The metamorphism of the Tso Morari ultra-high pressure nappe of the Ladakh Himalaya

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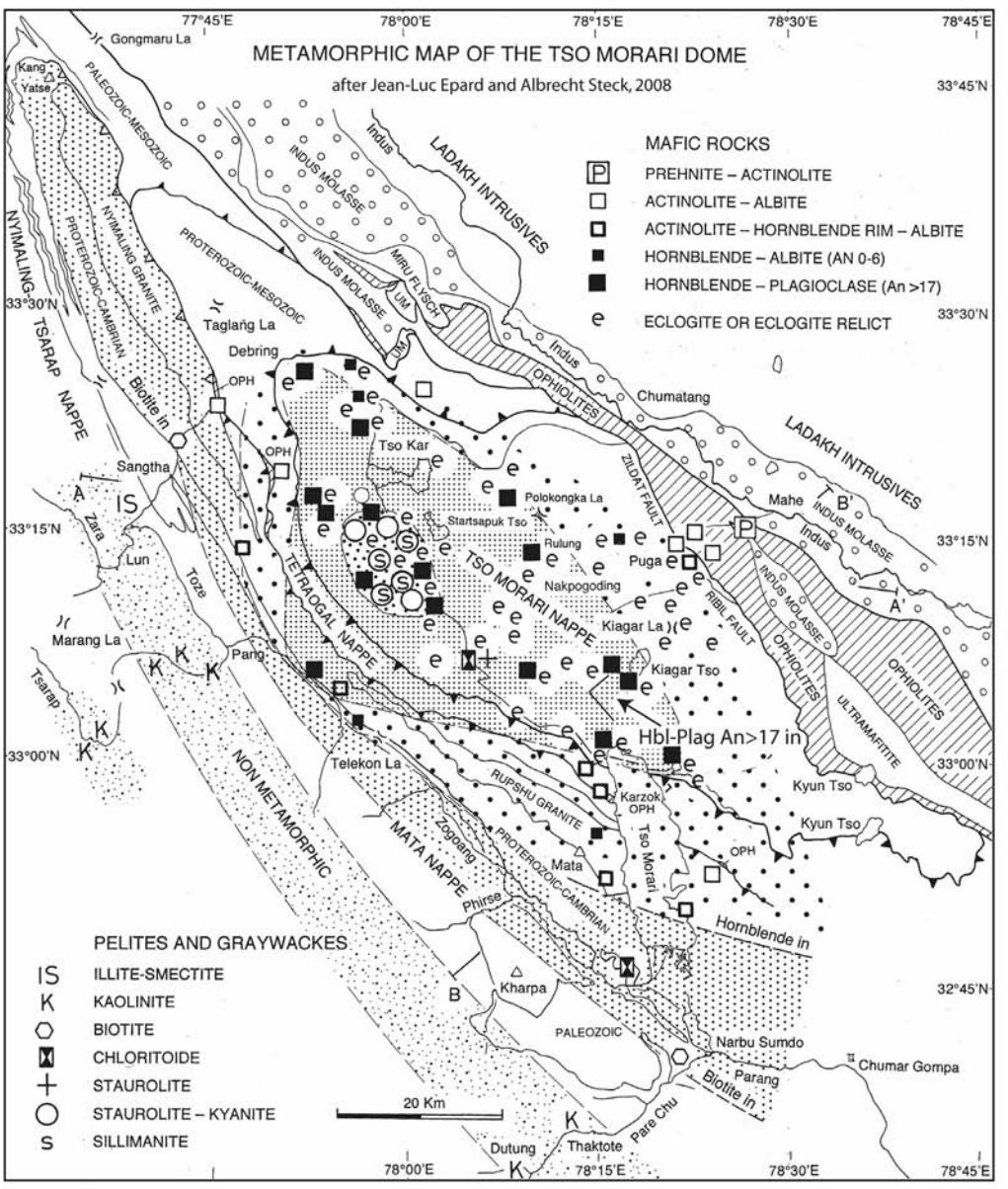
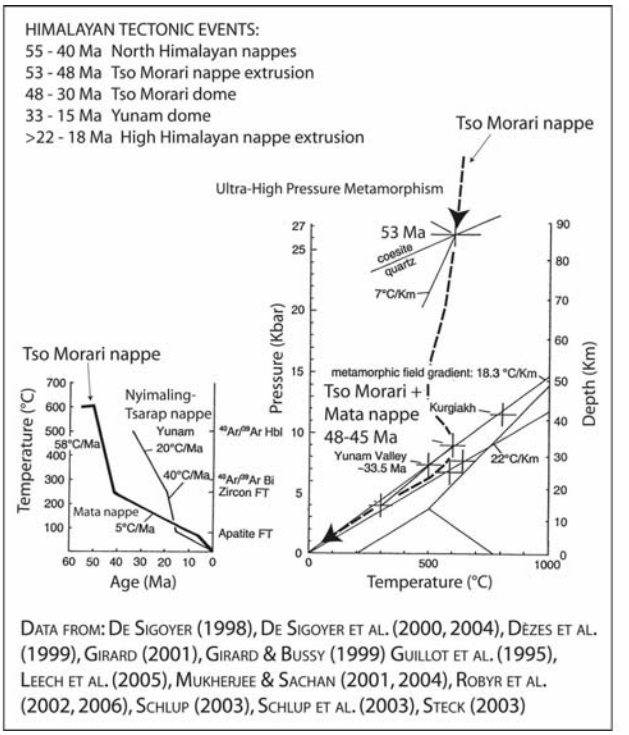
A map of the metamorphic zones of the North Himalayan nappe stack in the Tso Morari region is proposed. The Tso Morari nappe is composed of Late Proterozoic-Cambrian graywackes intruded by the 479 ± 2 Ma Tso Morari granite and mafic dikes (Girard and Bussy 1999). Eclogites and eclogite relicts testify of an oldest ultra-high pressure metamorphism limited to the deepest Tso Morari nappe (Epard and Steck 2008). This nappe and the higher Tetraogal, Karzok ophiolite and Mata-Nyimaling-Tsarap nappes are overprinted together by a Barrovian regional metamorphism, that grades from staurolite-kyanite assemblages in the Nuruchan region in the western Tso Morari dome down to metapelites with kaolinite and illite-smectite assemblages in an external zone of



