CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-80

January 5, 1979

1. Name of fault: Rose Canyon

2. Location of fault: La Jolla and Point Loma 7.5 minute quadrangle, San Diego County (figure 1).

3. Reason for evaluation: Part of 10-year program

4. List of References:

4. List of references:

Artim, E.R., Bemis, C.G., Pinckey, C.J. and Smillie, B.R., 1971, Western San Diego County fault systems: Geological Society of America, Abstract with Programs (Cordilleran Section), v. 3, no. 2, p. 75.

Artim, E.R. and Pinckney, C.J., 1973, La Nacion fault system, San Diego, California: Geological Society of America Bulletin, v. 84, p. 1075-1080.
(Claims that Holocene soil broken by fault but no evidence given- no trench logs or descriptions of cuts or locations of observations.)

Elliott, W.J., 1977, New evidence concerning age of movement of the La Nacion fault, southwest San Diego County, California, in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja, California; San Diego Association of Geologists, p. 53-58.
(A good report, it disprooves the contention of Artim and Pinckney (1973) that the La Nacion fault breaks Holocene soils. It is recommended that La Nacion fault be considered potentially active.)

Ellis, A.J. and Lee, C.H., 1919, The geology and ground water of the western part of San Diego County, California: U.S. Geological Survey Water Supply Paper 446, 321 p. (maps).
(Many photos of a very pristine landscape but no information on faults.)

Fairbanks, H.W., 1893, Geology of San Diego County; also of portions of Orange and San Bernardino Counties: California State Mining Bureau, Report 11, p. 76-120.

Fairchild Air Photos, 19 , 22930, 2-83, 84 and 85; 2-91, 92.
(On loan from Whittier College.)

Hanna, M.A., 1926, Geology of the La Jolla quadrangle, California: University of California Publications Bulletin of the Department of Geological Sciences, v. 16, no. 7, p. 187-246, map.

Hart, M.W., 1974, Radiocarbon ages of alluvium overlying La Nacion fault, San Diego, California: Geological Society of America Bulletin, v. 85, p. 1329-1332.
(Appears to give an abundance of hard evidence in addition to the age dating of soils.)

Hart, M.W., 1977, Landsliding, an alternative to faulting in San Ysidro, California, in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja, California: San Diego Association of Geologists, p. 37-42.
(A fair argument but not so well illustrated as to be totally convincing. The possibility that faults might be there and implicated in the landslide seems to have been overlooked.)

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.

Kennedy, M.P., 1968, Preliminary geologic map of a portion of northwestern San Diego City, California: California Division of Mines and Geology Open-File Resease 68-10, scale 1" = 800'.

Kennedy, M.P., 1973, Stratigraphy of the San Diego embayment, California: University of California, Riverside, unpublished Ph.D. Dissertation.

Kennedy, M.P., 1975a, Character and recency of faulting, San Diego metropolitan area, California: California Division of Mines and Geology Special Report 123, 33 p., map 1:50,000.

(Although Holocene sediments are not known to be displaced by the Rose Canyon fault zone in the onshore part of the area, offshore subbottom acoustic profiles of the area between La Jolla and Oceanside, and of the San Diego Bay and immediate offshore shelf areas south of Point Loma, show that sediments of probqble Holocene age on the sea floor are displaced by faults that appear to be related to this zone (Moore, 1972; Moore and Kennedy, 1975).)

Kennedy, M.P. and Tan, S.S., 1977, Geology of National City, Imperial Beach and Otay Mesa quadrangles, southern San Diego metropolitan area, California: California Division of Mines and Geology Map Sheet 29, map 1:24,000.

(A good map of the La Nacion fault. No Holocene displacement shown or inferred. Text covers rocks but not structure.)

Liem, T.J., 1977, Late Pleistocene maximum age of faulting, southeast Mission Bay area, San Diego, California: in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja,California: San Diego Association of Geologists, p. 61-64.

