

## RESEARCH ARTICLE

# PALEONTOLOGY, STRATIGRAPHY, PALEOENVIRONMENT AND PALEO GEOGRAPHY OF SIXTY-THREE CAMPANIAN-NEOGENE TETHYAN BENTHIC FORAMINIFERAL GENERA AND SPECIES OF ANAN B- SUBORDER LAGENINA

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## ARTICLE DETAILS

## ABSTRACT

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This study represents the second part of the erected assemblage of benthic foraminiferal genera and species of Anan, which related to the Suborder Lagenina, after the first part which belongs to the taxa of the Suborders Textulariina and Miliolina (Anan, manuscript). In this study, seven new genera and sixty-three Lagenid benthic foraminiferal species were erected from thirteen localities from Northern Tethys (USA, Mexico, Chile, Argentina, Spain, France Poland) and Southern Tethys (Tunisia, Egypt, UAE, Iraq, Iran, Pakistan). The six new Lagenid benthic foraminiferal genera and its species are: *Lerovia* (*L. aegyptiaca* *L. maqfiensis*, *L. tunisica*), *Lenticuzonaria* (*L. hodaie*, *L. misrensis*), *Lenticubella* (*L. polonica*, *L. kurkurensis*, *L. misrensis*), *Percultalina* (*P. misrensis*, *P. sinaensis*), *Vaginulinoides* (*V. fingeri*), *Vaginulinella* (*V. fingeri*). The other Lagenid species of the other genera are presented. Two of the identified species are believed here to be new: *Hemirobulina yehia* and *Ramulina fatemae*.

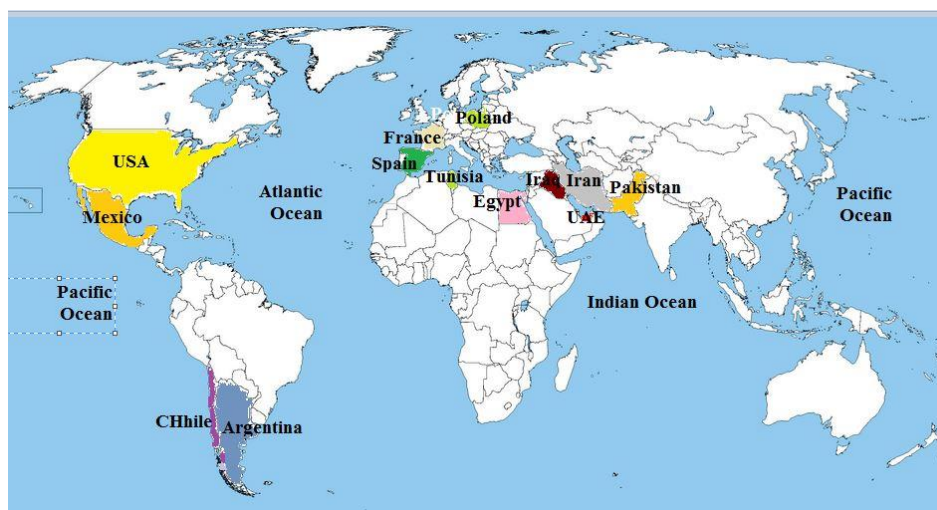
## KEYWORDS

Paleontology, Stratigraphy, Benthic Foraminifera, Lagenina, Tethys

## 1. INTRODUCTION

This study has been made to bring together the holotypes and paratypes of sixty-three Campanian-Neogene calcareous Lagenid benthic foraminiferal species were erected by the present author from many

countries in the Southern Tethys: Egypt, Iraq, United Arab Emirates (UAE), Iran, Pakistan, and Northern Tethys: USA, Mexico, Chile, Argentina, France, Poland (Figure 1).



**Figure 1:** The paleogeographic distribution of the identified Campanian-Neogene taxa in the world: North America (USA, Mexico), South America (Chile, Argentina) Europe in the Northern Tethys (Spain, France, Poland), and Southern Tethys (Tunisia, Egypt, Iraq, UAE, Iran, Pakistan).

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**2. MATERIAL OF STUDY**

Rich and well-preserved sixty-three Lagenid foraminiferal species of Anan from thirteen countries in the Northern and Southern Tethys (North and South America, Europe and Middle East) made it possible to elucidate them with its modern taxonomical consideration and its probable evolutionary trends of some of them. Following the Code of Zoological Nomenclature, a taxonomic revision of two species are re-described its morphological features, which are considered here as a new species *Hemirobulina yehiai* and *Ramulina fatemae*.

**3. SYSTEMATIC PALEONTOLOGY**

The taxonomy of Loeblich & Tappan (1988) is followed in this study for the sixty-three Campanian-Neogene Lagenid benthic foraminiferal species were erected by the present author during the time span of about thirty years (1993-2023) from many countries in the North America Northern (USA, Mexico), South America (Chile, Argentina), Northern Tethys (Spain, France, Poland) and Southern Tethys (Tunisia, Egypt, Iraq, UAE, Iran, Pakistan). The new taxonomic considerations and evolutionary lineages are used for some recorded species. These species are illustrated in Plate 1.



