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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF
NATIONAL DEVELOPMENT

BUREAU OF MINERAL
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NOTES TO ACCOMPANY ROCK TYPE MAP OF AUSTRALIA

SCALE 1:10 000 000

(Paper prepared to accompany Rock Type Map of Australia to be published in FAO/UNESCO Atlas of the Soil Map of the World, scale 1:5 000 000. The paper will form a chapter of the Notes to accompany the 1:5 000 000 scale Soil Map of Australia compiled by Mr K.H. Northcote, C.S.I.R.O. Division of Soils, Adelaide)

by

P.E. Simpson and W.D. Palfreyman

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NOTES TO ACCOMPANY ROCK TYPE MAP OF AUSTRALIA*

Rock type is a primary factor affecting the nature of soils although other agencies such as climate, relief and vegetation may, in the long term, have more influence on the final characteristics of soils. Composition and microstructure of parent rocks determine to some extent the nature and rate of rock weathering and thus, finally, the type of soil.

Macrostructures such as folds and faults affect weathering indirectly by determining rock exposure and to a small extent the physical nature of the rock. Structure (and rock type) can also influence the location of hills, valleys, and lakes, for example, and thus indirectly the nature of the soil within these areas.

The intensity and duration of structure-forming process during the Cainozoic has influenced the development of the present-day landscape and hence weathering and soil formation. The Australian continent was relatively stable during this time, and movements were restricted to vertical faulting and warping. The present landscape generally consists of land surfaces formed early in the Cainozoic and subsequently dissected to varying degrees. Many Precambrian areas have been stable for a much longer period. The surfaces carry weathering profiles in some places to depths greater than 50 m.

However, the distribution and types of rock exposed to soil-forming processes have been determined by the whole geological history of the continent. Briefly, the Australian continent consists of three major elements:

1. The Precambrian area which occupies the western two thirds of the continent, and which is extensively overlain by Phanerozoic basinal deposits ranging in age from Cambrian to Tertiary. The Precambrian consists of Archaean blocks and Proterozoic orogenic belts and platform cover. The most easterly Precambrian units of this element are the Mount Isa and Willyama Blocks (Tectonic Domains 13 and 11 of Figure 1), but Precambrian is also exposed in northern Queensland (Nos. 32 and 33) and Tasmania (Nos. 17 and 18).

2. The Eastern Australian orogenic province, which generally parallels the eastern coastline from Cape York to southern Tasmania, and which is a complex of orogenic belts and basins ranging in age from Precambrian to Mesozoic. Tertiary to Quaternary basalt sheets occur widely through the area and some Tertiary basin sediments have accumulated in parts of Queensland, Victoria, and Tasmania.

3. A belt of Upper Palaeozoic to Tertiary (but largely Mesozoic) basins which separate the western Precambrian area from the East Australian orogenic province.

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* By P.E. Simpson and W.D. Palfreyman, Bureau of Mineral Resources, Canberra A.C.T. with contributions by other Bureau Officers. Published with the permission of the Director, Bureau of Mineral Resources.

The geology of the Australian continent is described below in terms of the tectonic domains used on the 1:5 000 000 scale Tectonic Map of Australia and New Guinea (Geological Society of Australia, Sydney, 1971). The map shows three main types of tectonic domains based on style of sedimentation, igneous activity, deformation and metamorphism. The three units are: orogenic domains, transitional domains and platform domains (sedimentary basins).

Orogenic domains are characterized by geosynclinal sediments, widespread and varied volcanic and plutonic rocks, strong deformation, and widespread and intense metamorphism.

Transitional domains are intermediate in style and time and are characterized by molasse-type sediments, abundant volcanic and plutonic rocks, moderate deformation, and rare metamorphism.

Platform cover domains are characterized by widely distrubuted and thin marine and terrestrial sediments, rare plutons, and associated basalt sheets. Deformation is mild and metamorphism absent.

Orogenic and transitional domains broadly related in style and time can be grouped as an orogenic province, four of which have been recognized (Geological Society of Australia, op. cit.): West Australian, North Australian, Central Australian, and East Australian. In addition, two groups, Late Precambrian Domains and Unassigned Precambrian Metamorphic Complexes, cater for miscellaneous domains which do not fit into the main groups.

Similarly, the platform cover domains have been grouped into four platform covers: Trans-Australian, Central Australian, North Australian, and West Australian.

The groupings provide the framework for the following description of the rock types of Australia (Figure 1).

WEST AUSTRALIAN OROGENIC PROVINCE consists of deformed geosynclines and metamorphic complexes, and forms basement to the West Australian Platform Cover.

1 * PILBARA BLOCK

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* Numbers used are those on Figure 1.

The block consists principally of oval-shaped Archaean batholiths, intruded into narrow belts of low-grade metamorphosed basic and ultrabasic igneous rocks with abundant intercalations of banded iron formations. The 'greenstones' are overlain by arenaceous sedimentary formations, which are, however, of minor importance in the area. The granite contacts are accompanied by wide metamorphic aureoles. The granites mostly underlie plains, whereas the banded

iron formations form narrow but prominent ridges divided by valleys underlain by basic rocks. The region is essentially a low-lying dissected plateau, with the differences in altitude between the elevated plateau and the valleys being about 100 m.

2. YILGARN BLOCK

The Yilgarn Block consists chiefly of Archaean granites, granite-gneiss, paragneiss and granulites. The acid plutonic and metamorphic rocks enclose north-northwest trending belts of Archaean "greenstone belts", which consist of low-grade, metamorphosed, stratiform basic and ultrabasic rocks, acid porphyries, and pelitic to arenaceous sediments.

Prolonged and extreme weathering has reduced the area to a plateau at between 300 m and 500 m above sea level. The main relief is due to shallow ridges of basic igneous rocks. Otherwise exposure is very poor, most of the rock being concealed beneath a mantle of laterite, alluvial deposits, and dunes. A series of dry saline lakes represents an old drainage system which flowed into the Great Australian Bight.

