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RESEARCH ARTICLE

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Coral fauna across the Cretaceous–Paleogene boundary at Zagros and Sistan Suture zones and Yazd Block of Iran

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Abstract

From the upper Maastrichtian (Tarbur Fm.) and Paleocene of Iran, 20 species of scleractinian corals belonging to 17 genera and 14 families, and one species of the octocoral *Heliopora* are newly recorded. Furthermore, coral species previously described from the upper Maastrichtian Tarbur Fm. and the Paleocene are revised and included in the evaluation, resulting in a total of 37 species from 28 genera belonging to 20 families (including 3 subfamilies) for the Iranian K/Pg-boundary time period. The majority of the taxa (21 out of 37 = 57%) crossed the K/Pg-boundary. The genera *Acropora* and *Stylocoeniella* are recorded from strata older than the Paleogene (upper Maastrichtian) for the first time; for *Lobopsammia* it is the first report from strata older than the Eocene (Selandian–Thanetian). The vast majority of the coral taxa occurring in both the upper Maastrichtian (Tarbur Fm.) and the Paleocene of Iran have been reported from a variety of both reefal and non-reefal paleoenvironments. On the species level, a slight majority of the corals from the upper Maastrichtian (Tarbur Fm.) are endemic (14 out of 27 species = 52%). In contrast, the vast majority of the Paleocene Iranian corals are cosmopolitan to subcosmopolitan; only 4 taxa are endemic during the Paleocene. While the upper Maastrichtian coral fauna of Iran shows greatest affinities to contemporaneous assemblages of Europe and the Caribbean, the Paleocene coral fauna is most closely related to contemporaneous coral associations of central Asia, Europe, and North America.

Keywords Corals, Iran, K/Pg-boundary, Taxonomy, Paleogeographic distribution, Paleoecology

Introduction

Coral-bearing sediments formed during the K/Pg-time period are exposed in various places across Iran. Most notably are the upper Maastrichtian sections of the Tarbur Formation in the Naghan-Semirom area (southwestern Iran) and the middle-upper Paleocene (Selandian–Thanetian) sections of the Palang and other lithostratigraphically undefined formations that occur in eastern, central, and southwestern Iran. However, up to now, corals from strata of the K/Pg-boundary of Iran have been the focus of only a very small number of works. Kühn (1933) provided the first taxonomic descriptions of 12 coral species, 11 of which were collected from sediments of the Neyriz area and were originally referred to as "Cretaceous" (later considered to be Maastrichtian in age; see, e.g., Baron-Szabo, 2008; Kiessling & Baron-Szabo, 2004), one species was derived from the Paleocene of Tul-e-Nagarah (Shahr-e-Babak). Further works dealing with corals from Maastrichtian and Paleocene sediments have been published only fairly recently, either focusing on the taxonomy of corals (e.g., Khazaei, et al., 2009) or presenting coral

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material in studies on the microfacies (e.g., Afghah, 2022). Hence, the current paper adds considerably to our knowledge of the Iranian coral fauna. The aim of this study is to (i) describe newly collected upper Maastrichtian (Tarbur Fm.) and Paleocene corals from Iran; (ii) reevaluate and revise previously described corals from the K/Pg-boundary of Iran; and (iii) provide both their paleoenvironmental occurrences and paleogeographic distributional patterns.

Study area

The coral material was derived from upper Maastrichtian and Paleocene sediments collected in various parts of Iran, including central (Yazd), eastern (Zahedan), southern-southwestern (Shahr-e-Babak, Neyriz, Shiraz), and western (Naghan, Semirom) areas (Figs. 1, 2).

Upper Maastrichtian localities (Tarbur Formation)

Naghan section

The studied area in the folded Zagros belt is located approximately 50 km southwest of Naghan, near Gandomkar village (Figs. 1, 2, 3, Table 1). At this locality, the Tarbur Formation unconformably rests on the Gurpi Formation and is overlain by the Paleocene Sachun Formation. Lithologically, the Gurpi Formation consists of dark-colored shales and grey calcareous shales with planktonic foraminifera. The Sachun Formation consists of gypsum, red shales, anhydrite and rare layers of carbonates. The thickness of the Tarbur Formation at the Naghan section is about 274 m and consists of medium to thick-bedded grey limestones, shales and marls. Some beds contain abundant large-sized benthic foraminifera (e.g., *Loftusia*) and dasycladalean algae (e.g., *Pseudocymopolia*) that are well visible on the weathered rock surfaces. The Naghan section represents the type locality for several larger benthic foraminifera (Schlagintweit & Rashidi, 2016, 2017a, b, c). Corals occur scattered throughout the whole section (Fig. 3).

Fig. 1 Map showing general location of study area

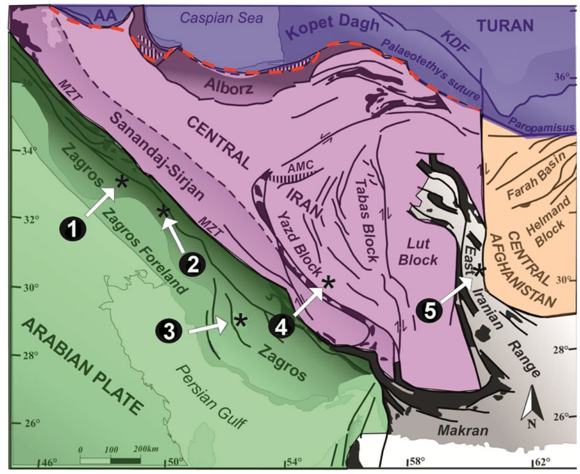

Fig. 2 Tentative locations of the upper Maastrichtian and Paleocene sections from which the newly described material was collected (1–5, arrows), plotted on the tectonic map of Iran (modified from Zanchi, et al., 2009). AA = Anatolian–Armenian Block, AMC = Anarak Metamorphic Complex, KDF = Kopeh Dagh Foredeep, MZT = Main Zagros Trust.); 1: Naghan section; 2: Mandegan section; 3: Qorban section; 4: Kuh-e-Chatorsh section; 5: Kuh-e-Patorgi and Bandan sections. For further information on the Shahr-e-Babak and Neyriz localities, see Kühn (1933), for details regarding the Semirom section, see Khazaei, et al. (2009)

Mandegan and Rod-Abad sections

The study area is located in the High Zagros Belt about 65 km south of the town of Semirom (Figs. 1, 2, Table 1). The Mandegan section is located about 10 km south of the village of Mandegan (for further details of the location see Schlagintweit, et al., 2016a, b, c). At this section, the Tarbur Formation has a thickness of 272 m and conformably overlies the Gurpi Formation. The top of the section is unconformably overlain by the conglomerates of the Pliocene Bakhtiari Formation. The Rod-Abad section is located ~ 6.5 km NE of Mandegan village (coordinates at the base: N 31°8′32.46″ and E 51°23′51.30″). Here, only the lower part of the Tarbur Formation (thickness ~ 65 m) above the Gurpi Formation is exposed. The succession records short sea-level transgressive–regressive pulses with intercalation of four marly levels rich in rudists in living-position between massive limestone with a fairly rich rotaloidean assemblage, *Loftusia*, and *Omphalocyclus* (Consorti & Rashidi, 2018, for details).

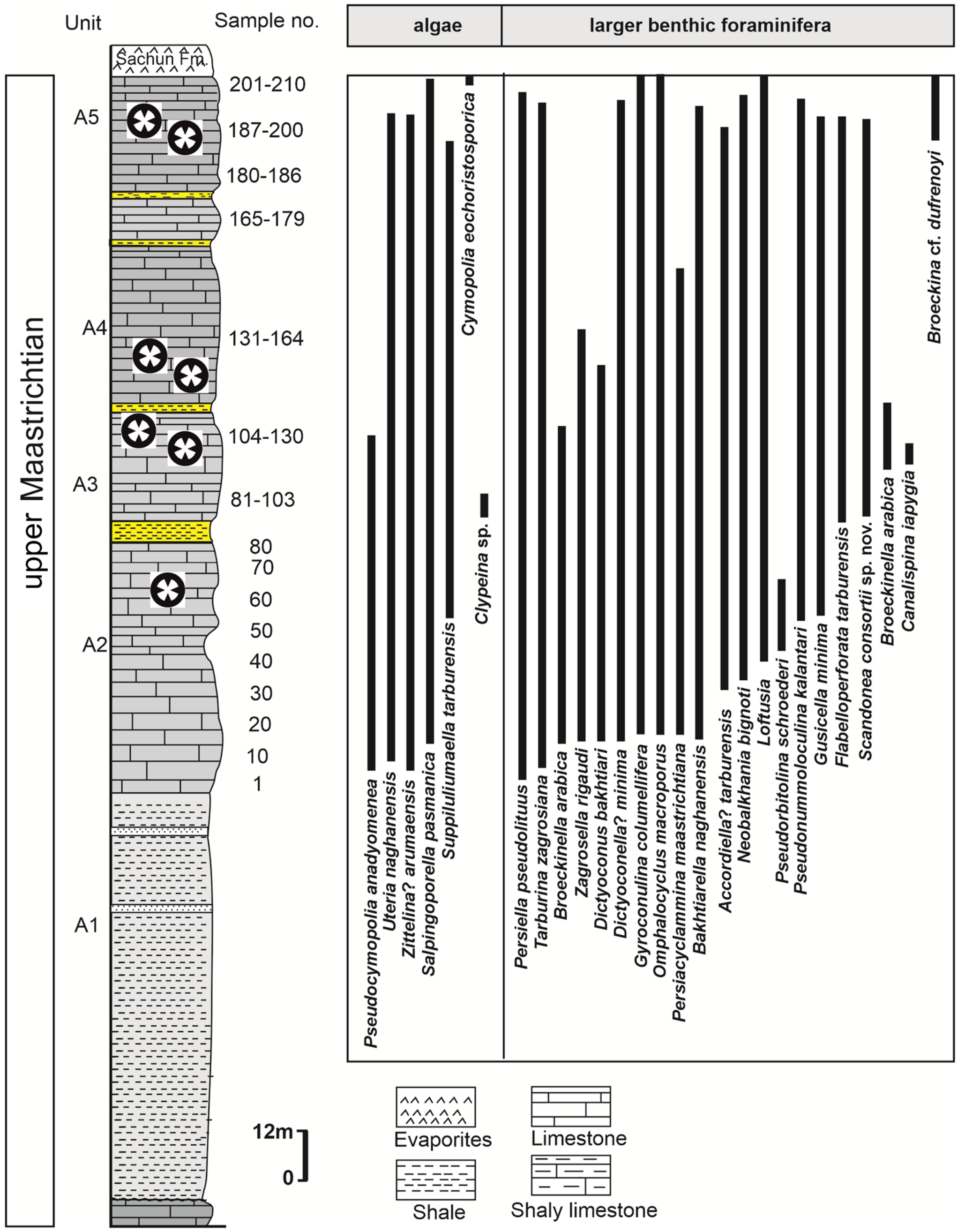

Fig. 3 Vertical distribution of larger benthic foraminifera, corals and dasycladalean green algae in the Tarbur Formation of the Naghan section, SW Iran

Semirom section

The study area is located in the High Zagros Belt. The section of the Tarbur Formation is exposed about 5 km southwest of the town of Semirom (Khazaei, et al., 2009) and is here referred to as Semirom section (Fig. 1; Tables 1, 2; Appendix Table 7). At this section, the Tarbur Formation has a thickness of around 400 m (for further details see Khazaei, et al., 2009).

Neyriz section

From this area (Fig. 1), Kühn (1933, p. 150 and 177–184) described material assigned to 11 coral species (Table 2; Appendix Table 7) which had been given to him by Dr. Shaw of the Anglo-Persian-Oil-Company (APOC). Kühn (1933), however, provided no information on the lithology of the collecting site other than "rudist limestone" ("Rudistenkalk"). Attempts to obtain further information

Table 1 Localities from which the Iranian corals included in the current study were collected, their geologic settings and lithostratigraphy

Locality (section base)	Paleocene					Upper Maastrichtian			
	East Iran ~215 km N of Zahedan (31°22′59.10′′N, 60°49′36.58′′E)	**East Iran ~218 km N of Zahedan (31°23′59.65′′N, 60°43′11.26′′E)**	**Central Iran ~70 km S of Yazd (31°14′37.28′N, 54°33′43.27′′E)**	**Southwestern Iran ~60 km SE of Shiraz (29°11′31.59′′N, 52°52′40′′E)**	**South-central Iran, Shahr-e-Babak (30°7′N, 55°9′E)**	**Southwestern Iran ~50 km SW of Naghan (31°47′52′′N, 50°32′53′′E)**	**Southwestern Iran ~65 km S of Semirom (31°2′N, 58°13′E)**	**Southwestern Iran ~5 km SW of Semirom (31°25 50′′N, 51°32′03′′E)**	**Southern Iran, Neyriz area (29°12′N, 58°18′E)**
Section name	Kuh-e-Patorgi	Bandan	Kuh-e-Chatorsh	Qorban	Tul-e-Nagarah	Naghan	Mandegan	Semirom	Neyriz
Section thickness	~315 m	320 m	>150 m	~210 m	?	~274 m	~272 m	~400 m	?
Formation	Palang Formation		Lithostratigraphically not defined	Sachun Formation, Qorban Member	?	Tarbur formation			
Geotectonic setting	Sistan Suture Zone (or East Iran Flysch Zone)		Yazd Block, Central Iran Microcontinent	Zagros Zone, Arabian Plate					
Paleogeographic setting	Northern Neotethyan margin			Southern Neotethyan margin					
Prefix of sample #	1pz, 2pz, Pz, P, PL, 2pb, Pb,	2BN, BN	AH	Qs	see Kühn (1933) and current study	2NG, NG	FT	see Khazaei, et al. (2009)	see Kühn (1933) and current study
Reference	Rahaghi (1983), Tirrul et al. (1983), Habibimood et al. (2016), Schlagintweit et al. (2020)		Deloffre et al., (1977), Khosrow-Tehrani (1987), Schlagintweit et al., (2019, 2020)	Rahaghi (1983), Consorti et al. (2020), Benedetti et al. (2021)	Kühn (1933)	Schlagintweit & Rashidi (2022)	Schlagintweit et al. (2016)	Khazaei, et al. (2009)	Kühn (1933) and pers. comm. Dr. Reza Ghotbi, Azad University, Iran

See text for further information on their lithology

Table 2 List of newly and previously (Neyriz and Shahr-e-Babak: Kühn, 1933; Semirom: Khazaei, et al,. 2009) reported Iranian corals species and their Iranian occurrences during the upper Maastrichtian (Tarbur Fm.) and Paleocene (see Appendix Table 10 for exact stratigraphic levels of new material). For taxonomic evaluation of previously reported taxa see Appendix Table 7

Corals species	Iranian localities								
	Paleocene					Upper Maastrichtian			
	Kuh-e-Patorgi	Bandan	Kuh-e-Chatorsh	Qorban	Shahr-e-Babak	Naghan	Mandegan	Semirom	Neyriz
Acropora bancellsae	X	X				X			
Actinacis barretti				X		X			
Actinacis reussi	X								
Agathelia asperella								X	
Aspidastraea orientalis									X
Asterosmilia alloiteaui	?	X	X	X					
Astraraea rosi								X	
Bathycyathus corneti							X		
Bathycyathus lloydi	X			X		X			
Cunnolites angiostoma							X		X
Cunnolites cancellata									X
Cunnolites giganteus									X
Cunnolites numismalis									X
Cunnolites scutellum									X
Faksephyllia faxoensis	X	X	X	X					
Goniopora elegans								X	
Goniopora imperatoris								X	
Goniopora cf. *microscopica*				X					
Heliopora incrustans				X					
Lobopsammia cariosa			X	X					
Monticulastraea insignis			X	X				X	
Neocoenia lepida								X	
Oculina conferta	X	X		X					
Pachygyra princeps				X					
Palaeopsammia zitteli									X
Paracycloseris nariensis									X
Placosmilia cf. *fenestrata*						X			
Rennensismilia inflexa									X
Stephanaxophyllia bicoronata								X	
Strotogyra copoyensis		X		X		X			
Stylocoenia maxima				X	X	X			X
Stylocoeniella expansa	X			X					
Stylocoeniella hoernesi						X		X	
Synastrea sp.						X			
Trochoseris aperta				X					
Trochosmilia sp.									X
Turbinolia dickersoni				X					

For taxonomic evaluation of previously reported taxa, see Appendix Table 7 on the geology of this outcrop by one of us (RBS) were unsuccessful.

Paleocene localities

Kuh-e-Patorgi area (Bandan and Patorgi sections)

The Patorgi section is located ~ 10 km SE of Bandan village, about 215 km from Zahedan, the central province city, and about 10 km from the Afghanistan–Iran border (Figs. 1, 4). The Bandan section is located ~ 10.3 km west-northwest of the Patorgi section, both accessible from the road Nehbandan to Zahedan. The geological setting is the same for both sections. Based on Bandan map 1:100,000 (Eftekhar Nezhad, et al., 1990), the oldest unit in these sections is represented by the Sefidabeh Formation that consists of volcanoclastic deposits. It is conformably overlain by the Paleogene Palang Formation, subdivided into two limestone members separated by coarse-grained clastics. The Paleocene sediments are unconformably overlain by Eocene rocks. Geotectonically, the study area is located between the Lut Block in the west and Helmand (or Afghan) Block to the east (Fig. 2). It is known as Flysch or Sistan Suture Zone and mainly includes ophiolitic mélanges and Upper Cretaceous to Paleogene sediments (Tirrul, et al., 1983). Paleogeographically it is part of the former Northern Neotethyan margin (Fig. 5). The microfacies is a packstone with rotaliids, e.g., *Lockhartia* aff. *retiata* Sander, small miliolids, and a diverse assemblage of dasycladalean algae. Directly below, specimens of *Rotorbinella* Smout [*R. detrecta* Hottinger, *R. hensoni* (Smout)] have been observed indicating shallow benthic zones (SBZ) 2–3 (Hottinger, 2014; Serra-Kiel, et al., 1998). *Lockhartia retiata* Sanders is known from SBZ 3–4 according to Hottinger (2014). For South Tibet, a biozonation with Lockhartiinae was established by Kahsnitz, et al. (2016) with *L. retiata* restricted to the *Lockhartia* biozones 1 and 2 (= SBZ 2 and lower part of SBZ 3). The upper part of the Bandan section can be assigned to the Thanetian based on the presence of *Ranikothalia solimani* Butterlin (Fig. 4). The coordinates of the Patorgi section base are 31°22′59.10″N, and 60°49′36.58″E, those from the Bandan section base are 31°23′59.65″N, 60°43′11.26″E.

Kuh-e-Chatorsh section

The Mount Chatorsh section is located about 55 km southeast of Mehriz, near Yazd city (Figs. 1, 6, Table 1). In previous works this locality has been named Kuh-é-Tchahtorch (Deloffre, et al., 1977), Tchah-Torch (Khosrow-Tehrani, 1987), Kamar-e-Chahtorsh (Nabavi, 1972), and Kuh-e-Chah Torsh (Majidifard & Vaziri, 2000). Geotectonically, the study site is part of the Central Iranian Microcontinent, namely the Yazd Block (e.g., Takin, 1972) (Figs. 2, 5). Paleogeographically it is part of the former Northern Neotethyan margin (Fig. 5). It is followed with erosional contact by clastic deposits, and finally upper Maastrichtian sandy limestones containing bryozoans, orbitoidid and siderolitid foraminifera. Above the last sample with orbitoidids assigned to the upper Maastrichtian (AH 73), an interval of sandy marls (0.8 m to 1.0 m) follows lacking any sample data (Fig. 6). Most likely it represents an emersion horizon at the K-Pg boundary interval. The lowermost sample of the following mixed carbonatic–siliciclastic marine bed (AH 74) documents a new transgression, containing textulariids and rotaliids, among which is *Rotorbinella detrecta* Hottinger. This facies grades into nodular carbonates containing abundant rather thick-walled miliolids (*Ankarella, Haymanella)*, the agglutinating taxon *Kolchidina paleocenica* (Cushman), and bryozoans, assigned to the Danian (e.g., Sirel, 2012). Upwards it is followed by alluvial fan conglomerates, non-fossiliferous reddish sandstones, mudstones exhibiting fine cracks and black pebble formation (mud-flat deposits), subtidal grain-packstones with miliolids and algae (subtidal lagoon), and intercalated lensoidal dolomite bodies. The repetitive appearance of (sandy) mudstones and lagoonal grain/packstones indicates cyclic sedimentation due to oscillating sea-level (T-R cycles). In the lower part of the cycles a rhyolitic sill is intercalated that is around 35–40 m in thickness. This unit is followed by a package of limestones that correspond to the subtidal beds of the T-R cycles when considering the microfacies. Going upwards, these are succeeded by thick-bedded to massive limestones reaching up to the summit of Mount Chah Torsh. The diversification of benthonic foraminifera and calcareous algae starts in the middle to upper part increasing markedly in the last third of this unit. The typical microfacies is a packstone containing abundant miliolids, associated with dasycladalean and halimedacean algae. The larger benthic foraminifer *Sistanites iranicus* Rahaghi is among the most common taxa in the upper part of the section. Its first occurrence is (in accordance with literature data from other regions, e.g., Pignatti, et al., 2008; Sirel, 1998, 2012) tentatively used as the separation of SBZ 1 and SBZ 2 sensu Serra-Kiel, et al. (1998). There is no biostratigraphic evidence that the Paleogene carbonates exposed at Mount Chah Torsh reach into the Thanetian. The coordinates of the section base are 31°14′37.28″N, and 54°33′43.27″E.

