

STUDIES ON THE LOWER CRETACEOUS CEPHALOPOD-BEARING BEDS OF THE "MARBLE-QUARRY" AT ZIRC (TRANSDANUBIAN CENTRAL RANGE)

by

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Data on marine Barremian rocks in the Transdanubian Central Range have been known only in the last decades. According to previous studies the Barremian was regarded as an interval of emersion and bauxite deposition in Hungary (see VADÁSZ 1960). This concept proved false with finding Barremian marine macrofauna first in the area of Zirc (WEIN, 1934; NOSZKY, 1934).

Geological setting

The so-called "Old Marble-quarry" is situated northwest of Zirc, in the abbey-forest on the Pintér-hegy (Fig. 1). The quarry was named after

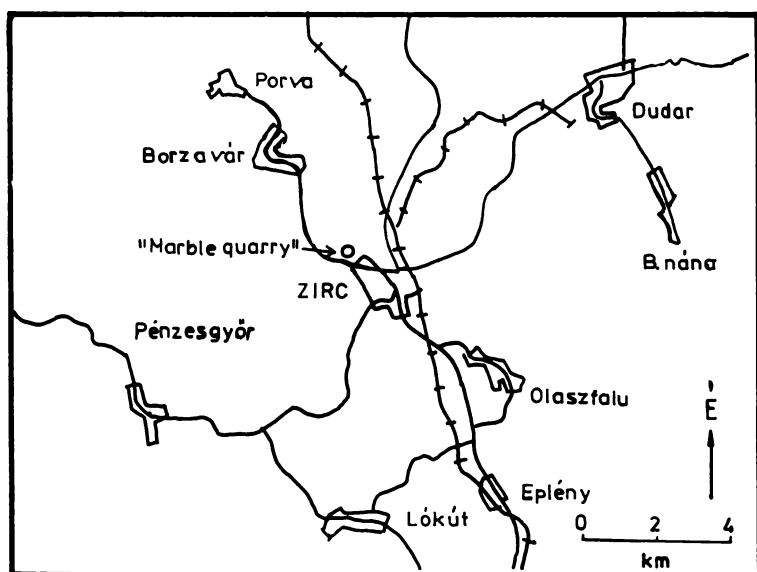


Fig. 1. Location chart of „Marble quarry“

the here quarried thick-bedded pink Tithonian limestone, the "Zirc marble". A detailed description and study on the outcrop is given by FÜLÖP (1964).

The quarry exposes mostly the pink, yellowish-white or light-grey, banded or thick-bedded Tithonian limestone of variable grain-size and nodularly weathering bedding planes. The limestone contains yellowish-brown chert nodules and rare Calpionellids in the microfauna.

The Tithonian limestone is paracomformably overlain by the Barremian cephalopod-bearing limestone of c. 50 cm. thickness. This is a brownish, pinkish limestone containing fine sand grains and very rich macrofauna, mainly ammonites. Other elements are sponges, corals, bivalves and gastropods, brachiopods, crinoids and echinoids. This cephalopod-bearing limestone is a member of the Borzavár Limestone Formation (Valanginian, Hauterivian, Barremian; CSÁSZÁR 1980). The overlying formation is the similarly paracomformable Aptian grey crinoidal limestone, i.e. the typical Tata Limestone Formation.

Thin-section studies

The microfauna of the Tithonian and Barremian limestones are markedly different. The thin-sections of the underlying limestone indicate the Middle and the uppermost Tithonian. This is a biomicrite indicating a rather quiet deposition. Benthonic foraminifers occur in strikingly great abundance, with calcareous Nodosariidae and agglutinated Textulariidae. The characteristic Tithonian facies with rich calpionellids does not occur. The pelletal texture with the associated poor planktonic association suggests shallow-water sedimentation.

The thin-section of the Barremian limestone shows biomicritic matrix with echinoderm skeletal fragments, foraminifers and radiolarians. Benthonic (*Lenticulina*, *Epistomina*), as well as planktonic foraminifers (*Hedbergella*) occur, with the dominance of the latter. This suggests, that the shallow-water facies was in connection with open-sea areas. This is supported by the result of nannoplankton studies of M. BEKE (1981, pers. comm). Further studies may result in the identifying the planktonic zones. This would make possible a correlation between zonal index planktonic forms and the zonal index ammonites, thus resulting a complex stratigraphic reference.

Ecological evaluation of the fauna

An evaluation of the non-ammonite fauna was carried out by quantitative methods.

