DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF–626
SHEET 1 OF 3

A CONTRIBUTION OF THE NATIONAL CENTER FOR EARTHQUAKE RESEARCH OF THE GEOLOGICAL SURVEY

Prepared in cooperation with
Santa Cruz County
and the
Department of Housing and Urban Development

CLASSIFICATION OF FAULTS

I. From air photo interpretation

Recognized by linear and aligned surface features often associated with geologically young (Quaternary) faulting; identified on air photographs and locally verified by field examination. Linear features include scarps, ridges, trenches, valleys, benches, and vegetation boundaries. When aligned, features such as notches, springs, sag ponds, and deflections in adjacent stream channels suggested the presence of a fault.

Fault

Horizontal (strike-slip) movement shown by arrows; Vertical (dip-slip) movement shown by U = up, D = down

Probable fault

Dashed where exposed at earth's surface; dotted where concealed beneath younger deposits or water

Possible fault

Dashed where exposed at earth's surface; dotted where concealed beneath younger deposits

Photolineament of Unknown Origin

II. From field mapping

Compiled primarily from Brabb (1970 and unpublished data), Clark (1966, 1970) and Clark and Reitman (1973). Recognized by anomalous relations between rock units such as offset layers and disrupted age sequences, and from outcroppings of sheared rocks and fault gouge. Most bedrock faults are of Tertiary age or older.

Bedrock fault

Dashed where approximately located; dotted where concealed beneath younger deposits or water. Horizontal (strike-slip) movement shown by arrows; vertical (dip-slip) movement shown by U = up, D = down