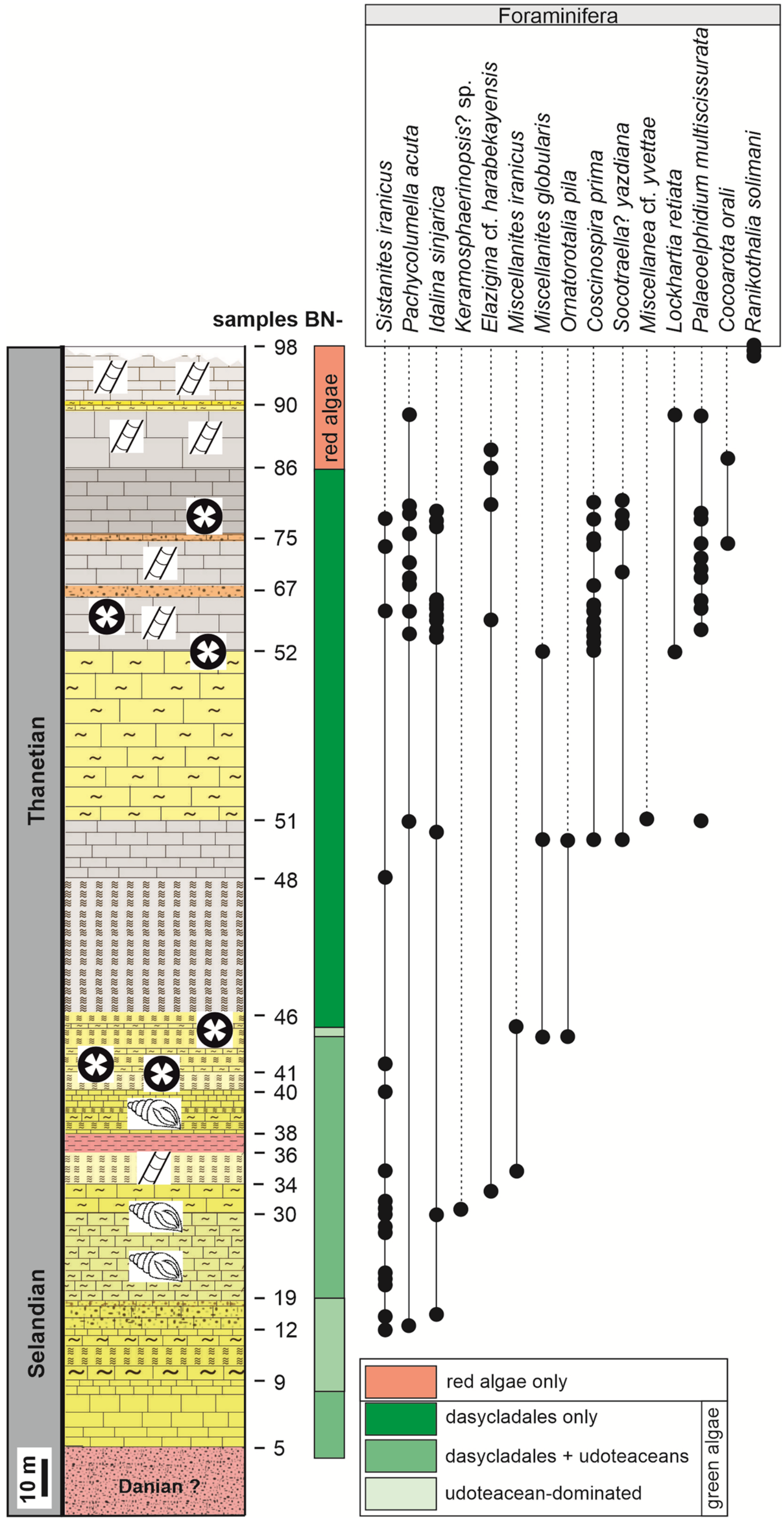

Fig. 4 Vertical distribution of larger benthic foraminifera, corals and principal algal groups in the Bandan section, eastern Iran

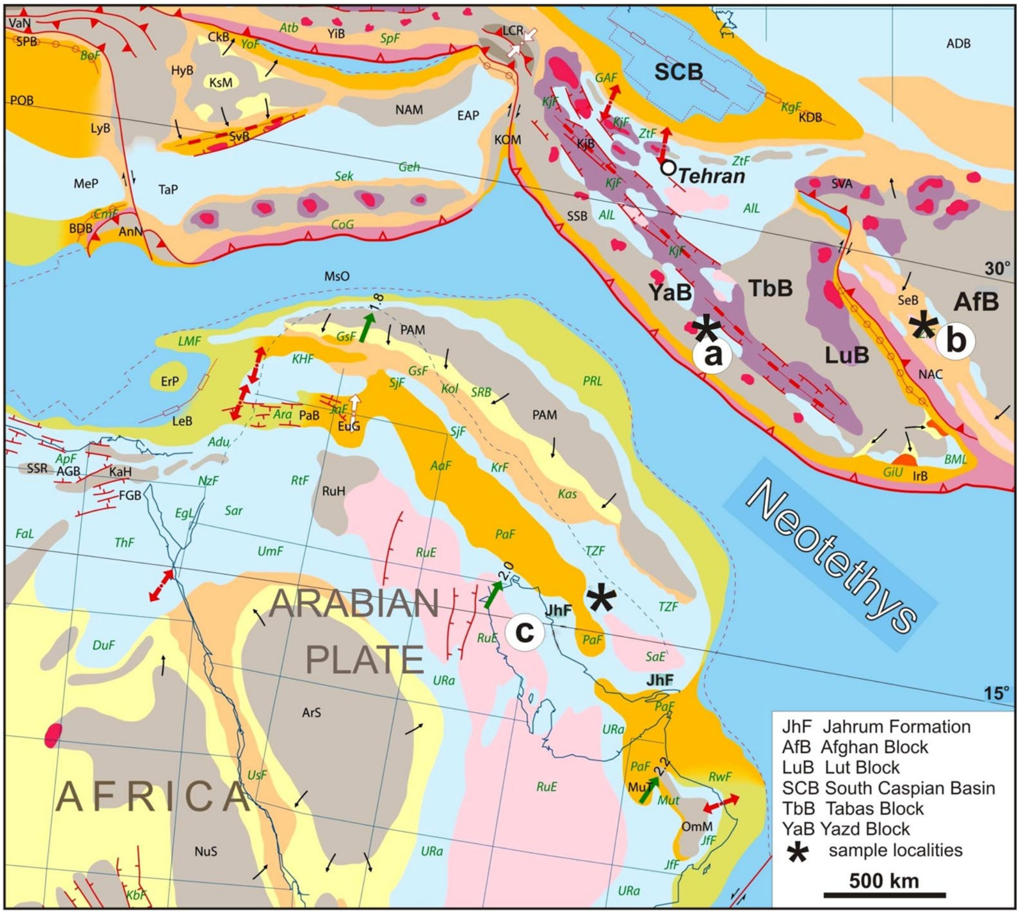

Fig. 5 Paleogeographic position of the three study areas (Ypresian map modified from Barrier & Vrielynk, 2008). **a** Kuh-e-Chatorsh section, Central Iran; **b** Zahedan-Bandan sections, East Iran; **c** Qorban section, Zagros Zone

Qorban section

The section name refers to the Qorban (or Ghorban) Member of the Paleocene–Lower Eocene Sachun Formation (e.g., Bavi, et al., 2016; James & Wynd, 1965). It is located about 70 km southeast of the city of Shiraz (Figs. 1, 2) and consists of thick-bedded gray limestone, yellowish sandy, dolomitic limestone and dolomite (Fig. 7). The Qorban member is a carbonatic unit within the Sachun Formation widespread in the area south and southeast of Shiraz. The thickness of the studied succession is about 210 m. The study site is located within the Mozaffari anticline structure, located 4 km near the road Shiraz-Jahrom. Paleogeographically it belongs to the Zagros Zone, SW Iran, part of the former southern Neotethyan margin (Fig. 5). The Ghorban (or Qorban) Member contains a diverse association of dasycladalean algae and benthic foraminifera, among which are many larger benthic foraminifera of biostratigraphic importance. The assemblage is discussed in detail in Benedetti, et al. (2021) and Schlagintweit, et al. (2020), allowing an attribution to SBZ 3–4 (late Selandian–Thanetian) (Hottinger, 2009, 2014; Pignatti, et al., 2008; Serra-Kiel, et al., 1998, 2016; Sirel, 2012). The coordinates of the section base are 29°11′40.58″N, 52°52′36.40″E.

Shahr-e-Babak area (Tul-e-Nagarah)

From this area (Fig. 1), Kühn (1933, p. 157 and 184) described material assigned to the coral *Astrocoenia rariseptata* [here grouped with *Stylocoenia maxima* Duncan] (see text below and Appendix Table 7) which had been given to him by Dr. Gray of the Anglo-Persian-Oil-Company (APOC). Kühn (1933), however, provided no information on the lithology of the collecting site other than "dark brown and crimson-purplish limestone". Attempts to obtain further information on the geology of the Tul-e-Nagarah area by one of us (RBS) were unsuccessful.

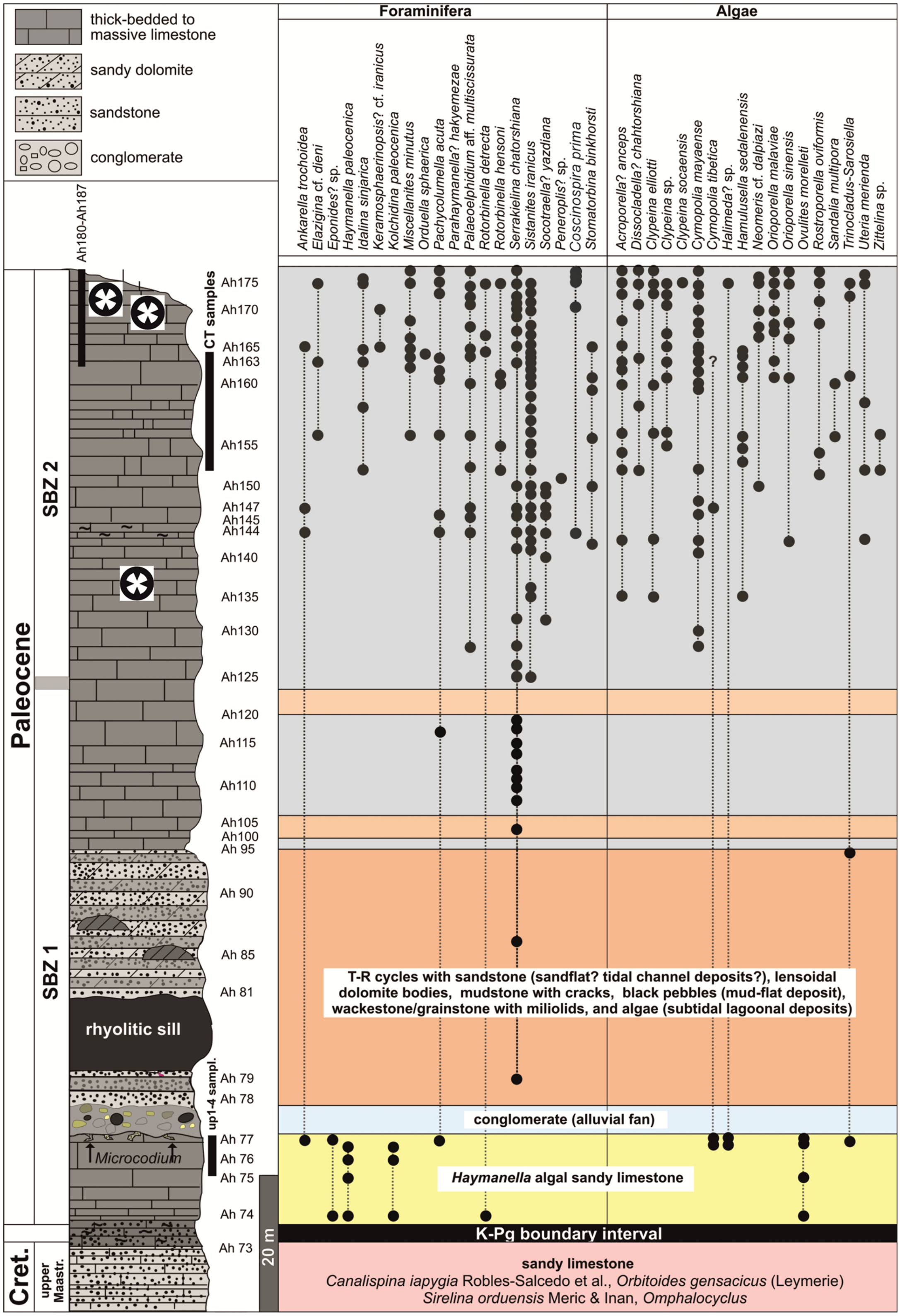

Fig. 6 Simplified lithostratigraphic column of the Kuh-e-Chatorsh section with position of samples, distribution of benthic foraminifera, corals and calcareous algae (modified from Schlagintweit, et al., 2019a)

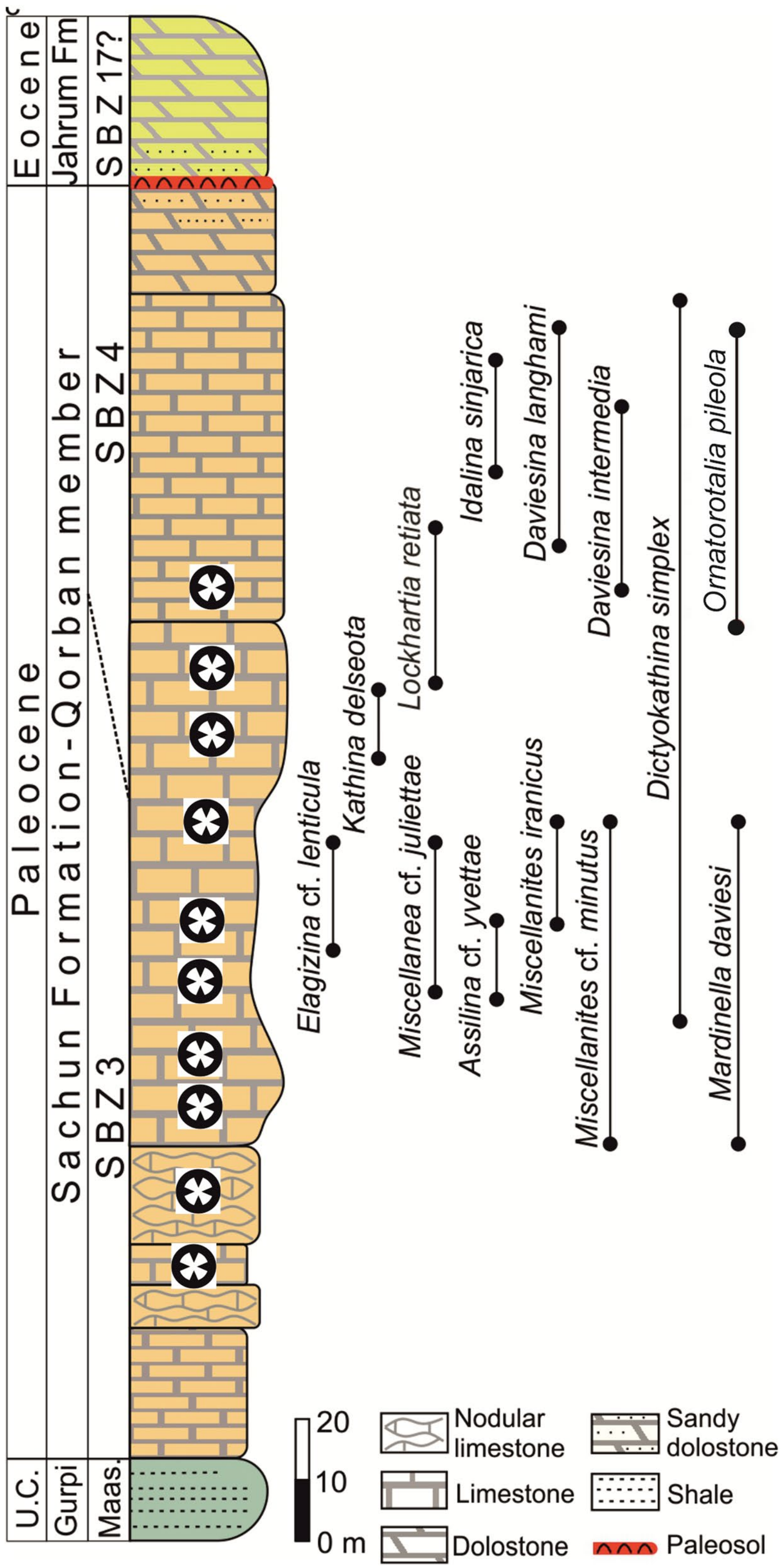

Fig. 7 Stratigraphy and vertical distribution of larger benthic foraminifera and corals at the Qorban section, southwestern Iran (modified after Benedetti et al., 2021)

Table 3 Stratigraphic distribution of the Iranian coral species

Iranian coral species	Stratigraphic range													
	Cretaceous								Paleogene			Neogene		
	Lower		Upper						Paleogene			Neogene		
	Apt.	Alb.	Ceno.	Tur.	Con.	Sa.	Cam.	Maast.	Pal.	Eo.	Oligo.	Mio.	Plio.	Pleisto.
Acropora bancellsae								–		–				
Actinacis barretti								–	—	–	–			
Actinacis reussi					—	—	—	—	–					
Agathelia asperella			–		—	—	—	—	—					
Aspidastraea orientalis						—	–	—	—					
Asterosmilia alloiteaui									—					
Astraraea rosi						—	—	–						
Bathycyathus corneti								–	–					
Bathycyathus lloydi								–	—					
Cunnolites angiostoma								—						
Cunnolites cancellata							–	—	—					
Cunnolites giganteus						—	—	—						
Cunnolites numismalis			—	—	—	—	—	—						
Cunnolites scutellum			—	—	—	—	—	—						
Faksephyllia faxoensis									—	- ? -	—			
Goniopora elegans							–	—	—	—	–	–		
Goniopora imperatoris							–	—	—		—	—	—	—
Goniopora cf. *microscopica*								—	—		—			
Heliopora incrustans									—					
Lobopsammia cariosa									–	—				
Monticulastraea insignis							–	—		—		—		
Neocoenia lepida				—	—	—	—	—						
Oculina conferta									–	–				
Pachygyra princeps						—	—	—	—					
Palaeopsammia zitteli		—	—	—	—	—	—	—	—					
Paracycloseris nariensis							—	—		–				
Placosmilia cf. *fenestrata*					—	—		–						
Rennensismilia inflexa	–	–	—	—	—	—	—	—						
Stephanaxophyllia bicoronata						–	–	—	—					
Strotogyra copoyensis								–		–				
Stylocoenia maxima								–	—					
Stylocoeniella expansa									–	—				
Stylocoeniella hoernesi								–		–				
Synastrea sp.								–						
Trochoseris aperta							—	—	—	—	—	–		
Trochosmilia sp.								–						
Turbinolia dickersoni									—	—	—			

Material, methods, abbreviations

In addition to previously described material from the Shahr-e-Babak (Paleocene) (Kühn, 1933), as well as the Neyriz and Semirom areas (upper Maastrichtian; Tarbur Fm.) (Khazaei, et al., 2009; Kühn, 1933), the current study includes 166 thin sections which were derived from upper Maastrichtian sediments of the Tarbur Formation at Naghan and Mandegan, and from the upper Paleocene (Selandian–Thanetian) strata at Bandan, Kuh-e-Chatorsh, Kuh-e-Patorgi, and Qorban areas (Tables 1, 2, Appendix Table 10).

