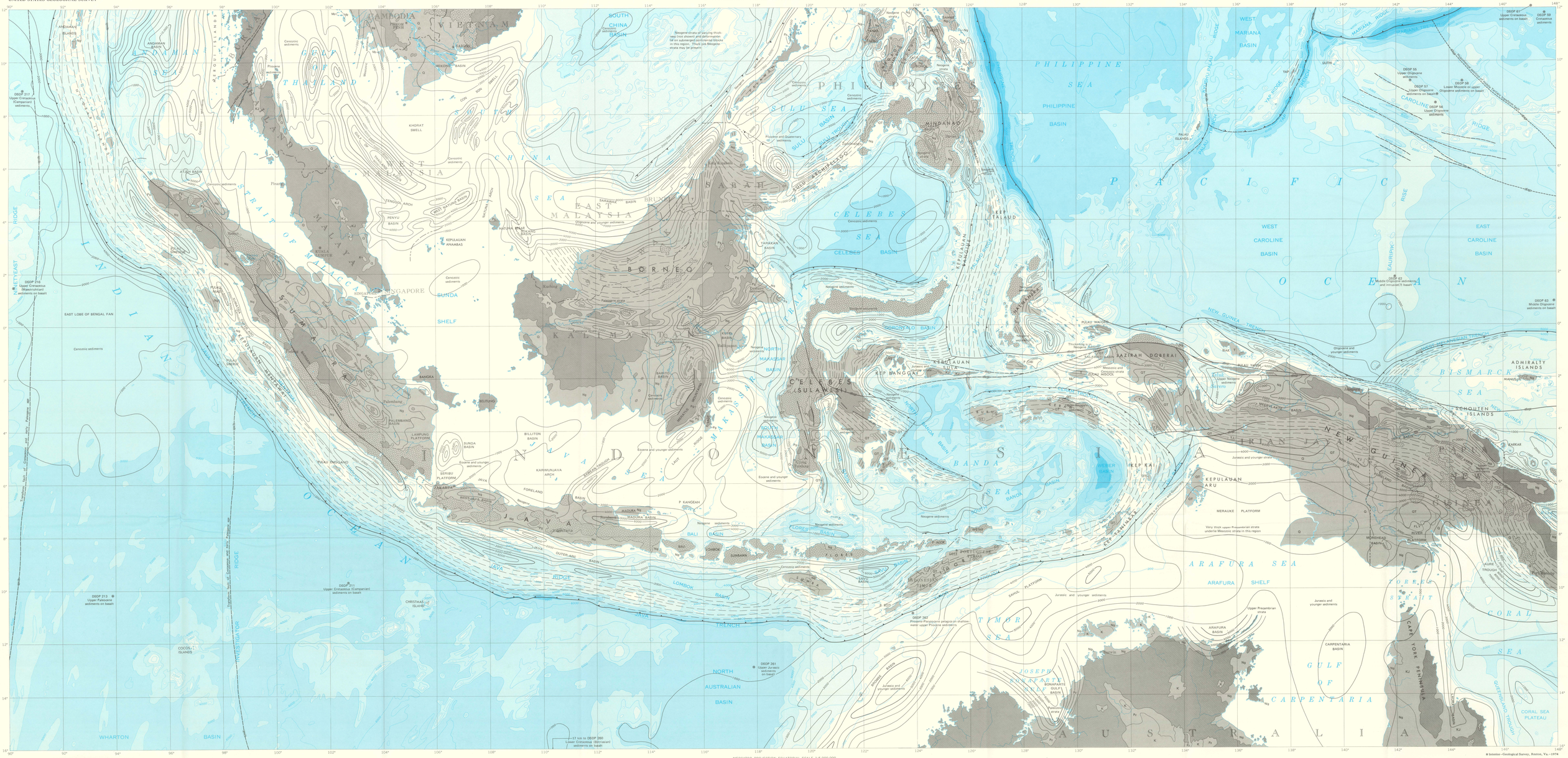
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED ON BEHALF OF THE MINISTRY OF MINES, GOVERNMENT OF INDONESIA
AND THE AGENCY FOR INTERNATIONAL DEVELOPMENT, U.S. DEPARTMENT OF STATE
IN COOPERATION WITH THE GEOLOGICAL SURVEY OF INDONESIA

