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Origin of U-Th-Pb isotopic disturbance in discordant monazite from UHT context (Napier Complex, East Antarctica) resolved by Atom Probe Tomography

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U-Th-Pb geochronology on monazite ($LREEPO_4$) is widely used in Earth Sciences. However, isotopic disequilibrium may occur in geochronometers coming from ancient and polymetamorphic rocks, leading to discordant dates and erroneous conclusions with respect to the geological history [1]. Whilst the framework for interpretation of discordant data attracted much attention in early applications of geochronology, the causes of discordance in the U–Th–Pb systems at the scale of the mineral lattice are still a matter of debate. To explore this matter, discordant monazites coming from ultrahigh temperature paragneiss from Zircon Point, in the Archean Napier Complex (Antarctica) were re-investigated [2], from the micro- to the nanoscale. *In-situ* conventional dating methods (LA-ICP-MS, SIMS and EMP) lead to discordant dates spread along a discordia between 2.4 and 1 Ga and whose degree of discordance is related to the monazite petrological position. At the nanoscale, Transmission Electron Microscope (TEM) revealed that monazites contain abundant Pb nano-inclusions (500 – 20 nm), the concentration and the size of which depends on the mineral hosting the monazite. Thank to TEM and Atom Probe Tomography (APT), some nano-inclusions are identified as galena (PbS) with radiogenic Pb (Pb^*) only. Excluding nano-inclusions, monazites yield an average $^{208}Pb/^{232}Th$ age of 1011 ± 221 Ma (2σ) obtained by APT [3]. $^{207}Pb/^{206}Pb$ isotopic signatures were obtained in galena nano-inclusions with APT, allowing the interpretation of the isotopic perturbation recorded in monazite at the microscale. These results show the possibility of improving our understanding and interpretations of discordant systems through nanoscale investigations by TEM and APT.

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