

16 million years of volcanism on Bolaven Plateau, Laos

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The Bolaven volcanic field is a 6000 km² basaltic complex emanating from a plateau of flat-lying Mesozoic bedrock. It is among the largest of dozens of isolated intracontinental volcanic centers in SE Asia collectively forming what has been termed a “Diffuse Igneous Province” [1] attributed to either localized extension [2] or a mantle plume [3]. Our preliminary assessment of Bolaven volcanism, however, suggests absence of extensional tectonics or regional uplift. Its 16 million year history of episodic volcanism is a unique recorder of volcanic and broader geological history in the region. We combine geochemistry, petrology, and field relations with ⁴⁰Ar/³⁹Ar geochronology to exploit this record. Lavas range from olivine-nepheline foidites to tholeiitic basaltic andesites. Alkaline magmas were primitive (7-12 wt% MgO) low-degree partial melts generated within the garnet stability field at depths ≥85 km [4], implying that the keel of continental lithosphere beneath the Khorat Plateau of eastern Thailand [5] extends into southern Laos. Alkaline lavas yield ⁴⁰Ar/³⁹Ar plateau ages of 15.81±0.05 Ma, 12.41±0.08 Ma, and 204±9 ka. Onset of volcanism coincided with cessation of eastward extrusion of the Sunda block from Indian-Asian collision [6]. Tholeiitic volcanism was coeval with alkaline volcanism insofar as ages range from 7.55±0.08 Ma to 215±41 ka. Major and trace element systematics indicate >10% melting at depths <70 km [7], suggesting persistent shallow mantle dynamicism lacking obvious tectonic expression. No fault offsets of volcanics are apparent and elevations of dated lavas constrain local mean incision rates of the Mekong and tributaries to <0.05 mm/yr for the past 16 Ma, precluding regional incision >800 m.

[1] Hoang & Flower (1998) *J of Petr* **39**, 369-395. [2] Fedorov & Koloskov (2005) *Petrology* **13**, 352–380. [3] Wang *et al.* (2013) *EPSL* **377**, 248–259. [4] Wood *et al.* (2013) *Elements* **9**, 421-426. [5] Yang *et al.* (2015) *Geophys J Int* **200**, 1582–1595. [6] Tapponnier *et al.* (1986) *GSL Spec Pub* **19**, 115-157. [7] Lee *et al.* (2009) *EPSL* **279**, 20-33.