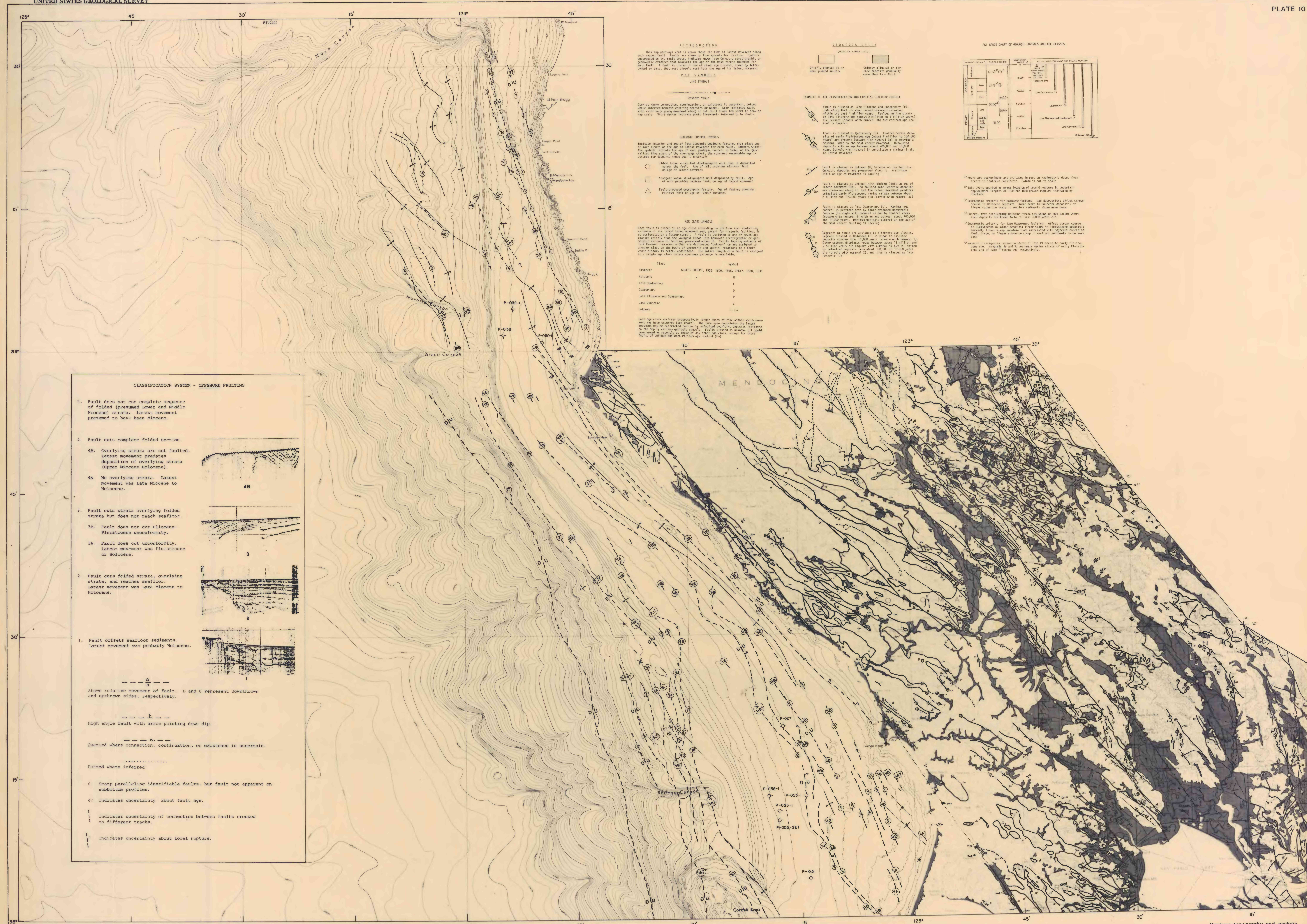
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
80-1095

PLATE 10



INTRODUCTION

This map portrays what is known about the time of latest movement along each mapped fault. Faults are shown by line symbols for location. Symbols superposed on the fault traces indicate known late Cenozoic stratigraphic or geomorphic evidence that brackets the age of the most recent movement for each fault. A fault is placed in one of seven age classes, shown by letter symbol or date, that most closely restricts the age of its latest movement.

