



A New Species of Angariid Gastropod from the Early Thanetian of the Haymana-Polatlı Basin, Turkey

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Abstract: A new trochoidean species, *Angaria calvii* n. sp., from the early Thanetian of the Kırkkavak Formation (Haymana-Polatlı Basin, Palaeocene) in central Anatolia, is described and placed in the family Turbinidae. Previously, the oldest Cenozoic *Angaria* was recorded from the Early Palaeocene (Danian) in France (Paris Basin). In this paper, we report the second discovery of the oldest angariid specimens from the Thanetian sediments of the Tethys realm, a stratigraphic position which is supported by the foraminiferal-red alga assemblages at this locality.

Key Words: *Angaria calvii* n.sp, early Thanetian, Orthogastropoda, Haymana-Polatlı Basin, Turkey

Erken Tanesiyen’de yeni bir Angariid Gastropod türü, Haymana-Polatlı Havzası, Türkiye

Özet: Kırkkavak Formasyon’unda (Haymana-Polatlı Havzası, Paleosen) erken Tanesiyen’de Turbinidae familyasına ait yeni bir trochoidean türü *Angaria calvii* n. sp. tanımlanmıştır. Bugüne kadar bilinen en yaşlı Senozoyik *Angaria* kaydı, Fransa’da Paris Havzası’nda Erken Paleosen’de (Danian)’dir. Bu çalışmada Tetis bölgesinde ikinci en yaşlı angariid türü Tanesiyen çökellerinde bulunmuştur, yaş aralığı, birlikte bulunduğu foraminifer-alg topluluğuna göre belirlenmiştir.

Anahtar Sözcükler: *Angaria calvii* n.sp, erken Tanesiyen, Orthogastropoda, Haymana-Polatlı Havzası, Türkiye

Introduction

Late Palaeocene gastropods of Turkey, particularly from NW and Central Anatolia, are not well-studied and there are very few articles dealing with the taxonomy and stratigraphy of this group. Stchépinsky (1941) summarized and reported ten species from the Kocaeli region of NW Anatolia. Recently Okan & Hoşgör (2008) listed four ampullinid gastropod species from the Polatlı region (Late Thanetian–Early Ilerdian). In contrast, Early Eocene (Cuisian) gastropod faunas from NW Anatolia (Stchépinsky 1946) and from Central Anatolia (Çankırı Basin) have recently been intensively studied (Okan & Hoşgör 2009). The gastropod record is particularly incomplete, with most discoveries represented by isolated spine and shell fragments. The earliest known Cenozoic *Angaria* [*Angaria polyphylla* (d’Orbigny 1850)] is from the Early Palaeocene (Danian) of the

Paris Basin in France (Pacaud *et al.* 2000). Here we describe the first discoveries from Kırkkavak hill, representing the first definitive record of angariids in Turkey. The age of the formation is supported by the foraminiferal assemblages at the Kırkkavak Hill locality.

Geological Background

A number of Late Cretaceous–Tertiary sedimentary basins formed in many localities on the Tauride-Anatolide Platform. The basins in the central eastern part of the platform were formed during Late Cretaceous–Early Tertiary time (Şengör & Yılmaz 1981; Yıldız *et al.* 2001; Okan & Sirel 2008; Okan & Hoşgör 2009). The Haymana-Polatlı Basin is located about 70 km SW of Ankara in Central Anatolia. The material was sampled from the Kırkkavak hill (Figure 1) section of the Upper Cretaceous–Middle

