048001

Bass Basin part I

GEOLOGICAL INTERPRETATION OF BASS BASIN

FOR

HAEMATITE EXPLORATIONS PTY. LTD.

BY

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ILLUSTRATIONS

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ABSTRACT:

The Bass Basin is the southernmost of the three sedimentary areas which were formed by the breakdown over the Palaeozoic belt between mainland Australia and Tasmania. Perhaps because of its southern position the Bass area was not affected by the basin-forming movement during Mesozoic. It is purely a Tertiary basin.

The basin is elongated northwest-southeast, measuring about 160 x 80 miles. Within this area a maximum of 13,000 feet of Tertiary accumulated which can be divided into four stratigraphic units, each overlapping considerably the older unit.

The basin was subsiding actively during the interval in which Units I and II were being deposited. This is manifest from the steep attitude of the northeast and southwest flanks and by the manner in which the two units pinched out within the confines of the silled basin.

After deposition of these lower two units the flanks of the basin became stabilized. Subsidence from then on continued as a gentle sag extending beyond the limits of the original basin. The upper two units total about 4,500 feet of marine sediments, presumably deposited in shallow water.

With regard to likely sources of hydrocarbons, Units I and II represent the more important portion of the section because of the silled environment and the appreciable thicknesses they attained in the central part of the basin.

The upper 1,000 feet of Unit II contains reefal build-ups out in the basin, and more extensive reefal bodies are developed on the shelf at the edge of the hinge zone. Below the reefal build-ups out in the basin, the unit is believed to be made up essentially of marls, shales and sands.

Unit I has no reefs from which to infer a marine environment. However, inasmuch as the character of the seismic reflections is somewhat similar to that of Unit II it may also be marine. There is certainly no apparent similarity with the lower Tertiary continental beds of the Gippsland and Anglesea areas.

Four types of prospects are mapped and illustrated in some detail: pinchout, drape structure, shelf reef and basin reef. The first three are favourably situated updip from the deepest part of the basin and thickest development of Units I and II. All features, the basin reefs possibly to a lesser degree, are capable of trapping hydrocarbons in quantities which, in terms of world standards, would be considered large.

The prospective features are relatively shallow due to their position on the sides of the basin where basement would be found generally at less than 10,000 feet. Water depth in this portion of the basin ranges from 150 to 250 feet.

The pinchout on the northeast and southwest sides of the basin coincides with the structurally high portions of the flanks; it involves the entire thickness of Unit I. Measured from the 3,000 foot thickness contour, the pinchout is about 70 miles long and 6 miles wide on the northeast side of the basin and some 60 x 7 miles on the southwest side of the basin.

Five drape structures are mapped on the sides of the basin within the area where the flanks are steeper, reflecting a structurally high condition. The structures are characterized by gentle arching from basement upward for as much as 7,500 feet. Arching is strongest near basement and within Unit I, but decreases considerably in Unit II. Measured at the base of Unit II, closure ranges from 150 feet to 500 feet and from 3 to 6 miles in width. Three of the structures are more than 20 miles long.

The shelf reefs grew on the northeast and on the southwest edge of the basin on flankal highs that were in evidence throughout the development of the basin. The shelf reefs are recognized in the surveyed area over distances of 35 x 12 miles on the northeast flank and 35 x 10 miles on the southwest flank. The thickness of the reefs is considered to vary from about 500 feet to about 2,000 feet.

Out in the basin 13 basin reefs are evident and many more should be present between the lines of control. The reefs appear as individual build-ups from one to four miles in diameter. They rise as much as 700 feet above the limestone bed that occupies the upper 1,000 feet of Unit II. The basin reefs are considered to be less prospective than the other features inasmuch as they are not well positioned with reference to updip migration from potential source beds in the lower part of the sedimentary section.

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INTRODUCTION:

The Bass basin is situated in the Strait north of Tasmania, in the partial enclosure formed by King Island, the coast of Victoria and Flinders Island. It occupies an area of about 160 x 80 miles (12,800 square miles) elongated northwest-southeast and contains a maximum of 13,000 feet of Tertiary sediments. Water depths of this area range from 150 to 250 feet.

Results of eight months intense study have clarified considerably the geophysical and geological aspects of the basin, revealing several attractive prospects.

The sequence leading to the present detailed study of the Bass basin began in March/April, 1961, when Lewis G. Weeks concluded from regional considerations that a major sedimentary basin could exist in Bass Strait north of Tasmania, between Flinders Island and King Island. Prior to this no one had recognized the potentialities of the area.

In order to verify Mr. Weeks' conclusion, an airborne magnetometer survey was completed by Aero Service Limited in December, 1961. This confirmed the existence of a large basin filled with as much as 12,000 feet of sediments.

The magnetic survey was followed by a reconnaissance seismic survey completed by Western Geophysical Company in May, 1963. (Final Report of August 1963.) The sedimentary thickness indicated by the magnetic data was verified and the general features of stratigraphy and structure were outlined. However, it became apparent that in order to fully evaluate the oil possibilities of the Bass basin a much more detailed study would be necessary.

The present investigation commenced with an extensive study of the seismic data followed up by detailed interpretational mapping of both stratigraphical and structural features. This work was carried out during the months of January, 1964, through August by A.S. Maureira, Geophysicist, whose services were obtained from United Geophysical Corporation. Beginning in May, the writer devoted full time to the study of the Bass basin, working in close co-operation with Maureira toward clarifying the problems and finally presenting the results of the investigation in terms of geology.

A brief discussion of the character of the seismic data and the procedure followed in the interpretation was prepared by Mr. Maureira. This appears in the Appendix.

The writer wishes to acknowledge the generous assistance given in many ways by Mr. Brian Hopkins and the invaluable co-operation of Mr. George Hosking who prepared the illustrations accompanying this report. The joint geophysical and geological approach to the study of the Bass basin has proved most profitable, due mainly to Mr. Maureira's excellent interpretation and mapping of the seismic data, which contributed greatly to the geological concepts and conclusions.

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CONCLUSIONS:

The study of the Bass basin leads to the conclusion that good possibility exists for hydrocarbons to be present in important quantities.

Four types of traps commonly found in oil producing provinces have been mapped. These are:

Type of Trap	Number Present	Total Area Sq, Miles.
Pinchout	2	800
Drape Structure	5	405
Shelf Reef	2	750
Basin Reef	13 plus	100 plus
	22 plus	2,055 plus

There is little doubt concerning the reality of the traps, and their position within the basin appears to be ideal with respect to potential source beds. The reservoirs within the traps are adequate for fields of the billion barrel category. While it is not yet known to what extent oil source beds were developed, three-fourths, if not all, of the sedimentary section is marine and the silled character of the basin during early sedimentation would seem to have offered a favourable environment.

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RECOMMENDATIONS:

Additional seismic work will be required, but whether it should be done before initial exploration in order to pinpoint the locations, or at a later date during the drilling programme when problems and objectives would be better understood, is somewhat optional and a matter of preference on the part of the operator. In the writer's view the prospects to be tested are sufficiently large in area for initial wells to be located without further delimitation.

The farmout consideration should stipulate at least two exploratory wells on each of the four types of prospective traps mapped. There is little preference as to which should be drilled first, except that an early test of a drape structure would afford more useful stratigraphic information. All tests should be drilled to basement, expected no deeper than 10,000 feet.

In addition to the above, at least one well should explore the supposed Palaeozoic under the southeastern edge of the basin.

Any prospective areas which may be recognized by the operator should be treated as additional prospects but not as substitutes for any of the four types outlined in this report.

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STRATIGRAPHY:

The position of the Bass basin with reference to the geology of Victoria, Tasmania and the flanking shallows is shown on the regional map, Fig. 1. The basin is mostly silled except for the upper 2,000 feet of sediments which spread to adjacent areas.

At the 2,000 foot contour the basin covers an area of about 10,200 square miles. containing a maximum of 13,000 feet of sediments. (Total Thickness, Fig. 17.)

Based on the seismic data the sedimentary section can be divided into four recognizable groups or units. In age they are in a general way referred to the overall Tertiary sequence as follows:

Unit IV	:	upper Tertiary-Quaternary (Pliocene-Pleistocene)
Unit III	:	upper Tertiary (Miocene-Pliocene)
Unit II	:	middle Tertiary (Oligocene-Miocene)
Unit I	:	lower Tertiary (Eocene)
Basement:		pre-Tertiary

The general tie-in with the Tertiary of the mainland was made through the upper 2,000 feet of sediments that cross the ridge separating Bass basin from Otway basin. It was thus possible to correlate broadly the upper part of Unit II with the Oligocene of the Anglesea well.

Correlation of Lower Part of Section:

In the initial stage of the basin study it was believed that the lower part of the section (Unit I) represented sediments of uppermost Mesozoic and that these sediments were spread over an area larger than the present basin. They were, as the thought went, preserved under the basin as it subsided. The main reason for this assumption was the belief that a gentle but widespread unconformity existed between Unit I and Unit II. A closer study has shown this to be untenable.

What was formerly thought to be an unconformity between Mesozoic and Tertiary is now explained in terms of:

1) overlap in the flankal portions of the basin,
2) upward decrease of draping over localized basement highs,
3) upward decrease of flexing along lines of movement, and
4) lateral variations of lithology rather than divergencies of structural dip.

With regard to this last point, no comparable change in thickness of Unit I is observed where these divergencies appear. In other words, regardless of apparent divergence of dip, the bases of Units I and II remain somewhat parallel.

The other factors that now add weight to the belief that the lower unit is lower Tertiary rather than upper Mesozoic are:

1) the tie-in of the top of Unit II with the Oligocene of the Anglesea wall,
2) there is no evidence as far south as the Bass basin of the Mesozoic basin-forming movement characterized by block faulting and thick sediments in the Gippsland and Otway basins, and
4) since there is evidence of only one tectonic breakdown in Bass basin, it is most likely to coincide with the early Tertiary breakdown of the Gippsland and Otway areas.

Tertiary of Adjacent Areas - Fig. 1:

The marine Tertiary seen on Flinders Island (and other islands of the Furneaux Group) and King Island, could be the overlapping spread of the younger sediments of Bass basin. The seismic control extends only to within 50 miles of Flinders Island, whereas one line comes to within 10 miles of King Island.

As for the northwest corner of Tasmania, it seems more likely that the marine Tertiary encroached from the west rather than from the Bass basin to the northeast.

Extensive areas of Pliocene-Pleistocene limestone are present on the western side of Flinders Island where they attain a thickness of 500 feet. They are mainly calcarenites and range in consolidation from loose to dense and well consolidated. The limestones rest on either metamorphics or granites.

On King Island several small outcrops of Miocene bryozoal limestone are present, although no thicker than 20 feet. The limestone is underlain by granite at the north end of the island and by Devonian basalt on the east coast.

In Tasmania, marine Tertiary, (Upper Oligocene to Middle Miocene) is present at a few localities in the northwestern tip only, westward from Wynyard. At Wynyard, richly fossiliferous calcareous sandstone, 84 feet thick, is exposed in a coastal bluff. It is underlain by Permian tillite and overlain by basalt. In the Smithton-Marrawah area, several small, isolated patches of pink and whitish limestones are present, mainly near the west coast. The limestone is fossiliferous and usually well consolidated. In the Marrawah area the base of the limestone is 135 to 150 feet above sea level. Here it is underlain by Palaeozoic rocks.

<u>Basement:</u>

The top of the basement is determined from the character of the seismic records and in general is placed near the lowermost reflections that can be related to sediments. In the shallower parts of the basin the line of demarcation is fairly clear and often accentuated by diffraction pattern. In the deeper areas, however, it is often sketchy. The map Structure Top Basement, fig. 11, gives a somewhat idealized picture of the basement surface, but there is evidence of several prominent highs. These are discussed under Drape Structures.

From regional considerations and from the magnetic data the basement would appear to be primarily granite and Palaeozoic metamorphics.

Under the southeastern 30 mile portion of the Tertiary basin sparse, though supposedly valid reflections are recorded, extending to about 20,000 feet. (Cross section B-10 and Figs. 11 and 1). Little can be conjectured about this because only lines B-10 and B-18 pass into the area. It is thought, however, that the mass may be the extension of the Devonian-Silurian Mathinna Beds from Tasmania which is in trough development, the dominant structures being asymmetrical folds. The uniform slope of the reflections suggests that they are from dolerite sills rather than from folded sediments. Whatever the thick mass may be, it is well stabilized, for the Tertiary that spreads over it is structurally featureless. From the magnetic data it is mapped as basement. It is possible that patches of the supposed Palaeozoic are present under the deeper portion of the Tertiary basin as well.

Unit I:

Very little has been determined concerning the nature of the sediments that were deposited in Unit I. It may be conjectured that inasmuch as the seismic characteristics of Units I and II are somewhat comparable, the rock types should not be greatly dissimilar. That is, shales, marls and sands may be expected to predominate.

Judging from the distinctive seismic reflections that characterize the coaly facies of the Eocene in Gippsland and in the Anglesea area it is safe to say that such a facies is not present in the Bass basin. Actually, the coaly environment of the onshore Anglesea area is known to be localized. The seismic data offshore shows that the coals play out shortly to the southeast of the Anglesea well.

Although the thickness map of Unit I (Fig. 15) gives a good picture of the overall form of the unit, it nevertheless reflects to a great extent the larger features of the basement (Fig. 11).

Several interesting conditions are brought out in the thickness map of Unit I:

1) The map shows the sediments of Unit I in an enclosed basin that attained a thickness of 5,000 feet.

2) The tectonic pattern of the basin and its effect upon deposition is clearly marked. A structural high that resulted in constriction of the northeast and southwest edges of the basin was effective during deposition of Unit I, producing a narrow and steep hinge zone along with sharp thickening of the sediments.

3) The thickest part of Unit I is between the constricted sides of the basin.

4) The prominent basement nose of the northwest edge of the basin is a reliably mapped feature over which Unit I is very thin. Thinning is also indicated over the basement highs of the drape structures.

Unit II:

The interval of Unit II is considered to be the more important portion of the section. The sediments, totalling 4,500 feet, are marine and the greater part of the prospective features fall within the unit.

Unit II is separated from Unit I by an overlapping relationship and in turn is overlapped by Unit III. (Cross sections B-15, B-2-24 and B-1-23 and Figs. 21, 22).

The depositional basin of Unit II shown by the thickness map, Fig. 16, preserves the same general form set out by Unit I, but is considerably broader and the thickness contours along the flanks are much gentler due to the overlapping condition. Much of this change, however, takes place within the upper half of Unit II. The pinchout of the very basal beds coincides approximately with the total pinch-out of Unit I (Fig. 12, Structure Base Unit II), but the upper half overlaps considerably the lower portion, showing that it was being deposited while the basin was subsiding actively along well defined hinge zones.

The uppermost part of Unit II contains a limestone bed 500 to 1,300 feet thick, called the Limestone Bank, from which reefal build-ups developed. (Fig. 13, Structure Top Unit II, and Fig. 25). On the northeast and southwest sides of the basin are features called shelf reefs. (Figs. 23, 24). These are believed to have grown from the base of the unit and in places occupy the thickness of the unit. The reef front presents an abrupt change in facies to deeper marine conditions where basinward mostly marls, shales and sands would be expected.

Unit III:

It is believed that Unit III is composed essentially of marls, calcarenites and calcareous sands deposited generally under shallow marine conditions. Marls are likely to prevail where the unit is thickest.

The basal beds of the Unit III wedge prominently against the build-ups of Unit II and overlap it extensively. (Cross Section B-15). The unit is in turn overlapped by Unit IV.

There is no thickness map for Unit III, but from comparison of Figs. 13 and 14, it is seen that the thickest portion (2,000 feet) falls within the central part of the basin, coinciding in general with the thick areas of the older units.

Unit IV:

It is assumed that Unit IV is made up mainly of shallow marine limestone and calcareous sands, somewhat as seen on Flinders Island and coastal Victoria.

A widespread shallow reflection marks the boundary between Units III and IV. This horizon was used for the map Structure Top Unit III (Fig. 14) which serves as a thickness map for IV. It shows a maximum thickness of 2,500 feet, thinning to about 500 feet along the rim of the basin.

It may be seen from the cross sections B-15, B-5, B-1-23 and B-2-24, that the beds of Unit IV are almost flat and spread beyond the confines of the original basin. They truncate and overlap the older beds and extend, no doubt, into Gippsland and Otway basins.

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STRUCTURAL FRAMEWORK OF THE BASIN:

The region of the Bass basin was apparently stable throughout Mesozoic and was not involved in the block faulting which during that period produced thick deposits in the Gippsland and Otway basins to the north. The large Selwyn fault along the northwest side of the Mornington-King Island ridge (Fig. 1) marks the southern limit of the region affected by the Mesozoic breakdown.

The initial stage of the Bass basin is correlated with the early Tertiary breakdown that is well marked in Victoria, especially in the Gippsland basin. The movements forming the Bass basin were, however, more passive and without block faulting. The display of mobility during development of the lower half of the basin was never strong and became quite gentle in the upper half.

The Mornington-King Island ridge may be looked upon in somewhat the same manner as the Bass ridge and King Island-Tasmania.

The "magnetometer ridge" evident from both magnetic and seismic data (Fig. 1) is of a different order. It shows on the magnetic map (Fig. 26) by the character of the anomaly pattern and by a swing of the depth-to-basement contours, thus indicating a high that constricts or narrows the basin on both sides. The steeper portion of the hinge zone on either side of the basin, and the flexure line on the northeast side, coincide approximately with the width of the ridge, which has a northeast-southwest trend and could be the continuation of the Gippsland Palaeozoic ridge or ridges at Foster and Wonthaggi.

Across the basin there is no expression of the ridge; actually, the deepest part of the basin coincides with the trend. It is upon the flankal highs of the ridge that the shelf reefs developed.

It is not clear how the ridge affected the tectonic development of the basin. It could be a matter of differential mobility which during subsidence of the basin caused it to remain relatively high in the area of the shelf. Where crossed by the northwest-southeast tectonic trend of the breakdown, the ridge, being relatively stable, offered more resistance to downwarping during the initial stage of subsidence than did the adjacent area. Therefore, hinging along the edge of the basin was sharp and confined to a narrow band. In other words, where crossed by the ridge the broad, gentle hinge along the flanks of the basin steepens appreciably and is accompanied on the northeast flank by flexing. The line of flexing displays progressive movement during Units I and the lower half of II. The movement of the flexure itself, measured in the lower part of Unit II, amounts to about 300 feet.

