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Large-scale flat-lying mafic intrusions in the granitic Baltica crust of central Sweden and implications for basement deformation during Caledonian orogeny

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The role of inheritance in localizing basement deformation in the foreland has been demonstrated in orogens in different parts of the world. In the external domain of the central Scandinavian Caledonides, questions remain about the amount and the distribution of deformation accommodated by the Baltica basement during Caledonian orogeny. However, to answer these questions, it is necessary to understand the architecture of the Baltica crust underneath the Caledonian nappes and to determine the occurrence of potential detachment horizons or inherited structures that accommodated the shortening.

In this work, we study the lithological and structural architecture of the Baltica basement in central Sweden, east and west of the present-day Caledonian front. The aim is twofold: 1) identifying the main geological features of the Fennoscandian Shield and their regional extent underneath the Caledonian nappes to the west, and 2) to address their role in accommodating deformation during Caledonian orogeny.

The study area is characterized by mainly ~1.8 Ga granitic bodies intruded by various generations of mafic intrusions and locally bounded by major crustal shear zones. On the one hand, based on seismic interpretations, magnetic and gravimetry forward modeling and mapping, and results from the recently drilled COSC-2 borehole (as part of the Collisional Orogeny in the Scandinavian Caledonides (COSC) drilling project), we show that the basement underlying the Caledonian nappes is characterized by inclined to sub-horizontal mafic intrusions with large extent, emplaced at mid-crustal level. We propose that these intrusions are similar in size, geometry, and potentially age, to the 1.25 Ga Central Scandinavian Dolerite Group (CSDG) that are mapped as 100's km long elliptic bodies or described as saucer-shaped intrusions further east. On the other hand, based on observations from COSC-2 drill cores and previous studies, analogue modelling and 2D seismic restoration, we propose that favorably oriented intrusions influenced, at least partly, crustal shortening in this area by localizing deformation along their margins. At a regional scale, we discuss the distribution of thick-skinned and thin-skinned deformation at the present-day orogenic

front. On a broader scale, this study raises the question regarding the influence of pre-existing mafic intrusions in controlling the structural evolution and the segmentation of orogenic or rift systems in general.