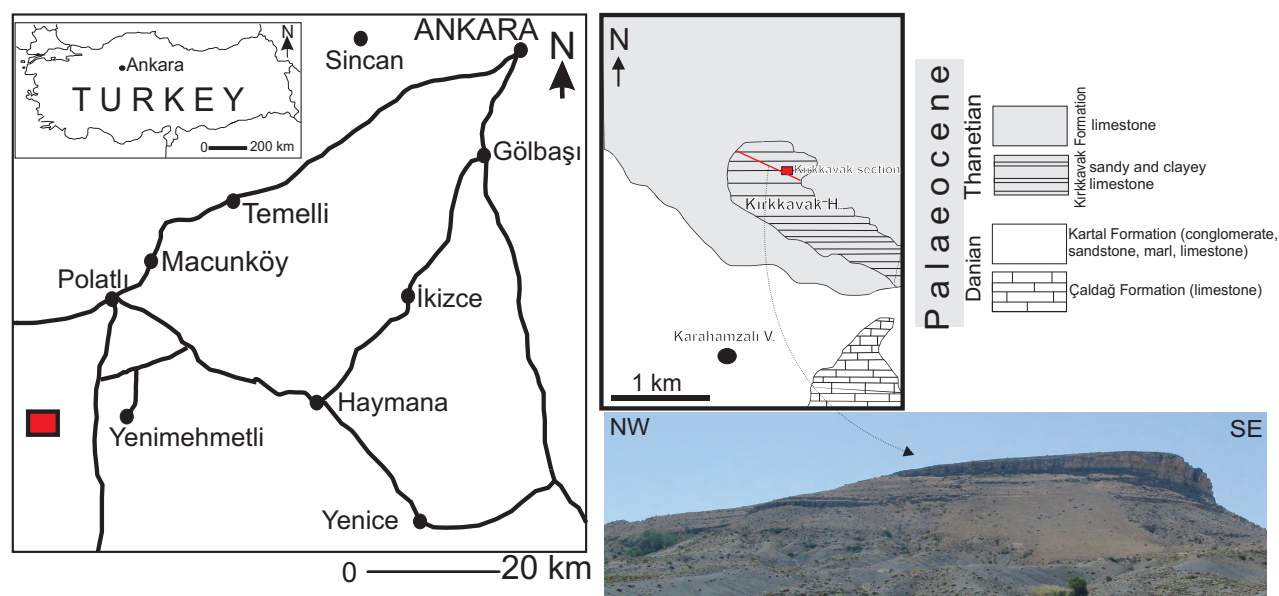


Figure 1. Location, geological map and field photographs of Kırkkavak hill (Okan & Sirel 2008).

Eocene forearc sequence of the Haymana-Polatlı Basin succession (Koçyiğit 1991), which includes extremely fossiliferous shallow marine beds. The Lower Cenozoic sediments are rich in marine fossil microbiota and consist of various rock types. The Palaeocene to middle Eocene parts of the basin sequence are characterized by abundant and diverse nummulitids and alveolinids (Özcan *et al.* 2007). Molluscs are locally abundant in some horizons, scarce in others (Stchépinsky 1941; Erünel 1942; Okan & Hoşgör 2008). Many researchers have focused on the stratigraphy, tectonics and general geology of the area due to the importance of the Haymana Basin sequence in terms of oil potential. Such studies were carried out in different parts of the basin (Figure 2).

The investigated outcrop is situated near Karahamzalı Village, 13 km south of Polatlı (SW Ankara) (1: 25000 scale topographic sheet-J28-a2). The section starts from Karahamzalı Village and extends to the north of Kırkkavak hill (Figure 1). The Palaeocene sequence, up to 900 m thick, unconformably overlies Upper Jurassic rocks and can be divided into two conformable units, both attributed to the Danian–Thanetian (Sirel 1975, 1998, 2009; Sirel & Acar 2008). The lower part of the sequence comprises a conglomerate, sandstone,

marl and limestones (Kartal Formation, Danian–Selandian), while the upper part consists of yellowish, thick-bedded limestones with sandy marl interbeds (Kırkkavak Formation, Thanetian). The present gastropod inventory is based mainly on sandy and clayey limestones outcropping in the Kırkkavak section (Figure 3). The Kırkkavak section, measured northeast of Kırkkavak hill southwest of Karahamzalı Village (Figure 1), is the type locality of *Angaria calvii* n. sp. This section, containing only Thanetian rocks, is composed of limestones, sandy and clayey limestones (Figure 3).

