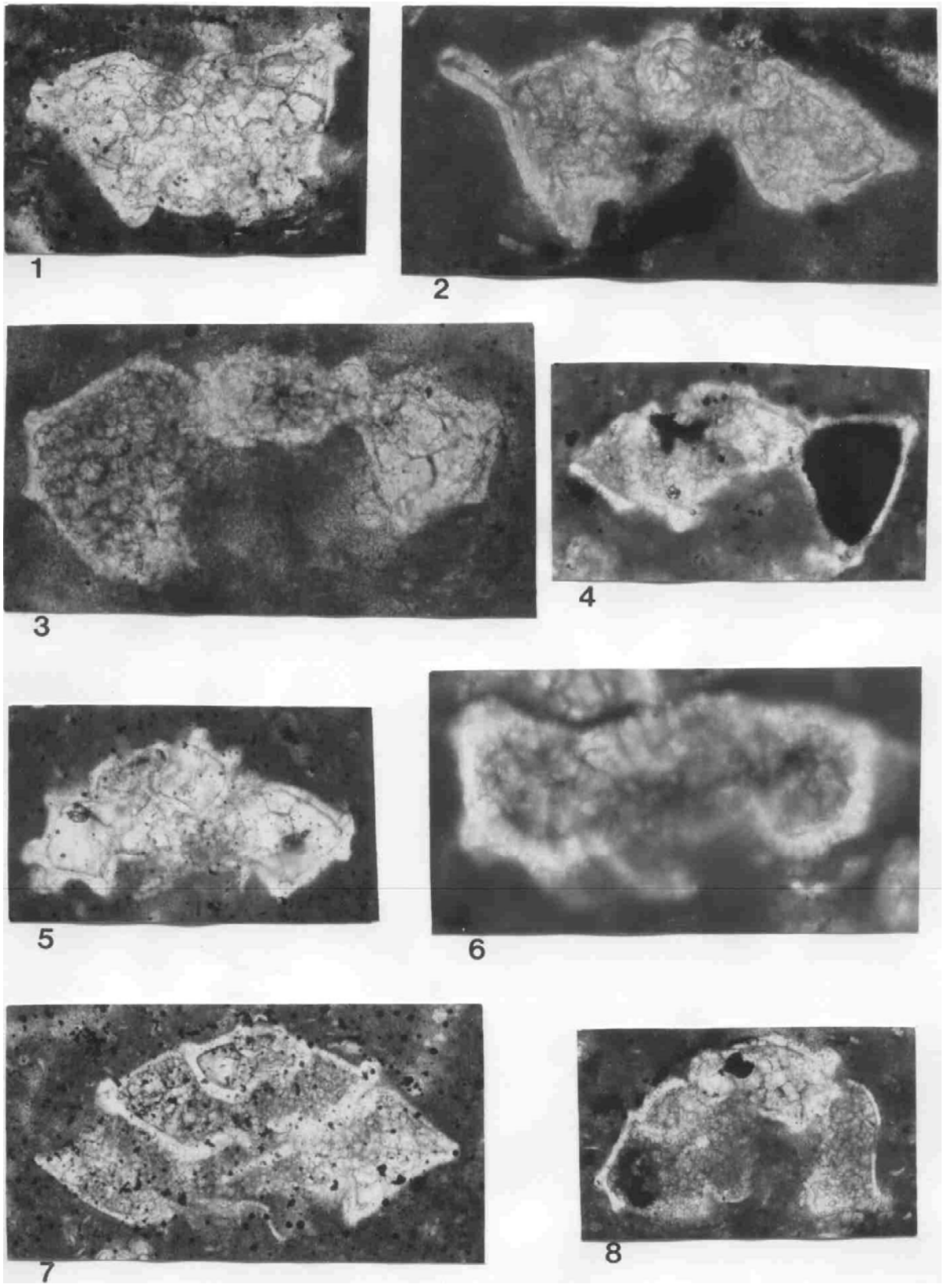

Plate 6.

