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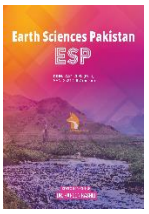

RESEARCH ARTICLE

NEW RECORD OF THE EGYPTIAN MAASTRICHTIAN PLANKTIC FORAMINIFERA *PLUMMERITA HAGGAGAE* ANAN IN IRAQ

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ABSTRACT

The latest Maastrichtian planktic foraminiferal Egyptian species *Plummerita haggagae* Anan from the planktic foraminiferal zonation *P. hantkeninoides* Zone of Duwi section (Qusseir area, Red Sea coast, Eastern Desert of Egypt) has last spine-like prolongation of the three penultimate of four-chambered volution test, and also recorded here from the same stratigraphic horizon of Per Fat section (Duhok area, Kurdistan region of Iraq). This species represents the third group of *Plummerita* (*Plummerita haggagae* group of Anan). The other two groups of *Plummerita,* which produced by Brönnimann (1952) from Trinidad, are: *Plummerita hantkeninoides* group (last five-chambered volution: *P. hantkeninoides, P. costata, P. inflata*), and *Plummerita reicheli* group (last six-chambered volition: *P. reicheli, P. pustulata, P. hexacamerata*). *P. haggagae* is distinguished by its four-chambered volition in dextral coiling, with axially pointed spine-like prolongation for the three penultimate chambers, but without spine-like prolongation of the last fourth inflated chamber. The fauna of Gabal Duwi in central Egypt is predominantly considered here to be related to MTF (middle-upper neritic environment (100-200 m water depth).

KEYWORDS

Planktic foraminifera, stratigraphy, paleogeography, Paleoenvironment, *Plummerita haggagae* group, Maastrichtian, Egypt, Iraq

1. INTRODUCTION

The Maastrichtian-Paleocene (K/T) boundary outcrops have an extensive distribution in the Middle East, particularly Egypt and Iraq and caught the attention of a great numbers of researchers (Nakkady, 1950; Said & Kenawy, 1956; Abdel-Kireem, 1986; Anan, 2008; Bamerni et al., 2021). Anan (2008) presented an new species *Plummerita haggagae* of last four-chambers volution from Gabal Duwi, Red Sea coast of Egypt (Figure 1), which represents the third group of *Plummerita: P. haggagae* group, beside *P. hantkeninoides* group and *P. reicheli* group (Anan, 2008; Brönnimann, 1952). In this study another record of *P. haggagae* in Per Fat section, Duhok, NE Iraq to be the second record of this species outside Egypt. The position of Duwi section in Southern Tethys is shown in Figure 2. The location map of Per Fat section, Duhok, NE Iraq is shown in Figure 3.

Figure 1: Location map of the Nile Valley facies, NVF in Egypt and Sinai Facies, SF (Issawi et al., 1999). The numbers are the studied section by the author and others: 5. Duwi section at the Red Sea coast is related to the Nile Valley Facies.

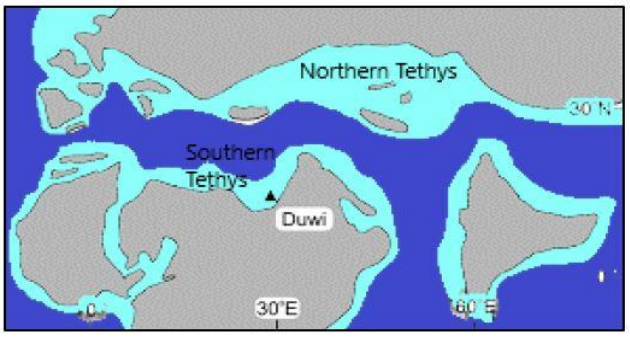

Figure 2: Location map of Duwi section, Red Sea coast, Egypt in the Southern Tethys (Anan, 2017).

