SEQUENCE STRATIGRAPHIC INTERPRETATION OF SEISMIC DATA NORTH OF 26°S, BOWEN AND SURAT BASINS, QUEENSLAND

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ABSTRACT

This Record outlines the products derived from a sequence stratigraphic interpretation of Permian and Triassic sediments of the Bowen Basin and Jurassic sediments of the Surat Basin in central eastern Queensland north of 26°S. Examples of the interpretation, in the form of structure contour and isopach maps (in two-way time), and seismic sections are displayed, along with brief notes on the methods used in their compilation, and a resume of the characteristics of the sequence boundaries and their confined sequences. The structure contour maps and isopach maps available from the AGSO Sales Centre, and the data from Petroseis™ available in digital format, are listed.

INTRODUCTION

PROJECT BACKGROUND

The Sedimentary Basins of Eastern Australia (SBEA) Project is a multidisciplinary study of the Bowen, Surat and Gunnedah Basins. It is part of the National Geoscience Mapping Accord and is a collaborative project between the Australian Geological Survey Organisation (AGSO, formerly the Bureau of Mineral Resources, BMR), Geological Survey of Queensland (Department of Minerals and Energy) and New South Wales Department of Mineral Resources (Geological Survey and Coal & Petroleum Geology branches), with cooperation from CSIRO, universities and industry.

The Bowen, Surat and Gunnedah Basins have considerable resource potential and, although there have been regional studies of the basins in the past, there are still uncertainties as to their precise geometry, mode of formation, the response of the basin to tectonic events in the adjacent orogens, and the control exerted by these events on the timing and generation of hydrocarbons.

OBJECTIVES

The aim of the project is to undertake an integrated basin analysis with emphasis on the tectonic, structural, sedimentary and thermal histories of the basins in order to assess their economic potential for hydrocarbons. This Record describes the interim products of the second phase of a regional seismic synthesis, and focuses on the application of the principles of sequence stratigraphy in the interpretation and integration of industry and BMR seismic data in the Bowen and Surat Basins, Queensland, between 23°30'S and 26°S (Fig. 1). It also includes examples of isopach and structure contour maps, in reduced format, based on this phase of interpretation, and briefly outlines the methods and techniques used to produce these maps. The maps are available through the AGSO Sales Centre, and digital data from the Petroseis™ System Software are available in various file formats.

TECHNIQUES AND METHODOLOGY

A network of industry seismic lines was selected to provide a regional coverage and, if feasible, a line spacing of no more than about 10 km (Figs 2, 3). Preference was placed on more recent multifold coverage surveys but in some areas only early single fold coverage was available and had to be used. Interpretation of the industry seismic lines commenced near Taroom in the northeastern corner of the Surat Basin (Totterdell et al., 1992) and continued from there to about 23°30'S in the north and to the New South Wales border in the south. The area to the south, from 26°S to 26°40'S, has been described by Dixon et al. (1993).

Maps accompanying this report cover the area from 23°30'S to 26°S (Fig. 1). The

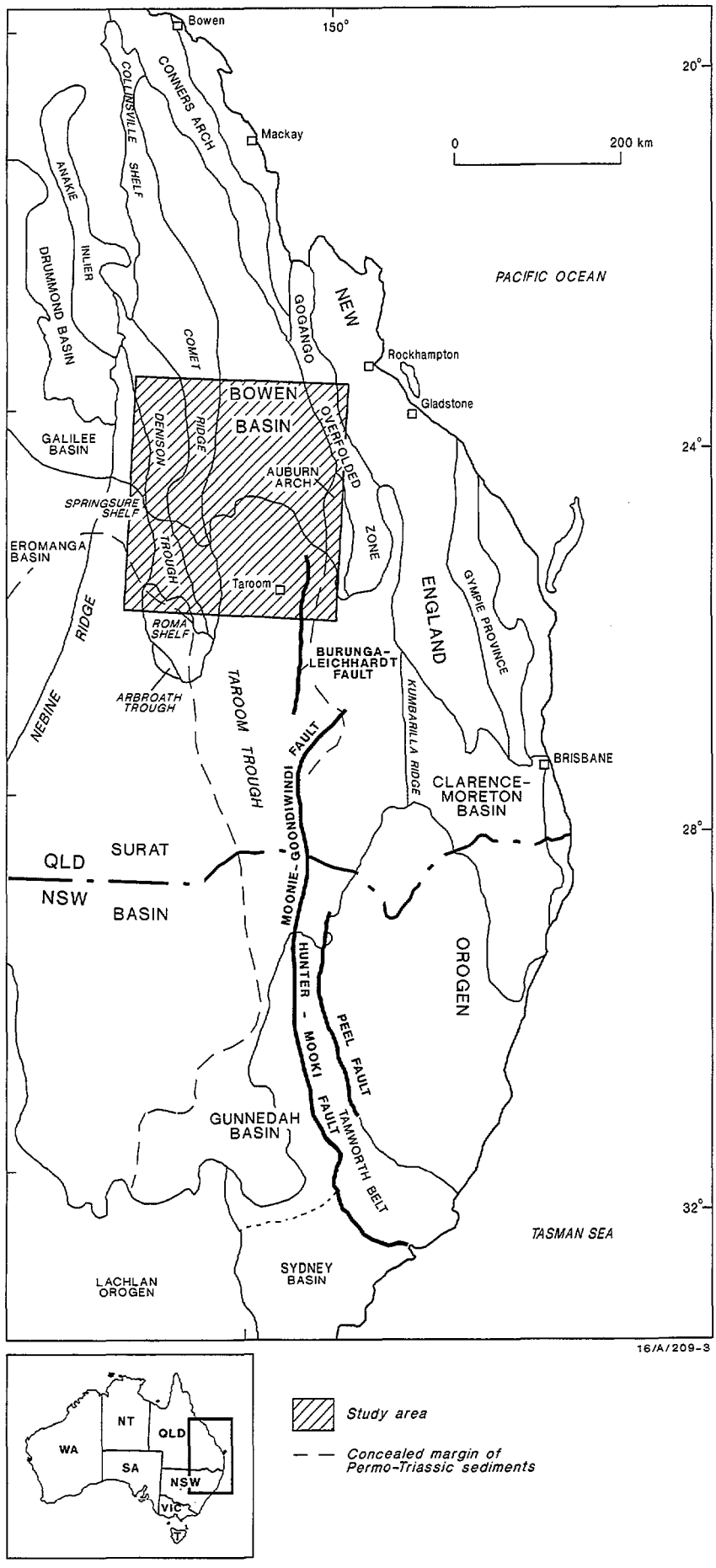

Figure 1. Locality map showing the area covered by this report.

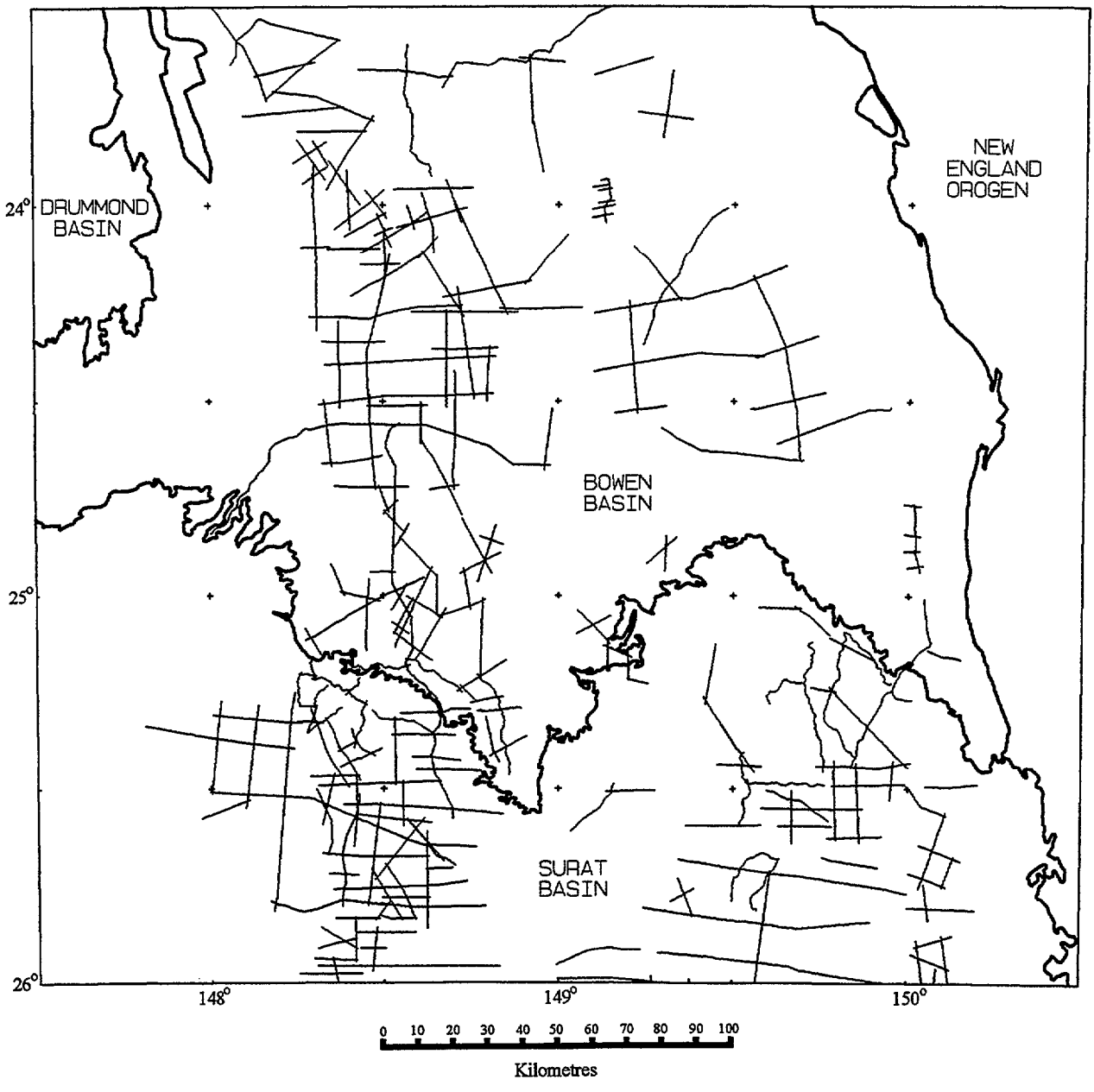

Figure 2. Map showing locations of the seismic lines that were interpreted in this study. For location of the map area see Figure 1.

northern border of the maps represents the northern limit of reasonable seismic coverage in the Bowen Basin, except for small isolated surveys and a limited amount of new shallow seismic data acquired for coalbed methane exploration.

The principles of sequence stratigraphy (for example, Vail et al., 1977a, 1977b; Mitchum, 1977; Vail, 1988; Van Wagoner et al., 1988, 1990) were applied to the interpretation of the seismic sections, commencing in the Taroom Trough where a

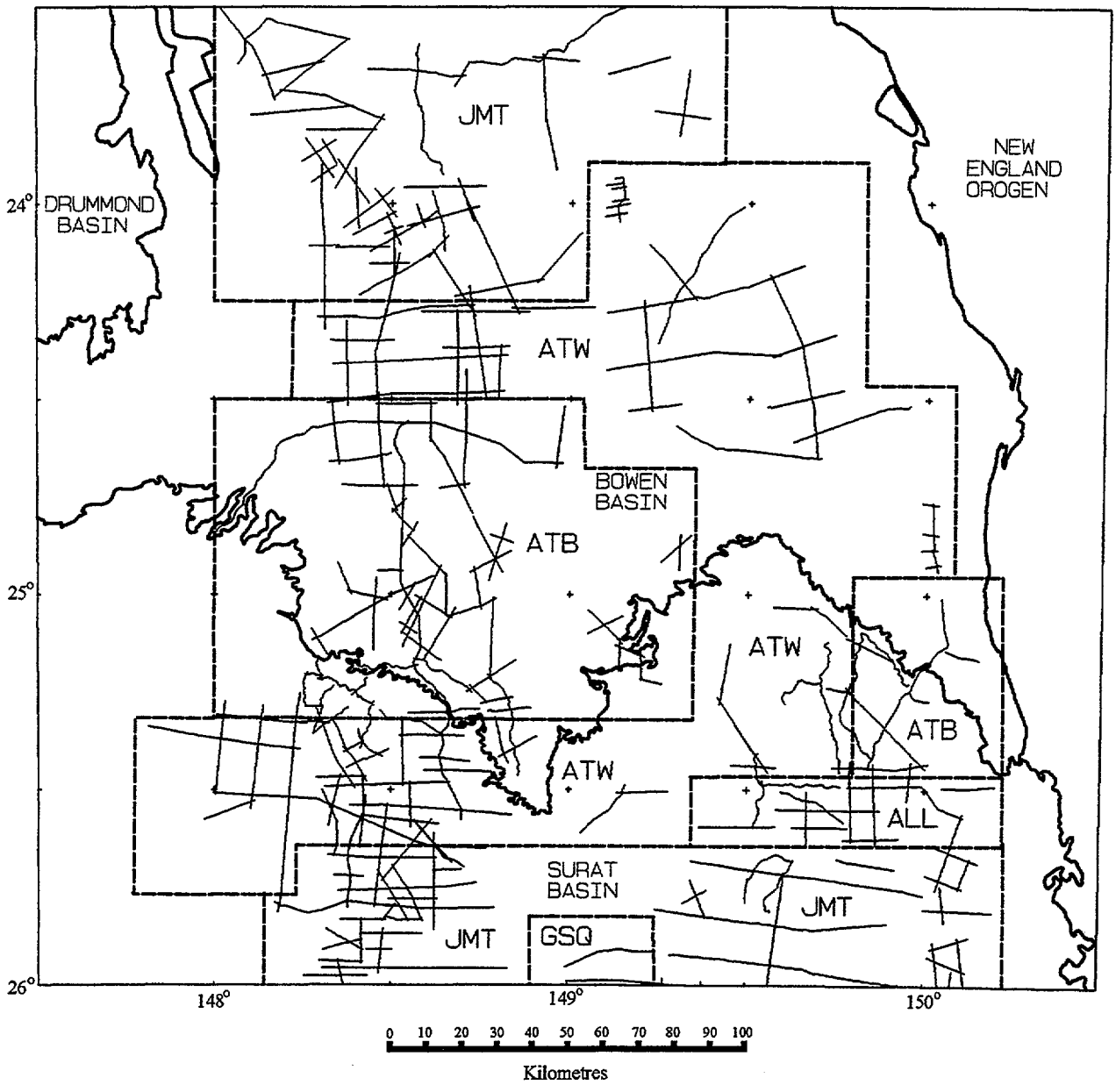

Figure 3. Map showing responsibilities for interpretation of the seismic lines. ATB - A.T. Brakel, JMT - J.M. Totterdell, ATW - A.T. Wells, ALL - all three interpreters. GSQ - represents an area interpreted by the Geological Survey of Queensland as part of their area south of 26°S (see Dixon et al., 1993).

several kilometre thick succession of Permian and Triassic sediments is preserved beneath a comparatively thin succession of Jurassic sediments of the Surat Basin. Prominent reflections were selected for mapping and an assessment was made of associated stratal patterns and their significance in defining stratigraphic sequences

in the sediments. Well ties were made using synthetic seismograms if digitised sonic logs were available; otherwise, standard graphic logs with well depths converted to two-way-time (TWT) using well velocity surveys or rms velocities were used. This allowed the sequences and sequence boundaries to be correlated with the lithostratigraphy (Fig. 4). Further details of the procedures followed are given in Totterdell et al. (1992).

Well control in the eastern part of the region is sparse. By contrast, there is a much higher density of petroleum exploration wells on the western side of the basin in the Denison Trough, and correspondingly more information available on correlation with lithostratigraphic data. Direct line ties from east to west across the basin in the region are not possible because the few seismic lines acquired on the Comet Ridge are isolated from the more dense coverage over the Taroom and Denison Troughs on either side.

After completion of the interpretation, verification of the closures around loop ties, correlating the selected seismic reflections with wells and recording the data, the boundaries on the interpreted lines were digitised and processed in the Petroseis™ seismic data processing package. Using this system, structure contour and isopach maps of the network of industry seismic lines were produced. The PEP™ system was used to process digital wireline log data for the production of synthetic seismograms.

GEOLOGICAL SETTING OF THE BOWEN AND SURAT BASINS

The Permian-Triassic Bowen Basin and the overlying Jurassic-Cretaceous Surat Basin are located in eastern Queensland and northern New South Wales (Fig.1). The Bowen Basin is the northernmost unit of the Sydney-Gunnedah-Bowen basin system. Outcrops of the Bowen Basin extend from the Collinsville area in the north, south to approximately 25°S, where they are unconformably overlain by sedimentary rocks of the Surat Basin. The Bowen Basin succession continues in the subsurface beneath the Surat Basin southwards into New South Wales, where it is contiguous with the Gunnedah Basin. During its development, the Bowen Basin was bounded to the east by the active New England Orogen, and to the west by a relatively stable craton of Early-mid Palaeozoic rocks. The basin contains up to 10 km of terrestrial and shallow marine, largely clastic sediments, along with substantial deposits of black coal. The thickest successions are found in the Taroom and Denison Troughs, which are separated by the Comet Ridge. The generalised stratigraphy of the Bowen and Surat Basins in the study area, as well as correlations between the successions in the Taroom Trough and the Denison Trough, are shown in Figure 4.

The Surat Basin is continuous with the Eromanga Basin across the Nebine Ridge in the west, and with the Clarence-Moreton Basin across the Kumbarilla Ridge in the east. The basin extends well into New South Wales where it unconformably overlies the Gunnedah Basin and parts of the Lachlan Orogen. The Surat Basin succession consists of up to 2500 m of generally flat-lying, clastic sedimentary rocks that were

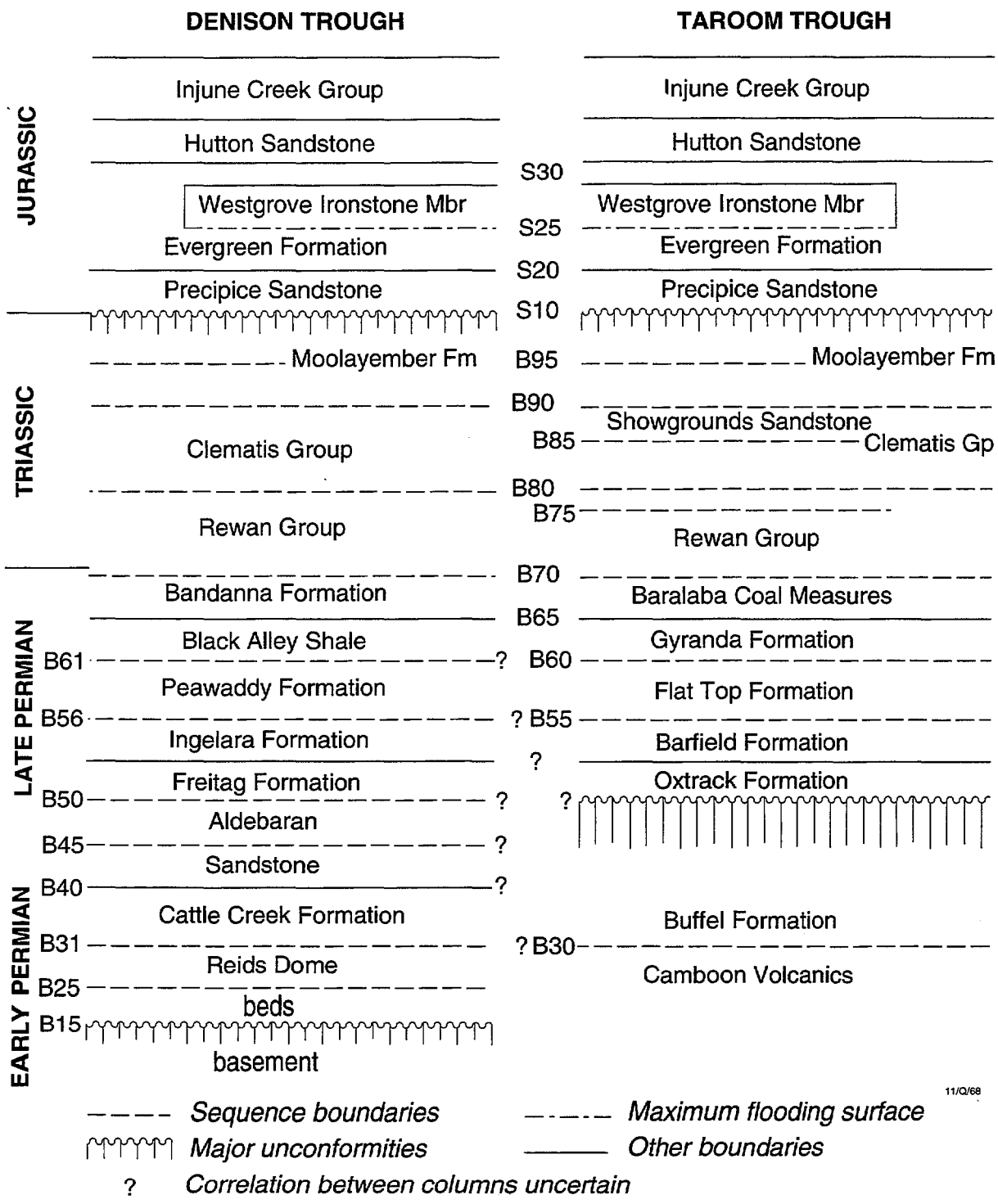

Figure 4. Stratigraphy and sequence boundaries in the Taroom Trough and Denison Trough north of 26°S, Bowen and Surat basins, Queensland.

deposited in fluvio-lacustrine to shallow marine environments. Sedimentary rocks of the Surat Basin are more widespread than those of the Bowen Basin, although the greatest sediment thickness approximately coincides with the axis of the underlying Taroom Trough.

The Bowen Basin was initiated in the latest Carboniferous-Early Permian as a result of back-arc extension associated with subduction along a continental margin volcanic arc (Camboon Volcanic Arc). Following a period of subsidence driven by thermal relaxation, the basin was affected by compression which commenced in the mid-Permian; this is interpreted as the onset of foreland basin conditions. From the Late Permian to the late Early Triassic, foreland loading resulted in accelerated subsidence in the Taroom Trough and the compressional event inverted the earlier extension-related structures. This period of shortening culminated in the Middle to Late Triassic. After erosion and peneplanation, sedimentation resumed in a gently subsiding intracratonic sag (Surat Basin) in the Early Jurassic.

