

PETROLOGY OF A BRECCIATED GLAUCOPHANE-LAWSONITE META-ARC BASALT BLOCK

FRANCISCAN COMPLEX, SONOMA COUNTY, CA

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Abstract

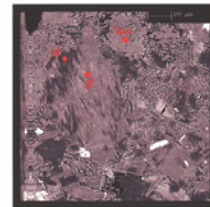
The block is an albite - Kspar - aragonite - chlorite - jadeitic pyroxene - lawsonite - glaucophane fels breccia. Aragonite is only present in sparse veins. The breccia is composed of fragments of coarse-grained glaucophane - lawsonite fels in a recrystallized fine-grained glaucophane - lawsonite fels matrix. A late dike, now metamorphosed to a fine-grained chlorite - lawsonite fels, cuts the block. Located at UTM 10 S, 0488535E, 4262320N.

Aragonite, glaucophane and albite were stable at maximum prograde conditions, circa 300 degrees Celsius and 7 +/- kb, based on Figure 6 of Evans (1990). The alumina in glaucophane geobarometer gives a minimum pressure of 7.8 kb and the chlorite geothermometer used on chlorite in the dike gives a temperature of 275 degrees Celsius. Jadeitic clinopyroxene was forming from glaucophane and lawsonite in the coarse-grained fragments. Veins of retrograde pumpellyite are present. The gas phase had very low X(CO2). Later, in an olistostrome, the block went to < 3kb pressure and < 300 degrees Celsius, forming laumontite veins in the matrix.

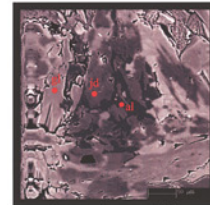
The protolith was a basaltic andesite (52.4% SiO2) of probable continental arc origin. A REE profile matches NMORB while a Pearce spidergram has arc-typical low Ta - Nb anomaly and high K, Rb, and Ba peaks, modified by low Ce, Sm, and Yb values.

Brecciation and recrystallization of the primary fels occurred at ~7 kb pressure in a single event, by hydrofracturing caused by water escaping the recrystallizing subducting plate.

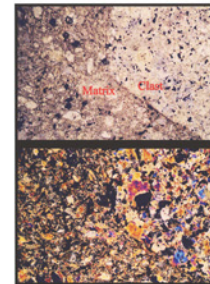
Our model is that (1) a subducting oceanic (Farallon?) plate released water into a wedge of depleted mantle, forming the protolith basaltic andesite magma, which erupted in a continental arc, probably the ancestral Sierras; (2) a portion of a flow was carried into the trench and subducted to ~7.5 kb pressure; (3) the protolith was metamorphosed to glaucophane - lawsonite fels, brecciated by hydrofracturing, and recrystallized; (4) the block of metabreccia was transported to the surface, perhaps by a diapir; (5) the block was deposited in an olistostrome; (6) the olistostrome was subducted to < 3 kb pressure and < 300 degrees Celsius, forming laumontite veins.



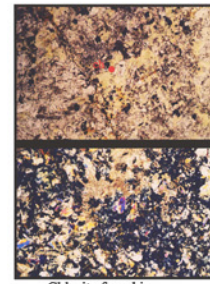
Backscatter image of jadeite in glaucophane fels.



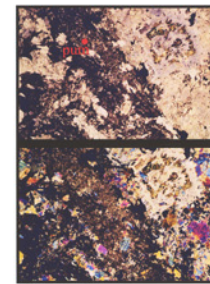
Backscatter image of albite + glaucophane + jadeite.



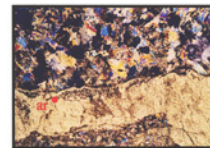
Typical breccia clast in fine-grained matrix, both of which, contain glaucophane + lawsonite + aragonite.



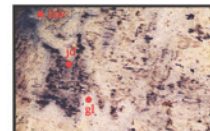
Chlorite found in metamorphosed breccia dike.



Pumpellyite vein.