On the southwestern side of the basin another type of flexing (or faulting) occurs at two localities. It is referred to as "young Tertiary" on Figs. 12, etc. because it displaced the entire section to the same degree (about 500 feet). The significance of this movement is not clear. It would not only seem too young to stem from the same adjustment that produced the Launceston graben, but there are no signs of similar movement in the intervening area of 80 miles.

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DEVELOPMENT OF THE BASIN:

The original surface of the basin appears to have been somewhat irregular topographically, although under the deeper area neither the pattern of the irregularities nor their amplitude is now clearly outlined. Near the shelf, however, the surface is fairly regular, as though having been extensively planed off when upper Tertiary spread over it.

Subsidence is considered to have commenced, in accordance with Gippsland and Otway basins, in the early part of the Tertiary. In a broad and simplified sense, it evolved through a well-developed sequence of four sedimentary units that represent individual stages of subsidence. Each seems to have been followed by a pause and readjustment in the framework of the basin. Thus each unit assumed a wider area of deposition in an overlapping relationship with the previous sedimentary unit. Probably there were fluctuations or minor pauses within the units, but the prominent changes are manifest on the edge of the basin by overlaps and elsewhere by wedging against highs of the underlying unit.

The steep attitude of the northeast and southwest flanks shown in Figs. 11, 12 and 15 illustrate the amount of active subsidence that took place along a pronounced tectonic trend prevailing from the beginning of the basin to about the middle of Unit II. This represents the first and main stage in the development of the basin, during which time its sediments were deposited under silled conditions.

Subsequently, through upper Unit II, the framework of the original basin became stabilized and inactive. Subsidence continued through upper Tertiary, but on a more regional scale. However, although deposition spread far over the shelf area, maximum sediment-ation continued to take place within the confines of the original basin. (Cross sections B-5, B-15, B-2-24, and B-1-23).

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PROSPECTIVE FEATURES:

Twenty-two features capable of trapping oil have been mapped. These potential traps are of four types:

Pinchout	2 features
Drape Structure	5 features
Shelf Reef	2 features
Basin Reef	13 features

The position of these with reference to the basin may be seen on the regional map, Prospective Features, Fig. 1. This map has a chart which shows the area in square miles of each feature. The features are illustrated in detail, with explanatory notes, on maps Figs. 18 to 25.

The sediments contained in Units I and II, and to a lesser degree basal Unit III, are considered to be the main potential sources of oil. Units III and II are marine and Unit I may also be marine.

The silled character of the basin during deposition of Unit I and the lower half of Unit II could have offered optimum environmental conditions for the development of source beds.

It is estimated that the silled portion of the basin covers an area of about 10,200 square miles (Fig. 17). Both Units I and II thicken appreciably toward the centre of the basin. Unit I which is completely pinched out along the shelf attains a thickness of 5,000 feet and Unit II thickens basinward from 1,000 feet to 4,500 feet. The thicker portion of each of these units contains about 4,000 square miles measured to the 3,000 foot thickness contour.

Unit III thickens basinward to about 2,000 feet where it may develop a deeper water marly facies. Under such conditions it could have source bed potentialities.

The drape structures, pinchouts and shelf reefs are situated on the northeast and southwest sides of the basin. They are updip from the thickest sediments of Units I and II as well as the deepest part of the overall basin, therefore in ideal position with reference to the potential source beds.

The basin reefs, however, are not so well positioned for updip migration. There may be other potential sources, but the more apparent one would be from the adjacent Unit III.

Reservoir conditions appear to be excellent in all of the prospective features, especially the reefs.

The shelf reefs (Figs. 23 and 24) are estimated to be from 500 to 2,000 feet thick and the basin reefs (Fig. 25) rise from a few hundred feet up to 700 feet above the top of the Limestone Bank.

The reservoir rock of both the pinchouts and drape structures is expected to be sand. The sand ratio is, of course, not known but the amount of effective sand could add up to a large figure. For example, the stratigraphic interval within the confines of the trap is from 2,500 to 7,500 feet in the drape structures (Figs. 18, 19, 20) and from zero (wedgeout) to about 3,000 feet in the pinchout features (Figs. 21, 22). Many individual sands could be contained within these intervals.

Pinchouts:

Unit I forms the main pinchout on both the northeast and southwest flanks. Only Unit I is considered in this category because the pinchout is complete and is contained in a fairly well defined zone.

However, the lower part of Unit II wedges out considerably and may turn out to be of importance. The pinchouts and their positions with reference to other features of the basin are shown on Fig. 1, Prospective Features and illustrated in detail in Figs. 21 and 22.

The pinchout as mapped on the southwest side of the basin is roughly 60 miles long and seven miles wide, covering an area of about 400 square miles. On the northeast side of the basin the area is some 70 miles long and six miles wide, totalling about 400 square miles. Downdip from the pinchout Unit I thickens to about 3,000 feet.

Although Unit I pinches out around the basin, the two areas mapped are sharper and more prominent than the rest of the basin edge. From Fig. 1 it is seen that the mapped areas are structurally high, associated with constriction or narrowing of the basin coincident with steepening of the hinge zone and presence of a flexure line on the northeast flank.

Drape Structures:

Five prominent drape structures are mapped on the northeast and southwest sides of the basin within the belt where the flanks are steeper. One of these is a plunging nose. More of the features are present, but they are of small amplitude with closure less than 50 feet. All of them are shown on Fig. 12, Structure Base Unit II, and the five important ones are illustrated in detail in Figs. 18, 19 and 20.

The structures are characterized by the presence of gentle arching from basement upward for 2,500 to 7,500 feet. The arching is interpreted as draping over growing basement highs and closure ranges from 150 to 500 feet measured at the base of Unit II. Closure would be greater, of course, were it not for the tilt of the flanks. Draping is considerably steeper in Unit I, decreasing upward and dying out, in some cases in the upper part of Unit II while in others (B-2-21 and B-4-16) the drape extends into Unit IV. Thus, in all structures effective closure extends over an appreciable stratigraphic interval.

Three of the structures are 20 miles or more in length and the other two are crossed by only one seismic line and may be no longer than 10 miles. The closed areas are from three to six miles wide but vary considerably even in one structure.

The following speculations concern the draping and the nature of the basement highs.

The most pronounced and at the same time most reliably mapped high is seen on B-12 and B-1 (Fig. 19 and Cross Section B-1-23). Under the other structures it is evident that the basement is high, but its extent and shape cannot be mapped with a satisfactory degree of accuracy. The form of the basement, therefore, is phantomed to a large extent in accordance with the reflections of Unit I. While it appears that the basement highs are real and are responsible for' draping in the overlying sediments it is believed that they represent growing blocks rather than erosional remnants. In other words they were blocks controlled by lines of weakness set up during the early development of the basin. The thought is that these blocks were not actually uplifted but rather subsided slower, lagging behind the area adjacent.

The main points supporting this idea are:

1) the alignment of the features parallel with the tectonic framework of the basin.

2) their position on the northeast and southwest mobile flanks of the basin, and

3) the coincidence of the stratigraphic interval of draping' with the tectonically active stage of basin subsidence during Units I and II.

About the only point in favour of an erosional basement high is that the form assumed for the basement as well as the form of the overlying draping often changes appreciably from line to line of the same feature. Likewise, the intensity of draping also changes. Such irregularities would seem to correspond with an erosional basement high better than with a high controlled by structure.

It is not clear why the draping, which plays out generally in the middle to upper part of Unit II, extends in two cases, B-2-21 and B-4-16, up into Unit IV.

The upper limit of compaction and draping apparently is not controlled by thickness of Units I and II, but rather by the duration of the motivating force associated with the tectonically active stage of basin subsidence. On B-13, for example. the draping extends for a thickness of 5,000 feet while in B-12 it is only 2,500 feet. In both cases, however, the draping dies out at about the same time level near the top of Unit II. From this it would follow that an appreciably higher extent of draping, such as in B-2-21 and B-4-16, would be due to additional or prolonged movement. On the other hand, it is felt that the break in sedimentation at the end of Unit II, followed by the overlapping Unit III, could have somehow terminated the upward continuation of draping. In any event the amount of draping measured near the top of Unit II is so small that it could be wiped out locally by a pause followed by sedimentary irregularities.

Individual Structures:

B-12-1-13 Structure: (Figs. 18 and 19)

This feature is essentially a southeast plunging nose controlled by a prominent, wide basement high or ridge. From the map Structure Top Basement, Fig. 11, it is seen that the basement high is a conspicuous feature that begins in the shallow edge of the basin and from B-12 plunges some 5,000 feet to B-13. In the area of B-12 and B-1, the basement high is 10 miles or so wide and has a relief of some 2,000 feet. Farther to the southeast the top becomes quite sketchy, but in B-13 it apparently has narrowed to about three miles and the relief has decreased to about 1,000 feet.

The other outstanding thing in connection with the nose is the northwestern wedging out of Unit I, over the crest of the basement high, shown on the map Thickness Unit I, Fig. 15. In B-13 it is about 3,000 feet thick but over the crest in B-1 and B-12 it is less than 500 feet or even absent. It thickens in the flanks to 2,500 feet.

The basement high, whether structural or purely topographic, remained as an island (between B-12 and B-1) until about the end of Unit I. A considerable amount of wedging and overlapping is seen on the flanks of the nose in B-12 and B-1. The overlying Unit II appears to have suffered no thinning that could be attributed to non-deposition, although some from draping. The effective draping extended, though faintly, to the top of the Limestone Bank and the contours on the map Structure Top Unit II (Fig. 13) show no further effect of the nosing feature.

The nose is at least 30 miles long and the plunge measured at the base of Unit II is about 2,000 feet.

B-12: Width of drape 7 miles.
Amount of drape 350 feet at base of Unit II.
Drape effective for 2,500 feet, to top of Unit II.

B-1: Width of drape 8 miles.
Amount of drape 200 feet at base of Unit II.
Drape effective for 3,500 feet, to top of Unit II.

B-13: Width of drape 3 miles.
Amount of drape 200 feet at base of Unit II.
Drape effective for 5,000 feet to base of Limestone Bank.

It is noted that the B-12-1-13 nose stems from the shallow edge of the basin northwest beyond the confines of the northeast-southwest belt of constriction and associated steep hinging that is present on either side of the basin.

B-2-21 Structure: (Figs. 18, 19)

This drape structure displays movement extending as high as Unit IV. Because of this and the presence of northwest closure it is felt that the structure is not part of the B-12-1-13 nose.

The structure appears to be somewhat domal with an estimated length of 9 miles and closure width of 6 miles. The amount of closure is 400 feet, measured at the base of Unit II. The closure extends at least to the base of Unit IV where it amounts to 150 feet. Thus, at least 7,500 feet of section has closure.

B-13 Structure: (Figs. 18-19)

The structure is crossed by one line and is mapped as being oval in shape, with a length of 7 miles and width of closure of 5 miles. It could, however, be considerably elongated, for the lines of control are widely spaced.

Closure at the base of Unit II amounts to 100 feet. (Probably B-13 passes through the plunge rather than the culmination). Draping extends to the middle of Unit II, or some 4,500 feet above basement.

The structure is very close to the B-12-1-13 feature and represents a second, basinward, trend. The basement is not clearly defined, but is mapped in accordance with the reflections of Unit I which are unusually gentle and only slightly steeper than those of Unit II.

<u>B-4-16 Structure:</u> (Figs. 18-19)

The structure is estimated to be about 20 miles long. The width of closed area, measured at the base of Unit II, is 4 miles. The amount of drape at the base of Unit II is 125 feet on line B-4 and 200 feet on B-16. The effective draping extends upward to at least the base of Unit IV where it is 40 feet, thus involving about 4,500 feet of section. Closure would be appreciably greater were it not for the position of the structure within the steep hinge zone.

<u>B-2-14-3 Structure:</u> (Fig. 20)

The structure is at least 20 miles long and is best developed along B-3. It may extend farther as suggested by a slight rise at the junction of lines B-20 and B-15. Also, it may extend to the northwest beyond B-2. It is the only drape structure of any magnitude found on the southwest, less mobile side of the basin.

The width of the closed area varies from 2.3 to 4.5 miles. Closure measured at the base of Unit II varies from line to line. On B-2 it is 250 feet, B-20 150 feet, B-14 100 feet and B-3 has the greatest closure of 500 feet. Draping is most intense in Unit I and decreases upward. It is effective up to the base of the Limestone Bank (upper part Unit II), involving about 4,500 feet of section (5,500 feet in B-14).

Although the actual top of the basement is somewhat vague, the form of the basement high on B-3 and B-14 appears to be somewhat sharp and steep on its southwest side but quite broad and gentle along B-2.

Shelf Reefs: (Figs. 23, 24)

The shelf reefs occur on the northeast and southwest shelf of the basin, extending into the hinge zone. These areas display extensive build-ups, believed to have risen from a common shelf reef or sort of reef plateau. The reefs and their relation to the basin are shown on Fig. 13 (Structure Top Unit II).

The shelf reefs are recognized in the surveyed area over distances of 35 x 12 miles (400 square miles) on the northeast flank and 35 x 12 miles (350 square miles) on the southwest flank. The maximum thickness of the shelf reef where built up is about 2,000 feet; otherwise probably only about 500 feet.

The reefs developed within Unit II and it is assumed that growth is from the base of the Unit which generally lies on basement in the shelf area.

The reef front appears to be steep and the facies change is abrupt. Basinward beyond this front the sediments of Unit II below the Limestone Bank are expected to be mostly marls and sands.

The build-ups are expressed in a prominent reflection marking the top of Unit II. Where not built up, only a slight rise of the reflection marks the basinward front of the shelf reef. The lower beds of the overlying Unit III wedge out against the build-ups, but the higher beds assume draping attitude. While the build-ups were growing they apparently kept ahead of sedimentation in the adjacent area.

It is thought that the overlap of Unit III was instrumental in terminating growth of the build-ups, thus implying that the sediments were argillaceous. If this is the case, the porous reefs are effectively capped.

The prominent reflection at the top of Unit II is common also to the basin reefs rising from the Limestone Bank (top Unit II) and the same wedge and drape relationship with the overlying Unit III is seen. The main difference between the two reefs is that the shelf reef is believed to grow from the base of Unit II whereas the basin reefs build up from the relatively thin Limestone Bank at the top of Unit II. The Limestone Bank is mapped in some parts as coming in close contact with the shelf reef, but this is mostly interpretational. There could be a considerable gap between the two (Fig. 13, Structure Top Unit II).

<u>Basin Reefs:</u> (Fig. 25)

Thirteen basin reefs are recognized and many more should be present between the lines of control. They are called basin reefs to distinguish them from the reefs on the shelf. The reefs and their position with reference to other features are shown on Fig. 13, (Structure Top Unit II). Five of the more representative ones are illustrated in detail, (Fig. 25).

The basin reefs appear to be individual build-ups, somewhat round and from one to four miles in diameter. The areas of the 13 added up total about 100 square miles. They rise, as much as 700 feet above the top of the Limestone Bank which occupies the upper 500 to 1,300 feet of Unit II.

The Limestone Bank is mapped (Fig. 13) over the northwest and southeast portions of the basin but its contact with the shelf reefs is questionable. Inasmuch as there are no reefal build-ups in the southeast portion of this area it would seem that either the mapping is in error or that the environment is unfavourable for reefs.

The basin reefs are grouped in the northeast half of the basin and fall mainly within the trend between the northeast and southwest shelf reefs. This suggests a shoaling tendency out in the basin during the latter part of Unit II.

The reef build-up is expressed, as with the shelf reef, in a prominent reflection marking the top of Unit II. With this as a reference horizon it is clear that the lower beds of the overlying Unit III wedge out against the build-up while the higher beds assume draping attitude. In the discussion of shelf reefs it was suggested that the overlap of Unit III with turbid sediments was instrumental in terminating growth of the build-ups, as well as producing an effective cap over the porous reef. The same would apply to the basin reefs.

. . . . .

Lyman C. Reed.

MELBOURNE
LCR:MJP
September 21, 1964.

APPENDIX

DISCUSSION OF SEISMIC DATA

BY

A.S. MAUREIRA

The seismic study of the Bass Basin was based on the data from a large general reconnaissance offshore survey covering approximately 9,800 square miles. The network of seismic lines extended 140 miles in a NW/SE direction and 70 miles in a NE/SW direction with widely spaced lines averaging 150 square miles per loop.

Eighty percent of the seismograms furnished good to fair data and the remaining percentage could be considered only a bit less reliable.

Due to the large amount of data and for practical consideration, no attempt was made to study the monitor records, and the entire interpretation was based on the short spread combined mode sections (variable density-galvanometer trace). In consequence, there was no truly character analysis made of the reflections on the records but rather a general appreciation of some of the physical characteristics of the geological horizons represented by reflections and anomalous events on the small sections.

"Multiple reflections" were indeed the predominant type of anomalous events which were present on almost 90 percent of the surveyed area. Their importance is emphasized due to the disturbing and masking effect over the bona fide reflections. It is believed that the multiples are attributable to the great amount of high frequency energy generated by competent beds (limestone ?) in the shallow part of the basin.

Careful attention to the appearance, uniformity, continuity, character, and amplitude of the reflections, was the main criteria utilized in the interpretation of the seismic horizons and stratigraphic features.

Top of Unit III (base Unit IV) is indeed the most reliable horizon mapped due to the good character and continuity of a strong shallow reflection in the NE half of the basin. This reflector is less developed and weakens in the SW half of the basin.

Top of Unit II (base Unit III) represents in part the identification of a large sedimentary body with seismic characteristics quite different from the overlying and underlying formations. Strong, intermittent reflections showing phasing, splitting and converging against some outstanding build-ups, gave evidence to believe this band of reflections was associated with a limestone bank approximately centred in the NW portion of the basin. When this horizon was carried to the flanks of the basin it was found that it tied into a group of strong reflections associated with a different type of build-up, and believed to represent reefs in the NE and SW shelf areas of the basin. This horizon was tied into the Anglesea Well in the zone where the geologic log shows Oligocene.