Micropalaeontology and Palaeoenvironment

The age of Lower Palaeogene shallow-marine carbonate successions of the Haymana-Polatlı Basin has usually been determined using the very rich fauna of larger foraminifera (Dizer 1968; Sirel 1975, 1998, 2009; Sirel *et al.* 1986; Özcan *et al.* 2001; Özcan 2002). The sediments of the Kırkkavak Formation yielded numerous foraminifera that could be studied in thin section (Figure 4). The sediments containing them were collected in association with the gastropods described herein (Figures 3 & 4). The benthic foraminifera include *Smoutina subferea*, *Nummulites heberti*, *Spherogypsina globula*, *Quenqueloculina* sp.,

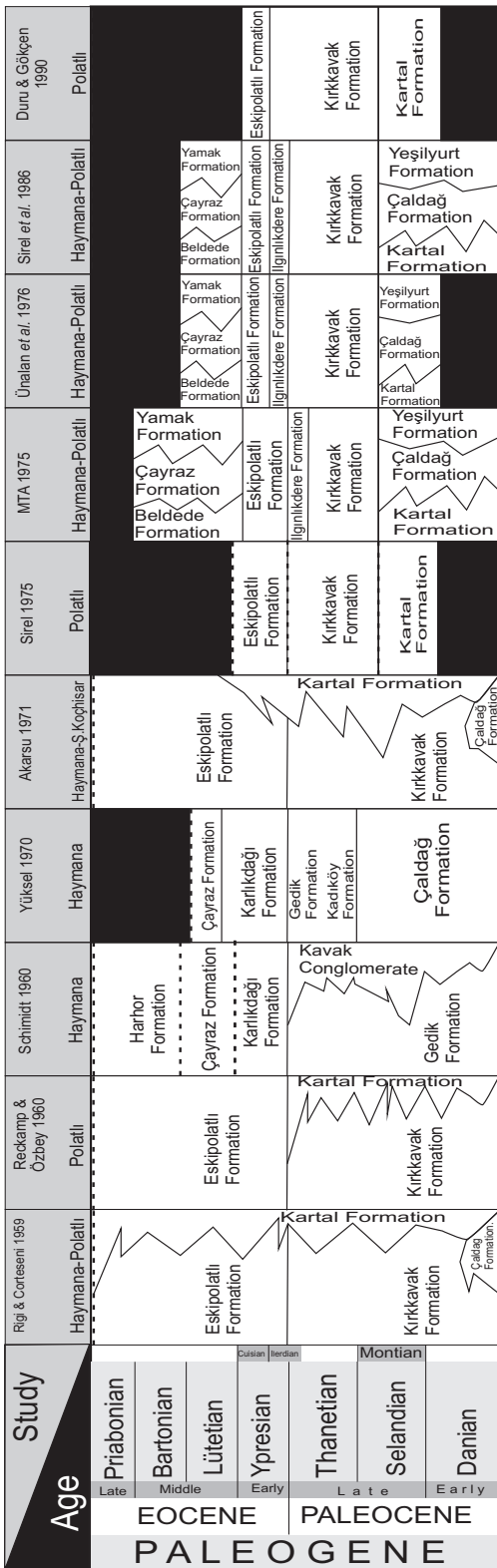


Figure 2. Correlation of Tertiary units of the Haymana-Polatlı Basin succession.

Rotalia sp., *Orbitoclypeus* sp., *Discocyclina seunesi*, *Valvulina* sp., *Missisippina* sp., *Glomalveolina* sp., *Glomalveolina primaeva*. Other fossils that are recognizable in thin section include calcareous red algae and bryozoa. A particular Palaeocene element is *Distichoplax biserialis*, a taxonomically uncertain calcareous red alga (Lithophylloideae) that is generally restricted to this time interval (Rasser *et al.* 2005).

