Mitt. Bayer. Staatsslg. Paläont. hist. Geol.	30	3–13	München, 31. 12. 1990

Some Paleogene Foraminifera from the Hamad Well No. 1 in Northeastern Desert of Jordan

By Joseph Samàn and Taleb Al-Harithi*

With 2 figures in the text and 2 plates

Abstract

Seventy-two cutting samples from Hamad well No. 1 in the Northeastern Desert of Jordan were analysed for their microfaunal content. The samples were taken from depths 25 m to 750 m (Total Depth) with an interval of 10 m between every two successive samples. The samples proved to be rich in microfauna, especially in foraminifera of Paleogene age. Some of the yielded foraminifera species (11 planktonic and 13 benthonic) as well as the paleoecology of the rock successions are discussed herein.

Kurzfassung

Aus Nordost-Jordanien wird die 750 m tiefe Bohrung Hamad Nr. 1 mikropaläontologisch durch 72 Proben im 10-m-Abstand bekanntgemacht.

Die Schichtfolge umfaßt Mitteleozän bis Oberkreide (Maastricht oder älter). 11 planktonische und 13 benthonische Foraminiferenarten werden kurz diskutiert, abgebildet und ihre Verbreitung im Profil aufgezeigt. Bis in den oberen Teil des Untereozän herrschen Flachwasserbedingungen. Im unteren Teil des Mitteleozän (120 m bis 240 m) konnte eine rasche Vertiefung (äußerer Schelf) festgestellt werden, der wieder eine Verflachung (innerer Schelf) im mittleren Teil des Mitteleozän folgt.

Introduction

The Hamad area of the Northeastern Desert of Jordan is mainly covered with Holocene wadi alluvial deposits and almost small stones, homogeneous in size and black due to Hamad weathering activities. The other outcrops in the area were assigned to the Tertiary in general. The drilling of Hamad well No. 1 (Fig. 1) in 1988 to a depth of 750 m in search for groundwater had allowed the geologists to have better idea about the geological setting as well as about the biostratigraphy and paleoecology of the Hamad area in the Paleogene. The fossil material described and figured is deposited with the second author.

*) Dr. J. Samàn, Water Authority of Jordan, P. O. Box (2412) Amman, Jordan; Dr. T. Al-Harithi, Natural Resources Authority, P. O. Box (7), Amman, Jordan.

