GEOLOGICA BELGICA (2012) 15/4: 317-328

Corals of the Upper Viséan microbial-sponge-bryozoan-coral bioherm and related strata of Kongul Yayla (Taurides, South Turkey)

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ABSTRACT. The microbial-sponge-bryozoan-coral bioherm of Kongul Yayla in the Central Taurides (South Turkey) contains a rich and diversified fauna. Sponges and rugose corals are of particular interest. The most common taxa are *Siphonodendron irregulare, S. pauciradiale, S.* cf. *intermedium, Lithostrotion araneum, L. decipiens, L. maccoyanum, Axophyllum* aff. *pseudokirsopianum, Palaeosmilia multiseptata, P. murchisoni, Clisiophyllum* aff. *keyserlingi, Amygdalophyllum* sp., *Rotiphyllum* cf. *densum, Amplexocarinia* aff. *cravenensis, Soshkineophyllum*? sp. and *Espielia tauridensis* sp. nov. newly described here. The tabulate corals are mostly micheliniids, syringoporids, cladochonids and auloporids. Heterocorals and chaetetids are also present. *Siphonodendron pauciradiale* and *Lithostrotion maccoyanum* are the guide taxa for the RC7β biozone and indicate an late Asbian age for the bioherm. Facies and coral assemblage argue for a South-European affinity of the Kongul Yayla reef and probably for the whole Anatolian terrane.

KEYWORDS: Mississippian, Viséan, Asbian, rugose corals, tabulate corals, bioherm, Turkey, Taurides.

1. Introduction

The Anatolian sub-continent is made of several continental fragments (terranes) juxtaposed during the Alpine orogeny (Middle Triassic-Late Eocene, Şengör, 1984) and separated by complex suture zones. From North to South, these terranes are named Rhodope-Strandja Zone, Istanbul Zone, Sakarya Zone, Kirşehir Block, Menderes Massif, Anatolide-Tauride Block and the Arabian Platform (Fig. 1A, Okay & Tüysüz, 1999). There is no consensus about the denomination and classification of these units (see Robertson, 2000; Moix et al., 2008). Many controversies persist concerning boundaries of the continental terranes and oceanic zones, despite years of researches on tectonics, stratigraphy and palaeogeography of the Turkish geology (see Görür & Tüysüz, 2001).

The southern part of Turkey corresponds mainly to the Anatolide-Tauride Block (Özgül, 1984) - also named Anatolide-Tauride Platform (Şengör & Yilmaz, 1981) - which corresponds to juxtaposed tectono-stratigraphic units, bounded by major faults (Fig. 1A). Recent studies (see Moix et al., 2008) on Turkish tectono-stratigraphic units show the affinities of the Anatolian terranes with Eurasia and the affinities of the Taurus Terrane (the "Cimmerian blocks" of Şengör, 1984) with Gondwana.

In the Western Taurides, Mississippian sedimentary rocks are present in two allochtonous tectonostratigraphic units: the Aladağ unit and the Bolkar Dağı unit. In the Hadim region between the towns of Konya and Alanya, Turan (2000, 2001) described in the latter unit the Zindancık Formation composed of a thick siltstone succession, in which large limestone blocks are interpreted as olistoliths included in Triassic flysch.

Three limestone bodies are exposed along the section of the Kongul Yayla sheep barn (Fig. 2). Each body is an olistolith and forms a small hill, separated from each other by depressions corresponding to the siltty fysch (Fig. 1B). The northern limestone unit olistolith (NLU, Fig. 2 & 3) is composed of 120 m of well bedded limestone including 60 m of variegated shallow-water limestone (level KY.10 on Fig. 3), 10 m of dark bioclastic limestone with corals, brachiopods and crinoids, 3 m of limestone with abundant productid brachiopods, 10 m of light oolitic grainstone with corals and brachiopods (KY.11), an 0.5 m-thick bed with many large *Lithostrotion araneum* colonies, 25 m of limestone facies poor in macrofossils (KY.12). The contact with the surrounding siltstones (KY.13-16) is sharp and oblique to the bedding. The second unit, called biohermal limestone unit olistolith (BLU, Fig. 3), is approximately 50 m thick. Its reefal character was already recognized by Özgül (1984, 1997). Its base is made up of 15 m of thin-bedded coarse crinoidal limestone with numerous bioclasts and fragments of corals, brachiopods, gastropods, bivalves, etc. including a 0.4 cm-thick bed constructed by large colonies of *Siphonodendron pauciradiale* (KY.1). The bioherm *sensu stricto* begins above the *Siphonodendron* bed with a 25 m-thick massive pale limestone rich in macrofossils (KY.2-3). The diversified fauna includes productid and spiriferid brachiopods, gastropods, stemmed echinoderms, foraminifers attached to various skeletal grains, abundant lithistid and

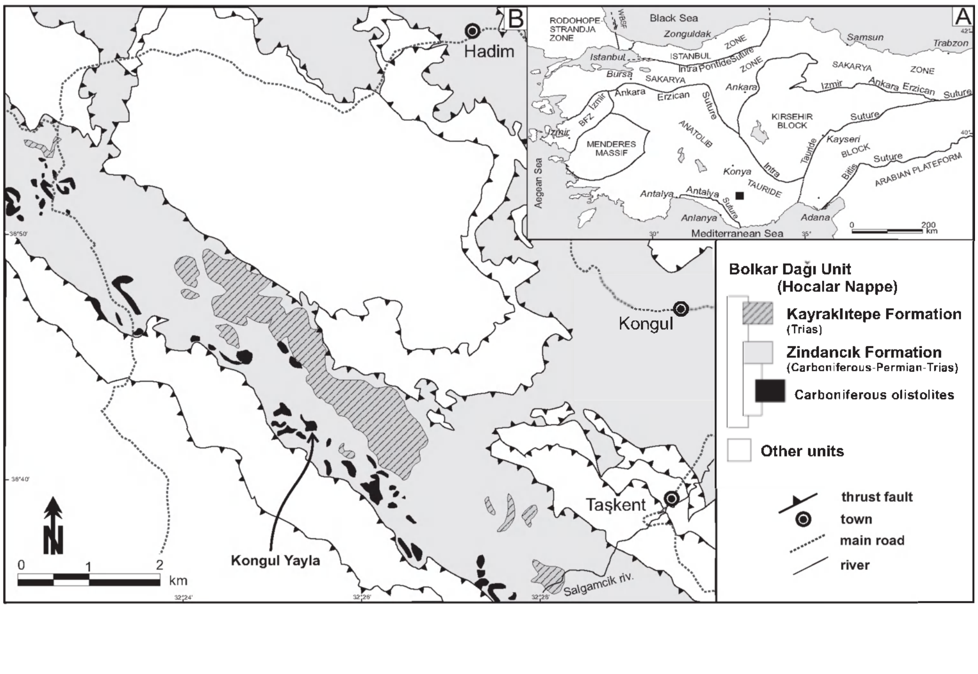

Figure 1. A: General structural map of Turkey, redrawn and modified after Okay & Tüysüz (1999) and Şengör (1984). The Anatolide-Tauride Block is presented in grey. B: Simplified tectonic map of the Hadım area (black square in Fig. 1A), redrawn after Turan (2000) showing the tectonostratigraphic units (nappes). The formations are detailled only for the Hocalar Nappe.

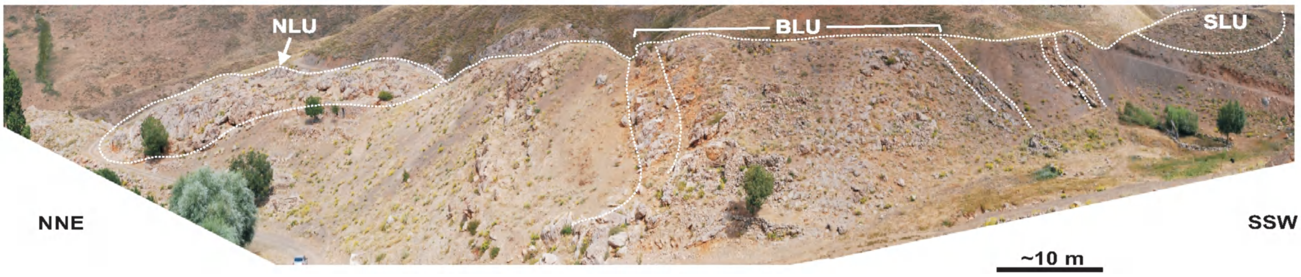

Figure 2. General view of the section with the three limestone units and the siltstone units. Abbreviations: NLU: northern limestone unit olistolith (part), BLU: biohermal limestone unit olistolith, SLU: southern limestone unit olistolith.

calcareous sponges, abundant massive stenoporids (*Tabulipora* sp.), massive encrusting fistuliporids (*Fistulipora* sp.), ramose rhabdomesid, reticulate fenestrate fenestellids bryozoans, tabulate corals (micheliniids, syringoporids, cladochonids, auloporids) and rugose corals. Most of the corals described here were collected in this facies. The bioherm is toped and flanked by a 5 m-thick coarse bioclastic limestone unit (KY.4). It is overlain by a 25-30 m-thick package of dark shale containing bioclasts (crinoids, corals and brachiopods), which is progressively silty and sandy up-section (KY.5-6). The southern limestone unit olistolith (SLU, Fig. 2 & 3) is a 20-25 m-thick, limestone block, mainly of bioclastic limestone with rare solitary rugose corals (KY.7), overlain by siltstone and sandstone beds (KY.8-9).

