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PAPUAN BASIN DATA COMPILATION:

MESOZOIC TO CAINOZOIC STRATIGRAPHIC

SUMMARY COLUMNS AND DATA MAPS

by

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SUMMARY

Mesozoic to Cainozoic data maps and stratigraphic summary columns for the Papuan Basin were produced as part of the BMR-APIRA Phanerozoic History of Australia Project. They are based on the compilation of basic data such as lithology, thickness, sedimentary structures, fossil assemblages and biochronological age, using a variety of data sources. The data presented in this report, in conjunction with data from the remaining areas of Papua New Guinea, and from Irian Jaya, New Zealand, the Pacific Ocean and the Indian Ocean will be used, at a later date, as a base for interpretive, palinspastically reconstructed palaeogeographic maps for a number of Mesozoic to Cainozoic time slices.

The Papuan Basin was initiated in the Mesozoic as a passive margin basin along the northern edge of the Australian craton. Sedimentation occurred initially in restricted depocentres of the developing rift grabens in the Triassic. Following break-up in the Early Jurassic, deposition became more widespread with the establishment of first fluvial and then paralic conditions. A transgression in the Middle Jurassic, which culminated in the Callovian and resulted in the deposition of mostly fine-grained sediments throughout the basin, was followed by a major regression in the Late Tithonian to Early Neocomian and the establishment of an extensive shore zone depositional system with predominantly sandstone deposition; these sandstones are the major reservoir rocks for Mesozoic hydrocarbon accumulations in the Papuan Basin. The Early Cretaceous period was again characterised by the deposition of mostly fine-grained sediments, however, several distinctive sandstone horizons are present within this sequence.

Late Cretaceous to Paleocene differential uplift and erosion related to extension in the Coral Sea resulted in the removal of Late Cretaceous sediments in the greater part of the basin, and of latest Jurassic to Late Cretaceous sediments in the eastern part of the basin. After a period of restricted deposition in the northern basin during the Paleocene, deposition became more widespread in the Eocene, with accumulation of carbonates in shallow to deeper water environments. A major hiatus in the Oligocene reflects the conversion of the Papuan Basin from a passive margin to a foreland basin caused by the collision of Australian continental lithosphere with the Pacific plate. Deposition of clastic sediments commenced in the Late Oligocene to Early Miocene in the proximal foredeep of the southward migrating thrust front, while thick reef- and reef-related carbonates accumulated in the shallow parts of the basin; they provide the second major reservoir in the Papuan Basin. By the Late Pliocene to Pleistocene, sediment influx from the emerging mountains to the north had caused the burial of the carbonate platform under a thick clastic sequence.

1. INTRODUCTION

Two major geotectonic provinces are present on the main island of Papua New Guinea: the autochthonous Australian craton and the New Guinea orogen, which consists of a para-autochthonous belt of deformed Australian craton and a northern region of allochthonous tectonostratigraphic terranes (Fig. 1a) (Pigram & Davies, 1987). The Papuan Basin (Fig. 1b) developed in the Early Mesozoic as a passive margin along the northern edge of the Australian craton. Northward drift of Australia in the Cainozoic led to the accretion of terranes to the edge of the craton, the conversion of the passive margin basin into a foreland basin (Pigram & others, 1989) and the deformation of the northern part of the basin (Papuan Fold Belt, Fig. 1b).

Seventeen stratigraphic summary columns (Enclosures 1 & 2, Appendix I) and thirty five data maps (Appendix II) for the Mesozoic to Cainozoic of the Papuan Basin have been produced as part of the Phanerozoic History of Australia Project. The columns and maps are based on the compilation of basic data, such as thickness, grain size, lithology, sedimentary structures, fossil assemblages and biochronological age, from various data sources including well completion reports, published and unpublished reports and papers, and explanatory notes for 1:250,000 and 1:100,000 geological maps. Biostratigraphic information for the petroleum exploration wells is based heavily on a recent revision of the Mesozoic by Morgan (1990a, b), and on Lloyd (1988) for the Cainozoic. Cainozoic biostratigraphic data for the offshore wells are based on Chaproniere & others (1990). Ages for outcrops along the northern margin of the basin are, to a large extent, based on Arnold & others (1979), Haig (1979, 1981), Belford (1984) and Francis & others (1990). A bibliography of data sources is given in Chapter 5. The data presented in this report, in conjunction with data from the remaining areas of Papua New Guinea, will be used as a basis for interpretive palaeogeographic maps plotted on palinspastically reconstructed base maps; these will be presented at a later date.

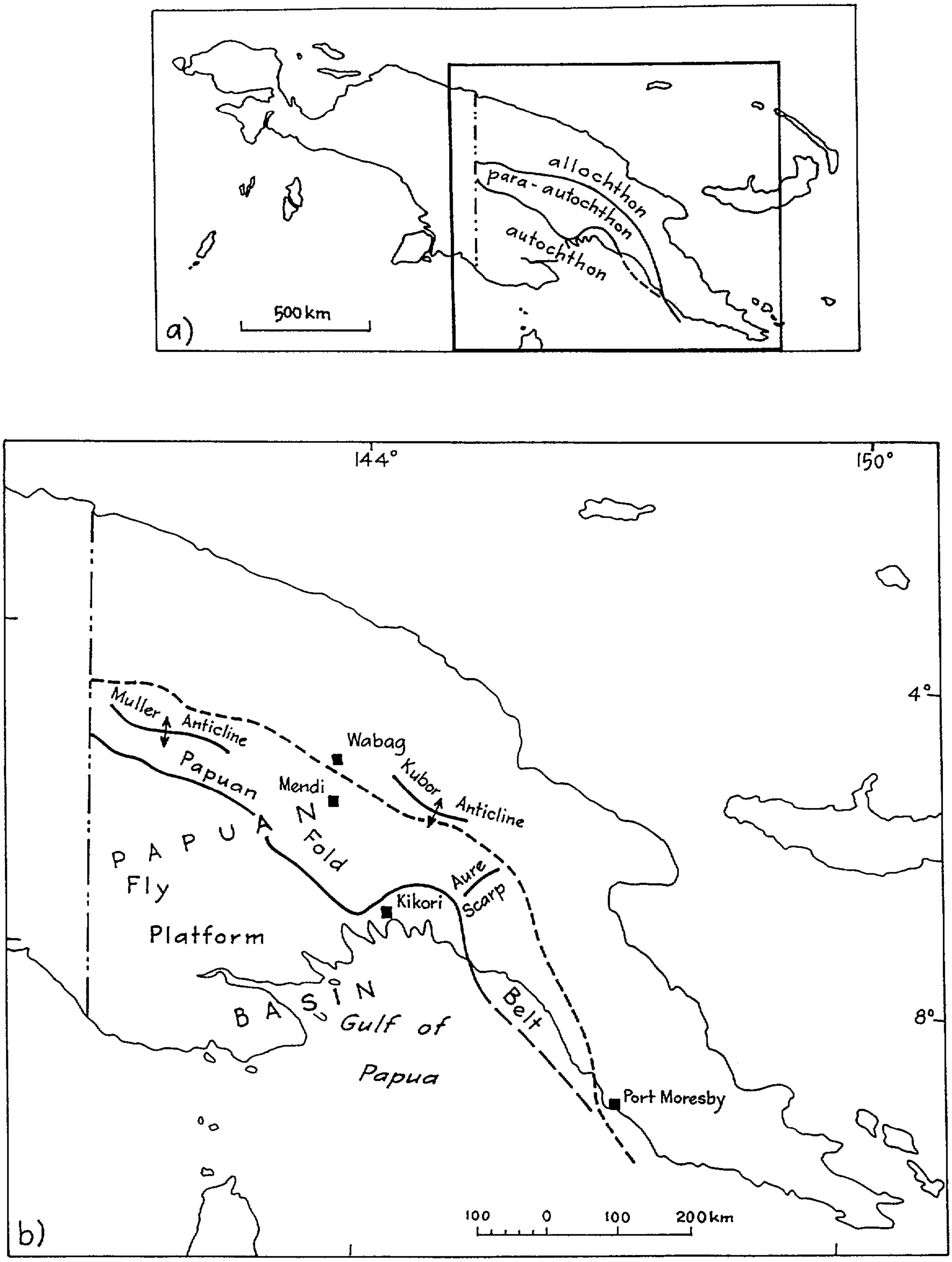

Figure 1: Location map for the Papuan Basin (dashed line shows approximate northern boundary of the basin).

1.1 **Summary Columns** (Enclosure 1 & 2; Appendix I)

The summary stratigraphic columns are composite columns which include information from exploration wells and outcrops. They are drawn against the Mesozoic time scale of Harland & others (1982) and the Cainozoic time scale of Berggren & others (1985a, b). Mesozoic dinoflagellate and spore/pollen zones of Helby & others (1987), a scheme which was also used during Stage I of the project (Palaeogeographic Maps Project), as well as other Mesozoic dinoflagellate zonation schemes used for the Papuan Basin (Davey, 1987; Lowe & Welsh, 1987) are presented with the columns. Isotopic ages based on old (pre-1978) decay constants were adjusted using the standard decay constants given by Harland & others (1982).

In view of the scale of the maps to be drawn (1:10,000,000), the minimum number of columns required to characterise the Mesozoic to Cainozoic stratigraphy of the Papuan Basin was compiled. Therefore not all formations described in the literature could be considered, but the key sequences and their lithology and depositional environments were illustrated. The columns are presented as a number of sections across the western, central and eastern Papuan Basin. Column location is indicated in Figures A 1 and A 2. Additionally, two columns showing the occurrence of intrusive rocks and changes in the tectonic setting are given together with the stratigraphic columns. A key to the lithological symbols used is presented in Figure A 3.

Data for the Kubor Range are included in this report, although it probably forms part of the allochthonous northern orogen (Davies, 1990) (Fig. 1). The area underwent large scale counterclockwise rotations of between 50° and 100° in the post Middle to Late Miocene (Klootwijk & others, 1987), but the similarity of the sedimentary sequence to that of the Papuan Basin suggests that it was never very far from its present location.

1.2 **Data Maps** (Appendix II; Figs. A 5 - A 39)

The data maps show the lithology and thickness of sediments for the Mesozoic to Cainozoic time slices (Tables A 2 to A 3) at the relevant data points. Two types of data points are given on the maps: those which depict true data *points*, i.e. petroleum exploration wells, and those which draw together information for an area of outcrop, i.e. outcrop summary points. The selection and number of the data points was based on criteria such as availability of biostratigraphic data, completeness of section and areal coverage of the basin. In some cases, the detailed biostratigraphic control for defining the time slices was not available. In these instances the thickness and lithology for the *time slice range* is given. For example, if a 450m thick sequence of interbedded mudstone and sandstone has a general Tithonian age, this information is shown as "J 9-10, 450m" on each of the two time slices J 9 and 10. This is considered to be a more realistic mode of illustration than dividing the thickness of sediment between the two time slices. Localities with no sediments in a given time slice, due to either erosion or non-deposition, are not shown on the data maps. Data maps were not prepared for time slices TR 1 (earliest Triassic) and Cz 3 (Early Oligocene), because sediments of this age are generally not present in the Papuan Basin.

Data sheets describing the thickness, lithology and depositional environment for each time slice present at each data point and reference point are given in Appendix III. Reference points are well sections and outcrop summary points not depicted on the data maps - they will be used as additional information for the palaeogeographic maps. The depositional environments listed on the data sheets are highly interpretive and may be subject to changes. The reliability of the time slice picks is described using a reliability code (Table A 5).

2. OUTLINE OF MESOZOIC TO CAINOZOIC STRATIGRAPHY AND GEOLOGICAL HISTORY

2.1 Introduction

The Papuan Basin developed in the Early Mesozoic as a passive margin basin along the northern edge of the Australian continent (e.g. Pigram & Panggabean, 1984; Struckmeyer & others, 1990). Triassic to Late Cretaceous sediments were deposited on Late Palaeozoic and probably partly Precambrian igneous and metamorphic rocks of the Australian craton. In places, these basement rocks are intruded by Middle Triassic felsic to intermediate igneous rocks (Kubor Complex, Strickland Granite, "Aramia Granite"; see Figure 2), which are probably related to incipient rifting along the margin. Sedimentation commenced in the Middle Triassic, but was generally restricted to the grabens and half-grabens of the developing rift system. Breakup in the Early Jurassic (Pigram & Panggabean, 1984) was followed by increasingly widespread fluvial to paralic conditions in the early Middle Jurassic and a major transgression in the late Middle to Late Jurassic.

In the latest Jurassic to Early Neocomian a regression resulted in the development of an extensive shore zone depositional system and the widespread deposition of beach, barrier bar and channel mouth sands. The regression culminated in a brief period of erosion which is reflected in the presence of a nearly basinwide unconformity in the mid-Valanginian. This was followed by a renewed transgression in the late Valanginian to Hauterivian. Environments remained shallow marine over much of the basin during the Early Cretaceous, but deepened to the north and northeast. Deeper water conditions in the Late Albian were, in many areas, followed by shallow marine to paralic sand deposition in the Cenomanian. A second extensional phase related to the formation of the Coral Sea affected the basin in the Late Cretaceous to Paleocene (e.g. Symonds & others, 1982) leading to differential erosion of Late Cretaceous sediments in most parts of the basin and to restricted deposition in the northernmost region of the basin. In the eastern part of the basin all Cretaceous and uppermost Jurassic sediments, with a few exceptions only, were removed during this erosional phase. A regression in the Campanian is reflected in the deposition of clean quartz sandstones in some areas.

During the Early Cainozoic, deposition in the Papuan Basin continued in the passive margin setting established during the Mesozoic. Restricted clastic deposition in the Paleocene was followed by more widespread deposition in the Eocene with accumulation of carbonates in shallow to deeper water environments. This change from dominantly siliciclastic to dominantly carbonate deposition is likely to have been the result of increasing rates of northward movement of Australia carrying the region into a warmer climate regime. A major hiatus in the Oligocene coincides with both a eustatic sealevel fall (Haq & others, 1987) and the conversion of the Papuan Basin from a passive margin to a foreland basin through the initial accretion of terranes along the northern boundary of the Australian craton (Pigram & others, 1989, 1990). Deposition of clastic sediments commenced in the Late Oligocene to Early Miocene in the proximal foredeep of the southward migrating thrust front, while thick contemporaneous carbonates accumulated in the shallow parts of the basin. By the Late Pliocene to Pleistocene, sediment influx from the emerging mountains had caused the burial of the carbonate platform under a thick clastic sequence.

2.2 Basement Rocks

The oldest rocks known to underlie the Papuan Basin are the ?Late Palaeozoic Omung Metamorphics (Bain & others, 1975) (Fig. 2), although a quartz diorite encountered at the location of Lake Murray-1 gave an isotopic age of 1415±45 Ma (Harrison, 1974). This date was initially dismissed as anomalous (AMDEL in Harrison, 1974) but it may indicate the presence of Proterozoic basement rocks in the westernmost part of the basin. These rocks may be a possible extension into Papua New Guinea of the Proterozoic granitic intrusives of the northtrending Mount Isa Orogen or Georgetown and Coen Inliers which have general ages of 1800 Ma and younger (Plumb & others, 1980). The Omung Metamorphics are exposed in the core of the Kubor Anticline (Fig. 1; Column XVI). They consist of a sequence of schist, slate, phyllite, shale, meta-sandstone and meta-siltstone and are intruded by granitic rocks of the Kubor Complex (Pigram & others, 1987; = Kubor Granodiorite of Bain & others, 1975). The Kubor Complex includes granite, granodiorite, tonalite, quartz diorite, diorite and gabbro as well as a number of younger aplite, adamellite, dolerite and basalt dykes (Bain & others, 1975; Pigram & others, 1987). Isotopic ages of the Kubor Complex are within the range 216 to 247 Ma, with 238 Ma the best estimate for the time of emplacement (Page, 1976, adjusted following Harland & others, 1982). Other dated Triassic intrusives are present in the northwestern basin (Strickland Granite, 227 Ma) and at Aramia-1 (241 Ma; Page, 1976). The intrusives are probably comagmatic with the bimodal volcanics of the Kana Group indicating that they are related to extension (Pigram & Panggabean, 1984). Granitic rocks encountered in other exploration wells (e.g. Komewu-2) may be of either Late Palaeozoic or Triassic age.

Other Palaeozoic basement rocks are exposed on the southern coast of western Papua and on several adjacent small coastal islands. They consist of biotite granite and granodiorite (Badu Granite) that intrude ?Carboniferous acid volcanics (Torres Strait Volcanics); these are present as small bodies or large xenoliths within the granites (Richards & Willmott, 1970). The Badu Granite has a K-Ar age of 292 to 300 Ma (= Late Carboniferous). Basement of this type and ?age was also encountered in a number of exploration wells in the southern Papuan Basin (e.g. Magobu Island-1).

2.3 Mesozoic

The Mesozoic stratigraphic nomenclature of the Papuan Basin was established mostly during 1:250 000 scale mapping (Willmott, 1972; Bain & Mackenzie, 1974, 1975; Davies & Norvick, 1974; Tingey & Grainger, 1976; Pieters, 1980; Brown & Robinson, 1982; Davies, 1983). Since then, work by the Geological Survey of Papua New Guinea and other geologists has resulted in a number of revisions and redefinitions of stratigraphic names. The nomenclature used in this report and on the summary columns is given in Figure 2. The scheme is not comprehensive but shows the major lithostratigraphic

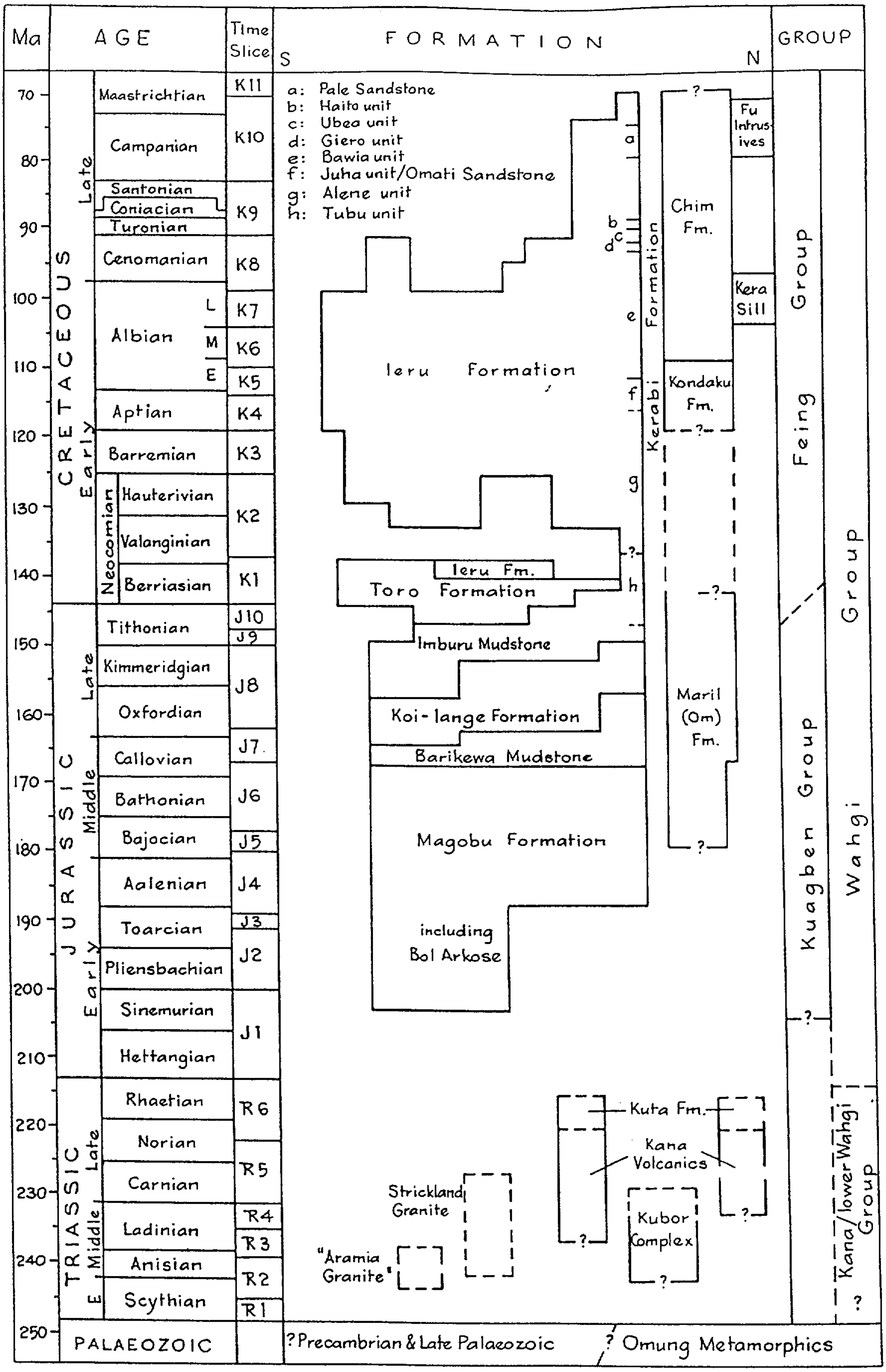

Figure 2: Mesozoic stratigraphic nomenclature.

subdivisions. The diagram is not intended to illustrate the true spatial distribution within the basin although, from left to right, it shows a generalized south-north distribution of formations.

2.3.1 **Triassic** (Figs. A 5-9)

The oldest Triassic rocks in the Papuan Basin are the granitic to dioritic rocks of the Kubor Complex which intruded Palaeozoic pelitic metamorphics (Omung Metamorphics) in the Early to Middle Triassic. The Kubor Complex and associated intrusives probably formed erosional highs for at least part of the Mesozoic and provided a sediment source for adjacent areas (Bain & others, 1975). Triassic sediments in the Kubor Range area (Column XVI) consist of a sequence of volcaniclastic sandstone, shale, conglomerate and bimodal volcanics (Kana Volcanics), which were probably deposited in mostly shallow marine environments. In the latest Triassic (time slice 6) shallow water limestone and calcarenite (Kuta Formation) accumulated around the fringes of the Kubor Complex. A recent reassessment of the Triassic rocks of the Wahgi Gorge in the eastern Kubor Range area by the Geological Survey of Papua New Guinea (Francis, in prep.) has revealed that sediments which were previously regarded as Jurassic, are actually Triassic in age and that Triassic sediments may be more widespread than previously thought. Francis (in prep.) described a 500 m thick sequence ("lower Wahgi Group") of mudstone with interbedded siltstone, graded lithic sandstone and conglomerate overlying a basal sequence of polymictic diamictite from the Wahgi Gorge. The only age control is given by a Norian macrofauna found in the upper part of the sequence; the sediments are therefore of probable Late Triassic age. They are in fault-contact with an overlying thin section of interbedded quartz-lithic sandstone and echinoid limestone which may be a deeper water equivalent of the Kuta Formation (Francis, in prep.).

Sediments of possible Triassic age are also present in two petroleum exploration wells (Kanau-1, Anchor Cay-1; Columns XII & XVII), however, apart from the presence of *Falcisporites australis* in the Anchor Cay-1 section, there is no positive age control. The sediments reach a thickness of more than 200 m and consist of feldspathic to lithic sandstone, conglomerate, siltstone and mudstone deposited in fluvial to fluvio-lacustrine environments.

2.3.2 Jurassic

Time Slice J 1-4: Hettangian to Aalenian/earliest Bajocian (Figs. A 10-13)

Due to poor age control and the structural complexity of the region, it is not clear whether deposition in the Late Triassic to Early Jurassic was continuous in some areas of the northern Papuan Basin. In the Wahgi Gorge (Column XVI), for example, Early to Middle Jurassic sediments could be faulted out, as Oxfordian/Kimmeridgian shales of the Maril Formation are in fault contact with ?Paleozoic Omung Metamorphics (Francis & others, 1990). The oldest Jurassic sediments intersected in petroleum exploration wells (Magobu Island-1, Anchor Cay-1; Columns XIV & XVII) are Sinemurian to Pliensbachian in age (Morgan, 1990a); they comprise a 200 to 300 m thick sequence of interbedded mudstone, sandstone and minor coal deposited in fluvial to fluvio-lacustrine environments (Magobu Formation). Similar lithologies of Toarcian to early Bajocian age are present at Iamara-1 (Appendix III, p. 124), and arkosic sandstone (?Bol Arkose) of late Aalenian to early Bajocian age was encountered at Kanau-1 and Barikewa-1 (Columns XII & XV). Sediments of Early to early Middle Jurassic age may be present in a number of other areas where exploration wells have not penetrated the oldest section.

Time Slice J 5-6: Mid-Bajocian to early Callovian (Figs. A 14-15)

Deposition in the Papuan Basin became much more extensive during the Middle Jurassic with increasingly widespread paralic conditions. Sediments of this age are typically between 100 and 1000 m thick with the greatest thickness in the present-day Fly Delta area. During time slices 5 to early 6, fluvial environments prevailed in the central and northwestern Papuan Basin (e.g. Kanau-1, Aramia-1, Iamara-1, western Muller Anticline) with deposition of mostly coarse-grained, arkosic sandstone (Bol Arkose/Magobu Formation), whereas paralic environments were established in the eastern part of the basin (e.g. Barikewa-1) indicating a southwestward progression of the sea. By the middle to later part of time slice 6, these paralic environments were present over much of the basin.

Time Slice J 7-9: Mid-Callovian to early Tithonian (Figs. A 16-18)

The Middle Jurassic transgression reached its peak in time slice 7, when shallow marine environments were widespread in the basin with extensive deposition of fine-grained clastics of the Barikewa Mudstone. The Barikewa Mudstone is likely to be an extension of the Maril Formation of the northern and eastern Papuan Basin, which consists mostly of shales deposited in bathyal environments. In the Barikewa-1 area (Column XV), mudstone deposition was thickest and had commenced earlier during time slice 6. In the northwestern part of the basin (Column X) conditions remained paralic until the mid-Oxfordian when shallow water deposition commenced. A regression in the early part of time slice 8 resulted in renewed paralic to deltaic conditions over much of the basin and the deposition of interbedded sandstone, siltstone and mudstone of the Koi-Iange Formation which ranges in thickness between 40 and 680 m. In the central Papuan Basin, in the Kanau-1 and Komewu-2 (Appendix III, p. 113) areas (Column XII), paralic environments prevailed throughout much of time slice 8, whereas the greater part of the basin was charaterised by increasing inundation and deposition of finer grained clastics (Imburu Mudstone). This transgression culminated in the early Tithonian (time slice 9).

2.3.3 Latest Jurassic to Early Neocomian

The late Tithonian to earliest Valanginian (time slice J 10 to K 1; Figs. A 19-20) was characterised by a major regression and the development of an extensive shore zone depositional system. The Toro Formation, which contains the major Mesozoic hydrocarbon reservoirs in the Papuan Basin, was deposited over wide areas of the basin. The unit ranges in age from late Tithonian to earliest Valanginian, but is time-transgressive and thins to the east and northeast where it becomes shalier and is represented by the Maril Formation or the Tubu unit respectively. The Toro Formation is 60 m (e.g. at Kiunga-1, where the unit rests unconformably on ?Palaeozoic basement;

Column X) to more than 500 m thick (e.g. at Iagifu-3X [Appendix III, p. 115]; Column XIII). The unit consists of very fine to coarse grained, mostly quartzitic sandstone with interbeds of siltstone and mudstone, deposited as beach, barrier bar and channel mouth sands. In the Barikewa-1/Iehi-1 area (Column XV) only thin sandstone beds are present and deposition occurred in probably open shelf environments. In the Wahgi Gorge area, the presence of graded sandstones within the Maril Formation indicates deeper water conditions.

Toro Formation Nomenclature

At its type section (composite sections) in the Strickland River Gorge in the northwestern Papuan Basin (Column XIII), the Toro Formation was originally defined by Jenkins & White (1970) as a sequence of medium to coarse grained, light coloured quartz sandstones with mudstone interbeds, overlying the Imburu Mudstone. The name has since been used and effectively formalized in outcrop and subsurface for sandstones occurring between the predominantly fine-grained clastics of the Imburu Mudstone and the Ieru Formation (e.g. Davies & Norvick, 1974; Brown & others, 1980). The lower boundary of the Toro Formation at its type section has been revised a number of times (Ridd, 1973; White & others, 1973; Nicholson & others, 1975; Sari, 1988) and a detailed palynological study was carried out by Davey (1987). In an attempt to better define and describe reservoir sands of Late Jurassic to Early Cretaceous age, oil company geologists introduced a number of informal names for several discrete sandstone units ("pre-Toro sands") occurring within a sequence of predominantly siltstone and mudstone in the Iagifu area in the southern highlands (Fig. 5; Column XIII). Denison & Anthony (1990) formalised the usage of the terms Digimu, Hedinia and Iagifu Sandstone giving them the status of 'Member' of the Imburu Mudstone. They restricted the name Toro Formation to the overlying sandstone-rich section of Berriasian age. At the same time, in an extensive review for the Geological Survey of Papua New Guinea, Sari (1990) redefined the Toro Formation to include all sedimentologically related sandstones of reservoir quality occurring above the Imburu Formation. He distinguished a lower Toro Formation composed of interbedded sandstone, siltstone and mudstone which includes the uppermost Imburu Mudstone of Jenkins & White (1970) and the pre-Toro sands of

Denison & Anthony (1990), and an upper Toro Formation consisting of sandstone with minor siltstone and mudstone. The age of the Toro Formation at its type section, based on dinoflagellate zones, ranges from the *B. simplex* zone to the *B. reticulatum* zone of Helby & others (1987) (see enclosure). The nomenclature used in this report follows that of the Geological Survey of Papua New Guinea (Sari, 1990). It should be noted that the Toro Formation is a lithostratigraphic unit and not a timestratigraphic unit as might be construed from Denison & Anthony (1990). These authors based their interpretations on work carried out mainly in the northern Papuan Basin. However, lithological subsurface correlation throughout the basin clearly shows that the Toro Formation is time transgressive with diachronous upper and lower boundaries (see also Morgan, 1990a, b) and is composed of a varying number of sandstone units of local to regional extent. For example at Barikewa-1 (Column XV), only two thin sandstone units of late Berriasian and mid-Tithonian age are developed (Morgan, 1990a), whereas at Aramia-1 (Column XI) a whole series of sands is present ranging from early Late Tithonian to earliest Valanginian in age (Morgan, 1990b).

Further complications in the definition of the Toro Formation arise from the use of different palynological schemes for the Mesozoic of the Papuan Basin and, in particular, their correlation with the European stages. In the schemes by Davey (1987) and BP (Lowe & Welsh, 1987 in Morgan, 1990a, page 8; Welsh, 1990), the *D. jurassicum* zone (and its subzones) are assigned an Early Kimmeridgian to mid-Tithonian age, whereas in the scheme by Helby & others (1987) it is entirely restricted to the Late Tithonian. This has considereable implications for the interpretation of sedimentation rates for this time period. Compilations for the Phanerozoic History of Australia Project are based on the Helby & others scheme, but the other zonations in use for the Papuan Basin, adjusted to the Helby & others (1987) scheme, are presented in the summary columns (Enclosure 1).

2.3.4 Cretaceous

Time Slice K 2-3: Valanginian to Barremian (Figs. A 21-22)

The greater part of the Valanginian is characterised by a hiatus that probably reflects a basinwide period of uplift and erosion, although deposition in the northernmost parts of the basin may have been continuous. In most areas of the basin, deposition resumed in the latest Valanginian to Hauterivian (*P. burgeri*-zone to *M. testudinaria*-zone; Morgan, 1990a, b). In several exploration wells (e.g. Kiunga-1, Morehead-1, Aramia-1) these early transgressive deposits of the Ieru Formation are typically sandstones, often quartzose, and reach a thickness of 40 to 130 m (Columns X & XI). They were probably deposited in environments similar to those of the Toro Formation and may contain good reservoir rocks. In the eastern part of the basin this section contains considerably less sandstone; here a sequence, up to 160 m thick, of interbedded siltstone, mudstone and minor sandstone and limestone was deposited in shallow marine environments (e.g. Barikewa-1, Magobu Island-1; Columns XV & XIV). Increasing inundation in time slice K 3 resulted in the establishment of open marine conditions over the entire basin.

Time Slice K 4-7: Aptian to Albian (Figs. A 23-26)

During this time period shallow marine environments were predominant in the Papuan Basin. Siltstones, mudstones and minor sandstones of the Ieru Formation were deposited across the basin. The Aptian section (K 4) contains abundant sandstone (Omati Sandstone) in a number of wells. In the Kubor Range area (Column XVI), lithic and often conglomeratic sandstone and interbedded mudstone of the Kondaku Formation reach a thickness of 400 m to possibly 2000 m (Francis & others, 1990); they were probably deposited in northwards deepening, open marine environments. By the Late Albian (time slice K 7), continued transgression had resulted in the establishment of bathyal environments across the basin. Intrusion of alkaline lamprophyre sills (Kera Sill) in the Kubor Range area during this time slice may be related to extension in the Coral Sea area.

Time Slice K 8-11: Cenomanian to Maastrichtian (Figs. A 27-30)

In most exploration wells the Late Cretaceous section is absent due to uplift and erosion in the later part of the Late Cretaceous. However, Cenomanian to Turonian (K 8-9) sediments are preserved in a number of wells, particularly in the western and northern parts of the basin. These sediments are about 300 m to more than 1000m thick with the thickest sections present in the Iagifu/Juha area (Column XIII; Fig. 5). They typically comprise quartzose to feldspathic sandstone, interbedded mudstone and siltstone, and minor limestone deposited in shallow marine to paralic environments. Several sandstone units (e.g. Haito unit, Giero unit; Fig. 2) may have good reservoir potential. Sediments younger than Turonian in age (K 8) are preserved in a number of outcrops in the Muller Anticline area, the Kubor Range area and the Aure Scarp (Columns X, XVI & XVII; data points 4030, 4032, 4034). A sequence of interbedded mudstone, sandstone and siltstone of Santonian to ?Maastrichtian age (K 9-10; Ieru Formation), deposited in shallow marine to paralic environments is present in the western Muller Anticline, whereas finer-grained clastics with subordinate interbeds of graded lithic sandstones (Chim Formation) in the Kubor area were deposited in mostly bathyal environments (Francis & others, 1990). In the Mendi area, the Chim Formation ranges into the latest Maastrichtian (Francis & others, 1990). Time slice K 10 was another period of sandstone deposition (e.g. Columns X, XII & XVII) in the Muller Anticline area (Davies & Norvick, 1974; Arnold & others, 1989), the Kagua area (Hill, 1990) and the Aure Scarp area (Pale Sandstone; Carman, 1990).

