ZIBELINE INTERNATIONAL™ PUBLISHING

Science Heritage Journal (GWS)

DOI: http://doi.org/10.26480/gws.02.2024.33.36

ISSN: 2521-0858 (Print)
ISSN: 2521-0866 (Online)
CODEN: SHJCAS

RESEARCH ARTICLE

THE EVOLUTIONARY LINEAGES OF THE MAASTRICHTIAN PLANKTIC FORAMINIFERA GENUS *Plummerita* IN THE TETHYS

Haidar Salim Anan

Stratigraphy and paleontology, Former Vice President of Al-Azhar University-Gaza, Palestine.
****Corresponding Author Email: profanan@gmail.com***

ARTICLE DETAILS

Article History:

Received 20 December 2023
Revised 15 January 2024
Accepted 08 February 2024
Available online 12 February 2024

ABSTRACT

Five phylogenetic lineages were observed by present author in the eleven Tethyan Maastrichtian planktic foraminiferal species of the genus *Plummerita*. These lineages help to define the major faunal changes from the species throughout of three groups of the *Plummerita.* The first group (*P. haggagae* group) belongs to the four-chambered volition (4-ch) with axially pointed spine-like prolongation evolved to another species of five-chambered volition (5-ch) (*P. hantkeninoides* group), to another species of six-chambered volition (6-ch) (*P. reicheli* group). The five lineages are: (1) The *Plummerita elkefensis* (4-ch) to *P. hantkeninoides* (5-ch), (2) *P. haggagae* (4-ch) to *P. costata* (5-ch) to *P. spainica* (6-ch), (3) *P. inflata* (5-ch) to *P. tunisica* (6-ch) (4) *P. kellerae* (5-ch) to *P. caribbeanica* (6-ch), (5) *P. premolisilvae* (5-ch) to *P. reicheli* (6-ch). Unfortunately, most of these lineage are uncompleted from four to five to six-chamber volution, while only one of them is completed (no. 2). In spite of this uncompleted lineages situation, it seems that we must await further study to complete these lineages by another unknown taxa.

KEYWORDS

Lineages, Planktic foraminifera, *Plummerita*, Maastrichtian, Tethys

1. INTRODUCTION

The Maastrichtian planktic foraminiferal genus *Plummerita* with its eleven species have three groups, according to its number chambers of the last whorl: *Plummerita haggagae* group, *P. hantkeninoides* group and *P. reicheli* group. The first one is of the four-chambered volition with axially pointed spine-like prolongation, which includes, so far, two species: *P. haggagae* and *P. elkefensis*. The second group is of the five-chambered volition, includes six species: *P. costata, P. hantkeninoides, P. hodae, P. inflata*, *P. kellerae, P. premolisilvae*. The third group with six-chambered volition, includes four species: *P. caribbeanica, P. reicheli, P. spainica* and *P. tunisica.* Five proposed lineages between the species in these three groups of the genus *Plummerita*. This assemblage is distributed in many countries in the Tethys (Figure 1).

