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Metamorphic zircon formation at the transition from gabbro to eclogite in Trollheimen-Surnadalen, Norwegian Caledonides

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A transition zone from gabbro to eclogite via coronitic stages has been investigated at Vindøldalen in south central Norway, with the aim of linking reaction textures to metamorphic zircon growth and obtaining a direct U-Pb zircon age of the metamorphic process. Different rocks from the transition zone contain various types of zircon: I) as igneous prismatic grains; II) metamorphic polycrystalline rims and pseudomorphs after baddeleyite, and III) tiny (> 10μm) bead-like zircon grains associated with a) oxidation and b) resorption of Ti-Fe oxides. During progressive transformation from gabbro to eclogite, titanomagnetite (magnetite with ilmenite lamellae) was oxidised to titanohematite (hematite + ilmenite); at advanced stages of recrystallization to eclogite, rutile was produced at the expense of Fe-Ti oxide. Textural relations suggests that the FeTi-oxides were the main source of Zr. Subsolidus liberation of Zr and formation of zircon beads took place by oxidation of titanomagnetite during fluid-assisted metamorphism in undeformed corona gabbro, and by resorption of FeTi-oxide in undeformed and strongly deformed rock domains that were recrystallized to eclogite. Secondary ionization mass spectrometry (SIMS) and Thermal ionization mass spectrometry (TIMS) were used to obtain U-Pb ages of zircon and baddeleyite. Magmatic baddeleyite yields a TIMS age of 1.46 Ga dating igneous crystallisation, whereas the SIMS age for baddeleyite and magmatic zircon from the same gabbro is slightly younger. Bead-type metamorphic zircon from eclogite gives an age of 425$\pm$10 Ma (TIMS), and dates directly the metamorphic transition from gabbro to eclogite in the upper basement of the Lower Allochthon in the south-central Scandinavian Caledonides. The metamorphic zircon age does not necessarily date the peak metamorphic temperature, but reflects fluid-induced reactions and oxidation of primary phases.