Coupling of multi-range imaging mass spectrometry and isotope chronology for multidisciplinary study on life and environmental sciences

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Images of trace-elements or isotopes can provide key information to evaluate the contribution of metamorphic events or movements of elements through secondary heating events. The LA-ICPMS technique is a useful tool to obtain image data of major to trace-elements from samples. Elemental and isotope images can be obtained by repeated analysis of line-scanning measurements using the LA-ICPMS technique. Time resolved-signal intensity profile obtained by laser rastering can be converted to a position based-signal intensity profile via the relationship between the rastering rate and the elapsed time. The resulting spatial resolution and the elemental sensitivity is dependent upon several key operational parameters such as, size of laser beam, raster rate as well as time slice of the data acquisitions (ie., dwell time for each analytes). The LA-ICPMS technique is highly sensitive to determine the abundance of the trace elements. One of the main advantages to use the LA-ICPMS technique for imaging analysis is that the sample is placed under atmospheric pressure, and neither evacuation of the sample housing nor coating with conductive materials is required. Moreover, because of both the minimum sample preparation and the post-ionization system configurations, the LA-ICPMS technique represents a fast and accurate method for quantitative imaging technique for trace-elements from biochemical or geochemical samples.
Another important feature of the elemental imaging using the LA-ICPMS technique is the analytical capability for large-sized samples (>10 mm). This is of crucial importance to secure a bridge between the microscopic and macroscopic realm in geochemical studies. The elemental imaging for trace-elements is an essential tool to derive inherent information from samples. Difference in the distribution pattern of the isotopes can reflect the geochemical and cosmochemical features of the elements. Moreover, the images suggests possible contribution of a re-distribution or secondary movement of these elements through heating or weathering. In addition, difference or similarity in the distribution pattern of the elements may provide key information concerning the status of system closure for chronologies. Thus, the coupling of the elemental imaging and the isotope chronology can become a major analytical tool to obtain reliable and precise age data from the geochemical samples, including biochemical or even micro-fossil samples. Analytical capability of the imaging mass spectrometer using the LA-ICPMS technique will be demonstrated in this presentation.

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