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Comparing trace element and Pb geochronology in zircon and titanite from mafic to granitoid intrusives: a laser ablation (LA)-ICP-MS study

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Due to the capability in preserving age structures, and the low contents of common Pb, zircon is generally the preferred mineral phase for in situ Pb geochronology. Titanite is a relatively common accessory U-rich mineral and potentially represents an alternative phase for Pb geochronology especially when zircon crystals are absent, small or damaged by metamictisation. Furthermore, in the case of the presence of both zircon and titanite in the same rock, their different closure temperatures towards the U-Pb system may furnish important information on the cooling history of the rock. Titanite is however, poorly considered in Pb geochronology because small amount of Pb are incorporated during the crystallisation and thus a common Pb correction is required for the achievement of reliable ages.

Mafic and granitoids rocks showing mingling relations from the high-K calc-alkaline suite of the Corsica-Sardinia batholith have been selected for this study. These rocks show relatively high amounts of titanite and zircon, and have been recently dated by ID-TIMS at about 340 Ma (Paquette et al., 2003). U/Pb ages were determined with a laser ablation instrument consisting in a 266 nm laser microprobe coupled with a sector field ICP-MS. The efficiency of correction for the laser induced U-Pb fractionation was evaluated and the analytical protocol for in situ Pb geochronology of zircons based on the external standardisation exported to titanite. Common Pb correction in titanite was performed either adopting the method of Compston et al. (1992) or on the basis of the measured ^{204}Pb.

Zircons from mafic rocks yield a large number of concordant ages whose most represented peak is at about 334 Ma. A minor peak (2 times less represented) at 324 Ma and few older zircons with ages up to 410±7 Ma have been also found. In granitoid rocks, zircons show the presence of two statistically distinct and almost equally represented age peaks at about 336 Ma and 320 Ma. In both rocks, few zircons yielding significantly younger concordant ages (236±5 and 265±6 Ma) are also present. Results on titanite from mafic rocks after common Pb correction yield two distinct ages of 310±9 and 336±10 Ma that resemble the age pattern given by zircon. Results on titanite from granitoid rocks yield common Pb corrected ages that are significantly younger than those from associated zircons. In situ trace element analyses on zircon and titanite by (LA)-ICP-MS provide additional information to address the origin of the variations in the geochronological determinations.

References

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Paquette et al., Chem. Geol., XX, 1-20. 2003