## Plate 1

**Plate 1:** *Chrysalogonium qarnelbarrensis* Anan, 2022a; **2.** *Laevidentalina ameeri* Anan, 2022a; **3.** *Laevidentalina hudaie* Anan, 2015; **4.** *Laevidentalina jannoui* Anan, 2023a; **5.** *Laevidentalina salimi* Anan, 2009; **6.** *Lagenoglandulina argentinica* Anan, 2023a; **7.** *Pyramidulina leroyi* Anan, 2020a; **8.** *Lingulina sliteri* Anan, 2022b; **9.** *Annulofrondicularia bignoti* (Anan, 2002); **10.** *Annulofrondicularia sztrakosae* Anan, 2022c; **11.** *Tollmannia argentinica* Anan, 2023a; **12.** *Tollmannia fingeri* Anan, 2023b; **13.** *Tristix aubertae* Anan, 2002; **14.** *Tristix sliteri* Anan, 2022b; **15.** *Tristix sztrakosae* Anan, 2022b; **16.** *Amphimorphina youssefi* Anan, 1994; **17.** *Lenticulina ennakhali* Anan, 2010; **18.** *Leticuzonaria argentinica* Anan, 2023a; **19.** *Leticuzonaria hodaie* Anan, 2021a; **20.** *Leticuzonaria misrensis* Anan, 2021a; **21.** *Percultazonaria abunnasri* Anan, 2015a; **22.** *Percultazonaria alii* Anan, 2015a; **23.** *Percultazonaria allami* Anan, 2015a; **24.** *Percultazonaria ameeri* Anan, 2015a; **25.** *Lenticubella kurkurensis* Anan, 2022d; **26.** *Lenticubella misrensis* Anan, 2022d; **27.** *Lenticubella polonica* Anan, 2022d; **28.** *Leroyia aegyptiaca* Anan, 2020b; **29.** *Leroyia argentinica* Anan, 2023a; **30.** *Leroyia maqfiensis* Anan, 2020b; **31.** *Leroyia tunisica* Anan 2020b; **32.** *Percultalina misrensis* Anan, 2022e; **33.** *Percultalina sinaensis* Anan, 2022e; **34.** *Saracenaria leroyi* Anan, 1994; **35.** *Palmula americana* Anan, 2023a; **36.** *Palmula ansaryi* Anan, 1994; **37.** *Palmula berggreni* (Anan, 2001); **38.** *Palmula salimi* Anan, 2002; **39.** *Hemirobulina bassiounii* Anan, 1994; **40.** *Hemirobulina olae* Anan, 2015b; **41.** *Hemirobulina yehiai* Anan, n. sp.; **42.** *Marginulina argentinica* Anan, 2023a; **43.** *Marginulina karimae* (Anan, 2009); **44.** *Vaginulinopsis argentinica* Anan, 2023c; **45.** *Vaginulinopsis emiratensis* (Anan, 1993); **46.** *Vaginulinoides fingeri* Anan, 2023c; **47.** *Vaginulinella fingeri* Anan, 2023c; **48.** *Citharina plummerae* Anan, 2001; **49.** *Citharina polonica* Anan, 2022b; **50.** *Vaginulina boukharyi* (Anan, 2010); **51.** *Vaginulina chilensis* Anan, 2023b; **52.** *Lagena rawdhae* Anan, 2020a; **53.** *Procerolagena emiratensis* Anan, 2022a; **54.** *Ramulina fatemae* Anan, n. sp.; **55.** *Ramulina futyani* Anan, 2015b; **56.** *Ramulina ismaili* Anan, 2022f; **57.** *Ramulina morsii* Anan, 2023a; **58.** *Ramulina orabii* Anan, 2022f; **59.** *Ramulina plummerae* Anan, 2022f; **60.** *Ramulina salahii* Anan, 2022f; **61.** *Ramulina shreifae* Anan, 2023b; **62.** *Ramulina subornata* Anan, 2023a; **63.** *Parafissurina pakistanica* Anan, 2021b (scale bar=100 µm).

## 3.1 Foraminiferida Eichwald, 1830

## 3.1.1 Suborder Lagenina Delage &amp; Hérouard, 1896

3.1.1.1 Genus *Chrysalogonium* Schubert, 1908

(1) *Chrysalogonium qarnelbarrensis* Anan, 2022a, p. 40, pl. 1, fig. 9 (= *Dentalina manifesta* Reuss - Abdelghany, 2003, p. 398, fig. 7.5).

