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Correlation of Miocene Volcanics in the Area of the North Hungarian Paleogene Basin by the Combination of Palaeomagnetic Marker Horizons and Magnetic Polarities

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There have been several waves of palaeomagnetic investigations in the Neogene volcanic areas of the Pannonian Basin (e. g., Márton & Márton 1968, 1969; Dagley & Ade-Hall 1970; Nairn et al. 1971; Andó et al. 1977; Balla & Márton 1978) aiming at dating and correlating volcanic rocks by magnetic polarities and at obtaining palaeomagnetic pole positions. The latter were based on selected site mean palaeomagnetic directions and the directions departing from the cluster of these were regarded as outliers. In these studies volcanoclastics were not included.

In the late 1980s, the Miocene ignimbrites of the Salgótarján Basin and of the southern Bükk foreland became the most interesting subjects for palaeomagnetic research in Hungary. The results were primarily of geodynamic significance, since they indicated large-scale tectonic rotations (Márton & Márton 1996) taking place in the intervals of 18.5–17.5 Ma and 16.0–14.5 Ma, respectively (Márton & Pécskay 1998). However, it was soon realized that the rotation events offered a new tool for stratigraphic correlation. The idea was that palaeomagnetic marker horizons (a one-way pattern of declination change) combined with traditional magnetostratigraphy could make age estimation and correlation highly reliable.

The palaeomagnetic marker horizons in the study area (comprising the volcanic areas named in Fig. 1) divide the Tertiary sequence into three parts. The oldest is a Late Eocene–Early Miocene segment, which ends with the lower (rhyolite) tuff, at about 18.5 Ma, and is characterized by 80° counter-clockwise rotated declination (N1–R1, Fig. 1). The segment between 17.5 and 16.0 Ma, shows 30° counter-clockwise rotated declination (N2–R2) and ends with the middle (dacite) tuff. Finally, the segment younger than 14.5 Ma includes the upper (rhyolite) tuff and exhibits about 10° clockwise rotated declination (N3–R3). The differences in declinations (induced by tectonic rotations) are so large that other mechanisms, which cause scatter also in the declinations of fast cooling igneous bodies can not weaken the correlation power of the marker horizons.

As a result of systematic palaeomagnetic investigation, the chronostratigraphic position of the volcanoclastics of the North Hungarian Paleogene Basin got known at more than one hundred sites.

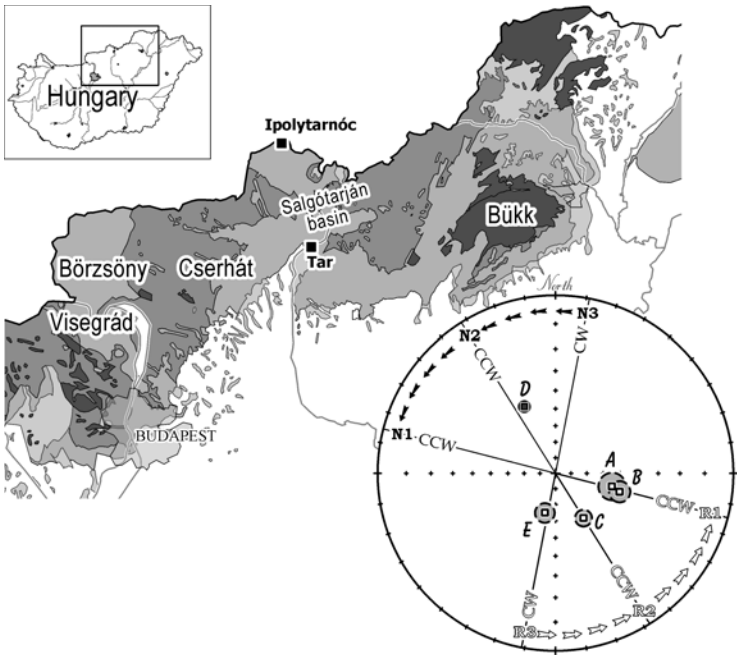

Fig. 1: The study area and some examples of the obtained palaeomagnetic directions (with the circle of confidence) compared with the expected declinations for the lower (N1–R1), the middle (N2–R2) and upper (N3–R3) tuff (ignimbrite) complexes. A) Southern Foreland of the Bükk Mts., lower ignimbrites. B) Salgótarján Basin, lower tuffs. C) Southern Foreland of the Bükk Mts., upper ignimbrites. D) Ipolytarnóc. E) Tar. All are of reversed polarity, except D.

It was found out that N1–R1 is confined to the Salgótarján Basin, and to the Bükk Mts. and their southern foreland. Sites showing N3–R3 declinations are few yet scattered all over the study area. The largest number of sites belong to the 16.0–14.5 Ma age group: they mark the onset of volcanic activity in the Visegrád Mts., in the Börzsöny Mts. and are widespread all around the Bükk Mts., cover the famous fossil footprint site, Ipolytarnóc (Fig. 1). The last occurrence was correlated with the oldest tuff horizon earlier. Apart from Ipolytarnóc, age revision is suggested on palaeomagnetic basis for several of the studied sites, among them for the quarry of Tar (Fig. 1), which was defined as the type locality for the middle tuff, by the name of Tar Dacite Tuff Formation, but turned out to belong to the upper tuff complex (ZELENKA et al. 2004).

To conclude, the combined application of palaeomagnetic marker horizons and magnetic polarity information proved to be a reliable correlation tool for the Miocene volcanoclastics. The limitation of the method is, however, that it cannot be used between areas that were displaced relative to each other after the eruption of the volcanoclastics in question.

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