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Geochemistry and Petrogenesis of Felsic Volcanic Rocks in Shillong Plateau, North East India: Implications for magma source compositions and geodynamic evolution

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The Proterozoic felsic volcanic rocks in the Shillong plateau are composed of rhyolites, rhyodacites, and bedded volcanic tuffs that occur as large outcrops and are in a few instances, underlain by the Khasi mafic intrusives. These rhyolites are capping Khasi mafic intrusives over various places and underlain by Shillong group of rocks out of which few outcrops are found as sills and dykes bodies relative to the Shillong group of rocks. Overall grain size variation for these felsic volcanics ranges from homogeneous fine grain to coarse grain with porphyritic texture. Rhyolites are fine grained and show porphyritic to glomeroporphyritic textures containing quartz, feldspar and orthoclase with altered biotites along with veinlets of quartz while volcanic tuffs are fine grained, composed of poorly sorted, angular to subangular fragments cemented together by a matrix showing lineation and found blended with the rhyolites. Chlorite, sericite and epidote are secondary minerals, whereas zircons and iron oxides are accessories.

The Petrochemical characteristics and trace element distribution indicate these rocks are silica-saturated metaluminous in nature, with high contents of SiO_2, K_2O, Al_2O_3, FeO^T, and low P_2O_5 contents. The trace element patterns of these volcanics reflect melts from the same source. These volcanics exhibit the characteristics of S-type granite (A/CNK>1.1(2.55), Na_2O<3.2 wt% (1.52 wt%), K_2O~4-5 wt% (3.70 wt%) and P_2O_5~0.14 wt% (0.19 wt%)). Overall, these rocks show LREE enrichments of 100-1000X Chondrite [La_N/Sm_N = 0.99-3.72 (3.72)] and flat HREE [Gd_N/Lu_N = 0.36-3.44 (1.60)] patterns with prominent negative Eu anomaly [Eu* = 0.48-1.17 (0.76)] in the chondrite-normalized REE distribution diagram, consistent with a mantle source origin similar to the Khasi mafics that they are capping. The behaviour of several elements and their ratios supports mantle as well as crustal affinities, which suggests a deep source, probably the mantle, and differentiation of the magma as it ascended into the crust with which it interacted. On the tectonic discrimination diagram, these volcanics fall into the intraplate setting, showing the signature of the active continental margin. We infer that the likely petrogenetic and geotectonic model for these volcanics is emplacement on an active continental margin in a within plate continental setting.