3. RUM JUNGLE COMPLEX

The Rum Jungle Complex occupies the core of an eroded dome of low-grade metasediments. It consists of Archaean schist, gneiss, granite, metadiorite, and minor banded ironstone. During a later period of folding and low-grade metamorphism, the metasediments were domed around the granitic basement.

Laterites and unconsolidated sandy material are common but so are soils derived from the underlying rocks. Granite and granite gneiss are exposed in the southeast, the structure resembling mantled gneiss domes.

NORTH AUSTRALIAN OROGENIC PROVINCE consists of deformed sedimentary sequences and forms basement to the North Australian Platform cover.

4 & 5. HALLS CREEK AND KING LEOPOLD BELTS

The Halls Creek Belt, trending in a northeasterly direction, forms the southeast border of the Kimberley Basin. The belt is defined by deformed Archaean basic lavas, greywacke, sandstone, siltstone, and dolomite which have been metamorphosed and intruded by acid and basic plutons.

A later period of folding produced high-grade metamorphism, anatectic granites, and granulites. Acid volcanics, postdating the deformation were intruded by granites and basic volcanics.

The King Leopold Belt trends in a northwest direction and forms the southwest border of the Kimberley Basin. Rocks exposed are similar to those of the Halls Creek Belt. The extent of outcrop of sedimentary rocks is less and metamorphism is more widespread but of a lower grade.

Generally the relief in both areas is rugged, with rocky hills and ridges and deeply-dissected plateaux separated by deep, narrow gorges. These give way in the south to rolling sandy plains. Lateritic remnants also occur throughout both areas.

6. GRANITES - TANAMI BLOCK

The rocks of the Granites - Tanami Block comprise phyllitic shale, quartzite, chert, basic and acid volcanics, and greywacke, locally intruded by granites. Relief is low, generally less than 30 m, and outcrops are scarce, consisting largely of low ridges separated by extensive sandy plains. Weathering of outcrop is severe and as a result only the most chemically stable rocks remain fresh; other rocks are leached and retain little trace of their original character.

7. TENNANT CREEK BLOCK

The Tennant Creek Block consists of a quartz-rich greywacke, shale, and siltstone sequence which has been strongly deformed but weakly metamorphosed. Massive and foliated granite and adamellite complexes, granite porphyry, quartz feldspar porphyry dykes and plugs intrude, and ignimbrites overlie the sediments.

Relief is low, and consists of sub-parallel lines of flat-topped hills rising from an extensive plain, which at Tennant Creek is about 340 m above sea level. The hills form mesas, buttes, and razor-backed ridges. The steep scarp of the hills gives way rapidly to the flat alluvial plains. Granite and porphyry crop out as low, rounded tors.

8. PINE CREEK GEOSYNCLINE

The Pine Creek Geosyncline, unconformably underlain by Archaean basement rocks, consists of Lower Palaeozoic sediments consisting of arkose, quartz-greywacke, sandstone, chert, and dolomite. The sediments have been intruded by granite.

In the north, broad alluvial plains, separated by low, gravel-covered rises have developed along the mature, lower reaches of the main rivers draining the uplands farther south. Some dissected laterites occur. Differential erosion has formed ranges with pronounced structural grain. Maximum relief in the area attains 300 m.

CENTRAL AUSTRALIAN OROGENIC PROVINCE consists mainly of metamorphic complexes. It forms basement to the Central Australian Platform cover.

9. GASCOYNE BLOCK

The Gascoyne Block lies north of the Yilgarn Block, and may incorporate parts of this and also the highly deformed western parts of the Hamersley Basin. Rock types include sandstone, shale, greywacke, and dolomite, and their metamorphic equivalents schist and gneiss. These have been intruded and partially migmatized by gneissic granulites. The topography is generally subdued with broad open flats and undulating low hills with an occasional higher ridge or flat-topped hill on the sandstone. Considerable areas are covered by alluvium from the rivers which drain the region.

10. PATERSON PROVINCE

The Paterson Province contains Precambrian quartzite, schist, slate, and some marble and dolomite which have been intruded by granite and overlain by sandstone and conglomerate. Large areas are covered by ironstained sand. Travertine is also widespread, especially near salt lakes.

The area consists of dissected uplands separated by wide sand plains. The uplands include strike ridges of metamorphics rising to 370 m and small hills and mesas less than 50 m high. The sand plains are covered by a longitudinal dune system and scattered salt lakes.

11. WILLYAMA BLOCK

The Willyama Block extends from the Barrier Ranges of New South Wales into South Australia where it is refered to as the Olary Province. It consists of highly folded and faulted high-grade metamorphic rocks and granite intrusives, displaying strong structural grain. Metamorphic grade is highest in the southeast and decreases to the southwest.

Outcrop over the block is variable; good exposures are extensive in the northeast and southwest. Most of the rocks are deeply weathered, with outcrops surrounded by clayey sediment.

12. GAWLER BLOCK

The Gawler Block occupies the Eyre and Yorke Peninsulas of South Australia. It is limited on its eastern and northern flanks by a cover of flat-lying and gently folded Proterozoic and Cambrian sediments, which thicken to the east and form the Adelaide Geosyncline. To the north, the cover rocks are flat-lying, thickening gradually toward the Musgrave Block. The Gawler Block is composed of gneiss, schist, quartzite, jaspilite, and amphibolite. The best exposures are in the southeast. Over most of the block the rocks are mantled by sands and carbonates. Erosion has reduced the relief to a peneplain with some inselbergs.

13. MOUNT ISA BLOCK

The Mount Isa Block consists of strongly folded, faulted, and metamorphosed geosynclinal sediments of Proterozoic age, divided into two belts by a slightly older north-trending complex of acid volcanics, granitic rocks, and metamorphics. In the southeast, small flat-lying remnants of Mesozoic sediments cap the Precambrian rocks. The geosynclinal strata are intruded by granite and dolerite; they contain basaltic and acid lavas, quartzite, slate, schist, and calc-silicate rocks. Granite crops out much more extensively in the east and southwest of the block than in the northwest, where the strata are slightly metamorphosed arenaceous, dolomitic, and argillaceous sediments, and basalt.

