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Short Note

A trionychid turtle from the late Aquitanian (early Miocene) of Neochori (Grevena, Western Macedonia, Greece)

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Our knowledge of the fossil record of turtles from Greece has improved greatly over the course of the last years. Although turtle fossils in Greece are known mainly from the late Miocene onwards (Georgalis & Kear, 2013; Vlachos, 2015), some remains have recently been reported from the early Miocene as well. In particular, Georgalis et al. (2013) described the first (and only) pleurodire turtle from the late Burdigalian (early Miocene) of Nostimo, Kastoria (NW Greece), based on a partial shell. Georgalis et al. (2017), on the other hand, published fragmentary specimens of Testudines indet. from the middle-late Burdigalian (MN4, early Miocene) of Karydia (NE Greece) and Aliveri (Euboea Island, Central Greece). The objective of this short note is to report another early Miocene turtle fossil from Greece, which expands the fossil turtle record of this country to the Aquitanian. Also, this specimen increases the turtle diversity in the early Miocene of Greece as it belongs to the cryptodiran clade of Pan-Trionychidae.

GEOLOGICAL SETTING

The new turtle specimen was found at the surface of an outcrop in one of the ravines that lead to the Megalos Lakkos river, a few kilometers NNE of the village of Neochori, in Grevena municipality, NW Greece (Fig. 1a-c). Various other fossils (e.g., corals, gastropods, bivalves) were found in the same level with the turtle specimen (Fig. 1b), in the molassic sediments of the Mesohellenic Basin and within consolidated sandstones, marls, and sandy marls (Fig. 1c) of the lower parts of the Tsotili Formation (I.G.M.R., 1979a, b). The most common fossil in the locality is the scleractinian coral preliminary identified herein as *Euphyllia* sp. (Fig. 1d). These deposits lay in this area unconformably over Jurassic ophiolites of the Subpelagonian geotectonic zone (Fig. 1a). The extensive Tsotyli series is dated to the late Aquitanian-Burdigalian (early Miocene). As the fossil is found near the base of the Tsotyli Formation and close to the contact with the underlying Pentalophos Formation (Aquitanian), we infer a late Aquitanian age for the fossil. Also, the preliminary identification of *Turritella* gastropods and *Panopea* bivalves from the locality is in accordance with the information given in the geological maps for the Tsotyli series in the area (I.G.M.R., 1979a, b). This age estimation should be corroborated by further sampling and detailed study of the accompanying fauna, both of which are beyond the scope of this short note. Plio-Pleistocene sediments (marls, sands, and conglomerates) and younger alluvial deposits lay unconformably above these Aquitanian deposits.

DESCRIPTION

The specimen forms part of the collection of the School of Geology of Aristotle University of Thessaloniki, Greece, under the catalog number LGPUT GNE-001. The fossil plate was found in August 2015 by NB in four broken fragments, all recovered close to each other; NB completed the preparation of the specimen shortly after its discovery. The preserved plate measures approximately 60 × 150 mm (Fig. 1e), allowing the reconstruction of a turtle shell of at least 35 cm in length. The specimen represents a partial costal plate, as evidenced by the presence of the costal rib on the visceral side (Fig. 1e2). The anterior and posterior sides are sub-parallel to each other, indicating that this costal plate was probably one of the middle ones, as the first and last costal plates are typically more trapezoid in pan-trionychids. A part of the disk outline is present, being curved and smooth. In cross-section, the plate is rather flat to slightly convex (Fig. 1e3), having a thickness between 5.9-7.6 mm. A part of the costal rib is preserved, indicating that the costal rib formerly extended beyond the outline. Dorsally, the costal plate shows the typical ornamentation or sculpturing pattern of pan-trionychids (Fig. 1e1), consisting of circular to semi-circular pits on the medial parts of the plate to continuous, vermiculated, ridges in the middle and lateral parts of the

