

Problems and progress in establishing a Late Neogene chronostratigraphy for the Central Paratethys:

Comments and Replies

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1. Foreword

Following the publication of our paper (Sacchi M., Horváth F, Magyar I. and Müller P., 1997. *Problems and progress in establishing a Late Neogene Chronostratigraphy for the Central Paratethys*. Neogene Newsletter, vol. 4, 37-46) we have received several comments, remarks and suggestions from a number of colleagues, mostly working on the Neogene stratigraphy of the Paratethys. The comments that we have received so far have touched several important issues and have greatly contributed to clarify our ideas and stimulate further discussion.

Soon after collecting the first comments and replies on the above-mentioned article we realized that it would be relevant and informative for the reader if we published the integral correspondence (letters, fax and e-mail messages) we have exchanged with our colleagues. We believe this documentation is particularly valuable, as it results from different approaches, experience, and perspective in addressing a specific controversy of chronostratigraphic nomenclature for the Late Miocene of the Paratethys.

The documents presented here also include very preliminary views of the authors that sometimes have evolved or changed through time.

2. Introduction

The Pannonian s. l. stage (Lőrentthey, 1900) of the Pannonian basin (Late Miocene of the Central Paratethys stage system) is classically subdivided into lower (Pannonian s.str.) and upper (Pontian) stages. In recent years, however, several authors have pointed out that this subdivision is affected by severe terminological and conceptual inconsistencies (Müller and Magyar, 1992; Magyar and Hably, 1994; Sacchi et al., 1997, 1998). Particularly it has become clear that none of the stage names currently used in the literature adequately represent the middle part of the Pannonian (s. Lőrentthey, 1900) (ca. 9.0 - 7.4 Ma, in the chronology adopted in this study).

The reasons for the inadequacy of the “official” Paratethys stage system in offering a reliable chronostratigraphic picture of the Pannonian s.l. stage are various. Among the important factors hindering time-stratigraphic correlation are: 1) the general diachronous trends of the lithostratigraphic patterns in the Paratethys continental realm (younging from W to E); 2) documented radiations and migrations of endemic mollusc faunas from central to eastern Paratethys during Late Miocene-Pliocene; 3) the remarkable facies dependence of faunas which makes difficult the recognition of First Appearance and Last Appearance Data (FAD and LAD).

3. Concept of Transdanubian stage (or substage)

Based on a recent sequence stratigraphic study on Southern Transdanubia (Western Pannonian basin), Sacchi et al. (1997, 1998) have shown that the so-called “Pontian facies” of central-western Hungary (Lower part of Pontian s. Stevanoviæ, 1951) correspond to a distinct chronostratigraphic unit which is older than the Pontian of the stratotype area in Black Sea basin (Pontian s. str.) and younger than the Pannonian stage as it is defined in stratotype area of the Vienna basin (Pannonian s.str). Sacchi et al. (1998) have proposed to use the term Transdanubian (Danubian in Sacchi et al., 1997) to denote this chronostratigraphic interval in between the Pannonian s.str. and Pontian s.str stages (Fig. 1) .

In terms of mollusc biozonation the Transdanubian stage (or substage) corresponds to the littoral *Congerina balatonica-Lymnocardium decorum* zone and part

