CIRCUM-PACIFIC MAP SERIES
MAP CP-37

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

CIRCUM-PACIFIC MAPS

This map is one in a series of maps covering the Pacific, Antarctic, and Arctic regions. The maps have been compiled as part of the Circum-Pacific Map Project, a cooperative international effort to show the relation of mineral and energy resources to such phenomena as geology, tectonics, and crustal dynamics. The project is one of the activities of the Circum-Pacific Council for Energy and Mineral Resources.

The Map Project is made up of six panels of Earth scientists from countries in the Pacific region who contribute to maps of the Northwest, Northeast, Southwest, Southeast Quadrants, the Arctic and Antarctic areas. Eight series of maps are already published or are being prepared for future publication: Geographic, Base, Plate-Tectonic, Geodynamic, Geologic, Tectonic, Mineral-Resources, and Energy-Resources.

The six overlapping maps cover the Pacific Basin at a scale of 1:10 million, and a seventh map covers the entire region at a scale of 1:17 million. All are plotted on the Lambert azimuthal equal-area projection. The index map shows the boundaries of the quadrant maps and the boundaries of the Arctic and Antarctic Sheets in the Pacific Ocean.

Geographic names are as recommended by the U.S. Board on Geographic Names, taking into account the recommendations of the Circum-Pacific Map Project panels. Names and boundaries on the maps do not necessarily reflect recognition of the political status of an area by those involved in the preparation and publication of these maps.

TECTONIC MAP SERIES

The Tectonic Map distinguishes the areas of oceanic and continental crust. Symbols in red mark active plate boundaries and colored patterns show tectonic units (volcanic or magmatic arcs, arc-trench gaps, and interarc basins) associated with active plate margins. Well-documented inactive plate boundaries are shown by symbols in black. The structural development of the oceanic area is shown by episodes of seafloor spreading based on magnetic anomalies. Oceanic plateaus and other prominences of greater than normal oceanic crustal thickness such as hotspot traces are also shown. Colored areas on the continents show the ages of deformation and metamorphism of basement rocks and emplacement of igneous rocks. The transitional tectonic (molassic) and reactivation basins are shown by a colored boundary; and if they are deformed, a colored horizontal hatching indicates the age of deformation. Colored patterns at separated continental margins show the age of inception of rift (prebreakup) and drift (breakup) sequences. Symbols mark folds and faults, and special symbols show volcanoes and other structural features.

SOURCES OF DATA

TECTONIC ELEMENTS AND STRUCTURAL DATA
Boundaries on land areas from the Geologic Map of the Circum-Pacific Region, Southwest Quadrant (Doutch, 1987), based on stratotectonic rather than time-stratigraphic units. Sources of plate-tectonic elements from Doutch (1986). Additional sources of data listed in the Explanatory Notes that accompany this map.

MAGNETIC LINEATIONS
Magnetic lineations principally from the Plate-Tectonic Map of the Circum-Pacific Region, Southwest Quadrant, 3rd edition (Doutch, 1986). Additional data from Malahoff et al (1982), G.W. Moore (pers. comm., 1985), R.S. Shaw (pers. comm., 1985), B. Taylor (pers. comm., 1985), Taylor and Hayes (1980, 1983), Johnson and Veevers (1984), and Tamaki and Larson (1988).

PALEOMAGNETIC DATA
Selected paleomagnetic data from J.J. Embleton (pers. comm., 1985), M.W. McElhinny (pers. comm., 1985), Falvey (1978), Falvey and Pritchard (1984), Jarrard and Sasajima (1980), R. McCabe (pers. comm., 1985), and McCabe et al (1982)

HOLOCENE VOLCANOS
Plotted with additions from the computerized Smithsonian Institution Volcano Reference File (Simkin et al, 1981) by the U.S. Geological Survey, Reston, Virginia. The contributions to the file by Lindsay McClelland, Smithsonian Institution, and John H. Latter, New Zealand Department of Industrial Research, and by many compilers of the International Association of Volcanology and the Volcanological Society of Japan are especially acknowledged. Submarine rift volcanism is not included.

ACTIVE PLATE BOUNDARIES
Adapted from boundaries on the Plate-Tectonic Map of the Circum-Pacific Region, Southwest Quadrant, 3rd edition (Doutch, 1986) with some modifications.

