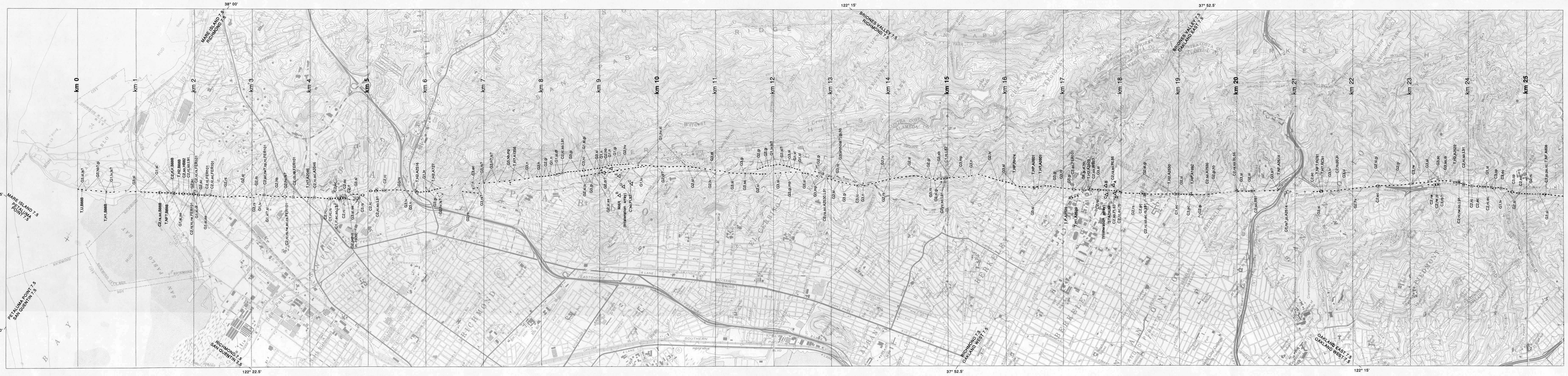
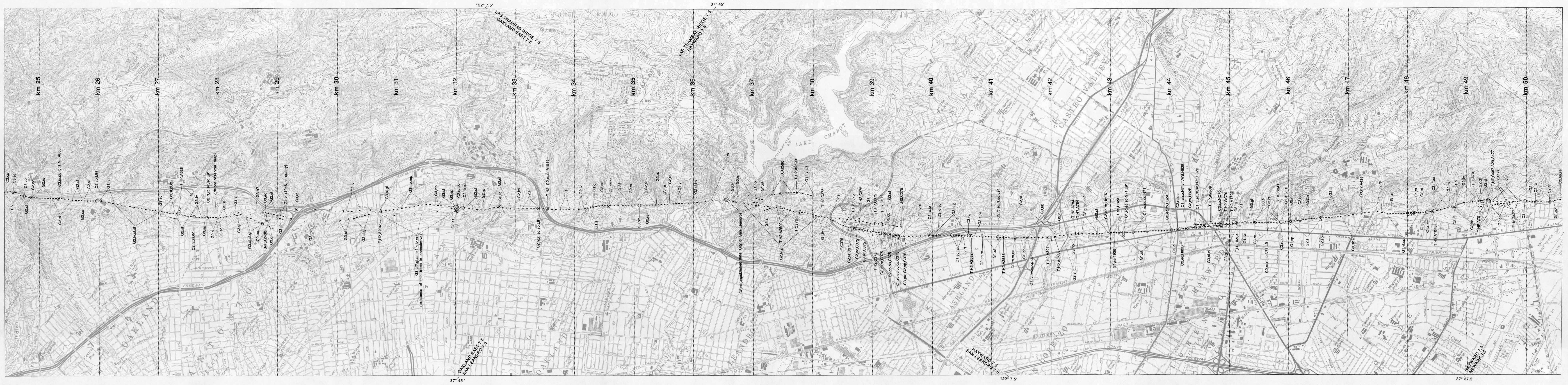
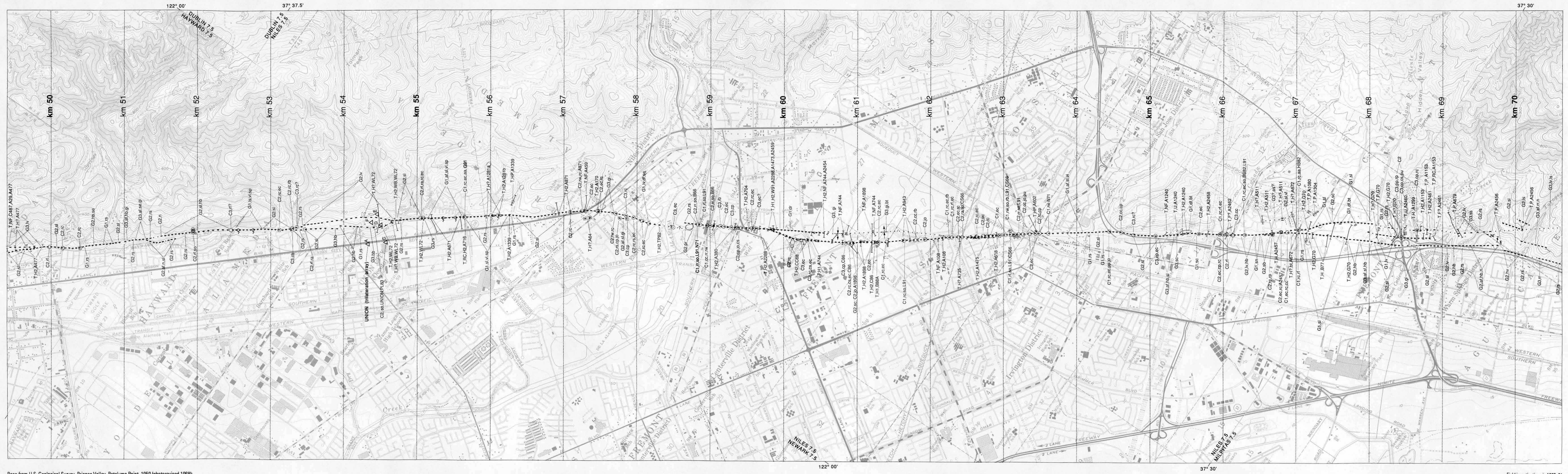
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF–2196
PLATE 1
Explanatory pamphlet accompanies map







