

***In situ* U-Pb dating of garnet A laser ablation ICP-MS approach on low-U garnet**

R. ALBERT ROPER^{1*}, A. GERDES¹, L.J. MILLONIG¹,
I.S. BUICK² AND L. MARKO¹

¹Dept. of Geosciences, Goethe University Frankfurt, Germany
(*correspondence: AlbertRoper@em.uni-frankfurt.de)

²Dept. of Earth Sciences, Stellenbosch University, S Africa

Recent studies show that the U-Pb system applied to garnet can be used as a chronometer, *e.g.* [1, 2], using the *in situ* LA-ICP-MS technique on relatively U rich garnet (*c.* > 2 ppm) from skarns. However, garnet formed during metamorphic reactions or magmatic processes commonly has sub-ppm levels of U, *c.* 1 to 300 ppb. This presentation discusses the complications of dating low-U garnet and highlights the potential and advantages of the method used.

Different synthetic glasses (NIST614/612), garnet, titanite and zircon were used to evaluate the effect of chemical composition and optical properties on the instrumental induced U/Pb fractionation, *e.g.* matrix induced element fractionation (MIEF). U/Pb fractionation differences between zircon-garnet, NIST614-garnet and zircon-titanite are larger than between zircon-NIST614 and titanite-garnet, indicating that this fractionation is to a certain extent laser induced. Hence, this U/Pb fractionation variability is spot size / ablation volume dependant, which highlights that MIEF is caused by differential ionisation in the Ar-plasma.

Several garnet compositions from known age have been tested, as for example: 1) Almandine-pyrope-rich garnet from a HP-HT potassic granulite (Plešovice). The obtained mean ages of 336 ± 10 Ma to 346 ± 12 Ma agree within uncertainty with the Plešovice zircon age of 337.13 ± 0.37 Ma [4]. 2) Almandine-rich garnet from eclogites (Variscan Orogen, Cabo Ortegal Complex). The age of HP-HT metamorphism, constrained by zircon U-Pb dating at *c.* 390 Ma [4], was confirmed by garnet dating (398 ± 20 Ma).

This ongoing work shows that low-U garnet, with variable amounts of common Pb, is datable, and therefore it is possible to date garnet formed in almost any geological scenario, including garnet-grade metamorphism.

[1] Seman *et al.* (2017) Chem. Geol. **460**, 106-116. [2] Deng *et al.* (2017) Contrib. Mineral. Petrol. 172:71. [3] Sláma *et al.* (2008) Chem. Geol. **249**, 1-35. [4] Albert Roper (2017) Nova Terra **48**, 336.