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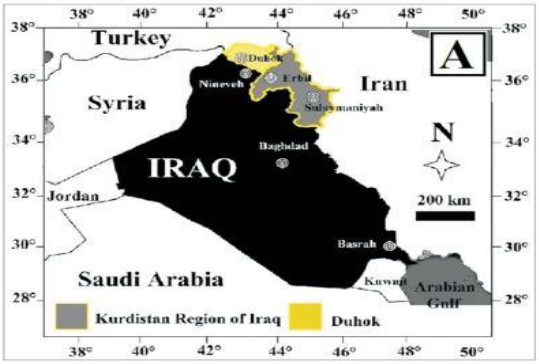

Figure 3: The location map of Per Fat section in the Duhok region, the Northeast Iraq (Bamerni et al., 2021).

2. STRATIGRAPHY

The stratigraphy and paleontological studies on Gabal Duwi of many authors (Nakkady, 1950; Youssef, 1957; Krasheninnikov & Abd El Razik, 1969; Anan, 2008) are pertinent to the present study. Seven samples around K/T boundary were collected from the Maastrichtian (*Plummerita hantkeninoides* Zone) and Danian (*Parasubbotina pseudobulloides*). The Cretaceous/Tertiary (K/T) boundary of Gabal Duwi section is represented by a thin layer (about 0.1 m) of *Nucula* spp. within the Dakhla Shale which rests directly on about 2 m of barren black shale (Figure 4).

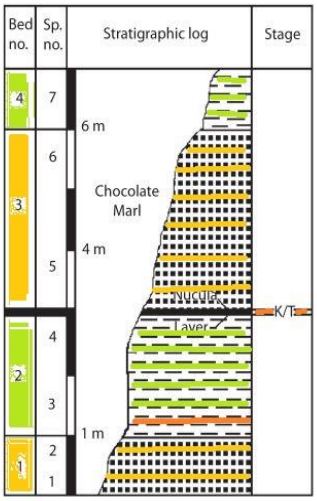

Figure 4: Stratigraphic log of the Cretaceous /Tertiary (K/T) boundary at Gabal Duwi, Red Sea coast, Egypt (Anan, 2008).

The Late Maastrichtian chocolate marly bed with about 1.0 m thick (bed. No. 1) yields rich and well preserved planktic and benthic foraminifera, e.g. *P. haggagae* Anan as well as the members of *Plummerita h. hantkeninoides* group. The stratigraphy and paleontological studies on Per Fat section, Duhok area, NE Iraq were treated by some authors (Al-Omari, 1970; Abawi & Abdo, 2001; Bamerni et al., 2021), and the K/T boundary is represented by the upper part of the Shiranish Formation (late Maastrichtian) with the overlying Aaliji Formation (Danian), positioned in a continuous pelagic marlstone that exhibits a change in color from pale blue of the Cretaceous (Shiranish Fm.) to light brown at the base of the Paleogene (Aaliji Fm.) (Figure 5).

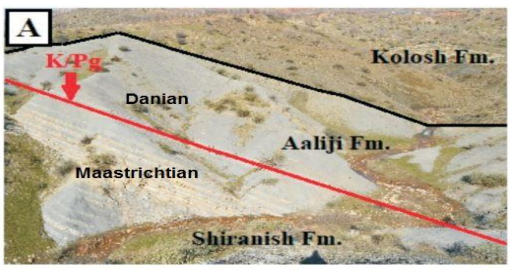

Figure 5: Field photos A: K-Pg boundary of Per Fat section, Dohuk area, NE Iraq (Bamerni et al., 2021).

3. FAUNAL REVIEW

Anan (2008) presented the third group of the *Plummerita*: *Plummerita haggagae* group (with last four-chambered volution), beside the other two groups of *Plummerita*: *P. hantkeninoides* group (with last five-chambered volution) and *Plummerita reicheli* group (with last six-chambered volution). The *Plummerita haggagae* species was originally recorded from the Late Maastrichtian of Duwi section of Egypt, but now it is also recorded also from the Late Maastrichtian of Per Fat section, Duhok area, NE Iraq.

4. TAXONOMY

The classification of Loeblich and Tappan (1988) is followed here.

