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From a collage of microplates to stable continental crust - an example from Precambrian Europe

Annakaisa Korja

University of Helsinki, Department of Geosciences and Geography, Helsinki, Finland (annakaisa.korja@helsinki.fi, +358 9 19151598)

Svecofennian orogen (2.0-1.7 Ga) comprises the oldest undispersed orogenic belt on Baltica and Eurasian plate. Svecofennian orogenic belt evolved from a series of short-lived terrane accretions around Baltica's Archean nucleus during the formation of the Precambrian Nuna supercontinent. Geological and geophysical datasets indicate W-SW growth of Baltica with NE-ward dipping subduction zones. The data suggest a long-lived retreating subduction system in the southwestern parts whereas in the northern and central parts the northeasterly transport of continental fragments or microplates towards the continental nucleus is also documented. The geotectonic environment resembles that of the early stages of the Alpine-Himalayan or Indonesian orogenic system, in which dispersed continental fragments, arcs and microplates have been attached to the Eurasian plate margin. Thus the Svecofennian orogeny can be viewed as proxy for the initial stages of an internal orogenic system.

Svecofennian orogeny is a Paleoproterozoic analogue of an evolved orogenic system where terrane accretion is followed by lateral spreading or collapse induced by change in the plate architecture. The exposed parts are composed of granitoid intrusions as well as highly deformed supracrustal units. Supracrustal rocks have been metamorphosed in LP-HT conditions in either paleo-lower-upper crust or paleo-upper-middle crust.

Large scale seismic reflection profiles (BABEL and FIRE) across Baltica image the crust as a collage of terranes suggesting that the bedrock has been formed and thickened in sequential accretions. The profiles also image three fold layering of the thickened crust (>55 km) to transect old terrane boundaries, suggesting that the over-thickened bedrock structures have been rearranged in post-collisional spreading and/or collapse processes. The middle crust displays typical large scale flow structures: herringbone and anticlinal ramps, rooted onto large scale listric surfaces also suggestive of spreading. Close to the original ocean-continent plate boundary, in the core of the Svecofennian orogen, the thickened accretionary crust carries pervasive stretching lineations at surface and seismic vp-velocity anisotropy in the crust. The direction of spreading and crustal flow seems to be diverted by shapes of the pre-existing boundaries.

It is concluded that lateral spreading and midcrustal flow not only rearrange the bedrock architecture but also stabilize the young accreted continental crust in emerging internal orogenic systems. Pre-existing microplate/terrane boundaries will affect the final architecture of the orogenic belt.