3. At the same time, or after it, the two units became folded. (development of small-scale folds and folded foliation)
4. The two units together thrust upon the Jurassic sequence.
5. At the time of overthrusting or after it, it is possible to have one more deformation phase with a compression of ENE–WSW that slightly refolded the previous existed structures.

References

ÁRKAI P. and KOVÁCS S., 1986. Diagenesis and regional metamorphism of the mesozoic of Aggtelek-Rudabánya Mountains (Northeast Hungary). *Acta Geologica Hungarica*, 29: 347-373.

KOVÁCS S. and ÁRKAI P., 1989. Significance of conodont and limestone-texture alterations in the recognition of the boundary between diagenesis and regional dinamothermal metamorphism, based on examples from the Aggtelek-Rudabánya Mts. (NE Hungary). Annual report of the Geol. Inst. Hungary 1987: 215-235.

KOVÁCS S., LESS GY., PIROS O., RÉTI ZS. and RÓTH L., 1989. Triassic formations of the Aggtelek-Rudabánya Mountains (Northeastern Hungary); *Acta Geologica Hungarica*, 32: 31-63.

LESS GY., GRILL J., RÓTH L., SZENTPÉTERY I., and GYURICZA GY., 1988. Geological map of the Aggtelek-Rudabánya-Mts., 1:25,000. Hung. Geol. Inst., Budapest.

LESS GY., KOVÁCS S., FODOR L., PÉRÓ CS. and HIPS K., 1998. Geological cross sections through the Aggtelek-Rudabánya Mts., NE-Hungary. Abstracts of the XIV^th CBGA Congress, Vienna, Austria, Geol. Survey of Austria, p. 337.

PÉRÓ CS., KOVÁCS S., LESS GY. and FODOR L., 2002. Tectonic setting of the Triassic "Hallstatt" (s.l.) facies in NE Hungary. *Geologica Carpathica*, 53, spec. issue: 24-25.

PÉRÓ Cs., KOVÁCS S., LESS, Gy. and FODOR L., 2003. Geological setting of Triassic "Hallstatt" (s.l.) facies in NE Hungary. *Annales Universitatis Scientiarum Budapestiensis de Rolando Eötvös nominatae, Sectio Geologica,* 35: 58-60.

Tertiary Rotations Detected in the Fruška Gora (South Pannonian Basin) by Paleomagnetic Measurements

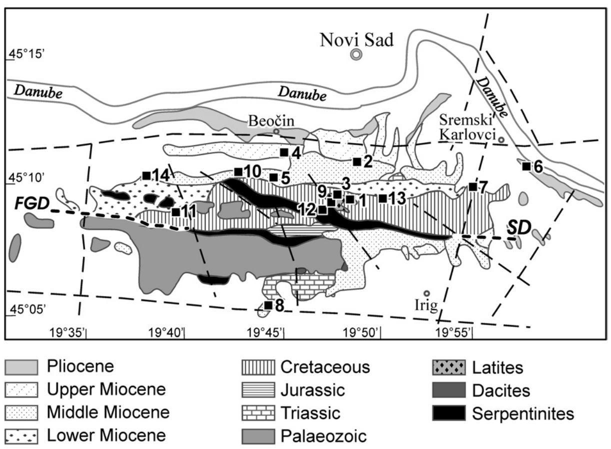
Vesna LESIĆ[1], Emő MÁRTON[2] and Vesna CVETKOV[3]

[1] Geomagnetic Institute, Narodnog Fronta 45, 11000 Belgrade, Serbia and Montenegro
[2] Eötvös Loránd Geophysical Institute of Hungary, Palaeomagnetic Laboratory, Columbus u. 17-23, H-1145 Budapest, Hungary
[3] University of Belgrade, Faculty of Mining and Geology, Department of Geophysics, Đušina 7, 11000 Belgrade, Serbia and Montenegro

Fruška Gora, is an inselberg, in the South Pannonian basin, which originally belonged to the Vardar ophiolite zone. The uplifted horst is partly covered and surrounded by Miocene and younger sediments. As paleomagnetic measurements carried out in the western and central South Pannonian basin revealed a co-ordinated counterclockwise rotation during the latest Miocene possibly early Pliocene, we decided to find out if Fruška Gora also participated in this rotation. Thought this was our primary task, we also sampled older rocks in order to trace possible pre-Miocene movements.

Of the 16 sampled localities, 14 gave statistically meaningful results. Some of them are relevant to the Miocene and later tectonic history indicating that Fruška Gora rotated in co-ordination with the Medvednica–Hrvatsko Zagorje area and with the Slavonian Mountains close to the end of Miocene i.e. was probably driven by the rotation of the Adriatic microplate (Márton et al. 2003).

Upper Cretaceous flysch and Oligocene (Knežević et al. 1991) latite intruding it shows clockwise rotation. Since our results represent one of the blocks of the Fruška Gora horst and the different blocks came into contact only after the Cretaceous (Dimitrijević 1997), the clockwise rotation can be interpreted in two ways. It can signify the emplacement of the block, which is north of the Srem dislocation zone or can be of regional significance. In the latter case, the Fruška Gora en block must have been displaced relative to the rest of the Vardar zone after the intrusion of the latite, during the Oligocene or early Miocene.