The material discussed in the current work includes specimens from the Department of Geology, Yazd University (Rashidi collection) (for prefix of sample numbers

Table 4 Distribution in the Maastrichtian of the upper Maastrichtian (Tarbur Fm.) coral genera found in Iran

	Europe									Africa			Asia/Australasia									Americas			
Maastrichtian coral genera	**Bulgaria**	**Croatia**	**Hungary**	**Italy**	**Netherlands**	**eastern Serbia**	**Slovakia**	**Spain**	**Ukraine**	**Libya**	**Madagascar**	**Tunisia**	**China**	**India**	**Iran**	**Oman**	**Saudi Arabia**	**Turkey**	**Turkmenistan**	**UAE**	**Australia**	**Cuba**	**Jamaica**	**Mexico**	**USA**
Acropora[a]															X										
Actinacis[a]				X				X	X						X	X				X			X	X	
Agathelia							?								X	X				X					
Aspidastraea					X										X	X				X					
Astraraea															X								X		
Bathycyathus[a]															X										X
Cunnolites	X				X		?			X			X	X	X	X	X	X		X			X		
Goniopora[a]															X	X				X		X	X	X	
Monticulas-traea															X	X				X					
Neocoenia															X	X				X					
Palaeopsam-mia										?	X	X			X				X		X				X
Paracycloseris											X				X							X	X	X	
Placosmilia							?								X	X									
Rennensis-milia	X	?	X			X								X	X	X	?								
Stephanaxo-phyllia															X					X					
Strotogyra[a]															X										
Stylocoenia															X										
Stylocoeniella[a]															X										
Synastrea					X		?	X			X				X								X	X	
Trochosmilia					X				X						X										

[a] Also found in the Paleocene of Iran (data from Paleobiology Database: https://paleobiodb.org; Baron-Szabo, 2006, 2008; Kiessling & Baron-Szabo, 2004; and current paper). Four Iranian genera (*Acropora**, *Strotogyra**, *Stylocoenia**, *Stylocoeniella**) have not been reported from other Maastrichtian localities yet

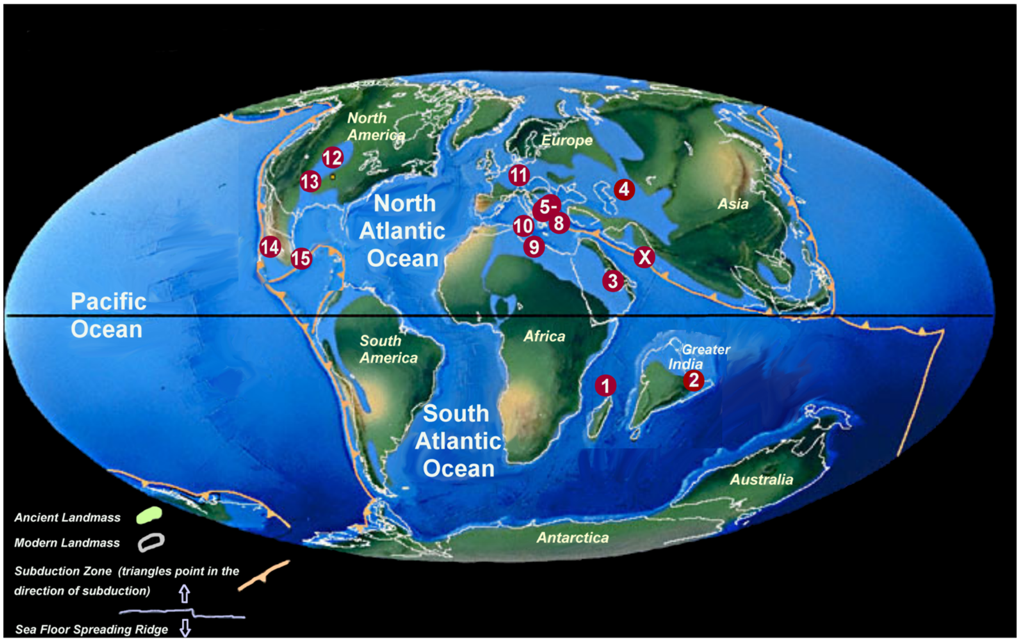

Fig. 8 Paleogeographic distribution of the Iranian species during the Maastrichtian. ***X*** = Iranian corals (Tarbur Fm., upper Maastrichtian; Kühn, 1933; Khazaei, et al., 2009; and current paper); ***1*** = Madagascar; ***2*** = India; ***3*** = Saudi Arabia; ***4*** = Turkmenistan; ***5*** = Bulgaria; ***6*** = Croatia; ***7*** = Hungary; ***8*** = eastern Serbia; ***9*** = Libya; ***10*** = Tunisia; ***11*** = The Netherlands; ***12–13*** = USA; ***14*** = Mexico; ***15*** = Jamaica; Paleocoordinates: ***X*** = 10°42′N, 45°18′E (Neyriz), 13°12′N, 43°12′E (Semirom); ***1*** = 29ºS, 36ºE; ***2*** = 33º30′S, 58º12′E; ***3*** = 8ºN, 38ºE; ***4*** = 33°N, 49°E; ***5*** = 29°42′N, 20°36′E; ***6*** = 28°N, 18°E; ***7*** = 32°N, 19°E; ***8*** = 31°N, 20°E and 32°24′N, 18°30′E; ***9*** = 20°N, 12°12′E; ***10*** = 24°N, 7°24′E; ***11*** = 43°24′N, 4°30E; ***12*** = 52°N, 75°W; ***13*** = 36°N, 76°W; ***14*** = 22°N, 75°W; ***15*** = 18°48′N, 72°30′W. Paleomap modified from Paleomap project Scotese [2014] at www.scotese.com. Paleocoordinates of the coral localities of Hungary and Tunisia estimated based on information provided by Paleobiology Database (paleobiodb.org); all others retrieved from Paleobiology Database (paleobiodb.org)

see Table 1); the Naturhistorisches Museum Wien, Österreich (Natural History Museum Vienna, Austria) (NHMW); the Department of Geology, University of Graz, Austria (GPU); and The Natural History Museum London, UK (NHMUK).

Abbreviations * = first description of taxon to which the assignment of specimen refers, **v** = material was studied by one of us (RBS), c–c = distance between corallite centers, d = corallite diameter, db = diameter of branch s = number of septa, s/mm: septal density

Note: citation in *italics* in synonymy list = taxon only listed in the work concerned (neither illustration nor description provided).

The Iranian coral fauna

General considerations

A total of 37 species from 28 genera belonging to 20 families (including 3 subfamilies) are determined from the upper Maastrichtian and Paleocene of Iran are arranged in an updated taxonomic framework (Tables 1, 2, 4; Appendix Tables 6, 7);

– the majority of the Iranian species (21 out of 37 species = 57%) crossed the K/Pg-boundary (Table 3);
– the majority of the coral taxa belong to colonial forms (23 out 37 = 62%) (Table 1), including 13 species (= 35%) having cerioid–plocoid corallite integrations, followed by highly integrated (meandroid, thamnasterioid) species (7 out of 37 species = 19%) and branching types (3 out of 37 species = 8%);
– The vast majority of the coral taxa occurring in both the upper Maastrichtian (Tarbur Fm.) and the Paleocene of Iran has been reported from a variety of both reefal and non-reefal paleoenvironments (Appendix Table 8). In the Tarbur Formation, corals occur in both outer and inner ramp settings associated with rudists, a diverse assemblage of larger benthic foraminifera such as *Loftusia* or *Omphalocyclus* and dasycladalean green algae (Fig. 3). Noteworthy is the absence of coralline red algae. In the Paleocene strata of Iran, corals preferentially occurred in external platform facies typically associated with larger benthic foraminifera including rotaliid foraminifera, dasycladales, halimedaceans and also red algae (Figs. 4, 6, 7).

Table 5 Distribution in the Paleocene of the Paleocene coral genera found in Iran

Paleocene coral genera	Europe												Africa			Asia						Americas		
	Austria	Belgium	Croatia	Denmark	France	Italy	Russia	Slovakia	Slovenia	Spain	Sweden	Ukraine	Egypt	Ivory Coast	Somalia	Azerbaijan	China	Iran	Kazakhstan	Pakistan	Turkey	Greenland	Puerto Rico	USA
Acropora[a]						X									X			X						
Actinacis[a]	X		X		X	X		X	X	X		X						X					X	X
Asteros-milia		X			X													X						
Bathycya-thus[a]		X												X				X				X		
Faksephyl-lia	X			X							X					X		X	X			X		
Goniopo-ra[a]						X	X	X	X	X		X			X		X	X		X	X			
Heliopora				X								X						X					X	
Lobop-sammia																		X						
Oculina				X				X	X	X			X					X				X		X
Pachygyra[a]									X				X		X			X		X				
Strotogyra[a]																		X						
Stylo-coenia[a]						X			X			X			X			X		X			X	
Stylocoen-iella[a]																		X						
Trochoseris												X						X		X				X
Turbinolia														X				X						X

[a] Also found in the upper Maastrichtian of Iran (Tarbur Fm.) (data from Paleobiology Database: https://paleobiodb.org; Baron-Szabo, 2006, 2008; Kiessling & Baron-Szabo, 2004; and current paper). Three Iranian genera (*Lobopsammia, Strotogyra*, Stylocoeniella**) have not been reported from other Paleocene regions yet

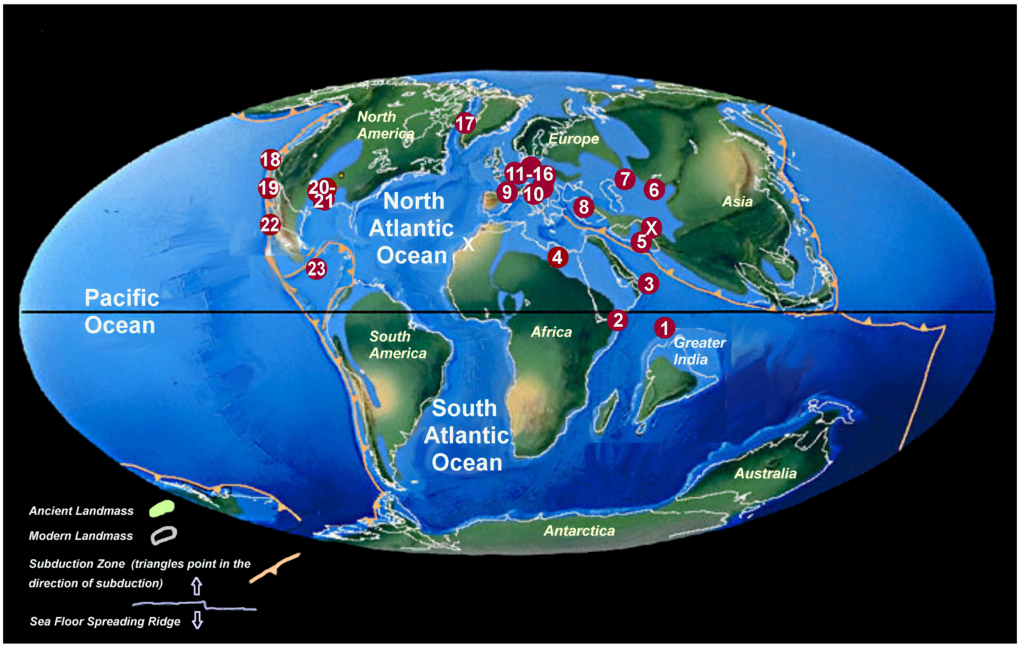

Fig. 9 Paleogeographic distribution of the Iranian species during the Paleocene. ***X*** = Iranian corals (Kühn, 1933; and current paper); ***1*** = Pakistan; ***2*** = Somalia; ***3*** = Azerbaijan; ***4*** = Egypt; ***5*** = Ukraine; ***6*** = Turkmenistan; ***7*** = Kazakhstan; ***8*** = Turkey; ***9*** = Spain; ***10*** = Italy; ***11*** = Belgium; ***12*** = The Netherlands; ***13*** = Denmark; ***14*** = Austria; ***15*** = Slovakia; ***16*** = Slovenia; ***17*** = Greenland; ***18–21*** = USA; ***22*** = Mexico; ***23*** = Puerto Rico; Paleocoordinates: ***X*** = 23°N, 53°E; ***1*** = 6°42′S, 57°42′E; ***2*** = 2°S, 36°54′E; ***3*** = 11°54′N, 49°36′E; ***4*** = 13°N, 24°E; ***5*** = 20°18′N, 46°12′E; ***6*** = 34°6′N, 49°30′E; ***7*** = 39°12′N, 45°18′E; ***8*** = 28°12′N, 31°24′E; ***9*** = 36°N, 2°24′W and 37°18′N, 3°6′W; ***10*** = 32°24′N, 12°18′E; ***11*** = 43°48′N, 2°18′E; ***12*** = 44°12′N, 3°54′E; ***13*** = 48°36′N, 9°30′E; ***14*** = 36°N, 14°E; ***15*** = 43°18′N, 14°42′E; ***16*** = 34°48′N, 13°18′E and 36°N, 12°54′E; ***17*** = 62°N, 20°48 W; ***18*** = 43°18′N, 100°48 W; ***19*** = 38°30′N, 97°24 W; ***20*** = 34°N, 70°48′W; ***21*** = = 38°6′N, 68°W; ***22*** = 32°54′N, 93°36′W; ***23*** = 7°N, 62°12′W. Paleomap modified from Paleomap project Scotese [2014] at www.scotese.com. Paleocoordinates of the coral localities of Austria estimated based on information provided by Paleobiology Database (paleobiodb.org); all others retrieved from Paleobiology Database (paleobiodb.org)

Corals of the upper Maastrichtian (Tarbur Fm.)

- 27 species from 20 genera are reported from the upper Maastrichtian (Tarbur Fm.) of Iran (Table 2, Appendix Table 6);
- on the genus level, *Actinacis, Cunnolites, Goniopora. Palaeopsammia*, *Paracycloseris*, and *Synastrea* are cosmopolitan during the Maastrichtian (6 out of 20 genera = 30%); the genera *Acropora, Strotogyra*, *Stylocoeniella*, and *Stylocoenia* reported from Iran are most restricted/endemic (Table 4, Appendix Table 6);

(See figure on next page.)

Fig. 10 **A** *Stylocoenia maxima* Duncan, 1880; NHMW 1933/0008/0006 (holotype of *Astrocoenia rariseptata* Kühn, 1933), calicular view of colony, upper surface, showing abraded intercorallite pillars (arrows) (image courtesy of Alice Schumacher, Natural History Museum Vienna, Austria); upper Maastrichtian (Tarbur Fm.), Neyriz area, southern Iran. **B** *Stylocoeniella expansa* (d'Achiardi, 1875); Pb29 (10), calicular view of colony, thin section, showing abraded intercorallite pillars as seen in, e.g., *Stylocoeniella armata*, USNM 80263 (arrows); Danian or Selandian, Kuh-e-Patorgi, Sistan Suture Zone, eastern Iran. **C** *Stylocoenia maxima* Duncan, 1880; 2NG202 (4), calicular view of colony, thin section; upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **D** *Stylocoeniella hoernesi* (Oppenheim, 1901); 2NG147 (42), calicular view of colony, thin section, showing abraded intercorallite pillars as seen in, e.g., *Stylocoeniella armata*, USNM 4922 and 80263 (arrows), upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **E** *Stylocoenia maxima* Duncan, 1880; Qs98 (16), calicular view of colony, slightly oblique, thin section; Selandian, Qorban, Zagros Zone, southwestern Iran. **F** *Acropora bancellsae* Álvarez-Pérez, 1997; 2NG127 (18), calicular view of colony, thin section, showing main corallite tube (arrow on right) and secondary corallite (arrow on left); upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **G** *Acropora bancellsae* Álvarez-Pérez, 1997; 2NG127 (19), calicular and oblique longitudinal views of colony, thin section, showing main corallite tube (arrow on upper right) and secondary corallite (arrow on lower left); upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **H** *Acropora bancellsae* Álvarez-Pérez, 1997; BN46–b (5), calicular and longitudinal views of colony, thin section, showing secondary corallites (arrows) standing off of main corallite tube; Selandian–Thanetian, Bandan, Sistan Suture Zone, eastern Iran

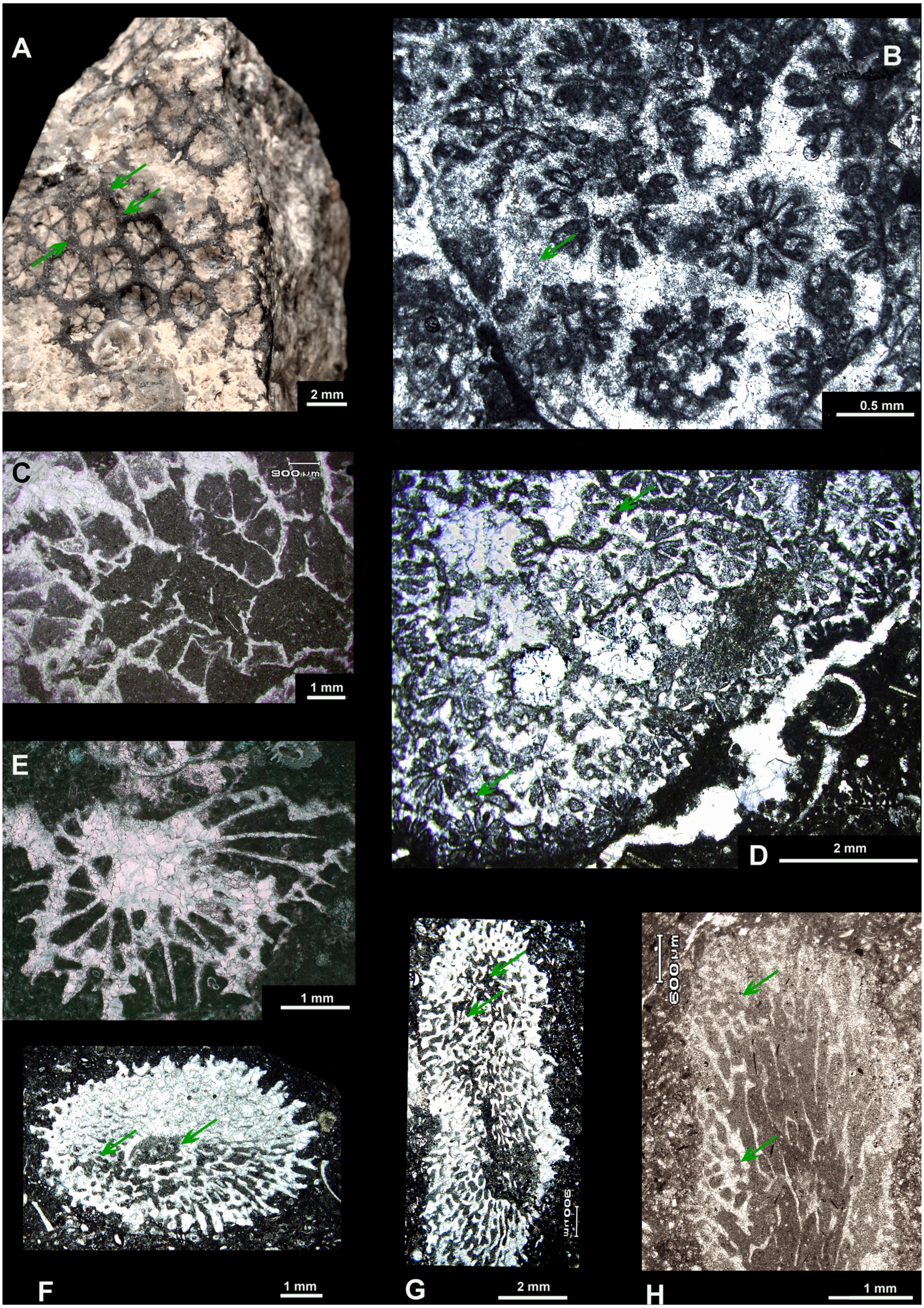

Fig. 10 (See legend on previous page.)

– on the species level, however, a slight majority of species is endemic during the upper Maastrichtian (15 out of 27 species = 55.6%) (Appendix Table 6);
– the vast majority of the coral taxa occurring in the Tarbur Fm. has been reported from a variety of both reefal and non-reefal paleoenvironments. Only the solitary species *Cunnolites angiostoma* and *Paracycloseris nariensis,* and the colonial form *Stylocoeniella hoernesi* have been known solely from non-reefal environments (Appendix Table 8);
– during the Maastrichtian, the species *Bathycyathus lloydi, Cunnolites cancellata, Cunnolites scutellum, Goniopora imperatoris, Palaeopsammia zitteli, Paracycloseris nariensis*, and *Rennensismilia inflexa* have the widest geographic distribution (Appendix Table 6);
– first-time report of *Acropora bancellsae, Actinacis barretti, Bathycyathus corneti, Strotogyra copoyensis, Stylocoenia maxima,* and *Stylocoeniella hoernesi* from strata older than Paleogene (Appendix Table 6);
– the Iranian coral fauna of the upper Maastrichtian (Tarbur Fm.) shows greatest affinities to contemporaneous faunas of Europe and the Caribbean (Appendix Table 6, Fig. 8).

Corals of the Paleocene

– 17 species from 16 genera are reported from the Paleocene of Iran (Table 2, Appendix Table 6);
– on the genus level, *Actinacis, Goniopora. Oculina, Stylocoenia, Trochoseris,* and *Turbinolia* are cosmopolitan during the Paleocene (6 out of 16 genera = 37.5%); the genera *Lobopsammia, Strotogyra*, and *Stylocoeniella* reported from Iran are most restricted/endemic (Table 5, Appendix Table 6);
– first report of *Lobopsammia* from strata older than the Eocene (Selandian-Thanetian);
– a significant majority of the coral taxa occurring in the Paleocene of Iran has been reported from a variety of both reefal and non-reefal paleoenvironments. Only the species *Bathycyathus lloydi* (may be solitary or branch of phaceloid colony), the solitary form *Turbinolia dickersoni,* and the colonial forms *Heliopora incrustans* and *Stylocoeniella expansa* have been known solely from non-reefal environments (Appendix Table 8);
– on the species level, the vast majority of corals is cosmopolitan to subcosmopolitan; only 4 taxa are endemic during the Paleocene (*Acropora bancellsae, Lobopsammia cariosa, Strotogyra copoyensis,* and *Stylocoeniella expansa*) (Appendix Table 6);
– during the Paleocene, the species *Actinacis barretti, Bathycyathus lloydi, Faksephyllia faxoensis*, and *Trochoseris aperta* have the widest geographic distribution (Appendix Table 6);
– the Iranian coral fauna of the Paleocene shows greatest affinities to contemporaneous faunas of the northern hemisphere, including central Asia, Europe, and North America (Fig. 9).

Systematic paleontology

The taxonomic framework followed here is based on a synthesis of the modern studies mentioned and discussed in Baron-Szabo (2021c) with the classical and recent works by Alloiteau (1952, 1957), Baron-Szabo (2021b, c), Baron-Szabo and Cairns (2019), Cairns (1997, 2001), de Fromentel (1861), Duncan (1884), Milne Edwards and Haime (1857), Morycowa and Roniewicz (1995), Oppenheim (1930), Vaughan and Wells (1943), Wells (1956), and additional references as listed in Appendix Table 9. For information on excluded taxonomic models see Baron-Szabo (2021b, p. 29–30 and 166).