FOLIO OF THE
INDONESIAN REGION
MAP I-875-B



Bathymetry compiled by Warren Hamilton, U.S. Geological Survey, in cooperation with the Scripps Institution of Oceanography, Univ. of California, San Diego, using the following sources: Indonesia: Hydrographic Office publication 1301; Bagien, J., Fisher, D.E., and Lichtman, G. B., eds., Geological-Geophysical Atlas of Indian Ocean (IGDE): State Dept. of Cartography and Geodesy (GUGK), Moscow, USSR (in press): Region north of Equator and east of 100° East Longitude: T. E. Chase and H. W. Menard, SIO, 1968, U.S. Navy Hydrographic Office Pub. 1301: Region between Equator and New Guinea: Jacqueline Mammerickx, SIO, 1971: Region south of New Guinea: Sclater, J. G., and Hilde, T. W. C., Marine Geology, v. 12, p. 173-204; version of Gaithersby, Sclater, J. G., Gunther, 1970, Geological Society of America Bulletin, v. 71, no. 8, fig. 3. Minor corrections in various areas by Hamilton.

MERCATOR PROJECTION EQUATORIAL SCALE 1:5 000 000

1000 KILOMETERS
500 STATUTE MILES
400 NAUTICAL MILES

BATHYMETRIC CONTOURS
CONTOUR INTERVAL 1000 METERS, WITH
200-METER CONTOUR ADDED

EXPLANATION

— 5000 — ISOPACH — Showing thickness of sediments and sedimentary rocks, in meters. The age of materials contoured is given by notes on map. Generally limited to materials that are at most moderately deformed, but includes highly deformed strata in inland part of Sarawak basin and in northern part of medial New Guinea. The data contoured are of widely variable quality and spacing. Isopachs end arbitrarily against areas of correlative deformed strata, against correlative or younger volcanic rocks, or before reaching isopachs of younger sedimentary series

SEDIMENTARY DEPOSITS — Areas in which little to moderately deformed sedimentary rocks are at the surface. Shown on land areas only. Symbols indicate age of strata: Q, Quaternary; QT, Quaternary to late Miocene; Ng, Neogene; Pg, Paleogene; T, Tertiary; TJ, early Miocene to Jurassic; K, Cretaceous; KJ, Cretaceous and Jurassic; Mz, Mesozoic; Pz, Paleozoic (Permian on Palawan). Precambrian strata not shown

NEOGENE VOLCANIC ROCKS—Includes granitic rocks in New Guinea, and both granitic and metamorphic rocks in Sulawesi. Shown on land areas only

SEVERELY DEFORMED CENOZOIC SEDIMENTARY ROCKS — Terrains of Cenozoic sedimentary rocks, with or without intrudded older strata, metamorphic rocks, and ophiolite fragments, deformed severely by mixing, imbrication, or crumpling. Occur primarily as wedges, as much as 20 km thick, of imbricated strata and melange in front of overriding lithosphere plates, above gently dipping subducting plates, at consuming plate boundaries. Wedges grow by scraping off oceanic materials against their basis and by imbrication of outer-arc-basin strata into their upper parts. Wedges are characterized in marine geophysical surveys by negative gravity anomalies of large amplitude and by general lack of coherent internal acoustic reflectors. Included with wedges are piles of thrust faults imbricated on to continental masses in eastern Sulawesi and in the southern part of medial New Guinea

BASEMENT COMPLEXES — Shown on land areas only: Sedimentary, volcanic, metamorphic, and granitic rocks, mostly of continental crustal type: Malay Peninsula, Indonesia, and Sumatra, Paleozoic and Mesozoic; central and western Borneo, probably mostly Mesozoic; northern Palawan, Sulu Islands, and northwestern and eastern New Guinea, Paleozoic; western Australia, Precambrian; eastern Australia, Precambrian(?) and Paleozoic; Sumba, Paleozoic; southeastern Borneo, and southwestern Sulawesi, Cretaceous and possibly very early Tertiary

Ophiolite (large uplifted masses, or slabs in melange, of oceanic crust and mantle): eastern Sulawesi and northern part of medial New Guinea, late Mesozoic; islands north of western New Guinea, Paleogene

Volcanic island arcs: northern New Guinea, Cretaceous to early Miocene (collided with continent in Miocene time); Palau, Paleogene