Triassic sediments exposed in the Dutung-Thaktote graben to the SE (Girard 2001, Girard et al. 1999, Steck et al. 1998, Steck 2003). The ultra-high pressure metamorphic rocks with coesite and micro-diamonds are characterized by pressures of over 27 kbars, temperatures of 580±6°C (De Sigoyer et al. 2004, Mukherjee and Sachan 2001 2004). The metamorphism is dated of 53.3±0.7 Ma (Leech et al. 2005). The generally non-oriented fabric of the eclogites testify of the static crystallisation of the metabasites at depth of over 90 km. The detachment and extrusion of the low density Tso Morari nappe, composed of 70% of the Tso Morari granite and 30% of graywackes with some eclogitic dikes, occurred by ductile pure and simple shear deformation. It was pushed by buoyancy forces and by squeezing between the underthrusted Indian lithosphere and the Asian mantle wedge (Epard and Steck 2008). The extruding Tso Morari nappe reached a depth of over 35 km at the base of the North Himalayan accretionary wedge some 48 Ma ago. There, the whole nappe stack crystallized under amphibolite facies conditions with a metamorphic field gradient of 20°C/km (De Sigoyer et al. 2004, Girard 2001). The crystallisation of sillimanite needles parallel to the first stretching lineation L1 and after kyanite testify of a pressure drop during the W-directed extrusion of the Tso Morari nappe (Epard and Steck 2008). Zoned amphiboles with an actinolite core and magnesiohornblende border, or a magnesiohornblende core with a tschermakite border indicate a prograde crystallisation during the Barrovian metamorphism (Schlup et al. 2003).



DATA FROM: DE SIGOYER (1998), DE SIGOYER ET AL. (2000, 2004), DÈZES ET AL. (1999), GIRARD (2001), GIRARD & BUSSY (1999) GUILLOT ET AL. (1995), LEECH ET AL. (2005), MUKHERJEE & SACHAN (2001, 2004), ROBYR ET AL. (2002, 2006), SCHLUP (2003), SCHLUP ET AL. (2003), STECK (2003)

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