GEOLOGIC MAP OF THE SLEEPY VALLEY 7.5' QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA

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INTRODUCTION

The California Geological Survey (CGS) recently completed geologic mapping of the Sleepy Valley 7.5' quadrangle in northeastern Los Angeles County as part of STATEMAP, an ongoing cooperative effort with the USGS to produce seamless geologic maps of 7.5' and 30'x60' quadrangles in California. This map presents a digital compilation of the best available geologic mapping augmented by new 1:24,000-scale bedrock field mapping and petrographic analysis by CGS, resulting in better lithologic descriptions and differentiation of the igneous and metamorphic units. CGS also utilized available LiDAR data, aerial photography, and field reconnaissance to complete new detailed mapping of Quaternary units and to more accurately locate major pre-Holocene faults. This detailed geologic mapping allows for an improved understanding of the geologic framework in this tectonically active area.

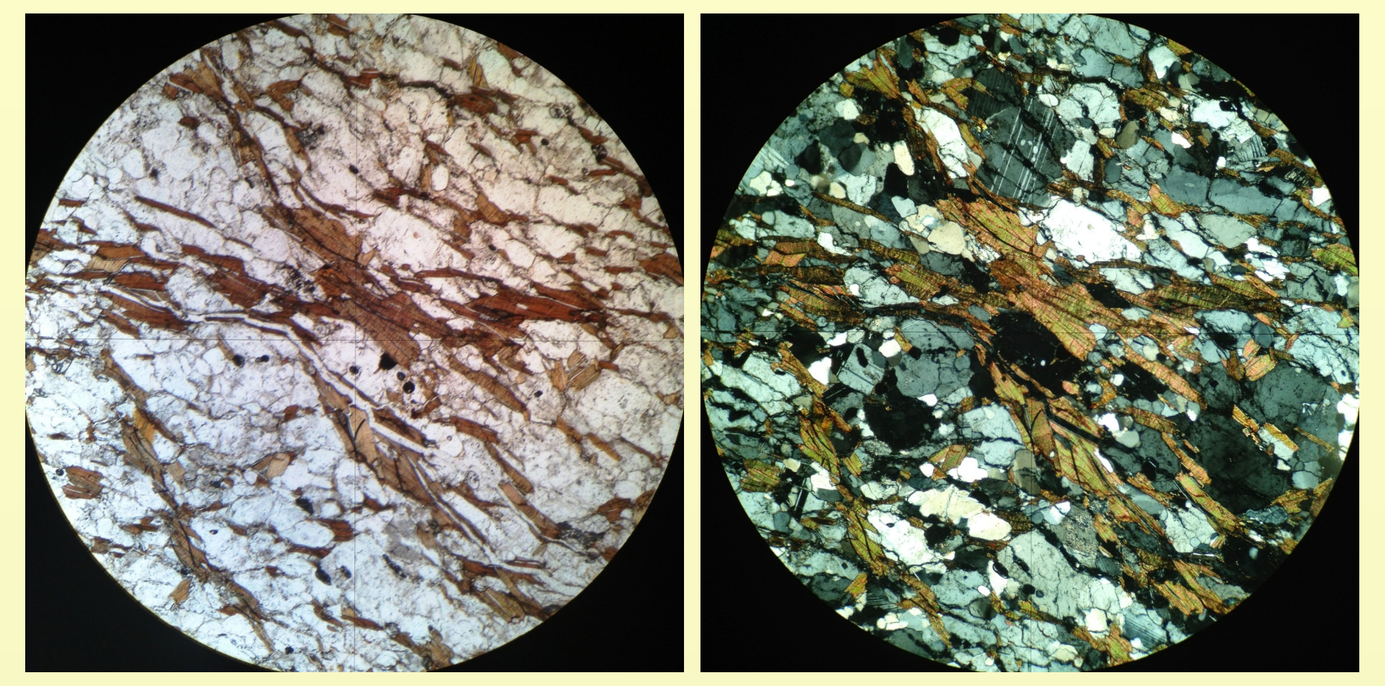
The San Andreas Fault Zone crosses obliquely through the northeast corner of the Sleepy Valley quadrangle, with distinctive rock units found north of, within, and south of the fault zone. North of the fault, the area is primarily underlain by Upper Cretaceous to Lower Tertiary Portal Schist. Breccia, arkosic sandstone, and clay shale of the Pliocene Anaverde Formation are exposed on a ridge within the fault zone. South of the fault, the dominant bedrock rock unit is the Upper Cretaceous to Lower Tertiary Pelona Schist, which is exposed in the Sierra Pelona, a westward-plunging antiform in the center of the map area. Other basement rocks include a Proterozoic quartzo-feldspathic and amphibolite gneiss complex, the San Gabriel Mountains anorthosite-gabbro-syenite complex, and Cretaceous gneissic granite and tonalite units. Mylonitic rocks mapped at the contact between the Pelona Schist and the Cretaceous gneissic granite formed as a result of movement along the south-dipping Vincent Thrust. The intrusive and metamorphic rocks are locally overlain by fluvial and volcaniclastic rocks of the Upper Oligocene Vasquez Formation. This formation marks the earliest sedimentation in the Soledad basin, which developed as a result of crustal extension associated with incipient development of the San Andreas transform margin. This basin was later trans-rotated and tectonically inverted along preexisting normal faults during the Miocene.

