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EL 169

TAILEM BEND - BORDERTOWN – MOUNT GAMBIER AREA

PROGRESS REPORTS TO LICENCE EXPIRY FOR THE PERIOD 20/7/74 TO 19/7/75

Submitted by
Jennings Mining Ltd
1975

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PRIMARY INDUSTRIES AND RESOURCES SA

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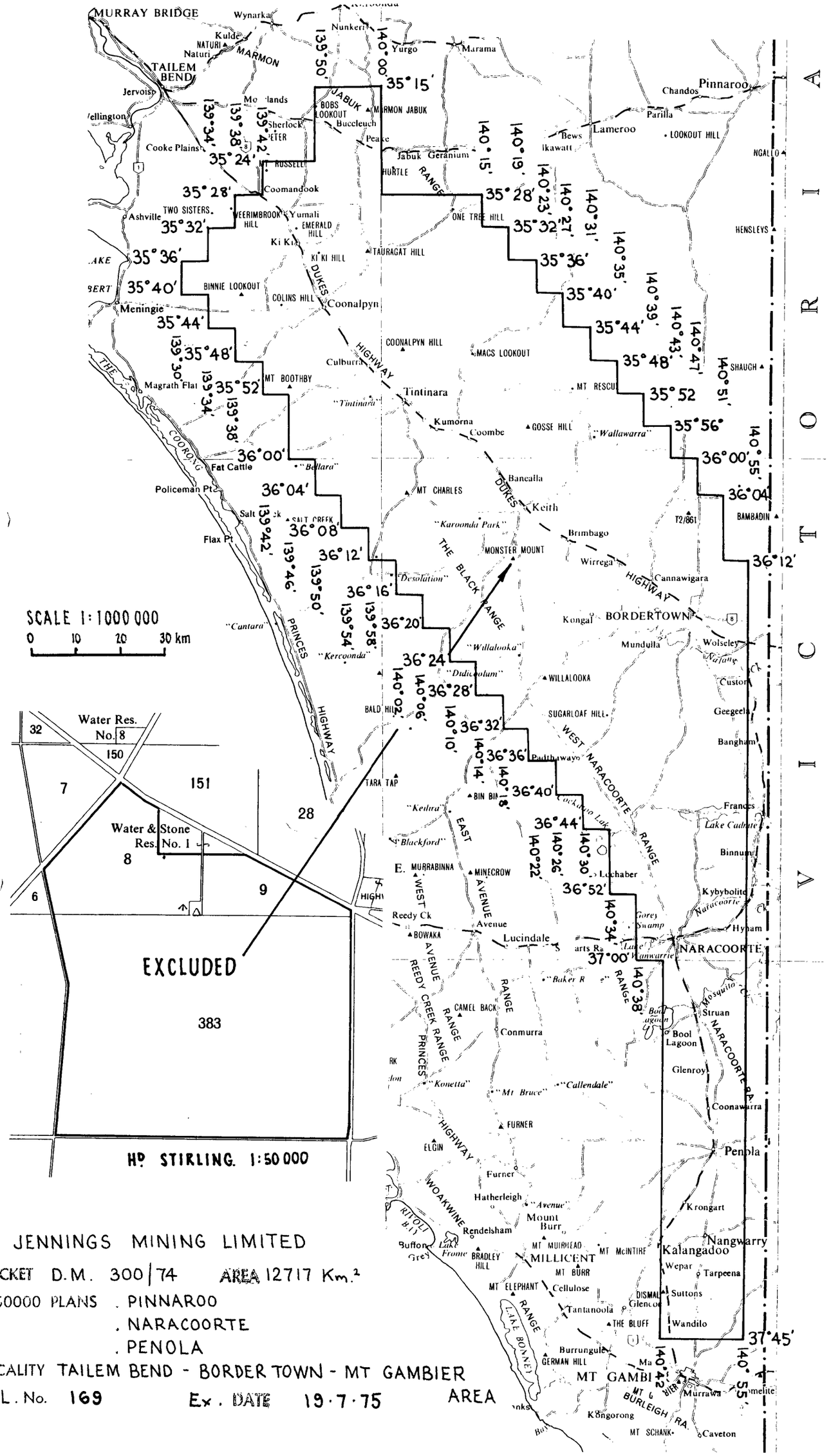

JENNINGS MINING LIMITED

DOCKET D.M. 300/74 AREA 12717 Km.²

1:250000 PLANS . PINNAROO
. NARACOORTE
. PENOLA

LOCALITY TAILEM BEND - BORDER TOWN - MT GAMBIER

E.L. No. 169 Ex. DATE 19·7·75 AREA

THE POTENTIAL FOR MINERAL SAND CONCENTRATIONS IN THE SOUTHEASTERN COASTAL PLAIN OF SOUTH AUSTRALIA

PREPARED FOR
JENNINGS MINING LIMITED
MULGRAVE, VICTORIA

DECEMBER, 1973

VOLUME I

C.E. Larson
Consulting Geologist
Canberra

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PREFACE

This report has been prepared under the specific authorisation of Mr. Lars Toft, Projects Officer, Jennings Mining Limited (letter of 11th December, 1973). The interpretations, recommendations and conclusions contained in the report and attached maps are considered confidential and for the exclusive use of Jennings Mining Limited unless, by mutual agreement, Jennings Mining Limited and the writer, C.E. Larson, Consulting Geologist, consider that it would be advantageous to disseminate the information to other parties.

The concepts and interpretations contained in this report, especially those directly pertinent to mineral sands, are original with the writer. The initial interest in the area and subsequent development of crudely formed concepts originated in 1968 when the writer was an independent consultant in association with Data Analysis Pty. Ltd., Sydney. The concepts were further advanced in 1969 when the writer was employed as Senior Geologist with Pickands Mather & Co. International, Sydney. Additional work at this time consisted mainly of development and confirmation of concepts through literature search. Before the writer could test the concepts in the field, he was assigned to an urgent program of phosphate exploration. Upon completion of the phosphate program, the writer resigned from Pickands Mather to join Samedan of Australia, Canberra. Pickands Mather & Co. are no longer active in mineral exploration in the eastern states of Australia.

Additional information pertinent to this report was gained in 1972 while the writer was in the employ of Samedan of Australia. After approximately three weeks literature and air photo research, followed by one week in the field, the writer recommended that Samedan initiate a reconnaissance drilling program. For various reasons, mainly full commitment of financial resources to other projects, Samedan declined to follow the recommendation.

As all previously interested parties have had ample opportunity to take advantage of at least the fundamental concepts upon which this report is based, the writer firmly believes he has faithfully discharged all ethical obligations to them. The information herein is therefore offered without ethical reservations to Jennings Mining Limited.

SUMMARY AND CONCLUSIONS

The southeastern coastal plain of South Australia contains a vast system of parallel dunes of Pleistocene to Holocene age (Plate 1). These dunes and their associated succession of shorelines clearly exhibit most of the features conducive to the development of littoral and aeolian concentrations of heavy minerals:

A. A succession of arcuate, gently embayed shorelines.
B. A favourable orientation with respect to inferred effective storm winds and swells such that strong northwesterly longshore littoral currents should have been effective in concentrating and localising heavy mineral concentrations.
C. Extensive development of parallel dunes under which littoral concentrations may have been preserved and which may themselves contain lower grade but extensive aeolian concentrations.
D. Possible or inferred development during the Pleistocene of a succession of major drainage channels, perhaps of the ancestral Murray itself. The streams which occupied such ancient channels may have nourished the succession of dunes and shorelines with arenaceous sediment including heavy minerals.

Point D above is the most tenuous of the important features. Establishment of the probable location of major Pleistocene alluvial channels is to be considered as highest priority in the recommended reconnaissance exploration program.

Because the younger, seaward systems of parallel dunes are mainly calcareous and highly indurated with calcrete, they are not considered highly prospective. It is recommended that initial reconnaissance be restricted to the older, siliceous, less indurated dunes comprising an area of approximately 3,600 square miles (9,300 km^2). Within this area, highest priority

should be given to the Keith-Naracoorte area where heavy mineral assemblages average 8% rutile and 22% zircon. Assuming rutile and zircon are the only economic products, the minimum target should be of the order of 20 million tons of raw sand at an average grade of 4% total heavy minerals, implying an economic cutoff grade of 2% heavy minerals. The subject area could well have the potential for such targets, perhaps several-fold.

A four months reconnaissance program consisting mainly of aerial photo interpretation and scout drilling is recommended. To affirm or negate the potential of the area, 200 open flight power auger holes for a total of 12,000 feet should be adequate. The estimated total cost of the program is $32,000. If the option of an airborne geophysical survey (radiometric and magnetic) is elected, the estimated total cost of the reconnaissance program would be increased to $51,000 and the required time extended to five months.

If results in South Australia are encouraging, reconnaissance might later be extended into southwestern Victoria.

THE POTENTIAL FOR MINERAL SAND CONCENTRATIONS IN THE SOUTHEASTERN COASTAL PLAIN OF SOUTH AUSTRALIA

* * *

INTRODUCTION

As the table of references attests, the general geology, stratigraphy and geomorphology of the Southeastern Coastal Plain of South Australia have been studied in considerable detail. It is unusual, perhaps unique, that an important aspect of economic geology, specifically the possible occurrence of economic concentrations of mineral sands, seems to have been neglected in an area so thoroughly studied and of such ready access.

LOCATION AND AREA

The general location of the area which comprises the subject of this report is defined on Plate I and the location inset within Plate I. The area consists of a coastal strip, as much as 60 miles wide, extending from Lake Alexandrina to the Victoria border and includes approximately 12,000 square miles (31,000 km^2). The area considered to be of immediate prospective interest, outlined in red on Plate I, is restricted to approximately 3,600 square miles (9,300 km^2). The area of interest may also be extended into southwestern Victoria.

ACCESS

Virtually the entire area is covered by an extensive network of railroads, main highways, improved secondary roads and country tracks. The most remote points within the main

area of interest would be scarcely one mile from a point accessible by conventional motor vehicles. Nearly all of the area would be accessible by 4 w.d. vehicles at any season except, perhaps, after periods of unusually heavy rains. The town of Keith, central to the main area of interest, is approximately 150 miles from Adelaide, or 310 miles from Melbourne, by rail or highway. Mt. Gambier is the nearest centre served by regular commercial airlines. Numerous landing grounds for light aircraft have been established within the area. The main high-voltage power transmission line from Adelaide to Mt. Gambier cosely follows the route of the Duke's Highway and the main railway line. In brief, the access is unusually good for a new exploration prospect. (Plate I and 1:250,000 topographic maps).

CLIMATE

The climate of the region is classified as "Semi-humid Warm Temperate". The mean annual precipitation at Keith is 22 inches, with maximum seasonal rainfall in winter. Keith receives a maximum monthly precipitation of 4.5 inches in June, with a minimum of 1 inch, or a little less, in February. The mean annual temperature for the area is in the range of 56° to 58°F. (Sprigg, 1952, p. 14).

PHYSIOGRAPHY

Physiographically, the area is a fairly typical subcoastal plain with a gradient to seaward of about 5 feet per mile. Superimposed on the regional plain, the stranded dune systems (Plate I) provide local relief generally between 30 and 50 feet, but in some localities, especially among the higher dune systems within a few miles of the present coastline, the local relief may slightly exceed 100 feet. A few isolated

erosional remnants of granite, such as Mt. Boothby, about 20 miles northwest of Keith (Pinnaroo 1:250,000), rise as much as 300 feet above the surrounding plain.

Slopes on the stranded dune systems are often steep, 20° to 25°, approaching the natural angle of repose of the unconsolidated dune material. Stabilised erosional gaps through the dune systems are abundant. Road grades have usually been developed through such gaps, minimising the depth of cut necessary to limit the road grades to maximum slopes of 5°.

Most of the area is open and cultivated, either under pasture or sown to cereal crops. Areas of irrigated crops and pasture are common in the flat inter-dune areas. Mixed areas of pine plantation and irrigated vineyards are common in the Naracoorte-Penola district, near the southern extremity of the area. Open to moderately dense native scrub of the mallee type persists over much of the stranded dune systems where slope and soil conditions are not amenable to cultivation.

A physiographic peculiarity of the area is evident on the 1:250,000 topographic maps, especially the Pinnaroo and Naracoorte sheets. No system of integrated surface drainage has developed over the area because of the extreme permeability of the surficial Pleistocene sands and underlying Tertiary limestones and sandstones.

GEOLOGICAL SETTING

Generalised Stratigraphy and Structure

Geologically, the whole of the area lies within the Murray Basin. The thickness of the Mesozoic and younger sedimentary rocks of the Murray Basin, known in considerable detail from seismic and airborne magnetic studies completed for petroleum exploration, varies considerably with respect to subsidiary fault blocks within the Basin. Most of the subject area

of the report lies within the Padthaway Horst or Ridge where a metamorphic basement complex, probably Precambrian, is overlain by 1,000 to 2,000 feet of Tertiary sedimentary rocks, apparently with no intervening Mesozoic section (Sprigg, op. cit., p.22 et. seq.). As noted in the Physiography section, the Tertiary and Pleistocene sediments may lie disconformably on or around localised highs or erosional remnants of granite, probably intruded at the climax of the Lower Ordovician Delamerian Orogeny.

Throughout the area of interest, the Tertiary section consists typically of:

> GAMBIER LIMESTONE (Oligocene - Early Miocene)
> Marine, foraminiferal and bryozoal limestone and marl; up to 1,000 ft. thick.
>
> KNIGHT GROUP (Eocene)
> Paralic to shallow marine sandstones with conglomerates and siltstones; also up to 1,000 ft. thick in the area of interest.
>
> (O'Driscoll, 1960, pp. 24-31)

Because of variations in deposition and later erosion cycles throughout the area, the thickness of the Tertiary section, especially the Gambier Limestone, may vary greatly. Pleistocene sediments, predominantly aeolian and littoral sands, have been reported to depths in excess of 300 feet in water bores (O'Driscoll, op. cit.).

Groundwater Resources

Widespread stratigraphic subdivisions of both the Gambier Limestone and the Knight Group include some prolific aquifers; hence the extensive development of groundwater throughout the region. O'Driscoll's report (op. cit.) on the "Hydrology of the Murray Basin Province" includes data from more than 10,000 wells. Characteristically, the water from the Gambier Limestone is of poorer quality (higher salinity) than water from the aquifers of the Knight Group. Near Keith,

for example, shallow bores into the Gambier Limestone produce water with a salinity in the range of 700 to 1,000 grains per gallon, generally suitable only for stock watering. Deeper bores in the Keith area usually encounter sand aquifers of the Knight Group at depths ranging from 130 to 275 feet. Water from the Knight Group sandstones is generally under artesian head with a salinity in the range of 75 to 125 grains per gallon. One well near Keith has been developed to produce 12,000 g.p.h. from the Knight Group (O'Driscoll, op. cit., p.170).

PREVIOUS INVESTIGATIONS

Literature Research; Comments and Observations

Occurrences of heavy minerals on the modern beaches and foreshores of South Australia have been investigated by the S.A. Geological Survey (Hillwood, 1960). With the exception of a rather small, apparently marginal deposit on Kangaroo Island, no concentrations of economic interest were noted. For the greater part, the investigations of the Geological Survey included analyses for total heavy minerals only, with scant reference to the composition of the heavy mineral assemblages. The Kangaroo Island deposit may, nevertheless, be considered as an encouraging indication that larger, potentially economic deposits may occur in the district.

In 1969, the writer chanced to fly over the subject area en route from Melbourne to Adelaide. At first glance, the pronounced development of parallel dunes immediately north of Lake Alexandrina appeared intriguing and prompted a brief literature search. This search, mainly through the papers of Sprigg (1962) and Blackburn (1965) disclosed that a vast system of parallel (stranded) dunes had been mapped in considerable detail across the entire southeastern coastal plain of South Australia, and extending into southwestern Victoria. The paper by Sprigg (op. cit.) has, in fact, emerged as a classic in the

interpratation of eustatic changes in sea level during the Pleistocene. It is interesting that neither of these scholarly papers include direct reference to mineral sands. Nevertheless, these papers led the writer to note the extent and configuration of the remarkable parallel dune systems which strongly suggest an environment conducive to the development of heavy mineral concentrations. The parallel dune systems of the subject area exhibit several features analogous to those of the elevated shorelines and associated parallel dune systems of the northern coast of N.S.W. and the southern coast of Queensland, which have been for many years the premier environment for rutile production. Certain features analogous to those of the region surrounding the deposits at Eneabba, W.A., may also be noted.