Family Astrocoeniidae Tomes, 1883

Remarks. In general, authors have credited the authorship of the family Astrocoeniidae to Koby (1889). However, the fact has been largely overlooked that Tomes (1883, p. 557; "Subfamily Astrocoeninae") already used the genus *Astrocoenia* to create the family-level taxon Astrocoeniinae, giving him priority of authorship of each family-level taxon based on this type genus.

Genus *Stylocoenia* Milne Edwards & Haime, 1849b

Type species. *Astrea emarciata* Lamarck, 1816, Eocene of France (designation by Milne Edwards & Haime, 1849b).
Diagnosis. Colonial, ramose, massive or incrusting, cerioid. Columniform projections arise at junctions of adjacent corallites. Budding extracalicular. Costosepta compact, thin, laminar, acute dentations laterally. Columella styliform. Endothecal dissepiments tabular. Wall septothecal.

***Stylocoenia maxima* Duncan, 1880**
Fig. 10A, C, E

*1880 *Stylocoenia maxima*: Duncan, p. 30–32, Pl. 12, Figs. 1–6.
?1880 *Astrocoenia cellulata*: Duncan, p. 42, Pl. 14, Fig. 7.
1925 *Stylocoenia maxima* Duncan, 1880*: Felix, pars 28, p. 248.*
v1933 *Astrocoenia rariseptata* nov. spec.: Kühn, p. 184–186, Pl. 17, Fig. 10.

2006 *Stylocoenia maxima* Duncan, 1880: Baron-Szabo, p. 14, Text—Fig. 6.

Dimensions. d: 2.4–4.5 mm, in areas of intense budding less than 2 mm; c–c: 2.5–5 mm; s: 10 + s.
Description. Cerioid ?subramose corallum; corallites irregularly polygonal to rounded in outline; costosepta generally thin, up to 10 reach corallite center; styliform columella small.
Type locality of species. Selandian–Thanetian of Pakistan (Jhirk, Sind).
Distribution. Upper Maastrichtian (Zagros Zone, Tarbur Fm., southwestern Iran; this paper), Selandian (Zagros Zone, southwestern Iran; this paper), and Paleocene (Shahr-e-Babak, south-central Iran) of Iran, Selandian of Pakistan (Jhirk, Sind).
New material. 2NG202 (3, 4, 13b) (Zagros Zone, Tarbur Fm., southwestern Iran); Qs98 (16) (Zagros Zone, southwestern Iran).

Family Pocilloporidae Gray, 1842

Genus *Stylocoeniella* Yabe & Sugiyama, 1935
Type species. *Stylocoenia hanzawai* Yabe & Sugiyama, 1933, Holocene, off Japan.

Diagnosis. Colonial, ramose, massive or incrusting, cerioid to subplocoid. Budding intra- and extracalicular. Costosepta compact, nonconfluent to subconfluent, with acute dentations laterally. Costae generally short, sometimes absent. Pali irregularly present. Auriculae regularly or irregularly (in type species) present. Columella styliform to short lamellar, or made of irregular trabecular portions. Endothecal and exothecal dissepiments subtabulate and vesicular. Wall septoparathecal, with occasional pores. Synapticulae ?present. Intercorallite pillars present which can be tall (up to around 1 mm tall in type species), or reduced to short knobs that appear as thickened portions at the peripheral edge of septa. Intercorallite pillars can be absent in large parts of colony.

Remarks. Study of original and topotypic material of the type species by one of the authors (RBS) revealed that the genus *Stylocoeniella* has auriculae, indicating some level of correspondence to the stylinids. But based on the presence of (1) intercorallite pillars; (2) septa with acute dentations laterally; and (3) septoparatheca with occasional pores, the genus *Stylocoeniella* is kept with the Pocilloporidae.

***Stylocoeniella expansa* (d'Achiardi, 1875)**
Fig. 10B

v*1875 *Astrocoenia expansa*, m: d'Achiardi, p. 183–184, Pl. 15, Fig. 3a–c.
1901 *Astrocoenia expansa* d'Achiardi: Oppenheim, p. 224, Pl. 14 (4), Figs. 17–b.
1925 *Astrocoenia expansa* d'Achiardi, 1875*: Felix, 240‑241 [cum synonymis].*

Dimensions. d (monocentric): 0.7–1 mm, in areas of intense budding 0.4–0.7 mm; c–c: up to around 1 mm; s: 12–16 (+ s).
Description. Ramose colony; corallites in cerioid to cerio-plocoid integration; costosepta developed in 2 complete cycles in 6, 8, or unclear systems; one or more septa of S1 reach corallite center, sometimes fusing with the small styliform columella.
Type locality of species. Eocene of Italy.
Distribution. Danian or Selandian of Iran (Zagros Zone, southwestern), Eocene of Italy, Middle Eocene of Bosnia-Herzegovina.
New material. Pb29 (10) (Sistan Suture Zone, eastern Iran); Qs93 (25) (Zagros Zone, southwestern Iran);

***Stylocoeniella hoernesi* (Oppenheim, 1901)**
Fig. 10D

v*1901 *Astrocoenia Hoernesi* n. sp.: Oppenheim, p. 222–223, Pl. 17 (7), Fig. 3–3a.
v2009 *Actinacis parvistella* Oppenheim, 1930: Khazaei, et al., p. 32, Pl. 2, Fig. 1–2 [chronotypic material from this area studied].
v2009 *Actinastrea ramosa* (Sowerby, 1832): Khazaei, et al., p. 32, Pl. 2, Figs. 3–4 [chronotypic material from this area studied].

Dimensions. d: 1–1.8 mm, up to 2 mm in some places, in areas of intense budding often 0.5–0.7 mm; c–c: 1–2 mm; s: 12–24, often 16–20.
Description. Cerioid to cerio-plocoid colony; costosepta thin and rather straight; one or more of S1 fuse with the columella.
Type locality of species. Middle Eocene of Croatia (Dubravica).
Distribution. Upper Maastrichtian of Iran (Zagros Zone, Tarbur Fm., southwestern Iran; new material this paper), Middle Eocene of Croatia.
New material. 2NG147 (28, 29, 36, 42) (Zagros Zone, Tarbur Fm., southwestern Iran).
Remarks. In the lectotype of Oppenheim's species *hoernesi* (UGP 1349) most corallites are in budding stage, having corallite diameters of 2 mm or even larger. However, monocentric corallites often range between 1.2 and 1.5 mm, in areas of intense budding they are around 0.5 mm.
In having (1) cerioid to cerio-plocoid corallites; (2) intra- and extracalicular budding; (3) irregularly occurring pali;

(4) a styliform or short lamellar columella; (5) septoparathecal walls with occasional pores; and (6) intercorallite pillars preserved in some places, the material from the upper Maastrichtian of Iran (Tarbur Fm.) assigned to *Actinacis parvistella* Oppenheim and *Actinastrea ramosa* (Sowerby) by Khazaei et al. (2009) corresponds to *Stylocoeniella*.

Family Acroporidae Verrill, 1902

Genus *Acropora* Oken, 1815

Type species. *Millepora muricata* Linnaeus, 1758, Holocene, Moluccas, designated by Verrill (1902).

Diagnosis. Colonial, ramose, rarely massive or incrusting. Branches with an axial or leading corallite larger than the more numerous radial corallites budded from it. Corallites united by light, reticulate, spinose or pseudocostate coenosteum. Columella and dissepiments absent. Wall synapticulothecal, porous.

***Acropora bancellsae* Álvarez-Pérez, 1997**

Fig. 10F–H.

*1997 *Acropora bancellsae* n. sp.: Álvarez-Pérez, p. 299–300, Pl. 2, Figs. 1–2.

Dimensions. db: 1.4–3 mm; d (axial corallite): 0.7–1.2 mm; d (secondary corallite): 0.3–0.6 mm; s (axial corallite): 12 (+s); s (secondary corallite): 6 (+s).

Description. Branching colony; corallites irregularly circular in outline; secondary corallites usually have 6–10 septa.

Type locality of species. Middle Eocene (Bartonian) of Spain (La Tossa Fm.).

Distribution. Upper Maastrichtian and Selandian–Thanetian of Iran (this paper; Zagros Zone, Tarbur Fm., southwestern Iran; Sistan Suture Zone, eastern Iran), Middle Eocene (Bartonian) of Spain (La Tossa Fm.).

New material. BN40–c (19, 24, 25), BN41–a (1), BN41–a (1–6, 11), BN41–c; BN41–c (11), BN46–a (1, 2, 6), BN46–b (5), BN53 (21), BN56–b (18), BN59–N1 (8, 15), BN63 (6, 8–10), BN64 (2, 16), P3171291–98; Pb62 (7), PL–2 (32–34, 37–39) (all from Sistan Suture Zone, eastern Iran); 2NG122 (30–31), 2NG127 (13, 16, 18–21), 2NG127–2 (1, 12), 2NG127–3 (1, 3, 5–6, 8–9), 2NG127–4 (1, 3–8, 15–16), 2NG127–5 (2–5, 8), 2NG147 (30), 2NG202 (2), 2NG202 (10), NG113 (32) (all from Tarbur Formation, southwestern Iran, Zagros Zone).

Remarks. With regard to both corallite arrangements and thecal developments, the Iranian material shows affinities to species such as *A. rongelapensis* Richards & Wallace, 2004, and forms of the *humilis*-group (sensu Wallace, et al., 2020).

Family Meandrinidae Gray, 1847

Genus *Pachygyra* Milne Edwards & Haime, 1848a

Type species. *Lobophyllia labyrinthica* Michelin, 1847, Coniacian–Santonian of France (Aude) (see Milne Edwards & Haime, 1848a).

Diagnosis. Colonial, massive, subflabellate–meandroid. Budding intracalicinal, resulting in sinuous, non–ramified, calicinal series, which are separated by perithecal walls and ambulacra. Calicinal series are always projecting, their edges remain free. Calicinal centers indistinct. Costosepta compact, finely granulated laterally. Septal anastomosis present. Columella lamellar, generally continuous. Wall septothecal. Perithecal and endothecal dissepiments thin, subtabulate.

Remarks. Genus *Pachygyra* was recently reevaluated and revised (Baron-Szabo, 2014, p. 43–44, Pl. 44, Figs. 1–5; Pl. 45, Figs. 1–3; Pl. 46, Fig. 2; Pl. 47, Fig. 2; Text–Fig. 9).

***Pachygyra princeps* Reuss, 1854**

Fig. 11, 1

v*1854 *Pachygyra princeps*: Reuss, p. 93, Pl. 3, Figs. 1–3.

1857 *Pachygyra princeps*: Milne Edwards & Haime, vol. 2, p. 212.

1858–61 *Pachygyra princeps*: de Fromentel, p. 157.

1880 *Diploria flexuosissima*, D'Ach.: Duncan, p. 39, Pl. 6, Figs. 11–12.

v1903 *Pachygyra princeps* Reuss: Felix, p. 310.

1930 *Pachygyra pusulifera* n. sp.: Oppenheim, p. 450, Pl. 33, Figs. 8.

(See figure on next page.)

Fig. 11 **A** *Pachygyra princeps* Reuss, 1854; Qs33 (32), calicular view of colony, thin section; Thanetian, Qorban, Zagros Zone, southwestern Iran. **B** *Trochoseris aperta* Duncan, 1864; Qs33 (33), calicular view of corallum, thin section; Thanetian, Qorban, Zagros Zone, southwestern Iran. **C** *Strotogyra copoyensis* (Frost & Langenheim, 1974); 2NG202 (14–15), calicular view of colony, thin section; upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **D** *Oculina conferta* Milne Edwards & Haime, 1850; BN59–N1 (4), calicular view of colony, thin section; Thanetian, Bandan, Sistan Suture Zone, eastern Iran. **E** *Placosmilia* cf. *fenestrata* (Felix, 1900); 2NG202 (16), calicular view of colony, showing rejuvenation, thin section (see Fig. G for comparison); upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **F** *Oculina conferta* Milne Edwards & Haime, 1850; BN59–N1 (14), calicular and longitudinal views of colony, thin section; Thanetian, Bandan, Sistan Suture Zone, eastern Iran. **G** *Placosmilia psecadiophora* (Felix, 1903) (=*Placosmilia sinuosa* [Reuss, 1854]); NHMW 1864/0040/1241, syntype, calicular view of colony, showing rejuvenation, upper surface; upper Santonian of Austria (Gosau Group at Neffgraben). **H** *Lobopsammia cariosa* (Goldfuss, 1826); Qs93 (41), oblique calicular view of colony, thin section; ?Selandian, Qorban, Zagros Zone, southwestern Iran

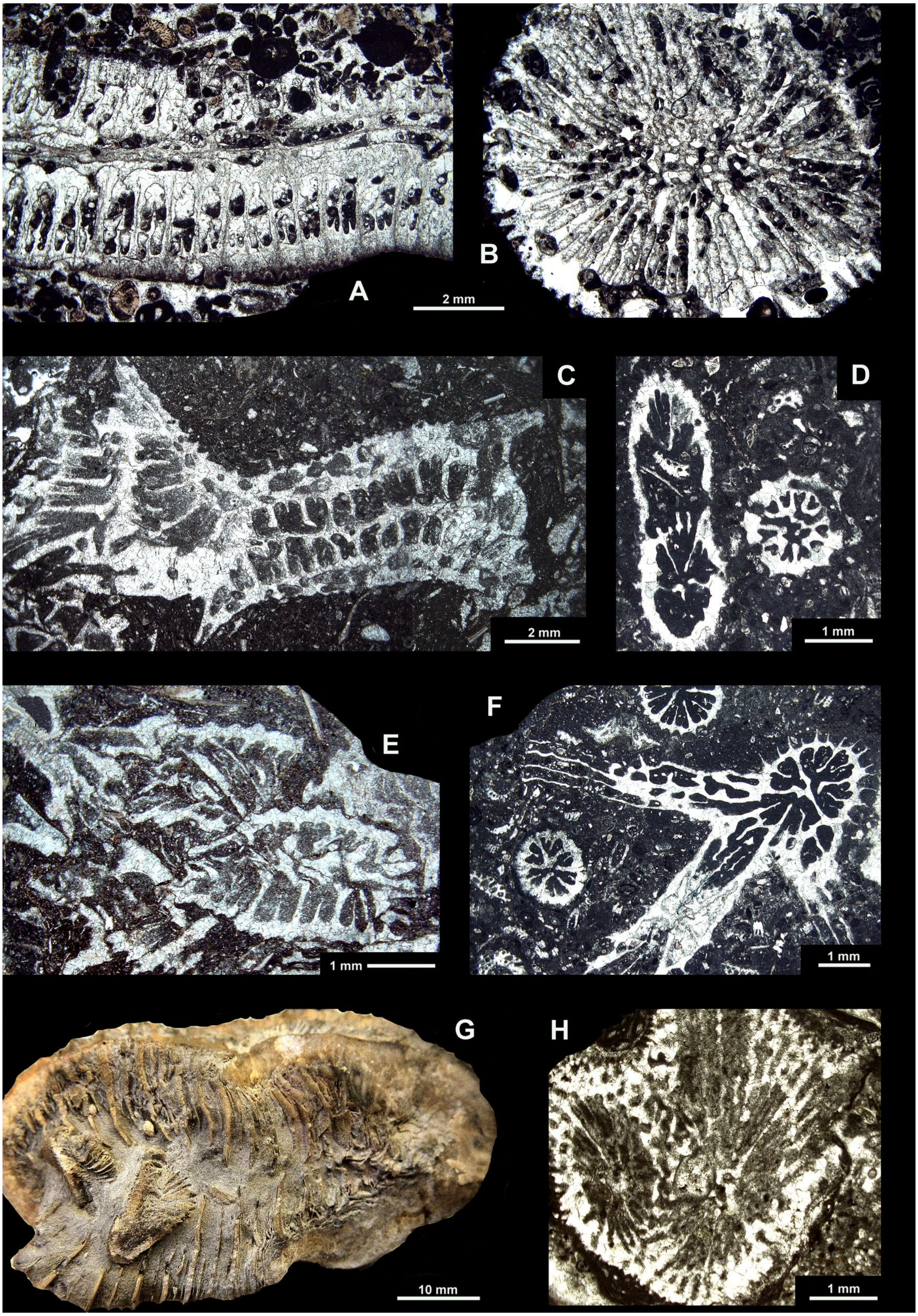

Fig. 11 (See legend on previous page.)

1937 *Pachygyra princeps* Reuss: Bataller, p. 92, Fig. on p. 92.
v1982 *Pachygyra princeps* Reuss, 1854: Beauvais, vol. 1, p. 188, Pl. 16, Fig. 1, Pl. 17, Fig. 1.
1982 *Pachygyra pusulifera* Oppenheim, 1930: Beauvais, vol. 1, p. 190.
v1998 *Orbignygyra* sp.: Turnšek & Drobne, p. 136, Pl. 6, Figs. 2–3.
v2006 *Pachygyra princeps* Reuss, 1854: Baron-Szabo, p. 76, Pl. 15, Fig. 2a–b [cum synonymis].
v2014 *Pachygyra princeps* Reuss, 1854: Baron-Szabo, p. 43–44, Pl. 44, Fig. 3, Pl. 45, Figs. 1–3, Pl. 46, Fig. 1.
v2019 *Pachygyra princeps* Reuss, 1854: Löser, et al, p. 99–100.

Dimensions. d: 3.5–5 mm; s/mm: 5–8/2.
Description. Colonial, subflabellate–meandroid sinuous calicinal series; costosepta arranged in 3 irregularly occurring size orders; columella lamellar, generally continuous.
Type locality of species. Upper Santonian of Austria (Gosau Group at Nefgraben).
Distribution. Coniacian–Santonian of Austria (Gosau Group), France (Corbières), and northern Spain (Catalonia), Maastrichtian of Jamaica, Selandian of Pakistan (Jhirk, Sind), Paleocene of Italy (Adriatic platform), Thanetian of Iran (Zagros Zone, southwestern Iran; this paper) and Slovenia.
New material. Qs33 (29, 32), Qs67 (39) (all from Zagros Zone, southwestern Iran).
Remarks. It should be noted that the dimensions of skeletal elements given for the species *P. princeps* by Löser et al., (2019: on p. 99, on Table "Fig. 90" width of rows given as 2.5–2.8 mm and septal density is given as 10–12 in 5 mm; on p. 100, width of rows given as 2.21–2.81 mm and septal density is given as 12 in 5 mm) are incorrect in that they do not cover the full range of dimensions seen in the holotype (see Baron-Szabo, 2014, Pl. 44, Fig. 1, Pl. 45, Figs. 1–, Pl. 46, Fig. 2) which are d (width of calicular series) : 1.5–5.5 mm [up to around 6 mm in a small number of places]; septa/mm: 12–17/5 (=often around 6–7 septa in 2 mm).

Genus *Strotogyra* Wells, 1937
Type species. *Rhipidogyra undulata* Reuss, 1854, Santonian of Austria (Gosau Group).
Diagnosis. Colonial, flabelloid. Budding intramural, linear, polystomodaeal, forming corallites arranged uniserially, contorted, free laterally. Corallite centers indistinct when positioned in linear series, subdistinct or distinct in areas where direction of series changes or at end of calicinal series. Septa exsert, numerous, compact, non–dentate on upper margins, granulated laterally. Costae bifurcating, distinct to base. Columella lamellar, discontinuous, often attached to processes from inner edges of septa. Endothecal dissepiments vesicular and subhorizontal. Wall septothecal, parathecal in earlier stages. Parathecal stereozone occurs irregularly. Multi–lamellar epitheca *s.l.* often present.
Remarks. Genus *Strotogyra* was recently reevaluated and revised (Baron-Szabo, 2014, p. 43, Pl. 42, Figs. 4–8; Pl. 43, Figs. 1–3).
***Strotogyra copoyensis* (Frost & Langenheim, 1974)**
Fig. 11C

*1974 *Placosmilia copoyensis* n. sp.: Frost & Langenheim, p. 240–242, Pl. 83, Figs. 1–7.

Dimensions. d (series, wall–wall): 2.5–5 mm, up to 9 mm in areas of bifurcation; s (monocentric): up to around 40; s/mm: 6–8/2.
Description. Flabelloid colony; corallites indistinct to subdistinct meandroid series; costosepta arranged in 3–4 size orders, regularly alternating in length and thickness; S1 reach center of corallite series; multilamellar epitheca *s.l.* present.
Type locality of species. Middle Eocene of Mexico (San Juan Formation).
Distribution. Upper Maastrichtian and Selandian–Thanetian of Iran (Zagros Zone, southwestern Iran; this paper), Middle Eocene of Mexico (San Juan Formation).
New material. 2NG202 (14–15) (Zagros Zone, Tarbur Formation, southwestern Iran); Qs80 (37), Qs95 (4–6) (Zagros Zone, southwestern Iran); 2BN59–1 (2, 4, 15, 24, 25, 30) 2BN59–2 (10), BN–59–N16 (3), BN–59–N19 (4) (all Sistan Suture Zone, eastern Iran).
Remarks. In having corallites forming laterally free, uniserially calicinal series and a septothecal wall with developments of a parathecal stereozone, the specimens described from the Middle Eocene of Mexico by Frost and Langenheim (1974) rather correspond to the genus *Strotogyra.* Therefore, its new combination is suggested.