3.1.1.2 Genus *Laevidentalina* Loeblich & Tappan, 1986

(2) *Laevidentalina ameeri* Anan, 2022a, p. 40, pl. 1, fig. 10 (= *Dentalina megalopolitana* Reuss - Abdelghany, 2003, p. 398, fig. 7.6).

(3) *Laevidentalina hudaie* Anan, 2015, p. 65, pl. 1, fig. 1.

(4) *Laevidentalina jannoui* Anan, 2023a, p. 36, pl.1, fig.1 (= *Dentalina* sp.- Jannou, 2009, p.177, fig. 6F).

(5) *Laevidentalina salimi* Anan, 2009, p. 3, pl. 1, fig. 2.

3.1.1.3 Genus *Lagenoglandulina* A. Silvestri, 1923

(6) *Lagenoglandulina argentinica* Anan, 2023a, p. 37, pl. 1, fig. 4 (= *Lagenoglandulina* sp.- Jannou et al., 2022, p. 36, pl. 3, fig. 3).

3.1.1.4 Genus *Pyramidulina* Fornasini, 1894

(7) *Pyramidulina leroyi* Anan, 2020a, p. 4, pl. 1, fig.10 (= *Nodosaria* sp. LeRoy, 1953, p. 41, pl. 4, fig. 9).

3.1.1.5 Genus *Lingulina* d'Orbigny, 1826

(8) *Lingulina sliteri* Anan, 2022b, p. 32, pl. 1, fig. 2 (= *Lingulina* sp. Sliter, 1968, p. 75, pl. 9, fig. 11).

3.1.1.6 Genus *Annulofrondicularia* Defrance, 1826

(9) *Annulofrondicularia bignoti* (Anan, 2002) (= *Frondicularia bignoti* Anan, 2002, p. 632, fig. 2. 2)

(10) *Annulofrondicularia sztrakosae* Anan, 2022c, p. 4, pl. 1, fig. 8 (= *Annulofrondicularia* sp. Sztrákos, 2000, p. 160, pl. 4, fig. 1).

3.1.1.7 Genus *Tollmannia* Sellier de Civrieux & Dessauvagie, 1965

(11) *Tollmannia argentinica* Anan, 2023a, p.37, pl.1, fig. 6 (= *Lingulina* sp.- Jannou, 2009, p.101, fig.6L).

(12) *Tollmannia fingeri* Anan, 2023b, p. 42, pl. 1, fig. 4 (= *Tollmannia costata* d'Orbigny - Finger, 2013, p. 404, pl. 7, fig. 11).

3.1.1.8 Genus *Tristix* Macfadyen, 1941

(13) *Tristix aubertae* Anan, 2002, p. 32, pl. 1, fig. 4.

(14) *Tristix sliteri* Anan, 2022b, p. 32, pl. 1, fig. 5 (= *Tristix* sp. Sliter, 1968, p. 80, pl. 10, fig. 15).

(15) *Tristix sztrakosae* Anan, 2022b, p. 32, pl. 1, fig. 6 (= *Tristix* cf. *carinatus* (Sidebottom) - Sztrákos, 2000, p. 160, pl. 9, fig. 12).

3.1.1.9 Genus *Amphimorphina* Neugeboren, 1850

(16) *Amphimorphina youssefi* Anan, 1994, p. 220, fig. 8. 7.

3.1.1.10 Genus *Lenticulina* Lamarck, 1804

(17) *Lenticulina ennakhali* Anan, 2010, p. 20, fig. 2.

3.1.1.11 Genus *Leticuzonaria* Anan, 2021

(18) *Leticuzonaria argentinica* Anan, 2023a, p. 37, pl. 1, fig. 9 (= *Marginulina asperuliformis* (Nuttall)- Jannou, 2009, p. 179, fig. 6P).

(19) *Leticuzonaria hodaie* Anan, 2021a, p. 34, pl. 1, fig. 3.

(20) *Leticuzonaria misrensis* Anan, 2021a, p. 34, pl. 1, figs. 5-8.

3.1.1.12 Genus *Percultazonaria* Loeblich & Tappan, 1968

(21) *Percultazonaria abunnasri* Anan, 2015, p. 16, pl. 1, fig. 1.

(22) *Percultazonaria alii* Anan, 2015, p. 16, pl. 1, fig. 2.

(23) *Percultazonaria allami* Anan, 2015, p. 17, pl. 1, fig. 3.

(24) *Percultazonaria ameeri* Anan, 2015, p. 17, pl. 1, fig. 4.

3.1.1.13 Genus *Lenticubella* Anan, 2022

(25) *Lenticubella kurkurensis* Anan, 2022d, p. 19, pl. 1, fig. 3 (= *Saracenaria* sp. Ali, 2003, pl. 6, fig. 21).

(26) *Lenticubella misrensis* Anan, 2022d, p. 19, pl. 1, fig. 4 (= *Saracenaria* sp. Ali, 2003, pl. 5, fig. 13).

