PETROLOGY AND GEOCHEMISTRY OF MAFIC-ULTRAMAFIC ROCKS FROM SELECTED AREAS: TECTONIC AND METALLOGENETIC IMPLICATIONS

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FAPESP # 2011/50307-0 | Term: May 2011 to Apr 2014

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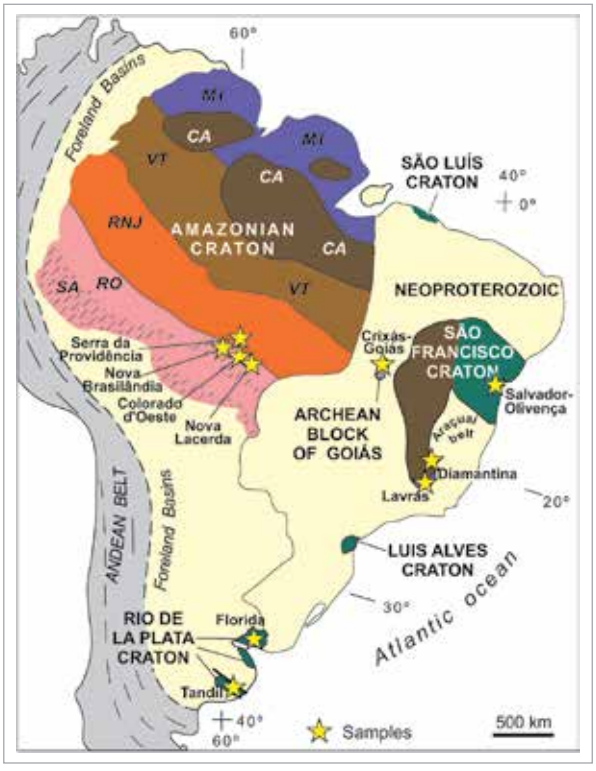

Figure 1.

The project is part of a research on mafic-ultramafic rocks which has been performed during the last four decades. The present study refers to four main types of mafic and ultramafic rock associations: the mafic dykes from the cratonic areas of the South American Platform, mainly those from the Amazonian Craton, the large mafic-ultramafic stratiform complexes of Niquelândia and Cana Brava, in Goiás State, the basalts and alkaline rocks form the Paraná-Etendeka system, in South America, Namibia and Angola, and the ultramafic-alkaline rocks of Planalto da Serra in the Amazonian Craton. Age determinations of mafic dykes can also generate important data on mantle composition and on the tectonic evolution of continental areas during the geological times. In several regions of the world, they are related to the breakdown of continents and supercontinents. Similar geochemical and tectonic importance is attributed to the study of the Mesozoic volcanism of the Paraná-Etedenka system, and its relationship with the opening of the South Atlantic Ocean. The studies on the age, stratigraphy and evolution of the stratiform complexes of Niquelândia and Cana Brava, important sources of nickel and asbestos respectively, are controversial with respect to their ages, stratigraphy and tectonic evolution. The alkaline ultramafic rocks from Planalto da Serra, in the Mato Grosso State, have been recently discovered, and their age, petrology and tectonic role are poorly known.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

The study of selected mafic dykes from cratonic areas of the South American Platform shows considerable differences in their mantle sources and geodynamic features. Dykes from Nova Lacerda (1.38 Ga) and Colorado Complex (1.35 Ga) are related to arc settings formed during the 1.47-1.35 Ga closure of the oceanic domain separating the Amazonian Craton and the Paraguá Block, whereas those from the Serra da Providência Intrusive Suite (1.55 Ga) and the Nova Brasilândia Sequence (1.10 Ga) are considered intracratonic. In spite of the diversity of geological settings, all dyke swarms originated from a mantle source composed mainly of an E-MORB end-member, with a variable addition of slab fluids, which indicates the presence of episodic oceanic lithospheres subductions during the Mesoproterozoic in the SW Amazonian Craton. The dyke swarms from the São Francisco Craton are associated with intraplate events. The mantle source of the Lavras swarm (1.9 Ga) has a predominant E-MORB characteristic, whereas the younger dykes from the Diamantina (0.93 Ga) and the Salvador-Olivença swarms (0.92 Ga), have significant influence of slab derived and deep fluids (OIB type). These dykes could be related to the initial disrupting of the Rodinia Supercontinent. The heterogeneity of mantle source is also shown by the Florida (1.79 Ga) and Tandil (2.0 Ga) dykes, which are associated with extensional events of the Rio de la Plata Craton; and by the Crixás-Goiás (2.49 Ga) swarm in the Archean Block of Goiás, suggesting that crustal recycling occurred since Archean times. U–Pb zircon ages provide compelling evidence that the Upper and the Lower Niquelândia Complexes formed during the same igneous event at ca. 790 Ma. Similarly, to the Ivrea Complex (NW Italy) both complexes grew incrementally as large crystal mush bodies, which were continuously stretched while, fed by pulses of fresh magma. Syn-magmatic recrystallization during this deformation resulted in textures and structures, which, although appearing metamorphic, are not ascribable to post-magmatic metamorphic event(s), but are instead characteristic of the growth process in huge and deep mafic intrusions such as the Niquelândia and Ivrea. Data of the Cana Brava complex suggest similar age and significant crustal contamination. The genesis of Paraná-Etendeka magmatism, which includes tholeiitic and K and Na alkaline rocks, requires heterogeneous mantle sources, probably related to "metasomatic processes," which would have occurred at ca. 0.5–1.0 Ga in Angola, Namibia, and Brazil; and 1.5–1.6 Ga in eastern Paraguay. The contribution of asthenospheric components, derived from mantle plumes to the genesis of the magmatism was not significant. Thermal anomalies in the deep mantle, mapped by geoid and seismic tomography, offer an alternative for a plume-unrelated heat source. The Planalto da Serra ultramafic alkaline rocks yielded an age of ca. 600 Ma. These age determination rules out geochronological and genetic relationship between the Planalto da Serra rocks and the Cretaceous bodies of the "Azimuth 125" Lineament. This age also indicates that the onset of the deformation of the Cuiaba Group may be older than 600 Ma, and is a strong argument against the existence of the Clymene Ocean, a controversial large Edicarian oceanic domain in South America.

MAIN PUBLICATIONS

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