The area is generally one of moderate relief but much of the terrain is rough, owing to abundant exposure of rock. Landforms differ with each dominant rock type, but strike ridges control drainage over much of the area. Weathering has profoundly affected many of the surface rocks west and south of the watershed which trends northwest across the block.

14. MUSGRAVE BLOCK

The Musgrave Block straddles the western part of the Northern Territory and South Australian border and extends into Western Australia. It is flanked on the south and west by the Officer Basin, on the north by the Amadeus Basin, and on the east by the Eromanga Basin.

The oldest rocks are granulites and granites, which are overlain unconformably by a sequence of acid and basic volcanics and quartzite. These rocks are intruded by mafic and ultramafic bodies, extending easterly for 320 km.

Well developed relief of hills and ranges with intervening plains characterizes the area. The volcanic and ultramafic rocks form rounded hills whilst the sedimentary rocks form ridges.

15. ALBANY-FRAZER BLOCK

The Albany-Frazer Block, situated along the southern and eastern margins of the Yilgarn Block, is composed of Proterozoic granites and granite gneiss. Almost the entire belt is covered by sand, with silt and clay in places, and laterite.

Relief is higher than that in the Yilgarn Block; ranges rise to heights of 1100 m above sea level.

16. NORTHAMPTON BLOCK

The Northampton Block is a small area of exposed Precambrian rocks on the coast of Western Australia, about 560 km north of Perth. The oldest rocks in the block are Archaean garnet granulites and gneisses. They are intruded by numerous, steeply dipping, dolerite dykes, trending in a northeast direction, transgressive to the regional trend.

LATE PRECAMBRIAN DOMAINS comprise metamorphics and granites of the Naturaliste Block in Western Australia and the Tyenna-Rocky Cape Geanticline in Tasmania.

17 & 18. TYENNA-ROCKY CAPE GEANTICLINE

The Tyenna-Rocky Cape Geanticline is a complex region of Precambrian and Palaeozoic metamorphics and sediments occupying the southwestern and northwestern portions of Tasmania. Precambrian rocks include schist, gneiss, quartzite, amphibolite, sandstone, siltstone, dolomite, and chert, with various interbedded volcanics. The Palaeozoic sequence comprises conglomerate, sandstone, siltstone, shale, greywacke, limestone, and dolomite, with interbedded mafic and intermediate volcanics. These have been intruded by acid to ultramafic material of various ages.

In general the relief is high; the terrain is much-dissected and extremely rugged in places although some gently undulating or flat areas occur.

19. NATURALISTE BLOCK

The Naturaliste Block consists of granulite, amphibolite, and granite gneiss, which crop out mainly on the coast. Overlying these are coastal aeolian calcarenite, and laterite and associated quartz sand farther inland.

The coastline is rugged with small sandy bays. Inland, low undulating sand and laterite-capped hills predominate.

EAST AUSTRALIAN OROGENIC PROVINCE consists of a number of deformed geosynclines and forms basement to the Trans-Australian Platform Cover.

20. KANMANTOO TROUGH

The Kanmantoo Trough contains Lower Palaeozoic sediments which rest unconformably on rocks of the Adelaide Geosyncline. Rock types exposed include greywacke, arkose, shale, quartzite, phyllite, and schist. They are overlain by Upper Palaeozoic tillite, shale, and mudstone, and Tertiary laterite, sand, and gravel.

The area has relief of about 300 m with rolling hills and minor rugged areas.

21. ANAKIE HIGH

The Anakie High is an elongate north-trending belt of Lower Palaeozoic metamorphics and granite. The metamorphics, which include schist, phyllite, slate, and limestone, have been intruded by granite and overlain by acid lavas and tuff, and basalt.

The area in the south forms steep hills and ridges, separated by V-shaped valleys with lower and more rounded hills on the granite. Basalt plugs form sharp hills rising to 300 m above the country. In the north the area is lower with rounded hills rising above soil-covered plains; here, widespread laterite lies on the metamorphics.

22. BROKEN RIVER EMBAYMENT

The Broken River Embayment is an arcuate southwest-trending embayment of Palaeozoic sediments on the eastern margin of the Georgetown Inlier. Rock types include sandstone, siltstone, shale, greywacke, arkose, and minor conglomerate and limestone, with interbedded basic and ultrabasic intrusives. These are intruded by small granite bodies and overlain by Permian acid and Tertiary to Holocene basic volcanics.

The area forms a dissected upland containing remnant tablelands and plateaux. A number of small lakes have been formed by the damming of streams by Tertiary basalt. Exposure is generally good with areas of rock outcrop and of rock thinly covered by soil.

23. DRUMMOND BASIN

The Drummond Basin is a largely terrestrial Palaeozoic sedimentary basin flanking the Anakie High on the east and west. Most abundant are fluvial and lacustrine sandstone, conglomerate, and mudstone, with minor marine limestone and volcanics. The sediments have been intruded by granite and are overlain by acid and basic volcanics.

The area forms dissected plateaux and tablelands separated by narrow inaccessible valleys. Dissected laterites are also present.

24. LACHLAN GEOSYNCLINE

The Lachlan Geosyncline is a complex region of folded Palaeozoic sediments in central Victoria and southeast and central New South Wales; it also extends into western and northeastern Tasmania. All major sedimentary rock types are present, commonly interbedded with acid to basic volcanics. Several orogenies and associated intrusion of large bodies of granite and smaller masses of mafic and ultramafic rocks have given rise to a complex structure. The Palaeozoic rocks are overlain in places by Tertiary basalt and Quaternary sand and clay.

The area is one of complex relief ranging from gently undulating plains to the Mount Kosciusko Plateau, the highest region in the continent. Exposure varies from poor to very good.

25. DARLING BASIN

The Darling Basin contains Upper Palaeozoic sandstone, siltstone, claystone, shale, and quartzite which lies between the Eromanga and Murray Basins to the north and south respectively. These sediments are overlain by large areas of Cainozoic dune sand, sand, alluvium, and clay and by dissected lateritic remnants.

