U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Suzette M. Kimball, Acting Director

CIRCUM-PACIFIC MAP SERIES
MAP CP--52
Explanatory pamphlet accompanies map

CIRCUM-PACIFIC COUNCIL FOR ENERGY AND MINERAL RESOURCES

CIRCUM-PACIFIC MAP PROJECT
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TECTONIC MAP OF THE CIRCUM-PACIFIC REGION

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HOLOCENE VOLCANOES

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Map Production by U.S. Geological Survey
Compilation Coordinated by Warren O. Addicott and George Gryc
Cartography and compilation by Fran R. Mills, and Douglas S. Aitken

SCALE 1:17 000 000

500 0 500 1000 1500 2000 KILOMETERS
500 0 500 1000 MILES
400 200 0 400 800 NAUTICAL MILES

Lambert Azimuthal Equal-Area Projection
(Map center point: Equator, 160°W.)

2013

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 magnetic lineations in the oceanic crust record the episodes of seafloor spreading based on magnetic anomalies. Oceanic plateaus and other prominences of greater than normal oceanic crustal thickness with subdued traces are also shown. Colored areas on the continents show the ages of deformation of the metamorphic rocks and the intrusive emplacement of igneous rocks. The transitional tectonic (mobilistic) 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 (pre-breakup) and drift (breakup) sequences. Symbols mark folds and faults, and special symbols show volcanoes and other structural features.

EXPLANATION

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 (did -- dolerite)

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 basin floor 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
MIOC 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

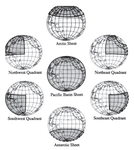
OCEANIC CRUST
Oceanic crustal rocks in present oceanic areas; color indicates age range determined by magnetic anomalies, breakup according to major tectonic events (see TIME/SPACE PLOT)
Oceanic plateau--either anomalous oceanic crust or of unknown origin. Microcontinents are shown by cover or continental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

ROCKS OF ACTIVE PLATE MARGINS
Igneous rocks of magmatic arcs; composition shown by pattern (see ROCK TYPES); 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 diagnostic traces of fluid hydrodynamics
Metamorphic rocks--includes complexes with metamorphic igneous rocks (e.g., gneisses, chamockites, metabasalts, etc.); conditions of metamorphism shown by metapyrat 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
Unmetamorphosed sedimentary and volcanic rocks; composition shown by overprint pattern (see ROCK TYPE); color indicates age of deformation

PERIPHERAL PACIFIC TECTONIC PLATES

MAJOR PLATES OF THE CIRCUM-PACIFIC



INDEX TO MAP SHEETS

ONSHORE ROCK TYPE

SEDIMENTARY ROCKS
Mostly marine
Mostly nonmarine

IGNEOUS ROCKS

	Extrusive	Intrusive
Felsic		
Felsic to intermediate		
Intermediate		
Intermediate to mafic		
Mafic		
Undifferentiated		
Alkali		
Ultramafic		

METAMORPHIC ROCKS

	(Trend lines of foliation)	Trend lines not available
*Low pressure and temperature		
*High temperature		
*High pressure		
Undifferentiated		

*Applicable only to island arc areas

SYMBOLS
Contact
Normal or strike-slip fault
Ice
Ice front or edge of ice shelf
Ice shelf
Bathymetric contours--Depth of water in meters shown by 200m contour and at 1000m intervals from 1000m depth. Intermediate contours dashed
Cities 1,000,000 or more
City less than 1,000,000 people
4190 **Topographic prominence**--Height in meters
International boundary

SOURCES OF DATA

Full lists of references cited as sources of data for the map elements shown on this sheet are listed in the accompanying explanatory notes booklet.

TECTONIC ELEMENTS AND STRUCTURAL DATA
Boundaries of land areas from the Geologic Map of the Circum-Pacific Region, Arctic, Northeast Quadrant, and the Southeast Quadrant, Northwest Quadrant, and part of the Antarctic Sheet, based on stratotectonic rather than time-stratographic units.