The parallel dune systems mark the configuration and approximate position of elevated Pleistocene shorelines. (Note the exphasis that the dunes mark only the approximate, not exact positions of ancient shorelines. Any particular parallel dune may, in fact, represent a whole succession of retreating shorelines). Although the parallel dunes seem to be of unusually high relief compared with other parallel dune systems along the coast of Australia, it is not likely that they have been mistakenly identified and represent, rather, parallel-trending parabolic dunes such as those found in the Jurien-Eneabba district of W.A. The dunes of South Australia lack the characteristic "festooned" outline in plan of parabolic dunes. Furthermore, the trend of the Jurien-Eneabba dunes parallel to the modern coastline is fortuitous as the effective storm winds responsible for their development are from the south and sub-parallel to the coastline. On the other hand, the effective storm winds along the coast of southeastern S.A. are from the south to southeast and produce markedly transgressive, not parallel parabolic dune trends adjacent to the modern coastline. The unusually high development of parallel dune systems without significant development of transgressive parabolic dunes in the Pleistocene dune systems of the subject area probably represents an unusual ability of the Pleistocene flora to stabilise the

parallel dunes before significant transgressive migration of the sand could develop. This condition, in turn, may be indicative of generally higher precipitation in the area during the Pleistocene.

Considering then that the stranded dunes of the subject area are true parallel dunes, their development is, by association, strongly indicative of the high-energy littoral environment necessary for the effective sorting and concentration of heavy minerals in beach deposits and the nourishment of larger but lower grade aeolian concentrations within the dunes themselves.

The arcuate, gently embayed configuration of the shorelines of the subject area, as indicated by the parallel dunes, is also considered to represent a favourable, even necessary condition for the development of significant heavy mineral concentrations. The ancient and modern shorelines of the area are especially favourably oriented as the littoral fronts of the effective storm waves and swells from the south are refracted as they break to develop a strong northwesterly longshore drift. The development of the Younghusband Peninsula and progressive restriction of the mouth of the Murray River at Lake Alexandrina is evidence of the effective development of the longshore drift, another important agent in the concentration and localisation of heavy mineral deposits. It is assumed that the effective storm winds and associated littoral currents have remained virtually constant throughout the Pleistocene and Holocene Epochs.

Most, if not all mineral sand deposits of economic significance are in close proximity to the mouth of an alluvial intermediate source or transporting agent. In the subject area, the ancestors of several major streams could have provided the alluvial source; the ancestral Murray, itself, perhaps the ancestral Glenelg and Tadiarra as well. The ancestral Murray, in common with many major streams and their ancestors, may well have developed a continuous succession of Pleistocene outlets across its associated coastal plain, forced in its course by the

progressive accretion of sand dunes and offshore bars, perhaps aided by minor tectonic activity. The present course of the Murray across the coastal plain of South Australia suggests that this progression has reached its penultimate in forcing the lower reaches of the Murray hard against more resistant Precambrian rocks. This general hypothesis has been supported by Howchin (1921, p.191) and by Blackburn (1965). Other recent authors (O'Driscoll, op. cit., and Ludbrook, 1961) tend to discount or downgrade the hypothesis, mainly on the basis of their failure to specifically identify Pleistocene alluvium in water bore cuttings. (Perhaps the wells studied were not in the right locations; or perhaps the criteria for identification of Pleistocene alluvium were inadequate).

The marked embayment of the ancient shorelines near Keith is of special interest. Scattered, generally low outcrops of Lower Ordovician granite near the cusps of the embayment undoubtedly represent former headlands which controlled the development of the intervening shorelines. The derangement of the dune trends near the southeastern cusp is consistent with a major stream, perhaps the ancestral Murray, having discharged into the bay at that locality. Alternatively, the deranged dune trends might have resulted from the vagaries of littoral currents and storm winds caused by the presence of the headland. If, however, the breach in the dune systems does, indeed, represent an ancient alluvial channel, any heavy mineral component of the stream's sediment load should have been concentrated near the mouth, especially to the northwest if the northwesterly longshore drift is assumed.

If the ancestral Murray is considered to be a potential intermediate source or transporting agent, it is not difficult to propose possible ultimate sources of heavy minerals. The Murray catchment area (Pleistocene and Holocene) encompasses an area including a wide variety of rocks potentially rich in rutile and zircon. The writer contends, however, that the abundance of heavy minerals in the ultimate source rocks is of

minor importance to the development of heavy mineral concentrations compared with the efficacy of the alluvial and littoral sorting and concentrating mechanisms. Any heavy mineral components contributed by an alluvial transporting agent will tend to be concentrated in a high-energy littoral environment. With regard to economic concentrations, this contention should be qualified by the recognition that the heavy mineral assemblage, hence the ultimate source, should not include an overabundance of uneconomic minerals such as garnet.

The rationale should not necessarily be down-graded by the apparent lack of any significant contribution of heavy minerals to the modern littoral zone by the present Murray River. In fact the present contribution of any fresh, arenaceous sediment by the Murray is probably negligible. Most of the arenaceous material along the modern coast has probably been recycled from adjacent inland dunes or nourished by shelly fragments from the seabed. During the Pleistocene, on the other hand, much of the catchment area of the Murray was of relatively higher elevation; the Murray had a higher gradient, perhaps a larger discharge and, hence, greater competence for transport of arenaceous sediment, perhaps including heavy minerals.

In 1970, an apparently small, Adelaide-based syndicate, Gold and Mineral Exploration N.L.,was granted Special Mining Lease 454 to explore for rutile, zircon, etc. in the Renmark-Loxton area. (Special Mining Leases have since been superseded by Mineral Exploration Licences as exploration titles under the South Australia Mining Act of 1971). The quality of performance and reporting by Gold and Mineral Exploration was of such a poor standard that the S.M.L. was revoked by the Department of Mines before expiration of the first term. The location of the S.M.L. suggests that Gold and Mineral Exploration were prospecting alluvial terraces of the Murray River. Alluvial terraces are characteristically too poorly sorted and too low in grade to be prospective for heavy minerals other than tin, gold or gemstones. The rutile and zircon potential of this area or terraces along other reaches of the Murray thus seems highly doubtful. Nevertheless, the reported or suspected occurrence of rutile and zircon in the terraces of the Murray strengthens the [illegible] for economic littoral concentrations along ancient

strandlines nourished by ancestral Murray sediments.

The reports of Gold and Mineral Exploration in respect of S.M.L. 454, however sketchy, are included in the Department of Mines file DM 711/70. To review the contents of this file, it would first be necessary to secure the permission of Mr. L.T. Ewens, Director-Secretary of Gold and Mineral Exploration N.L., 68 Grenfell Street, Adelaide. (Phone: Adelaide 23-5494). Such enquiry might be worthwhile for whatever information could be gained concerning the proportions of rutile and zircon in the heavy mineral assemblage, or even the remote possibility of economic concentrations in view of the currently high price levels for rutile and zircon.

Field Reconnaissance

To develop further the forgoing hypotheses and concepts, the writer, accompanied by an experienced field assistant, traversed the subject area in December 1972. The reconnaissance approach was to collect near-surface samples from road cuts and shallow hand auger holes while observing the relationships of the parallel dune systems to their surrounding environment. While performing the sample traverses, it was noted that the younger, seaward succession of calcareous dunes is separated quite markedly from the older, inland, mainly siliceous dunes by a relatively broad inter-dune corridor as marked on Plate 1. This relationship, apparently not noted by previous authors, bears a strong resemblance to the succession of older siliceous dunes and younger calcareous dunes in the Jurien-Eneabba district of W.A.

A total of 27 samples were collected from the brief reconnaissance traverses. The samples were panned in the field and the pan concentrates were collected to be forwarded to AMDEL. At AMDEL's laboratory, the pan concentrates were "scrubbed" of remaining silica and other minerals of low s.g. by T.B.E. separation. Microscopic grain counts were performed on

each "sink" fraction. In performing the grain counts, the volume percentage of rutile was corrected to account for the relative differences in median grain size between rutile and other components of the heavy mineral assemblage. As the heavy mineral components have a narrow s.g. range, the corrected volume percentages should be in close approximation to percentages by weight. Results of the grain counts of the 27 samples are included in Table 1. Sample locations are shown on Plate 1.

The purpose of the reconnaissance was not necessarily to discover potentially economic concentrations from the outset, but rather to establish the composition or range in composition of the heavy mineral assemblages across the area. That none of the 27 samples collected contained as much as 1% total heavy minerals (by visual estimate) should not be considered as particularly discouraging at this stage. In view of the sub-terranean drainage of the district, it would have been most surprising if surficial concentrations such as those commonly found along stream banks and road drains in close proximity to both east coast and west coast deposits had been discovered in the subject area.

At the time of the reconnaissance, ilmenite was considered to be a commodity of low priority. Special reference was therefore specified for rutile, zircon and monazite in the grain counts. Ilmenite was not differentiated from other opaque minerals. Qualitatively, it is suspected that the opaques included a large proportion of ilmenite, perhaps some hematite as well, as most of the opaque grains did not respond to a permanent magnet.

A few nearly opaque rutile grains were noted. It is possible that other opaque or nearly opaque rutile grains have been classified with undifferentiated "opaques". The recorded rutile content may thus be somewhat less than the true value.

From Table 1, the range and average content of rutile and zircon for all the panned concentrates, expressed as corrected volume percent are:

	High	Low	Average
Rutile	12	1	6
Zircon	35	8	20

The highest proportions of rutile and zircon in the heavy mineral assemblages occur in a cluster of 12 samples from the older silica sand dune systems of the Keith-Naracoorte area. The range and average of rutile and zircon content for these 12 panned concentrates are:

	High	Low	Average
Rutile	12	5	8
Zircon	35	14	22

Admittedly, no strong conclusions can be drawn from such a small number of widely spaced samples, but the results tend to increase the potential for deposits of economic interest in the Keith-Naracoorte area. It may be of interest to note that the grain count results suggest a generally inverse relationship between the proportions of rutile and zircon. Certain samples, PN-1, for example, do not exhibit this relationship.

A few samples from the younger, calcareous dune systems also contained interesting proportions of rutile and zircon in their heavy mineral assemblages. The calcareous dunes are not considered highly prospective, however, because widespread development of induration by calcrete would, no doubt, increase drilling as well as later mining and disaggregation costs to an uneconomic level.

SUGGESTIONS FOR FURTHER EXPLORATION

Minimum Targets

Exploration of the district, particularly the Keith-Naracoorte area, for targets of modest grade and quantity may be justified, in part, by the prospective environment as well as by the probably low cost of development, mining and infrastructure, should potentially economic deposits

be discovered. Because of the favourable location, the costs of transport, power and power installation, water supply, local steel fabrication and light engineering, labour and housing should all be at or near a minimum for Australia. No suitable facilities for export of rutile and zircon exist at nearby ports such as Robe or Kingston S.E., but it is possible that either could be developed for the purpose. Alternatively, it should be economically feasible to transport rutile and zircon concentrates by truck or rail to Port Adelaide. It is doubtful that it would be feasible to transport ilmenite to Port Adelaide.

Assuming the formerly stable F.Y. 1972-73 prices, F.O.B., of $110 per ton for rutile and $35 per ton for zircon, the relative value of these components of the average heavy mineral assemblage of the Keith-Naracoorte area is 54% rutile, 46% zircon, neglecting possible co-products such as monazite or kyanite and regarding ilmenite as waste. By a narrow margin, development of economic deposits of this composition would be principally rutile-based, with zircon as a strong co-product. Current price trends might reverse this relationship, but the recent high prices for zircon ($80 to $110 per ton) are considered to be a short term anomaly.

Again, based on F.Y. 1972-73 prices, the average heavy mineral assemblage of the Keith-Naracoorte area is approximately 15% rutile economic equivalent. The economic cutoff grade would thus be about 2% total heavy minerals in raw sand (0.3% rutile equivalent). A deposit of about 20 million tons at an average grade of 4% heavy minerals (0.6% rutile equivalent) should be the minimum economic target. If it appears likely that the current high prices for zircon and rutile will be maintained for a long term, the minimum grade or quantity could be reduced accordingly.

Exploration Titles

Mineral Exploration Licences are generally limited to a maximum of 2,500 km^2, although there is discretionary provision for larger areas under unspecified special circumstances. To cover the area presently considered prospective would thus require four separate M.E.L. applications, unless "special circumstances" could be demonstrated to the satisfaction of the Department of Mines. Both Mr. G. Whittle, Director and Mr. K. Johns, Senior Geologist, of the S.A. Geological Survey, have suggested that the Department of Mines would not necessarily be averse to granting several concurrent licences to a competent exploration company, provided they received assurances that a vigorous program of exploration and selective relinquishments were pursued. As an alternative, they suggested that reconnaissance could be performed without the formal protection of M.E.L.'s for a limited period, say six months. During this term, the Department would be agreeable to holding any competitors' M.E.L. applications over the area in abeyance while more definitely prospective areas were being selected for M.E.L. or other mining tenements. The Department's co-operation in this alternative would be contingent upon the exploring company's submission of regular, comprehensive progress reports as though the area were, in fact, under M.E.L.

If the security of the informal option is considered to be inadequate, it would probably be necessary to propose an exploration program budgeted to a minimum of $100,000 to assure appoval of the M.E.L.'s. The customary expenditure commitment for M.E.L.'s is $50 per km^2, but this recommended expenditure is primarily for base metal prospects. The Department of Mines could probably be persuaded that $10 per km^2 would be adequate for a mineral sand project. It should, however, be feasible to complete a reconnaissance program for a fraction of this amount and relinquish most of the area under M.E.L.'s long before the expiration of the first two year term. It would, nevertheless, be required to demonstrate the financial and technical capability to complete a minimum $100,000 program to receive approval for the M.E.L. applications.

As shown on the M.E.L. map, as of 17th December 1973, there are no current M.E.L.'s within the area of interest.

Exploration Methods

The reconnaissance aspect of highest priority would be to attempt to locate the probable courses of major channels of Pleistocene drainage throughout the area, with special reference to the location of their mouths in proximity to corresponding embayed Pleistocene shorelines. This can best be accomplished by photo interpretation with field checks, using as a base the 1:63,360 aerial photo mosaics available from the S.A. Department of Lands. The 1:63,360 photo mosaic coverage for the area of interest is listed in Table 2.

As most of the area is of low relief, it is doubtful that stereo interpretation from contact prints of the individual air photo negatives would provide much additional information in the early stages of reconnaissance. More detailed interpretation and mapping from selected stereo pairs might be required at a later stage.

Satellite imagery, especially the near-infra-red channel from ERTS-A might also be useful in detecting the subtle variations in flora which would probably be developed over ancient stream channels. It is questionable whether the scale and resolution of the ERTS-A imagery would be adequate or useful, but as only one or two photographic reproductions of the imagery would cover the entire area of interest, it should be a worthy experiment to examine all of the seven available channels, both individually and in superimposed images. It is understood that the ERTS-B satellite is producing far-infra-red imagery. If the far-infra-red coverage becomes available for the area of interest, the capability for defining the ancient channel courses might be further enhanced. Photo prints of the ERTS imagery for Australia are available on order from the Bureau of Mineral Resources.

In conjunction with photo interpretation and mapping, it might be worthwhile to re-log cuttings from water

well as from bores located along ancient strandlines, especially those northwesterly from suspected river mouths. Samples of cuttings from many bores in the district have been retained by the Department of Mines. Subject to the Department's approval, mechanical analyses of bore cuttings from appropriate depths might demonstrate the alluvial or non-alluvial nature of the sediments. T.B.E. analyses with grain counts might also be desirable on selected samples.

