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Neoproterozoic paleogeography: paleomagnetic perspective

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Although the evolution of Phanerozoic supercontinents (Pangea and Gondwana) is relatively well established, the exact configuration of the earlier supercontinent Rodinia and its predecessors are still widely debated due to our poor knowledge of Neoproterozoic paleogeography. The Late Neoproterozoic – Early Cambrian interval is marked by at least two major tectonic reconfigurations of the Earth: the final breakup of the remnants of the Rodinia supercontinent and the assembly of Gondwana. This was also one of the greatest orogenic epochs (Baikalian – Pan-African – Cadomian – Timanian orogenies). Many high-quality paleomagnetic poles have been used to construct Phanerozoic APWPs for the majority of continents, and there is general agreement about Phanerozoic tectonic history. In contrast, late Neoproterozoic paleomagnetic data are scarce and controversial, and it is difficult at this stage to apply the traditional APWP method to create a unique model for the latest Neoproterozoic – Cambrian global paleogeography. The key paleomagnetic controversy is in Laurentian (North American) database, where two equally reliable sets of data indicate contrasting paleolatitudes. Several explanations including some non-uniformitarian ones were proposed, but all of them are yet to be conclusively proven. Recent paleomagnetic studies do provide a good step forward, however. In the "Iapetian" (North Atlantic) realm of final Rodinia breakup, recent paleomagnetic data from Baltica verify the pre-Iapetian Laurentia-Baltica reconstruction and suggest that Baltica rifted away from Laurentia-Amazonia at around 600 Ma during the opening of the Eastern Iapetus and Tornquist Sea, although details of this process are still debated. In most published scenarios, this was followed by separation of Amazonia and Laurentia and opening of Western Iapetus. At the same time, a complicated collision between several continental blocks on the other side of the globe caused closure of oceanic basins and the assembly of Gondwana, accompanied by major collisional and accretionary events in northern Africa and northern South America (Cadomian orogeny), eastern Congo/Kalahari and western India/Australia/Antarctica (Pan-African orogeny), eastern and north-eastern Baltica (Timanian orogeny), and southern Siberia (Baikalian orogeny). Recent paleomagnetic and geological data from Australia, South America, Siberia, India provide some progress in understanding of these complicated processes and consequently in deciphering the history of the Iapetian surroundings.