PRESSURE DISSOLUTION FABRICS OF SOME JURASSIC AND LOWER CRETACEOUS LIMESTONES OF WESTERN BULGARIA

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Abstracts. Two examples of limestones with different pressure dissolution fabrics are presented. They come from some Middle-Upper Jurassic and Lower Cretaceous sections of Western Bulgaria. Middle Jurassic (Callovian) limestones show a distinct flaser structure, resulting of pressure dissolution diagenetic processes under burial condition. The Upper Jurassic-Lower Cretaceous limestones of Glozhene Formation are dolomitized in various degrees as a result of the same diagenetic processes. Callovian age of the limestones is determined by calcareous nannofossils for the first time in Bulgaria.

Key words: calcareous nannofossils, pressure dissolution, flaser structure, burial dolomitization, Jurassic–Lower Cretaceous, Western Bulgaria

Introduction

Carbonate sediments undergo gravitational loading or tectonic stress in burial environments (Wanless, 1979). The response of uncemented carbonate sediments to overburden is mechanical and/or chemical (intergranular pressure dissolution) compactions. The resulting limestones mainly acquire diagenetic structures as nodular, flaser, etc. In some cases the formation of secondary (burial) dolomite in limestones is related to pressure dissolution processes. Three different styles of pressure dissolution are distinguished: (1) fitted fabric; (2) dissolution seams and (3) stylolites (Clary and Martire, 1996).

Two examples of Jurassic and Lower Cretaceous limestones of Western Bulgaria with different pressure dissolution fabrics are discussed in the present study: Callovian limestones of Gorni Lozen section and Upper Jurassic-Lower Cretaceous limestones (Glozhene Fm.) of Komshtitsa, Barlya and Gorno Belotintsi sections (fig. 1).

Results and discussion

The Middle Jurassic (Callovian) limestones are exposed in a quarry around the village of Gorni Lozen (Lozen Mountain), near to the town of Sofia (fig. 1). Their total thickness is about 5.5 m. The studied succession is composed of medium to thick-bedded limestones with a massive appearance and in the middle part the limestones are thin-bedded with a distinct flaser structure (fig. 2).

Because the age of these limestones was not determined until now, we made a detailed micropaleontological sampling for biostratigraphic purposes. The examined samples yielded calcareous nannofossils – poorly to moderate preserved. A total of 8 species were identified (fig. 2). Callovian age of the sediments is inferred by the co-occurrence of *Cyclagelosphaera margerelii* Noel and *Ellipsagelosphaera ovata* (Bukry) Black (first occurrences at the Bathonian/Callovian boundary), as well as the presence *of Cy. deflandrei* (Manivit)*, Ellipsagellosphaera britanica* (Stradner) Perch-Nielsen*, E. lucasi* Noel*, Watznaueria barnesae* (Black) Perch-Nielsen and *W. biporta* Bukry in the nannofossil association.

Petrographic observations show that the massive limestones consist of filament wackestones and packstones. The filaments are of thin-shelled bivalves of the genus *Bositra*. *Bositra buchi* (Romer) is a pectinacean of Toarcian to Oxfordian age (Jefferies and Minton, 1965). The filaments are about 10% in the wackestones (mud-supported texture). Most probably the previously uncemented sediments underwent only mechanical compaction under burial conditions. Now scarce shells are flattened, aligned parallel to bedding and often broken. The filaments are about 75-80% in the massive packstones. Homogenous bivalve-supported beds, non-cemented before burial, were compacted first by mechanical compaction and later by chemical process. In these cases grain-supported sediments developed fitted fabric (Clary and Martire, 1996). In thin section we see that the shells are flattened and they have grain-to-grain contacts with insoluble residue at the boundaries between filaments. Neomorphic recrystallization of bivalves with syntaxial overgrowth is observed too.

The filament-rich packstones from the middle part of the succession show a flaser structure – clay-rich composite (anastomosing) dissolution seams (1-2 mm thick) surround small ellipsoidal bodies or lenses of relatively pure limestones (fig. 2). This type of structure was formed during late burial diagenesis in response to mechanical compaction (with generation of a fitted fabric in lenses – fig. 3) and pressure dissolution of calcium carbonate (with formation of composite dissolution seams). Dissolution seams are commonest in mud-supported lithologies (Clary and Martire, 1996). This structure resembles to flaser structures in Upper Cretaceous chalks of Southern England described by Garrison and Kennedy (1977).

