Serpentinites of the Motagua fault zone, Guatemala: A mineralogical assessment

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The Motagua Fault Zone (MFZ) of Guatemala is interpreted as the active plate boundary between the North American and Caribbean plates with accumulated displacement of ~10^3 km. Belts of serpentinite mélange are exposed on both sides of the MFZ, and these mélanges contain tectonic inclusions of high-pressure, low-temperature (HP/LT) rocks, including jadeitite, eclogite and various metabasites. The belts represent collisional emplacement of subduction channel assemblages. Ar-Ar ages from white micas of ~120 Ma from HP/LT rocks, including abundant lawsonite eclogite, south of the fault are significantly older than the ~70 Ma ages of similar rocks, but no lawsonite eclogite, from north of the fault. The juxtaposition of mélanges of different Ar-Ar age across a strike-strike slip fault is odd, and a robust interpretation has not been determined.

A mineralogical study of numerous serpentinite samples from both sides of the MFZ is underway to assess their metamorphic processing, diversity and origin. Most serpentinite is sheared and recrystallized to antigorite schist whether from north or south of the fault. Less-tectonized samples with relict textures and minerals are few; most commonly they have affinity with harzburgite (containing relict exsolved opx with few discrete cpx grains), followed by lherzolite (both relict opx and cpx) and rarely dunite (no relict pyroxene but common chromite). Relict cpx contains up to ~8 wt% Al_2O_3, suggesting high-T equilibration/formation. Antigorite predominates in all samples with much less, if any, lizardite, and chrysotile is only found in very-late veins. Magnetite is common; chromite less so; Mn-ilmenite, talc, and chlorite are not uncommon; and olivine, brucite and andradite are rare. Carbonates include both magnesite and dolomite; calcite and silica are secondary. Early results on sulfides shows pentlandite, mackinawite, heazlewoodite and millerite, which suggests low-T reequilibration and possible influence from late-stage fluids. Rare awaruite and Cu-awaruite are present.

The preponderance of antigorite in serpentinite supports the interpretation that these rocks are products of hydration in or immediately above a subduction channel. Serpentinite from north of the MFZ commonly contains magnesite which suggests higher levels of CO_2 in the serpentinizing fluids and may result from the distinct ~70 Ma event. The samples from the south more commonly contain lizardite with antigorite which is consistent with colder, and perhaps even wetter, conditions that produced lawsonite eclogites during the ~120 Ma event. The combination of interpreted original lithologies, mineralogies and mineral chemistries are most consistent with origin from a complex mantle-wedge peridotite assemblage.

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