



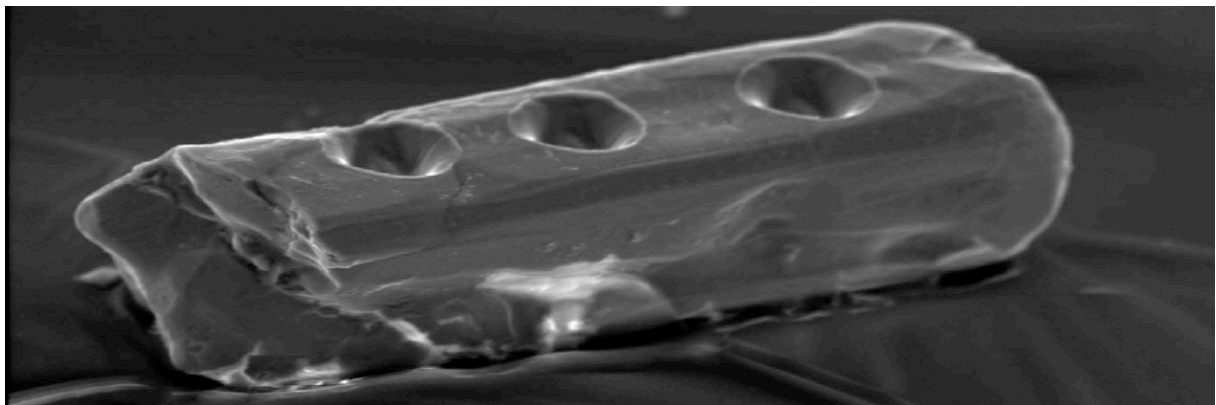
SEMINAIRE DU DÉPARTEMENT DE MINÉRALOGIE

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Developing New Analytical Strategies in Laser Ablation U(-Th)-Pb Geochronology with Application to Problems in Continental Tectonics



Abstract

Age-zoned accessory phase minerals provide a powerful means to quantify the timing and duration of a diverse range of geologic events. The full geochronologic utility of accessory phases lies in being able to unlock their history recorded in one, possibly several, age-domain(s) in a single crystal. For example, accessory phase minerals with inherited cores surrounded by very thin (often $<10\mu\text{m}$) and irregular rims are common throughout the geologic record. However, current in-situ U-Th-Pb analytical techniques (e.g. SIMS, LA-ICPMS) generally employ a static 'spot' analysis method which makes it difficult to confidently sample only the outer rim of such material. This limitation makes accurate and precise age determination of thin ($<20\mu\text{m}$) rim domains particularly challenging. In order to overcome this issue, a novel analytical strategy has been developed that involves mounting whole crystals on double-sided sticky tape and analysing them by LA-MC-ICP-MS. This presents the laser with the flat outer surface of the grain which can then be ablated using single pulses of a laser beam. Data acquisition relies on a low-volume ablation cell that facilitates 1) rapid transfer (~ 1.2 s) of ablated material to the mass spectrometer and; 2) a short (~ 0.5 s) sample washout time. Data from reference zircons indicate that it is possible to consistently measure $^{206}\text{Pb}/^{238}\text{U}$ and $^{207}\text{Pb}/^{206}\text{Pb}$ ratios with external reproducibilities of 3% and 2.5% (2SD) respectively. The level of uncertainty is achieved on up to 90% less material than 'multi-second' static ablation protocols making it an ideal way to rapidly generate accurate and precise age information from complex accessory phase minerals at the sub-micron scale. Further, it is comparable in terms of both volume of material consumed (0.6ng zircon / laser pulse) and precision achieved to other in-situ (e.g. SIMS) methods.