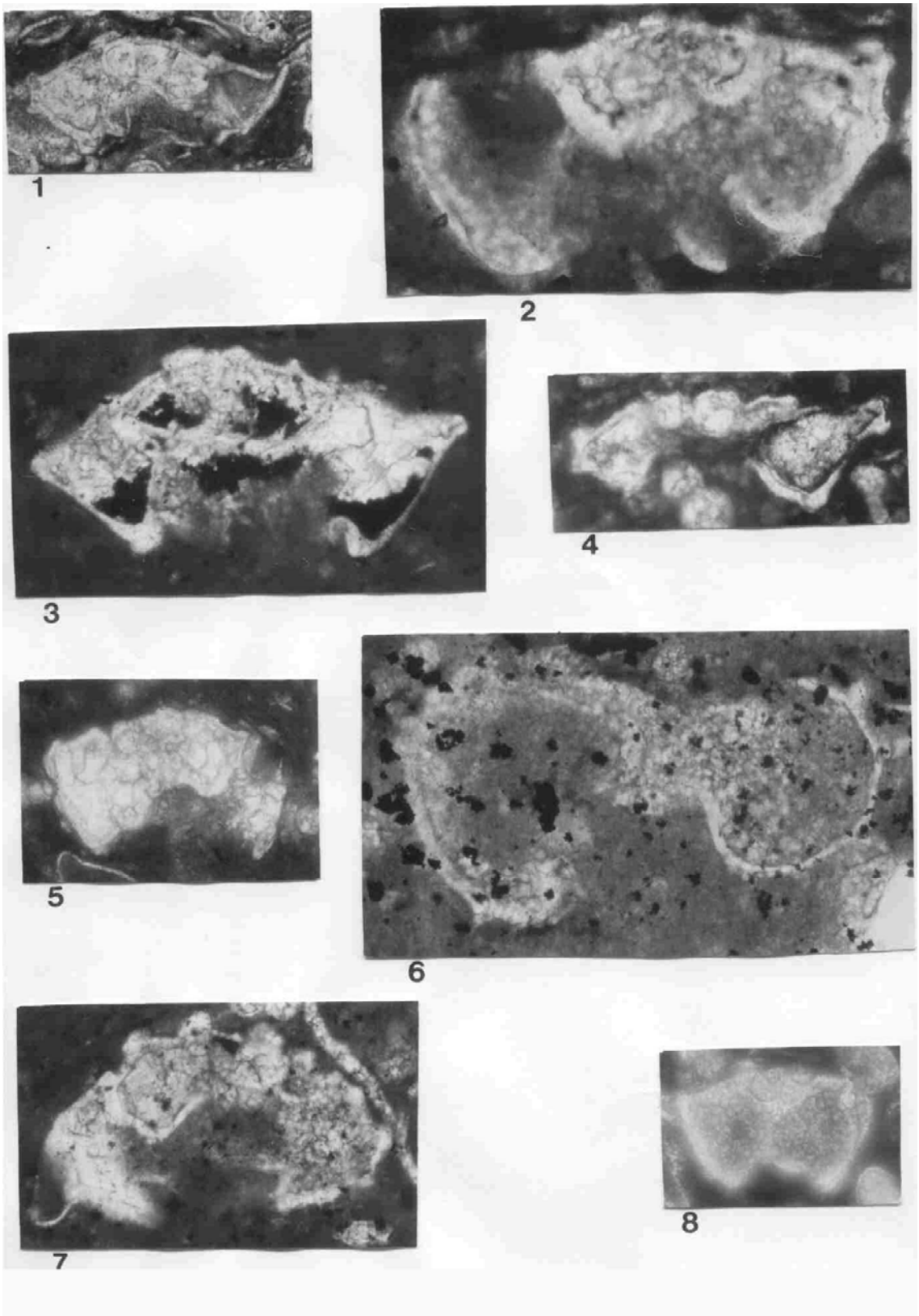

Plate 7.

Explanation of Plate 1

Figs. 1-3: *Globotruncana aegyptiaca* Nakkady, 1950,
1: Dorsal view, ×110
2: Lateral view, ×140
3. Ventral view, ×100
Formation: Gurpi
Age: Early-Middle Maastirchtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 4-6: *Rosita fornicata* Plummer, 1931,
4: Dorsal view, ×85
5: Lateral view, ×110
6: Ventral view, ×80
Formations: Ilam & Gurpi
Age: Middle Santonian-Early Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs 7-9 *Globotruncanita stuartiformis* Dalbiez, 1955,
7: Dorsal view, ×100
8: Lateral view, ×110
9: Ventral view, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 10-12: *Globotruncanita conica* White, 1928,
10: Dorsal view, ×75
11: Lateral view, ×110
12: Ventral view, ×90
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 13-15: *Rugotruncana subcircumndifer* Gandolfi. 1955,
13: Dorsal view, ×100
14: Lateral view, ×110
15: Ventral view, ×90
Formation: Gurpi
Age: Late Campanian-Late Maastrichtian
Locality; S.E. Shiraz, Sarvestan Area

Explanation of Plate 2

Figs 1-3: *Rosita contusa* Cushman, 1926,
1: Dorsal view, ×85
2: Lateral view, ×130
3: Ventral view, ×75
Formation: Gurpi
Age: Early-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 4-6: *Globotruncanita stuarti* De Lapparent, 1918,
4: Dorsal view, ×100
5: Lateral view, ×130
6: Ventral view, ×100
Formation: Gurpi
Age: Late Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 7-9: *Globotruncana aegyptiaca* Nakkady, 1950,
7: Dorsal view, ×90
8: Lateral view, ×130
9: Ventral view, ×100
Formation: Gurpi
Age: Early- Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 10-12: *Globotruncana arca* Cushman, 1926,
10: Dorsal view, ×100
11: Lateral view, ×130
12: Ventral view, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 13-15: *Globotruncana linneiana* D'orbigny, 1830,
13: Dorsal view, ×100
14: Lateral view, ×90
15: Ventral view, ×90
Formation: Gurpi
Age: Early Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Explanation of Plate 3

