

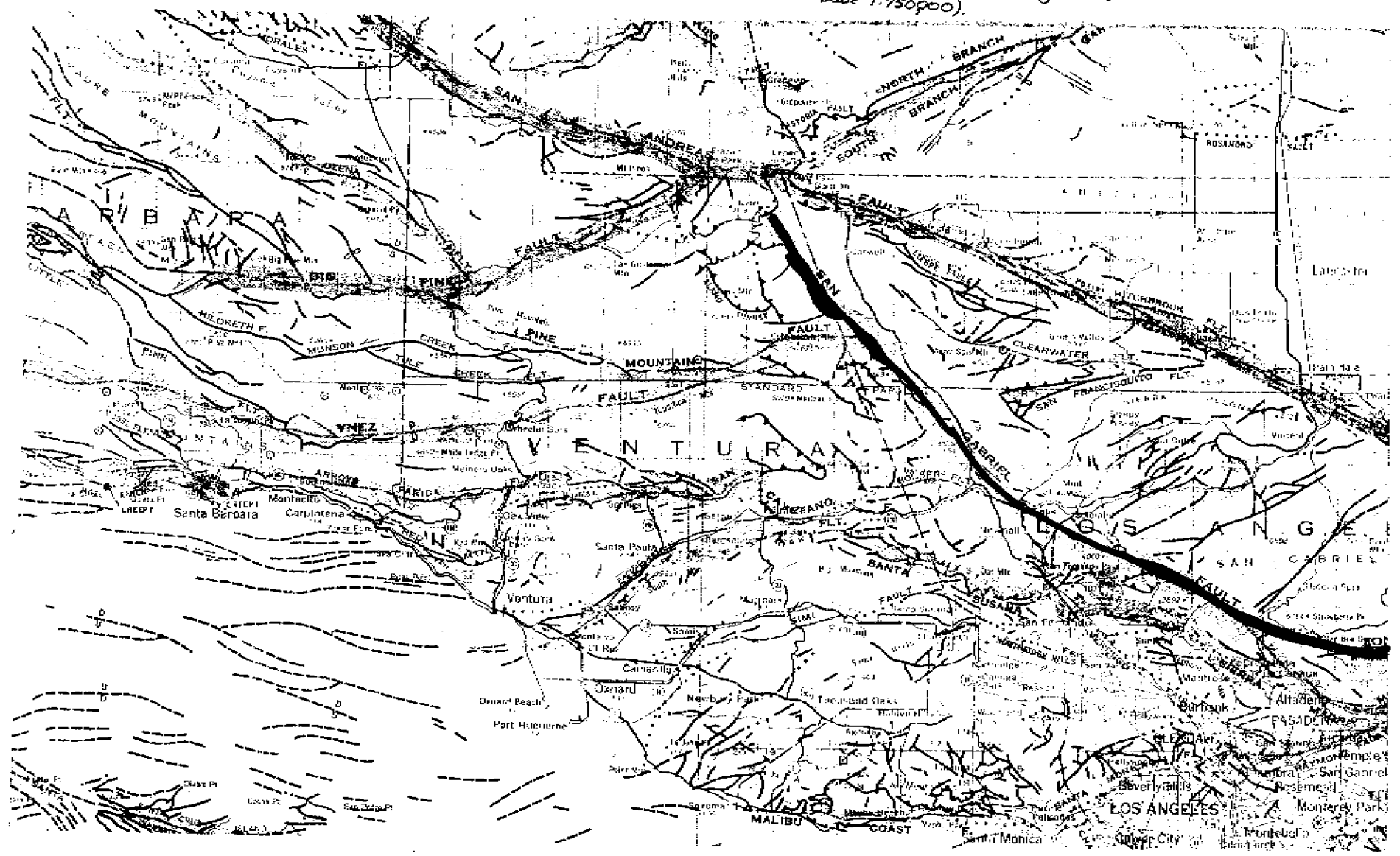
CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-58

