NEW KNOWLEDGE OF CRETACEOUS LITHOSTRATIGRAPHY AND BIOSTRATIGRAPHY IN THE SILESIAN UNIT IN THE MORAVSKOSLEZSKÉ BESKYDY MOUNTAINS AND THE PODBESKYDSKÁ PAHORKATINA UPLAND (OUTER WESTERN CARPATHIANS, CZECH REPUBLIC)

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Abstract : In the framework of solving the grant project of the Grant Agency of the Czech Republic, we paid attention to several issues not sufficiently clarified yet concerning the field of the lithostratigraphy and biostratigraphy of Lower Cretaceous deposits in the Silesian Unit. In addition to the precise field documentation of suitable sections, we had taken samples for thin sections and non-calcareous dinoflagellates, and tried to collect macrofaunas. It is the confirmation of Těšín Limestone occurrence in the Godula Nappe and especially the detailed biostratigraphic characteristics and paleoecological evaluation of Lower Cretaceous and also the lower part of Upper Cretaceous deposits of the Silesian Unit based on dinoflagellates that belong to the new knowledge.

Key words: Cretaceous, biostratigraphy, Silesian Unit, Western Carpathians

The uppermost Jurassic and the Cretaceous of the Silesian Unit in north-eastern Moravia and in Silesia are characterised by complicated facial relations. Whereas for the Těšín area, a classical lithostratigraphic scheme formulated by Hohenegger (1860) is valid, in the western part of the Silesian Unit in the Godula partial nappe, i.e. west of the Ostravice River valley, the development of the uppermost Jurassic and the Cretaceous of the Silesian Unit differs in many features (e.g. absence of the lower Těšín Formation, limited occurrence of the Těšín Limestone, specifics in the development of the Těšín-Hradiště Formation, pelitic development of the Veřovice Formation, and others), especially however in relation to the lithologically different Baška development of the Silesian Unit.

The biostratigraphy of the studied sequence of strata is complicated. In the lower part of the sequence, in the course of stratigraphic analysis of the lower Těšín Formation and the Těšín Limestone, tintinnids are helpful (Nowak, 1968). However, of Upper Jurassic and primarily Lower Cretaceous deposits, often monotonous grey to dark grey claystones are typical that are often non-calcareous, poor in macrofauna and microfauna as well. In places, they can contain ammonites and foraminifers. Lately, those dark grey rocks have shown to be promising as for the occurrence of non-calcareous dinoflagellates that rank among persistent microfossils usable both stratigraphically and ecologically.

By our study, the Těšín Limestone on the base of the Godula nappe by Měrkovice (west of Frýdlant n. O.) has been confirmed on the strength of the occurrence of calpionellids (e.g. *Calpionella elliptica, Tintinnopsella longa* – determined by D. Boorová, Bratislava), which represents the westernmost occurrence of it known so far. On the evidence of the calpionellids, the limestones of that place pertain to the middle Berriasian. By increasing the number of dark grey claystone layers, the limestones pass little by little into the Těšín-Hradiště Formation. According to the non-calcareous dinoflagellates in claystones in the immediate overlying beds of the limestones (*Kleithriasphaeridium fasciatum, Gonyaulacysta cretacea, Oligoshpaeridium complex*), basal deposits of the Těšín-Hradiště Formation in this place belong to the Late Berriasian to the Early Valanginian (Leereveld, 1995). In the locality of Skalice, the limestone layers in the upper part of the Těšín Limestone are less thick (60 cm maximally). The limestones pass gradually into the overlying Těšín-Hradiště Formation. In accordance with the content of dinocysts, e.g. *Gonyaulacysta cretacea, Kleithriasphaeridium eoinodes*, this gradual transition falls stratigraphically into the Early Valanginian (ammonite Pertransiens and Campylotoxus Zones). In the uppermost part, dinocysts were determined (e.g. *Cymososphaeridium validum*) indicating the beginning of the Late Valanginian (ammonite Verrucosum Zone). The lower part of the Těšín-Hradiště Formation at Skalice belongs prevailingly to the Late Valanginian.

According to Matějka – Chmelík (1956), sedimentation of the Těšín-Hradiště Formation began oftenest by the Berriasian/Valanginian boundary. In the Hauterivian, primarily at the north limitation of the original Silesian Basin, deep-sea fans of Hradiště sandstones occurred, whereas in the Barremian and the Early Aptian, sandy layers (flysch development) were rare. Claystones of Barremian to Early Aptian age contain also ammonites together with dinoflagellates, which enables the correlation between them (Skupien – Vašíček, in print). The lithofacial character of the deposits in this part of the Baška development and that in the Godula development are quite similar to one another.

The overlying Veřovice Formation, according to Matějka and Roth (1949), lacks fossils. It consists of dark grey to black non-calcareous claystones formed during the maximum of the Lower Cretaceous anoxic event (OAE 1). On the basis of superposition, we consider it to be pertinent to the Late Aptian. In the Baška development, partly the Chlebovice Member (conglomerates and flysch with claystones of the Veřovice type) is an equivalent of the Veřovice Formation. Towards the south, i.e. towards the Magura overthrust, the Veřovice Formation wedges out into the common development of the Těšín-Hradiště Formation.