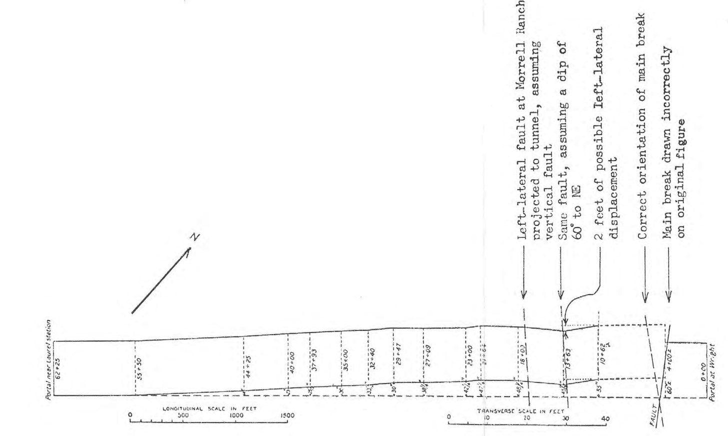
Inferred bedrock fault

III. From offshore geophysical surveys

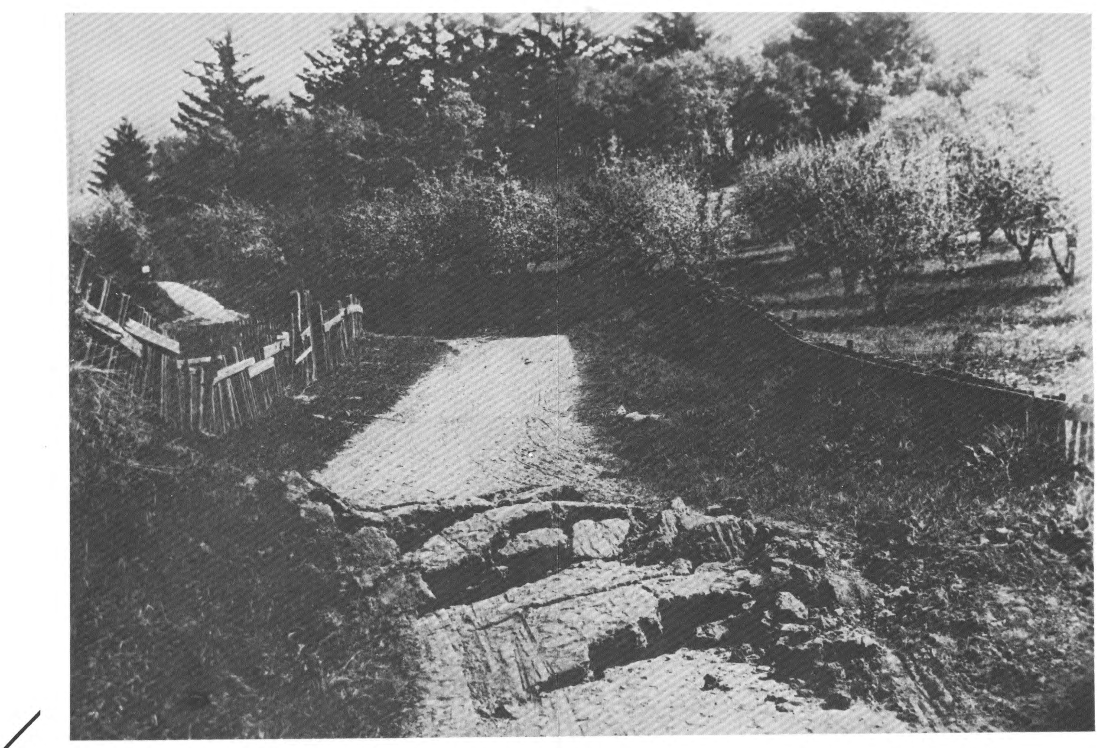
Recognized from continuous subbottom seismic reflection profiles made by the U.S. Geological Survey in 1969-70 (Greene and others, 1973). Faults identified by scarps on the sea floor, displacements in the young sea bottom sediment, and discontinuities in the subbottom deposits.

Offshore fault

Solid where well defined; dashed where approximately located or poorly defined; queried where questionably located or obscure; dotted where concealed beneath younger deposits