(No data on Holocene. Data removed by grading before discovery trench was cut.)

Milow, E.D., 1961, Guide to geologic field trip of southwestern San Diego County, in Thomas, B.E., editor, Field trip guidebook: Geological Society of America, 57th Annual Meeting (Cordilleran Section) p. 23-43.

Moore, G.W., 1972, Offshore extension of the Rose Canyon fault, San Diego, California: U.S. Geological Survey Professional Paper 800-C, p. 113-116.

(Appears to offer strong evidence of Holocene activity on Rose Canyon fault zone.)

Moore, G.W. and Kennedy, M.P., 1970, Coastal geology of the California-Baja California border area: in Pacific slope geology of northern Baja California and adjacent Alta California; Geological guidebook for 1970 Fall field trip, Pacific Sections AAPG,SEPM, and SEG, p. 4-7.

(Suggests that Rose Canyon fault extends southward into Mexico. Leaves question of Holocene activity ("tectonic deformation") open.)

Kennedy, M.P., 1975b, Geology of the San Diego metropolitan area, California--Section A, western San Diego area: California Division of Mines and Geology, Bull. 200, p. 1-39, 3 plates (1:24,000).

Moore, G.W. and Kennedy, M.P., 1975, Quaternary faults at San Diego Bay, California: U.S. Geological Survey Journal of Research, v. 3, p. 589-595.

Peterson, G.L., 1970, Quaternary deformation of the San Diego area, southern California: in Pacific slope geology of northern Baja, California and adjacent Alta, California; Geological guidebook for 1970 Fall field trip, Pacific Sections AAPG, SEPM and SEG, p. 120-126.
(A good discussion of the history of Quaternary faulting and deformation in the vicinity of the Rose Canyon fault zone based on geomorphologic evidence.)

Real, C.R., Parke, D.L. and Toppozada, T.R., 1977, Magnetic tape catalog of California earthquakes, 1900-1974: California Division of Mines and Geology.

Strand, R.G., 1962, Geologic map of California-San Diego-El Centro sheet: California Division of Mines and Geology.

Toppozada, T.R., Parke, D.L. and Higgins, C.T., 1978, Seismicity of California 1900-1931: California Division of Mines and Geology, Special Report 135, 39 p.
(Showes a number of Intensity V-VI earthquakes in area of concern.)

Treet, R.L., 1977, Texas Street fault, San Diego, California: in Farrand, G.T., editor; Geology of southwestern San Diego County, California and northwestern Baja, California: San Diego Association of Geologists, p. 45-51.
(A well documented but rather long winded description of a fault possibly relatable to La Nacion and concluded not to display Holocene activity. Recommends further investigation because the fault is not exposed.)

Weber, F.H., Jr., 1963, Geology and mineral resources of San Diego County, California: California Division of Mines and Geology County Report 3, 309 p.

Wehmiller, J.F. and others, 1977, Correlation and chronology of pacific coast marine terrace deposits of continental United States by fossil amino acid stereochemistry-technical evaluation, relative ages, kinetic model ages, and geologic implication: United States Geological Survey Open-File Report 77-680, 106 p.

Wehmiller, J.F. and others, 1978, Amino-acid recemization dating of Quaternary mollusks, Pacific Coast United States: in Zartman, editor; Short papers of the fourth international conference, geochronology, cosmochronology, isotope geology, United States Geological Survey Open-File Report 78-701.
(Explains a very useful means of dating coastal, marine terrace deposits. Dates Point Loma 121,000 ± 7,000 years.

Wood, H.O., 1916, California earthquakes: Seismological Society of America Bulletin, v. 6, no. 2, p. 55-180.

Ziony, J.I. and others, 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey Miscellaneous Field Studies Map MF-585, 3 sheets, scale 1:250,000, booklet 15 p.
(No indication of Holocene activity.)