Serra-Kiel *et al.* (1998) defined twenty shallow-water benthic foraminiferal biozones (SBZ 1–20) in the Tethyan Palaeocene and Eocene. The age of the studied section in the Kırkkavak Formation, determined by the rich assemblage of foraminifera, is well constrained. The foraminifera indicate a Late Palaeocene (early Thanetian) age. This age corresponds to the SBZ 3 benthic foraminiferal zone based upon the Serra-Kiel *et al.* (1998) scheme.

Benthic foraminifera were the most common constituents of Upper Palaeocene–Lower Eocene shallow-marine carbonates. The foraminiferal and calcareous red algae assemblage are supposed to bear photosymbiotic microalgae, which explains their maximum abundances in oligotrophic, tropical shallow-marine environments. Additionally, the problematic alga *Distichoplax biserialis* and the well-sorted components suggest deposition in a high-energy shallow marine environment (Rasser *et al.* 2005; Scheibner *et al.* 2007). Most of the trochoids can be interpreted as inhabitants of hard substrates of coral reefs or other shallow-water oligotrophic habitats, where they scraped algae (see Harzhauser 2004).

Systematic Palaeontology

Figured material is housed in the Paleontological Collections of the Geological Department of Ankara University, with specimen numbers prefix AU08.OI. The systematic study follows the classification of Hickman & McLean (1990) and Bouchet & Rocroi (2005).