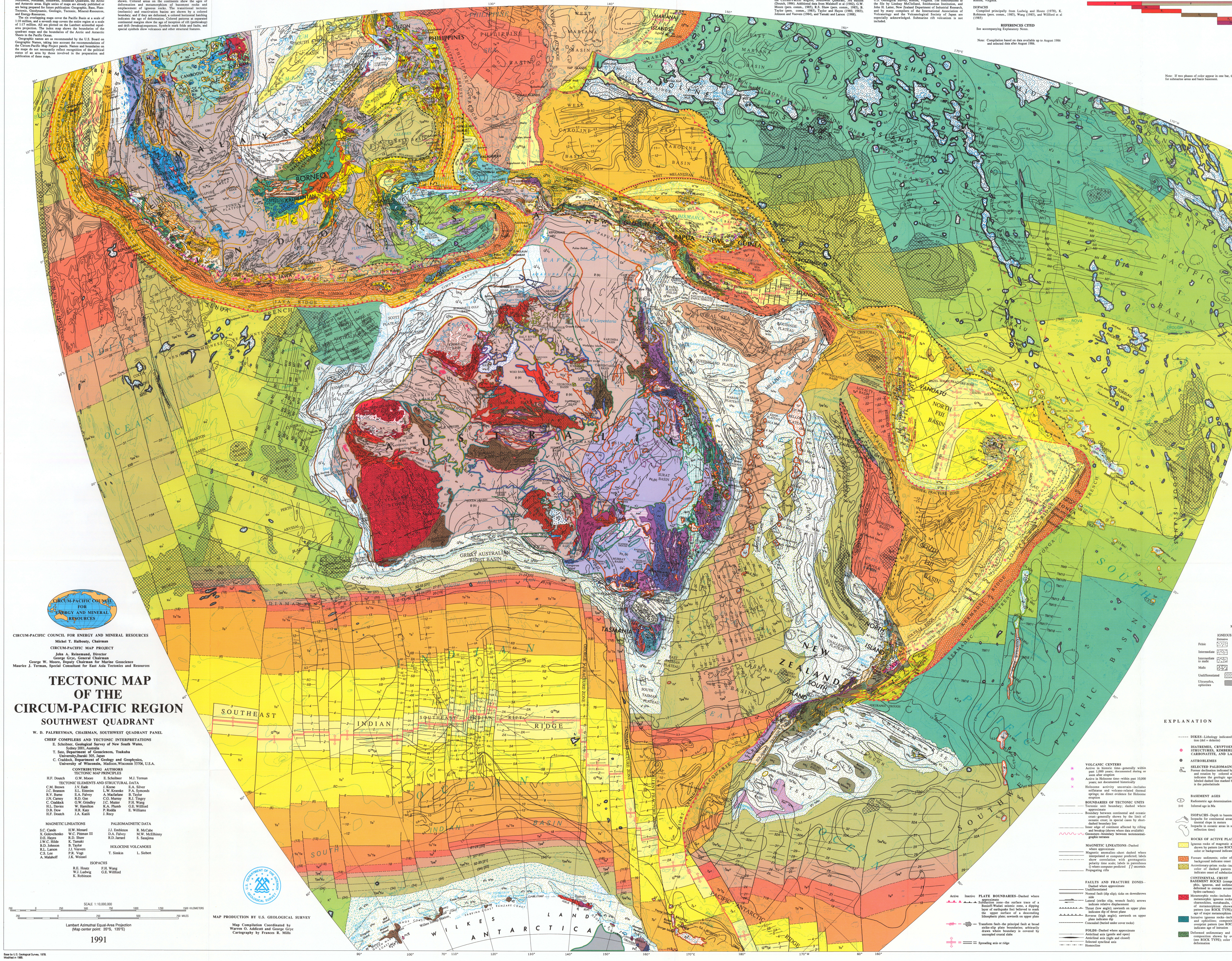
BASE MAP
Updated from the Geographic Map of the Circum-Pacific Region, Southeast Quadrant, American Association of Petroleum Geologists (1978), compiled by the U.S. Geological Survey, Reston, Virginia.

