Origin of the Early-Middle Jurassic stratigraphic gaps in the Central Balkanids

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Introduction

Numerous stratigraphic gaps are known from the Bulgarian Lower and Middle Jurassic sections. The more considerable of them *a priori* have been accepted as a result of regressions, emersions, erosion and new transgressions.

The most attractive among the Early-Middle Jurassic gaps in this country is the pre-Callovian stratigraphic gap which is very well developed in the Central Balkanids. We made a palaeoecologic (Sapunov) and microfacial (Belivanova) study of the sediments just below and above the gap in limited localities where the gap is a diastem and usually is marked by hardgrounds. Beside this, we made a similar research in continuous Bathonian-Callovian sections in the West Balkan Range. The aim of this research was the comparison between the depositional environments of the continuous Bathonian-Callovian sediments and the Bathonian and Callovian from the cover and the basement of the pre-Callovian diastem in the Central Balkanids.

The Bathonian-Callovian sequences near the village of Gintsi, Sofia District, West Balkan Range

The Callovian is situated in the first 1 m of the Yavorets Formation. It is represented by dark grey micritic limestones with ammonites. In the very base of the Formation *Macrocephalites* spp. (Lower Callovian) are found. In the higher levels representatives of *Hecticoceras* (subgenera) (Middle-?Upper Callovian) have been established.

In the highest 2 m of the Bov Formation (clayey limestones and marls) which lies below the Yavorets Formation *Clydoniceras cf. discus* (index of the highest Upper Bathonian ammonite zone) is found. The above-cited ammonite succession shows that near the Bathonian-Callovian boundary a stratigraphic gap does not exist.

As a result of the microfacies study from the lowermost 10 cm of the Yavorets Formation a pelagic wackestone was described. It is built up mainly of abundant filaments from thin-shelled bivalves (Атанасов, 1953, 1957; Атанасов, Стоянов, 1956; Начев, 1957; Начев, Сапунов, 1959; Koleva-Rekalova et al., 2002). In the older Bulgarian literature (1953-1959) it is well-known as “nematic structure” or “fibrous microstructure” represented by algae. Koleva-Rekalova et al. (2002) considered that these filaments belong to *Bositra*. This microfacies is correlated with the Standard Microfacies Type 3 — “pelagic mudstone and wackestone” (Wilson, 1975; Flügel, 1982). Limestones with filaments can be classified as deposits in subtidal (subbital) and bathyal environments (Flügel, 1982).

Mud supported texture with rare crinoid fragments as well as filaments of thin-shelled bivalves is typical for the clayey limestones/marls. The deposition of this sediments is possible to proceeds in calm marine environments of moderate depth, without intensive current energy.

These conclusions are in consent with the Bathonian-Callovian faunal spectrum established in the region of the Gintsi village. Beside
the above cited ammonite taxa in the Callovian part of the spectrum take part some Pseudoperisphinctidae and single Phylloceratina. The spectrum shows that during the Bathonian and the Callovian the depositional environments are in the framework of a lower part of the deep sublittoral — depth about 150-200 m.

The pre-Callovian stratigraphic gap in the Teteven District (Central Fore-Balkan)

The cover of the gap

The gap is covered by the grey micritic limestones of the Yavorets Formation in which have been collected numerous of ammonites of Hecticoceras (subgenera), single Kosmoceras, Choffatia etc.

The joint presence of Kosmoceras spinosum (Upper Callovian) and Choffatia (Upper Bathonian—Middle Callovian) proves that the lowermost 10 cm of the Yavorets Formation belong to condensed Middle-Upper Callovian.

Two microfacies types have been distinguished in the basement of the Yavorets Formation in the Teteven District (Polaten, Koznitsa River and Kostina River sections): bioclastic-peloidal packstone/grainstone and mudstone/wackestone with filaments of thin-shelled pelecipods. The first microfacial type could be correlated with the SMF Type 2 — “microbioclastic calcisiltite”. Open sea shelf or deep shelf margin are the possible environments of the deposition. The mudstone/wackestones with filaments of thin-shelled bivalves are correlated with the SMF 3 — “pelagic mudstone and wackestone” which deposition is connected with the deep sublittoral environment (deep shelf margin).

These conclusions are in consent with the faunal spectrum established in the Teteven District. Beside the ammonites, which predominate in the spectrum present brachiopods. The ammonites belong only to Ammonitina. In comparison with the faunal spectrum from the lowermost levels of the Yavorets Formation, here are presented some elements which indicate more shallow conditions — greater quantity of the benthos, and absence of Phylloceratina. These arguments give us grounds to consider that the sedimentation of the uppermost levels of the Polaten Formation proceeds in shallower conditions of the deep sublittoral — the depth was about 100-150 m.