Class Gastropoda Cuvier 1797

Subclass Orthogastropoda Ponder & Lindberg 1997

Order Vetigastropoda Salvini-Plawin 1989

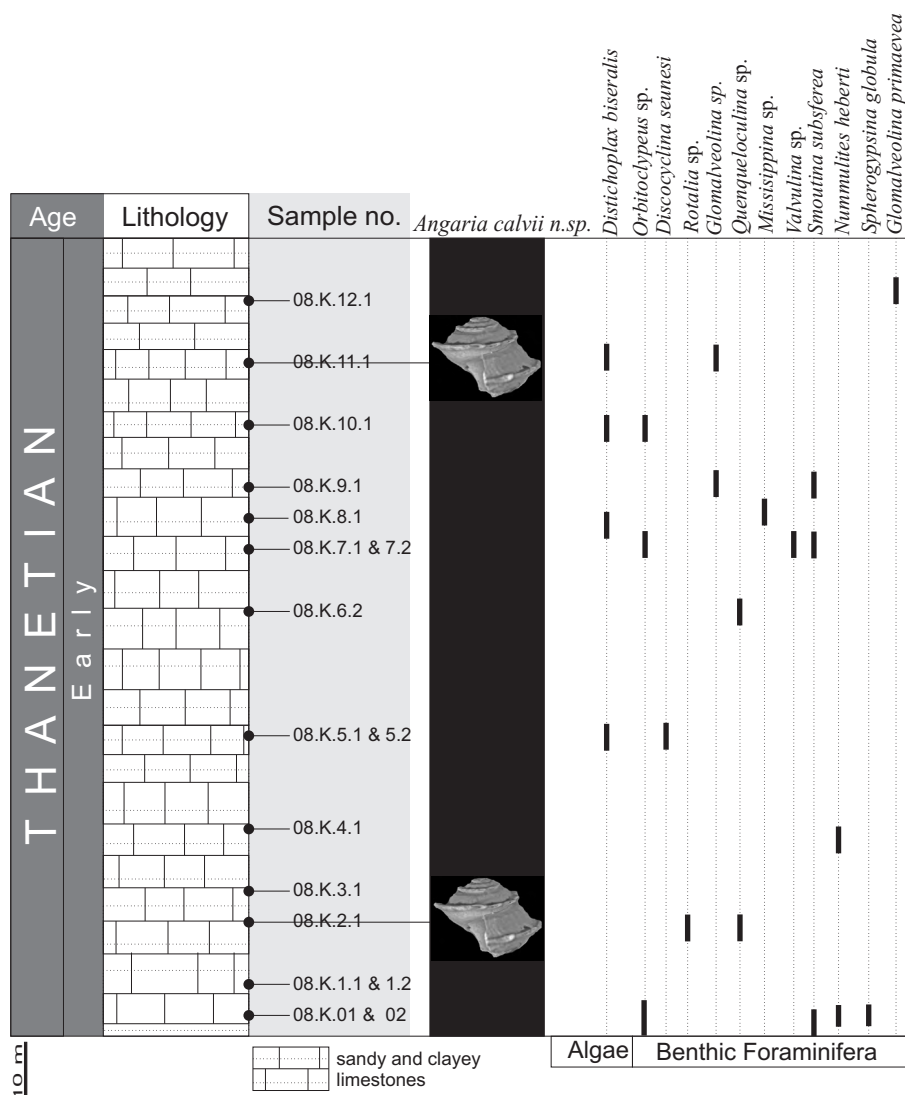


Figure 3. Measured stratigraphic section and distributions of benthic foraminifera, calcareous red algae (Lithophylloideae) and *Angaria calvii* n. sp., in the early Thanetian of the study area.

Superfamily Trochoidea Rafinesque 1815

Family Turbinidae Rafinesque 1815

Subfamily Angariinae Thiele 1924

Genus *Angaria* Röding 1798

Type Species. *Turbo delphinus* Linnaeus 1758, Recent, Indo-pacific, (Wenz 1938–1944: figure 742).

Angaria calvii n.sp.

Plate 1 (Figures a–f)

Derivation of Name. In honor of Prof. Dr. Wilhelm Salomon-Calvi, the founder of the Geological Department of Ankara University.

Type Material. Holotype and paratype from the type locality.