The area consists of dissected ridges and isolated hills rising to 500 m, separated by wide sandy plains carrying dunes and salt lakes. The Darling River which traverses the area is surrounded by a wide flood plain.

26. HODGKINSON BASIN

The Hodgkinson Basin consists of Palaeozoic limestone, chert, greywacke, siltstone, and mudstone, with interbedded andesite and basalt which have been folded, metamorphosed, and intruded by granite, and overlain by acid and basic volcanics.

Tertiary uplift has resulted in a hilly and incised upland area, broken by granite monadnocks, remnant peneplains, eroded tablelands, and plateaux. High temperatures and rainfall have resulted in very deep weathering.

27. NEW ENGLAND GEOSYNCLINE

The New England Geosyncline consists of rocks ranging in age from Lower Palaeozoic to Permian. The oldest beds are phyllite, chert, and greywacke, with interbedded flows of basic lavas. These beds crop out in a belt trending approximately northeast across the centre of the geosyncline. Overlying them are Silurian limestone, Lower and Middle Devonian mudstone, greywacke, and limestone, and Carboniferous mudstone, sandstone, tuff, and conglomerate, with interbedded andesite and rhyolite. These sediments have been intruded by a granite batholith and overlain in places by Tertiary basalt.

Rejuvenation of the drainage system by Cainozoic uplift resulted in the granite being fretted into domes. The Tertiary basalt forms resistant cap rocks, giving rise to plateau surfaces. Etched fault-block topography is common. There are some laterites and deep weathering.

28. YARROL BASIN

The Yarrol Basin is a narrow elongate belt of Palaeozoic and Mesozoic marine and continental sediments. An early marine sequence of andesite tuff, agglomerate, and lava is overlain by a greywacke and chert sequence and this in turn by limestone, sandstone, siltstone, and shale. Minor continental conglomerate, sandstone, and shale are exposed in the north. These sediments are intruded by granite, diorite, and ultrabasic material and are overlain by andesite and basalt lavas.

The relief is varied with dissected mountains in the south and an area of moderate to low relief in the north. Plateaux have formed on the acid volcanics. There are some laterites and deep weathering.

UNASSIGNED PRECAMBRIAN METAMORPHIC COMPLEXES

29. ARNHEM BLOCK

The Arnhem Block is a basement "high" of granite, gneiss, and granulite exposed in the northeast of the McArthur Basin and overlain by Mesozoic mudstone and sandstone, and Cainozoic laterite, bauxite, sand, and alluvium.

The area forms a lateritized Mesozoic plateau dissected by short streams on the east.

30. LITCHFIELD BLOCK

The Litchfield Block is an elongate belt of metamorphics and granite west of the Pine Creek Geosyncline. It is formed of schist, granulite, and amphibolite, intruded by granite, migmatite, and dolerite. These are overlain by acid volcanics, sandstone, siltstone, conglomerate, and extensive deposits of alluvium, sand, and gravel.

The area forms flat, soil-covered plains broken by rugged hills of metamorphics up to 200 m high. The granite mainly forms piles of boulders up to 30 m high.

31. ARUNTA BLOCK

The Arunta Block is an elongate east-west-trending belt of Precambrian metamorphic rocks, lying between the Amadeus Basin in the south and the Wiso Basin in the north. Rock types represented are schist, gneiss, amphibolite, metalimestone, and quartzite which are intruded by acid and basic igneous rocks. They are overlain by an extensive area of Quaternary sand and lesser amounts of Tertiary sandstone, limestone, and laterite.

The area consists of high, dissected ranges and hills with intervening areas of sand plains with scattered outcrops.

32. GEORGETOWN INLIER

The Georgetown Inlier is formed of two Precambrian sequences. One is metamorphic with schist, amphibolite, gneiss, granite, and migmatite, and one sedimentary with sandstone, siltstone, and shale, and minor greywacke, chert, and limestone. These have been intruded by granite, dolerite, and serpentinite and overlain by Upper Palaeozoic acid volcanics and Tertiary basalt.

The area consists of a dissected upland region of mountains, hills, and plateaux, giving a rugged relief in places although the local relief seldom exceeds 150 m.

33. YAMBO INLIER

The Yambo Inlier consists of Precambrian gneiss, schist, quartzite, and amphibolite which have been intruded by dolerite and granite. Minor upper Palaeozoic acid volcanics overlie a small area in the south.

The area forms gently undulating uplands and occasional low ridges of quartzite.

Exposure, apart from the quartzite and amphibolite, is poor and outcrops are usually confined to minor beds.

34. PENINSULA RIDGE

The Peninsula Ridge consists of an elongate north-south-trending belt of Precambrian slate, phyllite, quartzite, schist, amphibolite, and gneiss which is intruded by Palaeozoic granite. In the north it is overlain by Upper Palaeozoic acid and basic lavas and tuff.

The Ridge forms a northerly-trending axis of high ranges and plateaux bounded by a scarp on the east and gently dipping under the Carpentaria Basin to the west. The axis is low in the south rising to 800 m in the centre before dropping to 300 m in the north.

WEST AUSTRALIAN PLATFORM COVER

35. HAMERSLEY BASIN

Lower Proterozoic West Australian Platform Cover sediments surround the Pilbara Block. To the north and east, they are concealed beneath younger sediments of the Canning Basin. The Hamersley Basin in the south is the only basin developed in the West Australian Platform Cover. It covers an area of approximately 480 000 sq km and is roughly elliptical in plan.

Early acid and basic volcanics crop out in the north and central regions of the basin. They are overlain and almost surrounded by banded iron formations, chert, and dolomite, above which are greywacke, siltstone, shale, quartzite, and dolomite. The iron formations and the clastic sediments crop out north, south, and east of the central basic volcanic lavas. Subsequent folding produced structures suitable for silica leaching, leaving bodies of almost pure hematite. Weathering of the basic lavas has produced bare rocky hills with little soil or vegetation cover, constituting some of the most rugged and inaccessible terrain of the region. The banded iron formations are highly resistant to weathering processes and exert a dominant control on the landscape.