FAULTS — Long dashes, structure now inactive; short dashes, interpretation very uncertain; queries, continuation uncertain; dots, buried. In Moluccas Sea region, complications represent in part the overriding of a west-dipping Sangihe subduction zone by an east-dipping Halmahera zone, and reversals of Sangihe and Halmahera subduction polarities. Along north edge of eastern New Guinea, a south-dipping New Guinea subduction zone may have overridden a north-dipping Schouten-New Britain zone, following which the collision zone was replaced by a strike-slip fault

Trace of subduction zone

Strike-slip fault

Type not specified

DSDP 62 DRILLHOLE OF DEEP SEA DRILLING PROJECT — Notation indicates age and character of deepest material reached. Basaltic basement reached only where noted

SEDIMENTARY BASINS

Indian Ocean. — The floor of the Indian Ocean is of Late Jurassic and Early Cretaceous age near Australia, and of progressively younger Cretaceous and very early Tertiary age to the northwest of Australia. The basin formed as India migrated northwestward away from Australia. Only thin pelagic sediments lie upon most of the oceanic basement. The turbidite apron west of northern Australia is thin over near the continent. The east lobe of the enormous Bengal abyssal fan, derived primarily from the Ganges and Brahmaputra Rivers, extends south into the mapped area; but sediment is no longer being received from the north because of the closing of the gap between Ninetyeast Ridge and Java Trench by subduction. The basaltic Ninetyeast Ridge becomes younger southward, from Late Cretaceous to Tertiary; hence is separated from the Wharton Basin by a transform fault. The thin sediments on the ridge are mostly pelagic, although the basal strata in each sector along the ridge formed in shallow water.

Sunda Shelf Basins. — A chain of deeply filled basins lies between the volcanic ridge of Sumatra, Java, and the Banda arc, and the outer-arc ridge. The outer-arc ridge is the top of the wedge of melange and imbricated material above the subducting lithosphere of the Indian Ocean floor and, in the Timor sector, of Australia. The strata of the outer-arc basins lap onto the continental and volcanic basements on the north sides and are little deformed outward past the axis of the basins, but near the outer-arc ridge they become progressively more contorted, both downward and outward, by folding and thrust faulting. Basin strata provide a major component of the melange wedges into which they grade structurally. Basin sediments extend back at least to the Oligocene off Sumatra; they have not been dated farther east. The Weber Basin, the easternmost outer-arc basin, contains very little sediment and may be quite young.

Sumatra foreland basin. — Oligocene and earliest Miocene strata are primarily within the small subbasins, whereas later early Miocene and younger strata are widespread and record an axis of major subsidentation that has tended to shift northeastward with time. The lower and middle Miocene are transgressive, with coarse clastics giving way upward to bathyal shale in the subbasins. Most of the detritus came from the southwest. Reefs formed on basement highs but finally were covered by mud. The upper Miocene and higher sequence is regressive; marine sands give way upward to continental sand and mud. Anticlinal axes and synclines have grown throughout the period of sedimentation and are still active. They control sedimentary patterns in both transgressive and regressive facies. Thrust faults are present locally in the southwest.

Gulf of Thailand basin. — This large basin has broadened and subsided throughout its history; stratigraphic units thicken into it and younger strata overlap progressively farther onto the basin margins. The upper part of the section consists of as much as several thousand meters of Pliocene and Quaternary deltaic and estuarine sand, silt, and mud. Beneath this is a very thick marine shale whose upper part is probably late Miocene and whose lower part has not been reached. Long narrow shale-cored anticlines in the deep part of the basin have grown concurrently with late Neogene sedimentation.

Penyu and West Natuna basins. — Thick Cretaceous or Paleogene strata form part of the basement for these basins, which have broadened and deepened with time and are filled by Oligocene to Quaternary strata that record increasingly marine conditions upward. Folding and reverse faulting were largely completed before Pliocene time.

Sarawak basin. — The large crescentic Sarawak basin has very thick middle Tertiary bathyal shale beneath varied regressive marine clastic sediments of the upper Neogene. The shale is Oligocene and early and possibly middle Miocene onshore in Sarawak, but its top becomes younger northwestward and is very late Miocene or early Pliocene on the outer shelf. The overlying late Neogene strata are 2-4 km thick over much of the shelf and include great fresh-set units prograded seaward. Narrow anticlines have grown concurrently with sedimentation, and many are broken by shale diapirs. Many still-growing anticlines are capped by reefs and reef debris.

