



Petrology, geochemistry and geochronology of the Jacupiranga ultramafic, alkaline and carbonatitic complex (southern Brazil)

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Brazilian carbonatitic complexes are located at the edges of the Paleozoic basins and are usually associated to tectonic crustal flexuring or deep fault zones. The Jacupiranga Complex is a 65 km² ultrabasic-alkaline carbonatitic intrusive body outcropping at the northeastern border of the Paraná Basin, South of São Paulo State (Brazil). The northern portion of the unit is mostly composed of peridotitic rocks, while the southern part contains ijolites, melteigites, clinopyroxenites and carbonatites which host a phosphate deposit, mined since 1966. Even though the carbonatites only represent 1% of the Complex's area, they have concentrated most of the historical petrogenetic studies, leaving almost unknown the petrogenetic and the geochronological characteristics of other rocks. This explains why the few petrogenetic models from the literature are very partial and mostly unsatisfactory. While the peridotitic rocks are largely hindered by the absence of fresh outcrops, the regolith thickness and the high serpentinization degree, field observations and petrographic data notably show a heterogeneous zone around the peridotitic body. That zone is composed of a large variety of lithotypes over a relatively small area (~9 km²), comprising diorites, monzodiorites, alkali feldspar syenites, trachytes, lamprophyres and syenites. Moreover, these rocks present a restricted lateral continuity (decametric) and a lack of the magmatic bedding characteristic of the ijolitic and clinopyroxenitic rocks. The southern clinopyroxenitic zone (~20 km²) is composed of clinopyroxenite and melteigite with prominent magmatic layering, probably of cumulative origin, and a body of carbonatites which outcrops over less than 1 km² essentially composed of sovite and beforosite, with abundant apatite. The Jacupiranga Complex characteristics indicate that its formation possibly comprises at least five magmatic events which cannot at present be surely ordinated in time: a) the emplacement of the peridotitic unit; b) the intrusion and probable differentiation of the clinopyroxenites and ijolitic rocks; c) intrusions of several lithotypes forming the heterogeneous zone; d) intrusion of lamprophyric dykes into the syenites; e) the carbonatite intrusion. The precise geochronological sequence is still unknown, since only the syenites (134.9 ± 0.65 Ma this study), the carbonatite (131 Ma) and the clinopyroxenite (131 Ma) were dated at present. Our goal is now to investigate the origin and evolution of the magmas which formed the Jacupiranga Complex using geochronology with Ar/Ar, U-Pb and U-Th/He dating, as well as elemental and isotopic geochemistry. Considering that the Jacupiranga Complex is one of the most differentiated alkaline complexes around the world, this contribution will be important not only for the understanding of the unit itself but also for the general comprehension of the forming process, the evolution of the alkaline and carbonatitic magmas and the concentration of apatite in carbonatites, still controversial subjects among the scientific community.