Once areas considered more highly prospective have been selected from photo interpretation, mapping and possible analysis of bore cuttings, the writer considers that the optimum cost-effective approach would be to proceed directly with scout drilling. The recommended drilling method is Gemco (or equivalent) open-flight, 3 or $3\frac{1}{2}$ inch diameter auger, employing the "dead-stick" method of sample recovery in 6 foot increments. The more rapid and less costly method of continuous "spin out" of samples from the hole collar would not be appropriate unless it can be demonstrated that the ground is homogeneous and a uniform penetration rate can be assured. More accurate and costly drilling methods such as the Wallis reverse-circulation method are not considered to be justified for scout drilling unless particularly adverse conditions are encountered, such as fluid sand slurries associated with a water table well above target depth.

Emphasis for reconnaissance drilling might be limited further to the seaward toes of parallel dunes where the geomorphological relationships are otherwise prospective. Although littoral concentrations could have developed at any locality along a line normal to favourable embayments with river mouths, the seaward toes of parallel dunes are characteristically the most favourable sites for their preservation. The landward toes of the dunes should not be entirely neglected however, as they characteristically contain higher grade aeolian concentrations. The probability that the landward toes also

overlie littoral deposits is diminished but not insignificant. Progressive accretion of the dunes may have developed to such a pattern that the present landward toe was nearly the seaward toe of the incipient dune.

A scout drilling program of 200 holes to a target depth of 60 feet (12,000 feet total) would probably be adequate to confirm or negate the potential of the selected areas. Most of the holes could probably be drilled along road right-of-way, thus avoiding problems with landowners. It may often be desirable to enter private lands, however, and a provision for compensation to landowners is included in the cost estimate for the program (Table 3).

The cost estimate also includes an option for an airborne geophysical survey and interpretation. While the writer believes that a greater cost benefit would be derived from additional reconnaissance drilling of areas carefully selected on the basis of geomorphological relationships, a geophysically oriented company might elect to take the airborne survey option. Experience in W.A. has indicated that airborne surveys can be effective in locating heavy mineral concentrations and might offer a time advantage in selecting and limiting prospective areas. If the geophysical option is taken, the recommended method is a combined radiometric and magnetic, low-level airborne survey. The uranium content of the zircon as well as the thorium content of the monazite, or dispersion halos of their secondary salts and daughter-element salts should generate discernible radiometric anomalies over potentially economic concentrations. Likewise, the ilmenite and magnetite associated with potentially economic concentrations should produce complementary, small, localised, but well defined magnetic anomalies which would probably be most apparent as sharp, local variations in the gradient of the magnetic field. To achieve optimum precision and resolution, it is recommended that the

airborne instrumentation include a large-crystal, four channel, differential (window type, not threshold) gamma spectrometer and a magnetic gradiometer. Simultaneous analog and digital data acquisition should be specified in case computerised reduction and interpretive techniques are desired. Geometrics, Sydney, among others, are equipped to perform surveys to these general specifications.

The estimated time required to complete and interpret the recommended reconnaissance program is four months; five months if the geophysical option is taken.

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TABLE 1

RESULTS OF GRAIN-COUNTING "SINKS" FRACTIONS

Sample	Mineral (% Grains)						Average Grain Size mm		"Volume" % Rutile
	Monazite	Zircon	Opaques	Others*	Rutile	Total	Rutile	Other Phase	
BL-1	1	16	46	31	6	100	0.9	0.7	12
BL-2	3	16	38	36	7	100	0.8	0.7	10
BW-1	2	24	59	8	7	100	1.0	0.9	9
CH-1	1	16	54	24	5	100	1.0	0.9	7
CH-2	4	9	47	22	8	100	0.8	0.9	6
EA-1	1	26	53	16	4	100	0.7	0.6	6
EF-1	4	28	46	14	8	100	0.7	0.7	8
GN-1	-	23	48	20	9	100	0.5	0.7	5
GW-1	<1	30	55	12	3	100	0.7	0.8	2
KD-1	3	19	52	21	5	100	0.7	0.8	3
KE-1	<1	16	44	30	10	100	0.8	0.8	10
KE-2	2	14	50	26	8	100	0.9	1.0	6
LP-1	-	8	54	35	3	100	0.9	1.0	2
LV-1	<1	26	47	16	11	100	0.5	0.6	7
MV-1	<1	21	59	15	4	100	0.9	0.9	4
MV-2	2	25	52	16	5	100	0.8	0.7	7

Cont'd

* "Others" include kyanite, staurolite, andalusite, tourmaline and spinel.

TABLE 1: Cont'd

Sample	Mineral (% Grains)						Average Grain Size mm		"Volume" % Rutile
	Monazite	Zircon	Opaques	Others	Rutile	Total	Rutile	Other Phase	
NC-1	<1	18	58	16	7	100	0.8	0.7	10
NM-1	<1	14	44	36	5	100	0.7	0.7	5
PA-1	<1	22	54	14	9	100	0.8	0.9	6
PA-2	<1	19	54	20	6	100	1.2	1.3	5
PA-3	-	15	50	29	6	100	1.5	1.5	6
PN-1	3	35	43	9	10	100	0.7	0.7	10
PN-2	4	16	51	21	8	100	0.8	0.8	8
PN-3	-	26	48	18	8	100	0.7	0.7	8
SD-1	-	24	52	17	7	100	0.7	0.7	7
TH-1		18	33	45	4	100	0.8	0.8	4
VH-1	1	21	40	37	1	100	1.0	1.1	<1

TABLE 2

AERIAL PHOTO MOSAICS, 1:63,360 SERIES
COVERAGE REQUIRED FOR THE SOUTHEASTERN
COASTAL PLAIN OF SOUTH AUSTRALIA

SHEET NUMBER		SHEET NAME
6726	N,S*	Meningie
6727	N,S	Mobilong
6823	N,S	Robe
6824	N,S	Kingston
6825	N,S	Santo
6826	N,S	Coonalpyn
6827	N,S	Moorlands
6922	N,S	Millicent
6923	N,S	Conmurra
6924	N,S	Lucindale
6925	N,S	Keith
6926	N,S	Tintinara
6927	N,S	Parrakie
7012	N,S	Northumberland
7022	N,S	Gambier
7023	N,S	Penola
7024	N,S	Naracoorte
7025	N,S	Cannawigara
7026	N,S	McCallum
7027	N,S	Pinnaroo

* Each number and corresponding name includes separate sheets for north and south halves.

40 sheets @ $9.00 $360.00

Available on order from: The Director,
South Australia Department of Lands,
Box 293A, G.P.O.,
ADELAIDE, S.A. 5001

TABLE 3

COST ESTIMATE OF RECONNAISSANCE PROGRAM
SOUTHEASTERN COASTAL PLAIN OF SOUTH AUSTRALIA

ITEM	AMOUNT	
FIELD CHARGES		
Junior or intermediate geologist; 4 months	3,000	
Field assistant; 4 months	1,500	
Caravan, meals, etc.; 80 man days @ $7.00	560	
Travel; fares and lodging	500	
Vehicle charges; 5000 miles @ 12 c.	600	
Misc. supplies, sample bags, etc.	300	
Air freight; sample shipment	250	
Subtotal		6,710
CONTRACTING AND CONSULTING SERVICES		
Power auger drilling; 12,000 ft. @ 85 c.	10,200	
Drill location and mileage in area	500	
Consulting geologist, C.E. Larson; 25 days @ $100, plus expenses	2,800	
Subtotal		13,500
LABORATORY CHARGES		
T.B.E. analyses; 1,500 @ $1.50	2,250	
Grain counts; 150 @ $4.00	600	
Provision for chemical analyses	100	
Subtotal		2,950
ADMINISTRATIVE CHARGES		
Photo mosaics, selected stereo pairs, satellite photos, maps, etc.	500	
Draughting, printing, report preparation	300	
Exploration Licence fees	100	
Provision for compensation to landowners	1,000	*
Phone, postage	100	
Contingency allowance (5%)	1,200	
Administrative overheads, supervision, etc. (20%)	5,300	
Subtotal		8,500
TOTAL		31,660
SAY		$32,000

TABLE 3 (continued)

ADDITIONAL CHARGES FOR GEOPHYSICAL OPTION

ITEM	AMOUNT	
CONTRACTING AND CONSULTING SERVICES		
Airborne survey; 1500 line miles @ $8.00	12,000	
Provision for reduction and interpretation	3,000	
Consulting geologist, liaison with geophysical contractor; 5 days plus expenses	600	
Subtotal		15,600
FIELD CHARGES		
Geologist, field liaison with geophysical contractor; 1 week	200	
Meals, lodging	100	
Vehicle charges; 2,000 miles @ 12 c.	240	
Subtotal		540
ADMINISTRATIVE CHARGES		
Draughting, printing	200	
Phone, postage	50	
Contingency allowance (5%)	800	
Administrative overheads (estimate reduction to 10% for a predominantly "outside" service)	1,700	
Subtotal		2,750
TOTAL		18,890
SAY		$19,000

GRAND TOTAL, INCLUDING GEOPHYSICAL OPTION: $51,000

TABLE 4

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Current as at 17.12.73

SPECIAL MINING LEASES (Deemed to be Exploration Licences)

NO.	LESSEE	(APPROX.) SQ.MILES	EXPIRY DATE	GRID
691	Oilmin N.L. & Transoil N.L.	20	22.4.74	K5
703	North Flinders Mines Ltd	268	18.5.74	K5
704	" " " "	527	17.5.74	K4
705	" " " "	7	17.5.74	K4

EXPLORATION LICENCES (Mining Act, 1971)

NO.	LESSEE	(APPROX.) km^2	EXPIRY DATE	GRID
1	Electrolytic Zinc Co. of A/asia Ltd.	51.8	2.8.74	J5
9	Pechiney (Aust.) Exploration Pty. Ltd.	2231	20.3.74	D6
10	" " " " "	2029	20.3.74	C5
15	Petromin N.L., Oilmin N.L. & Transoil N.L.	2131	11.2.74	F3
16	Director of Mines	1885	25.10.74	L7
17	Stockdale Prospecting Ltd.	842	25.10.74	I7
19	Petromin N.L., Oilmin N.L., Transoil N.L. & Afmeco Pty. Ltd.	2072	25.10.74	K5
24	Sadex Pty. Ltd.	347	22.5.74	G7
32	North Broken Hill Ltd.	2279	27.12.73	L9
33	Uranerz (Australia) Pty. Ltd.	1607	3.1.74	H3
34	Tricentrol Australia Ltd.	2205	3.1.74	L5
35	Cultus Pacific N.L.	1188	3.1.74	J5
37	Chevron Exploration Corp.	1686	7.2.74	G8
39	Oilmin N.L., Petromin N.L. & Transoil N.L.	1447	14.2.74	F3
41	Nissho-Iwai Co. (Aust.) Pty. Ltd.	784	21.2.74	J4
44	Bridge Minerals Pty. Ltd.	49	12.3.74	J5
46	Carpentaria Exploration Co. Pty. Ltd.	88	15.3.74	J5
47	" " " " "	35	15.3.74	L6
48	Nissho-Iwai Co. (Aust.) Pty. Ltd.	1072	15.3.74	E5
49	Cultus Pacific N.L. & Kauzlaric, R.R.	1392	20.3.74	J8
50	Mt. Gunson Mines Pty. Ltd.	2215	22.3.74	I7
51	Sasearch Pty. Ltd.	92	22.3.74	K7
52	Gillespie, H.R.	1256	22.3.74	I4
53	" "	196	22.3.74	I4
54	Abadon Holdings N.L.	318	29.3.74	F5
55	" " "	226	29.3.74	G6
56	" " "	382	29.3.74	F5
57	Utah Development Co.	235	29.3.74	J7
58	Exploration Drilling Pty. Ltd.	902	29.3.74	G9
60	Delhi International Oil Corp.	3640	12.4.75	L7
61	Australian Oil & Gas Corp. Ltd.	100	18.4.74	I10
62	Carpentaria Exploration Co. Pty. Ltd.	454	18.4.74	L6
63	Tricentrol Australia Ltd.	1874	3.5.74	L7
67	Carpentaria Exploration Co. Pty. Ltd.	1767	24.5.74	G8
68	Mines Administration Pty. Ltd., Teton Exploration Drilling Co. Pty. Ltd. & Afmeco Pty. Ltd.	165	31.5.74	K5
69	Tricentrol Australia Ltd.	706	31.5.74	L6

NO.	LESSEE	(APPROX.) km²	EXPIRY DATE	GRID
70	Dampier Mining Co. Ltd.	2130	7.6.74	G4
71	Aquitaine Australia Minerals Pty. Ltd. & Fox Mining & Exploration Pty. Ltd.	208	21.6.74	K5
72	Endeavour Oil Co. Ltd.	52	21.6.74	J5
73	Mines Exploration Pty. Ltd.	73	21.6.74	L7
74	Jade (Australia) Pty. Ltd.	203	27.6.74	H8
75	Director of Mines	1282	5.7.75	I8
76	Aquitaine Australia Minerals Pty. Ltd. & Fox Mining & Exploration Pty. Ltd.	18	5.7.74	J5
77	Oilmin N.L., Transoil N.L. & Petromin N.L.	805	5.7.75	K5
78	Carpentaria Exploration Co. Pty. Ltd.	35	5.7.74	K5
79	Dampier Mining Co. Ltd.	2236	5.7.74	F1
80	" " " "	1866	5.7.74	G2
81	Mount Gunson Mines Pty. Ltd.	5631	19.7.74	H6
82	Utah Development Co.	35	19.7.74	K5
83	Carpentaria Exploration Co. Pty. Ltd.	61	19.7.74	L7
84	Petromin N.L., Oilmin N.L. & Transoil N.L.	5631	19.7.74	D5
85	Carpentaria Exploration Co. Pty. Ltd.	1585	24.7.74	L6
86	Aquila Minerals Ltd.	75	5.8.74	I10
87	Mines Adminsitration Pty. Ltd. & Teton Exploration Drilling Co. Ltd.	145	5.8.74	L6
88	Aquitaine Australia Minerals Pty. Ltd.	358	5.8.74	K9
89	Southern Ventures Pty. Ltd.	746	5.8.74	L6
90	" " " "	1838	5.8.74	L5
91	Petromin N.L., Transoil N.L. & Oilmin N.L.	1926	5.8.75	K5
92	Oilmin N.L., Transoil N.L., Petromin N.L. & Western Uranium Ltd.	1035	7.8.75	K5
93	Director of Mines	2772	19.8.74	D1
94	Utah Development Company	233	19.8.74	J7
95	Steetley Australasia Pty. Ltd.	85	23.8.74	K4
96	Aquitaine Australia Minerals Pty. Ltd. & Fox Mining & Exploration Pty. Ltd.	125	19.9.74	J5
97	Dampier Mining Company Ltd.	2403	23.9.74	E1
98	Sedimentary Uranium N.L.	1968	27.9.74	L6
99	Cominco Exploration Pty. Ltd.	11	9.10.74	J9
100	Utah Development Company	1573	14.1.74	E4
101	Mareloo Pty. Ltd.	18	14.10.74	K5
102	International Nickel Australia Ltd.	713	21.10.74	L7
103	Union Miniere Development & Mining Corporation Ltd.	123	21.10.74	K5
104	Shell Development (Aust.) Pty. Ltd.	2462	31.10.74	G4
105	Southern Ventures Ltd.	926	31.10.74	L5
106	Australian Anglo American Ltd.	1438	31.10.74	G9
107	" " " "	129	31.10.74	K5
108	Shell Development (Aust.) Pty. Ltd.	2400	31.10.74	G3
109	Pacminex Pty. Ltd.	2652	11.11.74	K6
110	Uranerz (Australia) Pty. Ltd.	263	15.11.74	G2
111	Dampier Mining Co. Ltd.	101	18.11.74	G9
112	" " " "	2141	18.11.74	J6
113	Northland Minerals Limited	142	20.11.74	K9
114	Utah Development Company	103	9.12.74	K9
115	Nissho-Iwai Co. (Aust.) Pty. Ltd.	89	9.12.74	K5
116	Bridge Minerals Pty. Ltd.	463	13.12.74	J5
117	" " " "	103	13.12.74	J5
118	" " " "	553	13.12.74	J5

ENV 2518 (I)-1

NOTES Compiled from Pinnaroo, Naracoorte, Penola 1:250,000 Dept. of Nat. Mapping Topo sheets.

JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)

S.E. COASTAL PLAINS PROJECT
E.L. 169 – SOUTH AUSTRALIA
POTENTIAL HEAVY MINERAL AREAS
& DRILLING PROGRAMME LOCATION

SCALE 1:250,000

Drg. No. S-SE-2-2

ENV 2518 (I)-2
JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)
S.E. COASTAL PLAINS PROJECT
E.L. 169 – SOUTH AUSTRALIA
SURFACE SAMPLES LOCATION MAP
SCALE 1: 250,000
Drg. No. S-SE-2-5
NOTES Compiled from Pinnaroo, Naracoorte, Penola 1:250,000 Dept of Nat. Mapping topo sheets
Reference Drawings and Nos.
Revisions
By
Date
LEGEND
E.L. Boundary
Major Roads
Strand Lines
Creeks
Palaeo-Drainage-channel
Sample location & N° (All of SE-R series)
N
Moorlands
Peake
Coonalpyn
Culburra
Tintinara
Keith
Bordertown
Padthaway
Naracoorte
Penola
Nangwarry
Tarpeena
Ki Ki
Yumali
Carcuma
Black Range N°1
Black Range N°2
Mundulla N°1
Naracoorte N°1
Naracoorte N°2
Naracoorte N°3
Francis N°1
Francis N°2
Francis N°3
Francis N°4
Penola N°1
Penola N°2
Nangwarry N°1
Nangwarry N°2
Tarpeena N°1
Tarpeena N°2
Tatiara Ck.
Nalang Ck.
Morambro Ck.
Naracoorte Ck.
Mosquito Ck.
Yallock Ck.
Mundalla N°1
139° 30'
140° 00'
140° 30'
141° 00'
140° 45'
35° 15'
35° 30'
36° 00'
36° 30'
37° 00'
37° 15'
37° 30'
37° 45'

ENV 2518(II)-3

JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)

S. E. COASTAL PLAINS PROJECT
E. L. 169 – SOUTH AUSTRALIA
DISTRIBUTION OF LITHOFACIES
OF THE BRIDGEWATER FORMATION

SCALE 1: 250,000

Drg. No. S-SE-2-8

Drawn	C.L./G.S.
Traced	G.S.
Checked	D.H.
Approved Proj. Geol.	D.H.
Date	June 1975

Reference Drawings and Nos.	Revisions	By	Date

NOTES Compiled from Pinnaroo, Naracoorte, Penola 1:250,000 Dept. of Nat. Mapping Topo sheets.

ENV 2518 (I) - 4

JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)

S. E. COASTAL PLAINS PROJECT
E. L. 169 – SOUTH AUSTRALIA
VISUAL HEAVY MINERAL PERCENTAGE
MAP - BRIDGEWATER FORMATION

SCALE 1: 250,000

Drg. No. S-SE-2-9

Drawn	C.L./G.S.
Traced	G.S.
Checked	D.H.
Approved Proj. Geol.	D.H.
Date	June 1975

Reference Drawings and Nos.	Revisions	By	Date

NOTES Compiled from Pinnaroo, Naracoorte, Penola 1:250,000 Dept. of Nat. Mapping Topo sheets.


ENV 2518 (I) - 5
JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)
S.E. COASTAL PLAINS PROJECT
E.L. 169 – SOUTH AUSTRALIA
PRE - BRIDGEWATER FORMATION
INTERPRETATIVE SOLID GEOLOGY
SCALE 1: 250,000
Drg. No.
S- SE - 2 - 11
Drawn D.H.
Traced G.S.
Checked D.H.
Approved Proj. Geol. D.H.
Date June 1975
NOTES Compiled from Pinnaroo, Naracoorte, Penola 1:250,000 Dept. of Nat. Mapping Topo sheets.
Reference Drawings and Nos.
Revisions
By
Date
MARMON - JABUK FAULT
PADTHAWAY RIDGE
KANAWINKA FAULT
N
Moorlands
Peake
Ki Ki
Coonalpyn
Culburra
Tintinara
Keith
Bordertown
Padthaway
Naracoorte
Penola
Nangwarry
Tarpena
139°30'
140°00'
140°30'
141°00'
140°45'
35°15'
35°
35°30'
36°00'
36°30'
37°00'
37°15'
37°30'
37°45'
LEGEND
E.L. Boundary
Major Roads
PRE-BRIDGEWATER FORMATION STRATIGRAPHY
Geological Time
Period
Epoch
Stratigraphic Unit
QUATERNARY
Lower Pleistocene
Coomandook Formation
Present Outcrop
Subsurface Extent
TERTIARY
Pliocene
Parilla Sand (& Loxton Sand, undifferentiated)
Present Outcrop
Oligocene - Miocene
Gambier Limestone
Present Outcrop
Subsurface Extent
ORDOVICIAN
Lower
"Granites"
Present Outcrop
Pre-Bridgewater Fm. Interpretative O/C.

PHOTO-INTERPRETIVE GEOLOGY

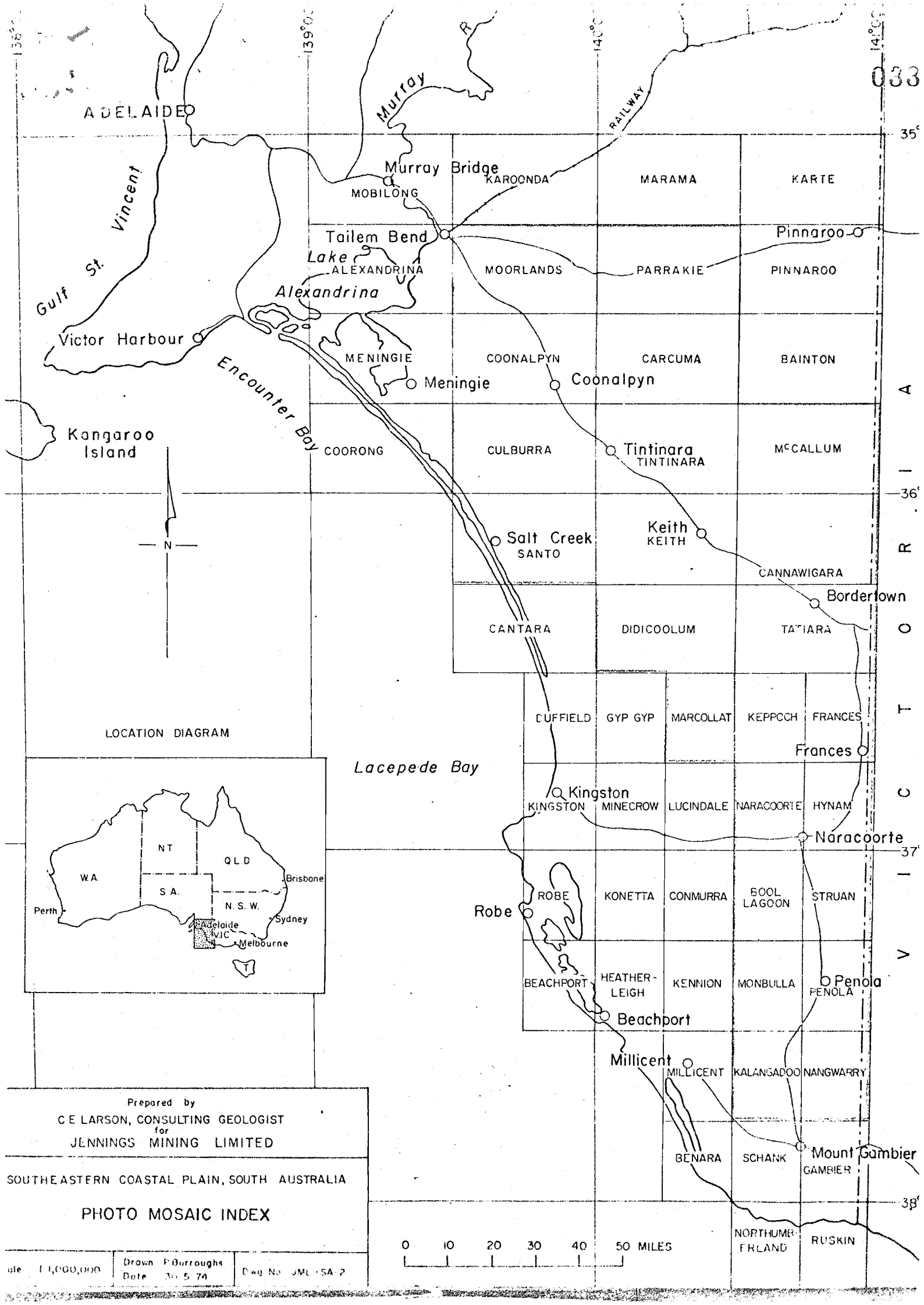
SOUTHEASTERN COASTAL PLAIN, SOUTH AUSTRALIA

PREPARED FOR

JENNINGS MINING LIMITED

SEPTEMBER 1974

C.E. Larson
Consulting Geologist
Canberra, Australia
and
Minneapolis, U.S.A.


033
ADELAIDE
Murray R.
RAILWAY
Murray Bridge
MOBILONG
KAROONDA
MARAMA
KARTE
Tailem Bend
Pinnaroo
Lake ALEXANDRINA
MOORLANDS
PARRAKIE
PINNAROO
Alexandrina
Gulf St. Vincent
Victor Harbour
MENINGIE
COONALPYN
CARCUMA
BAINTON
Meningie
Coonalpyn
Encounter Bay
Kangaroo Island
COORONG
CULBURRA
Tintinara
TINTINARA
McCALLUM
Salt Creek
SANTO
Keith
KEITH
CANNAWIGARA
Bordertown
CANTARA
DIDICOOLUM
TATIARA
DUFFIELD
GYP GYP
MARCOLLAT
KEPPOCH
FRANCES
Frances
LOCATION DIAGRAM
Lacepede Bay
Kingston
KINGSTON
MINECROW
LUCINDALE
NARACOORTE
HYNAM
Naracoorte
NT
QLD
WA
SA
NSW
Brisbane
Perth
Sydney
Adelaide
VIC
Melbourne
ROBE
KONETTA
CONMURRA
BOOL LAGOON
STRUAN
Robe
BEACHPORT
HEATHER-LEIGH
KENNION
MONBULLA
Penola
PENOLA
Beachport
Millicent
MILLICENT
KALANGADOO
NANGWARRY
BENARA
SCHANK
Mount Gambier
GAMBIER
NORTHUMBERLAND
RUSKIN
0 10 20 30 40 50 MILES
135°
139°
140°
141°
35°
36°
37°
38°
VICTORIA
Prepared by
C E LARSON, CONSULTING GEOLOGIST
for
JENNINGS MINING LIMITED
SOUTHEASTERN COASTAL PLAIN, SOUTH AUSTRALIA
PHOTO MOSAIC INDEX
Scale 1:1,000,000
Drawn P Burroughs
Date 30 5 74
Dwg No JML-SA-2

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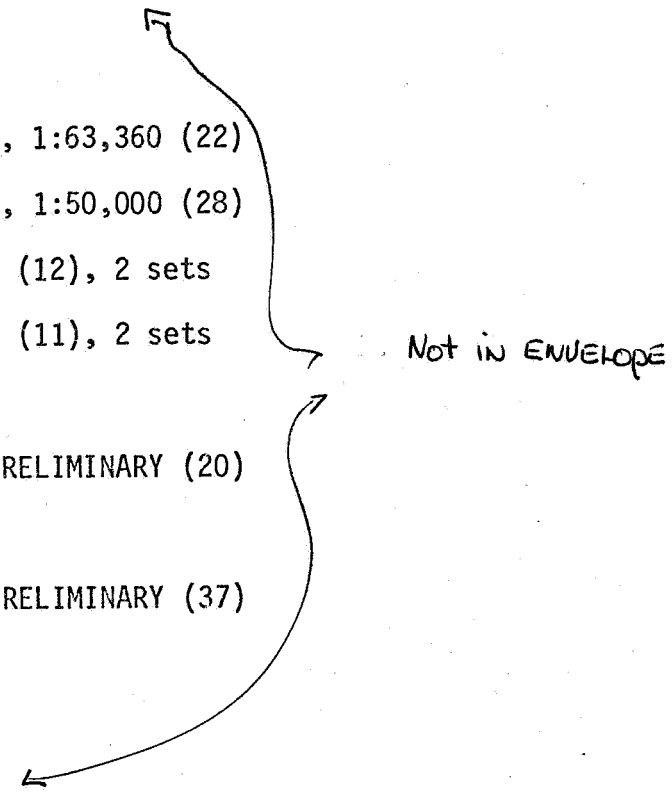


SUMMARY AND CONCLUSIONS

An interpretive study of aerial photo mosaics of the coastal plain of southeastern South Australia, embracing most of the Tertiary to Pleistocene Murray Gulf has confirmed that several localities present environments which should have been conducive to mineral sand concentrations. The southeastern extremity of the Keith Embayment seems to include a high degree of development of geomorphological features common to most large mineral sand deposits and should be considered a target of top priority.

Results of the interpretive study are presented on 50 transparent overlays and 23 interpretive maps at scales of 1:63,360 and 1:50,000. Recommended traverse locations for a reconnaissance program of power auger drilling are shown on one set of interpretive maps.

PHOTO-INTERPRETIVE GEOLOGY

SOUTHEASTERN COASTAL PLAIN, SOUTH AUSTRALIA

INTRODUCTION

This report, with accompanying maps, aerial photo mosaics and interpretive overlays comprises a supplement to the preliminary report, "The Potential for Mineral Sand Concentrations in the Southeastern Coastal Plain of South Australia" dated December, 1973. The previous report includes a summary of the location, access, geological setting, etc. as well as some preliminary interpretive statements. The preliminary interpretive statements are generally corroborated by the more detailed photo mosaic interpretation, but with a few highly significant departures.

Interpretive overlays on acetate film have been prepared for each of the 50 photo mosaics indicated on the Photo Mosaic Index. Of these, 22 are to a scale of 1:63,360. The remaining 28 mosaics and overlays are to a scale of 1:50,000. This somewhat unfortunate combination of scales resulted from the lack of uniform mosaic coverage available from the South Australia Department of Lands.

Reproducible tracings and colour-keyed dye-line prints have been prepared from each of the 23 interpretive overlays which lie wholly or in part within the area of the Exploration Licence Application (those sheets within the orange outline on the Photo Mosaic Index). Of these 23 maps, 12 are to a scale of 1:63,360; the remaining 11 at 1:50,000.

INTERPRETIVE METHODS

Only those geological or geomorphological features which have a direct bearing on the location of targets for mineral sand exploration are shown on the maps and interpretive overlays. Other natural and cultural features such as the modern coastline, lakes, railways, and roads are shown to provide a means of approximate horizontal control.

The geological and geomorphological features shown include ancient shorelines, dune trends or complexes, inferred alluvial channels and prominent outcrops of igneous rodks. In this context, the interpretive overlays and corresponding maps are "Morphostratigraphic" as they indicate the areal position and relative age of the selected geomorphological features, reflecting only indirectly any contrasts in lithological composition The features mapped appear on the mosaics as tonal variations, sometimes striking, more often subtle. In most instances, the tonal variations as marked on the overlays are substantiated by topographic relief or trends as indicated on the corresponding 1:50,000 and 1:31,180 topographic maps.

The dune systems plotted on the overlays and drawings do not represent an exhaustive presentation of each individual dune. Nevertheless, a large sample of individual dunes has been drawn to indicate clearly the predominating dune trends and to differentiate them clearly and definitively from the ancient shorelines to avoid any possible confusion between the two.

In general, the geomorphological features mapped bear a strong areal correlation with the lithological-stratigraphic units shown on the corresponding Pinnaroo, Naracoorte and Penola 1:250,000 geological maps.

