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GEOLOGY

First Find of the Tomakovka Beds in the Gerakleya Peninsula of Southwestern Crimea

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The Tomakovka Beds first defined near the eponymous settlement of the Dnepropetrovsk region [9] represent a reliable stratigraphic reference for the interregional correlation of Lower Miocene sections in the Eastern and Western Paratethys. They contain diverse assemblages of Mediterranean marine organisms and have been thoroughly studied [2, 3].

The Tomakovka Beds are now universally accepted to be Tarkhanian in age. The only difference between them and Tarkhanian sediments is that the latter are represented in the neostratotype of the Tarkhanian regional sediments in the Kerchenskii Peninsula exclusively by deep-water facies deposited in the lower part of the sublittoral zone, while Tomakovka sediments are represented by shallow-water facies.

Recent geological mapping has provided additional data on the almost universal distribution of Tarkhanian sediments in the Crimean Plain [6]. Of particular interest are finds of the mollusks *Chlamys* aff. *macrotis* (Sow.) in Tarkhanian sediments of the Alma Depression of the Crimean Plain [5]. This species has been reported from Neogene sediments of Europe [12]. The author of the present communication was the first to find the species in the Tomakovka Beds on the southern slope of the Ukrainian Shield [3]. Goretskii reported this species from the Fore-Carpathian Nagoryanka Beds [8] coeval with the Tomakovka Beds [2]. It should be emphasized that *Chlamys macrotis* (Sow.) is characteristic of the Carpathian regional stage of West and Central Europe. Finds of this species in Tarkhanian sediments of the Crimea substantiate their correlation with the Tomakovka Beds and the Carpathian regional stage of Europe.

Andrusov [1] was the first to establish Tarkhanian sediments in the Georgievskii Monastyr Ravine, and their age was substantiated by Moiseev [11] and Zhizhchenko [10]. We have studied these sediments in detail in the above-mentioned ravine on the coastal scarp exposed near the Diana Grotto [7] (figure), where one can see the following sedimentary succession on the eroded surface of Middle Jurassic volcanics (from the base upward):

1. Bentonitic clays with conglomerates enclosing *Lentipecten comeus denudatus* (Reuss). The thickness is 1.0 m.

2. Oyster bank with abundant molluscan shells including *Crassostrea gryphoides gingensis* (Schloth.), *Ostrea digitalina digitalina* Dub., *Pycnodonta cochlear* (Poli), and *Chlamys domgeri* (Mikh.); foraminifers (determinations by T.A. Ivanova) *Cibicidoides borislavensis* (Ais.), *C.* cf. *boueanus* (Orb.), *Cibicides* cf. *lobatalus* (W. et J.), *Protelphidium* aff. *insigne* (Pishv.), *Ammonia maschanliensis* (Pron.), *A. native* Koeen., *A. pseudobeccarii* (Putrja), *A.* ex gr. *beccarii* (L.), *Elphidium* cf. *macellum* (F. et M.), *E.* cf. *fichtellianum* (Orb.); ostracodes *Xesteleberis* sp.; scarce echinoderm spines, sponge spicules, *Spirorbis*, and fish bones and teeth. The thickness is 1.5–2.0 m.

3. Light gray sandstones with detritus and shells of mollusks *Ostrea edulis digitaliana* Dub., *Chlamys pertinax* (Zhizh.), *Gibbula tshokrakensis* (Andruss), *G. netas* (Koles.), *G. pictiformis* (Andruss.), *Bittium digitatum* Zhizh., *Cerithium cattleyae* Baily; abundant foraminifers (determinations by T.A. Ivanova) *Nubecularia* sp., *Quinqueloculina akneriana* Orb., *Q.* cf. *ungeriana* Orb., *Triloculina* cf. *gibba* Orb., *Pyrgo inornata* (Orb.), *Nodobaculariella* sp., *Spiroloculina* sp., *Articulina* sp., *Spirolina* sp., *Guttulina* sp., *Discorbis* sp., *Ammonia* ex gr. *beccarii* (L.), *Elphidium crispum* (L.), *E.* cf. *macellcum* (F. et M.), *E. angulatum* (Egger), *E.* ex gr. *rugosum* (Orb.), and *Neobulimina* cf. *elongata* (Orb.); ostracodes (determinations by O.M. Bondar) *Loxoconcha carinata alata* Schn., *Xestoleberis lutrae* Schn., *Pseudobythocythere dromas* Schn., *Eucyheropteron* cf. *inflatum* Schn., and *Pontocypris* aff. *vitrea* Suz.; common *Spirorbis*, branching bryozoans, and echinoderm spines and plates. The thickness is 6 m.

