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Celso B. Gomes, University of Sao Paulo (Brazil)
Excelso Ruberti, University of Sao Paulo (Brazil)
Piero Comin-Chiaramonti, University of Trieste (Italy)

Alkaline and alkaline-carbonatitic magmatism, mostly represented in Brazilian and Paraguayan territories, shows a clear tectonic control by crustal discontinuities and lies close to geographic borders of sedimentary basins, excluding Bolivian occurrences found within the Amazon craton. This magmatism is related to major extensional structural features (rifts, archs, lineaments, faults) active at least since Early Mesozoic.

Alkaline rocks intrude Precambrian basement or Paleozoic sediments and more rarely are associated in field with Early Cretaceous tholeiitic basalts. They are quite variable in size, mode of occurrence and composition. The more abundant silicate rocks are evolved silica undersaturated to saturated syenites, displaying large variation in igneous forms. Least evolved rocks are scarce and outcrops of effusive suites occur rarely. Potassic to ultrapotassic, mafic-ultramafic, strongly silica-undersaturated rock types characterize distinct groups almost restricted to a few occurrences. Over twenty carbonatite bodies are known, Ca-carbonatites being the most widespread variety. They are usually related to several kinds of cumulate rocks of ultramafic to mafic-intermediate composition. In some complexes, reaction bands are distinguished at the contact zone between the mafic-ultramafic suite and carbonatites; fenites are occasionally present. Alkaline magmatism started in Permo-Triassic times and lasted until the Paleocene. Several pulses, namely sodic (at ~241 Ma; ~118 Ma; ~59 Ma) and potassic (at ~139 Ma, predating the Serra Geral tholeiitic lavas, ~133 Ma; ~126 Ma; 90-50 Ma) in composition are recognized, the numerous occurrences being assembled into several provinces. Alkaline potassic and sodic rocks are distinguished by their negative and positive Nb-Ta anomalies, respectively. Negative spike is also common to tholeiitic rocks. Pb and Sr-Nd isotopes confirm the twofold distinction, with the sodic varieties ranging from depleted mantle to Bulk Earth in contrast with the potassic ones trending to the enriched quadrant. They are both plotted along a well defined trend, the tholeiitic basalts lying between the two types. Early and Late Cretaceous carbonatites have the same isotopic Sr-Nd initial ratios of the associated alkaline rocks. C-O isotopic data indicate typical mantle signature for some carbonatites and the influence of post-magmatic processes in others. Close association of alkaline and tholeiitic rocks requires that their parental magmas derived from small subcontinental mantle masses, vertical and laterally heterogeneous in composition and variously enriched in incompatible elements. Significant H-O-C-F activity is also expected in the mantle due to the presence of carbonatites. Isotopically distinct magmas were generated following two main enrichment events of the mantle at 2.0-1.4 and 1.0-0.5 Ga.

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