The basement of the gap

It is represented of sandy bioclastic limestones of the Polaten Formation. From the uppermost 10 cm of the Formation are found Oecotraustes (Paroecotraustes) serrigerus (Upper Bathonian, lower part), O. (P.) glojanensis (ibid.) etc. These species together with other non cited here taxa prove that the uppermost levels of the Polaten Formation belong to the lower part of the Upper Bathonian, Prohecticoceras retrocostatum Zone.

In the uppermost part of the Polaten Formation in Teteven District (Polaten, Koznitsa River and Kostina River sections) one microfacies type have been distinguished: bioclastic-lithoclastic packstone/rudstone. To some extent it can be attributed to the SMF 4 — “bioclastic-lithoclastic packstone”. It may be supposed that the features of this texture direct probably towards the more shallow parts of the deep sublittoral environment.

This conclusions are in consent with the faunal spectrum established in the Teteven District. Beside the ammonites, which predominate in the spectrum present brachiopods. The ammonites belong only to Ammonitina. In comparison with the faunal spectrum from the lowermost levels of the Yavorets Formation, here are presented some elements which indicate more shallow conditions — greater quantity of the benthos, and absence of Phylloceratina. These arguments give us grounds to consider that the sedimentation of the uppermost levels of the Polaten Formation proceeds in shallower conditions of the deep sublittoral — the depth was about 100-150 m.

The pre-Callovian stratigraphic gap in the Troyan, Kazanluk and Gabrovo Districts (Central Balkan Range)

Because of the more or less intensive submarine washout, from the west to the east the duration of the pre-Callovian stratigraphic gap almost gradually increased. Its lower boundary is found in more lower Middle Jurassic levels (Troyan District), in Lower Sinemurian levels (Gabrovo District), and even in Upper Triassic levels (izolated localities in Kazanluk District).

The cover of the gap

Like in the Teteven District, the cover is represented by the micritic limestones of the Yavorets Formation. In the lowermost 10-20 cm of the Formation numerous ammonites as well as single benthic representatives have been found. The joint presence of the Upper Callo-
vian Kosmoceras compressum together with the middle Callovian Hecticoceras (Zieteniceras) tuberculatum and H. (Rossieniceras) metomphalum acuticosta prove that the lowermost part of the Yavorets Formation belongs to condensed Middle and Upper Callovian, like in the Teteven District.

One microfacies type have been distinguished in the basement of the Yavorets Formation in Gabrovo District. It is described as pelagic mudstone. Mud supported texture with single allochems of thin-shelled pelecypods as well as undefined micritic fragments (peloids?) are characteristic for this sediments. This microfacies type could be correlated with the SMF Type 3 "pelagic mudstone and wackestone". It formation is connected with quite low energy environment in the conditions of the deep shelf margin.

These conclusions are in consent with the faunal spectrum established in the Trypto, Kazanluk and Gabrovo Districts. Here the ammonites strongly predominate among the faunas. Ammonitina repeatedly exceeded Phylloceratina (Lytoceratina are not found). Single bivalves, brachiopods and belemnites are presented too. This spectrum is connected with the lower part of the deep sulittoral environment — depth about 150-200 m.

Conclusions

1. The results of our palaeoecologic and microfacial study of the basement and the cover of the pre-Callonian stratigraphic gap prove that the gap has been realized in submarine conditions, especially in the deep sublittoral. They throw away the former ideas which connected this gap with a Bathonian regression, a Late Bathonian-Early Callovian emersion and erosion, and a Middle-Late Callovian transgression. The others known inner Early-Middle Jurassic stratigraphic gaps (all of them more insignificant in comparison with the pre-Callonian gap) have been realized in submarine conditions.

2. The bathimetric conditions which have existed during the sedimentation of the cover and the basement of the pre-Callonian gap are similar to the conditions which have existed during the continuous Bathonian-Callovian sedimentation.

3. The transition from submarine stratigraphic gap to a normal sedimentation (in which the biostratigraphic superposition can be followed) passes through a stage of very slow initial sedimentation (represented by condensation of the Middle and Upper Callovian).

4. As a result of the study of the pre-Callonian stratigraphic gap, it outlines a general natural development according to which four stages are differentiated: normal sedimentation → slow sedimentation → submarine stratigraphic gap (result of pause in the sedimentation — diastem) → submarine stratigraphic gap (result of washout). In some occasions the four stages can be followed (as in the example with the pre-Callonian stratigraphic gap). In others only two or three stages have been realized.

References

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