Family Placosmiliidae Alloiteau, 1952

Genus *Placosmilia* Milne Edwards & Haime, 1848a
Type species. *Turbinolia cymbula* Michelin, 1846, Santonian of France (Aude) (see Milne Edwards & Haime, 1848a).
Diagnosis. Colonial. Younger specimens flabellate, becoming meandroid in later ontogenetic stages. Budding intracalicinal, resulting in a single meandroid calicinal series. Costosepta compact, arranged bilaterally. Septal margins granular. Septal flanks often secondarily thickened which might cover granules and carinae. Endothecal dissepiments well-developed, occurring throughout the whole corallum. Columella lamellar, continuous or formed by irregularly occurring lamellar segments. Trabecular extensions of axial septal ends often

fuse with columellar structures. Wall parathecal to septoparathecal. Multilamellar epithecal *s.l.* wall sometimes present.

Remarks. The genus *Placosmilia* was recently revised and reevaluated (Baron-Szabo, 2014, p. 34–35, Pl. 24, Figs. 1–5; Pl. 25, Figs. 1–5; Pl. 26, Figs. 1–7).

***Placosmilia* cf. *fenestrata* (Felix, 1900)**
Fig. 11E

*1900 *Lasmogyra fenestrata*: Felix, p. 3.
v1903 *Lasmogyra fenestrata* nov. sp.: Felix, p. 246, Pl. 21, Figs. 6–8.
v1982 *Placosmilia fenestrata* (Felix) 1900: Beauvais, p. 68–69, Pl. 4, Fig. 4, Pl. 59, Figs. 3, 5–6.
v1997 *Placosmilia fenestrata* (Felix, 1900): Baron-Szabo, p. 73, Pl. 7, Fig. 5, Pl. 8, Figs. 2–3, 6.
v2003 *Placosmilia fenestrata* (Felix, 1900): Baron-Szabo, p. 73, Pl. 7, Fig. 5, Pl. 8, Figs. 2–3, 6 [cum synonymis].
v2014 *Placosmilia fenestrata* (Felix, 1900): Baron-Szabo, p. 34, ; Pl. 26, Figs. 6–7.
2019 *Phragmosgyra fenestrata* (Felix, 1900): Löser, et al., p. 102.

Dimensions. d (min): 3–6 mm; d (max): up to around 12 mm (incomplete specimens); s/mm: 7–10/2.

Description. Fragments of a meandroid–flabelloid colony; coralla affected by rejuvenation; corallites of rejuvenation have d (min) of up to 2.2 mm, parent corallum is up to 6 mm in width; costosepta arranged in 2–3 size orders in corallites of rejuvenation.

Type locality of species. Santonian of Austria (Gosau Group).

Distribution. Lower Coniacian and Santonian of Austria (Gosau Group), upper Maastrichtian of Iran (Zagros Zone, Tarbur Formation, southwestern Iran; this paper).

New material. 2NG202 (16), Rt-1171 (both Zagros Zone, Tarbur Formation, southwestern Iran).

Remarks. The assignment of the new Iranian material is based on the idea that the coralla represent flabelloid colonies that are in the process of rejuvenation, closely corresponding to the situation in material such as the syntype of *Placosmilia psecadiophora* (Felix) (=species considered to be a junior synonym of *P. sinuosa*) (see Fig. 11G). Because only colony fragments are preserved, the full dimensions of skeletal elements cannot be determined. The skeletal features present correspond to *P. fenestrata*.

Family Oculinidae Gray, 1847

Genus *Oculina* Lamarck, 1816

Type species. *Oculina virginea* Lamarck, 1816, Atlantic Ocean, Holocene (subsequent designation by Milne Edwards & Haime, 1850).

Diagnosis. Colonial; dendroid, ramose–dendroid, encrusting, reptoid, and irregularly massive. Ramose–dendroid colonies formed by alternate extracalicular budding with corallites found on all sides of branches. Costae present or absent. Coenosteum dense, striated (non–costate) or smooth. Pali before S1 and S2 in a crown that appears rather regular in small–size corallites (up to around 4 mm), becoming more irregular with increase in corallite size. Columella spongy, papillose, made of a small number of twisted segments, or absent. Endothecal dissepiments sparse or absent. Ahermatypic and hermatypic. Zooxanthellate and azooxanthellate species.

***Oculina conferta* Milne Edwards & Haime, 1850**
Fig. 11D, F.

*1850 *Oculina conferta*: Milne Edwards & Haime, p. 27, Pl. 2, Fig. 2.
1857 *Oculina conferta*: Milne Edwards & Haime, vol. 2, p. 109.
1860 *Oculina conferta*: de Fromentel, p. 176.
1881 *Oculina conferta*: Quenstedt, p. 970, Pl. 180, Fig. 48.
1925 *Oculina conferta M. Edw. et J. Haime 1850: Felix, pars 28, p. 222 (cum synonymis).*
1997 *Oculina* new sp.: Stemann, in Bryan *et al*, p. 33, Text—Fig. 2A.
v1998 *Oculina conferta* Milne Edwards & Haime, 1850: Turnšek & Drobne, p. 136, Pl. 5, Figs. 1–4.
v2006 *Oculina conferta* Milne Edwards & Haime, 1850: Baron-Szabo, p. 65, Pl. 13, Fig. 5.

Dimensions. d: 1.6–2 mm, in areas of intense budding around 1 mm; s: 14–24 (+s), in corallites in areas of intense budding 12.

Description. Dendro-phaceloid; corallites bud off nearly rectangular; septa compact, developed in irregular septal cycles, covered by spiniform and rounded granules laterally; costae short or absent; pali irregularly present; wall septothecal.

Type locality of species. Lower Eocene of England (London Clay).

Distribution. Paleocene of the USA (Alabama), Thanetian of Slovenia (Adriatic Platform), Selandian–Thanetian of Iran (this paper, Sistan Suture Zone, eastern Iran; Suture Zagros Zone, southwestern Iran), Lower Eocene of England.

New material. 1pz92 (13), 2pz94 (10, 18), BN–59–N1 (4–II) (all from Sistan Suture Zone, eastern Iran); Qs27 (1), Os87 (37), Qs93 (19) (all form Zagros Zone, southwestern Iran).

Family Dendrophylliidae Gray, 1847

Genus *Lobopsammia* Milne Edwards & Haime, 1848d

Type species. *Lithodendron cariosum* Goldfuss, 1826, Eocene of France (subsequent designation by Milne Edwards & Haime, 1850).

Diagnosis. Colonial, dendroid, forming small arborescent colonies by di- and tristomodaeal intracalicular budding. Corallites often irregularly shaped or elongate in outline. Septa subcompact to porous. Wall synapticulothecal, costate. Costae granular and serrate by deep intercostal furrows. Septa arranged in Pourtalès plan. Columella trabecular, mesh–like or made of twisted and elongate segments. Endotheca sparsely present or absent. Epitheca sensu lato present at base.

Lobopsammia cariosa **(Goldfuss, 1826)**
Fig. 11H

v*1826 *Lithodendron cariosum nobis*: Goldfuss, p. 45, Pl. 13, Fig. 7.
v1866 *Lobopsammia cariosa,* Goldfuss, sp.: Duncan, p. 48, Pl. 7, Figs. 6–10.
non1889 *Lobopsammia cariosa* Michelin: Reis, p. 106–107, Text—Fig. III.
1925 *Lobopsammia cariosa* Goldfuss*, sp.: Felix, p. 165 [cum synonymis].*
non1914 *Lobopsammia cariosa Goldf.*: Oppenheim, p. 700–701, Pl. 26, Figs. 9–12.
1974 *Lobopsammia cariosa* (Goldfuss, 1827): Eliášová, 145–146, Text—Fig. 21.
v2013 *Lobopsammia cariosa*: White, p. 245, Pl. 11, Figs. c, e, p. 246, Pl. 12, Fig. h, p. 247, Pl. 13, Fig. i [some of the specimens studied by one of us (RBS)].

Dimensions. d (great): 2.5–4 mm, in areas of intense budding 1 mm or less; d (small): 2.2–3 mm; s: 24 to around 40.

Description. Dendroid colony; corallite are elliptical in outline; septa nearly equal in thickness, developed in 3 to 5 size orders regarding septal length; columella irregularly parietal, small.

Type locality of species. Eocene of France.

Distribution. Selandian–Thanetian of Iran (this paper; Mount Chatorsh, central Iran; Zagros Zone, southwestern Iran), Eocene of the Czech Republic, England (Brockenhurst Bed, Headon Beds), and France, Upper Eocene of Ukraine.

New material. AH173 (61) (Mount Chatorsh, central Iran); Qs67 (4, 19), ?Qs91 (22), Qs93 (34, 38–41) (all from Zagros Zone, southwestern Iran).

Remarks. In having corallites forming meandroid series, the material described from the Eocene of Slovakia by Oppenheim (1914, p. 700–701, Pl. 26, Figs. 9–12) differs from *Lobopsammia* and might be related to *Stichopsammia* Felix. Because the material from the Lower Oligocene of Germany (Reit im Winkel) assigned to *Lobopsammia cariosa* by Reis (1889, p. 106–107, Text—Fig. III) is described as having an axial corallite around which secondary corallites occur, it differs from *Lobopsammia* and might belong to genera such as *Dendrophyllia* (see, e.g., Baron-Szabo & Cairns, 2019, p. 4, Fig. 1d) or *Cladopsammia* (see, e.g., Baron-Szabo & Cairns, 2019, p. 9, Fig. 1b).

Family Agariciidae Gray, 1847

Genus *Trochoseris* Milne Edwards & Haime, 1849a

Type species. *Anthophyllum distortum* Michelin, 1844, Eocene of France (Auvert) (see Milne Edwards & Haime, 1849a).

Diagnosis. Solitary, often turbinate or trochoid, subpatellate during early ontogenetic stages possible, fixed. Septa subcompact to porous, beaded marginally. Columella papillose. Synapticulae abundant. Pennular-structures (menianae) occasionally present. Endothecal dissepiments thin, sparse or absent. Wall synapticulothecal.

Trochoseris aperta **Duncan, 1864**
Fig. 11B

v*1864 *Trochoseris aperta, nobis:* Duncan, p. 303, Pl. 19, Fig. 5.
v1880 *Elliptoseris aperta, Duncan:* Duncan, p. 48, Pl. 8, Figs. 3–6 [topotypes studied].
v1880 *Trochoseris aperta, nobis:* Duncan, p. 107, Pl. 27, Figs. 9, 10.
v1899 *Trochosmilia hilli,* sp. nov.: Vaughan, p. 233, Pl. 36, Figs. 1–4.
v1899 *Trochoseris catadupensis,* sp. nov.: Vaughan, p. 242, Pl. 39, Figs. 5, 6 [topotypes studied].
v1919 *Trochoseris catadupensis* Vaughan: Vaughan, p. 426.
v1919 *Trochoseris meinzeri,* new species: Vaughan, p. 426, Pl. 106, Figs. 2, 2a, 2b.
v1934b *Trochoseris catadupensis* Vaughan: Wells, p. 78, Pl. 2, Figs. 9, 10.
v1941 *Trochoseris catadupensis* Vaughan: Wells, p. 288, Pl. 1, Fig. 1.
?1974 *Trochoseris* (?) sp. cf. *T. meinzeri* Vaughan: Frost & Langenheim, p. 197, Pl. 61, Fig. 4.
v1992 *Trochoseris meinzeri* Vaughan, 1919: Budd et al., p. 593.
v2002 *Trochoseris catadupensis* Vaughan: Mitchell, p. 6 ff., Table 1 (topotypes studied).

v2002 *Trochoseris catadupensis* Vaughan, 1899: Baron-Szabo, p. 122, Pl. 84, Figs. 3, 5.
v2003 *Trochoseris catadupensis* Vaughan, 1899: Schafhauser *et al.*, p. 190, tab 1.
2005 *Trochoseris catadupensis* Vaughan, 1899: Filkorn et al., p. 123, Fig. 2h.
?2006 *Trochoseris catadupensis* Vaughan, 1899: Lalor & Távora, p. 188, Text—Fig. 1 (Foto 1).
v2006 *Trochoseris aperta* Duncan, 1864: Baron-Szabo *et al.*, p. 25, Fig. 5.4.
v2008 *Trochoseris aperta* Duncan, 1864: Baron-Szabo, p. 135–136, Pl. 11; Figs. 5a–7b [cum synonymis].

Dimensions. d: 7.5 × 10.5 mm; s: 96 + s.
Description. Corallum elliptical in outline; septa developed in 6 incomplete cycles in 6 systems; paliform and pennular structures irregularly present; columella papillose.
Type locality of species. Lower Miocene of Pakistan (Sind, Kurachee).
Distribution. Campanian of Cuba, Campanian–lower Maastrichtian of central Saudi Arabia, Campanian–Maastrichtian and Eocene–Oligocene of Jamaica, Maastrichtian of Mexico (Ocozocoautla and Cardenas Formations), Thanetian of Iran (Zagros Zone, southwestern Iran; this paper) and the ?USA (Alabama, Salt Mountain Limestone), Danian of Ukraine, Selandian–Eocene of Pakistan, ?Upper Eocene of Mexico (Ixtaclum shale). Eocene–Oligocene of Cuba, Oligocene of Panama, Lower Miocene of Pakistan and ?Brazil.
New material. Qs33 (33) (Zagros Zone, southwestern Iran).
Remarks. Because the material from the Lower Miocene of Brazil (Lalor & Távora, 2006, p. 188) represents a fragment of unclear dimensions, its relationship to the species *T. catadupensis* (= interpreted to be a junior synonym of *T. aperta*) cannot be determined.

Family Actinacididae Vaughan & Wells, 1943

Genus *Actinacis* d'Orbigny, 1849
Type species. *Actinacis martiniana* d'Orbigny, 1850, Upper Santonian of France (Figuières).
Diagnosis. Colony plocoid. Colony formation by extracalicinal budding. Corallites are embedded in a coenosteum. Costosepta have few, but large perforations. Anastomosis present. Septal flanks granular. Wall synapticulothecate, incomplete. Columella parietal or substyliform or formed by elongated segments. No pali. Synapticulae abundant. Endothecal dissepiments sparse. Skeletal microstructure consists of simple and compound trabeculae.
***Actinacis barretti* Wells, 1934a**
Fig. 12A

v*1934a *Actinacis barretti*: Wells, p. 101, Pl. 4, Figs. 1–2.
v1960 *Actinacis barretti Wells: Berryhill*, et al*., p. 151.*
1974 *Actinacis caribiensis:* Frost & Langenheim, p. 217, Pl. 71, Figs. 1–5.
1974 *Actinacis* sp. cf. *A. barretti* Wells: Frost & Langenheim, p. 219, Pl. 72, Figs. 1–5.
1974 *Porites anguillensis* Vaughan: Frost & Langenheim, p. 221, Pl. 75, Figs. 1–3.
1974 *Goniopora copoyensis* n. sp.: Frost & Langenheim, p. 238, Pl. 81, Figs. 5–6.
1991 *Actinacis alabamensis:* Bryan, p. 426ff.
1997 *Actinacis alabamensis:* Stemann, *in* Bryan et al., p. 33, Text—Fig. 1A.
v1997 *Actinacis barretti* Wells, 1934: Vecsei & Moussavian, p. 131, Pl. 36, Fig. 3.
v2008 *Actinacis barretti* Wells, 1934: Baron-Szabo, p. 103–104, Pl. 8, Fig. 10 [cum synonymis].

Dimensions. d: 0.8–1.2 mm; c–c: 1.2–2.1 mm; s: 18–24, often 20.
Description. Submassive colony; corallites are regularly disposed over the colony, circular to subcircular in outline; costosepta are thin, subequal in thickness, irregularly alternating in length.
Type locality of species. Middle Eocene of Jamaica (Yellow Limestone).
Distribution. Upper Maastrichtian and Paleocene (?Selandian) of Iran (Zagros Zone, southwestern Iran;

(See figure on next page.)
Fig. 12 A *Actinacis barretti* Wells, 1934; Qs93 (71), calicular view of colony, thin section; ?Selandian, Qorban, Zagros Zone, southwestern Iran. **B** *Actinacis reussi* Oppenheim, 1930; Pb43 (1), calicular view of colony, thin section; Selandian (?Danian), Kuh-e-Patorgi, Sistan Suture Zone, eastern Iran. **C** *Goniopora* cf. *microscopica* (Duncan, 1863); Qs94 (4–5), calicular view of colony, thin section; ?Selandian, Qorban, Zagros Zone, southwestern Iran. **D** *Synastrea* sp.; 2NG61 (11), calicular view of colony, thin section; upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **E** *Cunnolites angiostoma* (Kühn, 1933); FT1337, calicular view of corallum, slightly oblique; upper Maastrichtian (Tarbur Fm.), Mandegan, Zagros Zone, southwestern Iran. **F** *Faksephyllia faxoensis* (Beck, *in* Lyell, 1837); Qs50 (13), calicular view of branch, thin section; Thanetian, Qorban, Zagros Zone, southwestern Iran. **G** *Asterosmilia alloiteaui* (Alloiteau & Tissier, 1958); Qs33 (28), calicular view of corallum, thin section; Thanetian, Qorban, Zagros Zone, southwestern Iran. **H** *Bathycyathus lloydi* (Vaughan, 1920); 2NG122 (6), calicular view of corallum, thin section; upper Maastrichtian (Tarbur Fm.), Naghan, Zagros Zone, southwestern Iran. **I** *Bathycyathus corneti* (Alloiteau & Tissier, 1958); FT1326, calicular view of corallum; upper Maastrichtian (Tarbur Fm.), Mandegan, Zagros Zone, southwestern Iran

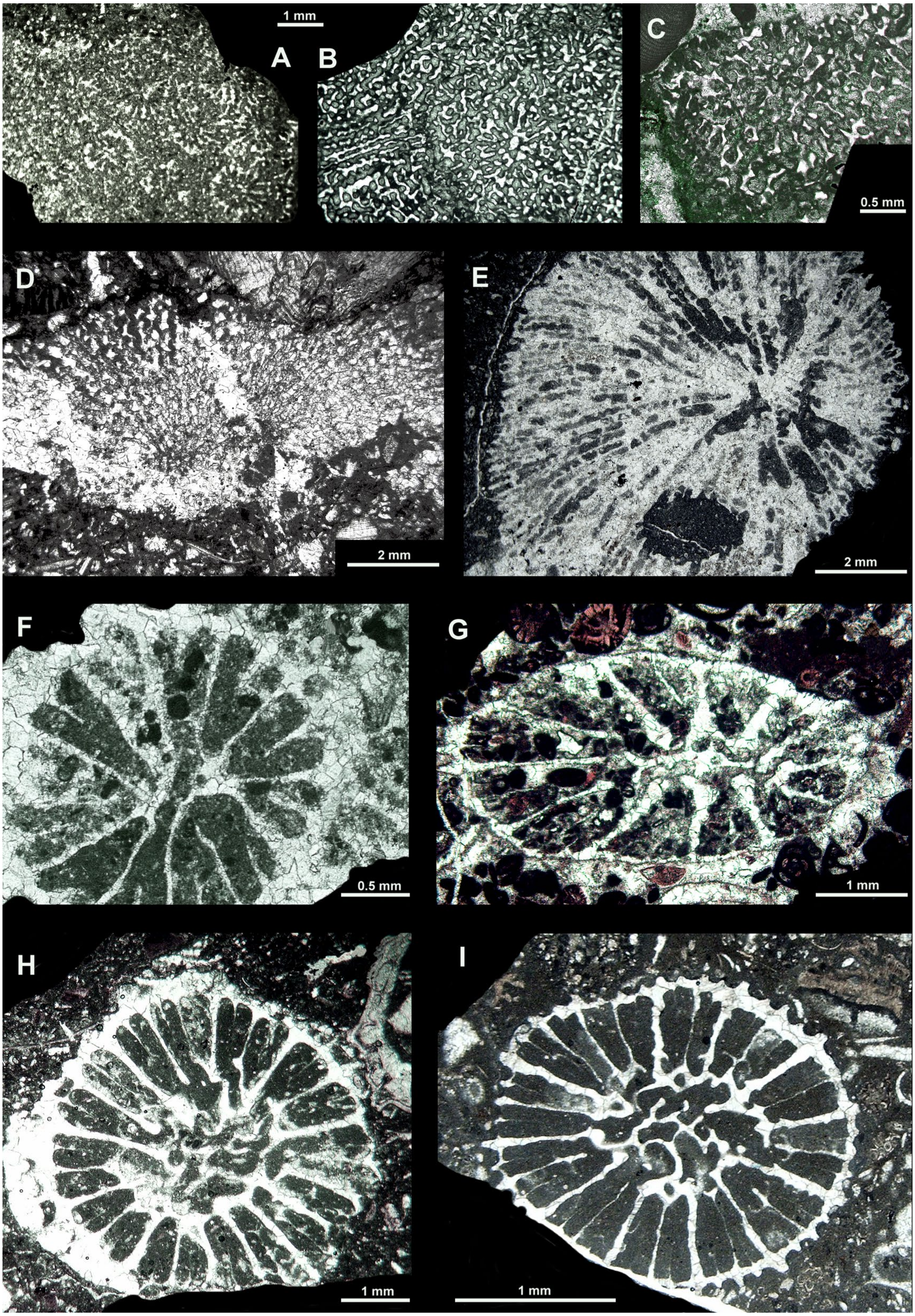

Fig. 12 (See legend on previous page.)

this paper), Danian of Puerto Rico, Thanetian of Italy (Maiella Platform) and the USA (Alabama, Salt Mountain Limestone), Middle Eocene of Jamaica (Yellow Limestone) and Mexico (San Juan Formation), Upper Oligocene of Mexico (La Quinta Formation).

