"IN SITU" ID-TIMS U-PB DATING OF SINGLE MONAZITES: A NEW METHOD TO UNRAVEL COMPLEX POLY-METAMORPHIC EVOLUTIONS. APPLICATION TO THE UHT GRANULITES OF ANDRIAMENA (CENTRAL MADAGASCAR)

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In terranes that have been subject to a complex tectono-metamorphic evolution, the U-Pb system of zircons and monazites can record successive growth and/or resetting episodes. State of the art conventional ID-TIMS (Isotope Dilution and Thermo-Ionisation Mass Spectrometry) dating applied to global zircon and monazite populations can result in scattered analytical points producing inaccurate intercept ages. Consequently, precise dating of a complex sample should be guided by a prior textural analysis so as to fully appreciate the significance of each zircon or monazite generation and corresponding ages. In this article, we propose a new technique which combines textural analysis and ID-TIMS dating on single monazite crystals. This method operates on thin sections with three successive steps comprising (1) a complete characterisation of textural relationships using EMP (Electron Micro-Probe), (2) the extraction by micro-drilling of selected individual monazite crystals and (3) the conventional U-Pb dating of each individual extracted grain by ID-TIMS. The potentialities of this new "in situ" dating technique are tested on UHT (Ultra High Temperature) granulite samples from Central Madagascar. These results are compared with those obtained by conventional dating on zircon and monazite global populations from three other samples. The "in situ" U-Pb dating approach allows to distinguish four distinct events on a single thin section. The UHT metamorphism was dated at 2.5 Ga in garnet-included monazites, while two retrogression events were dated at 790 Ma and 500 Ma in monazite grains from the hydrated assemblages. Finally, a single crystal
shielded in a quartz grain preserves a pre-metamorphic age around 2.7 Ga. The influence of the textural position on the variable degree of discordance reported in U-Pb analyses of monazites is discussed. The absolute timing of specific metamorphic reactions is estimated as well as the role of fluid composition in the U-Pb system resetting processes.