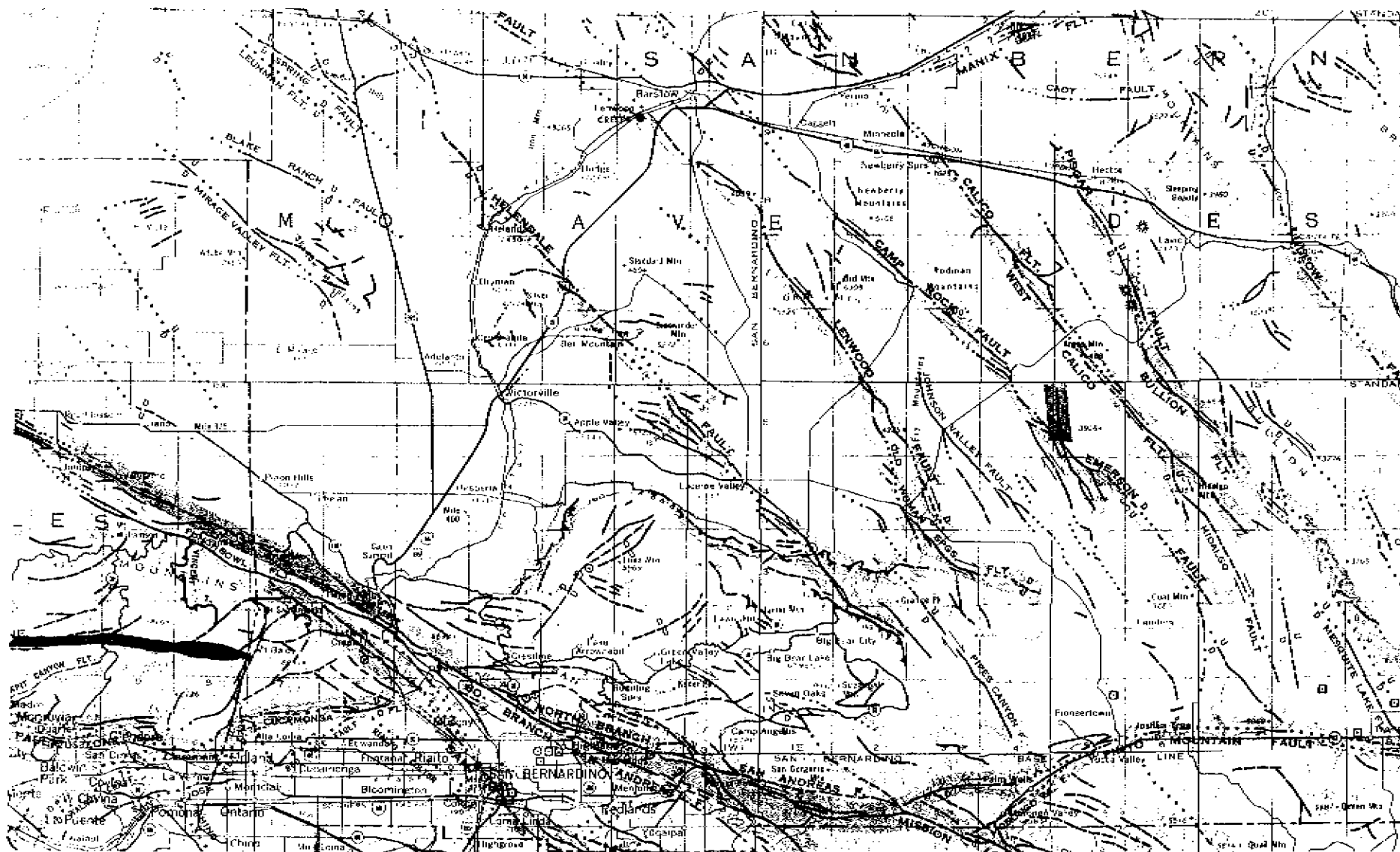
February 8, 1978

1. Name of fault: San Gabriel fault.
2. Location of fault: McDonald Peak, Black Mountain, Cobblestone Mountain, Whitaker Peak, Val Verde, Newhall, Mint Canyon, San Fernando, Sunland, Condor Peak, Chilar^o Flat, ~~San Gabriel~~, Mt. Wilson, and Azusa 7.5 minute quadrangles, Ventura and Los Angeles Counties (see figures 1A and 1B).
3. Reason for evaluation: Part of a ten-year program.
4. List of references:
 - a) Bettinger, Charles E., 1948, The geology of portions of Beartrap Canyon and Quail quadrangles, California: Unpublished M.S. thesis, University of Southern California, 48 p., map scale 1:24,000.
 - b) Bonilla, M.G., Buchanan, J.M., Castle, R.O., Clark, M.M., Frizzell, V.A., Gulliver, R.M., Miller, F.K., Pinkerton, J.P., Ross, D.C., Sharp, R.V., Yerkes, R.F., and Ziony, J.I., 1971, Surface faulting in the San Fernando, California, earthquake of February 9, 1971: U.S. Geological Survey Professional Paper 733, p. 55-76.
 - c) Chambers, Earl F., 1947, Geology of portions of the Whitaker Peak and Beartrap Canyon quadrangles, California: Unpublished M.S. thesis, University of Southern California, 56 p., map scale 1:24,000.
 - d) Cooksey, Charton D., Jr., 1934, The geology of portions of the Humphreys, Sylmar, Newhall, and Saugus quadrangles, Los Angeles County, CA: Unpublished M.S. thesis, California Institute of Technology, 42 p., map scale 1:24,000.

FAULT EVALUATION REPORT 5B
FIGURE 1A. General location of the
San Gabriel fault (Sennings, 1975,
scale 1:750,000).



