Thermal history of the Higher Himalayan Crystallines and over-underlying sediments in west-central Nepal, revealed by zircon fission-track dating

*中嶋 徹[1]、酒井 治孝[1]、岩野 英樹[2]、檀原 徹[2]
*Nakajima Toru[1], Harutaka Sakai[1], Hideki Iwano[2], Tohru Danhara[2]

1. 京都大学大学院理学研究科地球惑星科学専攻、2. (株) 京都フィッション・トラック
1. Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University, 2. Kyoto Fission-Track Co., Ltd.

Zircon fission-track (ZFT) dating was carried out along 120 km long transect across the Himalaya: from Mt. Annapurna to the Main Boundary Thrust (MBT) in west-central Nepal. We newly obtained 23 ZFT ages from the Higher Himalayan Crystalline, the overlying Tibetan Tethys sediments (TTS) and the underlying Lesser Himalayan sediments (LHS), and discuss cooling process of each geotectonic units and comprehensive cooling process of the Himalaya since early to middle Miocene.

The ZFT ages of the LHS show northward younging linear distribution from the oldest age in the frontal zone (13.4 ±1.0 Ma) to the youngest age in the root zone (1.5 ±0.2 Ma). Partially reset ZFT ages (~450 Ma) from the autochthonous LHS indicate that the LHS has undergone inverted thermal metamorphism caused by hot metamorphic nappe. The LHS in west-central Nepal is not covered by metamorphic nappe, however, these partially reset ages indicate that northern part of the LHS was once covered by the metamorphic nappe, and at present it was eroded out.
On the other hand, the ZFT ages from the HHC and the TTS range from 10.9 ±0.8 Ma to 1.7 ±0.4 Ma, and show southward younging distribution. The ZFT ages of the HHC have positive correlation to elevation excepting old ages nearby major shear zones, indicating that cooling of the HHC occurred downward. The ZFT ages of the TTS have positive correlation to structural distance from the MCT and the STD. The ZFT ages from the TTS indicate that the TTS was cooled downward accompanied by exhumation of the HHC. The ZFT age distribution pattern along transect well corresponds to present uplift rate distribution, which suggests that the ZFT age distribution pattern reflects regional vertical velocity. Inter-seismic vertical velocity distribution is considered to be controlled by kinematics and geometry of the MHT which is the main active decollement, thus the ZFT age distribution pattern seems to reflect exhumation and cooling of the hangingwall of the MHT.

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