

TURONIAN MARKER FORAMINIFERA ASSOCIATIONS FROM THE SOUTHERN PART OF THE EASTERN CARPATHIANS: DAMBOVITA VALLEY–INTORSURA BUZAU LUI AREA

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Abstract. Within the Turonian deposits of the area between Dambovitza Valley and the upper part of the Buzau Valley the foraminiferal fauna is represented by two very distinct assemblages. One of them mainly consists of planktonic foraminifera - up to 90 % (*Whiteinella*, *Helvetoglobotruncana*, *Dicarinella*, *Marginotruncana*, *Hedbergella*, *Praeglobotruncana*, *Schackoina*). The remaining 10 % belong to benthic (agglutinated and calcareous) foraminifera. The other association consists totally of small and primitive agglutinated taxa with siliceous wall cement and a long stratigraphic range. The corresponding biozones show also a relatively large range (*Bulbobaculites problematicus*, *Uvigerinammia jankoi*): from the Upper Cenomanian to the Lower Senonian.

The comparative study of these two micropaleontological assemblages allows a correlation between the standard (areal) biozone established on planktonic foraminifera and the local agglutinated deep water assemblages.

Keywords: Turonian, foraminifera associations, Eastern Carpathians

INTRODUCTION

In 1983, in the Proceedings volume of the Second International Symposium on Benthic Foraminifera, Stanislaw Geroch and Wieslaw Nowak published a paper entitled; "Proposal of zonation for the Late Tithonian–Late Eocene based upon arenaceous foraminifera from the Outer Carpathians, Poland".

This paper is among the first purely biostratigraphical works to deal with benthic agglutinated foraminifera associations, the only ones available in the Carpathian flysch area. Due to the quick, rhythmic sedimentation and to the accumulation of foraminifera tests in pelagic waters, below the lysocline, the calcium carbonate tests are destroyed also in the deep water deposits (red, black, purple clays), leaving only poorly-represented agglutinated forms and, at times, radiolarians. Agglutinated foraminifera tests are made up of a variety of particles gathered from the basin floor and cemented with a silica matrix. The absence of planktonic foraminifera associations among which the process of evolution is very fast (especially at the species level), and which have a very narrow time span, has made a thoroughly detailed microbiostratigraphical study nearly impossible in these deposits.

The credits go to the micropaleontological school of the late 19-th century and the early 20-th century from Krakow (Jagellonian University), led by Dr. Josef Gryzbowski, who for the first time used the planktonic and benthonic foraminifera associations - particularly the agglutinated species - for biostratigraphical correlations required by the oil industry, and for drafting of more accurate geological maps.

Stanislaw Geroch was Gryzbowski's successor at the Jagellonian University. Equipped with modern techniques and outstanding devotion to his field, nearly a century after Gryzbowski's first works, Geroch publishes between 1960 and his last years a series of articles dealing with the stratigraphic value of agglutinated foraminifera in deposits practically devoid of macrofossils.

His paper of 1983, presented at the Pau Symposium became after it was published an indispensable reference work with respect to the dating and correlation of the Cretaceous - Paleogene flysch deposits from the Carpathian domain. This exceptional work represents a synthesis based on the remarkable field and laboratory experience of an exceptional micropaleontologist, based

on 34 genera and species of small and very small foraminifera. These are found mainly in deep water sediments, surely accumulated below the CCD limit, in which macrofaunal and microfaunal (planktonic foraminifera and nannoplankton) biostratigraphic markers are completely absent. The great merit of the above work is that on the basis of valuable field data, Geroch managed to select and define the stratigraphic range of selected species in a way that would make them useful for clear biostratigraphical correlations.

THE FORAMINIFERA FROM DAMBOVITA VALLEY-INTORSURA BUZAU LUI AREA

In the western Dambovita Valley–Buzau Valley–Intorsura Buzaului, eastwards from the Cretaceous (particularly Upper Cretaceous) deposits, two very well-developed facies types occur. One facies with typical epicontinental deposits sedimented in an open sea, with a macrofauna and especially microfauna of an amazingly-rich assemblage, accompanied by a mixture of benthic calcareous and agglutinated foraminifera, remarkable both specifically and as a population.