2.4 Cainozoic

Four major sedimentary sequences separated by regional unconformities can be distinguished for the Cainozoic of the Papuan Basin: (1) restricted Paleocene clastics overlain by (2) Eocene carbonates and interbedded clastics, (3) Late Oligocene to Middle Miocene shallow water carbonates in the south and deeper water carbonates and clastics in the north and east, and (4) Late Miocene to Pleistocene clastics and volcanics. The stratigraphic nomenclature for the Palaeogene and Neogene, showing the major lithostratigraphic subdivisions, is given in Figures 3 and 4. The diagrams are not intended to illustrate the true spatial distribution within the basin.

2.4.1 Palaeogene

Time Slice Cz 1: Paleocene to Early Eocene (Fig. A 31)

In the greater part of the Papuan Basin, the Paleocene was a period of uplift and partial erosion of the Mesozoic section and of erosion and non-deposition of Paleocene sediment. This structural phase was probably related to the formation of the Coral Sea between about 62 Ma and 56 Ma (Weissel & Watts, 1979). Paleocene sediments occur in the northern part of the basin, in the Mendi and Kubor regions, along the Aure Scarp and in the Wabag 1:250,000 sheet area (Fig. A 31). The sediments are generally of middle to Late Paleocene age (Belford, 1984) with one isolated occurrence of Early Paleocene. The best defined Paleocene section was described from the Mendi and Kagua areas (Brown & Robinson, 1982), where approximately 700m of fine to coarse grained clastics of the Moogli Mudstone and Urubea Sandstone were deposited in open to shallow water shelf environments (Column V). The Pima Sandstone in the Kubor Anticline area may be up to 300m thick (Bain & Mackenzie, 1974) and is a possible equivalent of these clastics (Column VI). Carman (1987) described a 200m to possibly 415m thick Paleocene section of shallow water carbonates from the Aure Scarp (Column VIII). In the Wabag sheet area, an unnamed Paleocene section has an estimated thickness of 1000m and consists of marl, siltstone and minor limestone and volcanogenic sandstone deposited in deeper water environments (Davies, 1983). The presence of reworked Late Cretaceous to Paleocene foraminifera in Paleocene sediments of the northern Papuan Basin (Davies, 1990) supports the suggestion that they are the products of an extensive erosional event. Early Eocene sediments are typically absent and this period may have been characterised by a further erosional event.

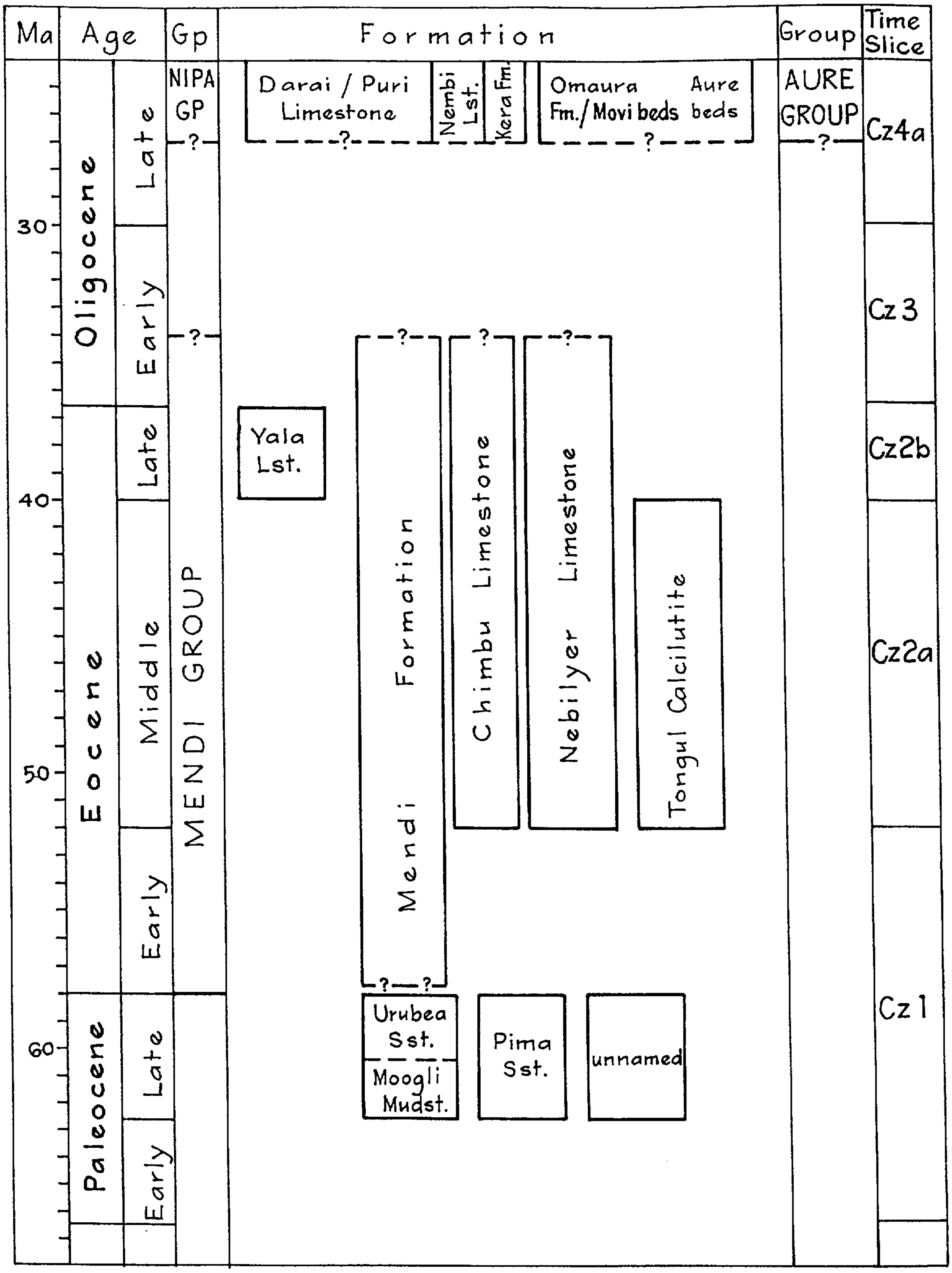

Figure 3: Palaeogene stratigraphic nomenclature.

Time Slice Cz 2a-b - 3: Middle Eocene to mid-Oligocene (Fig. A 32 - Cz 2a-b only)

Deposition became more widespread in the Middle to Late Eocene, although most of the Fly Platform remained emergent. Sedimentation occurred in the present Gulf and eastern foldbelt areas with conditions deepening to the north and northeast along a NW-SE trending shelf. Eocene sediments, up to 350m thick, were intersected in mostexploration wells of the Gulf area and typically comprise argillaceous or arenaceous carbonates (Mendi Group) that contain bryozoa, red algae, echinoids, benthic foraminifers and minor chert (Column VII). Chaproniere & others (1990) indicated that, in the Gulf of Papua, the Eocene section typically consists of a lower, deeper water planktic phase (letter stage Ta_3) and an upper shallowing phase with increasing occurrence of benthic fauna. Deeper water carbonates are present in onshore areas to the north, e.g. the Aure Scarp (Carman, 1990) or Barikewa-1 well (G. Francis, pers. comm., 1989) (Columns VIII and IV); they are typically hard microcrystalline limestone with chert and black mudstone interbeds and reach thicknesses of up to 500m.

In the Mendi/Kagua area (Column V), shallow water micrites, calcarenites with chert nodules, and quartz sandstones of the Mendi Group grade into the deeper water deposits of the Nebilyer Limestone, which consists of approximately 100m of fine-grained limestone with calcarenite and siltstone interbeds. Northeast of the Kubor Anticline (Column VI) in the Whagi-Chimbu Gorge, approximately 500m of algal-foraminiferal carbonates of the Chimbu Limestone were deposited in shallow water environments (Rogerson & others, 1988). Further to the west, in the Wabag sheet area, the Eocene sequence reaches up to 2000m in thickness and consists of deep water, red and green calcilutite, marl and micritic limestone (Tongul Calcilutite; Davies, 1983).

With the exception of the northern part of the basin, where a number of outcrops and floats of limestone have ages reaching up into the Early Oligocene (Belford, 1984; Rogerson & others, 1988), no Early to middle Oligocene sediments are present in the Papuan Basin. The middle Oligocene is characterised by a distinctive hiatus which is interpreted to represent the combined effects of initial collision of the Australian and

Pacific plates (Pigram & Davies, 1987) and a major, worldwide fall in sealevel (Haq & others, 1987).

2.4.2 Neogene

Time Slice Cz 4a-c - 5: Late Oligocene to Miocene (Figs. A 33-36)

Sedimentation resumed in the Late Oligocene with carbonate deposition across the platform. At the same time, clastic sediment was shed into the proximal foredeep of the initial thrust front in the northern part of the basin. During the Early to early Middle Miocene, the greater part of the Papuan Basin was characterised by the continued deposition of shallow water bioclastic limestone (Darai Limestone; Columns I-V). In the eastern part of the basin, in the Gulf and delta areas (Columns VII and VIII), this grades into argillaceous limestone containing planktonic foraminifers (Puri Limestone) which was deposited in deeper water. Stacked patch and barrier reefs developed along the shelf edge and on basement highs (e.g. Pasca reef, Borabi reef trend) during a period of accelerated subsidence. The Late Oligocene to Miocene carbonates are typically between 500 and 1200m thick but, in places, are as thin as 200m or thicker than 2000m. Deep water shelf and slope carbonates of the Nembi Limestone (Nipa Group) accumulated in the northern part of the basin (Column V); they grade into clastics deposited in the proximal foredeep of the advancing thrust load (e.g. Pnyang Formation, Iwoer Formation, Omaura Greywacke, Kera Formation, Movi beds, Aure Group). These initial foreland deposits range in age between Late Oligocene and Middle Miocene and are between 200 and ?5000m thick.

In the greater part of the basin, Middle to Late Miocene sediments (i.e. time slices Cz4c to early Cz5; foraminifer zones N10 to N16) are typically absent (Lloyd, 1988; Chaproniere & others, 1990). This hiatus narrows to the north in the fold belt area, where foredeep sediments of Middle to early Late Miocene are generally present. However, sediments of early Late Miocene age (foraminifer zones N15 to N16) are missing throughout the basin, with the exception of the western Papuan Peninsula (Column IX), where a sequence of up to 1800m of late Middle to Late Miocene

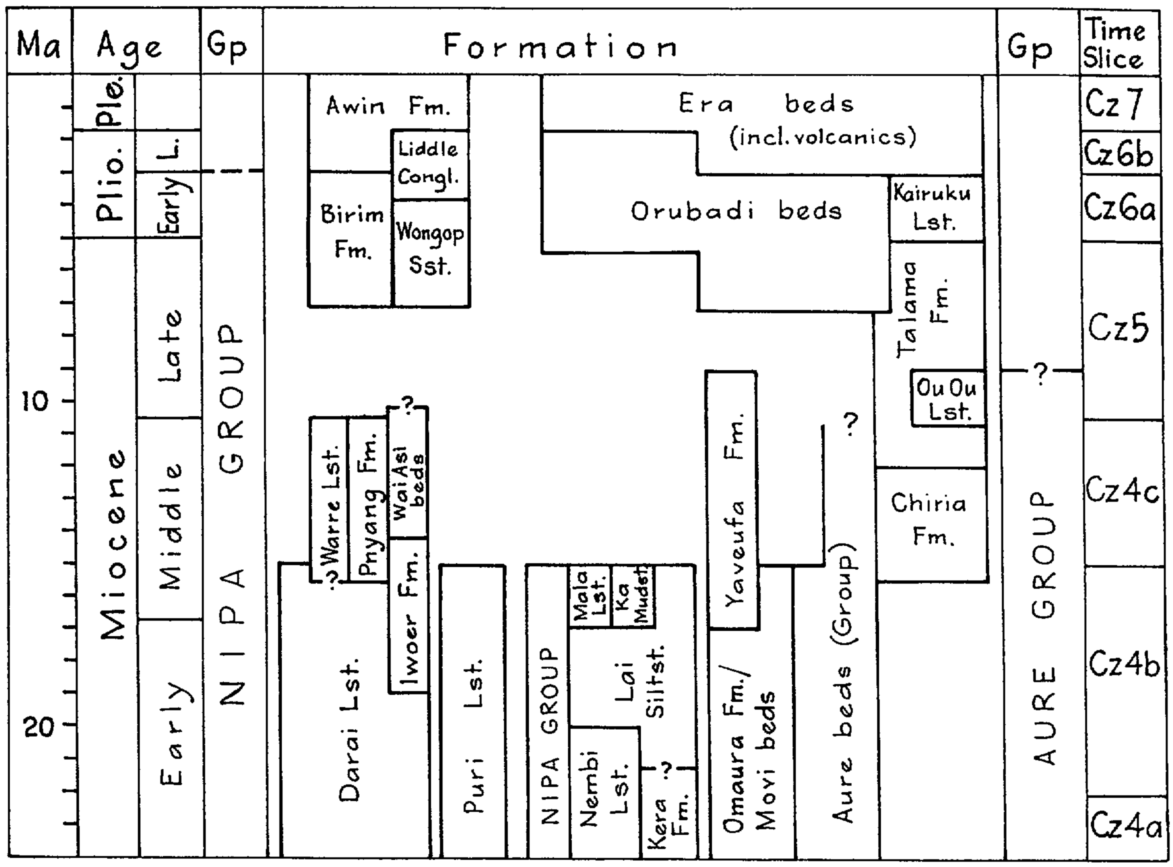

Figure 4: Neogene stratigraphic nomenclature.

volcanogenic mudstone, sandstone, conglomerate and tuff (Talama Formation) was deposited in mostly deep water conditions (Francis & others, 1986). The Late Miocene unconformity is thought to be related to a second major phase of accretion in northern New Guinea, possibly coincident with a further fall in sealevel. This tectonic phase resulted in uplift and associated igneous activity, and differential erosion of the carbonate platform and early foreland deposits. Sedimentation resumed in the latest Miocene with mostly fine grained clastics of the Orubadi beds over much of the basin; restricted limestone deposition continued in the southernmost part of the basin, an area which had not yet been covered by the clastics shed from the emerging mountains.

Time Slice Cz 6a-b - 7: Pliocene to Pleistocene (Figs. A 37-39)

With the exception of the northwestern part of the Papuan Basin (Columns II and III), where coarse grained clastics (Birim Formation, Wongop Sandstone, Liddle Conglomerate) accumulated in fluvial to paralic environments, most areas of the basin were characterised by deposition in marine environments with accumulation of up to 2000m of calcareous mudstone with minor sandstone interbeds (Orubadi beds). Shallow water deposition of mudstone, limestone and marl occurred in the southern parts of the basin (Columns I, IV, VII). The continuing southward progression and associated uplift of the thrust front during the Pliocene to Pleistocene is reflected in the southward progression of fluvial, fluvio-lacustrine and paralic environments (e.g. Era beds) and the incorporation of Miocene to Pliocene sediments into the fold belt. The Fly Platform which lies southwest of the region of greatest accretion is presently emergent; most of the sediment derived from the highlands to the north is transported to the Gulf by an extensive river system. The late Pliocene to Pleistocene was also a period of intense volcanism in the fold belt, particularly south of the Kubor Anticline.

3. HYDROCARBON POTENTIAL

3.1 Mesozoic

Oil and gas have been discovered in sandstones of the Toro Formation in the southwestern Papuan Fold Belt. Since significant amounts of oil flowed from the Iagifu-2X discovery well in March 1986, a considerable number of exploration and appraisal wells have been drilled, resulting in several new discoveries. Not all of these can be listed in this report, but Figure 5 shows the location of the major discovery wells. With the exception of the recent gas/condensate discovery at Elevala-1 in the foreland region of the Papuan Basin, all hydrocarbon accumulations in the Toro Formation occur in the Papuan Fold Belt. The sandstones of the Toro Formation are typically clean, well sorted, quartzitic and often glauconitic; they generally have fair to good porosity and good permeability. Other as yet unsuccessful but potential reservoir rocks occur in the Koi-Iange Formation (Middle to Late Jurassic), which in some wells has over 30%

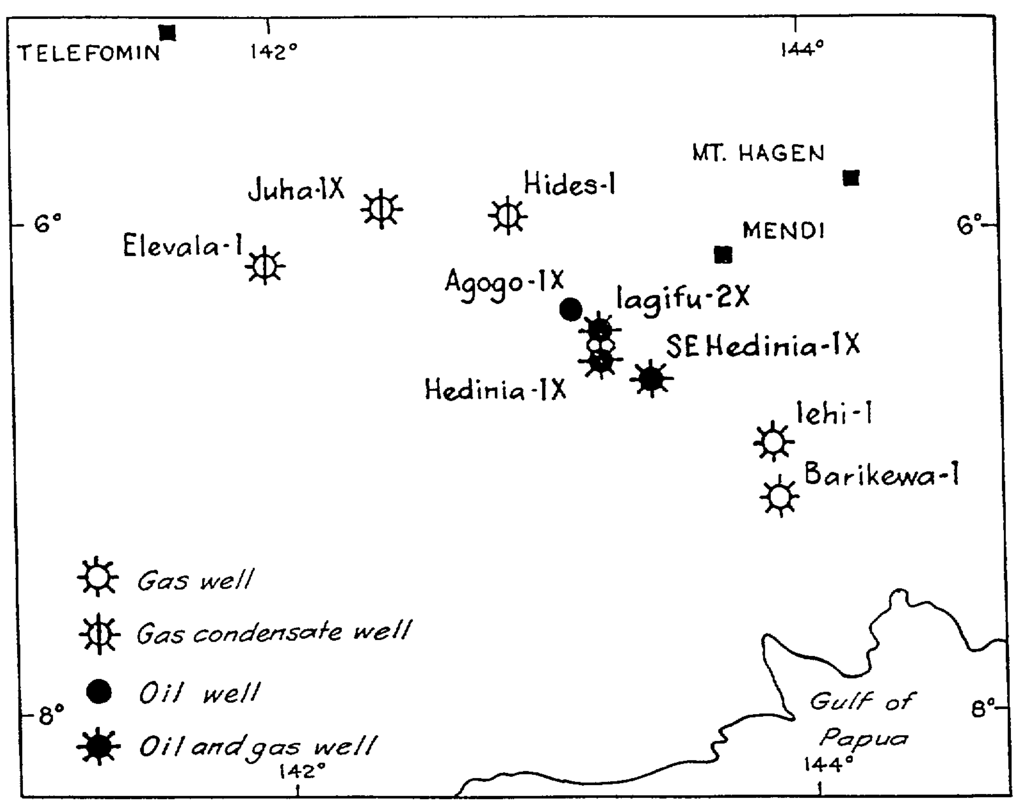

Figure 5: Hydrocarbon discoveries in Mesozoic rocks of the Papuan Basin.

porosity and has flowed gas and condensate in Omati-1 (Appendix III, p. 107) (Robertson Research, 1984), and in the Ieru Formation (Early to late Cretaceous) which contains several distinctive sand units, particularly in the late Valanginian to Hauterivian (*burgeri/testudinaria* sands, Morgan 1990a, b), Aptian (Omati Sandstone), Cenomanian to early Turonian (Haito and Giero units) and the Campanian (Pale Sandstone, Carman, 1987) sections.

Oil mature source rocks of fair to good quality have been described from the Middle to Late Jurassic Maril Formation (Burns & Beins, 1980; Robertson Research, 1984), and good source rocks are probably present in its thinner part-equivalents (Imburu and Barikewa Mudstone). Fair to good source rocks may also occur in the mostly non-marine coaly units of the Early to Middle Jurassic. A thick regional seal for the Toro Formation is provided by the fine-grained clastics of the Ieru Formation.

Typical traps for the major hydrocarbon accumulations in the Papuan Fold Belt are large thrust-faulted anticlines that developed in the Pliocene to Pleistocene (Hill & Gleadow, 1990). Hill (1990) suggested that some of these anticlines may be reactivated Mesozoic extensional structures that trapped and preserved oil generated before the Pliocene. Potential traps in the present-day foreland area (Fly Platform) include gentle folds, flower structures related to Late Cretaceous wrench faulting, tilted fault blocks related to Mesozoic extensional faulting, and drape and pinch-out features associated with basement highs (Stewart & Durkee, 1985; Osborne, 1990).

As a result of the discoveries in the Papuan Fold Belt, two major developments are planned for the early 1990s; the Hides Gas Field Development and the Kutubu Development Project. The Hides gas reservoir will supply natural gas for power generation for the Porgera gold mine to the northeast, involving the construction of an 8km gas pipeline, a gas processing plant/power station and approximately 80km of overhead transmission lines (Grainge & others, 1990). The second development involves the construction of a central production facility for the oil fields of the southern highlands near Lake Kutubu, a 270 km onshore and offshore pipeline and a marine terminal in the Gulf of Papua (Price, 1990).

3.2 Cainozoic

Several gas and gas-condensate discoveries and one oil and gas discovery, have been made in the Cainozoic section of the eastern Papuan Basin (Fig. 6). Detailed accounts of these discoveries and play types were given by Tallis (1975), Leamon & Parsons (1986), Durkee & others (1987), Lloyd (1988), Durkee (1990) and Davies & others (1988b). The principal Cainozoic reservoirs occur in reef and reef-related Late Oligocene to Middle Miocene carbonates of the Darai Limestone and in fractured carbonates of the Puri Limestone. The Jurassic Maril Shale, which is generally regarded as the major source rock for Mesozoic reservoirs in the Papuan Basin, may also have

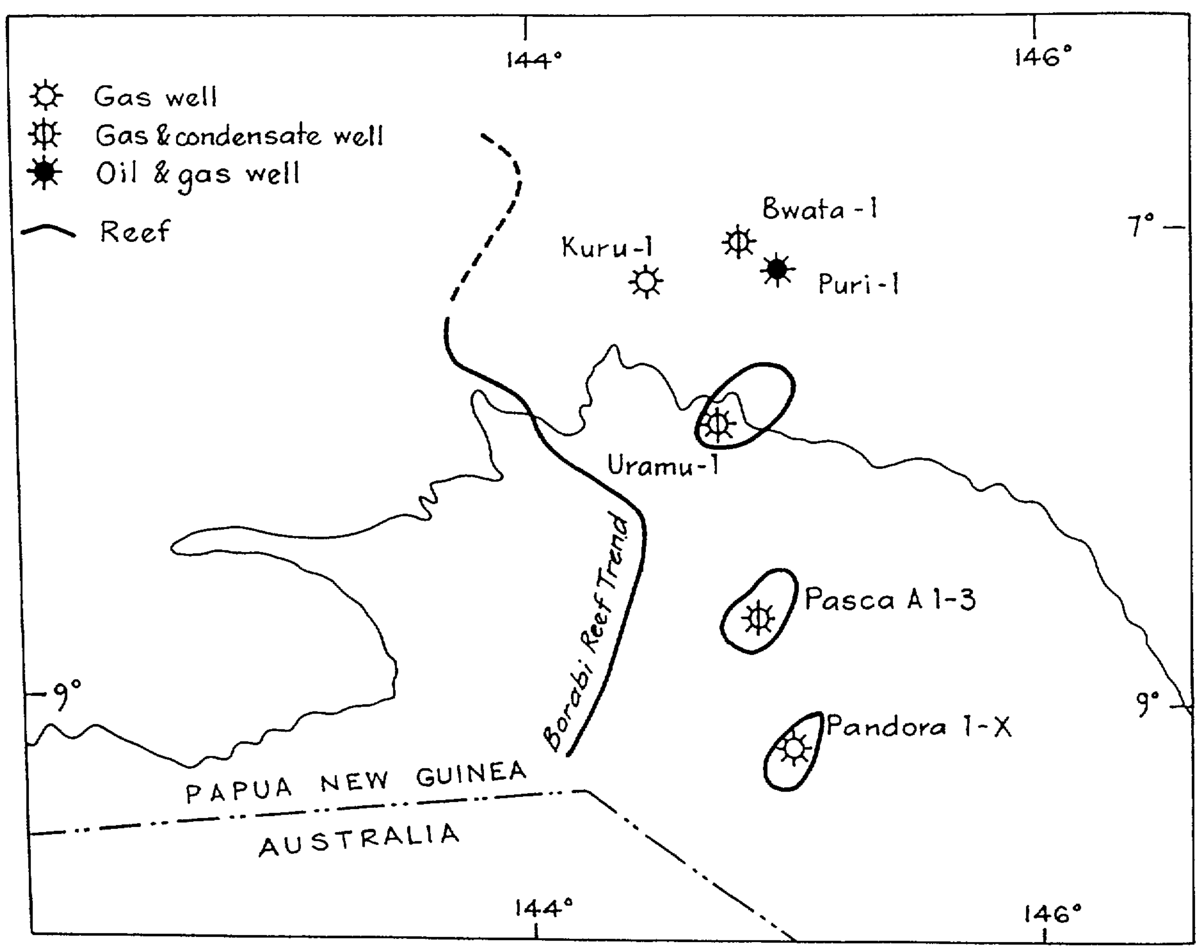

Figure 6: Hydrocarbon discoveries in Cainozoic rocks of the Papuan Basin.

provided the source for some of the Tertiary discoveries. Other source rocks possibly include Palaeogene mudstones (Davies & others, 1988b), Pliocene mudstones (e.g. Orubadi beds) and, in a number of places, biogenic gas was sourced by the Miocene limestones (e.g. Pandora-1).

Good regional seals are provided by the Pliocene mudstones and, additionally, in the fold belt, by overthrust Mesozoic mudstones. Proven plays within the Miocene carbonate section occur in patch reefs (e.g. Pandora, Pasca, Uramu) and in thrust-faulted anticlines of the Papuan Fold Belt (e.g. Bwata, Kuru, Puri). Other possible Miocene plays include barrier reefs and related carbonate wedges (e.g. Borabi Reef Trend) and algal banks southwest of Borabi (Leamon & Parsons, 1986; Durkee, 1990). Davies & others (1988b) identified two major Neogene reef plays in the Papuan Basin, one related to stacked reefs developed on north-south trending fault-controlled highs (e.g. Pasca, Borabi), and the other related to east-west trending reefs developing on, and migrating southward with, the flexural hinge of the foredeep of the foreland basin. Other possible Tertiary plays may be untested Eocene limestones of possible reefal origin, and Miocene to Pliocene plays in association with mud diapirs or local reef build-ups in the easternmost part of the basin along the coast of the Papuan Peninsula (Lloyd, 1988).

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APPENDIX I

KEY TO STRATIGRAPHIC SUMMARY COLUMNS

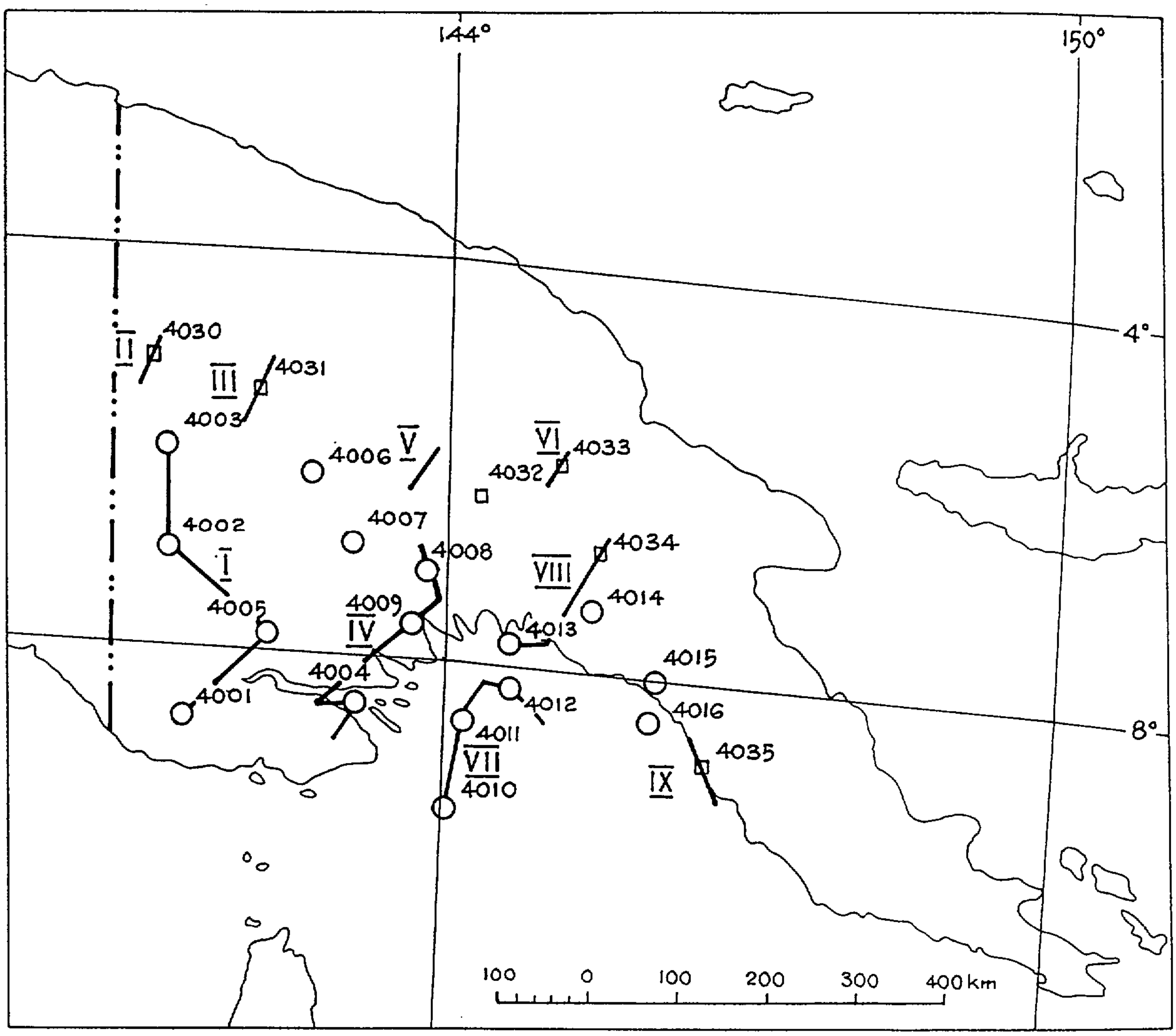


Figure A 1: Location map for Cainozoic stratigraphic summary columns (I = summary column; 4005 = data point).

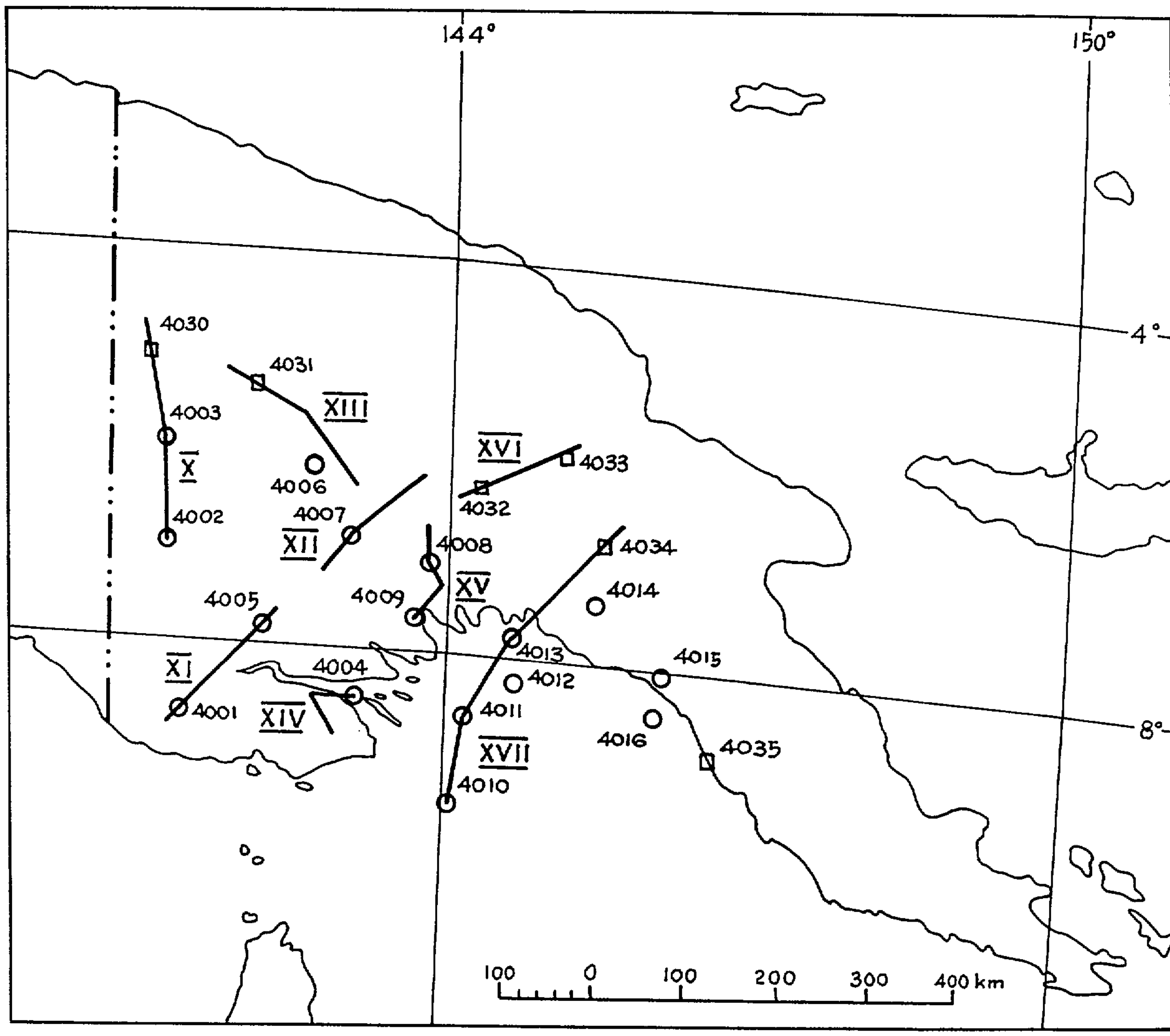


Figure A 2: Location map for Mesozoic stratigraphic summary columns (I = summary column; 4005 = data point).

