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Exhumation of the Baltoscandian continental margin during late-stage (Early Devonian) Caledonian contraction, northern Norway

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The western Norwegian Caledonides have been the focus of investigations into how continental crust is exhumed from ultra-high pressure conditions for over 25 years. In particular, understanding the timing, geometry and kinematics of deformation partitioning during exhumation places important constraints on continental crustal rheology in collisional settings. Furthermore, such studies have bearing on wider plate configurations during exhumation in such settings, most notably the role of post-collisional plate divergence, in this case between Baltica and Laurentia during the Devonian.

The Caledonian allochthons of north-central Scandinavia (Torneträsk-Troms-Ofoten) are dominated by a series of crystalline thrust sheets ("nappes") that were emplaced ESE-wards across the margin of Baltica, mainly during and immediately after the Scandian orogenic event (435-370 Ma). Several major shear zones cross-cut both the basement-cover contact and higher structural levels within the previously assembled thrust-stack and document late-stage, deformation partitioning under amphibolite-greenschist facies metamorphic conditions. 40Ar/39Ar thermochronology of muscovite from mylonites and phyllonites within several of these shear zones record cooling during synchronous, but partitioned, tops-east thrusting and tops-west extension over the period 420-370 Ma.

The Gullesfjord-Austerfjord shear zone (GASZ) records cooling from 420-380 Ma tops-east thrusting, whereas muscovites from the lower plate of the GASZ record cooling from 380-370 Ma. Muscovites from the tops-east Øse thrust, which cuts and possibly duplicates higher levels of the nappe stack east of Gullesfjord, record cooling from 400-370 Ma. This is synchronous with tops-east motion along the thrust contact between the allochthon and the Baltic Shield basement in this area. Recrystallised muscovite along the Eidsfjord-Fiskefjord detachment, dated at 403.6 Ma, document tops-west extensional movement directly west of Gullesfjord and implies that contraction was followed closely by extensional movement. Late-to-post-Caledonian extension in Lofoten-Ofoten thus is interpreted as having been accommodated by gravity-driven, foreland- and hinterland-directed movement away from a thermal dome created beneath over-thickened Caledonian crust, without significant plate divergence.