A second facies type is that of the deep and very deep water, with rhythmic turbidite-flysch type sedimentation, with very fine red clays, totally devoid of calcareous foraminifera. The biostratigraphic dating and correlation of these exclusively-agglutinated foraminifera were possible only based on the data in the above mentioned paper by Geroch.

In the Runcu–Pietrosita syncline (Ialomita Valley) one can find a very well-developed suite of epicontinental postectonogenic sediments beginning with the Dumbravioara formation (Vraconian–Cenomanian) and continuing uninterruptedly to the Oligocene with amazingly-rich and varied associations. Especially valuable from a biostratigraphical standpoint is the fact that these associations group together both agglutinated and calcareous foraminifera, although standing apart are the planktonic species, sometimes making up 80–90 % of the population. On the basis of the planktonic foraminifera, a detailed microbiostratigraphical study was undertaken and integrated on a continental level.

Puzzling and remarkable was the realization that in the finest samples (0.08 mm) were found the greater part of the agglutinated taxa which Geroch assigned,

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largely intuitively, a stratigraphic range which is accurate with respect to the Upper Cretaceous. Taking advantage of a series of micropaleontological samples from the Turonian–Senonian suite cropping out in the Tata and Voievozii Valleys (tributaries of the Ialomitza Valley), it was possible to confirm and define the microbiostratigraphic value of the taxa mentioned by Geröch from the exclusively-agglutinated assemblages (typically deep water deposits). Given this situation, we were able to observe that within, these typical taxa which are not found in epicontinental deposits were encountered.

Among these, the most important are:

Hormosina (*Caudammia*) - of small size, completely absent from the epicontinental associations up to the Campanian. In the Globotruncana ventricosa biozone, the genus makes its debut for the first time along with the planktonic taxa. It continues to grow in size up to the gigantic *H. gigantea* in the Maastrichtian.

Uvigerinammia - represented in the Turonian epicontinental deposits only by *U. praejankoi*, which appears for the first time in the Marginotruncana schneegansi-sigali biozone and continues into the lower part of the Dicarinella complanata biozone.

In the deep water associations, this species appears together with *U. jankoi* but with a significantly-reduced frequency, later on being found alone up to the Early Santonian. Frequently, *U. praejankoi* appears in association with *Textulariopsis foeda*, with a notable frequency, along with rare specimens of *Verneuilinoides* sp., which differs from *V. subfiliformis* (Barremian–Aptian, P. variabilis–*H. nonioninoides* Geröch, 1983). The type species of the genus *Uvigerinammia* is completely absent in the epicontinental associations, and is a very valuable marker for the interval corresponding to the *Marginotruncana schneegansi-Dicarinella concavata* biozones.

Another valuable taxon for the biostratigraphical correlation and dating of deep water deposits is:

Bulbobaculites problematicus, regarded as a marker for the Middle Cenomanian (*Th. reicheli* biozone)–Lower Turonian (*H. helvetica* biozone). In the epicontinental planktonic associations, in the fine samples, very frequently this taxon shows a remarkable morphological variability, especially in the sub-adult stages. Some specimens encountered in the *M. schneegansi-D. primitiva* biozones (Middle Turonian–Coniacian) have a young stage which is strongly developed and slightly trochospiral, together with others in which this stage is sensibly reduced to 2-3 globular chambers. A noteworthy fact is that the specimens from the Upper Cenomanian (*R. cushmani-W. archaeocretacea* biozones) do not present this phenomenon.

Haplophragmoides herbichi is another biostratigraphically important taxon. This taxon, both in the deep water and epicontinental zones has a clear range, from the *M. schneegansi-D. primitiva* biozones, a range equivalent to *Uvigerinammia jankoi*, which is not crossing beyond the Coniacian. It is worthy mentioning that for both sedimentary environments, its gracile test, very finely-agglutinated with silica cement, appears in various degrees of flattening - from a globular to a completely flat test. This species is a valuable indicator for the *Uvigerinammia jankoi* biozone, in association with

species of *Thalmanammia* and *Recurvoides* typical for the interval.