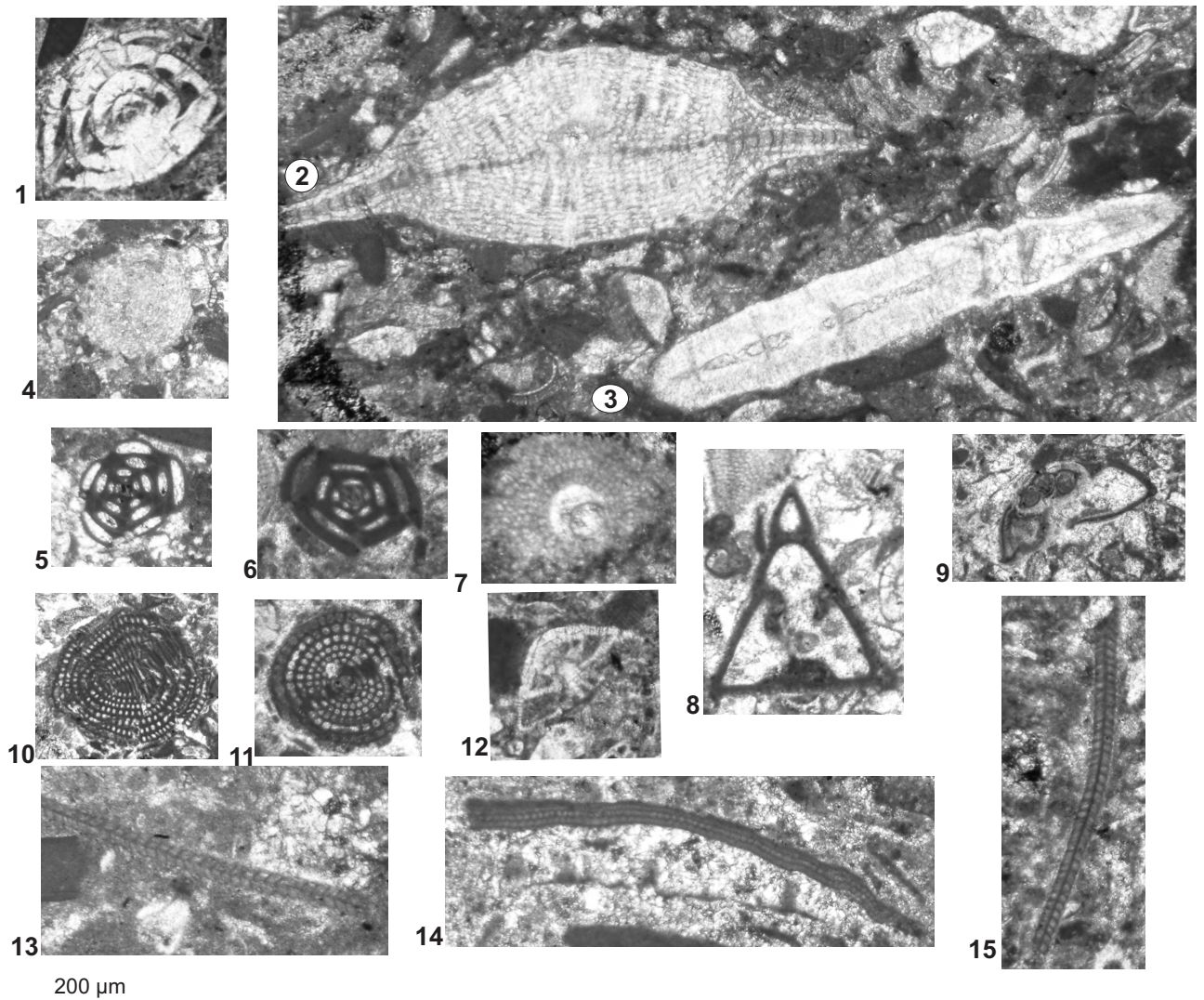


Figure 4. Biota, identified in thin section from the Kirkkavak Formation; 1– *Smoutina subsferea* 08.K.01, 2– *Orbitoclypeus* sp., 08.K.10.1, 3– *Nummulites heberti* 08.K.4.1, 4– *Spherogypsina globula*, 08.K.02, 5– *Quenqueloculina* sp., 08.K.2.1, 6– *Quenqueloculina* sp., 08.K.6.2, 7– *Discocyclusina seunesi*, 08.K.5.2, 8– *Valvulina* sp., 08.K.7.1, 9– *Mississippina* sp., 08.K.8.1, 10– *Glomalveolina* sp., 08.K.11.1. 11– *Glomalveolina primaeva*, 08.K.12.1, 12– *Rotalia* sp., 08.K.2.1, 13– *Dictichoplax biserialis* 08.K.11.1, 14– *Dictichoplax biserialis* 08.K.8.1, 15– *Dictichoplax biserialis* 08.K.5.1.

Type Locality. Central Anatolia, Haymana Basin, Karahamzalı Village, Kirkkavak Hill, Turkey, at GPS coordinates x: 0425041, y: 4368092, on topographic map sheet-J28-a2, 1: 25000 scale, sandy and clayey limestones units, 08.K.2.1 and 08.K.11.1.

Holotype. The specimen illustrated on Plate 1, Figures a–c. 08.K.2.1.

Paratype. The specimen illustrated on Plate 1, Figures d–f. 08.K.11.1.

Age. Kirkkavak Formation, early Thanetian.

Geographic Distribution. Known only from the type locality.

Dimensions. Holotype 08.K.2.1: Height: 4.4 mm, Width: 5.8 mm, Height of the last whorl: 2.6 mm, Height of the aperture: 2.1 mm. Paratype 08.K.11.1: Height: 6 mm, Width: 8.6 mm, Height of the last whorl: 4 mm, Height of the aperture: 3.1 mm.

Diagnosis. Shouldered whorls with pronounced spines at the periphery, sutures deep, wide umbilicus with dentitions.