4. Light gray marl with *Spaniodontella pulchella* Baily. The thickness is 10–15 m.

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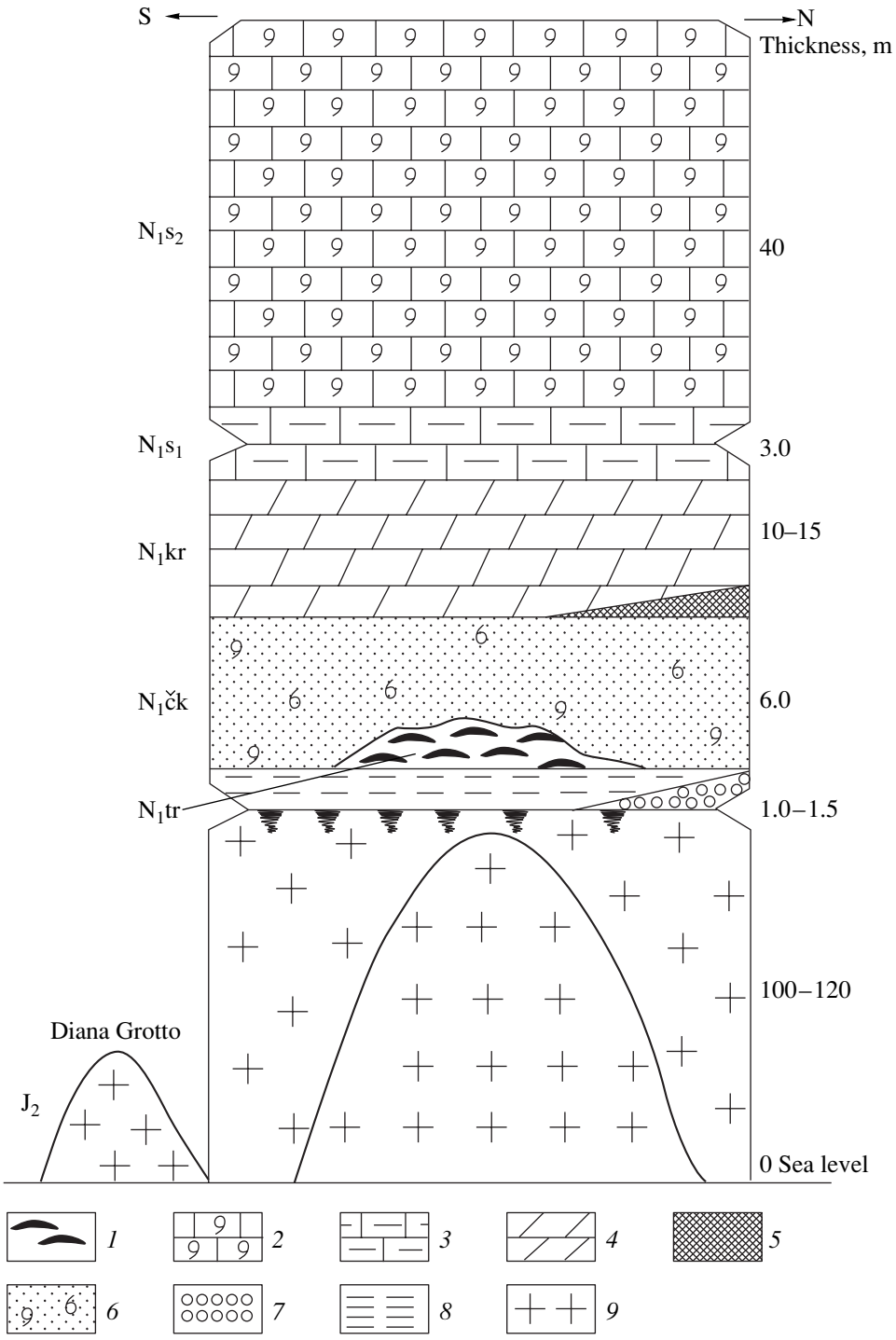