INTERPRETIVE GEOLOGY AND GEOMORPHOLOGY

With reference to the previous report, it should be noted that the 1:1,000,000 map of "Pleistocene Geology" presented mainly the location and configuration of "stranded dune systems" which, only in a general sense, could be correlated with the corresponding ancient shorelines. The maps and overlays of this study indicate, as precisely as possible within the limitations of scale, the locations and configurations of the major shorelines themselves.

In common with most reaches of emerging coastline developing upon unconsolidated or semi-consolidated sediments, the major shorelines appear

as a sub-parallel series of wave-cut benches or terraces. With a receding shoreline or emerging landmass, it may be considered that an infinite or continuous progression of shorelines would be represented. The more prominent shorelines as mapped probably represent intervals of relative stability, indicating a lapse of sufficient time for the development of benches accompanied by the development of prominent systems of parallel and transgressive dunes to landward. The wave-cut benches and terraces generally truncate the seaward margins of the dune systems, thus enhancing the contrast in topographic relief and providing a basis for the accurate location of the major shorelines.

Numerous sub-parallel, gently curved to sublinear features, mapped as ancient shorelines, occur many miles inland from the Marmon-Jabuk Range and the highest (oldest) stranded dune system mapped by Blackburn, et. al (1965). The highest and oldest inferred shoreline noted in this study appears on the Karte mosaic (outside the E.L. boundary) and may represent the earliest (Miocene?) and most deeply embayed configuration of the Murray Gulf.

All of the shorelines, from the modern coast to the most ancient, except for their more deeply embayed extremities near highlands of older rocks, seem to parallel structural lineaments trending northwest to southeast. The Naracoorte shoreline and adjacent West Naracoorte Range of stabilised sand dunes, for example, parallels and nearly coincides with the Kanawinka Lineament. It is possible that some of the features mapped as ancient shorelines northeast of the Marmon-Jabuk Range may be a more direct reflection of sub-parallel structural lineaments (faults or flexures) rather than distinct shorelines. It may, nevertheless, be inferred that the trends of the shorelines would have been controlled by the lineaments and conformed closely to them.

An astonishing number of ancient shorelines, perhaps 60 in all, have been either positively or tentatively identified on the interpretive overlays. A few of these, especially near the Keith Embayment, appear to represent bifurcations at constant elevations rather than incremental decreases in sea levels.

In direct contradiction to the preliminary interpretation of the stranded dune systems as noted in the previous report, the stranded dune systems within the E.L. area are clearly not parallel dunes, but coalescing systems of transgressive or parabolic dunes. Several prominent systems of parallel dunes occur among the younger, shoreward, calcareous sediments of the Bridgewater Formation, but, within the boundaries of the Exploration Licence, any parallel dune systems which may have developed contemporaneously with the shorelines have since been breached and overridden by the transgressive dunes.

The shape and direction of convexity of the transgressive dunes serve as an effective "weather vane" in determining the direction of winds prevailing at the time of contemporaneous shoreline development. Again, the interpretation is in direct contradiction to the previous report. Although it still seems, somewhat anomalously, that the Younghusband Peninsula has progressively closed the mouth of the Murray at Lake Alexandrina by lateral accretion from southeast to northwest as a result of effective southeasterly storm winds and ocean swells, the prevailing winds and, presumably, the associated swells contemporaneous with shoreline development in the E.L. area were from the west. By extension of this interpretation, resultant long-shore drifts should have tended to form heavy mineral concentrations in the easterly extremities of embayments.

Swarms of parallel to sub-parallel, subdued dune trends are abundant in the northern portions of the E.L. area. Their parallelism is, however, in respect to one another, not to the ancient shorelines, with which their trends make an angle of 10^{o} to 20^{o}. Furthermore, these parallel dune trends tend to occur in pairs. They are interpreted, therefore, as the modified remnants of parabolic dunes, the limbs of which had become stabilised by vegetation while the nose continued to be mobilised and finally dispersed by aeolian erosion.

In some areas, especially the northern portion of the E.L., a rare form of "reverse parbolic" dune occurs, i.e. the general geometry and dimensions of the dune is similar to adjacent or surrounding parabolic dunes, but the sense of convexity is reversed, with nose to windward. In this sense, the "reverse parabolic" dunes are similar to barchans, but differ from barchans in the ratio of lengths of the major and minor axes. Perhaps the "reverse parabolic" dunes formed as barchans which became stabilised on the nose portion while the horns remained mobile. The occurrence of barchan forms among parabolic dunes would, in itself, be somewhat anomalous as the criteria which determine the dune form depend on a critical balance of rainfall, flora development and wind velocity combining to favour one form to the exclusion of the other.

Several possible ancient stream channels have been identified and located on the overlays and corresponding maps. Most of the major channels are now occupied by underfit, ephemeral streams such as Tatiara Creek or Mosquito Creek. The largest of the inferred channels (Moorlands sheet), a possible abandoned channel of the Murray, appears to contain no definite modern stream course.

In concurrence with statements (personal communications) by Mr Johns and Mr Firman of the S.A. Geological Survey, it appears

unlikely that the Ancestral Murray could have traversed the Pinnaroo Block to form channels in reaches east or southeast of, perhaps, the Coonalpyn or Culburra sheets. Even here, there seems to be little or no geomorphological evidence for such channels, although they are suspected from generalised data from bore cuttings. Channels further south, particularly the ancestral channel of Tatiara Creek tributary to the southern extremity of the Keith Embayment, can be traced with some interpretive speculation into Victoria, near the present catchment of the Glenelg River. It is interesting to note that the inferred estuary of the ancestral Tatiara bears a strong resemblance in general outline and dimensions to the modern Swan Estuary at Perth and Fremantle, W.A.

RECOMMENDED EXPLORATION TARGETS FOR MINERAL SANDS

Following the rationale for reconnaissance drilling as set forth in the previous report, but recognising the implications of prevailing westerly winds and an inferred longshore drift to the southeast, bights in the southeast extremities of embayments should present targets of the highest priority. Nevertheless, the possibility of concentrations in the northwestern extremities of embayments should not be discounted. Storms and swells from the southeast, though subordinate to the westerlies, could have generated effective northwesterly longshore drifts, especially as the ancient Murray Gulf presented long expanses of open shoreline parallel to this direction.

The southeastern extremity of the Keith Embayment (Keith, Didicoolum and Keppoch Sheets), in confirmation of the previous report, seems to represent an ideal environment for heavy mineral concentrations: a deeply arcurate bight favourably oriented towards the probable direction of longshore drift; proximity to the mouth of a major alluvial channel

which could have provided a source of heavy minerals; a local heavy mineral assemblage known to contain zircon and rutile (although of as yet undemonstrated economic concentrations).

Several localities other than the southeastern extremity of the Keith Embayment may also represent only slightly less favourable environments. Accordingly, numerous targets have been identified which present either favourably oriented embayments, favourable proximity to inferred channel mouths, or both. The selected targets are identified in red on one set of prints of the photo-interpretive maps. It is recommended that each target indicated be explored by one traverse of ½ km. length with holes on 50 m. centres; 11 holes for each traverse, to ensure spanning the littoral zone corresponding to each major shoreline. As the dune systems flanking the shorelines are clearly transgressive, their potential for economic heavy mineral concentrations is diminished. Extension of the drill hole traverses more than one or two holes at 50 m. intervals beyond the top of the shoreline bench or terrace is not recommended.

As previo usly suggested, power auger holes of a maximum depth of 20 m. or 60 ft should be adequate to confirm or negate the presence of any economically accessible heavy mineral deposits. Sample increments of 2m. or 6 ft should be adequate for reconnaissance. Conditions of shallow water table and indurated zones are to be expected. As induration of the sands may well present the limiting constraint on economic development of any deposits which might be discovered, special attention should be given to logging the penetration rate of the auger as well as to the degree of induration evident in the cuttings.

The recommended traverses for the reconnaissance drilling are summarised in the following table, with each traverse designation marked on the corresponding interpretive Geology Sheet. To investigate all of the selected targets according to the recommended system would require perhaps three times the number of holes suggested in the preliminary report. If the reconnaissance program is to be limited to approximately 200 holes as contemplated, priority should be given to traverses marked with an asterisk.

RECOMMENDED RECONNAISSANCE DRILL HOLE TRAVERSES

Sheet No.	Sheet Name	Traverses
1	Moorlands	MR-1,2,3,4
3	Coonalpyn	CP-1,2,3,4
5	Culburra*	CL-1,2,3,4,5,6,7,8,9
6	Tintinara	TN-1,2,3
9	Keith*	KT-1,2,3,4
10	Cannawigara*	CN-1,2
11	Didicoolum*	DM-1,2,3,4,5,6,7
12	Tatiara	TA-1,2,3
14	Keppoch*	KP-1,2,3
15	Frances	FR-1
16	Naracoorte	NC-1,2,3,4
17	Hynam	HM-1,2,3,4
19	Struan	SN-1,2,3,4,5
21	Penola	PL-1,2
22	Kalangadoo	KD-1
23	Nangwarry	NY-1

Maximum effect and value will be gained from the reconnaissance drilling program by adhering to the discipline that follow-up drilling is to be planned for any anomalous mineral sand concentrations discovered, whether such anomalies represent immediate economic interest or not. It is recommended that any concentrations which are anomalous at the 95% confidence level be further investigated by traverses 200 m. either side of and approximately parallel to the traverse including the anomaly. The follow-up should continue until an anomalous trend has either led to potentially economic concentrations or has been demonstrated to diminish to background levels of concentration.

The younger shorelines west of the E.L. area are embayed at several localities and might also present several attractive targets if it were not for the apparently ubiquitous development of calcrete. If the initial reconnaissance drilling results in any success or encouragement, it might be worthwhile to investigate the favourable localities among the younger shorelines if zones of minimal induration can be identified by field mapping and limited drilling.

REFERENCE

BLACKBURN, G., et. al. 1965, C.S.I.R.O. Soils Publication No. 22.

JENNINGS MINING LIMITED

EXPLORATION LICENCE 169

SOUTHEASTERN COASTAL PLAINS HEAVY MINERAL SANDS PROJECT, S.A.

QUARTERLY REPORT TO MINES DEPARTMENT FOR PERIOD ENDING

20TH APRIL, 1975

---

1. INTRODUCTION

1.1 Location and Details of Licence

Exploration Licence 169 was granted to Jennings Mining Limited on 20th January, 1975 under some special terms of tenure. The licence covers an area of 12,717 sq. km. of the southeastern coastal plains of South Australia and approximately occupies a linear belt between Tailem Bend and Mount Gambier. This extensive area has been granted for a six month period to 20th July, 1975 at which time the Licence must be reduced in size to no more than 2,500 sq. km. (Of course the option of applying for a number of 2,500 sq. km. licence areas is also available).

1.2 Reasons for Interest in the Area

The project was conceived by Consulting Geologist, C.E. Larson as early as 1968. It is contended that the Pleistocene Bridgewater Formation of the emergent south-east coastal plains area of South Australia exhibits many of the features conducive to the development of littoral and aeolian concentrations of heavy minerals. Larson carried a latent interest in the area over many years and in December, 1972, collected a total of 27 near-surface samples from road cuts and shallow hand auger holes. None of these samples contained as much as 1% total heavy minerals (visual estimate), however, analysis revealed an interesting heavy mineral assemblage containing an average 8% rutile and 22% zircon.

2. WORK CONDUCTED

2.1 Pre-Licence Research

C.E. Larson was contracted by Jennings Mining Limited in late 1973 to write a report on the potential of the area.

2.1 Cont'd.

As a result Larson produced "The Potential for Mineral Sand Concentrations in the Southeastern Coastal Plain of South Australia", in December, 1973. Sufficiently encouraged by the concepts raised in the preliminary report, Jennings Mining Limited further contracted Larson to investigate the potential of the area and recommend an exploration programme. Larson then produced his second report in September, 1974, entitled "Photo-Interpretive Geology Southeastern Coastal Plain, South Australia".

Larson's second study was an extensive one. It involved the purchase of 50 photo mosaics, 22 at a scale of 1:63,360 and 28 at a scale of 1:50,000. This somewhat unfortunate combination of scales resulted from the lack of uniform mosaic coverage available from the South Australian Department of Lands. In addition, the various topographic maps covering the area were purchased i.e. 20 at 1:50,000 scale, 22 at 1:31,680 scale and 3 at 1:250,000 scale. Using various photogeology methods and 'form-line trend surface analysis' techniques of the topographic sheets Larson was able to define the various ancient shorelines (or strand lines), dune trends or complexes and prominent outcrops of igneous rocks and also to infer the position of ancient alluvial channels.

As a result of the photogeology study numerous "targets" were proposed and Larson recommended a reconnaissance programme of power auger drilling.

2.2 Current Field Programme

2.2.1 Drilling Programme

2.2.1.1 Objectives

A review of C.E. Larson's photogeology study indicated four areas which are most likely to have the requisite palaeogeographic requirements and/or close proximity to a likely source (ancestral hinterland drainage channel). These are, from north to south : *

1. Mt. Boothby Peninsula and Coonalpyn Bay.
2. Keith Bay and associated Mt. Monster Peninsula.
3. Padthaway Archipelago.
4. Penola Bay.

---

* These names have as their basis a locality name linked with an inferred palaeogeographic form.

2.2.1.1 Cont'd.

Keith Bay and Padthaway Archipelago look attractive due to their close proximity to a known possible source; the ancient Tatiara Creek. Further, Padthaway Archipelago has possible foreshore cliffs formed by the Tertiary Parilla Sand. Penola Bay is a well developed bay particularly in the younger Pleistocene dune strands and is held to be attractive due to its close proximity to the 'Mt. Gambier' volcanics (an ilmenite rich source). Coonalpyn Bay would appear to be a prominent bay formed in association with a large peninsula, the Mt. Boothby Peninsula and this area could be attractive due to its possible closer association with the ancestral Murray.

2.2.1.2 Programme

A 106 hole scout drilling programme using a Gemco 210B trailer-mounted rig and 1.5 m long, $4\frac{1}{2}$" diameter, open flight, auger rods has been planned to test the four most promising potential areas. 17 drill hole traverses are planned, each traverse containing an average 6 holes spaced 100 metres apart. (Some contain 8 holes and/or 150 m. drill hole spacing). Programmed depth of hole is 21 m. and samples are taken by the 'dead-stick method' every 1.5 m. Each sample is split on site, one split is panned on site for visual heavy mineral assessment and the other split is stored for possible stratigraphic and/or mineralogic analysis.

The programme is presented in Table 1. The drill hole traverses are located on the designated 1:50,000 and 1:31,680 topographic maps and on a 1:250,000 compilation.

2.2.1.3 Progress

The field team, comprising one geologist and one driller, arrived in the area on 9th April and commenced drilling on the 10th April. Working a 6 day week, four holes of the Mundulla 1 programme had been completed by 20th April, 1975. Log details of the strata intersected in these holes are not yet available from the field team.

Including commuting time from Melbourne, 24 man-days of exploration activity have been spent in the area to 20th April, 1975.

2.2.2 Regional Scout Reconnaissance Mapping and Sampling Programme

In addition to the drilling programme a two man team comprising a geologist and a field assistant are involved in a regional scout reconnaissance mapping and sampling programme. This programme was instigated in the last week of the quarter and to 20th April, 1975, a total of 15 samples had been collected. This programme is expected to continue for an approximate four week period.

The objectives of the programme are to :

i) Rapidly map the aerial distribution of various stratigraphic units.

ii) Test the 'morphostratigraphic' photogeologic mapping of C.E. Larson.

iii) Define possible beach strands on lithologic composition and granulometric evidence.

iv) Gain a representative sample suite of rocks covering the whole area.

An anticipated suite of approximately 200 rocks will be collected from quarries, road cuttings and other outcrops in this programme. It is then proposed to examine these rocks under the binocular microscope and describe their textural and lithological character. The disaggregated rocks (or a split thereof) will be panned for visual heavy mineral assessment.

2.3 Current Research

2.3.1 Study of Water Bore Data

Considerable consideration has been given to the study of water bore data. Twenty 1:50,000 scale, Cadastral Mapping base maps showing water bore locations have been purchased from the South Australian Department of Mines. An examination of these and water bore cards in the Department revealed the nature of the data available for a water bore study.