Taxonomic studies

The systematic treatment of the ammonites follows that in the Treatise (ARKELL, 1957), with the exception of genus *Crioceratites*, which is discussed after the scheme of IMMEL (1978).

714 of the studied 1003 cephalopod specimens belong into the following genera:

	specimen number	percentage (%)
<i>Lytoceras</i>	89	12
<i>Protetragonites</i>	119	17
<i>Crioceratites</i>	138	19
<i>Protacrioceras</i>	1	0.14
<i>Anahamulina</i>	3	0.42
<i>Hamulina</i>	39	5
<i>Ptychoceras</i>	26	4
<i>Neolissoceras</i>	10	1
<i>Barremites</i>	97	14
<i>Valdedorsella</i>	51	7
<i>Nicklesia</i>	2	0.28
<i>Belemnites</i>	96	13
<i>Duvalia</i>	3	0.42
<i>Rugaptychus</i>	40	6

The other, nearly 200 specimens are mainly fragments which were regarded as indeterminable.

Within the genus *Lytoceras* 37 specimens belong into the species *L. subfimbriatum* (Plate I).

Detailed studies were carried out on genus *Crioceratites*, which resulted in some specific determinations.

In the former literature usually younger specimens are figured. These, according to Immel, can be easily mixed, being of low variability. On the other hand the adult whorls show different sculpture, and this makes problems, too. Groups of species can be outlined with close connections, in many cases with similar specific characters. Usually the very characteristic features (i.e. the presence or lack of tubercules, number of ribs) are missing by wearing or bad preservation. *Crioceratites duvali*, *C. emerici* and *C. nolani* (Pls. II, III) are typical species in this respect, being easily mixed on the basis of fragmentary specimens. The three species are distinguished by the number of intervening ribs. This is lowest (1–7) in *C. emerici*, intermediate (2–17) in *C. nolani* and highest (5–20) in *C. duvali*. *C. nolani* and *C. emerici* share the feature of having tubercule rows externally, laterally and umbilically. *C. duvali* has a single, external tubercule row. The tubercules are situated on the main ribs, suffering primarily by wearing, so the presence of tubercules is hard to identify.

The degree of crioceratid uncoiling can be determined only in the most complete specimens, which makes possible calculating the ratio of the "dorsal" and "ventral umbilical diameter" In the formula

$$\frac{\text{dorsal umbilical diameter}}{\text{ventral umbilical diameter}}$$

the dorsal umbilical diameter means the umbilical width between the dorsal sides, while the ventral umbilical diameter refers to the diameter between the ventral sides (Fig. 2). When the whorls touch each other, the ratio is 1; values lower than 1 reflect involute coiling, and values higher than 1 (and this is the case in *Crioceratites*) suggest uncoiling with whorls not attached to each other. On the basis of measurements made on the *Crioceratites* species, the uncoiling ratio is 1.12. This is close to 1, i.e. the evolute whorl touching. Conclusively, the *Crioceratites* specimens are slightly uncoiled.

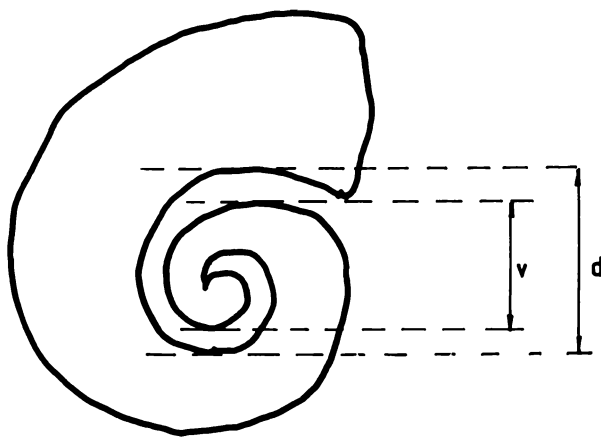


Fig. 2. Dorsal (d) and ventral (v) umbilical diameters

Stratigraphic evaluation of the fauna

On the basis of the faunal list of FÜLÖP (1964) and the recently studied elements of the fauna, it is suggested that the range of the cephalopod species found in the Marble quarry of Zirc is of Lower Barremian. The listed *Crioceras emerici* characterises the Nicklesia pulchella Zone, i.e. the basal Barremian in the stratotype (ROGER 1980, p. 110). Two specimens congeneric with the zonal index were also collected. The presence of *Hamulina* species suggests also the Lower Barremian.