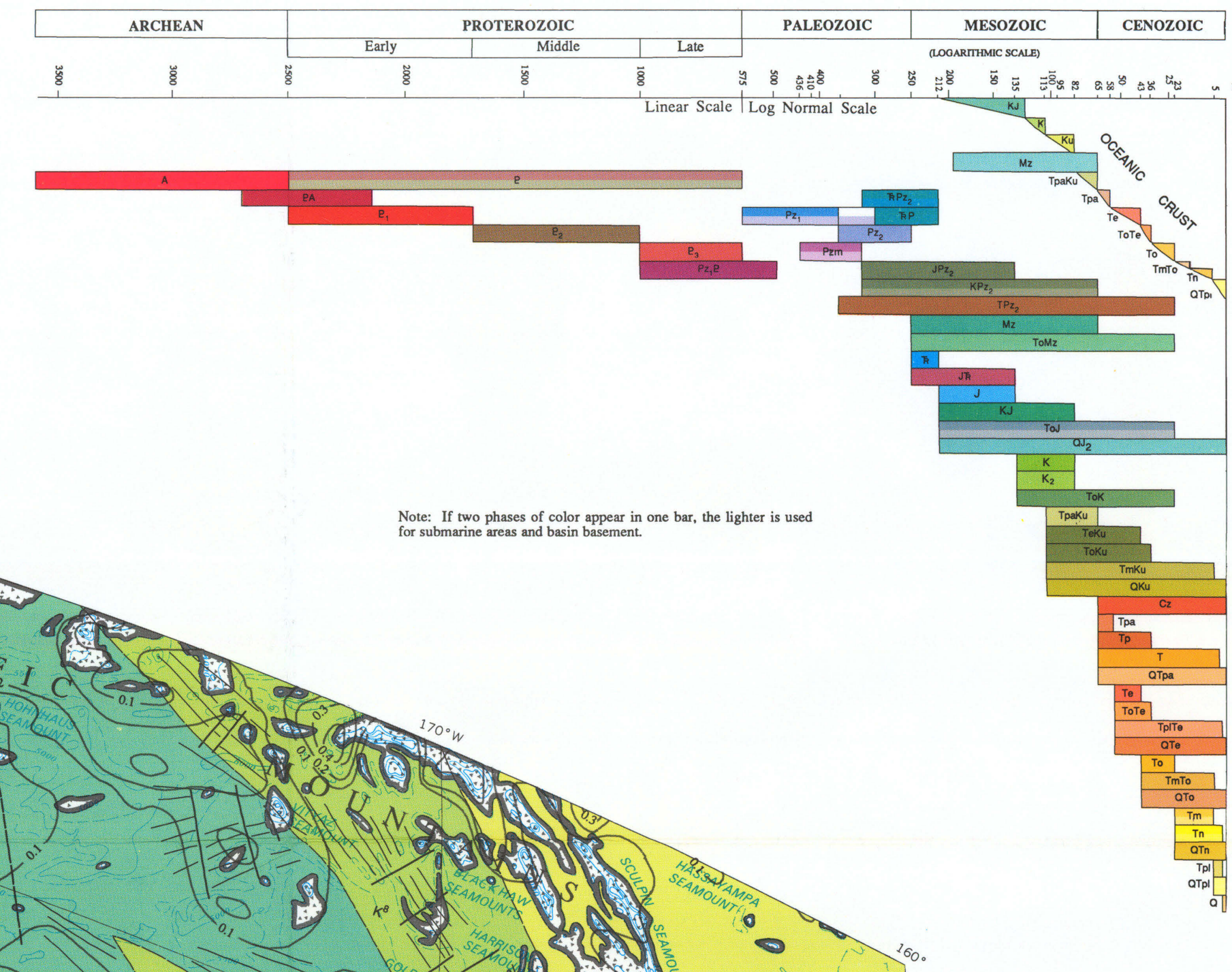
ISOPACHS
Compiled principally from Ludwig and Houtz (1978), K. Robinson (pers. comm., 1985), Wang (1985), and Willford et al (1985)

REFERENCES CITED

See accompanying Explanatory Notes.

Note: Compilation based on data available up to August 1986 and selected data after August 1986.