(27) *Lenticubella polonica* Anan, 2022d, p. 19, pl. 1, fig. 2 (= *Darbyella irregularis* Pożaryska, 1965, p. 66, pl. 8, fig. 6).

3.1.1.14 Genus *Leroyia* Anan, 2020

(28) *Leroyia aegyptiaca* Anan, 2020b, p. 54, pl. 1, fig. 8 (= *Marginulina* sp. C- LeRoy, 1953 p. 38, pl. 8, fig. 8).

(29) *Leroyia argentinica* Anan, 2023a, p. 38, pl.1, fig.13 (= *Marginulina* ex gr. *M. hochstetteri* Stache - Jannou et al. 2022, p. 38, pl. 2, fig. 17).

(30) *Leroyia maqfiensis* Anan, 2020b, p. 54, pl. 1, fig. 10 (= *Marginulina* sp. D- LeRoy, 1953, p. 39, pl. 10, fig. 24).

(31) *Leroyia tunisica* Anan 2020b, p. 55, pl. 1, fig. 13.

3.1.1.15 Genus *Percultalina* Anan, 2022

(32) *Percultalina misrensis* Anan, 2022e, p. 32, pl. 1, fig. 2 (= *Marginulinopsis tuberculata* (Plummer) - Youssef & Taha, 2012, p. 4289, pl. 2, fig. 18).

(33) *Percultalina sinaensis* Anan, 2022e, p. 32, pl. 1, fig. 3 (= *Marginulinopsis brantlyi* - Abul-Nasr, 2000, p. 68, fig. 14. 6).

3.1.1.16 Genus *Saracenaria* Defrance, 1824

(34) *Saracenaria leroyi* Anan, 1994, p. 222, fig. 8. 12.

3.1.1.17 Genus *Palmula* Lea, 1833

(35) *Palmula americana* Anan, 2023a, p. 38, pl. 1, fig. 11 (= *Palmula* sp. cf.

*P. magallanica* Todd & Kniker - Jannou, 2009, p. 179, fig. 7B.

(36) *Palmula ansaryi* Anan, 1994, p. 222, fig. 8. 14, 15.

(37) *Palmula berggreni* (Anan, 2001) (= *Planularia berggreni* Anan, 2001, p. 138, pl. 1, fig. 2)

(38) *Palmula salimi* Anan, 2002, p. 636, fig. 2. 7.

3.1.1.18 Genus *Hemirobulina* Stache, 1864

(39) *Hemirobulina bassiounii* Anan, 1994, p. 223, fig. 8. 16.

(40) *Hemirobulina olae* Anan, 2015, p. 71, pl. 1, fig. 8.

(41) *Hemirobulina yehiai* Anan, n. sp.- (= *Pandaglandulina* sp., Jannou, 2009- C, SEGEMAR 2868, CI-20, fig. 7C).

Holotype: Illustrated specimen in Pl. 1, fig. 41.

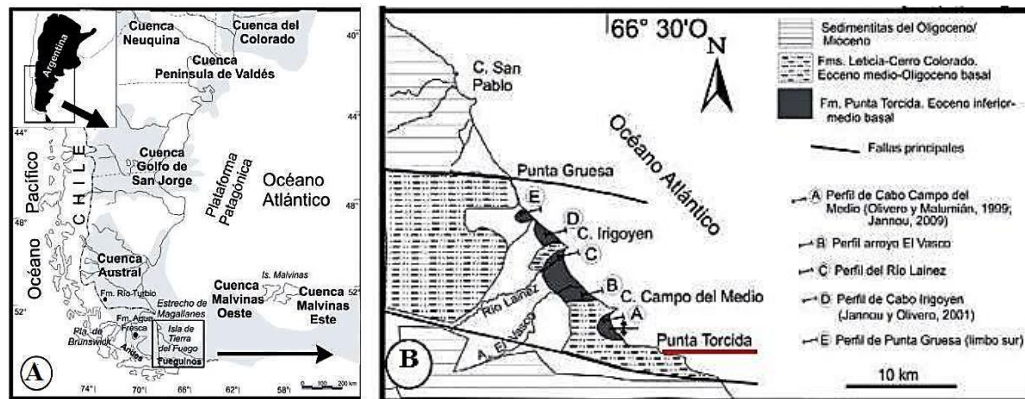
**Etymology:** After the late Egyptian geologist Prof. M. Adel Yehia, Ain Shams University, Egypt.

**Type locality and sample:** South Argentina Punta Torcida Formación, PTma-2, SEGEMAR 2868 (Figure 2A,B).

**Stratigraphic level:** Early Lutetian, 20-50 specimens (Table 1).

**Diagnosis:** This Early Lutetian species has large hyaline test, circular in cross section, coiled early portion occupy about ¼ of the test, while the last globose chamber occupies about ¾ of the test, slightly depressed sutures, radiate large aperture at the pointed end of the apertural face with smooth surface.

