

LOWER TURONIAN AT THE BREAZA-COMARNIC HIGHWAY BRIDGE PIERFEET (PRAHOVA VALLEY)

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Abstract: The present work is studying especially the planktonic foraminifera of the Lower Turonian to confirm its presence in this area.

The study of planktonic foraminiferal association revealed the presence of *Helvetoglobotruncana helvetica* population – fossil zone marker for the Lower Turonian. Besides this taxon other species such as *Praeglobotruncana oraviensis* and *Dicarinella hagni* appear, confirm the Lower Turonian age.

Keywords: Cretaceous, Turonian, planktonic foraminifera, Prahova Valley.

Rezumat: Lucrarea se ocupă în mod deosebit cu studiul foraminiferelor planctonice ale Turonianului inferior, în vederea confirmării prezenței acestuia în zonă.

Studiul asociației de foraminifere planctonice a pus în evidență prezența populației de *Helvetoglobotruncana helvetica* – fosil de zonă pentru Turonianul inferior. Asociat acestui taxon mai apar și specii ca *Praeglobotruncana oraviensis* și *Dicarinella hagni*, ce confirmă vârsta Turonian inferior.

Cuvinte cheie: Cretacic, Turonian, foraminifere planctonice, Valea Prahovei.

INTRODUCTION

In the studied area of the Prahova Valley (Fig. 1), from a lithological viewpoint, the lowermost Upper Cretaceous deposits (Cenomanian – Lower Turonian), are transgressive upon the Upper Aptian and are represented by grey marls which alternate with green-grayish or blackish sandstones. Interbedded reddish and violaceous marls appear in the upper part of Cenomanian – Turonian, confirming the change of anoxic event with low oxidic environment. The Turonian deposits present a great facies variation, generally characterized by sandstone-marls interbedded with sideritic calcareous marls, lens of reddish micaceous clay or even thin cineritic layers. The reddish calcareous marls facies, between Dâmbovița and Ialomița Valleys, appearing in Cenomanian, continues with small variations up to Senonian. The farther you go to the East the more changes are noticed; thus Cenomanian begins with reddish calcareous marls, which gradually become grey-blackish calcareous marls. On the other hand, Turonian is characterized by grey sandish marls interbedded with red clay.

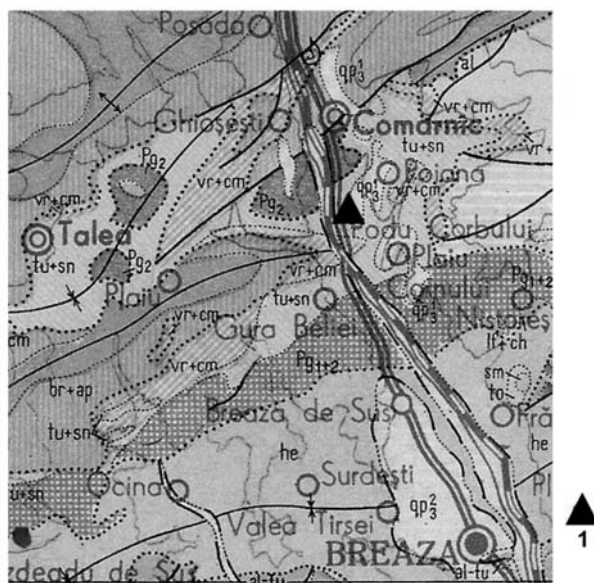
Comparing numerous outcrops of Cenomanian – Turonian boundary we found that a consistent rhythmicity characterized all of them along this interval, these being enriched in microfossils, microfossils, as well as nanofossils.

The Cenomanian – Lower Turonian deposits in the Eastern Carpathians (southern part) contain a very rich micropaleontological assemblage of benthonic and planktonic foraminifera. However, due to space shortage and because the Prahova Valley is strongly tectonized, this work approaches only the planktonic foraminifera study from Lower Turonian, thus confirming its presence in the studied area.

From a micropaleontological viewpoint it is well known that *Rotaliporids*, *Hedbergellids* and *Globotruncanids* are the commonest planktonic foraminifera families; out of these *Rotaliporids* and *Globotruncanids* have the most systematical and biostratigraphical importance for Cenomanian - Maastrichtian while *Hedbergellids* have the same importance for Hauterivian – Lower Maastrichtian.

