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Origin of K-feldspar megacrysts in the Quxu batholith, Gangdese belt, southern Tibet Plateau: Implications for magma rejuvenation in a crystal mush reservoir

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An integrated study of field geology, crystal size distribution (CSD), LA-ICP-MS zircon U-Pb geochronology, whole-rock geochemistry, mineral composition, in-situ trace element and Pb isotope analysis of feldspar were carried out for the monzonites and mafic microgranular enclaves (MMEs) from the Quxu batholith in the Gangdese belt, southern Tibet. These data are used to investigate the petrogenesis of the Quxu monzonites, the origin of the K-feldspar megacrysts and the rejuvenation process in a crystal mush reservoir. The monzonites have a crystallization age of ~50 Ma. The whole-rock geochemical compositions suggested that the Quxu monzonites and MMEs exhibit continuous variations, consisting with magma mixing between mantle-derived mafic magmas and crust-derived host granitoids. The CSD diagram of K-feldspars show a characteristic of straight lines and the alignment factors (AF) of K-feldspars are moderate, indicating the crystals grow in a melt-present environment and in-situ textural coarsening are not the main factor leading to the growth of these megacrysts. According to the textural, mineral compositional and in-situ Pb isotopes, the feldspars from the Quxu MMEs and monzonites can be divided into several types, including normal zoning, reverse zoning and oscillatory zoning or no zoning. These complex zoning patterns reveal that the Quxu monzonites were formed by assembly of multiple felsic magma pulses and subsequent recharging of mafic magmas. Together with the CSDs results, we suggested that K-feldspar megacrysts could grow prolongedly via crystals transfer or mixing into different magma batches in melt-present environments and cold-storage mush magma could be rejuvenated by the recharging of hot mafic magma.