Improvements of isotopic ratio reproducibility using EMs on the CAMECA IMS 1280-HR

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The success of the SIMS technique in the Geosciences field relies on its performance in terms of: 1) in-situ analysis of any solid flat polished surface; 2) great sensitivity which is mandatory for high precision measurements or to achieve low detection limits; 3) elemental as well as isotopic information ranging from low mass (H) to high mass species (U and above); 4) high spatial resolution from tens of microns down to sub-micron scale.

The IMS 1280-HR is a large geometry magnetic sector ion microprobe delivering unequalled analytical performance for a wide range of applications: tracking geological processes using stable isotopes, dating minerals, determining the content of trace elements, screening and analyzing large numbers of particles...

High density cesium or oxygen primary ion beam bombardment combined with optimized transmission allow high precision stable isotope studies and analysis of trace elements at high sensitivity (e.g. mandatory for Pb analyses in Zircon). The multicollector system ensures ultimate reproducibility for stable isotope ratio measurements and significantly increases the throughput of the instrument by reducing the total acquisition time. Thanks to its superior imaging capabilities, the IMS 1280-HR is capable of mapping the distribution of major, minor and trace elements or isotopes at sub-micron lateral resolution.

Tenth of permil isotopic ratio reproducibility can be routinely obtained on the IMS 1280-HR for multicollection analyses using multiple Faraday Cups ion detectors together with typically a few nA of primary current. Using FCs has nevertheless the drawback that it is not possible to achieve low count rate i.e. single ion counting. EM detectors (electron multipliers) work in a direct pulse counting mode, but when working with the high count rate, required to obtain sufficient statistics in reasonable time, aging of the EMs is known to limit the isotopic ratio reproducibility.

We implemented an iterative real-time control of the EM high voltage (HV) for automatically re-adjusting the EM HV before each isotopic ratio measurement, thus minimizing the effect of EM aging on reproducibility. We demonstrate that 0.2-0.3 permil isotopic reproducibility (1σ) is readily achievable on the IMS 1280-HR in automated mode, working with EM detectors and count rates up to the 1E6 counts/sec.