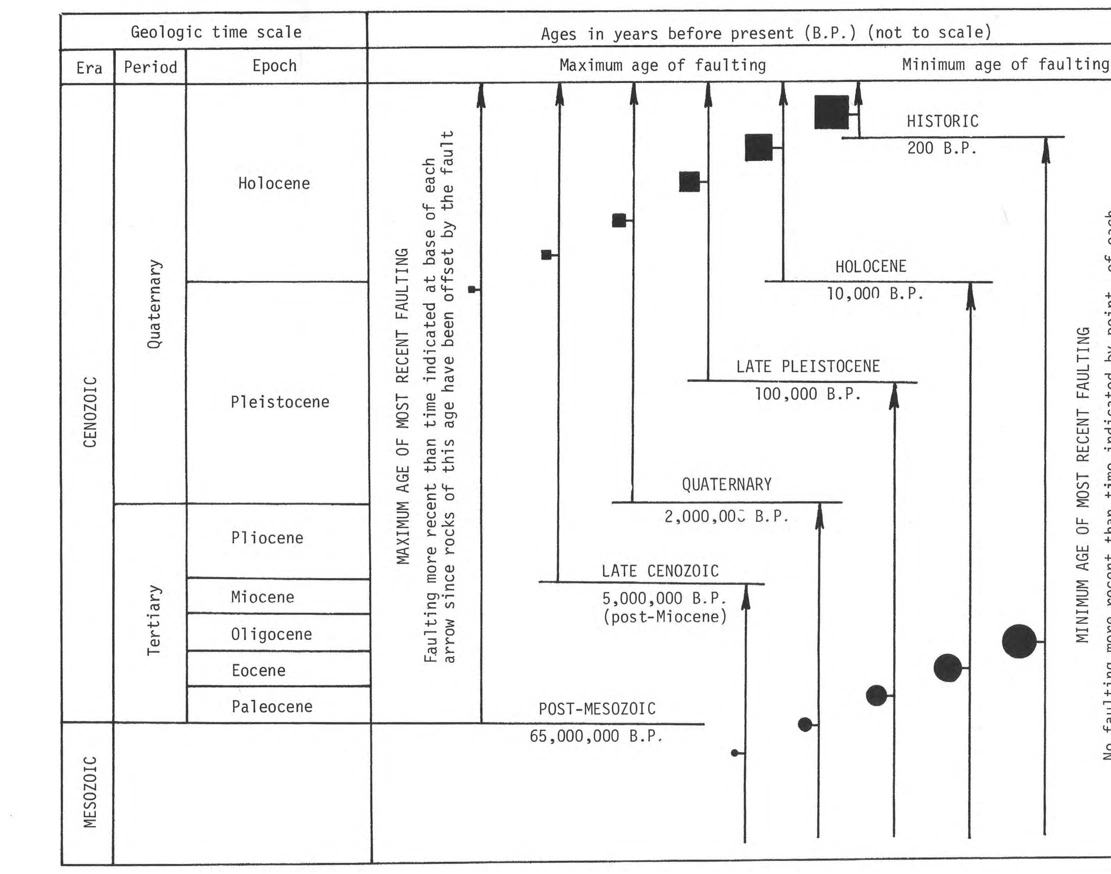


1200 m (4000 ft)-wide zone of deformation as shown by distortions within the old tunnel of the Pacific Coast Railroad Co., near Wright's Station (Wrights), after the 1906 earthquake, and projection of the left-lateral fault at the old Morrell Ranch (see photograph below) to the tunnel. Projection of this fault assuming a 60° dip to the northeast intersects the tunnel near a reentrant in the tunnel wall which may represent as much as 5 feet of left-lateral displacement. The trend of the main break in the original figure is drawn incorrectly. (Modified from Lawson, 1908, Fig. 47)



Left-lateral offset in the road at the Morrell Ranch above the tunnel at Wright's Station (Lawson, 1908, pl. 65A). Although this sense of movement is atypical of the San Andreas fault zone, this photograph shows the nature of ground disturbance formed along a fault during a major earthquake.

SYMBOLS FOR AGE OF FAULTING



AGE OF MOST RECENT SURFACE FAULTING

Uncertain / Probable / Definite

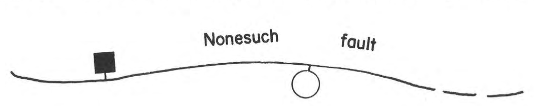
MAXIMUM AGE Determined by age of youngest geologic or cultural feature broken by the fault

MINIMUM AGE Determined by age of oldest geologic or cultural feature not broken by the fault

INTERPRETATION OF SYMBOLS FOR AGE OF FAULTING

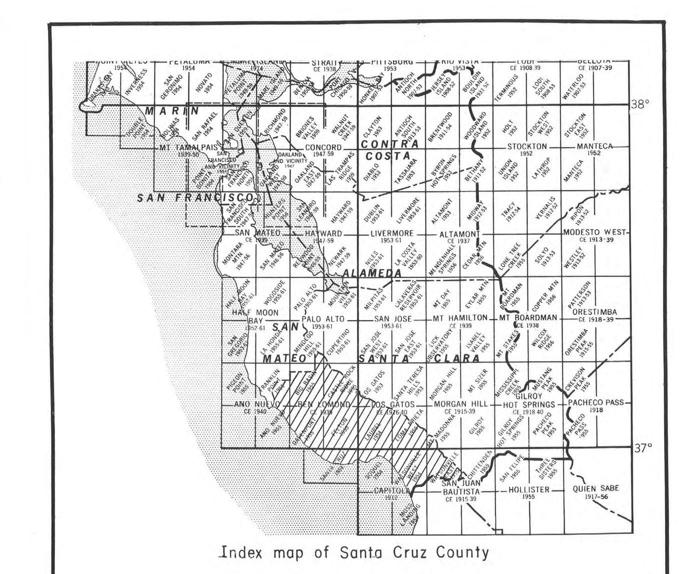
Where sufficient geologic information is available, it is possible to place narrow limits on the time of most recent faulting at the earth's surface. The age of the youngest feature offset by the fault establishes the "bottom" or maximum age of this time interval because the most recent activity of the fault cannot be older than the youngest offset feature. Similarly the age of the oldest feature that crosses the fault but is not offset by it establishes the "top" or the minimum age for the interval of most recent faulting. How closely the interval of most recent surface faulting can be resolved depends in part upon the nature of the geologic deposits adjacent to or across the fault and in part upon the geologist's ability to interpret their age.