FAULT EVALUATION REPORT 58
FIGURE 1B. General location of the
San Gabriel fault (Jennings, 1975, scale
1:750,000).



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- e) Crowell, J.C., 1950, Geology of Hungry Valley area, Southern California: Bulletin of the American Association of Petroleum Geologists, v. 34, no. 8, p. 1623-1646, map scale approximately 1:50,000.
- f) Crowell, J.C., 1952, Probable large lateral displacement on San Gabriel fault, southern California: Bulletin of the American Association of Petroleum Geologists, v. 36, no. 10, p. 2026-2035, map scale 1" = 5 miles.
- g) Crowell, J.C., 1964, The San Andreas fault zone from the Temblor Mountains to Antelope Valley, southern California: Pacific Section A.A.P.G.-S.E.P.M. and San Joaquin Geological Society Guidebook, p. 8-38, plate 1, map scale 1:62,500.
Note: Plate 1 has no topographic control.
- h) Crowell, J.C., 1968, Movement histories of faults in the Transverse Ranges and speculations on the tectonic history of California in Proceedings of conference on geologic problems of San Andreas Fault System, Dickinson, W.R., and Grantz, A., eds.: Stanford University Publications, Geological Sciences, v. XI, p. 323-341.
- i) Eaton, J.E., April 1939, Ridge Basin, California: Bulletin American Association of Petroleum Geologists, v. 23, no. 4, p. 517-558, scale 1 = 2.5 miles.
- j) Ehlig, P.L., 1958, The geology of the Mount Baldy region of the San Gabriel Mountains, California: Unpublished Ph.D. thesis, University of California, Los Angeles, map scale 1:16,000, 195 p.