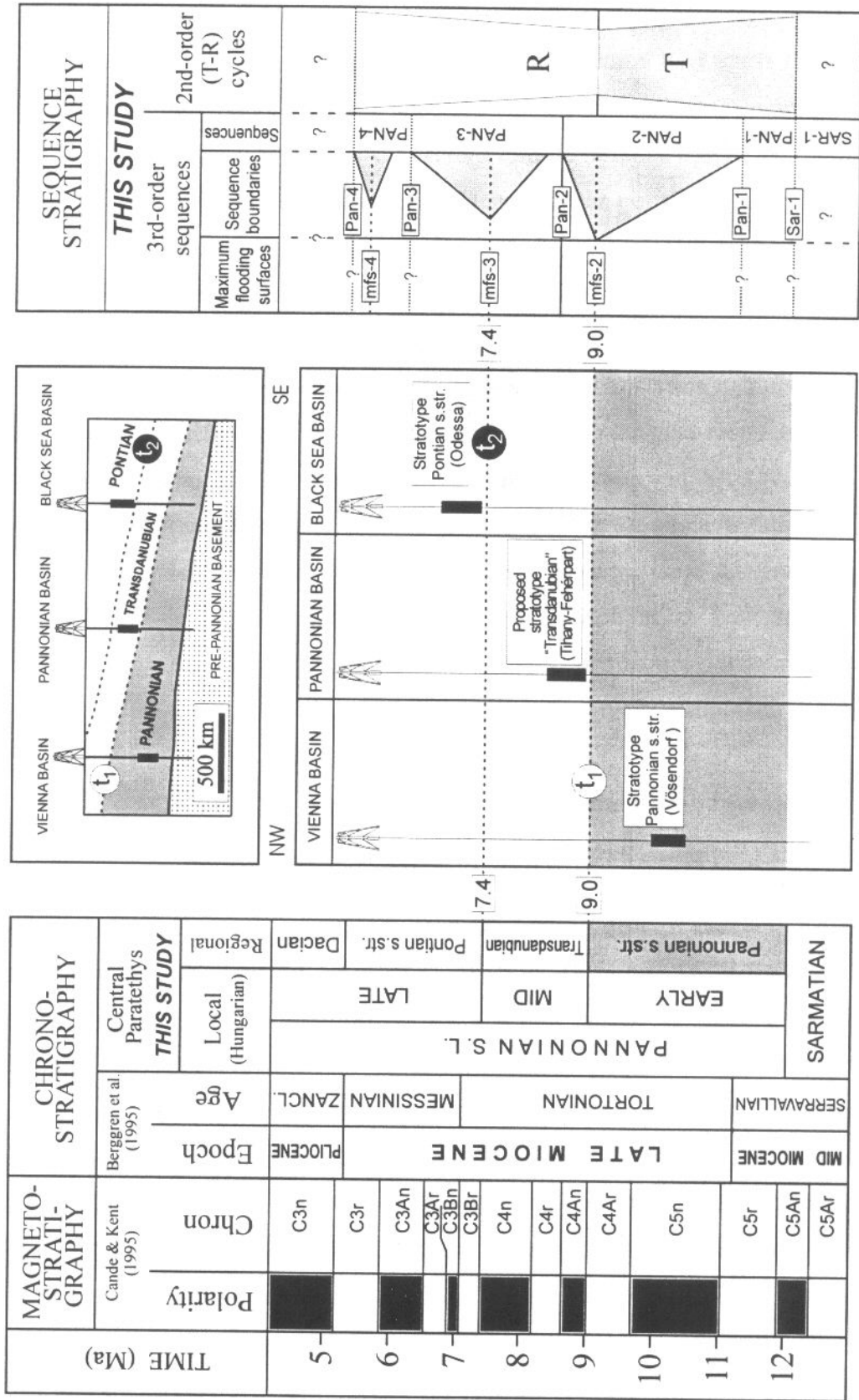


Fig. 1 - Sequence stratigraphic concept of the Transdanubian stage and the framework of Late Miocene stratotypes of the Paratethys (after Sacchi et al., 1998).

of the *Congerina unguilacapræ* - *Melanopsis pygmaea* zone (= *Lymnocardium ponticum* zone). It fairly well corresponds to the sublittoral *Congerina praerhomboidea* zone and the *Spiniferites validus* microplankton zone and hence may definitively substitute the lower part of the Pontian s. Stevanoviæ (1951) that caused severe problems in the stratigraphic correlation and nomenclature (Sacchi et al., 1998) (Fig. 2).

The boundaries of the Transdanubian stage correspond to two consecutive 3rd-order maximum flooding surfaces within the Pannonian s.l. sequence that in fact may be regarded as virtually isochronous surfaces at basin scale. The lower boundary of the Transdanubian correlates with the base of Chron *C4An* and displays an age of 9.03 Ma, while the upper boundary is within the lower part of zone *C3Br* (7.43 Ma) (Cande and Kent, 1995). As they correspond to maximum flooding surfaces, both boundaries of the Transdanubian stage are easily recognized in the outcrop (sharp facies contrast between the underlying open lacustrine beds and the overlying regressive fluvial-terrestrial strata) as well as in deep seismics (high-amplitude and high-lateral continuity of reflectors at the top of transgressive systems tract typically overlain by downlapping strata of the highstand systems tract deposits) (Fig. 3).