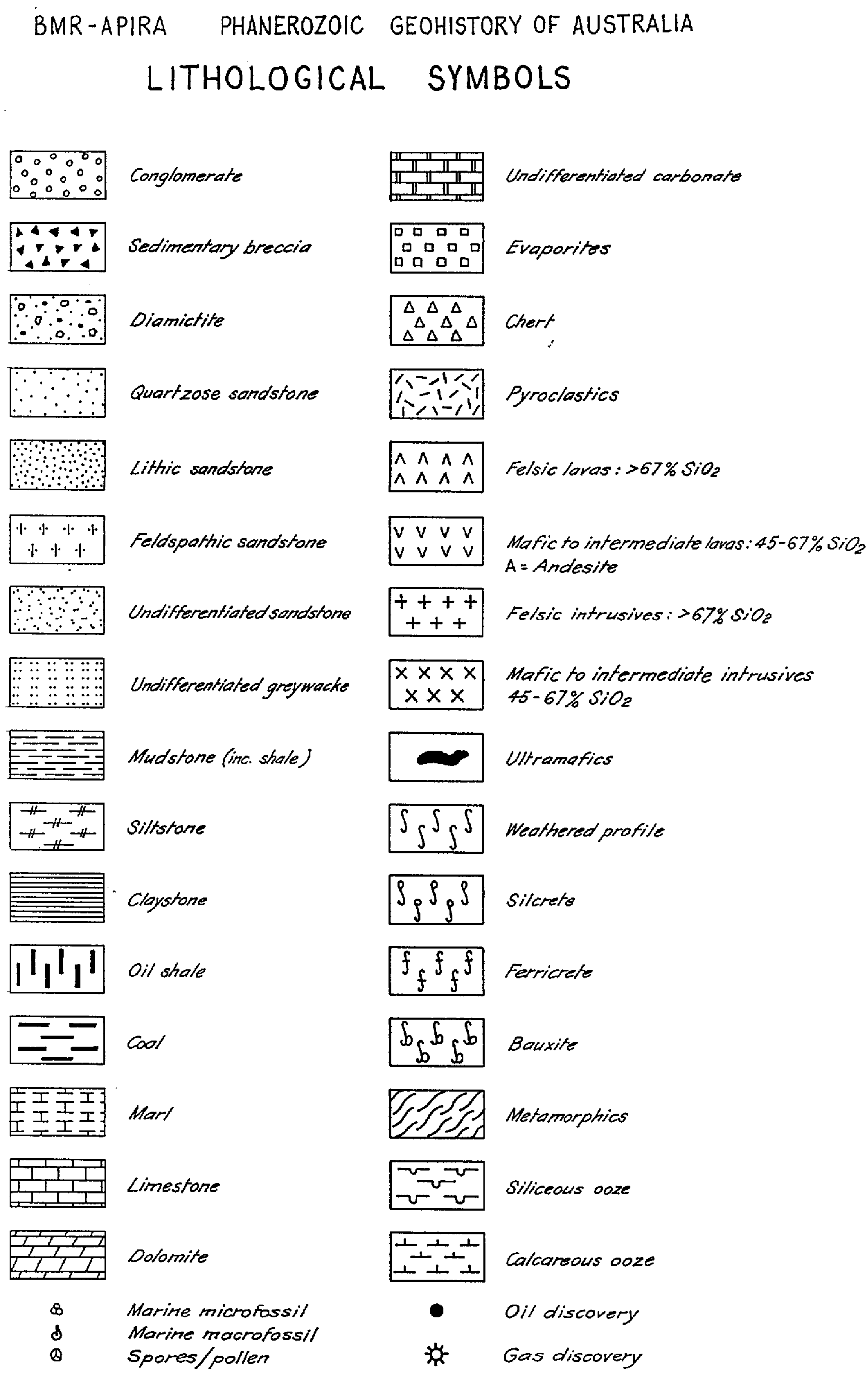


Figure A 3: Key to lithological symbols.

APPENDIX II

DATA MAPS

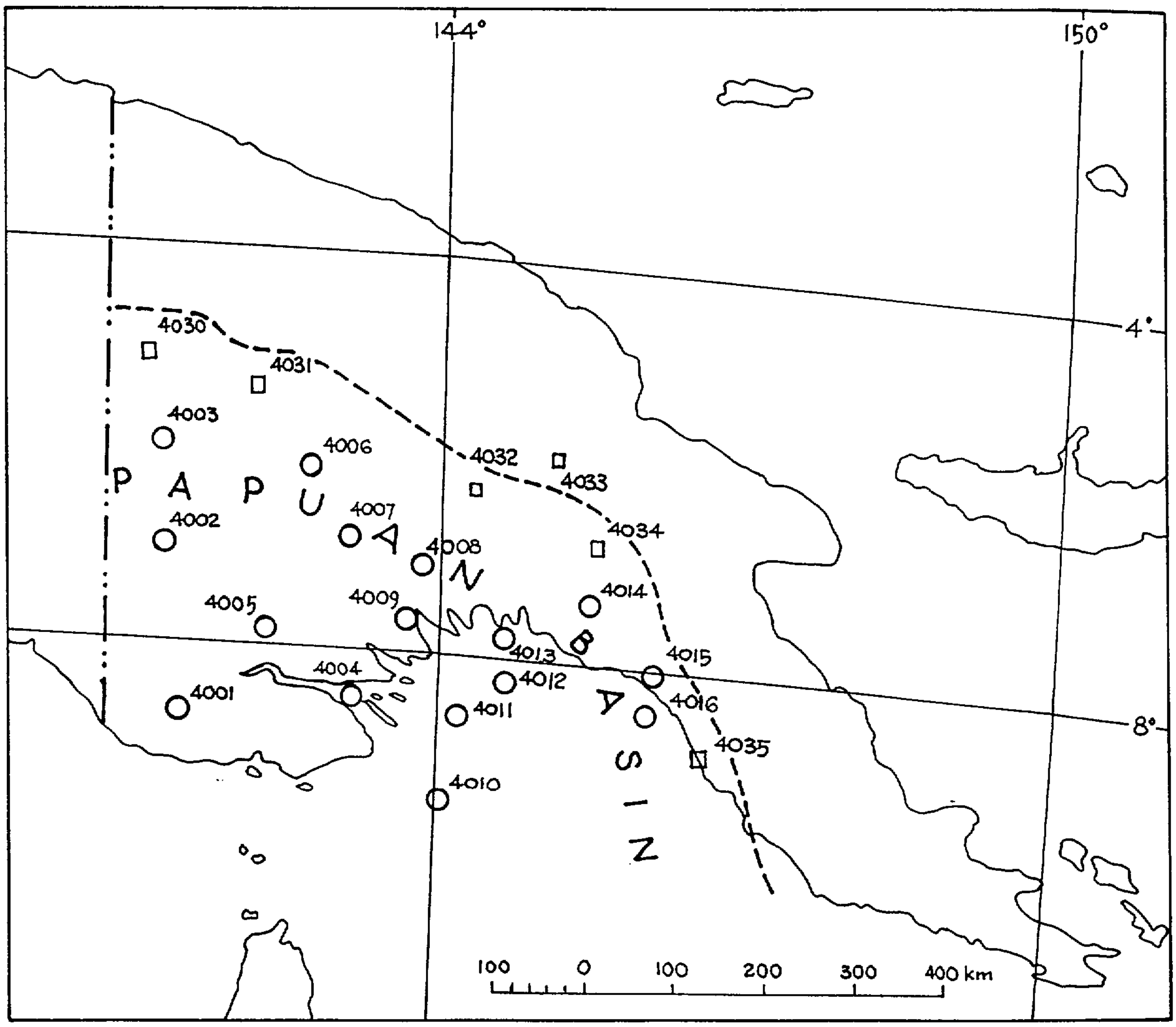


Figure A 4: Location of data points in the Papuan Basin.

Table A 1: PAPUAN BASIN DATA POINTS

o Petroleum Exploration Wells

No.	Name	Location	
		Longitude	Latitude
o 4001	Morehead-1	141 31 34.6	08 44 46.3
o 4002	Lake Murray-1	141 19 04	07 10 04
o 4003	Kiunga-1	141 18 35.5	06 00 56.1
o 4004	Magobu Island-1	143 16 31.2	08 31 47.4
o 4005	Aramia-1	142 19 05	07 51 16
o 4006	Mananda-1	142 49 31.7	06 10 10.6
o 4007	Kanau-1	143 11 25.9	06 54 45.4
o 4008	Barikewa-1	143 55 21	07 06 52
o 4009	Goari-1	143 51 44.1	07 38 08.3
o 4010	Anchor Cay-1	144 03 30.6	09 26 29.3
o 4011	Kusa-1	144 13 02.8	08 42 28.5
o 4012	Dibiri-1A	144 40 16.6	08 16 57.1
o 4013	Uramu-1A	144 41 40.9	07 48 28.4
o 4014	Kariava-1	145 29 27	07 24 52
o 4015	Tovala-1A	146 08 45	08 04 23
o 4016	Maiva-1	146 06 36	08 27 18

□ Outcrop Summary Points

□ 4030	Composite for outcrops in southern Hindenburg Range area (western Muller Anticline), Blucher Range (Ok Tedi) 1:250 000 sheet. Longitude: ≈ 141°00' - 141°45' E; Latitude: ≈ 5°05' - 5°25' S.
□ 4031	Composite for outcrops in eastern Muller Anticline area, Blucher Range (Ok Tedi) 1:250 000 sheet. Longitude: ≈ 142°00' - 142°40' E; Latitude: ≈ 5°20' - 5°35' S.
□ 4032	Composite for outcrops southeast of Kubor Anticline, Karimui 1:250 000 sheet. Longitude: ≈ 144°00' - 145°00' E; Latitude: ≈ 6°00' - 6°35' S.
□ 4033	Composite for outcrops northeast of Kubor Anticline (Wahgi-Chimbu Gorge area), Karimui and Ramu 1:250 000 sheets, Minj 1:1000 000 sheet. Longitude: ≈ 144°50' - 145°05' E; Latitude: ≈ 5°53' - 6°05' S.
□ 4034	Composite for outcrops along Aure Scarp; Kikori, Karimui and Markham 1:250 000 sheets. Longitude: ≈ 145°20' - 145°30' E; Latitude: ≈ 7°00' - 7°15' S.
□ 4035	Composite for outcrops in the Oiapu - Yule Island - Oroi region, Yule 1:250 000 sheet. Area bounded by ≈ 145°30' E / 8°00' S; 146°30' E / 7°45' S; 147°00' E / 9°20'S.

Table A 2: **MESOZOIC TIME SLICES**

TIME SLICE	AGE	MA	DINOFLAGELLATE ZONE
Cretaceous			
K 11	Late Maastrichtian	70.0 - 66.4	*T. longus**
K 10	Campanian to mid-Maastrichtian	83.0 - 70.0	*N. senectus - T. lilliei**
K 9	Turonian to Santonian	91.0 - 83.0	*P. infusorides - I. cretaceum*
K 8	latest Albian to Cenomanian	99.0 - 91.0	*X. asperatus - lowermost P. infusorides*
K 7	Late Albian	104.0 - 99.0	*P. ludbrookiae*
K 6	late Early to Middle Albian	110.0 - 104.0	*upper M. tetracantha - C. denticulata*
K 5	latest Aptian to Early Albian	114.0 - 110.0	*mid-D. davidii - M. tetracantha*
K 4	Aptian	119.0 - 114.0	*O. operculata - mid-D. davidii*
K 3	Barremian	125.0 - 119.0	*M. australis*
K 2	Valanginian to Hauterivian	137.0 - 125.0	*S. areolata - lowermost M. australis*
K 1	Berriasian to earliest Valanginian	144.0 - 137.0	*K. wisemaniae - E. torynum*
Jurassic			
J 10	late Tithonian	147.5 - 144.0	*D. jurassicum (= G. jurassica - R. serrata) - P. iehiense*
J 9	early Tithonian	150.0 - 147.4	*C. perforans - O. montgomeryi*
J 8	Oxfordian to Kimmeridgian	162.0 - 150.0	*W. spectabilis - D. swanense*
J 7	mid-Callovian to earliest Oxfordian	167.0 - 162.0	*W. digitata - R. aemula*
J 6	latest Bajocian to early Callovian	177.0 - 167.0	*mid- lower D. complex* - W. indotata*
J 5	mid-Bajocian	180.0 - 177.0	*uppermost C. turbatus - lowermost D. complex**
J 4	latest Toarcian to earliest Bajocian	189.0 - 180.0	*upper mid-C. turbatus**
J 3	late Toarcian	191.0 - 189.0	*lower C. turbatus**
J 2	Pliensbachian to early Toarcian	200.0 - 191.0	*mid-C. torosa - lowermost C. turbatus**
J 1	Hettangian to Sinemurian	213.0 - 200.0	*uppermost P. crenulatus - mid-C. torosa**
Triassic			
TR 6	mid-Norian to Rhaetian	222.0 - 213.0	*Falcisporites* Superzone*
TR 5	Carnian to mid-Norian	231.0 - 222.0	"
TR 4	Late Ladinian	235.0 - 231.0	"
TR 3	latest Anisian to Early Ladinian	239.0 - 235.0	"
TR 2	late Scythian to Anisian	245.0 - 239.0	"
TR 1	early Scythian	248.0 - 245.0	"

*spore/pollen zone

(based on Harland & others, 1982; Helby & others, 1987; Morgan, 1990)

Table A 3: CAINOZOIC TIME SLICES

Time Slice	Age	Foraminifera Zones	Ma
Cz 7	Quaternary	N 22-23	0 - 1.7
Cz 6b	Late Pliocene	N 21	1.7 - 3.0
Cz 6a	Early Pliocene	N 18-19/20	3.0 - 5.0
Cz 5	Late Miocene	Tf_3; late N 14 - N 17	5.0 - 10.5
Cz 4c	Middle Miocene	late Tf_1 - early Tf_3; N 9-14	10.5 - 15.2
Cz 4b	Early Miocene	late Te_5 - Tf_1; N 5-8	15.2 - 22.0
Cz 4a	Earliest Miocene to Late Oligocene	Te_4-early Te_5; P21b-N4	22.0 - 30.0
Cz 3	Early Oligocene	Tc - Te; P 18-21a	30.0 - 36.5
Cz 2b	Late Eocene	Tb; P 15-17;	36.5 - 40.0
Cz 2a	Middle Eocene	Ta_3; P 10-14;	40.0 - 52.0
Cz 1	Early Eocene to Paleocene	Ta_1 - Ta_2	52.0 - 66.4

Figure A 5: Triassic Data Map: Time Slice 2

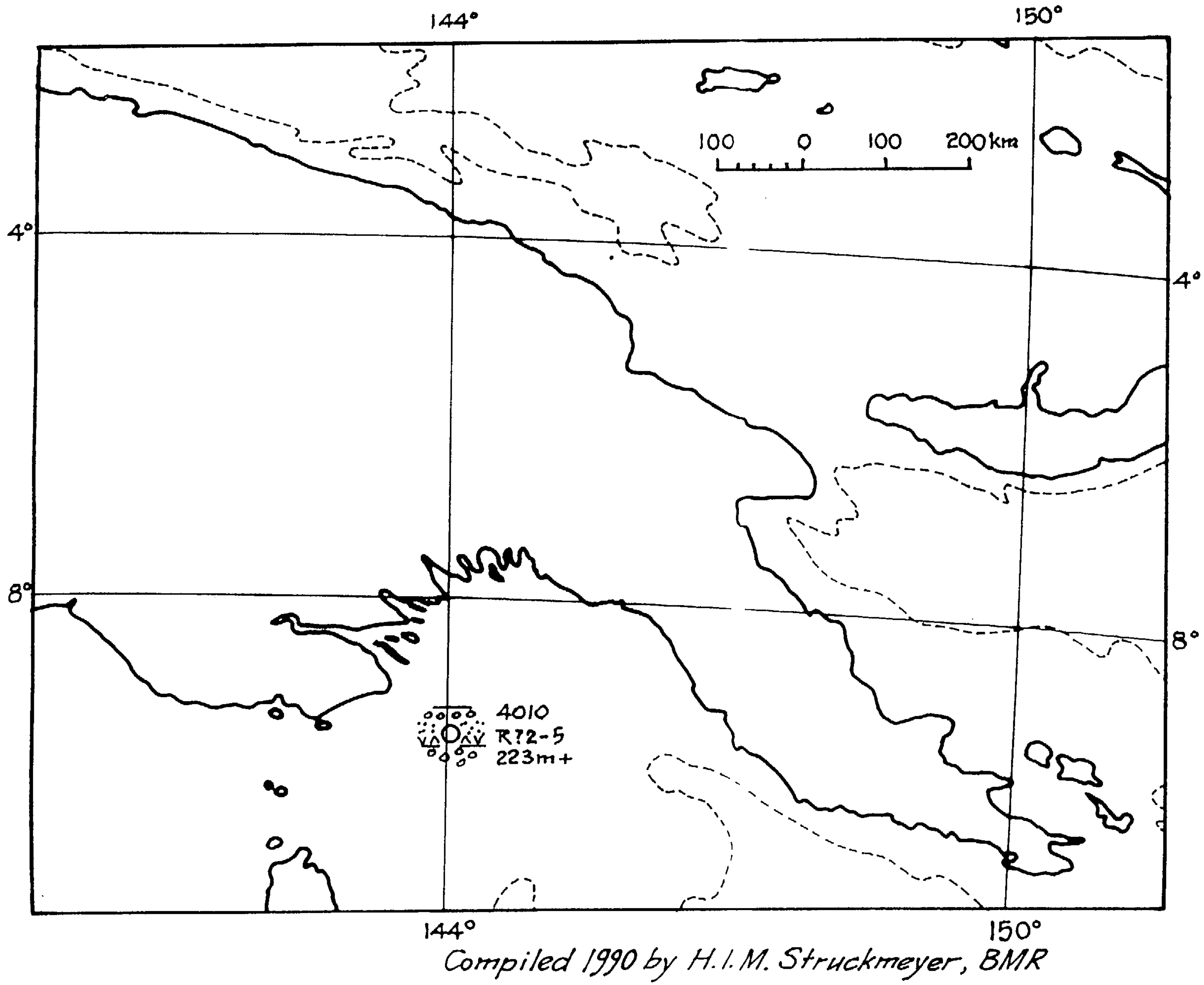
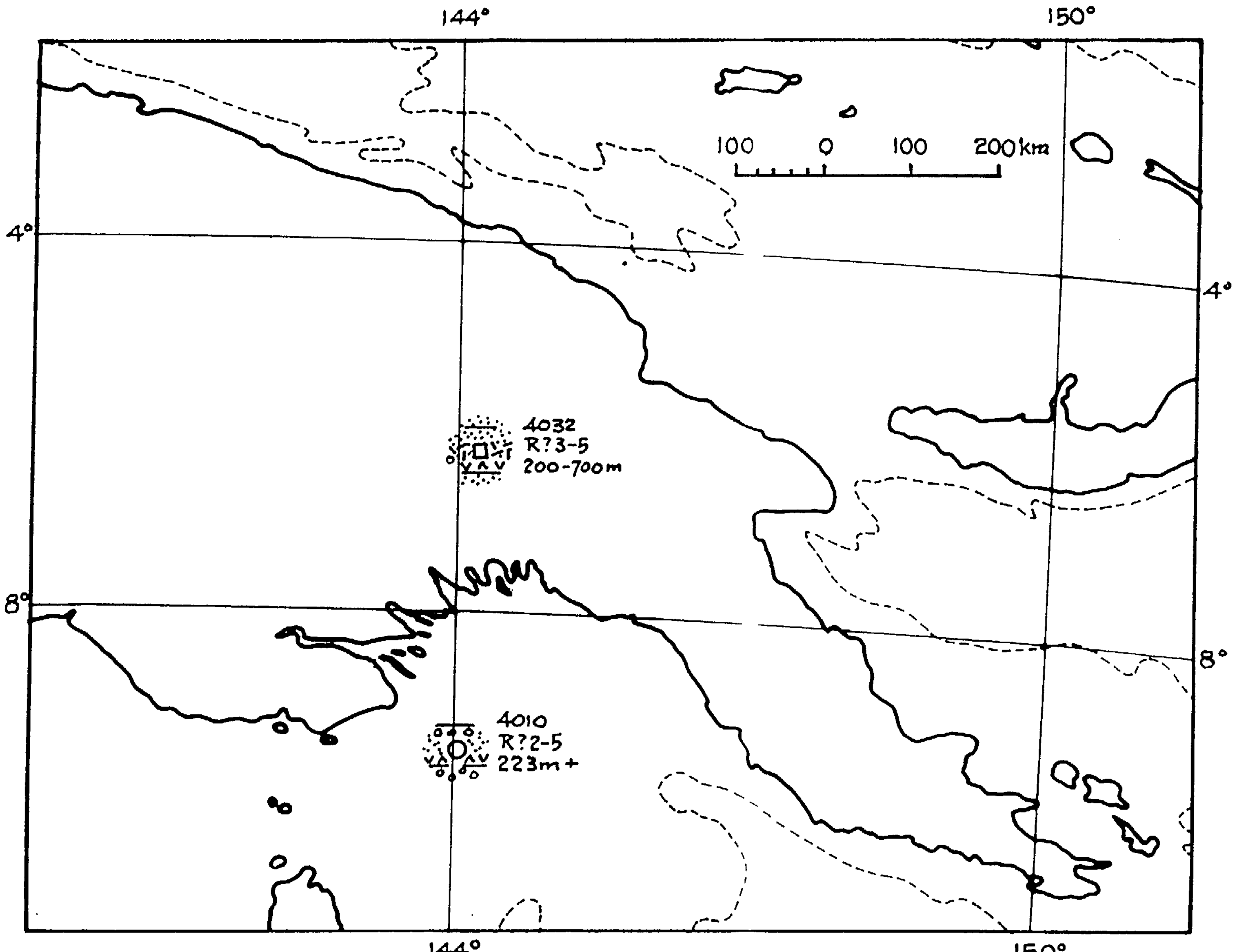
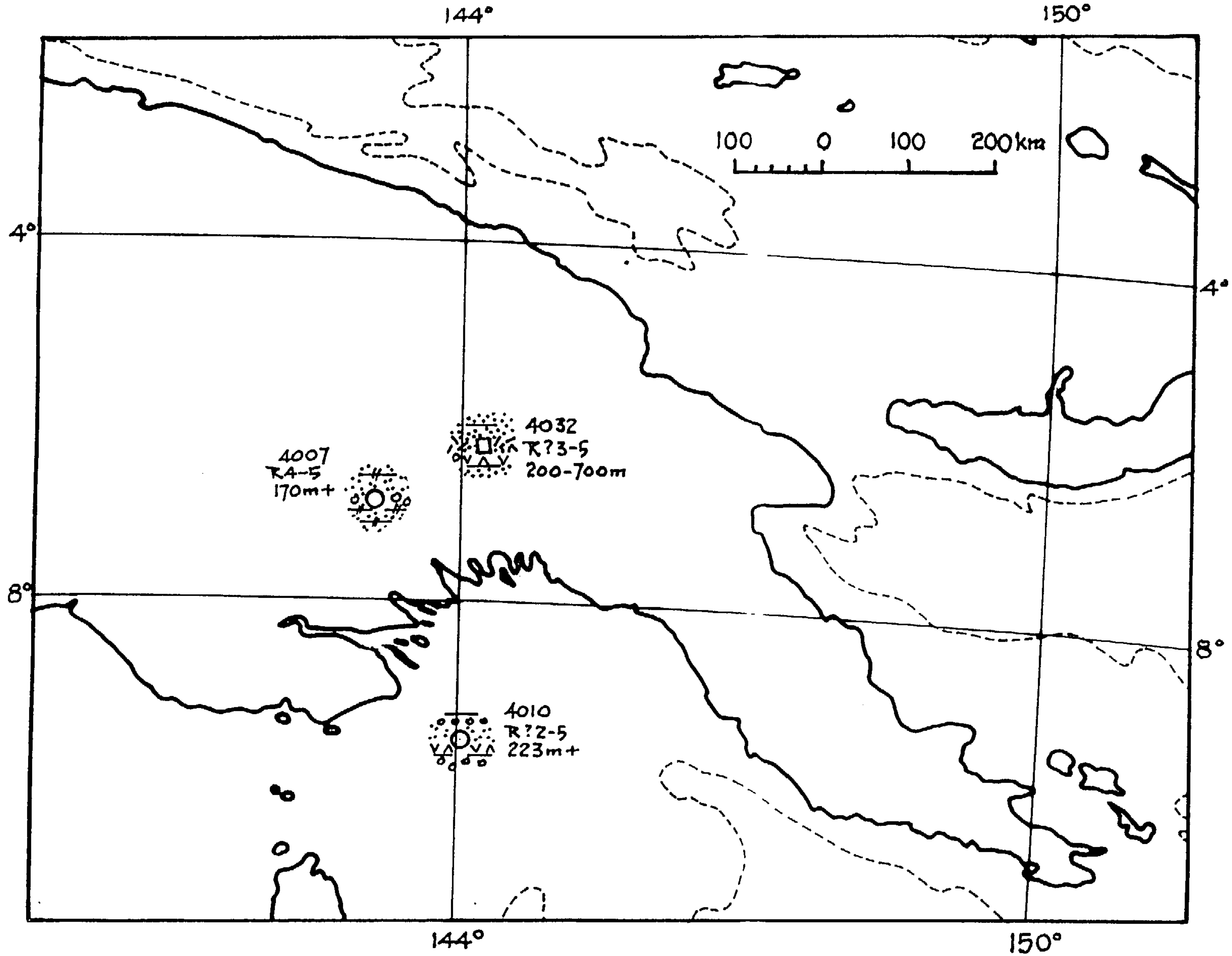


Figure A 6: Triassic Data Map: Time Slice 3



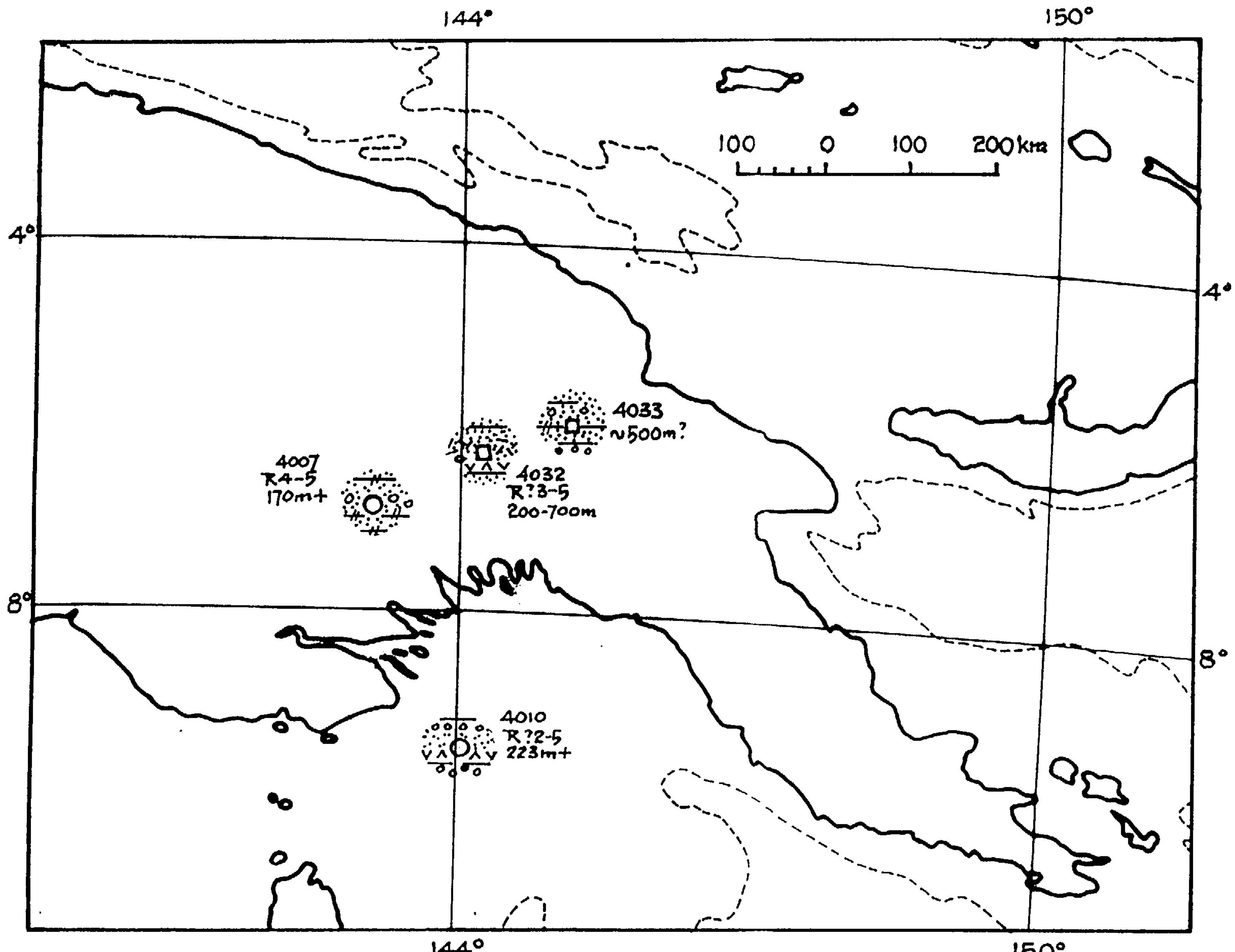
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 7 Triassic Data Map: Time Slice 4



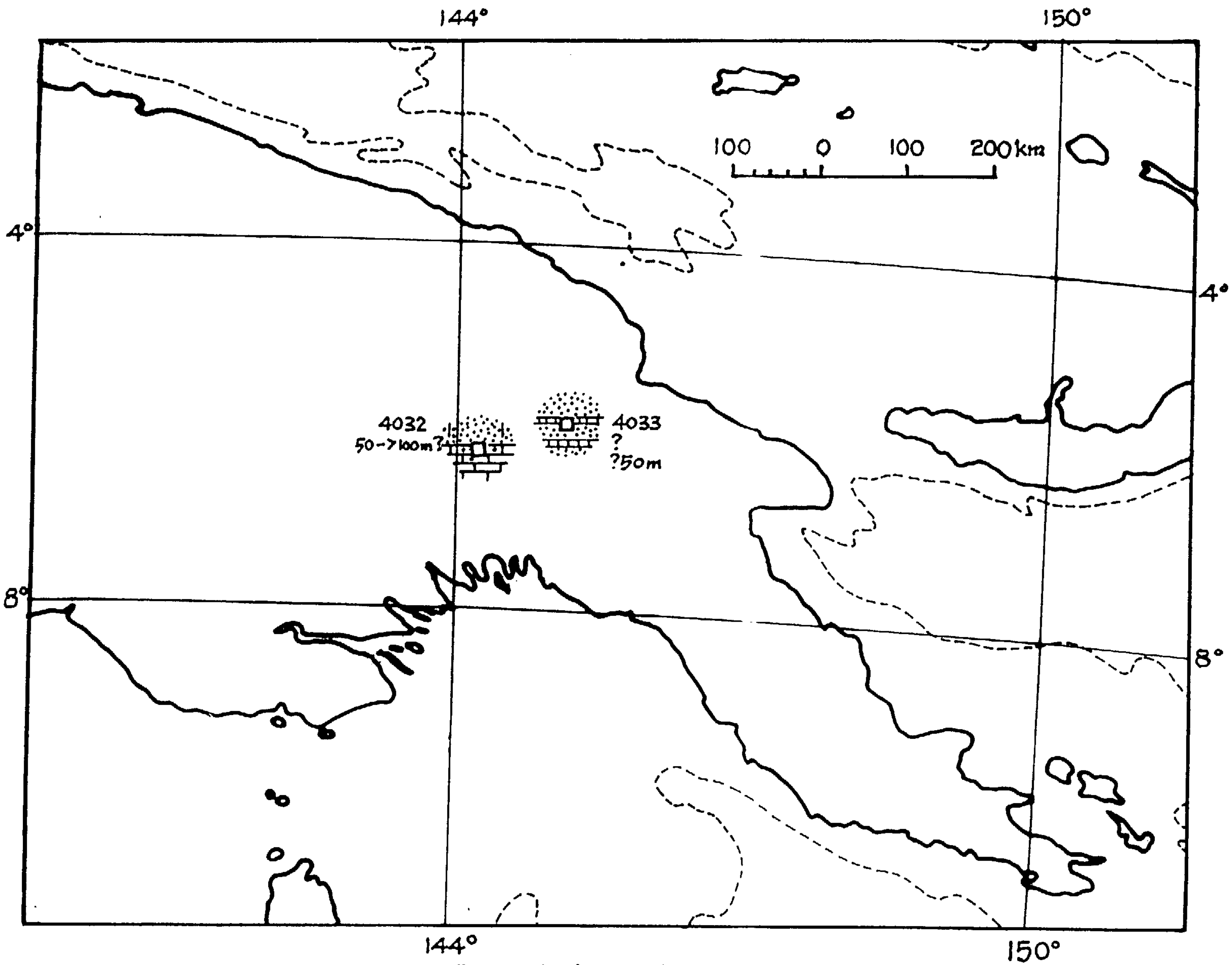
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 8: Triassic Data Map: Time Slice 5



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 9: Triassic Data Map: Time Slice 6



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 10: Jurassic Data Map: Time Slice 1