At the Cenomanian/Turonian boundary a decrease of planktonic foraminifera is noticed, which even today raises some questions and debates. However, the bicarinal species of *Marginotruncana* and *Dicarinella* which appeared at the end of Cenomanian created some marker species for Turonian - Santonian interval,

Fig. 1. Geological map of the Breaza-Comarnic area (after the map sheet L-35-XXVI, Tîrgoviște, 1:200.000). Triangle marks the position of the sampled sections



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excepting the monocarinal and planoconvex forms of *Helvetoglobotruncana*, which indicate the presence of the *H. helvetica* zone from Lower Turonian.

The most specific aspect of Cenomanian and Lower Turonian is represented by genus of *Rotalipora cushmani*, *Rotalipora reicheli* and *Helvetoglobotruncana helvetica*, where the first ones appear under reworked forms at the lowermost Lower Turonian.

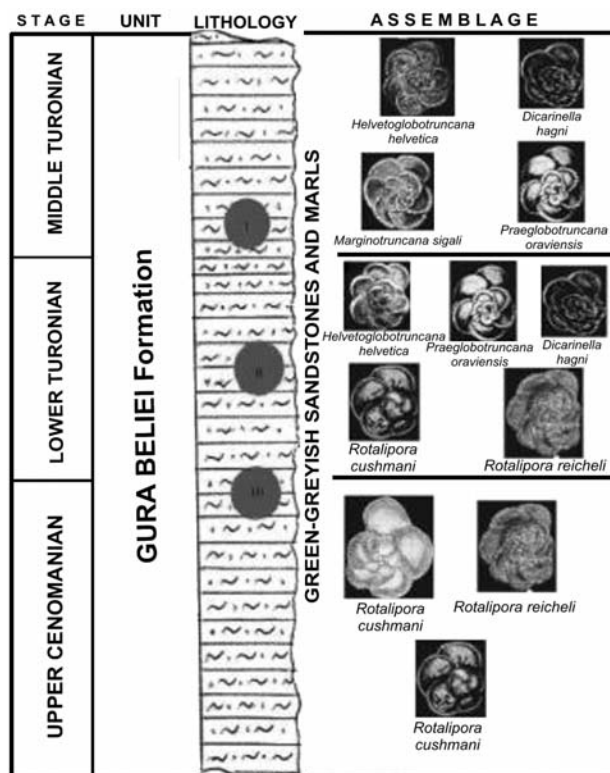
METHODS

The samples were collected from three sections of the same outcrop from Prahova Valley, on the Breaza - Comarnic highway pierfeet (Fig. 1). The land and laboratory researches were carried out in several stages and the species described latter on, are from a micaceous sedimentary breccia (with quartz and mica elements) interbedded within green-graysh marls layers (Fig. 2).

The samples were prepared and studied by standard techniques (boiling, washing-up, sieving, broiling, drawing and photo taking) at the Paleontological Laboratory from Bucharest University, under the direct supervision of professor dr. doc. Theodor Neagu – member of the Romanian Academy.

By studying the planktonic foraminifera from a sample we usually came to the conclusion that some forms could be identified as members of species described in the specialized literature, each of them having distinct morphological characteristics. However, according to earlier

Fig. 2. Synthetic lithological column, Breaza-Comarnic area, with the position of the samples



descriptions made by Robaszynski, Caron and EWGPF (1979), on the following, we will try to present a morphological and systematical description of the most important genera of planktonic foraminifera, as follows: *Whiteinella* PESSAGNO 1967, *Praeglobotruncana* BERMUDEZ 1958, *Dicarinelia* PORTHAULT 1970, *Marginotruncana* HOFKER 1956 and *Helvetoglobotruncana* DALBIEZ 1955.

PALEONTOLOGICAL FEATURES

Planktonic Foraminifera

The Suprafamily *Rotaliporaceae* Sigal: known only from Middle Jurassic (Upper Bajocian) to Upper Cretaceous (Maastrichtian), planktonic foraminifera have a trochospiral test while the primary aperture is extraumbilical - umbilical, being bordered by an apertural lip; some secondary sutural apertures on the umbilical side can be observed at the complex forms. Tests are trochospiral (low to high), some of them having carinal structures, non-perforated peripheral bands, and rows of pustules on peripheral side. Chambers are smooth to strongly ornated (with polygonal structures or meridional rows of pustules).

