Paired c. 1150 Ma compression-extension belts in S Norway and the geodynamics of Grenvillian orogens

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Assembly of continental lithosphere along Grenvillian orogens to form Rodinia at the end of the Mesoproterozoic provides an elegent paradigm for the preferential preservation of 1200-1000 Ma detrital zircons. Here we attempt to reconcile field observation with a model of collision for the ca. 600 km wide Sveconorwegian orogen of Scandinavia fringing Baltica. We report new 1:80.000 scale geological mapping of the Kongsberg lithotectonic domain, integrated by high resolution airborne geophysics and U-Pb zircon geochronology on 52 samples, with emphasis on the timing of metamorphism. The Kongsberg and Bamble domains form a c 25 km wide, steeply dipping and tightly folded gneiss belt, preserving evidence for an early-Sveconorwegian, MP-MT metamorphism, locally reaching granulite facies. Zircon rims at 1147-1123 Ma (7 samples) date this metamorphism. A steep high-grade shear zone bounds this metamorphism towards the east in Tyristrand, immediately west of the Permian Oslo rift. To the west of the Kongsberg /Bamble, the 70 km wide Telemark domain is markedly different. It is gently folded, contains low-grade, volcanic-sedimentary rocks, deposited in fault-bounded intramontane extensional basins between 1170 and 1120 Ma (and later), and hosts widespread bimodal magmatism between 1200 and 1140 Ma.

The Sveconowegian orogen is constructed on weak juvenile lithosphere, accreted westwards between ca 1700 and 1480 Ma at the margin of Baltica, atop an convecting mantle, ca. 100°C hotter than today. We interpret the paired Telemark and Kongsberg /Bamble domains as remnants (preserved in an orogenic lid) of a ca. 100 km wide orogenic cell, diagnostic of an (ultra-) hot orogen, involving extension, magmatism and removal of the lithospheric mantle under Telemark, and compression and eastwards (?) subduction of the lithospheric mantle below Kongsberg/Bamble. The orogen includes at least 3 contiguous ca. 100 km wide orogenic cells, involving subduction of lithosphere, active at 1150, 1050 (Idefjorden) and 980 Ma (Eastern Segment), i.e. younger continentwards. The very reason for preservation of the Mesoproterozoic crust at the margin of Balica may be its reworking inside the Sveconorwegian orogen.