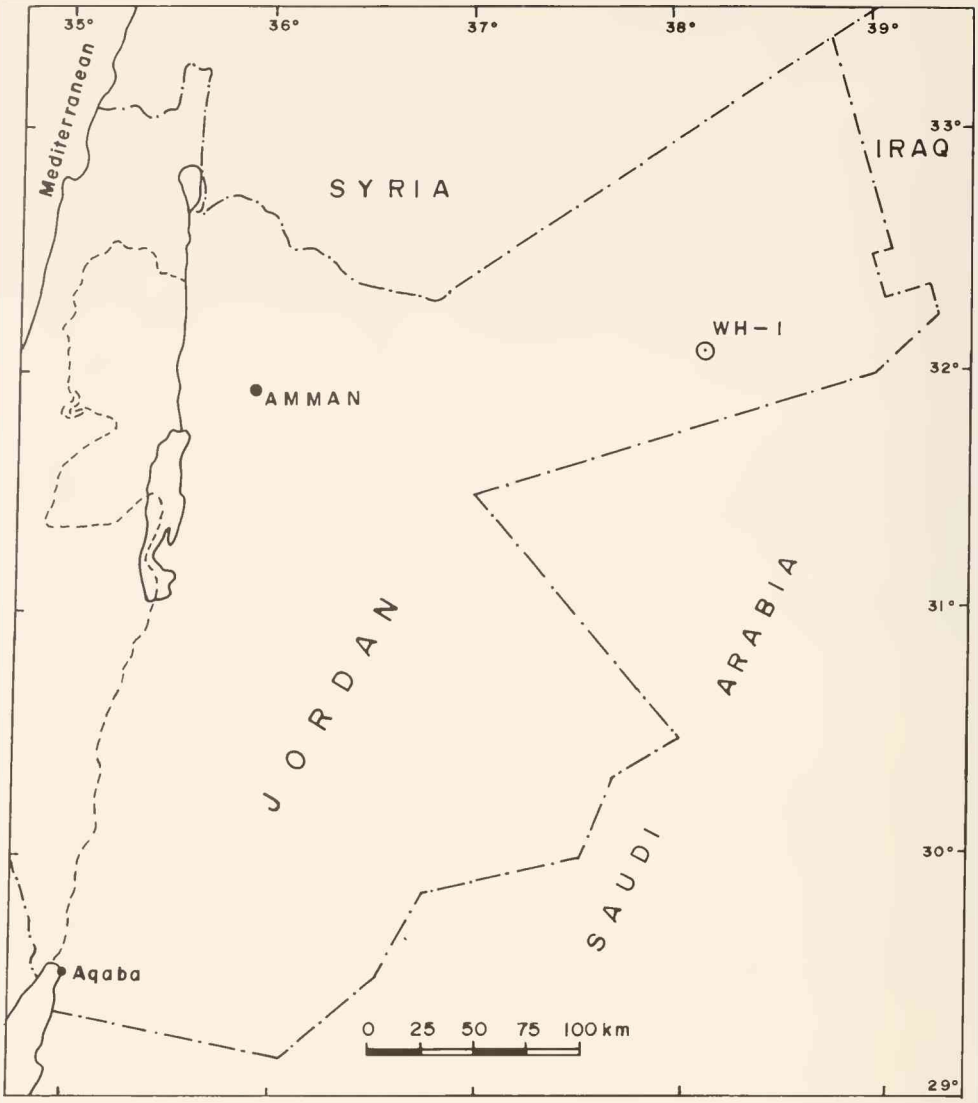


Fig. 1: Location map of Hamad well No. 1 (WH – 1).

Biostratigraphy

Eocene:

Due to the occurrence of many foraminiferal species, among them those photographed herein like *Globigerapsis kugleri, Globigerina bowerі, Globorotalia pseudotopilensis* and *Bulimina jacksonensis,* the rock sequence between the depths from 25 m to 190 m are assigned to the Middle Eocene.

The total absence of the known Middle Eocene species downhole the well below 190 m and the presence of *Chiloguembelina* cf. *wilcoxensis* and *Siphogerinoides eleganta* up to the depth 465 m could be an evidence of the encountering of Lower Eocene rocks.

Paleocene:

Rocks of Paleocene age (undiff.) were observed in the depths between 465 m to 560 m. This is well documented by the occurrence of many Paleocene microfossils especially *Anomalinoides danicus* and *Loxostomoides applinae*.

?Maastrichtian and/or older:

The decrease in number as well as in diversity of the microfauna below 560 m and the occurrence of *Gavelinella pertusa* cf. var. *maastrichtiensis* proved the encountering of Cretaceous rocks (?Maastrichtian and/or older).

Paleoecology

The percentage of the planktonic foraminifera (PF) to the whole foraminiferal assemblage increases from 5% to 10% in the samples from 25 m to 110 m respectively. This fact as well as the lower percentage of ostracodes could be an evidence that the rocks of the interval 25 m–110 m were deposited in the inner shelf marine environment.

The percentage of PF increased rapidly from 50% in the sample from 120 m to more than 90% in the sample from 240 m; which could be an indication for a change in the environment from outer shelf in the lower part to relatively deep inner shelf in the upper part. This conclusion leads to the assumption that the gypsum occurrences in this section are due to secondary diagenetic processes.

Below 240 m the percentage of benthonic foraminifera, especially the thick-walled ones, exceeds that of planktonic ones very much. This observation is accompanied by the occurrence of some gastropod shells and bone fillings. Both facts lead to the assumption that the marine environment, in which the whole rock succession below 240 m was deposited, could be a shallow inner shelf to near shore marine one.

Systematic description

Anomalinoides danicus (Brotzen, 1940)
Pl. 1, Fig. 1

1968 *Anomalinoides danicus* – Futyan: Ph. D-Thesis, Univ. London: 243; Pl. 16, Figs 5, 9, 10.

Remarks: From my observations as a micropaleontologist in the Oil Drilling Section this species could be considered as a Paleocene index fossil.

Uvigerina yazooensis Cushman, 1933
Pl. 1, Fig. 3

*1933 *Uvigerina yazooensis* Cushman – In Ellis et. al., Catalogue (1969), 3.

Remarks: This species was recorded mainly from Eocene rocks in many parts of the world and from younger rocks (Ellis et. al. 1969).

Uvigerina spinocostata CUSHMAN & JARVIS, 1929
Pl. 1, Figs. 4, 5

Remarks: The Hamad specimens could be considered as an intermediate form between those recorded by CUSHMAN & JARVIS 1929 and the ones recorded by CUSHMAN 1939 of the same species.

Uvigerina chirana CUSHMAN & STONE, 1947
Pl. 1, Fig. 6

1968 *Uvigerina chirana* – FUTYAN: Ph. D-Thesis, Univ. London: 158; Pl. 10, Fig. 3.