BEDROCK UNITS EXPOSED

North of the San Andreas Fault Zone

Portal Schist (Mzpos — Late Cretaceous to Paleocene)

Typical exposure of folded Portal Schist.



Photomicrograph showing abundant biotite foliation and quartz augen in plane (left) and cross-polarized (right) light. Note plagioclase twinning and overall highly fractured fabric.

Close up of typical Portal Schist outcrop showing strong foliation and deformation.

Within the San Andreas Fault Zone

Anaverde Formation (Tab, Tac, Tar Tabx — middle Pliocene)

Outcrop of the Anaverde Formation, Buff Arkose Member north of Elizabeth Lake Road and east of 90th Street in Leona Valley.

Roadcut showing of highly deformed gypsiferous lacustrine deposits of the Anaverde Formation, Clay Shale Member. Roadcut is along State Highway 14 east of the study area.

South of the San Andreas Fault Zone

Vasquez Formation (Tvab, Tvnb, Tvgb, Tvcs, Tvcg, Tvcgl — late Oligocene)

Outcrop of Vasquez Formation basal conglomerate unit (Tvcgl). Note typical reddish brown color, interbedded sand-stones, and clay-rich, matrix-supported conglomerate.

Andesite flow within Vasquez Formation conglomerate and breccia (Tvcg).

Biotite muscovite granite (Kgr — Cretaceous)

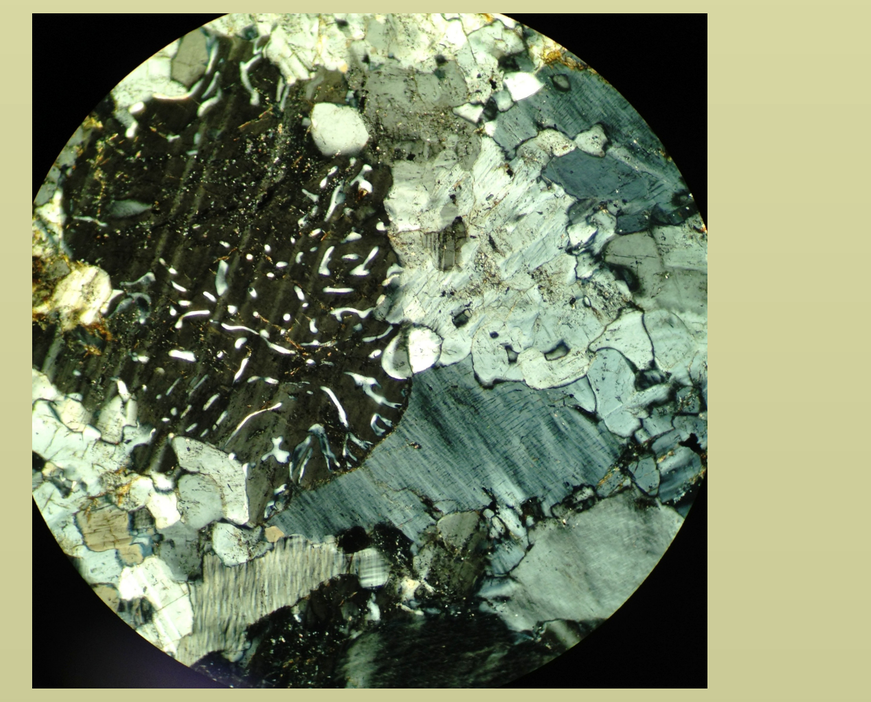
Typical exposure of highly-jointed light yellow granite.

Hornblende biotite tonalite (Kt — Cretaceous)

Foliated tonalite outcrop along Spunky Canyon Road at the western edge of the quadrangle.

Ferruginous syenite (Yfs— Proterozoic)

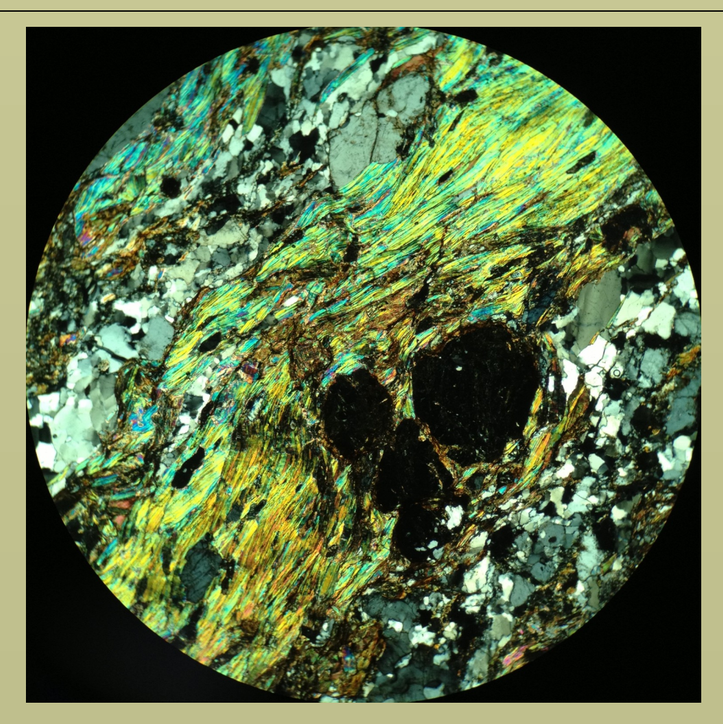
Outcrop of ferruginous syenite in the southeastern portion of the study area. Note the distinctive reddish brown weath-ered surface of this unit.