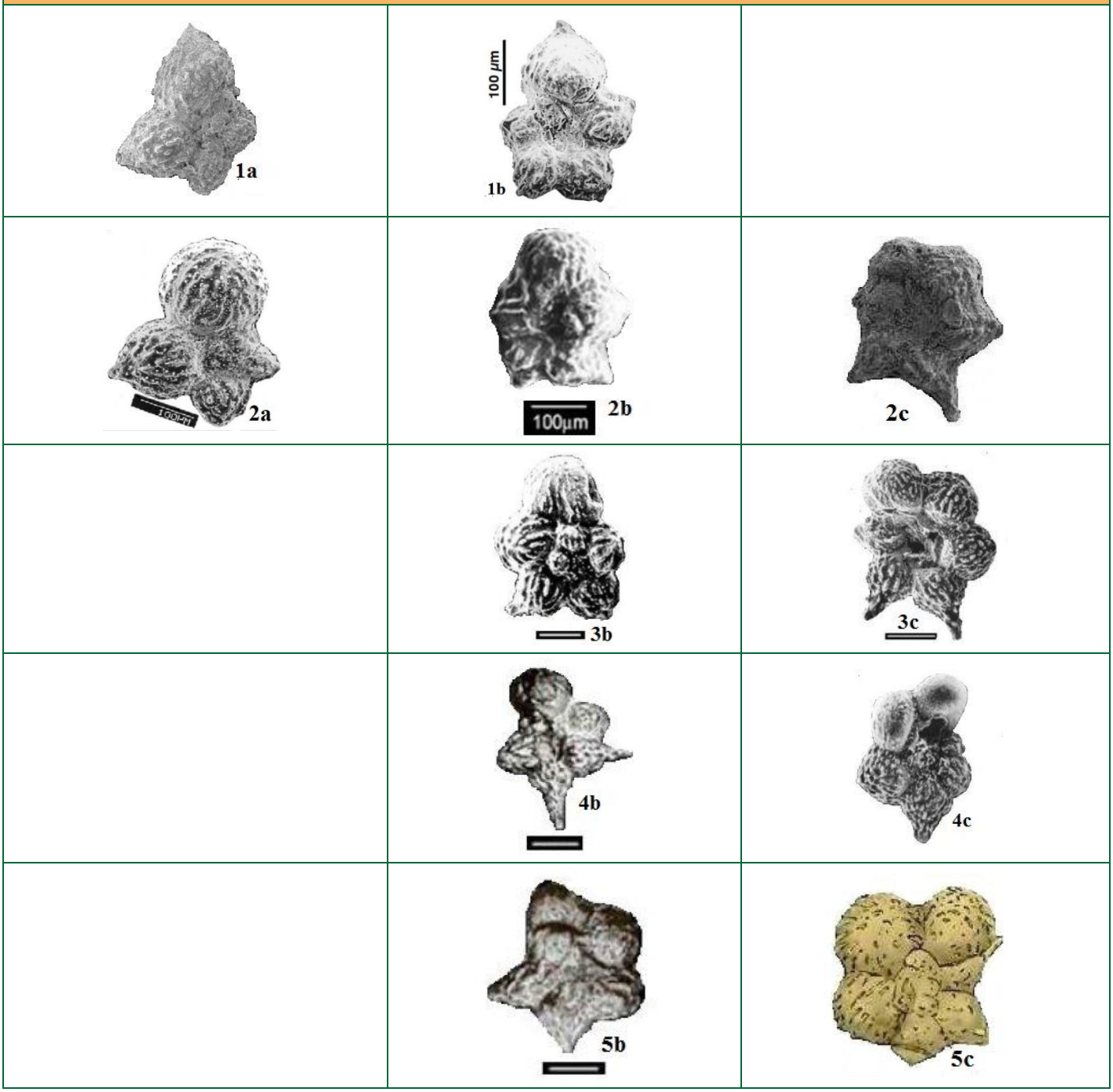
Figure 1: The Maastrichtian paleogeographic map showing the connected seas from west Atlantic Ocean (Caribbean) to east Atlantic (Spain, Italy) via the Mediterranean Sea (Tunisia, Egypt), as well as Iraq and Iran (Solakius et al., 1990).

Quick Response Code	Access this article online	
	Website: www.jscienceheritage.com	**DOI:** 10.26480/gws.02.2024.33.36

Cite The Article: Haidar Salim Anan (2024). The Evolutionary Lineages of The Maastrichtian Planktic Foraminifera Genus *Plummerita* in The Tethys. *Science Heritage Journal, 8(2): 33-36.*

Table 1. Fig. 1a. *Plummerita elkefensis*, **1b.** *P. hantkeninoides*; **2a.** *P. haggagae*, **2b.** *P. costata;* **2c.** *P. spainica*; **3b.** *P. inflata*, **3c.** *P. tunisica*; **4b.** *P. spainica*, **4c.** *P. caribbeanica*; **5b.** *P. premolisilvae,* **5c.** *P. reicheli* (scale bar= 100µm). The empty boxes are the specimens not identified until now.

Table 1: showing the different trends of the Maastrichtian *Plummerita* members.



2. Systematic Paleontology

The diagnostic Maastrichtian planktonic foraminiferal species of the genus Plummerita have spine-like prolongation of ultimate and penultimate chambers of the last whorl. These assemblage includes three main groups according to the number chambers of the last whorl: four-chamber volution (P. haggagae group), five-chamber volution (P. hantkeninoides group) and six-chamber volution (P. reicheli group) (Plate 1). The taxonomy followed here is that of (Loeblich and Tappan, 1988).