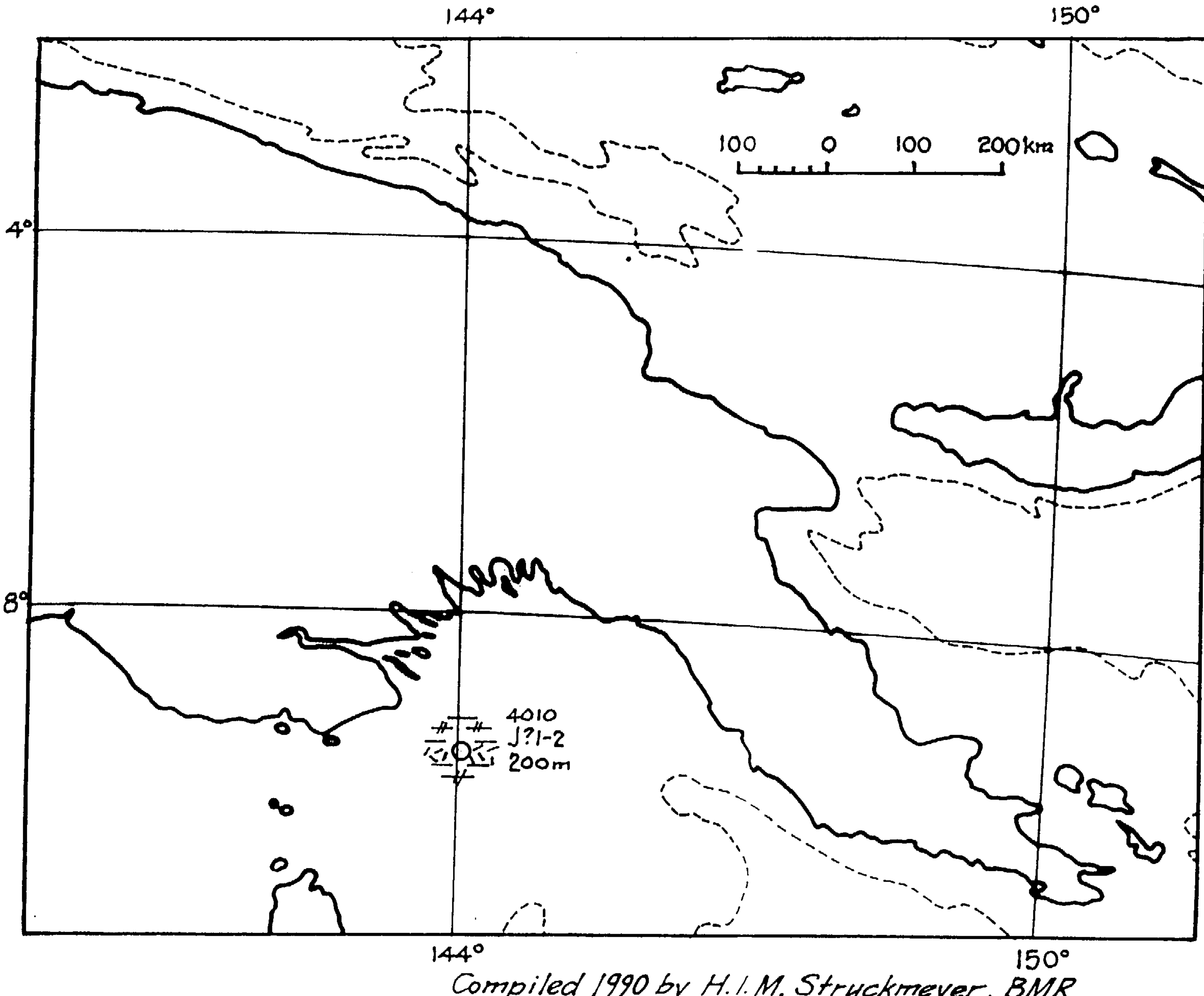
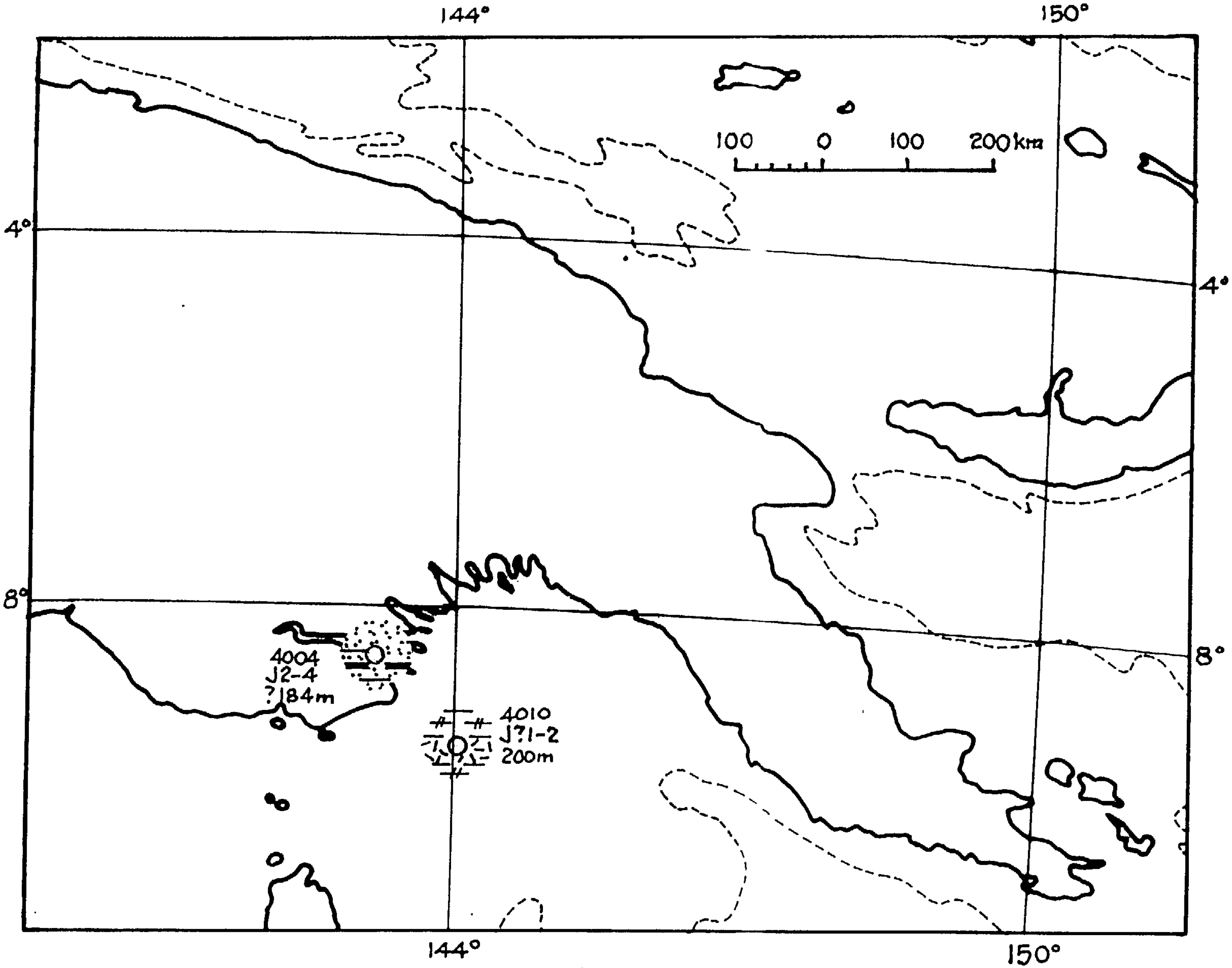


Figure A 11: Jurassic Data Map: Time Slice 2



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 12: Jurassic Data Map: Time Slice 3

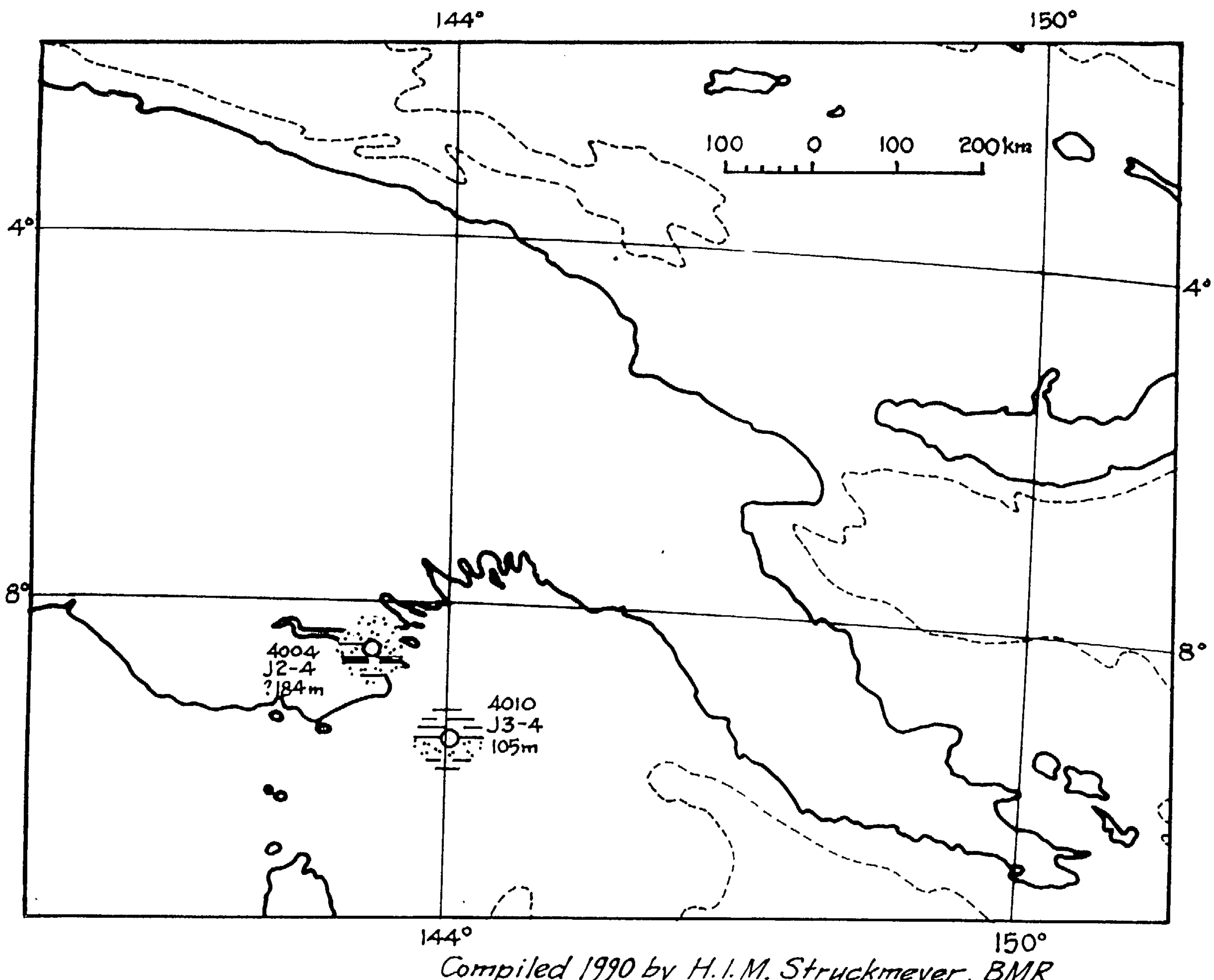
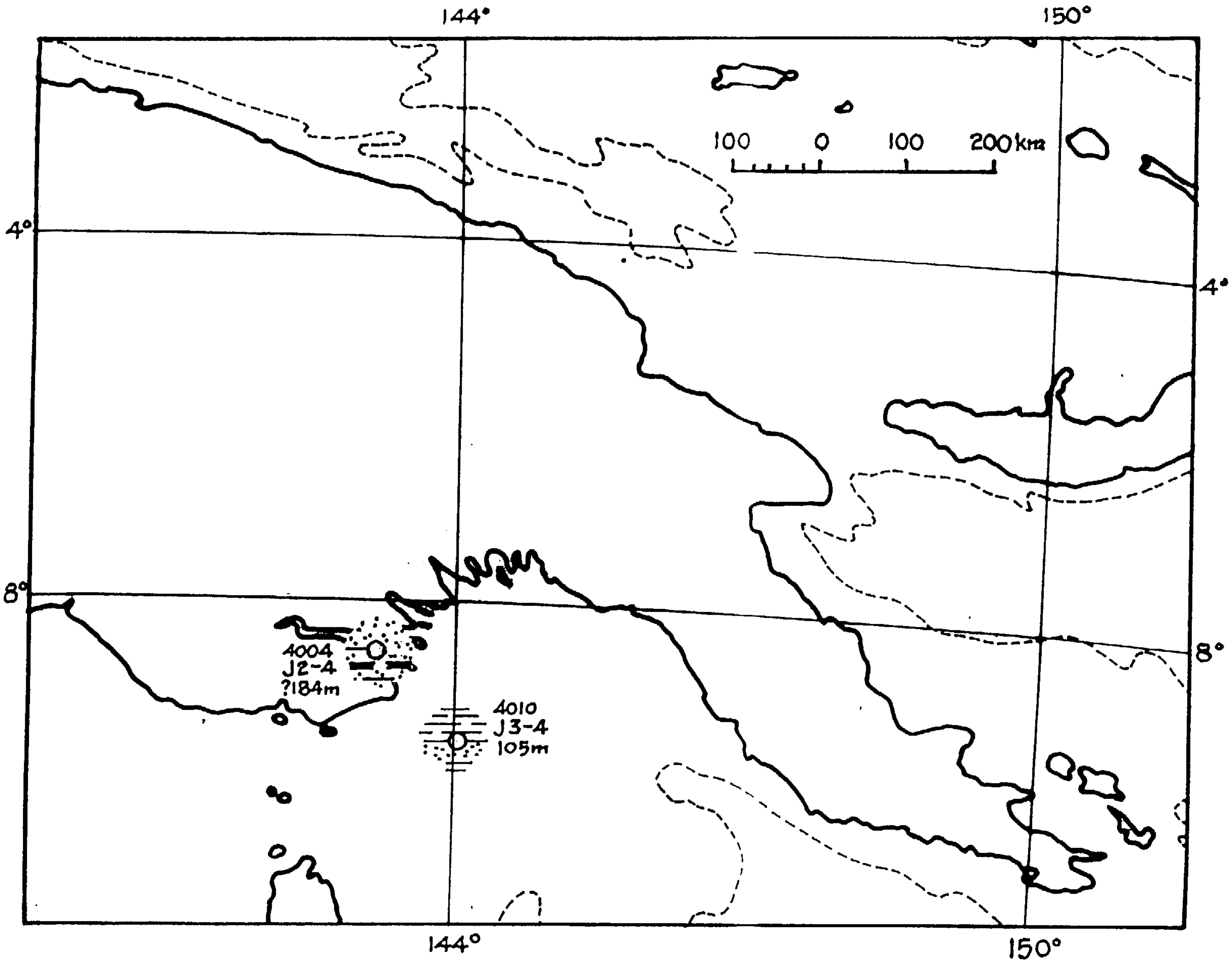


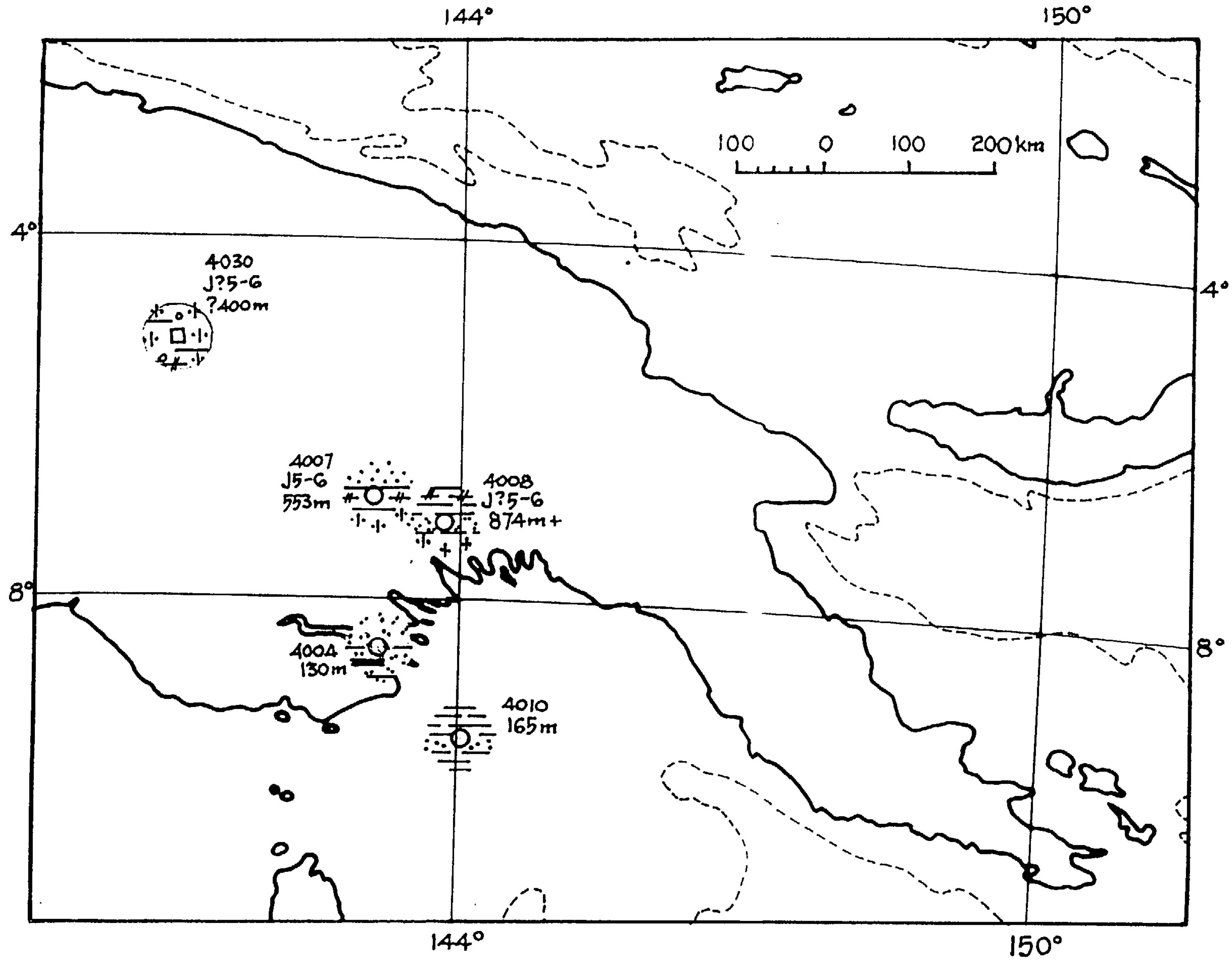
Figure A 13:

Jurassic Data Map: Time Slice 4



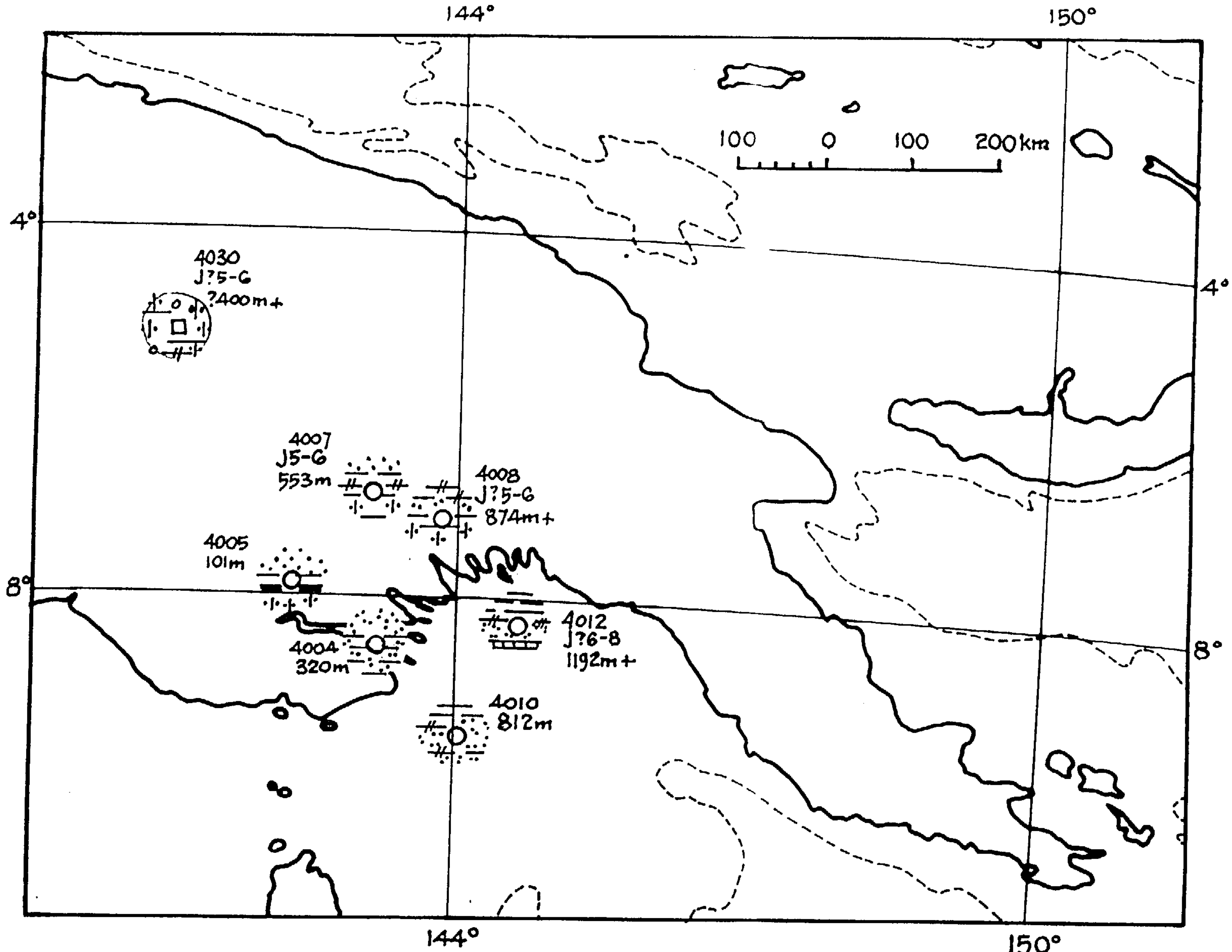
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 14: Jurassic Data Map: Time Slice 5



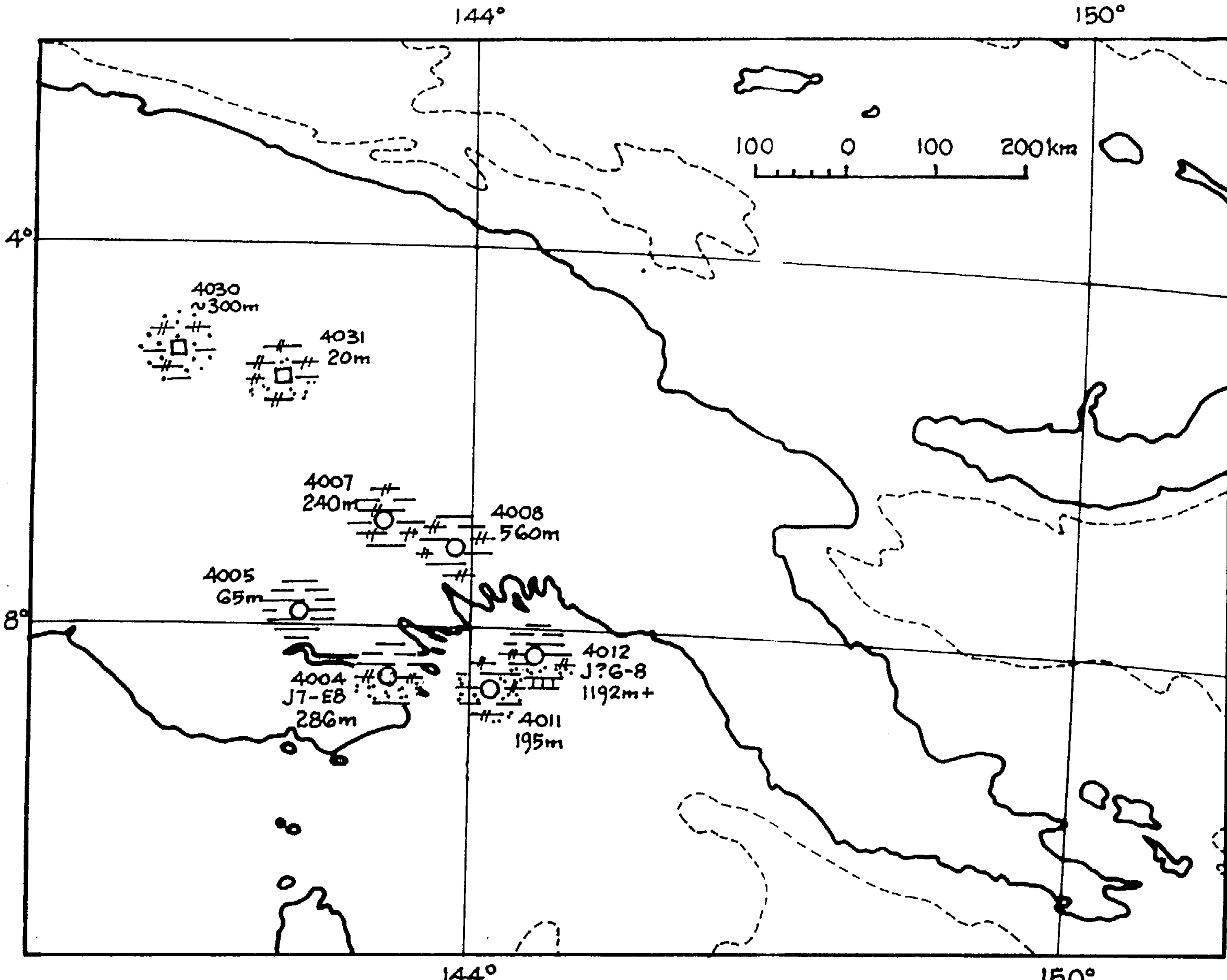
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 15: Jurassic Data Map: Time Slice 6



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 16: Jurassic Data Map: Time Slice 7



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 17: Jurassic Data Map: Time Slice 8

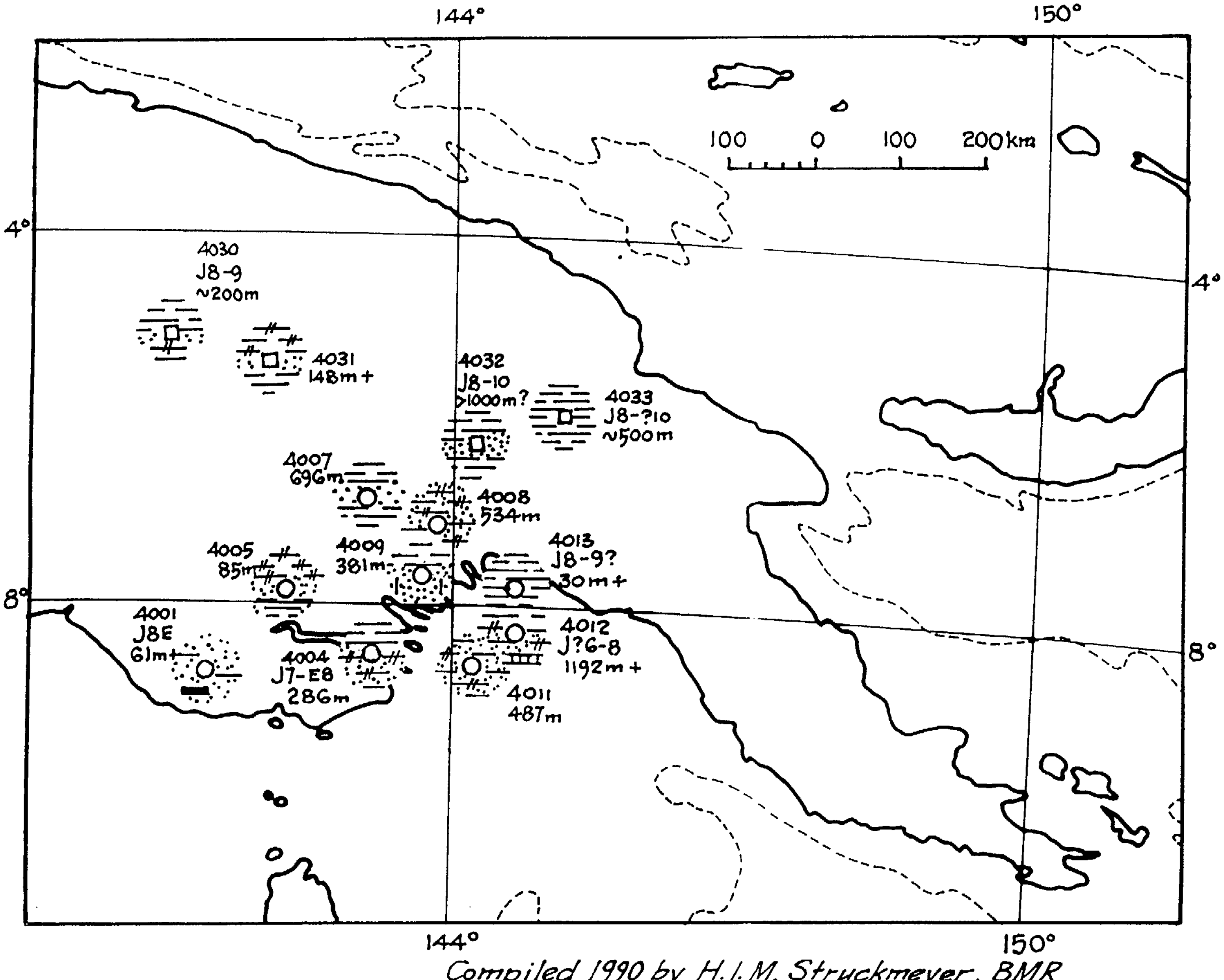
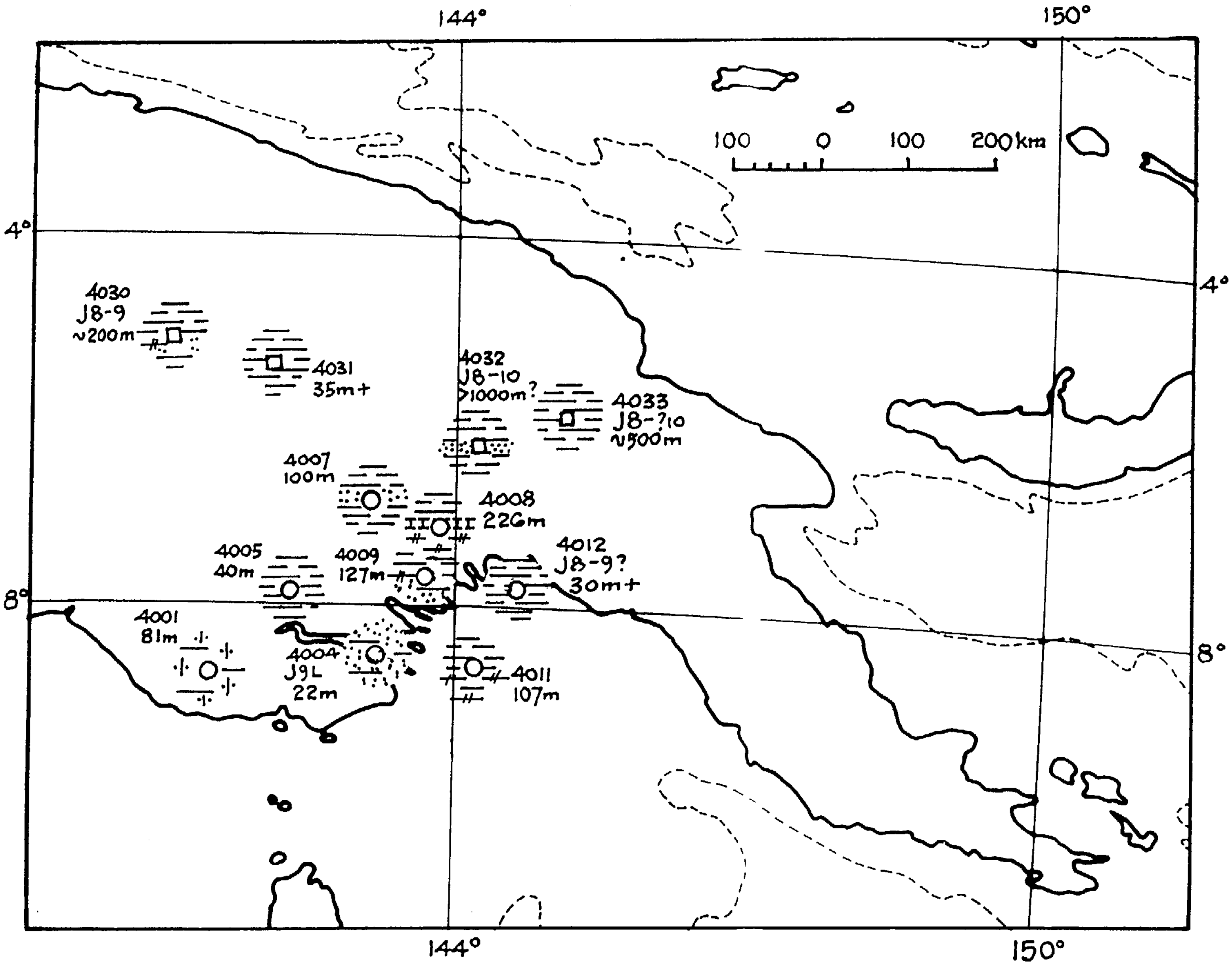
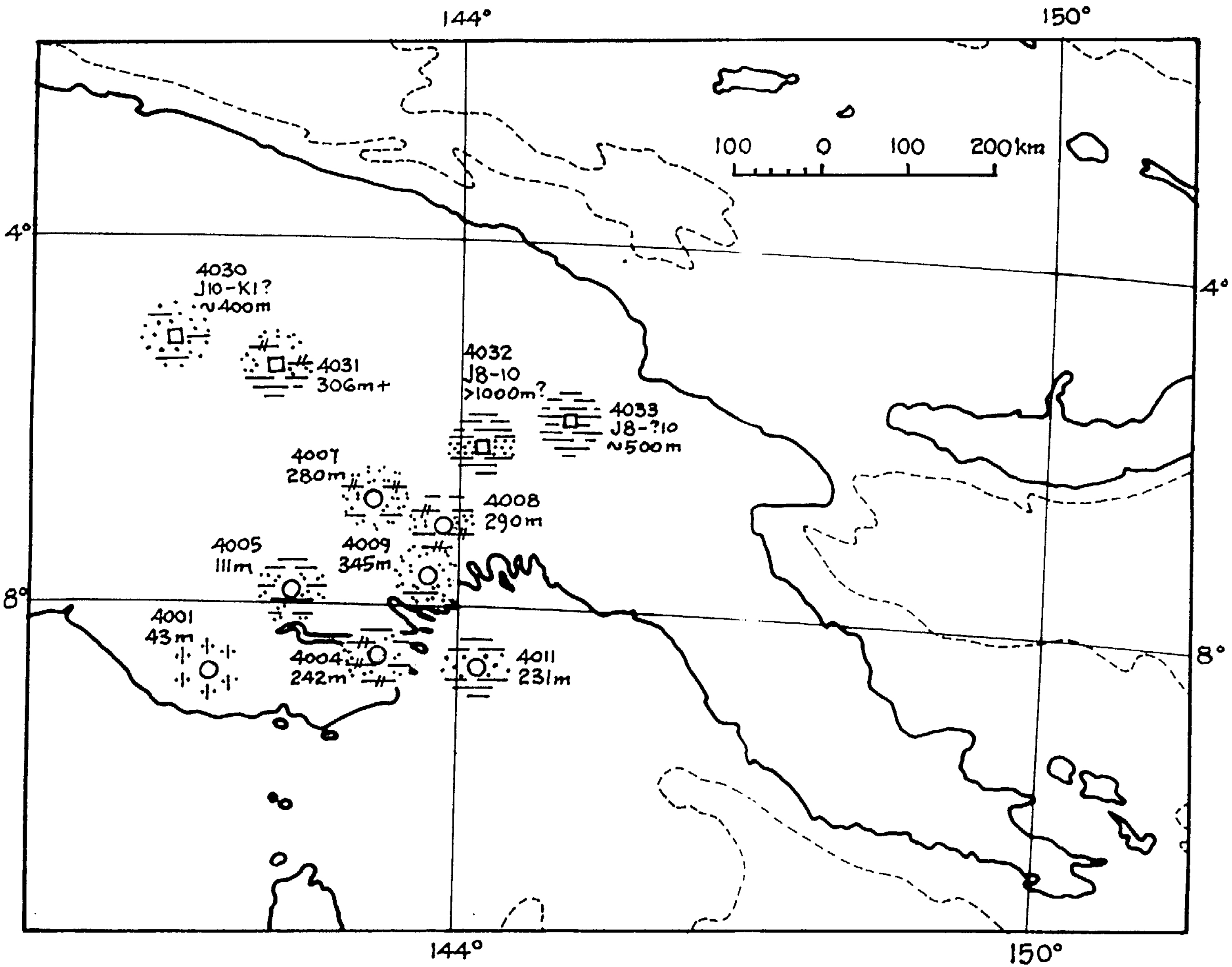