Base from U.S. Geological Survey, Briones Valley, Petaluma Point, 1959 (photorevised 1968); Hayward, Las Trampas Ridge, Newark, Oakland East, Oakland West, Richmond, San Leandro, San Quentin, 1959 (photorevised 1980); Dublin, Milpitas, Niles, 1961 (photorevised 1980); Mare Island 1968 (photorevised 1980)

Polyconic projection

Field investigations in 1987–91
Manuscript approved for publication February 19, 1992

SCALE 1:24 000

CONTOUR INTERVAL 20 AND 40 FEET
DOTTED LINES REPRESENTS 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

Fault – Dashed to show approximate maximum uncertainty in lateral position of fault traces. Each dash represents 30 m on map. Traces mainly derive from geomorphic data, but creep and trench data used where available to constrain the position of most intense deformation more precisely. Particular observations used to locate faults are annotated on the map in abbreviated form (see Abbreviations). Hachures indicate the lower side in apparent vertical separations of the ground surface from geomorphic evidence. Dotted traces interpolate fault locations where evidence is concealed or destroyed; queries indicate speculative connections where data is absent or suspect. Sawteeth on upper plate of fault that has significant thrust or reverse component

- $\leq\pm$ 20 m uncertainty (20-m space on map between 30-m dashes)
- $\leq\pm$ 40 m uncertainty (40-m space on map between 30-m dashes)
- $\leq\pm$ 60 m uncertainty (60-m space on map between 30-m dashes)

Creep locality

Trench location – Actual length

Short trench – Not to scale

Fault location in trench – No geomorphic trace recognized

Small tectonic depression (df or dr) – Not to scale

Tectonic depression (df or dr) **or pressure ridge** (pr) – Actual size, hand drafted

Spring or seep (sp) – Located on active fault trace

Monoclinal flexure

A △ **Trilateration monument** – See Prescott and Lisowski (1983)