**Remarks:** The new species most probably the ancestor of the Paleocene *Hemirobulina olae* Anan (2015) and developed to the Bartonian *Hemirobulina bassiounii* Anan (1994).



**Figure 2:** A) Location map of the study area (in box) of south Argentina in the Southern America, South Atlantic Ocean; B) Geological map of de la Isla Grande de Tierra del Fuego, Punto Torcida Formación, Argentina (after Jannou, 2009).

**Table 1:** Stratigraphic level of *Hemirobulina yehiai* Anan, n. sp.(= *Pandaglandulina* sp. Jannou, 2009.)

E O C E N O										Edad	
Inferior					Medio						
Formación Punta Torcida					Formación Leticia					DIVISIONES DEL PERFIL	
Mbro. Pta		Mbro. Ptb		Mbro. PTC	Mbro. La.		Mbro. Lb.		Mbro. Lc		Muestras
539	PTma-1	538	PTmb-2	537	537a	PTmb-3	CM-13a	CM-13b	CM-13c	CM-13d	
											<i>Pandaglandulina</i> sp.

3.1.1.19 Genus *Marginulina* d'Orbigny, 1826

(42) *Marginulina argentinica* Anan, 2023a, p. 38, pl. 1, fig. 11 (= *Lenticulina* sp.- Jannou, 2009, p. 179, Figure 6U).

(43) *Marginulina karimae* (Anan, 2009)(= *Marginulinopsis karimae* Anan, 2009, p. 6, pl. 1, fig. 8).

3.1.1.20 Genus *Vaginulinopsis* Silvestri, 1904

(44) *Vaginulinopsis argentinica* Anan, 2023c, p. 48, pl.1, fig.15 (= *Dentalina colei* Cushman & Dusembury - Jannou, 2009, fig. 6E, SEGEMAR 2849, CM-145).

(45) *Vaginulinopsis emiratensis* (Anan, 1993)(= *Marginulinopsis emiratensis* Anan 1993, p. 657, pl. 2, fig. 12).

3.1.1.21 Genus *Vaginulinoides* Anan, 2023

(46) *Vaginulinoides fingeri* Anan, 2023c, p. 91, pl. 4, fig. 4 (= *Marginulina cubana* Palmer - Finger, 2013, p. 416, pl. 10, fig. 10).

3.1.1.22 Genus *Vaginulinella* Anan, 2023

(47) *Vaginulinella fingeri* Anan, 2023c, p. 92, pl. 5, fig. 5 (= *Dentalina obliquecostata* (Stache) - Finger, 2013, p. 400, pl. 6, fig. 21).

3.1.1.23 Genus *Citharina* d'Orbigny, 1839

(48) *Citharina plummerae* Anan, 2001, p. 135, pl. 1, fig. 1.

(49) *Citharina polonica* Anan, 2022, p. 32, pl. 1, fig. 8.

3.1.1.24 Genus *Vaginulina* d'Orbigny, 1826 414

(50) *Vaginulina boukharyi* (Anan, 2010) (= *Vaginulinopsis boukharyi* Anan, 2010, p. 30, pl. 1, fig. 12).

(51) *Vaginulina chilensis* Anan, 2023b, p. 49, pl. 1, fig. 19.

3.1.1.25 Genus *Lagena* Walker & Jacob, 1798

(52) *Lagena rawdhae* Anan, 2020a, p. 5, pl. 1. 23.

3.1.1.26 Genus *Procerolagena* Puri, 1954

(53) *Procerolagena emiratensis* Anan, 2022a, p. 41, pl. 2, fig. 16.

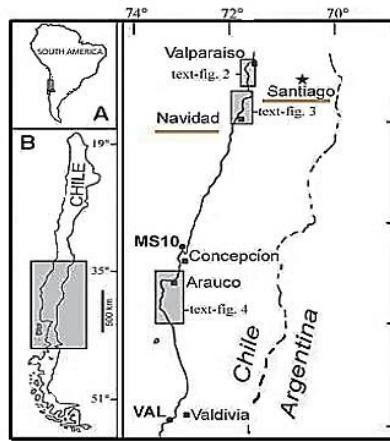
3.1.1.27 Genus *Ramulina* Jones, 1875

(54) *Ramulina fatemae* Anan, n. sp.(= *Procerolagena?* sp., Finger, 2013, pl.11, fig.20, UCMP50224, PTA).

Holotype: Illustrated specimen in Pl. 1, fig. 54.

**Etymology:** After the late Egyptian geologist Fatima Salaheddin, Ain Shams University, Egypt.

**Type locality and sample in Chile:** Navidad Formación (PPP, PTA).



**Figure 3:** A. Location map of Chile, west South America, B. The study area in the central Chile, C. The location of the Navidad Formation, south of the Capital Santiago, Chile (after Finger, 2013).