Figs. 1-3: *Globotruncana lapparenti* Brotzen. 1936,
1: Dorsal view, ×100
2: Lateral view, ×150
3: Ventral view, ×110
Formations: Ilam & Gurpi
Age: Late Santonian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 4-6: *Globotruncana bulloides* Vogler, 1941,
4: Dorsal view, ×100
5: Lateral view, ×150
6: Ventral view, ×110
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 7-9: *Globotruncana* cf. *falsostuarti* Sigal, 1952,
7: Dorsal view, ×120

8: Lateral view, ×150
9: Ventral view, ×140
Formation: Gurpi
Age: Late Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 10-12: *Globotruncana ventricosa* White, 1928,
10: Dorsal view, ×120
11: Lateral view, ×100
12: Ventral view, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Explanation of Plate 4

Figs. 1-3: *Gyroidinoides* sp.
1: Ventral view, ×120
2: Lateral view, ×110
3: Dorsal view, ×100
Formation: Gurpi
Age: Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 4-5: *Lenticulina* sp.
4: Dorsal view, ×100
5: Lateral view, ×120
Formation: Gurpi
Age: Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 6: *Heterohelix striata* Ehrenberg, 1840,
6: Ventral view, ×110
Formations: Ilam & Gurpi
Age: Late Santonian-Late Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 7: *Tritaxia* sp.
7: Dorsal view, ×110
Formation: Gurpi
Age: Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 8-9: *Heterohelix globulosa* Ehernberg, 1840,
8: Lateral view, ×110
9: Ventral view, ×110
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Explanation of Plate 5

Fig. 1: *Dicarinella asymetrica* Sigal, 1952,
1: Axial section, ×100
Formation: Ilam
Age: Santonian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 2: *Dicarinella concavata* Brotzen, 1934,
2: Axial section, ×100
Formation: Ilam
Age: Late Coniacian-Late Santonian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 3: *Dicarinella imbricata* Mornod, 1949,
3: Axial section, ×100
Formation:. Ilam
Age: Late Coniacian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 4: *Marginotruncana sigali* Reichel, 1950,
4: Axial section, ×100
Formation: Ilam
Age: Late Coniacian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 5: *Marginotruncana renzi* Gandolfi, 1942,
5: Axial section, ×100
Formation: Ilam
Age: Late Coniacian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 6: *Globotruncana angusticarinata*
6: Axial section, ×100
Formation: Ilam
Age: Late Coniacian-Early Santonian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 7: *Dicarinella primitiva* Dalbiez, 1955,
7: Axial section, ×200
Formation: Ilam
Age: Late Coniacian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 8: *Globotruncana lapparenti* Brotzen, 1934,
8: Axial section, ×100
Formations: Ilam & Gurpi
Age: Middle Santonian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 9: *Globotruncanita elevata* Brotzen, 1934,
9: Axial section, ×100
Formation: Gurpi
Age: Campanian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 10: *Globotruncanita calcarata* Cushman, 1927,

10: Axial section, ×100
13: Axial section, ×100
Formation: Gurpi
Age: Middle-Late Campanian
Locality: S.E. Shiraz, Sarvestan Area

Explanation of Plate 6

Fig. 1: *Globotruncana aegyptiaca* Tilev, 1951,
1: Axial section, ×100
Formation: Ilam
Age: Early-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 2: *Globotruncanita calcarata* Cushman, 1927,
2: Axial section, ×100
Formation: Gurpi
Age: Middle-Late Campanian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 3: *Globotruncana bulloides* Vogler, 1941,
3: Axial section, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 4: *Globotruncanita stuartiformis* Dalbiez, 1955,
4: Axial section, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 5: *Rosita fornicata* Plummer, 1931,
5: Axial section, ×100
Formations: Ilam & Gurpi
Age: Middle Santonian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 6: *Globtruncana linneiana* D'orbigny, 1839,
6: Axial section, ×200
Formation: Gurpi
Age: Early Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 7: *Globotruncanita conica* White, 1928,
7: Axial section, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 8: *Rosita contusa* Cushman, 1928,
8: Axial section, ×100
Formation: Gurpi
Age: Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Explanation of Plate 7

Fig. 1: *Globotruncana falsostuarti* Sigal, 1952,
1: Axial section, ×100
Formation: Gurpi
Age: Late Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 2: *Globotruncana ventricosa* White, 1928,
2: Axial section, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 3: *Globotruncanita stuarti* De'lapparent,
3: Axial section, ×100
Formation: Gurpi
Age: Late Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 4: *Marginotruncana coronata* Bolli, 1945,
4: Axial section, ×100
Formation: Ilam
Age: Late Campanian-Late Santonian
Locality: S.E. Shiraz, Sarvestan Area

Figs. 5, 8: *Gansserina gansseri* Robaszynski & Caron.
5: Axial section, ×100
8: Axial section, ×100
Formation: Gurpi
Age: Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 6: *Rugoglobigerina rugosa* Plummer, 1926,
6: Axial section, ×200
Formation: Gurpi
Age: Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

Fig. 7: *Globotruncana arca* Cushman, 1926,
7: Axial section, ×100
Formation: Gurpi
Age: Early Campanian-Middle Maastrichtian
Locality: S.E. Shiraz, Sarvestan Area

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