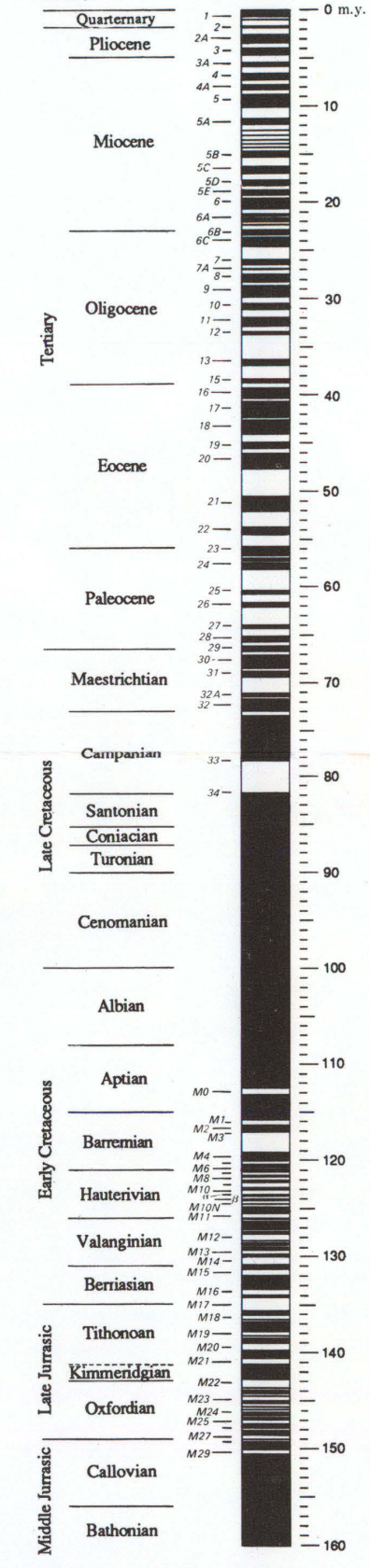


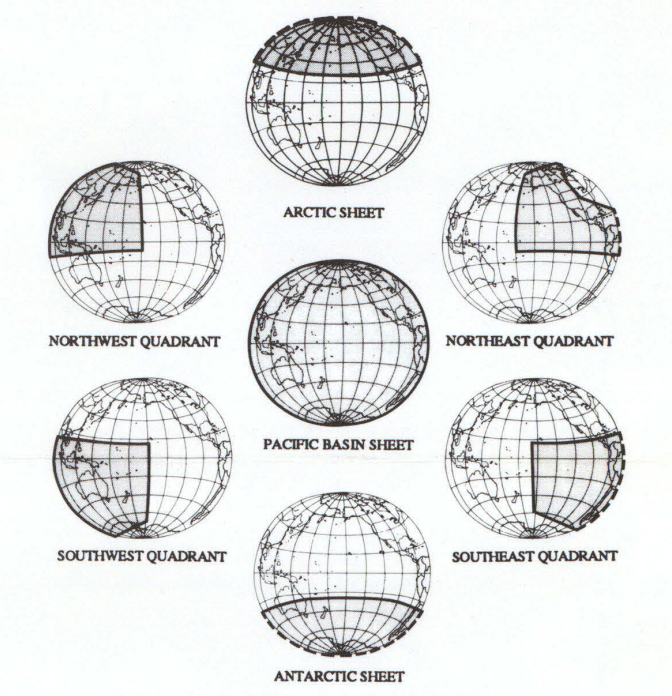


Note: If two phases of color appear in one bar, the lighter is used for submarine areas and basin basement.