On the other hand, some species, e.g. *Barremites hemiptychus*, occur in the Silesites seranonis Zone of the stratotype, which in turn belongs to the Upper Barremian. Being an old-collected fauna, further studies are needed to decide whether the associated occurrence of Lower and Upper Barremian species was a result of condensation or faunal mixing.

The detailed studies on the fauna made possible the comparison of some Hungarian Barremian occurrences. The work may serve as a basis of a future monographing of the fauna.

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PLATE I

Fig. 1. *Lytoceras subfimbriatum* (d'ORBIGNY) 1x

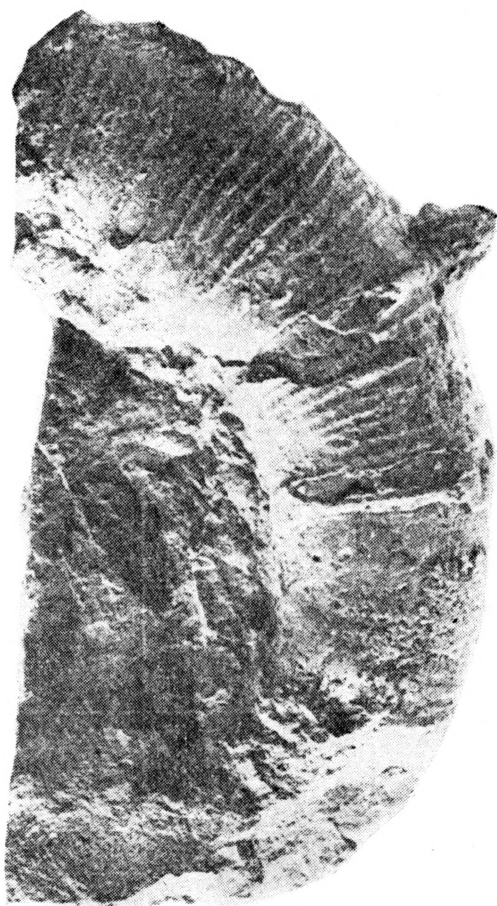


PLATE II

Fig. 1. Crioceratites cf. nolani (KILIAN) 1x

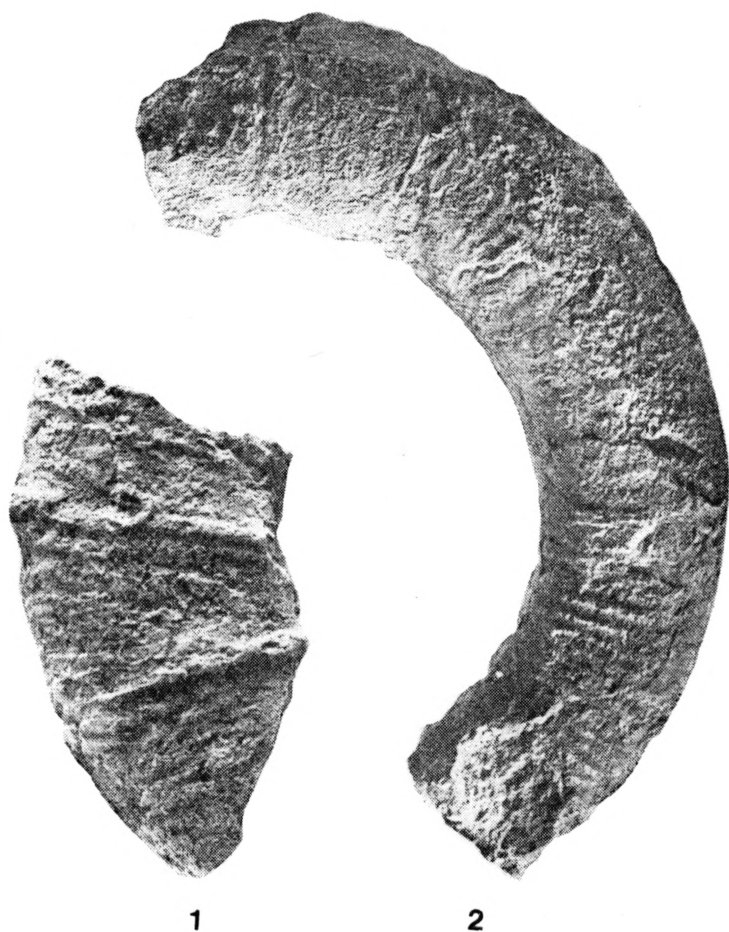


PLATE III

Fig. 1. *Crioceratites* cf. *emerici* (KILIAN) 1x

Fig. 2. *Crioceratites* cf. *duvali* (KILIAN) 0.6x