5. Summary of available data on fault. Fairbanks (1893, p. 95) appears to be the first to suggest the presence of the Rose Canyon fault. Subsequent groundwater work by Ellis and Lee (1919) yielded some geologic mapping but no evidence of significant faulting. Hanna (1926) drew an inferred fault extending from La Jolla southward through Soledad Mountain, down Rose Canyon and along the east side of Mission Bay, that approximated the general position of the Rose Canyon fault zone as mapped by Kennedy (1975, Plate 1). Kennedy's map is reproduced as figure 1 of this report. The trace of the Rose Canyon fault shown on the San Diego-El Centro sheet of the Geologic Map of California (Strand, 1962) is that of Hanna except that it is drawn slightly farther east at La Jolla. On a map by Ziony and others (1974), showing recency of faulting in coastal southern California, the Rose Canyon fault is shown as active during the Quaternary but not the Holocene. The same designation is used by Jennings (1975) on the Fault Map of California except that as the youngest age of faulting Jennings does not use Pleistocene or Holocene but instead indicates historic activity - a pragmatic necessity, in compiling such a large map, that "tunes out" most of the 11,000 year or younger (Holocene) interval. The southernmost segment of the Rose Canyon fault zone, the Old Town fault, was mapped and described by Artim and Pinckney (1973, p. 1078) who suggested that that segment might be extended south-southeasterly as the Sweetwater fault (included in FER-82).

The reports by Kennedy, (1975a & 1975b) California Division of Mines and Geology Bulletin 200; (Geology of the San Diego Metropolitan area, California) and CDMG Special Report 123; character and recency of faulting, San Diego metropolitan area, California, include this area, constitute an up-to-date and detailed description of the Rose Canyon fault and are the main sources for this work. Figure 1 is a copy of part of the map accompanying Special Report 123. The following are excerpts from Kennedy's description (1975a) of the Rose Canyon fault zone:

> The Rose Canyon fault zone...is locally more than 1 km wide and is composed of both dip-slip and strike-slip en echelon faults that together extend from La Jolla Cove on the north to San Diego Bay and beyond on the south.... The longest individual breaks within the zone include the Rose Canyon, Mount Soledad, Country Club, and Old Town faults. The magnitude and sense of displacement on the Rose Canyon fault zone is complicated by the apparent rotation of the block on the west side of the fault (Peterson, 1970; Kennedy, 1975) the north or elevated end being Mount Soledad and the south or depressed end lying beneath Mission Bay.

Kennedy (1975a) states:

> "In addition, the San Diego Formation has been displaced 4 km right laterally along the Rose Canyon fault, between Tecolote Canyon and Pacific Beach, since late Pliocene time (Kennedy, 1968, 1973)."

On the recency of displacement Kennedy writes:

> The upper Pleistocene Bay Point Formation is the youngest unit known to be offset by the Rose Canyon and Mount Soledad faults. The wave-cut terrace upon which these deposits rest is vertically offset more than 10 m at La Jolla Cove and is gently tilted downward to the south toward Mission Bay (Kennedy, 1975).

Although Holocene sediments are not known to be displaced by the Rose Canyon fault zone in the onshore part of the area, offshore sub-bottom acoustic profiles of the area between La Jolla and Oceanside and of the San Diego Bay and immediate offshore shelf areas south of Point Loma, show that sediments of probable Holocene age on the sea floor are displaced by faults that appear to be related to this zone (Moore, 1972; Moore and Kennedy, 1975).

It is pointed out by Kennedy (1975a) that the youngest strata known to be faulted belong to the upper Pleistocene Bay Point Formation (age approximately 1.2×10^5 years) and, because these strata are not commonly overlain by Holocene sediments, the Holocene record is at best incomplete. In addition Kennedy states that sediments of probable Holocene age on the sea floor are displaced by faults that appear to be related to the Rose Canyon fault.

