# Towards the integrated paleotephra record of the large Miocene silicic volcanic eruptions of the Carpathian-Pannonian Region

*Réka Lukács[1], Reinhard Roetzel[2], Slavomír Nehyba[3], Frane Marković[4], Karin Sant[5], Mathias Harzhauser[6], Marcel Guillong[7], Olivier Bachmann[7], István Dunkl[8], Fritz Finger[9], Krisztina Sebe[10], Ildikó Soós[11], János Szepesi[11]*

[1] *MTA-ELTE Volcanology Research Group, Budapest, Hungary; e-mail: reka.harangi@gmail.com*
[2] *Geologische Bundesanstalt, Vienna, Austria*
[3] *Masaryk University, Brno, Czech Republic*
[4] *Department of Geology, Zagreb University, Zagreb, Croatia*
[5] *Department of Earth Sciences, Utrecht University, Utrecht, Netherlands*
[6] *Geological-Paleontological Department, Natural History Museum, Vienna, Austria*
[7] *Institute of Geochemistry and Petrology, ETH Zürich, Zürich, Switzerland*
[8] *Sedimentology and Environmental Geology, Geoscience Center, University of Göttingen, Göttingen, Germany*
[9] *University of Salzburg, Salzburg, Austria*
[10] *Department of Geology and Meteorology, University of Pécs, Pécs, Hungary*
[11] *Department of Petrology and Geochemistry, Eötvös Loránd University, Budapest, Hungary*

Lukács *et al*. (2018) showed that a massive silicic volcanic eruption phase occurred between 18 and 14.4 Ma in the Pannonian basin that could be considered the largest volcanism in Europe for the last 20 Myr. The cumulative eruptive material during this ignimbrite flare-up episode is estimated to have been more than 4000 km$^3$, and the individual eruptions could eject several 100s km$^3$ volcanic ash. Such large volcanic material is obviously covered large areas. Indeed, several Miocene basins in the Alpine and Mediterranean area contain volcanic ash. Although they have undergone various degrees of alteration, zircons could still preserve their eruption ages as well as magma composition characters and therefore they can be used for correlation purposes. The proximal deposits of this volcanism are best preserved and exposed in the Bükkalja volcanic field (BVF) and in the Tokaj-Slankske Mts., Northern Hungary. In the BVF at least three large explosive eruption events were recognized (Mangó ignimbrite eruption at 17.055±0.024 Ma, Demjén ignimbrite eruption at 14.880±0.014 Ma and Harsány ignimbrite eruption at 14.358±0.015 Ma), each providing large amount of volcanic ash. In addition, at least three large-volume, calderas forming eruptions occurred in the Tokaj-Slanske Mts. postdating the BVF eruptions.

A zircon perspective correlation has been performed using the new zircon U-Pb age data, trace element and Hf isotopic compositions from the BVF (Lukács *et al*., 2015, 2018) and other published results from ashes accumulated in various Miocene sub-basins along the Alpine forelands during the Paratethys era (*e.g.*, Rocholl *et al*., 2018) and in the La Vedova marine sedimentary section near Ancona, east-central Italy (Wotzlaw *et al*., 2014). Lukács *et al*. (2018) demonstrated that on chronostratigraphic ground many of these distal volcanic ash occurrences show a remarkable fit with one of the three eruption events occurred in the BVF. However, this geochronological correlation requires independent support such as trace element composition of zircons. Thus, a new cooperative work has just started involving further known Miocene distal volcanic occurrences and applying a zircon perspective methodology to constrain better the far-reaching effect of the Mid-Miocene ignimbrite flare-up of the Pannonian basin. This could yield a strong chronostratigraphic framework to improve the correlation of scattered Paratethys sedimentary deposits.

***Acknowledgements.*** This research was supported by the Hungarian Scientific Research Fund (OTKA/NKFIH) projects PD112584 and PD 121048.

**REFERENCES**

Lukács, R., Harangi, Sz., Bachmann, O., Guillong, M., Danišík, M., Buret, Y., von Quadt, A., Dunkl, I., Fodor, L., Sliwinski, J., Soós, I., Szepesi, J. 2015. Zircon geochronology and geochemistry to constrain the youngest eruption events and magma evolution of the Mid-Miocene ignimbrite flare-up in the Pannonian Basin, eastern central Europe. *Contributions to Mineralogy and Petrology* 170 (online), https://doi.org/10.1007/s00410-015-1206-8.

Lukács, R., Harangi, Sz., Guillong, M., Bachmann, O., Fodor, L., Buret, Y., Dunkl, I., Sliwinski, J., von Quadt, A., Peytcheva, I., Zimmerer, M. 2018. Early to Mid-Miocene syn-extensional massive silicic volcanism in the Pannonian Basin (East-Central Europe): Eruption chronology, correlation potential and geodynamic implications. *Earth-Science Reviews* 179, 1–19.

Rocholl, A., Schaltegger, U., Gilg, H.A., Wijbrans, Jan., Böhmeet, M. 2018. The age of volcanic tuffs from the Upper Freshwater Molasse (North Alpine Foreland Basin) and their possible use for tephrostratigraphic correlations across Europe for the Middle Miocene. *International Journal of Earth Sciences* 107 (2), 387–407.

Wotzlaw, J.-F., Hüsinget, S.K., Hilgen, F.J., Schaltegger, U. 2014. High-precision zircon U–Pb geochronology of astronomically dated volcanic ash beds from the Mediterranean Miocene. *Earth and Planetary Science Letters* 407, 19–34.