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A shift in redox conditions near the Ediacaran/Cambrian transition and its possible influence in early animal evolution, Corumbá Group of western Brazil

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The Ediacaran-Cambrian transition witnessed some of the most important biological, tectonic, paleoclimatic and geochemical changes in Earth's history. Of utmost importance for early animal evolution is the likely shift in redox conditions of bottom waters, which might have taken place in distinct pulses during the late Ediacaran and early Paleozoic. To track redox changes during this transition, we present new trace element and the first iron speciation data on the Tamengo and Guaicurus formations of the Corumbá Group in western Brazil. The Tamengo Formation is composed mainly of limestone with interbedded marls and mudrocks, bearing fragments of upper Ediacaran biomineralized fossils such as *Cloudina lucianoi* and *Corumbella werneri*. The Guaicurus Formation represents a regional transgression of the shallow carbonate platform and is composed of a homogeneous fine-grained siliciclastic succession, bearing meiofaunal bilateral burrows, representing important ecological changes around 555-541 Ma. The new iron speciation data reveal predominantly anoxic and ferruginous bottom water conditions during deposition of the Tamengo Formation, with Fe_{HR}/Fe_T around 0.8 and Fe_{Py}/Fe_{HR} below 0.7. The transition from the Tamengo to the Guaicurus Formation, on the other hand, is marked by a stratigraphically rapid drop in Fe_{HR}/Fe_T to below 0.2, recording a shift to likely oxic bottom waters, which then persist upsection. We interpret the iron speciation data to reflect a transition between two distinct paleoenvironmental settings. The Tamengo Formation represents an environment with anoxic bottom waters, with fragments of biomineralized organisms that lived on shallower, probably mildly oxygenated surficial waters, and that were washed upon and transported down-slope. Similar to coeval successions (e.g., the Nama Group in Namibia), our data support the hypothesis that Ediacaran biomineralized organisms lived in a thin oxygenated surface layer above a relatively shallow chemocline. The Guaicurus Formation, on the other hand, records the expansion of oxic conditions to deeper waters during a sea level rise. This setting was crucial for the development of complex life forms capable of vertical burrowing, kicking off an agronomical revolution that would ultimately be one of the major factors responsible for early animal biodiversification.