Wobbles in the Early Cambrian Earth's spin axis? New high-quality paleomagnetic data from NE Brazil

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The Neoproterozoic-Paleozoic transition (~541 Ma) was a turning point in Earth’s history resulting in great biological changes between the microbial Precambrian life and the Ediacaran biotic revolution with the occupation of the sedimentary substrate, the dawn of biomineralization and the appearance of the earliest multicellular organisms. In parallel, this period is marked by a large plate reorganization leading to the assembly of Gondwana and by major climatic changes (extreme glacial events). Due in part to a poor paleomagnetic database for the different cratons in the Ediacarian-Cambrian times, the global paleogeography at that time still remains controversial. In this study we present a new paleomagnetic pole (Q= 6) for the Monteiro dike swarms in the Borborema Province (NE Brazil). They are fine-grained hornblende dolerite dated by U-Pb on zircon at ~538 Ma. Rock magnetic data indicate that magnetite and pyrrhotite are the main remanence carriers. Positive baked-contact tests support the primary remanence obtained for these dikes (19 sites). A positive reversal test (classified C) was also obtained from the 14 sites with normal polarity and the 5 sites with reversed polarity, indicating that the secular variations was eliminated with our sampling. Our new key pole is not consistent with the classical Apparent Polar Wander Path of the West Gondwana which consists of a long track from a southern polar position at ~590 Ma to an equatorial position at ~520 Ma. The Monteiro paleomagnetic pole suggest instead rapid and small oscillations of the APW, or wobbles, after 560 Ma. These rapid oscillations may be related to inertial readjustments in response to true polar wander (TPW) of the spin axis. TPW events have been suggested from 615 to 590 and then from 575 to 565 Ma in previous works. These TPWs are supposedly caused by changes in the inertia tensor of the Earth due to internal mass redistribution, related to rapid changes in subduction velocity. Possible links between these events and life evolution will also be discussed.