CARBONATE DEPOSITIONAL FACIES FROM THE DĂMBOVICIOARA AREA
(SOUTH PIATRA CRAIULUI MASSIF)
NEAR THE JURASSIC-CRETACEOUS BOUNDARY
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Abstract: Dămbovicioara area was selected for studying the Jurassic/Cretaceous boundary due to its particular feature. Here the Upper Jurassic shallow water limestones show sharp lateral facies changes controlled by a synsedimentary tectonic activity, while the Lower Cretaceous deeper water limestones are more homogeneous and sedimentation seems to be controlled mainly by sea level changes. Associated with this major facies change, several hardground surfaces and glauconitic limestones appear. They were mainly controlled by tectonic movements than the sea level change. The hardgrounds are not isochronous in all compartments so they cannot be used as a chronostratigraphycal limit for regional correlation.

Key words: J/K boundary, hardground, glaucony, carbonate facies

Introduction

Dămbovicioara area has a key position for understanding the geological evolution of the area between Piatra Craiului and Bucegi Mountains during Late Jurassic - Early Cretaceous time. The sedimentation was almost continuous, and predominantly in a carbonate facies during Late Jurassic - Early Cretaceous time span within the so-called "Getic Carbonate Platform" (Patruilus et al., 1976). Sedimentation gaps, like diastems, are not widespread and diachronous. Usually during these gaps, hardgrounds formed.

One of the main controversy regards the position of the Jurassic/Cretaceous boundary, which is usually put on the lithofacial criteria, due to lack of paleontological evidences, above the hardground surface. The Lower Cretaceous deposits are well known for the reach ammonite and foraminiferal faunas (Neagu, 1975, Patruilus & Avram, 1976), but this is not the case for the first 20m above the hardgrounds. The oldest Cretaceous faunas found belong to the Trinodosum Zone and Calidiscus Zone (Upper Valanginian (Avram, 1988, Avram & Gradinaru, 1993, fig 1).

The aim of our preliminary study focusses criteria to be used and caution to be taken in identifying the position of the Jurassic/Cretaceous boundary. The samples were collected from Orata Valley, Cetatea Neamțului, Dămbovicioara Valley.

Geological setting

The Upper Jurassic deposits consist of shallow water limestones (Strambeeld facies) showing high lateral variations and a general shallowing upward trend. Coralgal (Pl. I fig. 1) deposits seem to be contemporaneous with back-reef deep lagoons (Garwoodia sp. det. O. Dragastan), carbonate talus deposits, and with tidal flat deposits. The reefs are developed only as small patch reefs and they were formed in high wave energy environment in the windward side of the platform. In the internal part, skeletal and oolite grainstones overlaid by thick intertidal mudstones and wackestones can be found. A reef talus formed by intraclastic and bioclastic limestone surrounds the platform, and the clastic material was exported from the edge of the platform. This pattern suggests a fragmented carbonate platform formed in an extensional syntectonic regime.

Contrasting to the Upper Jurassic pattern, the Lower Cretaceous deposits show a quite uniform facies distribution, typical for medium water deep (50-200m). Even if the facies is mainly a carbonate one, the siliciclastic input from the land became significant. This deposits consists of bioclastic mudstones and wackestones, moderate to well sorted. The

Fig. 1. Synthetic lithostratigraphical column in the Dămbovicioara area
bioclasts are formed by fragments of echinoids, sponge spiculae and benthic forams (Pl. I, fig. 2,3).

On the upper part of the Stramberk facies, several well-developed hardgrounds were formed. These surfaces are associated with sudden change in lithofacies. The substrate of these hardgrounds are lithic-carbonate (Bromley, 1994) strongly affected by bioturbations and secondary cementsations. Biotic structures observed here are dominated by biocorrosion due to the endoliths.

**Hardground description**

The hardground surfaces were detailed examined in thin section to characterise the diagenetic processes and the effect of bioturbation. In this case the cementation pattern is due mainly to the early diagenesis during a sedimentation gap or a very low sedimentation rate.

