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Deformation mode of accretionary orogens: example of the Finnish Svecofennides

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The Finnish Svecofennian Shield corresponds to an accretionary orogen characterized by the accretion of island arc systems toward a more resistant craton. Syn-convergence deformations are associated with extremely homogeneous HT-LP metamorphism and extensive magmatism, suggesting high geotherms.

We present a new interpretation of structural patterns on the basis of a compilation of published data and on new observations. Field observations are highlighted by lithospheric-scale analogue models testing the mechanical behaviour of weak lithospheres undergoing compression.

Structural data (maps and cross sections) outline peculiar features that characterize the Southern Svecofennian domain. The regional-scale foliation pattern defines dome and basin structures locally reworked by sub-vertical transpressive zones. Where preserved, flat-lying foliations within domes and basins bear lineations at high angle to the bulk sub-horizontal shortening direction. Transpressive zones are characterized by steeply plunging lineations. There is no field evidence of large scale thrusts or extensional detachments. Instead, the geological pattern suggests burial of supracrustal basins between domes.

This structural pattern is consistent with a weak lithosphere where the thick ductile parts inhibit the development of large-scale localised thrust systems. Furthermore, the along-strike attitude of stretching lineations attached to flat-lying fabrics suggests lateral horizontal flow of the ductile crust, coeval with horizontal shortening.

Lithospheric-scale analogue models consist of three rheological layers: a thin brit-

tle upper crust, a thick low-viscosity ductile crust, and a ductile lithospheric mantle floating on a Newtonian fluid model-asthenosphere. A series of experiments was performed in order to examine strain pattern variations in function of three boundary conditions, temperature, shortening rate and ductile crust thickness. Experiments show that compression of weak lithospheres may be marked by burial of pop-downs of upper crust and by syn-thickening lateral escape of the ductile crust.