The facies analysis and discussions of the sedimentary

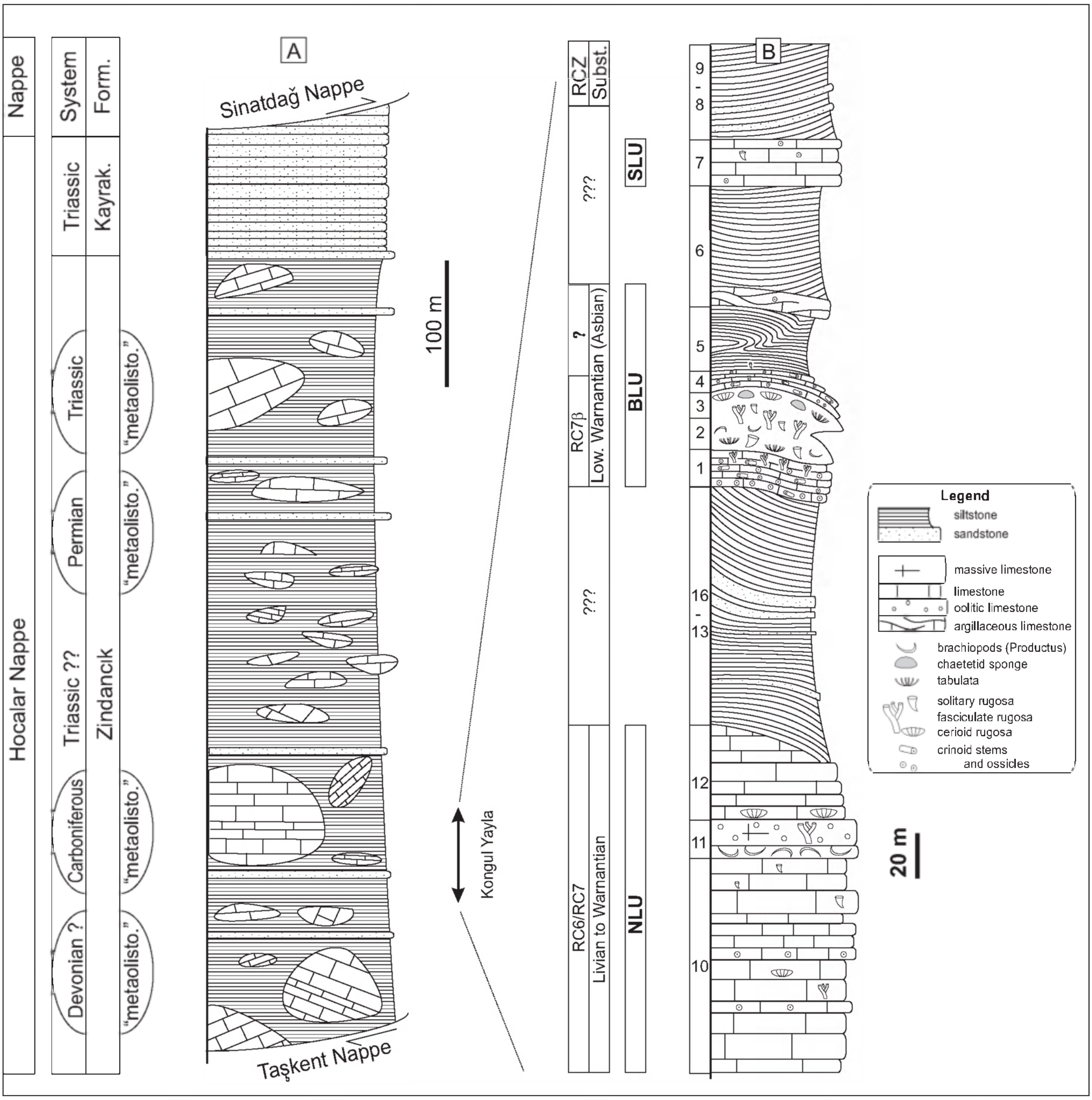

Figure 3. A: Lithostratigraphy of the Zindancık Formation with Carboniferous olistholites in siltstone-sandstone matrix, after Turan (2000). B: Schematic log of the Kongul Yayla section. SLU: southern limestone unit olistolith, BLU: biohermal limestone unit olistolith, NLU: northern limestone unitv. KY1 to KY16 corresponds to lithological units, KY1 to KY4 being the lithofacies of the bioherm. Legend: Kayrak.: Kayraklıtepe Formation; "metaolisto.": "metaolistostomu"(= olistoliths) of Turan (2000); RCZ: Rugose coral zones after Poty et al. (2006); Subst.: Viséan sub-stages (Belgium-British Isles).

and tectonic context are described and discussed in Denayer & Aretz (2011).

2. Systematic Palaeontology

The Mississippian corals of Turkey are very poorly known, especially in the Taurides where only few data are available. The main contribution is Ünsalaner-Kiraglı (1958) describing and figuring some corals, among which *Axophyllum vaughani*, *Clisiophyllum keyserlingi*, *Hexaphyllia* sp. and *Palaeosmilia* sp. coming from the Salahattin-Hadım area. The other taxa described in this paper come from the Eastern Taurides and North-Western Turkey (Zonguldak and Bartın area). The other contributions are very sparse: Frech (1895) described some small solitary undissepimented corals from the Eastern Taurides and Kato described a Viséan caninomorphic coral from the Eastern Taurides.