Fig. 1. Schematic Mesozoic–Cenozoic geological section of the Gerakleya Peninsula (Western Crimea). Arbitrary scale. (*1*) Oyster bank; (*2*) shelly limestone; (*3*) clayey limestone; (*4*) marl; (*5*) red marl with Pulmonata casts; (*6*) sandstone with molluscan shells; (*7*) conglomerate with *Lentipecten corneus denudatus*; (*8*) bentonitic clay; (*9*) intrusive and volcanic rocks; (J_2) Middle Jurassic Series; (N_1tr, N_1čk, N_1kr) Tarkhanian, Chokrakian, and Karaganian regional stages, respectively; (N_1s_1, N_1s_2) lower and middle Sarmatian regional substages, respectively.

In this succession, Bed 1 contains redeposited Tarkhanian conglomerates. Bed 2 corresponds to the Tomakovka Beds developed on the southern slope of the Ukrainian Shield. Bed 3 is coeval with the Chokrakian regional stage, and Bed 4 is a stratigraphic analogue of the Karaganian regional stage.

Of particular interest in this succession are sediments of Bed 2, which are similar in terms of the mol-

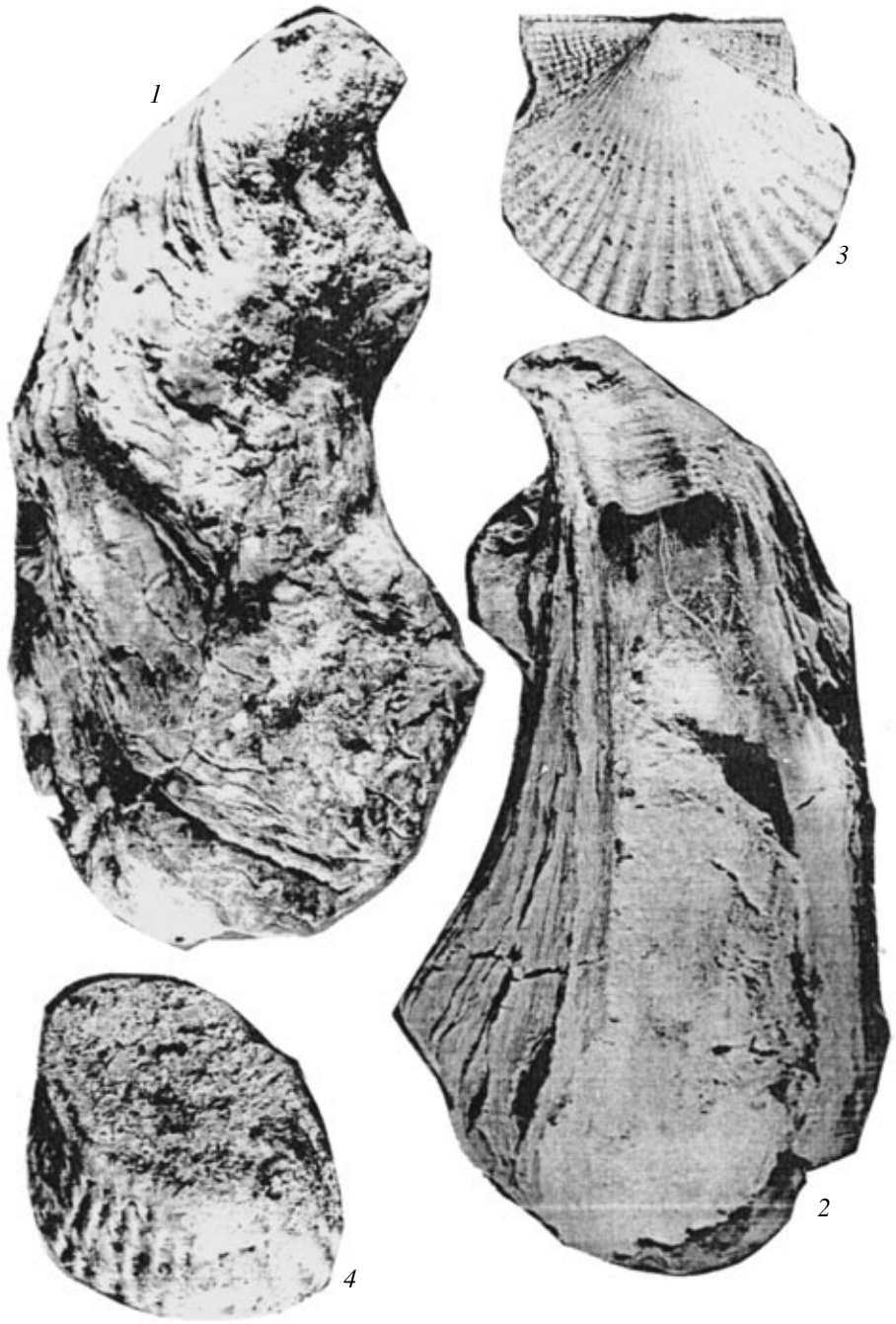

Fig. 2. Mollusks from the analogues of the Tomakovka Beds in the Gerakleya Peninsula of southwestern Crimea. (*1*) *Crassostrea gryphoides* (Schloth.) *gingensis* (Schloth.), external view of the left valve, ×0.9, Specimen G-17, Tarkhanian; (*2*) *Crassostrea gryphoides* (Schloth.) *gingensis* (Schloth.), internal view of the left valve, ×0.9, Specimen G-17, Tarkhanian; (*3*) *Chlamys domgeri* (Mikh.), external view of the left valve, ×1.5, Specimen G-18, Tarkhanian; (*4*) *Ostrea edulis digitalina* Dub., internal view of the left valve, ×1.5, Specimen G-19, Tarkhanian–Chokrakian.

