Three-stage cooling since 15 Ma of the Higher Himalayan Crystallines in the Mount Everest region by 1-D approaches

*Hideki Iwano[1], Harutaka Sakai[2], Tohru Danhara[1], Nakajima Toru[2]

1. Kyoto Fission-Track Co., Ltd., 2. Kyoto University

The Higher Himalayan Crystallines (HHC) in the Mount Everest region were extruded along the Qomolangma Detachment (QD) and the Main Central Thrust (MCT). Zircon and apatite fission-track (FT) data were used to reconstruct the cooling history of the HHC. Samples were collected perpendicular to the strike of the MCT, from Jubing (south of MCT) to the Rongbuk valley (north of Mount Everest). Three 1-D age profiles are compared: (1) age versus horizontal distance from the MCT, (2) age versus elevation and (3) age versus structural distance from the QD. Three cooling stages can be identified: (i) rapid cooling around 15 Ma, (ii) slow cooling during 15 –5 Ma (zircon) and 15 –2 Ma (apatite), and (iii) relatively fast cooling during 5 –3 Ma (zircon) and 2 –1 Ma (apatite). The FT length data indicate that downward cooling of the upper half of the HHC during 15 –5 Ma (zircon) and 15 –2 Ma (apatite) occurred perpendicular to the QD, but not along elevation. The different onset of relatively fast cooling of zircon and apatite from the lower half of the HHC cannot be explained by uplift and erosion. Horizontal and vertical cooling rates were estimated based on the above 1-D relationships. A large northward lateral cooling vector of >10 km/Ma after 5 Ma was recognized within the lower part of HHC, compared with a downward cooling vector of ~2.5 km/Ma. Our scenario is that after its southward extrusion around 15 Ma, the inner part of HHC remained at >250 degree C until 5 Ma, and that the northward lateral cooling (5 –1 Ma) occurred in the lower part of the huge HHC body related to its earlier extruded and exposed southern part. The northward directed lateral cooling is also supported by FT and $^{40}Ar/^{39}Ar$ data from the Kathmandu nappe, central Nepal Himalaya (Bollinger et al., 2006; Herman et al., 2010).

Bollinger et al. (2006) Earth Planet. Sci. Lett. 244, 58-71.
Herman et al. (2010) J. Geophys. Res., 115, B06407, doi:10.1029/2008JB006126.

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