Origins and significance of U-Th-Pb isotopic disturbance in monazite from UHT context (Napier Complex, East Antarctica)

M. TURUANI[1,2*],A-M. SEYDOUX-GUILLAUME [1,2],S. L. HARLEY[3], A. T. LAURENT[1], D. FOUGEROUSE[4], V.BOSSE[5], S. M. REDDY[4]

[1]Univ.Lyon, UJM, CNRS, LMV, F-42023, Saint-Etienne, France (*marion.turuani@univ-st-etienne.fr)

[2]Université de Lyon, UCBL, ENSL, CNRS, LGL-TPE, F-69622 Villeurbanne, France.

[3]School of Geosciences, University of Edinburgh, James Hutton Road, Edinburgh EH9 3FE, UK

[4]School of Earth and Planetary Sciences, Curtin University, Kent St, Bentley WA 6102, Australia

[5]Univ. Blaise Pascal, UCA-OPGC, CNRS, LMV, F-63001 Clermont-Ferrand, France

Monazite ($LREEPO_4$) is widely used in U–Th–Pb geochronology. Based on the assumption that U, Th and Pb (decay product) are immobile over time in the mineral, the isotopic composition of monazite yields geologically meaningful ages corresponding to monazite (re)crystallization. However, discordant dates are sometimes obtained[1], which indicate a disturbance of the U–Th–Pb isotopic system. Experimental studies[2] highlight the incomplete replacement of primary monazite with secondary monazite at the nanoscale, yielding apparent partial resetting of the U–Th–Pb geochronometer due to analysis of mixed domains. To constrain the origin of this type of disturbance we have examined discordant monazites from a ultrahigh temperature paragneiss from the Archean Napier Complex, Antarctica[1]. Monazite crystals are hosted in strained porphyroblasts as garnet or in the quartzo-feldspathic matrix. Grains exhibit complex internal features, such as chemical core rim zoning, linear, possibly planar, veinlets that are Th-rich and Y-poor but also Pb-rich nanoclusters (ca.0.2µm, identifed by TEM). Dating of the monazite grains by LA-ICPMS and EMP, yields U–Pb (and Th–Pb) ages that spread along a discordia between ca. 2.4Ga and 1.0Ga. However, the mechanisms responsible for this discordance remain unclear. We have therefore utilised atom probe tomography to target the different monazite textural features and characterize the heterogeneous isotopic variations in $^{208}Pb/^{232}Th$ and $^{207}Pb/^{206}Pb$ at the nanoscale. These results provide the constraints needed to identify the origin and mechanisms responsible for discordance in these monazites. [1] Black et al. (1984) Contrib. Min. Petrol. 85,141-148. [2] Grand'Homme et al. (2016) Geol. G37770,1.