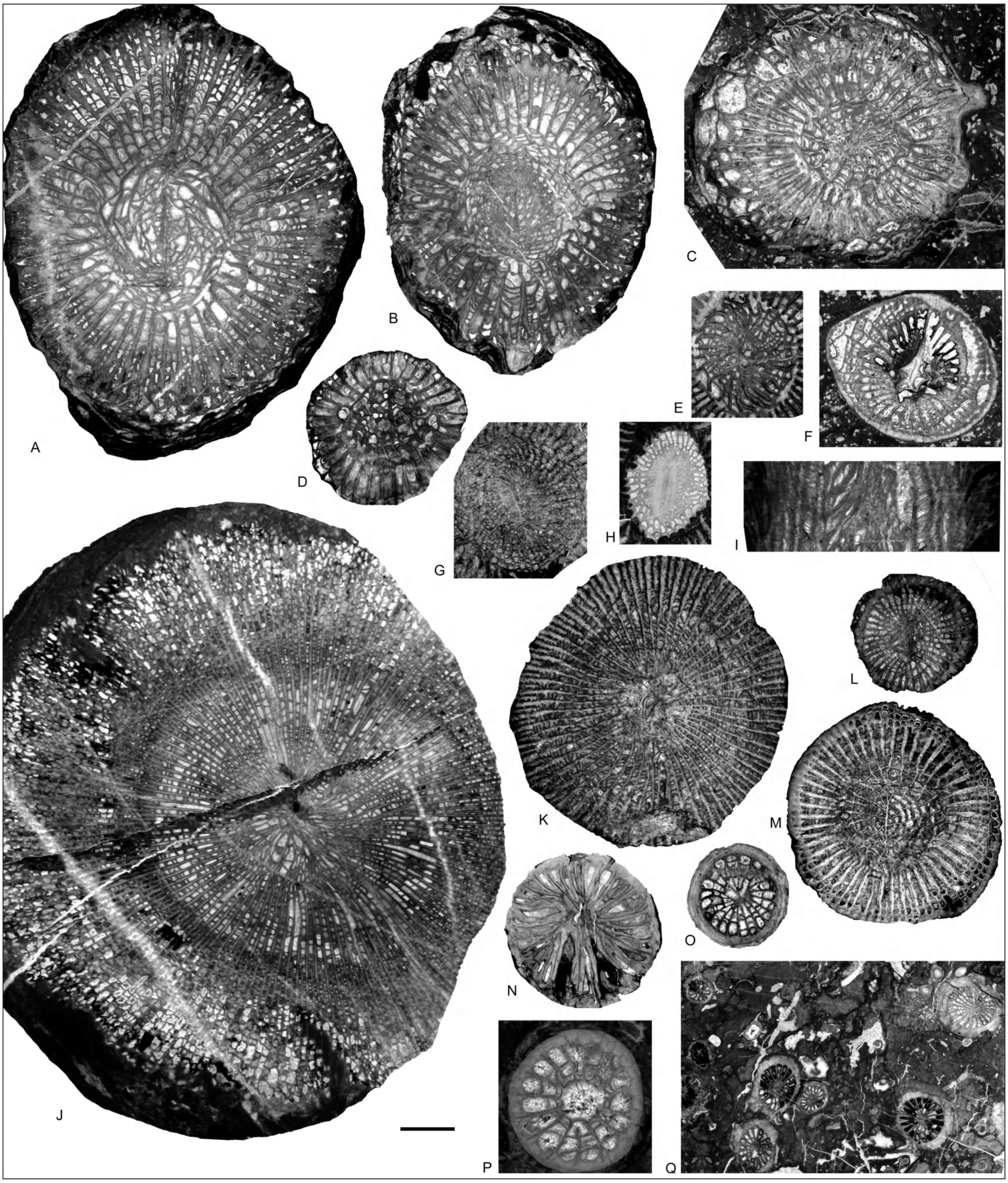

Figure 4. Solitary rugose corals from Kongul Yayla. a-i: *Axophyllum* aff. *pseudokirsopianum*. A-B, D: Successive transverse sections (specimen KY.2.3, x2); C: Mature stage (specimen KY.11.1, transverse section, x2); E: Spiral axial structure (specimen KY.2.10.b, transverse section, x2); F: Juvenile stage (specimen KY.10.2.e, transverse section, x2); G: Dense spiral axial structure (specimen TR.2.2.a, transverse section, x2); H: Dense amygdalophylloid-like axial structure (specimen KY.2.7.b, transverse section, x2); I: (specimen KY.2.3, longitudinal section, x2); J: *Palaeosmilia multiseptata* (specimen KY.2.2.d, transverse section, x2); K: *Palaeosmilia murchisoni* (specimen TR.1.1.I, transverse section, x2); L: *Amygdalophyllum* sp. (specimen TR.3.3, transverse section, x2); M: *Clisiophyllum* aff. *keyserlingi* (specimen KY.8.3, transverse section, x2); N: *Soshkineophyllum* ? sp. (specimen KY.5.1, transverse section, x2); O: *Rotiphyllum densum* (specimen KY.3.12, transverse section, x4); P: *Amplexocarinia* cf. *cravenensis* (specimen KY.8.2, transverse section, x4); Q: Microbial boundstone with gregarious *Rotiphyllum densum* (thin section KY.3.9, x2); Scale bar: 5 mm for all, except P and Q: 2.5 mm, cardinal fossula toward the bottom of the pictures.

The material presented here was collected during summer 2009 in the Taurus Mountains in order to give a preliminary description of the Mississippian coral fauna of Turkey. Many species are represented only by few specimen and the preservation is often very bad (tectonized and fractured rocks). The material is housed in the collections of the Service de Paléontologie animale et humaine of the Université de Liège (Belgium) and are labelled "Taurus 2009 - Kongul Yayla - KY.1.1" to "KY.13.2" and "Taurus 2009 -Tokluca -TR.1.1" to "TR.3.3". The classification follows Hill (1981).

Subclass Rugosa Milne-Edwards & Haime, 1850
Order Stauriida Verrill, 1865
Family Axophyllidae Milne-Edwards & Haime, 1851

Genus *Axophyllum* Milne-Edwards & Haime, 1850

***Axophyllum* aff. *pseudokirsopianum* Semenoff-Tian-Chansky, 1974**
(Fig. 4 A-I)

*Material.*13 specimens (KY.1.5, KY.2.1, KY.2.3, KY.2.7, KY.2.10, KY.3.11, KY.7.3, KY.10.1, KY.10.2, KY.11.1, KY.11.2, TR.2.2, TR.3.2).

Description. Medium to large solitary coral, conical or turbinate with common rhizoid process. The section of the calice is often elliptical. The mean diameter is 24 mm but usually up to 40 mm, the tabularium diameter varying between 10 and 22 mm. There are 39 major septa in average (max. 54). The major septa are long and thick, their axial ends are sharp or rounded. The minor septa are short to long (up to half the length of the major) and slightly thinner than the major. They enter the tabularium but never more than 1 mm. Major and minor septa are thickened, their maximum thickness is situated in the inner part of the dissepimentarium. The thickening is irregular and gives often a ragged aspect to the septa. Some specimens show a fibrous deposit continuous through the whole interseptal space. The dissepimentarium is made of 3-10 rows of interseptal dissepiments (simple concentric, V-shaped, herringbone, arched and irregular) and 2-5 rows of first and second order transeptal dissepiments. One or two rows (usually the innermost, Fig. 4a) are strongly thickened, continuous with the thickening of the septa. The outermost are long but narrow, except in juvenile stages where the dissepiments are irregular in shape and width. Some specimens show inconstant naotic dissepiments. The axial structure is complex (see below and discussion), always connected to the counter septum and often to the axial ends of other major septa. The axial structure varies in width (2/5 to 1/3 of the diameter of the coral) in shape and in thickening. The number and length of radial lamellae also varies, even in the ontogeny of the specimen. Many axial tabellae are involved in the axial structure, several being thickened. The tabulae are incomplete, axially depressed. There are in average 20 tabulae in 1 cm. The axial tabellae are strongly upturned toward the axis and form with the radial lamellae a strong axial column. In longitudinal section, the dissepiments are large and dip with an angle varying between 40 and 80°.

Discussion. These corals have all the generic features of the genus *Axophyllum* but resembles in some aspects *Gangamophyllum*. They have a very high morphological variability involving all the skeletal elements. For example, the shape of the axial structure, irregular in the juvenile stage, can change to a spiral with a distinct axial lamellae or a symmetrical clisiophyllid axial structure (Fig. 4A-B) or a very thick amygdallophyllid axial structure (Fig. 4G-H) or even to a irregular whorled gangamophyllid axial structure (Fig. 4C-E). The local disappearance of the axial plate is not sufficient to attribute our specimen to *Gangamophyllum* (as wrongly considered by Denayer & Aretz, 2011). Our corals cover the intraspecific variability of *A. pseudokirsopianum*, *A. kirsopianum* and *Axophyllum* sp. A (Semenoff-Tian-Chansky, 1974), but also the interspecific variability between them. The three species considered as distinct by previous authors seem to be the extreme poles of a highly variable group of taxa.

Distribution. A. pseudokirsopianum and close species are common in the upper Viséan, particularly in the reefal facies. It is known in Belgium (Poty, 1981), S Spain (Herbig & Mamet, 1985; Herbig, 1986; Gómez-Herguedas & Rodríguez, 2005) and N Africa (Said et al., 2007; Aretz, 2010a). In the Taurides, *A.* aff. *pseudokirsopianum* is known in the Kongul Yayla outcrop (both in the bioherm unit and the southern limestone unit olistolith). Ünsalaner-Kiraglı (1958) reported *A. vaughani* form the Taurides but the figured specimen is close to a juvenile stage of *A.* aff. *pseudokirsopianum*.

Family Palaeosmiliidae Hill, 1940

Genus *Palaeosmilia* Milne-Edwards & Haime, 1848

***Palaeosmilia murchisoni* Milne-Edwards et Haime, 1848**
(Fig. 4K)

See Semenoff-Tian-Chansky (1974), Poty (1981) and Aretz (2010a) for complete synonymy

Diagnosis. Small turbinate to cylindrical *Palaeosmilia* reaching 10 cm in diameter with usually 60-65 major septa (exceptionally up to 90). Many major septa reaching the axis. Narrow cardinal fossula widened toward the axis. Minor septa reaching 2/3 of the radius of the corallite but usually shorter. Incomplete tabulae forming an axial dome depressed in periphery.

Material. One unique badly preserved specimen (TR.1.1).

Description. Solitary corallite, 27 mm large with a tabularium diameter of 21 mm and 60 major septa. The major septa are long but do not reach the axis, creating a zone free of septa in the center, 5 mm wide. The cardinal major septum is shorter, withdrawn in a large fossula. The minor septa are long and enter slightly the tabularium. Minor and major septa are thick in the dissepimentarium, undulating and carinated. The fossula is narrow, open toward the free axial zone. The dissepimentarium shows 5-7 incomplete rows of small concentric dissepiments. Neither the outer part of the dissepimentarium, nor the wall is preserved.

Discussion. This specimen is clearly *Palaeosmilia*. Its dimensions and number of septa corresponds to *P. murchisoni* or to *P. ressoti*. It shares with the latter a large axial zone free of septa. Semenoff-Tian-Chansky (1974) distinguished *P. ressoti* on the base of this zone and on the narrow dissepimentarium. Because our specimen lacks a complete dissepimentarium, it is impossible to estimate its width. Moreover *P. murchisoni* shows occasionally this type of free axial zone (see Poty, 1981). For these reasons we consider our specimen as a small (juvenile?) form of *P. murchisoni*.

Distribution. P. murchisoni is a worldwide common species in the Viséan, particularly in the upper Viséan. In the Taurides, it is known the Kongul Yayla outcrop and reported from the same area by Ünsalaner-Kiraglı (1958).

***Palaeosmilia multiseptata* Semenoff-Tian-Chansky, 1974**
(Fig. 4J)

See Semenoff-Tian-Chansky (1974) for synonymy.

Diagnosis. Large *Palaeosmilia* (up to 50 mm in diameter) with many septa (more than 100 major septa). Minor septa half as long as the major and thinner. Both type of septa thickened, particularly in the inner edge of the dissepimentarium. Fossula large and almost reaching the axis. Axial zone occupied by the axial ends of the septa and upturned tabulae, producing a loose axial structure.

Material. 2 specimens (KY.2.2, KY.1.4).

