Geophysical Research Abstracts
Vol. 15, EGU2013-6101, 2013
EGU General Assembly 2013

Lithotectonic framework and continental collisional reworking in the eastern part of the Sveconorwegian orogen

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The eastern part of the Sveconorwegian orogen in Scandinavia exposes a transition from the foreland in the Fennoscandian Shield to the east, across a metamorphosed and uplifted parautochthonous belt (Eastern Segment) to a major crustal-scale shear belt − the Mylonite Zone − and into the overlying allochthonous belt (Idefjorden terrane). The section is characterized by medium to high P/T metamorphism of continental crust, distinctive for continental collisional orogeny. However, the timing of metamorphism and the structural build-up differ significantly between the Eastern Segment and the Idefjorden terrane.

The lower tectonic levels of the Eastern Segment hosts a c. 4000 km2 semi-continuous metamorphic complex composed of amphibolite, upper amphibolite and high-pressure granulite facies orthogneisses and metabasites which record pressures of 0.8-1.2 GPa and temperatures of 680-800ºC. Relict eclogite facies rocks (pressures »1.5 GPa) occur within a large scale (>1200km2) fold structure. Protoliths of the orthogneisses are dominantly 1.7 Ga old granites-syenitoids that can be directly linked to rocks of equivalent age and composition in the foreland, immediately east of the Sveconorwegian orogen. High- and medium-pressure metamorphism in the Eastern Segment is dated at 0.99−0.97 Ga. Regional-scale partial melting and ductile deformation with folding and stretching along E-W-trending axes took place at 0.98−0.96 Ga. Undeformed, felsic dykes that cut ductile deformational fabrics formed at 0.96−0.94 Ga. The Eastern Segment is also affected by large-scale, open and upright folding along N-S-trending axes. Dolerites intruded at 0.98−0.95 Ga; these dykes are also affected by ductile strain.

A conspicuous, up to 5 km wide and $\geq$ 450 km long, gently west-dipping to sub-vertical, ductile shear belt – the Mylonite Zone − separates the Eastern Segment from western allochthonous belts. This shear belt accommodated transpressive deformation with reverse, top-to-the-ESE displacement followed by top-to-the-W extension. It forms a major structural, metamorphic and lithological terrane boundary. Lithotectonic units west thereof have been displaced out of their original tectonic context and cannot be directly linked to the remainder of the pre-Sveconorwegian Fennnoscandian Shield. Thus, considerable displacement must be accounted for.

The Idefjorden terrane is the easternmost allochthonous belt of the orogen, directly overlying the Eastern Segment. It constitutes a patchwork of metamorphic sub-domains where high-grade complexes are juxtaposed against domains that show little or no imprint of Sveconorwegian reworking. Crustal thickening recorded by high-pressure granulite facies metamorphism (1.0-1.5 GPa and 700-740ºC) has been dated at 1.05-1.02 Ga, i.e. at least 30 Ma earlier than the high-pressure metamorphism in the underlying Eastern Segment. The structural grain is orogen-parallel (in contrast to that in the Eastern Segment), with N-S-trending ductile fabrics, including fold axes, regional deformation zones and tectonic contacts of metamorphic complexes.

The high- and medium-pressure metamorphism of the Eastern Segment (0.99-0.97 Ga) and the Idefjorden terrane (1.05-1.02 Ga) testifies to deep subduction of the Fennoscandian continental crust during the Sveconorwegian orogeny, broadly corresponding to the Rigolet and Ottawan phases of the Grenvillian orogeny, respectively. Both events are diagnostic of collisional orogeny, with syn-metamorphic intrusive activity limited to local dyke intrusion.