Skeletal grainstones belonging to the Stramberk facies are cemented by isopachous layers of fibrous or drusy calcite as the first cement generation, later followed by micrite meniscus cement and micrite infills. These cementation types are characteristic for the shallow to medium water deep marine diagenetic environment. During the burial diagenesis, a syntaxial overgrowth around echinoidal plates formed, equant and poikilitopic cement partially replaced the early cements.

On the hardground surface the lithic substrate was mineralised by calcium phosphate, glauconite and goethite. This mineralisation suggests oxidised condition in a high wave energy and slow sedimentation, but there is no evidence for subaerial exposure.

The bioturbations cut the grains and the early cement, thus proving the high lithification degree prior to these biotic activities. Usually bioturbations show a very simple behaviour patterns, such domiciles (Domiclinia) and are represented by macroborings as ichnogenus Trypanites - having a single aperture, very often with geopetal infill (Pl. I fig. 6) and ichnogenus Entobia - having branchings and multiple apertures (Pl. I fig. 5). The Entobia ichnogenus is represented by macroborings ranging from 0.2 cm to 4 - 5 cm (Pl. I fig. 4, 5) which are typical for bathyal settings (Bromley, 1994).

Lithification rate can be estimated (Wilson and Palmer, 1992) taking into account the primary porosity and permeability, the sedimentation rate, the water composition and degree of bioturbation. In this case the porosity and vertical permeability for grainstone and packstone cements was quite high, the sedimentation rate was extremely low, judging after cement types, the water composition was CaCO₃ saturated and the bioturbation degree was moderate to high. All these parameters, combined with the thin thickness of the hardground (only cm to several tens of cm) allowed us to estimate the lithification rate as a rapid one: hundreds to thousands of years.

Associated with the hardground, there are two glauconitic limestone units ranging from 30 - 120 cm. but the thickness is quite difficult to be estimated due to tectonical deformation. The glauconite consists of peloids, which represent about 40 % and are cemented by micrite and sparry calcite. Most of the peloids are coated by ferrous oxy hydroxide. The presence of this kind of coated glaucony peloids (Eh = 0, Fe²⁺/Fe³⁺) suggests changing in water depth, low sedimentary rate and a peculiar hydrodynamic activity on the sea floor. The glauconitic limestone contains a sparse bioclastic debris of echinoids, sponges spicules, benthic forams and locally can be seen nodular features occurring in the whole basal unit (Dâmbovicioara Valley).

**Conclusions**

A regional approach of the Upper Jurassic deposits from the studied area, show sharp lateral (coeval) facies changes controlled mainly by bathymetry and suggesting a synsedimentary tectonic activity (vertical movements) and the presence of different compartments with different bottom morphology (fig. 2). During the Lower Cretaceous the facies are more homogeneous and sedimentation seems to be controlled mainly by sea level changes and existent basin morphology.

In our opinion the development of the hardground and the subsequent glauconite limestone were mainly controlled by tectonic movements than the sea level change.
In this case the hardgrounds are not isochronous in all compartments and this could be an argument not to use the hardground as a chronostratigraphical limit and to use it with caution in regional correlation. There are places where more than one hardground surfaces occur both within the Stamberg limestone and glauconitic limestone (Avram & Gradinaru, 1993).

The time required for hardground development was estimated to be by order of thousands years based on diagenetic features. No evidence of subaerial erosion exist but also no evidence for what happened during Berrissian - Upper Valanginian time span or if this interval is totally missing. Thus the Jurassic/Cretaceous boundary in this setting is still a problem and its solving requires both paleontological and sedimentological criteria applied specifically for each outcrop.

References:


Captions of Plate

Plate 35. I

Fig. 1 Coralgal facies in Upper Tithonian (Garwooodia sp.)
Fig. 2,3 Mudstone and wackestone, Lower Cretaceous with echinoderms, sponge spicules and forams debris
Fig. 4 Macroborings of *Entobia* on the hardground surface
Fig. 5 Branching borings of *Entobia* ichnogenus in thin section (0.3mm in diameter)
Fig. 6 Boring of *Trypanites* ichnogenus with geopetal infill in thin section (0.4mm in diameter)