Photomicrograph showing distinctive myr-mekitic texture in plagioclase and alkali feld-spar exsolution lamellae (i.e. mesoperthite). (25x magnification)

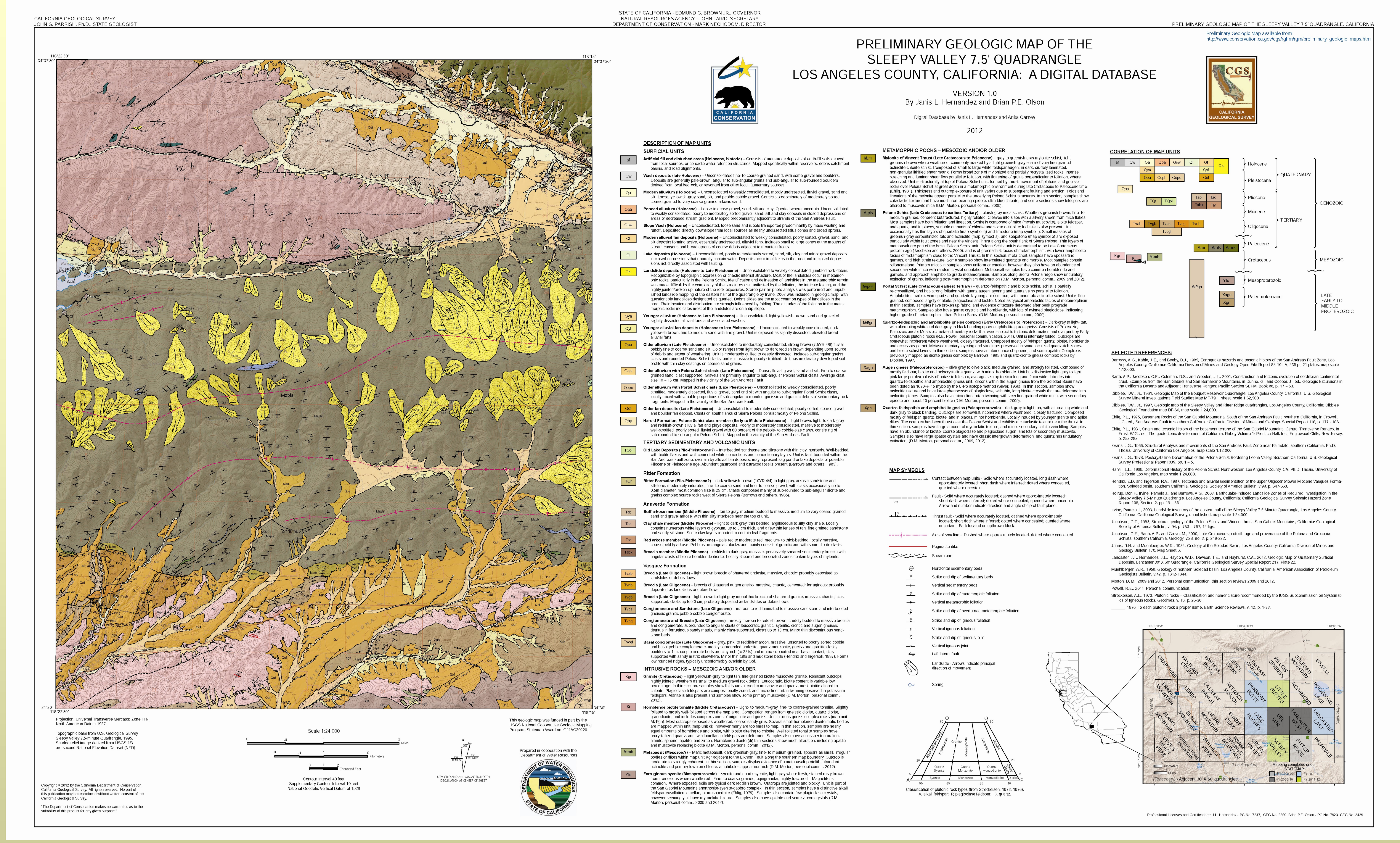
Pelona Schist (Mzpls — Late Cretaceous to Paleocene)

Roadcut exposure of well-foliated Pelona Schist along the north side of Boquet Canyon Road. Note distinctive greenish brown weathered surface.