The Family *Hedbergellidae* (K₁ht - K₂ma): includes foraminifera with trochospiral tests, a primary interiomarginal, extraumbilical-umbilical aperture with a prominent apertural lip. The former apertural lips are still visible, without forming relict apertures or secondary sutural apertures. The most significant genera of this family are *Hedbergella*, *Whiteinella*, *Praeglobotruncana*, *Helvetoglobotruncana*, *Dicarinelia*, quite important for Hauterivian - Maastrichtian interval.

Whiteinella archaeocretacea Interval Range Zone

Definition. This zone has been defined as the Interval Range Zone, ranging from the last occurrence of *Rotalipora cushmani* Morrow, to the first emergence of *Helvetoglobotruncana helvetica* Bolli (Caron, 1985; Sliter, 1989).

Stratigraphic Position. Upper Cenomanian–lower Turonian.

Author. Bolli (1966), = *Praeglobotruncana gigantea* Zone.

Remarks. Besides a species diversification of *Dicarinelia*, this zone includes a low-diversity assemblage represented by rare specimens of *Hedbergella* and *Whiteinella* and by a zonal marker scarcity. This low-diversity assemblage may be related to the widespread deposition of organic-rich sediments linked to the Oceanic Anoxic Event (Sliter, 1989; Robaszynsky *et al.*, 1990; Premoli-Silva and Sliter, 1994; Venkatachalapathy and Ragothaman, 1995).

In the Boreal realm, other authors have conferred an early Turonian age on this zone

(Caron, 1985; Venkatachalapathy and Ragothaman, 1995).

This zone expands over the Cenomanian/Turonian boundary. The *W. archaeocretacea* Zone in the present study corresponds to the transition from the shallow-marine facies to the hemipelagic and pelagic ones, being characterized by strong changes in the fossil associations. Its base is concordant with the disappearance of most large benthic foraminifera; in the lower part of this zone, there is a scarcity of fossils mainly due to the predominance of intertidal-supratidal facies with common sub-aerial exposure features for all the sections from the aforementioned outcrop.

***Helvetoglobotruncana helvetica* Total Range Zone (Plate I, fig. 13 – 18)**

Definition. Total Range Zone of *Helvetoglobotruncana helvetica* GANDOLFI.

Stratigraphic Position. In this study, the respective zone belongs to the lower to middle Turonian according to the total stratigraphic range of the *H. helvetica*. In Accordance with Hancock *et al.* (1993), the base of this zone corresponds to the middle part of *Mammites nodosoides* ammonite Zone (early Turonian), while its peak may be located approximately at the top of the *Collignonicerias woollgari* ammonite Zone and slightly above the *Romaniceras kallesi* ammonite Zone (middle Turonian, Tethyan realm).

Author. Dalbiez (1955).

Remarks: The first emergence of *Marginotruncana* occurs within this zone; this genus diversification marks the return of large-keeled planktonic foraminifera represented by species such as *H. helvetica*, *M. coronata*, *M. marianosii*, *M. pseudolineana*, *M. schneegansi*, and *M. sigali* (Sliter, 1989, Robaszinsky and Caron, 1995).

In the study area, the *H. helvetica* Zone is characterized by diverse and common *whiteinellids*, scarce *hedbergellids* and *heterohelicids*. In this zone, an increase in keeled planktonic foraminifera is also observed. The species of planktonic foraminifera include: *Whiteinella archaeocretacea*, *Dicarinella algeriana*, *Dicarinella hagni*, *Praeglobotruncana oraviensis*, *Marginotruncana sigali*, and *Helvetoglobotruncana helvetica*.

The *H. helvetica* Zone covers the Lower-Middle Turonian, where we identified two micropaleontological subzones: a *Praeglobotruncana oraviensis oraviensis* SCHEIBNEROVA subzone and a *Praeglobotruncana biconvexa biconvexa* SALAJ & SAMUEL subzone.

H. helvetica Zone (Lower-Middle Turonian) is characterized by the nominal taxon of *dicarinellids*, *praeglobotruncanids*, *whiteinellids* and *hedbergellids* and by the sedimentary deposits settled in exclusive pelagic conditions. The chronostratigraphic subdivisions and boundaries of

the Cenomanian and Turonian are commonly established by using ammonites, inoceramid bivalves, planktonic foraminifera and calcareous nannofossils (Birkelund *et al.*, 1990).

