Two tales of continental crust: Formation and Subduction

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1. Earth's first continental crust is largely composed of magmatic rocks with tonalitic-trondhjemitic-granodioritic composition (TTGs). These rocks formed through partial melting of hydrated basaltic host rocks but the precise starting material and especially the tectonic scenario of partial melting is the subject of discussion. One of the prime examples for Archean continental crust with well-preserved Eoarchean tonalites is the Itsaq Gneiss Complex in Western Greenland. I present combined thermodynamic and trace-element modeling to infer host rocks and melting depths. The best reproduction of major element and trace element composition of TTGs is achieved when local metabasalts from the Isua Supracrustal Belt are used as starting material and melting is assumed to have taken place at crustal levels. This result challenges the classic view that TTGs formed as slab melts in subduction zones.

2. Collision orogens contain dominantly continental as well as dominantly oceanic high-pressure units. In dominantly continental high-pressure units, only a small portion of rocks typically records eclogite-facies assemblages and it is unclear if these units represent coherent basement units or mélanges assembled from rocks of different paleogeographic origin and with different pressure-temperature histories. A classic example for a mixed gneiss unit with scattered preservation of high-pressure and ultra-high-pressure rocks is the Adula Nappe in the Central Alps. Structural, petrological and Lu-Hf age data show that mafic high-pressure rocks in the Adula Nappe (1) experienced variscan and alpine high-pressure metamorphism, (2) experienced a single short lived alpine high-pressure event in Eocene times, and (3) display a continuous metamorphic gradient from blueschist-facies conditions in the north to ultra-high-pressure conditions in the south. Scattering ages and conditions of alpine metamorphism presented in the literature are probably related to confusion of alpine and variscan mineral growth. The Adula represents a coherent pre-mesozoic basement complex that experienced the alpine cycle as a whole. During Eocene subduction and exhumation, the nappe got pervasively mylonitized and underwent a complete shape change but remained a continuous rock piece.