Order Foraminiferida Eichwald, 1830

Suborder Globigerinina Delage & Hérouard, 1896

Superfamily Globotruncanacea Brotzen, 1942

Family Rugoglobigerinidae Subbotina, 1959

Genus Plummerita Brönnimann, 1952

Type species: Rugoglobigerina (Plummerella) hantkeninoides hantkeninoides Brönnimann, 1952

I. Plummerita haggagae group: includes, so far, two species: P. elkefensis and P. haggagae.

I .1. Plummerita elkefensis Anan & Orabi, 2022, p. 183, figure 4. D, E) (Plate 1, figure 1a) (=Plummerita hantkeninoides (Brönnimann). Samir, 2002 p. 24, pl. 1, fig. 5; Plummerita hantkeninoides (Brönnimann) - Keller, 2005, 17 p. 741, pl. 16.4)

Remarks: It is distinguished by its radially elongated chambers with axially spine-like prolongation in linear pattern rugose surface in all four chambers in the last whorl with low trochoidal volution. It was recorded, so far, from Egypt and Tunisia.

I.2. Plummerita haggagae Anan, 2008, p. 249, pl. 1, figs. 2, 3 (Plate 1, figure 2a) (=Plummerita hantkeninoides (Brönnimann) - Ziko et al,1993, p. 143, fig. 4. 10, 11; Keller, 2003, p. 81, fig. 8 (non figs. 9, 10), Galal,2004, p. 246, fig. 7.4; Obaidalla et al, 2017, p. 67, fig. 18.K (non J); Bamerni et al., 2021, p. 8, pl. 1, figs. 5-8).

Remarks: It differs from P. elkefensis by its three spine-like prolongation of the last fourth inflated chamber, but without spine-like prolongation of

the last fourth inflated chamber. It was recorded, so far, from Egypt and Iraq.

II. The second Plummerita hantkeninoides group includes, so far, six species: P. costata, P. hantkeninoides, P. hodae, P. inflata, P. kellerae, P. premolisilvae.

II. 3. Plummerita costata (Brönnimann, 1952) (Plate 1, figure 2a) (=Rugoglobigerina (Plummerella) hantkeninoides costata Brönnimann, 1952, p. 40, pl. 3, figs. 4-6, text-fig. 18a-c.; Plummerita costata (Brönnimann) – Anan, 2012, p. 594, pl. 1, fig. 2).

Remarks: P. costata is distinguished by its five-chambered volition, with axially pointed spine-like prolongation for the four penultimate chambers, but without spine-like prolongation of the last inflated chamber. It was recorded from Trinidad, Italy, Egypt and Iran.

II. 4. Plummerita hantkeninoides (Brönnimann, 1952) (Plate 1, figure 1b) (=Rugoglobigerina (Plummerella) h. hantkeninoides Brönnimann, 1952, p. 37, pl. 3, figs. 1-3, text-fig.1a-k; Plummerita hantkeninoides (Brönnimann) - Arz et al, 2001, p. 224, pl.1, fig. 7).

Remarks: .It is characterized by the last five-chambered volition, radially elongated with axially spine-like prolongation of linear pattern rugose surface for all the five chambers in the last whorl. It was recorded from Trinidad, Mexico, Italy, Tunisia and Egypt.

II.5. Plummerita hodae Anan, 2022, p. 183, Fig. 4A (=Plummerita inflata (Brönnimann). Anan, 2012, p. 594, pl. 1, fig. 3).

Remarks: It is closely related to P. inflata (pl. 1, figure 6), but differs by the position of its larger fourth chamber than the last fifth chamber, and its third chamber exists perpendicular along the vertical line to the last fifth chamber in the final whorl of the test. Unfortunately, no four-chamber or six-chamber volution specimens, so far, were recorded for it to complete the lineage including this species. It was, so far, confined to Egypt.

II.6. Plummerita inflata (Brönnimann, 1952) (=Rugoglobigerina (Plummerella) hantkeninoides inflata Brönnimann, 1952, p. 40, pl. 3, figs. 7-9, text-fig. 19a-m; Plummerita sp. Kassab,1975, p. 350, pl. 2, fig. 5; Plummerita inflata (Brönnimann). Anan, 2012, p. 594, pl. 1, fig. 3) (Plate 1, figure 3b).

Remarks: It is characterized by axially pointed spine-like prolongations of the first three chambers, but strongly inflated shapes without spines for the last two chambers in the last whorl. It was recorded from Trinidad, Iraq and Egypt.

II.7. Plummerita kellerae Anan & Orabi, 2022, p. 183, Figure 4. B (=Plummerita hantkeninoides Keller et al, 2003, p. 279, pl. 2, fig. 14) (Plate 1, figure 4b).

Remarks: It differs from P. inflata and P. hodae by its first three radially elongate chambers with axially spine-like prolongation, while the last penultimate and ultimate chambers are inflated without spines. It was recorded from Egypt.

