

Title: Alkaline magmatism in Brazil and the enrichment of strategic elements (REE, Nb, Ta, Zr, and Hf)

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Proposal:

The objective of this research is the mineralogical, petrographic and geochemical characterization of alkaline intrusions located in southern Brazil. The project will be developed through the study of thin sections, chemical analyses (XRF, ICP-MS and Nd-Sr-Pb isotopes) on the bulk rock, a detailed in situ geochemical study of the characterizing mineral phases using EDS/WDS and LA-ICP-MS, U-Pb dating, and Sr-Nd-Pb-Hf-O-C isotopes. The analytical program will be carried out using the analytical methodologies of DiSTAR at the University of Naples Federico II, where the Ph.D. student will have the opportunity to acquire technical skills in mineralogical and petrographic methods, such as chemical analysis (XRF), polarized light and scanning electron microscopy with microanalysis (EDS/WDS), and Sr-Nd-Pb isotope analysis. "Doctoral School" training courses will also be available for the student at the host university to enhance his or her knowledge on various topics.

A period of about 1-6 months of study both at home and abroad is also included for the Ph.D. student to learn different analytical methods (isotopes of Sr-Nd-Pb-Hf-O-C, LA-ICP-MS, and U-Pb) and to have useful discussions with Italian and international scientists for a chance to further develop his or her career. The candidate's fees for activities related to the doctoral project will be covered by DiSTAR funds.

Research Program:

The proposed research project will focus on the Mesozoic alkaline magmatism, located at the margin of the Paraná Basin, and associated mineralization in Brazil through petrological, mineralogical, and geochemical studies of alkaline intrusions (kamafugites, kimberlites, lamprophyres, alkaline/peralkaline, and carbonatite rocks). Most of them have their own economic potential. They are rich in minerals and precious elements for industrial purposes, such as diamonds in kimberlites, or P, Zr, Hf, Nb, Ta, Ti, and REE elements in alkaline rocks. It is important to recall that the Araxá complex (Alto Paranaíba Igneous Province, southern Brazil) is known for its rich mineral deposits, including niobium (Nb), phosphate (P), barium (Ba), light rare earth elements (LREE) and iron (Fe) and has been the subject of mining operations since the 1950s.

This project study will be useful to: 1) determine the mineralogical, chemical and isotopic characteristics of alkaline and carbonatite rocks; 2) characterize the mantle sources; 3) determine the main mechanisms of genesis; 4) determine the chemical and physical parameters governing the evolution of these magmas (crystallization temperature, crystallization pressure, fugacity of

dissolved volatiles in magmas and their influence); 5) define areas where alkaline and carbonatite rocks are particularly enriched in elements such as P, Zr, Hf, Nb, Ta, Ti, and REE up to economic concentrations, and 6) clarify the role of hydrothermal fluids in REE enrichment. Data obtained on these objectives will form the basis for applied research in the field of resource and raw materials. Publications, oral and poster presentations based on the results of the project will be prepared and presented for prestigious national and at international scientific journals and conferences.

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