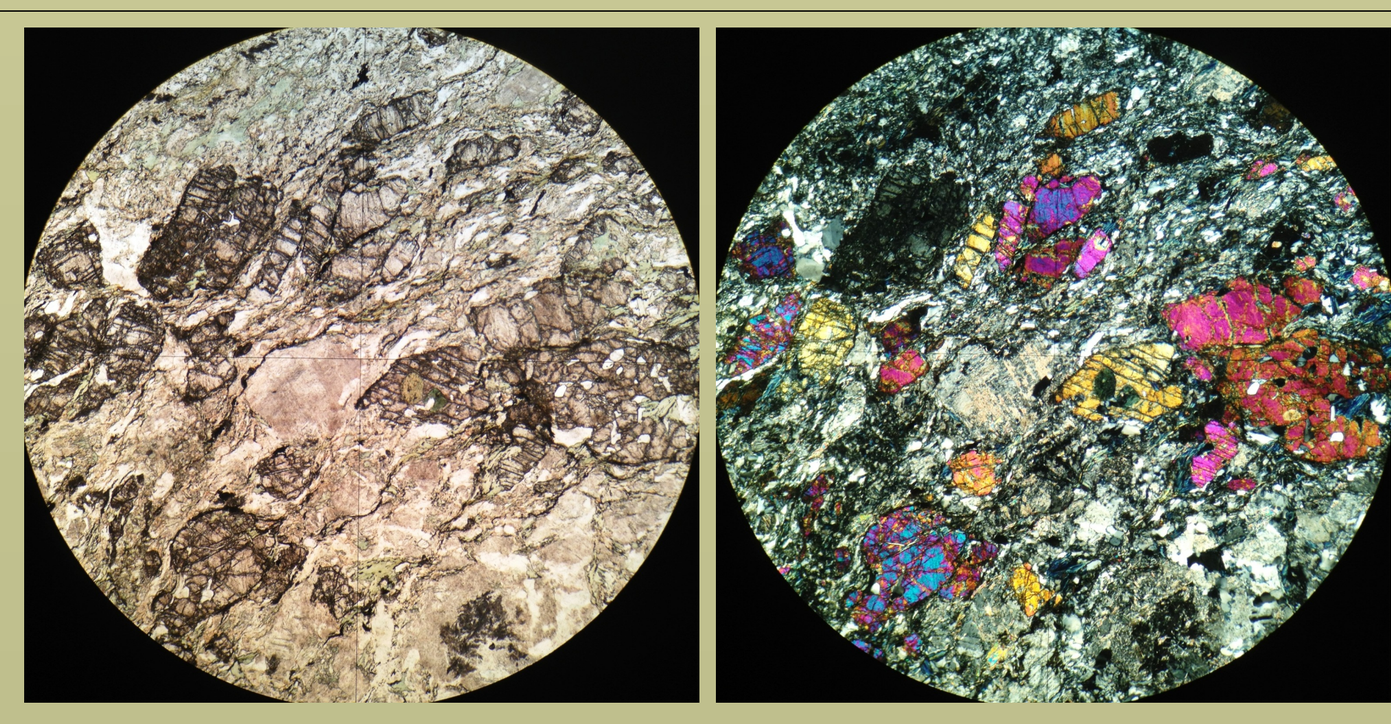
Photomicrograph showing strong quartz and muscovite foliation under cross-polarized light. Dark rounded minerals near the center of the picture are garnets. (10x magnification)

Outcrop of folded Pelona Schist near the eastern quadrangle boundary.



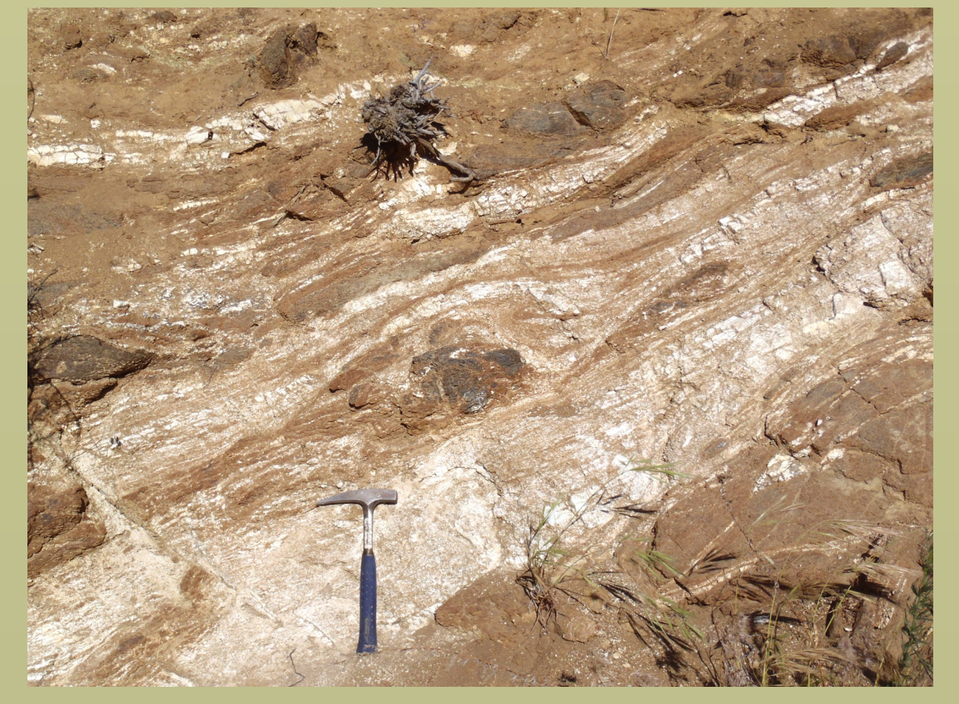
Mylonite of the Vincent Thrust (Mzm — Late Cretaceous to Paleocene)