ABBREVIATIONS

C - CREEP EVIDENCE

1 - strongly pronounced fault creep
2 - distinct and certain creep evidence
3 - inconclusive evidence for creep
? - additional uncertainty in tectonic origin
aa - alinement array
cb - concentration of cracks in above grade structure
cc - concentration of cracks in concrete slab
cp - concentration of pavement cracks
cs - curb separating from sidewalk or pavement
ec - en echelon left-stepping cracks in pavement
jo - opening of joints or cracks in concrete
pp - multiple patches in pavement
pu - compressional pop-up or buckle in concrete
ra - right-laterally offset aqueduct, water pipe, or tunnel
rb - distortion or racking of above-grade structure (including separating additions and stairways)
rc - right-laterally offset curb or form line
rf - right-laterally offset fence line
rp - right-laterally offset painted line
rr - right-laterally offset railroad tracks or guardrail
rs - right-laterally offset sidewalk
rt - right-laterally offset line of trees
rw - right-laterally offset wall
so - surveyed offset feature

G - GEOMORPHIC FEATURES

1 - strongly pronounced feature
2 - distinct feature
3 - weakly pronounced feature
? - additional uncertainty in tectonic origin
af - alignment of multiple features as listed
as - arcuate scarp
bt - downthrown surface tilts back toward fault
df - depression form by some aspect of fault deformation, undifferentiated
dr - sag, depression formed in right stepover of fault trace
gi - linear break (or gradual inflection) in slope
hb - linear hillside bench
hv - linear hillside valley
ls - fault scarp height enlarged by landsliding
lv - linear valley or trough
mp - Youngest traces disturbed by human activities. Mapped trace bisects disturbed zone. Dash gap equals half width of disturbed zone.
n - notch
pr - pressure ridge in left stepover
rr - right-laterally offset ridge line
rs - right-laterally offset stream or gully
sb - broad linear scarp (implies multiple traces)
sc - scissor point, sense of vertical separation reverses
se - subsoil exposed
sl - linear scarp, undifferentiated
sn - narrow linear scarp (implies dominant trace)
sp - spring
ss - swale in saddle
vl - line of vegetation

T - TRENCH EXPOSURES
(and other geologic evidence)

H1 - Holocene age of offset determined by radiocarbon (^{14}C) dating
H2 - Modern soil or alluvial unit distinctly offset, or contains features conclusive of shearing, such as gouge, rotated pebbles, transported materials in shear zone, and filled fissures over distinct Pleistocene faults
H? - Inconclusive signs of Holocene offset, such as steps in base of soil or apparent shears in clay-rich materials. Without corroboration such evidence neither proves nor disproves either existence or age of faulting
H - Active trace reported in trench, trench logs not in public file
HP - Distinct faulting in unconsolidated alluvium of possibly Holocene or more likely latest Pleistocene age
F? - Feature shown as fault in log resembles nontectonic feature such as bedrock-alluvial contact, buried terrace riser, or landslide plane
NF - No fault observed
P - Distinct evidence of significant faulting in Pliocene or Pleistocene sediments
RC - Roadcut log
WB - Ground water barrier
U - Age of faulting unobtainable because surficial deposits removed

REFERENCE CODES (see also Abbreviated Map References and text for full references.)

A2456 - Trench log or creep evidence in Alquist-Priolo report AP-2456, filed at California Division of Mines and Geology (CDMG), San Francisco.
C200 - Trench log or creep evidence in non-Alquist-Priolo consultant's report filed at CDMG.
G70 - Non-Alquist-Priolo unpublished report referenced in abbreviated references as G70.

ABBREVIATED MAP REFERENCES
(See text for full references)

