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Filograna minor nov. sp. (Worm Tube) From the Middle Triassic (Anisian) Reef Boulders of the Karaburun Peninsula, Western Turkey

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Abstract: A colonial serpulid worm tube, *Filograna minor* nov. sp., from the Anisian reef boulders of the Karaburun Peninsula, Western Turkey is described. The *Filograna*-bearing boulders occur together with Anisian reef boulders within the Upper Anisian siliciclastic deposits of the Gerence Formation. *Filograna minor* differs from the Norian species *Filograna serialis*, described by Senowbari-Daryan and Link from the Taurus Mountains, by the smaller dimensions of the tubes.

Key Words: *Filograna*, serpulid, Triassic, Anisian, Karaburun Peninsula, Turkey

Karaburun Yarımadası'nın (Batı Türkiye) Orta Triyas (Anisiyen) Resif Bloklarında Bulunan Bir Solucan Tübü, *Filograna minor* nov. sp.

Özet: Bu çalışma, Karaburun Yarımadası'nda (Batı Türkiye) Anisiyen resif bloklarında bulunan ve koloni halinde yaşayan bir serpulid solucan tübü, *Filograna minor* nov. sp.'yi tanımlar. *Filograna*'lı bloklar Gerence Formasyonu'nun Üst Anisiyen silisiklastik çökelleri içinde Anisiyen resif bloklarıyla birlikte bulunur. *Filograna minor*, Noriyen *Filograna serialis*'ten tüp yarıçapının küçük olmasıyla ayrılır.

Anahtar Sözcükler: *Filograna*, serpulid, Triyas, Anisiyen, Karaburun Yarımadası, Türkiye

Introduction

Both agglutinated and calcareous worm tubes occur as epifauna in Triassic reefs and shallow water carbonates. Solitary worm tubes occur also as bafflers in some Upper Triassic reefs from Spain (Braga & Lopez-Lopez 1989), and from Italy (Iannace & Zamparelli 1996; Cirilli *et al.* 1999; Zamparelli *et al.* 1999).

Serpulids from the Late Mesozoic (Jurassic–Cretaceous) are relatively well known (e.g., Götz 1931; Avnimelech 1941; Parsch 1956; Jäger 1983). However, only limited investigations and descriptions of Triassic serpulids have been carried out (e.g., Brönnimann & Zaninetti 1972; Ziegler & Michalik 1980; Senowbari-Daryan 1994; Misik *et al.* 1999; Stiller 2000). Taylor & Vinn (2006) favour that some of them may not be worms. The majority of Triassic serpulids are solitary worm tubes. Colonial worm tubes such as *Filograna* are extremely rare. Filogranids are considered as a paraphylethic group of primitive serpulimorphs (Kupriyanova 2003).

Filograna was reported for the first time from the Norian of the Taurus Mountains by Senowbari-Daryan & Link (2005). The present paper reports the oldest evidence for *Filograna* in the Anisian and confirms the occurrence of colonial worm tubes in Triassic deposits.

Geology and Locality

The Karaburun Peninsula is situated on the western margin of Turkey, west of İzmir (Figure 1). The name