The main river of the area occupies a broad, flat valley filled with clay. At the eastern end of the basin, the valley is about 60 km wide and unconsolidated sediments attain thicknesses of 100 m. Saline loams and clays are present along the coast.

NORTH AUSTRALIAN PLATFORM COVER

36. KIMBERLEY BASIN

This basin is bounded on the southwest by the King Leopold Belt and on the southeast by the Halls Creek Belt. Sediments of the Kimberley Basin dip and thicken to the northwest away from the Halls Creek Belt. Acid volcanics and tuffs comprising the oldest unit, lie unconformably on rocks of the Halls Creek Belt. The volcanics are overlain unconformably by a thick sequence of shallow-water sandstone, siltstone, and shale, and minor acid volcanics. Overlying them is a sandstone sequence with basic volcanics at the base. The rocks of the basin are nearly horizontal, and only near the Halls Creek and King Leopold Belts are they deformed to any extent.

Maximum relief is approximately 300 m, with the sandstone forming rough, rugged terrain with almost continuous outcrop. The valleys between the sandstone ridges form low, rounded hills. There are some lateritic remnants.

37. An unnamed basin containing Upper Proterozoic sandstone, shale and some conglomerate and minor dolomite lies east of the Canning Basin and surrounds the Granites-Tanami Block. The sediments are overlain by lateritized Lower Cambrian basalt, Tertiary limestone and Quaternary alluvium and sand.

The area consists of scattered marginally-dissected uplands up to 180 m high separated by gently undulating sand plains which in places carry dunes averaging 15 m in height. A number of salt lakes have formed by internal drainage.

38. McARTHUR BASIN

The McArthur Basin extends from Arnhem Land southeast to the Queensland border. The main rock types are acid and basic volcanics, granite, arkose and quartz sandstone, siltstone, and dolomite which lie unconformably on acid volcanics and granulite of the North Australian Orogenic Province.

Relief ranges from sea level to 150 m. In the north, the sandstone forms plateaux with deeply-dissected gorges. The western sides of the plateaux form scarps up to 270 m high; on the east the plateau dips gradually under the plains. The central area consists of strike ridges and valleys formed by the erosion of folded sandstone and siltstone. The sandstone forms cuestas and mesas. In the south a dissected plateau dips northwards beneath the coastal

plains, and southward beneath the overlying Barkley Tableland of the Georgina Basin. There are some lateritic remnants.

39. DAVENPORT "GEOSYNCLINE"

The Davenport "Geosyncline" comprises a sequence of sedimentary and extrusive igneous rocks, consisting of quartz-rich sandstone, shale, and siltstone, and acid and basic lavas.

Cainozoic sand and silt is present around the area of exposed platform cover. Small outcrops of travertine, containing much silty material are scattered throughout the area. Relief is generally low; the sandstones form ridges standing above the surrounding plain.

CENTRAL AUSTRALIAN PLATFORM COVER

40. BANGEMALL BASIN

The Bangemall Basin is an elongate northwest-trending basin broadening to the southeast and containing Upper Proterozoic sediments which unconformably overlie Lower Proterozoic sediments, metamorphics, and granite. The main rock types represented are dolomite, sandstone, greywacke, shale, and chert, with minor interbedded acid volcanics. These are intruded by numerous dolerite sills and are overlain by Cainozoic sands.

The area forms dissected uplands cut by a few steams which form steep-sided valleys and gorges. The dolerite sills form long narrow ridges or broad, flat plateaux.

41. ADELAIDE GEOSYNCLINE

The Adelaide Geosyncline consists of Upper Proterozoic and Middle Cambrian sediments. Inliers of Lower Proterozoic basement occur in places. The Upper Proterozoic consists of a sequence of sandstone, siltstone, shale, dolomite, and glacial sediments. Cambrian sediments crop out in several isolated areas and comprise limestone, shale, and sandstone.

The area is one of varied relief. In the north, maximum relief of about 100 m is attained in the prominent rugged strike ridges of the Flinders Ranges. In the central area relief is lower and is formed by gentle, rounded strike ridges. In the south, the Mount Lofty Ranges attain heights of 600 m; the terrain is characterized by rounded, soil-covered hills.

42. VICTORIA RIVER BASIN

The Victoria River Basin lies to the northeast of the Halls Creek Belt. It is formed of a sequence of about 2500 m of Precambrian sediments including quartz sandstone, siltstone, and dolomite. These beds are masked on three sides by Cambrian basalts.

Relief in the basin is between 100 and 200 m; the dominant landforms are a series of dissected plateaux, cuestas, and strike ridges.

43. AMADEUS BASIN

The Amadeus Basin is a Proterozoic-Palaeozoic basin occupying some 150 000 sq km in the Northern Territory and Western Australia. It is bounded and floored by Precambrian igneous and metamorphic rocks. To the east and west it is covered by younger sediments. The Proterozoic succession consists of a basal quartzite sequence followed by a dolomite, siltstone, and evaporite sequence. These have been folded and overlain by a thick continental sequence of siltstone, sandstone, and conglomerate.

Most of the basin is covered by superficial Cainozoic material, mainly sandy plains with some sand dunes, outwash plains and alluvial fans, and evaporites in the large salt lakes. Around the edges of the salt lakes travertine, kunkar, and calcrete have been formed.

44. NGALIA BASIN

The Ngalia Basin is a small, intracratonic depression filled with Proterozoic, Cambrian, Ordovician and Carboniferous sediments. It covers an area of some 15 000 sq km in the southern part of the Northern Territory. The basin is floored by Precambrian gneiss, granulite, and amphibolite which have been intruded by granite. Proterozoic sandstone and conglomerate lie unconformably on the Precambrian basement. They are overlain unconformably by Proterozoic tillite and dolomite, Cambrian dolomite and red beds, Ordovician sandstone and shale, and Carboniferous sandstone and conglomerate. Cainozoic sediments, consisting of sandy plains with some sane dunes and travertine, and alluvium, cover most of the basin; outcrop is limited mostly to a strip along the northern margin.