■ **Fig. 1.** Paleomagnetic sampling localities (1–14) in the Fruška Gora. Key: SD: Srem dislocation zone; FGD: Fruška Gora dislocation zone.

Acknowledgement

This work was partially supported by the Hungarian Scientific Research Found (OTKA) Project No. T034364.

References

DIMITRIJEVIĆ M.D., 1997. Geology of Yugoslavia. Geological Institute GEMINI, Belgrade.

KNEŽEVIĆ V., SZÉKY-FUX V., STEIGER R., PÉCSKAY Z. and KARAMATA S., 1991. Petrology of Fruška Gora latites-volcanic precursors at the southern margin of the Pannonian Basin. Geodinamic evolution of the Pannonian Basin, Proceedings of the International Symposium, pp. 234-235.

MÁRTON E., DROBNE K., ĆOSOVIĆ V. and MORO A., 2003. Palaeomagnetic evidence for Tertiary counterclockwise rotation of Adria. *Tectonophysics*, 377: 143-156.

Architectural Analysis of the Hlavačov Gravel and Sand – a Fluvial Relict of Neogene River System: Preliminary Report

Richard LOJKA and Marcela STÁRKOVÁ

Czech Geological Survey, Klárov 3, 118 21 Praha, Czech Republic

Fluvial deposits of Hlavačov gravel and sand represent the largest relict of Neogen river system, which drained the western and central Bohemia to the Most Basin (Pešek and Spudil 1986). The Most Basin is filled by late Eocene to early Miocene clastics and volcanic products and forms a part of NE-trending Eger Graben, a system of Cenozoic sedimentary basins and intense intraplate alkaline volcanism (Kopecký 1978, Malkovský et al. 1985, Adamovič and Coubal 1999, Cajz et al. 1999, Rajchl and Uličný 2000), recognized as a part of Central European Rift System (Ziegler 1990). The Hlavačov gravel and sand form NW-trending narrow belt, nearly 20 km long with maximum thickness varying around 40 metres (Bretšnaidr 1950, Váně 1985). The thickness and width of the belt generally decrease basin wards. At NW border, the Most Basin deposits overlay the Hlavačov gravel and sand. The age of deposits is not accurately proved and remains uncertain. However, the flora assemblages correspond to a temperate riparian forest probably of the uppermost Oligocene age (Teodoridis 2002). Hlavačov gravel and sand deposits were studied at three open gravel-pits situated at NW and SE borders of the belt (Hlavačov, Velká Černoc and Želeč).

Mostly coarse-grained deposits reflect high-energy, bed-load dominated depositional environment with significant portion of suspended-load material as shown by frequent clayey-sandy matrix. Sedimentary facies are arranged to a several depositional elements, such as gravel bars, sand flats, channels and chute channels. Gravel bars consist mostly of poorly sorted, planar-cross to horizontally bedded, pebbly to coarse-grained or sandy conglomerates with some sandstone interbeds and mudstone intraclasts. The base is usually planar or irregular, locally slightly erosional. Thickness can reach 5 m and lateral extend exceed 50 m. Widely spaced reactivation surfaces record slight changes in mainly downstream to oblique, preferably eastern or western ward accretion. The gravel bars are usually succeeded by sand flats or gravely/sandy channel fills. Sand flats are composed of number of small-scale trough-cross-bedded cosets of well-sorted mostly medium- to fine-grained sandstones. Occasionally some large-scale low-angle stratified sets may occur. Some erosional surfaces record small discharge fluctuations. Dispersed paleoflow directions usually differ from underlaying or overlaying depositional element. Their thickness reach up to 2 m and lateral extend can reach 50 m. Sand flats deposits result from mostly small-scale sandy dune trails running in rather shallow flows on bar tops and are usually truncated by channels. Package of medium- to well-sorted, trough-cross-bedded, coarse-grained sandstones to conglomerates fill the channels with pronounced concave erosional bases reaching several meters in relief (~ 3 m). The channel-fills consist of large- to small-scale cross-bedded sets and usually show a multi-storey framework; thickness of single channel-fill can exceed 4 m and lateral extend reach from 15 m to more than 40 m. The thickness of multi-storey channel-fill reach up to 8 m and lateral extend exceed 60 m (the limit of outcrop). Common alteration of open-framework and bimodal gravel laminas together with trough-cross-bedded sandstones suggests the filling of the channels by migrating high- to low-relief gravel and sand dunes. Frequent, usually erosional reactivation surfaces record discharge fluctuations and consequently minor changes in accretionnal directions. Significant lateral accretion surfaces show mostly northeast to east direction of accretion. Western or northwestern directions are subsidiary. Frequent channel shifting also display mostly northeastern to eastern trends. However, the channels are largely oriented to the north or northwest. Lenses of massive or laminated sandy clay representing the final stage of channel filling and subsequent abandoning can form the top of the channel-fills. Similar fine-grained deposits with gravel lag along the erosional, concave base locally truncate the gravel bars or sand flats. These channel shaped elements are interpreted as abandoned chute channels.

Described features are typical for gravel bed braided rivers with deep, perennial and relatively stable laterally slightly migrating channels. Huge gravel bars formed relatively stable banks or islands surrounded by channels; however, some bank collapse and frequent large mudstone intraclasts show to ex-