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Structure and evolution of the crust beneath the Scandinavian mountain belt from geophysical data

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Geophysical data provides an image of the deep sub-subsurface velocity, density or conductivity structure of mountain belts at the present day. However, that present day structure is the result of the evolution of the mountain belt over a period of time and hence the geophysical image represents the cumulative effects of the development of the mountain belt. The Scandinavian mountain belt has a protracted history. While it is best known from studies of the surface geology for preserving the core of the Scandinavian Caledonides, the crust forming the root of that orogen was involved in earlier Fennoscandian and Sveco-Norwegian mountain building and has subsequently been involved in epeirogenic uplift which has led to the present topographic expression. We present the results of 3 onshore geophysical profiles across the south, central and northern parts of the Scandinavian mountains approximately orthogonal to the strike of the Caledonian orogen. Acquired to look for along strike variations in crustal structure that could be related to epeirogenesis and variations in present day topography, these profiles all show very similar features. Moving from East to West: crust between 42 and 45 km thick with a very high velocity (>7.2 km/s) lower crustal layer up to 10 km thick passes into a region beneath the current mountain range of crust of similar thickness but without the high velocity layer. There is no significant orogenic root preserved which could be associated with the Scandinavian Caledonides. A minor root is present to the east of the present topographic high. There is no evidence for the thrust nappes which dominate the near surface geology having a significant geophysical expression. This picture is consistent with the core of the Scandinavian Caledonides being preserved along the Norwegian coastline (which is broadly consistent with the classic Wilson Cycle model) and the bulk of the crust beneath Norway and Sweden being dominated by basement formed by accretion during the Sveco-Fennian and Sveco-Norwegian collisional orogenic events. The nappes of the Caledonides are probably only thin skinned features with little geophysical expression, except close to the coastline, and shortening of Sveco-Fennian/Norwegian basement is limited to recovery of pre-orogenic extension. The Caledonian deformation appears to have, at least partially, erased the high velocity lower crustal layer if the formation of the layer predated that orogenic event. There is little indication that the cause of the Miocene epeirogenesis is the result of transformation of the existing crustal structure because there is no consistent variation in structure associated with the observed variations in topography. The Scandinavian mountain range provides a window into the long term evolution of the orogenic belts and the crust from which they are formed.