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Low temperature alteration of monazite megacrysts in pegmatite, Evje-Iveland, Norway

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Monazite megacrysts, up to 20 cm long, from the Evje-Iveland rare-mineral pegmatite field, southern Norway, were investigated by SEM, EPMA, SIMS, LA-ICP-MS and ID-TIMS to evaluate their low temperature alteration and geochronology. Seventeen monazite megacrysts from seven pegmatite bodies have a composition dominated by the monazite-(Ce), huttonite and xenotime components, with up to 11 wt% Th and 5000 ppm U. They display a systematic and classical [1] alteration trend characterized by breakdown of the magmatic monazite (Mnz 1) into a variably fine-grained assemblage of secondary monazite (Mnz 2), thorite and xenotime. The U-Pb age of monazite 1 ranges from c. 901 to 912 Ma, implying that different pegmatite bodies have slightly distinct ages. They can not be product of differentiation of a single granite pluton, but rather represent local magma batches formed by anatexis. Alteration involves redistribution of Th, Y, HREE, U, and Pb. U–Pb analyses of secondary monazite define trends of U-loss and common Pb-gain, implying largely open system for U and Pb. The age of alteration, whether shortly following intrusion or much younger, can not be constrained. SIMS and ICP-MS analyses of Th-rich monazite are complicated by significant matrix effects. Monazite megacrysts of pegmatites are too heterogeneous to be suitable as reference material. [1] Seydoux-Guillaume et al., 2012, Chemical Geology, v. 330, p. 140.