MAGNETIC LINEATIONS
Magnetic lineations principally from the Plate-Tectonic Map of the Circum-Pacific Region, Arctic, Northeast Quadrant Southeast Quadrant, Northwest Quadrant, and part of the Antarctic Sheet. Additional data from Malahoff et al (1982), G. W. Moore (pers. comm., 1985), R. S. Shaw (pers. comm., 1985), B. Taylor and Hayes (1980, 1983), Johnson and Veevers (1984), and Tamaki and Larson (1988).

HOLOCENE VOLCANOES
Plotted with additions from the computerized Smithsonian Institution Volcano Reference File (Simkin et al, 1983) by the U. S. Geological Survey, Reston, Virginia, and modifications to the file by Lindsay McClelland, Smithsonian Institution, and John H. Latter, New Zealand Department of Industrial Research, and 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 Regions, Pacific Basin, American Association of Petroleum Geologists (19) with some modifications.

BASE MAP
Updated fromt he Geographic Map of the Circum-Pacific Region, Pacific Basin Sheet, American Association of Petroleum Geologists (19), compiles by the U. S. Geological Survey, Reston, Virginia.

REFERENCES CITED
See accompanying Explanatory Notes.

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

GEOLOGIC BACKGROUND

Land geology for the Southwest Quadrant is generalized from Doutch (1988). Active plate boundaries are generalized from Moore (1981).

Land geology for the Northwest Quadrant region is generalized from Inoue (1988). Active plate boundaries are generalized from Nishiwaki (1981, 1983).

Land geology for the Southeast Quadrant region is simplified and generalized from Corvalan (1985). Active plate boundaries are generalized from Moore (1982), modified in 1991.

Land geology for the Northeast Quadrant region is generalized from Drummond (1983). Active plate boundaries are generalized from Moore (1981).

SEDIMENTARY BASINS

The sediment-thickness data for the Southwest Quadrant was compiled by W. David Palfreyman and Erwin Schelbner, of the Australian Geological Survey Organization. Principal source of data for Australia is from Bureau of Mineral Resources (1981).

The sediment-thickness data for the Northwest Quadrant region was compiled by Tomoaki Sumi, Geological Survey of Japan. The principal data are from Eremenko and others (1978), Khain (1985), Chinese Academy of Geological Science, Institute of Geology (1980), Geological Survey of Japan (1979), United Nations ESCAP (1985), and Drummond (1986).

The principal sources of sediment-thickness data for the Southeast Quadrant region for marine areas are Case and Holcombe (1980), Ludwig and Houtz (1979), Ludwig and others (1987), and Rodriquez and others (1980). Land isopachs were compiled by M. R. Yrigoyen with the assistance of individuals cited in the accompanying Explanatory Notes.

The principal sources of isopach data for the Northeast Quadrant region are Case and Holcombe (1980), Ludwig and others, (1984), Frezon and others (1983), Grantz and May (1982), Ludwig and Houtz (1979), Martin (1980), and Westbrook and others, (1984). Shoichi Hasui assisted in compiling sediment-thickness data.

Representative columnar sections for selected sedimentary basins are shown in the accompanying explanatory notes booklet.

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, an international effort to show the relations 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 Earth scientists from countries in the Pacific region who contribute to maps of the Northwest, Northeast, Southwest, and Southeast Quadrants, and the Antarctica and Arctic areas. Eight series of maps are already published or are in preparation. The maps are Base, Geographic, Topographic, Plate-Tectonic, Geologic, Tectonic, Geodynamics, 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 the Lambert azimuthal equal-area projection. The index map shows the boundaries of the quadrant map and of the Antarctic and Arctic area maps in the Pacific Basin.

Geographic names follow, in accordance with U.S. Board on Geographic Names usage, to account for the recommendations of the Circum-Pacific Map Project panel. 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.

Base by U.S. Geological Survey, 1989

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