luscan assemblage and its ecological affinity to the Tomakovka Beds on the southern slope of the Ukrainian Shield. Like in the Tomakovka Beds, large oyster shells belonging to the species *Crassostrea gryphoides gingensis* (Schloth.) and *Chlamys domgeri* (Mikh.), which is characteristic of this stratigraphic unit, are the main element of the molluscan assemblage from Bed 2. Similar oyster and pectenid faunas are typical of analogues of the Tomakovka Beds in shallow-water facies of the Western, Eastern, and Central Paratethys (Fig. 2). The find of analogues of the Tomakovka Beds in the Gerakleya Peninsula indicates that the Tarkhanian–

Carpathian transgression in the Ukrainian territory advanced from the Fore-Carpathian region [4] as two branches. One branch reached the Tomakovka, Kamenka, and Baburka settlements on the southern slope of the Ukrainian Shield, while another branch flooded southern areas of the Odessa region, Dobrudja foredeep, and the Gerakleya Peninsula in the Crimean Plain.

Thus, the finds of deep- and shallow-water facies of the Tarkhanian regional stage in the Crimean Plain, Kerchenskii Peninsula, and northern Black Sea region provide a convincing basis for their correlation with coeval sediments of the Crimean–Caucasian region and with the Carpathian regional stage of the Western and Eastern Paratethys. This type of correlation makes it possible to elaborate a reliable Miocene stratigraphic scale

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