6. Interpretation of air photos: None

7. Field observations: None

8. Conclusions: Although the Rose Canyon fault has been active during the late Pleistocene and may be involved in displacement of Holocene sediments in offshore areas (Kennedy, 1975), there is no confirmed evidence of Holocene activity onshore. The trace of the fault is ill-defined (it is far from pristine), being obscured to a considerable extent by development. Using present project guidelines, the fault is believed not to be sufficiently active to be considered Holocene. *

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* Lack of Holocene activity on many strands of the Rose Canyon fault are indicated by the presence of apparently unfaulted Pleistocene units (Bay Pt and Linda Vista ~~Loma~~ Fms.) across the strands (see Fig 1; also Kennedy, 1975a and 1975b) — EWH 12/13/79

9. Recommendations:

Using present project guidelines, the Rose Canyon fault should not be zoned for lack of confirmed evidence of Holocene activity. Further studies, especially on the offshore projection of the Rose Canyon fault, may confirm Holocene activity on this fault. Continued monitoring for new geologic data is recommended.

10. Investigating geologist's name: Richard B. Saul Date: 1-12-79

I agree with the recommendation not to zone, based on the existing evidence of recency (Pleistocene), as indicated under conclusions, this fault is not well-defined.
EWH
1/16/79

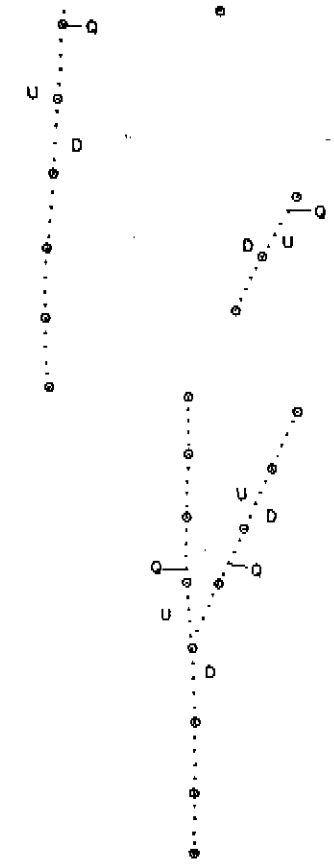


Figure 1
EXPLANATION

U
D
50

FAULT

Solid line where existence is certain, dashed where inferred, dotted where concealed by Holocene alluvium; U, upthrown side; D, downthrown side; single arrow and number indicate dip of fault plane; double arrows indicate sense of lateral slip.

FAULT ZONE

FAULT INFERRED FROM PHOTOGRAPHIC EVIDENCE

FAULT INFERRED FROM GEOPHYSICAL EVIDENCE
See plate 2 for magnetic, gravity and seismic data used for inference.

FAULT UNDERLYING SAN DIEGO BAY AND OFFSHORE AREA
(Modified from Moore and Kennedy in press).

