TitaniQ inclusions: thermobarometry of Tibetan Lhasa block granitoid zircons

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Geochemical studies of the Lhasa block, Southern Tibet, hint at a more complex deformation and thickening history than can be explained by endmember simple-shear or lithosphere extrusion models. While field surveys can provide two spatial dimensions, and geochronology a temporal dimension, understanding the depth of magma generation and assimilation, and thus the minimum depth of the Moho and thickness of the crust, requires direct reconstruction of depth using thermobarometry. The Al-in-hornblende barometer is sensitive to closure effects and deuteric alteration, and at best records emplacement depth, so is unsuitable for reconstruction of crustal thickness. Ti concentration in zircon and quartz allows for simultaneous solution for T and P, respectively, using the TitaniQ thermobarometer (T_{zir} and P_{qtz}). In Si-rich melts where quartz saturates early, P_{qtz} should record the depth of melt hybridization, which likely occurs at the base of the crust. While equilibrium between quartz inclusions in zircon hosts can be more easily established than separate whole crystals, petrography of quartz inclusions suggests alteration and recrystallization may confound the primary signal. Discordance in P_{qtz} between whole quartz grains and quartz inclusions in zircon – from a transect of plutons north of the southern margin of Eurasia, near Lhasa, Tibet – suggest a complex petrogenetic history in these plutons. Whole quartz results suggest rapid thickening following the onset of collision, with maximum P_{qtz} increasing from 12 to 20 kbar, while P_{qtz} of quartz inclusions have consistently high pressures up to 20 kbar as early as the late Jurassic. With careful selection of petrographically pristine, isotopically equilibrated quartz inclusions, this approach may reveal the depth of melt generation throughout the India-Asia collision. Coupling these data with crustal thickening estimates from indirect thermo-isotopic and geochemical models permits unprecedented insights into the response of southern Tibet to the collision of India.