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Evolution of early-orogenic deformation zones and their significance for the development of contrasting structural domains within the Palaeoproterozoic Skellefte District, Sweden

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The VMS-hosting Skellefte district, Sweden, occurs along a regionally significant transition zone between approximately N-S striking structures with an Archaean influence in the north, and more east-westerly Palaeoproterozoic structural trends in the south. Since high-strain zones of both the above orientations are present in the Skellefte district, their mutual relationship and significance for the build-up of the Svecokarelian orogen at around 1.89 Ga, and for the following tectonic overprint between 1.87-1.80 Ga could be evaluated. The methods used in this study included structural analysis complemented by potential field modelling and SIMS U-Pb geochronology on zircon.

We attribute the earliest deformation (D1) to district-scale extension at 1890-1875 Ma, when dextral N-S striking strike-slip zones and WNW-ESE striking normal faults were developed. These faults defined WNW-ESE trending pull-apart basins which accommodated the deposition of the Skellefte Group volcanic rocks and controlled the emplacement of the early-orogenic intrusive rocks, within a setting of regional-scale SE-NW transtension or SW-NE transpression. Variations in deformation fabric development across the district indicate that the crust was divided into an upper, un-metamorphosed domain and a deeper, strongly metamorphosed domain during D1. We further infer that the transition from the upper to lower crust was locally coupled with development of low-angle crustal-scale detachment zones during D1. Post-D1 overprint may be explained by two alternative models. The first model comprises a SSE-NNW transpressional event with distinct strain partitioning between the coaxially deformed upper crust, and the non-coaxially deformed deeper crust. A post-folding rhyolite dyke, here dated at 1871 $\pm$ 4 Ma, constrains the minimum age of this event (D2). The alternative model includes two separate compressional events: a SW-NE one at (1.88-) 1.87 Ga, followed by SSE-NNW transpression at 1.86 Ga. We infer that the boundary between the coaxial and non-coaxial domains is either a reactivated D1 detachment zone, or a reverse D2 shear zone.

As an outcome of this investigation, we provide a synthesis of the structural evolution of the Skellefte district. The presented results may be further used as a backbone in future investigations focusing at understanding the distribution of the mineralizations, and the variations in their tectonic transposition across the district. More regionally, we suggest that many of the major crustal-scale shear zones of the central Fennoscandian Shield have originated as 1.89-1.87 Ga crustal detachment zones, i.e. earlier than typically considered.