

⁴⁰AR/³⁹AR GEOCHRONOLOGY OF A THOLEIITIC LOW-TI DYKE FROM BRAZILIAN SOUTHEAST REGION: SECONDARY PHASES DISTURBANCES

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ABSTRACT: Geochronological and paleomagnetic data reveal that mafic dyke swarms preceded and postdated the Paraná-Etendeka flood basalt magmatism (133-135 Ma) associated with the opening of the South Atlantic. Accurate geochronological constraints for the various generations of mafic dyke swarms are essential for the geodynamic reconstruction of continental breakup, and ⁴⁰Ar/³⁹Ar geochronology on single plagioclase crystals is often the preferred method for determining the ages of the various generations of mafic dykes. Unfortunately, the complex thermal histories and close spatial proximity of intrusive bodies often lead to thermal disturbances and inconsistent results. Mafic dykes from Cabo Frio, Rio de Janeiro, Brazil, provide evidence that thermal events and hydrothermal alteration after dyke emplacement partially reset the plagioclase K-Ar system, but only partially affect this system in amphiboles. Results from two incremental-heating experiments for amphibole crystals from an NE-SW equigranular dyke yield two relatively flat incremental-heating spectra defining age plateaus containing 90 and 98% of the cumulative ³⁹Ar released at 132.38±0.58 and 132.23±0.60 Ma, respectively. Both samples reveal ascending steps at the low-temperature end of the experiment, suggesting small fractions of argon loss, and indicate the intrusion age of the dyke. Incremental-heating spectra for cloudy, visually altered plagioclase crystals from the same sample, however, yield two flat spectra with plateaus containing 90 and 95% of the cumulative ³⁹Ar released that define plateau ages of 106.22±0.51 and 106.24±0.59 Ma, respectively. These results likely record a hydrothermal event, when plagioclase phenocrysts partially altered to sericite. In contrast, incremental-heating spectra for apparently fresh plagioclase crystals yields a plateau containing 56% of the cumulative ³⁹Ar, defining an age of 95.6±1.2 Ma. These plagioclase crystals do not display primary zoning, and patchy Na enrichment in phenocryst rims suggests a late-stage albitization event; this is reinforced by the fact that the plateau is only established in the high-temperature portion of the spectra, which affects more albitic regions of the grain. The three distinct ages recorded by the K-Ar system for different phases (amphiboles, cloudy plagioclase, visually fresh plagioclase) in the same mafic dyke suggest that multiple overlaid hydrothermal alteration events impose a complex pattern. These results also show that two alterations processes have affected the plagioclase K-Ar register of this generation of mafic dykes, the first one consisting of a sericitization event contemporary to the coastal uplift of the Brazilian Southeast region. The more recent one, the border albitization, probably occurred in higher pressures, suggesting that the dyke was intruded in a deeper portion of the crust, during the Early Cretaceous Period, remaining there until, at least, 95 Ma ago. This secondary albitization event may be related to the early tectonic processes associated with the alkaline magmatism that affected the Cabo Frio region around 90 Ma ago.

KEYWORDS: ⁴⁰AR/³⁹AR GEOCHRONOLOGY OF THOLEIITIC INTRUSIVE ROCKS; CABO FRIO LOW-TI THOLEIITIC MAGMATISM; SECONDARY PHASES INFLUENCES ON ⁴⁰AR/³⁹AR GEOCHRONOLOGY