4. Subject of the discussion

Chronostratigraphic miscorrelation between the base of the eastern Paratethys Pontian (Pontian s. str.) and the base of the Central Paratethys Pontian (Pontian s. Stevanoviæ, 1951) due to diachronism of biofacies has been first demonstrated in the Pannonian basin by Müller and Magyar (1992, 1995). This problem was largely a consequence of the correlation suggested by Stevanoviæ (1951) who proposed the “extension” of the Pontian stage of the eastern Paratethys to the central Paratethys realm, based on the presumed coeval appearance of common mollusc species on both sides of the Carpathians. However, the Pontian mollusc fauna of the Eastern Paratethys consists of Pannonian Lake (Central Paratethys) immigrants and their descendants, and hence is much younger than its intra-Carpathian counterpart (Müller et al., 1999).

The fact that the base of the Pontian s.str. stage is nearly 2 Ma younger than the top of the Pannonian s.str (e.g. see Gyalog, 1996) actually represents a major obstacle in the chronostratigraphic procedure within the Central Paratethys. This circumstance

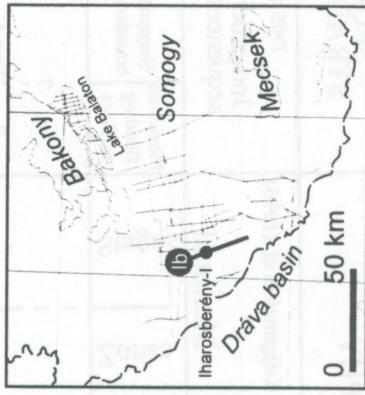
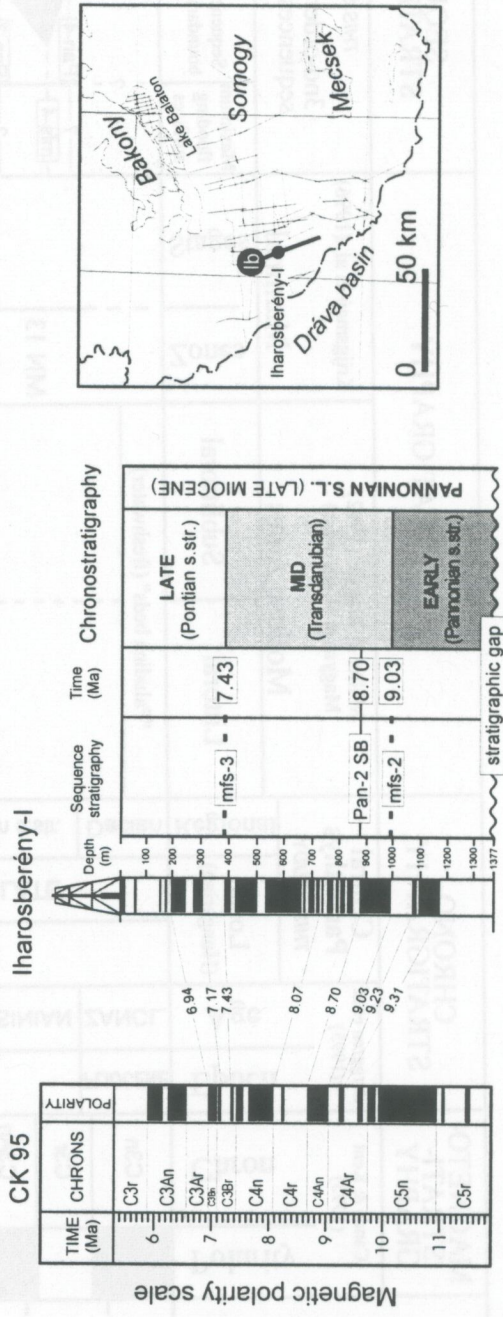
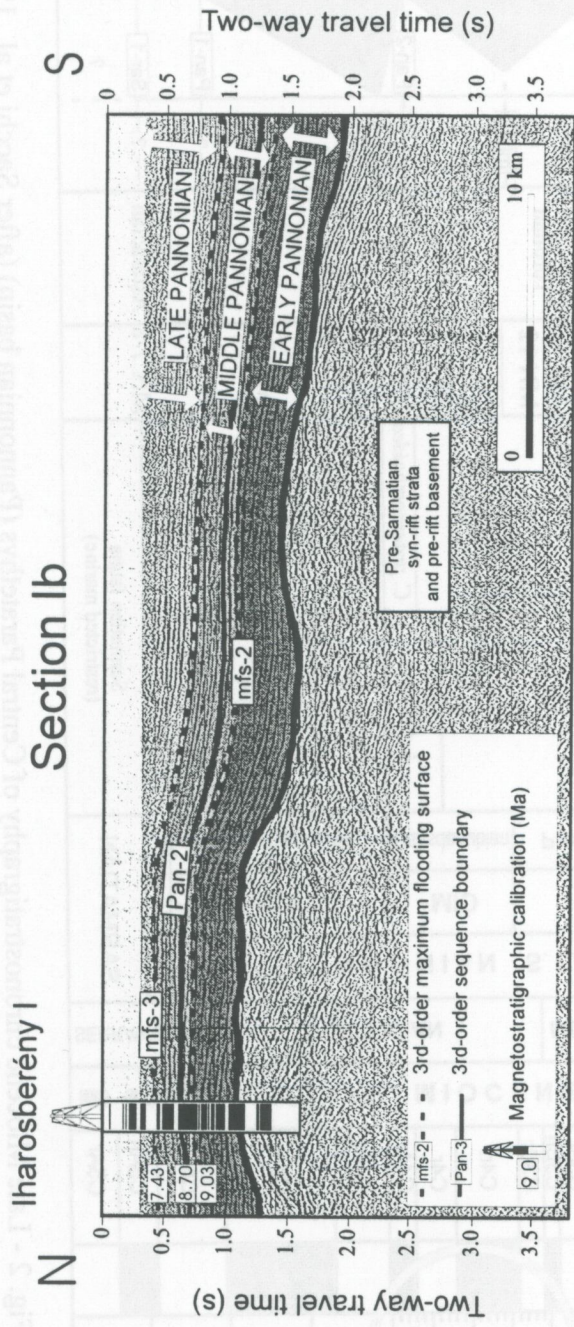