**Table 2:** Stratigraphic level of *Ramulina fatemae* Anan, n. sp. (= *Procerolagena?* sp., Finger, 2013, pl.11, fig. 20) in the Navidad Formation, Chile (VR = very rare, 1-10 specimens),

SECTOR	North										Central					South											
	Navidad										Arauco					Chiloé											
AREA	Las Cruces										Conc					Vald											
GEOLOGIC UNIT	Navidad Fm.										Ranquil Fm.					Lacui Fm.											
LOCALITY	NLP	LPER	MOS	RAP	PPP	PPT	PPN	LBZ	PTA	MAT	NAV5	MPUP	CPUP	MS10	FRA	FRM	ROT	ROK	RAN	MB	LEB	VAL	CHO	PCB	PNH	CHE	CUC
					VR				VR																		

Stratigraphic level: Miocene.

Diagnosis: This species has elliptical ornamented chamber with multi ribs along of the surface, with only two not concentric ends arms of the chamber.

Remarks: This species differs from other *Ramulina* species by its elliptical ribbed ornamented form, with only two arms at each end. It may developed from the Eocene *Ramulina shreiffae* with smooth surface.

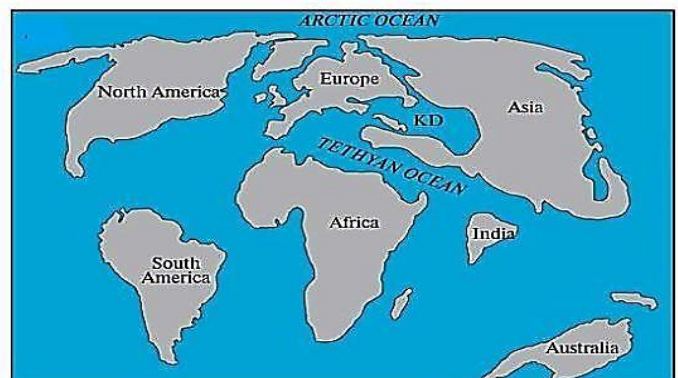
- (55) *Ramulina futyani* Anan, 2015.
- (56) *Ramulina ismaili* Anan, 2022f.
- (57) *Ramulina morsii* Anan, 2023a.
- (58) *Ramulina orabii* Anan, 2022f.
- (59) *Ramulina plummerae* Anan, 2022f.
- (60) *Ramulina salahii* Anan, 2022f.
- (61) *Ramulina shreiffae* Anan, 2023b.
- (62) *Ramulina subornata* Anan, 2023b.

3.1.1.28 Genus *Parafissurina* Parr, 1947

- (63) *Parafissurina pakistanica* Anan, 2021b, p. 45, pl. 2, fig. 7.

4. PALEOGEOGRAPHY

The paleogeographic maps of some authors show a that the ancestral Tethys is connected with the ancestral Atlantic, Indian and Pacific Oceans via Mediterranean sea (Mintz, 1981; Morsi et al., 2008; Finger, 2013; Anan, 2022b). Sixty-three small benthic foraminiferal species belong to twenty-eight diagnostic Lagenid foraminiferal genera: *Chrysalogonium* (1 species), *Laevidentalina* (4 species), *Lagenoglandulina* (1), *Pyramidulina* (1), *Lingulina* (1), *Annulofrondicularia* (2), *Tollmannia* (2), *Tristix* (3), *Amphimorphina* (1), *Lenticulina* (1), *Leticuzonaria* (3), *Percultazonaria* (4), *Lenticubella* (3), *Leroyia* (4), *Percultalina* (2), *Saracenaria* (1), *Palmula* (4), *Hemirobulina* (3), *Marginulina* (2), *Vaginulinopsis* (2), *Vaginulinoides* (1), *Vaginulinella* (1), *Citharina* (3), *Vaginulina* (2), *Lagena* (1), *Procerolagena* (1), *Ramulina* (9) and *Parafissurina* (1) were identified from thirteen localities in the Northern Tethys: USA, Mexico, Spain, France and Poland, and Southern Tethys: Chile, Argentina, Tunisia, Egypt, UAE, Iraq, Iran and Pakistan (Figure 4).



**Figure 4:** Paleogeography of the Tethys Ocean during the Early Paleogene showing the open sea water from east to west in the Tethys (Salahi, 2021).

5. PALEOENVIRONMENT

(Aubry et al., 2007) noted that the group researchers noted that the Midway-Type Fauna "MTF" are dominated throughout the Tethys, although deeper water Velasco-Type "VT" assemblage species are consistently present. The recorded species in this study were erected from both sides of the Northern and Southern Tethys, which indicate open connection of these both sides (see Figure 4).

