



New inoceramid bivalves of the genera *Endocostea* Whitfield, 1877 and *Trochoceras* Heinz, 1932 from the Western Fore-Balkan (Bulgaria)

Нови иноцерамидни бивалвии от родовете *Endocostea* Whitfield, 1880 и *Trochoceras* Heinz, 1932 от Западния Предбалкан (България)

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The Western Fore-Balkan Mts., in the area between the towns of Mezdra and Cherven Bryag, is a broad foothill region, which is composed of gently folded Cretaceous–Eocene sedimentary rocks. The latter were deposited into an epi-platform (Santonian–Eocene) basin with shallow-water carbonate deposition that succeeded an earlier (Hauterivian–Aptian) basin, with shallow- to medium-depth carbonate-siliciclastic sedimentary filling. The Upper Cretaceous sequence-slice consists of moderately expanded Campanian–Maastrichtian carbonates into which four formal lithostratigraphic units have been recognized (Jolkičev, 1986): Darmantsi, Kunino, Mezdra and Kaylaka Formations. The macrofossil content of these rocks is composed of common inoceramids, rare ammonites and belemnites, and scattered echinoids and bryozoans.

The inoceramid bivalves have long been proven to be stratigraphically significant fossils when studying the Upper Cretaceous strata, as having both high evolutionary rates and wide geographical distribution (e.g. Walaszczyk et al., 2001, 2002). This also applies to the Upper Cretaceous sediments in Bulgaria where the age-defining macrofossils, such as ammonites, usually have too scattered occurrence. Excluding the calcareous nannofossils that have increasingly been used for the purposes of biostratigraphy and correlations of the Upper Cretaceous rocks (e.g. Sinnyovskiy, 2013) the inoceramids are the only available stratigraphic markers that allow an accurate age assessment. The area of the Western Fore-Balkan containing the Upper Cretaceous rocks, which are the subject of the present study, is not an exception. The sections that underpin this work have yielded diverse inoceramid faunas and a limited number of ammonites. Apart from a few species formerly reported by Jolkičev (1986), the inoceramids from this region has never been studied in detail.

For several field-trips, we have collected a splendid inoceramid material, including good examples of *Cataceramus*, “*Inoceramus*” *sensu lato*, as well as new representatives of the genera *Endocostea* and *Trochoceras* that were not previously known (see Fig. 1A–F). The bulk of the obtained material came from the Uppermost Campanian–Lower Maastrichtian interval in five instructive sections of the Kunino Formation. A few specimens were also collected from Mezdra and Darmantsi Formations. This account deals with the record of the genera *Endocostea* and *Trochoceras*, and the full description of the inoceramid record will be given elsewhere.

It is known that the inoceramids of the genus *Endocostea* Whitfield, 1877 are excellent Maastrichtian index-fossils. The advent of *Endocostea typica* Whitfield was selected as biostratigraphic marker defining the lower boundary of the Maastrichtian (see Walaszczyk et al., 2001, 2002). Another valuable species of the genus *Endocostea* is *E. coxi* (Reyment), which is typical for the uppermost part of Lower Maastrichtian and lowermost part of Upper Maastrichtian interval in the Euro-American region and the East African Province (Walaszczyk et al., 2002). We found well-preserved inoceramids of both species. *Endocostea typica* were collected from two sections: Reselets and Kunino (Fig. 1D, F). In Kunino section, the record of *E. typica* was not supported by other inoceramids from lower levels, whereas in Reselets section this species was found in superposition above the presence of “*Inoceramus*” *wyomingensis* Walaszczyk, Cobban & Harries, 2001. Perhaps, the Reselets section contains the best inoceramid succession of the studied area and we will be able to draw the Campanian/Maastrichtian boundary by inoceramids. Our record of *E. coxi* also comes from three sections: Kunino (Fig. 1E), Reselets (Fig. 1G) and Darmantsi. Interestingly, the first appearance of