Top of Unit I horizon (base Unit II) represents the basal line of a thick section showing good continuity on many reflected events. Along this horizon and in the NW portion of the basin, several lines show a possible depositional unconformity with the underlying reflectors. A fair reflection with good character over 80 percent of the surveyed area, was used to map this important horizon.

Base of Unit I horizon represents what is being called "basement". Good strong reflections associated with low frequency, are believed to be caused by shallow basement along the edges of the basin. Toward the centre of the basin the basement reflections disappear, probably due to the shielding effect of hard competent shallow beds. Eroded basement could also be the reason for the absence of this type of reflection. Almost 70 percent of the basement horizon is represented by a phantom of the deepest bona fide reflected events unmasked by multiples.

Along the NE and SW flanks of the basin, Unit I depicts a prominent zone of truncated wedge edges and pinchouts in updip convergence. Steep and good reflections inside Unit I are clearly overlapped by gentle dipping events in the overlain Unit II.

Correlation of group reflections in Unit I and steep events in Unit II were the criteria used to identify the fault-flexures depicted in the NE flank of the basin.

Gentle arching over undisturbed flat sediments and present in zones of no reflections, have been interpreted as possible intrusive plugs.

Four basic contour maps and two thickness maps were prepared to illustrate the seismic interpretation of the Bass Basin:

1. Structure Top Basement
2. Structure Base Unit II
3. Structure Top Unit II
4. Structure Top Unit III
5. Thickness Unit I
6. Thickness Unit II

. . . . .

SOUTH AUSTRALIA
KANGAROO ISLAND
O.E.L. Nº 26
LACEPEDE SUB-BASIN
YOUNG ROCKS
VICTORIA
Mt GAMBIER
OTWAY BASIN
WARRNAMBOOL
MELBOURNE
GEELONG
PORT PHILLIP BAY
ANGLESEA SUB-BASIN
SALE
LAKES ENTRANCE
P.E.P. 38
GIPPSLAND BASIN
FARMOUT ESSO EXPLORATION
P.E.P. 49
P.E.P. 40
P.E.P. 39
STATE BOUNDARY
TASMAN SEA
INDIAN OCEAN
KING ISLAND
BASS BASIN
E.L. Nº 1/60
FLINDERS ISLAND
LAUNCESTON
TASMANIA
LEGEND
S. AUSTRALIA & VICTORIA
T POST MESOZOIC
M MESOZOIC
B PRE-MESOZOIC AND BASEMENT UNDIFFERD
TASMANIA
T POST MESOZOIC
MESOZOIC
Jd Dolerite
Tr Triassic
PRE-MESOZOIC
P Permian
B Basement Undifferentiated
HAEMATITE EXPLORATIONS PTY. LTD.
INDEX MAP
SOUTH AUSTRALIA, VICTORIA & TASMANIA
BASIN AREAS
PETROLEUM TENEMENTS
048037
5 cm
G.H.H. OCTOBER. 1963
L.C. REED
SCALE OF MILES
0 10 20 30 40 50 60 70 80
1: 1,013,760
OG-618
Bass Basin part I
OR-001

MAIN PROSPECTS

	LENGTH miles	WIDTH miles	AREA sq. miles	DEPTH TO BASEMENT feet
DRAPE STRUCTURES				
B2-14-3	20	2·3 4·5	60	9500
B4-16	20	3·5	70	6500
B2-21	9	6	55	9000
B13	7	5	35	9000
B12-1-13	30	3 8	185	9000
SHELF REEFS				
N.E. SHELF REEF	35	12	400	5000
S.W. " "	35	10	350	6000
PINCHOUTS				
N.E. FLANK	70	6	400	8000
S.W. "	60	7	400	8500
BASIN REEFS				
13 Recognised	3 miles av. diameter		100	

FIG. 1

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

PROSPECTIVE FEATURES

048038

G.H.H. SEPT., 1964.

L.C. REED

SCALE OF MILES

0 10 20 30 40 50

1 : 506,880

OG-676

5 cm

Bass Basin part 1

FIG. 2

CROSS SECTION B22 – B10
(IN PART)

Bass Basin part I

048039

OR-001

OG-666


FIG. 3
CROSS SECTION B1-B23
N.W.
B1
SCALE NORMAL
B23
S.E.
5000'
10,000'
15000'
SHELF
HINGE
UNIT I
UNIT II
UNIT III
PINCHOUT
B1
B23
HORIZONTAL SCALE OF MILES
0
5
10
15
20
STRATIGRAPHIC SEQUENCE
048040
OG-668

FIG. 4

CROSS SECTION B2.B24

Bass Basin part I

048041

OG-669

OR-C01

CROSS SECTION B15

STRATIGRAPHIC SEQUENCE

PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)
Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)
Marine clastics (?)

GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

Bass Basin part I

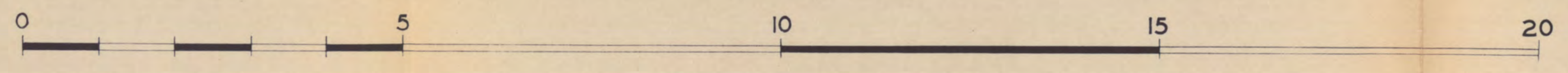
048042

OR-001

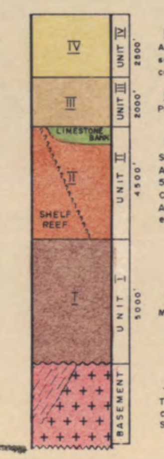
OG-670

CROSS SECTION B5

HORIZONTAL SCALE OF MILES



STRATIGRAPHIC SEQUENCE



PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)
Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)
Marine clastics (?)

GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

Bass Basin part I

048043

OG-671

OR-001

FIG. 7

CROSS SECTION B9

Bass Basin part 1

048644 OG-672

FIG. 8

CROSS SECTION B10
(IN PART)

Bass Basin part I

048045

OG-674

OR-001

FIG. 9

CROSS SECTION B21
(IN PARTS)

HORIZONTAL SCALE OF MILES

0 5 10 15 20

5 cm

STRATIGRAPHIC SEQUENCE

Bass Basin part 1

048046

GR-001

OG-673

FIG 10

CROSS SECTION B11

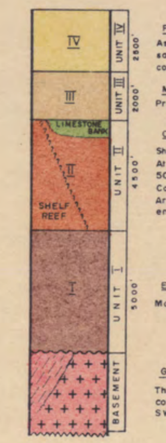
NORTHWEST HALF

HORIZONTAL SCALE OF MILES

0 5 10 15 20

5 cm

STRATIGRAPHIC SEQUENCE



PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)
Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)
Marine clastics (?)

GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

Bass Basin part I

048047

OG-667

OR-001

FIG 11
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
STRUCTURE TOP BASEMENT
048048
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0
10
20
30
40
50
1: 506,880
O.G. 683
STRATIGRAPHIC SEQUENCE
UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria
UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands.
LIMESTONE BANK
SHELF REEF
UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment
UNIT I 5000'
EOCENE (?)
Marine clastics (?)
MAPPED HORIZON
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
Cape Otway
MORNINGTON RIDGE
KING ISLAND CREST
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
AREA OF GENTLE TO STEEP REFLECTIONS IN THICK PALAEOZOICS (?) BELOW BASIN
2000'
3000'
4000'
5000'
6000'
7000'
8000'
9000'
10,000'
11,000'
12,000'
LEGEND
Volcanic Plug
Flexure
Cross Section


FIG 12
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
STRUCTURE BASE UNIT II
048049
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
OG-682
STRATIGRAPHIC SEQUENCE
IV
UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.
III
UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands.
LIMESTONE BANK
II
SHELF REEF
UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.
MAPPED HORIZON
I
UNIT I 5000'
EOCENE (?)
Marine clastics (?)
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
Cape Otway
MORNINGTON RIDGE
KING ISLAND CREST
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
PINCHOUT BASAL BEDS UNIT II
HINGE ZONE
SHELF
FIG 18
FIG 19
FIG 20
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
LEGEND
Drape Structure
Flexure
Flexure (Young Tertiary)
FIG.20 See Detailed Map
Cross Section

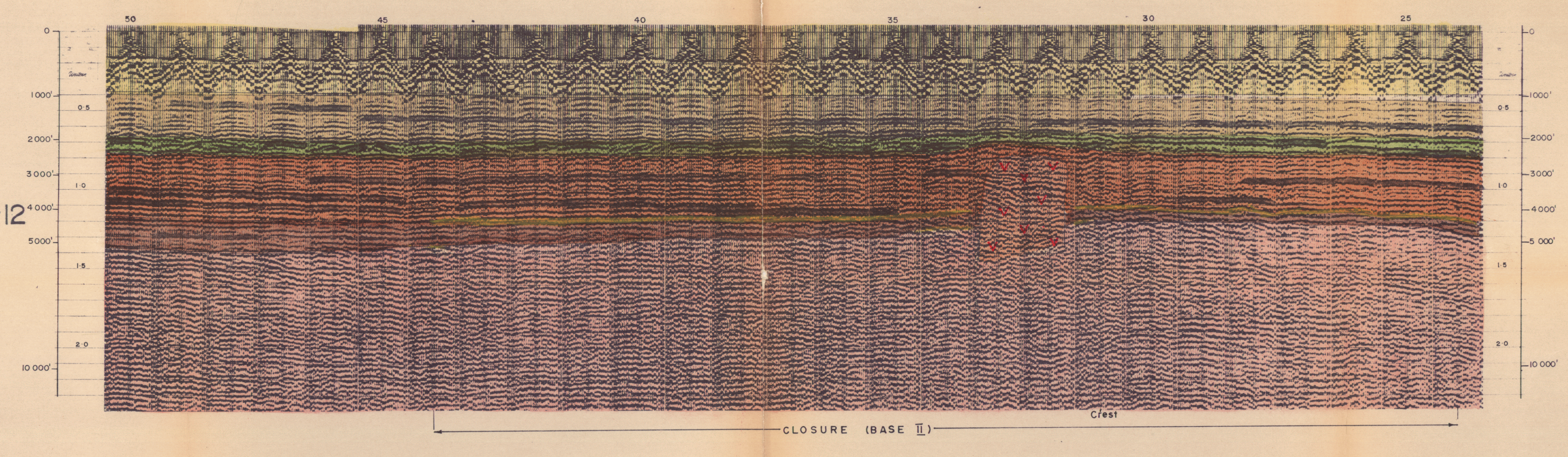
FIG. 13
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
STRUCTURE TOP UNIT II
048050
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
OG 675
STRATIGRAPHIC SEQUENCE
MAPPED
IV
UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.
III
UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands.
LIMESTONE BANK
II
SHELF REEF
UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.
I
UNIT I 5000'
EOCENE (?)
Marine clastics (?)
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
Cape Otway
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
SHELF
LIMESTONE BANK
SHELF REEF FRONT
ZONE OF NO REFLECTIONS
ZONE OF POOR OR WEAK REFLECTIONS
LEGEND
Flexure (Young Tertiary)
(Fig. 25) See Detailed Maps
Cross Section

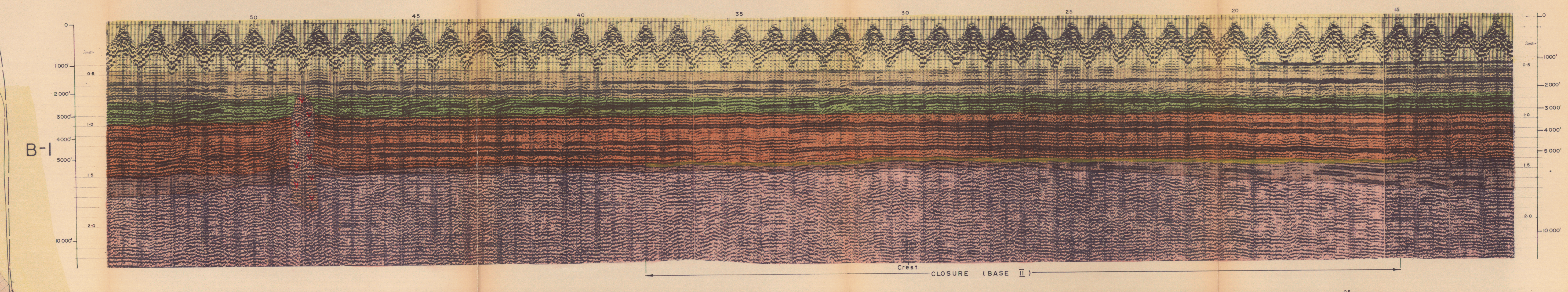
FIG. 14
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
STRUCTURE TOP UNIT III
048051
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
STRATIGRAPHIC SEQUENCE
MAPPED HORIZON
IV
UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.
III
UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands.
LIMESTONE BANK
II
SHELF REEF
UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500' - 1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.
I
UNIT I 5000'
EOCENE (?)
Marine clastics (?)
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
LEGEND
Gentle arching carried through from deeper features:
from drape
from reef
Reflection horizon with good character and excellent continuity. Suggests uniform sedimentary conditions.
NOTE: Upper part of Unit III overlaps into adjacent basins.
B2 Cross Section
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
Cape Otway
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
FLEXURE (Young Tertiary)
500'
1000'
1500'
2000'
2500'

FIG 15 Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
THICKNESS UNIT I
048052
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
O.G. 684
STRATIGRAPHIC SEQUENCE
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.
MIOCENE (?)
Probably marls, limestones and calcareous sands.
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.
EOCENE (?)
Marine clastics (?)
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
MAPPED
LIMESTONE BANK
SHELF REEF
UNIT IV 2500'
UNIT III 2000'
UNIT II 4500'
UNIT I 5000'
BASEMENT
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
Cape Otway
MORNINGTON RIDGE
KING ISLAND
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
LEGEND
Flexure
Cross Section


FIG. 16 Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
THICKNESS UNIT II
048053
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
OG 685
STRATIGRAPHIC SEQUENCE
MAPPED
IV
UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria
III
UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands.
LIMESTONE BANK
II
SHELF REEF
UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment
I
UNIT I 5000'
EOCENE (?)
Marine clastics (?)
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
LEGEND
Flexure
Cross Section
Cape Otway
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
PINCHOUT UNIT II
1000'
1500'
2000'
2500'
3000'
3500'
4000'
4500'


FIG. 17
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
TOTAL THICKNESS
UNITS I to IV
048054
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1: 506,880
O.G. 686
STRATIGRAPHIC SEQUENCE
MAPPED
IV UNIT IV 2500'
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is and coastal Victoria
III UNIT III 2000'
MIOCENE (?)
Probably marls, limestones and calcareous sands
LIMESTONE BANK
II SHELF REEF UNIT II 4500'
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment
I UNIT I 5000'
EOCENE (?)
Marine clastics (?)
BASEMENT
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank
LEGEND
Approximate Outline of Silled Basin (Pinchouts of Units I and Lower II.)
Volcanic Plug
Flexure
Cross Section
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
Cape Otway
MORNINGTON RIDGE
KING ISLAND CREST
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
NARACOOPA
CURRIE
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
AREA OF GENTLE TO STEEP REFLECTIONS IN THICK PALAEOZOICS (?) BELOW BASIN
2000
4000
5000
6000
7000
8000
9000
10000





B-13 STRUCTURE

EXPLANATION:

The structure is crossed by one line and is mapped as being oval in shape, with a length of 7 miles and width of closure of 5 miles. It could, however, be considerably elongated, for the lines of control are widely spaced.

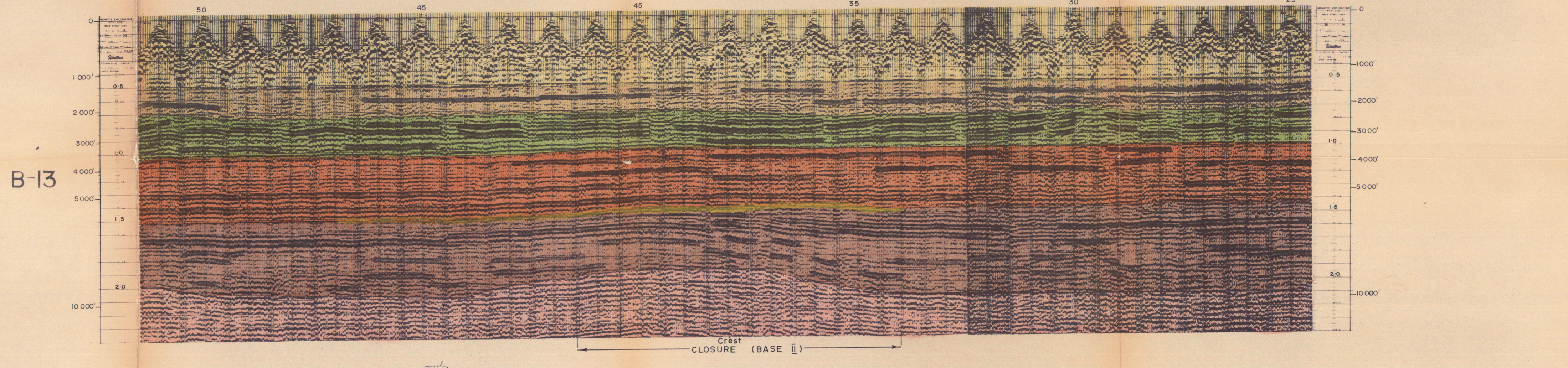
Closure at the base of Unit II amounts to 100 feet. (Probably B-13 passes through the plunge rather than the culmination). Draping extends to the middle of Unit II, or some 4,500 feet above basement.