II.8. Plummerita premolisilvae Anan & Orabi, 2022, p. 183, Figure 4. C (=Plummerita hantkeninoides (Brönnimann) - Coccioni & Premoli Silva, 2015, p. 59, pl. 3, fig. 15 (non figs. 12-14, 16). (Plate 1, figure 5b).

Remarks: This species has closely related to P. inflata and P. kellerae, but differs from it by its only first two radially elongate chambers with axially spine-like prolongation, while the last third, fourth and fifth last chambers are inflated without spines. It was recorded, so far, from Italy.

III. The third Plummerita reicheli group includes for species: Plummerita caribbeanica, P.

reicheli, P. spainica and P. tunisica.

III.9. Plummerita caribbeanica Anan, 2023, p. 26, pl. 1, fig. 5 (=Rugoglobigerina cf. reicheli or Plummerita cf. hantkeninoides-Robaszynski et al., 1983/4, p. 187, p. 286, pl. 50, fig. 6) (Plate 1, figure 4c).

Remarks: It is characterized by a tubulospine first three chambers of the six-chamber volution of the last whorl. This new was recorded from Puerto Rico, Caribbean region.

III.10. Plummerita reicheli (Brönnimann, 1952) (=Rugoglobigerina r. reicheli Brönnimann, 1952, p. 168, pl. 3 (3), figs. 10-12) (Plate 1, figure 5c).

Remarks: This species has closely resembles the chamber's arrangement of the last whorl of P. premolisilvae (Pl. 1, fig. 8), but with six-chamber volution instead of five-chamber only. It was recorded from Trinidad, Egypt and Iraq.

III.11. Plummerita spainica Anan, 2023, p. 25, pl. 1, fig. 7 (=Plummerita hantkeninoides (Brönnimann) - Gilabert et al., 2021, p. 6, fig. 3L) (Plate 1, figure 2c).

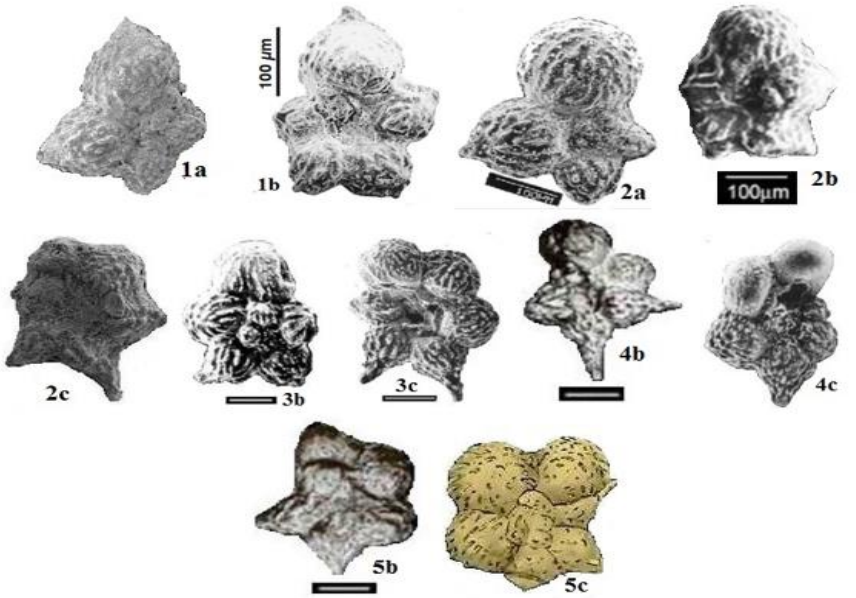
Remarks: This species has closely related to P. costata (Brönnimann), but differs by its six-chamber volution than five-chamber volution of the latter. It most probably developed from P. costata (Plate 1, figure 3). P. spainica, so far, was confined to Spain.

III.12. Plummerita tunisica Anan, 2023, p. 25, pl. 1, fig. 3 (=Plummerita hantkeninoides (Brönnimann) - Keller, 2012, p. 26, figure. 4.2, non figs. 4.1,3) (Plate 1, figure 3c).

Remarks: This species has closely related to P. inflata (Brönnimann) but differs from it by its last six-chamber in the final whorl, and most probably developed from it (Plate 1, fig. 6). It is, so far, confined to Tunisia.

