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A pure dipole analysis of the Gondwana apparent polar wander path: Paleogeographic implications in the evolution of Pangea

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The paleogeography of pre break-up Pangea at the beginning of the Atlantic Spreading has been a subject of debate for the past 50 years. Due to the lack of marine magnetic anomalies and hot spot tracks, reconstructions preceding the Jurassic are mainly held in paleomagnetic data. This 50-year-old debate focuses specifically on magnetic remanence and its ability to correctly record the inclination of the paleomagnetic field. In this contribution, we calculate a composite apparent polar wander path (APWP) for Gondwana without the use of inclination data in an innovative method, and then expand upon the paleogeographic implications of doing so. The zonal terms of the geomagnetic field and inclination shallowing in sediments only affect the inclination of the paleomagnetic directions, but have no effect on the declination. This means that the great circle linking the sampling locality and the distorted paleopole [Site-Pole: SP-Circle; Bazhenov and Shatsillo, 2010] should contain the unbiased paleopole at some point. A rigorous selection of paleopoles was made to find the great circles containing the paleomagnetic pole and the respective sampling site. The true dipole pole (TDP) was then calculated by intersecting these great circles, effectively avoiding non-dipolar contributions and inclination shallowing. A strong agreement between the Pangea paleomagnetic poles in the classic Wegenerian Pangea supports an A-type Pangea configuration from the Upper Permian (269 Ma) onwards. Nevertheless, the reconstructions performed confirm the disagreement between the Laurentian paleomagnetic poles in the classic Wegenerian Pangea for the Upper Carboniferous to early Permian ages. This discrepancy seems to leave no room for a 100 Ma quasi-static Pangea, requiring an adjustment of the paleogeographic model. It was necessary to reposition Laurentia to the West of Gondwana. It is contended that Pangea began to take shape as the B-type during the Upper Carboniferous, later evolving, during the Early Permian, to the final A-type configuration of the Upper Permian.
References: Bazhenov , M.L., Shatsillo, A. V ., 2010. Late Permian palaeomagnetism of Northern Eurasia: Data evaluation and a single-plate test of the geocentric axial dipole model. Geophys. J. Int. 180, 136–146. doi:10.1 1 1 1/j.1365-246X.2009.04379.x