- k) Ehlig, P.L., 1973, History, seismicity and engineering geology of the San Gabriel fault in Geology, seismicity, and environmental impact: Association of Engineering Geologists, Special Publication p. 247-251.
- l) Hill, M.L., 1930, Structure of the San Gabriel Mountains north of Los Angeles, California: University of California Publications, Bulletin of the Department of Geological Sciences, v. 19, no. 6, p. 137-170, map scale approximately 1:36,000.
- m) Jennings, C.W., 1975, Fault map of California with locations of volcanoes, thermal springs and thermal wells: California Division of Mines and Geology, California Geologic Data Map Series, Map no. 1, scale 1:750,000.
- n) Kriz, S.J., 1947, Stratigraphy and structure of the Whitaker Peak-Reasoner Canyon area, Ventura and Los Angeles Counties, California: Unpublished Ph.d. thesis, Princeton University, 68 p., map scale 1:24,000 (on planimetric base).
- o) MacNeill, Robert J., 1948, Geology of the Humphreys Station area, Los Angeles County, California: Unpublished M.S. thesis, California Institute of Technology, 39 p., map scale 1:24,000.
- p) Miller, W.J., 1928, Geomorphology of the southwestern San Gabriel Mountains of California: University of California Publications, Bulletin of the Department of Geology, v. 17, p. 193-240.
- q) Pollard, D.L., 1958, Geology of the Halsey Canyon area, Los Angeles, 74 p., map scale 1:12,000.

- Smith, D.P., 1978, Sierra Madre fault;
California Division of Mines and Geology,
Fault Evaluation Report FER-69 (unpublished).
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- r) Shepard, John B., Jr., 1961, The geology of part of the San Gabriel fault zone, Los Angeles and Ventura Counties, California: Unpublished M.A. thesis, University of California, Los Angeles, 125 pages, map scale 1:14,400.
 - s) Weber, F.H., Jr., 1977, Personal communication.
 - t) Weber, F.H., Jr., 1977, Investigation of the northwestern part of the San Gabriel fault zone, with regard to character and recency of movement, Los Angeles and Ventura Counties, California: California Division of Mines and Geology, Annual Technical Report-Fiscal year 1976-1977 (for U.S. Geological Survey Contract no. 14-08-0001-16600), 33 pages.
 - u) Weber, F.H., Jr., Kiessling, E.W., Sprotte, E.C., Johnson, J.A., 1975, Seismic hazards study of Ventura County, California: California Division of Mines and Geology, Open File Report 76-5LA, 396 p., 9 plates, map scale 1:48,000.
 - v) Wentworth, C.M., Bonilla, M.G., and Buchanan, J.M., 1969, Seismic environment of the Burro Flats site, Ventura County, California: U.S. Geological Survey open-file report 1973, 35 p., map scale 1:24,000.
 - w) Wentworth, C.M., and Yerkes, R.F., 1971, Geologic setting and activity of faults in the San Fernando area, California in the San Fernando, California, earthquake of February 9, 1971: U.S. Geological Survey Professional Paper 733, p. 6-16.
 - x) Winterer, Edward L., 1954, Geology of southeastern Ventura basin, Los Angeles County, California: Unpublished Ph.D. thesis, University of California, Los Angeles, 141 p., map scale 1:24,000.

- y) Winterer, E.L., and Durham, D.L., 1962, Geology of southeastern Ventura Basin, Los Angeles County, California: U.S. Geological Survey Professional Paper 334-H, scale 1:24,000.
- z) Ziony, J.I., Wentworth, C.M., Buchanan-Banks, J.M., and Wagner, H.C., 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-585, 15 p., map scale 1:250,000, 3 plates.

** continued on next page.*

5. Summary of available data:

The San Gabriel fault is a major fault zone that has no historic record of major seismic activity (Weber, 1977, p. 2; Wentworth, et al., 1969, p. 12). There is a difference of opinion among the many authors as to the sense and age of displacement. Some authors (Cooksey, 1934, p. 28; McNeill, 1947, p. 31; Eaton, 1939, p. 550; and Hill, 1930, p. 146) believe the San Gabriel to be a vertical or north-dipping reverse fault, north block up. Chambers (1947, p.) agrees that the fault is primarily a dip-slip fault, but concluded that the southern block rose during the Pliocene and later times. Contrarily, Crowell (1968, p. 14), for example, believes that the San Gabriel fault is primarily a right-lateral, strike-slip fault, although he admits that a large component of dip-slip movement is necessary to explain past presence of the Ridge Basin. Weber (1977) did not commit himself regarding the sense of movement, but noted a "consensus" favoring right-lateral displacement.