GEOMAGNETIC POLARITY TIME SCALE

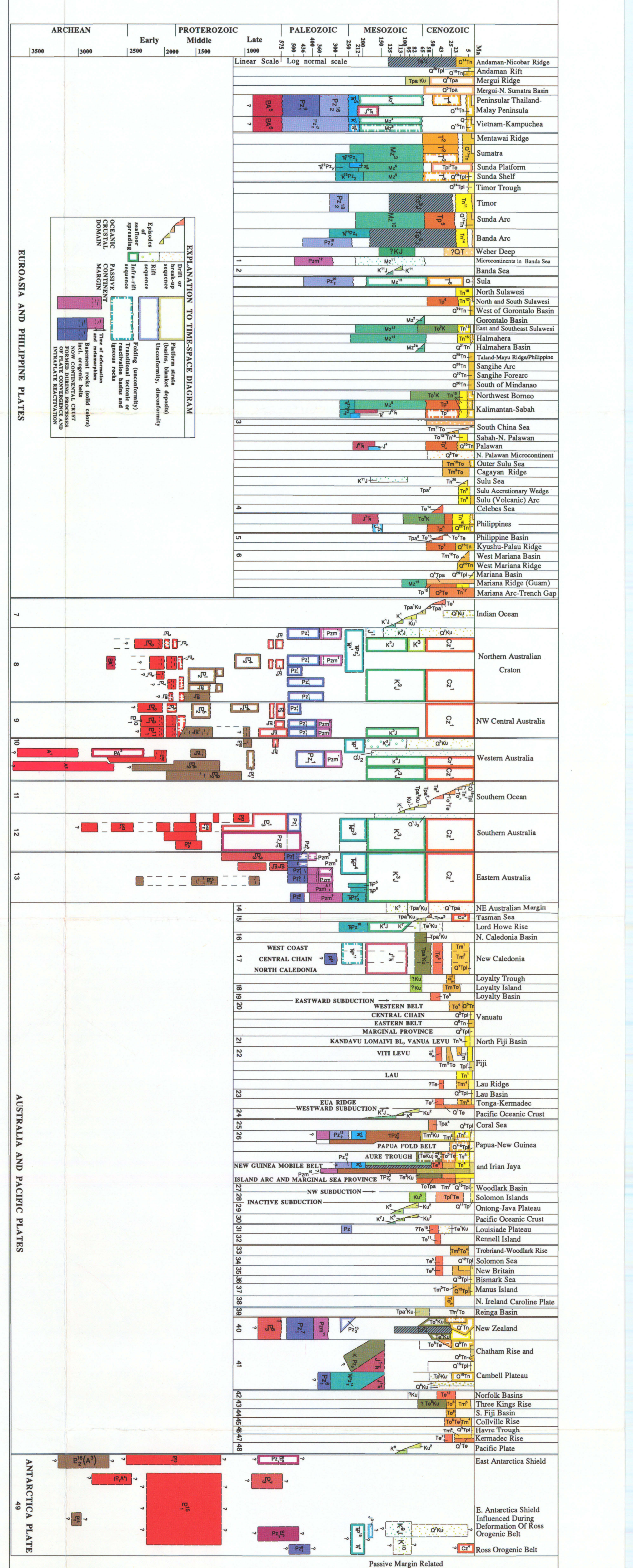
During periods marked in black, the Earth's north and south magnetic poles conformed to those at present, and during periods in white, the poles were reversed; numbers and letters identify magnetic intervals and reversals recorded by systematically oriented magnetization of mineral grains in seafloor lava and mapped as magnetic lineations (Larson et al, Plate-Tectonic Map of the Circum-Pacific Region, Pacific Basin Sheet, 1985).





INDEX TO MAP SHEETS

TIME/SPACE PLOT



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TECTONIC MAP OF THE CIRCUM-PACIFIC REGION

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PALEOMAGNETIC DATA
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HOLOCENE VOLCANOES
T. Simkin, L. Siebert

ISOPACHS
R.E. Houtz, W.J. Ludwig, K. Robinson, F.H. Wang, G.E. Willford

SCALE 1:10,000,000
250 0 250 500 750 1000 1250 1500 KILOMETERS
250 0 250 500 750 MILES

Lambert Azimuthal Equal-Area Projection
(Map center point: 35°S, 135°E)

1991

Base by U.S. Geological Survey, 1978.
Modified in 1985.

MAP PRODUCTION BY U.S. GEOLOGICAL SURVEY

Map Compilation Coordinated by
Warren O. Addicott and George Gryc
Cartography by Frances R. Mills

ROCK TYPE

SEDIMENTARY ROCKS
Marine/nonmarine ☐

IGNEOUS ROCKS (Extrusive, Intrusive)
- Felsic
- Intermediate
- Intermediate to mafic
- Mafic
- Undifferentiated
- Ultramafics, ophiolites

METAMORPHIC ROCKS (Trend lines of foliation) (Trend lines not available)
- Low pressure and temperature
- High temperature
- High pressure
- Undifferentiated

EXPLANATION

Active / Inactive **PLATE BOUNDARIES**--Dashed where approximate
- Subduction zone--the surface trace of a Benioff-Wadati seismic zone, a dipping layer of earthquake foci believed to mark the upper surface of a descending lithospheric plate; sawteeth on upper plate
- Transform fault--the principal fault at broad strike-slip plate boundaries; arbitrarily drawn where boundary is covered by uncoupled crustal slabs
- Spreading axis or ridge

VOLCANIC CENTERS
- Active in historic time--generally within past 1,000 years; documented during or soon after eruption
- Active in Holocene time--within past 10,000 years; not documented historically
- Holocene activity uncertain--includes solfataras and volcano-related thermal springs; no direct evidence for Holocene eruption

BOUNDARIES OF TECTONIC UNITS
- Tectonic unit boundary; dashed where approximate
- Boundary between continental and oceanic crust--generally shown by the limit of oceanic crust; in special cases by short-dashed boundary line
- Inner edge of continent affected by rifting and breakup (shown where data available)
- Geosuture--boundary between tectonostratigraphic terranes