For a more comprehensive summary on the geological setting and tectonic development of the Bowen and Surat Basins see Totterdell et al. (1992) and in references cited therein.

SEQUENCE BOUNDARIES AND REFLECTORS IN THE REGION

The seismic sequence analysis was carried out by identifying discontinuities on the basis of reflection terminations according to the method of Vail (1988), and others. The identification and verification of sequence boundaries in the Bowen and Surat Basins relies on the recognition of a variety of stratal boundary types, and the ease of their recognition depends largely on the quality of the seismic sections. The sequence boundaries were recognised by stratal geometry (e.g., truncation, downlapping, overlapping), erosional features such as channels and erosional relief, and by other evidence of unconformities. Several horizons, most of them regarded as sequence boundaries, were chosen initially as the framework for the seismic interpretation, and these have been augmented by others. Most of these are within the Bowen Basin succession, one is the major unconformity between the Bowen and Surat basins, and the remainder lie within the Surat Basin succession. The sequence boundaries, and other important interpreted horizons, have been given alphanumeric codes (Fig. 4). Note, however, that these are different from the provisional codes used by Brakel et al. (1992) and Totterdell et al. (1992). Throughout the text, reference is made to seismic lines which contain good examples of the sequence boundaries. Some of these lines will be illustrated in a future publication which is currently in preparation.

Little attempt has been made at present to identify the standard series of systems tracts defined by Van Wagoner et al. (1988). This is because most of the succession preserved in the region is non-marine, and the marine portion, mostly Permian, is relatively thin. Discriminating between systems tracts in non-marine sediments is not only difficult, but as the sequences themselves may be more related to tectonics and

sediment supply than to sea-level changes, the standard terminology for coastal margins is inappropriate.

PERMIAN

The stratigraphically lowest sequence boundary interpreted in the seismic data is **B15**, which is the **basal unconformity** in the Denison Trough between coal measures of the Reids Dome beds and pre-Permian basement rocks (Devonian Timbury Hills Formation and others). An example can be seen on line 84-M421 (SP 570, 1300 ms). Pronounced angular relationships are usually visible and onlapping reflections are common. The equivalent time horizon in the Taroom Trough, within or at the base of the thick Camboon Andesite, has not been recognised in any seismic section.

A sequence boundary **B25** is apparent in many seismic sections **within the Reids Dome beds**, for example, lines 84-E413 (SP 355, 900 ms) and 84-M421 (SP 595, 1230 ms). It was first identified as an unconformity by Brown et al. (1983). B25 is not everywhere discernable, partly because some sections may lie along strike or because the overlying coal measures may be locally absent, but also because the lenticularity of coal seams can make its recognition ambiguous. Nor is it certain that all the B25 picks represent the same surface; it is quite possible that episodic tectonic adjustments within the Denison Trough led to local unconformities at several different levels. Therefore maps have not been produced for B25.

An important regional sequence boundary is the base of the Early Permian marine rocks, corresponding to the Reids Dome-Cattle Creek boundary in the Denison Trough (**B31**) and the Camboon-Buffel boundary in the Taroom Trough (**B30**). It formed by the first major transgression in the Permian. This surface is commonly marked by obvious angular discordance, and in many sections displays a high acoustic impedance contrast. Good examples occur in lines BMR78.02 (SP 2490, 850 ms) and C83-GL-02 (SP 420, 3000 ms).

A significant horizon, **B40**, equivalent to the **base of the Aldebaran Sandstone** has been mapped because the unit is a potential hydrocarbon reservoir. B40 is not a sequence boundary, but a lithological contact separating deltaic sandy sediments from underlying finer-grained marine beds. In some parts of the Denison Trough (e.g. line 83-R315), the horizon has been traced beyond the Aldebaran Sandstone into mostly fine-grained prodelta deposits assigned to the Cattle Creek Formation. B40 may be either a maximum flooding surface or a parasequence boundary.

A significant sequence boundary is **B45** and correlates with the **intra-Aldebaran unconformity** located in the upper half of the Aldebaran Sandstone. It corresponds to the pronounced break shown on figure 3 of Elliott (1985). It is displayed in some sections (e.g., 80-P111; BMR78.02, SP 2780, 670 ms; 80-M5, SP 260, 1000 ms) as a low angle discordance, but is more commonly very subtle or apparently concordant.

A significant sequence boundary (**B50**) formed at the base of a transgressive systems

tract and is marked by low-angle discordances and/or onlaps or downlaps in many sections in the Denison Trough (e.g., line BMR78.02, SP 3140, 675 ms). It is correlated with the **sub-Freitag unconformity** which was identified as such by Cundill & Meyers (1964) from well logs.

There is some confusion over the use of the term Freitag Formation. The Freitag Formation was defined in outcrop by Power (1966), and therefore is the official Freitag by definition. There is, as well, Power's subsurface correlate of the surface unit, and referred to also as the undefined "Donnerstag Formation" (Price, 1983) and "Warrinilla Formation" (Elliott, 1985). It was clearly Power's intention to apply the name Freitag to the latter unit overlying the unconformity. This is how the name has been used in many subsequent publications, and it is used in this sense here. The lithologic nomenclature needs to be clarified, but is beyond the scope of this report.

It is uncertain whether the base of the Oxtrack Formation (or Mount Ox Group of Draper et al., 1990) of the eastern Taroom Trough correlates with B45 or B50. The base of the Oxtrack Formation is a major unconformity below which the whole of the Fauna III zone is missing. It is therefore likely to be equivalent to the predominant unconformity in that part of the Denison Trough succession, that is, B50. The Oxtrack base cannot be picked separately as a sequence boundary in the east because the Buffel Formation is too thin to be seismically resolved, and the surface merges with the underlying B30.

Horizon **B55**, at or near the **base of the Flat Top Formation** in the Taroom Trough, is usually a strong but variable amplitude reflection, exemplified by the strong trough flanked by strong peaks in line S84-BM-06 (SP1950, 3400 ms). Though it shows no explicit evidence of being a sequence boundary, palaeontological work (Parfrey, 1988) suggests that it is possibly equivalent to the **base of the Peawaddy Formation (B56)** in the Denison Trough to the west. The latter level has been interpreted to be of tectono-sedimentary significance by Dickins (1983), in that it records a marine transgression, which is unconformable in places and marked by the introduction of volcanic detritus. B56 is usually difficult to identify without recourse to well ties, and convincing truncations below it are rarely visible.

The next mapped horizon (**B60**) in the Taroom Trough lies at or above the **base of the Gyranda Formation**, and is the strong reflection in line C83-GL-02 at SP 480, 2740 ms. Throughout this region, the horizon usually displays no sequence boundary characteristics, but some truncations below it and onlapping strata have been interpreted in some sections. In the northern part of the study area, downlapping relationships are well displayed in lines OB80-1 and OB80-2. It may therefore be a subtle expression of a sequence boundary, especially if our belief, that it is the same surface as **B61** at the **base of the Black Alley Shale** in the west, could be confirmed. Unfortunately, no seismic survey has successfully imaged the stratigraphy across a gap between the Comet Ridge and the Taroom Trough. Truncations (usually vague) have been found below B61 on several lines, for example, 84-M405 (SP 360, 830 ms). Our field studies, which showed that the contact between the Peawaddy Formation and the overlying Black Alley Shale near Carnarvon Gorge truncates sandstone and

mudstone beds, and the suggestion of a hiatus between the same formations in figure 4 of Dickins (1983), are consistent with it being a sequence boundary.

Horizon **B65** is usually expressed as the base of a zone of strong reflections, as in line C83-GL-02 (SP 480, 2530 ms) illustrated in figure 3 (B17) of Brakel et al. (1992). It is equivalent to the **base of the Baralaba Coal Measures and Bandanna Formation**. The horizon does not usually show features associated with sequence boundaries. There are some truncations of underlying beds in only a few seismic sections (e.g., line BMR78.02, SP2110, 875 ms), and in the context of the overlying deltaic coal measures, most of these may be prodelta foresets, that is, there may be a toplap relationship. Beds onlap the surface in line 79-E12 (SP 360, 870 ms) in the Denison Trough, perhaps because of local differential subsidence. In line 88-M16 there is a local unconformity. While the identity of B65 as a possible sequence boundary is unresolved, it at least represents a parasequence boundary.

A particularly significant sequence boundary is **B70** which equates with the top of the Permian upper coal measures and **base of the Rewan Group**. As the nature of B70 is the subject of some debate among different workers, it is appropriate to elaborate on the reasons for our interpretation of it as a sequence boundary. First, note that there are differing definitions of the base of the Rewan Group. Jensen (1975) and some workers concerned with coal geology chose the top of the highest coal seam as the boundary for practical reasons, whereas other authors, such as Chiu Chong (1969), chose a higher boundary marked by a change from predominantly light grey and white sediments of the coal measures to the greenish colored sediments of the Rewan Group. Choosing the highest coal seam as the boundary is easier for mapping purposes, but where overlying coal measure clastics are preserved, a boundary so defined will inevitably be conformable. Also, where coal seams lens out or are eroded away, it leads to vertical "jumps" in the boundary which are artificial and can give a misleading impression of the highest coal seam in some areas being coeval with basal "Rewan" sediments. To understand the basin-filling processes involved, the higher choice of boundary is more meaningful.

A number of authors have reported that the contact between the Blackwater and Rewan Groups is locally disconformable and sharp. Dickins and Malone (1973, p. 72) note disconformities in the northern Bowen Basin and near Blackwater; local disconformities in the Blackwater region are also mentioned by Malone et al. (1969, pp. 54-55). In the Denison Trough and nearby Comet Ridge area, local low-angle unconformities and disconformable contacts have been described by Mollan et al. (1969, pp. 42-43; 1972, p. 31). A dipmeter survey in the Warrinilla 1 well showed a 10° dip difference across the contact between the two groups (Cundill and Meyers, 1964, p. 133). On the other side of the Bowen Basin in the Moura area, plotting of the basal Rewan contact in boreholes showed that it is regionally disconformable with local slight angular unconformities (Chiu Chong, 1969, p. 3). A similar conclusion was reached by Foster (1979, p. 138) for the Moura - Kianga area, on the basis of an abrupt change in palynomorph assemblages at this level, but south of Theodore the assemblage change is gradual (Foster, 1979, p. 127). Thus an erosion surface hundreds of kilometres in extent is present at this level, which is one of the criteria

advocated by Flint (1993) to recognize sequence boundaries in fluvial settings. Flint's other criteria are also applicable, namely an abrupt increase in sandstone amalgamation and an increase in mean grain size, suggesting a change in hydraulic regime and in the amount of accommodation space. These changes could have been brought about by tectonics and/or climate and sea-level variations, but tectonics was probably dominant (Brakel et al., 1993).

B70 is generally a strong reflection at the top of a zone of strong reflections caused by coal seams, for example, in line C83-GL-03 (SP 480, 2300 ms). Erosional relief on it is visible in places, underlying strata are truncated in many sections, and locally there are onlaps (B33 in line C83-GL-02 in fig. 3 of Brakel et al., 1992) and downlaps onto it. Examples of channels in this surface in line 81-H50 (SP 372 and 415) have incisions of about 40 m and 20 m respectively.

TRIASSIC

All the horizons picked within the Triassic succession are now regarded as probable sequence boundaries. The seismic expressions of B80, B85, B90, and B95 are illustrated in Figure 5 (and also as B48, B20, B46 and B10 in line T82-L-105 in fig. 4 of Brakel et al., 1992). The relationships of the sequence boundaries to lithostratigraphic units defined in outcrop (eg., Jensen, 1975) are shown in Figure 6.

An angular discordance has been described at the **base of the Brumby Sandstone Member** ("Malta Grit") by Woolley (1944, cited by Jensen, 1975, p. 25), in the Arcadia Valley on the eastern side of the Denison Trough. This occurs in the upper Sagittarius Sandstone of the lower Rewan Group, but locally the erosion has cut down into the top of the Bandanna Formation (Mollan et al.,1969). Coarse-grained detritus was deposited on the unconformity surface, which has a 15° discordance with the underlying beds. In the vicinity of 148°30'E, 25°15'S, a seismic interpretion of an angular discordance (**B71**) low down in the Rewan Group, of only local extent, may correspond to the reported discordance. It has been traced on only eight seismic lines (e.g. 88-Z4, SP 630, 130 ms), and this restricted occurrence roughly coincides with a high-standing part of the basement on the eastern side of the Denison Trough. Because of the localised occurrence of this horizon and the limited seismic coverage, no maps have been produced for it. The quality of the seismic data above B70 is not sufficiently good to be completely positive in the interpretation, and in the Arcadia Valley region the quality is too poor to recognize or trace B71 there. Regardless of the validity of the seismic interpretation, the outcrop observations suggest evidence of local tectonic activity at the time.

Within the Arcadia Formation of the upper Rewan Group (Fig. 6) lies a horizon (**B75**) that is truncated by the sequence boundary (B80) above it (as in line C83-GL-02), and is therefore locally absent. It can appear as a strong trough flanked by strong peaks, for example, in line S84-BM-06 (Fig. 5), at SP 1950, 2000 ms, but on many other lines it is poorly defined. Although its nature as a sequence boundary is usually unclear, it can be seen possibly truncating strata below it and with onlaps above in rare

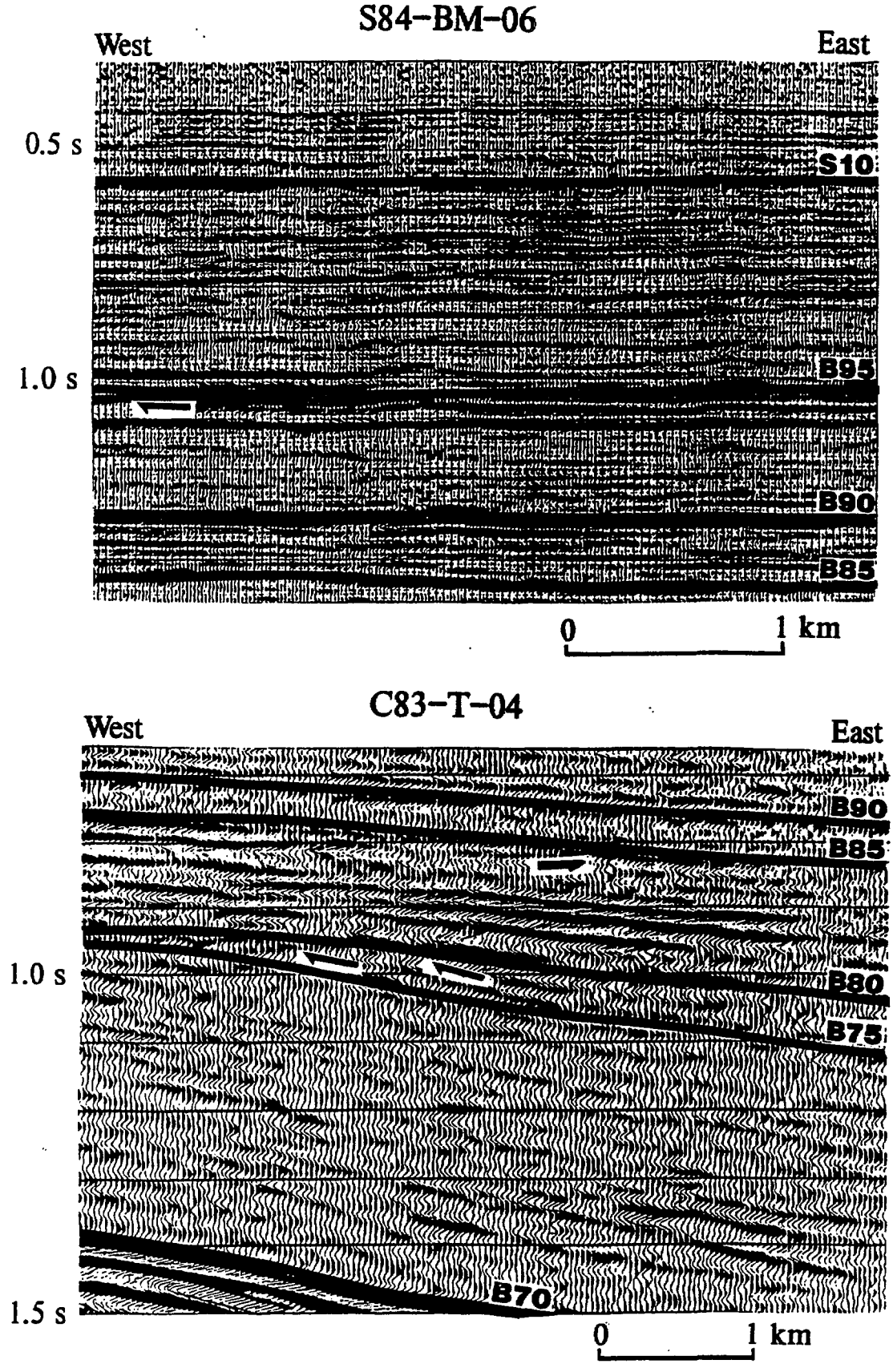

Figure 5. Characteristics of sequence boundaries identified on seismic lines S84-BM-06 and C83-T-04, Taroom region of the Taroom Trough.

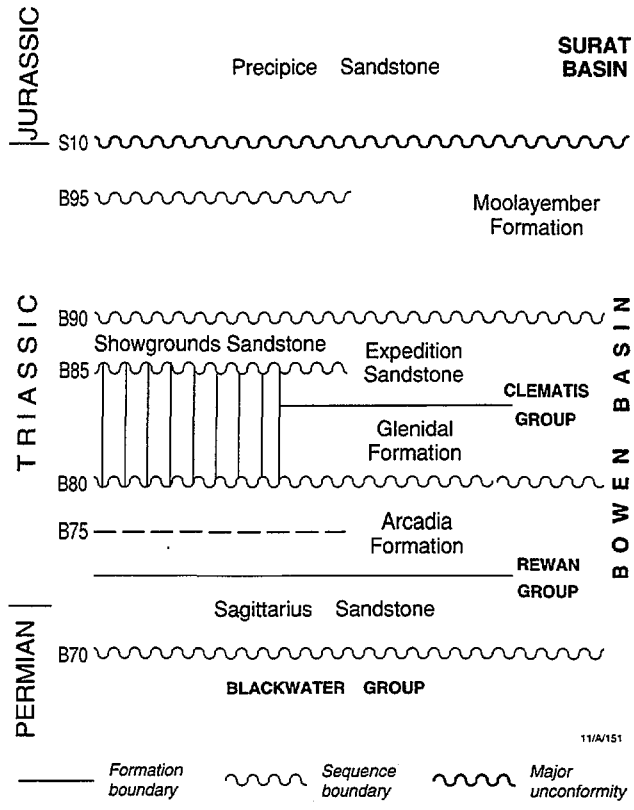

Figure 6. Sequence boundaries and their relationship to lithostratigraphic units in the Triassic sedimentary rocks of the Bowen Basin.

instances. The best example of truncations is in line OB80-2 (SP 440-500).

The horizon **B80** truncates B75 as well as many other beds is a major sequence boundary and represents the **base of the Clematis Group**. It is only intermittently well developed, but is a strong reflection in some lines, for example, S84-BM-06 (Fig. 5), and in places it separates two distinctly different packages of reflections, for example, line C83-T-04 (Fig .5). The base of the Clematis Group has been described previously as locally disconformable (Dickins & Malone, 1973) or erosional (Elliott & Brown, 1988), and is considered by Elliott (1993) to represent a major deformational event.

The horizon **B85** shows high impedance contrast in places, such as in line S84-BM-06 (Fig. 5) at SP 1630, 1200 ms, but is not evident as a sequence boundary. It occurs **within the Clematis Group**. In the well Tiggrigie Creek 1, however, it ties approximately with the base of a unit interpreted as the Showgrounds Sandstone (Elliott & Brown, 1988), a unit that further south on the Roma Shelf is known to have a hiatus below it, implying that it is an erosion surface, at least locally.

Horizon **B90** truncates underlying beds in some lines, and in C82-T-54 it cuts off the B85 surface. Usually, however, it does not show this trait, and on the poorer quality seismic lines can be difficult to identify. It is correlated with the **base of the**

Moolayember Formation. South of the present study area, B90 is, in places, known to be a very prominent and important erosion surface

A better-developed truncation surface (**B95**) is present **within the Moolayember Formation**, and is typified by the reflection at SP 1820, 240 ms in line S84-BM-06 (Fig. 5). South of Roma outside the present study area, however, B95 has not been recognised.

JURASSIC

The most pronounced unconformity in the region, **S22** (Fig. 4), is the **base of the Surat Basin succession**. It represents the peneplanation surface formed during the Late Triassic, following a major compressional episode. Erosion of uptilted beds is conspicuous near the eastern margin of the Bowen Basin (e.g., line 83-52/8, see fig. 8 of Totterdell et al., 1992). In the axial portion of the Taroom Trough the angular discordance is not as great, and in places the reflections are parallel.

Two horizons have been picked in the overlying sediments, corresponding to the **Precipice-Evergreen boundary** (**S20**) and the oolitic **Westgrove Ironstone Member** of the Evergreen Formation (S25) in the GSQ DRD 6 bore. S20 is the strong reflection in line S84-CT-03 at SP 4740, 180 ms, but can be difficult to pick in some other lines. S25 is the strong reflection in the same line at SP 4950, 140 ms. We have found no seismic evidence so far that either is a sequence boundary, however Elliott & Brown (1988) report a reflector coinciding with the boundary of the Boxvale Sandstone Member and the overlying Westgrove Ironstone Member as a "basin-wide sequence boundary". The ironstone records widespread chemical sedimentation, denoting a deficiency of clastic input, at the time of a possible marine incursion, as suggested by the presence of acritarchs reported by McKellar (1974). If the acritarchs signify true marine conditions, then such "sediment starvation" would be indicative of a maximum flooding surface. An alternative explanation has been proposed by O'Brien & Wells (in press), who discuss a similar coeval environment in the Clarence-Moreton Basin, where they postulate extensive lake formation as a result of a "backwater effect" generated by sea level rise, with acritarchs being introduced by upstream invasion of sea water during low flow periods. In such a scenario, the oolite formation in the lakes would not, strictly speaking, be at a maximum flooding surface, although it would occur at the same time as maximum flooding affected the continental shelves.

