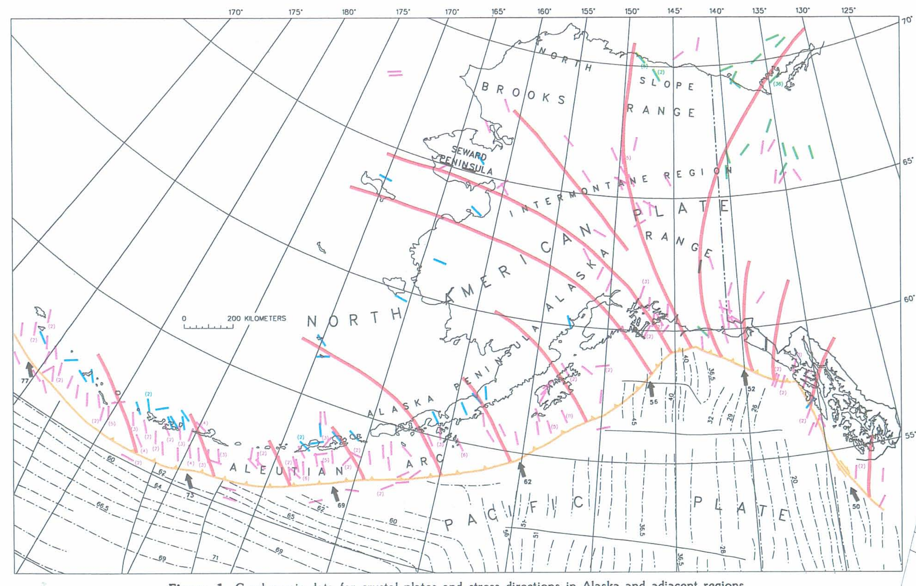


Figure 1. Geodynamic data for crustal plates and stress directions in Alaska and adjacent regions.

EXPLANATION

Plate displacement rate—Direction and amount of movement in mm/yr of Pacific plate relative to North America (DeMets and others, 1990)

Magnetic anomaly—Sea-floor magnetic lineations (Drummond, 1984). Number indicates approximate age in Ma for those lineations that can be tied to the geomagnetic polarity time scale

Stress direction indicator—Bar indicates direction of the maximum horizontal component of stress. Number in parentheses indicates that direction shown is an average for more than one data set

Active fault slip vector—Modified from Nakamura and others (1980)

Selected earthquake focal mechanism—Selected mechanisms from Adams (1985) and Zoback and others (1991)

Volcanic vent and fissure alignment—After Nakamura and others (1980)

Selected well bore deformation or breakout—Canada data from Gough and others (1983) and Bell and others (1986), Gulf of Alaska data from Hoffman and others (1979)

Inferred regional maximum horizontal stress trajectory—Modified from Nakamura and others (1980) and Plafker and Jacob (1985)

Plate boundary fault—Arrows indicate relative horizontal movement, sawteeth on upper plate of thrust

