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In-situ U-(Th-)Pb dating and REE analysis of zircon and monazite in the Grt-bearing gneisses from Gossa: Tracing early subduction into the highest-grade domains of the Western Gneiss Region, Norway

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To better understand the subduction–exhumation cycles of the Baltoscandian margin that reached (U)HP depths during the Caledonian orogeny, we have performed in-situ U-(Th-)Pb dating coupled with REE analysis of zircon and ± monazite in four samples from the supracrustal rocks of the Blåhø Nappe on Gossa island in the Western Gneiss Region (WGR) of Norway. We dated two garnet-plagioclase-biotite gneisses and two garnet-plagioclase-amphibole gneisses. Our research focused on deciphering the early metamorphic evolution of these complex rocks that have been overprinted by exhumation-related structures and pervasive retrogressive metamorphism.

The dated zircon grains are spherical or slightly elongated in shape, some of which display clear multi-stage growth features. Only one grain armored by garnet preserved an older detrital core that yielded early Neoproterozoic dates between 1.1-1.0 Ga. This grain does not provide any Caledonian signal. Younger individual $^{206}Pb/^{238}U$ dates show three distinct populations that yield three concordia ages, each obtained from distinctly different compositional domains, the oldest from cores and the two youngest from overgrowths. The cores are characterized by HREE enrichment (high Lu/Gd ratios ca. 14.5), high Th/U ratios (> 0.1), and large Eu anomalies. They yield a concordia age of 474 ± 6.4 Ma. These cores can be rimmed by two different types of zircon overgrowth. The first overgrowth type (1) displays the same REE pattern as the cores and gives a concordia age of 444± 4.3 Ma. The second overgrowth type (2) shows a very weak Eu anomaly, no HREE enrichment (low Lu/Gd ratios ca. 2.37) and a very low Th/U ratios (<0.1). These yield a concordia age of 416± 3.7 Ma. The two older U–Pb zircon age populations are tentatively interpreted as reflecting two distinct metamorphic events or a prolonged episode of metamorphism. The youngest concordant metamorphic zircon dates a high grade, probably (U)HP, metamorphic overprint at ca. 416 Ma, subsequent to the previous events. Analyses performed on monazite provided complementary age records to those obtained on zircon. Monazite grains are weakly zoned, exhibit wormy shapes and are aligned with the youngest foliation. Th–U–total Pb dating of monazite, coupled with major and trace element mapping of monazite, yielded a very homogeneous age of 382 ± 1.6 Ma (n=65) interpreted to date the late shearing, which possibly accommodated a late stage of exhumation.

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