Some Upper Jurassic-Lower Cretaceous limestones of Glozhene Formation were dolomitized by a pressure dissolution process under burial conditions. These limestones are investigated in three sections – Komshtitsa and Barlya ones are located in the West Balkan Mountain and Gorno Belotintsi section is situated in the West Fore-Balkan (fig. 1). In Komshtitsa and Barlya sections 48 m and respectively 37 m of gray hard micritic limestones are exposed. The thickness of the same limestones in Gorno Belotintsi section is about 240 m. The age of these sediments is proven to be Middle Tithonian to Berriasian (Lakova, 1993; Lakova et al., 1999). The Glozhene Formation is underlined by the Gintsi Formation (pink and gray nodular limestones) and covered by Salash Formation (alternation of micritic limestones, clayey limestones and marls).

The thin section observations show that the Glozhene Formation is mainly composed of micritic limestones (microfossiliferous mudstones and wackestones). The matrix amount varies from 85 to 95%. It consists of micrite that in some places is slightly recrystallized in microspar. Microfossils are the main allochems. Calpionellids, calcareous nannofossils and calcareous dinocysts were examined in detail (Lakova, 1993; Lakova et al., 1999). There are also foraminifers, radiolarians and calcitized spicules of siliceous sponges. More rarely crinoidal bioclasts are observed. Thin dissolution seams are observed into the micritic matrix in some thin sections. Thicker dissolution zones, which consist of some anastomosing dissolution seams, are present too. The dissolution seams and zones are stained by ferric oxides in various degrees. Abundance in dolomite rhombs is observed mainly in dissolution zones. In some cases single dolomite rhombs are presented at the matrix and some recrystallized bioclasts. Dimensions of the dolomite crystals vary from 0.010 x 0.015 to 0.10 x 0.15 mm. The dolomite amount is variable – from single crystals to 5-10%.

Under pressure from overburden the limestones were locally subjected to excessive stress. The limestone dissolution occurred at these stress foci. Insoluble materials (e.g. ferric oxides) were concentrated along dissolution seams. If magnesium was available during pressure dissolution, dolomite crystals grew in the vicinity of the surface or zone of dissolution (Wanless, 1979). Most probably magnesium for dolomite generation in the Glozhene limestones came from a neomorphic process (as micrite conversion to microspar) and/or dissolution of some skeletal fragments that were composed of high-magnesium calcite (as crinoidal bioclasts).

Conclusions

In burial condition carbonate sediments undergo mechanical and chemical (intergranular pressure dissolution) compactions. The resulting limestones show various pressure dissolution fabrics. In this study we present two typical examples of Jurassic and Lower Cretaceous limestones of Western Bulgaria with different burial evolution.

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Fig. 1. Location of the studied sections.

Fig. 2. Lithological structures and calcareous nannofossil occurrence in the limestones of Gorni Lozen section.

Fig. 3. Microphotograph of fitted fabrics of *Bositra*'s shells and dissolution seams in limestones with flaser structure (sample GL 12).