The age of most recent movement along the fault is a confusing issue. Crowell (1968, p. 14) favors the theory that the San Gabriel fault is an ancestral branch of the San Andreas (from late Miocene to early Pleistocene times). He states that the 30 miles of postulated,

right-lateral offset might indicate that the San Gabriel fault was the major fault during that time. Crowell (1950, p. 1644; 1960, p. 400; 1964, p. 14) notes that the San Gabriel has been reactivated, in some areas, during the Pleistocene. He states (1964, p. 14) that these recent movements have been minor, however. He cites as evidence (1950, p. 1644) the displacement of an exhumed pediment, just southeast of where it is overlapped by Plio-Pleistocene strata. Crowell (1968, p. 324) notes that the San Gabriel fault is "presumed not to be active, because terrace deposits are not cut except locally along minor faults not directly in line with the principal...fault." Table 1 summarizes the opinions of various ~~other~~ authors on the age of most recent faulting.

Additional References (Used on maps only)

- aa) Crowell, J.C., et al. (sic.), 1956, Geologic map of Ridge Basin, southern California: Unpublished map, scale 1:24,000.
- bb) Dibblee, T.W., Jr., 1958a, Unpublished geologic map of the Pomona 15-minute quadrangle, scale 1:62,500.
- cc) Dibblee, T.W., Jr., 1958b, Unpublished geologic map of the Santa Susana 15-minute quadrangle, scale 1:62,500.
- dd) Dibblee, T.W., Jr., 1967, Unpublished geologic map of the Valyermo 15-minute quadrangle, scale 1:62,500.
- ee) Dibblee, T.W., Jr., 1968a, Unpublished geologic map of the Chilao Flat 7.5 minute quadrangle, scale 1:24,000.
- ff) Dibblee, T.W., Jr., 1968b, Unpublished geologic map of the Condor Peak 7.5 minute quadrangle, scale 1:24,000.
- gg) Jennings, C.W., and Strand, R.G., 1969, Geologic map of California, Los Angeles sheet: California Division of Mines and Geology, map scale 1:250,000.
- hh) Kew, W.S.W., 1924, Geology and oil resources of a part of Los Angeles and Ventura Counties, California: U.S. Geological Bulletin 753, 202 p., map scale 1:62,500.
- ii) Oakeshott, G.B., 1958, Geology and mineral deposits of San Fernando quadrangle, Los Angeles County, California: California Division of Mines and Geology, Bulletin 172, map scale 1:62,500.

TABLE 1: Opinions on and evidence for (if noted) age of most recent faulting of San Gabriel fault.

<u>Reference</u>	<u>Opinions & Evidence</u>
Bettinger, 1948	Cuts mid-Pliocene unit, surface expression lacking in some areas.
Chambers, 1947	Active throughout Pliocene, upper Pleistocene terraces are tilted.
Cooksey, 1934, p. 28	Post-Saugus, but "hidden" by Quaternary terrace deposits.
Crowell, 1950, p. 1644	Reactivated in Pleistocene southeast of Bear Mountain fault.
Crowell, 1962, p. 400	Reactivated in Pleistocene.
Crowell, 1968, p. 324	Reactivated in Pleistocene.
Eaton, 1939	Active during early Pleistocene, but dead for last one million years; may still be active southeast of Castaic.
Ehlig, 1973, p. 247-250	Topographic expression is erosional in origin; ill-defined where Saugus Fm. is cut; alluvium not displaced, no Holocene fault scarps, but older alluvium is cut (p. 249).
Hill, 1930, p. 154-155	Doesn't cut terrace deposits; fault is late Pliocene or early Pleistocene in age.
Kriz, 1947, p. 49-50	No offset streams; fault is offset in Beartrap Canyon.
McNeill, 1947, p. 31	Post-Saugus, but pre-terraces.
Pollard, 1958, p. 57	Large displacements have not occurred since deposition of Saugus Formation.
Shepard, 1961	Pleistocene in age, but alluvium not displaced, no Holocene scarps.
Weber, et al., 1975, p. 177	Late Quaternary (?)
Weber, 1977	Late Quaternary (200,000 to 300,000 y.b.p.) movement indicated along the entire length of the fault <i>studied</i> .