The planktonic foraminiferal zones in pelagic facies have been assigned the following chronostratigraphic equivalencies: *Whiteinella archaeocretacea* Upper Cenomanian to Lower Turonian; *Dicarinella hagni* remaining part of the Lower to Upper Turonian and *Helvetoglobotruncana helvetica* Middle Turonian (Soto-Jaramillo, 1981).

Helvetoglobotruncana Reiss, 1957: *Helvetoglobotruncana helvetica* type Bolli, 1945, shows a plan-convex test, flattened on the spiral side and highly inflated on the umbilical side. At the same time, on the peripheral side even a keel could be present. The umbilicus is covered by a system of portici with accessorial infralaminar apertures, the umbilical side being covered with numerous pustules.

Helvetoglobotruncana has had a short evolution, that is from Lower Turonian to Middle Turonian, namely from *Hedbergella* (Cenomanian) through *Whiteinella* stage. *Helvetoglobotruncana* is also a homeomorphous similar to *Gansserina gansseri* from Middle Maastrichtian.

Helvetoglobotruncana helvetica Zone is a typical Total Range Zone: *G. imbricata* begins from the basal part, *G. schneegansi* shows up slightly above the basal part, while *G. sigali* starts from the top of this zone. As the *Rotaliporids* and *Globotruncanids* have not been mentioned together, underlines the importance of the boundary between *Rotalipora cushmani* Zone and *Helvetoglobotruncana helvetica* Zone.

Stratigraphic Position: in the present work, according to the total stratigraphic range of the *H. helvetica*, this zone corresponds to Lower-Middle Turonian interval.

***Praeglobotruncana (imbricata) oraviensis* (MORNOD) (Plate I, fig. 10 - 12)**

Definition: it corresponds to the lowermost Turonian being represented by a grey-green sandstone-marls complex.

Praeglobotruncana Bermudez, 1952: *Globorotalia delrioensis* type Plummer, 1931. This genus, presents forms with a carina made up of gathering pustules, more or less differentiated, so that this forms have two rows of pustules which disappear on the last whorl on some chambers.

Test is trochospiral, umbilical, biconvex, convexo-concave to spiroconvex. The periphery of the test is rounded up to subangular, which on the initial stages has a moderate keel, while in the next evolution stages to be ever lesser prominent; at the same time the keel could be also curled. The wall of the test is slightly perforated and the surface is smooth to hispid or partially nodose.

Chambers have forms from oval to subangular. The first chamber of the last whorl have round,

elliptic and ogival forms, the last one having ogival or angular aspect.

The sutures on the spiral side are radial or curved, depressed or raised, sometimes thickened or even curled on the last whorl, while on the umbilical side this could be depressed and radial.

The primary aperture is interiomarginal, relative high and open, like an extraumbilical – umbilical arch, bordered by a narrow lip or a spatulated ear-like (*P. delrioensis*) or a porticus (*P. stephani*). On the other hand on the umbilical side portici or relict ear-like can be noticed. The *Praeglobotruncana* genus evolved from *Hedbergella*, developing its sharp, nonperforated with some pustules peripheral side. During the evolution the double keel rose at *Dicarinella algeriana* as transition form. *Praeglobotruncana* genus differs from *Marginotruncana* by umbilical radial and depressed sutures as well as by the absence of double keel. Compared to *Falsotruncana*, *Praeglobotruncana* differs by presence of relict apertural ears-like or of portici on the umbilical side, and by absence of double keel.

Dicarinella Porthault, 1970: *Globotruncana indica* type Jacob and Sastry, 1950 is synonym with *Dicarinella hagni* Scheibnerova, 1962 (see Robaszynski and Caron, 1979) (Plate I, fig. 22 - 24)

Definition: this genus forms present on the last chambers of the last whorl, two-by-two rows of pustules, either closed or separated by a peripheral band, while the umbilical sutures are radial and depressed. *Dicarinella* differs from *Praeglobotruncana* by highly developed portici and keels, it also differs from *Marginotruncana* by depressed and usual radial umbilical sutures. On the evolution line *D. primitiva* - *D. concavata* - *D. asymetrica*, genus shows a curved tendency of the umbilical sutures, as known at ancestral specimens of *D. algeriana*.

