Spatially resolved fully simultaneous determination of large numbers of isotope concentrations and isotope ratios by LA-MH-ICP-MS

D. ARDELT, W. BARGER*, M. REIJNEN AND O. PRIMM

SPECTRO Analytical Instruments GmbH, Boschstr. 10, 47533 Kleve, Germany
(*correspondence: willi.barger@ametek.com)

Laser Ablation-ICP-MS has developed into a powerful tool for the determination of elements, element ratios and isotope ratios in solid samples. The analysis of more and more elements with high spatial resolution and from ever smaller sample sizes is a challenge for this technology.

The development of a fully simultaneous ICP-MS brings several advantages for resolving this challenge: 'all' elements and isotopes can be determined in the same analytical run without sacrifying analysis time for any isotope. The simultaneous measurement also allows elimination of correlated noise, like flicker noise from the plasma or noise generated by the ablation process itself.

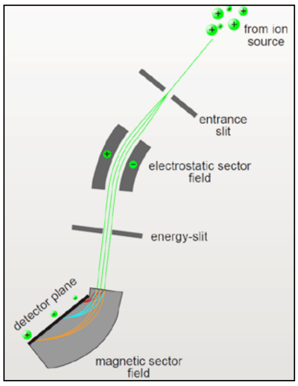

Figure 1: Mattauch-Herzog MS with Solid State Detector.

A double focussing sector field mass spectrometer in Mattauch-Herzog (MH) geometry (Figure 1) was combined with a 4800-channel, large CMOS based semiconductor direct ion detector, placed in the focal plane of the magnet. Each of the channels operates fully simultaneously, using two different amplifications, covering the mass range from ~5 to 240 amu.

The use of this new technology with laser ablation, for simultaneous chemical imaging of large numbers of isotopes, and analytical results for relevant samples, will be presented, with special emphasis on the expected advantages of the fully simultaneous detection.

Microstructures and compositions of melt inclusions from Jubrique (S Spain): Implications for anatexis

AMEL BARICH[1], ANTONIO ACOSTA-VIGIL[1], CARLOS J. GARRIDO[1], BERNARDO CESARE[2] AND OMAR BARTOLI[2]

[1]Instituto Andaluz de Ciencias de la Tierra, CSIC, Univ. Granada, Spain
(amelbarich@iact.ugr-csic.es)
[2]Dipartimento di Geoscienze, Univ. Padova, Italy
(bernardo.cesare@unipd.it)

Melt inclusions (MI) are small droplets of silicate liquid trapped by minerals growing either with or from the melt [1]. Most MI in anatectic terranes appear partially or totally crystallized due to slow cooling at depth, and have been named "nanogranites" [2]. MI represent a new and powerful method to study anatexis, because they can give information about melt compositions at the source region of crustal granites, including concentrations of H_2O [3].

There are very few studies of nanogranites, and only one has reported the presence of MI along a prograde metamorphic sequence from metatexites to diatexites [4]. We present a new occurrence of nanogranites along the prograde metamorphic sequence of Jubrique, located on top of the Ronda peridotites (S Spain). Jubrique represents a complete though strongly thinned (≤5 km) section of upper to middle-lower continental crust, ranging from carbonates and low-grade phyllites at the top to felsic Grt-bearing metatexites and granulites at the bottom and in contact with the peridotites.

MI show partially irregular to well facetted negative crystal shapes and occur in cores and rims of Grt porphyroblasts. They show a variable size, from ~5-10μm to several tens of μm in diameter; some of them reach up to ~200-300μm. Because of the large size, nanogranites at Jubrique have the potential to be remelted and analyzed by EMP but also by LA-ICP-MS. Nanogranites are composed of rare glass, daughter phases Qtz, Pl, Kfs, Bt and Ms, and solid inclusions of Ky and less frequently Gr, Hc, Rt, Ilm, Zrn, and Mnz. Ky was the main solid phase that favored the trapping of MI by poisoning crystal surfaces during Grt growth.

Previous studies concluded that anatexis in the granulites occurred in the Sil field during decompression and thining. The presence of Ky+Rt within MI, and their occurrence in the high-P cores of Grt, indicate that partial melting in granulites and migmatites initiated at high P conditions, and that most Grt in these rocks crystallized in the presence of melt.

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