New material. 2NG202 (13a) (Zagros Zone, Tarbur Formation, southwestern Iran); Qs93 (71) (Zagros Zone, southwestern Iran).

Actinacis reussi **Oppenheim, 1930**
Fig. 12B

v*1930 *Actinacis reussi* n. sp.: Oppenheim, p. 8, Pl. 1, Figs. 6, 6a, Pl. 10, Figs. 2, 2a, Pl. 15, Fig. 6 [topotypes studied].
v1982 *Actinacis reussi* Oppenheim, 1930: Beauvais, vol. 2, p. 271, Pl. 48, Figs. 5, 6. [topotypes studied]
v1994 *Actinacis reussi* Oppenheim, 1930: Turnšek, p. 14, Pl. 10, Figs. 1–3.
v2003 *Actinacis martiniana* d'Orbigny, 1850: Götz, p. 5ff., Pl. 1, Fig. 2.
2005 *Actinacis cognata* Oppenheim: Baceta, et al., p. 128ff, Fig. 8B.
v2008 *Actinacis reussi* Oppenheim, 1930: Baron-Szabo, p. 108, Pl. 8, Fig. 12 [cum synonymis].
v2014 *Actinacis reussi* Oppenheim, 1930: Baron-Szabo, p. 52–53, Pl. 57, Fig. 4.

Dimensions. d: 1.1–1.8 mm, in areas of intense budding around 0.8 mm; c–c: 1.6–2.4 mm; s: 24–26, in corallites in areas of intense budding 12.

Description. Plocoid (?submassive) colony; corallites irregularly elliptical in outline; costosepta often subconfluent, irregularly alternating in length and thickness; columella made of irregularly shaped portions, often fused with one or more septal axial ends.

Type locality of species. Santonian of Austria (Gosau Group at Pass Gschütt-Graben).

Distribution. Lower Coniacian of southern France, Upper Coniacian–Santonian of Austria (Gosau Group), Santonian–Campanian of Slovenia, Santonian and upper Campanian of Spain, Maastrichtian of Jamaica, Danian and Thanetian of northern Spain, Danian or Selandian of Iran (Sistan Suture Zone, eastern Iran; this paper).

New material. Pb43 (1) (Sistan Suture Zone, eastern Iran).

Family Poritidae Gray, 1840

Genus *Goniopora* de Blainville, 1830

Type species. *Goniopora pedunculata* Quoy & Gaimard, in de Blainville, 1830, Holocene, New Guinea.

Diagnosis. Colonial, massive, columniform or ramose, rarely incrusting. Budding extracalicular and extracalicular–marginal. Corallites united closely or separated by a reticulate coenosteum. Septa subcompact to porous, arranged bilaterally. Pali present. Columella spongy or made of twisted segments. Synapticulae present. Endothecal dissepiments thin, few in number. Wall parathecal or synapticulothecal, incomplete.

Goniopora **cf.** ***microscopica*** **(Duncan, 1863)**
Fig. 12C

v*1863 *Alveopora microscopica:* Duncan, p. 426, Pl. 14, Fig. 5.
v1900 *Litharaea Colae,* sp. nov.: Gregory, p. 37, Pl. 2, Figs. 12a–b.
v1919 *Goniopora regularis* var. *microscopica* (Duncan): Vaughan, p. 492.
1921 *Goniopora microscopica (Duncan): Vaughan* et al.*, p. 95, 108, and 111.*
1986 *Goniopora microscopica (Duncan): Foster, p. 86.*
v2008 *Goniopora microscopica* (Duncan, 1863): Baron-Szabo, 145–146, Pl. 13, Figs. 1–2 [cum synonymis].

Dimensions. d: 1.2–1.6 mm; c–c: ca. 1.4 mm; s: 24.

Description. Fragment of a ?subramose, cerioid colony; septa porous, nearly equal in thickness; columella weak, made of a few lamellar segments.

Type locality of species. Upper Oligocene of Antigua (Antigua Formation).

Distribution. Maastrichtian of Jamaica, Paleocene (?Selandian) of Iran (Zagros Zone, southwestern Iran; this paper), Selandian of Pakistan (Jhirk, Sind), Oligocene of Haiti, Upper Oligocene (Antigua Formation) of Antigua.

New material. Qs94 (4–5) (Zagros Zone, southwestern Iran).

Remarks. Because only colony fragments are available, the full range of dimensions of skeletal elements cannot be determined. The skeletal features present correspond to *G. microscopica*.

Family Synastreidae Alloiteau, 1952

Genus *Synastrea* Milne Edwards & Haime, 1848b

Type species. *Astrea agaricites* Goldfuss, 1826, Santonian of Austria (greater Salzburg area, Abtenau) (see Milne Edwards & Haime, 1848b).

Diagnosis. Colonial, massive, thamnasterioid. Budding intracalicinal. Septa confluent, perforated, marginally moniliform, granulated and pennulated laterally. Columella subpapillose, rudimentary. Synapticulae abundant. Endothecal dissepiments thin, sparse.

***Synastrea* sp.**
Fig. 12D
Dimensions. c–c: 2–4 mm; s/mm: 8–10.
Description. Fragment of a thamnasterioid colony; septa are nearly equal in thickness, irregularly alternating in length.
Distribution. Upper Maastrichtian of Iran (this paper; Zagros Zone, Tarbur Formation, southwestern Iran).
New material. 2NG61 (11) (Zagros Zone, Tarbur Formation, southwestern Iran).
Remarks. Because only a colony fragment is preserved, the full dimensions of skeletal elements cannot be determined.

Family Cunnolitidae Alloiteau, 1952
Genus *Cunnolites* Alloiteau, 1957
Type species. *Cunnolites barrerei* Alloiteau, 1957, Campanian of France.
Diagnosis. Solitary, cunnolitid (cupolate), free, circular or elliptical in outline. Base flat to concave. Calicular pit circular or elongate. Septa perforate (younger septa) to subcompact. Columella absent or feebly developed, trabecular. Synapticulae abundant. Endothecal dissepiments thin, few in number. Epitheca present or absent.
Cunnolites angiostoma (**Kühn, 1933**)
Fig. 12E

v*1933 *Cyclolites angiostoma* nov. spec.: Kühn, p. 179, pl. 17, Figs. 5–6.
1942 *Cyclolites elliptica* Lamarck (Guettard sp.): Maccagno, p. 793, pl. 1, Figs. 5–5b.
v2008 *Cunnolites angiostoma* (Kühn, 1933): Baron-Szabo, p. 176, Pl. 16, Fig. 1.

Dimensions. d (d x D): 9 × 10.5 mm; septa: around 120; septa/mm (peripheral area): 8–9/2; septa/mm (calicinal pit): 5–6/1; d/D: 0.86.
Description. Cupolate corallum, nearly circular in outline; septa thin, nearly equal in thickness, straight to slightly wavy; calicinal pit small, elongate; calicinal groove parallel to calicinal pit might be present.
Type locality of species. Upper Maastrichtian of Iran (Neyriz, Esfahan).
Distribution. Upper Maastrichtian of Iran (Neyriz; Zagros Zone, southwestern Iran; this paper).
New material. FT1337–FT1338 (Zagros Zone, southwestern Iran).
Remarks. The new material from Iran represents a rather more juvenile form. Corallum shape and dimensions of skeletal elements very closely correspond to the holotype of *C. angiostoma* (see Baron-Szabo, 2008).

Family Caryophylliidae Dana, 1846

Genus *Faksephyllia* Floris, 1972
Type species. *Caryophyllia faxoensis* Beck, *in* Lyell, 1837, Middle Danian of Denmark (Fakse limestone); neotype designation by Floris (1972, p. 76).
Diagnosis. Colonial, subdendroid, fasciculate or phaceloid. Budding intracalicular, generally distomodaeal; tristomodaeal condition in areas of intense budding possible. Budding by septal division with succeeding dichotomic forking of corallites in some calices. Costosepta compact, smooth or covered by small, rounded granules laterally; straight, free, and cuneiform, or irregularly fusing with neighboring ones in a fashion that resembles both dendrophylliid and micrabaciid septal arrangements. Costae short or absent. Pali, stereome, coenosteum, and synapticulae absent. Columella weakly to well developed, spongy–papillose or formed by a small number of twisted segments, or absent. When absent, trabecular extensions of septal axial ends can form a pseudocolumella. Endothecal dissepiments thin, sparse, vesicular to subtabulate. Wall thin or thick, septothecal, septoparathecal, and parathecal. Epitheca *s.l.* present or absent.

***Faksephyllia faxoensis* (Beck, *in* Lyell, 1837)**
Fig. 12F

v*1837 *Caryophyllia faxoensis*: Beck, *in* Lyell, 1837, p. 249, Fig. 4 (topotypes studied).
v1972 *Faksephyllia faxoensis* gen. n. & Beck, *in* Lyell (1837) sp.: Floris, p. 73–80, Pl. 4, Figs. 7–11; Pl. 5, Figs. 1–5 [topotypes studied] [cum synonymis].
v2014 *Faksephyllia faxoensis* (Lyell, 1837): Lauridsen & Bjerager, p. 1ff., Fig. 3C [topotypes studied].
v2016 *Faksephyllia faxoensis* (Beck, *in* Lyell, 1837): Baron-Szabo, p. 529–533, Pl. 1, Figs. 1–13; Pl. 2, Figs. 1–15 [cum synonymis].
v2020 *Faksephyllia faxoensis* (Beck, *in* Lyell, 1837): Baron-Szabo & Sanders, p. 330–332, Pl. 2, Figs. 1–2.

Dimensions. d: 1–4 × 1.7–5.5 mm; height of branches: up to around 35 mm; s: 18–44.
Description. Fragments of a branching colony; corallites irregularly elliptical in outline; septa are subequal in thickness;
Type locality of species. Middle Danian of Denmark (Fakse limestone).
Distribution. Paleocene of Austria (Kambühel limestone, Styria), Danian of Azerbaijan (Dash–Salakhly). Kazakhstan (Mangyshlag), Sweden (Limhamn), and Greenland (Kangilia and Nûgssuaq areas), middle

Danian of Denmark (Fakse), Selandian–Thanetian of Iran (this paper; central Iran, Mount Chatorsh; eastern Iran, Sistan Suture Zone southwestern Iran), ?Eocene of Bosnia–Herzegovina (Rošići area), lower Oligocene of Italy (Monte Pulgo and Castelgomberto, Vicenza area), Austria (quarry Wimpissinger), Germany (Reit im Winkel, Bavaria, Reiter beds), and ?Hungary.

Type locality of species. Middle Danian of Denmark (Fakse limestone).

New material. BN–52–b (3), BN–59–N1 (3, 4–I, 7), ?BN–59–N10 (2), BN–60–b (4), BN–76 (2, 3) (all Sistan Suture Zone, eastern Iran); Qs42 (40), Qs50 (13), ?Qs59 (159), Qs94 (13), Qs96 (18) (all Zagros Zone, southwestern Iran).

Remarks. Though the specimens are generally preserved as fragments, the skeletal features present in the material very closely correspond to the species *F. faxoensis* (species recently revised and evaluated; Baron-Szabo, 2016).

Genus *Asterosmilia* Duncan, 1867

Type species. *Trochocyathus abnormalis* Duncan, 1863, Miocene of the West Indies (subsequent designation Vaughan, 1919).

Diagnosis. Solitary, trochoid–ceratoid, generally free, subcircular to elliptical in outline. Costosepta compact, minutely and densely granulated laterally. Costae prominent or flat. Pali or paliform lobes next to last one or two cycles, usually opposite S3. Columella lamellar at surface, trabecular below. Wall septothecal to septoparathecal. Epithecal wall *s.l.* pellicular when present.

Asterosmilia alloiteaui (Alloiteau & Tissier, 1958)
Fig. 12G

v*1958 *Sphenotrochopsis alloiteaui* nov. sp.: Alloiteau & Tissier, p. 269, Pl. 1, Figs. 1a–b'.
v1958 *Sphenotrochopsis chavani* nov. sp.: Alloiteau & Tissier, p. 271, Pl. 1, Figs. 2a–b'.
v1958 *Sphenotrochopsis straeleni* nov. sp.: Alloiteau & Tissier, p. 272, Pl. 1, Figs. 3a–b'.
v1958 *Kionotrochus briarti* nov. sp.: Alloiteau & Tissier, p. 277, Pl. 1, Figs. 7a–b'.
v1958 *Kionotrochus montensis* nov. sp.: Alloiteau & Tissier, p. 280, Pl. 1, Figs. 6a–b'.
v2008 *Asterosmilia alloiteaui* (Alloiteau & Tissier, 1958): Baron-Szabo, p. 78–79, Text—Figs. 12A–J.

Dimensions. d: 1.1–4 × 1.6–6 mm; s: 24–48.

Description. Corallite elliptical in outline; costosepta developed in 3 cycles in 6 systems; septa of a beginning fourth cycle present in corallites larger 3 mm; axial ends of septa of some S1 and S2 fuse with columella.

Type locality of species. Upper Danian of Belgium.

Distribution. Upper Danian of Belgium, Selandian–Thanetian of Iran (this paper; Zagros Zone, southwestern Iran; Sistan Suture Zone, eastern Iran; Mount Chatorsh, central Iran).

New material. AH175 (26–28) (Mount Chatorsh, central Iran); BN–59–b (81), BN59–N3 (3), BN–59–N12 (1), 2BN59–1 (14) (all from Sistan Suture Zone, eastern Iran); Qs33 (28), Qs42 (40) (all from Zagros Zone, southwestern Iran). ?Pb62 (1).

Genus *Bathycyathus* Milne Edwards & Haime, 1848c

Type species. *Bathycyathus chilensis* Milne Edwards & Haime, 1848c, Holocene, Pacific Ocean (off the coast of Chile).

Diagnosis. Turbinate or variably conical, fixed or free when solitary, forming phaceloid clumps by basal budding or parricidal intracalicular budding when colonial. Corallites often circular in outline in juvenile stages, becoming compressed in later ontogenetic stages. Costosepta laminar, compact. Septal margins smooth or nearly smooth. Pali not distinct from columellar laths. Columella formed by twisted trabecular segments. Endothecal dissepiments few in number. Wall septothecal, septoparathecal when not properly thickened.

Bathycyathus lloydi (Vaughan, 1920)
Fig. 12H

v*1920 *Paracyathus lloydi,* n. sp.: Vaughan, p. 62, Pl. 10, Figs. 3–3b.
v1920 *Paracyathus thomi,* n. sp.: Vaughan, p. 63, Pl. 10, Figs. 4–4d.
v1920 *Paracyathus kayserensis,* n. sp.: Vaughan, p. 68, Pl. 10, Figs. 5–5b.
v1933 *Steriphonotrochus* ? *manorensis* n. sp.: Wells, p. 123 (205), Pl. 14, Fig. 21.
1972 *Paracyathus kangliaensis* sp. n.: Floris, p. 60, Pl. 3, Figs. 6A–9.
v2008 *Bathycyathus lloydi* (Vaughan, 1920): Baron-Szabo, p. 53–54, Pl. 4, Figs. 3a–4b.

Dimensions. d: 3.5–5 × 5–6 mm (slightly incomplete specimens); s: 36–52; d/D: 0.77–0.94.

Description. Corallite is circular to elliptical in outline; costosepta are developed in 4 size orders, irregularly alternating in length and thickness; columella is made of flexuous segments, connected to trabecular extensions of axial ends of septa.

Type locality of species. Upper Maastrichtian of the USA (Cannonball Member, Lance Formation).

Distribution. Upper Maastrichtian and Selandian–Thanetian of Iran (this paper; Tarbur Fm., Zagros Zone, southwestern Iran; Sistan Suture Zone, eastern Iran), upper Maastrichtian of the USA (Navarro Formation,

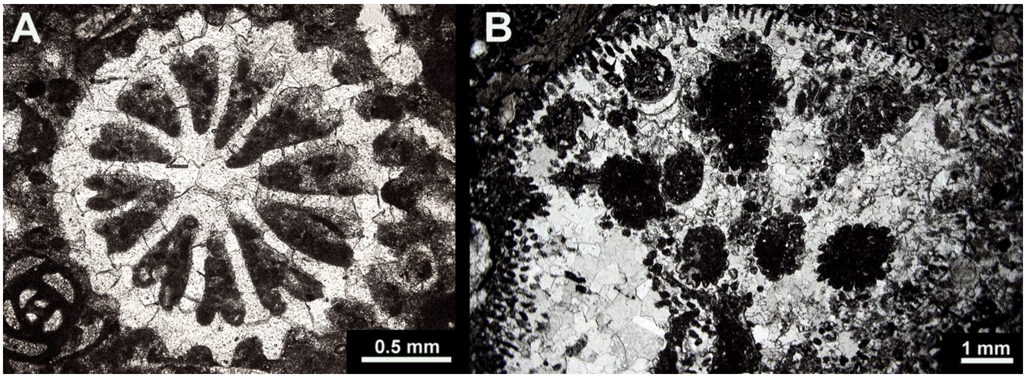

Fig. 13 **A** *Turbinolia dickersoni* Nomland, 1916; Qs26-a (68), calicular view, thin section; Thanetian, Qorban, Zagros Zone, southwestern Iran; **B** *Heliopora incrustans* Nielsen, 1917; calicular view of colony, slightly oblique, thin section; Qs86 (1), Selandian (Thanetian?), Qorban, Zagros Zone, southwestern Iran

Texas; Cannonball Marine Formation), lower Danian of Denmark (Greenland).

New material. 2NG122 (6), 2NG127 (12), 2NG199–1 (2) (all from Tarbur Fm., Zagros Zone, southwestern Iran); P316008, 2pb50 (20) (all from Sistan Suture Zone, eastern Iran); Qs31 (21), (Zagros Zone, southwestern Iran).

Remarks. Ontogenetic studies on the species *B. lloydi* were carried out by Baron-Szabo (2008, p. 53–54, Pl. 4, Figs. 3a–4b), according to which the Iranian material corresponds to the juvenile stage of *B. lloydi*.

Bathycyathus corneti **(Alloiteau & Tissier, 1958)**
Fig. 12I

v*1958 *Kionotrochus corneti* nov. sp.: Alloiteau & Tissier, p. 279, pl. 1, Figs. 9a–b'.

v2008 *Bathycyathus corneti* (Alloiteau & Tissier, 1958): Baron-Szabo, p. 52–53, Text—Figs. 3A–J [cum synonymis].

Dimensions. d (d × D): 2 × 2.3 mm; s: 42; d/D: 0.87.

Description. Corallite is circular to elliptical in outline; costosepta are developed in 4 size orders, irregularly alternating in length and thickness; columella is made of flexuous segments, connected to trabecular extensions of axial ends of septa.

Type locality of species. Danian of Belgium.

Distribution. Upper Maastrichtian of Iran (Zagros Zone, southwestern Iran; this paper), Danian of Belgium.

New material. FT326 (Zagros Zone, southwestern Iran).

Remarks. Ontogenetic studies on the species *B. corneti* were carried out by Baron-Szabo (2008, p. 52–53, Text—Figs. 3A–J), according to which the Iranian material corresponds to the juvenile stage of *B. corneti.*

Family Turbinoliidae Milne Edwards & Haime, 1848c

Genus *Turbinolia* Lamarck, 1816

Type species. *Turbinolia sulcata* Lamarck, 1816, Middle Eocene of France (by subsequent designation Milne Edwards & Haime, 1850).

Diagnosis. Solitary, ceratoid, circular in cross section and small (rarely exceeding 3.5 mm) in diameter; septa compact, exsert, hexamerally arranged in 2–4 cycles (12–48 septa); costae independent in origin, usually well-developed, smooth ridges, and C1–2 sometimes 'thickened basally'. Costae present or absent, depending on species; in type species present as alignment of low mounds, becoming low ridges only near calice; series of circular pits up to 70 µm in diameter flank each costa, each bordered on distal and proximal edges by small thecal buttresses oriented perpendicular to the costa and often fused to the costae, if present; thecal pits thus appear to form a double column, often in alternating arrangement. Paliform structures absent. Columella quite variable, including styliform, stellate, and lamellar.

Turbinolia dickersoni **Nomland, 1916**
Fig. 13A

(v)*1916 *Turbinolia dickersoni,* n. sp.: Nomland, p. 61, Pl. 3, Figs. 5–8.

v1945 *Turbinolia barbadiana* Wells, n. sp.: Wells, p. 13, Pl. 3, Figs. 8–10.

v1945 *Turbinolia barbadiana* var. *crassicostata* Wells, n. var.: Wells, p. 14, Pl. 3, Fig. 11.

1997 *Turbinolia dickersoni* Nomland, 1916: Cairns, p. 24.

1997 *Turbinolia frescoenis* Barta–Calmus, 1969: Cairns, p. 24.

v2008 *Turbinolia dickersoni* Nomland, 1916: Baron-Szabo, p. 91–92, Text—Figs. 17A–B [cum synonymis].