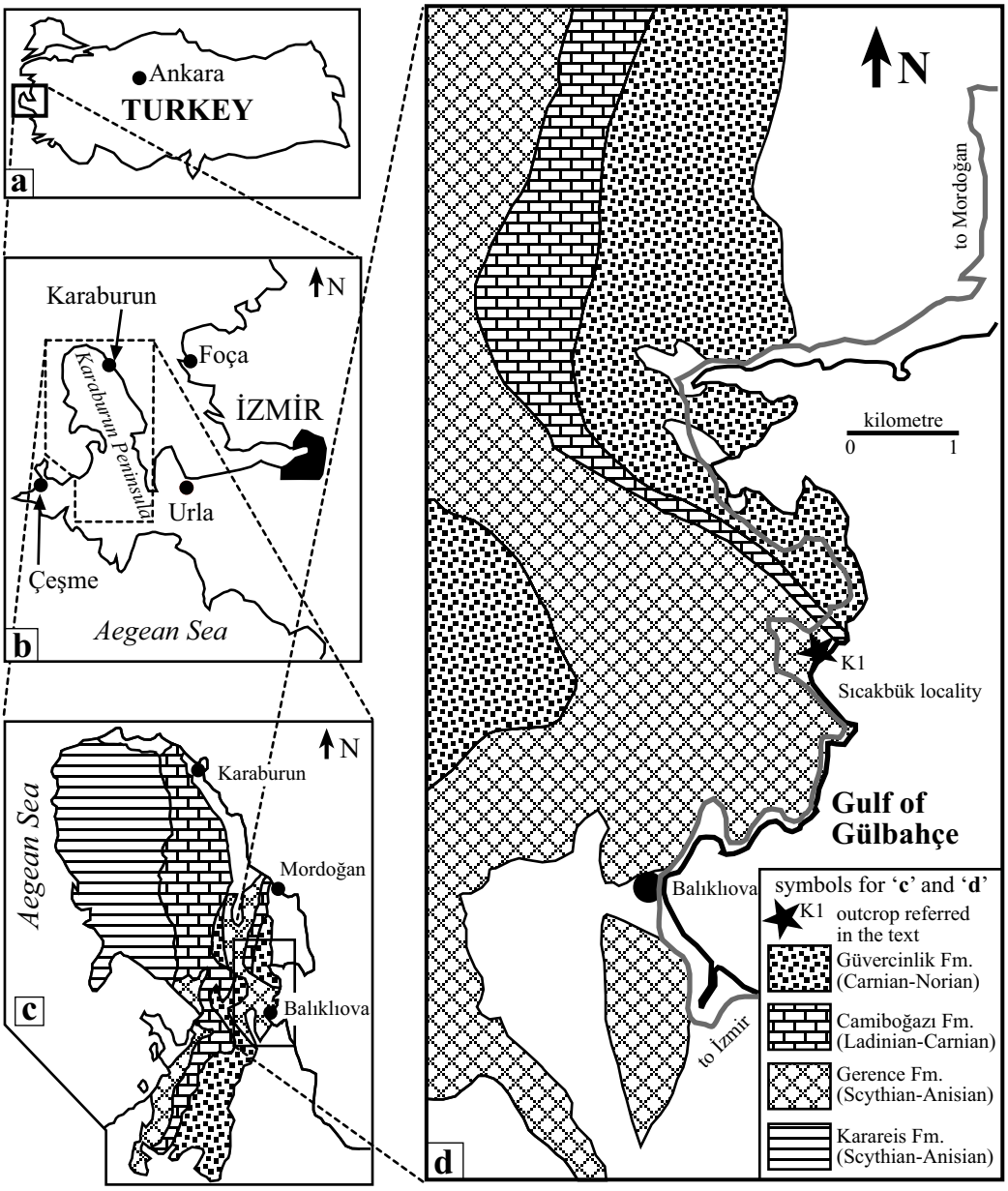

Figure 1. Location of the *Filograna*-bearing boulders in the northeastern Karaburun Peninsula (c and d after Erdoğan *et al.* 1990).

Karaburun is derived from the eponymous town at the northern end of the peninsula, and the term Karaburun is a Turkish metaphor for 'land's end'.

The peninsula is geologically part of the İzmir-Ankara zone, corresponding to the Vardar zone in Greece (Brinkmann *et al.* 1972; Erdoğan 1990). Deposits from Carboniferous to Neogene age are exposed in the northern part of the peninsula, where the study area is located.

Mesozoic deposits start with the lower–middle Triassic (Scythian?–Anisian) Denizgiren Group which is subdivided into the Karareis and Gerence formations (Erdoğan 1990). The detritic Karareis Formation in the northwestern part of the Karaburun Peninsula consists of

sandstones and siltstones, with cherts and pelagic limestones. The carbonate-rich part of the group is the Gerence Formation in the eastern and mid-western parts of the peninsula which exhibits intercalations of thin-bedded limestones, marls, sandstones, and conglomerates. Reef boulders are interbedded in the siliciclastic sediments of the formation (Koyutepe unit of Brinkmann *et al.* 1972).

Reef boulders found at the locality of Sıcakbük (Figure 1), probably date from the Anisian and contain highly diverse reef organisms (e.g., hypercalcified sponges, corals, and algae). Algae from this locality have been described by Senowbari-Daryan *et al.* (2006). The *Filograna*-bearing boulder was collected, together with other reef boulders, from an outcrop of the Anisian Gerence Formation (Koyutepe unit of Brinkmann *et al.* 1972; samples K1 and KAB, Sıcakbük), about 12.5 km south of Mordoğan (Figure 1).