In the whole area under study, the Lhoty Formation is characterised by a claystone development, merely with a low portion of apparent turbidites. It is composed of grey to green-grey chondrite-spotted claystones representing the Albian. In the Bystrý potok stream by Frenštát p. R., about a 10 m thick zone of light grey claystones with rare thin intercalations of dark grey claystones and silicified siltstones to cherts, which are an equivalent of the Mikuszowice cherts in Poland, is locally inserted between the Lhoty and the Mazák Formation. In its higher part, several centimetres thick intercalations of grey fine-grained siliceous sandstones with glauconite appear. In compliance with dinoflagellates, these deposits belong to the Early Cenomanian.

The Mazák Formation is characterised by the prevalence of variegated (red, red-brown and green) claystones interbedded with thin slabs of greenish grey quartzose sandstones. They contain up to several meters thick deep-sea fans of the Ostravice Sandstone. Higher in the overlying beds in the Bystrý potok stream, dark grey pelites are there that pertain, in virtue of the association of dinoflagellates (*Chatangiella williamsii, Senoniasphaera rotundata*), to the Early Turonian (Robaszynski et al., 1980). On them, a complex of pelitic deposits with thin layers of brown-grey and brown-red claystones interbedded with more than 13 m thick sandy turbidites continues. In virtue of non-calcareous dinoflagellates in pelites (*Chatangiella madura, Isabelidium bakeri*), it belongs to the uppermost Turonian to the Coniacian. The mentioned complex represents most likely an anomalous development of the lower part of the Godula Formation. Only in its overlying beds, the thick sandy flysch of the Godula Formation *sensu stricto* follows.

The palynological study has also brought interesting results following from the quantitative composition of palynomorphs. In the uppermost part of the lower Těšín Formation and in pelitic intercalations of the Těšín Limestones, cysts of dinoflagellates are dominant; merely in the Early Valanginian part of the Těšín Limestone, sporomorphs occur more. As far as the composition of palynomorph assemblages is concerned, sporomorphs play a more important role in the Těšín-Hradiště Formation in the Late Valanginian – Early Aptian period. This is proved by an increased supply of terrestrial material. The composition of Early Barremian palynomorphs of the Silesian Unit is characterised by a presence of prasinophytes (those indicate decreased surface water salinity). In the other parts, sporomorphs represent only a negligible part of palynomorph assemblages.

In the lower part of the sequence of strata in the Silesian Unit from the Těšín Limestone (Berriasian to Early Hauterivian), dinocysts corresponding to the shallow-sea environment of variable salinity prevail (e.g. *Circulodinium, Muderongia, Pseudoceratium*). Towards the overlying beds, neritic species increase in number (*Achomosphaera, Oligosphaeridium, Spiniferites*) and especially deep-sea (oceanic) dinocysts (*Pterodinium*). The quantitative composition of dinocysts of the Těšín-Hradiště Formation of the uppermost Barremian and the Early Aptian is characteristic of the deeper shelf environment. In the Albian, it is already the case of sedimentation in a basinal sedimentary environment (oceanic dinocysts are present here as an autochthonous element) with the redeposition of material supplied from littoral to deeper shelf areas.

The quantitative composition of dinocyst assemblages reflects a gradual deepening of the sedimentary space from the Berriasian till the Cenomanian that is, however, also a reflection of the rising sea level in the upper part of the Lower Cretaceous (according to the 2^{nd} order eustatic curve – see Haq et al., 1988). In the uppermost Albian, a sudden increase in the portion of peridinioid dinocysts occurred reflecting the eutrofization of surface waters, and probably their cooling as well.