MAP SYMBOLS

LINE SYMBOLS

Onshore fault

Queried where connection, continuation, or existence is uncertain; dotted where inferred beneath covering deposits or water. Star indicates fault with relatively young movement along it but fault trace too short to show at map scale. Short dashes indicate photo lineaments inferred to be faults

GEOLOGIC CONTROL SYMBOLS

Indicate location and age of late Cenozoic geologic features that place one or more limits on the age of latest movement for each fault. Numbers within the symbols indicate the age of each geologic control as based on the generalized time spans of the age-range chart; the youngest reasonable age is assumed for deposits whose age is uncertain

○ Oldest known unfaulted stratigraphic unit that is deposited across the fault. Age of unit provides minimum limit on age of latest movement

□ Youngest known stratigraphic unit displaced by fault. Age of unit provides maximum limit on age of latest movement

△ Fault-produced geomorphic feature. Age of feature provides maximum limit on age of latest movement

AGE CLASS SYMBOLS

Each fault is placed in an age class according to the time span containing evidence of its latest known movement and, except for historic faulting, is so designated by a letter symbol. A fault is assigned to one of seven age classes chiefly from the youngest known late Cenozoic stratigraphic or geomorphic evidence of faulting preserved along it. Faults lacking evidence of late Cenozoic movement either are designated "unknown" or are assigned to another class on the basis of geometric and spatial relations to a fault whose history is better understood. The entire length of a fault is assigned to a single age class unless contrary evidence is available.

Class	Symbol
Historic	CREEP, CREEP?, 1906, 1890, 1868, 1861?, 1838, 1836
Holocene	H
Late Quaternary	L
Quaternary	Q
Late Pliocene and Quaternary	P
Late Cenozoic	C
Unknown	U, Um

Each age class encloses progressively longer spans of time within which movement may have occurred (see chart). The time span containing the latest movement may be restricted further by unfaulted overlying deposits indicated on the map by minimum geologic symbols. Faults classed as unknown (U) could have moved as recently as those of any other age class, except for those faults of unknown age with minimum age control (Um).

GEOLOGIC UNITS

(onshore areas only)

Chiefly bedrock at or near ground surface

Chiefly alluvial or terrace deposits generally more than 15 m thick

EXAMPLES OF AGE CLASSIFICATION AND LIMITING GEOLOGIC CONTROL

Fault is classed as late Pliocene and Quaternary (P), indicating that its most recent movement occurred within the past 4 million years. Faulted marine strata of late Pliocene age (about 2 million to 4 million years) are present (square with numeral 3b) but minimum age control is lacking

Fault is classed as Quaternary (Q). Faulted marine deposits of early Pleistocene age (about 2 million to 700,000 years) are present (square with numeral 3a) to provide a maximum limit on the most recent movement. Unfaulted deposits with an age between about 700,000 and 10,000 years (circle with numeral 2) constitute a minimum limit on latest movement

Fault is classed as unknown (U) because no faulted late Cenozoic deposits are preserved along it. A minimum limit on age of movement is lacking

Fault is classed as unknown with minimum limit on age of latest movement (Um). No faulted late Cenozoic deposits are preserved along it, but the latest movement predates unfaulted early Pleistocene marine strata between about 2 million and 700,000 years old (circle with numeral 3a)

Fault is classed as late Quaternary (L). Maximum age control is provided both by fault-produced geomorphic feature (triangle with numeral 2) and by faulted rocks (square with numeral 2) with an age between about 700,000 and 10,000 years. Minimum geologic control on the age of the most recent faulting is lacking