At the type locality of *Filograna minor* nov. sp., the Gerence Formation is characterized from base to top by thin-bedded and laminated green mudstones intercalated with thin-bedded sandstones, conglomerates, sandy, limy mudstones containing reef boulders and reddish pink, thin- to thick-bedded limestones intercalated with mudstones (Figures 2 & 3). The level containing reef boulders is approximately 100 m thick and includes boulders 0.5 m to 2.5 m in size. At this level, the size of the reef boulders decreases from base to top.

For more information about the geology, stratigraphy and palaeontology of the Triassic sediments of the Karaburun Peninsula, see Brinkmann *et al.* (1972), Erdoğan (1990), Erdoğan *et al.* (1990), Steuber (1992), İşintek (2002) and İşintek *et al.* (2000).

Systematic Palaeontology

Family Serpulidae Rafinesque, 1815
Subfamily Filograninae Rioja, 1923
Genus *Filograna* Berkeley, 1835

Type Species. Serpula filograna Linné 1767

Filograna minor nov. sp.
(Plate 1, Figures 1–7)

Derivatio nominis. Minor (latin= comparative of parvus: smaller), because of the small dimensions of the tube bundles and the individual tubes compared with *Filograna serialis* Senowbari-Daryan & Link (2005).

Holotype. A single bundle (marked with an arrow) of the colony illustrated in Plate 1, Figure 1, magnification of the bundle figured in Plate 1, Figure 3 (thin section K77).

Locus Typicus. About 7 km northeast of the village of Balıklıova, between Balıklıova and Mordoğan, on the northeast part of the Karaburun Peninsula (see Figure 1).

Stratum Typicum. Anisian reef boulders interbedded within the siliciclastic Gerence Formation (upper Anisian?).

Diagnosis. Colony at least 12x7.5 cm (size of available sample), composed of numerous tube bundles (diameter 3–5 mm) having circular to oval outline in cross section. Each bundle contains approximately 300 or more tubes. Tubes are not sculptured, and diameter varies from 0.16–0.24 mm.

Material. Only one specimen, from which four thin sections were made (K1/77a, K1/77b, K1/77c and K1/77d). The rest of the colony remains in the rock matrix.

Depository. The remaining rock piece and thin sections are deposited at the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main (Germany), inventory number SMF XXX844.

Description. The available specimen is a fragment (12x7.5 cm) of a large 'colony' composed of numerous bundles of tubes. Individual bundles are circular, oval or rod-like in cross section. Circular bundles usually have a diameter of 4 mm (3–5 mm). The short side of the rod-like bundles (e.g., the holotype) reaches a maximum length of 5 mm, the long side up to 20 mm. Some bundles remained isolated during growth, while others grew together. The boundary between the bundles and the surrounding sediment is more or less sharp (Plate 1, Figures 1 & 3).

Individual tubes are circular, rarely oval, in cross section and have a diameter of 0.16–0.24 mm. The thickness of the tube wall is 0.02 mm and tubes are arranged in meandroid lines appearing as chains (Plate 1, Figures 2, 6 & 7). The wall between neighbouring tubes is usually absent within each line of tubes. Recent representatives of the colonial serpulid worm tubes do