Description. Large solitary corallite, 72 mm in diameter with a mean tabularium diameter of 30 mm and 110 major septa. The major septa are long and thickened in their median part. Their axial ends grouped into bundles of 5-7 before fusing in the center, creating a weak axial structure in which upturned axial tabulae take part. The cardinal major septum is shorter, withdrawn in a long and narrow fossula. The minor septa are long and enter slightly the tabularium. The outer parts of the septa are carinated and zig-zag-like. The dissepimentarium is composed of 10-15 rows of small simple concentric dissepiments and 10-15 rows of irregular arched and second order transeptal dissepiments. Some naotic dissepiments are also presents.

Discussion. The large dimensions and high number of septa (and thus the low ratio of number of septa/diameter), as well as the weak axial structure created by the axial ends of the septa are characteristic of *P. multiseptata* as defined by Semenoff-Tian-Chansky (1974). It is close to the largest *P. murchisoni* in which a weak axial structure can also appear but the high number of septa is a distinguishing feature.

Distribution. *P. multiseptata* is common in the upper Viséan and lower Namurian of the Béchar Basin (Semenoff-Tian-Chansky, 1974). In the Kongul Yayla, *P. multiseptata* was collected in the reefal facies of the bioherm. Moreover, *P. multiseptata* seems to be characterized, and perhaps restricted to reefal facies (I. Somerville, personal communication, 2012).

Family Aulophyllidae Dybowski, 1873

Genus *Clisiophyllum* Dana, 1846

***Clisiophyllum* aff. *keyserlingi* McCoy, 1849**
(Fig. 4M)

Material. One specimen (KY.8.3) and one fragment (KY.3.6).

Description. Solitary corallite, 22 mm large with a tabularium diameter of 17 mm. There are 45 major septa. Major septa short (no more than 1/4 of the diameter), straight and thickened. Maximum thickness (0.5 mm) reached near the inner edge of the dissepimentarium. Cardinal major septa shorter and counter one longer. Minor septa short (half length of major), thin and undulating. Axial structure typically clisiophyllid-like, with a long axial plate connected to the counter septum and bearing thin undulating radial lamellae connected to the axial ends of the major septa. Upturned axial tabulae taking part to the axial structure. Width of the axial structure reaching 10 mm in diameter. Dissepimentarium composed of 1-3 incomplete rows of small concentric dissepiments, the inner row being slightly thickened. Wall thick (up to 1.5 mm). Tabulae incomplete, laterally depressed in periphery and upturned toward the axis in the central part of the tabularium. There are 10-12 tabulae in 1 cm. Dissepiments small and almost vertical.

Discussion. This specimen belongs to the *C. keyserlingi* group of species although it is quite smaller. Moreover it seems to present some other juvenile characters as the narrowness of the dissepimentarium and the simplicity of the axial structure. In that points, it resembles in some aspect to *C. garwoodi*.

Distribution. *Clisiophyllum keyserlingi* (and related species) is common in the upper Viséan in Belgium (Denayer et al., 2011) S Spain (Rodríguez et al., 2005; Rodríguez and Somerville, 2007), N Africa (Semenoff-Tian-Chansky, 1974; Aretz & Herbig, 2010), Poland (Fedorowski, 1971), S China (Wu, 1964) and NW Turkey (Denayer, 2011). Ünsalaner-Kiraglı (1958) reported *C. keyserlingi* from a locality near Kayseri in the Eastern Taurides. In Kongul Yayla, it was collected in the SLU and BLU limestone unit olistoliths of the Kongul Yayla outcrop.

Genus *Amygdalophyllum* Dun & Benson, 1920

***Amygdalophyllum* sp.**
(Fig. 4L)

Material. One eroded specimen from an isolated block of non reefal facies (TR.3.3).

Description. The specimen is eroded and a large part of the dissepimentarium is missing. The corallite diameter is 12 mm, the diameter of the tabularium is 10 mm and 40 major septa have been counted. The cardinal and counter septa are connected to the axial structure. The other major septa extend almost to the axis but are intercepted by upturned tabulae. The minor septa do not reach the tabularium and thus, very few are preserved. The axial structure is composed of a axial plate, highly thickened, from which extend densely packed radial lamellae toward the axial ends of the septa. Thickened upturned tabulae are also included in the axial structure. Only three rows of simple dissepiments are preserved, the inner one is highly thickened (up to 1 mm).

Discussion. This specimen is very badly preserved and its outer margin is completely eroded at least to the inner part of the dissepimentarium. After the width of the tabularium, the number of septa and the shape of the axial structure, our specimen could be compared to *A.* aff. *nexile* figured by Rodríguez et al. (2001) or to juvenile stage of *A. etheridgei*. It is also very similar to *A.* sp. of Aretz & Herbig (2010) and *A. pachyphylloides* of Semenoff-Tian-Chansky (1974).

Distribution. *Amygdalophyllum* is represented by several species in the upper Viséan in Belgium (Denayer et al., 2011), S Spain (Rodríguez et al., 2005), N Africa (Aretz & Herbig, 2010; Semenoff-Tian-Chansky, 1974), Australia (Pickett, 1966) and Japan (Kato, 1990). In the Taurides, it is only known from a fallen block found in the Kongul Yayla outcrop.

Genus *Espielia* Rodríguez & Hernando, 2005

***Espielia tauridensis* sp. nov.**
(Fig. 5A-E)

Derivation of name. The new specific name refers to the Taurides where the material was found.

Holotype. Colony KY.3.10 (4 thin sections, 1 peel and 1 polish slab).

Paratype. Colony KY.3.7 (7 thin sections).

Type locality and horizon. Kongul Yayla bioherm, near the Kongul Yayla sheep barn, 7 km south of Hadım town, south of Konya, South Turkey. *E. tauridensis* was collected in the microbial facies of the bioherm (upper part, levels KY2-KY3), together with *Palaeosmilia multiseptata* and *Axophyllum* aff. *pseudokirsopianum*. Zindancık Formation, Bolkar Dağı tectonostratigraphic unit, Rugose coral biozone RC7β of Poty et al. (2006), Asbian (lower Warnantian, upper Viséan, Mississipian).

Diagnosis. Small *Espielia* with a mean diameter of 3.9 mm (max. 4.5 mm) and 18 major septa in average (16 to 20).

Description. The large colonies (up to 1 m in diameter, Fig. 5A) are phacelloid with long cylindrical corallites growing parallel to each other. The increase is lateral and non-parricidal. The corallites have a mean diameter of 3.8 mm (3.1 mm for the tabularium) for an average of 18 major septa (max. 20, see Fig. 6). The major septa are long and reach the axis where they are connected to the columella. The minor septa are short (1/2 length of the major) and restricted to the dissepimentarium. Major and minor septa are undulating and thickened in the dissepimentarium, their thickness is maximum near the outer wall. The columella is extremely thickened and sub-circular (0.3-1 mm in diameter) in transverse section. It is always connected to the counter septum and usually to the cardinal one. The other septa join the columella or are connected to it by radial lamellae. There is one (rarely a second) row of simple concentric dissepiments always thickened (0.2 mm), except in juvenile corallites. The wall is thick (0.2-0.4 mm) and straight. The tabulae are incomplete and arranged in two rows: bell-shaped tabulae occupying the axial half part of the tabularium, and depressed horizontal tabulae forming a peripheral gutter. There are 20-24 tabulae in 1 cm. The dissepiments are small (0.5 mm in height and length) and steeply declined (75°-

