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CORRELATIONS AMONG LARGE IGNEOUS PROVINCES RELATED TO THE WEST GONDWANA BREAKUP: A GEOCHEMICAL DATABASE REAPPRAISAL OF THOLEIITIC PLUMBING SYSTEMS

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The opening and spreading of the Atlantic Ocean between Africa and South America evolved during the Early Cretaceous and were preceded by dramatic mafic (tholeiitic) magmatism and minor silicic and alkaline volcanism. These features are presently recognized from the equatorial regions of Brazil and Africa to the Falklands and South Africa. In southeastern South America, continental flood basalts and related plumbing systems constitute the Paraná Magmatic Province (PMP), whose African counterpart is the Etendeka Magmatic Province (EMP). In northeastern Brazil, dike swarms and sill complexes compose the Equatorial Atlantic Magmatic Province (EQUAMP). As a common feature, these provinces are chemically represented by two prevalent magma types: (1) tholeiitic basalts and basaltic andesites with low Ti ($\text{TiO}_2 < 2 \text{ wt.}\%$), also including transitional Ti tholeiites with $\text{TiO}_2 \sim 2.7\text{--}1.7 \text{ wt.}\%$, and low incompatible element contents. This type is predominantly found in the southern PMP and EMP, with minor occurrences in the EQUAMP. (2) Tholeiitic basalts and basaltic andesites with high Ti ($\text{TiO}_2 > 2 \text{ wt.}\%$) and incompatible element contents. High Ti tholeiites are relevant in the northern PMP and EMP, and dominant in EQUAMP. Evolved rocks ($\text{SiO}_2 = 57\text{--}65 \text{ wt.}\%$) interpreted as byproducts of assimilation and/or fractional crystallization (AFC) processes from high Ti tholeiitic magmas, are scarce (but present) in all three provinces. An accurate analysis of multivariable databases collected from the literature for dikes and sills, including major and trace element and radiogenic isotope data, reveals close similarities in their geochemical signatures. In a paleogeographic reconstruction of West Gondwana, the intrusive remnants of the PMP, EMP and EQUAMP are spread over an area of nearly 10 Mkm², forming perhaps the most extensive set of plumbing systems on Earth, with a relatively consistent chronology based on a vast collection of K–Ar and ⁴⁰Ar/³⁹Ar data available in the literature. This work provides the first comprehensive data comparison to support the existence of what may have been a single intercontinental-scale magmatic province of West Gondwana.

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