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J/K Transition Geochemistry in the Araripe Basin, Brazil: Evaluating Volcanic and Meteorite Signals

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The Jurassic-Cretaceous (J/K) transition was characterized by profound global transformations, including eustatic sea level fluctuations, climatic shifts, tectonic reorganization associated with the opening of the Atlantic Ocean, and ecological turnover in terrestrial and marine ecosystems. This interval also records large-scale geodynamic events, such as intensified volcanism and meteorite impacts (Morokweng and Mjølnir). In this context, this study aims to characterize the geochemical signature of the Brejo Santo Formation (Araripe Basin, Northeastern Brazil), focusing on the distribution, enrichment, and stratigraphic variability of siderophile elements (Ir, Cu, Zn, Ni, Co, and Cr) and volcanism proxies (Hg and Te). The Araripe Basin comprises a stratigraphic succession associated with the development of the Atlantic Ocean. The Brejo Santo Formation reaches ~450 m in thickness and consists of green siltstones, calcareous sandstones, and red shales, deposited in an arid, oligotrophic lacustrine system of the Tithonian (Upper Jurassic). Fourteen samples were collected from outcrop BS-1 following removal of weathered surfaces, at 12 cm stratigraphic intervals. Samples were dried (60°C, 12 h), powdered using an agate mortar and pestle, homogenized, and stored to analysis. Geochemical analyses were performed using inductively coupled plasma mass spectrometry (ICP-MS; Agilent 8900). Approximately 0.25 g of powdered material was digested in 10 mL of double-distilled HNO3. For Hg analysis, 0.5 g of sample was digested with 10 mL HNO_3 and analyzed by Cold Vapor Atomic Absorption Spectrometry (CV-AAS; RA-7000, NIPPON®). Elemental concentrations were normalized using Enrichment Factors (EF) to minimize lithological interference. The Hg-EF ranged between 0.6 and 4.1, and the Te/Th oscillated between 0.9 and 3.5. Iridium concentrations range from 6 to 24 ppb (Ir^{EF}: 0.3–2.9). Additional enrichments were identified for Cu^{EF} (0.7–13), Co^{EF} (0.7–16), Cr^{EF} (0.4–8.1), and Zn^{EF} (0.7–17). Volcanism anomalies indicate restricted enrichment, suggesting diffuse atmospheric input. For the siderophile elements, anomalies were observed for all elements in sample BS-1.3, temporally consistent with the Morokweng impact, supporting a potential extraterrestrial contribution recorded in this lacustrine succession. These findings provide new insights into the geochemical record of the J/K transition and highlight the interplay between terrestrial sedimentation, volcanic input, and extraterrestrial events during the Late Jurassic.