Plate 1

Fig. 1a. Plummerita elkefensis Anan & Orabi, 2022; 1b. P. hantkeninoides (Brönnimann, 1952); 2a. P. haggagae Anan, 2008; 2b. P. costata (Brönnimann, 1952); 2c. P. spainica Anan, 2023; 3b. P. inflata (Brönnimann, 1952); 3c. P. tunisica Anan, 2023; 4b. P. kellerae Anan & Orabi, 2022; 4c. P. caribbeanica Anan, 2023; 5b. P. premolisilvae Anan & Orabi, 2022; 5c. P. reicheli (Brönnimann, 1952).



3. PALEOGEOGRAPHY

All the identified species of Brönnimann (1952): *Plummerita hantkeninoides*, *P. costata, P. inflata* and *P. reicheli* were originally identified from Trinidad, and some of them are also recorded from other countries, e.g. Mexico, Italy, Tunisia, Egypt, Iraq and Iran. Other identified species of *Plummerita* were recoded from Caribbean (*P. caribbeanica*), Spain (*P. spainica*), Italy (*P. premolisilvae*), Tunisia (*P. elkefensis* and *P. tunisica*), Egypt (*P. elkefensis, P. haggagae, P. hodae* and *P. kellerae*), and Iraq (*P. haggagae*)(Figure 2).

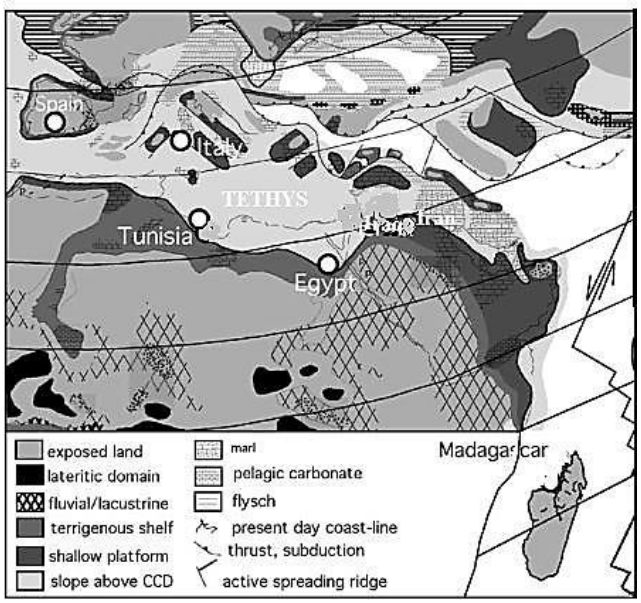


Figure 2: The Maastrichtian paleogeographic map of the Northern Tethys (Spain and Italy) and Southern Tethys (Tunisia, Egypt, Iraq and Iran) (Keller, 2005).

4. PALEOENVIRONMENT

According to many authors the planktonic foraminiferal *Plummerita* spp. are mostly representing a warm stratigraphic interval water environment which have radiations of its tests, and deep marine, outer shelf-upper bathyal environment, 200-400 m, and represents the Latest Maastrichtian Warming Event (LMWE) (Frerichs, 1971; Abramovich and Keller, 2002; Keller, 2003; Gilabert et al., 2021). An abrupt global warming of 3-4^{o}C occurred near the end of the Maastrichtian at 65.45-65.10 Ma. During the warm event, the relative abundance of a large number of species decreased, including tropical-subtropical affiliated species, whereas typical mid-latitude species retained high abundances.

ACKNOWLEDGMENTS

The author is greatly indebted to the editor and other colleagues in the SWG. Thanks are presented to my daughter Dr. Huda Anan for the development of the figures, table and plate.

REFERENCES

Abramovich, S., Keller, G., 2002. High stress late Maastrichtian paleoenvironments: inference from planktonic foraminifera in Tunisia. Palaeogeography, Palaeoclimatology, Palaeoecol ogy,178, Pp. 145–164.

Anan, H.S., 2008. Latest Maastrichtian Plummerita haggagae and Paleocene Pseudoclavulina hewaidyi, two new foraminiferal species from Egypt. Egyptian Journal of Paleontology, 8, Pp. 245-254.

Anan, H.S., 2012. Paleontology, paleoecology, paleobathymetry, paleogeography and stratigraphic significance of the latest Maastrichtian genus Plummerita in Duwi section, Egypt and Tethys. Revue de Paléobiologie. 31(2), Pp. 589–600.

Anan, H.S., 2023. Six-chambered volution of the Maastrichtian planktic foraminiferal Plummerita species in the Tethys. Geosciences Research Journal (GSRJ), 1(1), Pp. 25-27.