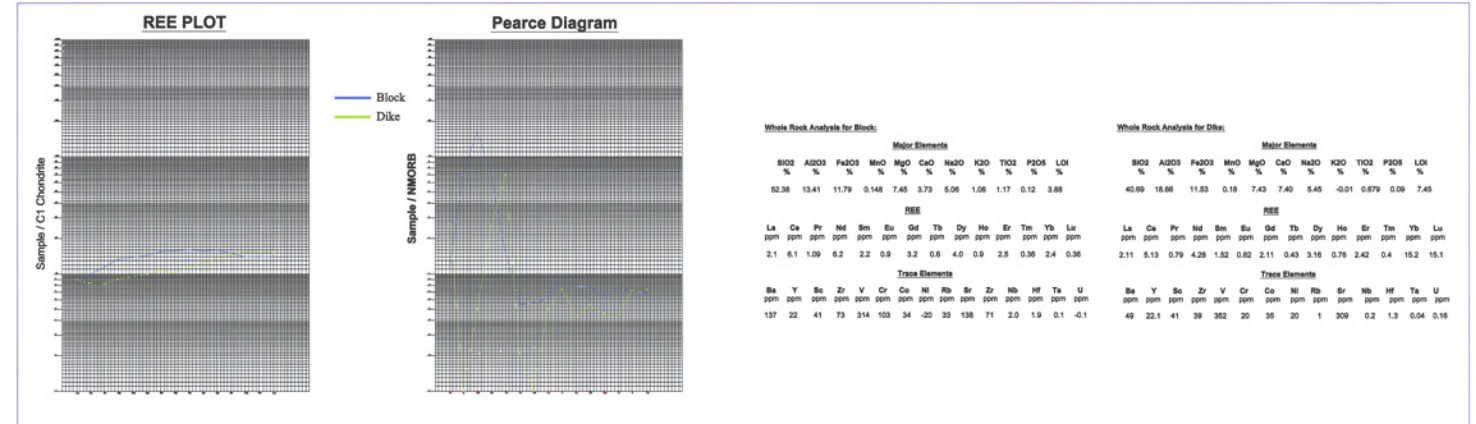


Aragonite vein.

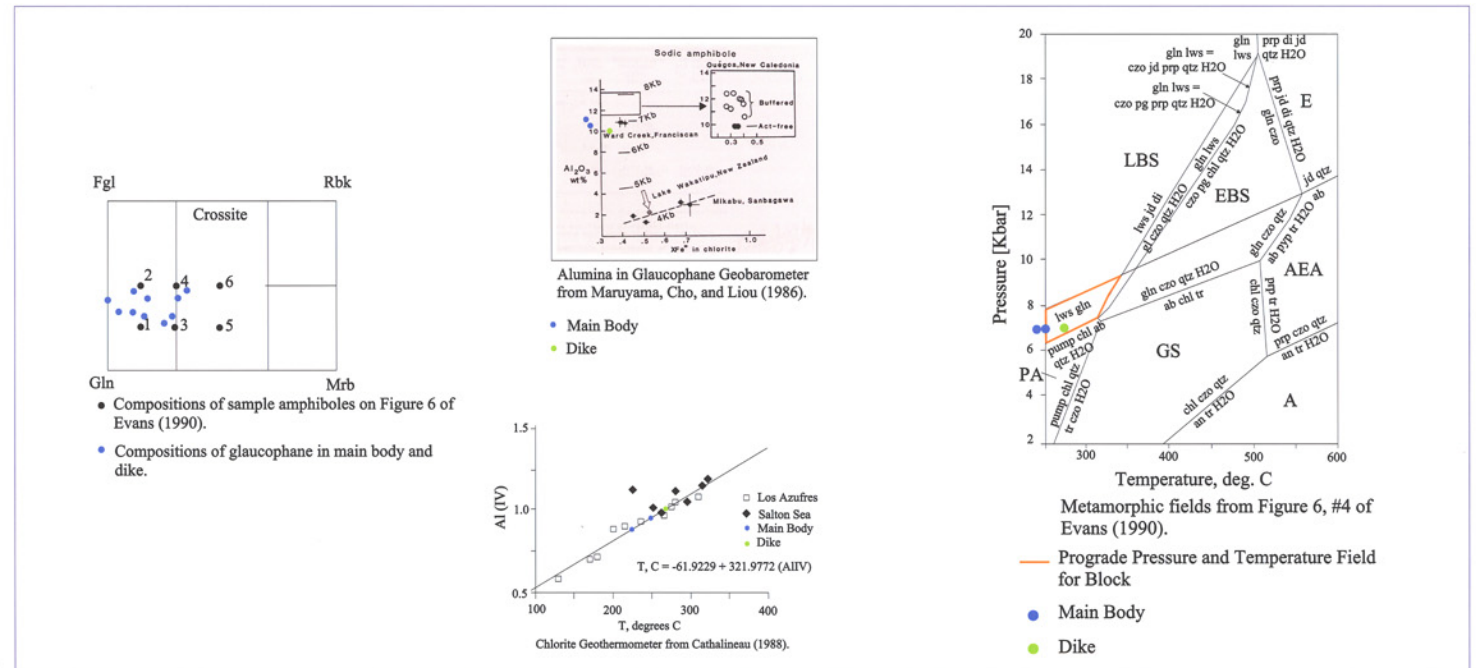


Possible optical evidence of glaucophane - jadeite reaction.

EXAMPLES OF MINERAL ASSEMBLAGES AND TEXTURES



WHOLE ROCK DATA



P-T INTERPRETATION



Breccia block exposed at Cazadero, Ca.



Metamorphosed breccia dike in block.