Western interior of Borneo. — The two narrow basins contain downfolded Paleocene through Oligocene strata, dominantly clastic, which formed in shallow-marine, estuarine, and, mostly late in the sequence, continental environments. Deformation is generally gentle to moderate but locally is severe.

Barito basin. — The Barito basin of southeastern Borneo was first differentiated from the Meratus Mountains to the east in middle Miocene time. Eocene clastic strata and the widespread Oligocene—early Miocene sheet limestone covered both basin and present mountains. The Neogene sediments are of shallow-marine, deltaic, and continental facies; they lap westward onto the Cretaceous(?) basement,and are bounded against the Meratus Mountains by steep folds and east-dipping reverse faults.

Kutei basin. — The Oligocene and lower Miocene shelf limestone of southeastern Borneo gives way northward to a thicker section of marine clay, sandy shale, sand, and silicic volcanic rock, in the west, and to thick shale both onshore and offshore in the east. Regressive sands and shallow-water sediments are found higher in the Miocene. Both Oligocene and Neogene record the eastward progradation of the Mahakam delta, and the depositional axis is progressively farther eastward in progressively younger sediments. Much of the continental shelf has been prograded over oceanic crust. The sediments are much deformed by flat synclines and narrow anticlines that are subparallel to the coast and that decrease in both age and intensity eastward. The folds have grown concurrently with Neogene sedimentation, and the middle Tertiary shale has risen into the anticlines. Normal and reverse faults have formed in response both to rising cores and to seaward sliding of the Neogene. The Kutei section thins rapidly northward; both Paleogene and Neogene are thin over eastern Mangkalihat Peninsula.

Tarakan basin. — Overlapping delta deposits of several major river systems form the small Tarakan basin of northeastern Borneo. As in the Kutei basin, deformation decreases upward in the section and is still in progress.

Northeastern Sabah. — The continental shelf between the northeast coast of Sabah and the Sulu Sea contains basins filled by Miocene shale beneath varied clastic sediments of Pliocene and Quaternary age. The shale has risen into diapiric anticlines in the deeper part of the eastern basin. The basins may be the filled outer-arc basin of the now inactive Sulu island-arc system, which in the middle Tertiary swung westward across Sabah.

Sulu Sea. — The turbidite of the small deep-water basin of the Sulu Sea has not been drilled. The high heat flow suggests a Tertiary age for the oceanic basement. The thickly filled basin of the shallow northwestern part of the sea lies between the microcontinent and early Tertiary melange of Palawan and an extinct submerged volcanic island arc and may be the outer-arc basin of a Paleogene Palawan subduction system.

Philippine Islands. — The sedimentary basins of the Philippine Islands are filled by Neogene, and locally Oligocene, clastic and subordinate carbonate rocks. The clastic detritus has come mostly from the mafic and intermediate volcanic terrains of flanking highlands, and volcanic and sedimentary materials are equivalent laterally. The Agusan and Davao basins lie along a suture formed when two island arcs (Sangihe and Halmahera?) collided in the early Neogene.

Celebes Sea. — Thick turbidite floors the Celebes Sea but has not been drilled. Heat flow and water depths are appropriate for a Late Cretaceous or early Paleogene age for the oceanic basement.

Makassar Strait. — Southeastern Borneo and southwestern Sulawesi share similar Cretaceous basement rocks overlain by similar quartzose continental Eocene strata and Oligocene shelf limestone. The strait may have opened in middle Tertiary time by the rifting away of Sulawesi from Borneo.

Java Sea. — The basement rocks of the Java Sea trend northeastward and are mostly variably metamorphosed sedimentary rocks and Cretaceous volcanic and granitic rocks. Massive shelf limestone of Oligocene and early Miocene age covers much of the shelf; this limestone lies directly on basement in some areas but is underlain by Eocene clastic strata in others. Much of the fill of the northeast-trending basins is Eocene.

West Java and Madura basins. — The foreland basins of northern Java contain mostly Neogene clastic sediments. The lower strata are derived from northern sources and the higher ones are derived from the volcanic terrain to the south. Reef limestone is widespread in the north. North-directed deformation has prograded the continental shelf southward and is continuing.

Banda and Flores Seas. — The rough oceanic basement of these seas is thinly and discontinuously veneered by pelagic sediments. It may be entirely of Neogene age, formed behind migrating elements of the Banda arc system. Separation of the arms of Sulawesi may also have been a Neogene event.