A considerable number of water bores have been drilled in the south-east coastal plains of South Australia resulting in a dense subsurface coverage of the area. The water-bores drilled on the Keith 1:50,000 sheet area were taken as a model study. At a guess only 20 to 30 percent of bores have a driller's strata log and only a few (something less than 5% of the 20%) of these have any stratigraphic interpretation. Fully realizing these limitations the water bore data provides an excellent subsurface coverage.

2.3.1 Cont'd.

The main drawback in commencing a detailed study of the water bore data is the scope of such a study. It would of necessity be a large study involving much time, personnel and money. Accordingly, this study has been shelved until such time as our drilling, mapping and sampling programmes provide sufficient 'target area' leads. The water bore data would then be useful.

3. CONCLUSIONS

This quarterly report is intended to be a brief, interim progress report only. A detailed geologic description of the area has been purposefully omitted from this report at this stage as it would essentially be a re-hash of various survey and Mines Department papers without much personal contribution.

It is our intention to submit a full, comprehensive technical report at the end of the next quarter (i.e. 20th July, 1975).

D. M. HARRISON
Project Geologist

22nd April, 1975

TABLE 1 : PROPOSED DRILLING PROGRAMME TO 20TH JULY, 1975

Traverse No.	Holes	Hole Spac'g	Approximate Co-ordinates	Topographic Sheet	Base	Approx. distance to base (miles)	Approx. Duration (weeks)	Remarks
MUN.1	6	100	67.700 N/60.400 E	Mundulla 1:50,000	Bordertown	17		To test t
MUN.2	6	100	69.800 N/62.200 E	"	"	17	3	To test the Padthaway
MUN.3	6	100	70.300 N/66.500 E	"	"	11		Archipelago
LAF.1	8	150	92.000 N/26.500 E	Laffer 1:50,000	Keith	15		To test "The Black Range" foredune
KTH.1	8	100	07.400 N/42.400 E	Keith 1:50,000	"	3		
KTH.2	6	100	07.200 N/48.300 E	"	"	4.5		
KTH.3	6	100	07.450 N/49.350 E	"	"	5	6	To test Keith Bay
KTH.4	6	100	88.450 N/50.750 E	"	"	14		
KTH.5	6	100	89.300 N/52.200 E	"	"	13		
PEN.1	6	150	74.250 N/94.150 E	Penola 1:50,000	Penola	10		
PEN.2	6	100	75.500 N/95.400 E	"	"	11	3	To test Penola Bay
PEN.3	6	100	76.100 N/96.300 E	"	"	12		
CUL.1	6	150	79.000 N/84.800 E	Culburra B 1:31,680	Tintinara	14.5		
CUL.2	6	150	79.000 N/80.000 E	"	"	17		
CUL.3	6	150	78.800 N/76.500 E	Culburra A 1:31,680	"	19	5	To test Mt. Boothby Peninsula and associated Coonalpyn Bay.
CUL.4	6	150	72.800 N/83.000 E	Culburra B 1:31,680	"	15		
CUL.5	6	150	68.900 N/78.900 E	Culburra D 1:31,680	"	18		
TOTAL 17	106						17	

JENNINGS MINING LIMITED

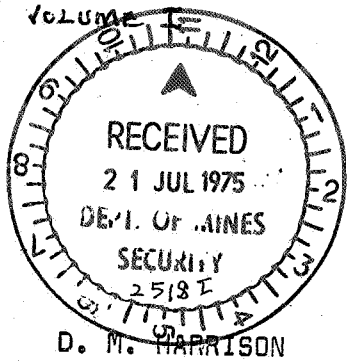
EXPLORATION LICENCE 169

SOUTH EASTERN COASTAL PLAINS HEAVY MINERAL SANDS PROJECT;

SOUTH AUSTRALIA

SECOND QUARTERLY REPORT TO MINES DEPARTMENT

FOR PERIOD ENDING 20TH JULY, 1975



D. M. HARRISON
Project Geologist

1st July, 1975

SUMMARY

In December 1973 Consulting Geologist C. E. Larson presented the concept to Jennings Mining Limited that the Pleistocene Bridgewater Formation of the emergent south-east coastal plains area of South Australia exhibited many of the features conducive to the development of littoral and aeolian concentrations of heavy minerals. As a result, Jennings Mining Limited acquired Exploration Licence 169. EL 169 was in fact a Special Mining Lease granted for a six month term from 20th January to 20th July, 1975.

The following exploration activities were conducted during the tenure of the Licence :

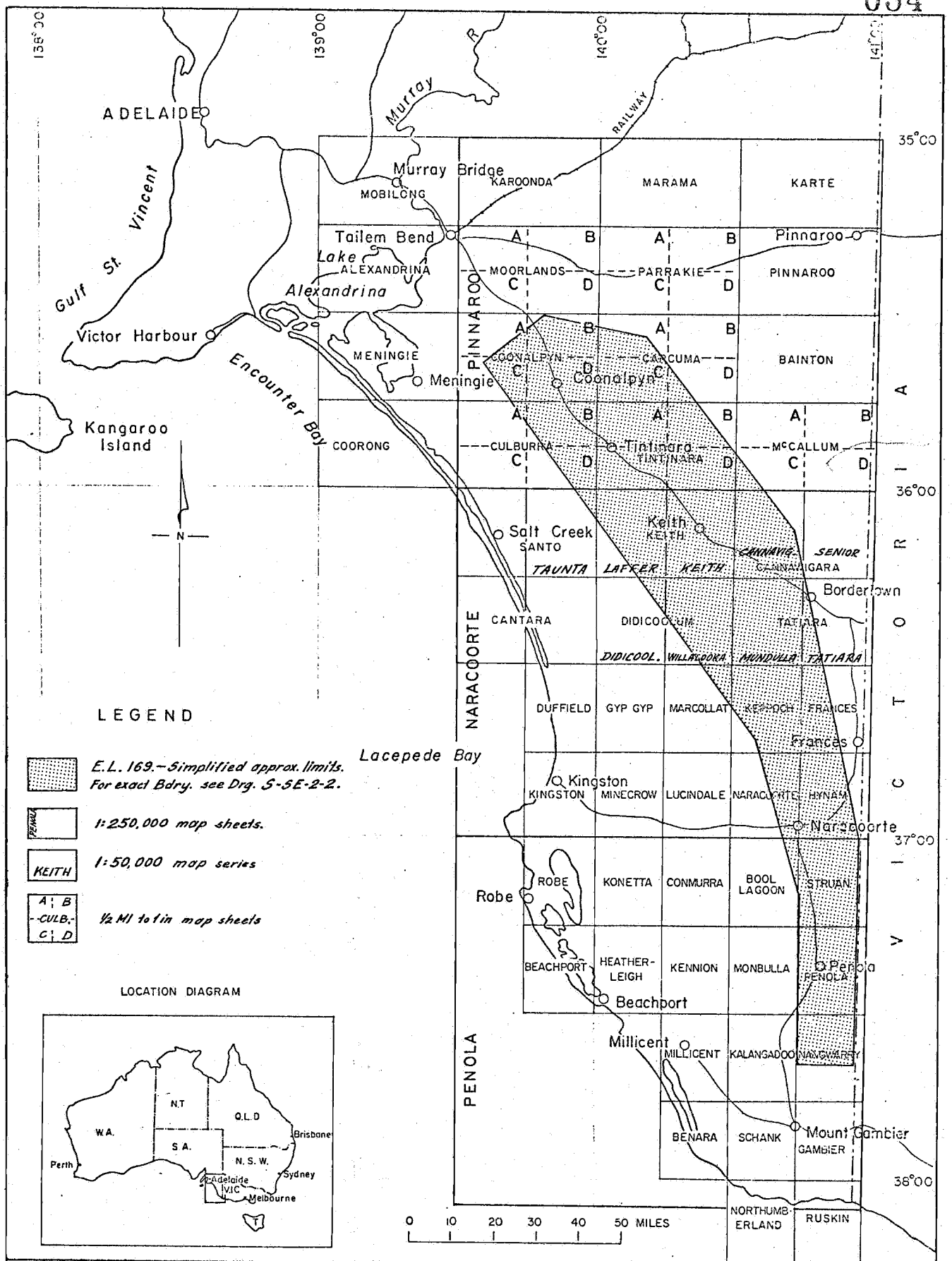
- a detailed photogeologic study which delineated possible 'beach' strand lines of the Bridgewater Formation.
- 23 auger holes comprising 189.0 metres have been drilled and 126 incremental 1.5 m samples were collected.
- 252 rock chip surface samples were collected in a regional mapping and sampling programme.
- 144 rocks of the surface sample suite were examined under the binocular microscope to determine percentage and type of heavy minerals present and the petrography of the sediments.
- 7 samples, two from the drilling programme and five from the surface sampling programme were sent to AMDEL, Adelaide for detailed heavy mineral analysis.
- an examination of available underground water bore data.

The results of these exploration activities indicate that there is little chance that commercial heavy mineral beach sand deposits exist in EL 169. The reasons for this are;

- the best samples of a representative sample suite collected within EL 169 contained only an average 0.45% (by weight) heavy minerals with a valuable mineral assemblage of 9% rutile, 9% zircon and 32% ilmenite.
- other theoretical considerations strongly downgrade the project. These are dominant calcareous nature of the Bridgewater Formation, an uninteresting likely provenance area and a suspected minimal longshore drift.

- Drilling within the area is extremely difficult using conventional drilling equipment used for beach sand exploration due to the ubiquitous hard calcrete layers. (Only 39% of the holes drilled could penetrate below 4.5 m depth.)

The expense of an alternate drilling technique would not seem to be warranted considering the potential of the area and the fact that our current programme has not defined drilling 'target areas' within a very large (2,500 sq. km.) tenement area.



NOTE:
Adapted from C.E. LARSON's report.

JENNINGS MINING LIMITED
EXPLORATION DIVISION (VIC.)

Drawn	P.B.
Traced	
Checked	G.S.
Approved Proj. Geol.	D.H.
Date	June 1975

S.E. COASTAL PLAINS PROJECT
E.L. 169 - SOUTH AUSTRALIA
LOCATION MAP AND KEY DIAGRAM

SCALE As shown

Drg. No.
S-SE-1-1

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1. INTRODUCTION

1.1 Location and Details of Licence

Exploration Licence 169 was granted to Jennings Mining Limited on 20th January, 1975 under some special terms of tenure. The Licence covers an area of 12,717 sq. km. of the south-eastern coastal plains of South Australia and approximately occupies a linear belt between Tailem Bend and Mount Gambier. (Refer Figure S-SE-1-1.) This extensive area has been granted for a six month period to 20th July, 1975 at which time the Licence must be reduced in size to no more than 2,500 sq. km. (Of course the option of applying for a number of 2,500 sq. km. licence areas is also available.)

1.2 Reasons for Interest in the Area

The project was conceived by Consulting Geologist, C. E. Larson as early as 1968. It is contended that the Pleistocene Bridgewater Formation of the emergent south-east coastal plains area of South Australia exhibits many of the features conducive to the development of littoral and aeolian concentrations of heavy minerals. Larson carried a latent interest in the area over many years and in December 1972 collected a total of 27 near-surface samples from road cuts and shallow hand auger holes. None of these samples contained as much as 1% total heavy minerals (visual estimate), however, analysis revealed an interesting heavy mineral assemblage containing an average 8% rutile and 22% zircon.

1.3 Access

Access is excellent as virtually the entire area is covered by an extensive network of main highways, improved secondary roads and country tracks. The main Melbourne to Adelaide rail line passes right through the centre of EL 169.

2. WORK CONDUCTED

2.1 Pre-Licence Research

C. E. Larson was contracted by Jennings Mining Limited in late 1973 to write a report on the potential of the area. As a result Larson produced "The Potential for Mineral Sand Concentrations in the Southeastern Coastal Plain of South Australia", in December, 1973. Sufficiently encouraged by the concepts raised in the preliminary report, Jennings Mining Limited further contracted Larson to investigate the potential of the

2. WORK CONDUCTED (Cont'd)

2.1 Pre-Licence Research (Cont'd)

area and recommend an exploration programme. Larson then produced his second report in September, 1974, entitled "Photo-Interpretive Geology Southeastern Coastal Plain, South Australia".

Larson's second study was an extensive one. It involved the purchase of 50 photo mosaics, 22 at a scale of 1:63,360 and 28 at a scale of 1:50,000. This somewhat unfortunate combination of scales resulted from the lack of uniform mosaic coverage available from the South Australian Department of Lands. In addition, the various topographic maps covering the area were purchased i.e. 20 at 1:50,000 scale, 22 at 1:31,680 scale and 3 at 1:250,000 scale. (Refer Figure S-SE-1-1.) Using various photogeology methods and 'form-line trend surface analysis' techniques of the topographic sheets Larson was able to define the various ancient shorelines (or strand lines), dune trends or complexes and prominent outcrops of igneous rocks and also to infer the position of ancient alluvial channels.

As a result of the photogeology study numerous "targets" were proposed and Larson recommended a reconnaissance programme of power auger drilling.

2.2 Pre-Field Work Planning

C. E. Larson's photogeology study was reviewed by the application of 'form-line trend surface analysis' of the topographic sheets and some strand lines were either excluded or modified from the earlier interpretation. The strand lines were given geographic names of reference. (Refer Figure S-SE-2-2.)

As a result of this review four areas were indicated to have more potential than any other areas for the accumulation of heavy minerals on the basis of favourable palaeogeography and/or close proximity to a likely source (ancestral hinterland drainage channel). These are, from north to south : *

1) Mt. Boothby Peninsula and Coonalpyn Bay
2) Keith Bay and associated Mt. Monster Peninsula
3) Padthaway Archipelago
4) Penola Bay

and they are indicated on Figure S-SE-2-2.

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* These names have as their basis a locality name linked with an inferred palaeogeographic form.

2. WORK CONDUCTED (Cont'd)

2.2 Pre-Field Work Planning (Cont'd)

Experience shows that the thickest heavy mineral placers found elsewhere in the world occur in embayments adjacent to headlands. The headlands form a barrier to longshore drift currents and the embayments form a natural trap area for heavy mineral accumulation. Accordingly the considered favourable palaeogeographic framework in the Licence area has been indicated by curved strand lines (presumed to form in palaeo-bays) and outcropping older 'basement' rocks (presumed to have been palaeo-headlands).

Coonalpyn Bay would appear to be a prominent bay formed in association with a large peninsula, the Mt. Boothby Peninsula and this area was considered to be attractive due to its possible closer association with the ancestral Murray. Keith Bay and Padthaway Archipelago looked attractive due to their close proximity to a known possible source; the ancient Tatiara Creek. Further, Padthaway Archipelago has possible foreshore cliffs formed by the Tertiary Parilla Sand. Penola Bay is a well developed bay particularly in the younger Pleistocene dunal ranges and was held to be attractive due to its close proximity to the 'Mt. Gambier' volcanics (an ilmenite rich source).

A 106 hole scout drilling programme using a Gemco 210B trailer-mounted rig and 1.5 m long, $4\frac{1}{2}$" diameter, open flight, auger rods was planned to test the four most promising potential areas. This proposed programme is presented in Table 1 and drill traverse location is shown on Figure S-SE-2-2. 17 drill hole traverses were planned, each traverse containing an average 6 holes spaced 100 metres apart and to be drilled to 21.0 m depth. (Some contain 8 holes and/or 150 m drill hole spacing - Refer Table 1).

2.3 Current Field Programme

2.3.1 General

Including commuting time from Melbourne, 93 man-days of exploration activity, 69 in this quarter, have been spent in the area to 20th July, 1975. 52 man-days, comprising a geologist and driller were spent on the drilling programme and 41 man-days, comprising a geologist and field assistant were spent on the regional scout reconnaissance mapping and sampling programme.