Among the found samples we have discovered and identified *Dicarinella hagni* SCHEIBNEROVA 1962, which presents spiral oblique sutures assigning a high aspect to the test (on the dorsal side). Populations of this genus from Turonian present a subtrapezoidal aspect of the last chambers from the last whorl.

Marginotruncana sigali Bermudez, 1970 (Plate I, fig. 19 - 21):

Definition. This zone has been defined from the last appearance of *Helvetoglobotruncana helvetica* to the first appearance of *Dicarinella concavata* Brotzen (Sliter, 1989).

Other authors recognized this zone as *Marginotruncana schneegansi* Interval Range Zone and Partial Range Zone (Robaszynski and Caron 1995). The appearance of *M. sigali* is marked in the *Romaniceras kallesi* ammonite Zone (middle of the middle Turonian, Tethyan realm, Tunisia), while its top is close to the base of *Dicarinella asymetrica* Zone (Sliter, 1989).

Marginotruncana has forms with two rows of quiet closed and best-marked pustules while the umbilical sutures present a sigmoidal aspect. Besides this genus other two more recent forms present similar features (*Falsotruncana* CARON 1981 and *Sigalitroncana* KORCHAGIN 1982), the last one being different from the other two by the presence of a keel made up of a single row of pustules or of two imbricated rows, which cannot be observed but by SEM method.

This genus forms, characteristic for the rest of Turonian series, obviously represent the transition from *Whiteinella* to *Archaeoglobigerina*.

Stratigraphic Position. Middle-Upper Turonian. The age of this zone is poorly constrained because few samples were taken at that interval.

CONCLUSIONS

Planktonic foraminifera genera described in the present paper, belonging to a micaceous sedimentary breccia, prove the presence of the Lower Turonian in this area. At the same time, species like *Rotalipora cushmani* (Plate I, fig. 1 – 6) and *Rotalipora reicheli* (Plate I, fig. 7 – 9) confirm their remnant character from the Upper Cenomanian into the lowermost Turonian, determined us to consider that there was a sedimentary lacuna at Cenomanian – Turonian boundary.

It is true that there exist a very rich and vast literature concerning world wide researches (several regions from Romania included) on the Cenomanian – Turonian boundary events as well as on the description of the planktonic foraminifera in the Upper Cretaceous. Although several researchers mention the sedimentary deposits on Prahova Valley (“Gura Beliei Marls Formation”) in their works, they do it in only a few words, not more, being generally mentioned not a concrete study of the respective area. So far, none of them have ever performed detailed studies in the aforementioned area trying to prove the presence of the Turonian and of the *Helvetoglobotruncana helvetica*, especially, within the deposits at “Gura Beliei” on Prahova Valley.

Therefore, we think that this work could be considered as a new and original approach of studies and researches developed at the level of the Prahova Valley, respectively, in “Gura Beliei” area, the more so as this is only a part of a larger study on this topic.

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EXPLANATION OF PLATE I

- Fig. 1–3. *Rotalipora cushmani* (Morrow), Middle – Upper Cenomanian, Prahova Valley, L.P.B., X 100 (from samples II and III);
- Fig. 4–6. *Rotalipora cushmani* (Morrow), Middle – Upper Cenomanian, Prahova Valley, L.P.B., X 70 (from samples II and III);
- Fig. 7–9. *Rotalipora reicheli* Mornod, Upper Cenomanian, Prahova Valley, LP.B., X 100 (from samples II and III);
- Fig. 10–12. *Praeglobotruncana (imbricata) oraviensis* Mornod, Lower Turonian – Upper Coniacian, Prahova Valley, LP.B., X 70 (from samples I and II);
- Fig. 13–15. *Helvetoglobotruncana helvetica* Gandolfi, Lower – Middle Turonian, Prahova Valley, LP.B., X 90 (from samples I and II);
- Fig. 16–18. *Helvetoglobotruncana helvetica* Gandolfi, Lower – Middle Turonian, Prahova Valley, LP.B., X 70 (from samples I and II);
- Fig. 19–21. *Marginotruncana sigali* Bermudez, Lower – Middle Turonian, Prahova Valley, LP.B., X 80 (from sample I);
- Fig. 22–24. *Dicariela hagni* Porthault, Lower – Middle Turonian, Prahova Valley, LP.B., X 90 (from samples I and II).

