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The archetypal giant UHP terrane of the southern Scandinavian Caledonides

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The Western Gneiss Region (WGR) of Norway is a key location for understanding the subduction and exhumation of continental crust. Although the WGR is the one giant UHP terrane not significantly overprinted by younger tectonism, separating the petrological and structural characteristics of the Caledonian orogeny from those of earlier orogenic events is not trivial because they are often confusingly similar. Geochronology has proven to be critical in this regard, and, combined with structural and petrological studies, has provided considerable insight into the tectonism that led to the subduction and exhumation of this giant UHP terrane. Closure of Iapetus and emplacement of nappes onto the Baltica margin began around 430 Ma. Modest, 650–750°C, temperatures at 1–1.3 GPa suggestive a relatively short lived crustal burial or thickening of the Seve Nappes, which 40Ar/39Ar dates imply lasted from ∼435–415 Ma. Close to the foreland the WGR was buried beneath the Seve and lower allochthons and underwent local eclogitization, but preserves mainly Precambrian fabrics and Precambrian Sm-Nd garnet, U-Pb zircon, U-Pb titanite, and U/Th-Pb monazite dates. In contrast, the core of the orogen preserves three or four discrete UHP domains, exhibits a marked NW increase in strain, Caledonian melting, and Zr-in-titanite and Zr-in-rutile temperatures up to ∼800°C. The eclogites show reasonably smooth gradients in metamorphic conditions that culminate at UHP conditions of 2.6–3.2 GPa at 650–800°C; the presence of local, distinctly higher P-T rocks suggests tectonic mixing or overprinting events. A broad range of minerals and isotopic systems from the WGR—Lu-Hf garnet in eclogite, Sm-Nd garnet in eclogite, Sm-Nd garnet in gneiss, U-Pb zircon in eclogite, U-Pb zircon in gneiss, U-Pb monazite in gneiss—burial of the Baltica margin to eclogite-facies depths from ∼425–400 Ma. Zircon U-Pb dates from post-UHP, plagioclase-stable dikes indicate an end to the eclogite-facies metamorphism by 404 Ma, and record a marked change in the style of overall E–W stretching from ductile, high strain through ∼396–392 Ma to local, low strain thereafter. Titanite U-Pb dates in accord with this indicate a general westward progression in cooling or termination of major ductile deformation from 400–390 Ma; mylonitic deformation continued in discrete zones in the core of the orogen until ∼380 Ma. Muscovite 40Ar/39Ar dates that decrease monotonically from the foreland to hinterland from 400 to 380 Ma reflect either cooling or also waning deformation.