2.3.2 Drilling Programme

The following drill hole designation was used. Firstly an abbreviated traverse area name, followed by the

TABLE 1 : PROPOSED DRILLING PROGRAMME TO 20TH JULY, 1975

Traverse No.	Holes	Hole Spac'g	Approximate Co-ordinates	Topographic Sheet	Base	Approx. distance to base (miles)	Approx. Duration (weeks)	Remarks
MUN.1	6	100	67.700 N/60.400 E	Mundulla 1:50,000	Bordertown	17		To test t
MUN.2	6	100	69.800 N/62.200 E	"	"	17	3	To test the Padthaway Archipelago
MUN.3	6	100	70.300 N/66.500 E	"	"	11		
LAF.1	8	150	92.000 N/26.500 E	Laffer 1:50,000	Keith	15		To test "The Black Range" foredune
KTH.1	8	100	07.400 N/42.400 E	Keith 1:50,000	"	3		
KTH.2	6	100	07.200 N/48.300 E	"	"	4.5		
KTH.3	6	100	07.450 N/49.350 E	"	"	5	6	To test Keith Bay
KTH.4	6	100	88.450 N/50.750 E	"	"	14		
KTH.5	6	100	89.300 N/52.200 E	"	"	13		
PEN.1	6	150	74.250 N/94.150 E	Penola 1:50,000	Penola	10		
PEN.2	6	100	75.500 N/95.400 E	"	"	11	3	To test Penola Bay
PEN.3	6	100	76.100 N/96.300 E	"	"	12		
CUL.1	6	150	79.000 N/84.800 E	Culburra B 1:31,680	Tintinara	14.5		
CUL.2	6	150	79.000 N/80.000 E	"	"	17		
CUL.3	6	150	78.800 N/76.500 E	Culburra A 1:31,680	"	19	5	To test Mt. Boothby Peninsula and associated Coonalpyn Bay.
CUL.4	6	150	72.800 N/83.000 E	Culburra B 1:31,680	"	15		
CUL.5	6	150	68.900 N/78.900 E	Culburra D 1:31,680	"	18		
TOTAL 17	106						17	

2. WORK CONDUCTED (Cont'd)

2.3 Current Field Programme (Cont'd)

2.3.2 Drilling Programme (Cont'd)

traverse number for the area and then within the traverse sequential numbering for each line.

e.g. : Area Keith
Traverse KTH 3
First Hole KTH 31 (read Keith three one)
Second Hole KTH 32 (read Keith three two),
etc.

Programmed depth of hole was 21.0 m and samples were taken every 1.5 m by the 'dead-stick method'. Each sample was split on site, one split being panned for visual heavy mineral assessment and the other split stored for possible sedimentologic and/or mineralogic analysis. Each of these drill hole samples were designated with the hole number, the sample number within the hole and the interval number. e.g. : MUN 1/1-4/4.5-6.0.

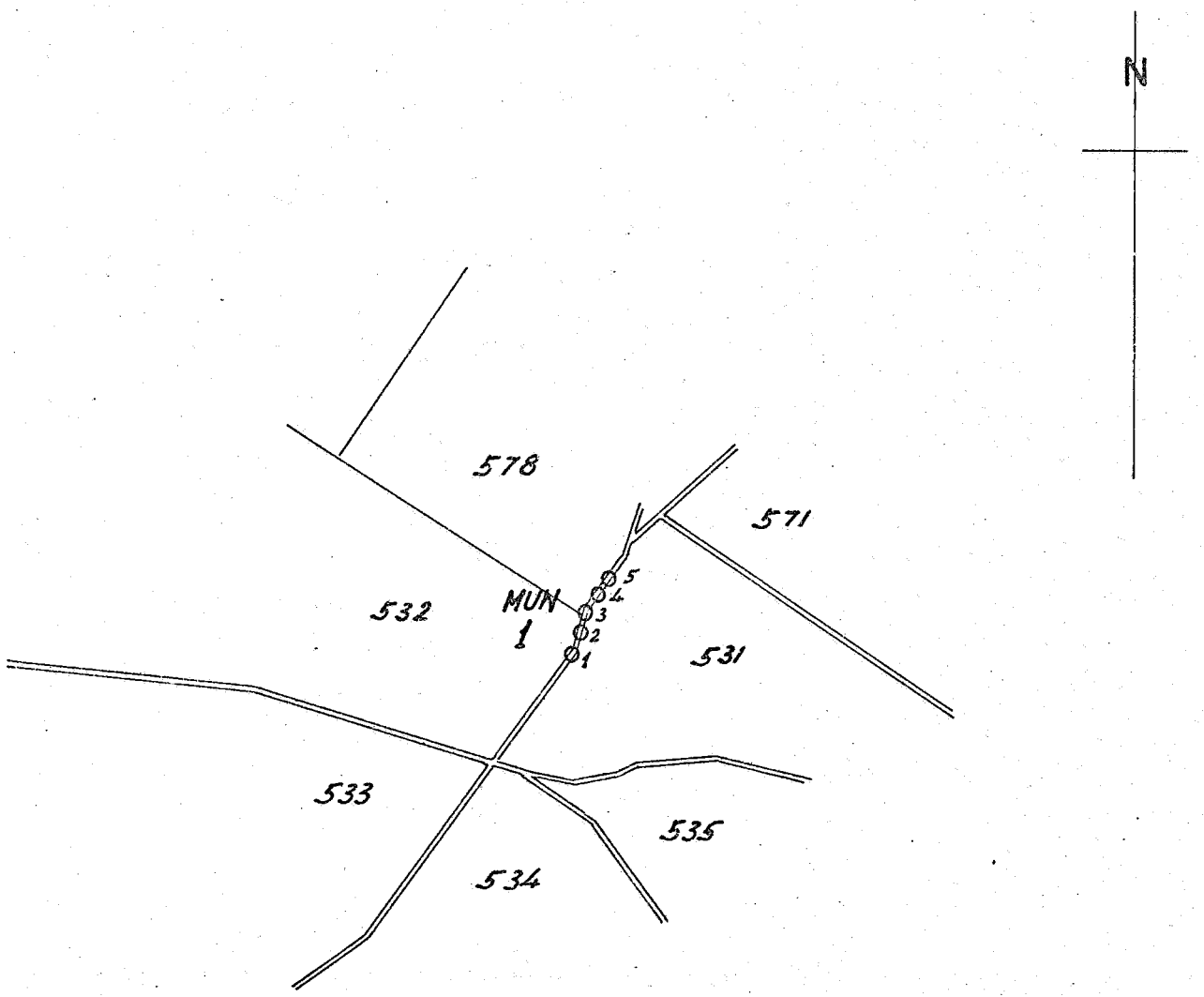
The drill and crew arrived in the area on 9th April and commenced drilling on the 10th April. The drilling programme was terminated on the 8th May at which stage 23 holes of 5 drill hole traverses comprising 189.0 m had been completed and 126 incremental 1.5 m samples were collected. 5 holes of Mundulla 1 traverse, 4 holes each on Keith 1, 2 and 3 traverses respectively and 6 holes on Keith 4 traverse were drilled. Drill hole traverse location is indicated on Figure S-SE-2-2 and detailed drill hole location is indicated on the Mundulla and Keith 1:50,000 sheets respectively. (Figures S-SE-2-3 and S-SE-2-4a & b.) Drill hole log sheets of 19 of the total 23 holes drilled are presented in Appendix I. No logs are presented for the four holes drilled on the Keith 1 traverse as none of the holes reached more than 0.5 m before striking solid calcrete and further drilling was abandoned.

2.3.3 Regional Scout Reconnaissance Mapping and Sampling Programme

The objectives of this programme were to ;

i) Rapidly map the aerial distribution of various stratigraphic units

ii) Test the 'morphostratigraphic' photogeologic mapping of C. E. Larson.



H^{D} WIRREGA

H^{D} PARSONS

H^{D} BEEAMMA

LEGEND

Traverse N°	MUN 1
Hole N° & location	O'
Section N°	531

NOTE:

Traced from MUNDULLA 1:50.000 map sheet.

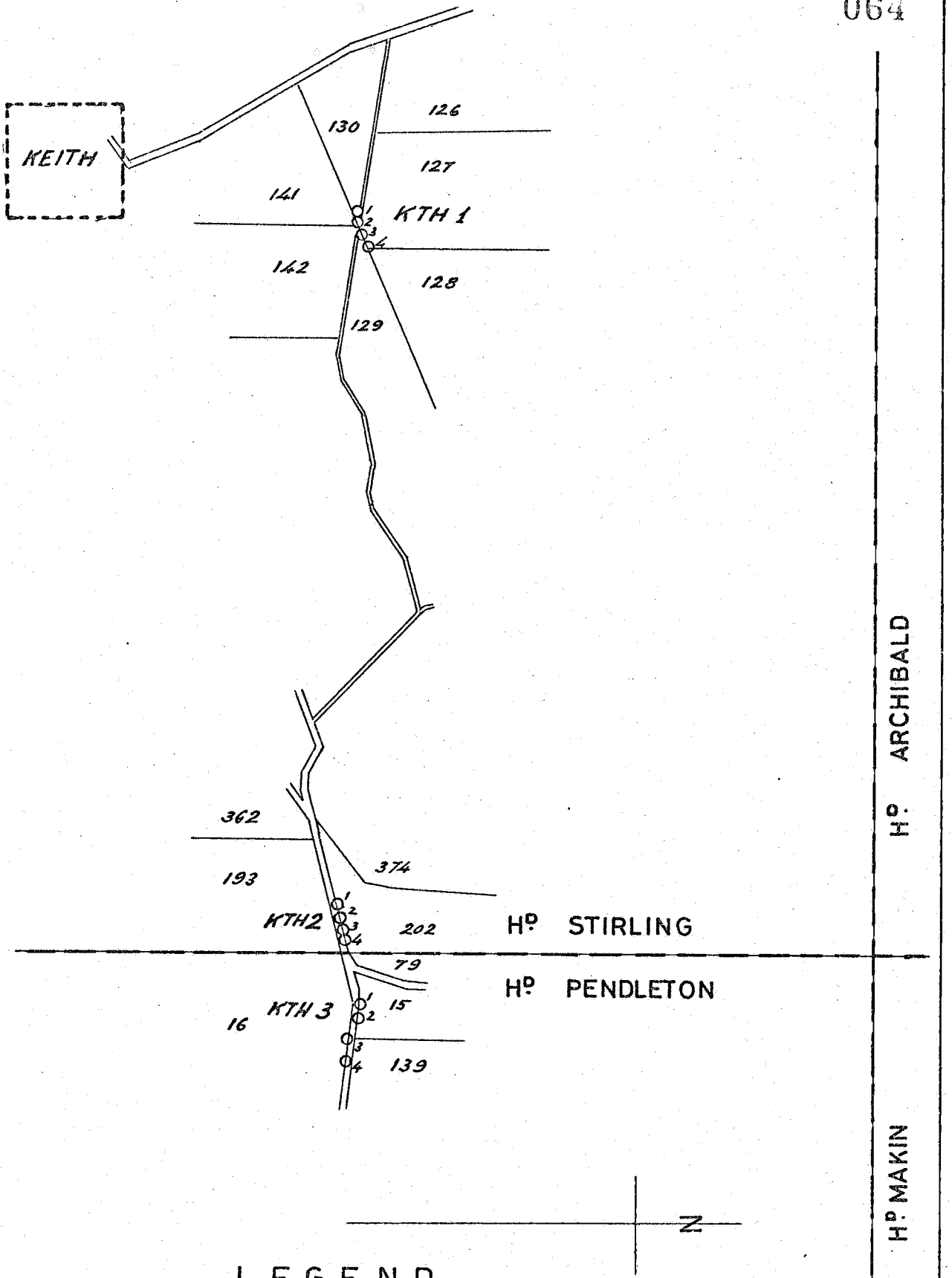
JENNINGS MINING LIMITED
EXPLORATION DIVISION

Drawn	G.S.
Ckd. Apprd.	D.H.
Date	June 1975.

MUNDULLA 1
DRILL HOLE LOCATIONS

SCALE 1:50.000

Drg. No. S-SE-2-3

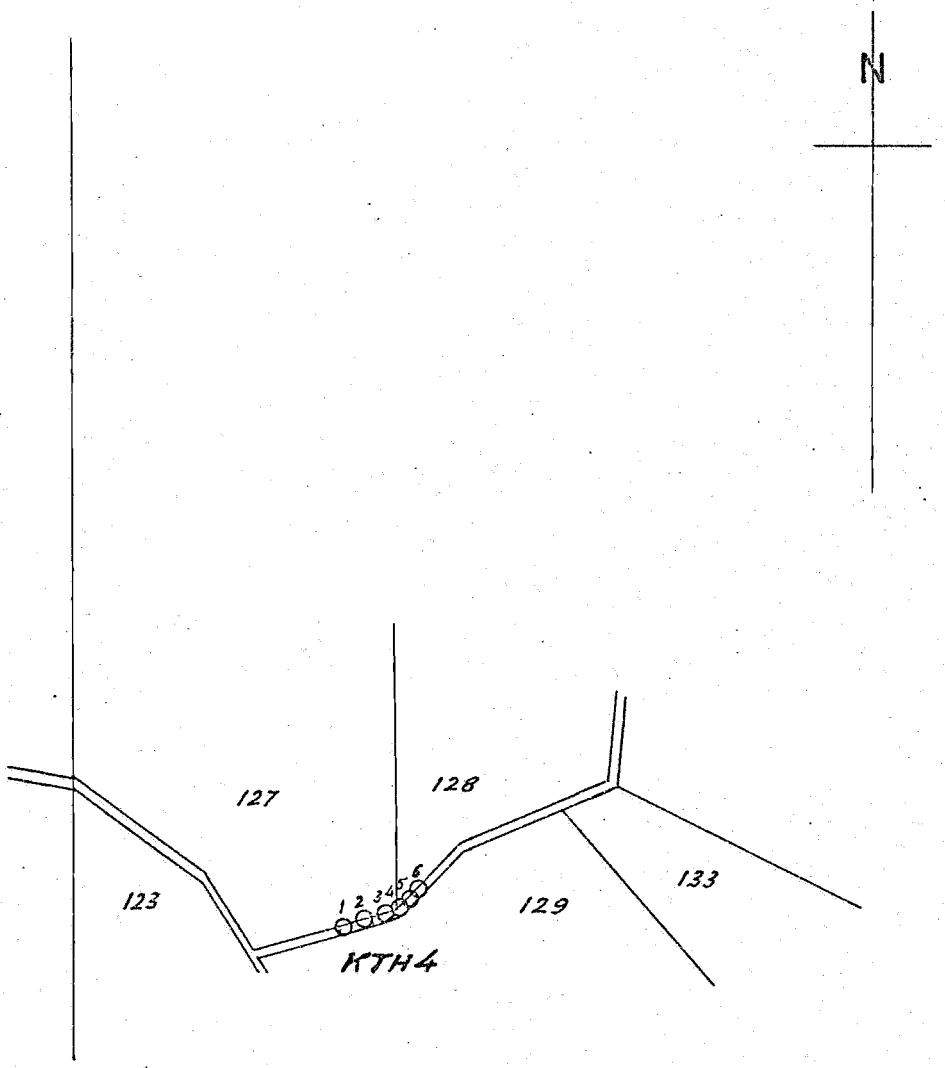


LEGEND

Traverse N° KTH 1
Hole N° & location 0'
Section N° 128

NOTE:
Traced from KEITH 1:50,000 map sheet.

JENNINGS MINING LIMITED EXPLORATION DIVISION			
Drawn	G.S.	KEITH 123 DRILL HOLE LOCATIONS	SCALE 1:50.000
Ckd. Apprd.	D.H.		Drg. No. S-SE-2-4 a
Date	June 1975		



LEGEND

Traverse N°	KTH 4
Hole N° & location	O'
Section N°	129

NOTE:

Traced from KEITH 1:50,000 map sheet.

JENNINGS MINING LIMITED EXPLORATION DIVISION			
Drawn	G.S.	KEITH 4 DRILL HOLE LOCATIONS	SCALE: 1:50.000
Ckd. Apprd.	D.H		Drg. No. S-SE-2-4
Date	June 1975		

2. WORK CONDUCTED (Cont'd)

2.3 Current Field Programme (Cont'd)

2.3.3 Regional Scout Reconnaissance Mapping and Sampling Programme (Cont'd)

iii) Define possible beach strands on lithologic composition and granulometric evidence

iv) Gain a representative sample suite of rocks covering the whole area

v) Determination of the heavy mineral percentage and assemblage of these samples by petrographic studies was hoped to 'shake-out' more prospective areas worthy of drilling.

vi) Provide information about the suitability to drill certain targets.

