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Exhumation of UHP-rocks by dominant diffusion creep in eclogites and amphibolites of the TromsøNappe, Northern Norway

Holger Stunitz (1), James MacKenzie (2), Renée Heilbronner (2), Kåre Kullerud (1), Erling Ravna (1), Steffen Bergh (1)

(1) Institute of Geology, University of Tromsø, Dramsveien 201, 9037 Tromsø, Norway

(2) Geologisches Institut, Basel University, 4056 Basel, Switzerland

The Tromsø Nappe represents the uppermost unit of the Northern Norwegian Caledonides nappe pile and is regarded as part of the Laurentian continental margin. Its present position is caused by thrusting of continental margin sediments together with mafic rocks onto high temperature amphibolites of Laurentian origin. Thrusting took place after subduction, reaching UHP conditions in the Troms Nappe. Together, these Laurentian units are thrust onto the Baltica continent during exhmuation.

Mapping and structural analysis of eclogitic and amphibolite units indicates that there is a consistent shear sense top to the SSE throughout the Troms Nappe and adjacent shear zones. Thus, the whole nappe can be regarded as one thick shear zone which has maintained the same movement sense during subduction and exhumation. Pressure-conditions have been estimated to have decreased from 3.35 GPa to about 2 GPa during the first exhumation stage. The duration of this part of the exhumation has been dated as 2 to 3 Ma. Assuming an approximate thickness of the shear zone of 1 km and a typical thrust angle of 30°, the resulting bulk rock strain rates for the exhumation are on the order of 10^{-12} sec^{-1}, for localized deformation even higher.

The microstructures of the eclogites and retrograde eclogites (amphibolites) display pervasive fibrous overgrowth structures of pyroxenes and amphiboles, crack-seal-pyroxenes between pulled-apart garnet fragments, and a fine grained matrix of feldspar

and other phases. The spatial distribution of omphacite and garnet indicates a deviation from a random fabric towards an anticlustered fabric. The anticlustering is typical for nucleation of new phases during deformation. The associated grain size reduction, phase mixing, and absence of interconnected weak layers are typical features of diffusion creep and suggest that the rapid exhumation of these UHP rocks was accommodated by diffusion rather than dislocation creep.