Order Foraminiferida Eichwald, 1830

Suborder Globigerinina Delage and Hérouard, 1896

Genus *Plummerita* Brönnimann, 1952

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

***Plummerita haggagae* Anan, 2008** - (Pl. 1, figs. 1-5)

1993 *Plummerita hantkeninoides* (Brönnimann) - Ziko et al., p. 143, Figure 4. 10, 11.

2002 *Plummerita hantkeninoides* (Brönnimann) - Keller, p. 81, Figure 8 (*non* figs. 9, 10).

2004 *Plummerita hantkeninoides* (Brönnimann) - Galal, p. 246, Figure 7.4.

2008 *Plummerita haggagae* Anan, p. 249, pl. 1, figs. 2, 3.

2017 *Plummerita hantkeninoides* (Brönnimann) - Obaidalla et al, p. 67, Figure 18.K (*non*-J).

2021 *Plummerita hantkeninoides* (Brönnimann) - Bamerni et al., p. 8, pl. 1, figs. 5-7.

Remarks: The figured specimens of Ziko et al. (1993) and Galal (2005) from Sinai, as well as of Keller (2002) from central Egypt are regarded here to fall in the species concept of *P. haggagae*. It was recorded, so far, from Egypt (Ziko et al., 1993; Keller, 2002; Obaidalla et al., 2017) and Iraq: Bamerni et al. (2021).

Plate 1

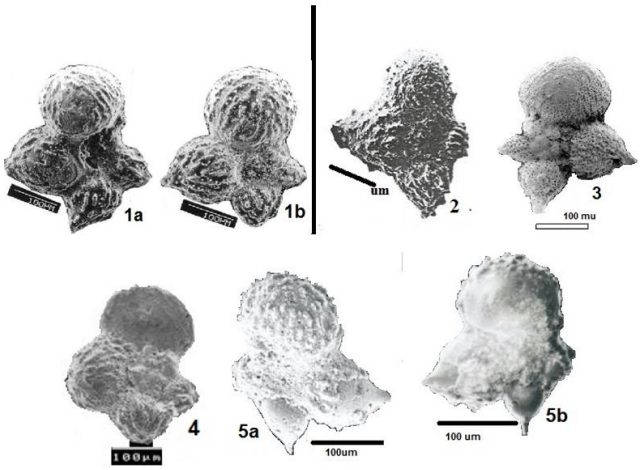

Figure 1-5: *Plummerita haggagae* Anan (2008): **1a,b.** *Plummerita haggagae* Anan (2008), 1a. ventral view, 1b. dorsal view; **2.** *P. hantkeninoides* (Brönnimann), after Galal (2004); **3.** *P. hantkeninoides*, after Keller (2002); **4.** *P. hantkeninoides*, after Obaidalla et al. (2017); **5a,b.** *P. hantkeninoides*, after Bamerni et al. (2021**),** 5a. ventral view, 5b. dorsal view**.**

5. PALEOGEOGRAPHY

Keller (2002) noted that among Rugoglobigerinids, only *P. hantkeninoides* is largely restricted to the low latitude Tethys, and these surface dwellers rarely appear in middle latitudes (Figure 6). Anan (2008) noted that the wide geographic distribution of the closed forms which are treated here as *Plummerita haggagae* in many localities in the Nile Valley Facies of Issawi,

et al., 1999) at Central Egypt, and in Sinai (represents the Sinai Facies of Issawi et al., 1999). In this study, it is also recorded also from the Late Maastrichtian of Per Fat section, Duhok area, NE Iraq.

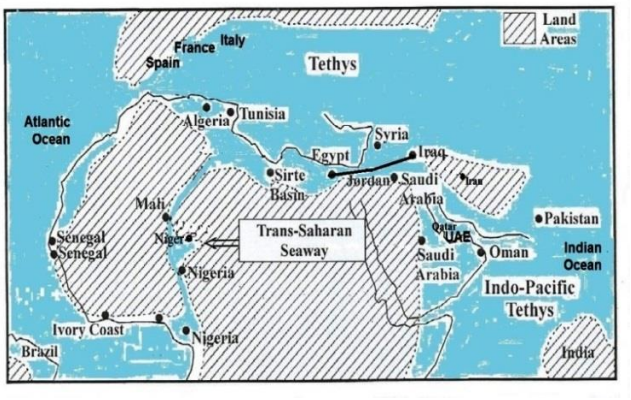

Figure 6: The open Tethyan sea water between the Egypt and Iraq in the Southern Tethys during the K/T boundary (Morsi et al., 2008, with some modifications).