Two reflections (B30 and S40) picked by us at higher stratigraphic levels to the south of 26°S could not be recognized in the region under discussion here.

FAULT MAPPING

Faults were interpreted on seismic lines that were approximately orthogonal to the strike of the faults and then, where possible, the geometries of the faults were mapped

onto intersecting seismic lines. To compile a map of the faults, the intersections of the faults and the sequence boundaries were mapped for the B30/B31 and the B70 horizons, and the faults interpreted between the positions of the seismic sections. The tip lines for the faults were noted and used to prepare an individual fault map for each sequence boundary. The faults were mapped initially at 1:100 000 scale for final presentation at 1:500 000 scale. The faults were digitised using Petroseis™ and are available in digital format. The individual fault maps have been incorporated into the relevant structure contour and isopach maps.

Faults that had small amounts of displacement often could not be traced beyond one seismic section and created a problem for interpretation and display. Because there is no control over the orientations of these faults, they are shown on the maps as short faults perpendicular to the seismic section.

STRUCTURE CONTOUR AND ISOPACH MAPS

Structure contour and isopach maps have been generated for the Bowen and Surat basins in the area that has been seismically mapped between 23°30'S and 26°S, and are displayed on paper copies at a scale of 1:500 000. The maps are examples of contour maps that can be produced from the data compiled during the interpretation of seismic reflections in a regional network of seismic lines from the Taroom and Denison Troughs. Petroseis™ software was used to digitise interpreted seismic horizons and produce structure contour maps of the sequence boundaries in two-way travel time, and isopach maps of the interval between sequence boundaries, also in two-way travel time. Whilst not equivalent to true structure contour or isopach maps, these time-based maps provide a useful indicator of structural geometry or thickness trends within the succession.

For the structure contour maps, the data were gridded with a 1000 m grid cell size. The contours are well constrained in areas where there is a reasonably close line spacing, but they are poorly constrained in areas where there are few lines. All structure contour maps are displayed with a contour spacing of 100 ms. On at least one of the isopach maps, however, where the total thickness being contoured is relatively thin, a contour interval of 25 ms was used, leading to some spurious contours or artifacts generated by the contouring software (such as string of pearls and hourglass artifacts; see Krajewski & Gibbs, 1994). Thus for the isopach maps, the grid cell size was increased to 2500 m or 5000 m to eliminate some of the artifacts. The contour spacing used for the isopach maps depended on the maximum thickness of the interval being contoured, with intervals of 100 ms, 50 ms and 25 ms being used on different maps.

In most cases, the faults mapped in the seismic sections were used by the contouring software to constrain the structure contour patterns. In a few cases, however, the contours were generated without the faults, which were later included on the maps as an overlay. In particular, this was done in the Yarrabee Zone (Blackwater-Shotover

area) because the geometry of the numerous faults was not easily determined, and where only a limited number of sequence boundaries were interpreted on widely spaced lines. The isopach maps were gridded and contoured without the faults, in an attempt to reflect the true sedimentary thickness at the time of depsoition.

The relevant portions of the 1:500 000 Bowen Basin Solid Geology map (Balfe et al., 1988) were also digitised using Petroseis™. This included the contacts with basement, mapped faults in areas where there was no seismic coverage, and formation boundaries where they correlated with sequence boundaries or seismic horizons determined in this study. These features, along with the faults mapped in the seismic data, were used to provide control on the position of the zero contours.

The isopach maps were compiled by subtracting the two-way travel time of the upper sequence boundary from that of the lower sequence boundary. Thus, in areas where the base of one sequence has been eroded, or in areas where one of the sequences was not deposited, the complete interval between the two sequence boundaries does not exist. In these cases, the interval is shown as absent on the isopach maps, even though part of the interval may be still be present due to only partial erosion. Thus, some caution is necessary when interpreting the isopach maps.

One isopach map for which particular care in interpretation is necessary is the B90-S10 interval, which is approximately equivalent to the base of Moolayember Formation to the base of Precipice Sandstone (base of Surat Basin). This is because of an indeterminable amount of erosion of the Moolayember Formation that has occurred prior to the commencement of deposition of the Surat Basin. The map shows considerable thinning on the eastern margin of the Taroom Trough, which reflects the partial erosion of the Moolayember Formation due to tilting and uplift. It is not possible to estimate the amount of erosion of the formation in the centre of the Taroom Trough where the Surat Basin appears to be conformable on top of the Moolayember Formation. Partial erosion of the Moolayember Formation has also occurred on the western margin of the Taroom Trough, and thus this map reflects the amount of the Moolayember Formation preserved to the present day, rather than its original depositional geometry.

Examples of a structure contour map (Fig. 7) and an isopach map (Fig. 8) generated using the Petroseis™ System Software from the digitised sequence boundaries are included in this Record. A cross-section (Fig. 9) along seismic line M-81A-7A illustrates the style of presentation available using Petroseis™ Software. The data are also available as a Petroseis™ dump file or as a UKOOA or other fixed format ASCII dump file. It should be noted that these maps and section are representative, and that a suite of 22 maps based on selected combinations of the mapped sequences and unit boundaries, together with digital data sets, are available from the AGSO Sales Centre, and are listed in Appendix 1. Data formats are listed in Appendix 2.

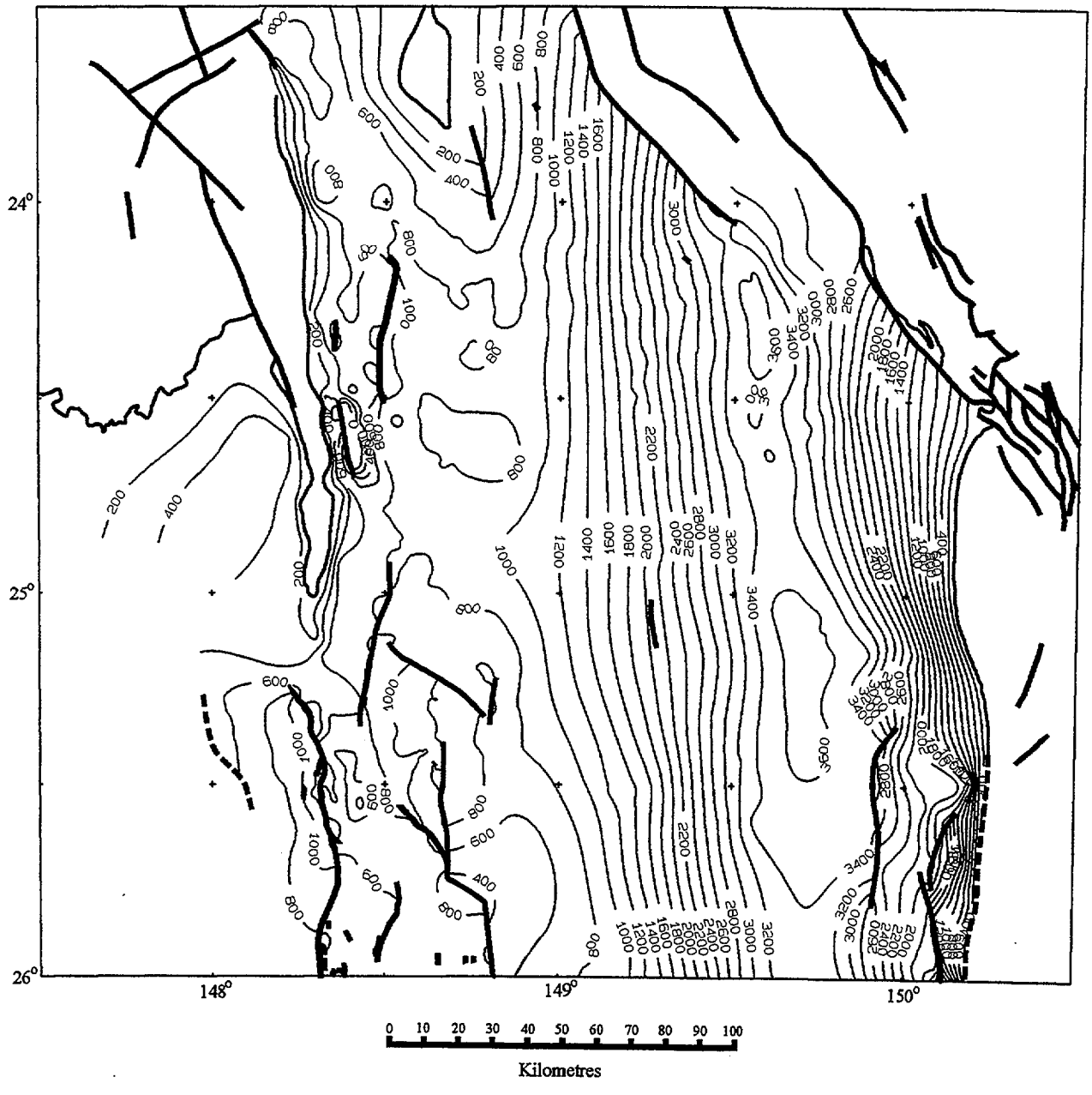

Figure 7. Structure contour map in two-way travel time of the B55/B56 reflector, which is approximately equivalent to the base of Flat Top/Peawaddy Formations.

CONCLUSIONS

Interpretation of a network of industry seismic lines in a transect across the Bowen and Surat Basins north of 26°S using sequence stratigraphic techniques has indicated that many of the seismic reflectors in the Taroom Trough and the Denison Trough show the

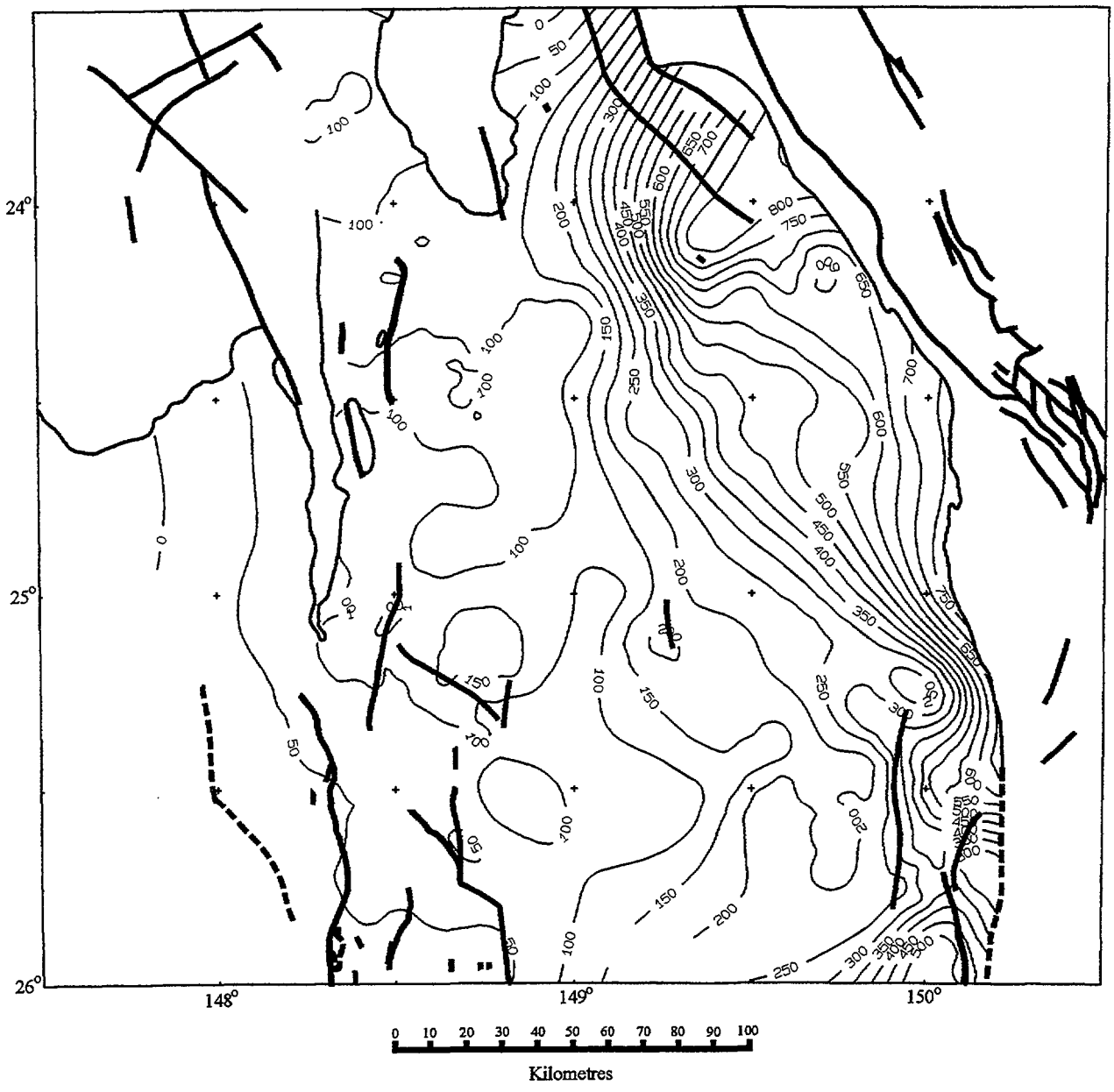

Figure 8. Isopach map of the B60/B61-B65 interval, in two-way travel time, which is approximately equivalent to the interval from the base of Gyranda Formation/Black Alley Shale to the base of Baralaba Coal Measures/Bandanna Formation.

characteristics of sequence boundaries. The succession includes both non-marine and marine rocks and our study has newly recognised and defined sequence boundaries in non-marine rocks.

The identification and verification of sequence boundaries in the Bowen and Surat Basins relies on the recognition of a variety of stratal boundary types, and the ease of

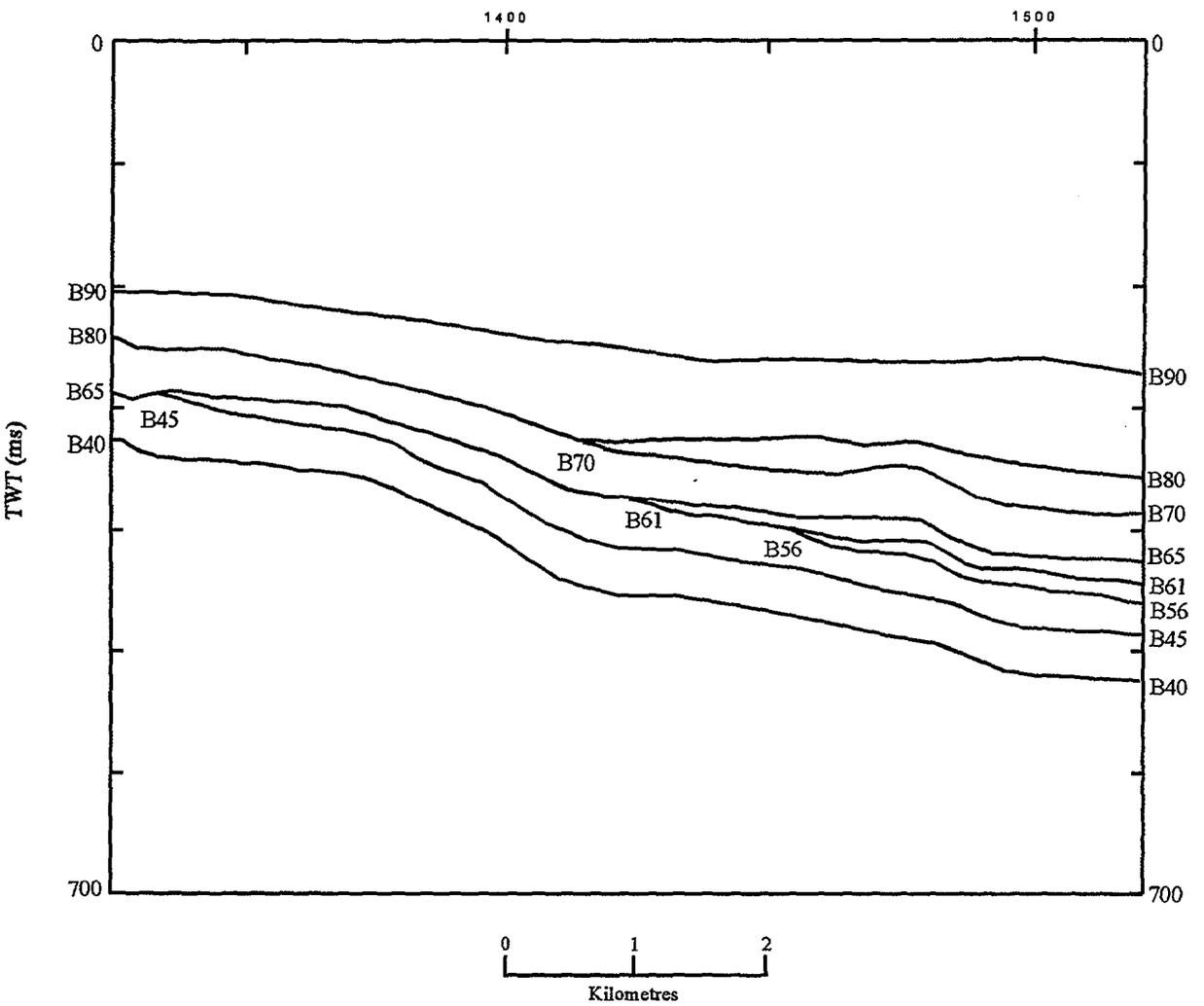

Figure 9. Cross section along seismic line - M-81A-7A, Nebine Ridge, showing relationships and geometry of units, including onlapping and truncation of Rewan Group.

their recognition depends largely on the quality of the seismic sections. The sequence boundaries were recognised by stratal geometry (e.g., truncation, downlapping, overlapping), erosional features such as channels and erosional relief, separation of packages of reflections of different character and by other evidence of unconformities; their relationship to defined lithostratigraphic units was established in well ties and correlation with outcrop data. In most cases, the stratal terminations and other indicators of sequence boundaries are mostly very subtle and evidence for a sequence boundary is usually scattered over several lines.

Detailed isopach and structure contour maps have been generated to illustrate the

geometry of the mapped sequence boundaries and reflectors. This provides a better understanding of the distribution and geometry of the sedimentary packages, and their subsurface configuration.

ACKNOWLEDGEMENTS

This Record is a contribution to the National Geoscience Mapping Accord project Sedimentary Basins of Eastern Australia. We thank our colleagues in the project for their support. In particular, we are indebted to officers of the Geological Survey of Queensland for organising copies of the industry seismic sections and for the provision of data from QPED (Queensland Petroleum Exploration Database). We also wish to thank Santos Ltd (through Lindsay Elliott) and MIM Holdings Limited (through Dr R.A. Brotherton) for access to recently acquired seismic data prior to the data becoming open file. We thank Clinton Foster and Phil. O'Brien for their very useful comments on the manuscript.

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APPENDIX 1. List of maps available through AGSO Sale Centre

22 MAPS AVAILABLE IN 2 FORMATS:

A. 1:500 000 black & white contour maps
B. Appproximately 1:1.23 million (A3 size) maps of colour-fill grid

Map No.	Description
1	Bowen and Surat Basins north of 26°S: seismic line location map (interpreted lines only)

Structure Contour Maps (in two-way travel time; datum = 450 m)

2	B30/B31 reflector - base of Buffel/Cattle Creek Formations
3	B40 reflector - base of Aldebaran Sandstone
4	B45 reflector - intra-Aldebaran Sandstone unconformity
5	B50 reflector - base of Freitag Formation
6	B55/B56 reflector - base of Flat Top/Peawaddy Formations
7	B60/B61 reflector - base of Gyranda Formation/Black Alley Shale
8	B65 reflector - base of Baralaba Coal Measures/Bandanna Formation
9	B70 reflector - base of Rewan Group
10	B75 reflector - intra-Rewan group
11	B80 reflector - base of Clematis Group
12	B85 reflector - intra-Clematis Group/base of Showgrounds Sandstone
13	B90 reflector - base of Moolayember Formation
14	B95 reflector - intra-Moolayember Formation
15	S10 reflector - base of Precipice Sandstone

Isopach Maps (in two-way travel time; datum = 450 m)

16	B30/B31-B55/B56 interval - base of Buffel/Cattle Creek Formations to base of Flat Top/Peawaddy formations
17	B55/B56-B60/B61 interval - base of Flat Top/Peawaddy Formations to base of Gyranda Formation/Black Alley Shale
18	B60/B61-B65 interval - base of Gyranda Formation/Black Alley Shale to base of Baralaba Coal Measures/Bandanna Formation
19	B65-B70 interval - base of Baralaba Coal Measures/Bandanna Formation to base of Rewan Group
20	B70-B80 interval - base of Rewan Group to base of Clematis Group
21	B80-B90 interval - base of Clematis Group to base of Moolayember Formation
22	B90-S10 interval - base of Moolayember Formation to base of Precipice Sandstone (base of Surat Basin)

Appendix 2. Data from Petroseis available in digital format

Appendix 2 Data has been omitted from the hardcopy of Record 1993/51.

1. INTERPRETED SEISMIC DATA

Digital data for the Bowen and Surat basins north of 26°S includes seismic line location and shot point data for all interpreted lines plus horizon (reflector) data for all horizons interpreted in the seismic sections. The digital data can be exported in the following formats:

- Petroseis^{TM} dump file, which can be imported into any Petroseis system.
- UKOOA or other fixed format ASCII dump file.
- Data can be formatted for systems such as LANDMARK and GEOQUEST.

