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Oceanic crust within the paleozoic Granjeno Schist, northeastern Mexico. Remnants of the Rheic and paleo-Pacific Ocean.

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Late Paleozoic metamorphic rocks in Mexico are related to the Laurentia-Gondwana collision in Carboniferous time, during Pangaea amalgamation. Vestiges of the Mexican Paleozoic continental configuration are present in the Granjeno Schist, the metamorphic basement of the Sierra Madre Oriental.

Field work and petrographic analysis reveal that the Granjeno Schist comprises metamorphic rocks with both sedimentary (psammite, pelite, turbidite, conglomerate, black shale) and igneous (tuff, lava flows, pillow lava and ultramafic bodies) protoliths. The chlorite geothermometer and the presence of phengite in the metasedimentary units as well as 40Ar/39Ar ages on metavolcanic and metaultramafic rocks indicate that the Granjeno Schist was metamorphosed under sub-greenschist to greenschist facies with temperatures ranging from 250-345°C with 2.5 kbar during Carboniferous time (330±30 Ma).

The presence of metabasalt, metacumulate, serpentinite and talc bodies suggests an oceanic tectonic setting for the evolution of the Granjeno Schist. Serpetinite rocks have mesh, granular and ribbon textures which indicate recrystallization and metasomatic events. The serpentinite rocks are enriched in the very large incompatible elements Cs, U, and Zr and depleted in Ba, Sr, Pb, Zr and Ce. Normalized REE patterns (LaN/YbN = 0.51 – 19.95 and LaN/SmN = 0.72 – 9.08) of the serpentinite and talc/soapstone are characteristic of peridotite from both suprasubduction and mid-ocean ridge zones. Serpentinite from the Granjeno Schist have spinel content which can reveal different stages of evolution in host serpentinite. The composition of chromite indicates that they belong to podiform chromite that may have crystallized from mid-ocean ridge magma. Al-chromite in the serpentinite is characterized by #Cr 0.48 to 0.55, which indicates a depleted mantle source affected by 17 to 18% of partial melting. The ferritchromite has #Cr values of 0.93 to 1.00 which indicates a metamorphic origin.

Our study suggests at least two serpentinization stages. The first serpentinization stage is related to an ocean-floor environment. At this stage, mesh-textured serpentinite formed under static conditions under subgreenschist to greenschist conditions. The second serpentinization stage occurred under greenschist to low amphibole conditions. During this stage Cr-spinel progressively was replaced by ferritchromite with magnetite rims due to regional metamorphism. Tectonic contact of the serpentinite with metavolcanic and metasedimentary rocks indicates lithospheric mantle slivers juxtaposed during the metamorphism of the Granjeno Schist during Pennsylvanian time. This metamorphic event occurred in an active continental margin. It represents the last events of the southern closure of the Rheic Ocean and Permo-Carboniferous convergence of Pacific plates on the western margin of Pangea.