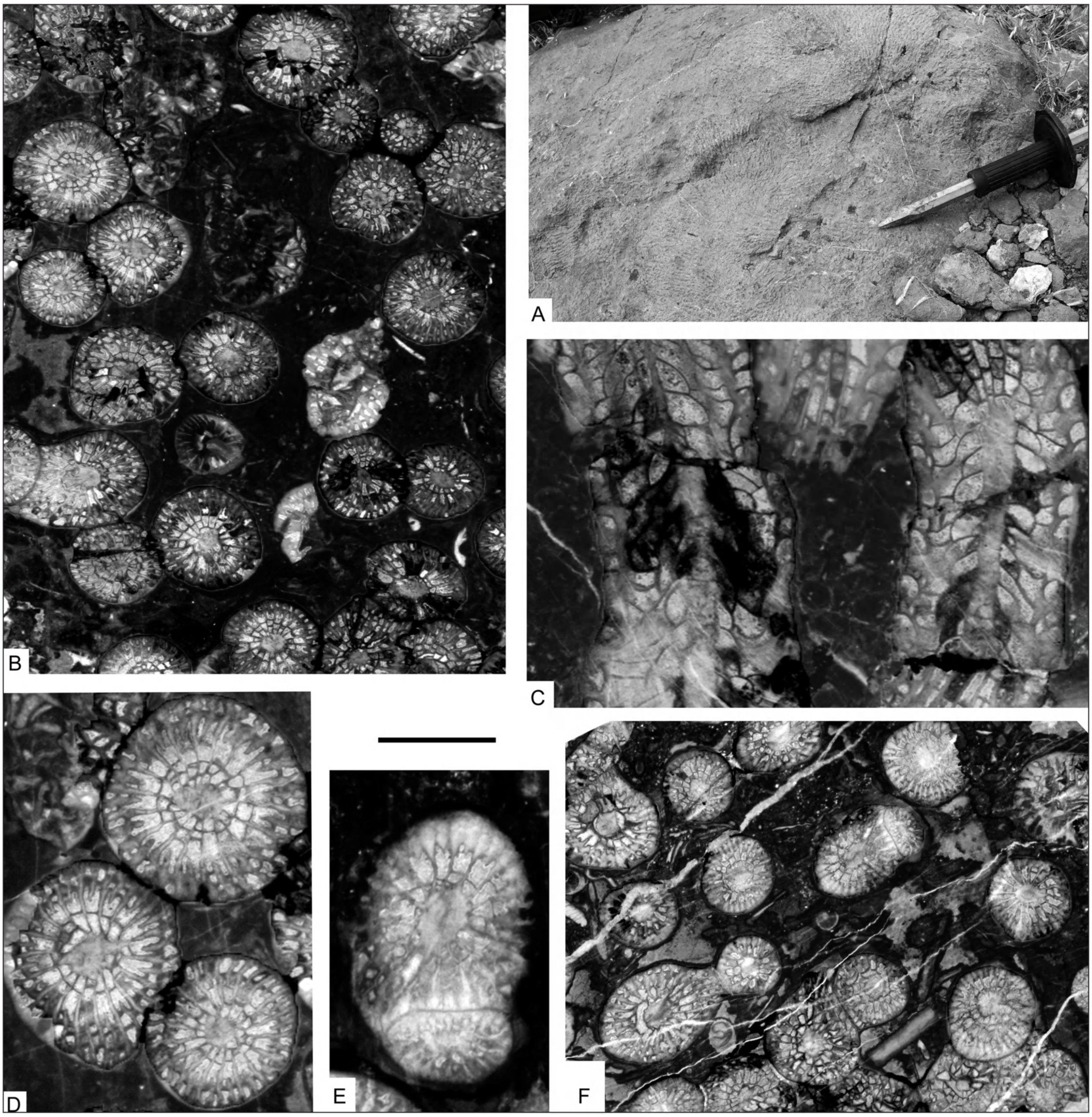

Figure 5. *Espielia tauridensis* sp. nov. from Kongul Yayla. A: Holotype (specimen KY.3.10.a, transverse section, x3); B: Large colonies of *Espielia tauridensis* sp. nov. (view from the field, the chisel is 30 cm long); C: Holotype (specimen KY.3.10, longitudinal section, x3); D: Closer view of the corallites (holotype, specimen KY.3.10.a, transverse section, x6); E: Offset in the holotype (specimen KY.3.10.c, transverse section, x6); E: Paratype (specimen KY.3.7, transverse section, x3). Scale bar: 5 mm for all, except D and E: 2.5 mm.

80°) toward the tabularium. There are 22-24 dissepiments in 1 cm. The variability of the species is not wide and affects mainly the thickening of the septa and dissepiments, and the width of the axial structure. Some corallites are diphymorphic and may develop very rare transeptal dissepiments.

Comparison. These corals belongs to the genus *Espielia* and share its generic features: the circular thick columella, the double rows of tabulae, the thickened septa and the lateral increase. The type-species of the genus, *E. columellata* from the upper Viséan of S. Spain, shows 23-25 major septa for a mean diameter of 6.5 mm (Rodríguez & Hernando, 2005). *Espielia columellata* with similar dimensions is also known from the Asbian of the Béchar Basin, N Africa (Aretz, 2011) and from the Montagne Noire, S France (Aretz, 2002). The Turkish specimen is two times smaller than this species and have less septa. Consequently, the *Espielia* of Kongul Yayla is considered as a new distinct species.

Family Lithostrotionidae d'Orbigny, 1852

Genus *Lithostrotion* Fleming, 1828

***Lithostrotion araneum* (McCoy 1844)**
(Fig. 7D)

See Poty (1981) and Aretz (2010) for synonymy.

Diagnosis. Large *Lithostrotion*, maximum 5.3 mm in tabularium diameter and having 26 to 31 major septa. Minor septa short. Dissepimentarium large, made of numerous rows of simple interseptal, V-shaped, herringbone dissepiments and occasional transeptal dissepiments.

Material. Fragments of two colonies, 60 cm in diameter (KY.13.1 and KY.13.2).

Description. The specimens have a mean tabularium diameter of 6.25 mm for 22 major septa in average (max. 23). The major septa are long, some are connected to the columella, the other show

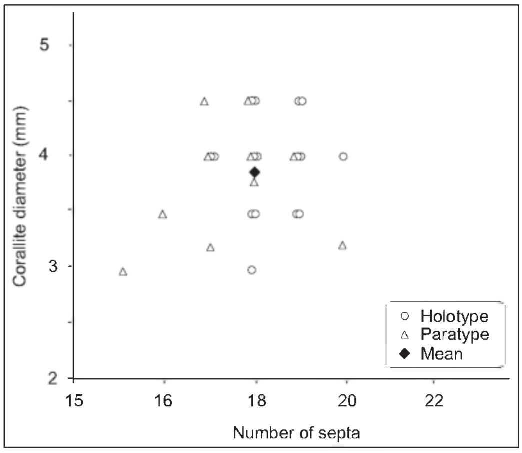

Figure 6. Statistical data for *Espielia tauridensis* sp. nov. Plot of number of septa versus external diameter (analyses on 64 corallites).

usually a slightly curved axial end. They are undulating in the dissepimentarium. The minor septa are short (1/3-1/2 length of the major), thin and undulating. They rarely enter the tabularium. The columella is a simple plate variably thickened (0.5 mm large, 2 mm long). There 4-8 rows of simple, concentric, V-shaped and herringbone dissepiments. The wall is thin (0.2-0.4 mm) and straight.

Discussion. The Turkish specimens are larger than typical Western European *L. araneum* (6.25 mm versus 5.3 mm) but show less major septa (max. 23 versus 28), but these differences are considered to be part of the normal variability.

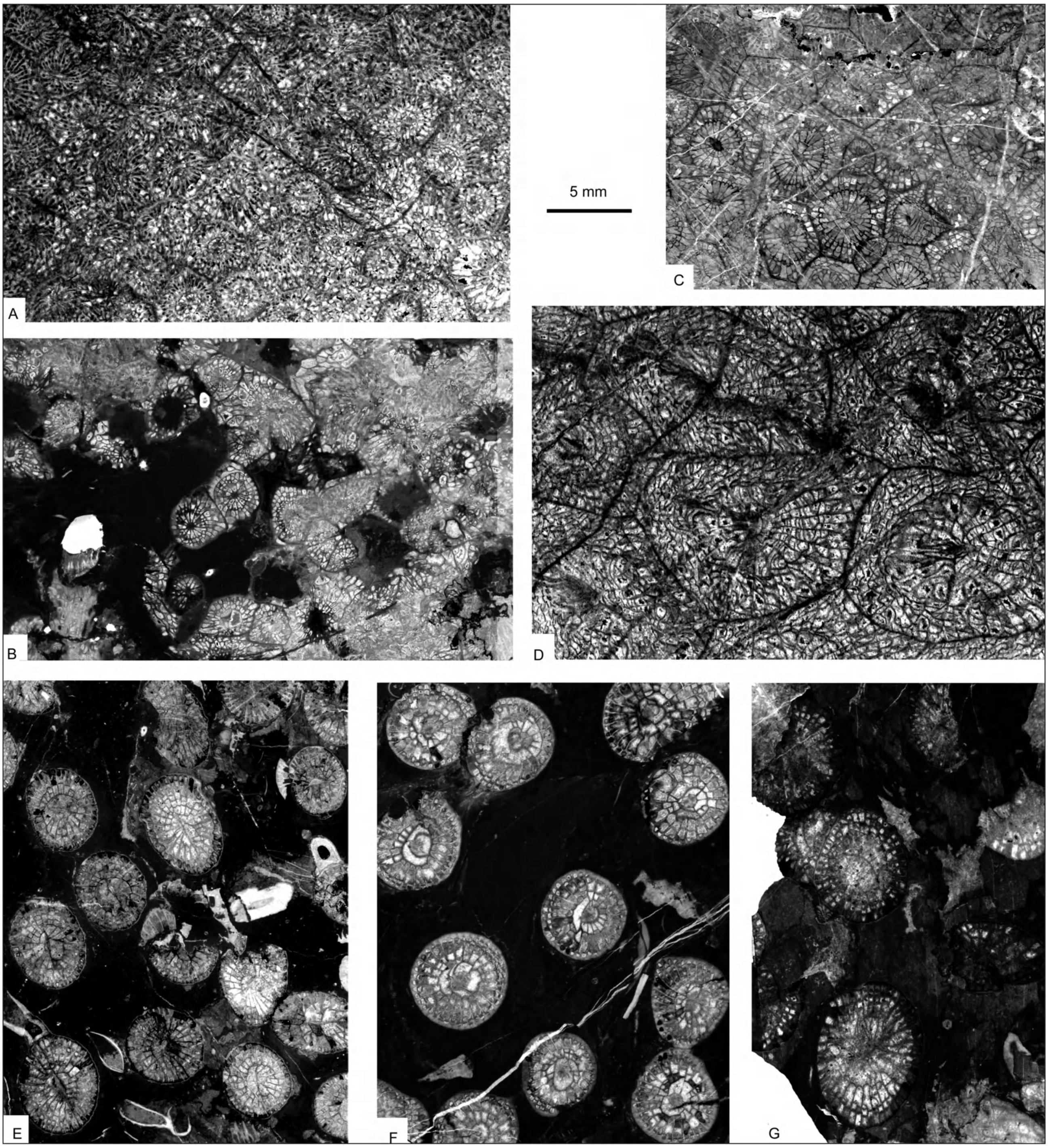

Figure 7. Colonial rugose corals form Kongul Yayla. A: *Lithostrotion maccoyanum* (specimen KY.3.5.a, transverse section, x3); B: *Lithostrotion maccoyanum* showing sub-fasciculate trends and transeptal dissepiments due to sediment fouling on the top of the colony (specimen KY.3.3.b, transverse section, x3); C: *Lithostrotion decipiens* (specimen KYB.2, transverse section, x3); D: *Lithostrotion araneum* (specimen KY.13.2.a, transverse section, x2); E: *Siphonodendron pauciradiale* (specimen KY.1.1, transverse section, x3); F: *Siphonodendron* cf. *intermedium* (specimen KY.2.4.b, transverse section, x3); G: S*iphonodendron irregulare* (specimen KY.1.3.a, transverse section, x3).