Figure A 18: Jurassic Data Map: Time Slice 9



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 19: Jurassic Data Map: Time Slice 10



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 20: Cretaceous Data Map: Time Slice 1

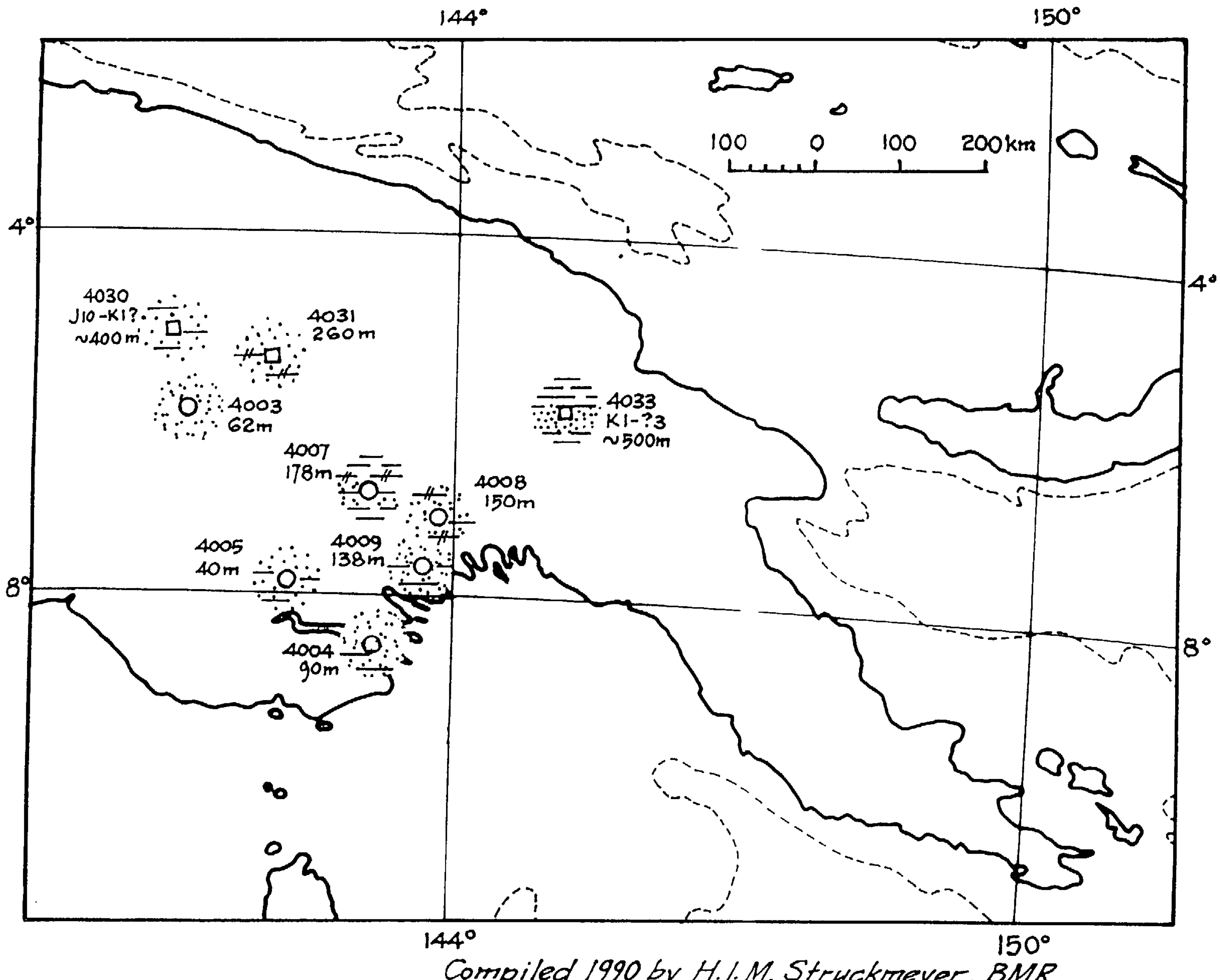
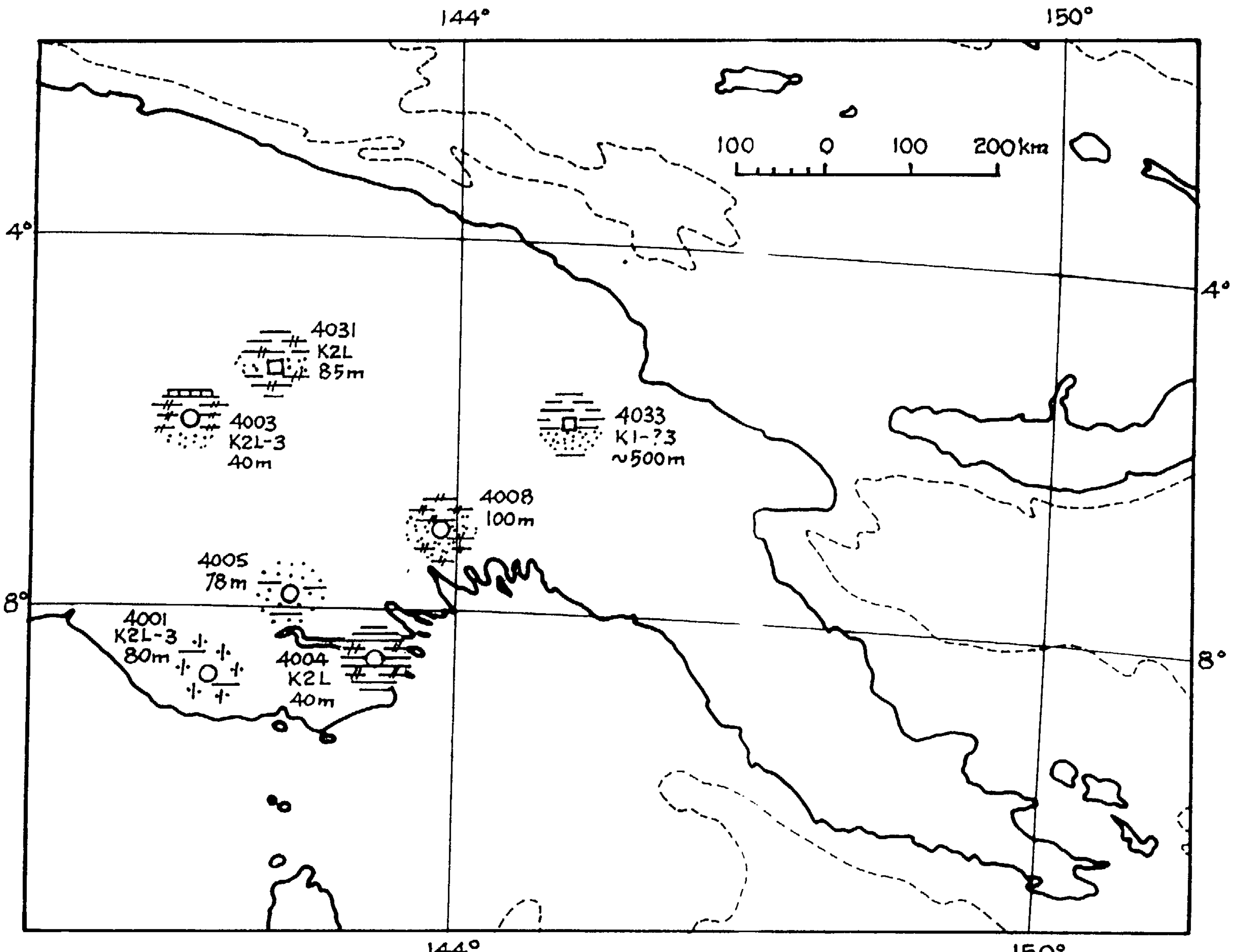
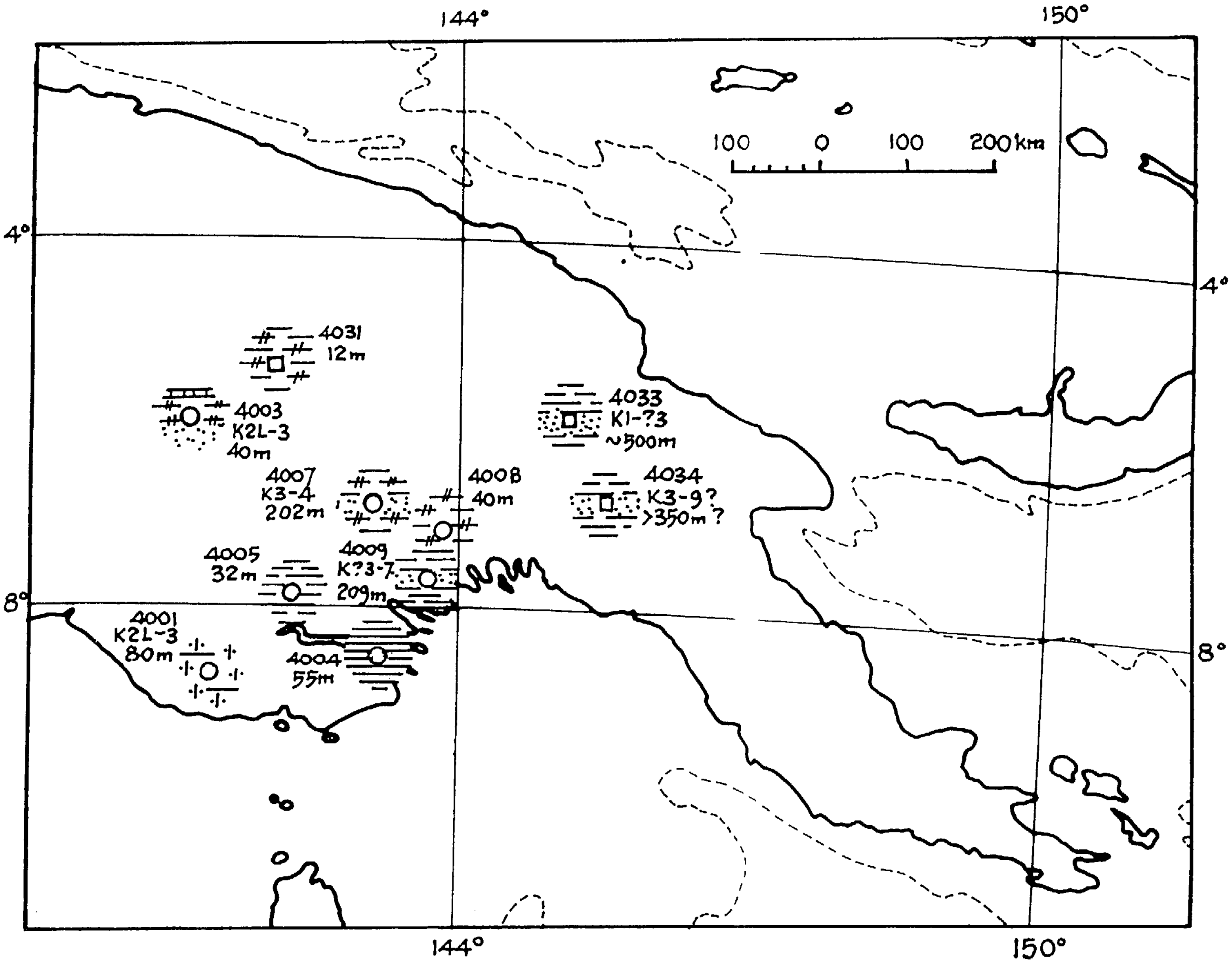


Figure A 21: Cretaceous Data Map: Time Slice 2



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 22: Cretaceous Data Map: Time Slice 3



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 23: Cretaceous Data Map: Time Slice 4

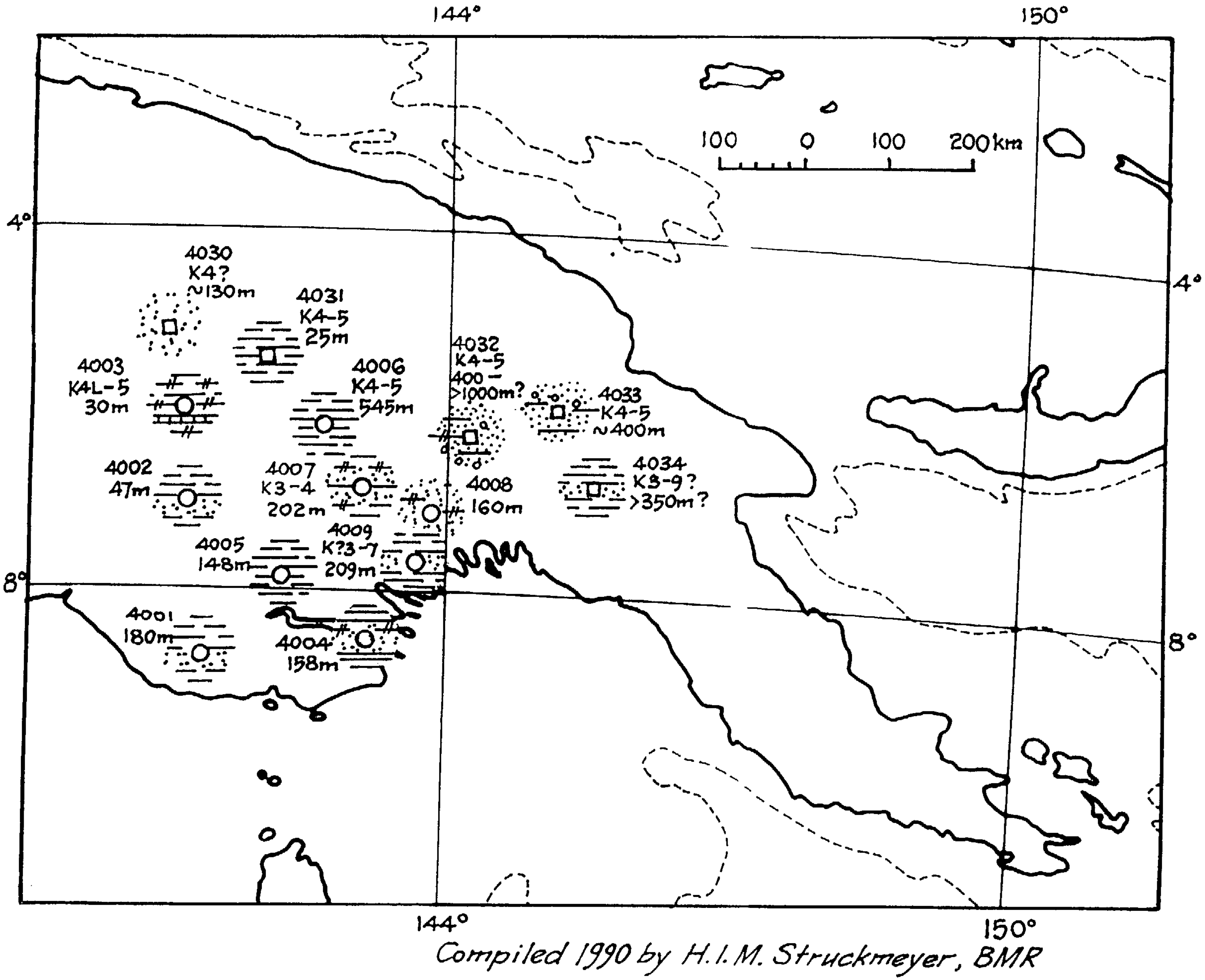
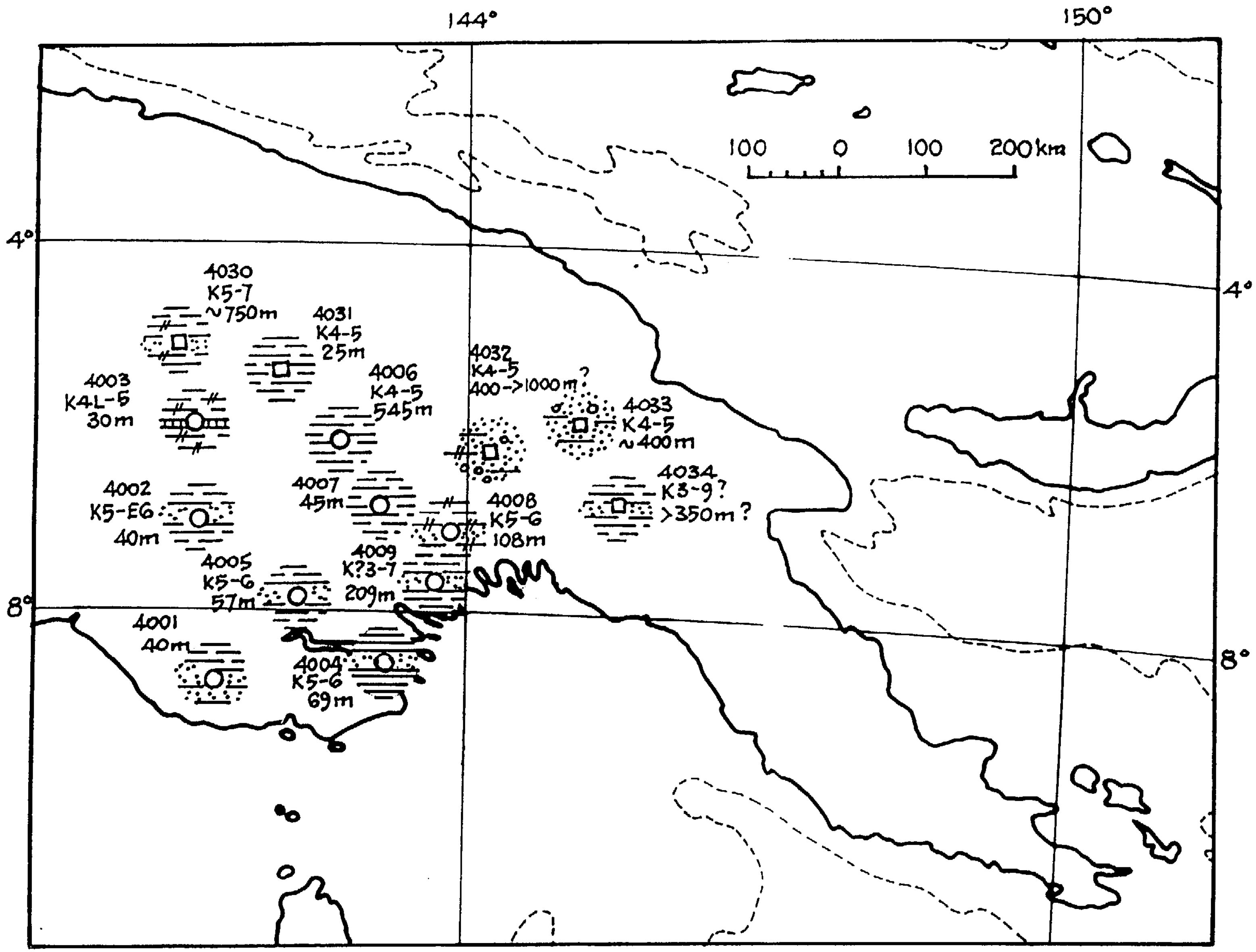
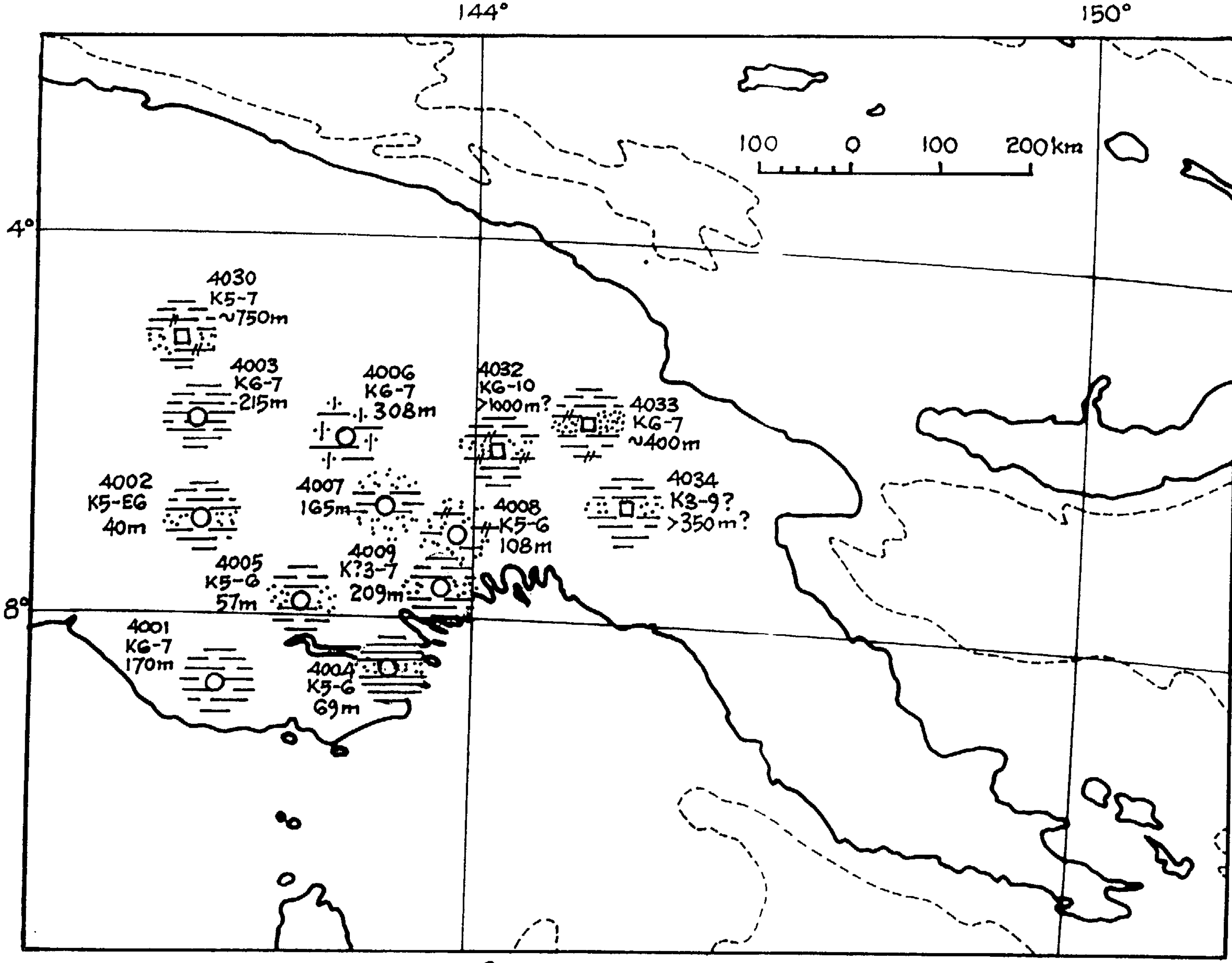


Figure A 24: *Cretaceous Data Map: Time Slice 5*



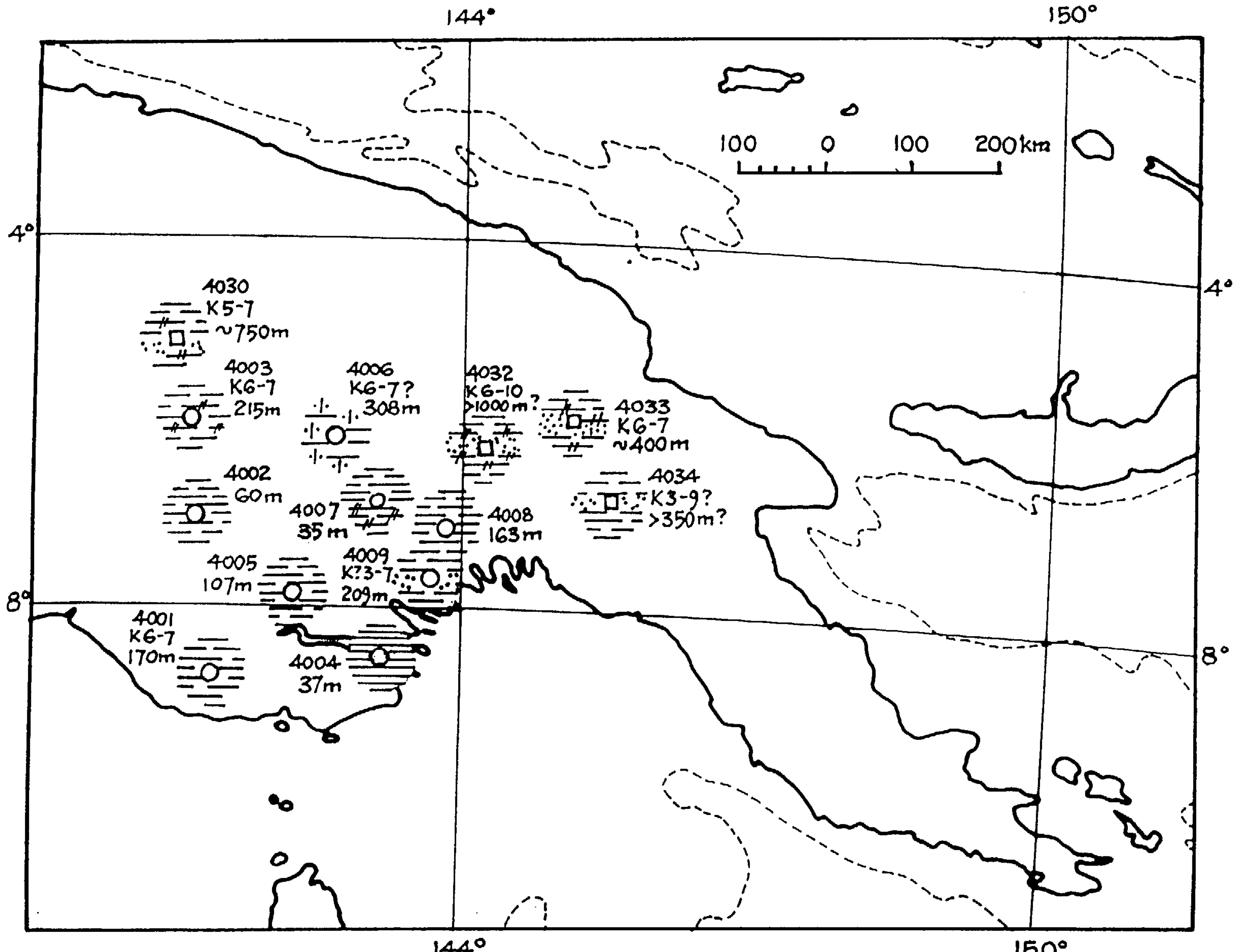
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 25: Cretaceous Data Map: Time Slice 6



Compiled 1990 by H. I. M. Struckmeyer, BMR

Figure A 26: Cretaceous Data Map: Time Slice 7



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 27:

Cretaceous Data Map: Time Slice 8

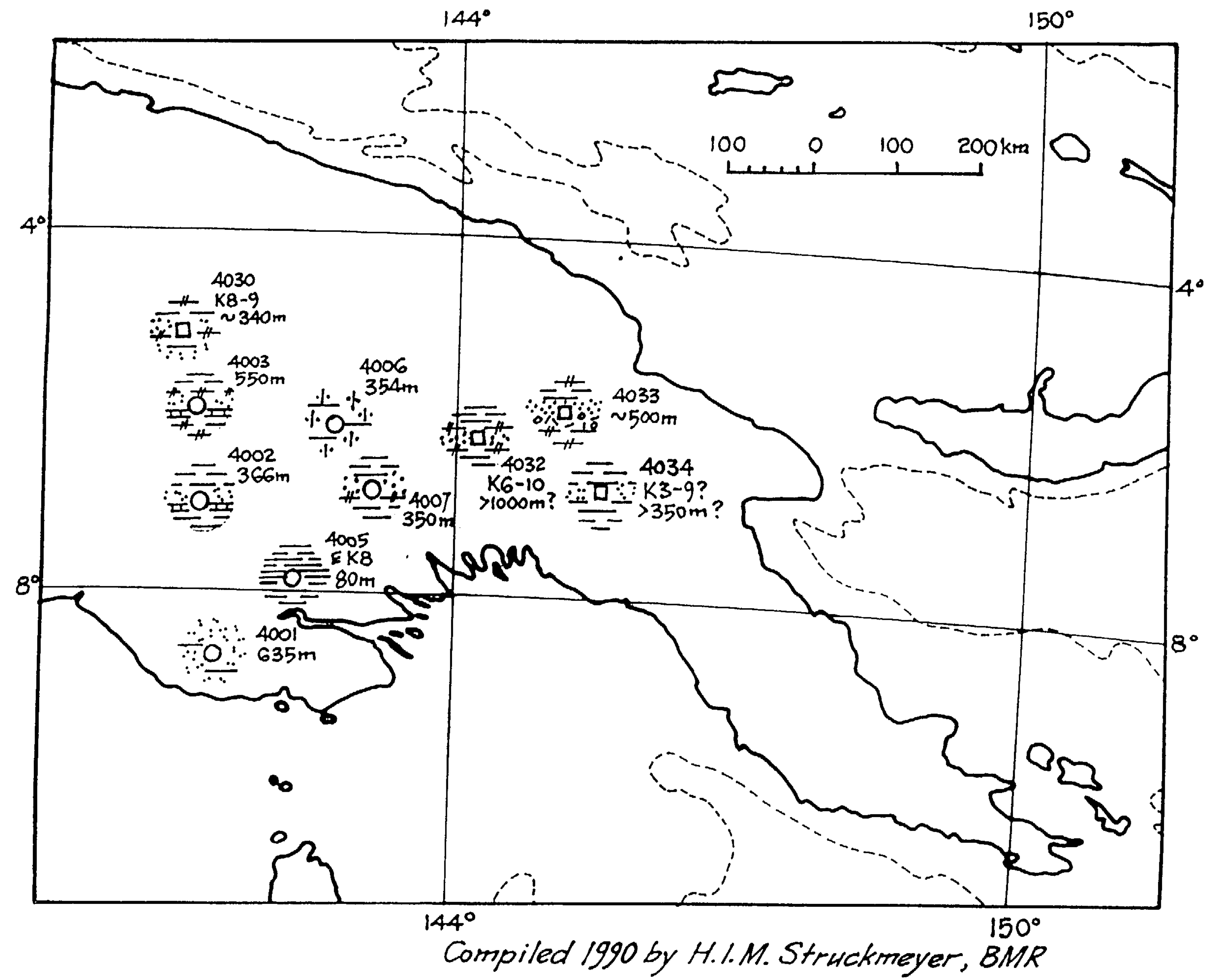
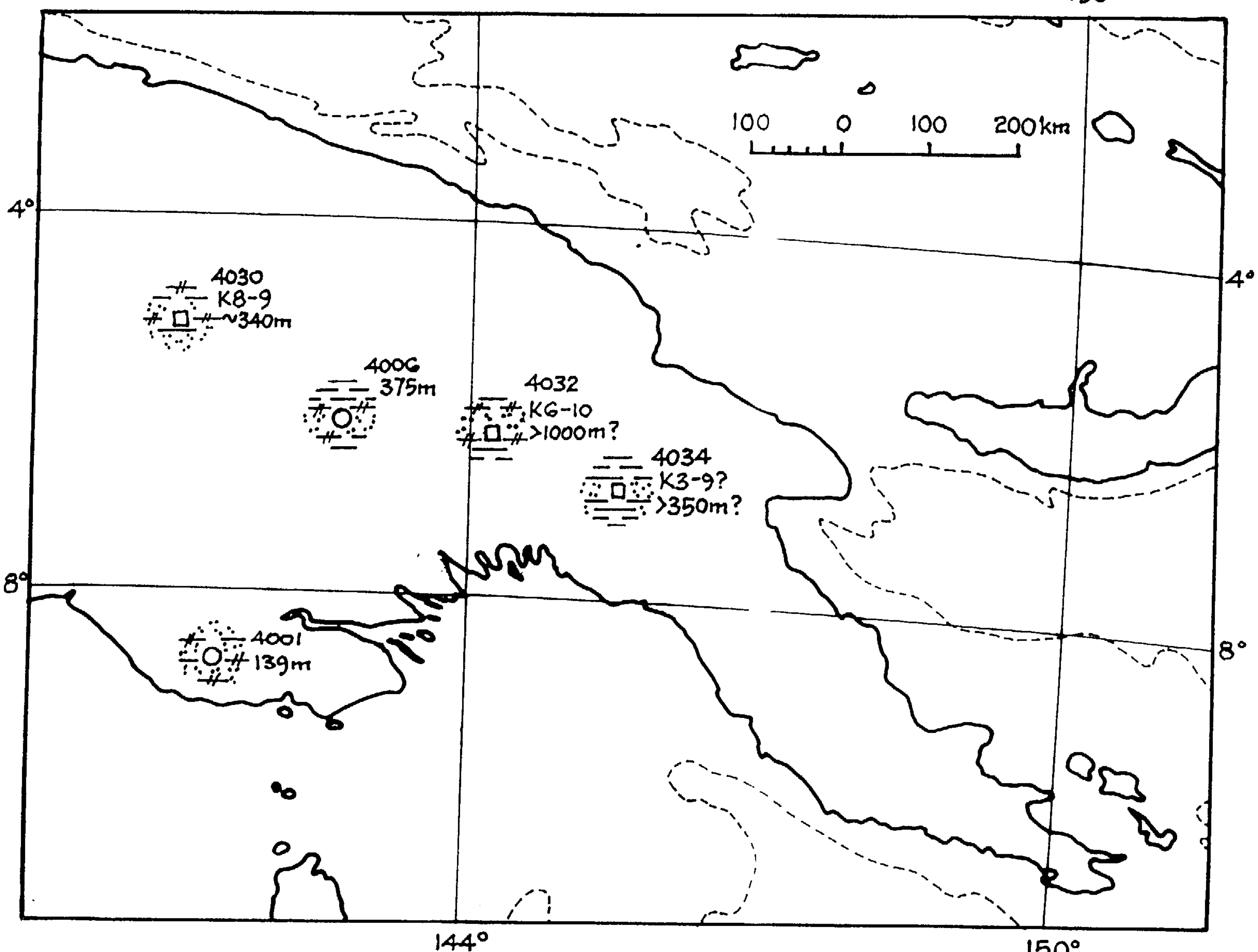


Figure A 28:

Cretaceous Data Map: Time Slice 9



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 29: Cretaceous Data Map: Time Slice 10

