Redefining late Cambrian/Early Ordovician subduction of the Seve Nappe Complex: tectonic implications for the Scandinavian Caledonides

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The Scandinavian Caledonides are an excellent record of Wilson-cycle tectonics. The Seve Nappe Complex (SNC) is a key component for understanding the tectonic evolution of the Caledonides. It comprises relics of the Baltican outermost margin that records Iapetus ocean opening and closure leading to continental collision. The SNC in Sweden has often been discussed according to three major (ultra-)high pressure (UHP) regions, defined here from south to north as: the west-central SNC (west-central Jämtland), the central SNC (northern Jämtland/southern Västerbotten), and the northern SNC (Norrbotten). Initial stages of the Caledonides in late Cambrian/Early Ordovician were first recognized in the northern SNC, whereas the other SNC localities were thought to only record Middle Ordovician (U)HP metamorphism. This apparent pressure-temperature-time (P-T-t) dichotomy suggested either northeast to southwest oblique collision of the Baltican margin or collision of a margin promontory in the northeast. However, recent research has begun to redefine the late Cambrian/Early Ordovician subduction history of the SNC. In the northern SNC, three (U)HP terranes demonstrate a progressive decrease in P-T conditions related to subduction that are recorded within the same time interval, from southwest to northeast: Grapesvare nappe (2.8-3.1 GPa and 660-780°C at 482-480 Ma), Råvvejávvre nappe (2.4-2.6 GPa and 580-680°C at c. 486-482 Ma), and the Mårma terrane (1.0-1.5 GPa and 590-660°C at c. 488-481 Ma). Evidence for (U)HP metamorphism apparently disappears in the SNC northeast of the latter; a record of (U)HP metamorphism is absent in upper gneiss unit of the Váivančohkka-Salmmečohkat region. Altogether, the P-T-t pattern indicates southwest-to-northeast oblique subduction of the northern SNC with decreasing continental material present within the subduction channel, leading to predominant oceanic subduction. Recent work in the west-central and central SNC supports the late Cambrian/Early Ordovician south-to-north subduction of the SNC. The Tväråklumparna gneiss (west-central SNC) and the Avardo and Marsfjället gneisses (central SNC) all record partial melting in (U)HP conditions at c. 483-480 Ma. In the Marsfjället gneiss, this partial melting event may have succeeded the formation of metamorphic microdiamonds included in garnet, suggesting continental material was deeper in the central regions of the SNC compared to the north in the late Cambrian. Exhumation (or possible stagnation) within the subduction channel appears to be broadly coeval across the SNC at c. 480-470 Ma, regardless of the prior P-T conditions. However, the west-central and central SNC both record (U)HP events at c. 463-455 Ma, which is not recorded in the northern SNC. Subsequent exhumation of the west-central SNC occurred at c. 446-435 Ma through 700-820°C, associated with partial melting, whereas central SNC exhumation occurred at c. 446-440 Ma in temperatures of ~550-690°C without partial melting, and the northern SNC was exhuming at c. 447-440 Ma through temperatures of ~350-500°C, consistent with deeper to shallower burial of the presently exposed (U)HP SNC terranes from the southwest to northeast. The incipient record of continental (Scandian) collision appears uniform across the SNC at c. 434-424 Ma. The emerging tectonic record of the SNC demonstrates that a larger volume of continental crust was being subducted across the extent of the Scandinavian Caledonides than previously thought. This requires revisiting of our understanding of the Caledonian Orogeny starting in the late Cambrian and establishing tectonic relationships with subduction processes in the Iapetus Ocean for influencing the SNC subduction-exhumation cycles and accommodating closure of the Iapetus Ocean leading to continental collision.