Segments of fault are assigned to different age classes. Segment classed as Holocene (H) is known to displace deposits younger than 10,000 years (square with numeral 1). Other segment displaces rocks between about 12 million and 4 million years old (square with numeral 4) but is limited by unfaulted deposits from about 700,000 to 10,000 years old (circle with numeral 2), and thus is classed as late Cenozoic (C)

AGE RANGE CHART OF GEOLOGIC CONTROLS AND AGE CLASSES

GEOLOGIC TIME SCALE
GEOLOGIC CONTROL
YEARS BEFORE PRESENT 1/
FAULT CLASSES CONTAINING AGE OF LATEST MOVEMENT
QUATERNARY
TERTIARY
Holocene
Pleistocene
Pliocene
Miocene
Late
Early
Middle and early
Pre-late Miocene
0
10,000
700,000
2 million
4 million
12 million
Historic 2/
(Creep, creep? 1906, 1890, 1868, 1861? 1838, 1836)
Holocene (H)
Late Quaternary (L)
Quaternary (Q)
Late Pliocene and Quaternary (P)
Late Cenozoic (C)
Unknown (U)

1/ Years are approximate and are based in part on radiometric dates from strata in southern California. Column is not to scale.

2/ 1861 event queried as exact location of ground rupture is uncertain. Approximate lengths of 1836 and 1838 ground rupture indicated by brackets.

3/ Geomorphic criteria for Holocene faulting: sag depression; offset stream course in Holocene deposits; linear scarp in Holocene deposits; or linear submarine scarp in seafloor sediments above wave base.

4/ Control from overlapping Holocene strata not shown on map except where such deposits are known to be at least 3,000 years old.

5/ Geomorphic criteria for late Quaternary faulting: offset stream course in Pleistocene or older deposits; linear scarp in Pleistocene deposits; markedly linear steep mountain front associated with adjacent concealed fault trace; or linear submarine scarp in seafloor sediments below wave base.

6/ Numeral 3 designates nonmarine strata of late Pliocene to early Pleistocene age. Numerals 3a and 3b designate marine strata of early Pleistocene and of late Pliocene age, respectively.

CLASSIFICATION SYSTEM - OFFSHORE FAULTING

5. Fault does not cut complete sequence of folded (presumed Lower and Middle Miocene) strata. Latest movement presumed to have been Miocene.

4. Fault cuts complete folded section.

4B. Overlying strata are not faulted. Latest movement predates deposition of overlying strata (Upper Miocene-Holocene).

4A. No overlying strata. Latest movement was Late Miocene to Holocene.

4B

3. Fault cuts strata overlying folded strata but does not reach seafloor.

3B. Fault does not cut Pliocene-Pleistocene unconformity.

3A. Fault does cut unconformity. Latest movement was Pleistocene or Holocene.

3

2. Fault cuts folded strata, overlying strata, and reaches seafloor. Latest movement was Late Miocene to Holocene.

2

1. Fault offsets seafloor sediments. Latest movement was probably Holocene.

1

Shows relative movement of fault. D and U represent downthrown and upthrown sides, respectively.

High angle fault with arrow pointing down dip.

Queried where connection, continuation, or existence is uncertain.

Dotted where inferred

S Scarp paralleling identifiable faults, but fault not apparent on subbottom profiles.

4? Indicates uncertainty about fault age.

? Indicates uncertainty of connection between faults crossed on different tracks.

? Indicates uncertainty about local rupture.

Bathymetry from NOS Chart 1307N-18B

Onshore topography and geology from Pampeyan, 1979.
Offshore geology by D.M. Rubin, 1980.

FAULT AND STRUCTURE MAP OF BODEGA AND ARENA BASINS, CALIFORNIA

WORK DONE IN COOPERATION WITH U.S. BUREAU OF LAND MANAGEMENT

Scale 1:250,000

5 0 5 10 15 20 25 30 KILOMETERS

5 0 5 10 15 NAUTICAL MILES