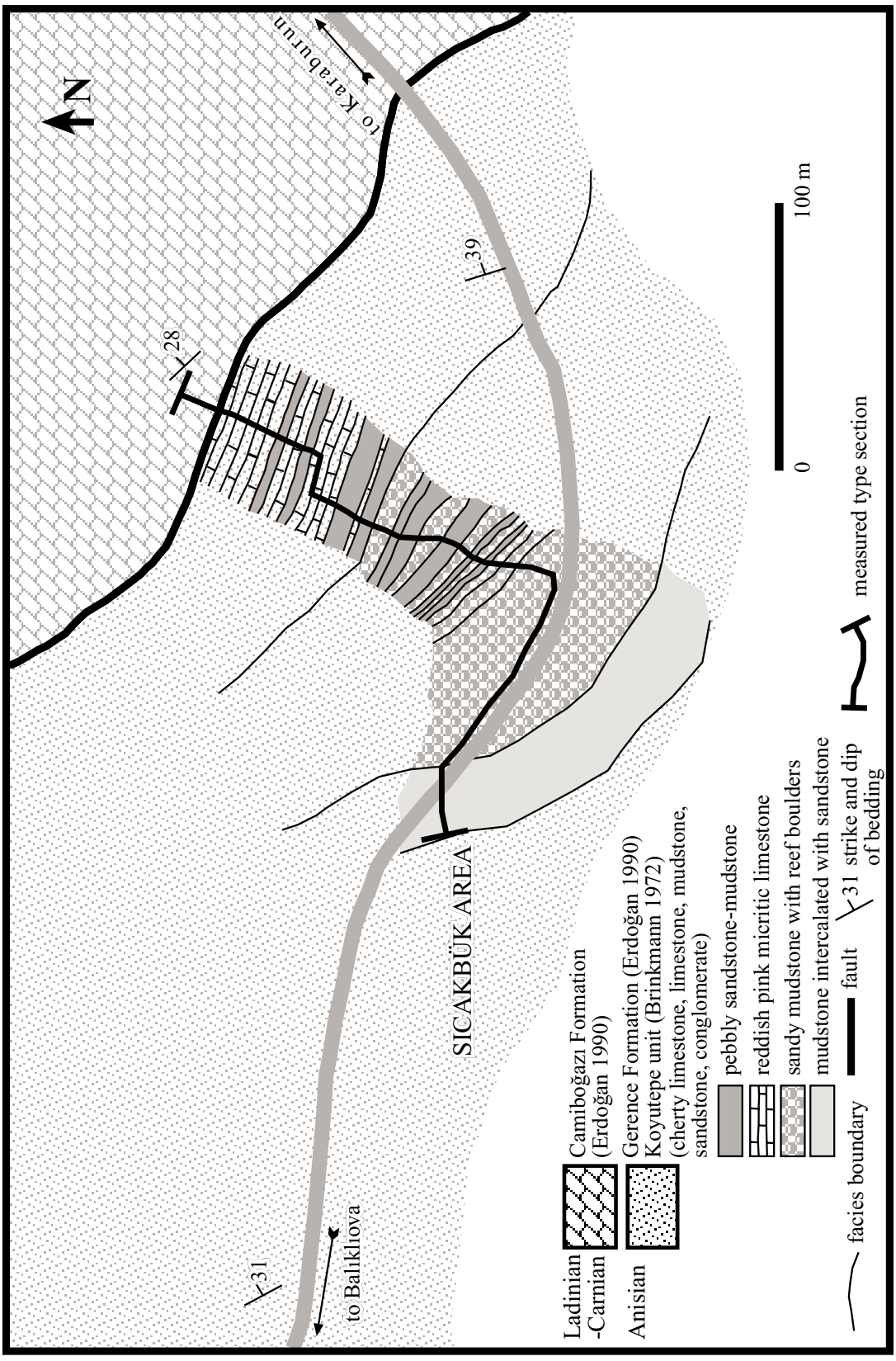

Figure 2. Detailed geologic map of the Gerence Formation, in the vicinity of *F. minor*'s type locality.