SYNCLINE

ANTICLINE

41

LOCATION OF TEXT FIGURE

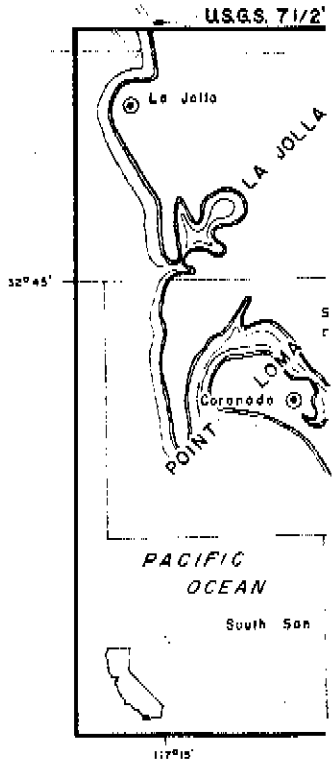
T/h

AGE OF FAULT MOVEMENT

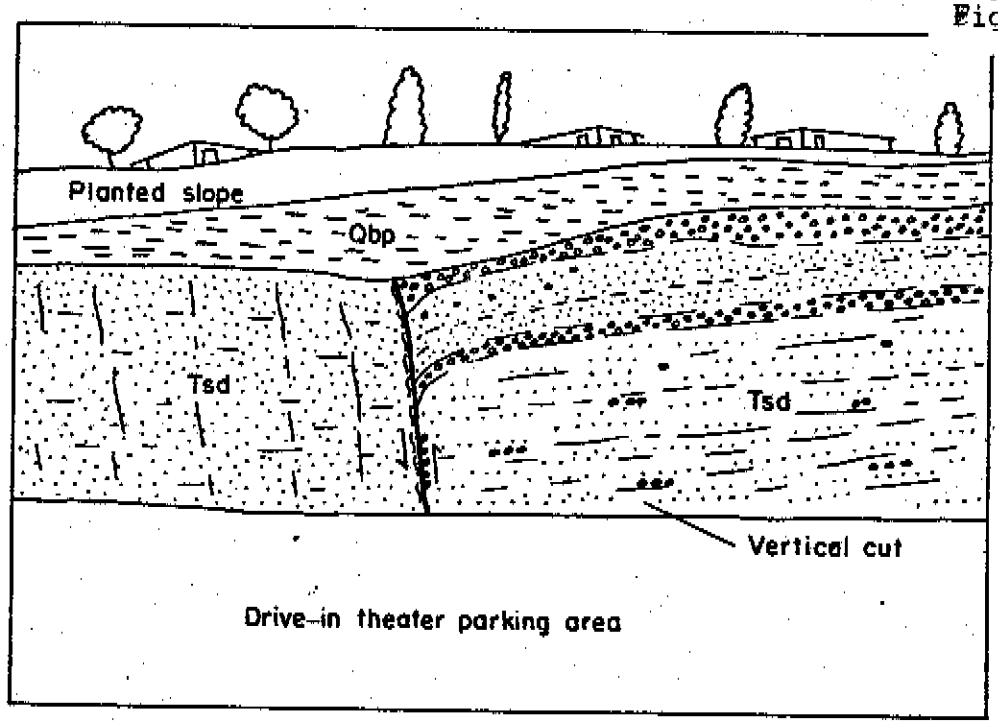
Capital letter indicates age of strata known to be faulted, lower case letter indicates age of strata known to be unfaulted. (See key below and text discussion of ages of strata faulted and not faulted).

Key to age of fault movement symbols

Strata and age	Faulted	Not faulted
HOLOCENE (Soil, alluvium,slopewash)	H	h
LATE PLEISTOCENE (Bay Point Formation)	L	l
EARLY PLEISTOCENE (Lindavista Formation)	Q	q
TERTIARY OR OLDER STRATA (San Diego Formation, Otay Formation, Poway Group, La Jolla Group, Rosario Group)	T	t