6. CONCLUSIONS

The present study deals with the recording of the Lagenid sixty-three identified benthic foraminiferal genera and species of Anan, which were recorded from thirteen Tethyan localities in the North America (USA, Mexico), South America (Chile, Argentina), Europe (Spain, France, Poland), Southern Tethys (Tunisia, Egypt, UAE, Iraq, Iran, Pakistan). The Tethyan realm had been connected with the Atlantic Ocean from west to the Indo-Pacific Ocean to the east, via Mediterranean Sea, crossing the Middle East region during the Campanian-Neogene time. Evolutionary changes of the some identified species are presented, and these changes help to define the major faunal change through that time, and can be used in the Paleontology, stratigraphy, paleogeography and paleoenvironmental conditions.

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## REFERENCES

- Abdelghany, O., 2003. Late Campanian-Maastrichtian foraminifera from the Simsima Formation on the western side of the Northern Oman Mountains. *Cretaceous Research*, 24, Pp. 391-405.
- Abul-Nasr, R.A., 2000. Middle-Upper Eocene benthic foraminifera of Wadi Tayiba and Wadi Bagha (western Sinai): A comparative study. Middle East Research Center, Ain Shams University, Earth Science Series, Cairo, 14, Pp. 49-76.
- Ali, M.Y., 2003. Micropaleontological and stratigraphical analyses of the Late Cretaceous/Early Tertiary succession of the Southern Nile Valley (Egypt). Der Fakultät für Geowissenschaften an der Ruhr-Universität Bochum vorgelegte Dissertation zur Erlangung des Grades eines, Pp. 1-197.
- Anan, H.S., 1994. Benthic foraminifera around Middle/Upper Eocene boundary in Egypt. Middle East Research Center, Ain Shams Univ., Earth Science Series, Cairo, 8, Pp. 210-233.
- Anan, H.S., 2001. Paleocene Vaginulininae (benthic foraminifera) of Duwi section, Red Sea coast, Egypt. *Egyptian Journal of Paleontology*, 1, Pp. 135-139.
- Anan, H.S., 2002. Stratigraphy and paleobiogeography of some Frondiculariinae and Palmulinae benthic foraminiferal general in the Paleocene of Egypt (Misr). *Neues Jahrbuch für Geologie und Paläontologie*, Mh., 10, Pp. 629-640.
- Anan, H.S., 2010. *Lenticulina ennakhali* n. sp. (benthic foraminifera) from the Paleocene-Early Eocene succession of Abu Zenima section, west central Sinai, Egypt (Misr). 1<sup>st</sup> International Conference for Basic and Applied Sciences (ICBAS), Gaza, Palestine, 2010, Pp. 19-22.
- Anan, H.S., 2015a. Paleogene Lagenid Percultazonarias (Foraminifera) in Egypt: paleontology, stratigraphy, paleogeography and some taxonomical considerations. *Egyptian Journal of Paleontology*, 15, Pp. 13-30.
- Anan, H.S., 2015b. Paleocene Lagenid benthic foraminifera of Jabal Mundassa, Al Ain Area, United Arab Emirates. *Egyptian Journal of Paleontology*, 15, Pp. 61-83.
- Anan, H.S., 2020a. Early Paleogene benthic foraminifera of Duwi section, Red Sea coast, Egypt. *Journal of American Science*, 16 (2), Pp. 1-22.
- Anan, H.S., 2020b. *Leroyia*, a new Tethyan Lagenid benthic foraminiferal genus. *Earth Sciences Pakistan (ESP)*, 4 (2), Pp. 53-57.
- Anan, H.S., 2021a. *Lenticuzonaria*: a new Tethyan Lagenid benthic foraminiferal genus. *Earth Science Pakistan (ESP)*, 5 (1), Pp. 33-36.
- Anan, H.S., 2021b. Paleontology and paleoenvironment of the Early Paleogene Pakistanian benthic foraminiferal species of Haque. Suborders Miliolina and Lagenina. *Earth Sciences Pakistan (ESP)*, 5 (1), Pp. 42-47.
- Anan, H.S., 2022a. Evaluation of the Maastrichtian to Priabonian benthic foraminiferal type specimens from the United Arab Emirates (UAE). 4<sup>th</sup> International Conference for Basic and Applied Sciences (ICBAS), Gaza, Palestine, 24, Pp. 36-52.
- Anan, H.S., 2022b. Members of some diagnostic small calcareous Lagenid benthic foraminiferal genera *Lingulina*, *Tristix* and *Citharina*. *Geological Behavior (GBR)*, 6 (1), Pp. 31-34.