Dimensions. d: 2 mm; s: 24.
Description. Corallite circular in outline; costosepta developed in 3 cycles in 6 systems; S1 and S2 are nearly equal in length and thickness.
Type locality of species. Paleocene of the USA (Cannonball Marine Formation).
Distribution. Danian–Selandian of the USA (Mississippi, Alabama), ?Selandian–Thanetian of Iran (this paper; Zagros Zone, southwestern Iran), Eocene of Ivory Coast, Mexico, and the USA (Alabama, Louisiana, Mississippi, and Texas), Lower Eocene of Barbados (Upper Scotland Formation) and the USA (California), Upper Eocene of Colombia, Oligocene of Peru (Mirador facies).
New material. Qs26-a (68), Qs80 (29) (all from Zagros Zone, southwestern Iran).
Remarks. Species *Turbinolia dickersoni* well documented in Nomland (1916, p. 61, Pl. 3, Figs. 5–8.)

Family Helioporidae Moseley, 1876

Genus *Heliopora* de Blainville, 1830
Type species. *Millepora coerulea* Pallas, 1766, Indian Ocean, Holocene (by subsequent designation in Milne Edwards & Haime, 1851, p. 148).
Diagnosis. Colonial, plocoid. Corallites subcircular to irregularly elliptical in outline. Budding extracalicular. Pseudosepta compact, short, generally 10% or less of the corallite diameter in length. Endothecal tabulae numerous, thin. Corallite wall trabecular, compact or has pores. Coenosteum made of small–sized (mainly 100–150 µm in diameter) tubes.

Heliopora incrustans **Nielsen, 1917**
Fig. 13B

*1917 *Heliopora incrustans* n. sp.: Nielsen, p. 12–13, Figs. 16–17.
1990 *Heliopora incrustans* Nielsen, 1917: Bernecker & Weidlich, p. 115, Pl. 31, Fig. 5, Pl 32, Fig. 4.
2014 *Heliopora incrustans* (Nielsen, 1917): Lauridsen & Bjerager, p. 5ff., Fig. 4A.

Dimensions. d (small): 0.5–1.1 mm; d (great): up to around 1.8 mm; pseudosepta: ranging between 20 and 30; tubes/0.5 mm^2: generally 10–15.
Description. Small (around 10 mm in diameter), massive colony; corallite tubes are subcircular in outline; pseudosepta developed extremely irregularly in size and thickness, some are around 20% the corallite diameter in length, other are spine–like and less than 50 µm in length.
Type locality of species. Middle Danian of Denmark (Faxe limestone).
Distribution. Middle Danian of Denmark (Fakse limestone), Selandian or Thanetian of Iran (Zagros Zone, southwestern Iran; this paper).
New material. Qs86 (1–4) (Zagros Zone, southwestern Iran).
Remarks. Species *Heliopora incrustans* well documented in Lauridsen & Bjerager, (2014, Fig. 4A).

Appendix
See Tables 6, 7, 8, 9 and 10.

Table 6 Newly and previously (Khazaei, et al., 2009; Kühn, 1933) reported coral species from Iranian K/Pg-localities, characteristics of their skeletal elements, and their stratigraphic and geographic ranges

Iranian species	Corallite integration; corallite size*	Colony shape	Iranian occurrences		K/Pg-range	Geographic distribution in the K/Pg-range	Distribution outside the K/Pg-range
			uM	P			
Acropora bancellsae	Plocoid; small	Columnar, ramose	X	X	Upper Maastrichtian–Thanetian	Iran	Middle Eocene of Spain
Actinacis barretti	Plocoid; small	Submassive	X	X	Upper Maastrichtian–Thanetian	Iran, Italy (T), Puerto Rico (D), USA (T)	Middle Eocene of Jamaica and Mexico, Upper Oligocene of Mexico
Actinacis reussi	Plocoid; small	?Submassive		X	Maastrichtian–Thanetian	Iran, Jamaica (M), Spain (D, T)	Lower Coniacian of France, upper Coniacian–Santonian of Austria, Santonian–Campanian of Slovenia and Spain
***Agathelia asperella*	Plocoid; medium	Massive	X		Upper Maastrichtian–Thanetian	Iran, Slovakia (T)	Upper Cenomanian of the Czech Republic, Coniacian–Santonian of Austria, Senonian of Slovakia, Santonian of Armenia and Greece, Campanian of Spain, upper Campanian–lower Maastrichtian of Oman and UAE
***Aspidastraea orientalis*	Circumoral; large	Cupolate	X		Upper Maastrichtian–?Paleocene	Iran, ?Pakistan (P)	Santonian of Austria, upper Campanian–lower Maastrichtian of Oman and UAE
Asterosmilia alloiteaui	None [solitary]; medium	Conical		X	Paleocene	Belgium (D), Iran	–
***Astraraea rosi*	(cerio-) thamnasterioid; medium to large	Massive	X		Upper Maastrichtian	Iran	Santonian–Campanian of Spain
Bathycyathus corneti	?None? [?solitary]; small to medium (here juvenile specimens at small size)	Conical	X		Upper Maastrichtian–Danian	Belgium (D), Iran	–
Bathycyathus lloydi	?None? [?solitary]; medium	Conical	X	X	Upper Maastrichtian–Thanetian	Greenland (D), Iran, USA (M)	-
***Cunnolites angiostoma*	None [solitary]; large	Cunnolitid–cupolate	X		Maastrichtian	Iran	-
***Cunnolites cancellata*	None [solitary]; large	Cunnolitid–cupolate	X		Maastrichtian–Selandian	India (M), Iran, The Netherlands (M, D), Pakistan (S), Saudi Arabia (?M), eastern Serbia (M)	Upper Campanian of Oman, eastern Serbia, and UAE
***Cunnolites giganteus*	None [solitary]; large	Cunnolitid–cupolate	X		Maastrichtian	Iran, eastern Serbia (M)	Santonian–Campanian of Slovenia, Campanian of eastern Serbia

Table 6 (continued)

Iranian species	Corallite integration; corallite size*	Colony shape	Iranian occurrences		K/Pg-range	Geographic distribution in the K/Pg-range	Distribution outside the K/Pg-range
			uM	P			
***Cunnolites numismalis*	None [solitary]; large	Cunnolitid–cupolate	X		Maastrichtian	Iran, Libya (M), The Netherland (M), eastern Serbia (M)	Cenomanian–Santonian of France, Coniacian–lower Campanian of Austria, Santonian of Romania and Spain, Campanian of Hungary and eastern Serbia
***Cunnolites scutellum*	None [solitary]; large	Cunnolitid–cupolate	X		Maastrichtian–Paleocene	Bulgaria (M), Iran, Jamaica (M), Pakistan (S)	Cenomanian of Ukraine, Turonian–Campanian of Austria, Santonian–Campanian of Slovenia, Campanian of Greece and Jamaica, Campanian–Maastrichtian of Tibet
Faksephyllia faxoensis	Phaceloid, subdendroid; small to medium	Branching, often arborescent, bushy		X	Paleocene	Austria (P), Azerbaijan (D), Denmark (D), Greenland (D), Iran, Kazakhstan (D), Sweden (D)	?Eocene of Bosnia-Herzegovina, Lower Oligocene of Austria Germany, ?Hungary, and Italy
**,(*)*Goniopora elegans*	Cerioid; medium	Submassive-?incrusting	X		Upper Maastrichtian–Thanetian	Iran, Italy (D), Pakistan (S), Slovenia (D, T), Turkey (T), Ukraine (D)	Upper Campanian–lower Maastrichtian of Oman, Eocene of Bosnia, Egypt, Slovakia, Peru, Somalia, Eocene–Lower Oligocene of France, Italy, Spain, Lower Miocene of Egypt
***Goniopora imperatoris*	Cerioid; small to medium	Massive	X		Maastrichtian–Thanetian	Iran, Jamaica (M), Slovenia (D, T)	Upper Campanian of Oman, upper Campanian–lower Maastrichtian of UAE, Oligocene–Pleistocene of the Caribbean, Miocene–Pleistocene of Central America, Miocene of Venezuela
Goniopora cf. *microscopica*	Cerioid; small	?Subramose		X	Maastrichtian–Paleocene	Iran, Jamaica (M), Pakistan (S), Somalia (P)	Oligocene of Haiti, Upper Oligocene of Antigua
Heliopora incrustans	Plocoid; small	Small massive		X	Paleocene	Denmark (D), Iran	–
Lobopsammia cariosa	Dendroid; medium	Branching		X	Selandian–Thanetian	Iran	Eocene of the Czech Republic, England, France, and Ukraine

Table 6 (continued)

Iranian species	Corallite integration; corallite size*	Colony shape	Iranian occurrences		K/Pg-range	Geographic distribution in the K/Pg-range	Distribution outside the K/Pg-range
			uM	P			
***Monticulastraea insignis*	Hydnophoroid; medium	Massive	X		Upper Maastrichtian	Iran	upper Campanian–lower Maastrichtian of Oman and UAE, Lower Eocene of Pakistan Upper Eocene of Indonesia, Miocene of Iran, Pakistan, Somalia
***Neocoenia lepida*	Plocoid; medium	Massive	X		Upper Maastrichtian	Iran	Turonian–Campanian of Georgia, upper Turonian–lower Coniacian of Austria, Santonian–Campanian of Croatia and Slovakia, Campanian of eastern Serbia, upper Campanian–lower Maastrichtian of Oman and UAE
Oculina conferta	Dendro-phaceloid; small	Branching		X	Paleocene	Iran, Slovenia (T), USA (P)	Lower Eocene of England
Pachygyra princeps	Meandroid; medium	Subflabellate to massive		X	Maastrichtian–Paleocene	Iran, Italy (P), Jamaica (M), Pakistan (S), Slovenia (T)	Coniacian–Santonian of Austria, France, and Spain
***Palaeopsammia zitteli*	None [solitary]; large	Conical	X		Maastrichtian–Paleocene	Egypt (D, S), Iran, Libya (?M, P), Madagascar (M), Mexico (P), Tunisia (M), Turkmenistan (M, D), USA (M, P, S, T)	Albian of USA, Cenomanian of Madagascar, Santonian–lowermost Campanian (Piripauan) of New Zealand, upper Campanian of Oman and UAE
***Paracycloseris nariensis*	None [solitary]; large	Subpatellate	X		Maastrichtian	Iran, Jamaica (M), Madagascar (M)	Campanian–Maastrichtian of Cuba and Jamaica, Upper Eocene of Pakistan
Placosmilia cf. *fenestrata*	Meandroid; medium	Flabelloid	X		Upper Maastrichtian	Iran	Coniacian–Santonian of Austria
***Rennensismilia inflexa*	None [solitary]; large	Conical	X		Maastrichtian	?Croatia (M), Hungary (M), Iran, ?Saudi Arabia (M), eastern Serbia (M)	upper Aptian–lower Albian of Iran, Upper Cretaceous of Hungary, upper Turonian of Austria, Senonian of India and Romania, Santonian of Croatia, Santonian–Campanian of Slovenia, Campanian of Saudi Arabia, Spain
***Stephanaxophyllia bicoronata*	Plocoid, cerio-plocoid, submeandroid; medium	Massive	X		Upper Maastrichtian–Paleocene	Iran, Somalia (P)	upper Santonian of France, upper Campanian of Bulgaria, upper Campanian–Maastrichtian of UAE

Table 6 (continued)

Iranian species	Corallite integration; corallite size*	Colony shape	Iranian occurrences		K/Pg-range	Geographic distribution in the K/Pg-range	Distribution outside the K/Pg-range
			uM	P			
Strotogyra copoyensis	Meandroid; medium	Flabelloid	X	X	Upper Maastrichtian–Thanetian	Iran	Middle Eocene of Mexico
^*Stylocoenia maxima*	Cerioid; medium	?Subramose	X	X	Upper Maastrichtian– Paleocene	Iran, Pakistan (S)	–
Stylocoeniella expansa	Cerioid to cerio-plocoid; small	Ramose		X	Paleocene	Iran	Eocene of Italy, Middle Eocene of Bosnia-Herzegovina
^*Stylocoeniella hoernesi*	Cerioid to cerio-plocoid; small	Subramose, massive	X		Upper Maastrichtian	Iran	Middle Eocene of Croatia
Synastrea sp.	Thamnasterioid; medium	?Massive	X		Upper Maastrichtian	Iran	–
Trochoseris aperta	None [solitary]; large (here juvenile specimen at medium to large size)	Conical–patellate		X	Maastrichtian–Lower Miocene	Iran, Jamaica (M), Mexico (M), Pakistan (S), Ukraine (D), ?USA (T)	Campanian of Cuba and Jamaica, Campanian–lower Maastrichtian of Saudi Arabia, Eocene–Oligocene of Jamaica, Eocene of Pakistan, ?Upper Eocene of Mexico, Eocene–Oligocene of Cuba, Oligocene of Panama, Lower Miocene of Pakistan and ?Brazil
***Trochosmilia* sp.	None [solitary]; large	Conical–turbinate	X		Upper Maastrichtian	Iran	–
Turbinolia dickersoni	None [solitary]; small	Conical		X	Paleocene	Iran, USA (D, S)	Lower Eocene of Barbados, Eocene of Mexico, Ivory Coast, and USA, Upper Eocene of Colombia, Oligocene of Peru

*(corallite size: small = 2 mm or less; medium = > 2 to 10 mm; large = > 10 mm). ** = taxa previously reported (Kühn, 1933; Khazaei, et al., 2009; for taxonomic decisions of material described therein see Appendix Table 7); ^ = taxa previously reported and additionally found in current study; (*) = see Remarks below; D = Danian; (u)M = (upper) Maastrichtian; P = Paleocene; S = Selandian; T = Thanetian. For more information on age of Iranian specimens of the Paleocene see Appendix Table 8. Information on stratigraphic and geographic ranges from Kiessling and Baron-Szabo (2004); Baron-Szabo (2006, 2008, 2016); and Paleobiology Database [paleobiodb.org]

(*) Reevaluation by one of us (RBS) of the material described as *Goniopora elegans* from the Coniacian of Austria by Baron-Szabo (2001) revealed that it more closely corresponds to the genus *Litharaeopsis* (family Negoporitidae); dimensions of skeletal elements match the ones seen in *L. vaughani* (family Negoporitidae was recently revised [Baron-Szabo, 2021a]).

– Because the material from the Turonian of Armenia assigned by Kuzmicheva (1987) to *Aspidastraea orientalis* has dimensions of skeletal elements more closely corresponding to *A. waehneri* (Felix, 1903), it is excluded from the distribution of *A. orientalis*

Table 7 Overview of the coral species previously described from the Paleocene (Shahr-e-Babak) and upper Maastrichtian of Iran (Tarbur Fm. at Neyriz and Semirom), and remarks on their taxonomic position

Corals species	Remarks	References
Agathelia asperella Reuss, 1854	In having (1) plocoid corallites; (2) intra- and extracalicular budding; (3) a septothecal wall; (4) costosepta, mainly arranged bilaterally; (5) abundant exotheca, the material described by Khazaei, et al. (2009) as "Faviidae" very closely corresponds to *Agathelia*; with regard to the dimensions of skeletal elements, it shows close affinities to *A. asperella* Reuss	Khazaei, et al. (2009); updated herein
Aspidastraea orientalis Kühn, 1933		Kühn (1933); Baron-Szabo (2000, 2008)
Astraraea rosi Reig Oriol, 1992	Refers to material assigned to *Microsolena* sp. and *Pseudofavia grandiflora* (Reuss, 1854) by Khazaei et al., (2009; in the caption of Pl. 4, Fig. 5, the latter material is referred to as only *Pseudofavia*) but has (1) haplaraeid structures; (2) corallites in subcerio-thamnasterioid integration; (3) intracalicular mono- to polystomodaeal; and a (large) parietal-papillose columella, thus closely corresponding to *Astraraea*; with regard to the dimensions of skeletal elements, the material shows close affinities to *A. rosi* Reig Oriol	Khazaei, et al. (2009); updated herein
Cunnolites angiostoma (Kühn, 1933)		Kühn (1933); updated herein
Cunnolites cancellata (Goldfuss, 1826)	Refers to material assigned to *Cyclolites medlicotti* Noetling; recently transferred to the species *C. cancellata* (Goldfuss) (Baron-Szabo, 2008)	Kühn (1933); Baron-Szabo (2008)
Cunnolites numismalis (Lamarck, 1801)		Kühn (1933)
Cunnolites giganteus (d'Orbigny, 1850)	Refers to material assigned to *Cyclolites robustus* Quenstedt; recently transferred to the species *C. giganteus* (d'Orbigny) (Baron-Szabo, 2008)	Kühn (1933); Baron-Szabo (2008)
Cunnolites scutellum (Reuss, 1854)		Kühn (1933); Baron-Szabo (2008)
Paracyloseris nariensis (Duncan, 1880)	In 1) forming a subpatellate corallum, 2) having spiniform and pennular septal ornamentations; and 3) compact to porous septa, the type material described as *Cycloseris lamellata* Kühn (NHMUK R.30275) shows close affinities to *Paracyloseris* Wells; with regard to the dimensions of skeletal elements, the material shows close affinities to *P. nariensis* (Duncan); species *nariensis* was recently revised (Baron-Szabo, 2008, p. 180–182, Pl. 17, Figs. 1a–9)	Kühn (1933); updated herein
Goniopora elegans (Leymerie, 1846)		Khazaei, et al. (2009)
Goniopora imperatoris Vaughan, 1919		Khazaei, et al. (2009)
Monticulastraea insignis Duncan, 1880	Refers to material assigned to *Hydnophora styriaca* (Michelin, 1847) by Khazaei et al., (2009; in the caption of Pl. 5, Figs. 5–6, the material is referred to as *Hydnophora* cf. *styriaca*) but has exotheca and larger dimensions of skeletal elements, thus more closely corresponding to *Monticulastraea insignis* (see Baron-Szabo [2006]; discussions and studies on ontogeny carried out on *H. styriaca* [= *styriana*] by Baron-Szabo [2003, 2021]; for a different opinion on the species *insignis* see Bosellini [1999])	Khazaei, et al. (2009); updated herein
Neocoenia lepida (Reuss, 1854)	Refers to material in Khazaei, et al. (2009) assigned to *Phyllocoenia* sp. but has paliform structures and a short lamellar columella, thus closely corresponding to *Neocoenia;* with regard to the dimensions of skeletal elements, the material shows close affinities to *N. lepida* (Reuss)	Khazaei, et al. (2009); updated herein

Table 7 (continued)

Corals species	Remarks	References
Palaeopsammia zitteli (Vaughan, 1900)	Refers to material described as *Palaeopsammia fastigiata* Kühn; recently transferred to *Palaeopsammia zitteli* (Vaughan) (see Baron-Szabo, 2008)	Kühn (1933); Baron-Szabo (2008)
Rennensismilia inflexa (Reuss, 1854)	Includes material assigned to *Placosmilia rudis* (Sowerby)	Kühn (1933); Kiessling and Baron-Szabo (2004)
Stephanaxophyllia bicoronata (Gregory, 1900)	In having corallites in cerio-plocoid, and short submeandroid series, extra- and intracalicular budding, columella that is spongy-papillose or formed by fused lamellar segments, irregularly occurring synapticulae, the material in Khazaei, et al. (2009) assigned to *Placocoenia major* Felix, 1903 (in the caption of Pl. 4, Fig. 7, the material is referred to as *Placocoenia* cf. *major* Felix, 1903) and *Columnocoenia arnaudi* Alloiteau closely corresponds to *Stephanaxophyllia*; with regard to the dimensions of skeletal elements, the material shows close affinities to *S. bicoronata* (Gregory)	Khazaei, et al. (2009); updated herein
Stylocoenia maxima Duncan, 1880	Refers to material described as *Astrocoenia rariseptata* Khn, but has septal and thecal features more closely corresponding to *Stylocoenia*; with regard to the dimensions of skeletal elements, the material shows close affinities to *S. maxima* (see Fig. 10A)	(1933); updated herein and current study
Stylocoeniella hoernesi (Oppenheim, 1901)	Refers to material assigned to *Actinastrea ramosa* (Sowerby, 1832) and *Actinacis parvistella* Oppenheim, 1930 (see text for discussion)	Khazaei, et al. (2009); updated herein and current study (see text)
Trochosmilia sp.	Refers to material assigned to *Trochosmilia cf. brevicula* Stoliczka, 1873	Kühn (1933); Kiessling and Baron-Szabo (2004)