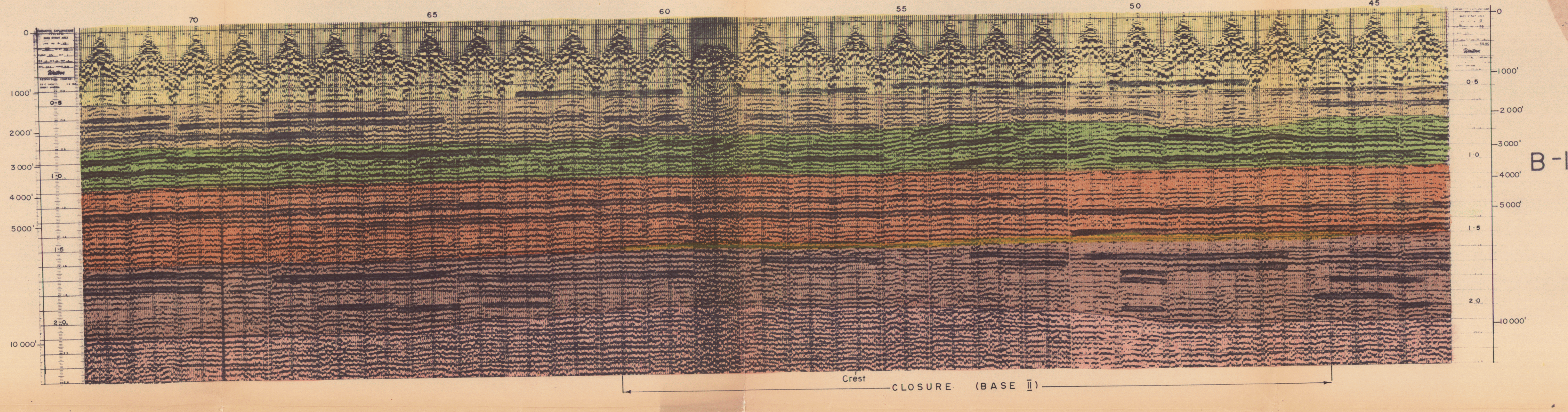
The structure is very close to the B-12-1-13 feature and represents a second, basinward, trend. The basement is not clearly defined, but is mapped in accordance with the reflections of Unit I which are unusually gentle and only slightly steeper than those of Unit II.

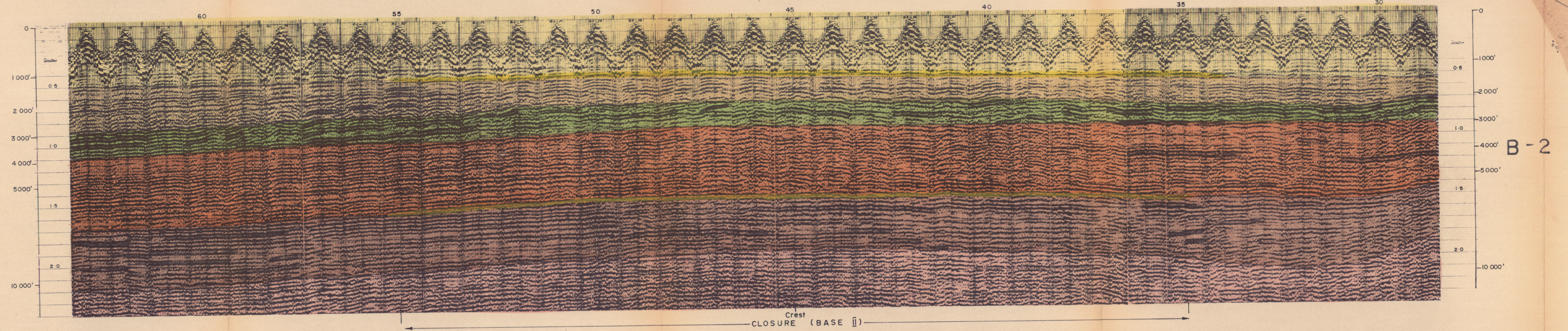
Oil Prospects:

This structure may be longer and have considerably more closure than now appears to be the case, for in all probability the line B-13 does not pass through the highest part. The potentialities of this feature should not be downgraded because of the small amlunt of closure that is indicated.

The questions of source beds, migration and reservoir possibilities, are similar to those discussed under B-4-16 and B-2-14-3.







B-12-1-13 STRUCTURE

EXPLANATION:

This feature is essentially a southeast plunging nose controlled by a prominent, wide basement high or ridge. From the map Structure Top Basement it is seen that the basement high is a conspicuous feature that begins in the shallow edge of the basin and from B-12 plunges some 5,000 feet to B-13. In the area of B-12 and B-1 the basement high is 10 miles or so wide and has a relief of some 2,000 feet. Farther to the southeast the top becomes quite sketchy, but in B-13 it apparently has narrowed to about 3 miles and the relief has decreased to about 1,000 feet.

The other outstanding thing in connection with the nose is the northwestern wedging out of Unit I over the crest of the basement high, shown on the map Thickness Unit I. In B-13 it is about 3,000 feet thick but over the crest in B-1 and B-12 it is less than 500 feet or even absent. It thickens in the flanks to 2,500 feet.

The basement high, therefore, was in existence before Unit I was deposited and remained as an island (between B-12 and B-1) until about the end of Unit I. A considerable amount of wedging and overlapping is seen on the flanks of the nose in B-12 and B-1. The overlying Unit II appears to have suffered no thinning that could be attributed to non-deposition, although some from draping. The effective draping extended, though faintly, to the top of the Ls. Bank and the contours on the map Structure Top Unit II and show no further effect of the nosing feature.

The nose is at least 30 miles long and the plunge measured at the base of Unit II is about 2,000 feet.

B-12: Width of drape 7 miles.
Amount of drape 350 feet at base of Unit II.
Drape effective for 2,500 feet, to top of Unit II.

B-1: Width of drape 8 miles.
Amount of drape 200 feet at base of Unit II.
Drape effective for 3,500 feet, to top of Unit II.

B-13: Width of drape 3 miles.
Amount of drape 200 feet at base of Unit II.
Drape effective for 5,000 feet to base of Ls. Bank.

It is noted that the B-12-1-13 nose stems from the shallow edge of the basin northwest beyond the confines of the northeast-southwest belt of constriction and associated steep hinging that is present on either side of the basin.

Oil Prospects:

The B-12-1-13 nose is the only feature of this type that has been found within the basin. It presents an interesting prospect for both the Unit I and Unit II.

The Unit I, as pointed out in the above discussion, is 3,000 feet thick down the plunge and 2,500 feet thick on the flanks of the nose. The beds on both plunge and flanks wedge out to less than 500 feet on the crest, on lines B-12 and B-1. Such wedging should produce effective traps for oil migrating from source beds deeper in the basin.

Pinching out within Unit II, mostly of the lower beds, takes place in the course of thinning toward the edge of the basin. This amounts to about 1,000 feet (from 3,500 to 2,500 feet) between B-13 and B-12. Facies changes may also play a part in producing effective traps.

B-2-21 STRUCTURE

EXPLANATION:

This drape structure displays movement extending as high as Unit IV. Because of this and the presence of northwest closure it is felt that the structure is not part of the B-12-1-13 nose.

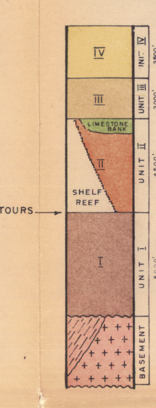
The structure appears to be somewhat domal with an estimated length of 9 miles and closure width of 6 miles. The amount of closure is 400 feet, measured at the base of Unit II. The effective closure extends at least to the base of Unit IV where it amounts to 150 feet. Thus, at least 7,500 feet of section has closure.

Oil Prospects:

This is one of the most interesting of the drape structures. It has a relatively large amount of closure at the base of Unit II as well as through the section into Unit IV. Accumulation, therefore, is possible not only within the sands (assumed) of Units I and II, but also within the Ls Bank and overlying Unit III.

The structure is in a favourable position for updip migration from the potential source beds of Units I and II in the deepest portion of the basin.

STRATIGRAPHIC SEQUENCE



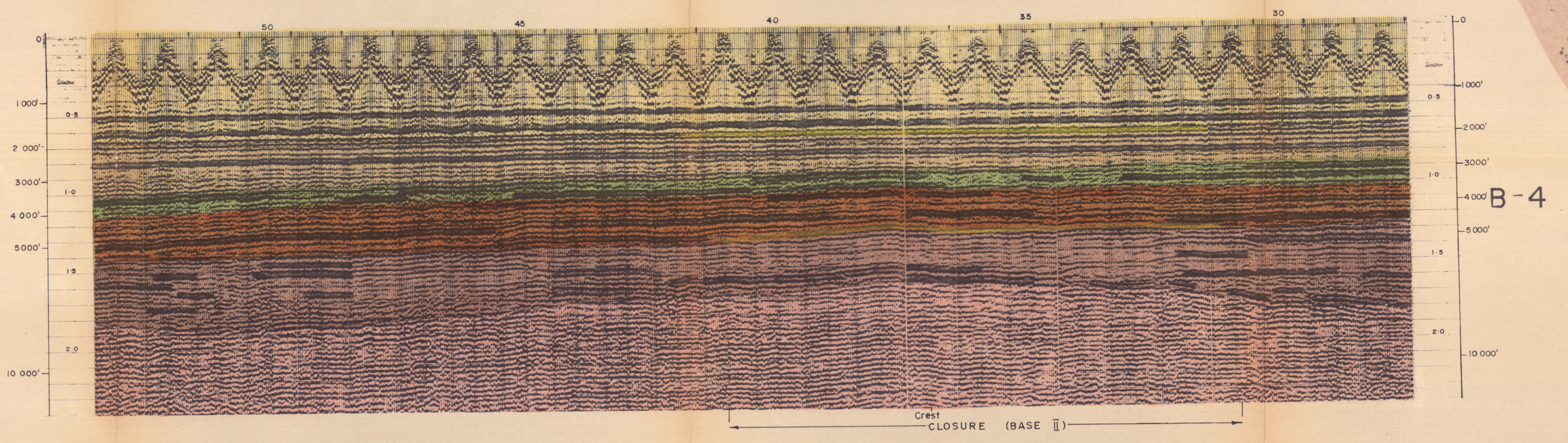
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)
Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water

EOCENE (?)
Marine clastics (?)

GRANITE, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.



B-4-16 STRUCTURE

EXPLANATION:

The structure is estimated to be about 20 miles long. The width of closed area, measured at the base of Unit II, is 4 miles. The amount of drape at the base of Unit II is 125 feet on line B-4 and 200 feet on B-16. The effective draping extends upward to at least the base of Unit IV where it is 40 feet, thus involving about 4,500 feet of section. Closure would be appreciably greater were it not for the position of the structure within the steep hinge zone.

Oil Prospects:

Units I and II are the more likely to contain source beds, but Unit III must also be considered. The flankal or hinge zone location of this structure places it in a favourable position for updip migration. Accumulation is possible not only within the sands of Units I and II, but also within Unit III.

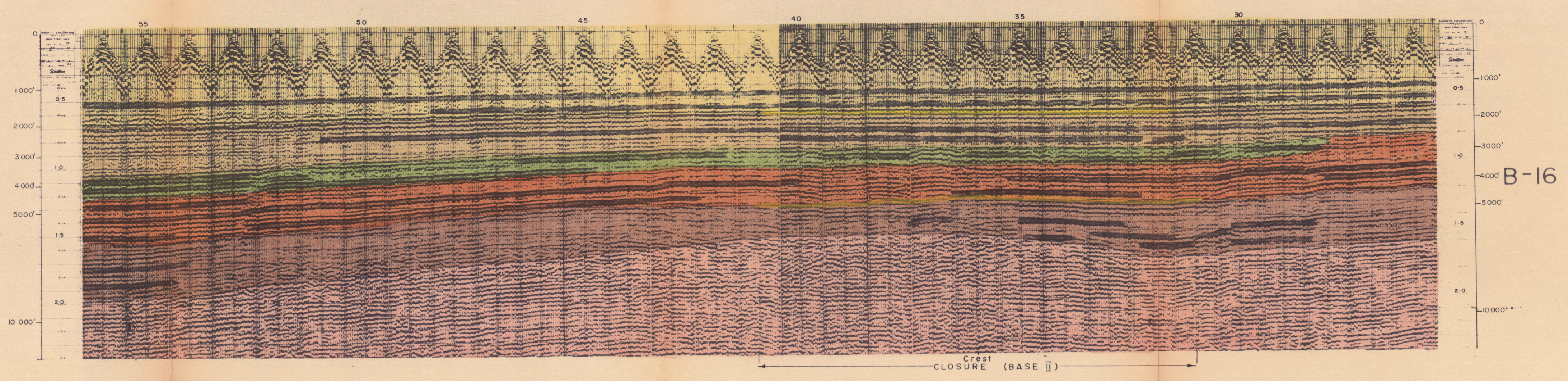


FIG. 18 19

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

048055

DRAPE STRUCTURES

NORTH EAST SIDE OF BASIN

5 cm

G.H.H. SEPTEMBER, 1964

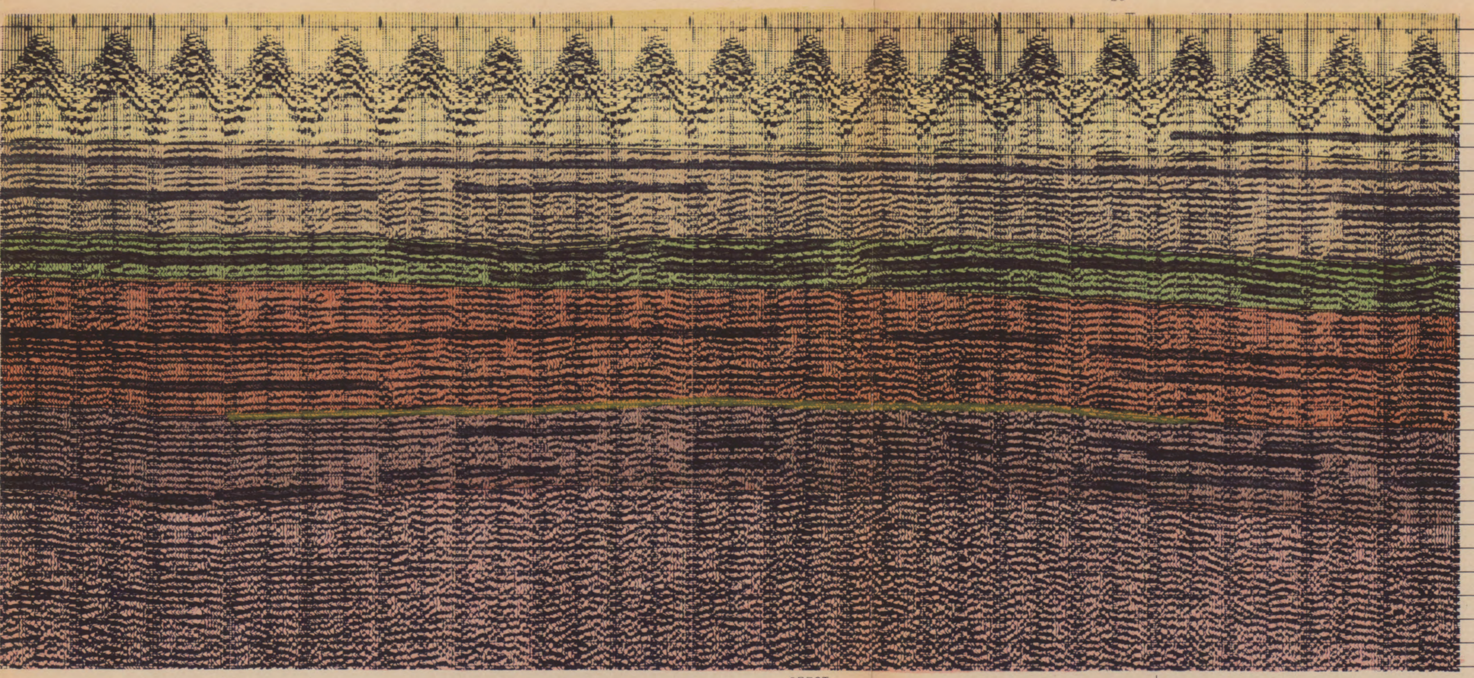
L.C. REED
A.S. MAUREIRA

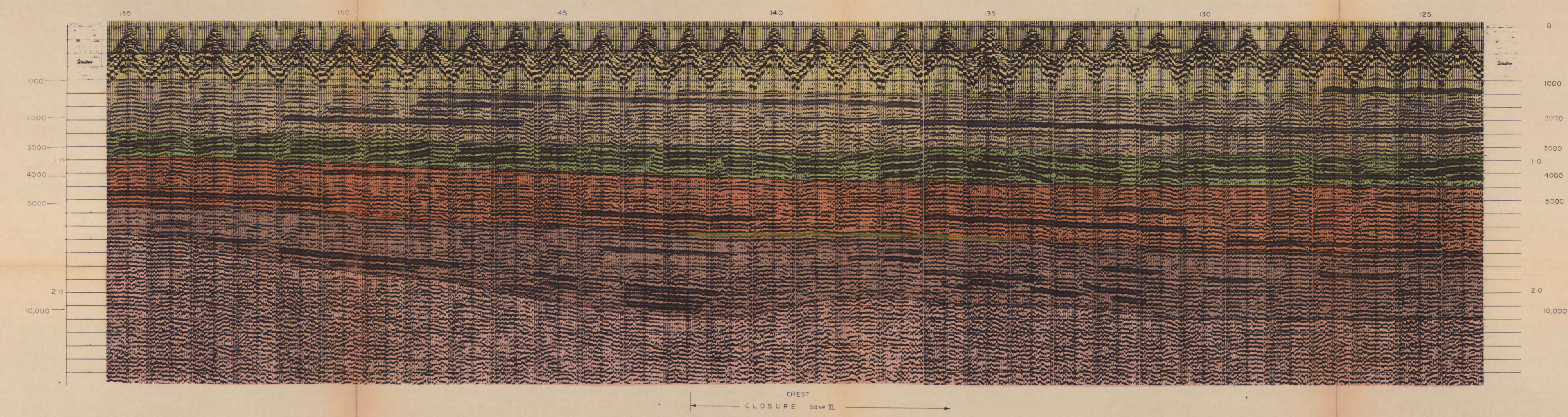
SCALE OF MILES
0 5 10 15 20
1 : 250,000

OG 687

Bass Basin part I

OR-001





B-2-14-3 STRUCTURE

EXPLANATION:

The structure is at least 20 miles long and is best developed along B-3. It may extend farther as suggested by a slight rise at the junction of lines B-20 and B-15. Also, it may extend to the northwest beyond B-2. It is the only drape structure of any magnitude found on the southwest, less mobile side of the basin.

