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Metagabbros from Marlborough, central Queensland: Relics of a Paleozoic ocean?

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Metagabbros occurring with ultramafic rocks in Marlborough, central Queensland, Australia could potentially represent fragments of an ancient ocean that subducted beneath the Gondwanan margin. We present field and initial petrological and geochemical data that constrain the origin and evolution of these mafic units. The metagabbros range from highly deformed sheets thrusted against ultramafic and metamorphic rocks, to silicified boulders, and clasts occurring with serpentinite enclosed in a serpentinite matrix. The rocks are coarse-grained, exhibit sheared surfaces and pervasive replacement to greenish mineral assemblages. The original assemblage classifies the rocks as gabbros with clinopyroxene (pseudomorphed to amphibole) and plagioclase (seritized), with cumulate textures still discernible in the plagioclase and pyroxene pseudomorphs. Thin, greenish, and bladed amphibole is common in the metagabbros while epidote is present in minor quantities.

Initial geochemical data show low total alkali (Na_2O+K_2O) and silica concentrations, as typical of mafic rocks. The metagabbros are characterized by high bulk MgO (>6 wt.%), Al_2O_3 (>15 wt.%), and CaO (>10 wt.%). Bulk Th and Nb systematics are akin to mid-ocean ridge basalt (MORB) and range from depleted-MORB to enriched-MORB compositions. Chondrite-normalized rare earth element (REE) patterns of relic clinopyroxene define flat middle to heavy REEs and depletions in light REEs similar to mid-ocean ridge gabbros. At the bulk rock scale, bulk chondrite-normalized REE patterns of the metagabbros are flat with some samples showing minor enrichments in the light REEs. Bulk multi-element spidergrams also show positive anomalies in large ion lithophile elements (Rb, Ba), and Sr, implying extensive reaction with subduction-related fluids. Trace element systematics suggest that the mafic rocks in Marlborough likely represent oceanic crust from an oceanic spreading center (i.e., mid-ocean ridge or back-arc basin) that was transported into a supra-subduction zone setting, possibly related to its exhumation.