Remarks: The Hamad specimens show a very high resemblance to those recorded by FUTYAN 1968 from the Lower Eocene Rocks of South Jordan.

Bulimina jacksonensis CUSHMAN, 1925
Pl. 1, Fig. 7

Remarks: This species is considered to be a good index fossil for the Middle Eocene in Jordan. Many observations in the oil exploration wells confirms this assumption.

Loxostomoides applinae (PLUMMER, 1927)
Pl. 1, Fig. 8

1968 *Loxostomoides applinae* – FUTYAN: Ph. D-Thesis, Univ. London: 171; Pl. 10, Figs. 22, 23.

Remarks: In spite of that this species is not abundant in the samples it is a good Paleocene marker in Jordan.

Loxostomoides applinae aegyptiaca NAKKADY, 1950
Pl. 1, Fig. 9

Remarks: This subspecies could be a phylogenetal evolution from *Loxostomoides applinae* species, as the subspecies shows a costate surface more than smooth.

Siphogerinoides eleganta (PLUMMER, 1927)
Pl. 1, Fig. 10

1968 *Siphogerinoides eleganta* – FUTYAN: Ph. D-Thesis, Univ. London: 149; Pl. 9, Figs. 13, 14.

Remarks: Varieties of this species were recorded from Paleocene and Eocene rocks from different areas in the world (ELLIS et. al. 1969).

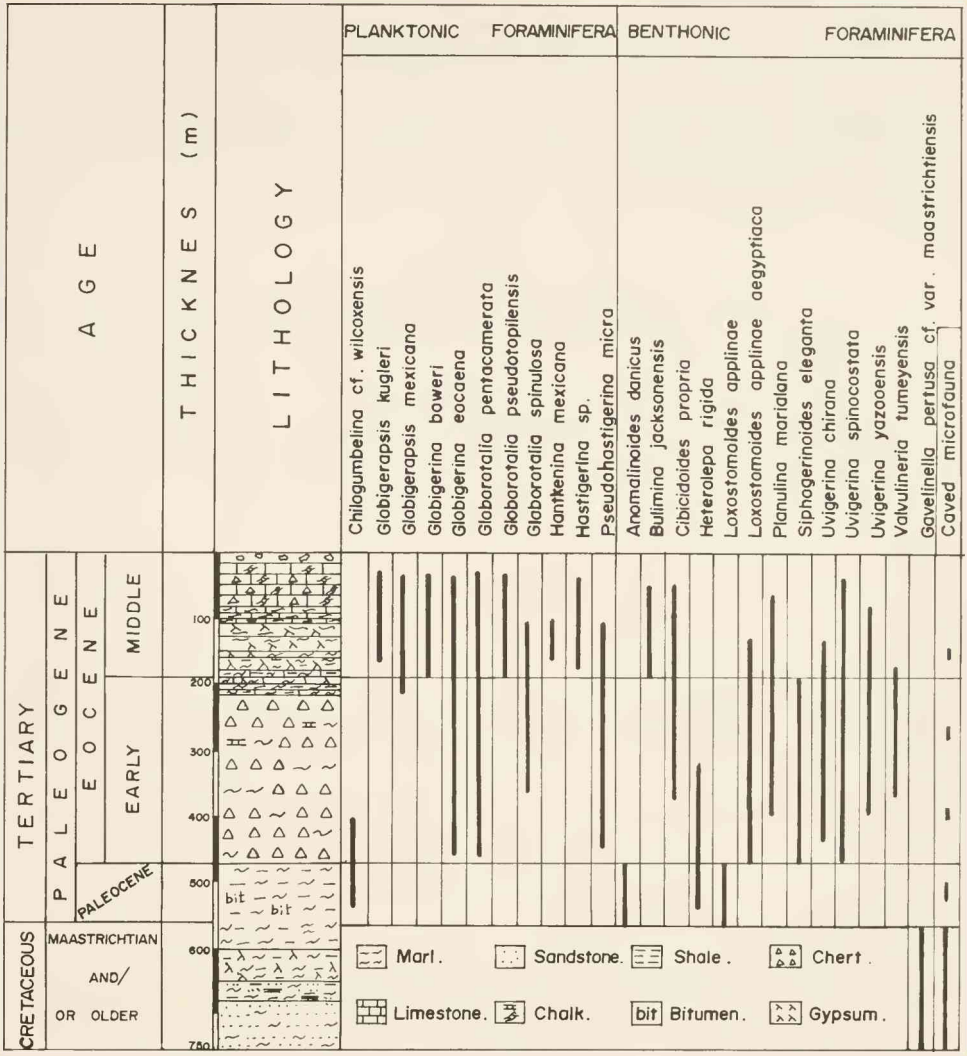


Fig. 2: Distribution of foraminifera in the Hamad well No. 1.