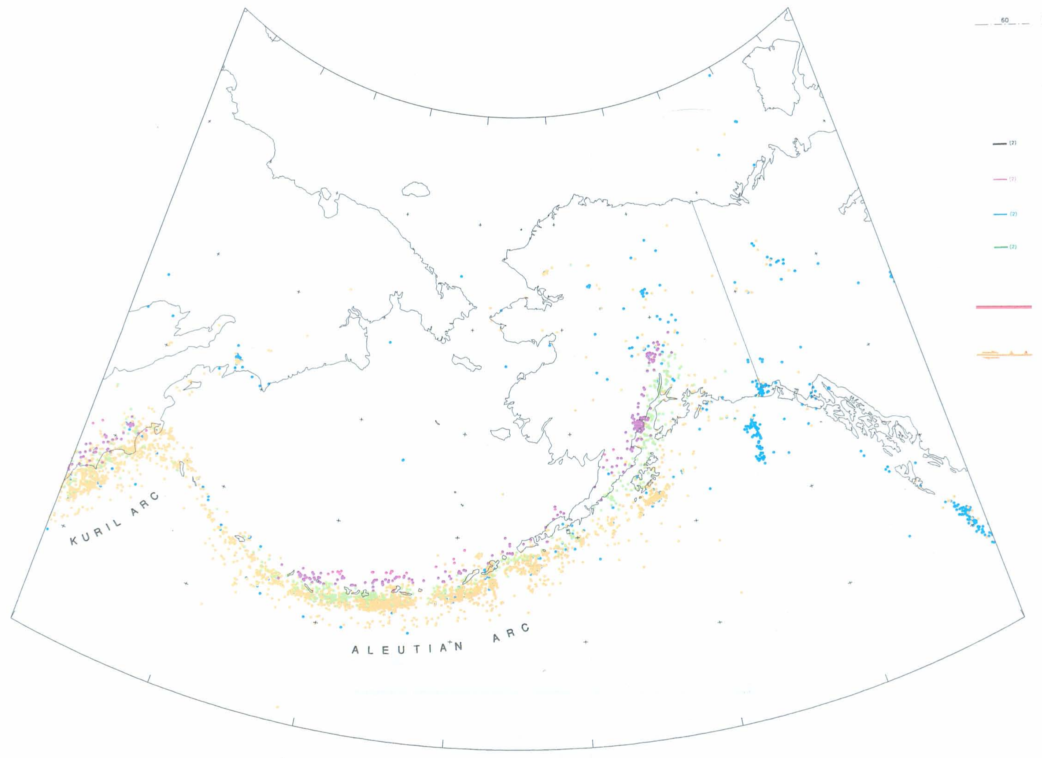


Figure 2. Seismicity of Alaska and adjacent regions from January 1, 1975 to April 30, 1992, showing earthquakes having associated body-wave magnitude of 4.5 or greater (data furnished by Susan Goter, National Earthquake Information Center, June, 1992).

EXPLANATION

Depth of focus

- 0-25 kilometers
- 26-50 kilometers
- 51-100 kilometers
- 101-200 kilometers
- ≥201 kilometers (Kuril arc only)

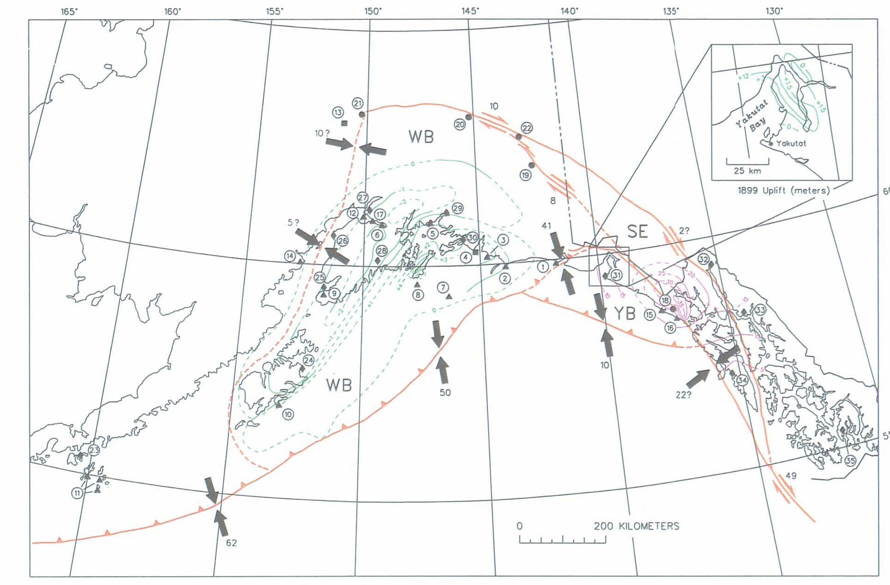


Figure 3. Neotectonic displacements and displacement-rate data for southern Alaska.

EXPLANATION

Plate and block boundaries—Known and inferred boundaries of active crustal plates and tectonic blocks delineated by seismicity and late Holocene faults; dashed where inferred or uncertain. Sawteeth on upper plate of thrust fault. WB, Wrangell block; SE, Saint Elias block; YB, Yakutat block

Horizontal displacement rate—Direction and amount of movement in mm/yr across crustal plate and tectonic block boundaries (DeMets and others, 1990; Lahr and Plafker (1980)

Locality at which horizontal displacement rate of strike-slip fault has been determined—An age of 10,000 years is assumed for offset late Pleistocene glacial deposits. Numbers refer to table 3

Vertical displacement—Isobase contours in meters; dashed where inferred

Coseismic uplift and subsidence—In meters per year for the 1964 Alaska earthquake (Plafker, 1969) and 1899 Yakutat Bay earthquakes (Tarr and Martin, 1912; Plafker and Thatcher, 1982)

Gradual historic regional uplift in millimeters per year in southeastern Alaska—Determined from tide gage data for 20-yr period from 1959-1979 (Hicks and Shofnos, 1965; Hudson and others, 1982a). Uplift mainly due to glacio-isostatic rebound, but may include a tectonic component

Vertical displacement rate—Includes tectonic and isostatic components of deformation. Coastal data assume average 1.5 mm/yr late sea level rise since 6,000 years b. p. (Bard and others, 1990)

Locality at which historic vertical displacement rate of strandline has been determined from tide gage data—Numbers refer to table 3

Locality at which late Holocene vertical displacement rate of strandline has been determined by ¹⁴C dating—Numbers refer to table 3

Locality at which late Cenozoic uplift rate has been determined by fission-track dating—Numbers refer to table 3

EXPLANATORY NOTE

This plate portrays deformation related to the Paleogene (post-Oligocene) tectonic regime in the shallow crust of Alaska. Features depicted on the map are the Paleogene faults, folds, volcanic rocks, active thermal springs, focal regions and epicenters of major earthquakes, and the configuration of the Pacific plate beneath the margin of southern Alaska. These neotectonic features, and the regional horizontal stress trajectories inferred from them, are primarily associated with strains across the boundary between the Pacific and North American plates. The figures show relative motions of crustal plates and of tectonic blocks (Figure1), the distribution of seismicity (Figure 2), and coseismic deformation and localities at which neotectonic displacements and displacement rates have been determined (Figure 3).