The width of the closed area varies from 2.3 to 4.5 miles. Closure measured at the base of Unit II varies from line to line. On B-2 it is 250 feet, B-20 150 feet, B-14 100 feet and B-3 has the greatest closure of 500 feet. Draping is most intense in Unit I and decreases upward. It is effective up to the base of the Ls. Bank (upper part Unit II), involving about 4,500 feet of section (5,500 feet in B-14).

Although the actual top of the basement is somewhat vague, the form of the basement high on B-3 and B-14 appears to be somewhat sharp and steep on its southwest side but quite broad and gentle along B-2.

Oil Prospects:

The potentialities of this structure are essentially the same as for the others.

Conditions for migration are favourable, either from the deep portion of the basin or from the immediate area. The interval of the more likely source beds, Units I and II, are contained within the 4,500 feet of effective draping.

Little can be said concerning reservoir beds except that sands are expected and that no limestones are recognized below the Ls. Bank.

STRATIGRAPHIC SEQUENCE

PLIOCENE (?) - PLEISTOCENE

Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)

Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)

Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500' - 1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)

Marine clastics (?)

GRANITES, METAMORPHICS

Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

FIG. 20

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

DRAPE STRUCTURE

SOUTH WEST SIDE OF BASIN

C48056

5 cm

G.H.H. SEPTEMBER, 1964

L.C. REED
A.S. MAUREIRA

SCALE OF MILES

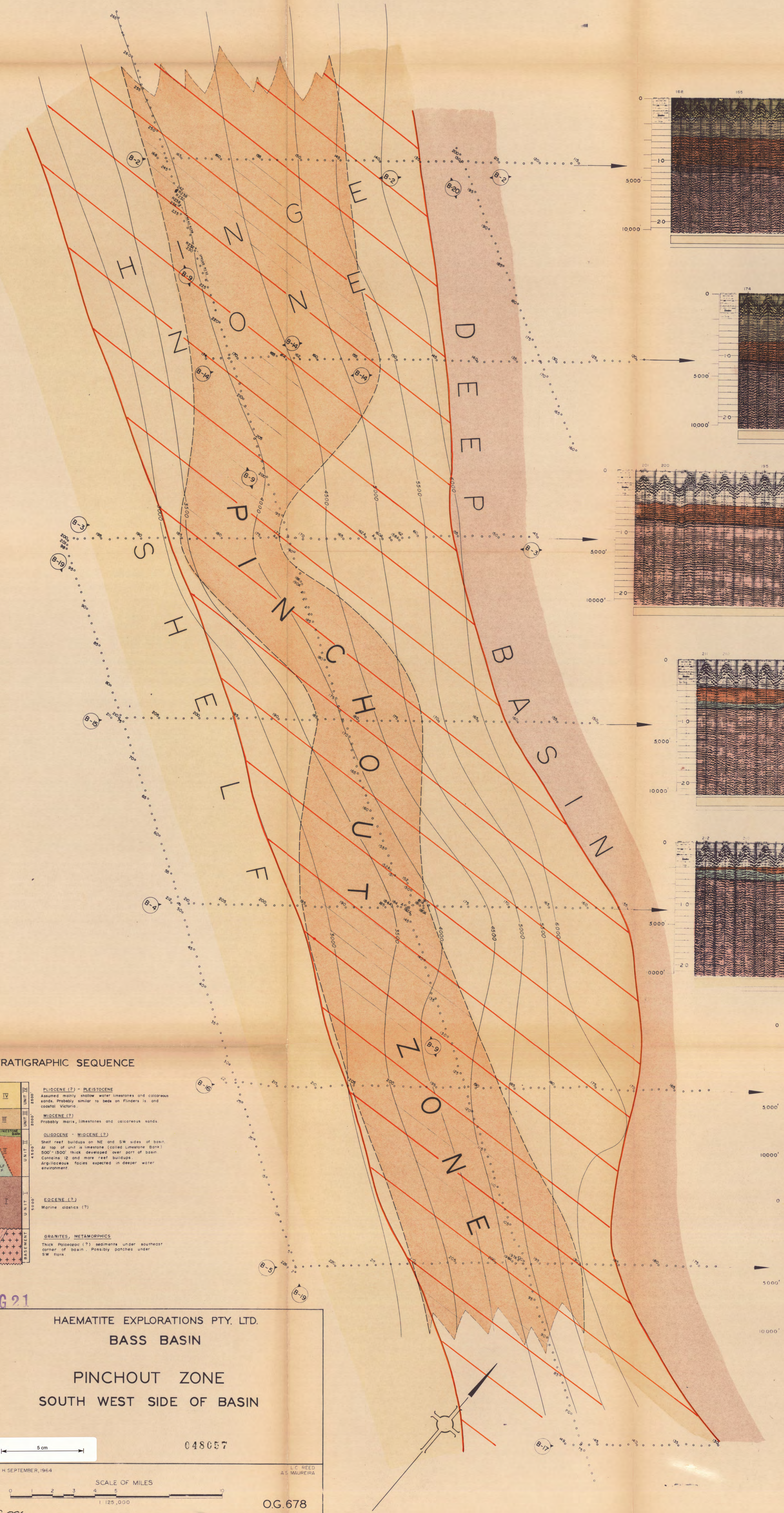
0 5 10 15 20

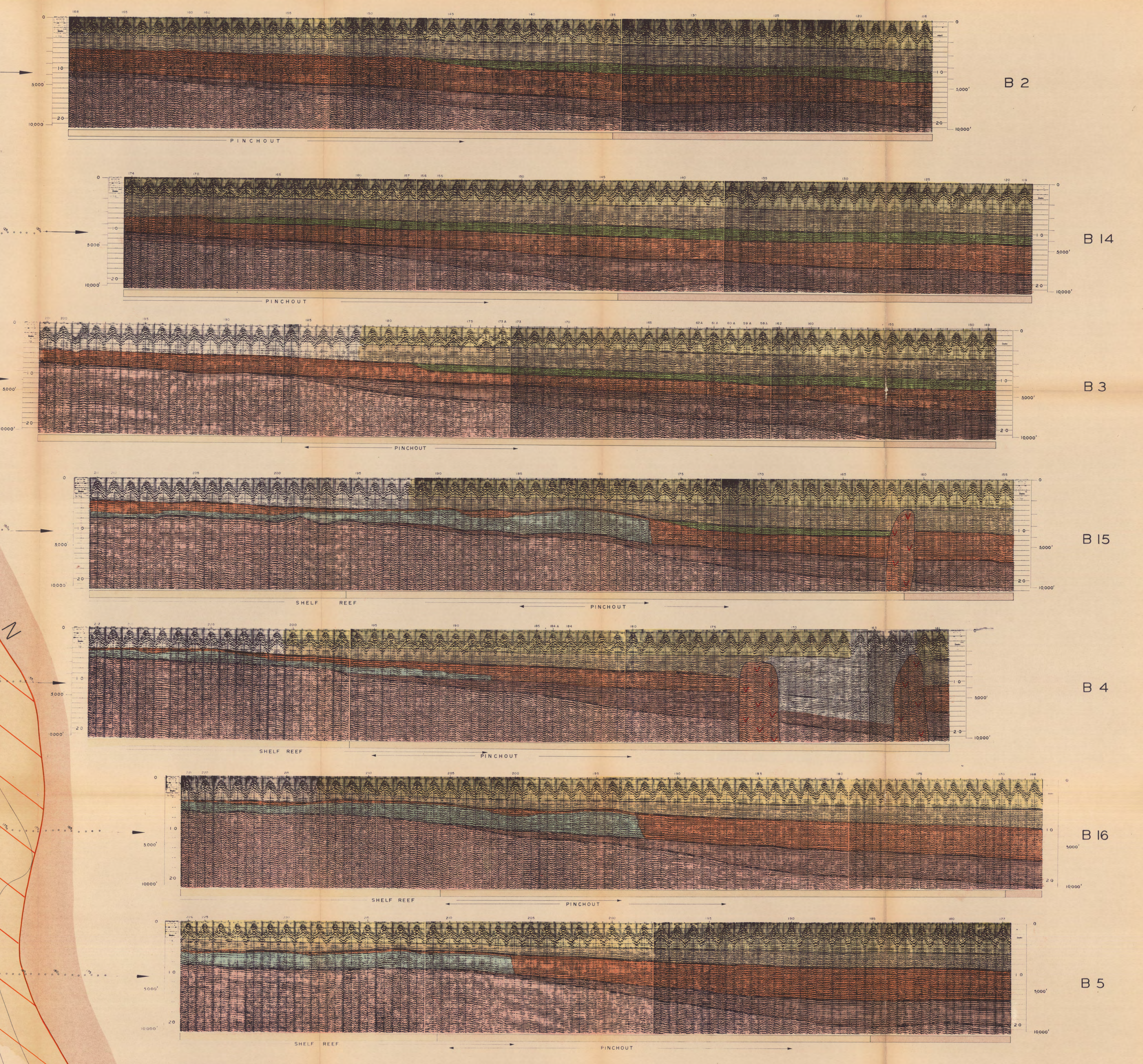
1:250,000

OG 690

Bass Basin part I

OR-001





STRATIGRAPHIC SEQUENCE

UNIT IV	2500'	PLIOCENE (?) - PLEISTOCENE	Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.
UNIT III	2000'	MIOCENE (?)	Probably marls, limestones and calcareous sands.
UNIT II (LIMESTONE BANK; SHELF REEF)	4500'	OLIGOCENE - MIOCENE (?)	Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.
UNIT I	5000'	EOCENE (?)	Marine clastics (?)
BASEMENT		GRANITES, METAMORPHICS	Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

FIG 2.1

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

PINCHOUT ZONE

SOUTH WEST SIDE OF BASIN

5 cm

048057

G.H.H. SEPTEMBER, 1964

L.C. REED
A.S. MAUREIRA

SCALE OF MILES

0 1 2 3 4 5 10

1 : 125,000

O.G. 678

OR-001

Bass Basin part I

EXPLANATION:

The main pinchout is of Unit I which basinward is about 300 feet thick. As mapped it covers an area of roughly 60 x 6 miles.

The structural contours on the top of Unit I show gentle nosing between B-3 and B-16.

Although Unit I pinches out around the basin, there are two areas (those mapped) in which the pinchout is sharper and more intensified. One area is on the northeast flank and the other on the southwest flank. The regional maps show these two areas to be structurally high, associated with the constriction or narrowing of the basin, steepening of the hinge zone and the flexures of the northeast flank.

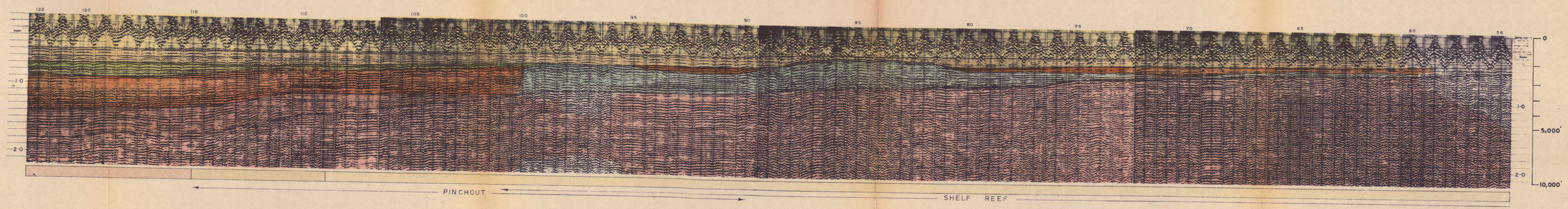
Oil Prospects:

As in the case of the shelf reefs, the two prominent pinchout zones are situated updip from the deepest portion of the basin. This deep area and enclosed nature of the basin during deposition of Unit I are important when considering the possibilities of oil source beds.

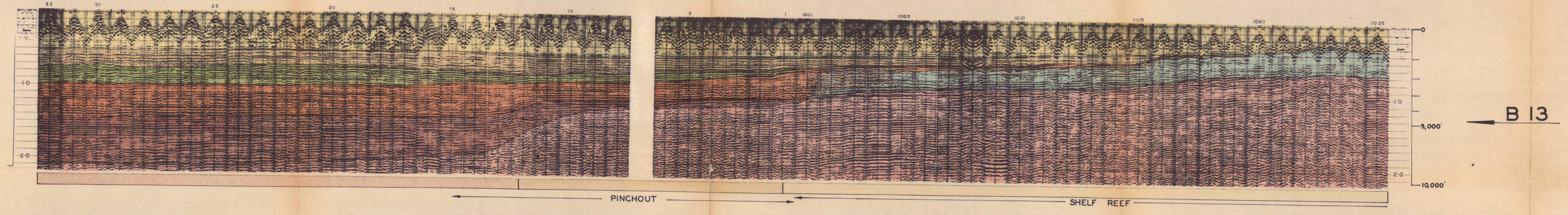
The basin is about 60 miles wide at the pinchout and updip migration is a very interesting consideration, especially in view of the structurally high condition within the area of this map.

Trap possibilities are decidedly good. Apart from the overall thinning and overlap by the overlying unit, it can be seen that there is much wedging out of the beds within the unit itself.

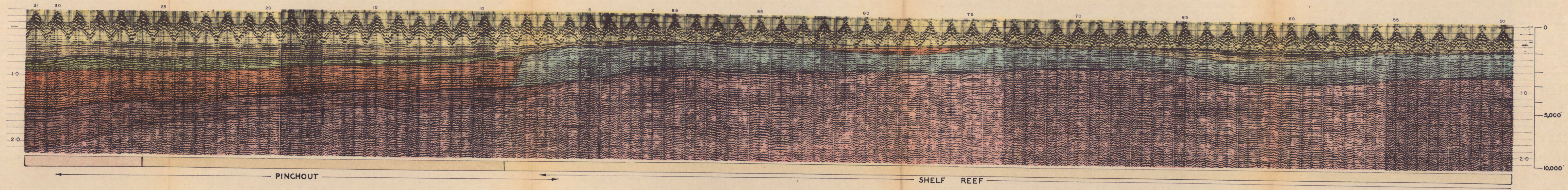
B 23



B 13



B 2



EXPLANATION:

The main pinchout is of Unit I which basinward is about 300 feet thick. As mapped it covers an area of 70 x 6 miles. (400 sq. mls.)

The structural contours on the top of Unit I show gentle nosing between B-23 and B-16 (next beyond B-4).

Although Unit I pinches out around the basin, there are two areas (those mapped) in which the pinchout is sharper and more intensified. One area is on the northeast flank and the other on the southwest flank. The regional maps show these two areas to be structurally high, associated with the constriction or narrowing of the basin, steepening of the hinge zone and the flexures of the northeast flank.

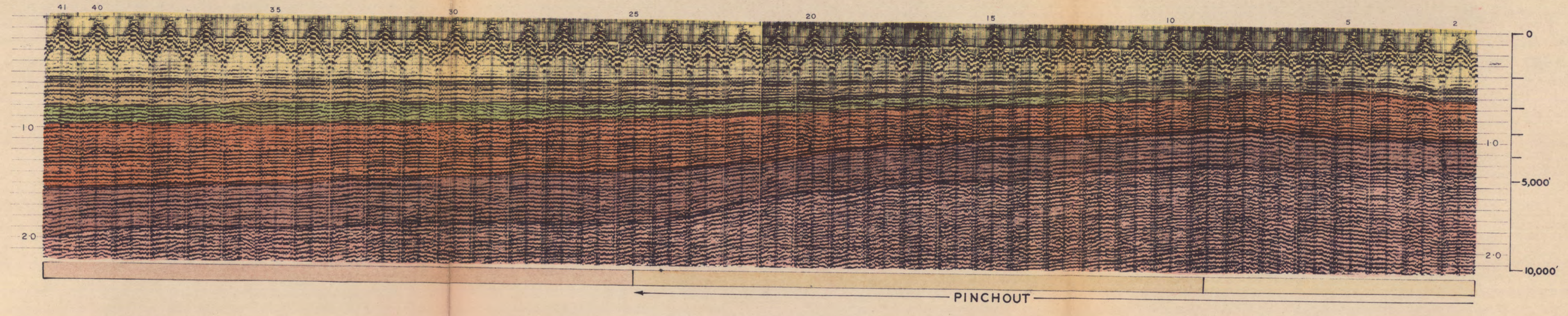
Oil Prospects:

As in the case of the shelf reefs, the two prominent pinchout zones are situated updip from the deepest portion of the basin. This deep area and enclosed nature of the basin during deposition of Unit I are important when considering the possibilities of oil source beds.

The basin is about 60 miles wide at the pinchout and updip migration is a very interesting consideration, especially in view of the structurally high condition within the area of this map.

Trap possibilities are decidedly good. Apart from the overall thinning and overlap by the overlying unit, it can be seen that there is much wedging out of the beds within the unit itself.