Table 8 Paleoenvironmental occurrences of the Iranian species

Iranian species	Environmental occurrences	References[a]
Acropora bancellsae	Reef, buildup or bioherm, shallow subtidal	Álvarez-Pérez (1997)
Actinacis barretti	Reef, buildup or bioherm, shallow subtidal	Wells (1934a); Berryhill, et al. (1960); Bryan, et al. (1991); Vecsei and Moussavian (1997); Stemann (2004)
Actinacis reussi	Reef, buildup or bioherm, open shallow subtidal	Turnšek (1994); Götz (2003); Baceta, et al. (2005); Baron-Szabo (2008)
Agathelia asperella	Reef, buildup or bioherm, shallow subtidal, open shallow subtidal	Samuel, et al. (1972); Kuzmicheva (1987); Hladil, et al. (1991); Eliášová (1997); Sanders and Baron-Szabo (1997); Steuber (1999); Baron-Szabo (2000, 2003); Götz (2003)
Aspidastraea orientalis	Reef, buildup or bioherm, shallow and open shallow subtidal, deep subtidal shelf	Kühn (1933); Smith, et al. (1995); Baron-Szabo (2000, 2003)
Asterosmilia alloiteaui	Shallow subtidal, coastal indet.	Alloiteau and Tissier (1958)
Astraraea rosi	Shallow subtidal, coastal indet. (?reefal)	Reig Oriol (1992)
Bathycyathus corneti	Shallow subtidal, coastal indet.	Alloiteau and Tissier (1958)
Bathycyathus lloydi	Shallow subtidal, coastal, basin reef	Vaughan (1920); Wells (1933); Floris (1972)
Cunnolites angiostoma	Shallow subtidal	Kühn (1933)
Cunnolites cancellata	Reef, buildup or bioherm, shallow subtidal	Kühn (1933); Leloux (1999); Baron-Szabo (2000, 2008)
Cunnolites gigantea	Reef, buildup or bioherm, shallow subtidal, deep subtidal	Kühn (1933); Turnšek (1978, 1997)
Cunnolites numismalis	Perireef or subreef, shallow subtidal	Kühn (1933); Oppenheim (1930)
Cunnolites scutellum	Reef, buildup or bioherm, shallow subtidal	Kühn (1933); M. Beauvais (1982); Tchéchmédjiéva (1986)
Faksephyllia faxoensis	Shallow (incl. lagoonal)- to deep-water (300 m depth); often in coral thickets, bioherms, carpets	Floris (1972); Frost (1981); Bernecker and Weidlich (1990, 2005); Bosellini and Trevisani (1992); Baron-Szabo (2016); Baron-Szabo and Sanders (2020)
Goniopora cf. *microscopica*	Reef, buildup or bioherm, open shallow subtidal, coastal	Vaughan (1919); Vaughan, et al. (1921); Baron-Szabo (2008)
Goniopora elegans	Reef, buildup or bioherm, perireef or subreef, shallow subtidal, foreshore, slope/ramp reef	Chevalier (1956); Álvarez-Pérez, et al. (1989); Metwally (1996); Vecsei and Moussavian (1997); Baron-Szabo (2000); Zamagni, et al. (2009); Zorlu, et al. (2011)
Goniopora imperatoris	Reef, buildup or bioherm, perireef or subreef, open shallow subtidal, shallow subtidal	Frost and Langenheim (1974); Drobne, et al. (1988); Klaus and Budd (2003); Baron-Szabo (2008); Johnson, et al. (2009)
Heliopora incrustans	Shallow subtidal, deep-water coral mounds	Bernecker and Weidlich (1990); Lauridsen & Bjerager (2014)
Lobopsammia cariosa	Reef, buildup or bioherm, perireef or subreef, shallow subtidal	Eliášová (1974); Kuzmicheva (1987)
Monticulastraea insignis	Reef, buildup or bioherm, open shallow subtidal, shallow subtidal, basinal	Duncan (1880); Gerth (1933); McCall, et al. (1994); Schuster & Wieland (1999); Baron-Szabo (2000); Gameil (2005)
Neocoenia lepida	Reef, buildup or bioherm, open shallow subtidal, shallow subtidal	Sanders and Baron-Szabo (1997); Baron-Szabo (2000); Gameil (2005)
Oculina conferta	Reef, buildup or bioherm, shallow subtidal	Bryan, et al. (1991); Turnšek and Drobne (1998)
Pachygyra princeps	Reef, buildup or bioherm, shallow and open shallow subtidal	Duncan (1880); Beauvais (1982); Turnšek and Drobne (1998); Baron-Szabo (2006)
Palaeopsammia zitteli	Reef, buildup or bioherm, shallow subtidal, perireef or subreef, coastal	Turnšek, et al. (2003)
Paracycloseris nariensis	Shallow and open shallow subtidal	Kühn (1933); Filkorn, et al. (2005); Baron-Szabo (2008)
Placosmilia cf. *fenestrata*	Reef, buildup or bioherm, shallow subtidal	Sanders and Baron-Szabo (1997); Baron-Szabo (2003)
Rennensismilia inflexa	Reef, buildup or bioherm, perireef or subreef, open shallow subtidal, deep subtidal, shoreface	Stoliczka (1873); Turnšek (1978); Pal., et al. (1984); Baron-Szabo (1998, 1999, 2014)
Stephanaxophyllia bicoronata	Reef, buildup or bioherm, shallow and open shallow subtidal	Tchéchmédjiéva (1986); Baron-Szabo (2000); Gameil (2005)
Strotogyra copoyensis	Reef, buildup or bioherm, shallow subtidal	Frost and Langenheim (1974)
Stylocoenia maxima	Reef, buildup or bioherm, shallow subtidal	Duncan (1880)

Table 8 (continued)

Iranian species	Environmental occurrences	References[a]
Stylocoeniella expansa	Shallow subtidal	Oppenheim (1901, 1908)
Stylocoeniella hoernesi	Shallow subtidal, marine indet	Oppenheim (1901)
Synastrea sp.	Genus has been reported from a variety of reefal and non-reefal environments from shallow (coastal, lacustrine deltaic) to deep subtidal	Beauvais (1964); Eliášová (1997); Baron-Szabo (2014, 2018b)
Trochoseris aperta	Reef, buildup or bioherm, shallow subtidal	Duncan (1880); Wells (1934b, 1941); Bryan, et al. (1997); Filkorn, et al. (2005); Baron-Szabo, et al. (2006)
Trochosmilia sp.	Genus has been reported from a variety of reefal and non-reefal environments such as coastal, lagoonal/ restricted shallow subtidal, open bay to various shoreface environments, deep subtidal	Kühn (1933)
Turbinolia dickersoni	Shallow subtidal, deep water indet.	Nomland (1916); Howe (1960)

[a] Including paleoenvironmental information concerning the Iranian localities of the current paper

Table 9 Iranian coral genera (arranged according to family assignment [families are in alphabetical order]) and references used for information regarding genus concept

Family	References for further information on genus concept
Family / Genus — Acroporidae Verrill, 1902	
Acropora Oken, 1815	Wallace (2008); Santodomingo (2014)
Family / Genus — Actinacididae Vaughan & Wells, 1943	
Actinacis d'Orbigny, 1849	M. Beauvais (1982); Bosellini & Russo (1995); Baron-Szabo (2003)
Family / Genus — Agariciidae Gray, 1847	
Trochoseris Milne Edwards & Haime, 1849a	Wells (1956); Baron-Szabo (2006, 2014)
Family / Genus — Agatheliidae L. & M. Beauvais, 1975	
Agathelia Reuss, 1854	L. & M. Beauvais, (1975); Eliášová (1992); Baron-Szabo (2003, 2014)
Family / Genus — Astrocoeniidae Tomes, 1883	
Stylocoenia Milne Edwards & Haime, 1849b	Álvarez-Pérez (1993); Baron-Szabo (2006)
Family / Genus — Caryophylliidae Dana, 1846	
Asterosmilia Duncan, 1867	Alloiteau & Tissier (1958); Baron-Szabo (2008)
Bathycyathus Milne Edwards & Haime, 1848c	Baron-Szabo (2008, 2018a); Baron-Szabo, *et al.* (2010)
Faksephyllia Floris, 1972	Floris, (1972); Baron-Szabo (2016)
Family / Genus — Columastreidae Alloiteau, 1952	
Stephanaxophyllia Alloiteau, 1957	Alloiteau (1957); Baron-Szabo (2002)
Family / Genus — Cunnolitidae Alloiteau, 1952	
Aspidastraea Kühn, 1933	Kühn (1933); Baron-Szabo (2003, 2008)
Cunnolites Alloiteau, 1957	Géczy (1954); Morycowa & Roniewicz (1995); Baron-Szabo (2003, 2008)
Paracycloseris Wells, 1934	Filkorn & Pantoja-Alor (2009); Baron-Szabo (2008)
Family / Genus — Dendrophylliidae Gray, 1847	
Lobopsammia Milne Edwards & Haime, 1848d	Eliášová (1974); Cairns (2001); Baron-Szabo & Cairns (2019)
Palaeopsammia Wanner, 1902	Cairns (2001); Baron-Szabo (2008); Jell, *et al.* (2011); Baron-Szabo & Cairns (2019)
Family / Genus — Haplaraeidae Vaughan & Wells, 1943	
Subfamily Haplaraeinae Vaughan & Wells, 1943	
Astraraea Felix, 1900	M. Beauvais (1982); Baron-Szabo (2014)

Table 9 (continued)

Family / Genus	Helioporidae Moseley, 1876	
Heliopora de Blainville, 1830		Hernández Morales & Löser (2018)
Family / Genus	Meandrinidae Gray, 1847	
Pachygyra Milne Edwards & Haime, 1848a		Baron-Szabo (2006, 2014)
Strotogyra Wells, 1937		Wells (1937); Turnšek, *et al.* (1992)
Family / Genus	Merulinidae Milne Edwards & Haime, 1857	
Monticulastraea Duncan, 1880		Duncan (1880); Eliášová (1989); Baron-Szabo (2006)
Neocoenia Hackemesser, 1936		M. Beauvais, (1982); Baron-Szabo (2014)
Family / Genus	Oculinidae Gray, 1847	
Oculina Lamarck, 1816		Wells (1956); Baron-Szabo (2006)
Family / Genus	Placosmiliidae Alloiteau, 1952	
Subfamily Placosmiliinae Alloiteau, 1952		
Placosmilia Milne Edwards & Haime, 1848a		Baron-Szabo (2003, 2014)
Subfamily Euphylliinae Alloiteau, 1952		
Rennensismilia Alloiteau, 1952		Baron-Szabo (1999, 2014)
Family / Genus	Pocilloporidae Gray, 1842	
Stylocoeniella Yabe & Sugiyama, 1935		Yabe & Sugiyama (1935)
Family / Genus	Poritidae Gray, 1840	
Goniopora de Blainville, 1830		Bernard (1903); Chevalier (1962); Baron-Szabo (2008)
Family / Genus	Synastreidae Alloiteau, 1952	
Synastrea Milne Edwards & Haime, 1848b		Alloiteau (1957); Morycowa & Roniewicz (1995); Baron-Szabo (2021b)
Family / Genus	Thecosmiliidae Duncan, 1884	
Trochosmilia Milne Edwards & Haime, 1848a		Gill & Russo (1973); Baron-Szabo (2006)
Family / Genus	Turbinoliidae Milne Edwards & Haime, 1848b	
Turbinolia Lamarck, 1816		Cairns (1997)

Table 10 List of newly described Iranian specimens, and both their taxonomic and stratigraphic assignments

Iranian specimens	Stratigraphic level
1pz92 (13): *Oculina conferta*	Selandian–Thanetian
2BN59-1 (14): *Asterosmilia alloiteaui*	Thanetian
2BN59-1 (15): *Strotogyra copoyensis*	Thanetian
2BN59-1 (2): *Strotogyra copoyensis*	Thanetian
2BN59-1 (24): *Strotogyra copoyensis*	Thanetian
2BN59-1 (25): *Strotogyra copoyensis*	Thanetian
2BN59-1 (30): *Strotogyra copoyensis*	Thanetian
2BN59-1 (4): *Strotogyra copoyensis*	Thanetian
2BN59-2 (10): *Strotogyra copoyensis*	Thanetian
2NG122 (30): *Acropora bancellsae*	Upper Maastrichtian
2NG122 (31): *Acropora bancellsae*	Upper Maastrichtian
2NG122 (6): *Bathycyathus lloydi*	Upper Maastrichtian
2NG127 (12): *Bathycyathus lloydi*	Upper Maastrichtian
2NG127 (13): *Acropora bancellsae*	Upper Maastrichtian
2NG127 (16): *Acropora bancellsae*	Upper Maastrichtian
2NG127 (18): *Acropora bancellsae*	Upper Maastrichtian
2NG127 (19): *Acropora bancellsae*	Upper Maastrichtian
2NG127 (20): *Acropora bancellsae*	Upper Maastrichtian
2NG127 (21): *Acropora bancellsae*	Upper Maastrichtian
2NG127-2 (1): *Acropora bancellsae*	Upper Maastrichtian
2NG127-2 (12): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (1): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (3): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (5): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (6): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (8): *Acropora bancellsae*	Upper Maastrichtian
2NG127-3 (9): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (1): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (15): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (16): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (3): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (4): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (5): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (6): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (7): *Acropora bancellsae*	Upper Maastrichtian
2NG127-4 (8): *Acropora bancellsae*	Upper Maastrichtian
2NG127-5 (2): *Acropora bancellsae*	Upper Maastrichtian
2NG127-5 (3): *Acropora bancellsae*	Upper Maastrichtian
2NG127-5 (4): *Acropora bancellsae*	Upper Maastrichtian
2NG127-5 (5): *Acropora bancellsae*	Upper Maastrichtian
2NG127-5 (8): *Acropora bancellsae*	Upper Maastrichtian
2NG147 (28): *Stylocoeniella hoernesi*	Upper Maastrichtian
2NG147 (29): *Stylocoeniella hoernesi*	Upper Maastrichtian
2NG147 (30): *Acropora bancellsae*	Upper Maastrichtian
2NG147 (36): *Stylocoeniella hoernesi*	Upper Maastrichtian
2NG147 (42): *Stylocoeniella hoernesi*	Upper Maastrichtian
2NG199-1 (2): *Bathycyathus lloydi*	Upper Maastrichtian
2NG202 (10): *Acropora bancellsae*	Upper Maastrichtian
2NG202 (13a): *Actinacis barretti*	Upper Maastrichtian

Table 10 (continued)

Iranian specimens	Stratigraphic level
2NG202 (13b): *Stylocoenia maxima*	Upper Maastrichtian
2NG202 (14): *Strotogyra copoyensis*	Upper Maastrichtian
2NG202 (15): *Strotogyra copoyensis*	Upper Maastrichtian
2NG202 (16): *Placosmilia* cf. *fenestrata*	Upper Maastrichtian
2NG202 (2): *Acropora bancellsae*	Upper Maastrichtian
2NG202 (3): *Stylocoenia maxima*	Upper Maastrichtian
2NG202 (4): *Stylocoenia maxima*	Upper Maastrichtian
2NG61 (11): *Synastrea* sp.	Upper Maastrichtian
2pb50 (20): *Bathycyathus lloydi*	Selandian–Thanetian
2pz94 (10): *Oculina conferta*	Selandian–Thanetian
2pz94 (18): *Oculina conferta*	Selandian–Thanetian
AH173 (61): *Lobopsammia cariosa*	Selandian
AH175 (26): *Asterosmilia alloiteaui*	Selandian
AH175 (27): *Asterosmilia alloiteaui*	Selandian
AH175 (28): *Asterosmilia alloiteaui*	Selandian
BN40-c (19): *Acropora bancellsae*	Selandian–Thanetian
BN40-c (24): *Acropora bancellsae*	Selandian–Thanetian
BN40-c (25): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (1): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (1): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (11): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (2): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (3): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (4): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (5): *Acropora bancellsae*	Selandian–Thanetian
BN41-a (6): *Acropora bancellsae*	Selandian–Thanetian
BN41-c (11): *Acropora bancellsae*	Selandian–Thanetian
BN41-c: *Acropora bancellsae*	Selandian–Thanetian
BN46-a (1): *Acropora bancellsae*	Selandian–Thanetian
BN46-a (2): *Acropora bancellsae*	Selandian–Thanetian
BN46-a (6): *Acropora bancellsae*	Selandian–Thanetian
BN46-b (5): *Acropora bancellsae*	Selandian–Thanetian
BN-52-b (3): *Faksephyllia faxoensis*	Thanetian
BN53 (21): *Acropora bancellsae*	Thanetian
BN56–b (18): *Acropora bancellsae*	Thanetian
BN-59-b (81): *Asterosmilia alloiteaui*	Thanetian
BN59–N1 (15): *Acropora bancellsae*	Thanetian
BN-59-N1 (3): *Faksephyllia faxoensis*	Thanetian
BN-59-N1 (4-I): *Faksephyllia faxoensis*	Thanetian
BN-59-N1 (4-II): *Oculina conferta*	Thanetian
BN-59-N1 (7): *Faksephyllia faxoensis*	Thanetian
BN59-N1 (8): *Acropora bancellsae*	Thanetian
BN-59-N10 (2): *Faksephyllia faxoensis*	Thanetian
BN-59-N12 (1): *Asterosmilia alloiteaui*	Thanetian
BN-59-N16 (3): *Strotogyra copoyensis*	Thanetian
BN-59-N19 (4): *Strotogyra copoyensis*	Thanetian
BN-59-N3 (3): *Asterosmilia alloiteaui*	Thanetian
BN-60-b (4): *Faksephyllia faxoensis*	Thanetian
BN63 (10): *Acropora bancellsae*	Thanetian

Table 10 (continued)

Iranian specimens	Stratigraphic level
BN63 (6): *Acropora bancellsae*	Thanetian
BN63 (8): *Acropora bancellsae*	Thanetian
BN63 (9): *Acropora bancellsae*	Thanetian
BN64 (16): *Acropora bancellsae*	Thanetian
BN64 (2): *Acropora bancellsae*	Thanetian
BN-76 (2): *Faksephyllia faxoensis*	Thanetian
BN-76 (3): *Faksephyllia faxoensis*	Thanetian
FT1338: *Cunnolites angiostoma*	Upper Maastrichtian
FT326: *Bathycyathus corneti*	Upper Maastrichtian
NG113 (32): *Acropora bancellsae*	Upper Maastrichtian
P316008: *Bathycyathus lloydi*	Upper Maastrichtian
P3171291: *Acropora bancellsae*	Upper Maastrichtian
P3171292: *Acropora bancellsae*	Upper Maastrichtian
P3171293: *Acropora bancellsae*	Upper Maastrichtian
P3171294: *Acropora bancellsae*	Upper Maastrichtian
P3171295: *Acropora bancellsae*	Upper Maastrichtian
P3171296: *Acropora bancellsae*	Upper Maastrichtian
P3171297: *Acropora bancellsae*	Upper Maastrichtian
P3171298: *Acropora bancellsae*	Upper Maastrichtian
Pb29 (10): *Stylocoeniella expansa*	Danian or Selandian
Pb43 (1): *Actinacis reussi*	Selandian (?Danian)
pb62 (1): ?*Asterosmilia alloiteaui*	Selandian
Pb62 (7): *Acropora bancellsae*	Selandian
PL–2 (32): *Acropora bancellsae*	Selandian–Thanetian
PL–2 (33): *Acropora bancellsae*	Selandian–Thanetian
PL–2 (34): *Acropora bancellsae*	Selandian–Thanetian
PL–2 (37): *Acropora bancellsae*	Selandian–Thanetian
PL–2 (38): *Acropora bancellsae*	Selandian–Thanetian
PL–2 (39): *Acropora bancellsae*	Selandian–Thanetian
Qs26-a (68): *Turbinolia dickersoni*	Thanetian
Qs27 (1): *Oculina conferta*	Thanetian
Qs31 (21): *Bathycyathus lloydi*	Thanetian
Qs33 (28): *Asterosmilia alloiteaui*	Thanetian
Qs33 (29): *Pachygyra princeps*	Thanetian
Qs33 (32): *Pachygyra princeps*	Thanetian
Qs33 (33): *Trochoseris aperta*	Thanetian
Qs42 (40): *Asterosmilia alloiteaui*	Thanetian
Qs42 (40): *Faksephyllia faxoensis*	Thanetian
Qs50 (13): *Faksephyllia faxoensis*	Thanetian
Qs59 (159) ?*Faksephyllia faxoensis*	Thanetian
Qs67 (19): *Lobopsammia cariosa*	Thanetian
Qs67 (39): *Pachygyra princeps*	Thanetian
Qs67 (4): *Lobopsammia cariosa*	Thanetian
Qs80 (29): *Turbinolia dickersoni*	Selandian or Thanetian
Qs80 (37): *Strotogyra copoyensis*	Selandian or Thanetian
Qs86 (1): *Heliopora incrustans*	Selandian (Thanetian?)
Qs86 (2): *Heliopora incrustans*	Selandian (Thanetian?)
Qs86 (3): *Heliopora incrustans*	Selandian (Thanetian?)
Qs86 (4): *Heliopora incrustans*	Selandian (Thanetian?)

Table 10 (continued)

Iranian specimens	Stratigraphic level
Qs87 (37): *Oculina conferta*	Selandian (Thanetian?)
Qs91 (22): ?*Lobopsammia cariosa*	?Selandian
Qs93 (19): *Oculina conferta*	?Selandian
Qs93 (25): *Stylocoeniella expansa*	?Selandian
Qs93 (34): *Lobopsammia cariosa*	?Selandian
Qs93 (38): *Lobopsammia cariosa*	?Selandian
Qs93 (39): *Lobopsammia cariosa*	?Selandian
Qs93 (40): *Lobopsammia cariosa*	?Selandian
Qs93 (41): *Lobopsammia cariosa*	?Selandian
Qs93 (71): *Actinacis barretti*	?Selandian
Qs94 (13): *Faksephyllia faxoensis*	?Selandian
Qs94 (4): *Goniopora* cf. *microscopica*	?Selandian
Qs94 (5): *Goniopora* cf. *microscopica*	?Selandian
Qs95 (4): *Strotogyra copoyensis*	Selandian
Qs95 (5): *Strotogyra copoyensis*	Selandian
Qs95 (6): *Strotogyra copoyensis*	Selandian
Qs96 (18): *Faksephyllia faxoensis*	Selandian
Qs98 (16): *Stylocoenia maxima*	Selandian
Rt-1171: *Placosmilia* cf. *fenestrata*	Upper Maastrichtian

For information on acronyms see Table 1. For information on previously described material from Iran, see Appendix Table 7

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Author contributions

RBS wrote most of the manuscript. FS provided information regarding the stratigraphy and geology of the collecting sites. KR made available the newly described material and provided information regarding both the geography and paleogeography of the study sites. All authors read and approved the final manuscript.

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Declarations

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We have no competing interests.

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