Paleomagnetically Constrained Geodynamic Events and the Formation of the Ipolytarnóc – Lipovany Ignimbrites

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In the area of the Paleogene Basin of N Hungary and S Slovakia two phases of CCW rotation were recognized during the Miocene, through paleomagnetic studies of ignimbrites and sediments (Márton and Márton, 1996, Márton et al., 1996): the first, about 50°, after the emplacement of the lower, the second, about 30°, after the formation of the middle tuff horizon. By combining paleomagnetic and radiometric age data from the Bükk Foreland, the two phases were dated as occurring between 18.5–17.5 Ma and 16.0–14.5 Ma, respectively (Márton and Pécskay, 1998).

An important feature of the paleomagnetic data set is that the three Miocene tuff horizons or tuff complexes (Szakács et al., 1998) are clearly distinguishable by their declinations. In the Ipolytarnóc area, however, some outcrops of the ignimbrite, overlying the "footprint" sandstone, and known as belonging to the lower tuff horizon, exhibited also 30° CCW rotation (Márton and Márton, 1996). This implied younger age than 17.5 Ma. We have followed up the above indication and now present a summary of the paleomagnetic studies so far carried out. There are two localities, one in Ipolytarnóc, (the glauconitic sandstone underlying the "footprint" sandstone), one at Lipovany (ignimbrite), where the angle of the CCW rotation corresponds to that of the lower tuff complex. On the contrary, about 2 km of Lipovany (close to the Hungarian boundary) and at all the sampled points (8 points and/or levels, deposited in water and on dry land) in Ipolytarnóc show only 30° CCW rotation. A limited number of samples drilled from the "footprint" sandstone also seems to belong to the second group. Thus, our data suggest that the first Miocene paleomagnetic marker horizon is older than the ignimbrite eruption producing the material deposited in the vicinity of Ipolytarnóc, i.e. the ignimbrite here must belong to the middle tuff complex of 17.5–16.0 Ma.

Though the age of the ignimbrite in the vicinity of Ipolytarnóc in strictly not controlled stratigraphically, the paleomagnetically indicated age seems to be problematic for the following reason.

The ignimbrite body covering the „footprint" sandstone at Ipolytarnóc is in similar geological position as the ignimbrite at Čakanovce and at Lipovany. If the Ipolytarnóc ignimbrite is younger than the other ignimbrites in the wider vicinity, we have to assume that the whole Ottnangian and Karpatian was removed by erosion locally at Ipolytarnóc.

References

MÁRTON E. and MÁRTON P., 1996. Large scale rotations in North Hungary during the Neogene as indicated by palaeomagnetic data. In: A. MORRIS and D.H. TARLING (Editors) Palaeomagnetism and Tectonics of the Mediterranean Region. *Geological Society Special Publication*, 105: 153-173.

MÁRTON E. and PÉCSKAY Z., 1998. Correlation and dating of the Miocene ignimbritic volcanics in the Bükk foreland, Hungary: complex evaluation of paleomagnetic and K/Ar isotope data. *Acta Geologica Hungarica*, 41: 467-476.

MÁRTON E., VASS D. and TÚNYI I., 1996. Rotation of the South Slovak Paleogene and Lower Miocene rocks indicated by paleomagnetic data. *Geologica Carpathica*, 47: 31-41.

SZAKÁCS A., SEGHEDI I., ZELENKA T., MÁRTON E., PÉCSKAY Z. and PÓKA T., 1998. Miocene acidic explosive volcanism in the Bükk Foreland, Hungary: identifying eruptive sequences and searching for search location. *Acta Geologica Hungarica*, 41: 413-435.

Geodynamic Application of Paleomagnetism in the ALCAPA Region

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Paleomagnetists, prior to 1990, applied their method mostly to Mesozoic and Paleozoic tectonic problems in the Alpine–Mediterranean belt of Europe, and within it, the ALCAPA region. Around this date, the importance of Tertiary displacements was realized (Márton and Mauritsch, 1990), and interest became shifted accordingly. Today, a large number of new paleomagnetic results are available for the Tertiary. The present paper will attempt to evaluate them from the viewpoint of post-Cretaceous geodynamic processes. It has to be emphasized, however, that the same data are also important for the correct interpretation of pre-Tertiary paleomagnetic declinations in terms of tectonic rotations, since any measured declination is the resultant of all rotations which involved the area in question, after the acquisition of a paleomagnetic signal.