Vincent Thrust mylonite outcrop near the eastern edge of the quadrangle. Feldspar augen and laminated shear fabric are visible



Photomicrograph showing cataclastic fabric of mylonite unit under plane (left) and cross-polarized (right) light. (10x magnification)

Quartzo-feldspathic and amphibolite gneiss complex (MzPgn — E. Cretaceous to Proterozoic)



Boudinage in gneiss outcrop southwest of Leona Valley.

Highly-folded migmatite outcrop southwest of Leona Valley.

Augen gneiss (Xagn — Paleoproterozoic)

Dark gray gneiss with large potassium feldspar augen porphyroblasts .

Quartzo-feldspathic and amphibolite gneiss (Xgn — Paleo-proterozoic)

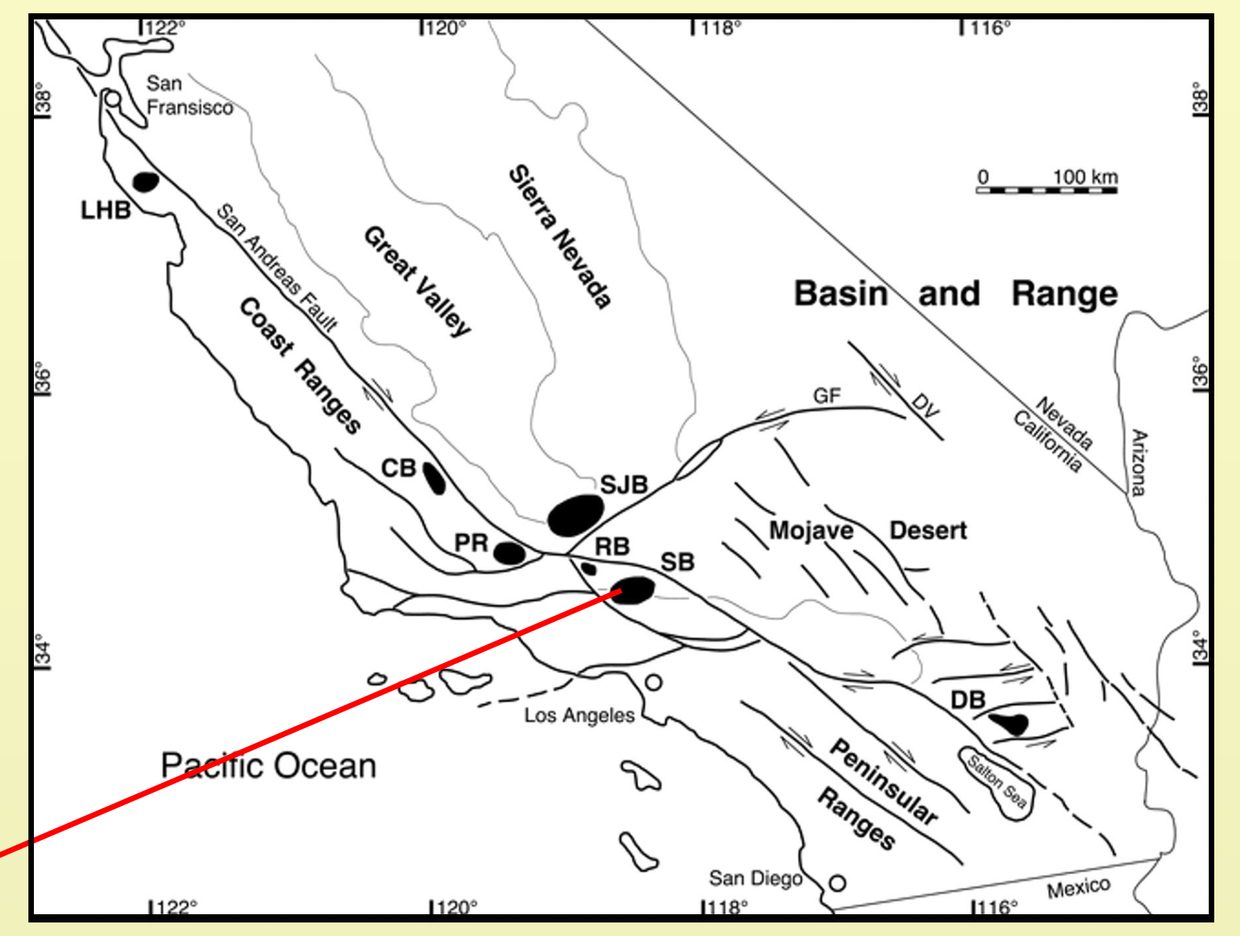
Banded gneiss outcrop south of Sierra Highway near the eastern edge of the quadrangle.

