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Synchronicity between the South Atlantic Magmatic Province and the Weissert Event

ANTOMAT MACEDO FILHO[1], DAWID SZYMANOWSKI[2] AND VALDECIR DE ASSIS JANASI[3]

[1]Universidade de São Paulo
[2]ETH Zurich
[3]Instituto de Geociências, Universidade de São Paulo

Large igneous provinces (LIPs) are thought to play a key role in driving climate change events associated with most major mass extinctions. The South Atlantic Magmatic Province (SAMP) is an Early Cretaceous LIP linked to the West Gondwana fragmentation and encompasses the previously recognized Paraná–Etendeka and Equatorial Atlantic provinces, whose remnants are preserved in South America and Africa. Unlike other Phanerozoic LIPs of comparable scale, the SAMP is not associated with mass extinction events; instead, it has been discussed as a potential trigger of the Valanginian Weissert Event, which is a period of global climate perturbation tracked by a prominent positive carbon isotope excursion. To date, the role of the SAMP in Valanginian climate perturbations remains unclear, largely due to the lack of high-precision geochronological constraints both from within the LIP and for paleoclimatic records themselves. To address this, we obtained new single-grain zircon U–Pb CA-ID-TIMS ages from mafic, felsic, and alkaline units distributed across the entire LIP, documenting a magmatic history spanning ca. 3 Myr. Two main magmatic sequences are recognized in the SAMP: (1) early low-Ti tholeiitic magmatism active between ca. 133.9 and 133.3 Ma, culminating in silicic volcanism that persisted until 132.8 Ma; and (2) high-Ti tholeiitic magmatism accompanied by coeval silicic volcanism, initiating at 133.4 Ma and continuing until 130.9 Ma. We also used zircon geochronology of volcanic ash layers from DSDP Site 535 (Gulf of Mexico) core to constrain the timing of the rising limb of the Weissert carbon-isotope excursion. These ash layers yield U–Pb ages demonstrating synchronicity between the emplacement of the SAMP's early phases and the onset of the Weissert Event, thereby supporting the role of the SAMP as a key driver of global climatic perturbations coeval with the early stages of West Gondwana breakup.