Valvulineria tumeyensis CUSHMAN & SIMSON, 1944
Pl. 1, Figs 11–14

1965 *Valvulineria tumeyensis* – HORNADY: Contr. Cush. Found. Foram. Res., **16**,1: 36; Pl. 3, Figs 13–15.

Remarks: This species shows many varieties which differ mainly in two diagnostic features, the degree of suture limbation and the hight of the spire. In Jordan, this species was probably misidentified under the names *Eponides elevatus, Valvulineria pseudotumeyensis* and *Gavelinopsis*(?) *baylisi.*

Planulina marialana HADLEY, 1934
Pl. 1, Figs 15, 16

*1934 *Planulina marialana* HADLEY – Bull. Amer. Paleont., **20**, 70 A: 27; Pl. 4, Figs 4, 5, 6 (in ELLIS et. al. 1969, 3).

Remarks: The Hamad specimens are rather similar to those reported by COLOM (1954) from the Eocene of Spain.

Gavelinella pertusa cf. var. *maastrichtiensis* HOFKER, 1956
Pl. 1, Figs 17, 18

1957 *Gavelinella pertusa* var. *maastrichtiensis* – HOFKER: Beih. Geol. Jb, **27**: 293; Figs 347, 348.

Remarks: The varieties of the Hamad specimens, which are abundant in the samples below 590 m, differ from the N-Europe ones in having less inflated chambers, indistinctive aperture and oblique initial part which all make the identification cf. rather than ss.

Heterolepa rigida (SCHWAGER, 1883)
Pl. 1, Figs 19, 20

1968 *Heterolepa rigida* – FUTYAN: Ph. D.-Thesis, Univ. London: 260; Pl. 18, Figs 1–3.

Remarks: The Hamad specimens differ from those identified from the Central South Jordan by FUTYAN 1968 in having a coiled hammock raised wide belt on the dorsal side rather than being smooth.

Cibicidoides propria (BROTZEN, ?)
Pl. 1, Figs 21, 22

1970 *Cibicidoides propria* – BERGGREN: Init. Rep. DSDP, **12**: 974; Pl. 11, Figs 14, 15.

Remarks: The main difference between Hamad specimens and those of North Atlantic of BERGGREN is that the Hamad specimens are sinistraly coiled while the BERGGRENS are dextral.

Hastigerina sp.
Pl. 1, Figs 23–25

Remarks: this species is rather to be misidentified with *Nonion* sp. from the first look but when good examined it shows a high resemblance to *Hastigerina* sp.

Chiloguembelina cf. *wilcoxensis* (CUSHMAN & PONTON, 1932)
Pl. 1, Fig. 2

*1932 *Gümbelina wilcoxensis* CUSHMAN & PONTON – CUSHMAN & PONTON: Cush. Lab. Foram. Res. Contr., **8**, 3: 66; Pl. 8, Figs 16, 17a–b.

Remarks: The Hamad specimens differ from the most figured *Chiloguembelina* species by being costate to rather ripped in the initial part. The ripping vanishs quickly with growth.

The species *Hantkenina mexicana, Globigerina boweri, Globorotalia pseudotopilensis, Globigerapsis mexicana, Globigerapsis kugleri, Globorotalia spinulosa, Pseudohastigerina micra, Globorotalia pentacamerata* and *Globigerina eocaena* are fully discussed in the literature.

Literature

Al-Harithi, T. (1986): Biostratigraphy and Paleoecology of the Upper Cretaceous in N. Jordan; with the help of foraminifera and small mollusca. – Ph. D-Thesis, Hannover Univ.: 121p; 15 Figs, 18 Pls.

Al-Harithi, T. (1989): Some foraminifera from the Middle Eocene of the Aroud Section, Idna near Hebron, West Bank, Palestine. – N. Jb. Geol. Palaont. Mh. (in press).

Ansary, S. (1955): Report on the foraminiferal fauna from the Upper Eocene of Egypt. Publ. Inst. Des. Egypt, **6:** 1–160, 4 pls.

Ansary, S. E. & Tewfik, N. M. (1969): Biostratigraphy & time stratigraphy of subsurface Upper Cret. of Ezz El-Orban Area, Gulf of Suez region, U. A. R. – Procc. 3rd Afric. Micropal. Colloq. Cairo, 1968: pp. 95–106, 2 Tab.; 2 pls.