Relief in the area is low and the central part of the basin is a flat plain. Sandstone and quartzite ridges crop out in narrow belts along the northern margin, and have a maximum relief of 200 m.

45. OFFICER BASIN

The Officer Basin has an area of about 325 000 sq km. It underlies the Great Victoria and Gibson Desert in the eastern part of Western Australia. It is flanked in the south by the younger sediments of the Eucla Basin in Western and South Australia. The basin is separated from the Canning Basin in central Western Australia by a subsurface basement ridge. The basin is filled with unmetamorphosed Proterozoic to Tertiary sedimentary rocks; Precambrian sandstone, siltstone, and glacial sediments predominate, and Upper Proterozoic stromatolitic dolomite, cherty oolite, and sandstone are also present.

The area forms a plain lying between 300 m and 450 m. Rock outcrops are sparse and deeply weathered.

Dissected ranges of marked relief are confined to the edges of the basin, where Precambrian volcanic and metamorphic rocks are exposed at the surface. The main drainage features are dry salt lakes and alluvial depressions. The basin is covered by Cainozoic sands and in places sand dunes. Lateritic remnants also occur.

46. DALY RIVER BASIN

The Daly River Basin includes Lower Palaeozoic marine sediments resting on early Cambrian plateau basalt. The sediments include limestone, dolomite, sandstone, siltstone, and marl, overlain by Mesozoic sandstone and siltstone, and Cainozoic sand and laterite.

The area is generally coincident with the Daly River drainage basin and consists of broad plains interrupted by low rises. Streams have cut channels up to 15 m deep in the Cainozoic sediments.

47. GEORGINA BASIN

The Georgina Basin occupies a surface area of about 285 000 sq km, and extends in a belt trending northwest from western Queensland to the central part of the Northern Territory. It is bounded on the east, north, and west by Precambrian rocks, and the southeastern and northwestern boundaries are obscured by Mesozoic sediments. Most of the northern half of the basin contains a thin blanket of Cambrian marine carbonate rocks, and minor shale and sandstone. In the southern half of the basin, Lower Palaeozoic carbonates, sandstone, and shale are exposed. Overlying are Tertiary limestone, siltstone, and sandstone and extensive areas of clay.

The area is of low relief, characterized by rolling clay downs, with low, stony and sandy rises. The downs occur mainly on the Cambrian and Tertiary carbonate rocks. Lateritic remnants also occur.

48. WISO BASIN

The Wiso Basin forms the southern extension of the Daly River Basin, occupying some 65 000 sq km between Tennant Creek and Tanami in the Northern Territory. The basin is bounded by Precambrian sandstone in the west; schist, arenite, and volcanic intrusives in the southwest; Archaean metamorphics and granite in the south; and by Lower Proterozoic arenites in the east. Devonian and Ordovician sandstones crop out in the south, Middle Cambrian dolomite in the north and Lower Cambrian is sporadic, most of the basin being covered by Cainozoic sand; some areas have marked aeolin features.

49. ORD BASIN

The Ord Basin occupies an area of about 19 000 sq km south of the Bonaparte Gulf Basin, on the border of Western Australia and the Northern Territory.

Lower Cambrian basalt, about 1 000 m thick, unconformably overlies Upper Proterozoic sediments. The basalt is overlain disconformably by Middle Cambrian limestone, gypsiferous shale and siltstone, and ferruginous sandstone and siltstone. Sandstone of probable Upper Devonian age, 400 m thick, unconformably overlies the Cambrian sequence.

The basalts form terraced mesas up to 200 m high, and the sediments form extensive plains with sparse soil cover.

50. CARNARVON BASIN

The Carnarvon Basin is an elongated basin lying along the central western coast of Western Australia. It is bounded in the south and east by Precambrian igneous and metamorphic rocks, and the north-eastern margin is obscured by Cainozoic sediments.

Thick Proterozoic and early Palaeozoic sandstone and siltstone rest unconformably on Precambrian crystalline basement in the southeast. Devonian and Carboniferous sandstone, limestone, and siltstone crop out in the northeast, and Permian sandstone and finely laminated siltstone and shale crop out in the east. Jurassic rocks are known in outcrop only on the northern and southern margins of the basin. Cretaceous sandstone, siltstone, shale, and limestone are seen in the northeast and southwest.

The basin is characterized by low relief, with large, gently-undulating sand plains, contrasting strongly with the area of Precambrian rocks to the east, which has high relief and mature valley topography.

51. BONAPARTE GULF BASIN

The Bonaparte Gulf Basin in northwestern Australia covers an area of about 18 000 sq km. The oldest rocks, basalts of Cambrian age, crop out in the south. Progressively younger rocks are present northwards. Sandstone with interbedded dolomitic limestone form a sequence overlying the basalts; they are thickest (almost 1 000 m) in the west of the basin.

Outcrop is generally poor, and extensive sand and clay areas occur. Along the coast saline loam and clay have developed.

52. CANNING BASIN

The Canning Basin covers an area of 400 000 sq km. It is a deep, graben-like trough, containing up to 9 000 m. of Palaeozoic and Mesozoic sediments which rest on Precambrian sedimentary, igneous, and metamorphic basement. The Palaeozoic sediments consist of Ordovician limestone, dolomite, shale, and sandstone, and Devonian conglomerate, sandstone, siltstone, calcilutite, and limestone breccia. Sandstone of Mesozoic age, together with Devonian limestone and conglomerate, forms ranges which rise 100 m or more above the surrounding flat country. In the southern part of the basin, the Permian and Mesozoic rocks are relatively thin, and unconformably overlie an extensive development of Devonian and Ordovician sediments, including evaporite sequences with bedded salt. Over most of the basin, Cainozoic sandstone and lateritic remnants are present. Scattered outcrops of Tertiary sandstone, limestone, and travertine are present in the south. The surface of the basin is virtually flat and is dune-covered.

