New U-Pb age constraints on Tertiary magmatism and Pb-Zn skarn formation in the Madan district, Central Rhodopes, Bulgaria

HANTSCHE, A.L.[1*], KOUZMANOV, K. [1], DINI, A.[2], VASSILEVA, R.[3], GUILLONG, M.[4], VON QUADT, A.[4]

[1]*Department of Earth Sciences University of Geneva, Rue de Maraîchers 13, 1205 Geneva, Switzerland (*correspondence: aaron.hantsche@unige.ch)*
[2]*Istituto di Geoscienze e Georisorse, CNR - Pisa, Via Moruzzi 1, 56124 Pisa, Italy*
[3]*Geological Institute, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. 24, 1113 Sofia, Bulgaria*
[4]*Istitute of Geochemistry and Petrology, ETH Zürich, Clausiusstrasse 25, 8092 Zürich, Switzerland*

Mineralization in the Madan polymetallic district of Bulgaria primarily occurs as polymetallic veins, distal Pb-Zn skarn and carbonate replacement ore bodies. It is hypothesized that mineralizing fluid circulation along a low-angle fault surface was initiated by heat released from intrusive igneous bodies at depth, though no causative intrusion has been discovered [1]. Rhyolite dikes in the region, emplaced between 31 and 32 Ma, are suggested to be the subvolcanic expression of such a magmatic reservoir related to Pb-Zn skarn and vein mineralization [2]. The mineralization is interpreted to have occurred around 30.4 Ma, based on $^{40}Ar/^{39}Ar$ dating of hydrothermal muscovite [3].

We now provide maximum age constraints of skarn formation based on cross cutting relationships with a rhyolite dike (31.22 ± 0.39 Ma). This is the first upper age constraint on the skarnification in the Madan district, and confirms that distal skarn formation occurred shortly before Pb-Zn mineralization.

Additionally, magmatic zircon trace element data provide insight to the evolution of magmatism from the onset of Eocene extension ~42 Ma to the emplacement of the rhyolite dike swarm and ignimbrite deposition around 31 Ma [2].

[1] Marchev *et al.* (2005) *Ore Geology Reviews,* **27**, 53-89. [2] Kaiser-Rohrmeier *et al.* (2013) *Economic Geology*, **108**, 691-718. [3] Kaiser-Rohrmeier *et al.* (2005) *Ore Geology Reviews*, **27**, 53-89.