Avnimelech, M. & Reiss, Z. (1954): On the Upper Cretaceous and Tertiary stratigraphy of a boring near Beth-Govrin (Israel). – Geol. Inst. Government of Israel and Hebrew Univ. Jerusalem, Publ. **6:** 171–276; 2 figs.

Bandy, O. (1964): Cenozoic planktonic foraminiferal zonation. – Micropaleont., **10**, 1: 1–17, 6 text-figs, 1 tab.

Bang, I. (1971): Planktonic foraminifera of the Lowermost Danian. – Proceed. 2nd Plankt. Conf., Rome 1970, **1:** 17–27, 1 Fig., 6 pls.

Bayliss, D. (1973): Micropaleontology of sections Cenomanian to Middle Eocene, West Bank of Jordan. – London Inst. Geol. Sci., Overseas Geol. Min. Res., **43:** 1–24; 8 text-figs; 4 tabs.; 5 pls.

Benjamini, C. (1980): Planktonic foraminiferal biostratigraphy of the Avedat Group (Eocene) in the Northern Negev, Israel. – J. Paleont., **54**, 2: 325–358, 7 text-figs, 7 pls.

Berggren, W. (1971): Tertiary boundaries and correlations. – In: B. M. Funnel and W. R. Riedel (eds.): Micropaleontology of the Oceans. Cambr. Univ. Press: 693–809, 40 tabs.

–– (1972): Cenozoic biostratigraphy and paleobiogeography of the North Atlantic. – Init. Rep. DSDP, **12:** 965–1002, 6 figs, 13 pls.

–– (1974): Late Paleocene-Early Eocene benthonic foraminiferal biostratigraphy and paleoecology of Rockall Bank. – Micropaleont., **20**, 4: 426–448, 6 text-figs, 4 tabs.; 6 pls.

Boltovskoy, E. & Wright, R. (1976): Recent foraminifera (Study-book). 515p., many figs.

Brotzen, F. (1934): Foraminiferen aus dem Senonian Palästinas. – Zeitschr. Deutsch. Palästina Verein, **57:** 28–72, 4 pls.

Cita, M. (1955): The Cretaceous-Eocene boundary in Italy – Proc. 4th World Petrol. Congr., Rom 1955, Sect. I/D, Pap. **2:** 127–152, 1 fig., 8 text-figs.

Cushman, J. (1946): Upper Cretaceous Foraminifera of the Gulf coastal region of the United States & adjacent areas. – U. S. Geol. Surv. Prof. Pap. **206:** pp. 0–241, Pls. 66; Washington.

Cushman, J. & Jarvis, P. W. (1931): Some new Eocene foraminifera from Jamaica. – Contr. Cush. Lab. Foram. Res., **7:** 75–78, pl. 10.

Dorreen, J. (1974): The western Gaj River section, Pakistan, and the Cretaceous-Tertiary boundary. – Micropaleont. **20**, 2: 178–193, 7 text-figs, 1 pl.

Ellis, B. et. al. (edit. 1969): Catalogue of index smaller foraminifera. – **2:** Tertiary planktonic foraminifera. **3:** Mesozoic-Tertiary benthonic foraminifera. Many photos and figs.

Fayose, E. & Osseez, L. (1972): Micropaleontological investigation of Ewekoro area, southwestern Nigeria. – Micropaleont., **18**, 3: 369–385, 6 text-figs, 2 tabs, 1 pl.

Futyan, A. (1968): Benthonic foraminifera from the Upper Cretaceous-Lower Tertiary successions in East Jordan. – Ph. D-Thesis, Univ. Coll. London: 353p., 18 pls.

—— (1976): Late Mesozoic and Early Cenozoic benthonic Foraminifera from Jordan. – Paleont., **19**,3: 517–537, pls. 81–83.

HASSON, P. (1985): New observations on the biostratigraphy of the Saudia Arabia Umm er Radhuma formation (Paleogene) and its correlation with neighbouring regions. – Micropaleont., **31**, 4: 335–364, 8 text-figs, 8 pls.

HOFKER, J. (1957): Foraminiferen der Oberkreide von Nordwestdeutschland und Holland. – Beih. Geol. Jb., **27**: 464 S., 495 Abb..

HORNADAY, G. (1965): An Eocene foraminiferal faunule from the northeastern Santa Ynez mountains, California. – Contr. Cush. Found. Foram. Res., **16**, 1: 29–39, 2 text-figs, 2 pls.

