

OUTLOOKS IN EARTH AND PLANETARY MATERIALS

INVITED CENTENNIAL ARTICLE

Franciscan geologic history constrained by tectonic/olistostromal high-grade metamafic blocks in the iconic California Mesozoic-Cenozoic accretionary complex

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ABSTRACT

Subduction generated a NW-trending Andean arc along the Californian margin beginning at ~175 Ma. Coeval high-pressure (HP) transformation of oceanic crust in an east-dipping, subduction zone probably accompanied plate convergence, but recovered Franciscan eclogite and garnet blueschist blocks chiefly possess younger recrystallization ages of ~165–150 Ma. These Jurassic HP metamafic rocks were sequestered in a low-temperature environment well into Cretaceous time. Fragments of actinolitic rinds partially surround many such high-grade blocks.

Only slightly younger than the HP metamorphism, these rinds reflect metasomatic exchange between metabasalt and serpentinized harzburgite along the dynamic oceanic crust-mantle hanging wall during storage of the mafic rocks at moderate depth. High-grade tectonic blocks later were brought toward the surface in circulating, low-density, sheared mud-matrix *mélange* and/or in buoyant serpentinite bodies. Most exotic HP metamafic blocks occur in *mélanges* of the Franciscan Central Belt, reflecting tectonic insertion within the subduction zone—not near-surface additions to the clastic section. However, rare, high-grade clasts in feebly recrystallized Franciscan conglomerates suggest erosion and sedimentary deposition for some HP blocks. The addition of dense metabasaltic olistoliths to the mid- and Upper Cretaceous section requires that these HP material were carried surfaceward first as tectonic fragments, perhaps immersed in low-density serpentinite or mud-matrix *mélange*, then eroded and transported into the trench. HP rocks are conspicuously lacking in coeval Great Valley strata. Whatever the origin of particular high-grade rocks, widespread post-depositional shearing has largely obliterated their original natures, but all dense metamafic blocks of Jurassic recrystallization age must have been supplied to the Cretaceous Franciscan accretionary complex by entrainment in a low-density, circulating muddy matrix or serpentinite body. The vast majority of exotic HP blocks resides in Central Belt *mélanges*, and appears to be tectonic rather than olistostromal in origin.

Keywords: High pressure, metamorphic petrology, petrogenesis, sedimentary petrology, Earth science, Invited Centennial article

