

In-situ measurements (U-Pb, Lu-Hf, trace elements) in zircons to unravel the record of magmatic evolution within a Cretaceous ABTS belt

A. VON QUADT¹ I. PEYTCHEVA^{1,2} AND C.A. HEINRICH¹

¹IGMR, ETH-Zurich, 8092 Zurich, Switzerland,
vonquadt@erdw.ethz.ch, heinrich@erdw.ethz.ch

²CLMC-Bulgarian Academy of Sciences, Sofia, Bulgaria

The development of improved techniques for the in situ U-Pb and Lu-Hf isotope analysis and trace element contents has revolutionized approaches to modelling the origin and evolution of magmas and the petrogenesis of granites. The key point is to obtain representative samples that preserve “record” of the processes and it has been accepted that is best provided by zircons. In magmatic rocks zircons saturate from the primary magma, but may be also inherited from host magmatic or metamorphic rocks with mantle or continental crust origin. For our case studies we selected intrusive and extrusive magmatic rocks with gabbroic to granitic composition from the Central Srednogie zone of the Cretaceous Apuseni-Banat-Timok-Srednogie belt. Based on conventional U-Pb single zircon grain dating a magmatic age migration from north to south (92.1 Ma – 78.8 Ma) is obtained, whereas Sr, Pb and Nd analyses on WR samples indicate a decreasing crustal input into mantle derived magmas.

In-situ LA-ICP-MS trace elements distribution of zircons is useful to distinguish between newly saturated and inherited grains/cores, whereas the concentration of more than 30 trace elements have been determined for zircons from a wide range of rock types. Generally REE patterns in magmatic zircons change insignificantly, but the hybrid gabbro zircons reveal the highest abundances of REE, U and Th. Some characteristic geochemical signatures of zircon from different rock types are recognized in bivariate discriminant diagrams.

In-situ LAM-MC-ICPMS Hf isotopic ratios are routinely measured with sub-epsilon unit precision. Yb interfering-correction for the zircon measurements is made by standard zircon material including adding of Yb solutions. ϵ -Hf of the magmatic zircons range between +7 and +11 and a typical $^{176}\text{Lu}/^{177}\text{Hf}$ ratios for zircons of 0.0009–0.0064 is measured. Detrital parts within grains with lead inheritance shift the ϵ -Hf data to negative values.

The *in-situ* microanalytical data help here to illustrate the complexity of magma genesis processes in a subduction-roll back scenario. The application of detailed studies of crystal growth history, integrated with high-resolution trace-element and isotopic analysis, can provide new insights into magmatic processes.

References

[1] von Quadt, A., Moritz, R., Peytcheva, I. and Heinrich, C.A. Ore Geol. Rev. 27, 2005, 95-126.