UNIVERSITÉ DE GENÈVE
FACULTÉ DES SCIENCES
Département des sciences de la Terre

Seminar of the Department of Earth Sciences, UNIGE
May 22, 11h15 in Room 001
Rue des Maraîchers 13, CH-1205 Genève or via Zoom

LA-ICP-MS imaging in the geosciences and its applications to geochronology

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Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) is a microanalytical technique that has driven major advances across the Earth sciences. It enables quantitative trace element and isotopic analysis of geomaterials at the ppm level across nearly the full mass range of the periodic table. This talk explores the opportunities opened up by LA-ICP-MS imaging, as well as the challenges involved in applying the method.

Uranium-lead (U-Pb) dating of calcite is challenging because calcite commonly contains very low uranium and high initial lead concentrations, yet it offers exciting possibilities for dating calcite veins in mountain belts, fossil-free ancient limestones, and ore-bearing vein systems. This talk demonstrates how a U-Pb image-mapping approach can overcome key limitations of the calcite U-Pb system, including low U concentrations and high initial Pb.

Pixels on a U-Pb age map can be pooled into "analyses" according to their elemental or isotopic ratio distributions, generating a spread of U-Pb data on concordia. Regions affected by detrital components or chemically distinct carbonate generations can then be excluded using user-defined regions of interest or chemical criteria. The approach also allows direct correlation with complementary microtextural datasets, including optical petrography, cathodoluminescence, Raman spectroscopy, and EBSD maps, and is readily extendable to other LA-ICP-(MS)-MS geochronological systems, including Rb-Sr dating of micas.

Applications from a range of geological settings will be presented, including the Carboniferous North Dublin Basin, where late Eocene LA-ICP-MS U-Pb ages from calcite veins linked to folding and flexural-slip deformation record far-field, N-directed shortening associated with the Alpine-Pyrenean orogenies, together with examples using beta-decay chronometers.