A hypothetical example of how to read the symbols which indicate age of faulting is given below:

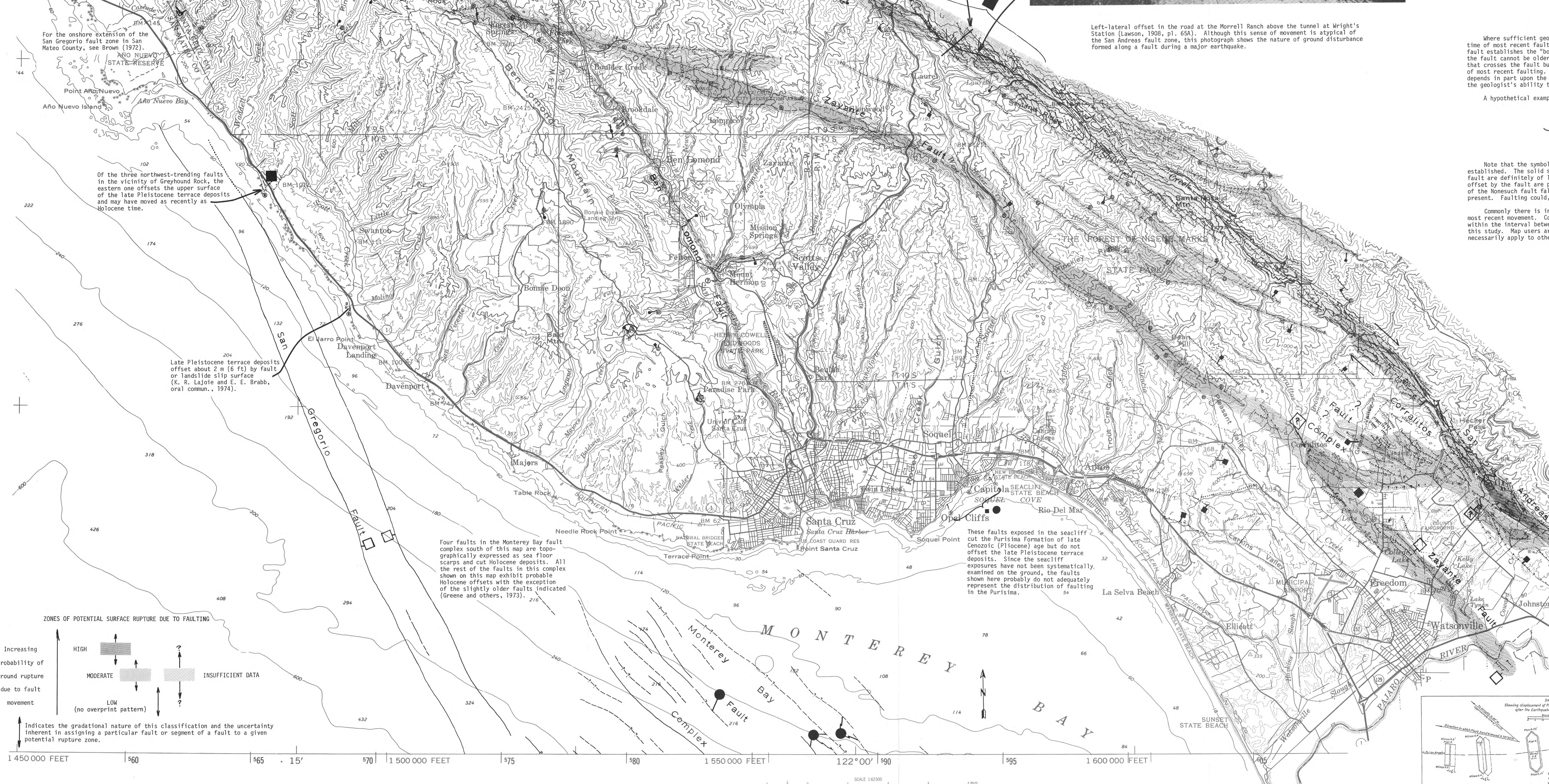


Note that the symbols are attached to the fault at the places where the age relations have been established. The solid square symbol indicates that the youngest datable deposits cut by the Nonesuch fault are definitely of late Pleistocene age. The open circle indicates that the oldest deposits not offset by the fault are probably, but not definitely, of Holocene age. Hence the most recent faulting of the Nonesuch fault falls in the time interval between approximately 100,000 and 10,000 years before present. Faulting could, of course, have taken place any time or several times within this interval.

Commonly there is insufficient geologic evidence to establish with confidence the minimum age of most recent movement. Consequently faults which lack a minimum age symbol could have moved at any time within the interval between very recent historic time and the time of maximum age established during this study. Map users are cautioned that the age relations established for one segment of a fault do not necessarily apply to other segments of the same fault.



Index map of Santa Cruz County



For the onshore extension of the San Gregorio fault zone in San Mateo County, see Brown (1972).

Of the three northwest-trending faults in the vicinity of Greyhound Rock, the eastern one offsets the upper surface of the late Pleistocene terrace deposits and may have moved as recently as Holocene time.