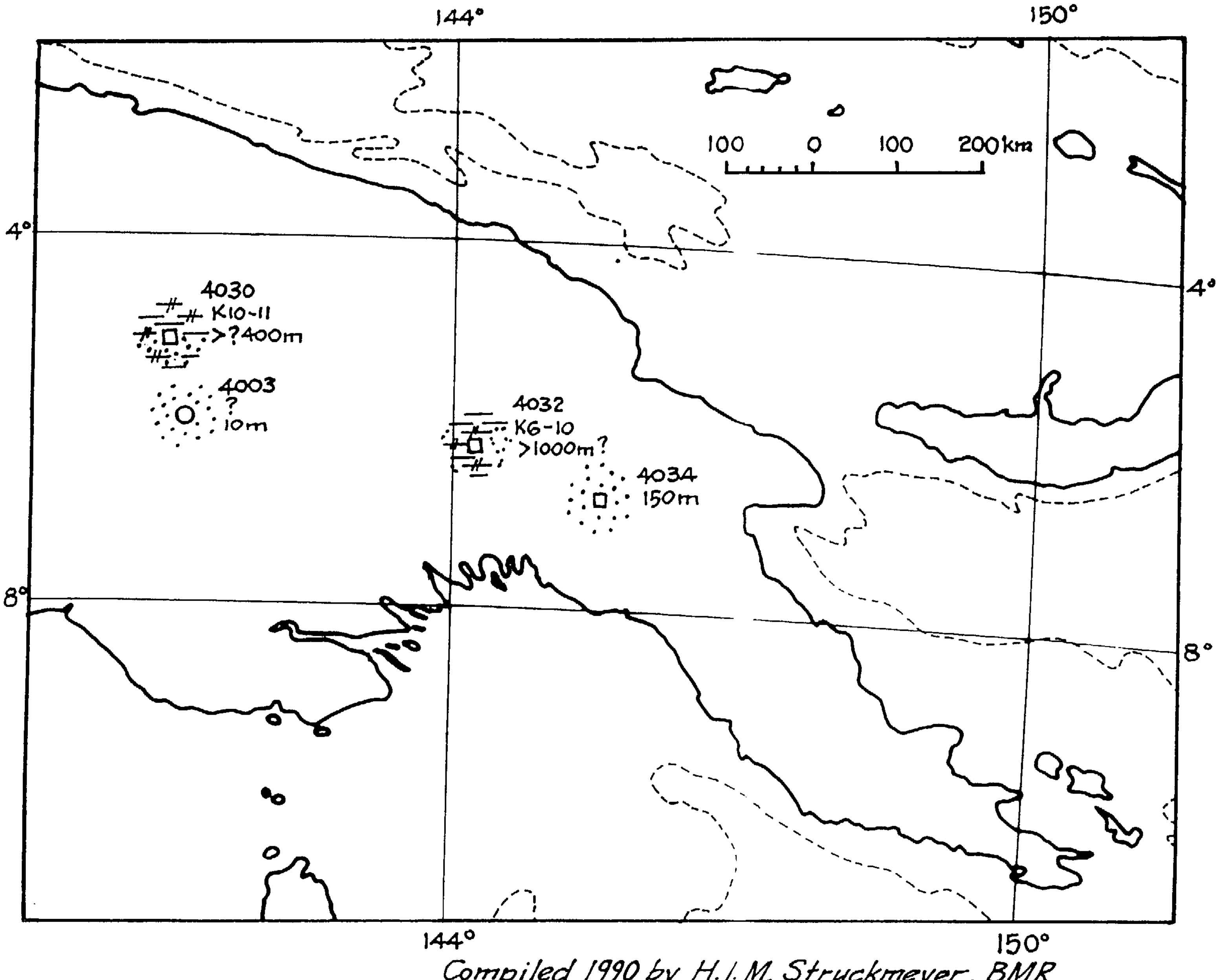
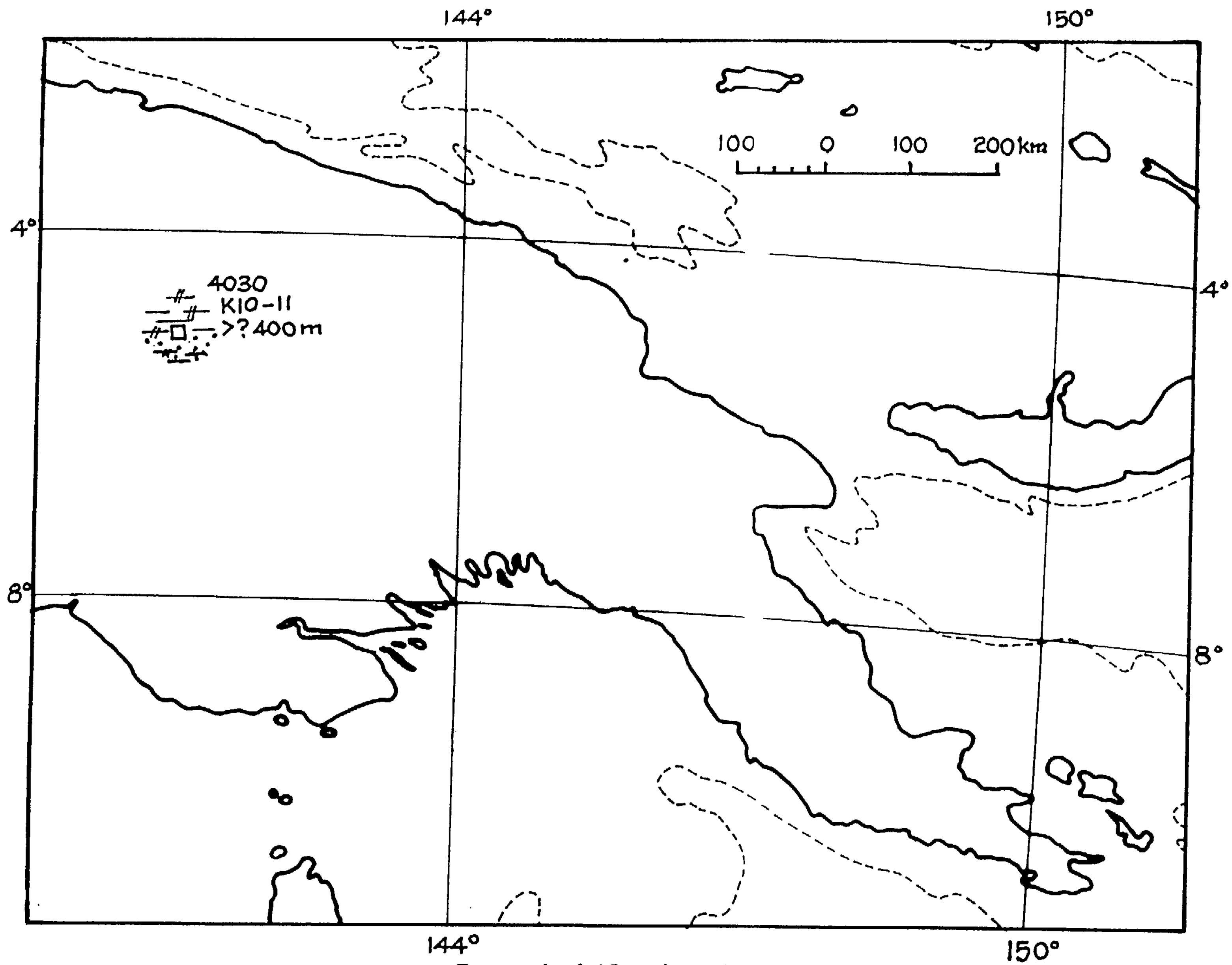
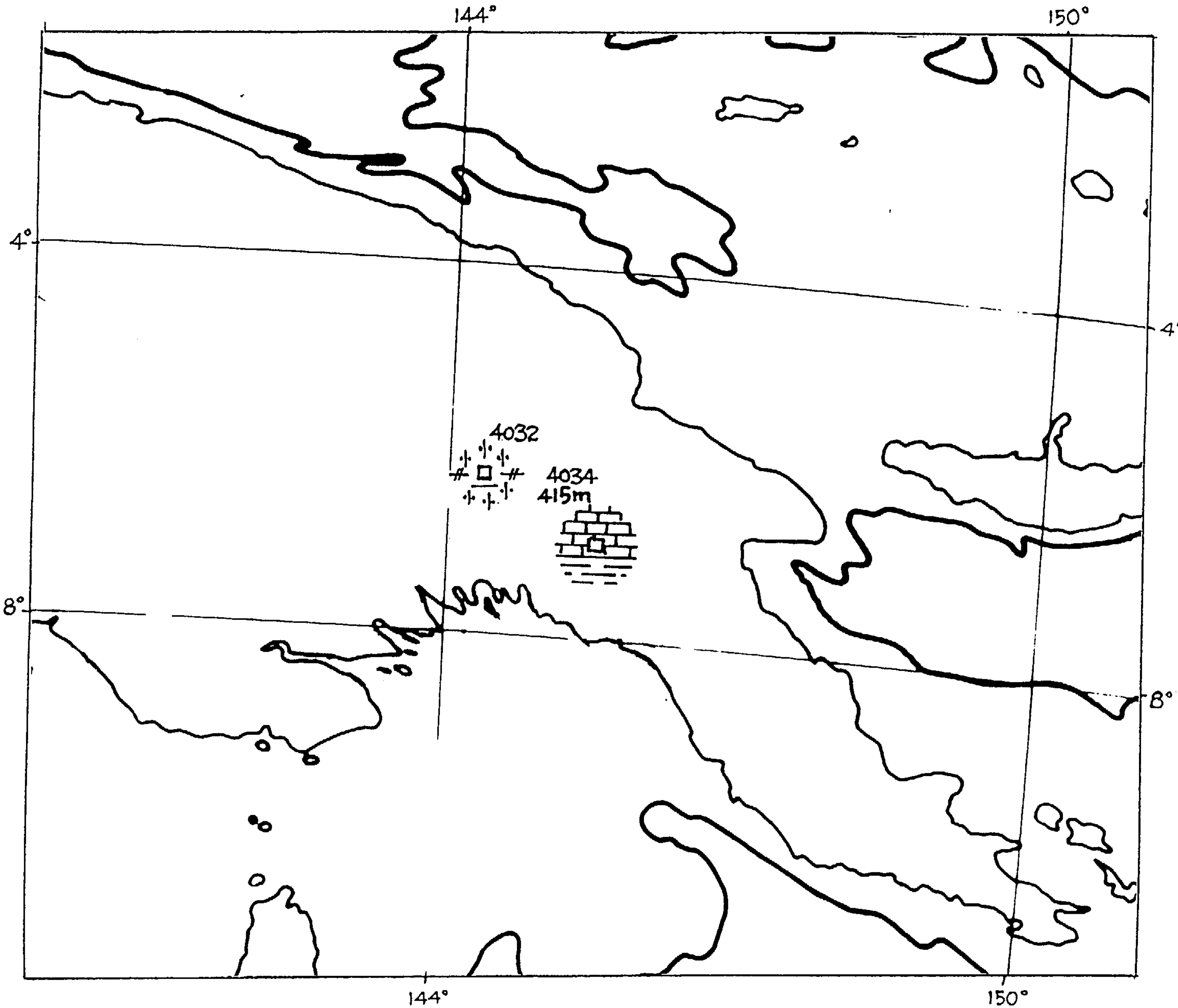


Figure A 30: Cretaceous Data Map: Time Slice 11



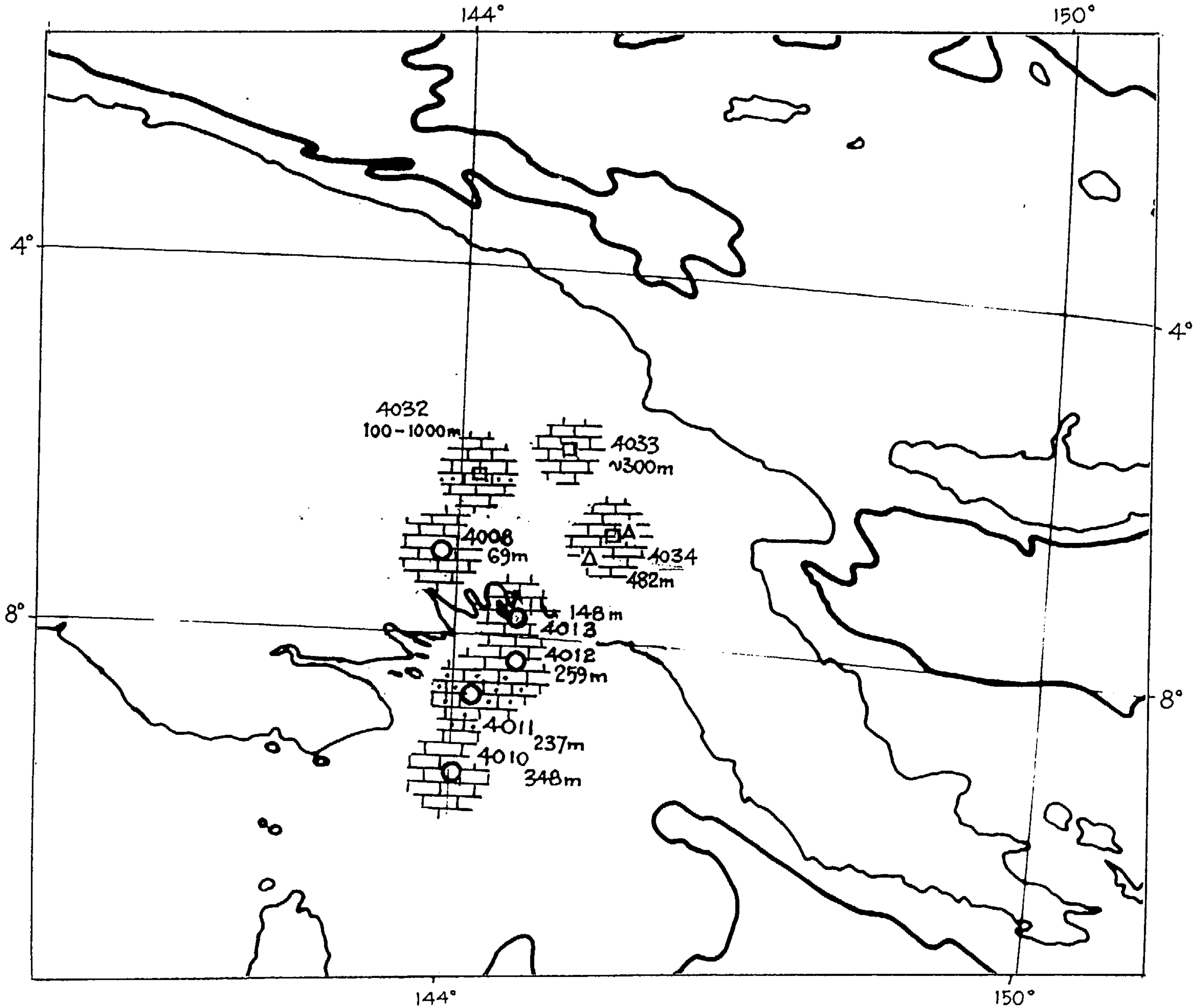
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 31: Cainozoic Data Map: Time Slice 1



Compiled 1990 by H.I.M. Struckmeyer, BMR

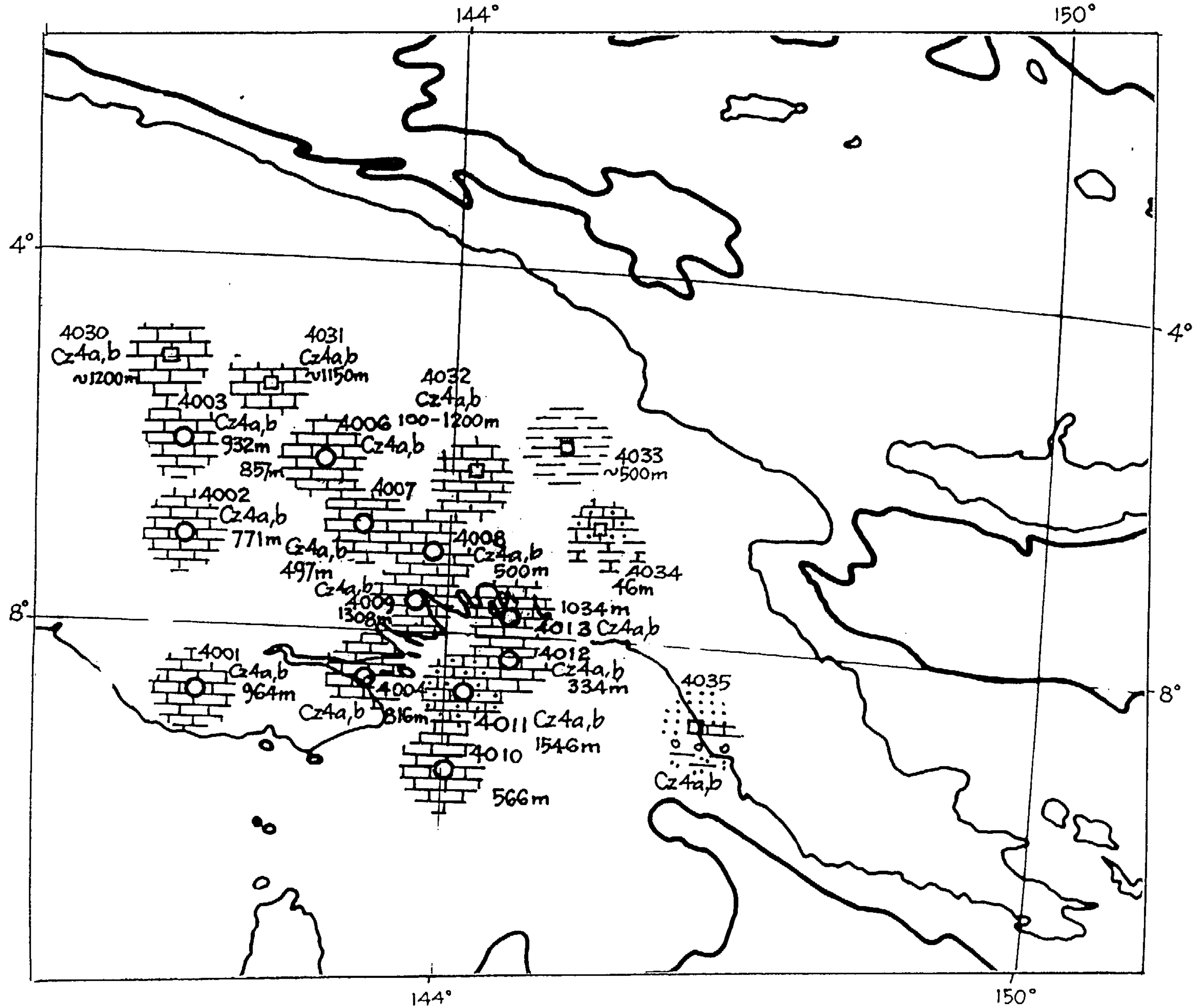
Figure A 32: Cainozoic Data Map: Time Slices 2a &b



Compiled 1990 by H.I.M. Struckmeyer, BMR

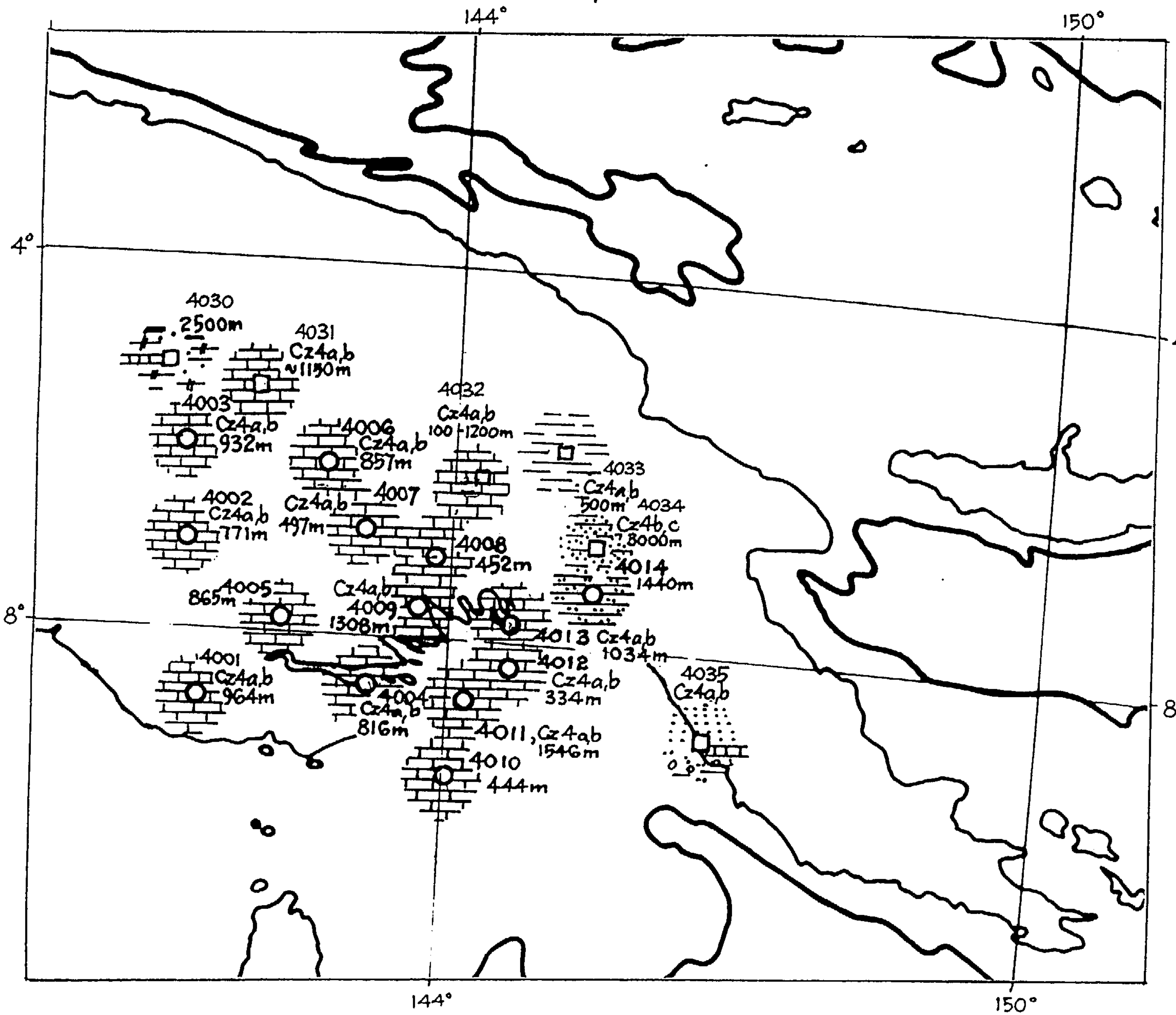
Figure A 33:

Cainozoic Data Map: Time Slice 4a



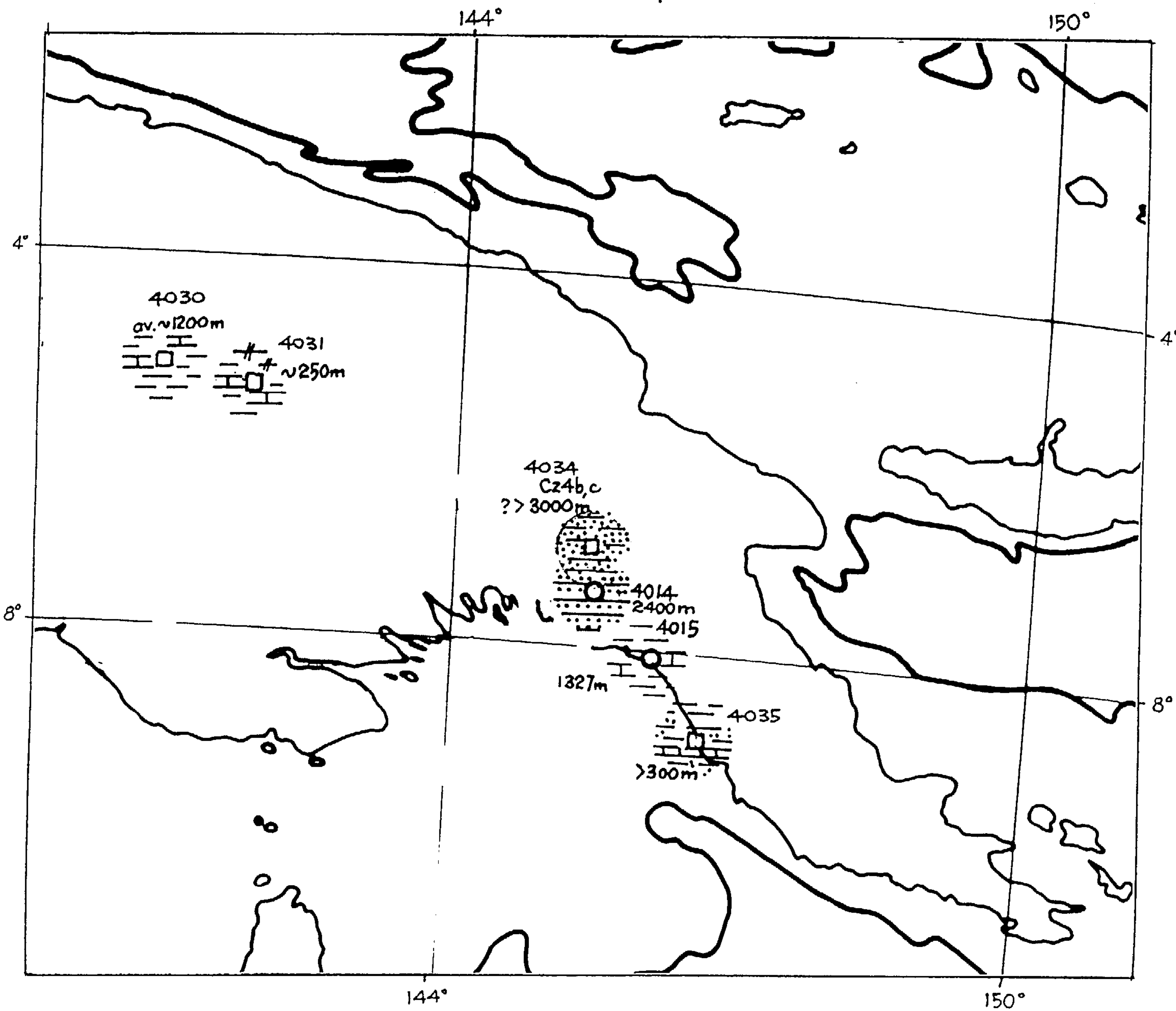
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 34: Cainozoic Data Map: Time Slice 4b



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 35: Cainozoic Data Map: Time Slice 4c



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 36:

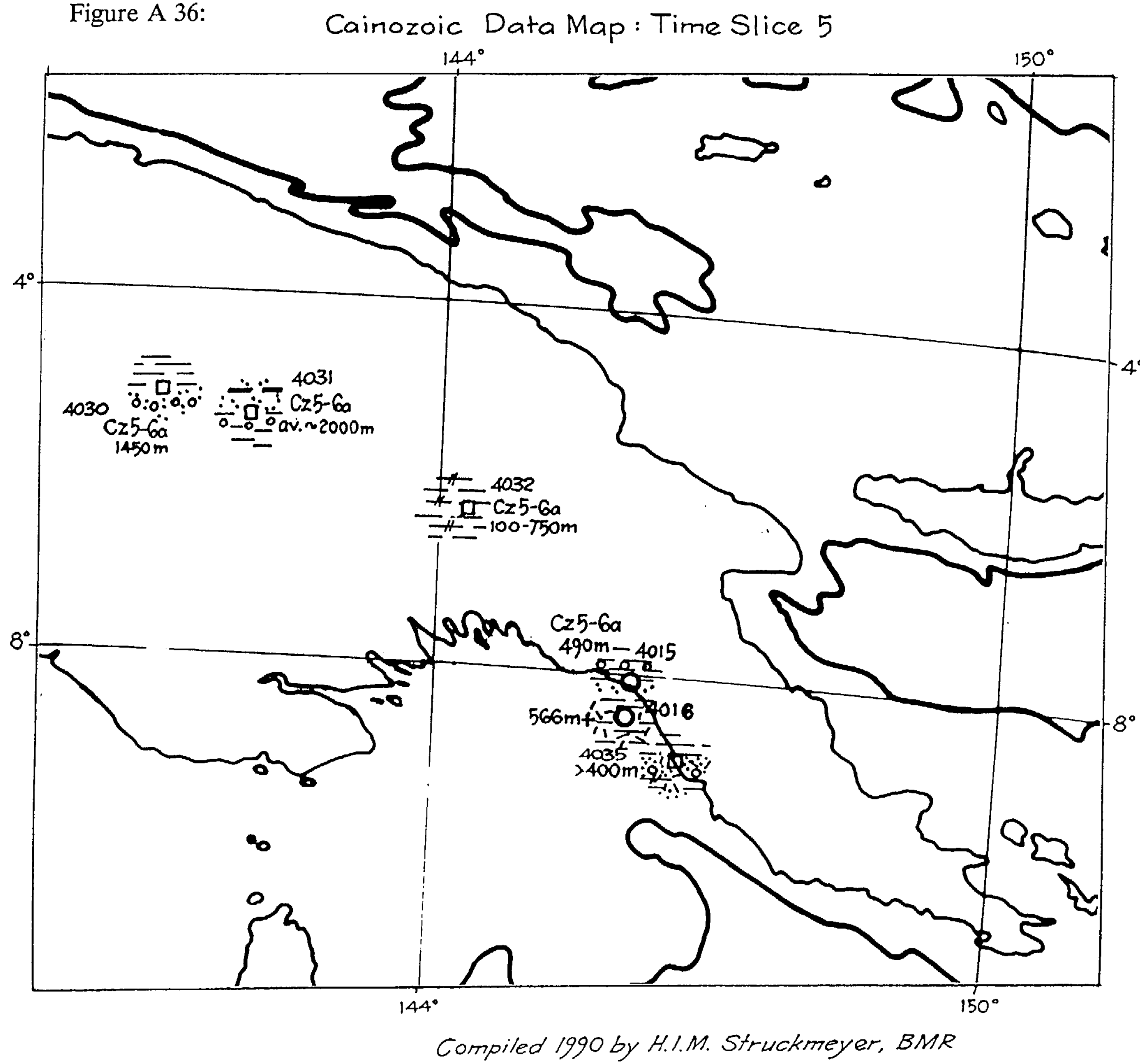
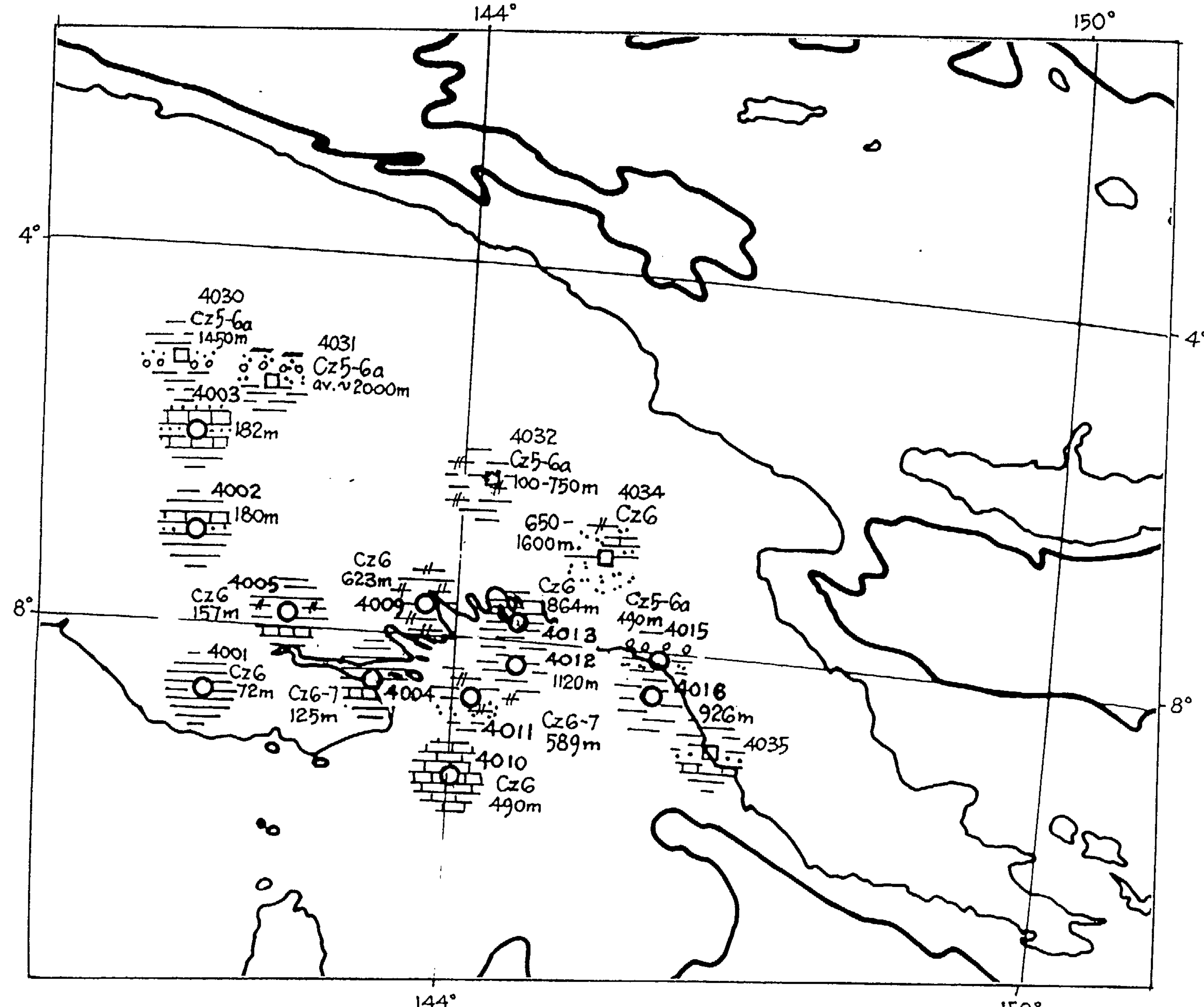
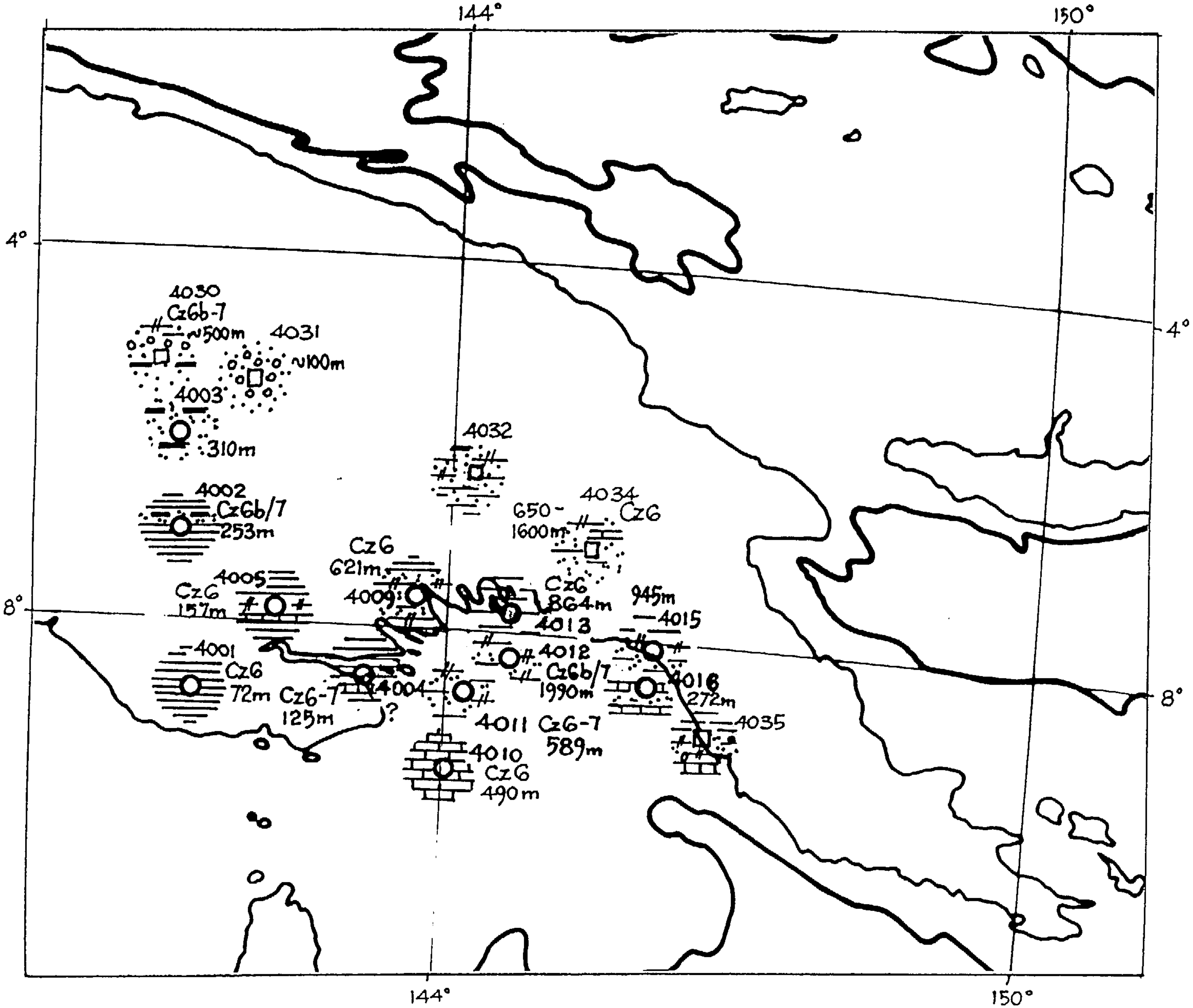