(Table 1 cont.)

Reference

Wentworth, et al., 1969,
p. 12

Wentworth and Yerkes,
1971, p. 12

Winterer, 1954

Winterer and Durham,
1962, p. 337

Ziony, et al., 1974

Opinions & Evidence

East of Sierra Madre Fault the San Gabriel
~~Northern of the two southeastern~~
branches does not seem to disturb
late Quaternary terrace deposits.

Cuts Pacoima Fm., but terrace deposits
are not obviously offset.

Notes deformation zone within the
Saugus Fm. along San Gabriel fault.

Most of movement was pre-Saugus Fm.
in age; notes zone of "relatively minor"
faults in Saugus Fm.

Cuts a Plio-Pleistocene unit.

Weber (p.c., 1977), reporting on work in progress, noted that he has not found any evidence of Holocene displacement along the San Gabriel fault. He believes that he does have evidence for late Pleistocene activity (200,000 to 300,000 y.b.p.) in several areas. As noted on the accompanying plates, this evidence includes offset older alluvium, apparently offset landslides, and ^{minor} topographic evidence.

The fault is, apparently, not well-defined in some areas. Hill (1930, p. 146) described three branches of the San Gabriel which were one foot to three feet thick, each. Shepard (1961, p. 87) found ~~the~~ ^{two} branches, which were not described in detail. Ehlig noted (1973, p. 247) that the San Gabriel was not a "single rupture", but a multitude of faults, and Weber (1977) agrees. The zone varies from a few hundred feet to a mile in width, and, according to Weber (1977, p. 1) dips steeply to the northeast. Weber (p. 2) cites the presence of some ground cracks along the fault in Little Tujunga Canyon and speculates that these may have formed during the 1971 San Fernando earthquake. This is the only, and very weak, evidence for ^{historic} activity of the San Gabriel fault.

Finally, Ehlig (p. 250) noted that the San Fernando fault apparently truncates the San Gabriel at depth, since the epicenter of the 1971 event was three miles north of the San Gabriel fault, ~~while~~ ^{and} the surface rupture was located four miles south of the San Gabriel. While, if this is the case, movement on the San Gabriel is not precluded, the effects on the driving mechanism may be significant.

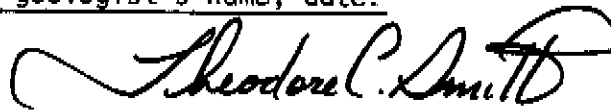
6. Interpretation of aerial photographs: Not attempted.
7. Field observations: Not attempted.

8. Conclusions:

The San Gabriel fault has apparently been active during the late Pleistocene. ^(Weber, 1977) However, no evidence for Holocene displacement has been reported except for the "ground cracks" of Weber (1977, p. 2; see item 5 above). The fault does not appear to be well-defined in some areas, especially where Saugus and younger units are present. These units cover much of the area along the fault which may be considered open to development. ^{Moreover,} ~~Therefore,~~ the San Gabriel fault is apparently neither sufficiently active nor well-defined ~~at least~~ in a major part of the area where ~~Reports, were they to be required,~~ ^{future development might} ~~could~~ be expected ~~to be conducted.~~

9. Recommendations:

Under the present project guidelines, zoning of the San Gabriel fault is not recommended. In light of the most recent work by Weber it is unlikely that the personnel assigned to this project could find any new evidence supporting recent movement in the time available. Therefore, no further work on part of this projects personnel appears necessary.

10. Investigating geologist's name; date:


THEODORE C. SMITH
Assistant Geologist
February 8, 1978

*Agree with the
recommendations.
EHLA
3/6/78*