Northwestern Australian shelf. — Upper Permian, Triassic, and Jurassic strata are clastic sediments derived primarily from a continent (India?) which then lay to the northwest. The present outer shelf/upper slope of northwestern Australia was rifted away in the Late Jurassic. A section of clastic sedimentation from Australian sources, prograding across a northwest-dipping shelf, developed gradually during Cretaceous time and continued into the Paleocene. Eocene and younger strata are dominantly carbonates, which form a northwest-thickening wedge deposited across, and largely independent of, the longitudinal late Mesozoic basins of the outer shelf. The continental-shelf section inflects gently downward at the south edge of the Timor Trough, a subducting trench; the shallow-water Permian through Pliocene section plates into the trench, is thinly covered by upper Pliocene and Quaternary deepwater sediments, and slides beneath the great melange wedge of Timor.

Northern Australian shelf and southern New Guinea. — The Paleozoic crystalline basement of eastern Australia and the Precambrian basement of western Australia continue northward to medial New Guinea. This continental-interior strata of various ages, Cambrian to Permian, are present in southern New Guinea. Middle Jurassic through middle Miocene strata, by contrast, were deposited on a northward-deepening continental shelf whose edge lay in medial New Guinea. Rifting away, during Triassic or Early Jurassic time, of Sumatra and Southeast Asia from medial New Guinea is inferred. Late Mesozoic clastic sediments thickened northward to the shelf edge and also eastward into broad shallow basins lying to the west of Mesozoic highlands of Paleozoic crystalline rocks. The early Paleogene continued the pattern of clastic sedimentation on a northward-deepening shelf. The rest of the Paleogene and much of the Miocene section is shallow-water limestone in the south, and deeper water carbonate and clastic sediments in the north. In the later Miocene, shelf strata began to be imbricated southward onto southern New Guinea. Slope sediments of northern medial New Guinea were crumpled in response to collision with a south-facing island arc. Thick late Neogene clastic sediments, shed from the rising mountains of the deformed terrain, formed a foreland basin whose sedimentational axis has migrated southward as the northern sediments have become incorporated in the thrust belt.

Northern New Guinea basins. — The Meervlakte, Sepik, and Ramu basins are filled by thick middle or upper Miocene to Quaternary sediments, mostly clastic, which show great fluctuations in water depths before inauguration for of paralic and then of continental-fluvial Quaternary conditions. The Meervlakte and Sepik basins are still subsiding rapidly. These basins postdate the island-arc collision.

Salawati basin. — A rim of Miocene patch reefs separates northwestern deep-water clastic Neogene sediments from shallow-water strata in the south and east.

Pacific Ocean. — The Pacific Ocean is known to have a cover of Mesozoic age only in the northwest quarter of the area. Pelagic sediments lie on the oceanic basement in Cenozoic, broken into a number of lithospheric plates whose past and present relationships are poorly understood. The basins and ridges between the Philippine and Mariana Trenches become irregularly younger eastward, from early Paleogene to Neogene, and may have formed at the frontal part of the Mariana arc system repeatedly migrated away from the rear part. These basins contain thin pelagic sediments and generally thin clastic wedges on their edges. The large plate that extends from the Caroline Ridge to the trenches north of New Guinea has a smooth basement. Where dated, the basement is of Oligocene age, covered typically by 500 m of pelagic sediments. The small plates near New Guinea must be of Cenozoic age. Little clastic sediment is present on the ocean floor north of New Guinea because whatever had been deposited there has either been subducted against the continent or has been carried westward upon or in front of various Pacific plates to lodge in the voluminous subduction melange of the Moluccas Sea region.

Coral Sea basin. — The oceanic crust of the Coral Sea formed in the early Paleogene, perhaps as eastern New Guinea swung away from Australia. Upon this crust were deposited lower Paleogene pelagic sediments, and these are covered by northward-thickening upper Paleogene and Neogene turbiditic and pelagic deposits.

SOURCES OF DATA

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INTERNATIONAL BOUNDARIES SHOWN ON THIS MAP ARE NOT NECESSARILY AUTHORITATIVE

GLOSSARY OF INDONESIAN GEOGRAPHICAL TERMS

Jazirah	peninsula	Kep.	island group
Kepulauan	island	P.	island
Pulau	island		
Sungai	river		
Teluk	bay		
Danau	lake		

MAP OF SEDIMENTARY BASINS OF THE INDONESIAN REGION

By
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