A29	Soil Engineering Construction Company (1973)	A2458	Earth Systems Consultants (1988a)
A64	Gribaldo Jones and Associates (1970a)	A2459	Lettis and Associates (1991)
A70	Berlogar Long and Associates (1975)	A2460	Cleary Consultants Incorporated (1989)
A108	Rose (1974)	A2461	Earth Systems Consultants (1988b)
A170	Burkland and Associates (1975)	A2462	Earth Systems Consultants (1987a)
A380	Woodward-Clyde Consultants (1976)	A2514	California Department of Transportation (1991)
A436	Woodward-Clyde Consultants (1977)	A2516	Terrasearch Incorporated (1991)
A459	Terrasearch Incorporated (1977a)	A2522	Kaldveer and Associates (1981)
A477	Cooper-Clark and Associates (1974)	A2529	Harding Lawson Associates (1986)
A511	Burkland and Associates (1976a)	A2530	Lennert and Curtis (1985)
A538	Engeo Incorporated (1977)	A2566	Epigene Incorporated (1990)
A602	Terrasearch Incorporated (1977b)	A2582	Cooper Engineers (1986)
A618	Burkland and Associates (1977b)	A2586	Epigene Incorporated (1986)
A671	Burkland and Associates (1972)	A2589	Hull and Associates (1981)
A672	Burkland and Associates (1976b)	A2590	Terrasearch Incorporated (1990)
A679	Burkland and Associates (1973)	A2601	Harding Lawson Associates (1991)
A704	Terrasearch Incorporated (1977c)	B66	Bonilla (1966)
A716	Burkland and Associates (1976c)	B77	Burkland and Associates (1977c)
A727	Woodward-Clyde Consultants (1978b)	B81	Brown, Brekke, and Korbin (1981)
A735	Gribaldo Jones and Associates (1978)	B88A	Borchardt, Lienkaemper, Budding, and Schwartz (1988a)
A744	Woodward-Clyde and Associates (1970b)		
A784	Hull and Associates (1976)	B88B	Borchardt (1988)
A807	Purcell Rhoades and Associates (1976)	BL66	Blanchard and Laverty (1966)
A808	Hillebrandt Associates (1978)	BS82	Burford and Sharp (1982)
A871	Terrasearch Incorporated (1978)	C86	Cotton, Hall and Hay (1986)
A943	Burkland and Associates (1978)	C341	Woodward-Clyde Consultants (1978c)
A1075	Hull and Associates (1979)	C375	Woodward-Clyde Consultants (1978a)
A1080	Earth Systems Consultants (1979)	C487	Earth Systems Consultants (1980b)
A1153	Cotton and Associates (1979)	CC68	Cooper-Clark and Associates (1968)
A1153	Jones, W.F., Incorporated (1980)	CS66	Cluff and Steinbrugge (1966)
A1240	Earth Systems Consultants (1980a)	FER101	Smith (1980a)
A1281a	Myers Associates (1980)	G70	Gribaldo Jones and Associates (1970b)
A1281b	Earth Systems Consultants (1987b)	G91	Galehouse (1991)
A1299	Merrill and Seeley Incorporated (1979)	H82A	Hirschfeld (1982)
A1304	Earth Systems Consultants (1980c)	H82B	Hirschfeld, Ridley, and Nason (1982)
A1339	Myers Associates (1981)	HB82	Harsh and Burford (1982)
A1356	Zickefoose and Associates (1981)	L82	Lennert (1982)
A1473	Earth Systems Consultants (1981)	L91	Lienkaemper, Borchardt, and Lisowski (1991)
A1475	Burkland and Associates (1977a)	N71	Nason (1971)
A1519	Kaldveer and Associates (1982)	NC70	Nason, R.D. and Carey, J.P., 1970, unpublished data; see Woodward-Clyde (1970a).
A1705	Myers Associates (1984)		
A1898	Earth Systems Consultants (1983, 1986)	PL83	Prescott and Lisowski (1983)
A1992	Harding Lawson Associates (1987)	RC91	Rutherford and Chekene (1991)
A2046	Myers Associates (1987)	RH74	Radbruch-Hall (1974)
A2288	Purcell Rhoades and Associates (1989)	RL66	Radbruch and Lennert (1966)
A2341	Myers Associates (1989)	TP82	Taylor and Page (1982)
A2430	Soares and Associates (1986)	W91	Williams (1991)
A2454	Earth Systems Consultants (1985)	WB87	Wilmesher and Baker (1987)
A2456	Earth Systems Consultants (1990)	WC70	Woodward-Clyde and Associates (1970a)
A2457	Crosby and Associates (1989)	WL72	Woodward-Lundgren and Associates (1972)

