Towards a standard calpionellid zonation of the Mediterranean Realm (Tithonian to Valanginian)

Предпоставки за приемане на стандартна калпионелидна зонална схема за Медитеранската област от Титонския до Валанжинския етаж

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Introduction

The intensive recent calpionellid studies in many regions of the Early Cretaceous Mediterranean Realm led to the accumulation of comprehensive and precise record of successive calpionellid bioevents in the time interval from the mid-Tithonian to Lower Hauterivian. These bioevents are often directly correlated to ammonite zonations, magnetic polarity chrons and the evolutionary events in calcareous nannofossils and calcareous dinocysts. Calpionellid zonation is crucial in detailed subdivision of early Lower Cretaceous pelagic and hemipelagic carbonate sequences. This report aims at synthesizing the achievements in calpionellid zonation in the Mediterranean during the last 25 years and proposing a zonal standard valid from Mexico to Iran. The summary of calpionellid zonations of the publications referred is confirmed and refined by the present authors with results from Bulgaria and Eastern Serbia.

Results

The successive events in the calpionellid evolution shown in Fig. 1 are used in definition of the zonal/subzonal boundaries. These events are mostly first occurrences, with exception of a couple of last occurrences and the “explosion of sphaerical form of *C. aplina*” which marks the base of Calpionella Zone. All 11 calpionellid bioevents were largely recorded in this successive order in the Carpathian-Balkan region but also elsewhere in Europe, and in Central America, North Africa and Asia. Due to documented controversies in the recorded vertical ranges the zonation here presented excludes such FO events and subzones/zones as bermudezi Subzone in Chitinoidella Zone, colomi Subzone in Crassicollaria Zone, cadishiana Subzone in Calpionella Zone, C zone based on the abundance of large *Tintinnopsella carpathica* and D3 subzone based on the FO of *Lorenziella hungarica*.

As a result of direct correlations between ammonite and calpionellid zones, the following calpionellid zones and subzones enhanced their chronostratigraphical value, thus their bases could surve as indicators of the lower stage/substage boundaries of the Geological Time Scale: Chitinoidella boneti Subzone for the Upper Tithonian, Calpionellopsis Zone for the Upper Berriasian, Calpionellites Zone for the Valanginian, Tintinnopsella Zone for the Upper Valanginian. The base of Calpionella alpina Subzone is slightly above the base of Berriasian, i.e. the base of Berriasella Jacobi ammonite zone.

Recent studies focus on detailed succession of calpionellid events in the Upper Tithonian and Lower Berriasian tied to ammonite and/or nannofossil ones, as well as to magnetic polarity chrons with the purpose to define the base of Berriasian in a way to be applicable in both the Tethyan and Boreal realms. The avalanche of joint microfossil and magnetostratigraphic studies in 21-th century has shown, however, that none of the magnetic polarity chron boundaries coincides with a calpionellid zonal/subzonal boundary. A promising exclusion is the base of M19r magnetozone which almost coincides with the FO of *Calpionella grandalpina* and/or *Calpionella alpina* (Houša et al., 2004) and thus, with the base of the second subzone of Crassicollaria Zone known as intermedia or brevis or massutiniana, as here designated. At the same stratigraphic level important calcareous nannofossil and calcareous dinocyst bioevents were also reported.

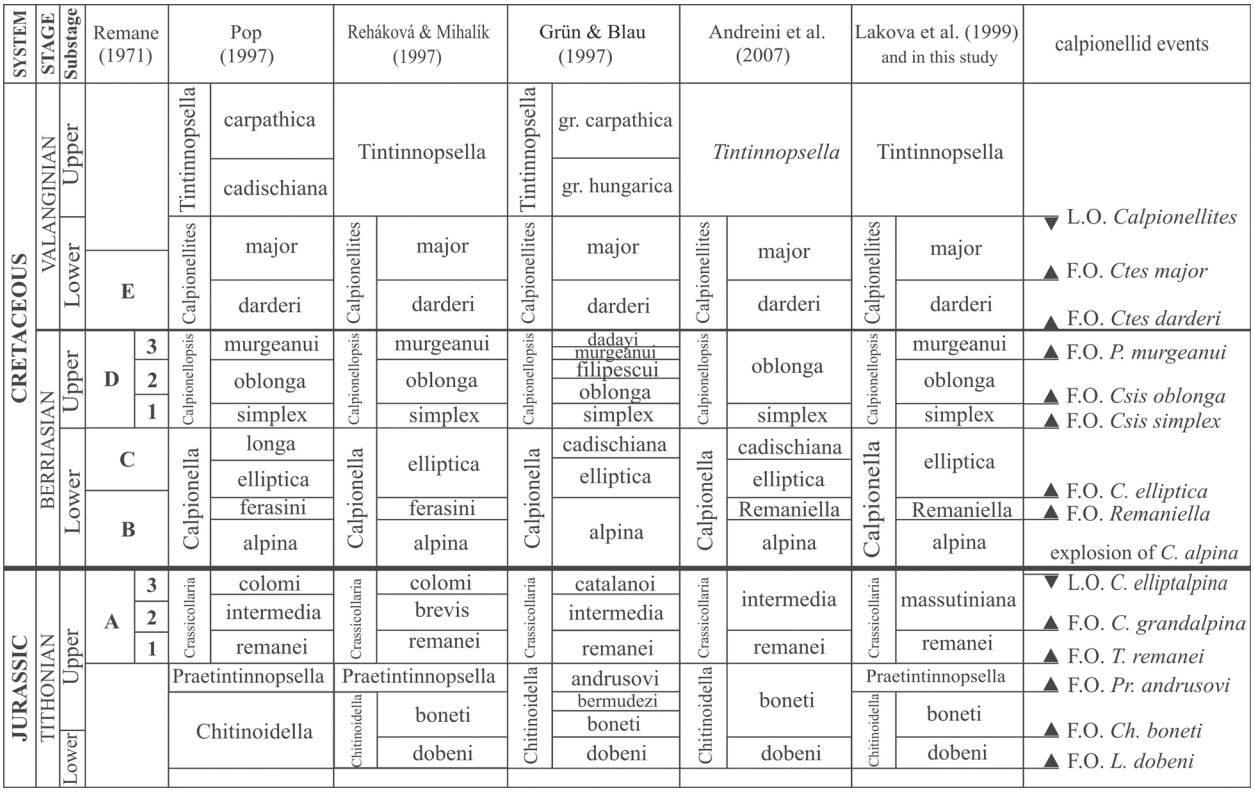

Fig. 1. Correlation of calpionellid zonation in the Mediterranean Realm and calpionellid bioevents

Conclusions

The modern detailed calpionellid zonal and subzonal scheme which was first eatablished in the Western and Southern Carpathians in Romania and Slovakia, respectively, (Pop, 1997; Reháková, Michalik, 1997) and confirmed in Sicily (Italy) is being applied in the Balkan Mts of the west Bulgaria and east Serbia (Lakova et al., 1999 and this study). It works also in the Tithonian to Valanginian pelagic carbonates in Cuba, Spain, Poland, Hungary, Austria, Iran, etc. On the other hand, the fairly different zonation by Grün and Blau (1997) from northern Italy is only partly applied in its Tithonian part in North Africa. Thus, the "Carpathian" calpionellid zonation needs just insignificant refinement and precision towards its formal approval as standard for the Mediterranean Realm.

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