



A major synmetamorphic Early Devonian thrust and extensional fault system in the Mid-Norway Caledonides: Key to exhumation of HP and UHP rocks

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The northern ('Nordøyane') UHP domain of the Western Gneiss Region contains occurrences of microdiamonds, coesite and quartz pseudomorphs after coesite, and petrologically based peak P estimates 3-6 GPa. The structure is dominated by post-peak, near orogen-parallel, sub-horizontal, ductile sinistral-shear and top-SW extensional fabrics, overprinted locally by amphibolite-facies mylonites. Thus, earlier features related to subduction and exhumation are greatly obscured, and complicating segmentation was created. Nevertheless, top-SE eclogite-facies fabrics are locally preserved in Nordøyane, that can be equated with subduction and earliest exhumation. Zones preserving evidence of top-NW transport in early extension are also identified. Robust U-Pb zircon chronology indicates peak UHP eclogite-facies crystallization at 415-410 Ma (Early Devonian Lochkovian to Pragian, cf. Kauffmann 2006), followed by pegmatite crystallization at 395 Ma (late Emsian) in neck lines of boudins produced in ductile subhorizontal extension, thus limiting the process to 15-20 million years.

In coastal areas north and west of Trondheim, the postulated Agdenes extensional detachment is identified by a major break in titanite U-Pb geochronology. Basement gneisses below contain Mesoproterozoic igneous titanite fully reset at 395Ma, as well as significant development of Devonian pegmatites. Ordovician granitoids of the Støren Nappe of the Upper Allochthon, just above the detachment, contain igneous titanite barely influenced by Devonian recrystallization and no evidence of post-Ordovician melts, implying removal of a significant section on a very- large-scale detachment. Rocks both above and below the detachment are overprinted by the same late, subhorizontal, sinistral ductile extensional fabric, obscuring any fabrics produced during development of the detachment itself. Notably, deep-seated metamorphism overlaps the Late Emsian (403-392 Ma) age of sandstones and conglomerates determined by plant fossils that lie unconformably on parts of the Upper Allochthon. When traced as the base of the Upper Allochthon, the detachment covers a present minimum area of 450 x 180 km.

The eastern part of the region in Trollheimen escaped the late strong subhorizontal overprint, and shows this sequence of deformations: 1) Early emplacement of thrust nappes of Lower and Middle Allochthons over Baltican basement with Late Neoproterozoic quartzite cover. 2) Major SE-directed recumbent folding of the entire thrust-imbricated sequence including basement. 3) Major out-of-sequence SE-directed thrusting (Storli thrust) of the recumbent-folded sequence over deeper, less deformed, lower basement gneisses and unconformable Neoproterozoic quartzite cover. This thrust has a minimum transport of 80 km across strike. Upper basement contains boudins of eclogite and garnet-corona gabbro that are lacking in lower basement. With respect to Trollheimen, similar thrust imbrication of basement is documented 190 km NE in the Tømmerås window, 240 km NE in the Grong-Olden culmination, where a minimum of 100 km across-strike transport is demonstrated, and 100 km W at Reksdalshesten. We suggest that crustal imbrication by the Storli and related thrusts, covering a conservatively estimated present minimum area of 400 x 100 km, provided gravitational potential to trigger the overlying Agdenes detachment, leading toward exhumation of a large region of eclogite-bearing rocks.