JOHNSON, D. & PARKER, F. (1972): Tertiary radiolaria and foraminifera from the equatorial Pacific. – Micropaleont., **18**, 2: 129–143; 4 text-figs, 4 tabs, 3 pls.

NAKKADY, S. (1950): A new foraminiferal fauna from the Esna shales and Upper Cretaceous chalk of Egypt. – J. Paleont., **24**,6: 675–692, 2 text-figs, pls. 89–90.

NSEIR, H. (1985): Microbiostratigraphy of the Paleogene in Syrian. – Syrian Geol. J., **8**: 66–76, 9 tabs, 2 figs, 1 tab., 2 pls.

POSTUMA, J. (1971): Manual of planktonic foraminifera. – Royal Dutch/Shell Group, The Hague-Netherlands: 420p, many pls.

RAMSAY, W. R. (1962): Hantkenininae in the Tertiary rocks of Tanganyika. – Contr. Cush. Found. Foram. Res., **13**,3: 79–89, 3 figs, 1 pl.

REISS, Z. (1952): On the Upper Cretaceous and Lower Tertiary microfaunas of Israel. – Geol. Inst. Government Israel and Hebrew Univ. Jerusalem, **2**: 37–50, 1 pl..

SAID, R. & SABRY, H. (1964): Planktonic foraminifera from the type locality of the Esna shale in Egypt. – Micropaleont., **10**,3: 375–395, 2 text-figs, 2 tabs, 3 pls.

STAINFORTH, R. et. al. (1975): Cenozoic planktonic foraminiferal zonation and characteristics of index forms. – Univ. Kansas Paleont. Contr., **62**: 425p, 213 figs.

THOMAS, F. (1988): Taxonomy and stratigraphy of selected Cenozoic benthic foraminifera, Canadian Atlantic margin. – Micropaleont., **34**, 1: 67–82, 5 text-figs, 3 tabs, 2 pls.

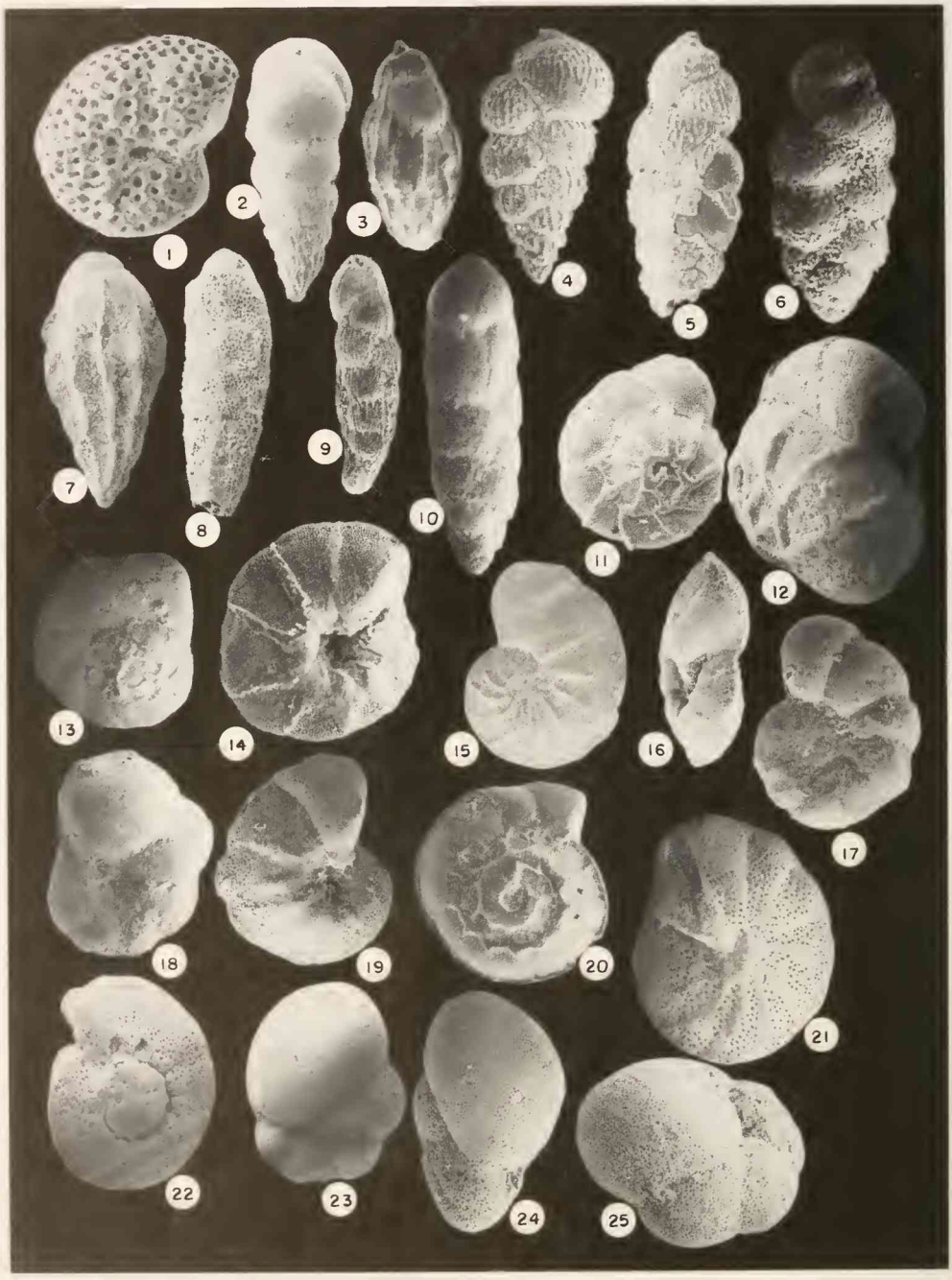
YASSINI, I. (1978): Maastrichtian-Lower Eocene biostratigraphy and the planktonic foraminiferal biozonation in Jordan. – Rev. Esp. Micropaleont., **11**, 1: 5–57, 3 tabs, 2 text-figs, 13 pls.

