

## Regional scale titanite U-Pb dates, what do they mean? Telemark, Norway

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In metamorphic environment, titanite U-Pb geochronological data are interpreted in terms of thermochronology or petrochronology. Contextual and compositional information is guiding interpretation. Titanite, however, is known to incorporate minor amount of Pb, unradiogenic or radiogenic, from its precursor minerals, complicating interpretation. A regional scale study from the newly mapped Nissedal area, Telemark, Norway, shows that in felsic metagneous rocks, primary magmatic titanite is metamorphosed by interfacial dissolution-reprecipitation, incorporating (not expelling) variable proportions of radiogenic Pb produced since the magmatic event. In the area, a mylonitic to ultramylonitic extensional detachment (Nisser detachment zone) separates an amphibolite-facies gneiss footwall (Vråvatn complex) from an epidote-amphibolite-facies hangingwall made of bimodal metavolcanic rocks (Nissedal complex). Titanite was imaged with SEM-BSE and analysed for U-Pb and 25 elements by laser-ablation split-stream ICP-MS, in 24 samples with known intrusion age (zircon U-Pb). Foliation parallel anhedral titanite crystals exhibit both sector zoning, controlled by crystallographic orientation, and patchy to concentric zoning, controlled by inwards increments of interfacial dissolution–reprecipitation. Individual textural zones were targeted in felsic samples from the 3 tectonic units, 15 of them with intrusion age of c. 1200 Ma. In metarhyolite from the Nissedal complex hangingwall, cores of magmatic titanite with high trace element content (e.g. Sm) are preserved. Apparent dates spread between the intrusion age of 1200 Ma and 970 Ma. A group of higher-Al and Pbc zones yield an age of c. 930 Ma interpreted to record metamorphic neoblastesis, in accordance with local titanite corona surrounding oxides minerals. In the Vråvatn complex footwall, titanite apparent ages spread between 1050 and 920 Ma with low Pbc and poor correlation between trace elements: 1050 Ma may correspond to complete resetting of precursor titanite during high-grade metamorphism by Pb diffusion and/or dissolution-reprecipitation, while 920 Ma to cessation of the dissolution-reprecipitation process and de-facto exhumation of the footwall, as supported by amphibole 40Ar-39Ar data. In (ultra)mylonites of the detachment, titanite occurs as phenoclast, with similar zoning and apparent date distribution than the underlying Vråvatn complex. Planar features related to mylonitization are too thin to be analysed individually and