Serpentinite within the Creeping Bartlett Springs Fault, Northern California: An Analogue for the San Andreas Fault near SAFOD?

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The Bartlett Springs Fault (BSF) is an active, right-lateral strike-slip fault, about 170 km in length, that is part of the San Andreas Fault system north of San Francisco, California. Its slip rate is currently estimated to be ~6 mm/yr, and along a segment that crosses Lake Pillsbury half the slip (3.1 ± 0.3 mm/yr) is taken up by creep. An exposure of the BSF ~1.6 km northwest of Lake Pillsbury (Figure 1) consists of sheared serpentinite that has risen buoyantly during right-lateral shear within Late Pleistocene to Holocene (?) fluvial deposits. Some serpentinite has extruded onto the ground surface. The serpentinite-rich mass contains a large concentration of porphyroclasts distributed in a sheared and foliated, fine-grained matrix that varies from light greenish- to dark bluish-gray in color. The lighter-colored zones are dominated by antigorite serpentinite that shows some retrograde recrystallization to chrysotile and lizardite. The darker zones are rich in porphyroclasts containing one or more of the minerals talc, chlorite, and tremolite-actinolite in a sheared matrix of the same minerals. The mineral assemblage of the darker areas is characteristic of metasomatic reaction zones formed between ultramafic and crustal rocks at greenschist- to subgreenschist-facies conditions. Incipient low-temperature alteration accompanying shear has formed Mg-rich smectitic clays, with local development of foliated, clay-rich gouge containing clasts of the other rock types. Textures and mineral assemblages of the gouge in this exposure of the BSF are very similar to those observed in samples of Phase 3 SAFOD core from the southwest and central deforming zones (SDZ and CDZ, respectively). The main difference is that the low-temperature, clay-forming reactions have progressed to a substantially greater extent in the SAFOD gouge zones. This outcrop of the BSF therefore warrants more detailed study as a possible analogue of the early stages in the development of the SDZ and CDZ.

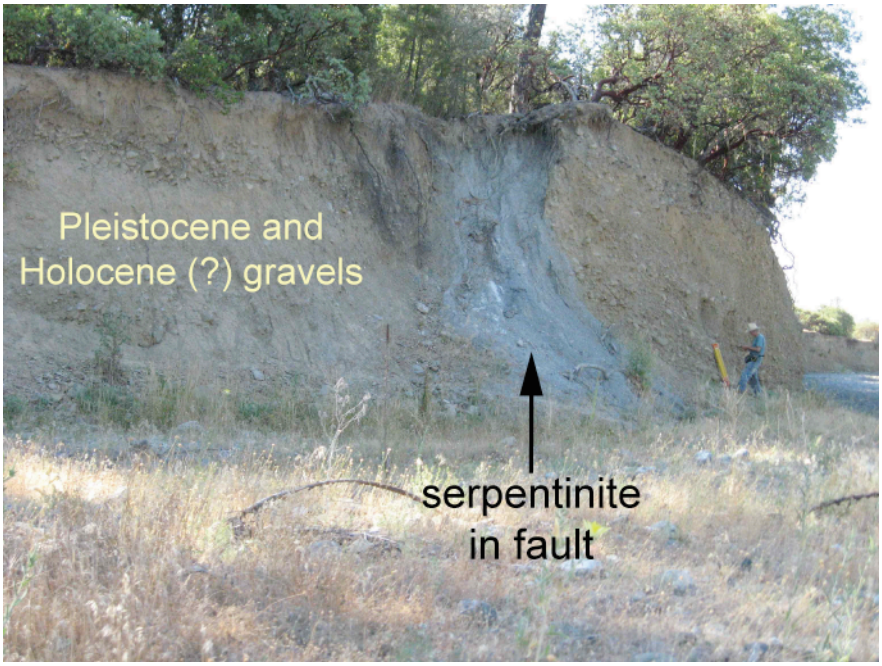

Figure 1. The serpentinite-filled Bartlett Springs Fault, exposed along a scarp roughly 1.6 km northwest of Lake Pillsbury in northern California. Photo by J. J. Lienkaemper.