Description. Shell small, rather thick, evenly convex, with three to four rapidly increasing penultimate whorls. Spire low, slightly elevated. Body whorl large and ornamented with wavy keel at the periphery of the whorl. Suture deep with a flat sutural ramp ornamented with angular rows of undulate striae on the teleoconch whorls. Last whorl descends to aperture. Aperture circular, inner lip and outer lip smooth. A wide and deep umbilicus; the umbilical margin is broadly dented.

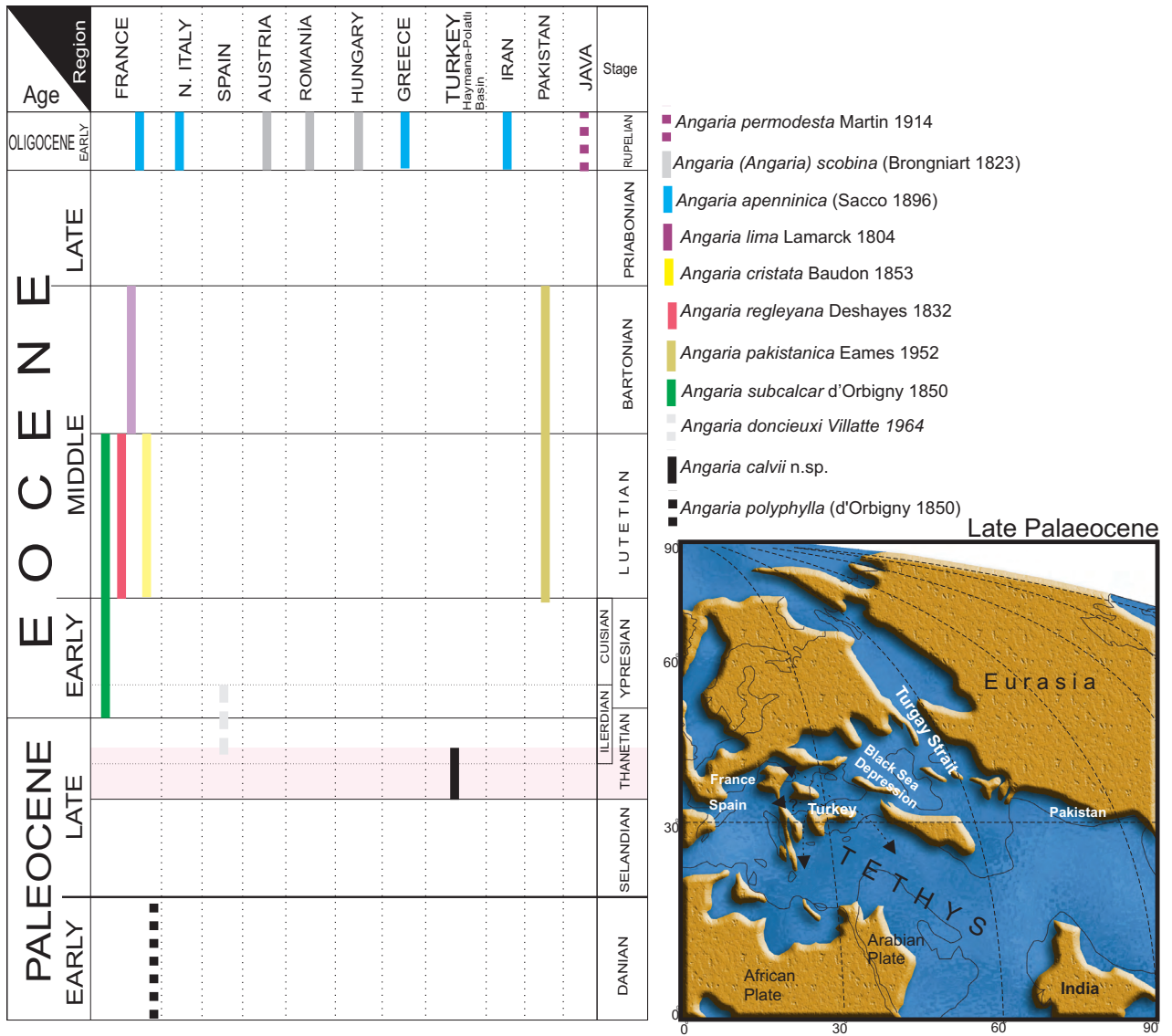


Figure 5. Stratigraphic range and geographic distribution of the most representative Cenozoic (Palaeocene–Early Oligocene) *Angaria* species in the Tethyan-Mediterranean region (Cossmann 1915; Martin 1931; Eames 1952; Moisescu 1972; Llompart 1977; Piccoli & Savazzi 1983; Baldi 1986; Bonci *et al.* 2000; Pacaud *et al.* 2000; Harzhauser & Mandic 2001; Harzhauser 2004 and this study). Palaeogeographic map of the Late Palaeocene (redrawn from Smith *et al.* 1994).

Discussion. The superfamily Trochoidea has been described as the diverse clade within the Vetigastropoda, and as one of the most diverse among all marine gastropods. Trochoideans have an extensive fossil record, thought to extend back at least as far as the Middle Triassic (Hickman & McLean 1990). *Angaria polyphylla* (d'Orbigny 1850) (Pacaud *et al.* 2000; figure 2.6) which is strongly reminiscent of the Paris Basin (Vigny) shells in its spire whorl shape, differs obviously in its spiral ornamentation at the adapical suture, and the less rapidly increasing whorls. *Angaria pakistanica* Eames 1952 from the Eocene of Pakistan is larger and differs in having a broad-conical shape. *Angaria calvii* n. sp. is similar to *Angaria apenninica* (Sacco 1896) (Harzhauser 2004; p. 108, plate 2, figures 12–15) from the Early Oligocene strata in Western Tethys from France, Italy, Greece and as far east as Iran, but differs in having a smaller shell, ornamentation on the upper