

Plate motions from porphyroblasts: direct dating of multiple deformation phases in the NW Himalaya

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In northern Pakistan, rocks of Eurasian continental origin are separated from those of Indian origin by the Kohistan-Ladakh Arc (KLA) and its presence fundamentally changes the orogenic geometry of this area compared to those along strike across the Himalaya. The absolute timings of collisions and relative plate motions between the Indian Plate, the Eurasian Plate, and the KLA during the Cenozoic are poorly constrained, and precludes correlation with more well-understood tectonic events recorded further east.

There is evidence of three distinct phases of deformation and four phases of metamorphism in the Swat region of northern Pakistan^{1,2}. Each of these relates to a discrete episode of tectonism linked to the collision of the Indian and Eurasian plates during the Himalayan orogeny.

When garnet porphyroblasts grow during prograde metamorphism, they can record these deformation phases as inclusion trails. In the Swat area, pre-, syn-, and post-kinematic garnets have been found. Three samples have been chosen for detailed Sm-Nd garnet dating, one each from three formations and structural domains.

This study aims to provide new insights into the timings of collisional tectonics in the NW Himalaya by dating garnet from the Swat Valley that have been tectonically constrained using the relationship between porphyroblast inclusion trails and regional structures.

¹Shah, S. Z., et al (2011). *Tectonophysics*, 509(1–2), 14–32.

²Sayab, M., et al. (2016). *Tectonophysics*, 671, 110–126.