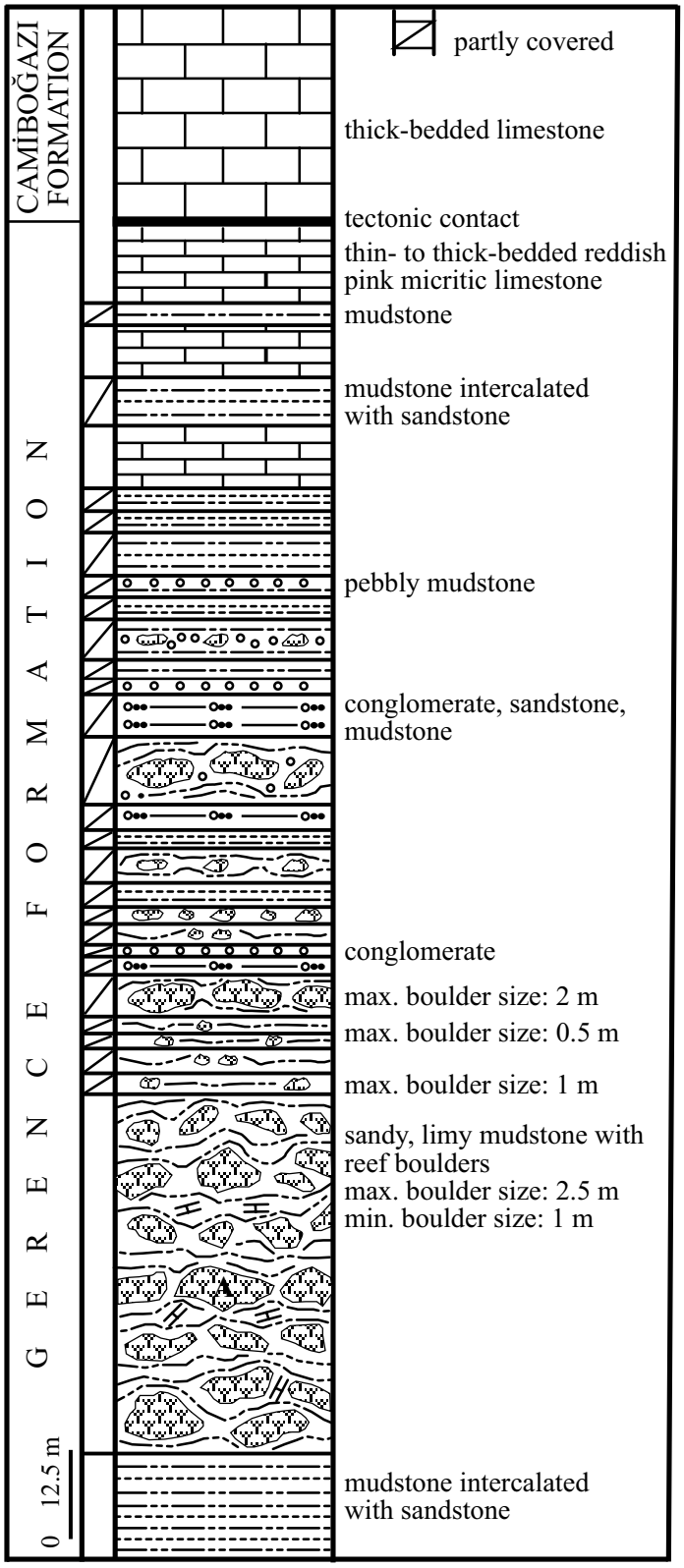

Figure 3. Lithostratigraphic section of the type locality exposed in the Sıcakbük area

not confirm this observation. In Recent *Filograna* and other 'colonial' serpulids individual tubes may be fused, but never the lumens (Nishi & Nishihira 1994). It is uncertain whether this phenomenon is primary or a result of diagenesis.

In longitudinal section (Plate 1, Figures 4 & 5) the bundles are isolated or grow together. Individual tubes are straight or curved and run parallel to the axis of the bundles.

The holotype (Plate 1, Figure 3: arrow, compare it with Plate 1, Figure 1: arrow) is a plate-like bundle with length almost 20 mm and width about 4 mm.

Discussion

The majority of Triassic worm tubes occurring in reefs are solitary, but Senowbari-Daryan & Link (2005) described two species of gregarious worm tubes, *Filograna taurica* and *Filograna serialis*, from the Norian of the Taurus Mountains: most of the characteristics described here, especially the arrangements of the tubes in meandroid lines, of the Anisian species from the Karaburun Peninsula, are similar to the Norian species *F. serialis*. The Anisian species differs, however, in the smaller dimensions of the tube bundles and individual tubes. The dimensions of *Filograna minor* nov. sp. are similar to *F. taurica* but the new species is distinguished from the latter by diagnostic criteria noted by Senowbari-Daryan & Link (2005) for *F. serialis* (sharp boundary between bundles and surrounding sediment, no isolated individual tubes, and tubes arranged in rows).

Table 1 shows the dimensions of the bundles, individual tubes, and the tube walls of three Triassic taxa of *Filograna*.

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Table 1. Dimensions of *Filograna*-species from the Anisian (Karaburun Peninsula) and Norian (Taurus Mountains) deposits in western and southern Turkey. All measurements in mm.

Species	Diameter of the bundles	Diameter of the tubes	Thickness of the tube wall
F. taurica	3–6	0.3 (rarely deviating)	0.02–0.04
F. serialis	6–9	0.3–0.5	0.05–0.06
F. minor nov. sp.	3–5	0.16–0.24	0.02