Fig. 3 - Magnetostratigraphic calibration of Pannonian s.l. strata at Iharosberény-I well site (after Lantos et al. 1992; Cande and Kent, 1995). The adopted three-fold subdivision of Pannonian s. Lórénthey (1900) is based on regional maximum flooding surfaces mfs-2 (9.0 Ma) and mfs-3 (7.4 Ma) (after Sacchi et al., 1998)

recalls the attention on the questionable practice of adopting a stage defined in the Eastern Paratethys (like the Pontian s.str.) for chronostratigraphic subdivision in the Central Paratethys. The problem is very complex indeed, as the term “Pontian” has deep roots in the literature. It is widely used by both Paratethyan and Mediterranean stratigraphers, and certainly it would not be easy to convince workers to substitute it with a different stage name “labeled” for Central Paratethys use only. On the other hand, the correlation of the Eastern Paratethys Pontian with time-equivalent strata of the Central Paratethys is not straightforward.

It might be thought that an easy (conceptual, not practical) solution to the problem would be to “stretch” the upper boundary of the Pannonian s.str. stage (s. Stevanoviæ, 1951) up to the lower boundary of the Pontian s.str. stage (e.g. Rögl, 1996, 1998). This solution, unfortunately, would cause even more confusion in the terminology. In fact, the “short” Pannonian s.str. stage (Stevanoviæ, 1951) at least had the basic advantage of being correlative with the Lower Pannonian of the Hungarian literature (s. Lőrenthey, 1900, Halaváts, 1903). This equivalence appears to be deeply rooted and “stable” in the Central Paratethys stratigraphic terminology of the last decades. With the eventual upward shifting of the top of the Pannonian s.str. stage this correlation would be lost, and much confusion would arise. Furthermore, the uppermost strata of such “stretched” Pannonian stage would include sedimentary deposits that display typical “Pontian facies” resemblance (e.g. at Tihany, Lake Balaton, Hungary) and have been referred to as Pontian for several decades.