2. DIGITAL CONTOUR MAP DATA

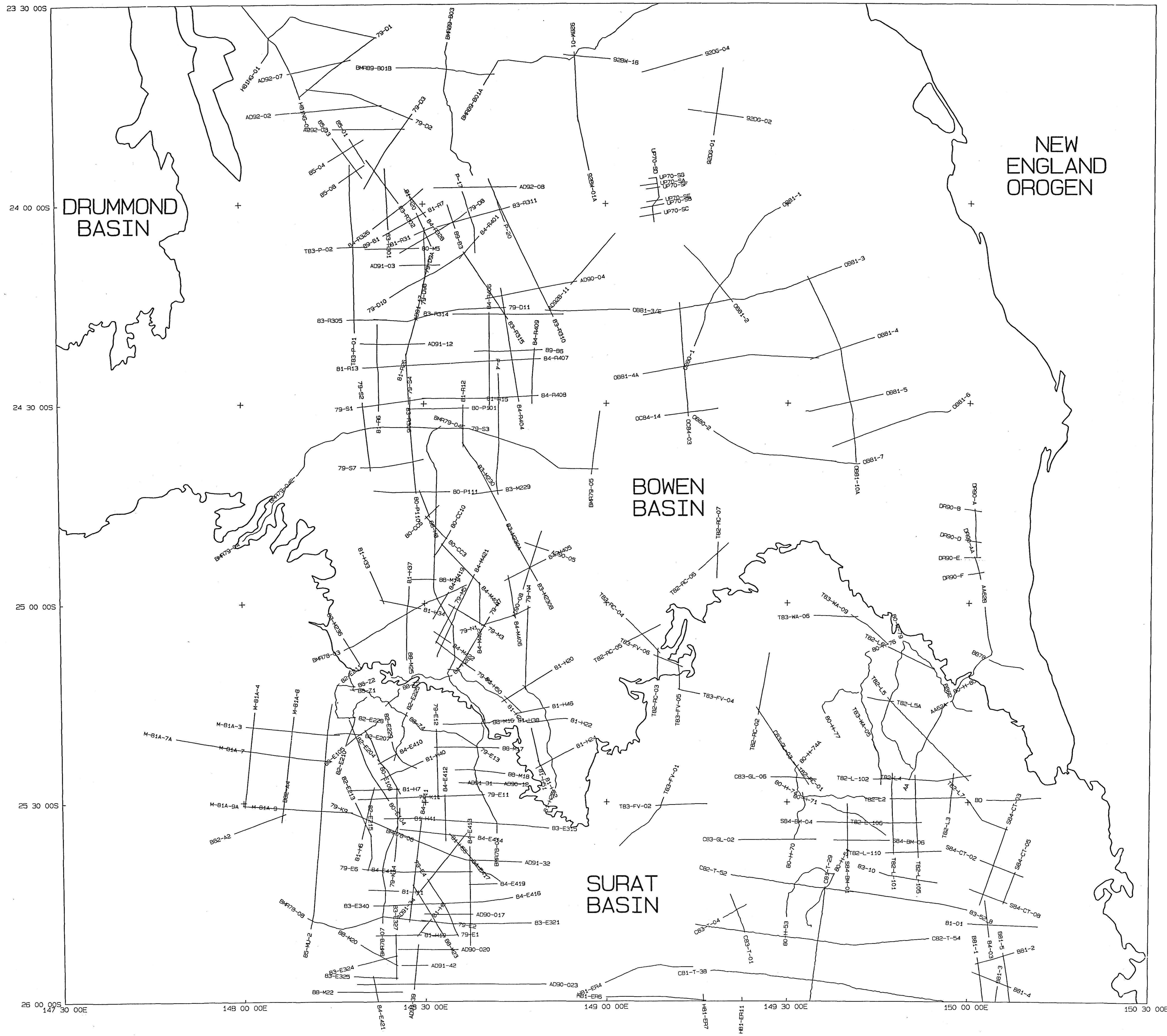
The 1:2.3 million colour-fill grid maps are available as digital files in formats such as HPGL, EPS or Petroseis PIC.

Further information on the digital data in terms of formats, release conditions and costs can be obtained from:

AGSO Sales Centre
Australian Geological Survey Organisation
GPO Box 378
CANBERRA ACT 2601
PH (06) 249 9519 *FAX* (06) 249 9982

BOWEN BASIN NORTH OF 26°S, QUEENSLAND

1. SEISMIC LINE LOCATION MAP (INTERPRETED LINES ONLY)



AUSTRALIA

AGSO
AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

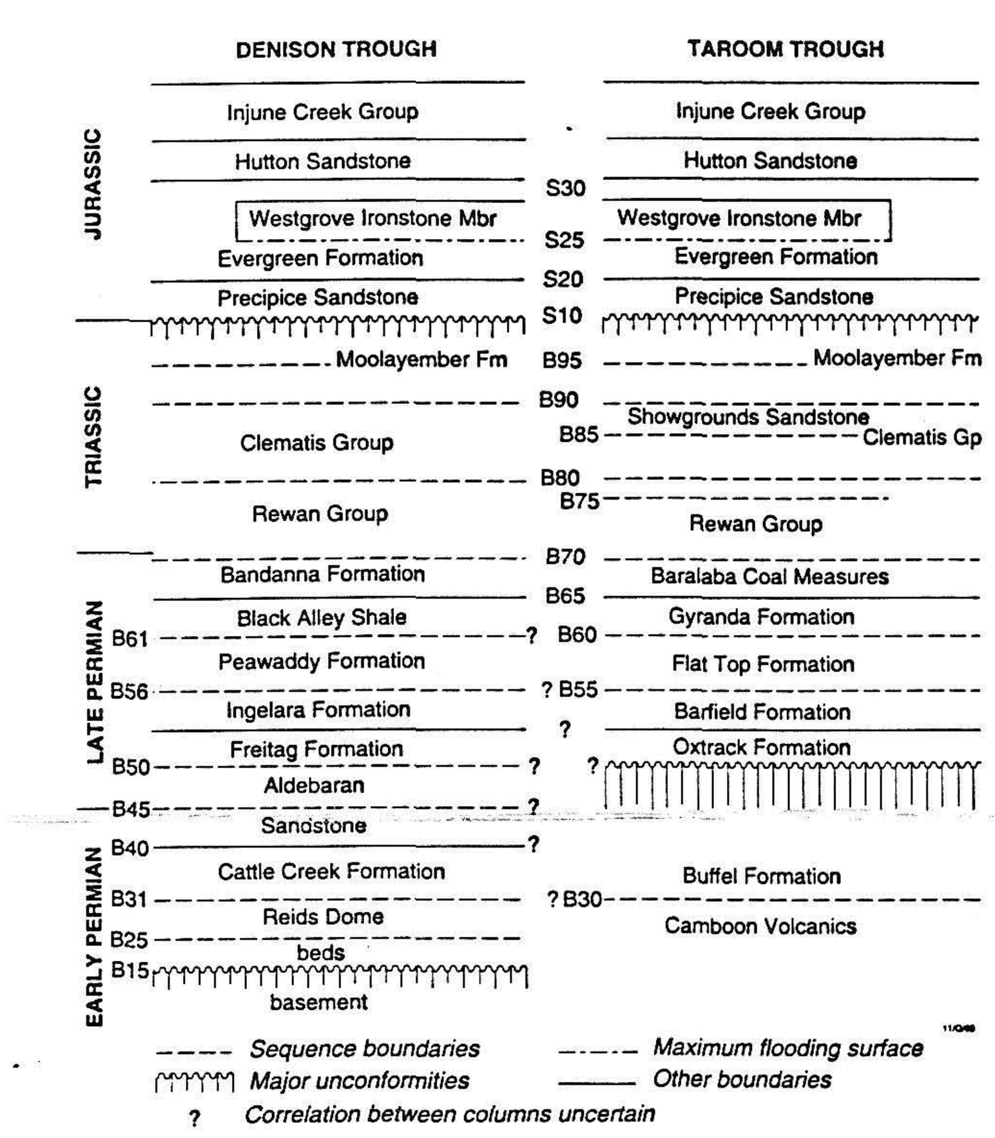
1:500 000

0 10 20 30 40 50

KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

81-H20 Seismic line with line name



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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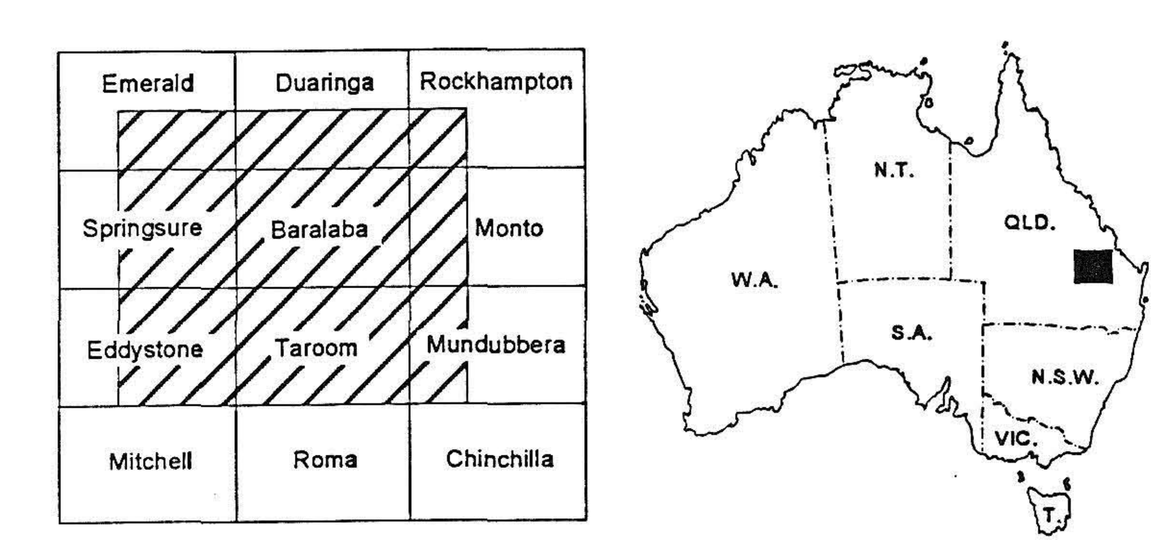

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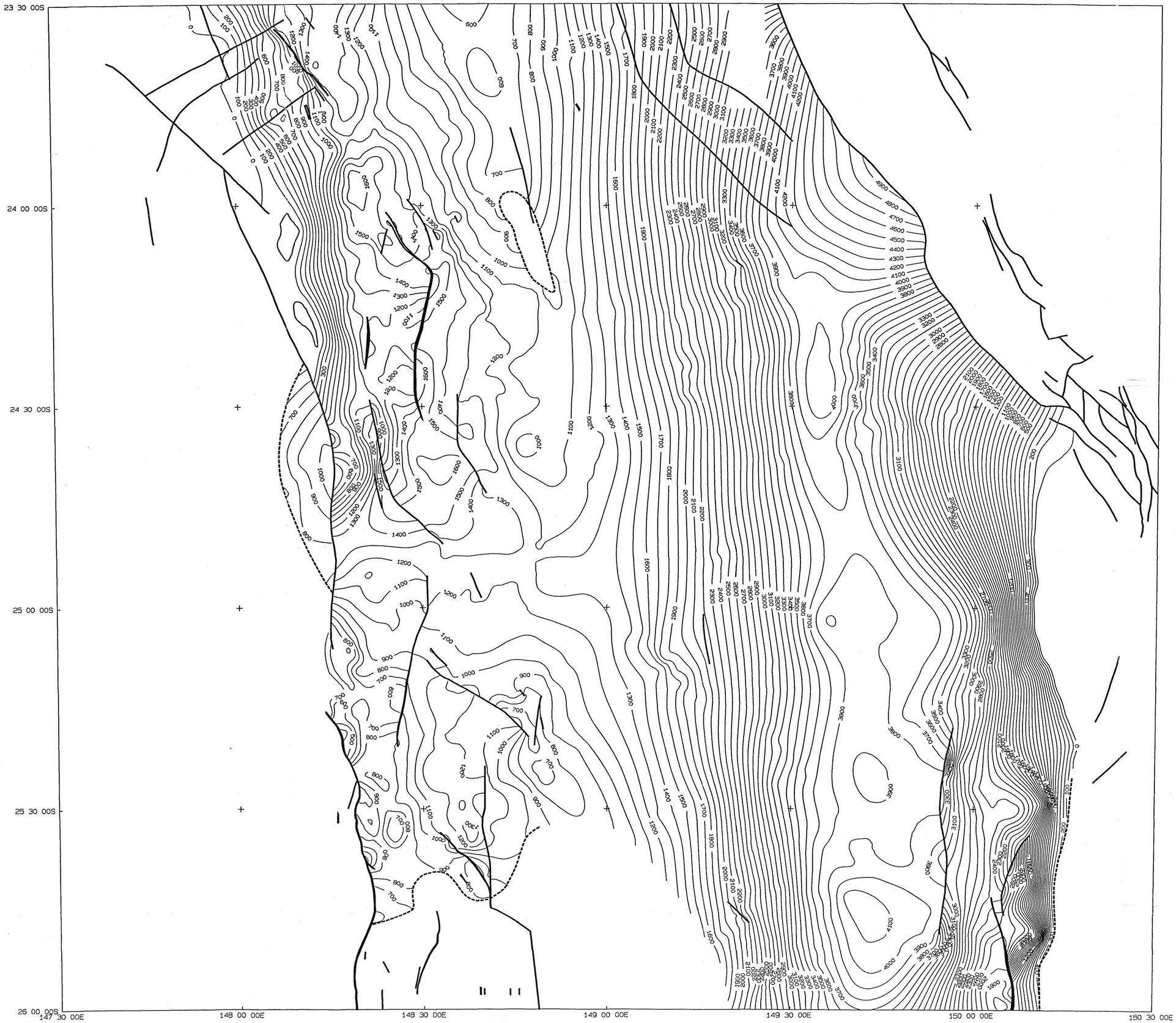
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

2. STRUCTURE CONTOUR MAP OF B30/B31 REFLECTOR IN TWO-WAY TIME (BASE OF BUFFEL/CATTLE CREEK FORMATIONS)



AUSTRALIA

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

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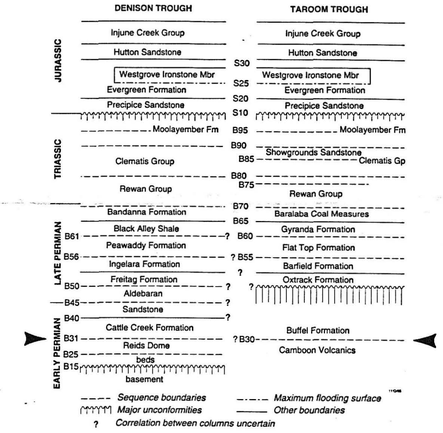
0 10 20 30 40 50
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



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Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

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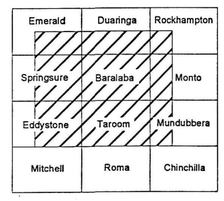
PH (06) 249 9519 *FAX* (06) 249 9982



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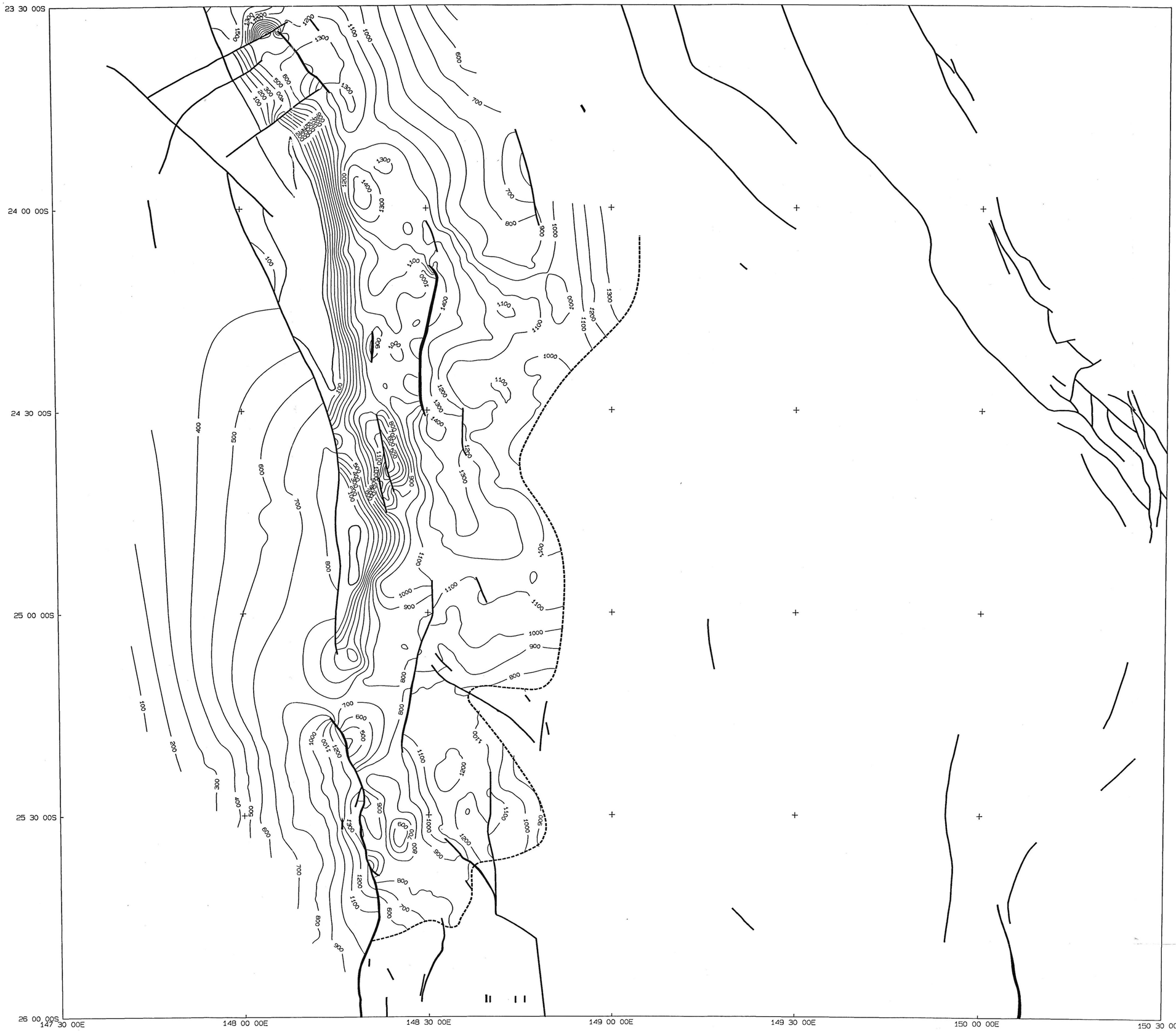
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

3. STRUCTURE CONTOUR MAP OF B40 REFLECTOR IN TWO-WAY TIME (BASE OF ALDEBARAN SANDSTONE)



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1:500 000

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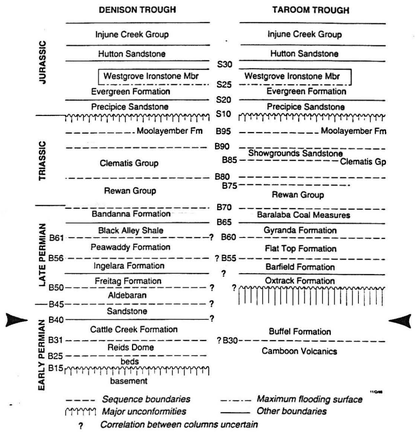
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



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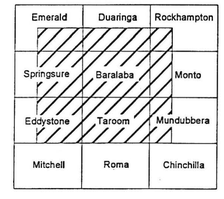

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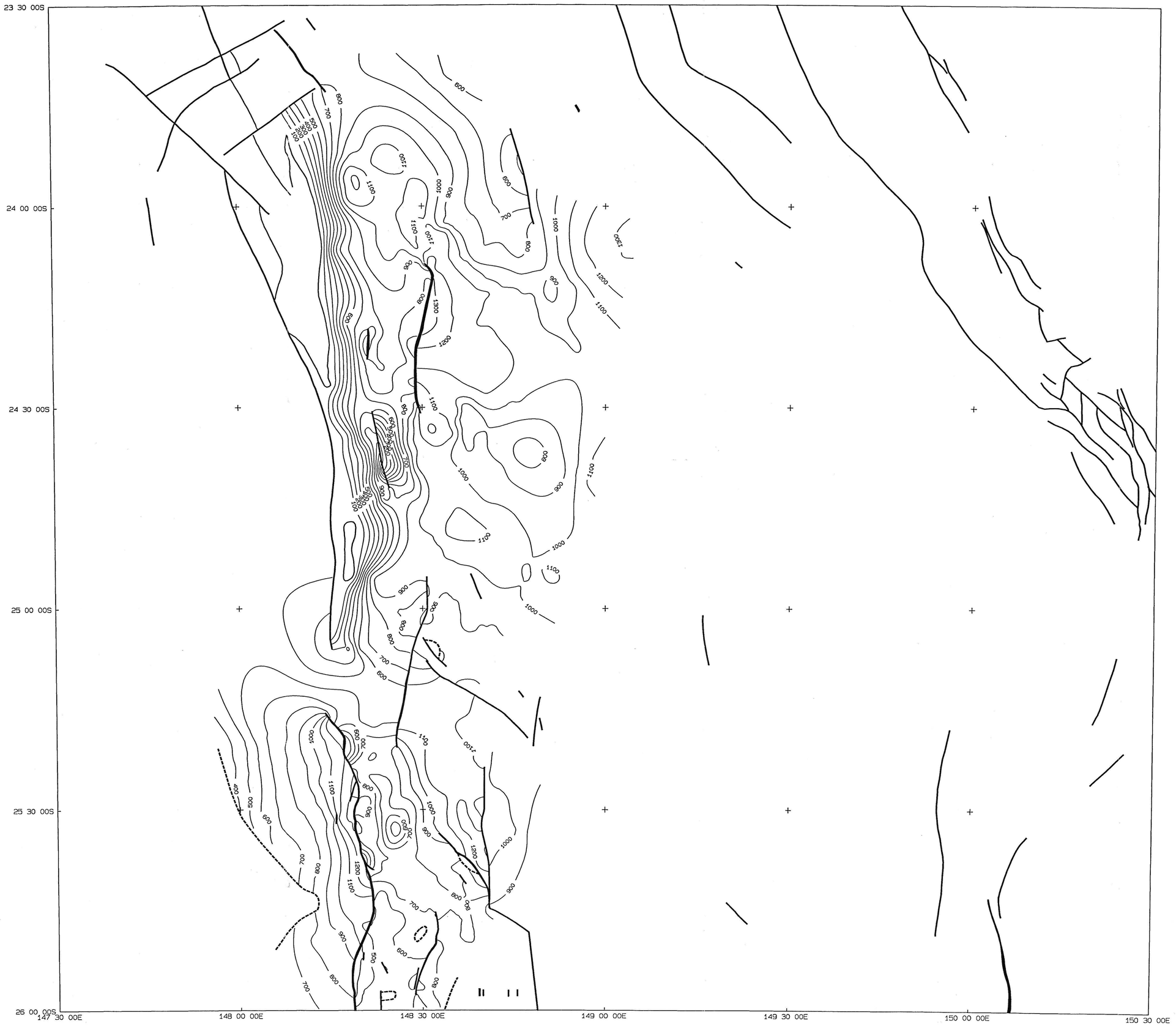
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

