1.74 Ga felsic magmatism formed via crustal melting: Investigation of mylonitic orthogneisses in the frontal zone of the Kathmandu Complex, central Nepal

*今山 武志[1]、在田 一則[2]、福山 繭子[3]、Yi Keewook[4]、川端 凌市[5]
*Takeshi Imayama[1], Kazunori Arita[2], Mayuko Fukuyama[3], Yi Keewook[4], Ryoichi Kawabata[5]

1. 岡山理科大学自然科学研究所、2. 北海道大学総合博物館、3. 秋田大学大学院理工学研究科、4. 韓国基礎科学研究所、5. 岡山理科大学生物地球学科
1. Research Institute of Earth Science, Okayama University of Science, 2. Department of Natural History Sciences, Hokkaido University, 3. Graduate School of Engineering Science, Akita University, 4. Geochronology Team, Korea Basic Science Institute, 5. Faculty of Biosphere-Geosphere Science, Okayama University of Science

The Paleoproterozoic magmatism in the Himalaya orogen has been known in the lower Lesser Himalaya Sequence which marks the northern margin of the exposed Indian plate. Different tectonic settings have been suggested for the formation of the Paleoproterozoic orthogneisses and metavolcanic rocks, such as a plume or rift-related environment, a collision belt, and a continental arc setting. The contrasting interpretations make it unclear whether the Paleoproterozoic development at the northern Indian margin contains active or passive continental margins. In this study, mylonitic orthogneisses in the frontal zone of the Kathmandu Complex, central Nepal have been investigated using whole-rock and mineral chemistry, Rb–Sr isotopes, and zircon U–Pb age dating. Chondrite normalized zircon REE patterns of orthogneisses are characterized by enriched HREE patterns and prominent Eu anomaly, indicating a magmatic origin. The U–Pb zircon age dating revealed that ca. 1.74 Ga felsic magmatism occurred in this area. Temperatures of 705–765 ℃ calculated using Ti-in-zircon thermometer are typical crustal melting temperatures for felsic magmatism. Whole-rock data from most orthogneisses in this and previous studies fall between the 'syn-collisional' and ‘post-collisional’ fields on the tectonic discrimination diagram. Very high Sr isotopic ratios (0.865–3.585) and high Th and U concentrations for all orthogneisses represent components of old crust. These occurrences indicate that mylonitic orthogneisses are largely of crustal origins. This and previous studies in Nepal are indicative of at least two Paleoproterozoic magmatic episodes: ca. 1.92–1.90 Ga rift-related magmatism and 1.84–1.74 Ga crustal melting. Considering the absence of a Paleoproterozoic collision in the Himalaya, the later crustal melting could have been accompanied by burial of the Indian basement during thermal subsidence after rifting. This study indicates the Paleoproterozoic magmatism along the northern margin of the India basement during and after the break-up of the supercontinent Columbia.

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