surface of the shouldered whorls and strong spines on the peripheral angulation of the body whorl. The new species somewhat resembles *Angaria* (*Angaria*) *scobina* (Brongniart 1823) from the early Oligocene of Romania (Moiescu 1972; p. 69, plate 36, figure 8) but differs in having a deep sutures, strong spines, and a wide umbilicus.

Conclusions and Palaeobiogeographic significance of the new species

The present paper presents *Angaria calvii* n. sp. from the Kırkkavak Formation of the Haymana-Polatlı Basin near Ankara, Central Anatolia in the

Mediterranean Alpine fold belt. The genus *Angaria* has been reported sporadically in Eurasia, E. Africa and Australia within shallow warm-water faunas from Middle Jurassic to Recent, with a significant radiation since the Eocene to early Miocene (Piccoli 1984). Known Palaeogene occurrences of *Angaria* within the Tethys-Mediterranean region (Palaeocene–Early Oligocene) are summarized graphically in Figure 5, based on Cossmann (1915), Martin (1931), Eames (1952), Moiescu (1972), Llombart (1977), Piccoli & Savazzi (1983), Baldi (1986), Bonci *et al.* (2000), Pacaud *et al.* (2000), Harzhauser & Mandic (2001) and Harzhauser (2004). These works focus mainly on Old World Cenozoic *Angaria* species. *Angaria* has been variously reported as ranging from Early Palaeocene–Danian [*Angaria polyphylla* (d'Orbigny 1850)] to Early Oligocene (Figure 5). *Angaria calvii* n. sp. provides the first evidence that representatives of the family Turbinidae belonging to the genus *Angaria* lived in Turkey in the Late Palaeocene. This suggests that central Anatolia was located on the east-west migration route (Figure 5) of the Late Palaeocene–Eocene *Angaria* species.

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PLATE 1

(a) – (f) *Angaria calvii* n. sp., Holotype: (a) apical view, (b) lateral view, (c) basal view 08.K.2.1, Paratype: (d) apical view, (e) lateral view, (f) basal view 08.K.11.1. (scale bars 10 mm).