MAP EXPLANATION

Faults and lineaments—See table 1 for principal data sources. Submarine faults on the continental shelves and slope based on marine seismic-reflection profile records with at least three crossings in 20 km of fault length. In offshore areas of multiple faults, fault zone is named. Aleutian megathrust and Transition fault traces based on widely spaced reflection profiles and on more detailed bathymetric data; traces shown represent the seaward extent of active deformation associated with plate-bounding structures and it is likely that active faulting associated with these structures is complex and includes faults on slope and outer shelf that can not be resolved with available data

Fault or lineament—Dashed where approximately located or inferred, dotted where concealed by unconsolidated deposits, water, bays, or ice, queried where uncertain. U - relatively upthrown side, D - relatively downthrown side; arrows indicate relative horizontal movement

Thrust fault—sawteeth on upper plate

Oblique thrust fault—Barbs on upper plate; arrows indicate relative horizontal movement

Submarine offset strata—Probable Neogene age, identified in seismic reflection records; orientation and continuity uncertain because crossings are too widely spaced

1959 **Age of most recent fault movement**—Color band denotes age category

Historic—Fault along which displacement is known to have occurred or is inferred (post-1796) and is associated with one or both of the following: (a) a recorded earthquake with observed surface rupture (1880? Chirikof, 1958 Fairweather, and 1964 Alaska) or inferred buried rupture (1984 event on Talkeetna segment of Castle Mountain fault and April 2, 1981 event on Susitna-Chisana segment of the Denali fault), (b) earthquake(s) for which surface rupture can be reasonably inferred from dislocation modeling of vertical strandline displacements (1899 Yakutat Bay earthquakes) and (or) seismic data (Aleutian megathrust earthquakes, 1973 Cross Sound, 1972 Sitka, and 1949 Queen Charlotte earthquake sequences). Triangles are located at the ends of the fault rupture or seismic zone and date indicates the earthquake with which it is known or inferred to have ruptured

Holocene—Fault displacement during about last 11,000 years without historic record. Recognized by scarps in alluvium, terraces, or other Holocene units; offset stream courses; alignment of fault-related topographic depressions (sag ponds, fault troughs, and fault saddles); linear, steep mountain fronts; and fault-bounded range fronts

Late Pleistocene—Fault displacement that offsets late Quaternary deposits and surfaces (approximately 500,000 to 11,000 years) without younger historic or Holocene record

Quaternary—Fault displacement that offsets undifferentiated Quaternary deposits or surfaces (approximately 2 million to 11,000 years) without younger historic, Holocene, or late Pleistocene record

Neogene—Fault displacement that offsets late Cenozoic units or surfaces (less than about 24 million years) without historic, Holocene, late Pleistocene, or Quaternary record

Pre-Neogene—Fault displacement offsets Paleogene units (older than about 24 million years) without historic, Holocene, late Pleistocene, or Quaternary record

Suspicious—Age of fault or lineament displacement is unknown. Nearby shallow seismicity, and/or known Neogene faults with similar orientation indicates the possibility of Neogene displacement

Folds in Neogene strata—Does not include many folds in the Gulf of Alaska that are associated with thrust faults

Monocline

Syncline

Anticline

Seismicity—Earthquakes recorded from 1899 to 1988 with magnitudes greater than 7.0 ($m_B/M_s/M_w$); the record is incomplete for events prior to the early 1900's. See table 2 for data tabulation and data sources

Rupture zone of large earthquake on plate boundary—Defined by spatial distribution of aftershocks (modified from Davies and others, 1981). Mainshock date indicated

Earthquake epicenter ≤50km depth with magnitude 7.0-7.2 (M_s)

Earthquake epicenter ≤50km depth with magnitude 7.3-7.7 (M_s)

Earthquake epicenter ≤50km depth with magnitude >7.8 (M_s)

Earthquake epicenter >50km depth with magnitude 7.0-7.2 (mg)

Earthquake epicenter >50km depth with magnitude 7.3-7.7 (mg)

