



The Vincent Fault in the San Gabriel Mtns, southern California, USA: a modified plate boundary shear zone

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The Vincent Fault in southern California separates the ocean-affiliated Pelona schist of Late Cretaceous age in the footwall from a Meso-Proterozoic gneiss complex and Mesozoic granitoid rocks in the hanging wall. The Vincent fault has been regarded as the original megathrust formed during Laramide flat-slab subduction. Our new pressure, temperature and geochronologic data from the rocks in the hanging wall and the footwall indicate that the Vincent fault has undergone post-subduction modification.

The Pelona schist in the San Gabriel Mtns was metamorphosed up to high-pressure greenschist facies. The peak metamorphic temperature given by laser Raman spectroscopy of carbonaceous material is $518.9 \pm 19.6^\circ\text{C}$, consistent with the temperature range of $515\text{-}550^\circ\text{C}$ from the quartz c-axis opening-angle thermometer. The peak pressure yielded by Si-in-muscovite barometry is 10.5 ± 1 kbar.

The upper ~ 50 m of the Pelona schist was then mylonitized together with the lower 500-800 m of the hanging wall, which overprinted the pre-existing texture. Mylonitization produced a strong ESE-trending lineation in both rock units, with a consistent ESE sense of shear: opposite to what would be predicted by E-directed subduction. Pressure and temperature of mylonitization of the Pelona schist and the lower part of the hangingwall mylonite zone constrained by the Ti-in-quartz thermobarometer and Si-in-muscovite barometer is around ~ 4.7 kbar and 372 to 425°C ; whereas the upper part of the mylonite zone was equilibrated at ~ 2.4 kbar and $\sim 365^\circ\text{C}$. The quartz c-axis fabric opening-angle thermometer also gives a temperature range from 360 to 420°C in the entire mylonite zone. Mylonitization therefore took place during exhumation and cooling of the Pelona Schist.

Fission track ages of detrital zircons from both the footwall and the hanging wall of the Vincent fault cluster around 46.7 ± 5.9 Ma, indicating that both footwall and hanging wall had cooled to $\sim 200^\circ\text{C}$ by that time. No other major faults or shear zones can be identified in the hanging wall above the mylonites above it, so the mylonite zone together with the Vincent fault were likely to have been responsible for the exhumation of the Pelona schist.

Combined with the published Ar-Ar amphibole age of 60.3 ± 2.6 Ma to 58.9 ± 2.5 Ma, and Ar-Ar muscovite age of 57.8 ± 0.1 Ma in the Pelona Schist, a P-T-t path for the Pelona Schist and the overlying mylonites can be established. The protolith of the Pelona schist was subducted by 68 Ma, and the peak P-T of 10.5 kbar and $\sim 518.9^\circ\text{C}$ was achieved around 60.3 Ma. The exposed part of the Pelona Schist was underplated at about this time. During exhumation along the Vincent fault, the top of the Pelona Schist was mylonitized together with the base of the hanging wall at ~ 4.7 to 2.4 kbar and 425 to 365°C . Mylonitization initiated by 57.8 ± 0.1 Ma and ceased by 46.7 ± 5.9 Ma.