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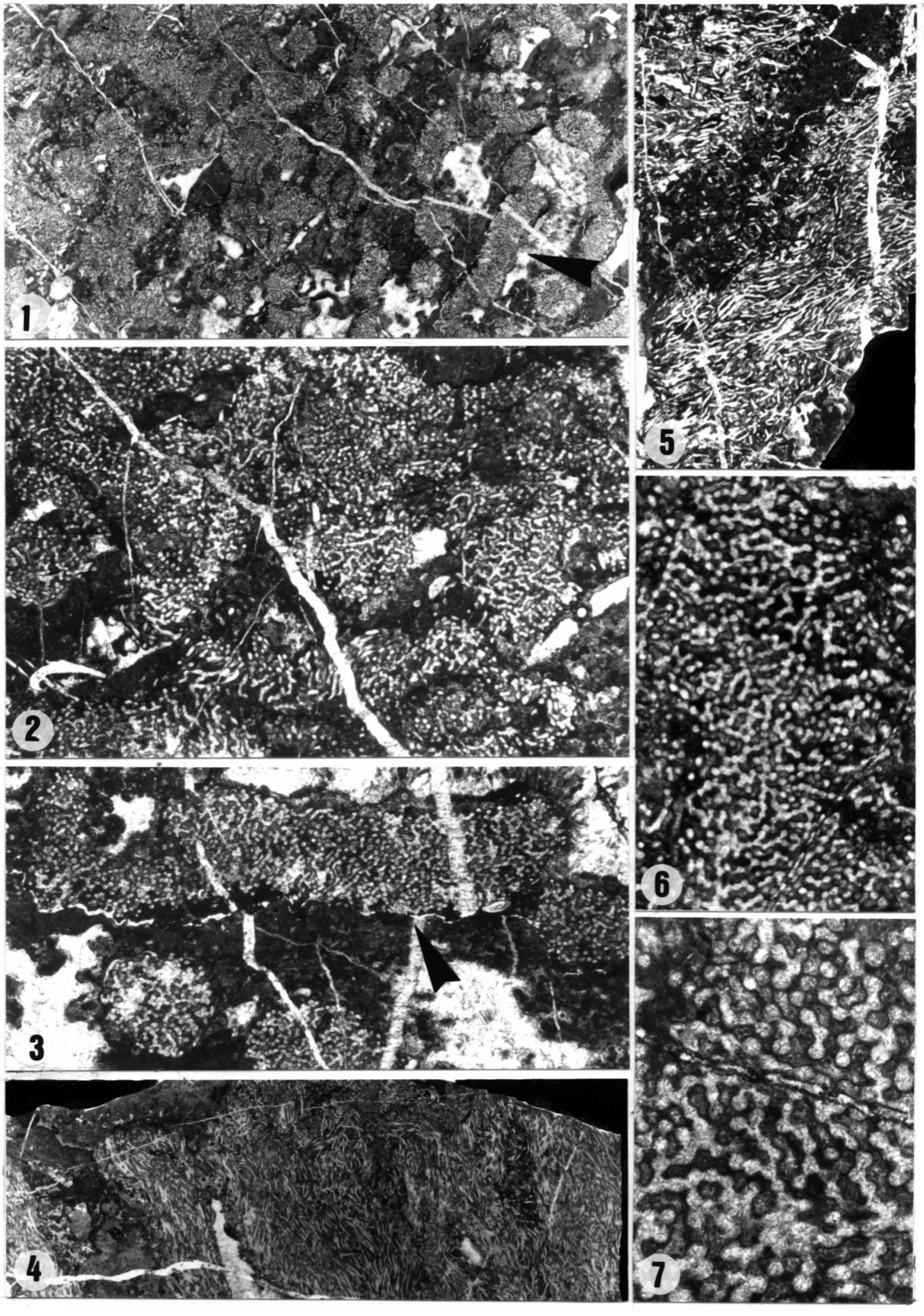
PLATE 1

Figures 1–7, *Filograna minor* nov. sp. from an Anisian reef boulder from Karaburun, Turkey. 1– Cross section through a colony composed of numerous bundles growing parallel to each other. The space between the bundles is filled with sediment or calcite cement. An arrow indicates the holotype in Figure 3. K1/77, x1.7. 2– A magnification of Figure 1 showing the individual tube bundles growing together, x3. 3– A (mirrored) magnification of Figure 1 (arrow) showing the holotype (arrow) and three additional cross sections of tube bundles, x3. 4– Longitudinal section through the same colony exhibiting several tube bundles, partly growing together. The individual tubes are straight or curved and run parallel to the axis of the bundle. K1/77d, x2. 5– Longitudinal section showing the same characteristics as Figure 4, K1/77b, x3. 6– A magnification of Figure 1 showing the individual tubes arranged in straight or meandroid lines appearing as chains, x8. 7– A magnification of Figure 1 showing the same feature of the tubes. The wall between neighbouring tubes is usually absent within each line of tubes. It is uncertain whether this phenomenon is primary or the result of diagenesis, x16.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