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From Rodinia to Pangea: Geologic and isotopic evidence for an entire supercontinent cycle in the Chiapas Massif Complex, Southern Mexico

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Although it is widely accepted that Late Mesoproterozoic granulite basement of central and southern Mexico reflects Rodinia assemblage during the Grenville orogeny [1], there has been no geologic record of Rodinia breakup reported from Mexico so far, except few mafic dikes that intruded the 1.0 Ga Novillo gneiss in NE Mexico, yielding a $^{40}Ar/^{39}Ar$ hornblende date at ca. 550 Ma [2].

The Chiapas Massif Complex (CMC) forms the crystalline basement of the southern Maya Block along the southeastern boundary of the North American Plate. It is constituted mainly of a Permian batholith and isolated metaigneous and metasedimentary rocks that reached metamorphic conditions up to ca. 800°C and 9 kbar at 254-250 Ma, mainly in the central CMC [3]. In the southeastern part of the CMC Permotriassic metamorphism did not exceed greenschist facies. This particular situation opens a window to the pre-Permian geologic history of the southern Maya Block.

The area is dominated by a suite of Ordovician arc-related igneous rocks that intruded a deformed medium to high-grade metamorphic basement [4] that was locally migmatized around 450 Ma. The basement consists of (1) a pelitic to psammitic metasedimentary sequence with minor marble, (2) amphibolite intercalated with orthogneiss, and (3) anorthosite series rocks. Lu-Hf and Sm-Nd isotope data as well as U-Pb age constraints imply a Late Mesoproterozoic (Grenvillian) age for orthogneiss and anorthosite series rocks, whereas strongly positive εNd- and εHf- values of deformed amphibolite layers with E-MORB chemical characteristics are interpreted in terms of rift-related mafic intrusion of the basement during the Neoproterozoic. Small zircon crystals that were exsolved from rutile and ilmenite during metamorphic reheating of the anorthosite, probably reflect the time of basaltic permeation around 600 Ma. A similar Ediacaran age of deposition (600-580 Ma) is suggested from Sr-isotope compositions and further supported by $\delta^{13}C$ values of marbles from the metasedimentary sequence.

The new data favor a model in which the southern Maya block was affected by extension, basaltic underplating, and crustal thinning during the Neoproterozoic. Deposition of deep-sea clastic sediments and carbonates during Ediacaran times probably above a thinned Mesoproterozoic crust that was intruded by E-MORB magma reflects breakup of Rodinia, separation of Baltica from Amazonia (including Oaxaquia and similar peri-Gondwanan terranes), and opening of the Iapetus Ocean. Hence, the geologic history of the CMC reflects an entire supercontinent cycle from Rodinia assemblage at 1.0 Ga, Rodinia breakup and opening of the Iapetus Ocean (ca. 600 Ma), Ordovician active margin along western

Gondwana (Northern Famatinian extension), and the Permian assemblage of Pangea (southwestern Ouachita extension).

References:

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