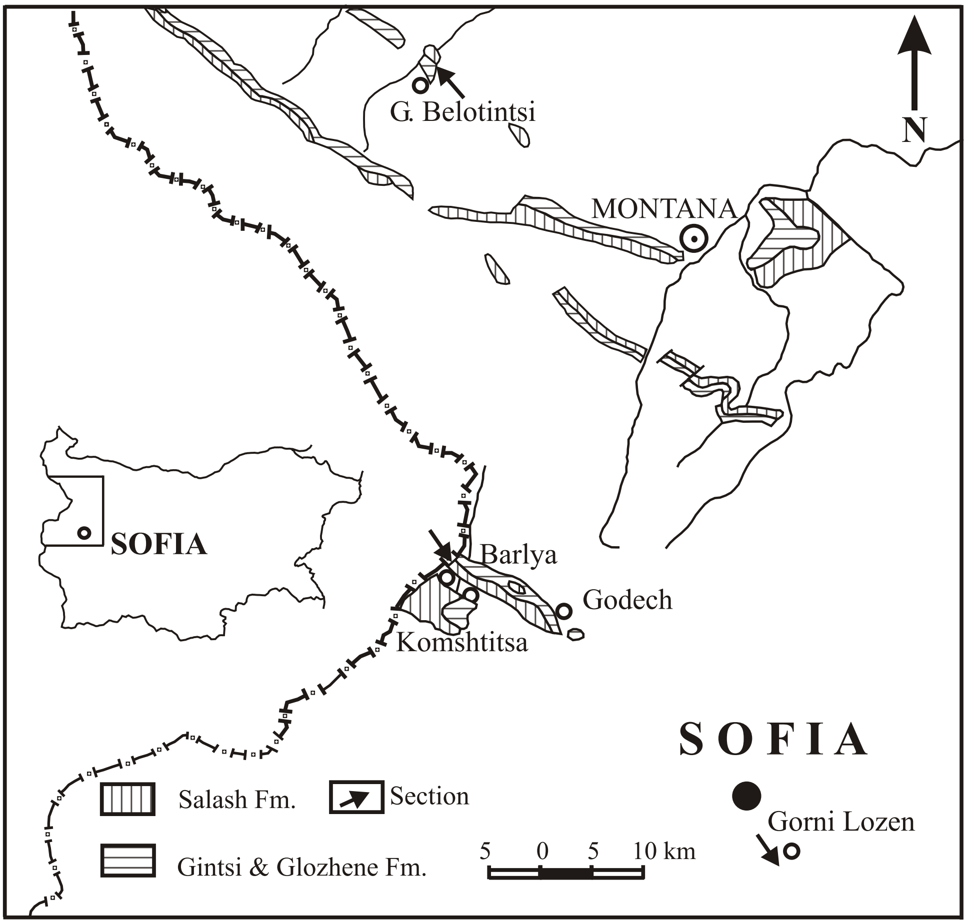

Fig. 1. Koleva-Rekalova et al.

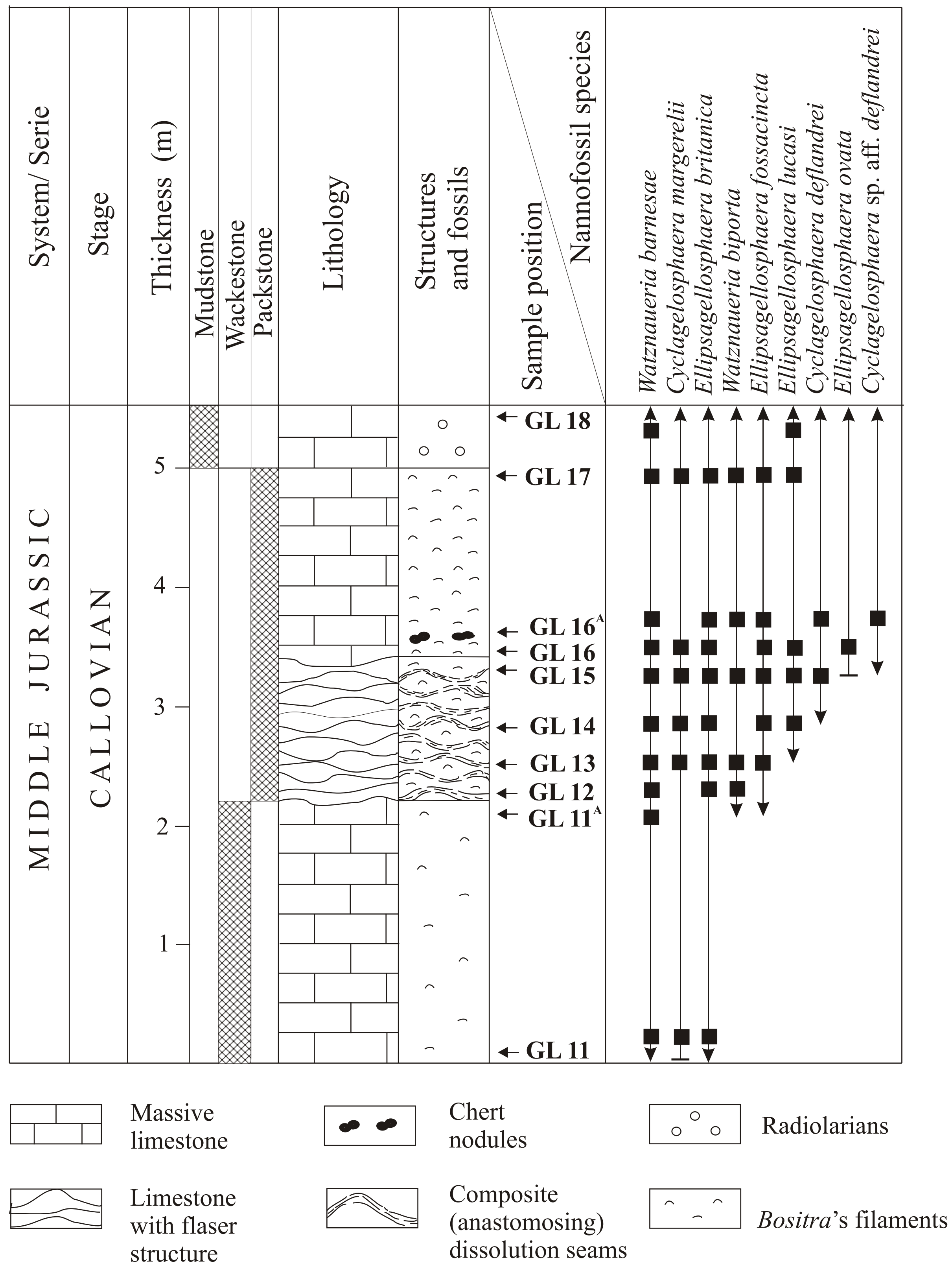

Fig. 2. Koleva-Rekalova et al.