The most striking feature of ALCAPA is that Tertiay rocks, up to a certain age, exhibit mostly westernly declinations. The declination deviations are due to Neogene displacements. During the Paleogene a general northward shift is observed. The space and time distribution of the paleomagnetic declinations permits to recognize a number of areas within the ALCAPA, with their special patterns of rotations. The most complete and best constrained Tertiary paleomagnetic record is available from the Paleogene Basin for N Hungary and S Slovakia (from late Eocene to Sarmatian), which shows that this area rotated twice (Márton and Márton, 1996, Márton et al., 1996), first at 18.5–17.5 Ma, second time at 16.0–14.5 Ma (Márton and Pécskay, 1998). Paleomagnetic observations from the Inner and Outer Western Carpathians suggest similar history (Márton et al., 1999, Márton et al., 2000a). It is also likely that the two older phases of Tertiary rotations of the Transdanubian Range were synchronous with the above events, but less intensive (Márton and Fodor, 2003). The so far described movements could have been induced by subduction pull, while the youngest rotation of the Transdanubian Range, probably shared by the Eastern Alps (Márton et al, 2000b, Scholger et al., 2003, Thöny et al., 2003), may be connected to the northward shift and rotation of Adria (Márton and Fodor, 2003). East of the Hernád line, in the Tokaj Mts and in the East Slovak Basin, a single phase of counterclockwise rotation occurred at about 12 Ma (Márton et al., 2000c, Márton, 2001).

A large number of observations come from the molasse in front of the nappe pile of the Eastern Alps and the Western Carpathians (Márton et al., 2001, Márton et al., 2003). Only a very few of them exhibit „European" declinations. The majority suggests counterclockwise rotations occurring at the southern margin of stable Europe. The geodynamic interpretation of these observations is not without problems, but the quality and number of data deserve attention.

References

MÁRTON E., 2001. Tectonic implications of Tertiary paleomagnetic results from the PANCARDI area (Hungarian contribution). *Acta Geologica Hungarica*, 44: 135-144.

MÁRTON E. and FODOR L., 2003. Tertiary paleomagnetic results and structural analysis from the Transdanubian Range (Hungary); sign for rotational disintegration of the Alcapa unit. *Tectonophysics*, 363: 201-224.

MÁRTON E. and MÁRTON P., 1996. Large scale rotations in North Hungary during the Neogene as indicated by palaeomagnetic data. In: A. MORRIS and D.H. TARLING (Editors) Palaeomagnetism and Tectonics of the Mediterranean Region. *Geological Society Special Publication*, 105: 153-173.

MÁRTON E. and MAURITSCH H.J., 1990. Structural applications and discussion of a paleomagnetic post-Paleozoic data base for the Central Mediterranean. *Physics of the Earth and Planetary Interiors*, 62: 46-59.

MÁRTON E. and PÉCSKAY Z., 1998. Correlation and dating of the Miocene ignimbritic volcanics in the Bükk foreland, Hungary: complex evaluation of paleomagnetic and K/Ar isotope data. *Acta Geologica Hungarica*, 41: 467-476.

MÁRTON E., VASS D. and TÚNYI I., 1996. Rotation of the South Slovak Paleogene and Lower Miocene rocks indicated by paleomagnetic data. *Geologica Carpathica*, 47: 31-41.

MÁRTON E., MASTELLA L. and TOKARSKI A.K., 1999. Large counterclockwise rotation of the Inner West Carpathian Paleogene Flysch – evidence from paleomagnetic investigation of the Podhale Flysch (Poland). *Physics and Chemistry of the Earth* (A), 24: 645-649.

MÁRTON E., TOKARSKI A.K. and NEMCOK M., 2000a. Paleomagnetic constraints for the accretion of the tectonic units at the stable European margin, north of the western Carpathians. European Geophysical Society XXV. General Assembly, Nice, France. *Geophysical Research Abstracts*, 2.

MÁRTON E., KUHLEMAN J., FRISCH W. and DUNKL I., 2000b. Miocene rotations in the Eastern Alps – Paleomagnetic results from intramontane basin sediments. *Tectonophysics*, 323: 163-182.

MÁRTON E., VASS, D. and TÚNYI I., 2000c. Counterclockwise rotations of the Neogene rocks in the East Slovak Basin. *Geologica Carpathica*, 51: 159-168.

MÁRTON E., TOKARSKI A.K., SCHOLGER R., KREJČÍ O., STINGL K. and MAURITSCH H.J., 2001. Molasse in front of the Outer West Carpathians: growing evidence for counterclockwise rotation. PANCARDI, Sopron, Hungary, Abstracts II, CP-19.

MÁRTON E., SCHOLGER R., MAURITSCH H.J., TOKARSKI A.K., THÖNY W. and KREJČÍ O., 2003. Counterclockwise rotated Miocene molasse at the southern margin of Stable Europe indicated by palaeomagnetic data. 6th ALPSHOP, Sopron, Hungary. *Annales Universitatis Scientiarum Budapestinensis, Sectio Geologica*, 35: 96-97.

SCHOLGER R., STINGL K. and MAURITSCH H.J., 2003. New palaeomagnetic results from the Eastern Alpine Neogene basins indicate rotations of micro-plates during the Neogene. 6th ALPSHOP, Sopron, Hungary. *Annales Universitatis Scientiarum Budapestinensis, Sectio Geologica*, 35: 89.

THÖNY W., ORTNER H. and SCHOLGER R., 2003. Palaeomagnetic data from the Northern Calcareous Alps, Central Alps and Southern Alps: jointed post-Oligocene counterclockwise rotation. 6th ALPSHOP, Sopron, Hungary. *Annales Universitatis Scientiarum Budapestinensis, Sectio Geologica*, 35: 90-91.