VASQUEZ FORMATION — TEXAS CANYON SUB-BASIN PALEOTECTONIC SETTING

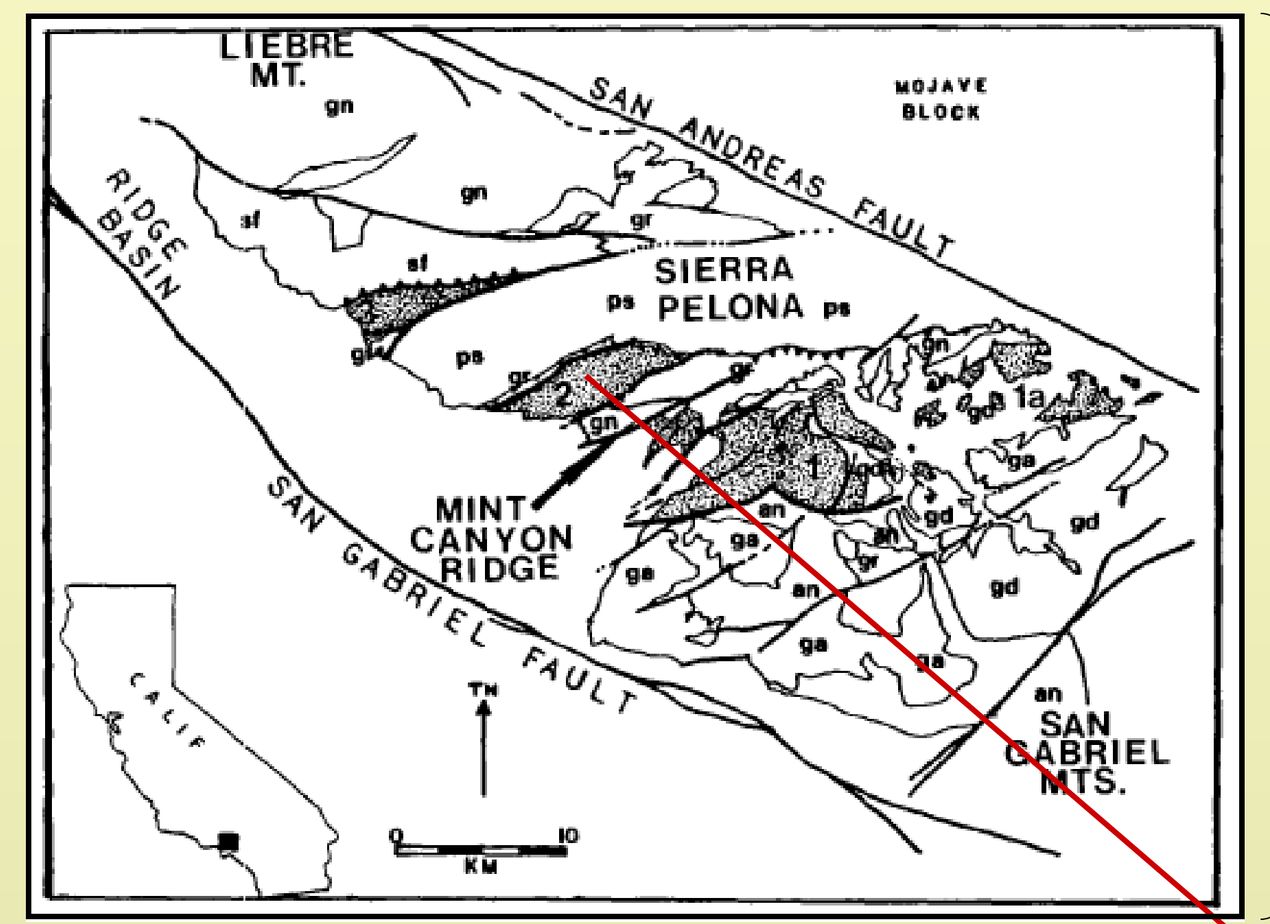
The Vasquez Formation marks the earliest sedimentation in the Soledad basin, which developed as a result of crustal extension during the late Oligocene. The formation was deposited in three distinct fault-bounded sub-basins (Hendrix and Ingersoll, 1987). The portion of the Vasquez exposed in the southwest corner of the Sleepy Valley quadrangle was deposited within the Texas Canyon sub-basin, which is bounded by the Pelona Fault on the northwest basin margin and the Vasquez Canyon Fault along the southeast margin. Both of these faults exhibited normal dip-slip displacement forming an asymmetrical graben into which the Vasquez sediments were deposited. The conglomerates, breccias, and sandstones of this formation represent alluvial fan and debris flow deposition off the uplifting basement terranes on either side of the basin-bounding faults.

