

Cenozoic crustal evolution of the Yangtze Block: Eocene to Early Oligocene granitic magmatism in Phan Si Pan uplift area, northwestern Vietnam

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The Phan Si Pan uplift area of NW Vietnam is a part of the Archean to Paleoproterozoic Yangtze Block (Southwest China) which was displaced during the India-Eurasia collision along the Ailaoshan-Red River Fault shear zone and adjacent structures (i.e. Song Da zone). This area is of particular interest to geologist because it has been at the forefront of the debate regarding extrusion tectonics associated with the India-Eurasia collision. This study is focused on Eocene and Early Oligocene granitic plutons in Phan Si Pan uplift area, NW Vietnam. The Eocene rocks are alkalic ferroan A₁-type granites with U/Pb age 49 ± 0.9 Ma. The trace element ratio of this granite are similar to the spatially associated Late Permian Emeishan A₁-type granites (Th/Nb=0.2, Th/Ta = 2.5, Nb/U = 24, Nb/La =1.2, Sr/Y=1). The $\epsilon\text{Nd}_{(t)}$ values range from -2.5 to -1.4 and indicate the rocks are moderately enriched. However, the peralkaline nature of the rocks suggest a non-crustal source. It is possible that the Eocene rocks are derived by partial melting of underplated Emeishan large igneous province rocks. The Early Oligocene granite is characterized as alkali-calcic to calc-alkalic magnesian peraluminous within-plate granite with U/Pb ages of 31.3 ± 0.4 to 34 ± 1 Ma. The Early Oligocene granite has negative $\epsilon\text{Nd}_{(t)}$ values (-8.7 to -2.6), ISr values ranging from 0.7058 to 0.7076 and prominent negative anomalies of Ta-Nb suggesting derivation from a crustal source. The Phan Si Pan uplift was neither a subduction zone nor an arc environment, during the Early Oligocene thus the granite may have formed as the result of partial melting of the lower crust by the upwelling of asthenosphere. The thinner and reworked Yangtze crust after Early Oligocene magmatism may be one of reasons for Ailaoshan-Red River Fault movement.