

Precise geochronological constraints on the relationship between spatially closely associated carbonatites and alkaline silicate rocks

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The spatially closely associated carbonatite and alkaline silicate rocks are generally assumed to be genetically related in which carbonatite was derived from silicate magma, or that both groups of rocks shared a same parental magma. Though experimental petrology reveals that carbonatites can be developed from silicate magma through fractionial crystallization or by liquid immiscibility, it also confirms the formation of carbonatites by partial melting of carbonated mantle peridotite, unaccompanied by silicate rock generation. Geochemical data, including isotope data offer no definitive evidence that carbonatites are derived from silicate magmas, nor are they inconsistent with such a relationship. We insist that precise age determination of both carbonatites and silicate rocks is a prerequisite for confirming whether they are genetically related or not. In a case study of alkaline-carbonatite complex from Hubei province, China, both alkaline silicate rocks and associated carbonatite were dated by SIMS U-Pb analysis of zircon and monazite. The results show that there is an apparent age gap of ~200 Ma between the silicate rocks and the carbonatites, with the silicate rocks formed much earlier. Such age discrepancy provided solid evidence that the spatially associated carbonatite and alkaline silicate rocks are genetically unrelated, the spatial rather than genetic association is probably caused by two separately generated magmas having used the common conduit to reach the crust from their formation sites in the mantle.