4. STRUCTURE CONTOUR MAP OF B45 REFLECTOR IN TWO-WAY TIME (INTRA-ALDEBARAN SANDSTONE UNCONFORMITY)



AUSTRALIA

AGSO
AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1:500 000

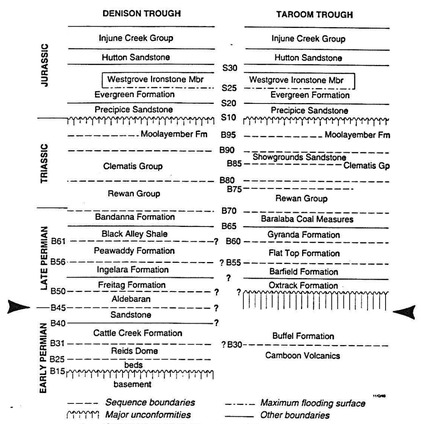
0 10 20 30 40 50
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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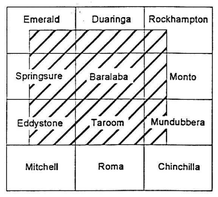

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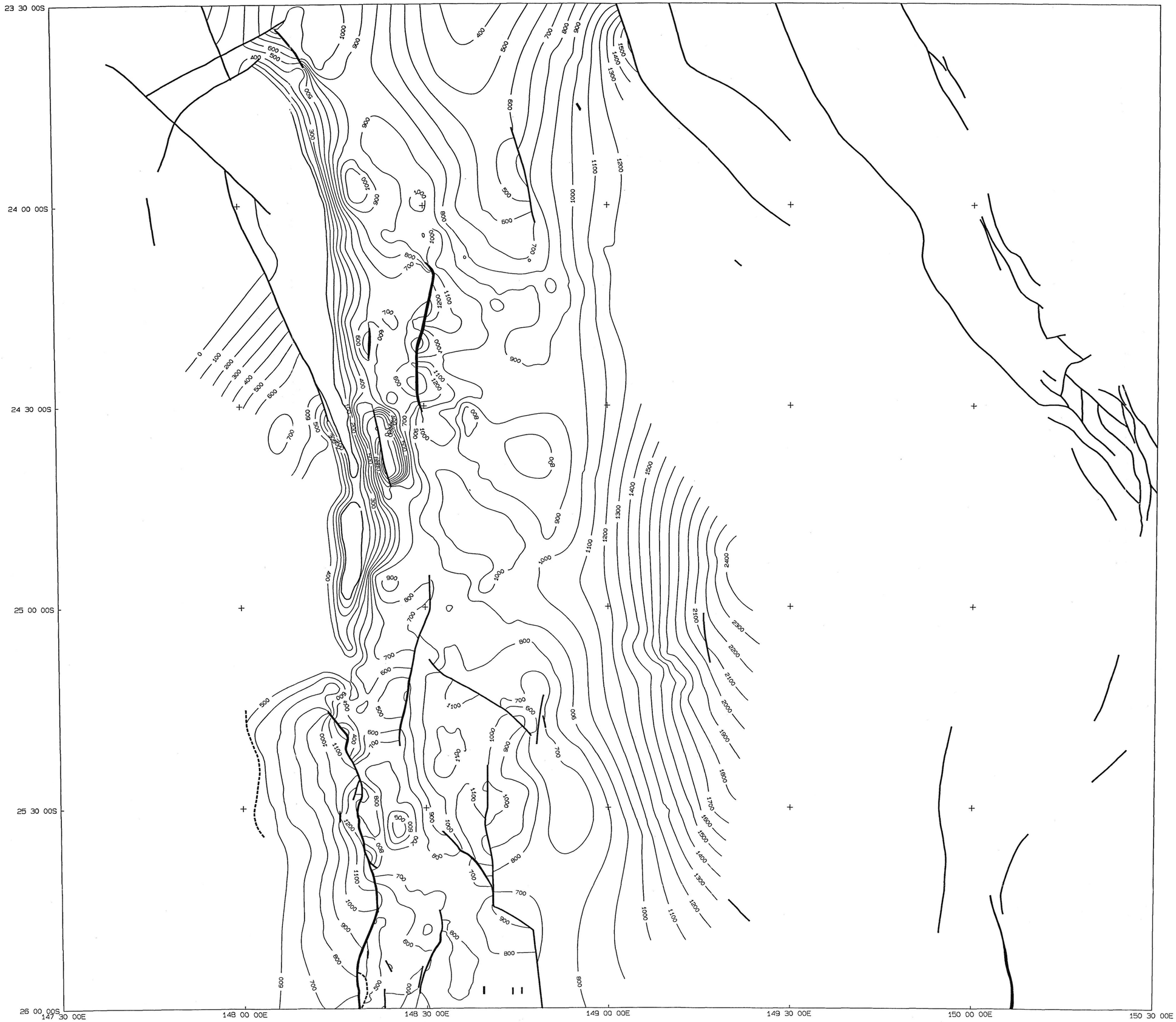
5. STRUCTURE CONTOUR MAP OF B50 REFLECTOR IN TWO-WAY TIME (BASE OF FREITAG FORMATION)



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1:500 000

0 10 20 30 40 50

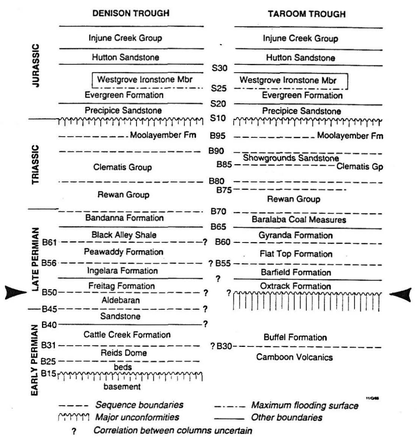
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
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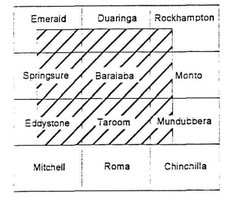

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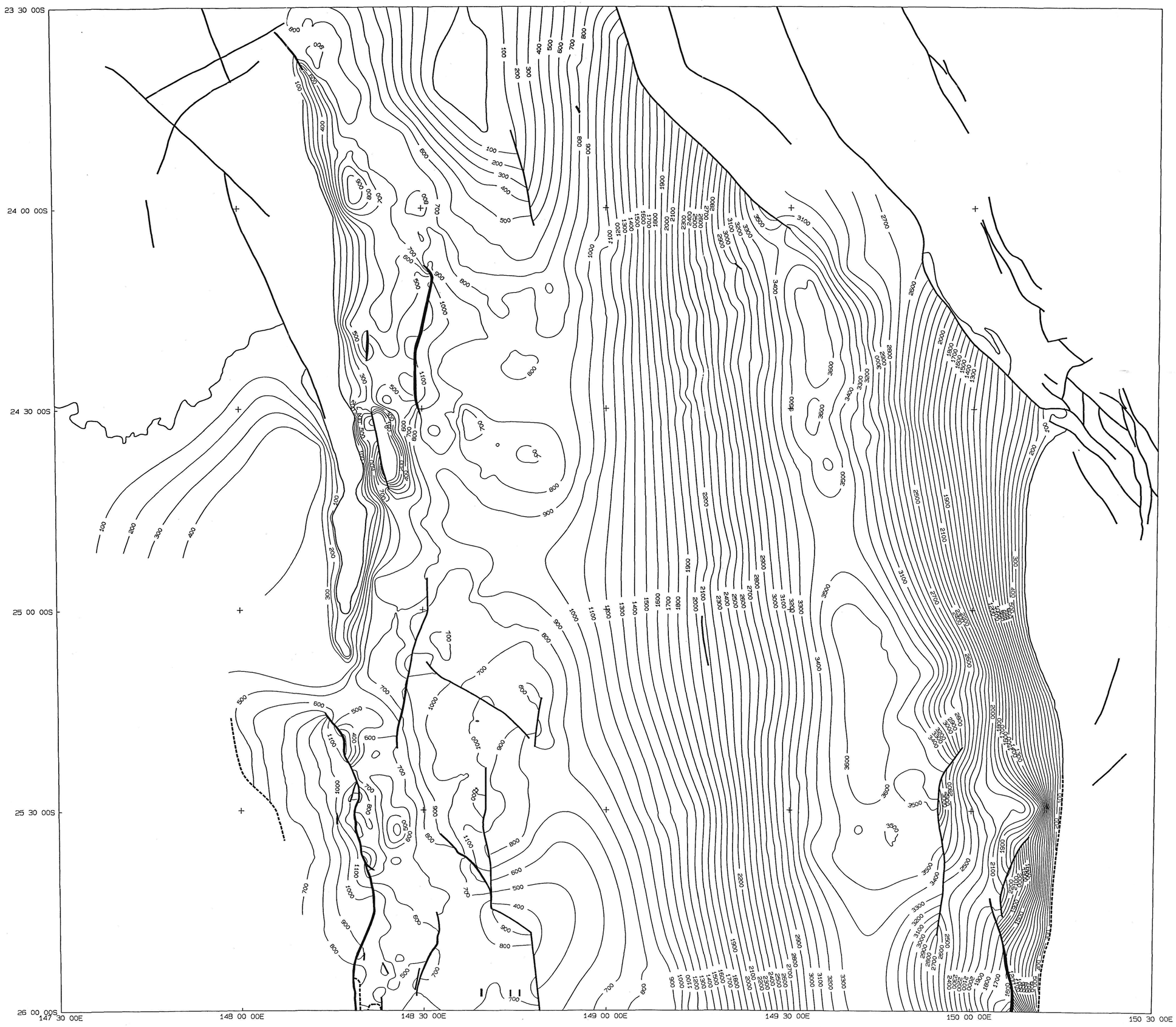
6. STRUCTURE CONTOUR MAP OF B55/B56 REFLECTOR IN TWO-WAY TIME (BASE OF FLAT TOP/PEAWADDY FORMATIONS)



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1:500 000

0 10 20 30 40 50

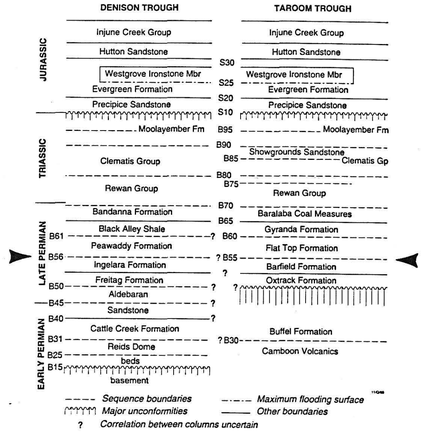
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
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Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
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Map plotted: June 1994

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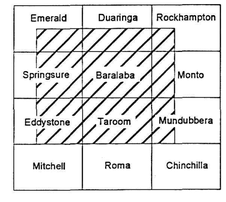

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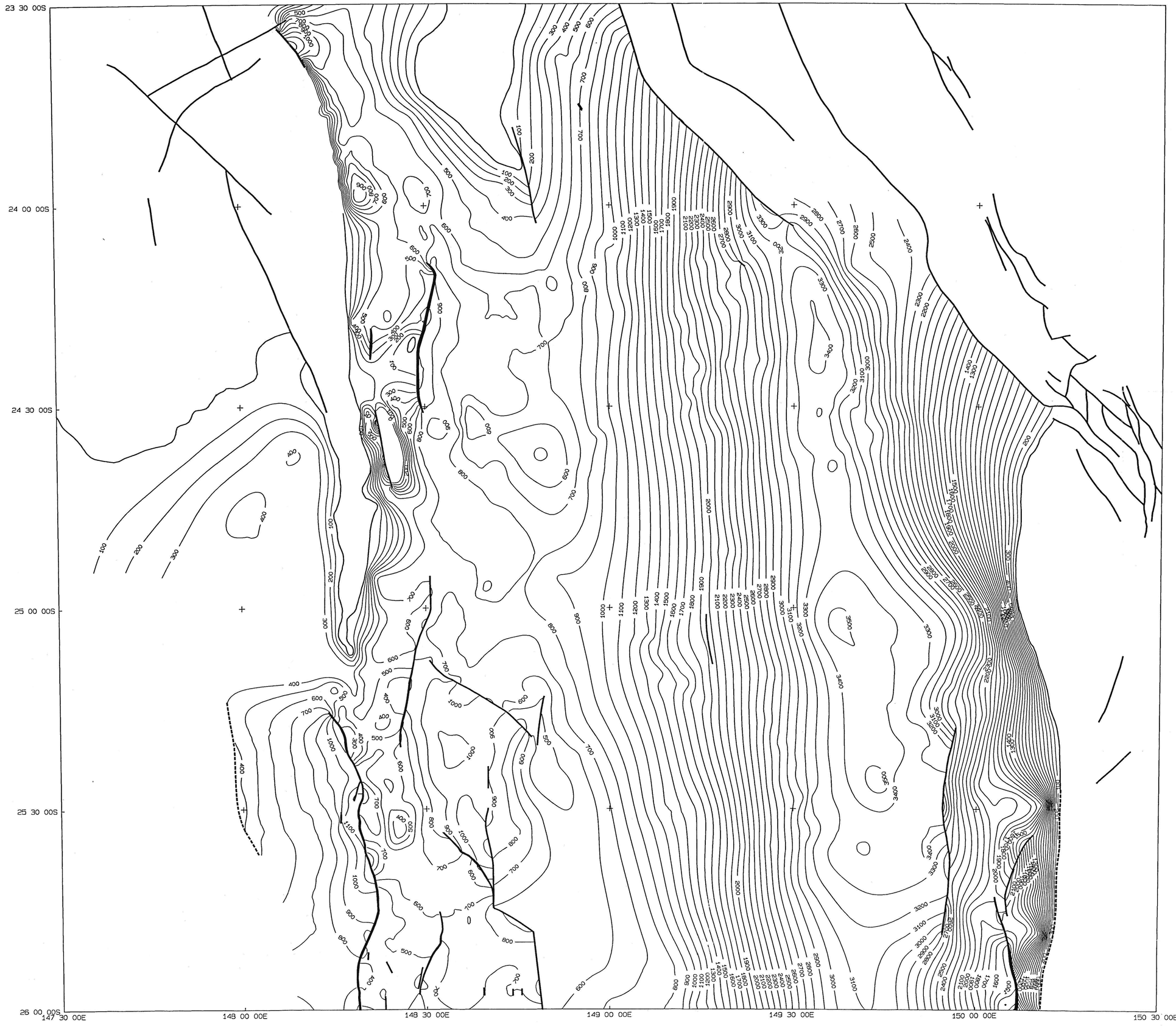
7. STRUCTURE CONTOUR MAP OF B60/B61 REFLECTOR IN TWO-WAY TIME (BASE OF GYRANDA FORMATION/BLACK ALLEY SHALE)



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1:500 000

0 10 20 30 40 50

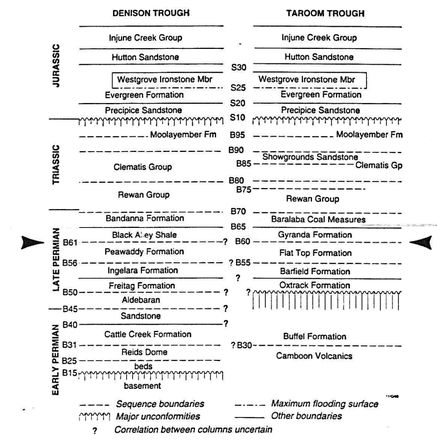
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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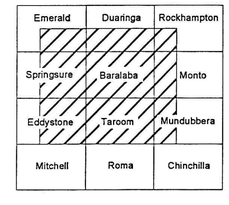

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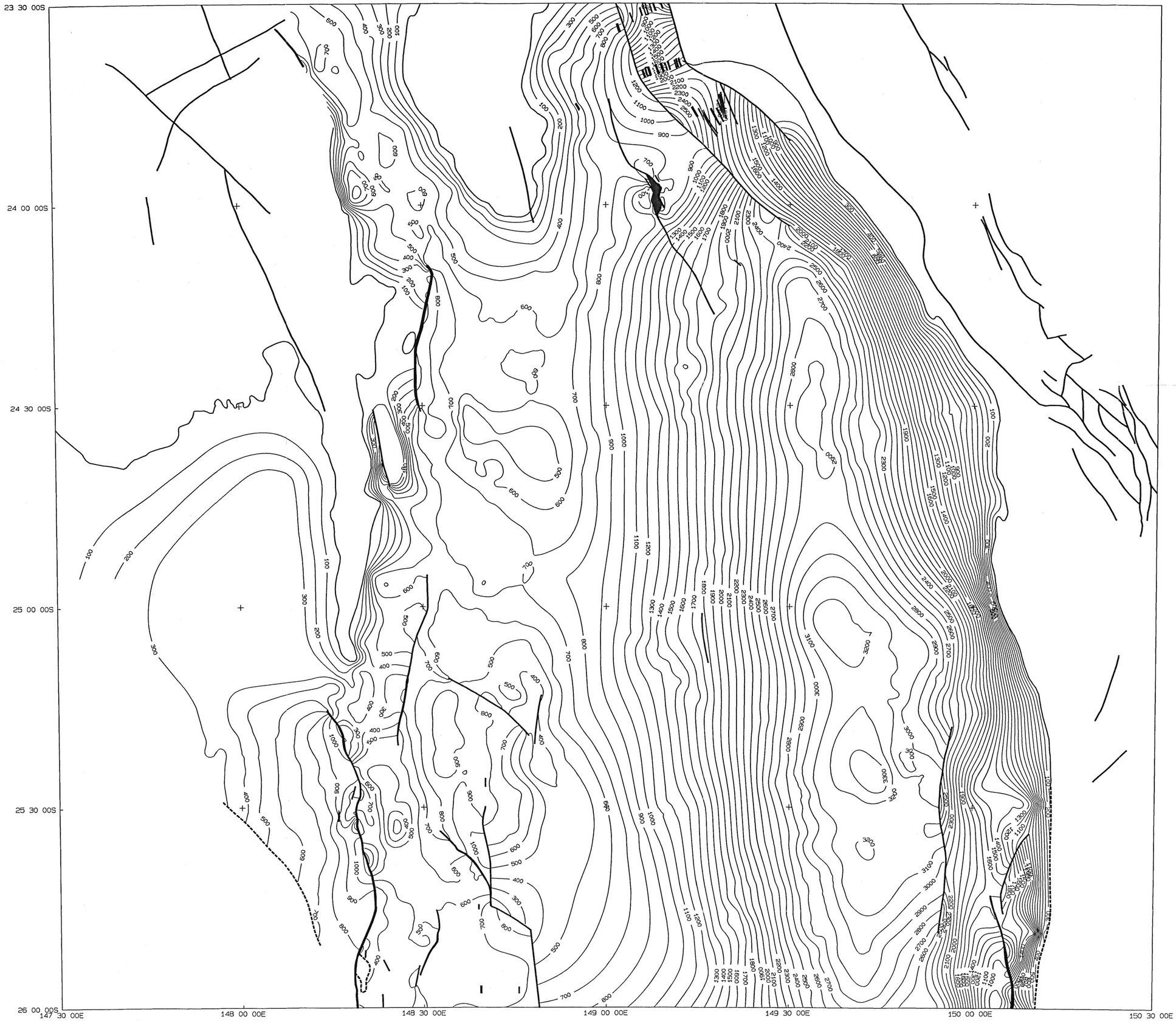
8. STRUCTURE CONTOUR MAP OF B65 REFLECTOR IN TWO-WAY TIME (BASE OF BARALABA COAL MEASURES/BANDANNA FORMATION)



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1:500 000

0 10 20 30 40 50

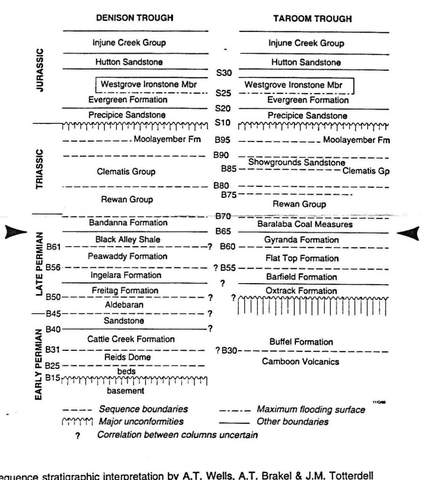
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petrosеis™ software
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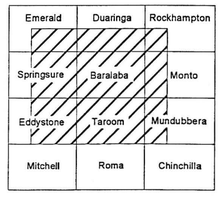