Distribution. *L. araneum* is known in the Livian of Belgium, N France, British Isles (Poty, 1981) and in NW Turkey (Denayer, 2011), in the Asbian of S Spain (Gómez-Herguedas & Rodríguez, 2005) and N Africa (Said et al., 2007; Aretz, 2010a). In Kongul Yayla, it is known only form one level (KY.11) topping the oolithic limestone of the NLU.

Lithostrotion decipiens **(McCoy 1849)**
(Fig. 7C)

See Poty (1981) and Aretz (2011) for synonymy.

Diagnosis. Medium-sized *Lithostrotion* maximum 3 mm in tabularium diameter and having maximum 18 major septa.

Material. One colony from an isolated block (KY.B.2).

Description. This single specimen has a mean tabularium diameter of 3.5 mm for 16 major septa in average (max. 19). The major septa are straight, long, usually connected to the columella, but are withdrawn where the columella is absent. The minor septa are long enough to enter the tabularium. The columella is a simple plate variably thickened (0.5 mm large, 1.2 mm long). It is always connected to cardinal and counter septa and often to other septa. There are 2-4 rows of simple dissepiments, the inner usually thickened. Some diphymorphic corallites show unusual irregular transeptal dissepiments. The wall is thin (0.1-0.3 mm) and straight.

Discussion. The Turkish specimens are very similar to typical Western European *L. decipiens* but are slightly larger (3.5 mm in average, *versus* 2.5 mm in Belgian specimens). This difference is not incompatible with intraspecific variability.

Distribution. *L. decipiens* is known in the Asbian of Belgium, N France and British Isles (Poty, 1981; Somerville & Rodríguez, 2007). In Kongul Yayla, it is known in the NLU.

Lithostrotion maccoyanum **Milne-Edwards & Haime, 1851**
(Fig. 7A-B)

See Poty (1981) and Aretz (2010a) for synonymy.

Diagnosis. Small *Lithostrotion* maximum 2 mm in tabularium diameter and having maximum 14 major septa.

Material. Parts of three large colonies, 60 cm in height and more than 1 m in diameter (KY.3.3, KY.3.5 and KY.3.8).

Description. The Turkish specimens have a mean tabularium diameter of 2 mm for 13 major septa in average. The major septa are long, usually connected to the columella, and thickened in the dissepimentarium. The minor septa are short (half length of the major) or longer and enter the tabularium. They are undulating in some corallites. The columella is thick, elliptical (0.3 mm large, 0.5 mm long) and bears small spines. There are 1-3 rows of simple dissepiments, the inner being usually thickened. Some corallites of the border of the colony show several irregular transeptal dissepiments and sub-fasciculate trend. The wall is variable in thickness, 0.15 mm in average but is sometimes thicker and sometimes partly absent. The tabulae are complete and bell-shaped with a peripheral gutter. Rare axial tabellae occur. There are 20-24 tabulae in 1 cm. In longitudinal section, the dissepiments are declined toward the tabularium and their height varies between 0.2 to 0.5 mm. There are up to 30 dissepiments in 1 cm.

Discussion. The Turkish specimens fit with the definition of *L. maccoyanum* as known in Europe. The upper surface of the colony is usually fouled with fine argillaceous material and the corals seem to have fought against this detrial influx (ragged borders, rejuvenescence features, Fig. 7B), some corallites getting a fasciculate trend and a circular section.

Distribution. *L. maccoyanum* is known in the upper Asbian of Belgium and N France (Poty, 1981), British Isles (Rodríguez & Somerville, 2007), S Spain (Gómez-Herguedas & Rodríguez, 2005), S France (Aretz, 2002) and in equivalent strata in N Africa (Said et al., 2007; Aretz, 2010a). In Kongul Yayla, it was collected from the crest facies of the microbial bioherm, upper Asbian in age.

Genus *Siphonodendron* McCoy, 1849

Siphonodendron **cf.** ***intermedium*** **Poty, 1981**
(Fig. 7F)

Material. 3 fragments of colonies (KY.2.4, KY.B.1 and KY.2.6).

Description. Phacelloid colonies showing small corallites with a mean diameter of 5.8 mm and having 21-23 major septa (max. 26). Major septa long, reaching the axis and connected to the columella. Minor septa short. Columella made of a short axial plate, strongly thickened, elliptical to circular in transverse section. 1-4 (usually 2) rows of small concentric dissepiments. Wall straight and thick (0.8-1 mm). Tabulae complete, bell-shaped or tent-shaped, upturned toward the axis. There are 12-14 tabulae in 1 cm. Dissepiments small (0.8-1.2 mm long, 0.5 mm high) and almost vertically disposed.

Discussion. The specimens are very similar to *S. intermedium* but are smaller and the dissepimentarium is narrower. The strongly thickened columella reminds *Espielia* (particularly *E. columellata* of similar dimensions) but the tabulae are clearly those of *Siphonodendron*.

Distribution. *S. intermedium* is known in the upper Viséan of Belgium, N. France and British Isles (Poty 1981), S. Spain (Rodríguez et al. 2002). The Turkish material was collected in the microbial facies of the bioherm of Kongul Yayla and is upper Asbian in age.

Siphonodendron irregulare **(Phillips, 1836)**
(Fig. 7G)

See Poty (1981) and Aretz (2010) for synonymy.

Diagnosis. Dendroid to phaceloid colonies. Corallites mean diameter 4.5 mm for 21-23 major septa (max. 26). Usually 1 row of dissepiments, but commonly up to 4.

Material. 2 fragments of colonies (KY.1.3 and KY.B.3).

Description. Phacelloid colonies of cylindrical corallites, 5 mm in mean diameter (max. 6 mm) for 20-22 major septa. Major septa long but rarely reaching the axis and connected to the columella. Minor septa long, entering the tabularium on 0.5-0.8 mm. Columella made of a simple axial plate, usually thin, connected to the counter septum, rarely to other. There are 0-1 rows of simple concentric dissepiments, some corallites show another incomplete row.

Discussion. These corals fit with the definition of *S. irregulare*. They are similar but larger than *S. pauciradiale* and have less septa than *S. intermedium*. Unfortunately, their bad preservation does not allow further discussion.

Distribution. *S. irregulare* is known in the upper Livian and Warnantian of Belgium and N France (Poty, 1981), British Isles (Somerville & Rodríguez, 2007), NW Turkey (Denayer, 2011), S Spain (Herbig & Mamet, 1985; Herbig, 1986; Gómez-Herguedas & Rodríguez, 2005) and in equivalent strata in N Africa (Said et al., 2007; Aretz, 2010a). In Kongul Yayla, it was collected in the bioherm, upper Asbian in age.

Siphondendron pauciradiale **(McCoy, 1844)**
(Fig. 7E)

See Poty (1981) and Aretz (2010a) for synonymy.

Diagnosis. Dendroid to phaceloid colonies. Corallites mean diameter 4 mm for 18-20 major septa (max. 22). 1-2 rows of dissepiments, rarely up to 4.

Material. 3 fragments of colonies (KY.1.1, KY.B.1 and KY.B.4).

Description. Phacelloid colonies with small corallites, 4-4.5 mm in diameter and having 18-20 major septa (max. 23). Major septa long, usually reaching the axis but some corallites have withdrawn major septa. Minor septa short, never overcrossing the inner edge of the dissepimentarium. Major counter septa longer, connected to the columella. Columella made of a long axial plate, often undulating, more or less thickened and connected to some of the major septa (usually the peri-counter septa). 1-2 rows of small concentric dissepiments, thickened or not. Wall straight and thick (0.5-1 mm). Tabulae incomplete, dome-shaped, downturned toward the dissepimentarium, forming a peripheral gutter. There are 10-14 tabulae in 1 cm. Dissepiments small (0.7-1 mm long, 0.5 mm high) and strongly downturned toward the tabularium (75°-80°).

Discussion. The Turkish specimens fit with the definition of *S. pauciradiale* as known in Europe. They are close to *S. intermedium* and *S. irregulare* but are smaller and have less septa.

