Pannotia didn’t exist, but the “Pannotian geodynamic cell” formed as the Mozambique Ocean closed and Gondwana amalgamated—the view from Arabia and the East African Orogen

Alan Collins¹, Morgan Blades¹, John Foden¹, Sheree Armistead², Théodore Razakamanana³, Brandon Alessio¹, and Andrew Merdith⁴

¹The University of Adelaide, Tectonics and Earth Systems, Department of Earth Sciences, Adelaide, Australia (alan.collins@adelaide.edu.au)
²Geological Survey of Canada, Ottawa & Metal Earth, Laurentian University, Canada
³Université de Toliara, Toliara, Madagascar
⁴Laboratoire de Géologie, Université of Lyon 1, France

There is a view that a supercontinent, called Pannotia, existed for a short time at the end of the Neoproterozoic. This hypothetical continent requires collision between Neoproterozoic India, Australia-Mawson and the African and South American continents to occur before formation of Iapetus as Laurentia rifted off Amazonia.

Data from the last decade demonstrate the complexity of consumption of the Mozambique Ocean that separated Neoproterozoic India from the African Neoproterozoic continents (Congo-Tanzania-Bangweulu, the Sahara Metacraton and Kalahari). In particular, the presence of pre-Neoproterozoic terranes that lie within the East African Orogen of Arabia, east Africa, Madagascar and South India demonstrate the multi-phase collision of the this ocean closure?. Here we examine the Cryogenian to Cambrian tectonic geography of the closure of the Mozambique Ocean from a full-plate perspective. We focus on the northern East African Orogen, where Gondwana-formation shortening and crustal thickening has been considerably less than seen in East Africa/Madagascar/South India. We focus on the Neoproterozoic India–Azania-Sahara Metacraton collision represented by the northernmost part of Madagascar (the Bemarivo Domain), and throughout Arabia. We conclude that final ocean closure and formation of central Gondwana occurred in the latest Ediacaran and into the Cambrian, along a suture that passes under the Rub' al Khali region of Arabia and through the northeast of Madagascar. It separates the extended Neoproterozoic India margin (now in Oman, The Seychelles and the northern Bemarivo Domain), from the growing kernel of Gondwana (the east-most parts preserved in Saudi Arabia, Yemen and Central Madagascar).

Considering the early Ediacaran formation of Iapetus, there is growing evidence that Pannotia never existed as connected continental crust, yet the ‘Pannotian geodynamic cell’ with lithosphere divided into continental and oceanic hemispheres had formed. The closure of the Mozambique Ocean represented the termination of >500 million years of subduction at this locale.
termination of this subduction with the formation of Gondwana, and the initiation of the Terra Australis Orogen led to the present geodynamic configuration.