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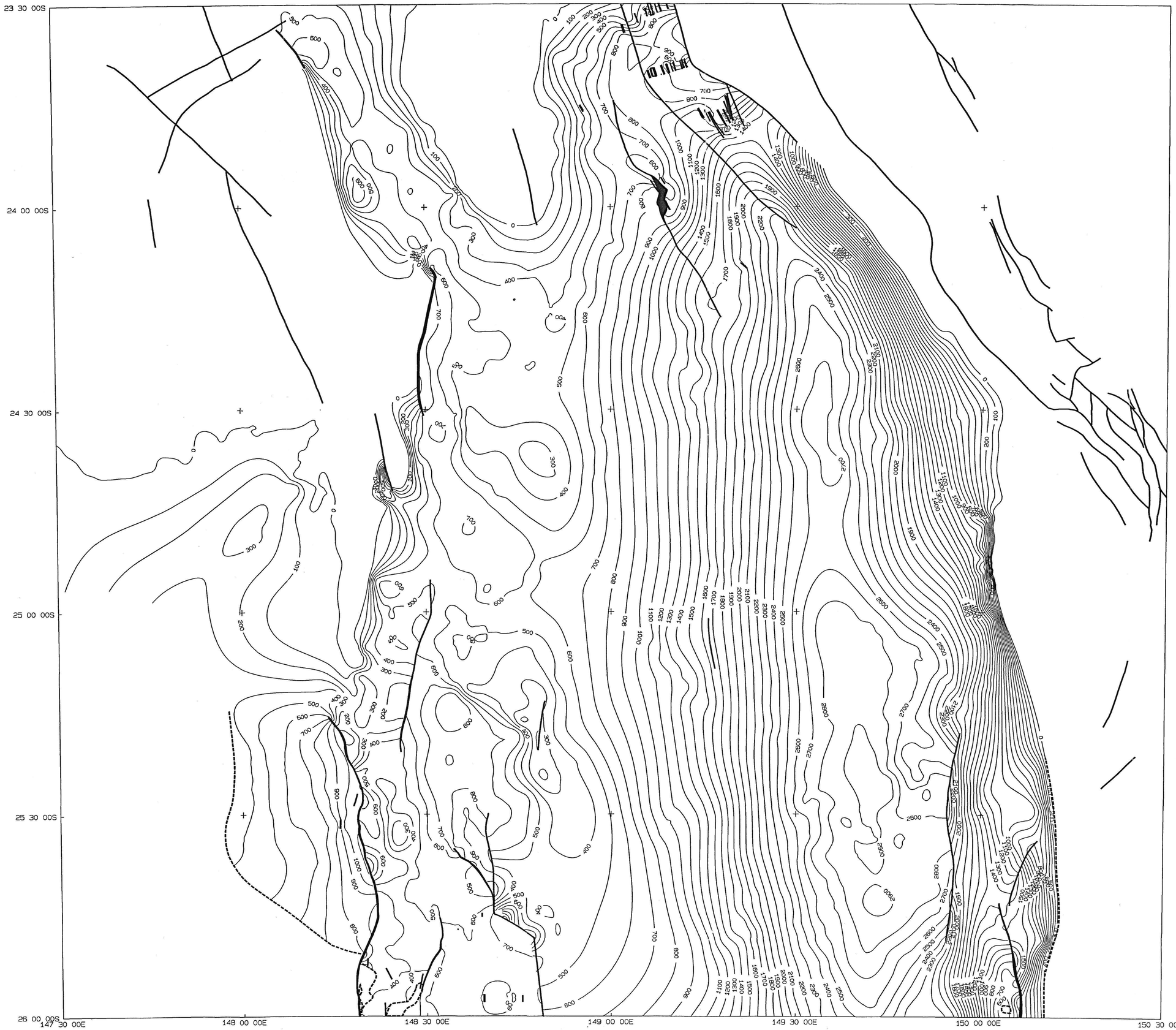
9. STRUCTURE CONTOUR MAP OF B70 REFLECTOR IN TWO-WAY TIME (BASE OF REWAN GROUP)



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0 10 20 30 40 50

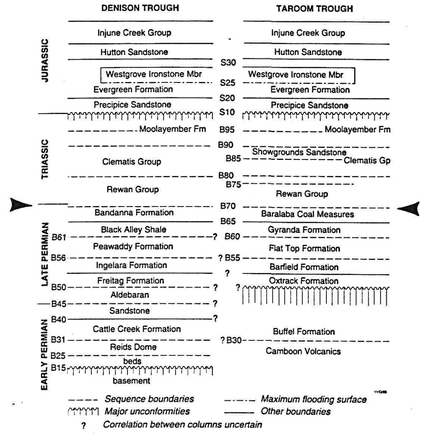
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
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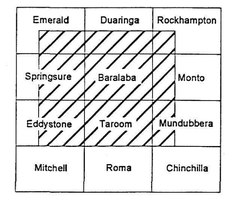

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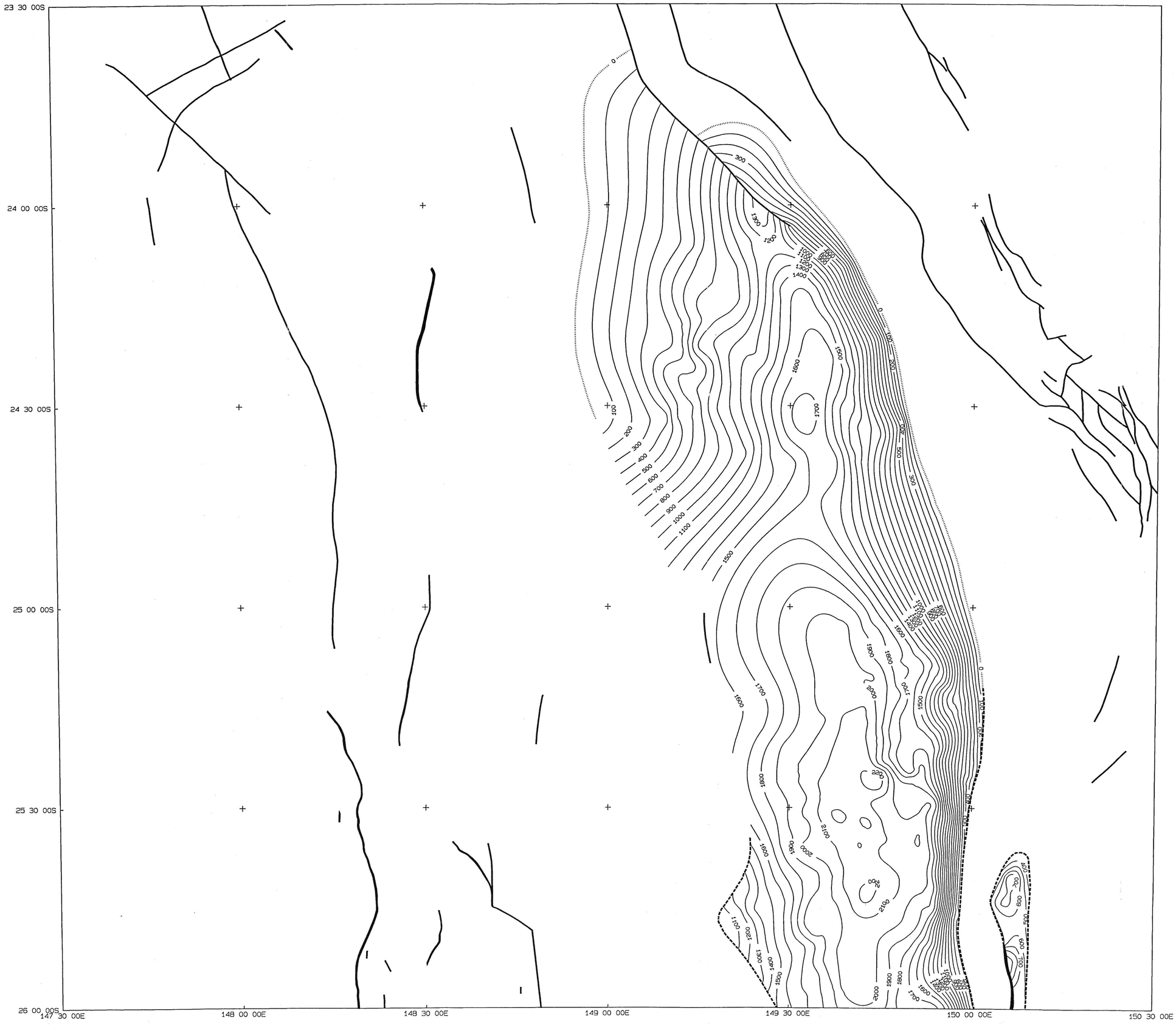
10. STRUCTURE CONTOUR MAP OF B75 REFLECTOR IN TWO-WAY TIME (INTRA-REWAN GROUP)



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1:500 000

0 10 20 30 40 50

KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
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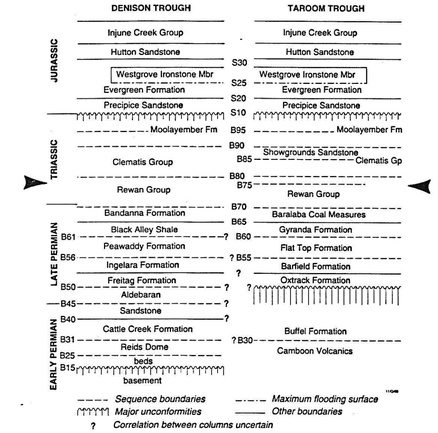
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
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Map plotted: June 1994

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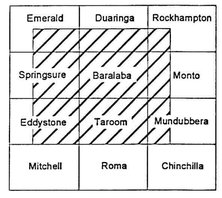

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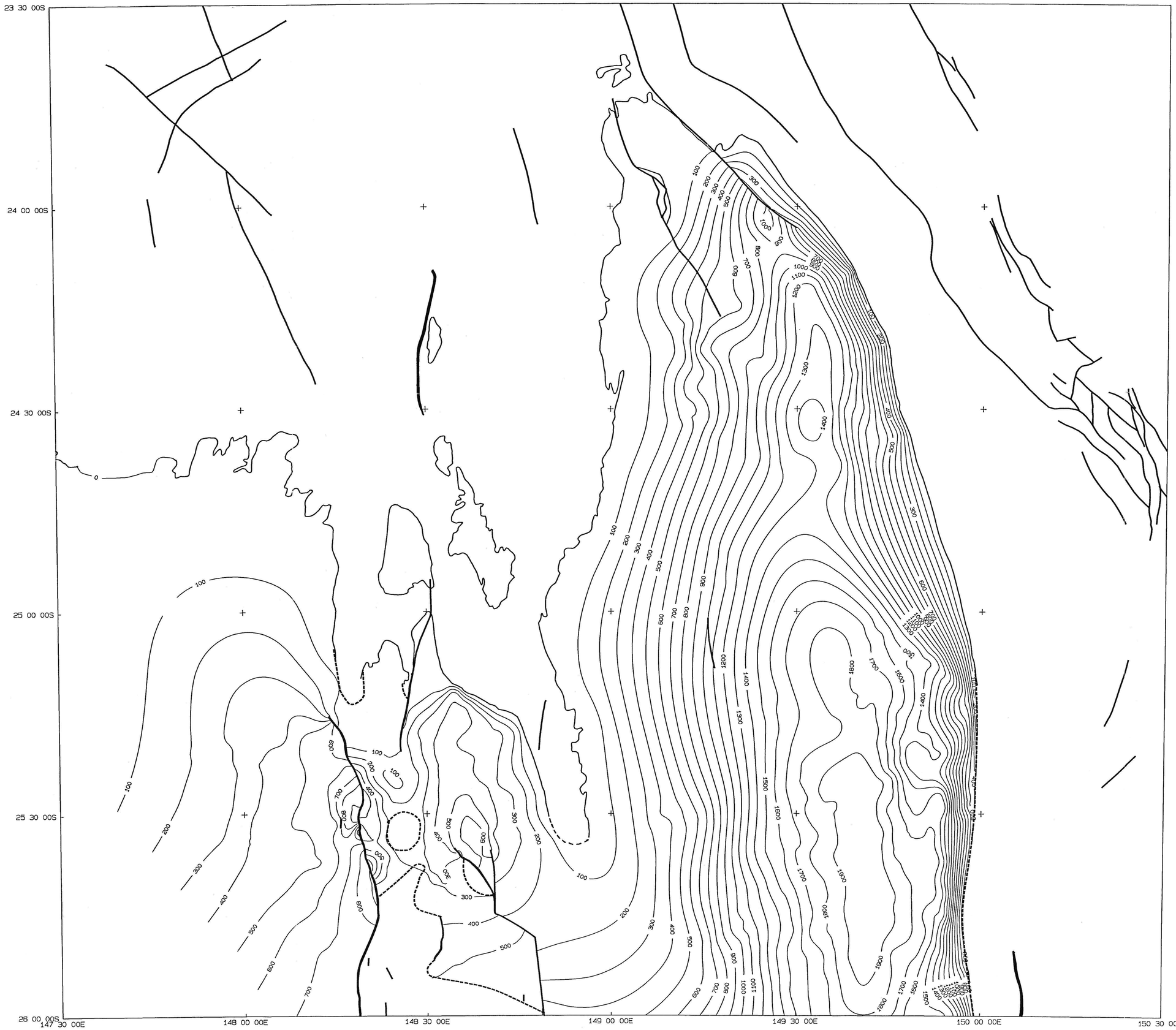
11. STRUCTURE CONTOUR MAP OF B80 REFLECTOR IN TWO-WAY TIME (BASE OF CLEMATIS GROUP)



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1:500 000

0 10 20 30 40 50

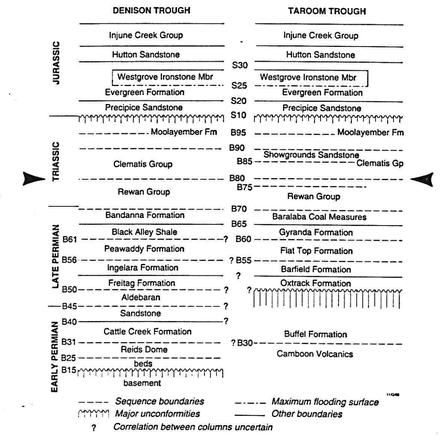
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
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Map plotted: June 1994

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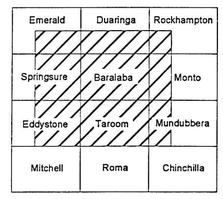

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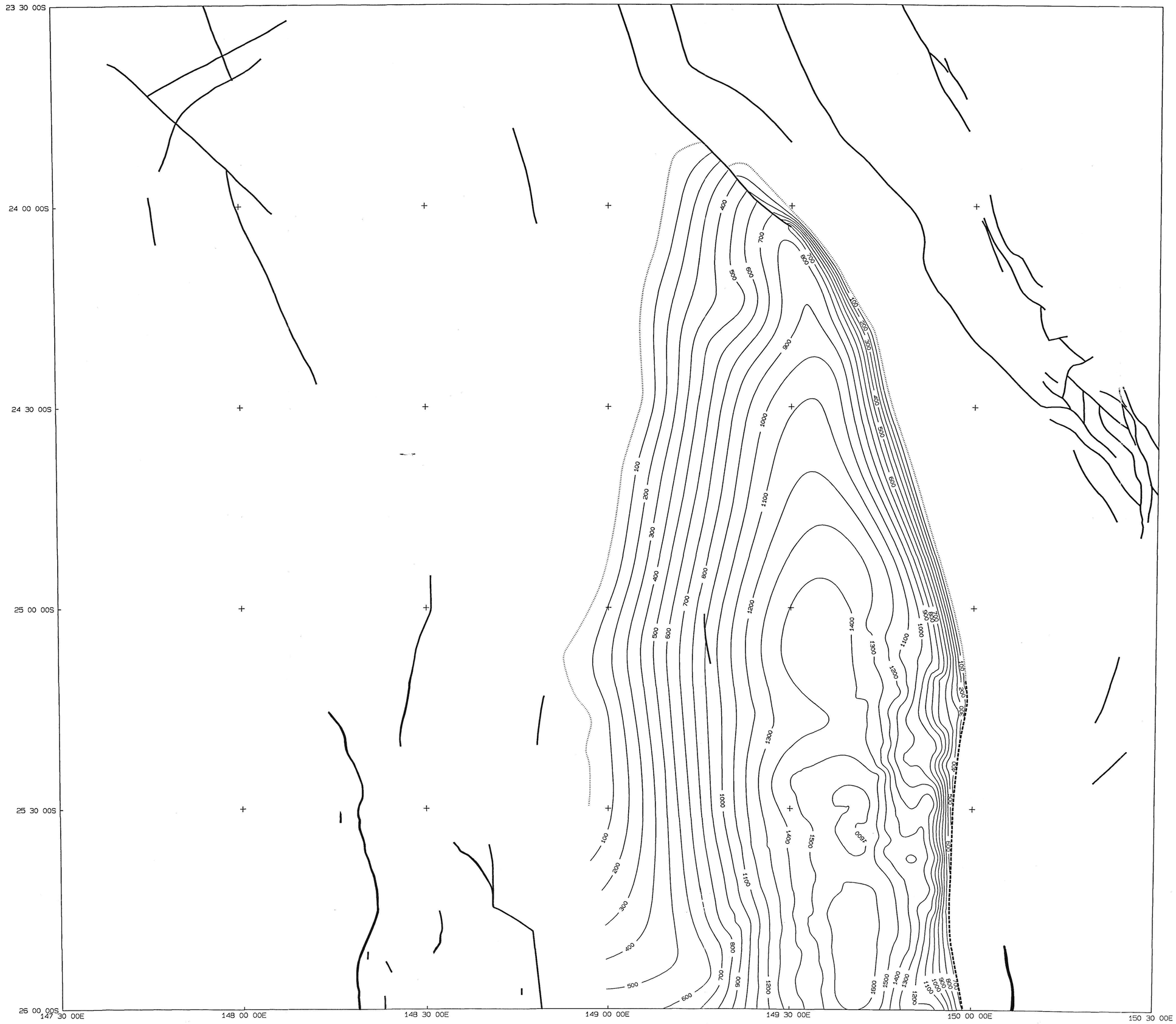
12. STRUCTURE CONTOUR MAP OF B85 REFLECTOR IN TWO-WAY TIME (INTRA-CLEMATIS GROUP/BASE OF SHOWGROUNDS SANDSTONE)



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1:500 000

0 10 20 30 40 50

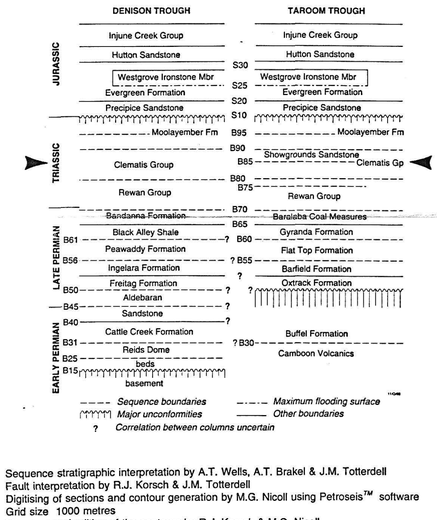
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
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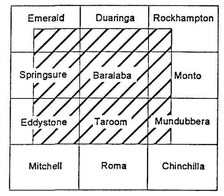

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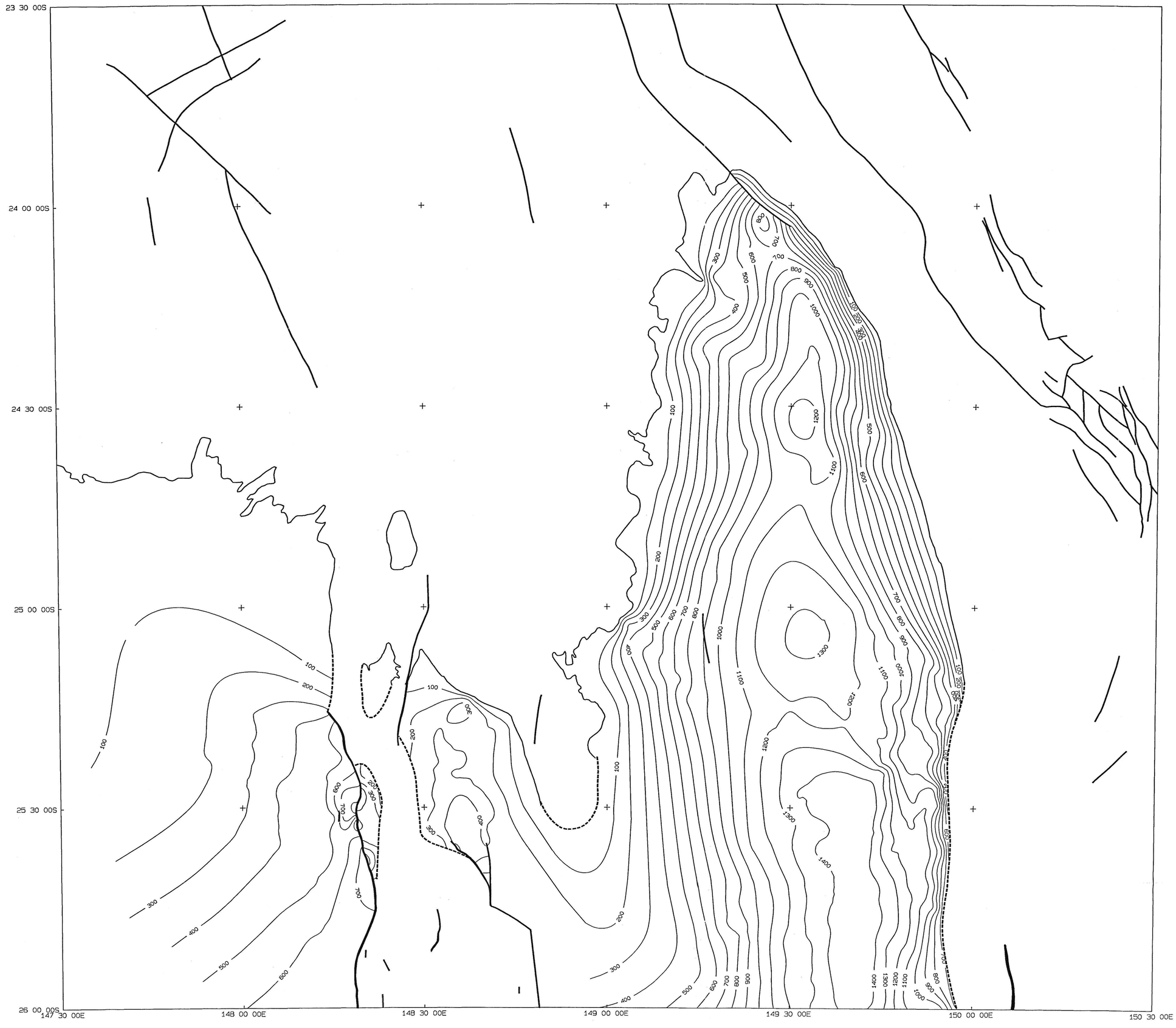
13. STRUCTURE CONTOUR MAP OF B90 REFLECTOR IN TWO-WAY TIME (BASE OF MOOLAYEMBER FORMATION)



AUSTRALIA

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1:500 000

0 10 20 30 40 50

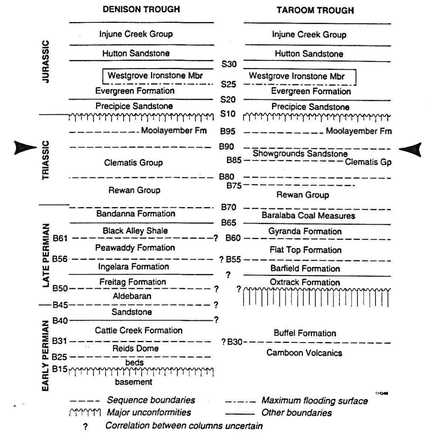
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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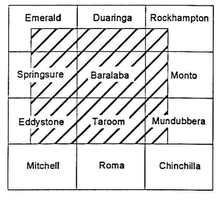