Paleomagnetic studies on the volcanic rocks in the Vasquez Formation and overlying formations beyond the map area indicate the Soledad basin rotated approximately 53° clockwise during the middle Miocene. Subsequent to this the basin then experienced about 16° of counterclockwise rotation through the Pliocene and Pleistocene (Frizzell and Weigand, 1993).

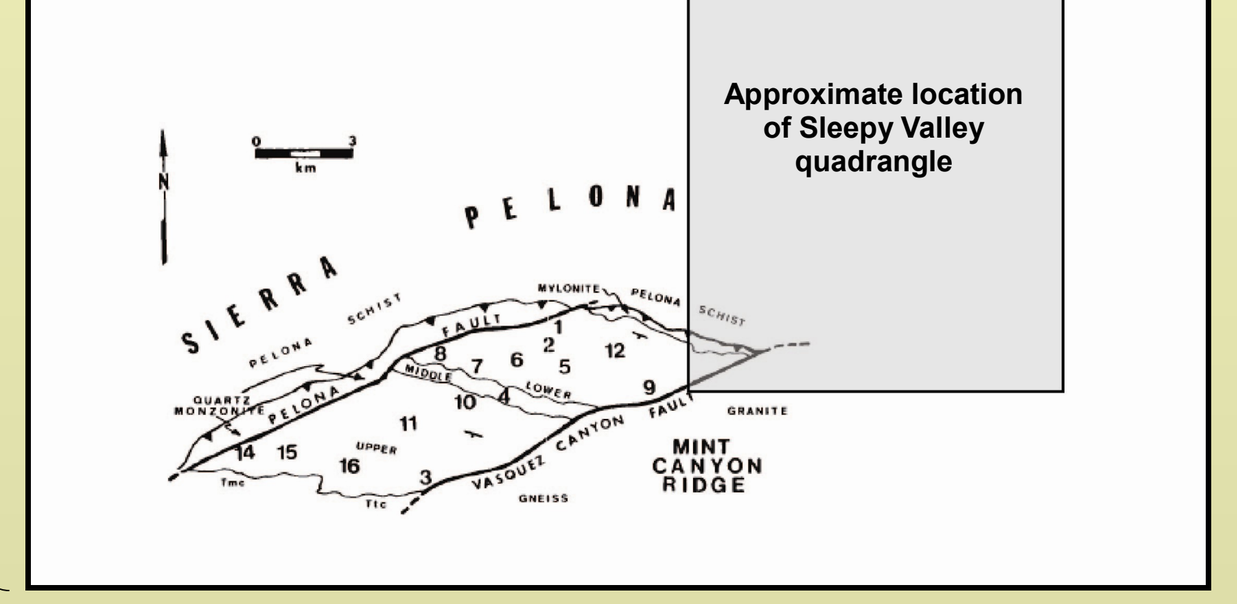
As stated above, the Pelona Fault initially developed as a normal dip-slip fault during Late Oligocene crustal extension and was one of the boundary faults forming the Texas Canyon sub-basin graben. West of the map area, slickenlines on the main fault plane plunge ~25° southeast suggesting most recently the Pelona Fault was a left-lateral strike slip fault with a significant component of vertical motion (Muehlberger, 1958). This transition in faulting style is likely related to a major shift in the Pacific-North American plate boundary to the Gulf of California around 6 Ma. This longitudinal shift effectively initiated the modern, southern strand of the San Andreas Fault. The newly altered surface trend of the plate boundary created an overall restraining bend, which resulted in a transpressional configuration that induced many pre-existing Oligo-Miocene normal faults to reactivate and assume oblique strike-slip and reverse motion in order to accommodate the new compressional stresses. This transpression and subsequent reverse oblique strike-slip faulting inverted many depositional centers throughout southern California, including the Soledad basin.