TRANS-AUSTRALIAN PLATFORM COVER

53. SYDNEY BASIN

The Sydney Basin, containing Permian and Triassic marine and terrestrial sediments, is bounded on the west and north by the Lachlan Geosyncline and the New England Geosyncline respectively. Marine sandstone, shale, and tuff, with interbedded basalt, are overlain by terrestrial sandstone, siltstone, shale, and coal. These are overlain in places by Tertiary basalt and Quaternary sand and alluvium.

The area forms rugged dissected tablelands with steep narrow gorges, separated by areas of undulating lowlands. There are remnants of laterite, especially in the southern part of the basin.

54. BOWEN BASIN

The Bowen Basin is composed of Permian volcanics overlain by Permian and Triassic marine and continental sedimentary rocks. The broad stratigraphic sequence consists of intermediate volcanic rocks at the base, marine clastic sedimentary rocks, coal measures with minor tuff, continental red beds, quartz-rich sandstone, and at the top, a continental mudstone and sandstone sequence.

The topography of the area underlain by the basin varies from broad plains to steep-sided ridges and plateaux.

55. TASMANIA BASIN

The Tasmania Basin contains several hundred metres of Permian and Triassic marine and continental sediments. Rock types exposed include tillite, conglomerate, sandstone, siltstone, shale, coal,

arkose, and limestone. These have been intruded by small bodies of granite and by large sills and dykes of dolerite. Overlying are Tertiary basalt and Tertiary to Recent lacustrine sediments.

The area forms dissected, steep-sided plateaux and tablelands separated by broad, flat or gently undulating lowlands.

56. PERTH BASIN

The Perth Basin is an elongated north-south trending belt of Permian and Mesozoic terrestrial and marine sediments. Basal sequences include tillite, sandstone, siltstone, limestone, shale, and coal; these are confined to the northern portion of the basin. Overlying sediments are mainly conglomerate, sandstone, and shale, with minor limestone and coal and interbedded basalt near the top of the sequence.

The area forms flat coastal plains and gently rolling hills inland. Much of it is covered by Cainozoic sand and silt and in places laterite.

57. MURRAY BASIN

The Murray Basin, consisting of Mesozoic and Cainozoic sediments, is bordered on the west by Proterozoic rocks of the Adelaide Geosyncline, on the northwest by Precambrian and Lower Palaeozoic rocks of the Willyama Block and Darling Basin, and on the east and southeast by the Palaeozoic Lachlan Geosyncline. Rock types exposed include Mesozoic and Tertiary sandstone, limestone, basalt, and tuff, overlain by gravel, sand, silt and alluvium.

The basin is an area of low relief, with thick unconsolidated sediments. In the east, finer material deposited by a distributory system of prior streams, forms a gently undulating plain. The western half of the basin consists of sandy ridges, interrupted only by flood plains, lakes, and lunettes.

58. CLARENCE - MORETON BASIN

The basin is composed mainly of Triassic-Jurassic rocks, divisible into two sequences. The lower consists of coal measures and volcanics of Triassic age, overlain by a sequence of uppermost Triassic to Upper Jurassic sandstone and siltstone with some coal and minor volcanics. Tertiary basic lavas crop out extensively in the northwest of the basin.

The central part of the basin is characterized by low relief. In the peripheral area there is a rapid gradation to dissected plateaux topography which is profoundly modified locally by the presence of Tertiary igneous intrusives. In the north, intrusives rise hundreds of metres above the surrounding country.

59. MARYBOROUGH BASIN

The basin contains 2 000 m of Jurassic sandstone, shale, conglomerate, and coal, and 6 500 m of Cretaceous intermediate and acid volcanics, sandstone, shale, limestone and coal. Some small granite plutons, associated with the Lower Cretaceous volcanics, intrude older sediments. Folded Triassic sediments and volcanics up to 3 300 m thick form basement.

In the west, Jurassic rocks form hilly country where elevation ranges from 15 m to 650 m; farther east relief is more subdued. The coastal lowlands consist of marine sandstone and siltstone on an emerged coastline, admixed with Quaternary alluvium in places.

60. LAURA BASIN

The Laura Basin, which contains continental and marine Mesozoic sediments, lies in a basement depression north of the Hodgkinson Basin. Continental deposits include conglomerate, sandstone, siltstone, and shale. These are overlain by marine claystone.

The central and northern parts of the basin are flat and its rocks dip gently northward. In this area the Mesozoic sediments are overlain by Tertiary or Quaternary continental and marine conglomerate, sandstone, and siltstone. In the south the Mesozoic rocks crop out as dissected sandstone tablelands.

61. EUCLA BASIN

The Eucla Basin is a Tertiary basin, marginal to the Great Australian Bight. Tertiary limestone, nowhere in excess of 300 m, covers a shelf area of Cretaceous sandstone and shale.

The limestone is flat-lying, and forms a low, stony plain with many sink holes. The plain ranges in height from 200 m at its seaward edge to 160 m at its northern margin. The area lacks surface drainage and large cave systems have developed.

62. GIPPSLAND BASIN

The Gippsland Basin contains Mesozoic and Tertiary marine and terrestrial sediments in south and southeastern Victoria. Main rock types exposed are feldspathic sandstone, mudstone, shale, and minor coal. These are overlain by Tertiary to Quaternary basalt, brown coal, gravel, sand, silt and coastal dune limestone.

The area is of moderate or low relief with intricate dendritic drainage on the exposed Mesozoic.

63. OTWAY BASIN

The Otway Basin contains Mesozoic and Tertiary marine sediments. Lower sequences include greywacke, siltstone, mudstone, and coal which are overlain by limestone, marl, conglomerate, sandstone and coal.

The area forms deeply and intricately dissected ranges with high cliffs along the coastline.

64. SURAT BASIN

The Surat Basin contains terrestrial and marine Mesozoic sediments which overlie the Bowen Basin sequence. Rocks exposed are sandstone, siltstone, mudstone, and minor coal and conglomerate. In places these are deeply weathered and chemically altered. Overlying the Mesozoic sediments are Tertiary sandstone, conglomerate and Quaternary alluvium, sand, silt, and clay.