6. PALEOENVIRONMENT

Frerichs (1971) noted that the radiations of planktonic foraminiferal genera are characteristic of the warm stratigraphic intervals, and the oxygenic level of the atmosphere should be low during times of extinction (e.g. K/T boundary). Anan & Hewaidy (1986) considered the fauna in Duwi section, Egypt (represents the Nile Valley Facies) are related to the Midway-Type Fauna 'MTF' of middle-outer neritic environment (50-200 m). Speijer et al. (2000) noted that the Duwi section (central Egypt) represents middle shelf (150-200 m), but (100-300 m) by Speijer (2003) (Figure 7).

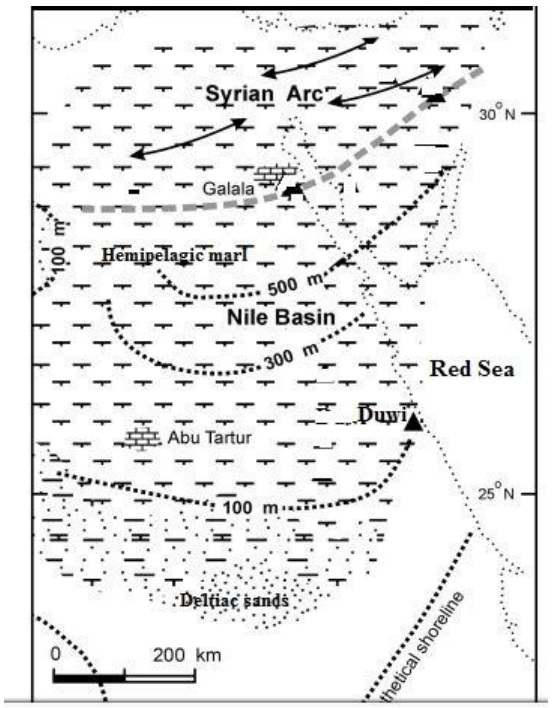

Figure 7: The paleoenvironmental depths of the Egyptian localities (north, center, south) in the K/T boundary time (Speijer, 2003).

Keller (2002) noted that the wide geographic distribution of the *P. hantkeninoides* (s. l.) in different localities in central Egypt and Sinai are controlled by most probably similar, deep marine, outer shelf-upper bathyal environment, 200-400 m. The *Plummerita haggagae* Anan (2008) was recorded in Central Egypt (Nile Valley Facies) and Northern Egypt (Sinai Facies), which seems that both facies are controlled by middle-deep marine environment by many authors (i. e. Nakkady, 1950; Ziko et al, 1993; Speijer, 2003; Anan, 2008; Obaidalla et al., 2017). The high resolution planktonic foraminiferal biostratigraphy across the K-Pg boundary in the Dohuk area, NE Iraq by Bamerni et al. (2021) reveals that the boundary transition covers the uppermost part of the Shiranish Formation (late Maastrichtian) and the entire Aaliji Formation (Danian) (see Figure 5), and the planktonic foraminiferal biozonation shows continuous sedimentation occurred across the K-Pg boundary in this section.

7. CONCLUSIONS

The present study deals with the recording of only two locations of the planktic foraminiferal species *Plummerita haggagae* Anan (2008) in the Southern Tethys: originally from Egypt and later from Iraq. The existence of this species (*P. haggagae*) in many localities in the Southern Tethys (Egypt and Iraq) prove again that these wide provinces are connected in an open sea water in the Maastrichtian-Paleogene times. The rarity recorded of this species in other localities in the Southern Tethys, or even the Northern Tethys may due to probability of species occurrence, habitat suitability, or misidentification of the species (see synonymy). More detailed studies in the future may prove the existence of the recorded species (*P. haggagae*) in another localities in the Southern Tethys, and also Northern Tethys.

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