Whatever the solution to be adopted may be, the key question remains how to fill the “chronostratigraphic gap”, or rather “conceptual gap”, between the Pannonian s.str. and Pontian s.str. stages. Of the several possible alternatives that one could propose to redraw the Late Miocene chronostratigraphy of the Central Paratethys in the light of new data, Sacchi et al., 1997 have discussed four, as shown in Fig. 4. Most of the enclosed comments and /or replies specifically refer to these proposed solutions.

STANDARD CHRONO- STRATIGRAPHY

CENTRAL PARATETHYS CHRONOSTRATIGRAPHY (Pannonian basin)

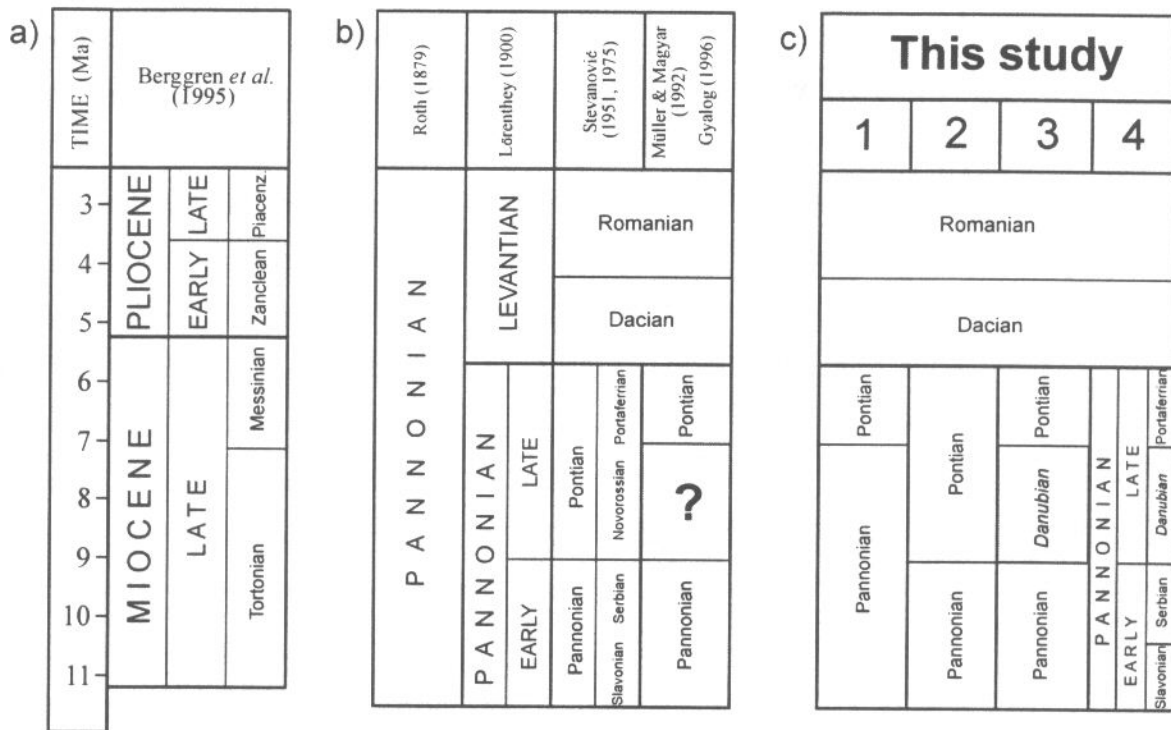


Fig. 4 - Correlation between (a) Mediterranean and (b) Central Paratethys chronostratigraphic units for the Late Miocene. Column (c) illustrates four possible solutions discussed in Sacchi *et al.* (1997) to fill the "chronostratigraphic gap" between the Pannonian s.str. and the Pontian s.str. stages.

- 1 Shift the boundary between Pannonian s. str. and Pontian s. Stevanović (1951) up to the base of the Euxinian basin Pontian (Eastern Paratethys).
- 2 Maintain the Pontian s. Stevanović (1951) only for the Central Paratethys and use the term Pontian with two different meanings.
- 3 Introduce a new stage between the Pannonian s. str. and Pontian s. str. (as defined in the Euxinian basin).
- 4 Delete the stage name "Pontian" from the Western-Central Paratethys stage system and reintroduce the use of the term "Pannonian" s. Lörentthey (1900).

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