Plate 1

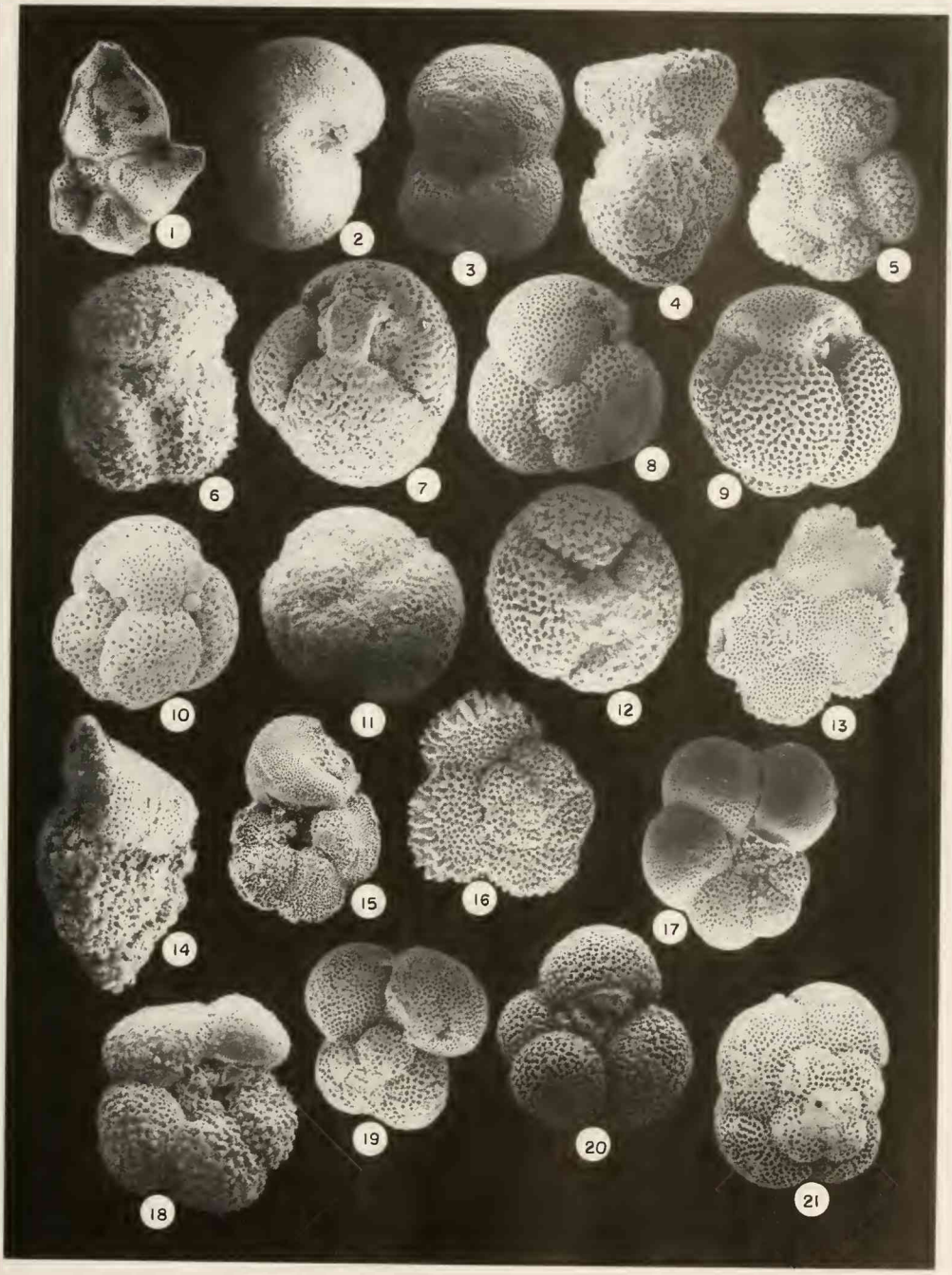
Fig. 1: *Anomalinoides danicus* (BROTZEN, 1940) Sample 480 m (×122).
Fig. 2: *Chiloguembelina* cf. *wilcoxensis* (CUSHMAN, 1940) Sample 400 m (×144).
Fig. 3: *Uvigerina yazooensis* CUSHMAN, 1933 Sample 180 m (×58).
Figs 4, 5: *Uvigerina spinocostata* CUSHMAN & JARVIS, 1926 Sample 200 m (×132).
Fig. 6: *Uvigerina chirana* CUSHMAN & STONE, 1947 Sample 200 m (×108).
Fig. 7: *Bulimina jacksonensis* CUSHMAN, 1925 Sample 100 m (×56).
Fig. 8: *Loxostomoides applinae* (PLUMMER, 1927) Sample 500 m (×130).
Fig. 9: *Loxostomoides applinae* var. *aegyptiaca* NAKKADY, 1950 Sample 180 m (×144).
Fig. 10: *Siphogerinoides eleganta* PLUMMER, 1927 Sample 360 m (×115).
Figs 11–14: *Valvulineria tumeyensis* CUSHMAN & SIMONSON, 1944, Sample 320 (11 is ×58, 12 is ×70, 13 is ×33, and 14 is ×65).
Figs 15, 16: *Planulina marialana* HADLEY, 1934 Sample 180 m (15 is ×43; 16 is ×60).
Figs 17, 18: *Gavelinella pertusa* cf. var. *maastrichtiensis* HOFKER, 1956. Sample 600 m (17 is ×60, 18 is ×67).
Figs 19, 20: *Heterolepa rigida* SCHWAGER, 1883. Sample 300 m (19 is ×53; 20 is ×60).