Tritaxia gaultina is another taxon with a notable evolution encountered in both types of facies. This taxon appears as a constant component, present in foraminifera associations from the Vraconian (*Rotalipora appeninica* biozone) to the middle part of the *Dicarinella concavata* biozone. In the Cenomanian associations, this taxon appears as three morphospecies (*T. gaultinus carinatus* Neagu, *T. gaultinus gaultinus* Morozova, *T. gaultinus intermedius* Neagu).

In the Turonian, this species has a weak frequency among the agglutinated associations, while in the epicontinental planktonic associations it is a constant component throughout the interval from *Whiteinella-Dicarinella primitiva-Dicarinella concavata*, but with a wide morphological variability that would allow the separation of intra-specific taxa.

With a reduced frequency and a much smaller size in the epicontinental associations are the species of the genera *Thalmanammia* and *Recurvoides*, species which frequently make up the fundamental mass of the deep water (exclusively-agglutinated) assemblages. These two genera can be considered together with *Uvigerinammia jankoi* as typical taxa of these particular associations from below the CCD limit. In the epicontinental associations, these two genera have an average frequency. Worthy to note is their somewhat better frequency towards the lower part of the *Marginotruncana schneegansi-M. sigali* biozone.

Reophax sp. ex gr. multilocularis (Haeusler) has a constant presence throughout the interval from *M. schneegansi-D. primitiva* and is totally absent in the deep water associations.

Hyperammia sp. - Found within the same association as *Reophax*. The large morphological variability of the specimens, from those of small size and reduced diameter, to those with a remarkably large size, leads us to the conclusion that they belong to a different species than *H. gaultina* (ten Dam). Along with these, well-developed specimens of *Kalamopsis sp.* markedly different than *K. grzybowskii* also appear.

Ammovertelina irregularis - This genus differs from *Glomospira*, with which it was often confused, by the finely- to moderately coarse test, which is not as shiny smooth as that of *Glomospira*.

Paratrochamminoides sp. - A taxon present in both types of associations but with a lower frequency in the epicontinental assemblages.

Gaudryina carinata - Has a weak to moderate frequency in both types of assemblages. In the epicontinental assemblages, this taxon has a moderate size, while in the deep water assemblages the size of the test decreases sensibly along with the frequency.

Geröchammia sp. - This genus has for a very long time been confused with *Gaudryina* or *Karrerulina* because of its small size and the difficulty in following its development from young to adult stages. Observations of specimens immersed in glycerin have revealed particular characters which define the genus: multiserial young stage, which progressively transforms into an

adult biserial stage, and a typical internal neck. The genus is represented in both types of associations, but with an appreciable development and variability in the deep water assemblages. Here it generates marker species (*G. obesa* for the *M. schneegansi*-*D. primitiva* biozones). Their evolution continues into the Campanian with *G. levis*. In the epicontinental assemblages, the genus is represented albeit with an at best moderate frequency and a much reduced size. Biostratigraphically, it appears starting with the *H. helvetica* biozone (*G. obesa* and *G. stanislawi* from the Cenomanian).

Spiroplectamina praelonga has a sporadic frequency, although with its elongated, gracile test it represents a significant taxon for the the *M. schneegansi*-*D. concavata* interval in the epicontinental assemblages. Geroch, 1983 cites this species only in the *Bulbobaculites problematicus* biozone from the Polish Carpathians. In the Carpathian domain, this species appears predominantly in the epicontinental assemblages and very rarely in the agglutinated ones.

Marsonella crassa - This taxon has a nearly constant presence and a moderate frequency in the *H. helvetica*-*D. concavata* biozones. According to Geroch, in the agglutinated assemblages, this species has a range from the *B. problematicus*-*Hormosina (Caudammina) gigantea* zone of the Maastrichtian. In the Intorsura Buzaului area, this species as well as *Spiroplectamina praelonga* is rare and does not represent a significant element, often missing entirely from the agglutinated assemblages.

Trochammina wetteri - A taxon with a reduced size and frequency in the epicontinental assemblages, it is remarkably frequent and very large in the agglutinated ones. The systematic position of this taxon has been rather confusing. Initially it was attributed to *Trochammina globigeriniformes* PARKER & JONES 1965, P. Bronnimann and J. Whittaker, 1988 show that: "in our opinion no subsequent reference to globigeriniformis corresponds to the original description, though the name, usually placed in the genus *Trochammina* is still in wide use today". Subsequently, H. Tappan 1957, introduces the name *T. umiatensis*, and Eicher, 1967, proves that according to the principle of priority, the correct name is *T. wetteri*.