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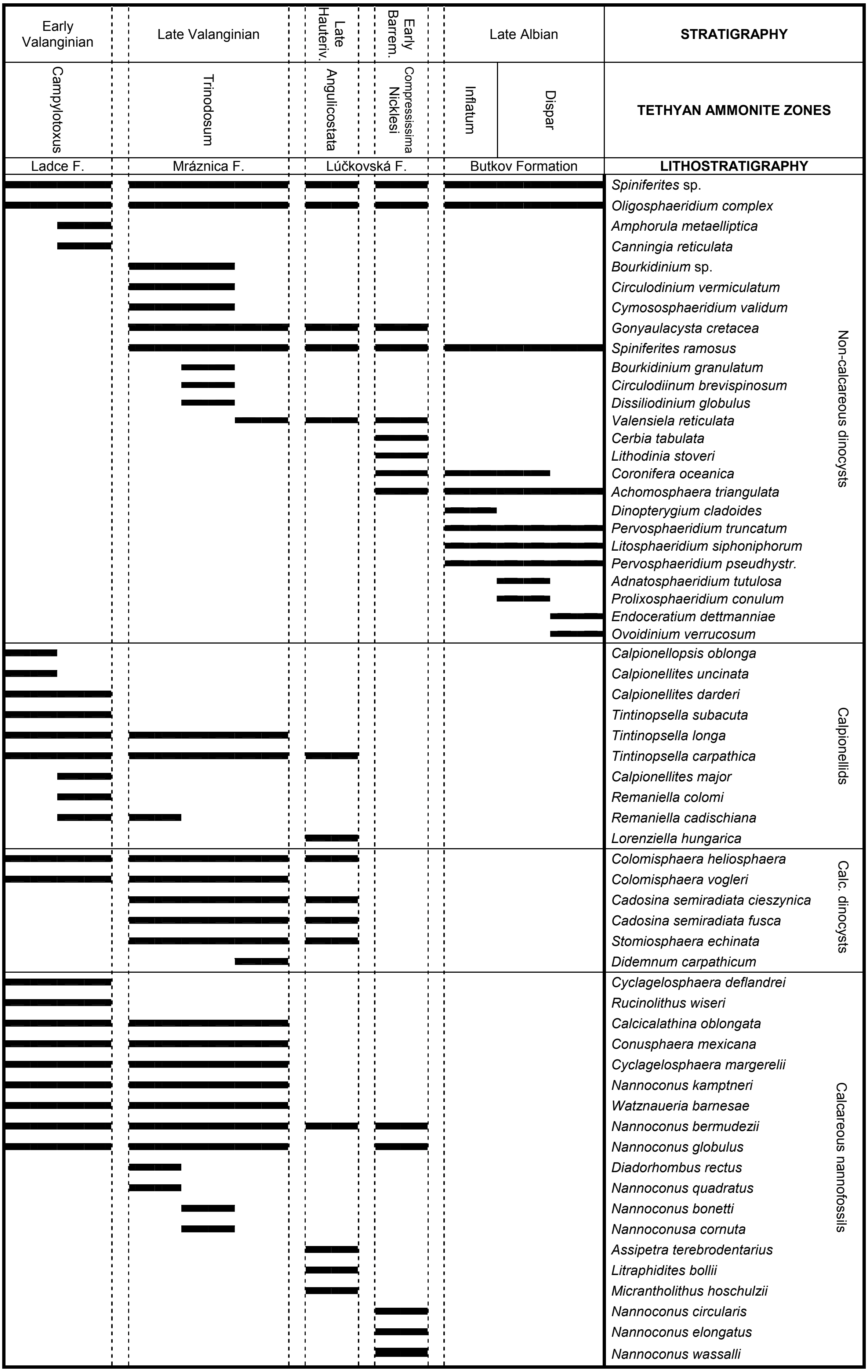
Tab. 1. Proved ammonite zones in the Silesian Unit and the bioevents of stratigraphically significant dinocysts. Grey fields represent those parts of the formation studied that are deducible well from positions in the sequence of strata, or that are evidenced with ammonites; white fields represent parts without ammonites.



Early Valanginian
Late Valanginian
Late Hauteriv.
Early Barrem.
Late Albian
STRATIGRAPHY
Campylotoxus
Trinodosum
Angulicostata
Compressissima Nicklesi
Inflatum
Dispar
TETHYAN AMMONITE ZONES
Ladce F.
Mráznica F.
Lúčkovská F.
Butkov Formation
LITHOSTRATIGRAPHY
Spiniferites sp.
Oligosphaeridium complex
Amphorula metaelliptica
Canningia reticulata
Bourkidinium sp.
Circulodinium vermiculatum
Cymososphaeridium validum
Gonyaulacysta cretacea
Spiniferites ramosus
Bourkidinium granulatum
Circulodiinum brevispinosum
Dissiliodinium globulus
Valensiela reticulata
Cerbia tabulata
Lithodinia stoveri
Coronifera oceanica
Achomosphaera triangulata
Dinopterygium cladoides
Pervosphaeridium truncatum
Litosphaeridium siphoniphorum
Pervosphaeridium pseudhystr.
Adnatosphaeridium tutulosa
Prolixosphaeridium conulum
Endoceratium dettmanniae
Ovoidinium verrucosum
Non-calcareous dinocysts
Calpionellopsis oblonga
Calpionellites uncinata
Calpionellites darderi
Tintinopsella subacuta
Tintinopsella longa
Tintinopsella carpathica
Calpionellites major
Remaniella colomi
Remaniella cadischiana
Lorenziella hungarica
Calpionellids
Colomisphaera heliosphaera
Colomisphaera vogleri
Cadosina semiradiata cieszynica
Cadosina semiradiata fusca
Stomiosphaera echinata
Didemnum carpathicum
Calc. dinocysts
Cyclagelosphaera deflandrei
Rucinolithus wiseri
Calcicalathina oblongata
Conusphaera mexicana
Cyclagelosphaera margerelii
Nannoconus kamptneri
Watznaueria barnesae
Nannoconus bermudezii
Nannoconus globulus
Diadorhombus rectus
Nannoconus quadratus
Nannoconus bonetti
Nannoconusa cornuta
Assipetra terebrodentarius
Litraphidites bollii
Micrantholithus hoschulzii
Nannoconus circularis
Nannoconus elongatus
Nannoconus wassalli
Calcareous nannofossils