Distribution. *S. pauciradiale* is known in the Warnantian of Belgium and N France (Poty, 1981), in the Asbian of British Isles (Somerville & Rodríguez, 2007), NW Turkey (Denayer, 2011), S Spain (Herbig & Mamet, 1985; Herbig, 1986; Gómez-Herguedas & Rodríguez, 2005) and in equivalent strata in N Africa (Said et al., 2007; Aretz, 2010a). In Kongul Yayla, it was collected in the microbial facies of the bioherm and are upper Asbian in age.

Family Antiphyllidae Iljina, 1970

Genus *Rotiphyllum* Hudson, 1942

***Rotiphyllum* cf. *densum* (Carruthers, 1908)**
(Fig. 4O, 4Q)

Material. Many specimens in gregarious clusters included in microbial texture (KY.3.9, KY.3.12).

Description. Small solitary coral with a mean diameter of 4 mm having in average 17 septa (max. 22). Major septa long and reaching the axis, fusing by group of 4-5 septa before joining the axis, forming a more or less thickened axial structure. Base of the septa thickened, especially in cardinal quadrant. Minor septa not developed but sometimes present in the stereoplasma of the wall. The direction cardinal-counter is shown by the symmetry of the axial structure and sometimes by a shorter cardinal septum withdrawn in the fossula. Alar fossulae present in some specimens but often inconspicuous. Wall extremely thick (0.4 mm in juvenile corallites, up to 1.2 mm in mature).

Discussion. The Turkish specimens are close to *R. densum* by their characters but are smaller (4 mm in average, versus 8-19 mm). They share a very thick wall with *R.* aff. *costatum* figured by Rodríguez & Falces (1994) but are larger.

Distribution. *R. densum* is known in the strata around the Tournaisian-Viséan boundary in Belgium, N France and British Isles (Mitchell et al., 1986), in the Asbian in England (Hudson, 1944) and upper Viséan of S Spain (Rodríguez & Falces, 1994). In Kongul Yayla, *Rotiphyllum* cf. *densum* is present in the upper part of the bioherm, associated with lithistid sponges and microbial boundstone.

Family Laccophyllidae Grabau, 1928

Genus *Amplexocarinia* Soshkina, 1941

***Amplexocarinia* aff. *cravenensis* Smith, 1955**
(Fig. 4P)

Material. One specimen encrusted by microbial mats (KY.8.2).

Description. Small solitary coral, 6.5 mm in diameter for 15 septa. Septa short (2 mm) and thick (0.25 mm) with dilated axial ends. Base thickened, continuous with the wall. No minor septa. Cardinal (?) septum slightly shorter. Aulos incomplete, 2.5 mm in diameter, formed by the axial ends of septa and upturned tabulae. Rare small dissepiments.

Discussion. This coral belongs incontestably to *Amplexocarinia*. It is close to *A. cravenensis* by its dimension and number of septa. The presence of dissepiments also reminds *A. smithi* but the latter is smaller.

Distribution. *Amplexocarinia* comprises species ranging from the Middle Devonian to the Upper Permian. In the Mississippian, *Amplexocarinia* is often found in microbial facies of reefs as in the upper Tournaisian and upper Viséan of the British Isles (Smith, 1925; Bancroft et al., 1988; Mundy, 1994). Our specimen was collected in a blocs with microbial facies, coming from the upper part of the bioherm.

Family Polycoeliidae de Fromentel, 1861

Genus *Soshkineophyllum* Grabau, 1928

***Soshkineophyllum*? sp.**
(Fig. 4N)

Material. 4 specimens, crushed and eroded (KY.5.1, KY.5.3, KY.5.4, KY.5.5).

Description. Large solitary coral with a maximum diameter of 18 mm having in average 32 septa. Major septa unequal in length, the longer reaching the axis and fusing by groups, forming a more or less twisted axial structure. Usually four major septa are thicker and longer than the others, except in highly mature stages. Minor septa short, more developed in the counter quadrants. Minor

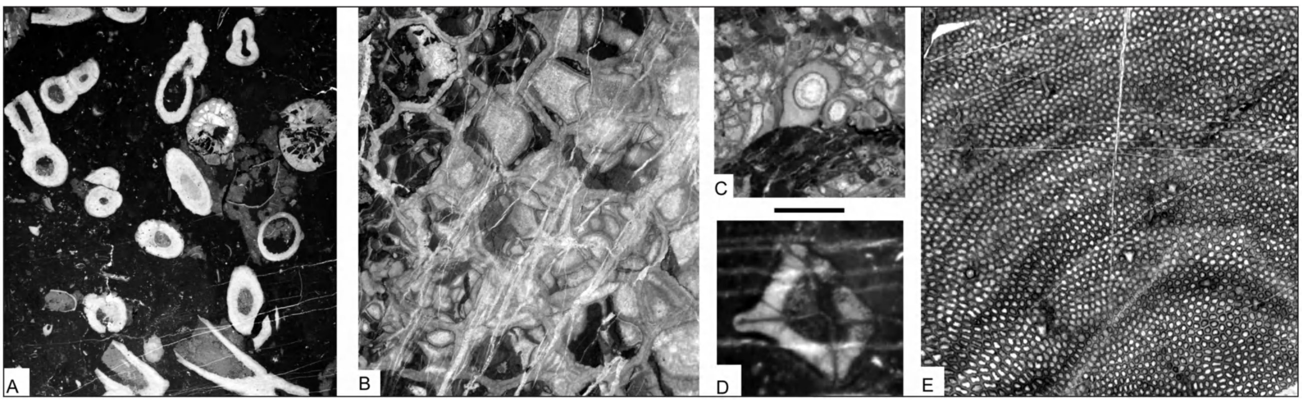

Figure 8. Tabulate corals, Heterocorals and Chaetetidae from Kongul Yayla. A: Cladochonids tabulate coral (specimen KY.1.2, transverse and tangential sections, x2); B: Micheliniid tabulate coral (specimen KY.3.2, transverse section, x2); C: Auloporid tabulate coral covered by stenoporid bryozoan (specimen KY.2.8, transverse section, x6); D: *Hexaphyllia* sp. (specimen KY.3.1, transverse section, x8); E: *Chaetetes* sp. (specimen KY.3.4, transverse section, x4). Scale bar: 5 mm for a and b, 2.5 mm for E, 1.75 mm for C, 1.25 mm for D.

and major septa extremely thick (up to 1.2 mm) and contiguous. Cardinal septum short and thick, withdrawn in a large fossula. The wall is 1.6-2 mm thick.

Discussion. The specimens are attributed to *Soshkineophyllum* with a query because they share with this genus the dominating four major septa, the other septa being of various length, and the reduced development of minor septa in cardinal quadrants. Nevertheless, *Soshkineophyllum* is not so thickened and have rhopaloid major septa. Moreover, the Turkish specimens are very close to Gen. et sp. indet. of Rodríguez & Falces (1992) by having the same septal pattern and dimensions. Aretz (2011) attributed similar taxa to "*Streptelasmina* gen. et sp. unknown". These three taxa are probably the same (same morphology, age and occurrence in similar facies) and seem to belong to a new genus.

Distribution. Gen. et sp. indet. of Rodríguez & Falces (1992) comes from the upper Viséan of S. Spain, Gen. et sp. unknown of Aretz (2011) is from equivalent strata of N. Africa. In Kongul Yayla, *Soshkineophyllum ?* sp. was collected at the base of the shaly unit capping the bioherm.

3. Discussions

3.1. Faunal association

In the bioherm of Kongul Yayla and related facies, four faunal associations of corals and other organisms can be recognized.

1) The bioclastic facies includes all the lateral facies the BLU (flanking facies KY.5, sole facies KY.1). These facies yielded many specimens of *Axophyllum,* and *Palaeosmilia*

Facies	Main components	Classifications		
		Aretz 2010a	Somerville & Rodríguez 2007	Madi et al. 1996
Bioclastic facies	*Axophyllum* aff. *pseudokirsopianum* *Palaeosmilia multiseptata* *Clisiophyllum* aff. *keyserlingi* *Amygdalophyllum* sp. *Siphonodendron* cf. *Intermedium* *Siphonodendron irregulare* *Siphonodendron pauciradiale* *Espielia tauridensis* cladochonids syringoporids	B2 & D1	RCA2 & RCA5	Zones 5 & 6
Microbial facies	*Axophyllum* aff. *pseudokirsopianum* *Rotiphyllum* cf. *densum* *Amplexocarinia* aff. *cravenensis* micheliniids auloporids heterocorals	D3	RCA6 (part)	Zone 4
Reef-crest	*Lithostrotion maccoyanum* chaetetids	D2	RCA7	
Silts.	*Soshkineophyllum* ? sp.	D2 (part)	RCA8	

Figure 9. Summarized corals associations of the Kongul Yayla bioherm and their equivalents in various classifications. The classification of Aretz (2010a) was established mainly on Western European corals. Somerville & Rodríguez (2007) based their classifications on British and Spanish associations. Madi et al. (1996) based their study on Algerian corals (Béchard Basin). See also Denayer & Aretz (2012) for comparison of facies with other reefs.

and, in a lesser abundance, colonies of *Siphonodendron* and *Espielia*. This facies is also very rich in lithistid and calcareous sponges, in bryozoans (fenestellids, fistuliporids, stenoporids, rhabdomesids), brachiopods, gastropods, crinoids, tabulate corals (cladochonids, Fig. 8A) and heterocorals (*Hexaphyllia*, Fig. 8D). The corals are rarely in living position and are mostly reworked and encrusted by other organisms. This first association correspond to B2-Patchy coral meadow (low biodiversity coral meadow) and D1-Bioherm dwellers (moderate biodiversity bioherm environment) in the classification of Aretz (2010a). After Somerville & Rodríguez (2007)'s classification, it corresponds to the Rugose Coral Association RCA2 (*Palaeosmilia-Axophyllum-Clisiophyllum* association) with a moderate biodiversity in low energy wackestone-packstone facies; and to RCA5 (*Dibunophyllum-Axophyllum-Siphonodendron* association) with a moderate biodiversity in low energy wackestone-packstone facies. This association is also typical of the Zones 5 and 6 of Madi et al. (1996), respectively corresponding to the crinoid-fenestellid assemblage and sponge-fenestellid assemblage. Said et al. (2011) described such an association in their Assemblage 2 but the latter is richer and more diversified.