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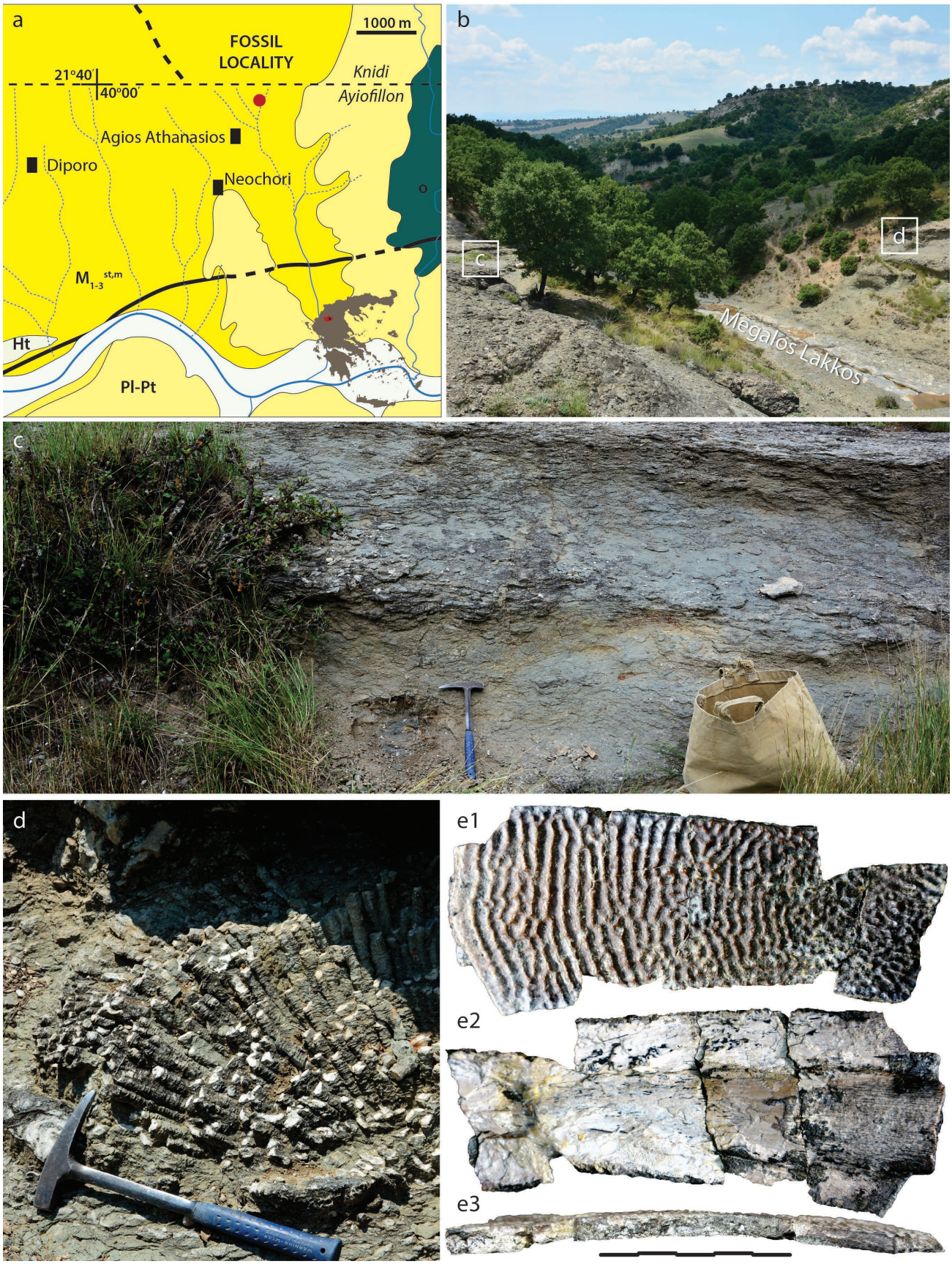
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1000 m
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plate. Several studies have shown that this pattern alone cannot be used for taxonomic identification beyond the family or clade level, and skulls and complete shells are needed for precise identifications (e.g., Gardner & Russell, 1994; Vitek & Joyce, 2015; Georgalis & Joyce, 2017; and references therein). The specimen is therefore identified only as Pan-Trionychidae indet. Further identification is not possible for the moment.

CONCLUDING REMARKS

The new specimen reported herein can be clearly attributed to a soft-shelled turtle of the cryptodiran clade Pan-Trionychidae. This clade has only been recently identified in the fossil record of Greece from the Pliocene of the Thessaloniki area (Vlachos et al., 2015) and the earliest late Miocene of Crete Island (Georgalis et al., 2016). All soft-shelled turtle fossils from Greece cannot be identifiable beyond Pan-Trionychidae (Georgalis & Joyce, 2017). The new find reported herein extends the presence of this clade to the early Miocene of Greece (late Aquitanian) and therefore currently represents the oldest Greek turtle. The previously oldest records of fossil turtles from Greece were *Nostimochelone lampra* Georgalis et al., 2013 from the late Burdigalian of the Zeugostasion Formation (see Georgalis et al., 2013 and references therein), and fragments of Testudines indet. from the middle-late Burdigalian of Karydia and Aliveri (Georgalis et al., 2017). Therefore, the soft-shelled fossil turtle reported herein extends the Greek fossil record of turtles to the Aquitanian. This is the first fossil turtle finding from the Mesohellenic Basin, providing further evidence of the presence of early Miocene Testudines in NW Greece. These preliminary results highlight the necessity of increasing fieldwork efforts in the Mesohellenic Basin, an area with extensive sediments of high fossil preservation potential, as additional finds from this region are expected to provide valuable information regarding the early history of turtles in Greece.