FER-80 Attachment #1
Kennedy (1975) figures
Keyed by number to
Figure 1



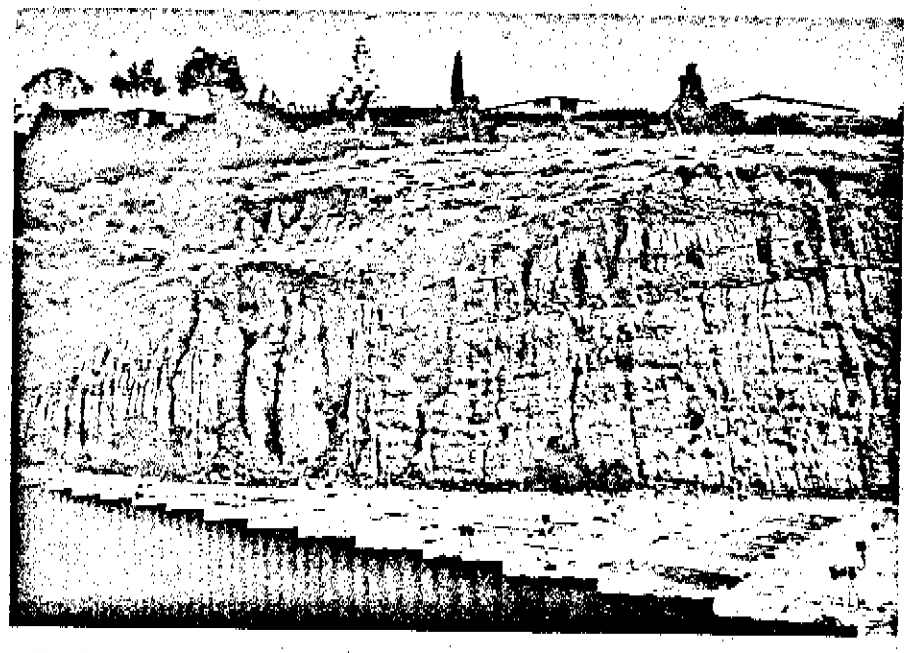


Figure 5. Conglomerate and sandstone facies of the San Diego Formation (Tsd) in fault contact with finer grained sandstone facies of the San Diego Formation. The slope is capped by a thin succession of late Pleistocene Bay Point Formation (Qbp) which has not been truncated by the fault. Strata of the Lindavista Formation are faulted immediately north of this exposure. The fault strikes N. 45° W. and dips 80° E. View north (see plate 1 for location).

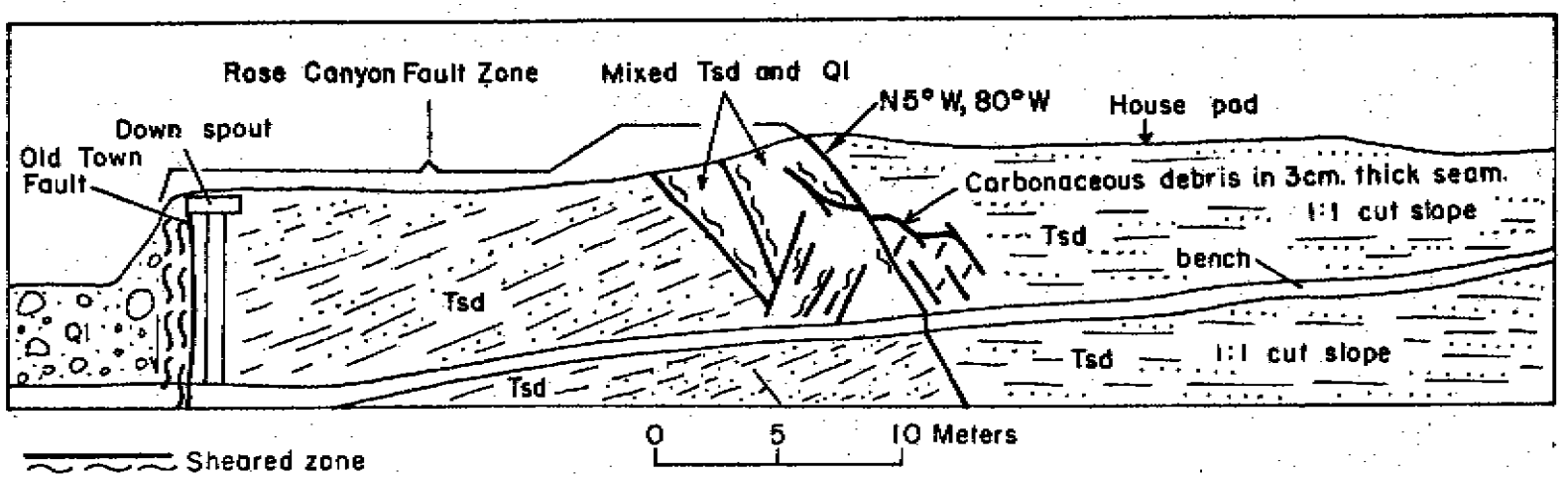


Figure 6. The Old Town fault here strikes N. 5° W. and dips 80° E. Rocks of the San Diego Formation (Tsd) lie to the east and within part of the fault zone and are juxtaposed with rocks of the Lindavista Formation (Ql). Bedding within the fault zone strikes N. 25° E. and dips 20° W. View north (see plate 1 for location).

