



## **The Scandian collision revisited - when did the orogeny start?**

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Scandian Orogeny, the result of the collision of continents Baltica and Laurentia, was first defined in the mid 1970's on the basis of two main criteria: the sedimentary record of the Baltoscandian foreland basin, and the numerous, but rather imprecise isotopic age determinations that apparently correlated with the basin stratigraphy. With regard to the stratigraphy and sedimentology of the foreland basin, attention was drawn to the deposition of turbidites in the Mid Ordovician, followed by shallowing of the depositional environments near the end of the Ordovician, with the deposition of quartz sandstones and then limestones in the earliest Silurian. The basin deepened again in the mid Llandovery (early Telychian), as seen in the rapid transition into black shales and then turbidites and the latter coarsen upwards and are overlain by shallow water quartz sandstones. These may correlate in time with the facies changes from carbonates and shales into fluvial sandstones that occurred in the mid-late Wenlock farther south in the Scandes, in the Oslo area.

With regard to the isotope age data, it is important to note that, in the early 1970's, the radiometric time-scale was less well defined; the base of the Silurian was thought to be about ten million years younger than it is today. The best estimate for the base of the Silurian today is 443-444 Ma and the base of Telychian is 436 Ma. These ages fit well the evidence of granulite facies migmatization in the Åreskutan Nappe of the Seve Nappe Complex of west-central Jämtland, where new SIMS U/Pb zircon data provide ages of 442-441 Ma for peak (T) metamorphism of migmatites and leucogranites and a leucosome segregation in mafic paleosome yields a particularly precise age of 436 Ma. These new data confirm previous zircon, titanite and monazite studies that Scandian orogeny started at c. 440 Ma, rather than 430 Ma (as has been generally accepted since the 1970's). Evidence of previous higher pressure metamorphism in the Seve of the Åre and Snashögarna areas suggests that this may have occurred in the (late) Ordovician as recognized farther north in Jämtland, and indicated by recent EMP monazite dating. Even farther north in the orogen (southern Norrbotten), the Seve Nappe Complex provides clear evidence of Early to Mid Ordovician HP metamorphism.

The question naturally arises as to which criteria are decisive for distinguishing the time of collision of Baltica and Laurentia from the long previous period of pre-collisional, subduction-related deformation and metamorphism along the Baltoscandian outer margin during Ordovician closure of the Iapetus Ocean. Laurentian faunas of the Stören Nappe (Upper Allochthon) indicate that this Ocean was still open in Early-Mid Ordovician, while turbidites were being deposited in the Baltoscandian foreland basin. Our preferred interpretation is that these turbidites were related to pre-Scandian subduction along the edge of the Baltica continent prior to Scandian collision. The latter started at c. 440 Ma and lasted for about fifty million years, with emplacement of the nappes many hundreds of kilometres onto the Baltoscandian platform. That this collision was more or less synchronous along the whole Scandinavian margin remains to be demonstrated.