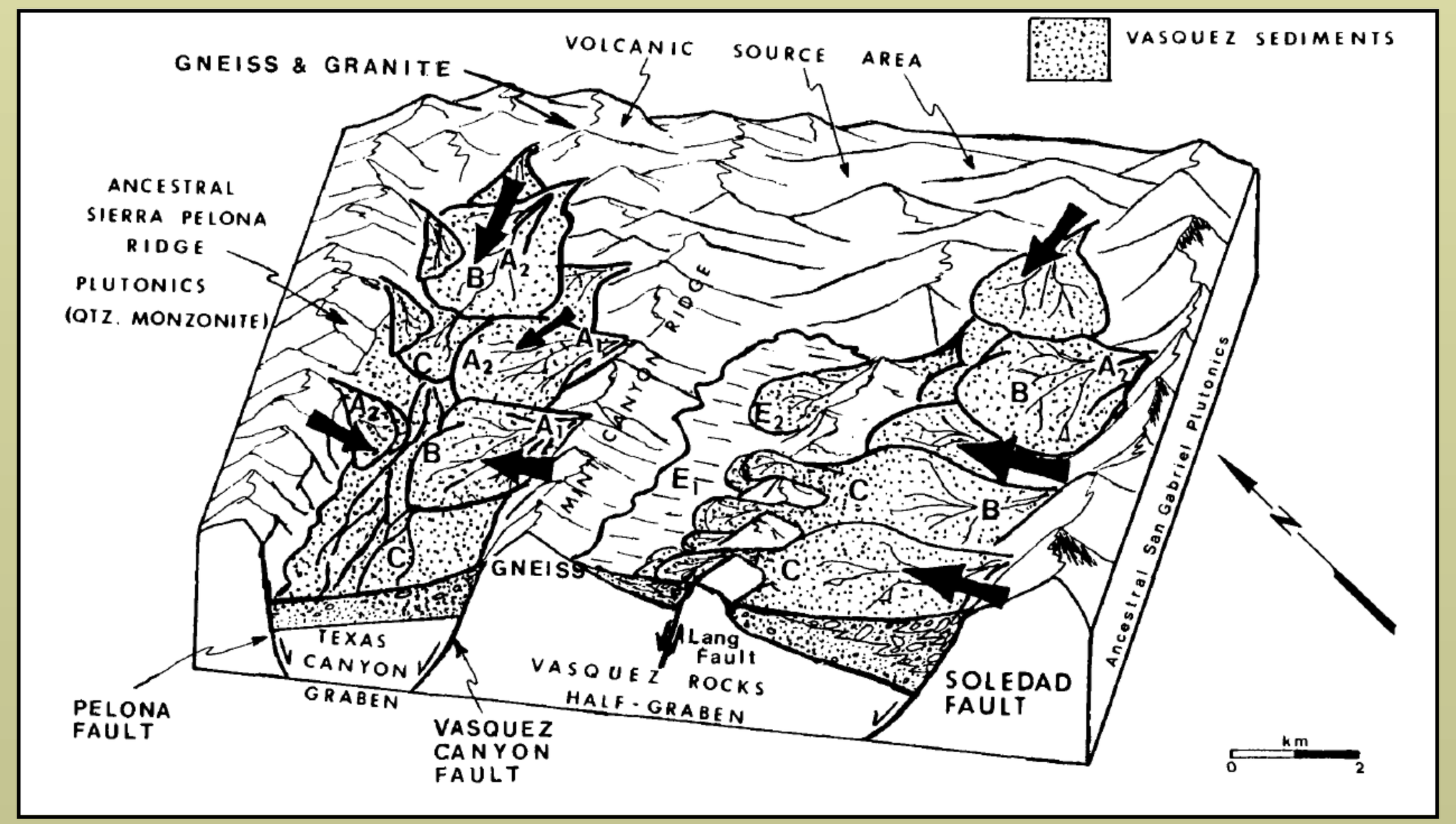
Index map showing location of major faults and Mid-Tertiary depositional basins in southern California; SB, Soledad Basin; RB, Ridge Basin; DB, Diligencia Basin; SJB, San Joaquin Basin; PB, Plush Ranch Basin; LHB, La Honda Basin; CB, Cuyama Basin (from Law et al., 2001)



Overview map of the Soledad Basin depicting the three distinct depositional sub-basins of the Vasquez Formation. 1, Vasquez sub-basin; 2, Texas Canyon sub-basin; 3, Charlie Canyon sub-basin. (from Hendrix and Ingersoll, 2987)



Generalized geologic map of the Texas Canyon Sub-basin, showing basin-bounding faults, stratigraphic intervals, locations of measured sections (numbers), and local basement lithologies. Ttc, Tick Canyon Fm.; Tmc, Mint Canyon Fm. (modified from Hendrix and Ingersoll, 1987)



Paleogeographic block diagram illustrating Texas Canyon sub-basin graben and deposition of lower Vasquez sediments, which are exposed in the study area; lithofacies are: A1, high-yield strength debris flow; A2, low-yield strength debris flows; B, braided-fluvial/mid-fan; C, sheetflow.

References:

Frizzell Jr, V. A., & Weigand, P. W., 1993, Whole-rock K-Ar ages and geochemical data from middle Cenozoic volcanic rocks, southern California: A test of correlations across the San Andreas fault. The San Andreas fault system: Displacement, palinspastic reconstruction, and geologic evolution: Boulder, Colorado, *Geological Society of America Memoir*, v. 178, p. 273-287.

Hendrix, E.D. and Ingersoll, R.V., 1987, Tectonics and alluvial sedimentation of the upper Oligocene/lower Miocene Vasquez Formation, Soledad basin, southern California: *Geological Society of America Bulletin*, v. 98, p. 647-663.

Law, R.D., Eriksson, K., and Davisson, C., 2001, Formation, evolution, and inversion of the middle Tertiary Diligencia basin, Orocopia Mountains, southern California, *Geological Society of America Bulletin*, v. 113, p.196-221.

Muehlberger, W.R., 1958, Geology of northern Soledad basin, Los Angeles County, California, American Association of Petroleum Geologists Bulletin, v.42, p.