Late Pleistocene terrace deposits offset about 2 m (6 ft) by fault or landslide slip surface (K. R. Lajoie and E. E. Brabb, oral commun., 1974).

Four faults in the Monterey Bay fault complex south of this map are topographically expressed as sea floor scarps and cut Holocene deposits. All the rest of the faults in this complex shown on this map exhibit probable Holocene offsets with the exception of the slightly older faults indicated (Greene and others, 1973).

These faults exposed in the seacliff cut the Purisima Formation of late Cenozoic (Pliocene) age but do not offset the late Pleistocene terrace deposits. Since the seacliff exposures have not been systematically examined on the ground, the faults shown here probably do not adequately represent the distribution of faulting in the Purisima.

These lines delineate ground failure features such as bedrock scarps and sag ponds possibly caused by concentration of seismic energy along ridge crests.

ZONES OF POTENTIAL SURFACE RUPTURE DUE TO FAULTING

Increasing probability of ground rupture due to fault movement

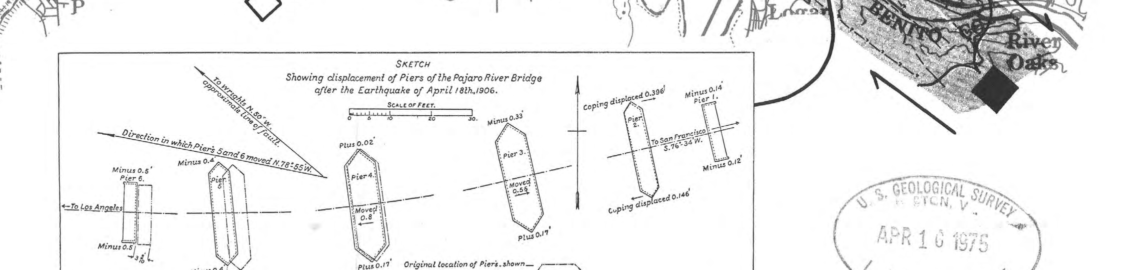
HIGH

MODERATE

INSUFFICIENT DATA

LOW
(no overprint pattern)

Indicates the gradational nature of this classification and the uncertainty inherent in assigning a particular fault or segment of a fault to a given potential rupture zone.



Displacement of steel piers of railroad bridge at Chittenden (Lawson, 1908, Fig. 43)

FAULTS AND THEIR POTENTIAL HAZARDS IN SANTA CRUZ COUNTY, CALIFORNIA

by

N. Timothy Hall, Andrei M. Sarna-Wojcicki, and William R. Dupré

1974

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