B 14



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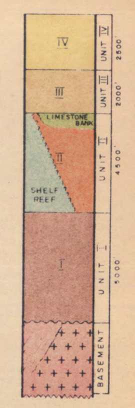


PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders is and coastal Victoria

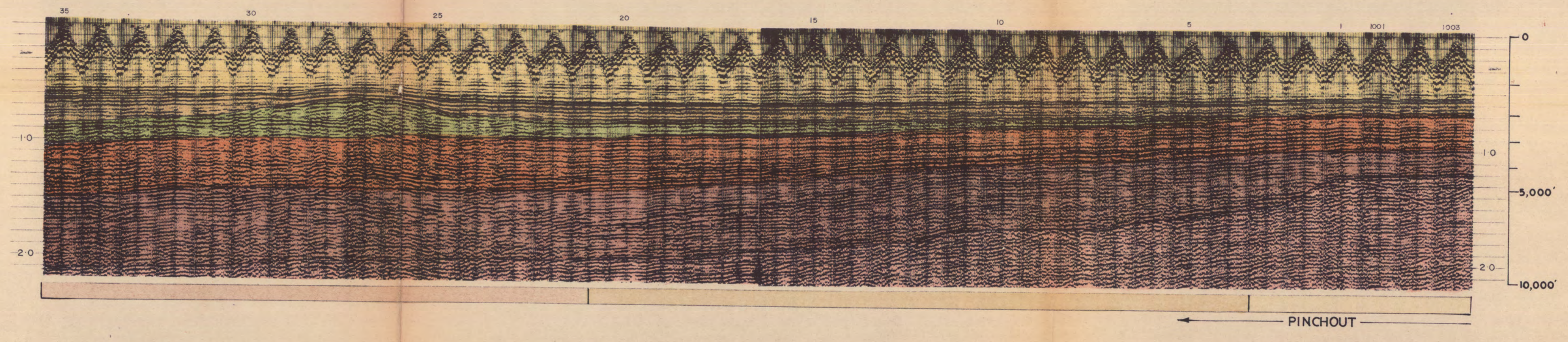
MIOCENE (?)
Probably marls, limestones and calcareous sands

OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500' - 1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment

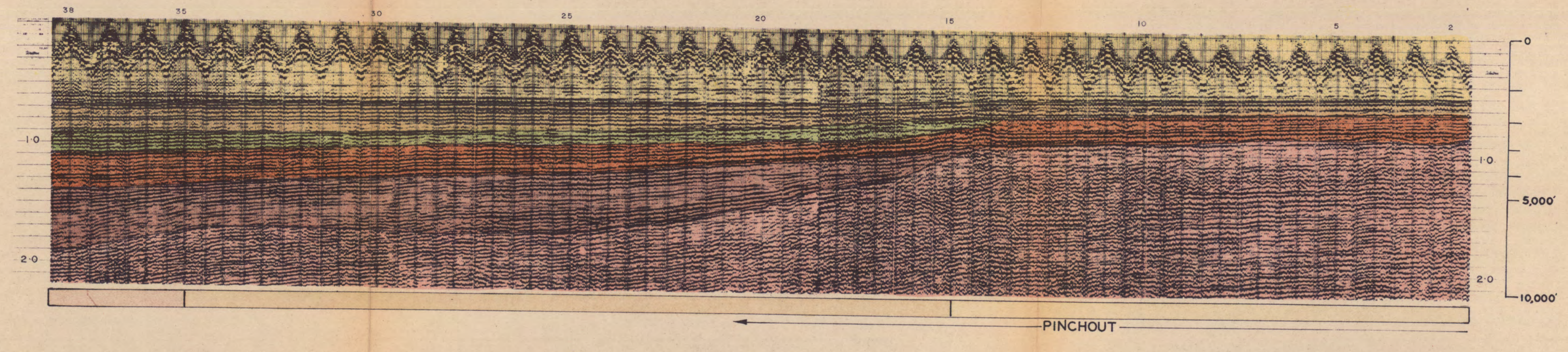
EOCENE (?)
Marine clastics (?)

GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

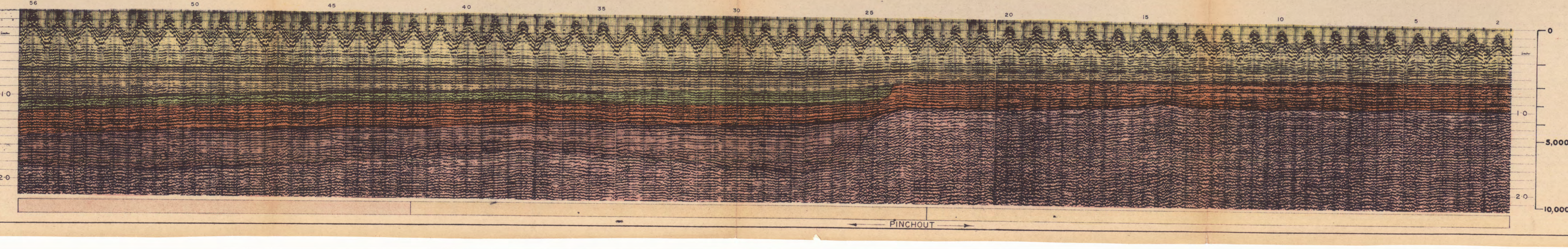
B 3



B 15



B 4



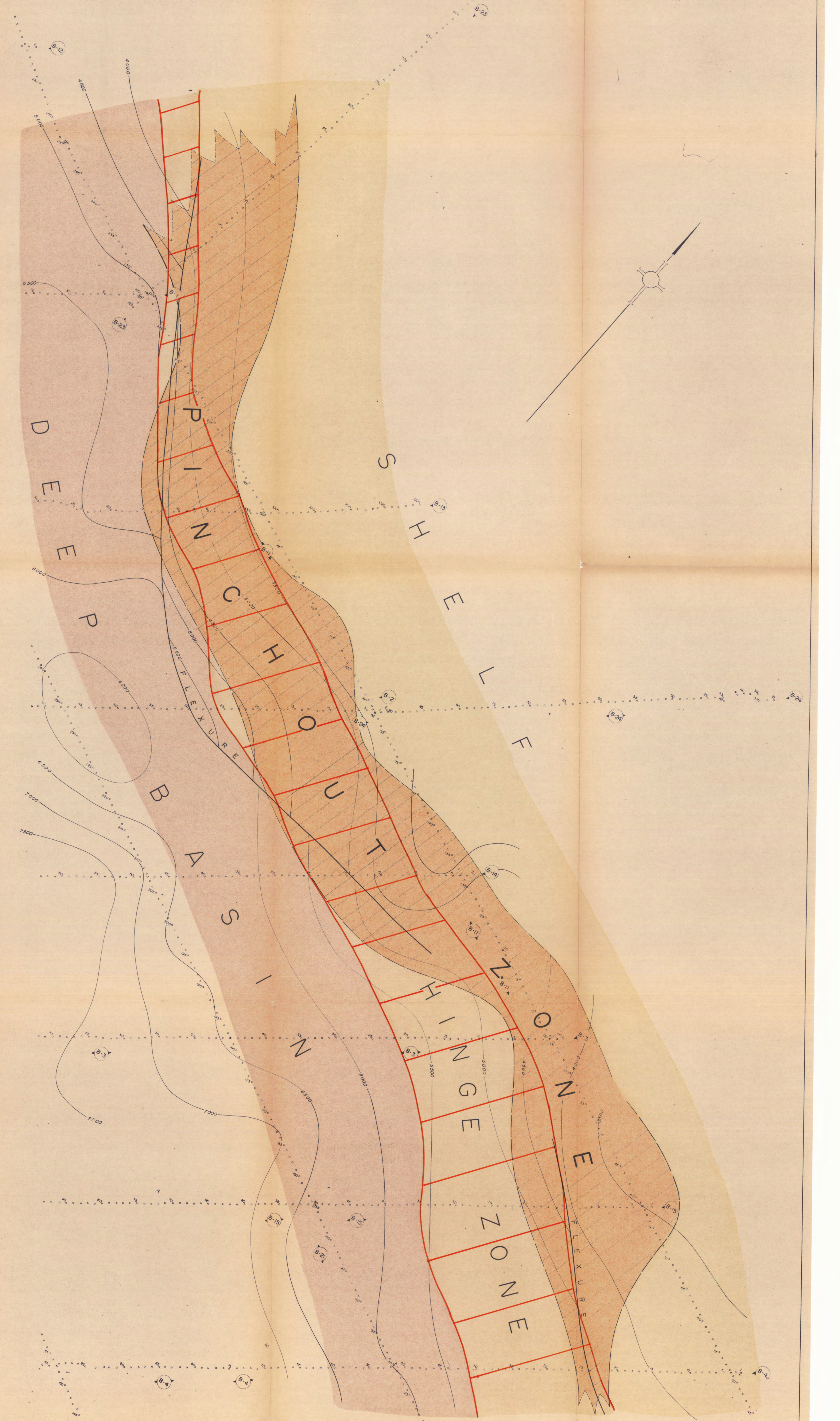


FIG. 22

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

PINCHOUT ZONE

NORTH EAST SIDE OF BASIN

5 cm

048058

G.H.H. SEPTEMBER, 1964

SCALE OF MILES

0 1 2 3 4 5 10

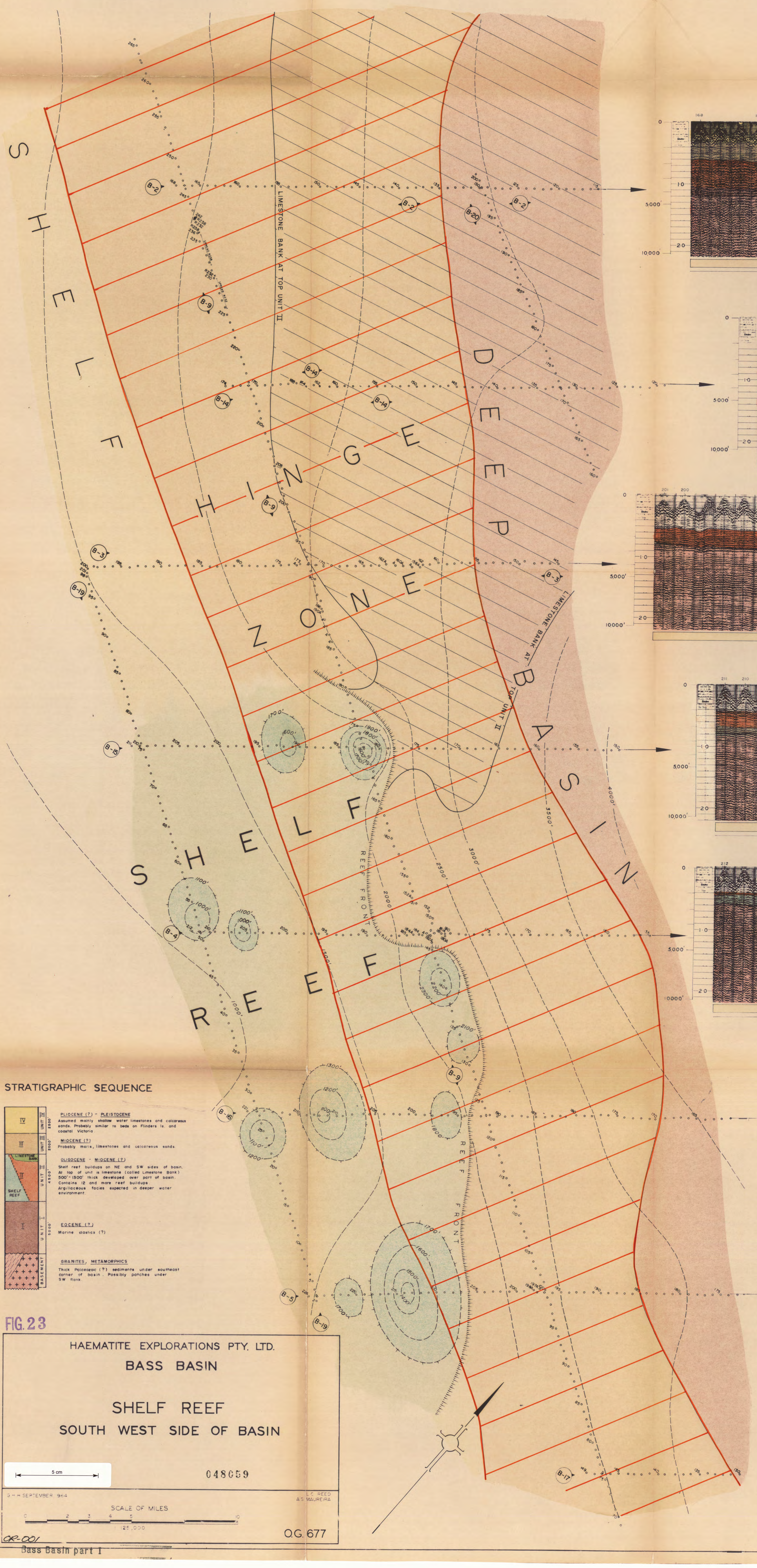
1 : 125,000

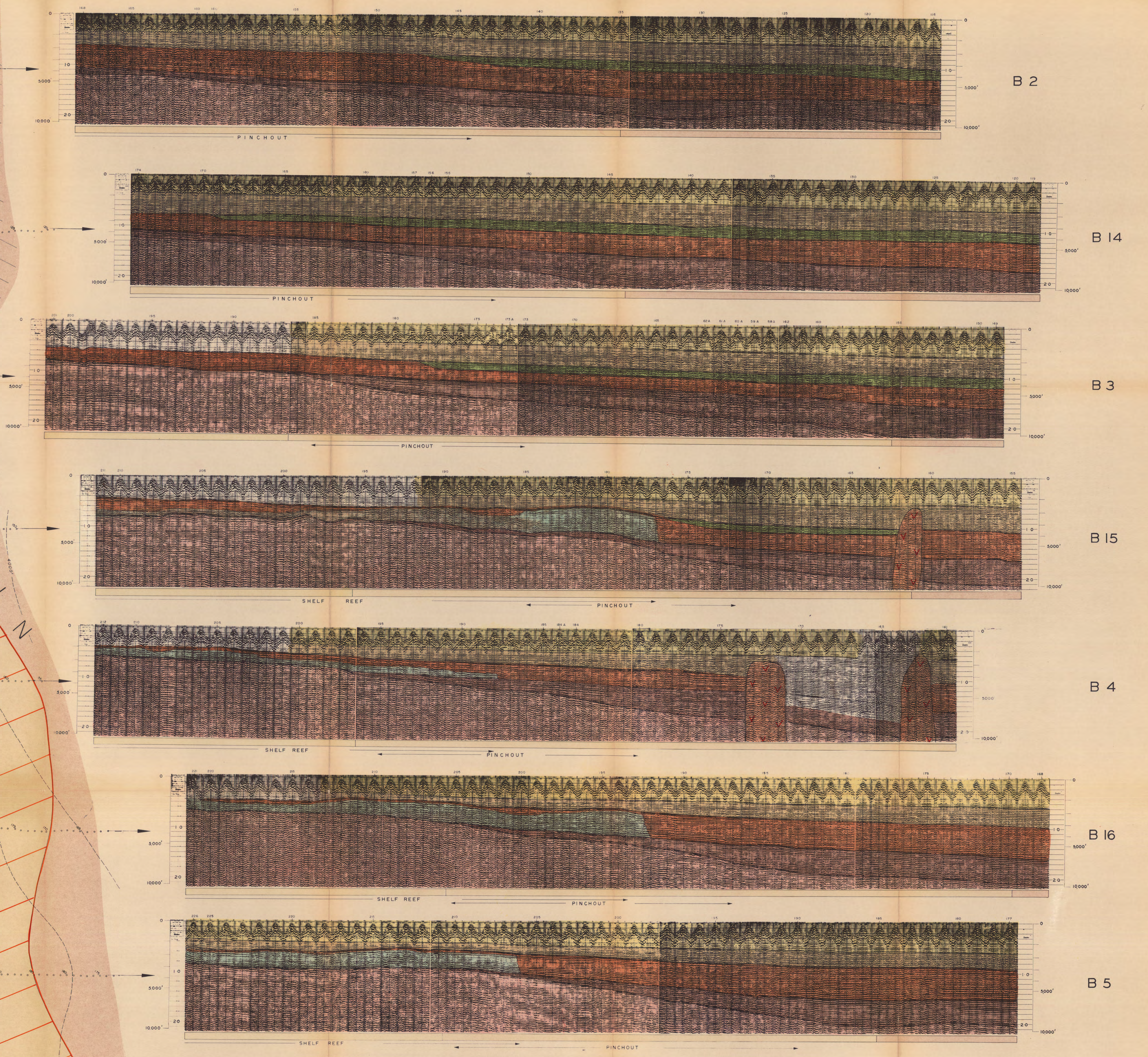
L.C. REED
A.S. MAUREIRA

O.G. 679

Bass Basin part I

OR-001





STRATIGRAPHIC SEQUENCE

PLIOCENE (?) - PLEISTOCENE

Assumed mainly shallow water limestones and calcareous sands. Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)

Probably marls, limestones and calcareous sands.

OLIGOCENE - MIOCENE (?)

Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500' - 1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)

Marine clastics (?)

GRANITES, METAMORPHICS

Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

FIG. 23

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

SHELF REEF

SOUTH WEST SIDE OF BASIN

5 cm

048059

G.H.H. SEPTEMBER, 964

L.C. REED
A.S. MAUREIRA

SCALE OF MILES

0 2 3 4 5 10

1:125,000

O.G. 677

OR-001

Bass Basin part I

EXPLANATION:

On both the northeast and southwest edge of the basin extensive areas display buildups. These are believed to have grown from a common shelf reef or sort of reef plateau.

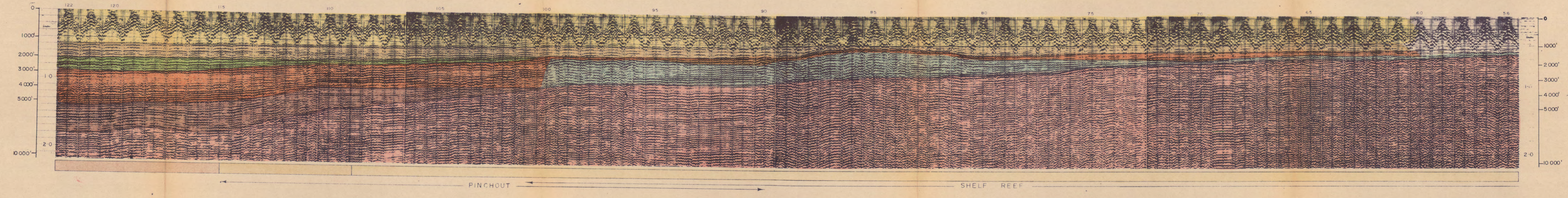
These features are recognized in the surveyed area over distances of 30 x 12 miles on the northeast flank and 35 x 10 miles on the southwest flank. The maximum thickness of the shelf reef where built up is about 2,000 feet, otherwise probably about half that amount. It is assumed that growth of the shelf reef is from the base of the Unit II.