CONCLUSION

The micropaleontological study of the two distinct foraminiferal assemblages has proven the validity of the Geroch's 1983 biozones based on agglutinated foraminifera. It also made possible a direct correlation between the two different assemblages, thus reinforcing the opinions regarding the validity of the agglutinated foraminifera in biostratigraphy.

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PLATES

PLATE I

Fig. 1–6. *Reophax ex. gr. multilocularis* (HAEUSLER, 1883). Middle–Upper Turonian (*M. schneegansi*-*D. primitiva* zone), Valea Țâței.

Fig. 7–11. *Hyperammina* sp. (n. sp.), not *H. gaultina* TEN DAM. (*M. schneegansi*-*M. sigali* zone), because of its size and variability of the first chamber, this is undoubtedly a new species.

Fig. 12–13. *Kalamopsis* sp. (n.sp. possibly n.gen), (*M. schneegansi*-*M. sigali*-*D. primitiva* zone).

Fig. 14. *Caudammina ovulum* (GRYBOWSKI, 1896)-Turonian, Intorsura Buzaului.

Fig. 15–22. *Haplophragmoides herbichi* NEAGU, 1968. Middle Turonian–Coniacian, (*M. schneegansi*-*D. primitiva* zone), Valea Țâței, specimens deformed more or less severely during the fossilization process.

Fig. 23–25. *Trochammina wetteri* STELCH & WALL, 1955. Turonian, Intrarea Buzaului–Valea Soparlei, typical taxon for deep water deposits.

- Fig. 26–29. *Uvigerammina jankoi* MAJZON, 1943. (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței.
 Fig. 30–33. *Uvigerinammina praejankoi* NEAGU, 1989. (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței.
 Fig. 34–37. *Uvigerinammina jankoi* MAJZON, 1943., Bradet–Intorsura Buzaului, the classic morphotype from Turonian deep water deposits.
 Fig. 38–41. *Textulariopsis foeda* (REUSS, 1845), (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței.
 Fig. 42–44. *Spiroplectammina praelonga* (REUSS, 1845), (*M. schneegansi-M. sigali-D. primitiva*), Valea Țâței.

PLATE II

- Fig. 1- 5. *Bulbobaculites problematicus* (NEAGU, 1962), Valea Soparlei–Intorsura Buzaului, typical for Lower Turonian deep water deposits.
 Fig. 6–22. *Bulbobaculites sp. ex. gr. problematicus* (NEAGU, 1962), (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței, wide morphological variations can be observed (probably genetic mutations), especially in the wide trochospiral young stage (fig. 8) which can sometimes be as short as three chambers, as well as the variation in test composition, from finely to coarsely agglutinated.
 Fig. 23. *Gerochammina stanislawi* NEAGU, 1989, Lower Turonian, Valea Soparlei–Intorsura Buzaului.
 Fig. 24–30. *Gerochammina obesa* NEAGU, 1989, Lower Turonian, Valea Soparlei–Intorsura Buzaului.
 Fig. 31–33. *Ammovertelina ex. gr. irregularis* (GRZYBOWSKI, 1898), Turonian, Valea Soparlei–Intorsura Buzaului.

PLATE III

- Fig. 1–13. *Tritaxia ex. gr. gaultina* (MOROZOWA, 1948), Lower Turonian (*Whiteinella archeocretacea-H. helvetica*), Valea Țâței.
 Fig. 14–18. *Vermeulinoides sp. n.sp.* (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței.
 Fig. 19–20. *Gaudryina carinata* FRANKE, 1928, Turonian, Valea Țâței.
 Fig. 21. *Paratrochamminoides sp.* (*D. primitiva* zone), Upper Turonian, Valea Țâței.
 Fig. 22–29. *Marsonella crassa* (MARSSON, 1877), (*M. schneegansi-M. sigali-D. primitiva* zone), Valea Țâței–Intorsura Buzaului, rarely found in deep water deposits.
 Fig. 30–31. *Haplophragmoides herbichi* NEAGU, 1968, Turonian, Valea Soparlei–Intorsura Buzaului, found only in deep water deposits.