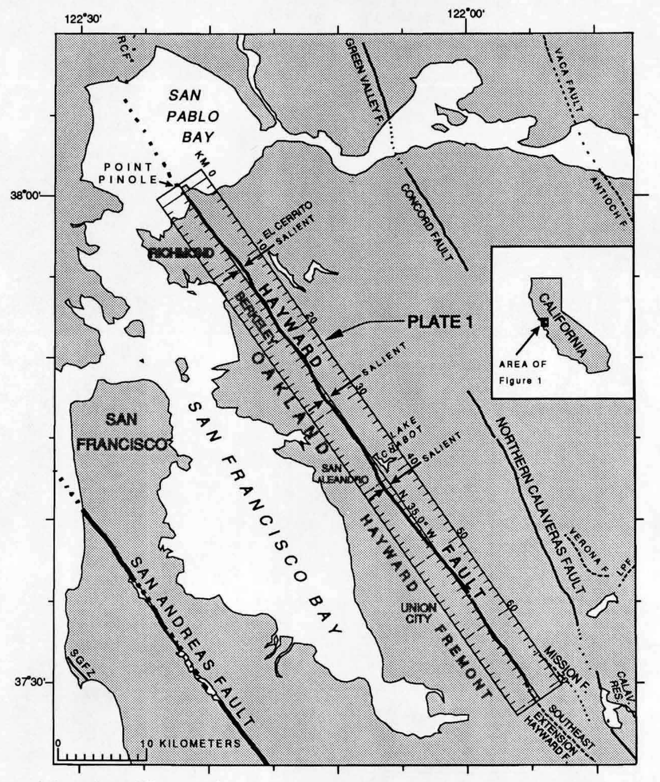


Figure 1. Location of Hayward Fault strip map. Strip map is divided into three overlapping sections: km 0-25, km 25-50, and km 50-70. See text for further description of kilometer grid. Salients marked by arrows indicate the three largest deviations of fault from a straight line parallel to the average strike of N. 35° W. Faults shown above are Holocene (see Lienkaemper and others (1991) for more). Abbreviations: CALAV. RES., Calaveras Reservoir; F., fault; KM, kilometer; LPF, Las Positas Fault; RCF, Rodgers Creek Fault; SGFZ, San Gregorio Fault Zone.

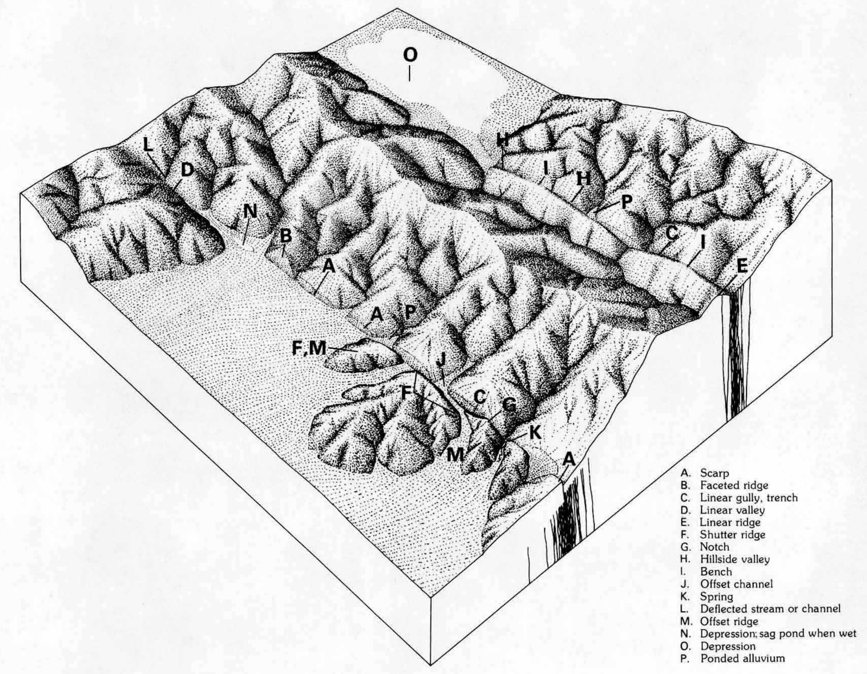


Figure 2. Block diagram showing landforms produced along recently active strike-slip faults. Modified from Sharp (1972).

MAP OF RECENTLY ACTIVE TRACES OF THE HAYWARD FAULT, ALAMEDA AND CONTRA COSTA COUNTIES, CALIFORNIA

By
James J. Lienkaemper

1992