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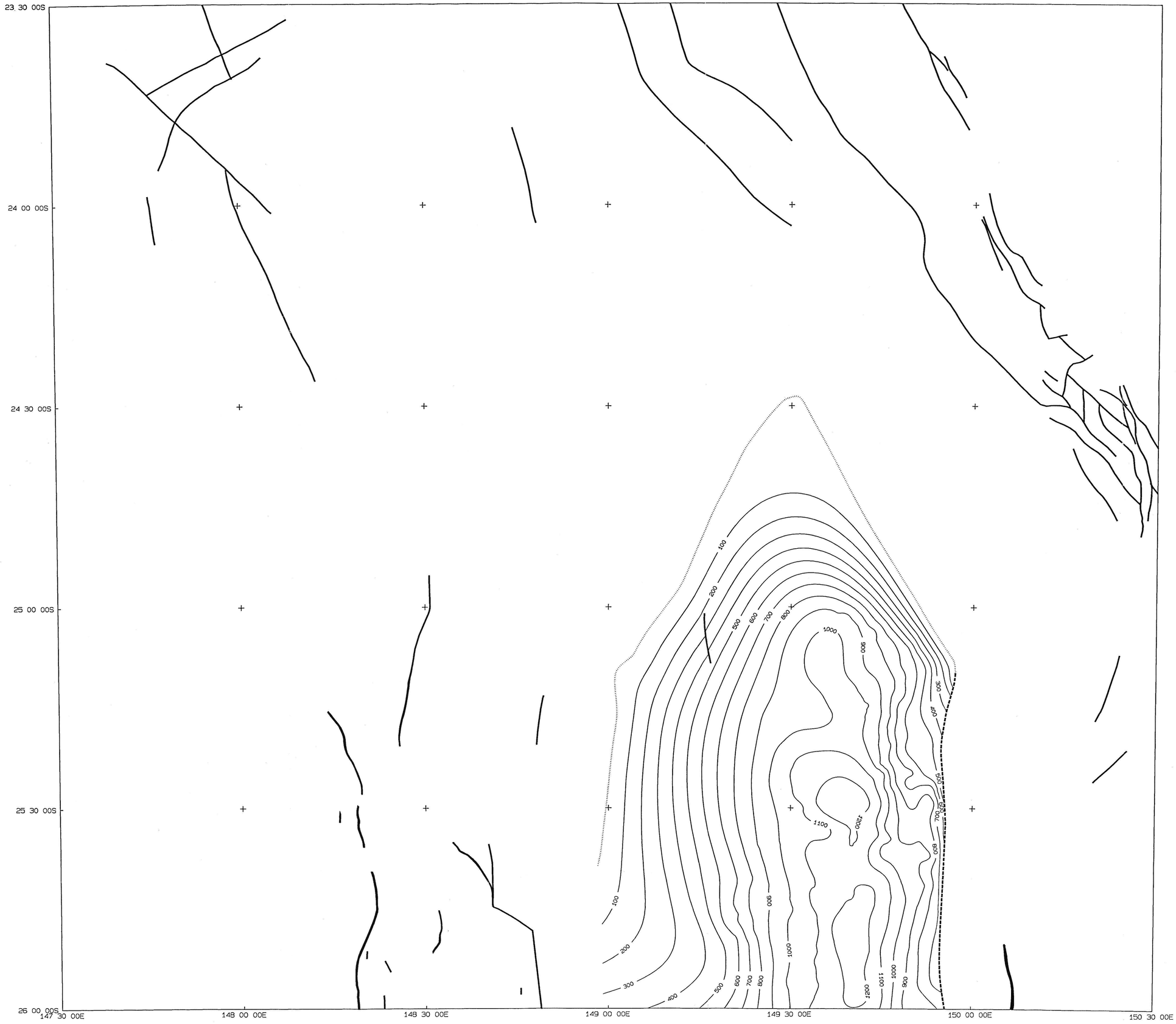
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

14. STRUCTURE CONTOUR MAP OF B95 REFLECTOR IN TWO-WAY TIME (INTRA-MOOLAYEMBER FORMATION)



AUSTRALIA

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1:500 000

0 10 20 30 40 50

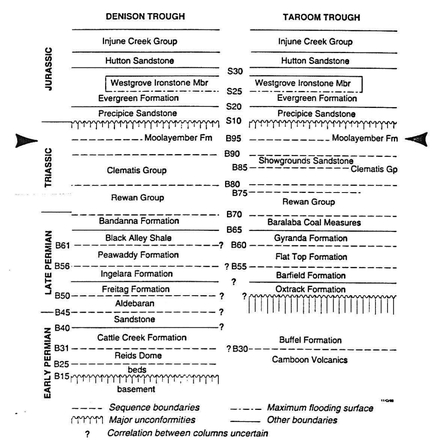
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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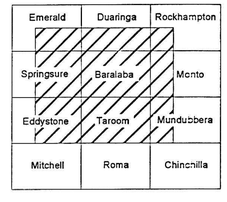

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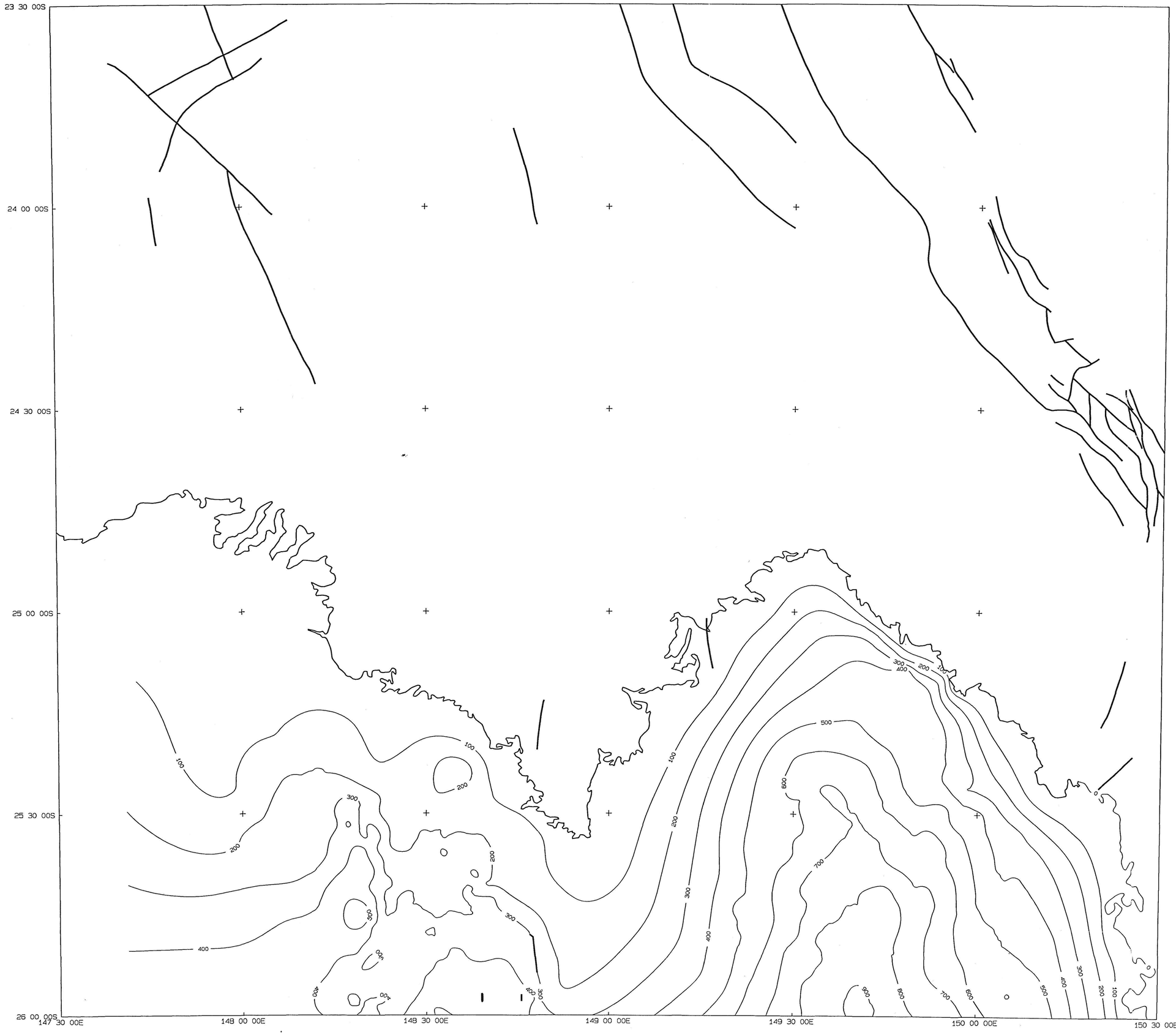
SURAT BASIN NORTH OF 26°S, QUEENSLAND

15. STRUCTURE CONTOUR MAP OF S10 REFLECTOR IN TWO-WAY TIME (BASE OF PRECIPICE SANDSTONE)



AUSTRALIA

AGSO
AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1:500 000

0 10 20 30 40 50

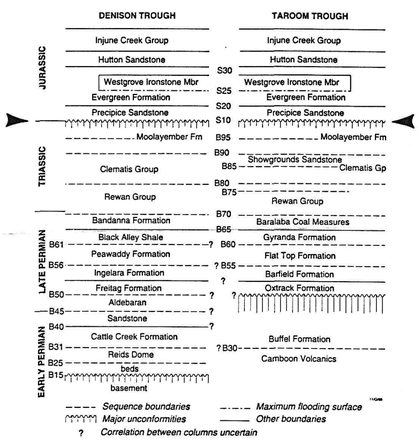
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

800 — Structure contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 1000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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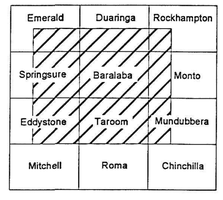

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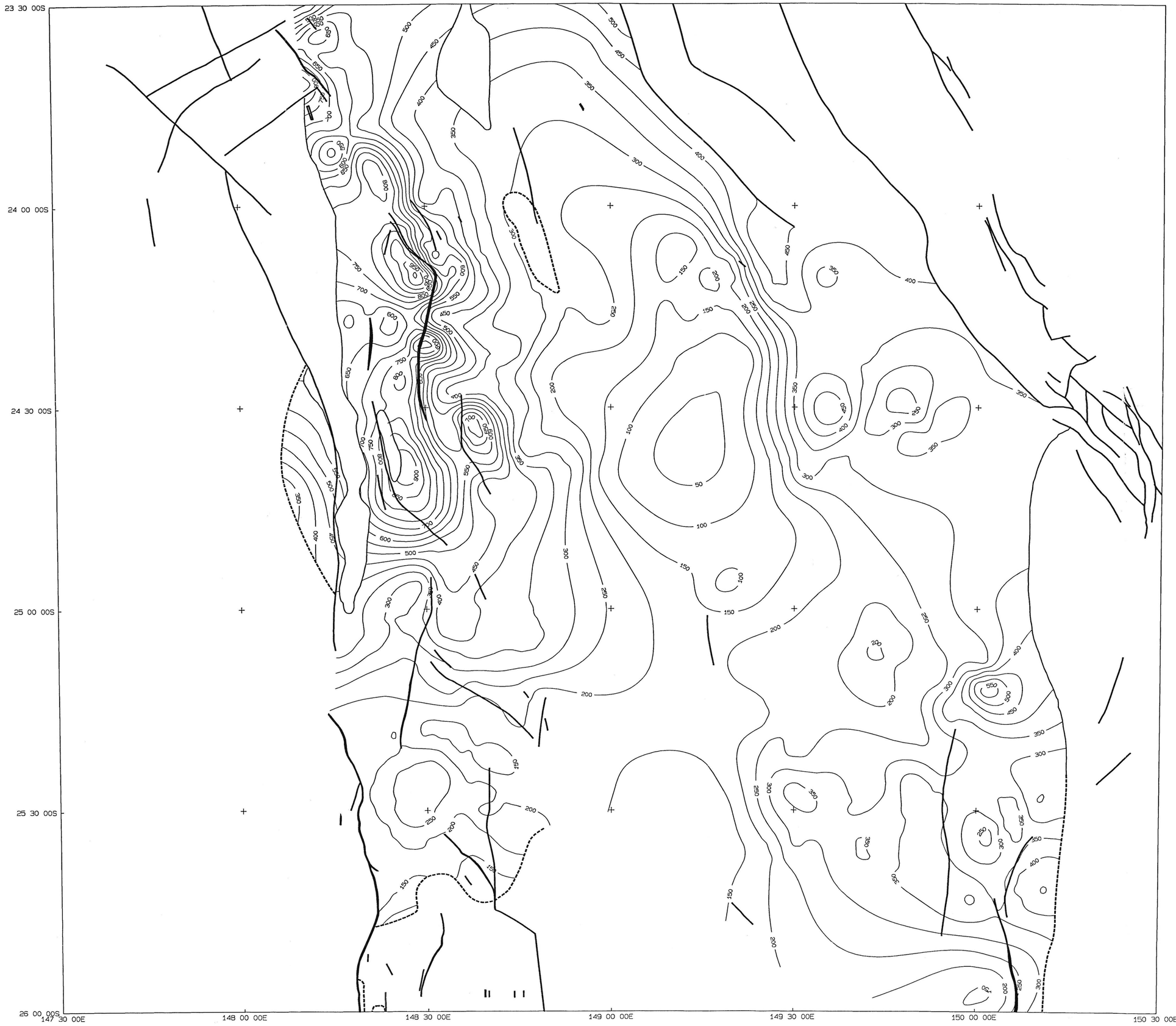
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

16. ISOPACH MAP OF B30/B31-B55/B56 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1:500 000

0 10 20 30 40 50

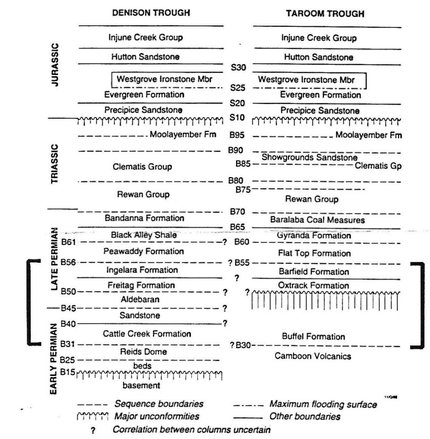
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 50 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 2500 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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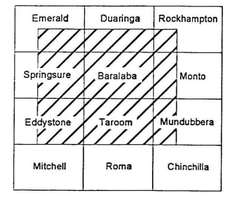

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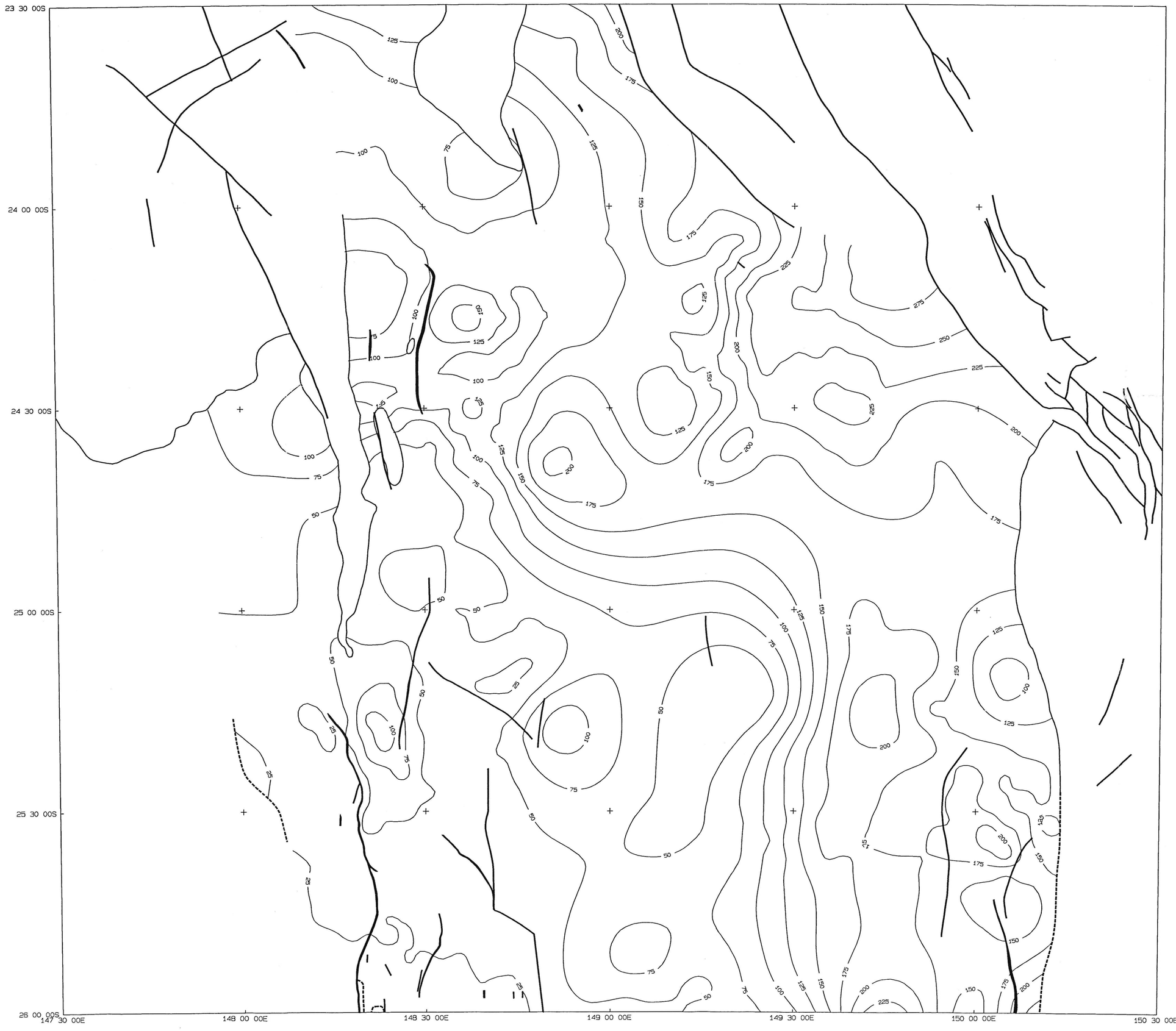
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

17. ISOPACH MAP OF B55/B56-B60/B61 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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1:500 000

0 10 20 30 40 50

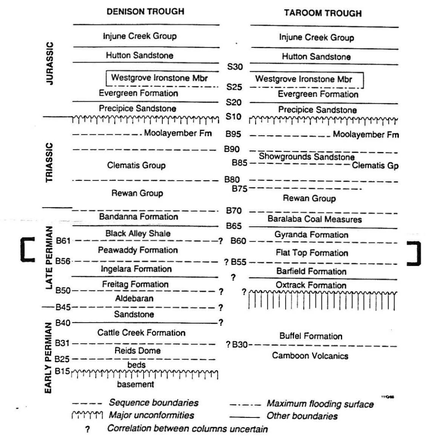
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 25 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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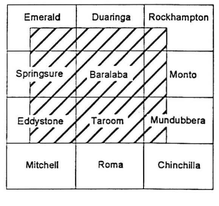

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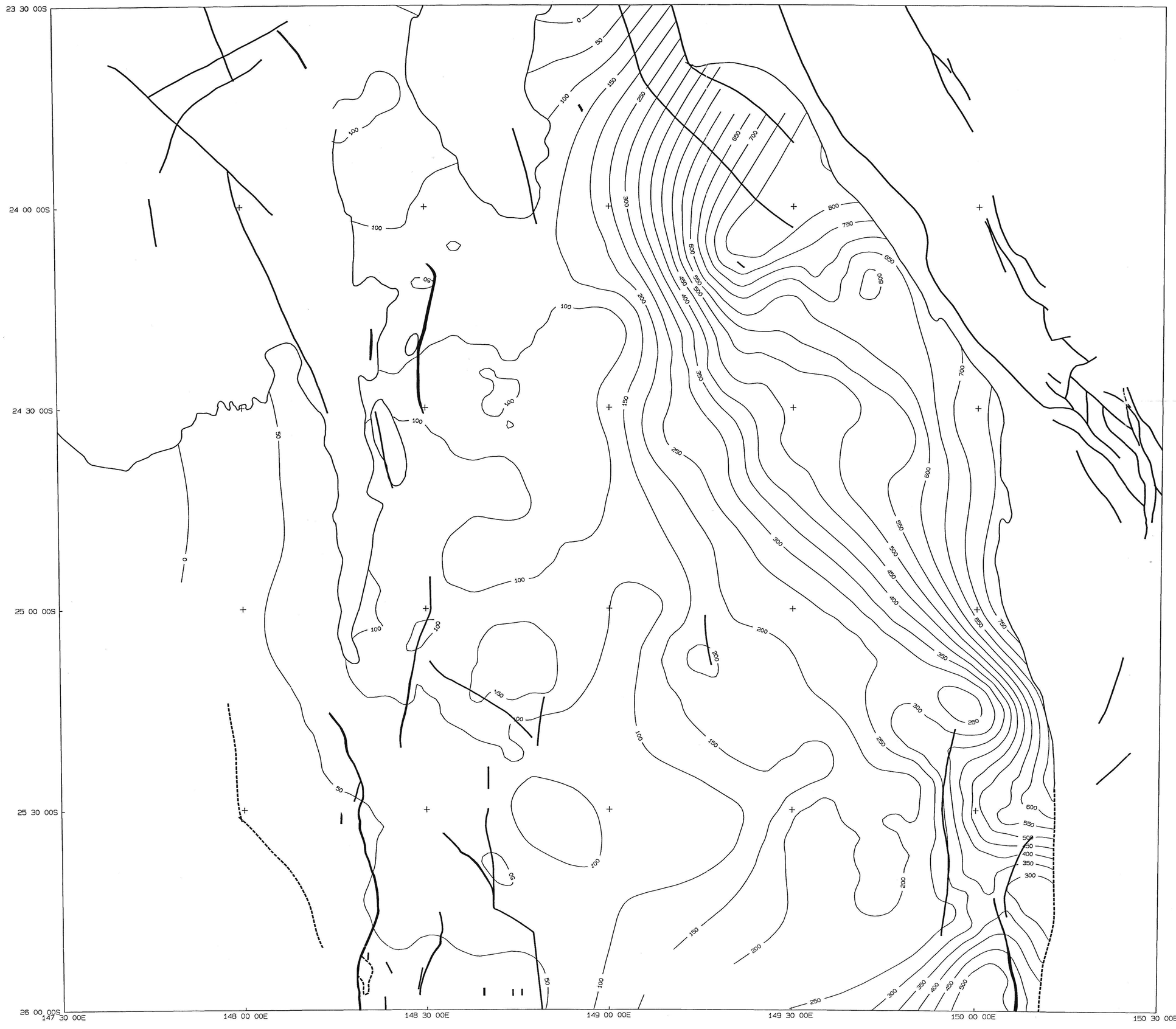
18. ISOPACH MAP OF B60/B61-B65 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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1:500 000

