

# **On the association of Carbonatites and Alkaline silicate rocks: A case study from Sarnu-Dandali complex, India**

MILAN KUMAR MAHALA AND JYOTIRANJAN S. RAY

Physical Research Laboratory

Presenting Author: milan@prl.res.in

Carbonatites often occur together with alkaline silicate rocks such as nephelinite, phonolite, syenite, alkali pyroxenite etc. The emplacements of both types of magmas, i.e., carbonate and silicate, in a given complex are usually coeval, suggesting cogenesis. Despite decades of research, the exact nature of carbonate-silicate magma relationship and hence, the origin of carbonatites remains uncertain. Competing hypotheses argue for direct extraction of carbonate and alkaline silicate melts from the mantle, or liquid immiscibility of carbonate and silicate melts at crustal/lithospheric depths, or formation of residual carbonate melt at the end of fractional crystallization of silicate rocks within the crust. The late Cretaceous Sarnu-Dandali alkaline complex of western India, considered to be one of the peripheral magmatic activities of the Deccan Igneous Province (Basu *et al.*, 1993), is a unique carbonatite-alkaline silicate rock association. Results of our  $^{40}\text{Ar}/^{39}\text{Ar}$  dating suggest that the complex hosts at least two generations of alkaline silicate intrusive/extrusive (~89 Ma & 68.6 Ma), where the younger activity replaces the carbonatites as well. This repetition of alkaline magmatism within the same complex, at a gap of ~20 Ma, rules out the involvement of the Deccan-Reunion plume as the source of these rocks. Identical C-O-Sr-Nd-Pb isotopic compositions of the 68.5 Ma carbonatites and alkaline silicate rocks suggest a common parentage for both, and the origin of the primary magma from a LREE depleted mantle source. There is no evidence of significant crustal contamination of the parental carbonated silicate magma, and the major and trace element variations point towards separation of a carbonate melt from a parental magma by liquid immiscibility, towards the end of fractional crystallization of silicates, i.e., the formation of alkaline silicate rocks. The presence of large carbonate crystals in alkaline silicate rocks, having pristine isotopic compositions, is a testimony to such a process.

Basu, A. R. *et al.* (1993) 'Early and late alkali igneous pulses and a high-3He plume origin for the Deccan flood basalts', *Science*, 261(5123), pp. 902–906. doi: 10.1126/science.261.5123.902.