The buildups are expressed in a prominent reflection marking the top of Unit II and rise as much as 500 feet. Where not built up, only a slight rise of the reflection marks the front of the shelf reef. The lower beds of the overlying Unit III wedge out against the buildups, but the higher beds assume draping attitude. While the buildups were growing they apparently kept ahead of sediments being deposited in the adjacent area. If the overlap of Unit III was instrumental in terminating the buildups it would imply that the sediments were turbid. The prominent reflection is common also to the reefs rising from the Ls. Bank and the same wedge and drape relationship with the overlying Unit III is seen.

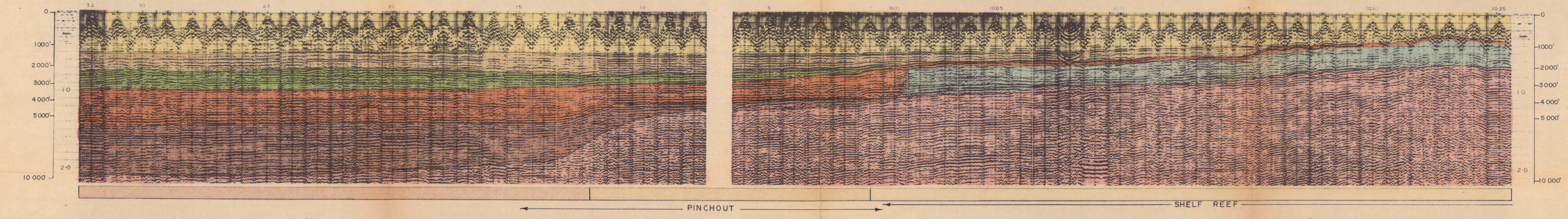
As may be observed from the regional map, the shelf reefs coincide with the magnetometer basement ridge that is apparent on both the northeast and southwest edge of the basin. Inasmuch as the ridge was apparently somewhat positive throughout the development of the basin, it would be expected that the shelf reefs would be confined to this area of slower subsidence. Thus the northeast and southwest shelf reef areas would tend to be structurally higher than the areas adjacent.

Oil Prospects:

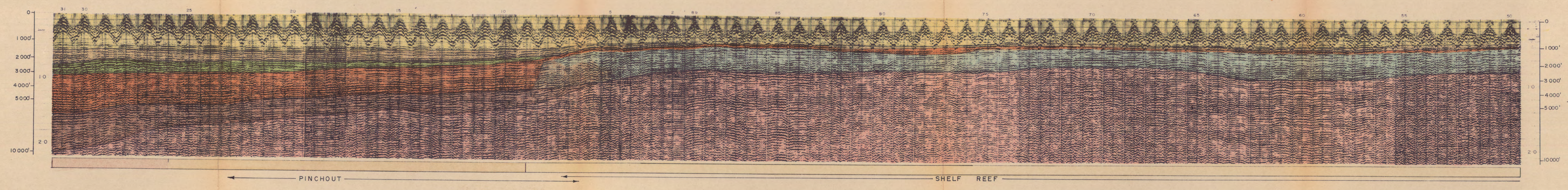
There are several favourable factors that make the shelf reefs of both northeast and southwest sides of the basin attractive from the standpoint of possible oil accumulation. (1) The overall reef area is structurally high, (2) the reef area is situated updip from the deepest portion of the basin where optimum conditions for source beds are generally pictured. The source bed potentialities are further enhanced by the presence of an enclosed basin during Unit I and the lower part of Unit II, (3) the conditions are ideal for updip migration from Units I and II as well as lateral migration from lower Unit III, (4) good reservoir conditions are assured, and (5) probably good sealing conditions are provided from updip pinchouts and from capping by argillaceous sediments of the overlapping Unit III.



B-23



B-13



B-2

EXPLANATION:

On both the northeast and southwest edge of the basin extensive areas display buildups. These are believed to have grown from a common shelf reef or sort of reef plateau.

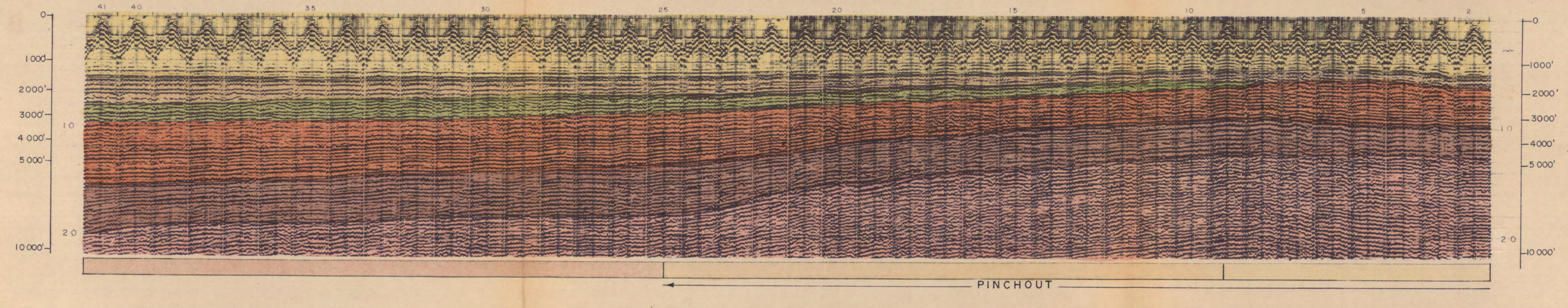
These features are recognized in the surveyed area over distances of 30 x 12 miles on the northeast flank and 35 x 10 miles on the southwest flank. The maximum thickness of the shelf reef where built up is about 2,000 feet, otherwise probably about half that amount. It is assumed that growth of the shelf reef is from the base of the Unit II.

The buildups are expressed in a prominent reflection marking the top of Unit II and rise as much as 500 feet. Where not built up, only a slight rise of the reflection marks the front of the shelf reef. The lower beds of the overlying Unit III wedge out against the buildups, but the higher beds assume draping attitude. While the buildups were growing they apparently kept ahead of sediments being deposited in the adjacent area. If the overlap of Unit III was instrumental in terminating the buildups it would imply that the sediments were turbid. The prominent reflection is common also to the reefs rising from the Ls. Bank and the same wedge and drape relationship with the overlying Unit III is seen.

As may be observed from the regional map, the shelf reefs coincide with the magnetometer basement ridge that is apparent on both the northeast and southwest edge of the basin. Inasmuch as the ridge was apparently somewhat positive throughout the development of the basin, it would be expected that the shelf reefs would be confined to this area of slower subsidence. Thus the northeast and southwest shelf reef areas would tend to be structurally higher than the areas adjacent.

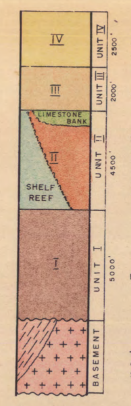
Oil Prospects:

There are several favourable factors that make the shelf reefs of both northeast and southwest sides of the basin attractive from the standpoint of possible oil accumulation. (1) The overall reef area is structurally high, (2) the reef area is situated updip from the deepest portion of the basin where optimum conditions for source beds are generally pictured. The source bed potentialities are further enhanced by the presence of an enclosed basin during Unit I and the lower part of Unit II, (3) the conditions are ideal for updip migration from Units I and II as well as lateral migration from lower Unit III, (4) good reservoir conditions are assured, and (5) probably good sealing conditions are provided from updip pinchouts and from capping by argillaceous sediments of the overlapping Unit III.



B-14

STRATIGRAPHIC SEQUENCE



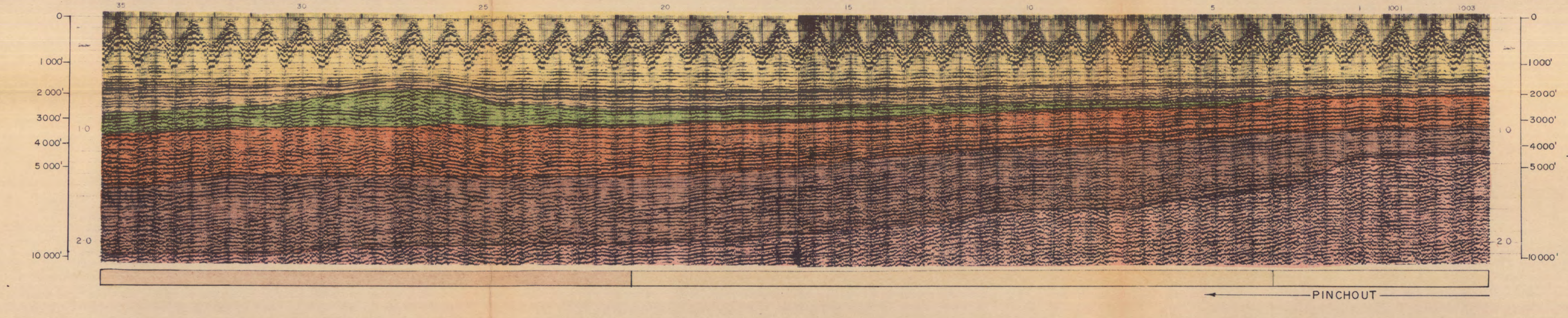
PLIOCENE (?) - PLEISTOCENE
Assumed mainly shallow water limestones and calcareous sands Probably similar to beds on Flinders Is. and coastal Victoria.

MIOCENE (?)
Probably marls, limestones and calcareous sands.

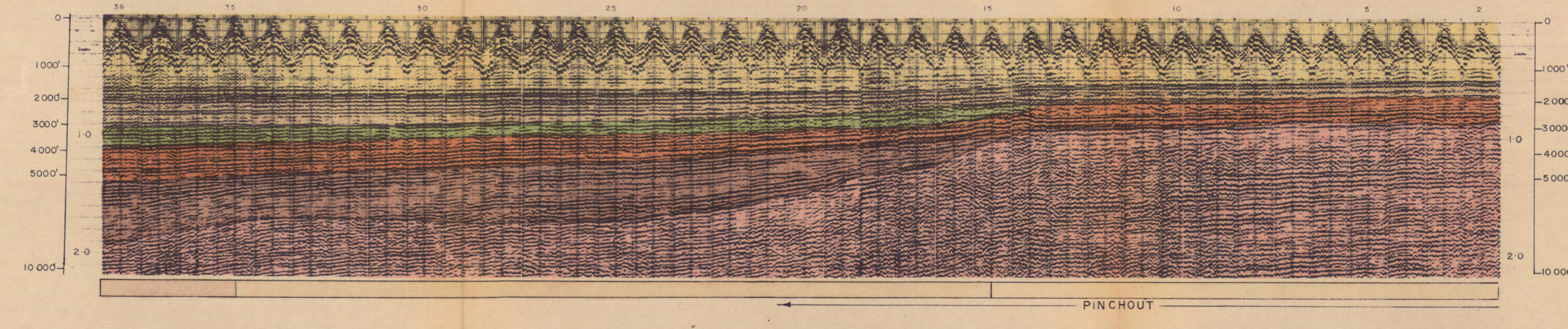
OLIGOCENE - MIOCENE (?)
Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'- 1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environmenf.

EOCENE (?)
Marine clastics (?)

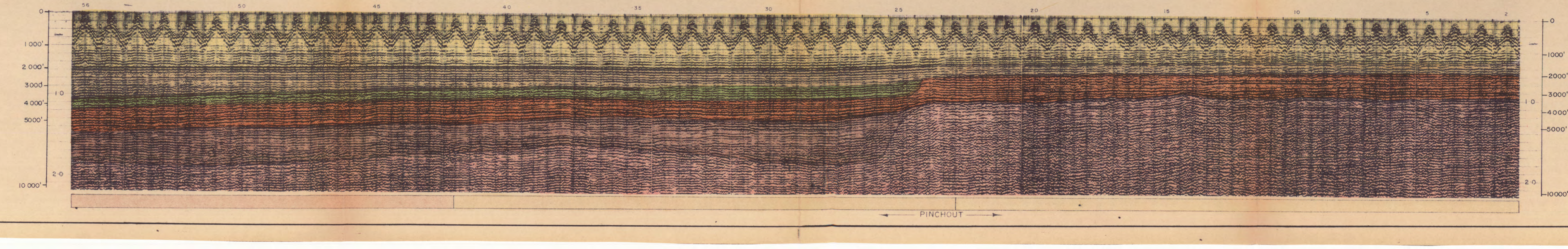
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.



B-3



B-15



B-4

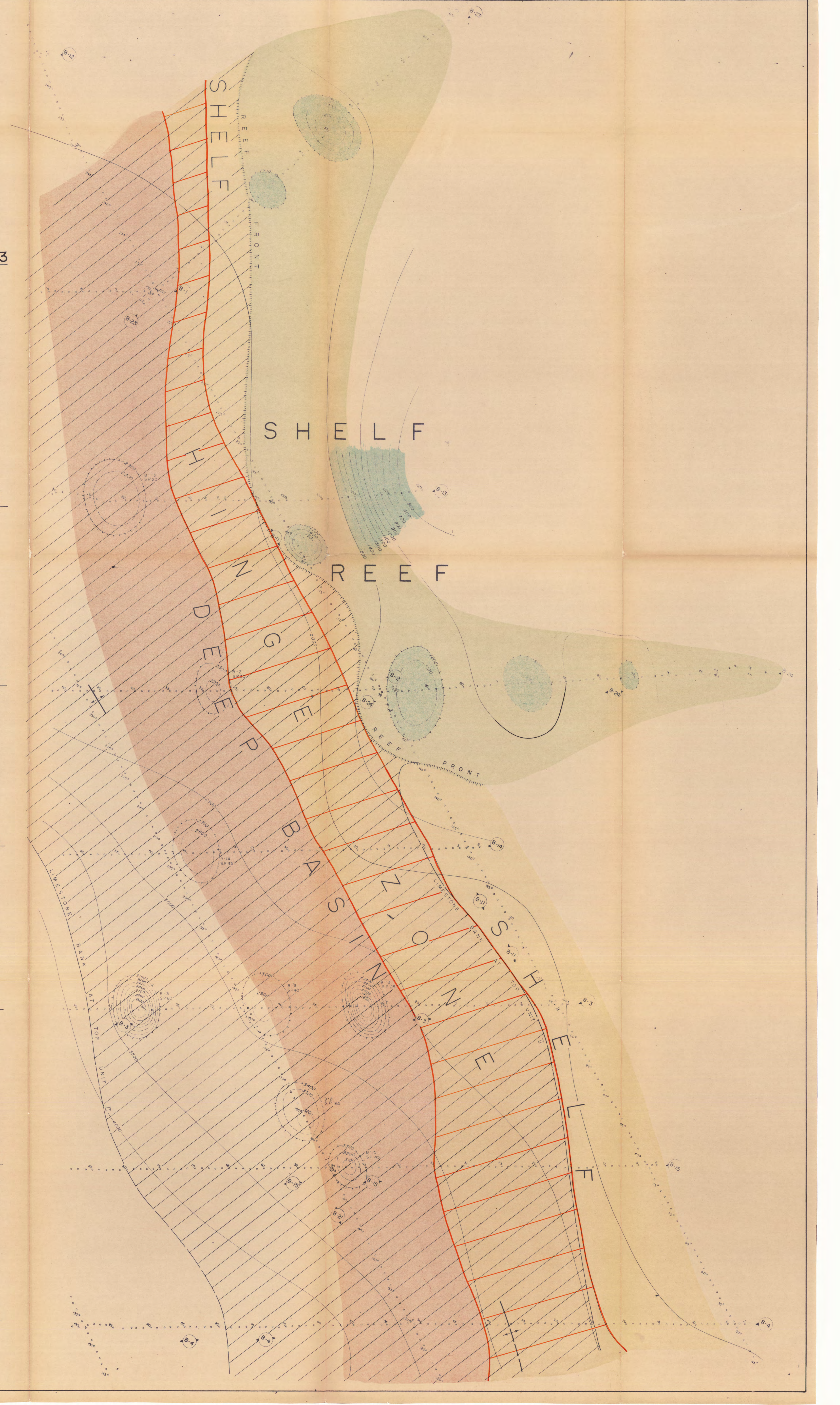


FIG. 2.4

HAEMATITE EXPLORATIONS PTY. LTD.