0 10 20 30 40 50

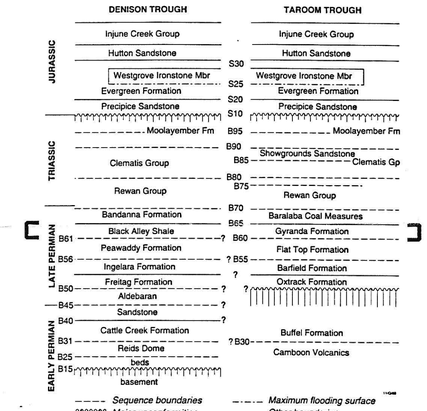
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 50 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

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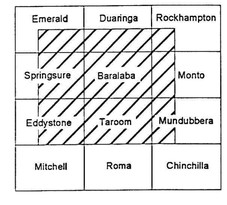

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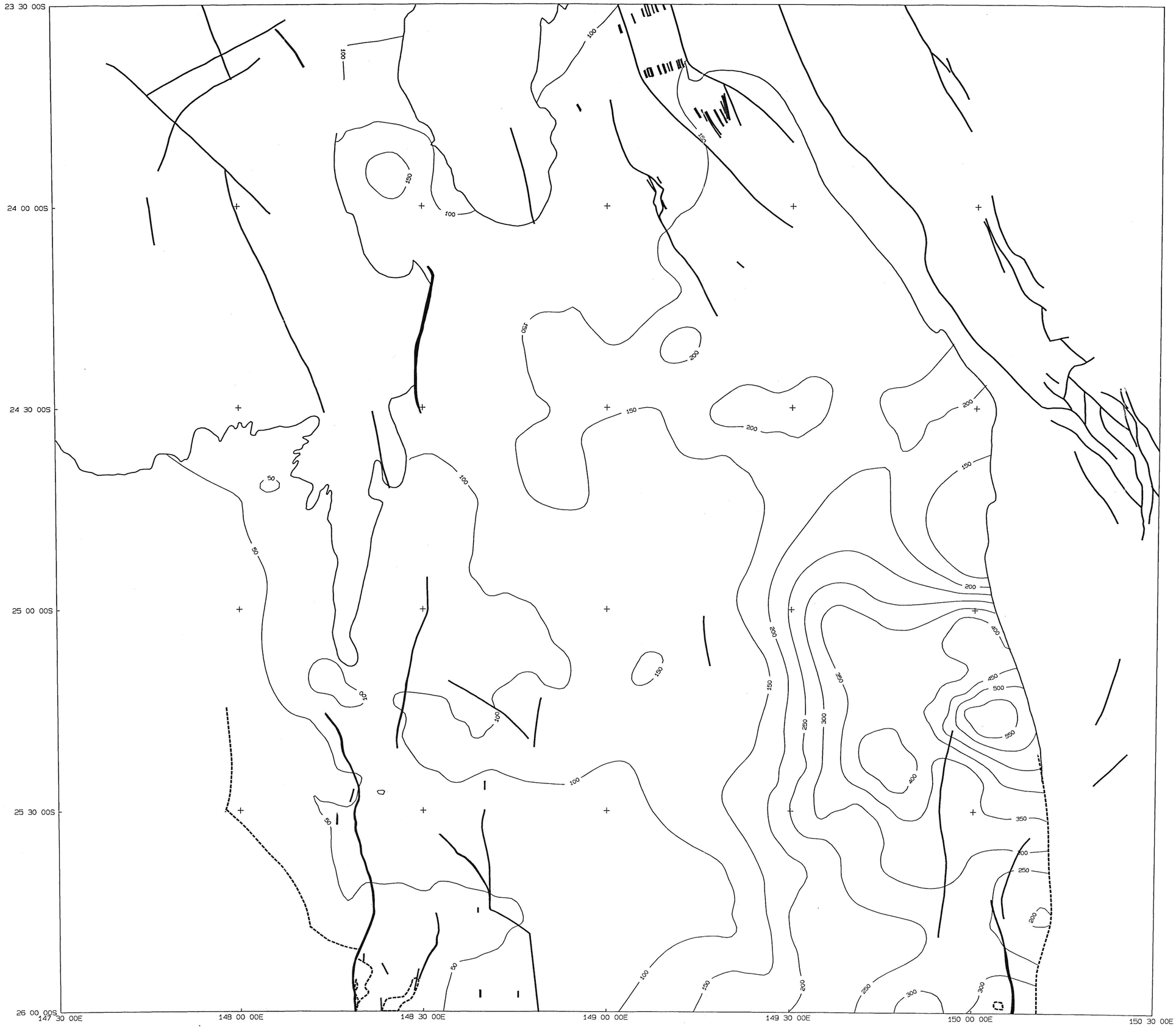
19. ISOPACH MAP OF B65-B70 INTERVAL IN TWO-WAY TIME



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1:500 000

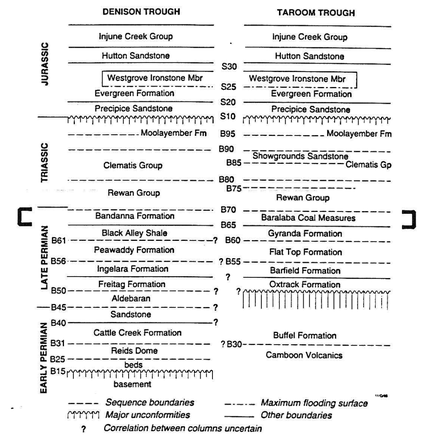
0 10 20 30 40 50
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 50 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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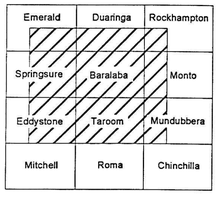

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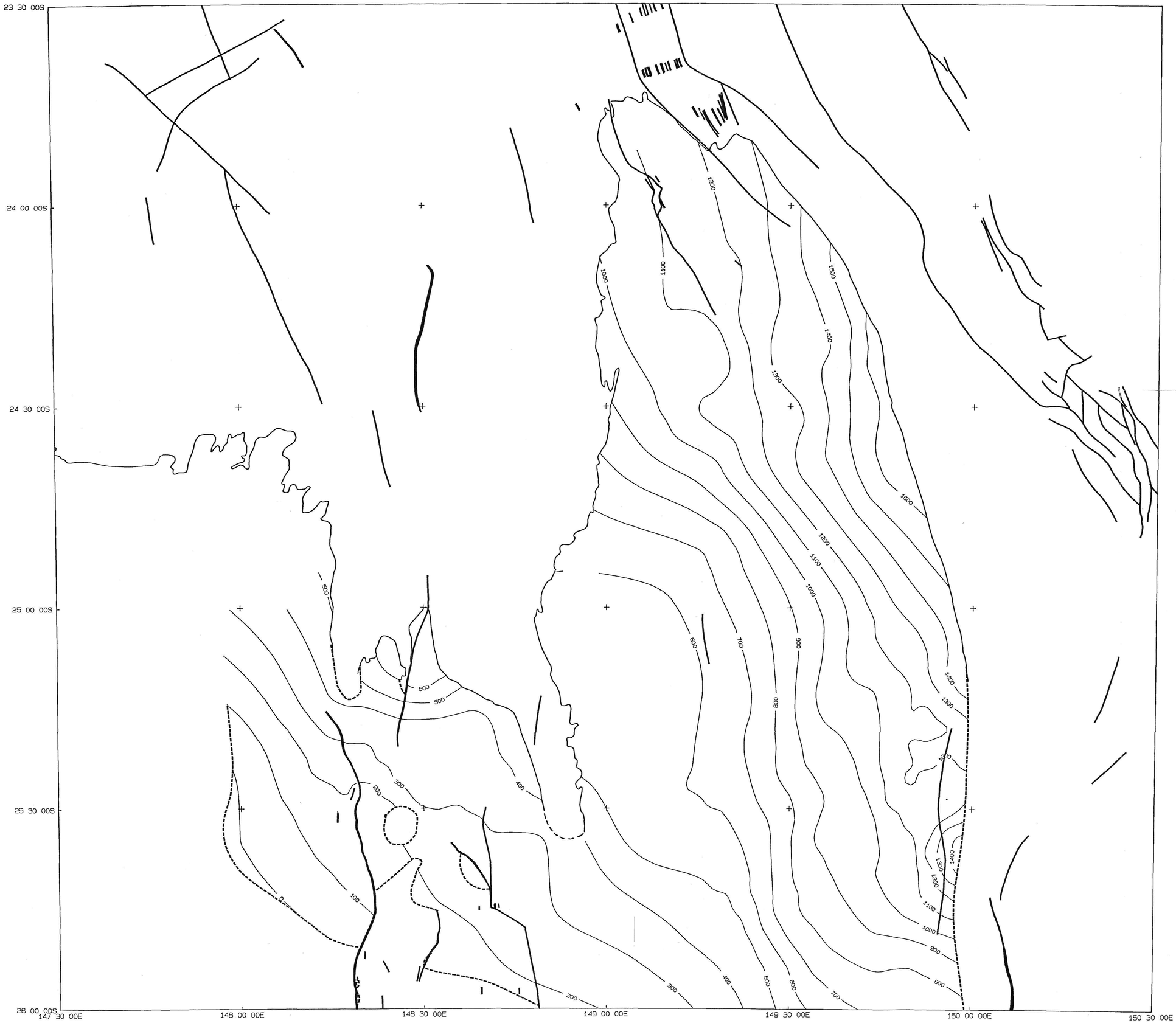
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

20. ISOPACH MAP OF B70-B80 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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1:500 000

0 10 20 30 40 50

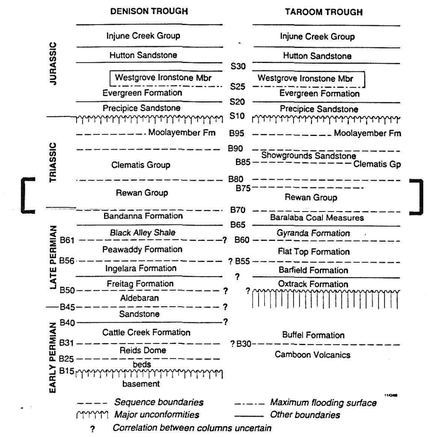
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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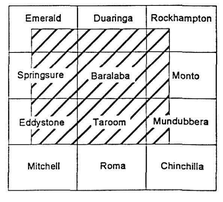

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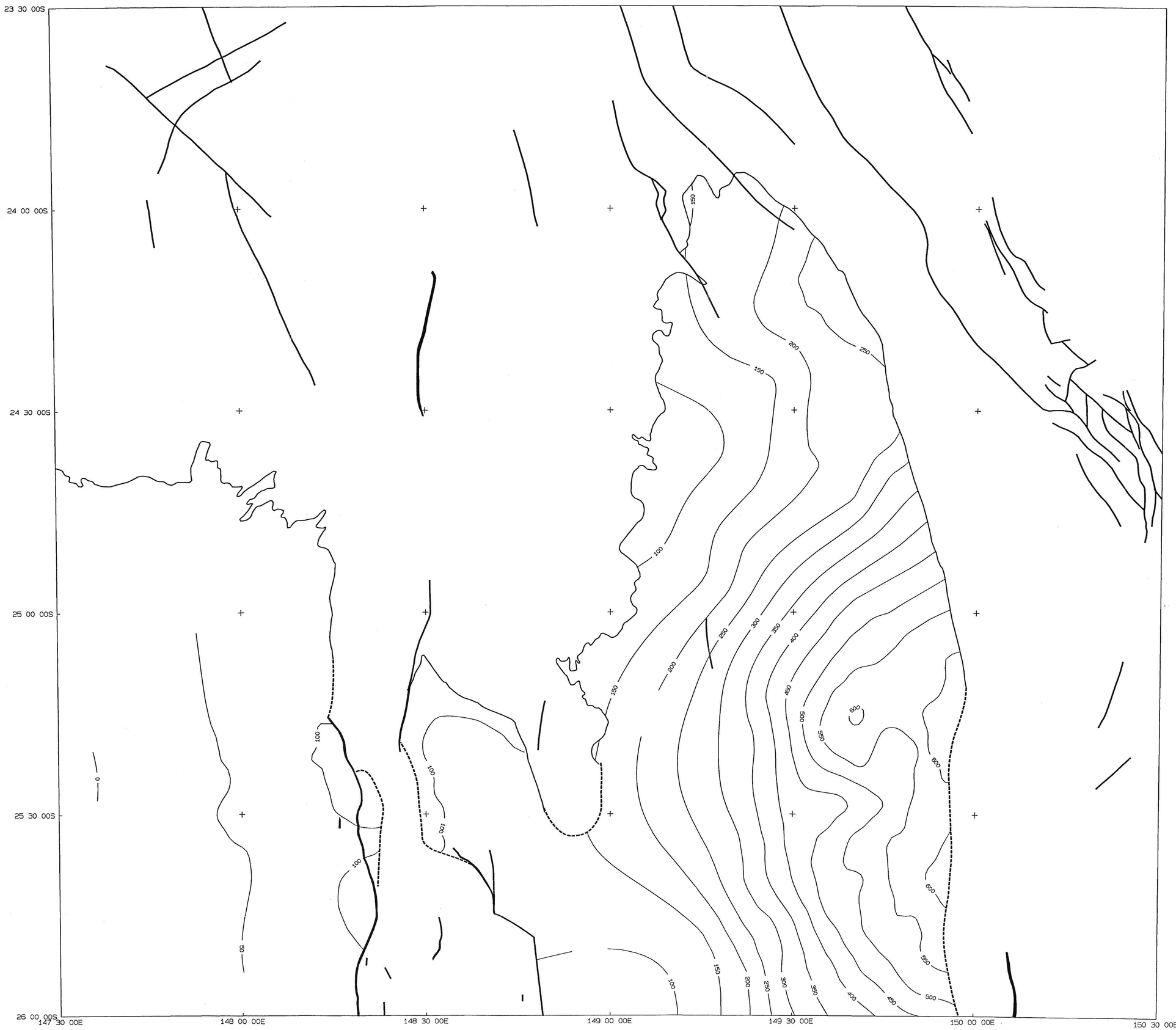
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

21. ISOPACH MAP OF B80-B90 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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1:500 000

0 10 20 30 40 50

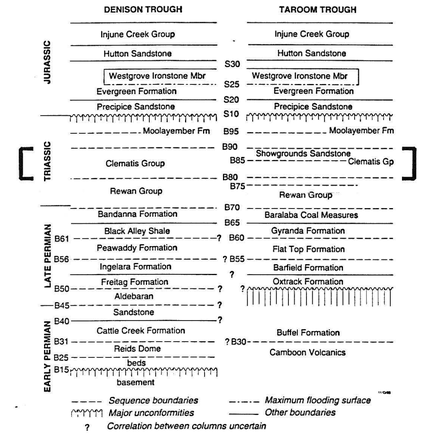
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 50 milliseconds

LEGEND

200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

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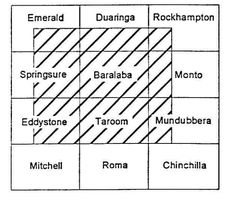
PH (06) 249 9519 *FAX* (06) 249 9982



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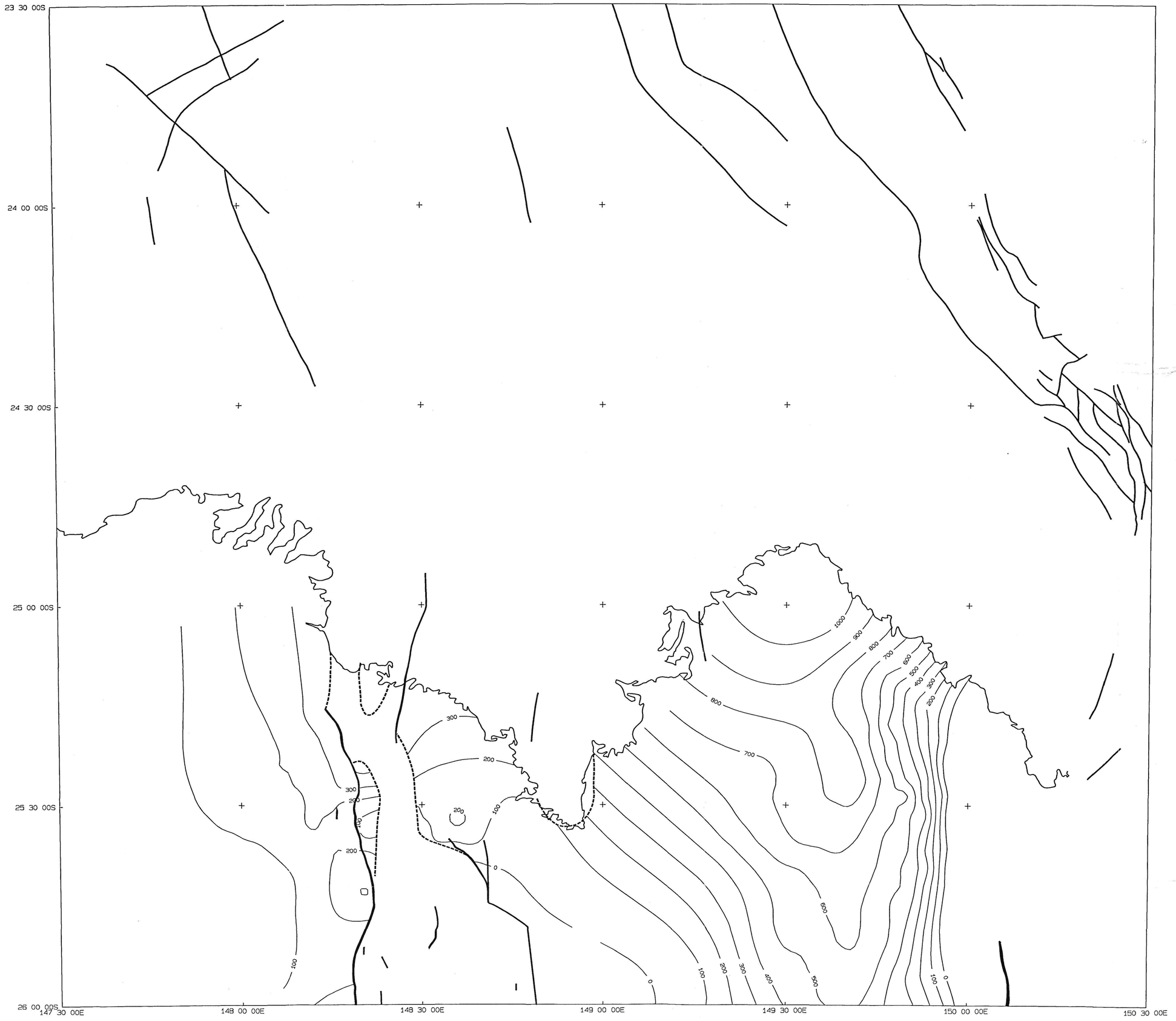
BOWEN BASIN NORTH OF 26°S, QUEENSLAND

22. ISOPACH MAP OF B90-S10 INTERVAL IN TWO-WAY TIME



AUSTRALIA

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1:500 000

0 10 20 30 40 50

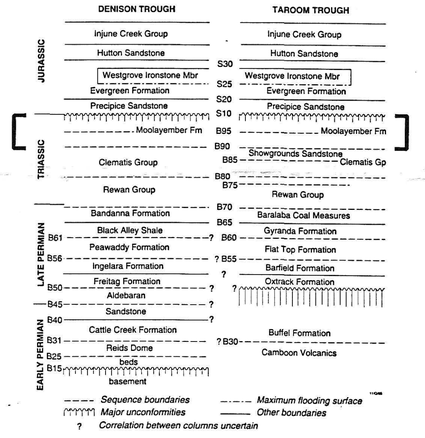
KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Contour interval 100 milliseconds

LEGEND

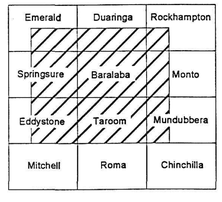
200 — Isopach contour (ms)
Fault
Subsurface limit of horizon
Inferred subsurface limit of horizon



Sequence stratigraphic interpretation by A.T. Wells, A.T. Brakel & J.M. Totterdell
Fault interpretation by R.J. Korsch & J.M. Totterdell
Digitising of sections and contour generation by M.G. Nicoll using Petroseis™ software
Grid size 5000 metres
Minor manual editing of the contours by R.J. Korsch & M.G. Nicoll
This is a provisional map, subject to change
Map plotted: June 1994

This map accompanies a text publication: Wells, A.T., Brakel, A.T., Totterdell, J.M., Korsch, R.J., & Nicoll, M.G., 1994. Sequence stratigraphic interpretation of seismic data north of 26°S, Bowen and Surat Basins, Queensland. *Australian Geological Survey Organisation, Record* 1993/51.

The digital data for this map were compiled using Petroseis™ software and may be suitable for transfer to other digital systems. Information on formats, release conditions, and costs can be obtained from: AGSO Sales Centre
GPO Box 378, Canberra ACT 2601
PH (06) 249 9519 *FAX* (06) 249 9982



ONSHORE SEDIMENTARY & PETROLEUM GEOLOGY PROGRAM

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SEDIMENTARY BASINS OF EASTERN AUSTRALIA

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