MAGNETIC LINEATIONS--Dashed where approximate
- Magnetic anomalies--short dashed where interpolated or computer predicted; labels show correlation with geomagnetic polarity time scale; labels in parentheses () where computer predicted [ ] uncertain
- Propagating rifts

FAULTS AND FRACTURE ZONES--Dashed where approximate
- Undifferentiated
- Normal fault (dip slip); ticks on downthrown side
- Lateral (strike slip, wrench fault); arrows indicate relative displacement
- Thrust (low angle); sawteeth on upper plate indicates dip of thrust plane
- Reverse (high angle); sawteeth on upper plate indicates dip
- Concealed (buried under cover rocks)

FOLDS--Dashed where approximate
- Anticlinal axis (gentle and open)
- Anticlinal axis (tight and closed)
- Selected synclinal axis
- Homocline

DIKES--Lithology indicated by abbreviation (dol = dolerite)

⊕ **DIATREMES, CRYPTOEXPLOSION STRUCTURES, KIMBERLITE PIPES, CARBONATITE, AND LAMPROITES**

⊕ **ASTROBLEMES**

9.7E 18S **SELECTED PALEOMAGNETIC DATA**-Former declination indicated by degrees E or W and rotation by colored sector; the color indicates the geologic age of rotation; a labeled dashed line marked by degrees N or S is the paleolatitude

BASEMENT AGES
- (3) Radiometric age determination in Ma
- (2.3) Inferred age in Ma

ISOPACHS--Depth to basement rocks
- 1000 Isopachs for continental areas to foot of continental slope in meters
- 1.4 Isopachs in oceanic areas in seconds (two-way reflection time)

ROCKS OF ACTIVE PLATE MARGINS
- Igneous rocks of magmatic arcs; composition shown by pattern (see ROCK TYPE); pattern color or background indicates age
- Forearc sediments; color of dot pattern or background indicates onset of sedimentation
- Accretionary-prism rocks--includes melanges; color of dashed pattern or background indicates onset of subduction

CONTINENTAL CRUST
BASEMENT ROCKS (comprising metamorphic, igneous, and sedimentary rocks too deformed to contain accumulations of fluid hydro-carbons):
- Metamorphic rocks--includes complexes with metamorphic igneous rocks (e.g., gneisses, charnockites, metabasalts, etc.); conditions of metamorphism shown by overprint pattern (see ROCK TYPE); color indicates age of major metamorphism
- Intrusive igneous rocks--includes ultramafics and ophiolites; composition shown by overprint pattern (see ROCK TYPE); color indicates age of intrusion
- Deformed sedimentary and volcanic rocks; composition shown by overprint pattern (see ROCK TYPE); color indicates age of deformation

ROCKS OF TRANSITIONAL AND REACTIVATION BASIN

Transitional sequence--deposits immediately succeed major orogenic deformation and immediately precede platform-strata deposition. Igneous rocks include mostly felsic volcanics, bimodal volcanics, and post-kinematic granitoids and associated volcanics. Sedimentary rocks include molasse-like deposits, commonly in foredeeps and grabens

Reactivation sequences--seem to be related to plate collisions (China-type basins) or to oblique plate interaction
- Color of dash-dot line indicates onset of sedimentation
- Color of parallel lines indicates age of deformation
- Concealed deformed rocks

COVER ROCKS
- Continental platform strata--includes sedimentary basins and blanket deposits not in tectonic downwarps; band of color adjacent to black boundary indicates age range
- Intraplate igneous rocks--plateau basalts and other anorogenic intrusives and extrusives; composition shown by pattern (see ROCK TYPE); pattern color indicates age of emplacement
- Orogenic rocks forming basement (b)

CONTINENTAL MARGIN DEPOSITS
- Rift or prebreakup sequence--proved by seismic data or implied on basis of deposit thickness; color indicates onset of rifting
- Drift or breakup sequence--deposits accumulated over rift sequence and contemporaneous shelf area; color indicates onset of sedimentation

OCEANIC CRUST
- Oceanic crustal rocks in present oceanic areas; color indicates age range determined by magnetic anomalies, breakup according to major tectonic events (see TIME/SPACE PLOT)
- Oceanic plateau--either anomalous oceanic crust or of unknown origin. Microcontinents are shown by cover or continental margin deposits
- Oceanic islands and seamount volcanics (epiliths); composition shown by pattern (see ROCK TYPES; color indicates age
- Age unknown

* References cited on Time/Space Plot are listed in "References Cited" section and fuller explanations of the units are given in the accompanying Explanatory Notes Booklet.

☆ INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1991