BASS BASIN

SHELF REEF

NORTH EAST SIDE OF BASIN

5 cm

048060

G.H.H. SEPTEMBER, 1964

SCALE OF MILES

0 1 2 3 4 5 10

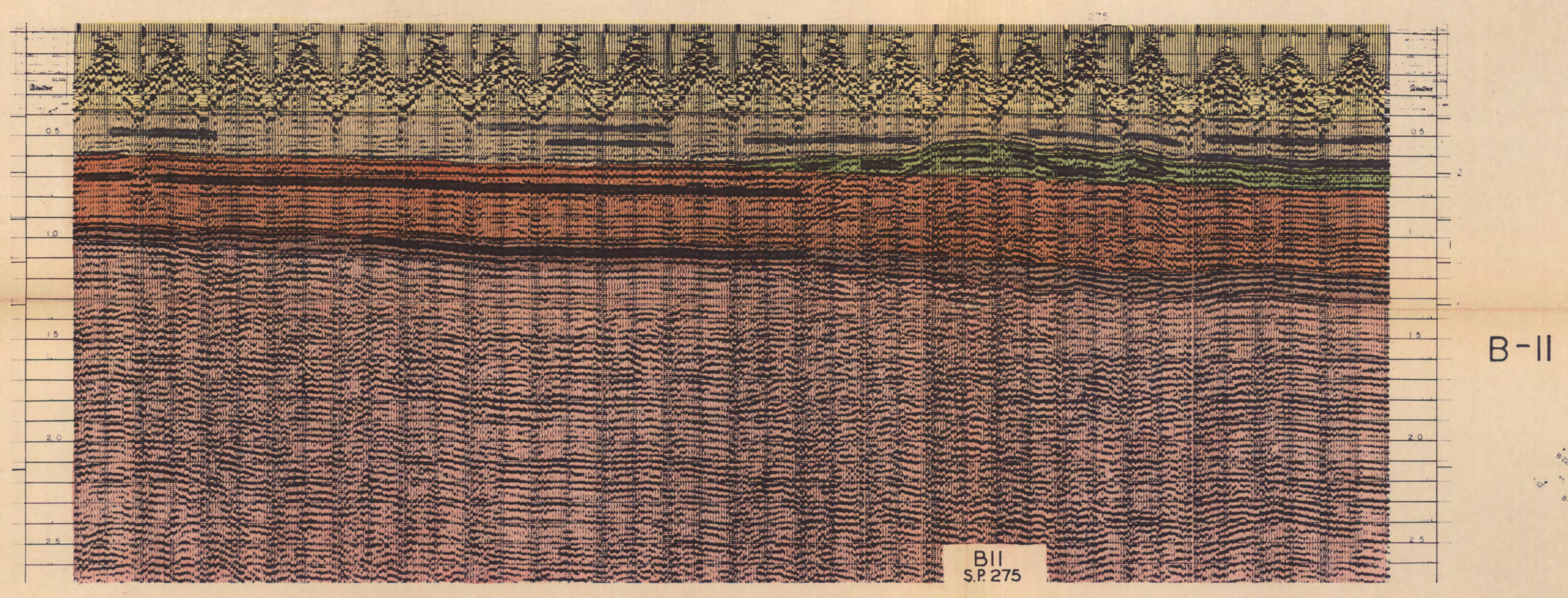
1 : 125,000

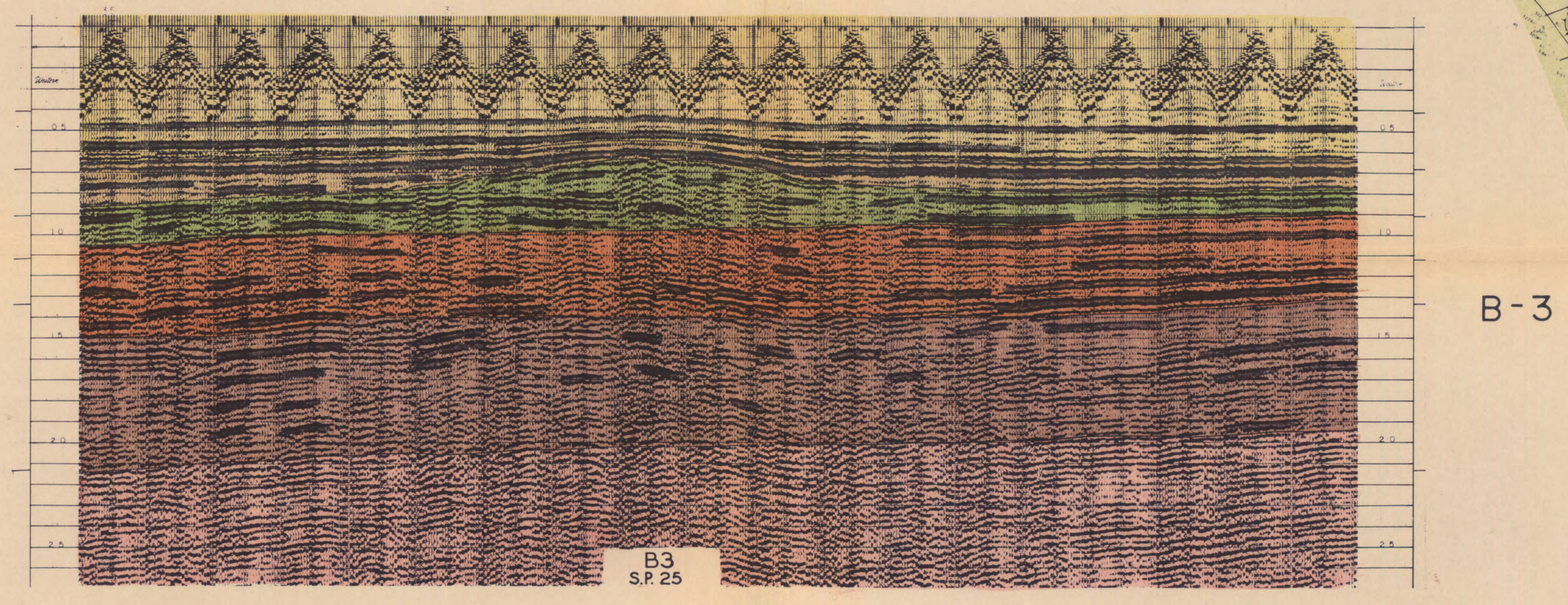
L.C. REED
A.S. MAUREIRA

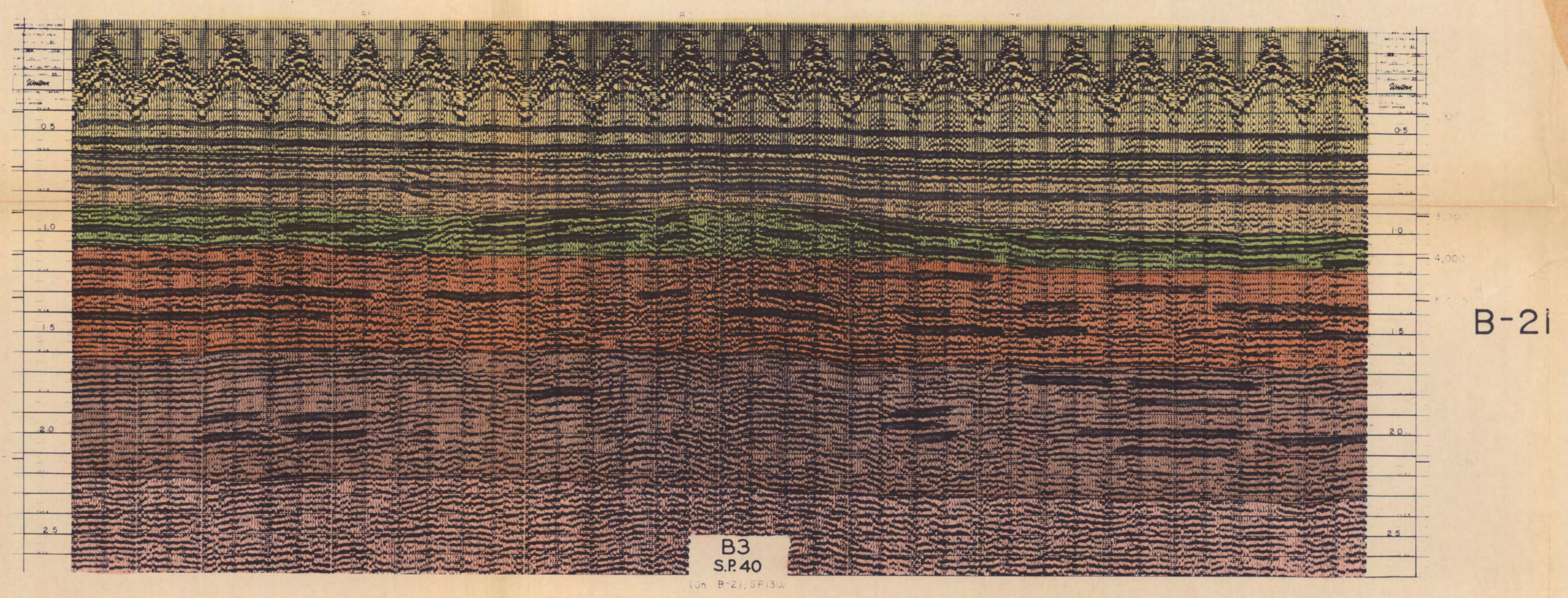
O.G. 680

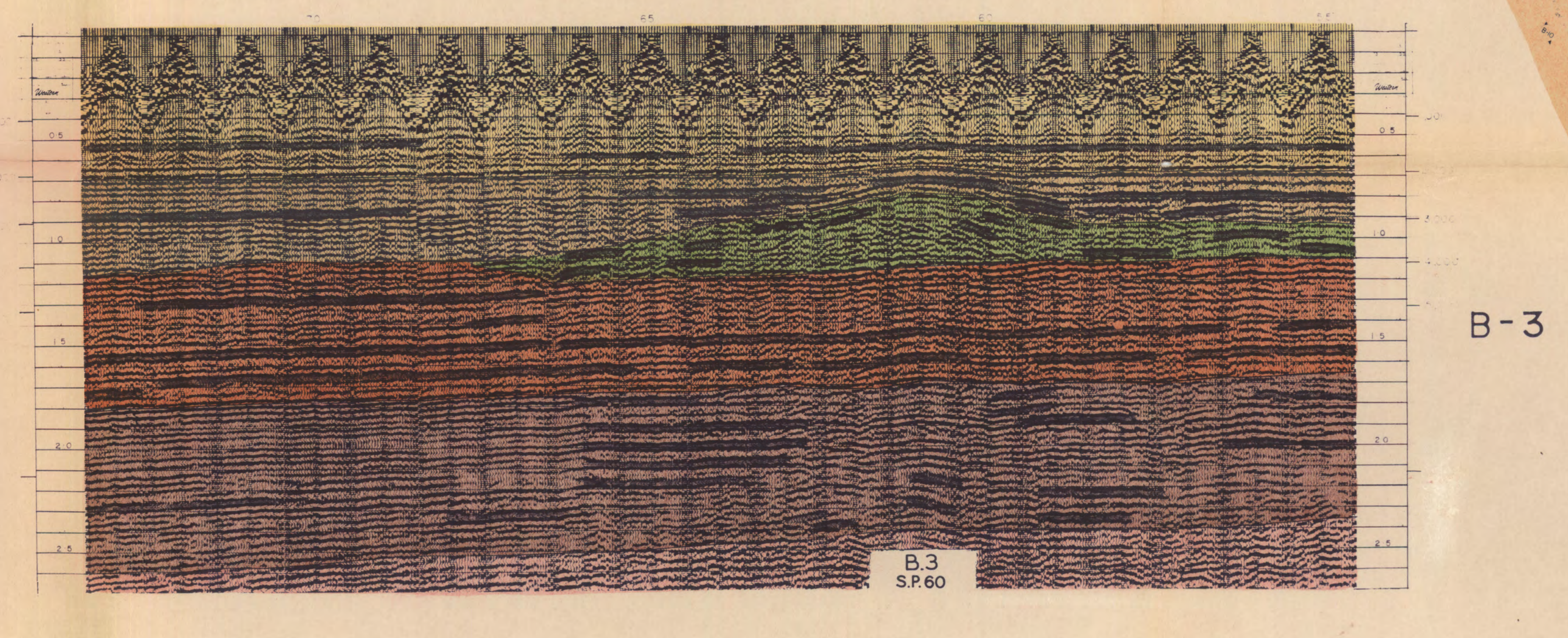
Bass Basin part I

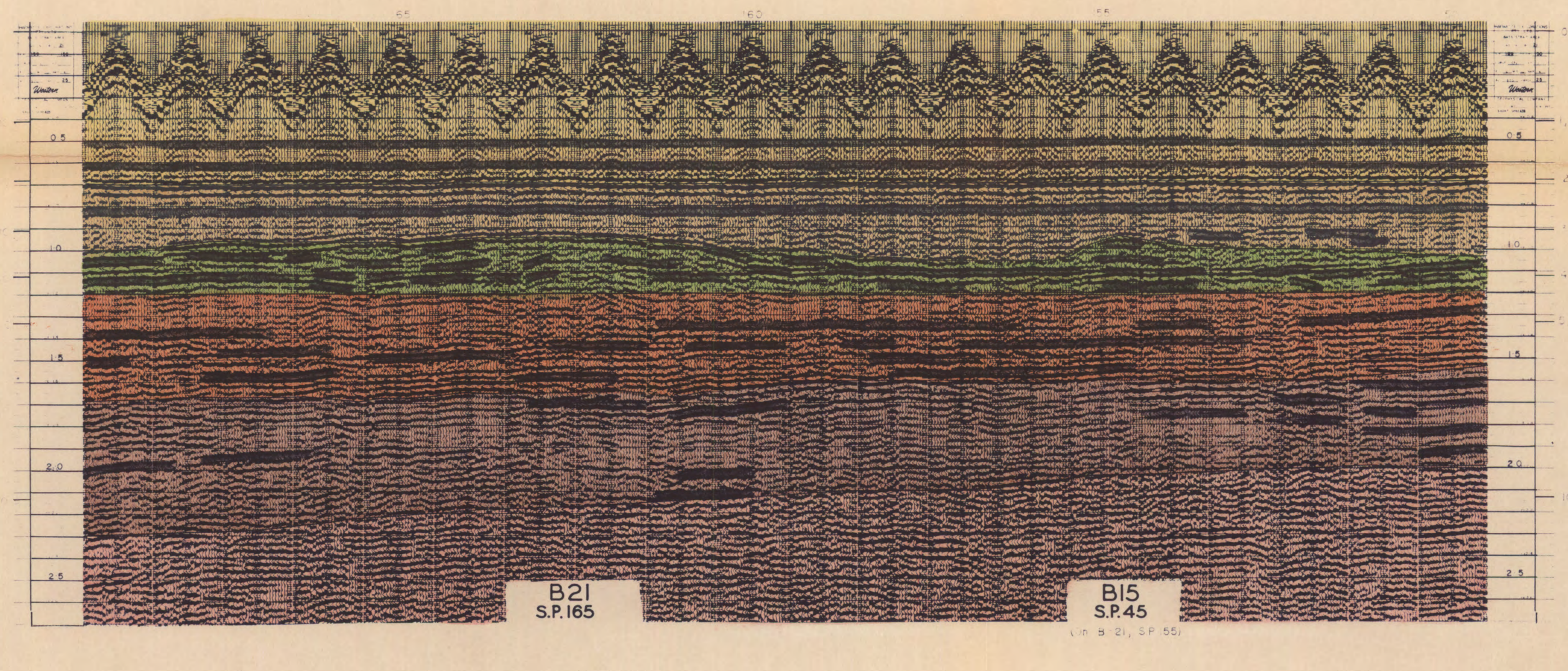
OR-001











BASIN REEFS

EXPLANATION:

Thirteen basin reefs are recognized and many more should be present between the lines of control. Five of the more representative ones are illustrated on this map.

The basin reefs appear to be individual buildups, somewhat round and from 1 to 4 miles in diameter. They rise as much as 700 feet above the top of the Ls. Bank which occupies the upper 500 to 1,300 feet of Unit II.

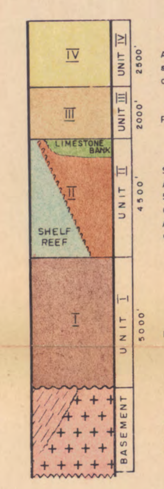
The overall distribution of the Ls. Bank with its basin reef buildups is shown on the map Structure Top Unit II. From this it is seen that the Ls. Bank is developed over the northwest and southeast portions of this area. The basin reefs are grouped in the northeast half of the basin and fall mainly within the trend between the northeast and southwest shelf reefs. This suggests a shoaling tendency out in the basin during the latter part of Unit II.

As with the shelf reefs, the buildup is expressed in a prominent reflection marking the top of Unit II. The lower beds of the overlying Unit III wedge out against the buildup while the higher beds assume draping attitude.

Oil Prospects:

The basin reefs should have good reservoir properties and may be effectively sealed by argillaceous sediments of Unit III. There may be other potential sources from which oil could migrate into the reefs, but the more apparent one would be from the adjacent Unit III.

STRATIGRAPHIC SEQUENCE



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MIOCENE (?)
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Shelf reef buildups on NE and SW sides of basin. At top of unit is limestone (called Limestone Bank) 500'-1300' thick developed over part of basin. Contains 12 and more reef buildups. Argillaceous facies expected in deeper water environment.

EOCENE (?)
Marine clastics (?)

GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.

FIG. 25

HAEMATITE EXPLORATIONS PTY., LTD.

BASS BASIN

BASIN REEFS AND LIMESTONE BANK

5 cm

048061

G.H.H. SEPTEMBER, 1964.

SCALE OF MILES
0 5 10 15 20
1 : 250,000

L.C.REED
A.S.MAUREIRA

OG·688

Bass Basin part I

OR-001

GEELONG
PORT PHILLIP BAY
FRENCH ISLAND
CAPE NELSON
CAPE OTWAY
NEAR SURFACE EFFECTS
OTWAY BASIN
FAULT
CREST OF RIDGE
DEEPER
MAGNETOMETER RIDGE
CORNER INLET
SOUTH EAST POINT
KENT GROUP
KING ISLAND
FLINDERS ISLAND
CAPE BARREN ISLAND
ROBBINS ISLAND
STANLEY
BURNIE
STONY HEAD
LEGEND
ANOMALY OUTLINES 12-2
POSSIBLE FAULTS & BOUNDARY ZONES
ISOMAGNETIC CONTOURS
BASEMENT DEPTH
(FEET BELOW SEA LEVEL)
ANALYTICAL DEPTH ESTIMATES 4000
~~FIG 27~~ FIG. 26
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
MAGNETOMETER MAP
SURVEYED AND COMPILED BY AERO SERVICES LIMITED
1961 – 62
048062
G.H.H. MAY, 1964.
L.C. REED
SCALE OF MILES
0 10 20 30 40 50
1: 506,880
OG·691
Bass Basin part I
OR-001

FIG. 27
Bass Basin part I
OR-001
HAEMATITE EXPLORATIONS PTY. LTD.
BASS BASIN
WATER DEPTH
CONTINUOUS FATHOMETER RECORDINGS
BY WESTERN GEOPHYSICAL COMPANY.
048063
5 cm
G.H.H. SEPTEMBER, 1964
L.C. REED
A.S. MAUREIRA
SCALE OF MILES
0 10 20 30 40 50
1:506,880
OG·689
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EOCENE (?)
Marine clastics (?)
GRANITES, METAMORPHICS
Thick Palaeozoic (?) sediments under southeast corner of basin. Possibly patches under SW flank.
UNIT IV 2500'
UNIT III 2000'
UNIT II 4500'
UNIT I 5000'
BASEMENT
LIMESTONE BANK
SHELF REEF
Cape Otway
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
KING ISLAND
CURRIE
NARACOOPA
FLINDERS ISLAND
WHITEMARK
CAPE BARREN ISLAND
CLARKE ISLAND
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
Depths in feet
Cross Section