

Fission track thermochronology applied to Phanerozoic thermotectonic events in the Swedish part of the Baltic Shield

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Abstract

The Swedish part of the Baltic Shield is characterized by a Precambrian basement and a few remnants of Phanerozoic cover rocks. The Phanerozoic geological development in Sweden is therefore poorly established. A geological event known to have affected the Baltic Shield is e.g. the collision between Laurentia and Baltica resulting in the Caledonian Orogeny at c. 400 Ma. Nevertheless, the former thickness and extent of the erosional deposits originating from the Caledonian thrust belt have been unknown and so also the Palaeozoic to Cenozoic thermotectonic history of southern Sweden.

The fission track (FT) dating method is a useful method for investigating low-temperature events, and has been applied to apatite, zircon and titanite basement samples from southern and central Sweden. In addition, apatite samples from Finland have been analysed. The obtained FT results reveal that the western part of central Sweden and southern Sweden were heated above at least 100° C, during the Phanerozoic, while the eastern part of central Sweden and Finland experienced reheating to temperatures below 100° C. Furthermore, three areas with significantly different trends among the FT results have been discerned in southern Sweden.

It is concluded that Caledonian foreland basin deposits were responsible for the extensive Palaeozoic heating event that affected Sweden and Finland. The sediments probably reached a thickness of at least 2.5 km in western and southern Sweden, and at least 1 km in the Åland Archipelago. The discrepancy between the FT data in southern Sweden indicates that large-scale vertical tectonic movements within the basement were triggered by the load. Non-uniform exhumation of southern Sweden during the Carboniferous-Jurassic was accompanied by deposition offshore. The Cretaceous unroofing of the basement was followed by renewed covering. Modelling of apatite FT data from southern Sweden suggests a temperature rise in the order of 20° C and 35° C along the southwest and the southeast coast, respectively. It is interpreted as the result of covering of c. 650-1000 m thick deposits. The Cenozoic final exhumation of southern Sweden was most pronounced around the southern tip of Lake Vättern and along the southeast coast of southern Sweden.

Keywords: Fission track analysis; Phanerozoic; Foreland basin; Baltic Shield; Exhumation

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