Cainozoic Data Map : Time Slice 5
144°
150°
4°
8°
4030
Cz5-6a
1450m
4031
Cz5-6a
av.~2000m
4032
Cz5-6a
100-750m
Cz5-6a
490m
4015
566m+
4016
4035
>400m
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 37: Cainozoic Data Map: Time Slice 6a



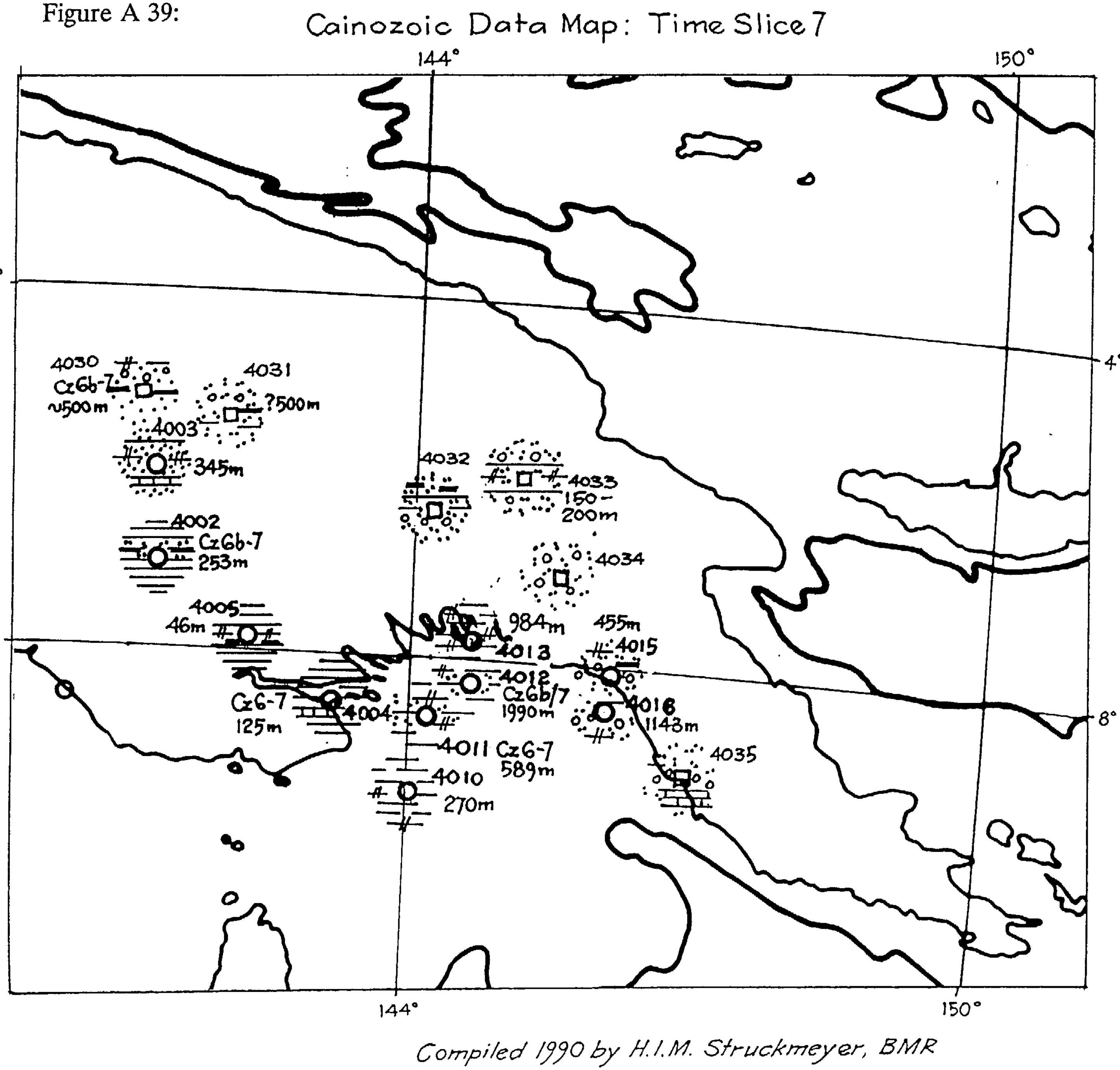
Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 38: Cainozoic Data Map: Time Slice 6b



Compiled 1990 by H.I.M. Struckmeyer, BMR

Figure A 39:


Cainozoic Data Map: Time Slice 7
144°
150°
4°
8°
4030
CzGb-7
~500m
4031
?500m
4003
345m
4002
CzGb-7
253m
4005
46m
4032
4033
150-
200m
4034
984m
4013
4012
CzGb/7
1990m
455m
4015
4016
1143m
4035
CzG-7
125m
4004
4011 CzG-7
589m
4010
270m
Compiled 1990 by H.I.M. Struckmeyer, BMR

APPENDIX III

DATA SHEETS FOR DATA POINTS AND REFERENCE POINTS

Table A 4: LIST OF DATA POINTS AND REFERENCE POINTS

Petroleum Exploration Wells

Data Points:

4001	Morehead-1	4009	Goari-1
4002	Lake Murray-1	4010	Anchor Cay-1
4003	Kiunga-1	4011	Kusa-1
4004	Magobu Island-1	4012	Dibiri-1A
4005	Aramia-1	4013	Uramu-1A
4006	Mananda-1	4014	Kariava-1
4007	Kanau-1	4015	Tovala-1A
4008	Barikewa-1	4016	Maiva-1

Reference Points

A	Juha-1X	H	Iviri-1
B	Iamara-1	J	Wana-1
C	Komewu-1	K	Wuroi-1
D	Iehi-1	L	Komewu-1
E	Omati-1	M	Muabu-1
F	Borabi-1	N	Iagifu-1
G	Pasca-C1		

Outcrop Summary Points

4030 Composite for outcrops in southern Hindenburg Range area (western Muller Anticline), Blucher Range (Ok Tedi) 1:250 000 sheet.
4031 Composite for outcrops in eastern Muller Anticline area, Blucher Range (Ok Tedi) 1:250 000 sheet.
4032 Composite for outcrops southeast of Kubor Anticline, Karimui 1:250 000 sheet.
4033 Composite for outcrops northeast of Kubor Anticline (Wahgi-Chimbu Gorge area), Karimui and Ramu 1:250 000 sheets, Minj 1:1000 000 sheet.
4034 Composite for outcrops along Aure Scarp; Kikori, Karimui and Markham 1:250 000 sheets.
4035 Composite for outcrops in the Oiapu - Yule Island - Oroi region, Yule 1:250 000 sheet.

Table A 5: LEGEND FOR DATA SHEETS

Depositional Environments

Terrestrial		Coastal		Marine	
LDU	land unclassified	CDP	paralic	MU	unclassified
LDF	fluvial	CDD	deltaic	MVS	very shallow (0-20 m)*
LDFL	fluvio-lacustrine	CDIS	intertidal-supratidal	MS	shallow (0-200 m)*
LDL	lacustrine			MBA	bathyal-abyssal (>200 m)*
				MA	abyssal (>1000 m)*

*refers to water depth

Reliability Code (after Palaeogeographic Atlas Project, University of Chicago)

A	complete biostratigraphic control
B	some biostratigraphic control
C	stratigraphic interpolation
D	geologic inference
E	radiometric determination
F	secondary information
G	guesswork

Lithology

aggl. - agglomerate; aren. - arenite/arenaceous; argill. - argillaceous; ark. - arkose/arkosic; benth. - benthonic; biocl. - bioclastic; biomicr. - biomicrite; biosp. - biosparite; calc. - calcareous; carb. - carbonaceous; cgl. - conglomerate; clcar. - calcarenite; clst. - claystone; cly - clayey; cse - coarse; dmict. - diamictite; dol. - dolomite/dolomitic; f. - fine; fdsp. - feldspathic; ferr. - ferrugineous; foram. - foraminifera(l); foss. - fossiliferous; glauc. - glauconite/glauconitic; intb. - interbedded/interbeds; lign. - lignite/lignitic; lith. - lithic; lst. - limestone; mdst. - mudstone; mdy - muddy; med. - medium; mic. - micaceous; micr.- micrite; pbly - pebbly; plkt. - planktonic; py. - pyritic; qtz - quartz; qtzc - quartzitic; sdy - sandy; sh. - shale; shy - shaly; sil. - siliceous; slst. - siltstone; sst. - sandstone; std. - sorted; sty - silty; tuff. - tuffaceous; turb. - turbiditic; v. - very; volc. - volcanics; volcl. - volcaniclastic;

DATA POINT: ○ **4001** <u>**MOREHEAD NO. 1**</u> T.D.: 2465 m

Latitude 08 44 46.3 S
Longitude 141 31 34.6 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6		MS		72	F	clst.
hiatus						
Cz 4a,b		MS	72	964	F	detr. lst. (partly sdy) >> sst. (f.-med., qtz)
hiatus						
K 9	*P. infusorides* & younger?	MS?	1036	139	B	sst. (med.-cse, poorly std), slst., mdst.
K 8	*D. multispinum - P. infusorides*	CDP	1175	635	B	sst. (f., med.-cse at top, well std) >> mdst.
K 6-7	*C. denticulata - P. loodbrookiae*	MS-MBA	1810	170	B	mdst. (black, minor plkt. foram.)
K 5	*D. davidii - M tetracantha*	MS	1980?	40	B	mdst., sst. with mdst. bands
K 4	*A. cinctum - D. davidii*	MS	2020?	180	B	mdst. (grey-black) > sst. (v. f.)
K late 2-3	*M. testudinaria - A. cinctum*	CDP	2200?	80	B	sst. (med.-cse, ark., coarsening up) > mdst.
hiatus	*B. simplex - P. burgeri*					
J 10	*D. jurassicum (N. similis)*	CDP	2280?	43	A	ark. sst. (med.)
hiatus	*G. jurassica - N. pellucida*					
J 9	*C. perforans - O. montgomeryi*	CDP?	2323	81	A/B	ark. sst. > mdst.
hiatus	*W. clathrata - D. swanense*					
J 8 (early)	*W. spectabilis*	CDP??	2404	61+	A	sst. > mdst. >> lign.

References: Helby and Partridge (1976d); Bee (1982); Lloyd (1977, 1988); Robertson Research (1984); Morgan (1990a).

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: 6-8-1990

DATA POINT: o **4002** <u>**LAKE MURRAY-1**</u> T.D.: 1765 m

Latitude 07 10 04 S
Longitude 141 19 04 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		CDP/LDF?	6	24.5	F	sst., mdst.
Cz 6b		CDP	30.5	269.5	F	clst. > sst. >> lign.
Cz 6a		MS	300	163	G	clst., sst. > lst.
hiatus						
Cz 4a, b		MS	463	771	F	lst. (detr., foss.)
hiatus						
K 8	*D. multispinum*	MS	1234	366	A/B	mdst. >> sst., minor lst.
??hiatus	*X. asperatus*					
K 7	*P. ludbrookiae*	MBA	1600	50	B	mdst. (plkt. foram.)
??hiatus	*C. denticulata-* early *P. ludbrookiae*					
K 5-early 6	*M. tetracantha*	MS	1650	40	B	mdst. >> sst.
K 4	*O. operculata-D. davidii*	MS	1690	47	B	mdst. > sst.

?Precambrian basement at 1737 m.

References: Harrison (1974), Bee (1982), Robertson Research (1984), Lloyd (1977, 1988), Morgan (1990a).

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: 8-8-1990

DATA POINT: ○ **4003** **KIUNGA-1**

T.D.: 3026 m

Latitude 06 00 56.1S
Longitude 141 18 35.5E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		MS	95	345	F/G	sst. (lith., poorly std) > clst., slst., lst.
Cz ?6b		?LDF	440	310	F/G	sst. > lign.
Cz 6a		?MS	750	182	F/G	sst., lst.
hiatus						
Cz 4a,b		MS	932	1133	F	lst. (massive, biocl.)
hiatus						
K ?10		?CDP/MS	2065	10	F	sst. (qtzc)
K 8	*D. multispinum - P. infusorides* (early)	MS	2075	550	F	mdst. > slst. > sst., minor lst.
K 6-7	*C. denticulata - X. asperatus (P. turneri)*	MBA	2625	215	F	mdst., slst.
K 4(late)-5	*D. davidii - M. tetracantha*	MS	2840	30	F	slst., mdst. > lst.
?hiatus	*?O. operculata*					
K 2(late)-3	*M. testudinaria - M. australis*	MS	2870	40	F	slst. > sst. at base, lst. at top
hiatus	*S. areolata - P. burgeri*					
K 1	*P. mirabilis - E. torynum*	?CDP	2910	62	F/B	mostly sst. (glauc.)

basement (quartzite, rhyolite) at 2972 m.

References: Bee (1982), Robertson Research (1984), Lloyd (1977, 1988), Welsh (1990);

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: 8-8-1990

DATA POINT: ○ **4004** **MAGOBU ISLAND NO. 1** T.D.: 2634.7 m

Latitude 08 31 47.4 S
Longitude 143 16 31.2 E

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 6-7		MS		125	F	clst., lst.
hiatus						
Cz 4a,b		MS	125	816	F	lst.
hiatus						
K 7	*P. ludbrookiae*	MBA	941	37	B	clst. (plkt. foram.)
K 5-6	*D. davidii - C. denticulata*	MS	978?	69	B	clst. >> sst.
K 4	*A. cinctum - D. davidii*	MS	1047	158	B	clst. > slst. >> sst.
??hiatus	*upper M. australis*					
K 3	*M. australis - A. cinctum*	MS	1205	55	A/B	clst.
K 2 (late)	*M. testudinaria - M. australis*	?MS	1260	40	A/B	clst., slst.
hiatus	*S. areolata - P. burgeri*					
K 1	*??P. mirabilis - ?E. torynum*	CDP	1300	90	B	sst. >> clst.
J 10	*D. jurassicum (jurassica-iehiense)*	CDP	1390	242	B	intb. mdst., slst., sst. (barrier bar in upper part)
J 9 (late)	*O. montgomeryi*	CDP	1632?	22	C	sst. > mdst.
hiatus or fault	*upper W. spectabilis - C. perforans*					
J 7-8 (early)	*W. digitata - lower W. spectabilis*	MS	1654	286	B	sh. (lower and middle parts of time slice), intb. mdst., slst., sst. (upper part)
J 6	*?D. complex - W. indotata*	CDD	1940	320	B	sst. (cse, well-std), sh., slst. with sst. intb.
J 5	upper *C. turbatus - D. complex*	LDF?	2260	130	B	sst. (f.-cse) > sh. >> coal
J 2-4	*C. torosa - C. turbatus*	LDF?	2390?	184?	B	sst. (f.-cse), sh., coal

References: Hocking & others (1971), Morgan (1990a).

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: 6-8-1990

DATA POINT: ○ **4005** **ARAMIA-1** T.D. 2020.2 m

Latitude: 07 51 16 S
Longitude: 142 19 05 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		MS		46	F	clst. > slst. > lign.
Cz 6		MS	46	157	F	clst. > slst. > lst.
hiatus						
Cz 4b		MS	203	865	F	lst.
hiatus						
K 8 (early)	*X. asperatus* (?and younger)	MBA	1068	80	B	clst. (dark grey), mdst. (black)
K 7	*P. ludbrookiae*	MBA	1148	107	B	mdst. (black, plkt. foram.)
K 5-6	*D. davidii - C. denticulata*	MS	1255	57	B	mdst. > sst.
K 4	*O. operculata - D. davidii*	MS	1312	148	B	mdst.
K 3	*M. australis - A. cinctum*	MS	1460	32	B	mdst. (dark grey)
K 2 (late)	*P. burgeri - M. testudinaria/M. australis*	CDP?	1492	78	B	sst. (med.-cse, qtzc) > mdst.
?hiatus	*S. areolata - S. tabulata*					
K 1	*B. lobispinosum* (and ?older) - *E. torynum*	CDP	1570	40	A/B	sst. (med.-cse, qtzc) > mdst.
J 10	*G. jurassica - P. iehiense*	CDP*-MS	1610	111	A	intb. mdst., sst.
J 9	*C. perforans - O. montgomeryi*	MS	1721	40	A	mdst.
J 8	*W. spectabilis - W. clathrata/?D. swanense*	CDP@-MS	1761	85	B	sst. (f.-cse, cross-bedded, fining upwards) > mdst. (lower part), slst. (upper part)
J 7	*W. digitata*	MS	1846	65	B	mdst.
J 6	*C. halosa/D. complex - W. indotata*	CDP#	1911	101	B	sst. (f.-cse, qtzc, ark. near base) > sh. (carb.) > coal

basement (granite) at 2011.7 m
*in lower part
@increasingly marine towards top
#LDF at base?

References: Helby and Partridge (1976a), Bee (1982), Lloyd (1977, 1988), Robertson Research (1984), Morgan (1990b).

T = thickness Rel. Code = age reliability code

Compilation/Revision Date: 27-8-1990

DATA POINT: o **4006** <u>**MANANDA-1**</u>

T.D.: 2808.7 m

Latitude: 06 10 10.6 S
Longitude: 142 49 31.7 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 4a, b		MS	4	852	F	lst. (micr., biocl.)
hiatus						
K 9		MBA-MS*	856	375	F	sh. (dark grey, py.) > slst. (glauc.) > sst. (v.f.)
K 8		MS	1231	354	F	sst. (v.f.-f., fdsp., glauc., py.) > sh.
K 6/7?		MBA-MS@	1585	308	F/G	sst. (as above) = sh.
K 4-5		MS	1893?	545+	F/G	sh.
thrust fault: repeat of Cz 4a, b						

*upper 150m probably MS
@upper 100m probably MS
thickness approximate

References: Robertson Research (1984), Lloyd (1977, 1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: September 1989

DATA POINT: ○ **4007** **KANAU-1**

T.D.: 3519 m

Latitude: 06 54 45.4
Longitude: 143 11 25.9

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 4a, b		MS	8	497	F	lst. (biocl.)
hiatus						
K 8	*D. multispinum*	MS-?MBA	505	350	B	mdst. (plkt. foram.) >> slst., sst.
K 7	*??P. ludbrookiae - X. asperatus*	MBA	855	35	B/C	mdst. (plkt. foram.) >> slst.
K 6	*M. tetracantha - C. denticulata*	MS	890?	165	B	sst. (v.f., glauc.) > mdst.
K 5	*D. davidii - M. tetracantha*	MS	1055?	45	B/C	mdst., slst.
K latest 2-4	*M. australis (and ?older) - D. davidii*	MS	1100?	202	B/C	slst., mdst., sst.
hiatus?						
K 1	*D. lobispinosum (+?older) - E. torynum*	CDP/MS	1302	178	B	mdst. (sty) > sst.
J 10	*D. jurassicum - P. iehiense*	CDP(MS*)	1480?	280	B	sst. (well std, glauc., coarsening up) > slst. > mdst.
J 9	*C. perforans - O. montgomeryi*	MS	1760?	100	B	mdst. (sty) >> sst.
J 8	*W. clathrata and older?*	CDP#	1860?	696	B/G	mdst. (sty) > sst. (qtzc)
J 7		MS-CDP	2556?	240	D	slst. (glauc.), mdst., traces of coaly material
J 5-6		LDF-CDP	2796	553	D	sst. (feldsp.), mdst./slst. intb. grading into sst. (v.f.-cse, qtzc.) with mdst. (carb.) beds
hiatus						
TR 4-5		?LDF	3349	170+	G	slst., sst., cgl.

* at base; # MS at top

References: Bee (1982), Ingram (1982), Robertson Research (1984), Lloyd (1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 1989

DATA POINT: ○ **4008** **BARIKEWA - 1** T.D.: 4233.7 m

Latitude: 07 06 52 S
Longitude: 143 55 21 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 4b (Darai)		MS	8.5	451.5	F	lst.
Cz 4a,b (Puri)		MBA	460	500	F	lst.
hiatus						
Cz 2b		MBA*	960	69	F	lst.
hiatus						
K 7	*P. ludbrookiae*	MBA	1029	163	A/B	mdst. (dark grey, sty, calc., py., rare plkt. foram.)
K 5/6	late *D. davidii* - *C. denticulata*	MS	1192	108	A/B	slst., mdst. > sst.
K 4	*O. operculata* - *D. davidii*	MS (?CDP)	1300	160	A/B	sst. (f., glauc.) >> slst.
K 3	*M. australis*	MS	1460	40	A/B	slst.
K 2 (late)	*P. burgeri* - *M. australia* (early)	MS	1500	100	A/B	slst., sst.
hiatus						
K 1	*C. delicata* - *E. torynum*	MS	1600	150	A/B	slst., mdst. > sst. (poorly std, glauc., coarsening upwards)
J 10	*N. similis* - *P. iehiense*	MS	1750	290	B	mdst. > slst., sst. (med., glauc.)
J 9	?*C. perforans* - *O. montgomeryi*	MS?	2040	226	B	mdst. (grey, mic., sty) >> slst., marl
J 8	*W. spectabilis* - *D. swanense*	MS	2266	534	A/B	intb. mdst., slst., sst. (minor, v. f.)
J 7	?*W. digitata* - *R. aemula*	MS	2800	560	B/D	mdst. (some oolitic, sideritic) > slst.
J 5/6 (?older)	*C. cooksonii* and ?older	MS to CDP#	3360	874+	D	upper part: mdst. > slst. > sst.; lower part: ark. grading up to v.f.-med. sst., slst., mdst., and minor oolitic lst.

*G. Francis, pers. comm., 1989
LDF? at base

References: Helby and Partridge (1976b); Bee (1982), Lloyd (1977, 1988); Robertson Research (1984); Morgan (1990a).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 31-7-1990

DATA POINT: ○ **4009** **GOARI - 1**

T.D.: 3138 m

Latitude: 07 38 08.3 S
Longitude: 143 51 44.1 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6		CDP	7	623	F	sst. (v.f.-f., glauc., lign.), intb. with slst., clst., minor lign.
hiatus						
Cz 4a,b		MS	630	1308	F	lst. (biocl.), clcar.
hiatus						
K ??3-7	no data	MS??	1938	209	G/F	intb. mdst. (calc.), sst.; minor sh. (carb.), lst.
hiatus						
K 1	*C. delicata - ??E. torynum*	MS-CDP?	2147	138	B	sst. (cly to sty) >> mdst. (partly glauc., py., carb.)
J 10	*G. jurassica - P. iehiense*	CDP-MS	2285	345	A/B	as for K 1 but sandier;
J 9	*C. perforans - O. montgomeryi*	MS	2630	127	A/B	intb. slst. and sh. (glauc., py., carb., partly calc.), minor sst.
J 8	*W. spectabilis - D. swanense*	CDP*-MS	2757	381+	B	intb. sst. (fdsp.-lith., calcite cemented, sty, glauc. in part), slst., sh.

*in lower part

References: Lloyd (1977, 1988); Helby and Partridge (1979); Bee (1982); Robertson Research (1984); Morgan (1990a).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 31-7-1990

DATA POINT: ○ **4010** <u>**ANCHOR CAY - 1**</u> T.D.: 3623 m

Latitude: 09 26 29.3 S
Longitude: 144 03 30.6 E

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 7/8		MS		270	F	mdst. (black-green, coral debris), sst. in upper part (f., black, foss., calc.)
Cz 6		MS	270	490	F	lst. >> mdst.
hiatus						
Cz 4b (Darai)		MS	760	444	F	lst. (coral, bryozoa, foram., echinoids, red algae)
Cz 4a (Puri)		MBA	1204	566	F	lst. (marly, argill. to crystalline) > calc. mdst. (plkt. foram.)
hiatus						
Cz 2		MS	1770	348	F	lst. (crystalline, argill., minor chert, qtz, dol.; bryozoa, red algae, echinoids, foram.), sh. (red & yellow) at base
hiatus						
J 6	*C. complex - W. indotata*	CDP	2118	812	B	sst. > slst. > sh. (brown to black, py.)
J 5	upper *C. turbatus - C. complex*	?LDFL	2930?	165	B/C	sh. (dark grey), minor sst.
J 3-4	*C. turbatus*	?LDFL	3095?	105	B	sh. (dark grey), minor sst.
J ?1-2	*C. torosa - C. turbatus*	?LDFL	3200?	200	B	sh., minor slst. > ?tuff
?hiatus						
TR ?2-5	*Falcisporites australis*	LDF	3400?	223+	F	cgl., sh., sst., volc., slst., intb. of clst. (red-green)

REFREENCES: Lloyd (1977, 1988); Bee (1982); Robertson Research (1984); Chaproniere & others (1990); Morgan (1990a).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 31-7-1990

DATA POINT: ○ **4011** <u>**KUSA No. 1**</u> T.D.: 3433.6 m

Latitude 08 42 28.5
Longitude 144 13 02.8

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6-7		MS	42	589	F	mdst. (foss., glauc., carb.) > sst. & slst. (glauc., calc., carb.), clay
hiatus						
Cz 4a, b		MS	631	1546	F	micr. lst. > skeletal clcar.
hiatus						
Cz 2a, b		MS	2177	237	F	clcar.
hiatus						
J 10	*G. jurassica/N. pellucida-similis*	CDP*-MS	2414	231	A/B	slst., sst. (qtzc, cse-pbly), sh.
J 9	*C. perforans-O. montgomeryi*	MS	2645	107	A/B	sh. > slst.
J 8#	lower *W. spectabilis-D. swanense*	CDP-MS@	2752	487	A	thinly intb. sh., slst., sst.
J 7	*W. digitata-R. aemula*	?CDP	3239	195+	A	intb. sst., slst., sh.

* at top
\# includes hiatus: upper *W. spectabilis* - lower *W. clathrata* probably not present
@ at top

References: Lloyd (1977, 1988), Robertson Research (1984), Chaproniere & others (1990), Morgan (1990a).

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: 8-8-1990

DATA POINT: ○ **4012** **DIBIRI - 1A**

T.D.: 4895.4 m

Latitude: 08 16 57.1 S
Longitude: 144 40 16.6 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6b-7		MS		1990?	F	mdst. >> slst. > sst.
Cz 5-6a		MBA	1990	1120	F	sh.
hiatus						
Cz 4a, b		MS/MBA	3110	334	F	lst.
hiatus						
Cz 2a, b		MS(MBA#)	3444	259	F	lst.
hiatus						
J ?6- 8		MS (MBA?)	3703	1192+	F	mdst. (calc., py.) >> sst. (f.), slst. > rare lst. bands

G. Francis, pers. comm., 1989

References: Robertson Research (1984); Lloyd (1977, 1988);

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 31-7-1990

DATA POINT: ○ **4013** <u>**URAMU-1A**</u>

T.D.: 3080.3 m

Latitude: 07 48 28.4
Longitude: 144 41 40.9

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		MS	21	984	F	mdst. (sty) > sst.
Cz 6a,b		MBA*	1005	864	F	mdst.
hiatus						
Cz 4a, b		MVS	1869	1034	F	lst.
hiatus						
Cz 2a, b		MS	2903	148	F	lst.
hiatus						
?J 8-9		MBA?	3051	30+	F	sh.

*MS (Robertson Research, 1984)
thickness approximate

References: Robertson Research (1984); Lloyd (1988); Chaproniere & others (1990).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: August 1989

DATA POINT: ○ **4014** **KARIAVA-1**

T.D.: 3846.9 m

Latitude: 07 24 52
Longitude: 145 29 27

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 4c		MBA	7	2400	F	"coarser clastics": intb. clst. & greywacke; rare calc. beds; larger and plankt. foram.
Cz 4b		MBA	2407	1440	F	"finer clastics": as above;

REMARKS: gas shows throughout.

REFERENCES: Lloyd (1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: August 1989

DATA POINT: ○ **4015** **TOVALA-1A** T.D.: 3207.1 m

Latitude: 08 04 23
Longitude: 146 08 45

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		CDP		455	F/G	sst, cgl., slst., coal, sh.
Cz 6b		MS	455	945	F/G	mdst. > slst., sst.
Cz 5-6a		MBA	1400	490	F	mdst. with sst. and cgl. intb.
Cz 4c		MBA	1890	1317	F	mdst., marl

thickness approximate

References: Owings (1969), Robertson Research (1984), Lloyd (1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 9-8-1990

DATA POINT: ○ **4016** **MAIVA-1**

T.D.: 2989.2 m

Latitude: 08 27 18
Longitude: 146 06 36

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 7		MS	82	1143	F	intb. cgl. sst. (cse), slst., clst., lst., minor lign.
Cz 6b		MS	1225	272	F	lst. (locally argill. or aren.), sst, mdst.
Cz 6a		MBA	1497	926	F	mdst.
Cz 5		MBA	2423	566+	F	tuff > basalt > clst., sst.

thickness approximate

References: Robertson Research (1984), Lloyd (1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 9-8-1990

DATA POINT : □ 4030 Southern Hindenburg Range (western Muller Anticline), Blucher Range (Ok Tedi) - 1:250 000 sheet.

Longitude: ≈ 141 00 to 141 45 E
Latitude: ≈ 5 00 to 5 30 S

Timeslice	Environment	Thickness m	Rel. Code	Lithology
Cz 6b-7	LDF	≈ 500	G/F	qtz sst., cgl., volcl. aren., slst., mdst., lign.
Cz 5-6a	CDP-LDF	≈1450	F	volcl. mdst., sst., slst., aren., cgl., lign.
hiatus				
Cz 4c	MS	200-500	F	mdst., lst.
Cz 4b	MS	2500?	F	slst., sst., lst., lign.
Cz 4a,b(early)	MS (Darai)	≈200	F	lst.
hiatus				
K 10-11	MVS	>400?	F	mdst., slst. (grey) with lenses of sst. (f.-med., qtzc, glauc.)
K 8-9	MS*	≈340	F	sst. (v.f., grey-green, calc.) at base, mdst. (light to med. grey), sst. (v.f., poorly std, glauc.), mdst., slst. (sdy)
K 5-8 (earliest)	MS-?MBA	≈750 (av.)	F	mdst. (dark grey-black), minor slst. and thin beds of sst. (glauc.); ammonites, belemnites
K ?4 + ?older	MS	≈130	F/G	sst. (v.f.-f., poorly std, glauc., argill., sty)
?hiatus				
J 10-K 1@	CDP	≈400	F	sst. (med.-cse, qtzc, glauc., coarsening-up cycles), minor sh., mdst.
J 8-9	MS	≈200	F	mdst. (dark grey) > lenses and laminae of slst. and sst.
J 7-8 (earliest)	CDP#	≈300	F	intb. sst. (v.f.-med., qtzc), slst., sh., bivalves and ammonites; mdst. (dark grey) at base
J ?5-6	LDF/LDFL	400+	F	ark., cgl. (ark.) > mdst. (maroon), slst.

*CDP at base
@and younger?
#MS at base and top

REFERENCES: Davies & Norvick (1974), Arnold & others (1979), Challinor (in prep.)

Rel. Code = age reliability code

Compilation/Revision Date: 23-8-1990

DATA POINT: □ 4031 **Eastern Muller Anticline (including Strickland River section), Blucher Range (Ok Tedi) 1:250 000 sheet.**

Longitude: ≈ 142 00 to 142 30 E
Latitude: ≈ 5 15 to 5 40 S

Time Slice	Environment	Thickness m	Rel. Code	Lithology
Cz 7	?LDF	500max	G/F	sst. > cgl. > slst. > mdst. > lign.
Cz 6?b	?LDF	≈ 100	G/F	cgl. > aggl.
Cz 5(late)-6?a	MS*-?CDP	≈2000	G/F	sst. > cgl. > slst. > lign. (at top)
?hiatus				
Cz 4c	MS	≈ 250	F	mdst. > slst. > lst.
Cz 4a,b	MS	≈1150	F	lst.
hiatus				
K 4-5 (early)	MS	≈ 25	B	mdst.
K 3	MS	≈ 12	B	mdst., slst.
K 2 (upper)	MS	≈ 85	B	slst. (sdy, mic., ferr.) > sst. (dark grey, v.f., sty) > mdst. (calc.)
hiatus S. areolata				
K 1	CDP#	≈ 260	A	sst. (v.f.-f., qtzc, glauc.), slst. intb.
J 10	MS-CDP	≈ 306+	B	mdst. (sty), grading into intb. slst. and sst.
J 9	MS	≈ 35+	B	mdst. with common lamellibranchiata
J 8	MS@	≈ 148+	B	mdst., slst.; sst. in lower part
J 7	CDP	≈ 20	B	mostly slst., minor sst. & mdst.