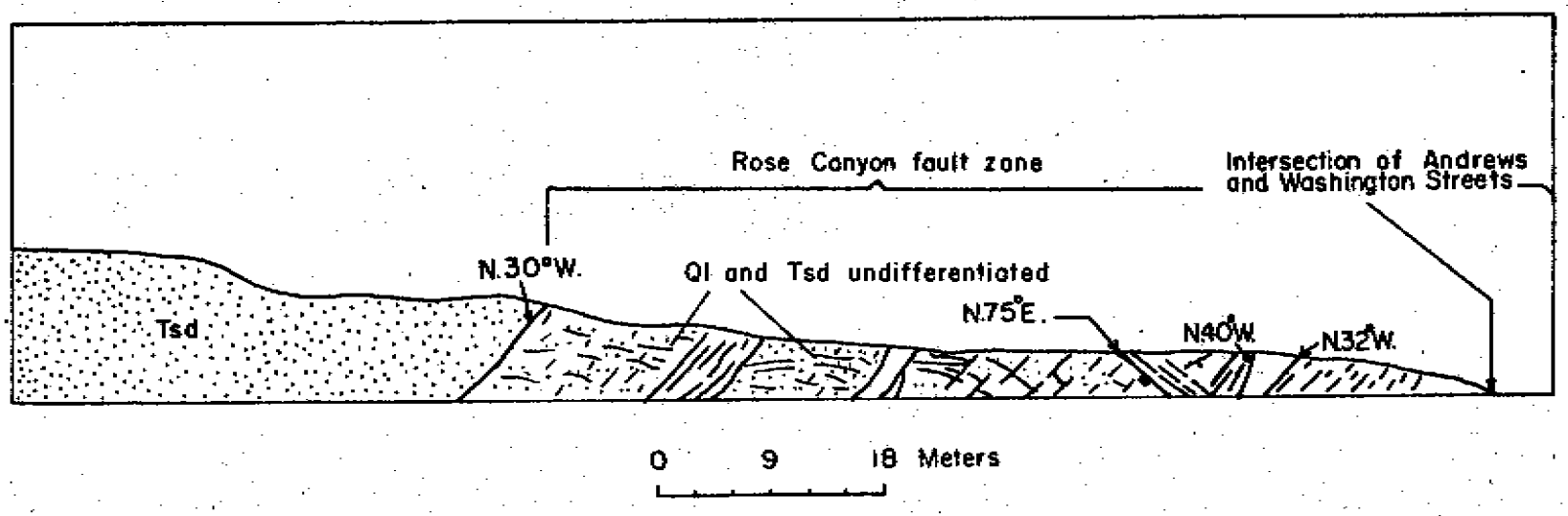


Figure 7. Rose Canyon fault zone juxtaposes strata of the upper Pliocene San Diego Formation (Tsd) and lower Pleistocene Lindavista Formation (Ql). The fault zone here is approximately 70 m wide and the strike is N. 35° W. View south (see plate 1 for location).