Anan, H.S., Orabi, O.H., 2022. Four and five-chambered evolution of the Late Maastrichtian planktic foraminiferal Plummerita species in the Tethys. Journal of Microbiology and Experimentation, 10 (5), Pp. 181-187

Arz, J.A., Alegret, L., Arenillas, I., 2001. Foraminiferal extinction across the Cretaceous/Tertiary boundary at Coxquihui (Mexico) and its relationship with the impact evidence. Revista Española de Micropaléontologie. 33(2) Pp. 221–236.

Bamerni, A., Al-Qayim, B., Hammoudi, R.A., 2021. High-resolution biostratigraphic analysis of the Cretaceous-Paleogene Boundary in the Kurdistan Region (NW Iraq). Stratigraphy, 18(4), Pp. 1–18.

Brönnimann, P., 1952. Plummerita new name for Plummerella Brönnimann, 1952 (not Plummerella De Long, 1942). Cushman Foundation for Foraminiferal Research, 3, Pp. 1–146.

Coccioni, R., Premoli Silva, I., 2015. Revised Upper Albian–Maastrichtian planktonic foraminiferal biostratigraphy and magnetostratigraphy of the classical Tethyan Gubbio section (Italy). Newsletters on Stratigraphy, 48(1), Pp. 47–90.

Frerichs, W.E., 1971. Evolution of planktonic foraminifera and paleotemperatures. Journal of Paleontology, 45(6), Pp. 963–968.

Galal, G., 2004. Graphic correlation for the cretaceous/tertiary boundary of the Abu Zenima section, west central Sinai, Egypt. Revue de Paléobiologie, 23(1), Pp. 239–262.

Kassab, I.I.M., 1975. Globotruncana falsocalcarata Kerdany and Abdelsalam from northern Iraq. Micropaleontology, 21(3), Pp. 215–238.

Keller, G., 2003. Guembelitria-dominated late Maastrichtian planktic foraminiferal assemblages mimic early Danian in central Egypt. Marine Micropaleontology, 47(1–2), Pp. 71–99.

Keller, G., 2005. Biotic effects of late Maastrichtian mantle plume volcanism: implications for impacts and mass extinctions. Lithos, 79, Pp. 317 – 341.

Keller, G., 2012. Defining the Cretaceous–Tertiary boundary: a practical guide and return to first principles. The End-Cretaceous Mass Extinction and the Chicxulub Impact in Texas, SEPM Special Publication No. 100, Copyright 2011, SEPM (Society for Sedimentary Geology), Print ISBN 978-1-56576-308-1, CD/DVD ISBN 978-1-56576-309-8, Pp. 23–42.

Loeblich, A.R., Tappan, H., 1988. Foraminiferal genera and their classification. Van Nostrand Reinhold (VNR), New York, Part 1, Pp. 1-970, part 2, Pp. 1–847.

Obaidalla, N., El-Younsy, A., Philobbos, E., 2017. Impact of the African/Arabian and Eurasian plates collision on the evolution of the upper cretaceous-lower Paleogene sedimentary basin, Eastern Desert, Egypt. International Journal of Ecological Science and Environmental Engineering, 4(5), Pp. 51–71.

Robaszynski, F., Gonzalez Donoso, J.M., Linaris, D., 2000. The Upper Cretaceous of the Kalaat Senan region, central Tunisia. Integrated litho-biostratigraphy based on ammonites, planktonic foraminifera and nannofossils zones from Upper Turonian to Maastrichtian. Bulletin of Centres Research, Production of Elf- Aquitaine, 22(2), Pp. 359–490.

Samir, A.M., 2002. Biostratigraphy and paleoenvironmental changes in the Upper Cretaceous-Early Paleogene deposits of Gebel Samra section, southwestern Sinai, Egypt. Egyptian Journal of Paleontology, 2, Pp. 1–40.

Solakius, N., Pomoni-Papaioannou, F., Alexopouios, A., 1990. On the paleogeographic distribution of the Late Maastrichtian planktonic foraminiferal genus Kassabiana Salaj and Solakius, 1984.- Acta Geologica Hispanica, 25 (4), Pp. 289-298.

Ziko, A., Darwish, M., Eweda, Sh. 1993. Late Cretaceous-Early Tertiary stratigraphy of the Themed area, East Central Sinai, Egypt. Neues Jahrbuch für Geologie und Paläontologie Mh., H. 3, Pp. 135–149.