* at base
\# MS at top
@ CDP at base

REFREENCES: Davies & Norvick (1974), Davey (1987), Morgan (1990a), Sari (1990).

Rel. Code = age reliability code

Compilation/Revision Date: 23-8-1990

DATA POINT: □ 4032 **Southern flank of Kubor Anticline, Karimui 1:250 000 sheet.**
Longitude: ≈ 144 00 to 145 30 E
Latitude: ≈ 6 00 to 6 35 S

Time Slice	Environment	Thickness m	Rel. Code	Lithology
Cz 7(late)-8	LDF	180	F	clay, sand, silt, gravel, peat, soil, volc.
Cz 6b/7 (early)	?CDP	300+	F	sst., slst., mdst., coal, sst. (qtzc, shelly), volc.
Cz 5/6a	MU	100-750	F	mdst. > slst., sst.
?hiatus				
Cz 4a,b	[1.(MS-)MBA		F	slst., sh., marl, thin lst. beds (pelagic), arenite, cgl., sst.; plkt. & benth. foram., fragmental macrofossils
	2. MS?	100-1200	F	lst. > arenite]
hiatus				
Cz 2-3(early)	MBA	100-1000	F	clcar. with thin sty argill. intb., lst. (f.); plkt. foram. and algae.
Cz 1	MS	??2000	F	sst. (fdsp., f.-cse) with lenticular coquina beds, tuff, rare cgl., slst., mdst. (dark grey to black).
??hiatus				
K 6-10	MBA-MS	>1000?	F	sh. > sst. (laminated), slst., minor clcar., tuff.
K 4-5	MS?	400->1000?	F	sst. (cse, lith.), slst., sh.; minor cgl., breccia
??hiatus - possible continuous deposition of Maril Shale				
J 8-10@	MS-MBA	?>1000	F	sh. (*M. malayomaorica, R. haasti**), graded lith. sst.
TR 6	MS	50->100?	F	sst. (qtzc-feldsp.), sst. (lith.), clcar., massive lst.
TR ?3-5	MS	200-700?	F	tuff, lava, aggl., sst. (lith., feldsp.), mdst.

@ probably includes sediments as old as J 5, but may be faulted out (Francis & others, 1990).

*these bivalves are associated with *C. perforans* zone (Davey, 1987) = *D. swanense/C. perforans* zones of Helby & others (1987) → late Kimmeridgian to early Tithonian. The basal Maril Shale conglomerate of Bain & Mackenzie (1974) is now regarded as Triassic (Francis, in prep.).

REFERENCES: Bain & Mackenzie (1974), Haig & others (1986), Pigram & others (1987), Davey (1987), Hill (1989), Francis & others (1990), Francis (in prep.).

Rel. Code = age reliability code

Compilation/Revision Date: 23-8-1990

DATA POINT: □ 4033 **Wahgi-Chimbu Gorge, Karimui and Ramu 1:250 000 sheets, Minj 1:100 000 sheet.**
Longitude: ≈ 144 50 to 145 05 E
Latitude: ≈ 5 55 to 6 10 S

Time Slice	Environment	Thickness m	Rel. Code	Lithology
Cz 7	LDF	150-200	F	cgl. (polymictic), sst. (lith.), gravel, sand, mud,; minor tephra and lign., volc.
hiatus				
Cz 4a,b	MBA (MS*)	≈ 500	F	mdst. and slst. (tuff., plkt.>benth. foram.), minor sst. and cgl. (lith.), rare lst. intb., volc.
hiatus				
Cz 2/3(early)[1]	MS	≈ 300	F	biosp., biomicr. (algal-foram.)
fault / or ?*hiatus*				
K 8	MBA-MS?	≈ 500?	F	mdst. (grey-black), slst., minor sst. (lith.) intb. and occasional lith. cgl. (channel fills), rare lapilli tuff and spilite; graded bedding occasionally present, slump folds in fine clastics
K 6-7	?MBA	≈ 400	F	mdst. (dark grey), minor intb. slst. & sst. (lith.) (plkt.-benth. foram., ammonites).
K 4-5	MBA	≈ 400	F	sst. (lith.) with turb. structures (detritus is mainly basaltic-andesitic-trachytic), slst. & mdst. intb. at base; overlain by thinly bedded mdst. with slump folds; overlain by massive, thick-bedded lith. sst. & cgl. (turb. structures) with intb. mdst. & sst.
K 1-?3	MBA	≈ 300	F	mdst. (grey, bioturbated) with graded beds of sst. (lith.) at base.
J 8-?10	MBA	≈ 500	F	base: mdst. with bivalves (*M. malayomaorica, R. haasti*) in fault contact with ??Late Triassic lst.; overlain by mdst. (grey, bioturbated).
fault + ??*hiatus*				
TR ??6	MS	? 50	F	intb. sst. (quartz-lith.) and lst. (echinoidal); intruded by Kera Sill (101 Ma).
TR 5	MS (MBA**)	≈ 500?	F	basal sequence of cgl., dmict. (poorly std) with pebble to boulder sized clasts (slate, volc., rare micr. lst.) in a mdy-sty matrix (rare bivalve fragments); overlain by mdst. with intb. slst., sst. (lith.) & cgl. (locally occurring as channel fills) containing Norian brachiopods (*Halorella, Balanocrinus novaguineana*).

*at top
** at base
[1]Chimbu Limestone occurs on top of Cretaceous sills, i.e. on basement highs in outer shelf area (G. Francis, pers. comm., 1989)

REFERENCES: Skwarko (1967), Bain & Mackenzie (1975), Bain & others (1975), Haig (1981), Pigram & others (1987), Rogerson & others (1988), Francis & others (1990), Francis (in prep.).

Rel. Code = age reliability code

Compilation/Revision Date: 23-8-1990

DATA POINT: □ 4034 Aure Scarp (section exposed in unnamed creek draining into the Pale River across Aure Fault scarp), at juncture between Kikori, Karimui and Markham 1:250 000 sheets.

Longitude: ≈ 145 20 to 145 30 E
Latitude: ≈ 7 00 to 7 15 S

Time Slice	Environment	Thickness m	Rel. Code	Lithology
Cz 7	?LDF		F	angular cgl., gravel, sand
Cz 6	MU	650-1600	F	sst., slst., mdst., pebble cgl. (calc., carb.), coral lst. concretions
hiatus				
Cz 4b,c	MBA(?MA)	up to 3000	F	sst. (lith.) > mdst.
Cz 4a	MS-MBA	≈ 50	F	lst. (argill.), marl
hiatus				
Cz 2/early 3	MS-MBA*	482	F	flaggy lst. with banded chert;
Cz 1	MS	415	F	crystalline lst., mdst. intb. at base
?hiatus				
K 10	CDP	150	F	sst. (qtzc)
K ?3-?9	?MBA	>?350	F	mdst. > sst.

*upper bathyal (150-4000m water depth)

REFERENCES: Carman (1987)

Rel. Code = age reliability code

Compilation/Revision Date: May 1989.

DATA POINT: □ 4035 **Neogene of Oiapu-Yule Island-Oroi region, Yule 1:250 000 sheet. Area bounded by approximately 145 30/08 00, 146 30/ 07 45 and 147 00/09 20.**

Time Slice	Environment	Thickness m	Rel. Code	Lithology
Cz 7*	MVS/CDP/LDFL	?	F	coral and alluvium
hiatus				
Cz 6b@	MS/CDP/LDF	?	F	mdst., sst., cgl., tuff, coralgal lst.
Cz 6a#	MS/MVS	?	F	mdst., biocl. lst. > slst., sst.
Cz 5[1]	MS-MBA	400-1500	F	volcanogenic sst. & cgl., slst., mdst., tuff with aggl., biocl. lst.
Cz 4c	MBA	>300	F	mdst., sst. (turb.), slst. > lst.
Cz 4a,b	MS	?	F	sst., lst., pebble cgl.

* MVS (reef remnants, on Yule Island); CDP-LDFL in 25 km NW-SE trending area bounded to W by coastal hills and to E by mountains, complex overlap of interrelated beach-barrier, estuarine and shifting deltaic environments in littoral areas, in fluvial plains, meandering rivers and swamps;

@ rapid facies variations, dominant environment probably CDP, Wedge Hill Limestone = MVS occurs in Oiapu Anticline, LDF in Dilava River fluvial plain, approx. 146 38 and 146 48 E, and 08 42 and 08 57 S;

\# unit is regressive ranging from upper bathyal (150-500m) to neritic near top, Kairuku Limestone on Yule Island is MVS;

1 most of Talama Formation (i.e. Cz 4c-5) is MBA, but transition to neritic facies occurs within the N14 zone at Delena and within the N16 zone at Yule Island (Ou Ou Limestone Member).

REMARKS: Francis & others (1986): mid-Oligocene to Miocene Aure association includes: Aure Beds sensu stricto, Omaura Formation, Dokuna Tuff, Boira and Fairfax Formations, Chiria Formation.

REFERENCES: Brown (1977); Francis & others (1986).

Rel. Code = age reliability code

Compilation/Revision Date: May 1989.

REFERENCE POINT: A **JUHA-1X** T.D.: 3741.7 m

Latitude: 05 54 14.6
Longitude: 142 26 06.3

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 6a		MBA	6	87	F	lst. (argill.)
hiatus						
Cz 4a, b		MS	93	1526	F	lst. (biocl.)
hiatus						
K 9 (early)	upper *P. infusorides*	MS	1619	351	B	clst. > sst., sh., slst.
K 8	lower-mid *D.multispinum-hiatus-P. infusorides*	?MS	1970	748	B	intb. slst., sst., mdst.
?hiatus	*X. asperatus*					
K 7	*P. ludbrookiae*	MBA	2718	42	A/B	sh.
K 6	*C. denticulata*	?MBA	2760	95	B	sh.
?hiatus	*M. tetracantha*					
K 4	*O. operculata* - *D. davidii*	MS	2855	153	A/B	slst. > mdst.
K 2 (late) - 3	*P. burgeri* - *M. australia*	MS	3008	149	A	slst. > sst.
hiatus	*S. areolata* - *S. tabulata*					
K 1	*C. delicata* - *E. torynum*	CDP*	3157	183	A	sst. (qtzc) with minor mdst. intb., slst. at top
J 10	*N. pellucida* (and ?older) - *P. iehiense*	??MS	3340	200	A/B	mdst., slst.
J 9 (& older)	*C. perforans* and older	?MS	3540	202+	C	clst., sh., minor sst.

* MS at top and base

References: Lloyd (1988), Morgan (1990a), Welsh (1990).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 8-8-1990

REFERENCE POINT: B **IAMARA-1** T.D.: 1813.6 m

Latitude: 08 24 04 S
Longitude: 142 56 19 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6		MS		137	F	clst. > lst.
hiatus						
Cz 4a, b		MS	137	779	F	lst. (biocl., chalky in parts)
hiatus						
K 4 (early)	*O. operculata*	MS	916	3	A	mdst. (dark grey)
K 3	*M. australis*	MS	919	46	B	mdst. (dark grey)
K 2 (late)	*P. burgeri - M. australis* (early)	CDP-MS?	965	80	A/B	intb. sst. (f.-cse, glauc.) and mdst.
hiatus	*E. torynum-S. tabulata*					
K 1	*? - B. reticulatum*	CDP	1045	85	B	sst. (f.-cse, qtzc, glauc.), minor mdst.
J 10	*N. similis* (and ?older) - *P. iehiense*	CDP	1130	150	B	intb. sst. (f.-cse, qtzc, glauc., well rounded) and mdst.
?? *hiatus*	*0. montgomeryi-G. jurassica?*					
J 9	*C. perforans* and ?younger	MS	1280	30	C	mdst., slst.
J 8	*W. spectabilis - W. clathrata*	CDP-MS	1310	120	B	sst. (qtzc with lith. and high matrix components) > slst., sh. (in upper part)
possible hiatus	*R. aemula?*					
J 7	*?early W. digitata - upper W. digitata*	CDP#	1430?	99	B	mdst., sst. at top
J 6	*?mid C. complex - W. indotata*	CDP@	1529?	211	A/B	intb. sst. (v.f.), minor mdst.; transgressive sst. at top
J ?3-5	*?C. turbatus - ?mid C. complex*	?LDF-LDFL?	1740?	57	B	sst., mdst.

Basement (?Carboniferous rhyolite) at 1797 m.

MS at base, @ MS at top

References: Hawkins & Allen (1963); Bee (1982); Lloyd (1977, 1988); Helby & Partridge (1977a); Robertson Research (1984); Mollan & Blackburn (1990); Morgan (1990a).

T = thickness
Rel. Code = reliability code

Compilation/Revision Date: 2-8-1990

REFERENCE POINT: C **KOMEWU-1** T.D.: 1948.6 m

Latitude 07 18 05 S
Longitude 143 02 42 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6-7		??CDP	3	119	F	mdst. with occasional bands of lign., marl, sst. (tuff.)
Cz 4a, b		MS	122	1435	F/G	lst. (aren.-argill., foram. in part, chalky in part, py.) > dol.
hiatus						
J ?5-6		?CDP (?CDD)	1557	313	F	sst. (f., calc. in part) > slst. (carb.), coal, shale (black, carb.)

Basement (dacite) at 1870 m.

REFERENCES: Helby & Partridge (1977b), Robertson Research (1984).

T = thickness
Rel. Code = age reliability code

Compilation Date: September 1989

REFERENCE POINT: D **IEHI - 1** T.D.: 3061 m

Latitude 06 57 06.2 S
Longitude 143 52 06.8 E

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 4a, b		MS	8	662	F	lst. (biocl., white-light brown)
hiatus						
Cz 2b		MS	670	61	F	lst. (biocl.), cgl. at base
hiatus						
K 8	*?D. multispinum*	MS	731	255	A/B	mdst. (dark grey, sty) > sst. (f.-med., argill. & lign.) intb. with mdst. and slst.
K 7	*P. ludbrookiae*	MBA	986	146	A/B	mdst. (plkt. foram.) > sst.
hiatus	*M. tetracantha-C. denticulata*					
K 4-5 (early)	*O. operculata-D. davidii*	MS	1132	148	A	intb. slst., mdst., sst (green, sty with irregular mdst. partings)
K 2(late)-3	*M. testudinaria-M. australis*	MS	1280	110	A	mdst., slst., minor sst.
hiatus	*S. areolata-P. burgerii*					
K 1	*C. delicata-E. torynum*	MS	1390	130	B	sst. (f.-cse, coarsening up), slst., mdst. (belemnites)
J 10	*G. jurassica-P. iehiense*	MS	1520	380	A/B	mdst. (sty, calc.) with occasional sst. (f.-cse) intb. up to 40cm thick
J 9	*C. perforans-O. montgomeryi*	MS	1900	123	B	mdst., slst.
J 8	lower *W. spectabilis-D. swanense*	MS	2023	447	B	sh., intb. with sst. (v.f., sty, occasional coarsening upwards cycles)
J 7	upper *W. digitata-R. aemula*	MS	2470	170+	B	mdst. > slst., sst. (v.f.)

Fault at ≈ 2640 m: 421m repeat section (J 9 - J 10; *C. perforans - N. similis*)

References: Gay & Brown (1961), Helby & Partridge (1976c), Robertson Research (1984), Ingram (1985), Morgan (1990a).

T = thickness
Rel. Code = Reliability Code

2-8-1990

REFERENCE POINT: E **OMATI-1** **T.D.: 4374.5 m**

Latitude: 07 26 00.6
Longitude: 143 57 30

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 4b		MS (Darai)	8	1039	F	lst. (white, detr., bryozoa, algae, corals and shells), minor mdst. and slst. intb.
Cz 4a, b		MBA (Puri)	1047	1896	F	lst. (argill., black to dark grey, plkt. foram.)
hiatus						
Cz 2		MBA*	2943	125	F	lst. (detr., glauc. at top, cherty at base)
hiatus						
K 7	*P. ludbrookiae*	MBA	3068	59	A	sh. (dark grey, py.) with slst. intb.
K 5-6	*M. tetracantha - C. denticulata*	MS	3127	54	A	sst. (f., qtzc, glauc.) > mdst. intb.
K 4	*O. operculata - D. davidii*	MS	3181	169	A	mdst. > sst. (as above)
K ?2-?3	*??S. areolata - M. australis*	MS	3350	160	C/G	slst., mdst. (dark, marly)
probable *hiatus*						
K 1??	-	MS	3510	60	C	slst. > sst. (f.-med.) at top
J 10	*D. jurassicum - P. iehiense*	MS	3570	340	B	slst., clst., sst.
J 9	*O. montgomeryi*	MS	3910	90	B/C	sty clst. (calc. in part, py.)
?hiatus	*C.perforans* (recylcled microplankton present - indicates uplift and erosion)					
J 8	*W. spectabilis - D. swanense*	MS	4000?	374.5	B/C	mdst., sst. (cse, glauc.)

*G. Francis, pers. comm., 1989

References: Helby and Partridge (1977d); Bee (1982); Lloyd (1977, 1988); Robertson Research (1984).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 9-8-1990

REFERENCE POINT: F **BORABI-1** T.D.: 2878 m

Latitude: 08 10 40.1
Longitude: 144 22 28.6

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6-7		MS	32	1186	F	mdst., slst.
hiatus						
Cz 4a, b		MVS (reef)	1218	1361	F	lst.
hiatus						
Cz 2a, b		MS	2579	294	F	lst.
hiatus						
J ??8		MS	2873	5+	F	mdst.

REFERENCES: Lloyd (1988), Robertson Research (1984), Chaproniere & others (1990).

T = thickness
Rel. Code = Reliability Code

Compilation/Revision Date: March 1990

REFERENCE POINT: G **PASCA-C1** T.D.: 4267 m

Latitude: 08 30 44.6
Longitude: 144 58 31.1

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6b-7		MS	100	1482	F	mdst.
Cz 6a		MBA	1582	1963	F	mdst./sh.
hiatus						
Cz 4a-b*		MVS(reef)	3545	673	F	lst.

*lower b

?Basement (quartzite(at 4218 m.

Oil and gas shows: 2197-2208m: 8.06 MMcfd, plus 124 BC/MMcfg with liquid ratio increasing to 337 BC/MMcfg. 2467-2502: 1.64 MMcfd, plus 495 BWPD.

REFERENCES: Robertson Research (1984); Lloyd (1988); Chaproniere & others (1990).

Compilation/Revision Date: March 1990

REFERENCE POINT: H <u>**IVIRI-1**</u>

T.D.: 3662.2 m

Latitude: 07 35 54
Longitude: 144 46 30

Time Slice	**Biostratigraphic Zone**	**Environment**	**Top m**	**T m**	**Rel. Code**	**Lithology**
Cz 7		CDD		1619	F	intb. sst., slst., mdst.; lign. bands
Cz 6		MS-MBA	1619	693	F	sh. (slightly calc., often sty, plankt. foram.)
hiatus						
Cz 4a, b		MVS	2312	521	F	lst. (foss., reefal)
hiatus						
Cz 2a, b		MS	2833	333	F	lst., sst. (glauc.) at top
hiatus						
J 6-8	upper *C. halosa* - *W. clathrata*	MBA	3166	496+	F	sh. (black, sty, lamellibranchs), occ. thin sst. bands

References: Helby and Partridge (1977c); Bee (1982); Robertson Research (1984); Lloyd (1988).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 8-8-1990

REFERENCE POINT: J **WANA-1** T.D.: 3007.1 m

Latitude: 07 25 24
Longitude: 144 45 16

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		MS	6	889	F	mdst., slst., sst.
Cz 6		MBA	895	1158	F	mdst.
hiatus						
Cz 4a, b		MBA?	2053	571	F	lst. (argill.) >> marl
hiatus						
Cz 2 b		MS	2624	328	F	lst. (aren.)
hiatus						
J 8	*W. clathrata/W. spectabilis*	MU	2952	55 +	F	sh.

REFERENCES: Helby & Partridge (1977c), Robertson Research (1984), Lloyd (1988).

t = thickness
Rel. Code = age reliability code

Compilation/Revision Date: August 1989

REFERENCE POINT: K **WUROI-1**

T.D.: 1295.1 m

Latitude: 08 48 52
Longitude: 143 02 20

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6		MS		27	F	clay (red, yellow, grey)
hiatus						
Cz 4a, b		MS	27	672	F	biocl. lst. (foram., corals, gastrop., pelecyp.), dol. at base
hiatus						
K 1	*C. delicata* and ?younger	?CDP	699	33	B	slst., ?sst.
J 10	*N. similis - P. iehiense*	?CDP	732	123	B	intb. sst. and slst.
J 9	*C. perforans - O. montgomery*	?CDP	855	53	C	intb. sst. and slst.
J 8	*W. spectabilis - ?D. swanense*	?MS-CDP?	908	80	B	sst., sh.
J 7	*W. digitata - R. aemula*	CDP*(?CDIS)	988	134	B	clst. grading into sst. intb. with slst., mdst.
J 6	*C. halosa - W. indotata*	CDP (?CDIS)	1122	148	A/B	sst., slst., clst. > lign.

?Basement at 1270 m.

*MS at base
thickness approximate

References: Robertson Research, 1984; Bee, 1982; Lloyd (1988); Morgan (1990a).

T = thickness
Rel. Code = reliability code

Compilation/Revision Date: 9-8-1990

REFERENCE POINT: L **KOMEWU-2** T.D.: 3041 m

Latitude: 07 13 20
Longitude: 143 02 44

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 6		MS	6	130	F	clst., slst., lign.
hiatus						
Cz 4a, b		MS	136	1379	F	lst. (detr., shelly)
hiatus						
K 5-7	*D. davidii - P. ludbrookiae*	MS-?MBA	1515	245	B/C	slst., mdst. (plkt. foram.) > minor sst.
K 3-4	*M. australis - D. davidii*	MS*	1760?	128	B/C	slst., sst. (coaly streaks, glauc.), mdst.
K 2(late)	*P. burgeri - M. testudinaria*	CDP?#	1888?	44	B	mdst. > sst. (f.-med., glauc.)
hiatus	*??E. torynum - S. tabulata*					
K 1	*D. lobispinosum* and younger	CDP-MS	1932	98	B	sst. (f.-cse, poorly std, glauc.) at top; slst., mdst.
J 10	*G. jurassica - P. iehiense*	MS	2030?	222	B	slst. and intb. mdst. > sst. (glauc., py.)
J 9	*C. perforans - O. montgomeryi*	MS?	2252	40	A/B	mostly mdst., some sst. (f., argill.)
J 8	*W. spectabilis - D. swansense*	CDP	2292	157	B	mostly sst. (f., argill.) with thin mdst. bands
J 7	*W. digitata*	MS-CDP	2449?	187	B	mostly mdst. intb. with slst., minor sst.
J 6	*?C. complex/C. halosa - W. indotata*	CDD@	2636	336	B	sst. (poorly std, f.-med., igneous grains), intb. coal, slst., mdst.

Basement at 2972 m.

* CDP at base
#MS in lower part
@MS at top

References: Dilley (1958); A.P.C. (1961); Helby and Partridge (1977b); Bee (1982); Lloyd (1988); Robertson Research (1984); Morgan (1990a).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 9-8-1990

REFERENCE POINT: M **MUABU-1** T.D.: 3666.3 m

Latitude: 07 22 52 S
Longitude: 144 40 11 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 7		?LDF	4	171	F	sst. (v.f.-cse, pbly, qtzc), lign., slst.
Cz 6b		?MS	175	645	F	slst., sst. (v.f., qtzc), mdst.
Cz 6a		MA	820	904	F	mdst. (marly, foss. at base; calc. and carb. at top; plkt. foram.)
hiatus						
Cz 4a, b		MBA-MA?	1724	557	F	lst. (micr., argill., brown chert, plkt. foram.)
hiatus						
Cz 2b		MS	2281	299	F	lst. (aren., skeletal-micr.)
hiatus						
J 10 (latest)	*P. iehiense*	MU (?MS)	2580	30	B	slst. (dark grey, glauc.)
hiatus/fault	*D. jurassicum*					
J 9 (late)	*O. montgomeryi*	MU (?MS)	2610	18	B	slst., sst. (v.f., py.)
hiatus	*C. perforans*					
J 8	*W. spectabilis - D. swanense*	MU (?MS)	2628	212	B	sh. (dark grey, slightly calc., py.), silt and sand intb.
J 7	*W. digitata (and ?older) - R. aemula*	MU (?MS)	2840	826+	B/C	as above

References: Robertson Research (1984); Bee (1982); Helby and Partridge (1977c); Lloyd (1988); Morgan (1990a).

T = thickness
Rel. Code = age reliability code

Compilation/Revision Date: 10-9-1990

REFERENCE POINT: N **IAGIFU 3X** T.D.: 3094.3 m

Latitude: 06 24 22 S
Longitude: 143 11 27 E

Time Slice	Biostratigraphic Zone	Environment	Top m	T m	Rel. Code	Lithology
Cz 4a,b?		MS?	0	1362	F	lst. (cream-white, microcrystalline to cryptocrystalline, traces of crystalline calcite).
hiatus						
K 8	*X. asperatus - P. infusorides*	MS*	1362	858	A/B	intb. sst. (v.f.-f., qtzc, moderately calc., abundant glauc., partly mic., lith. fragments and py.), clst. and slst.; argill. matrix increases with depth within time slice.
K 7	*P. ludbrookiae*	MS	2220	177	A	clst. with intb. of slst., sst. and minor sh.
hiatus	*M. tetracantha - C. denticulata* (could be faulted out - dip changes)					
K 4	*O. operculata - D. davidii*	MS	2397	103	A	clst., slst., isolated sst. beds
K 3	*M. australis - A. cinctum*	MS	2500	40	B	as for K 4
K 2 (late)	?*P. burgeri - M. australis*(early)	MS#	2540	35	A/B	as for K 4, sst. at base (f.-cse, round to subangular grains, poorly to moderately std, qtzc)
hiatus	*S. areolata - S. tabulata*					
K 1	*C. delicata - E. torynum*	CDP	2575	180	A	sst. (med.-cse, qtzc, subangular-subrounded, poorly-moderately std) > slst. > trace of lst.
J 10	*N. similis - P. iehiense*	CDP	2755	339+	A	predominantly sst. (qtz, med.-cse, several coarsening up cycles), intb. slst. >> clst., trace of lst.

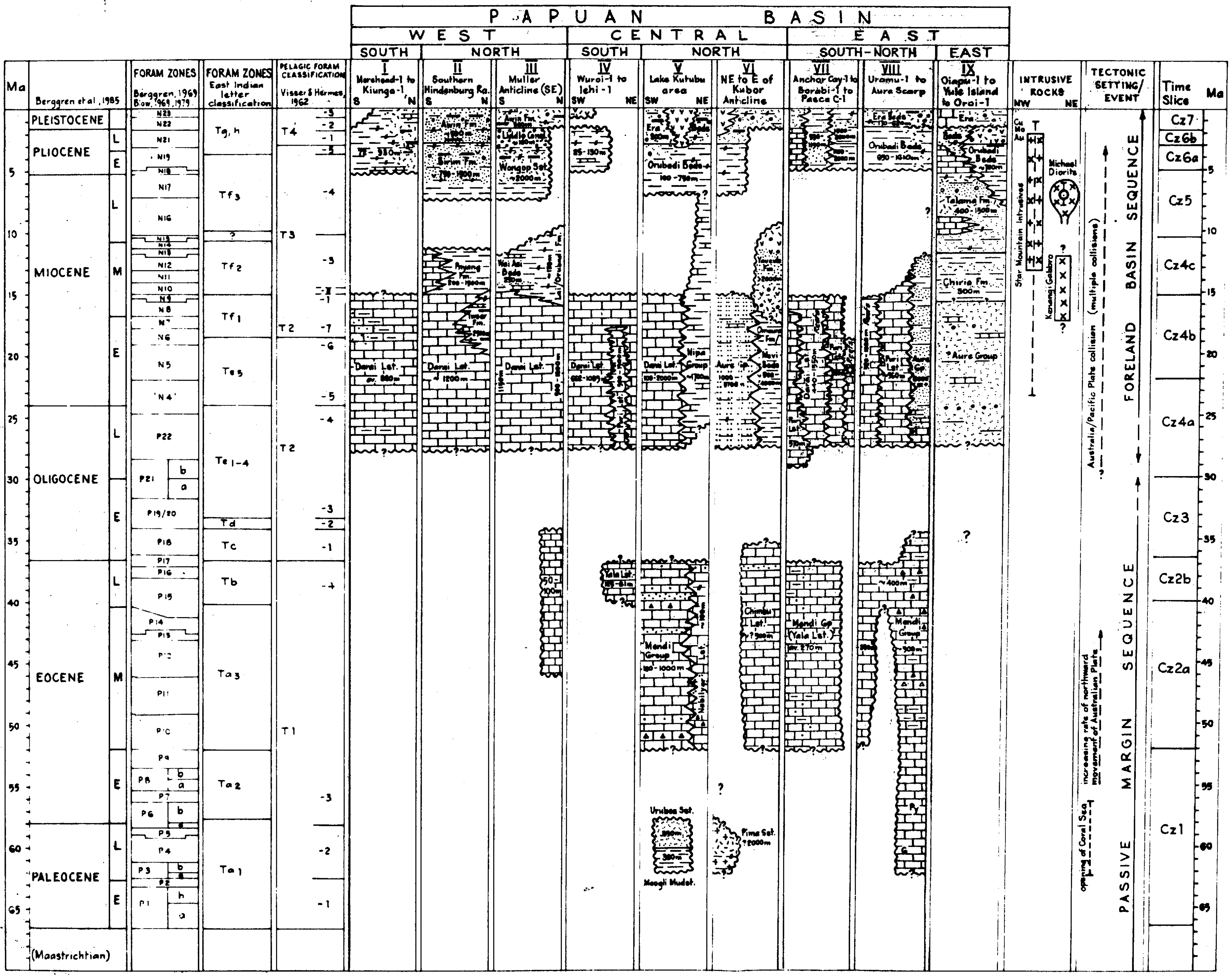
* CDP at top
# CDP at base

References: Derrington (1986), Morgan (1990a).

T = thickness
Rel. Code = age reliability code

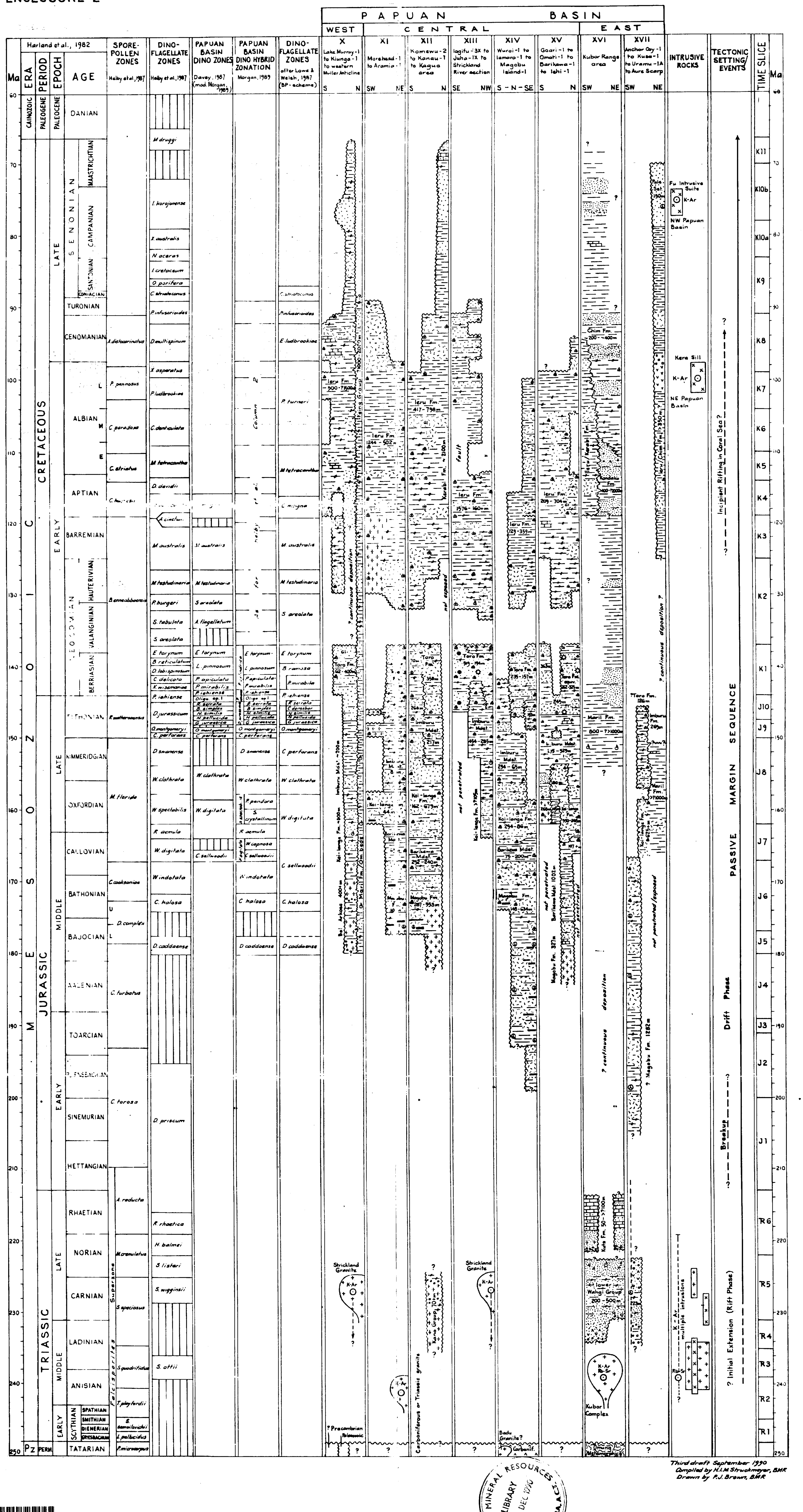
Compilation/Revision Date: 31-7-1990

ENCLOSURE 1



Second draft compiled November 1989 by H.I.M. Struckmeyer, BMR Drawn by P.J Brown, BMR

ENCLOSURE 2



Third draft September 1990
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Drawn by P.J. Brown, BMR