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# Evolution of the Caledonian Collisional Orogen: Insight into Processes at the Base of the Tibetan Plateau

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The Caledonian orogen of Greenland and Scandinavia records the long-lived Paleozoic collision between Laurentia and Baltica and is often compared to the Himalayan orogen. The deep level exposures of the Caledonides provide insight into the deeper levels of the Himalayan orogeny. The Greenland-Scandinavian Caledonides, now separated by and in part well exposed due to rifting in the North Atlantic, record subduction and exhumation processes in both the down-going plate, Baltica, and the overriding plate, Laurentia. Closure of intervening ocean basin(s) separating Laurentia and Baltica is preserved by imbricated remnants of arcs, ophiolites and possible microcontinents, some of which experienced a number of HP and UHP events in subduction zone environments outboard of Baltica (Brueckner and van Roermund, 2004), and emplacement of subduction-related granitoids in North-East Greenland (Kalsbeek et al. 2008). Collision resulting in thickening of Laurentian crust and subduction of Baltican continental lithosphere was on going by 430 Ma based on HP metamorphism of the Baltican margin preserved in the Western Gneiss region of Norway WGR (e.g., Griffin and Brueckner 1985) and emplacement of crustally derived leucogranites in North-East Greenland (Kalsbeek et al., 2008). Subduction of Baltica culminated with widespread HP and UHP metamorphism of the Western Gneiss region (e.g., Kylander-Clark et al., 2009; Hacker et al., 2010) and HP metamorphism in North-East Greenland by ca 400 Ma (Gilotti et al., 2004). Slow exhumation of deeply subducted Baltican crust and HP Laurentian crust between 400 and 360 Ma is accompanied by extension and basin development at shallow crustal levels (e.g., Gilotti and McClelland, 2008), and displacement on conjugate dextral and sinistral strike-slip faults across the orogen. Continued continental convergence is recorded by UHP metamorphism of deeply subducted Laurentian crust in North-East Greenland at ca. 360 Ma (Gilotti et al., 2004; McClelland et al., 2006). Dextral and sinistral strike-slip faults in North-East Greenland were active during and after UHP metamorphism and are, therefore, interpreted to be directly related to formation and exhumation of the North-East Greenland UHP terrane. Deep subduction of Laurentian crust 100s of kilometers from the Baltica-Laurentia suture zone marked by peri-Laurentian nappes in Scandinavia is interpreted to record intracontinental subduction of the overriding plate of a collisional orogeny (Gilotti and McClelland, 2007, 2011). This model is analogous in both timing and geometry to the intracratonic subduction suggested for present day Tibet (Tapponnier et al., 2001). The timing of Caledonian UHP metamorphism at 360 Ma, approximately 60-70 m.y. following the initial Baltica-Laurentia collision, is consistent with present day intracratonic subduction beneath Tibet approximately 55 m.y. following the initial Himalayan collision. The geometry of conjugate strike-slip faults associated with formation and exhumation of UHP rocks in the Greenland Caledonides is similar to active faults in the Tibetan Plateau that can be interpreted as crustal scale faults associated with intracratonic subduction (Tapponnier et al., 2001). "Channel flow" in the Greenland Caledonides may be represented by mid-crustal migmatites and leucogranites beneath the syn-collisional extensional detachment system and associated basins. However, these processes were active at relatively shallow levels, and did not impact contractional deformation and eventual UHP metamorphism associated with intracratonic subduction of Laurentian crust. Similarly, models for intracontinental subduction beneath Tibet do not conflict with models for migmatites and horizontal flow at shallow crustal levels.

**Key words**: Caledonides, Tibetan Plateau, UHP metamorphism, exhumation, collisional orogen

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