Identifying contribution of juvenile components to the generation of Miocene Himalayan magmatism

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The Cenozoic orogenic process of the Himalaya was accompanied by the widespread development of Himalayan leucogranites which were considered as pure crustal melts derived solely from metasediments without any mantle contribution. Thus, the collisional orogenesis in the Himalaya may involve no crustal growth.

The Himalayan lecogranites are mainly distributed in two sub-parallel and E-W striking belts including the Tethyan Himalayan leucogranites, mainly within the North Himalayan Gneiss Domes (NHGD) in the Tethyan Himalaya, and the Higher Himalayan leucogranites along the Southern Tibetan Detachment System (STDS). However, there are some intrusive rocks in between and are exposed in different emplacement types, such as sills intruding into the Tethyan sedimentary rocks and small intrusion controlled by N-S trending fault.

These sills and small intrusion yield Miocene ages. They have fast magma migration and emplacement process and show different petrological and geochemical characteristics from the adjacent leucogranite intrusions. There is an evident trend of assimilation and fractional crystallization indcated by samples from sills through fault-controlled small intrusion to the leucogranite intrusion, as the emplacement rate gradually slowing down. And the highly evolved melts (muscovite granite) of the fault-controlled intrusion are identical to the Himalayan leucogranites. The felsic sills display the most primitive components implying derivation from partial melting of thickened lower crust with important contribution of juvenile materials on the basis of elemental and isotopic compositions, such as positive $\varepsilon_{Hf}(t)$ values and relatively primitive Sr-Nd isotopes. Thus the leucogranites could be generated by evolution of the most primitive melts and not represent pure crustal melts derived from metasediments. And the identified juvenile components may be related to potential crustal growth in the Cenozoic Himalyan collisional orogenesis.