Figs 21, 22: *Cibicidoides propria* (BROTZEN). Sample 180 m (21 is ×86; 22 is ×79).
Figs 23–25: *Hastigerina* sp. Sample 100 m (23 is ×60; 24 is ×74; 25 is ×103).

Plate 2

Fig. 1: *Hantkenina mexicana* CUSHMAN, 1924. Sample 150 m (×113).
Figs 2, 3: *Globigerina bowerí* BOLLI, 1957. Sample 160 m (both ×79).
Figs 4–6: *Globorotalia pseudotopilensis* (SUBBOTINA, 1953). Sample 100 m (4 and 6 are ×115; 5 is ×106).
Figs 7–10: *Globigerapsis mexicana* (CUSHMAN, 1925). Sample 120 m (7 is ×106; 8 is ×94; 9 is ×102; 10 is ×110).
Figs 11, 12: *Globigerapsis kugleri* BOLLI, LOEBLICH & TAPPAN, 1957. Sample 100 m (11 is ×115; 12 is ×113).
Figs 13–16: *Globorotalia spinulosa* CUSHMAN, 1927. Sample 220 m (13 is ×110; 14 is ×146; 15 is ×68; 16 is ×94).
Fig. 17: *Pseudohastigerina micra* (COLE, 1927). Sample 300 m (×120).
Figs 18, 21: *Globorotalia pentacamerata* SUBBOTINA, 1947. Sample 180 m (18 is ×98; 21 is ×89).
Figs 19, 20: *Globigerina eocaena* GUMBLER, 1868. Sample 180 m (19 is ×101; 20 is ×116).



SAMAN, J. & AL-HARITHI, T.: Paleogene Foraminifera of Jordan **Plate 1**



SAMÁN, J. & AL-HARITHI, T.: Paleogene Foraminifera of Jordan

Plate 2