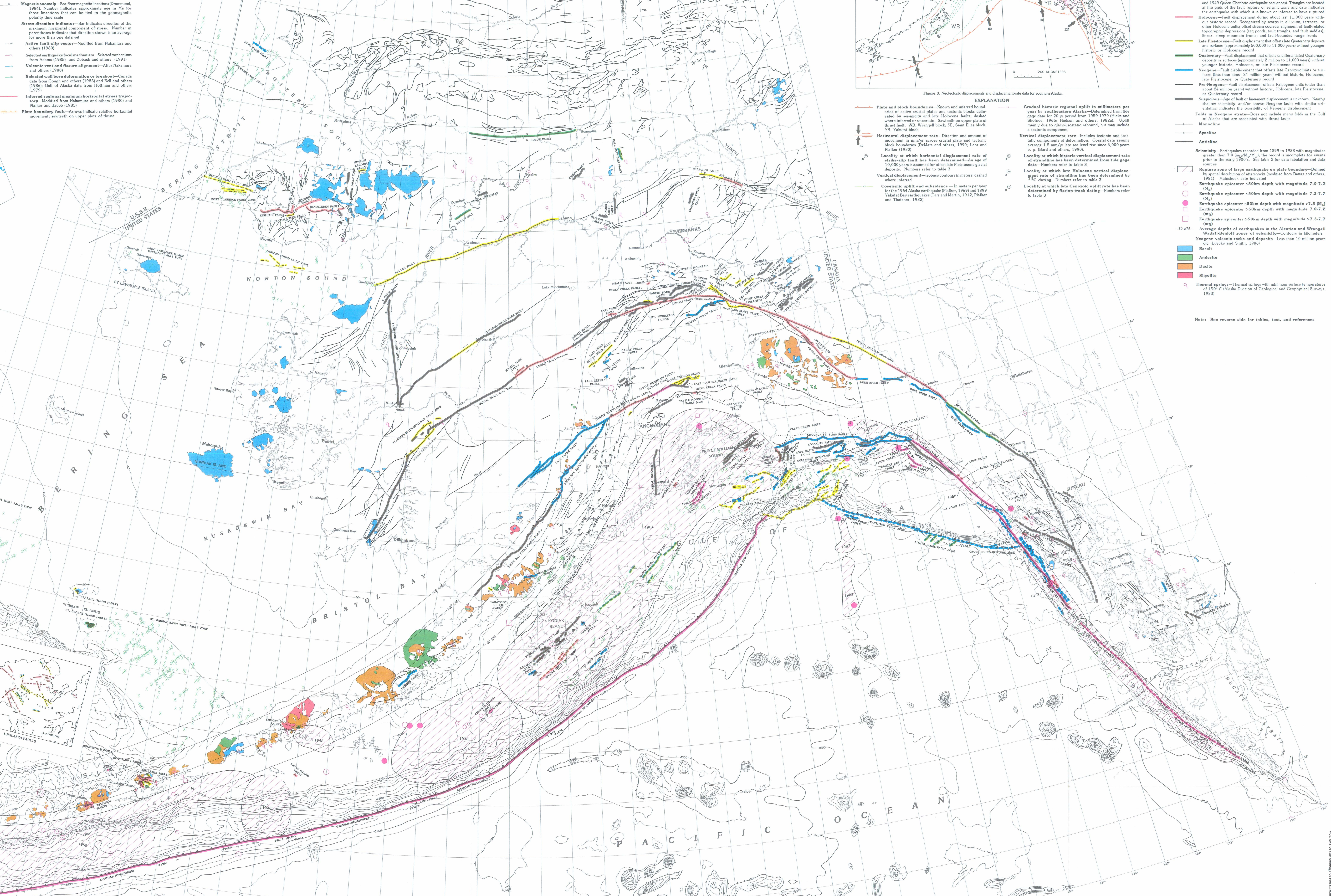
Average depths of earthquakes in the Aleutian and Wrangell Wadati-Benioff zones of seismicity—Contours in kilometers

Neogene volcanic rocks and deposits—Less than 15 million years old (Luedke and Smith, 1986)

- Basalt
- Andesite
- Dacite
- Rhyolite

Thermal springs—Thermal springs with minimum surface temperatures of 150° C (Alaska Division of Geological and Geophysical Surveys, 1983)

Note: See reverse side for tables, text, and references



Base from U.S. Geological Survey National Atlas, 1970

Bathymetry from U.S. Geological Survey Open-File maps 78-821, 78-822, and 78-823, 1978

Albers equal area projection based on standard parallels 55° and 65°

SCALE 1:2 500 000

50 0 50 100 150 200 250 MILES

50 0 50 100 150 200 250 KILOMETERS

NEOTECTONIC MAP OF ALASKA

by

George Plafker, L.M. Gilpin, and J.C. Lahr

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Plate 12. Neotectonic map of Alaska
Geology of Alaska
Vol. G-1 of the Geology of North America (GNA-G1)