- Anan, H.S., 2022c. Homeomorphy in some benthic foraminiferal species. 4<sup>th</sup> International Conference for Basic and Applied Sciences (ICBAS), Gaza, Palestine (Natural Sciences), 24, Pp. 1-13.
- Anan, H.S., 2022d. *Lenticubella*: A new Tethyan Lagenid benthic foraminiferal genus. *Earth Science Pakistan, Earth Sciences Pakistan*, 6 (1), Pp. 17-21.
- Anan, H.S., 2022e. *Percultalina*: A new Lagenid benthic foraminiferal genus. *Earth Science Pakistan (ESP)*, 6 (2), Pp. 30-35.
- Anan, H.S., 2022f. On the variability of benthic foraminiferal species of the genus *Ramulina* in the Tethys. *Journal of Foraminiferal Research*, 52 (3), Pp. 1-7.
- Anan, H.S., 2023a. Taxonomical consideration, phylogeny and paleogeography of some Argentinian Early Paleogene benthic foraminiferal species. *Earth and Planetary Science*, 2 (1), Pp. 33-43.
- Anan, H.S., 2023b. Contribution to the Knowledge of Twenty Members of the Lagenid Benthic Foraminifera in the Southern Tethys. *Earth and Planetary Science*, 2 (2), Pp. 38-54.
- Anan, H.S., 2023c. Contribution to the paleontology of the Campanian-Neogene benthic foraminiferal Textulariid and Lagenid genera and species. *Journal of Microbiology & Experimentation*, 11(4), Pp. 90-96.
- Anan, H.S. (manuscript): Paleontology, paleogeography, paleoenvironment of the Campanian-Neogene Tethyan foraminiferal genera and species of Anan, A- Suborders Textulariina and Miliolina. *Science Heritage Journal (GWS)*,
- Aubry, M.-P., Ouda, Kh., Dupuis, C., Berggren, W.A., Van Couvering, J.A., 2007. The Global Standard Stratotype-section and Point (GSSP) for the base of the Eocene Series in the Dababiya section (Egypt). *Episodes*, 30 (4), Pp. 271-286.
- Finger, K.L. 2013: Miocene foraminifera from the south-central coast of Chile. *Micropaleontology*, 59 (4-5), Pp. 341-492.
- Mintz, L.W., 1981. *Historical Geology, the Science of a Dynamic Earth*, 3<sup>rd</sup> Edition. Merrill Publication Company, USA, Pp. 1-611.
- Jannou, G.E., 2009. Microfósiles Marinos del Eoceno inferior, Isla Grande de Tierra Del Fuego, Argentina: bioestratigrafía, paleoambiente y paleobiogeografía. *Biblioteca Digital, Universidad de Buenos Aires (UBA), Facultad de Ciencias Exactas Naturales (FCEN)*, Pp. 1-228.
- Jannou, G.E., Nández, C.A., Malumián, N., 2022. Foraminíferos bentónicos de la Formación Punta Torcida, Eoceno inferior-medio (Ypresiano-Lutetiano inferior), Isla Grande de Tierra del Fuego y plataforma continental fueguina. *Serie Contribuciones Técnicas. Geología Regional N° 9*, Pp.1-53.
- LeRoy, L.W., 1953. Biostratigraphy of Maqfi section, Egypt. *Geological Society of American Memoir*, 54, Pp.1-73.
- 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.
- Morsi, A.M., Faris, M., Zalat, A., Salem, R.F., 2008. Maastrichtian-Early Eocene ostracodes from west-central Sinai, Egypt-taxonomy, biostratigraphy, paleoecology and paleobiogeography. *Revue de Paléobiologie*, 27 (1), Pp. 159-189.
- Pożaryska, K., 1965. Foraminifera and biostratigraphy of the Danian and Montian in Poland. *Paleontologica Polonica*, Warsaw, 14, Pp. 1-156.
- Salahi, A., 2021. Late Paleocene-Middle Eocene Planktonic and Small Benthic Foraminiferal Fauna from the Type Section of Khangiran Formation, Kopet-Dagh Basin (NE Iran), Southernmost Peri-Tethys. *Stratigraphy and Geological Correlation*, 29, (3), pp. 303-321.
- Sliter, W.V., 1968. Upper Cretaceous foraminifera from Southern California and Northwestern Baja California, Mexico. *University of Kansas Paleontological Contribution*, 49 (7), Pp. 1-141.
- Sztrákó, K., 2000. Les Foraminifères De L'Éocène Du Bassin De L'Adour (Aquitaine, France): Biostratigraphie Et Taxinomie Eocene Foraminifères In The Adour Basin (Aquitaine, France) (French) Eocene foraminifera in the Adour Basin (Aquitaine, France): Biostratigraphy and Taxonomy. *Revue de Micropaléontologie*, 43 (1-2), Pp. 71-172.
- Youssef, M., Taha, S., 2012. Biostratigraphy and Paleoecology of Paleocene/Eocene (P/E) interval of some geological sections in Central Egypt. *Arabian Journal of Geosciences*, Pp. 1-23.