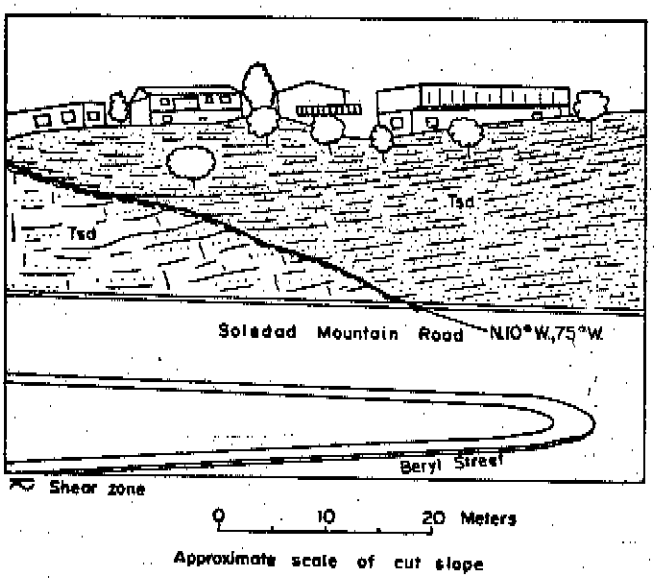


Figure 8. Fine-grained sandstone of the Pliocene San Diego Formation (Tsd) in fault contact with a sandstone and siltstone facies also of the San Diego Formation. The fault strikes N. 5°-10° W. and dips 75° W. The sandstone and siltstone facies, southeast side of the fault, appears to be elevated with respect to the rocks on the northwest side. View east (see plate 1 for location).

Figure 10. Inclined Pleistocene rocks of the Lindavista Formation dip 20 degrees to the west. They lie adjacent to the Rose Canyon fault zone here and project beneath the northern end of San Diego Bay (see plate 1 for location).

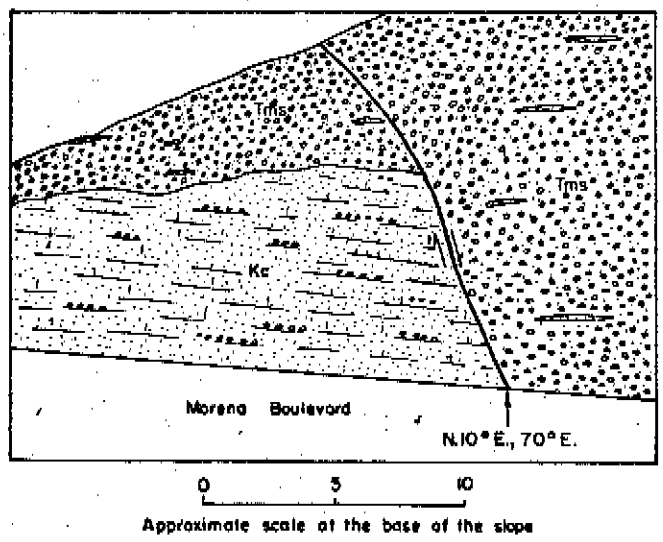


Figure 9. Small fault within the Rose Canyon fault zone strikes N. 10° E. and juxtaposes rocks of the Upper Cretaceous Cabrillo Formation (Kc) and the conglomeratic part of the Eocene Mount Soledad Formation (Tms). No Quaternary rocks occur along this part of the fault zone. View east (see plate 1 for location).

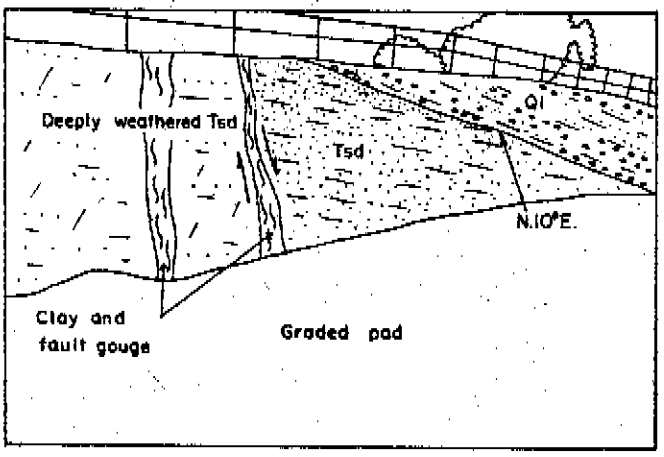


Figure 11. Faulted strata of the San Diego Formation (Tsd) and Lindavista Formation (Ql) are juxtaposed and tilted approximately 10 degrees west. View south (see plate 1 for location).