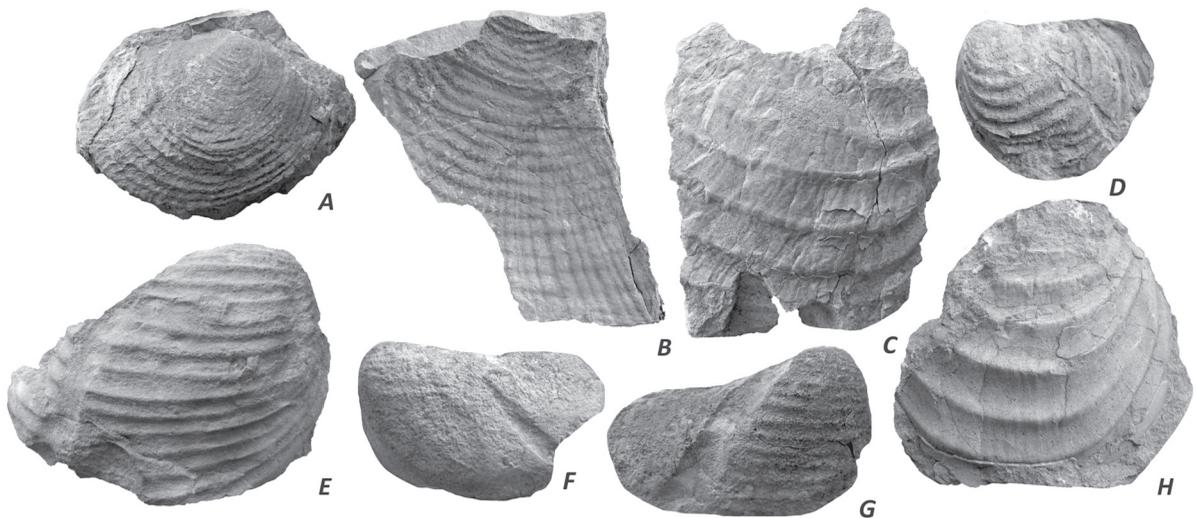


Fig. 1. Inoceramid bivalves from the Western Fore-Balkan (Bulgaria): *A, B, Trochoceramus costaeus* (Khalafova), section Rumiantsevo (lower part), Kunino Fm. (Uppermost Campanian), $\times 0.5$; *C, H, Trochoceramus radiusus* (Quaas), section Darmantsi (lower part), Darmantsi Fm. (middle part of the Lower Maastrichtian), $\times 0.5$; *D, F, Endocostea typica* Whitfield: *D*, lower, and *F*, middle part of section of Kunino, Kunino Fm. (Lower Maastrichtian), $\times 1.0$; *E, G, Endocostea coxi* (Reyment), $\times 1.0$: *E*, section Kunino (middle part), Kunino Fm. (Lower Maastrichtian), *G*, section Reselets (upper part), Kunino Fm. (Lower Maastrichtian)

this taxon was found to be coeval with that of *E. typica* in section Reselets, whereas in section Darmantsi *E. coxi* is coeval with *Trochoceramus radiusus* (Quaas). The latter evidence suggests an earlier onset of *E. coxi* than recorded outside Bulgaria.

The genus *Trochoceramus* Heinz, 1932 displays very characteristic ornamentation, which is composed of concentric commarginal rugae and weak to moderately well-developed radial ornament. It has never been discovered in Bulgaria before, but we had a chance to collect a few specimens that refer to two species: *T. costaeus* (Khalafova) (Fig. 1A, B) and *T. radiusus* (Quaas) (Fig. 1C, H). The former species was defined on inoceramids from section Rumiantsevo that displayed closely spaced and fine concentric rugae and radial ribs, whereas the latter was identified on examples from the sections Reselets, Darmantsi and Moravitsa that have more widely spaced commarginal rugae and less pronounced radial ornament. *Trochoceramus costaeus* was erected as index-species of the eponymous Uppermost Campanian inoceramid zone (Walaszczyk et al., 2002), and our specimens indicate the presence of this zone in Bulgaria. The advent of *T. radiusus* defines the base of the eponymous zone in the upper part of the Lower Maastrichtian (Walaszczyk et al., 2002). In section Reselets, it was found slightly above the last occurrence of *E. typica* that means the middle part of the Lower Maastrichtian. In sections Darmantsi and Moravitsa, this species associates with large specimens of *Cataceramus* and “*Inoceramus*” *sensu lato*, and this suggests a higher stratigraphic position of *T. radiusus*, probably referring to the middle or the upper part of the Lower Maastrichtian.

It became evident from the above stated notes, that the Upper Cretaceous rocks from the studied area have the potential to be subdivided in terms of their inoceramid successions. Apart from the genera *Endocostea* and *Trochoceramus*, there are many more inoceramids that occur in several distinct faunal horizons, and the drawing of the Campanian/Maastrichtian boundary by inoceramids seems possible. Both *Endocostea* and *Trochoceramus* appear to be fine biostratigraphic markers that can be used for precise correlation with other coeval inoceramid assemblages both in Bulgaria and elsewhere.

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