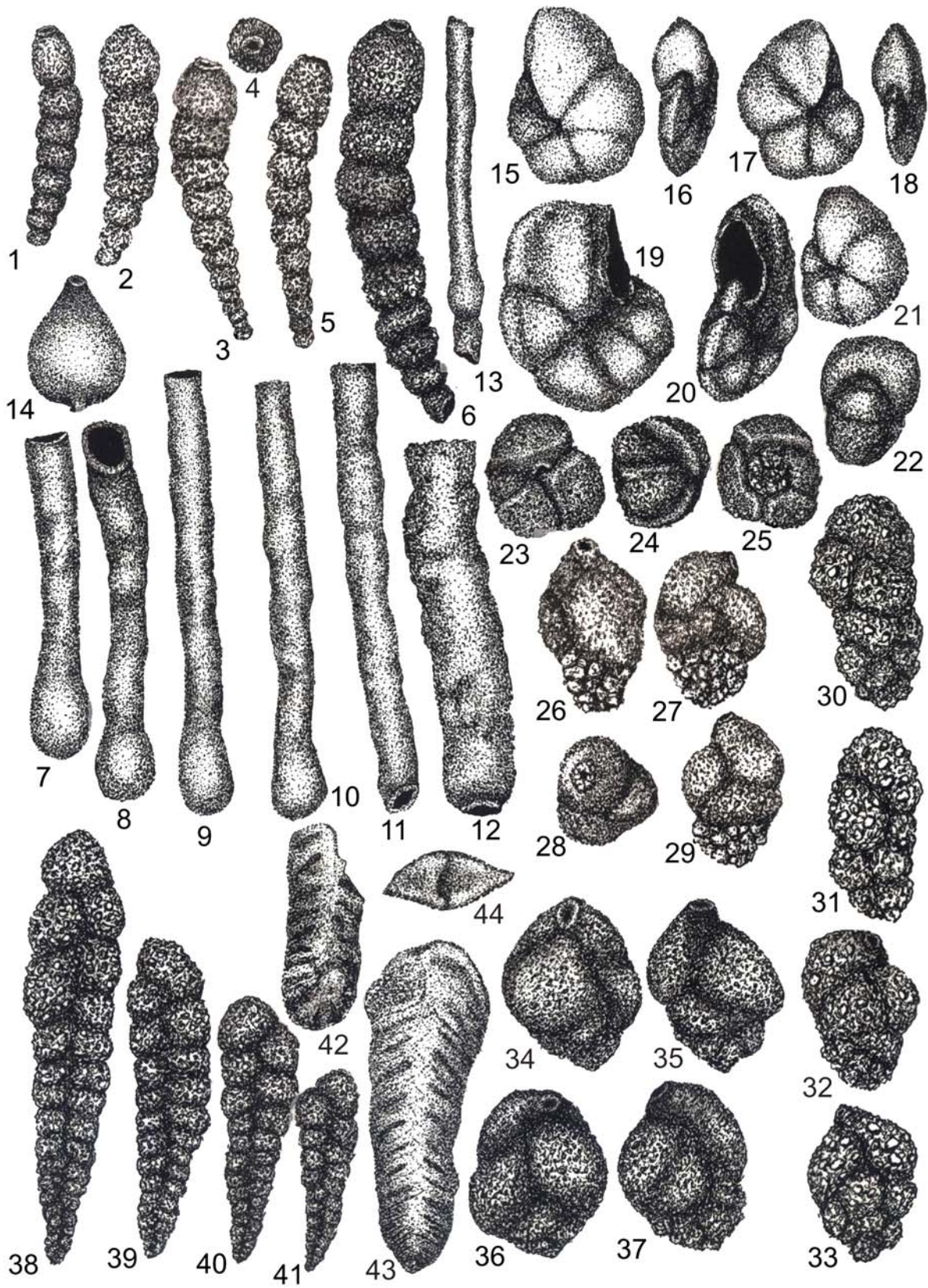


PLATE II



