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In-Situ U-Pb Carbonate Age Constraints on the Rise of Complex Multicellular Life in the Southeastern Amazonian Craton

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The Ediacaran period, which began after the extreme Marinoan glacial event, holds significant evolutionary importance due to the emergence of the first complex multicellular organisms. Ediacaran fossils have been discovered worldwide, with notable occurrences in Australia, Brazil, Canada, China, and Namibia. In Brazil, the Tamengo Formation of the Corumbá Group (Southern Paraguay Belt) is known for preserving fossils of the Nama biota, including *Cloudina* and *Corumbella*[1]. The most precise age currently available for the limestone-dominated Tamengo Formation is derived from zircon grains within thin intercalations previously interpreted as ash beds, which yielded U-Pb CA-TIMS ages of approximately 542 Ma[2]. Recent advances in in-situ U-Pb geochronology of carbonate minerals have opened new opportunities to directly date carbonate rocks to establish the timing of deposition and diagenesis, and verify ages previously reported using different geochronometers. In this context, our goal was to directly date carbonate rocks from the Tamengo Formation to test the proposed timing of deposition or constrain diagenetic events, using samples from the ICDP's GRIND project. Seven samples from Core 3B were analyzed by LA-ICP-MS at ETH Zurich, generating ten Tera-Wasserburg concordia diagrams. Of these, only two isochrons exhibited low MSWD values (below 3) and a significant spread in U/Pb ratios, making them geologically meaningful. Each isochron consists of at least 30 spots. Both results were obtained from calcite in shell fillings and shell fragments within organic-rich limestone. The obtained U-Pb ages are statistically consistent with the previously reported ~542 Ma, reinforcing a terminal Ediacaran–early Cambrian age for the Tamengo Formation.

[1]Amorim, KB, et al., (2020). *Sedimentology*, 67(7), 3422-3450.

[2]Parry, LA, et al., (2017). *Nature Ecology & Evolution*, 1(10), 1455-1464.