2) The microbial framework of the core facies is rich in clusters of small undissepimented rugose corals (*Rotiphyllum, Amplexocarinia*), micheliniid and auloporid tabulate corals (Fig. 8B-C), associated with lithistid sponges and microbial mats. The diversity is lesser and no colonial rugose corals was observed. Similar association of solitary rugose corals standing in microbial texture were described from northern England by Mundy (1994) and in the Béchard Basin by Madi et al. (1996) in their Zone 4 (coral-microbialite assemblage). It corresponds also partly to the D3 (supporting framestone builders) category of Aretz (2010a) and partly to the microbial boundstone association (RCA6) of Somerville & Rodríguez (2007). The coral association 5 described by Said et al. (2011) form the Adarouch area (Morocco) is also very similar.

3) The reef-crest facies composed of large colonies of *Lithostrotion maccoyanum* and chaetetid sponges in upright growth position (Fig. 8E) and rare solitary rugose corals (*Axophyllum*). The biodiversity is also low but the rugose corals and chaetetid sponges form large colonies, up to 80 cm in diameter. They are commonly ragged and show rejuvenescence features, probably due to sediment fouling. It is typically the high energy facies of the capping beds association described as D2 in Aretz (2010a). Somerville & Rodríguez (2007) included such facies in their RCA7 (*Lithostrotion-Siphonodendron* association) characterized by densely packed cerioid colonies, typical of high energy environment. These associations are comparable to the Assemblage 1 of Said et al. (2011).

4) The siltstones facies (KY.5) yielded a monospecific association of solitary rugose coral (*Soshkineophyllum* ? sp.). It is comparable to the level-bottom community A1 of Aretz (2010a) with its low diversity of solitary corals embedded in marly facies. Somerville and Rodríguez (2007) included this association in their RCA8 (*Cyathaxonia-Rylstonia-Rotiphyllum*) typical of low energy environments. Said et al. (2011) described similar association (Assemblage 4) in the Adarouch Area.

The non-reefal associations include the fossiliferous facies of the NLU (oolithic grainstone, bioclastic packstone, etc.) but are not detailed further here. Theses association are dominated by solitary rugose corals (*Axophyllum, Clisiophyllum, Palaeosmilia, Amygdalophyllum*). Colonial corals are locally abundant (*Lithostrotion, Siphonodendron*). Tabulate corals are also common (cladochonids, syringoporids). The diversity is not high but the organisms are usually abundant. Figure 9 summarizes the distribution of corals associations in the bioherm and their equivalent in other classification.

3.2. Biostratigraphy

Based on the identification of a few foraminifers (*Endostafella, Eostafella, Archaediscus, Neoarchaediscus, Permodiscus, Pseudoglomospira, Millerella*), Özgül (1997) and Altıner & Özgül (2001) attributed a Viséan to Serpukhovian age to the Zindancık Formation (considered by this author as a Member of their "Kongul Formation"). Ekmekçi & Kozur (1999) indicated a Moscovian age for the entire formation based on four conodonts (juvenile *of Idiognathodus incurvus*, of *Idiognathodus* ? cf. *suberectus* and of *Neognathodus columbienis* and fragments of *Idioprionodus* sp.) from one single sampled locality. Turan (2000) identified as well some foraminifers and macrofossils and indicated a Carboniferous age for one olistolith of the Zindancık Formation. Other olistoliths are supposed to be Permian based on the occurrence of microfossils (*Stafella* sp., *Pseudovermiporella* sp., *Nagatoella* sp., *Ungdarella* sp., *Eolasiodiscus* sp., *Baisalina pulchra*). The siltstones are surprisingly supposed to be Triassic but this age is not argued by this author and remains questionably.

The identification of rugose corals allows us to indicate a more precise age. The northern limestone unit olistolith (NLU) provided few corals, among them *Axophyllum* aff. *pseudokirsopianum* and *Lithostrotion araneum*, which both have rather long stratigraphic ranges through the Livian and Warnantian. The NLU is thus not precisely dated. The occurrence of *Siphonodendron pauciradiale* at the base of the biohermal unit (BLU) and of *Lithostrotion maccoyanum* at the top, and without younger fauna, is sufficient to indicate a late Asbian age (RC7β biozone of Poty et al., 2006) of this bioherm. The bioclastic rudstone and (?) parts of the siltstones above the BLU seems to be also Viséan because it yielded *Soshkineophyllum*? sp. which is apparently analogous to yet unnamed taxa from that time slice. Further investigation of foraminifers should allow a more precise dating of each block as well as the whole Zindancık Formation.

3.3. Palaeobiogeography

Despite the preliminary and discontinuous aspect of the sampling, the Kongul Yayla bioherm yielded many taxa useful for palaeobiogegraphy. The occurrence of *Lithostrotion, Siphonodendron, Axophyllum* and *Palaeosmilia* indicates relationships with the Eurasian Fauna. The absence of *Kueichouphyllum* excludes the Bolkar Dağı unit from the "*Kueichouphyllum* zone" of Minato & Kato (1977) extending from eastern Asia up to Iran and neighbouring tectonostratigraphic units of Taurides (in the Aladağ Unit; Kato, 1979). All of the corals genera present in Kongul Yayla are known from similar environments in S Spain: Ossa Morena (Rodríguez & Falces, 1992, 1994; Gómez-Herguedas & Rodríguez, 2005; Rodríguez et al., 2001), Bétic Cordillera (Herbig, 1986), S France (Montagne Noire: Aretz, 2002) and N Africa: Azrou-Khenifra Basin of the Moroccan Meseta (Aretz & Herbig, 2010), Jerada Massif (Aretz, 2010a, 2010b), Adarouch Area (Said & Rodríguez, 2008, Said et al. 2010, 2011), Béchar Basin (Semenoff-Tian-Chansky, 1974) and Algerian Sahara (Aretz, 2011). Like all these regions, the Bolkar Dağı unit belongs to the southern branch of the Western Europe Coral Province of Sando (1990). The absence of typical taxa (e. g. *Kizilia, Dibunophyllum*) indicates that the Kongul Yayla is most similar to the southern part of this palaeogeographic zone (North Africa), but it could be local anomalies based on limited material from these areas (I. Somerville, personal communication, 2012). However, the richness in axophyllids seems to be a typical feature of the Béchar Basin (Semenoff-Tian-Chansky, 1974). Further comparison and additional material should lead to a precise understanding of the palaeobiogegraphical relationship of the Turkish corals.

4. Conclusions

The coral fauna collected in and near the microbial-sponge-bryozoan-coral bioherm of Kongul Yayla in the Taurides includes three genera (seven species) of colonial rugose corals, seven genera of solitary rugose corals, and additional tabulate corals and heterocorals. The colonial corals are dominated by *Siphonodendron* (*S. irregulare*, *S. pauciradiale* and *S.* cf. *intermedium*) and *Lithostrotion* (*L. araneum, L. decipiens* and *L. maccoyanum*). *Espielia tauridensis* sp. nov. is described here for the first time. Among the solitary corals, *Axophyllum* aff. *pseudokirsopianum* and *Palaeosmilia multiseptata* are the most common. *Clisiophyllum* cf. *keyserlingi*, *Amygdalophyllum* sp., *Palaeosmilia murchisoni*, *Amplexocarinia* aff. *cravenensis, Rotiphyllum densum* and *Soshkineophyllum* ? sp. are the other solitary corals. The tabulate corals are represented by cladochonids, syringoporids, micheliniids and auloporids. This coral assemblage and particularly the guide taxa *L. maccoyanum* and *S. pauciradiale* indicate a late Asbian (lower Warnantian) age (RC7β biozone, upper Viséan). The coral fauna is very similar to the assemblages known in the Asbian strata of S. Europe and N. Africa belonging to the southern branch of the Western Europe Coral Province of Sando (1990).

5. Acknowledgements

The author thanks D. Altıner for his help in the field in the Taurides. E. Poty and M. Aretz are thanked for helpful discussions on taxonomy and interpretation. The author gratefully acknowledges the very helpful reviews of H.-G. Herbig and I.D. Somerville who provided many comments which greatly improved the manuscript. Research and field mission were supported by a FRIA grant from the Belgian Fond National de la Recherche Scientifique.

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Manuscript received 12.12.2011, accepted in revised form 19.04.2012, available on line 15.09.2012