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REFERENCES

Gardner J.D. & Russell A.P. (1994). Carapacial variation among soft-shelled turtles (Testudines: Trionychidae), and its relevance to taxonomic and systematic studies of fossil taxa. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 193: 209-244.

Georgalis G.L. & Joyce W.G. (2017). A review of the fossil record of old world turtles of the clade Pan-Trionychidae. *Bulletin of the Peabody Museum of Natural History*, 58: 115-208.

Georgalis G.L. & Kear B.P. (2013). The fossil turtles of Greece: an overview of taxonomy and distribution. *Geobios*, 46: 299-311.

Georgalis G.L., Velitzelos E., Velitzelos D. & Kear B.P. (2013). *Nostimochelone lampra* gen. et sp. nov., an enigmatic new podocnemidoidean turtle from the lower Miocene of northern Greece. *In* Brinkman D., Holroyd P. & Gardner J. (eds), Morphology and evolution of turtles: papers in honor of Eugene S. Gaffney, Volume 3, Pleurodires. Springer: 277-287.

Georgalis G.L., Villa A., Ivanov M., Roussiakis S., Skandalos P. & Delfino M. (2017). Early Miocene herpetofaunas from the Greek localities of Aliveri and Karydia - bridging a gap in the knowledge of amphibians and reptiles from the early Neogene of southeastern Europe. *Historical Biology*, DOI: 10.1080/08912963.2017.1417404.

Georgalis G.L., Villa A., Vlachos E. & Delfino M. (2016). Fossil amphibians and reptiles from Plakias, Crete: a glimpse into the earliest late Miocene herpetofaunas of southeastern Europe. *Geobios*, 49: 433-444.

[I.G.M.R.] Institute of Geological and Mineralogical Research of Greece (1979a). Ayiofillon sheet, Geological Map 1:50,000, mapping by Mavridis A. & Matarangas D., Publication Department of Geological Maps of I.G.M.R.

[I.G.M.R.] Institute of Geological and Mineralogical Research of Greece (1979b). Knidi sheet, Geological Map 1:50,000, mapping by Mavridis A. & Kelepertzis Ak., Publication Department of Geological Maps of I.G.M.R.

Vitek N.S. & Joyce W.G. (2015). A review of the fossil record of New World turtles of the clade Pan-Trionychidae. *Bulletin of the Peabody Museum of Natural History*, 56: 185-244.

Vlachos E. (2015). The fossil chelonians of Greece. Systematics - evolution - stratigraphy - palaeoecology. 479 pp. Ph.D. thesis, Aristotle University of Thessaloniki, Greece.

Vlachos E., Cerda I. & Tsoukala E. (2015). The first record of a soft-shelled turtle (Testudines: Pan-Trionychidae) from southern Balkans (Pliocene, Gefira, N. Greece) and new information from bone histology. *Science of Nature*, 102: 45.

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Fig. 1 (color online) - a) Simplified geological map of the study area, indicating the locality of the fossil find described herein near the village of Neochori, Grevena (NW Greece). The composite simplified map is based on the geological maps of the sheets Ayiofillon and Knidi of I.G.M.R. (1979a, b); the connection point of the two maps is indicated by a dashed line; b) general view of the locality, showing the collection points of the pan-trionychid and coral specimens (boxed areas detailed in c and d); c) close-up of the outcrop where the pan-trionychid fossil was collected; d) *Euphyllia* sp. in situ, the most common coral fossil in the locality; e) LGPUT GNE 001, a partial costal plate of Pan-Trionychidae from Neochori, Grevena (NW Greece) in (e1) dorsal, (e2) visceral, and (e3) anterior or posterior views. Scale bar equals 5 cm. Hammer used as scale in (c) and (d) measures 40 cm. Abbreviations (as in the original geological maps) are as follows: Ht: alluvial deposits; $M_{1\text{-}3}^{st,m}$: sandstones, marls and arenaceous marls of the Tsotylion series (late Aquitanian-Burdigalian); o: Jurassic ophiolites; Pl-Pt: Plio-Pleistocene deposits.