The area is flat-lying or gently rolling, with occasional mesas or low plateaux.

65. EROMANGA BASIN

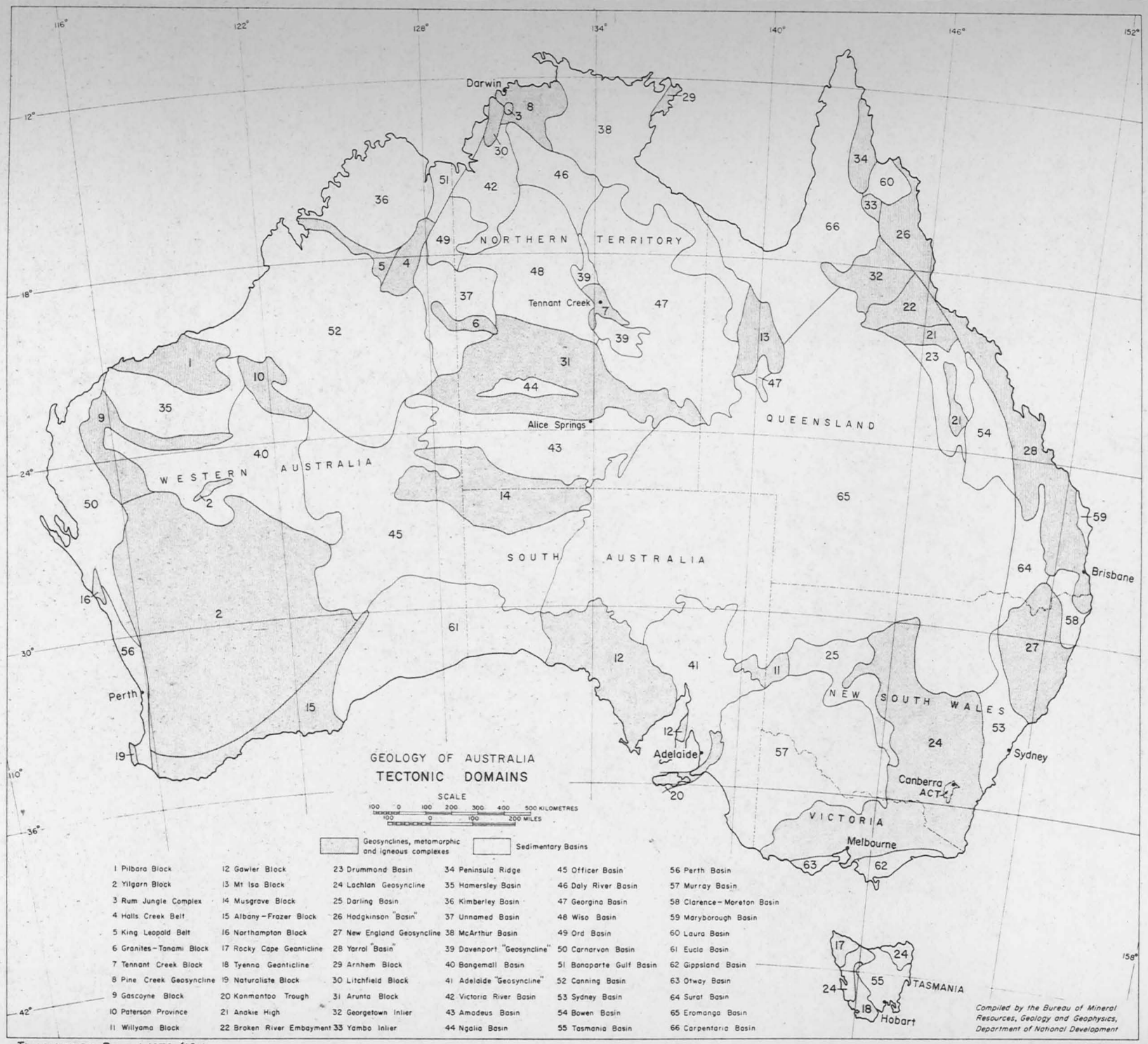
The Eromanga Basin, of 800 000 km ^{2}, consists of terrestrial and marine Mesozoic sediments including conglomerate, sandstone, siltstone, and mudstone, with minor limestone and coal. These are deeply weathered and in places overlain by Tertiary-Quaternary sand, silt, clay and gravel.

The area is flat-lying or gently rolling with occasional mesas and low plateaux. Sand ridge systems are well developed in the west of the basin but clay plains and ridges of lateritic remnants typify much of the east. The western part of the basin is characterized by internal drainage, with wide watercourses and extensive flood plains.

66. CARPENTARIA BASIN

The Mesozoic Carpentaria Basin which is separated from the Eromanga Basin by a buried basement ridge contains continental conglomerate, sandstone, and siltstone, overlain by marine mudstone and minor limestone. These are deeply weathered in places and almost entirely overlain by Cainozoic laterite, bauxite, alluvium, and colluvial sand and clay.

Low plateaux and mesas occur generally around the margin of the basin; its interior is flat, low-lying, and has low relief.



To accompany Record 1972/104

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GEOLOGY OF AUSTRALIA
DISTRIBUTION OF MAIN ROCK TYPES

SCALE

100 0 100 200 300 400 500 KILOMETRES

100 0 100 200 MILES

α	Sand, silty and clayey in places	θ	Carbonates including metamorphosed carbonates
β	Clay and silt	ι	Low grade metamorphic rocks
γ	Evaporites, saline sand, clay and silt	κ	Granites, granodiorites and gneisses
δ	Laterites and associated materials	λ	Basic intrusives
ε	Sandstones	μ	Acid extrusives
ζ	Siltstones, claystones and mudstones	ν	Basic extrusives
η	Interbedded sandstones, siltstones, claystones and mudstones	π	Undivided basic and ultrabasic igneous rocks ("greenstones") of the Yilgarn Block

Bedrock unknown or at considerable depth. Stippling indicates underlying crystalline basement, mostly granite and granite-gneiss

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