

Off-craton Metasomatism recorded by the Apatite-Kaersutite-Phlogopite Assemblage in Pyroxenite Xenoliths at South Atlantic Volcanic Islands

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The Trindade and Martin Vaz Archipelago (3.9 – 0.05 Ma) is composed of alkaline volcanic rocks undersaturated in SiO₂ that represents the last volcanism in Brazilian territory. The islands have alkaline sodic metaluminous affinity, covering from basanites to phonolites. The Trindade Complex is the basal unit of Trindade Island and presents ultramafic enclaves in the coherent rocks and ultramafic blocks in the volcanoclastic portions. On Martin Vaz Island, fragments of ultramafic rocks are found in the form of blocks in the Mirante Formation, which is well exposed throughout the island. This study aims to unravel the origin of these ultramafic fragments through petrography, mineral chemistry and SEM data, and trace elements geochemistry in apatite, pyroxene, amphibole, and phlogopite. Six petrographic groups were identified: (1) Pyroxenite, (2) Olivine Pyroxenite, (3) Apatite Pyroxenite, (4) Amphibole-Phlogopite Pyroxenite, (5) Wehrlite and (6) Phlogopite Pyroxenite. The samples present an equigranular to protogranular texture, with intensely zoned mafic phases (groups 1, 4, 5 and 6) and richness in fluid inclusions. Mineral chemistry revealed that olivines (present in groups 2, 4 and 5) have #mg (Mg/(Mg/Fe)) ranging from 79-91. Clinopyroxenes (all groups) have #mg 68-88 and TiO₂ ranging from (1-4%). The other minerals are classified as kaersutite, phlogopite, fluorapatite, as well as titanomagnetite and ilmenite. Analysis of REE in pyroxenes (normalized by chondrite) for all groups indicates enrichment of LREE relative to HREE, with enrichment of MREE forming a convex pattern. Some pyroxenes show a non-planar HREE pattern (Tm, Yb and Lu). The [(La/Nb)_N/(Ti/Eu)] ratio shows a strong contribution of silicate metasomatism for all groups analyzed. The presence of the presence of volatiles-rich phases such as apatite and phlogopite and the absence of orthopyroxene indicate a probable refertilization of the lithospheric mantle or fluids percolation by the rise of magma.