A total of 252 rock chip surface samples have been collected, a large number of them from quarries, with the following stratigraphic distribution ;

YAMBA FM.	1
MOLINEAUX SAND	13
RIPPON CALCRETE	2
BRIDGEWATER FM.	212
PARILLA SAND	13
LOXTON SAND / ETTRICK FM.	3
GAMBIER LIMESTONE	4
GRANITE	4
TOTAL	252

The sample locations are shown on a 1:250,000 scale compilation. (Figure S-SE-2-5). Sample numbers associated with particular formations are listed in Appendix IV.

2.3.4 Laboratory Studies

144 samples of the rock suite have been examined under the binocular microscope by company staff. Insufficient time was available to examine all of the collected rock suite so accordingly some method of selection had to be applied. The sample suite was arranged on sliding priorities based upon the following criteria ;

../6

2. WORK CONDUCTED (Cont'd)

2.3 Current Field Programme (Cont'd)

2.3.4 Laboratory Studies (Cont'd)

Priority 1 : Samples taken from a beach environment.

Priority 2 : Samples which were thought to have black minerals more common (above the norm.) in hand specimen.

Priorities 3 to 8 : Representative samples from all strands arranged in considered favourable order according to palaeogeography.

Priority 9 : A sufficient number of samples were examined of formations other than the Bridgewater Fm. for provenance reasons (Loxton Sand, Parilla Sand) and prospective reasons (Molineaux Sand).

The objectives of the microscope work were to ;

i) gain a visual estimate of the percentage of heavy minerals.

ii) determine the heavy mineral assemblage.

iii) describe the petrographic character of the sediments.

iv) describe textural, granulometric and lithologic characters which help define sedimentary environments of deposition.

The examination technique was a rapid one adopted for use with minimal equipment. The samples were firstly disaggregated with mortar and pestle and a representative split put through a 1Ø sieve set. This together with microscope examination allows the determination of main textural characters. Roundness and sphericity values were determined by comparison with visual charts. Petrographic characters were described qualitatively under the microscope and recorded. Another split was panned to give a visual estimate of the heavy mineral percentage. The heavy 'tail' was examined under the microscope to give a qualitative indication of the heavy mineral assemblage. The relative abundance - qualitative assessment terms used for description of heavy minerals present were ;

a : abundant; c : common; f : few; and

2. WORK CONDUCTED (Cont'd)

2.3 Current Field Programme (Cont'd)

2.3.4 Laboratory Studies (Cont'd)

p : present (i.e. : 1 or 2).

The descriptions were recorded on standard sheets and these are included in Appendix II.

In addition to our laboratory studies, five of the most interesting samples; namely SE-R-3056, 3119, 3121, 3170 and 3196; were sent to 'The Australian Mineral Development Laboratories (i.e. AMDEL)' in Adelaide, South Australia for standard quantitative evaluation of beach sand samples. Their technique includes crushing and screening, a tetrabromoethane H.M. separation and the quantitative determination of heavy minerals by point counting. The AMDEL laboratory report is enclosed as Appendix III and the results are discussed in Sections 4.3 and 5.4.2.

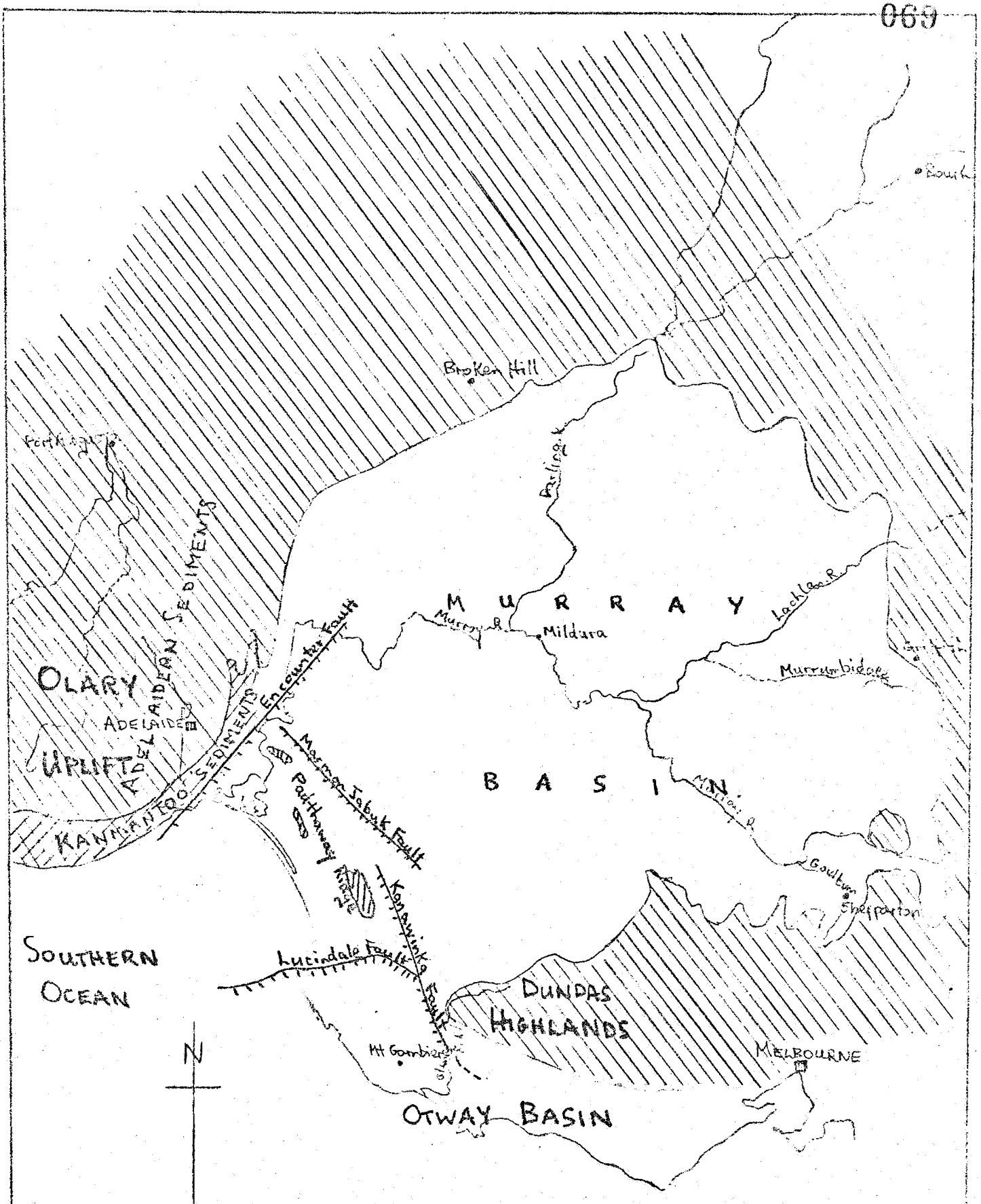
3. GEOLOGY

3.1 Regional Geology

A series of sub-parallel, Quaternary dune ridges are preserved on the low-lying, subdued, southeastern coastal plains of South Australia. This area lies within the most western (seaward) portions of the Murray Basin and Otway Basin and is confined to the north by Proterozoic Adelaidean and Cambrian Kanmantoo sediments of the Olary Upwarp, to the east by Tertiary fault-monoclinal-cliffed shoreline coasts of which the major two are the Marmon-Jabuk and Kanawinka Fault scarps, and to the south-east in Victoria by Cambro-Ordovician sediments of the Dundas Highlands. (Figure S-SE-2-6.)

Both the Murray and Otway Basins contain thick accumulations of Mesozoic and Tertiary sediments with a thin veneer of Quaternary sediments. The thickness of the sedimentary fill known from seismic, airborne magnetic surveys and petroleum exploration drilling, varies considerably within the basins due to subsidiary fault block activity.

The basins essentially have suffered horst/graben style tectonism along two major orthogonal sets of faults, one set striking NW/SE, the other NE/SW, from Mesozoic times onwards. The NW/SE striking faults, of which the Marmon-Jabuk and Kanawinka faults are most important, and associated lineaments are dominant and felt to reflect normal faulting basinwards as a response to the accumulation of thick, relatively flat dipping sediments



JENNINGS MINING LIMITED EXPLORATION DIVISION			
Drawn	D.H.	TECTONIC SKETCH MAP OF E.L. 169. AND ADJACENT AREAS	SCALE 1:5,000,000
Ckd. Apprd.			Drg. No S-SE-2-6
Date	June 1975		

3. GEOLOGY (Cont'd)

3.1 Regional Geology (Cont'd)

deposited on a shelf. The dominant NW/SE structural framework has left its imprint on the dominantly NW/SE trending Quaternary beach dunes of the south-east.

The NE/SW lineaments are less abundant but mark more diastrophic horst/graben tectonism. For example, the NE/SW Encounter Fault in the north marks the NW boundary of the Murray Basin in contact with the Proterozoic Adelaidean and Cambrian Kanmantoo sediments of the Olary Upwarp and the NE/SW (in part, in part curvilinear) Lucindale Fault in the south marks the boundary between the Murray Basin and the Gambier Embayment of the Otway Basin (refer Figure S-SE-2-6).

A structure of major importance in the south-eastern coastal plains area of South Australia is the NW/SE trending Padthaway Ridge or Horst. Surface evidence of the horst is the presence of several Lower Ordovician granites exposed in 'windows' of the Quaternary sediments. Subsurface evidence consists of the absence of Mesozoic section on the horst, thinning of the Knight Group over the horst and confinement of deposition of the Gambier Limestone to the east of the horst. Drill hole intersections indicate that the ridge is dominantly probably metamorphosed sediments of the Cambrian Kanmantoo group intruded by Lower Ordovician granites and it remained a positive area of non-deposition until the Eocene. (Rochow, 1971)

In addition, parts of the Padthaway Ridge are contended to have formed prominent headlands during Quaternary times which are considered to play an important palaeogeographic role in possible localisation of beach/dune strand lines. The cluster of granitic outcrops near Bordertown are referred to as the Padthaway Archipelago and it is believed to have formed a prominent headland with offshore islands during both the Tertiary and Quaternary. Two other major granite outcrops of the Padthaway Horst; Mount Monster, near Keith, and Mt. Boothby further north, are proposed to have formed headlands during Quaternary times at least. (Refer Figures S-SE-2-2 and S-SE-2-11)

3.2 Detailed Stratigraphy

3.2.1 General

The stratigraphy of the area is summarised in Table 2.

3.2.2 Palaeozoic

The only exposure of Palaeozoic rocks in the area is the Lower Ordovician granites of the Padthaway Ridge.

TABLE 2 : STRATIGRAPHY OF THE SOUTH EAST COASTAL PLAINS

Note : The table shows the main stratigraphic units recognised in the Otway and Murray Basins. The formations underlined outcrop within EL 169, all others are only represented in the subsurface.

GEOLOGICAL TIME			STRATIGRAPHIC UNITS		
ERA	PERIOD	EPOCH	GROUP	FORMATION	MEMBER
CAINOZOIC	QUATERNARY	Recent		Molineaux Sand	
				Yamba Fm.	
		Upper Pleistocene -Recent		Padthaway Fm.	
		Middle Pleistocene		Bridgewater Fm.	Upper : Bakara Calcrete
					Rippon Calcrete
					Lower
		Lower Pleistocene		Coomandook Fm.	
		Plio-Pliestocene		'Gambier Volcanics'	
	TERTIARY	Upper Pliocene		Parilla Sand	Norwest Bend Fm.
		Lower Pliocene		Loxton Sands	
		Miocene-Pliocene		Bookpurnong Beds	
			Murray Group	Pata Lst. *	*time equivalent of Gambier Lst.
		Oligocene-Miocene		Morgan Lst. *	
				Mannum Fm. *	
				Gambier Lst	Naracoorte Lst
			Glenelg Group	Ettrick Fm	
		Upper Eocene	Buccleuch Group		
		Eocene	Knight Group	(Moorlands Coal Measures)	
MESOZOIC	CRETACEOUS		Otway Group		
PALAEOZOIC	PERMIAN		'Glacial Sediments'		
	ORDOVICIAN	Lower	Granites		
	CAMBRIAN		Kanmantoo Group		

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.2 Palaeozoic (Cont'd)

The Lower Ordovician granites are subdivided into three distinct rock types; granodiorite-adamellite, quartz keratophyre, and potash-soda granite and microgranite.

Water bore data in the area indicates that the igneous rocks intrude metamorphosed sediments of the Cambrian Kanmantoo Group. Further water bore and petroleum exploration drilling data indicate a local area of Permian glacial sediments preserved near Salt Creek and Blackford which are interpreted to represent deposition within a glaciated valley. (Rochow, 1971)

3.2.3 Mesozoic

Mesozoic sediments are not found in outcrop in the area, however, a thick sequence of Lower Cretaceous sediments referred to as the Otway Group are found in the sub-surface in the Gambier Embayment of the Otway Basin south of the Lucindale Fault. The Otway Group consists of arkosic sandstones, greywackes, grits and carbonaceous mudstones and siltstones deposited in a continental or mixed (paralic) environment.

3.2.4 Tertiary

Four Tertiary formations, the Parilla Sand, the Gambier Limestone, the Loxton Sand and the Naracoorte Limestone outcrop within EL 169. The first two of these are areally the most important and the first three are considered to be important to our present studies as they provide significant source material to the Quaternary formations. The bulk of the other Tertiary formations listed in Table 2 are either solely, or at least are best, defined from subsurface intersections. Subsurface data indicates that the Tertiary sequence rarely exceeds 1,000' in thickness in the Murray Basin but attains at least 4,000' in the Gambier Embayment of the Otway Basin. The Murray Basin appears to have been shallow and the resulting stratigraphic units are thin and interdigitating either as a result of local regressions and transgressions or as a result of subsequent local erosion.

The base of the Tertiary is marked by the deposition in Eocene times of a relatively thick series of paralic sediments; the Knight Group. The Knight Group consists

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.4 Tertiary (Cont'd)

of commonly coarse grained sandstones and conglomerates and siltstones and claystone with weakly lignitic beds developed in places. The Moorlands Coal Measures occur in the subsurface near Moorlands and are a part of the Knight Group. The Knight Group has been deposited either side of the Padthaway Horst but thins out over the Horst where highly carbonaceous beds are developed in areas of bedrock highs.

After a hiatus the Knight Group is succeeded by the Buccleuch Group in the Upper Eocene. The Buccleuch Group is a marine unit consisting of limestones and sandstones with interbedded carbonaceous clays which have been deposited in a small but moderately deep embayment near Coonalpyn.

A major marine transgression occurred in the Oligocene-Miocene in which marine Tertiary sediments were deposited over practically the entire Murray Basin which was co-extensive with the Otway Basin at this time. (Although it should be observed that the Gambier Limestone does not exist west of the Padthaway Horst.) The sediments are dominantly bryozoal limestones, marls and argillaceous limestones with numerous flint bands. Foraminifera and mollusca are also very plentiful. Two time-equivalent groups have been defined for this depositional period; the Murray Group and the Glenelg Group. Formations within each group are generally of limited aerial extent (exception is the Gambier Limestone) and in no vertical section within the basin would all formations be present as may be misconstrued from an examination of Table 2. The units are generally thin and interfingering and may be interpreted as being deposited in loosely connected sub-basins of the major basin.

The Glenelg Group is the major group of interest in EL 169 and in particular the Gambier Limestone and Naracoorte Limestone formations of that group. The Naracoorte Limestone is a lenticular bio-facies variant within the upper part of the Gambier Limestone which has been recognised and named by Ludbrook. It should be reserved member status only. The Gambier Limestone itself consists of white to cream yellow coquinitic bryozoal limestone, sometimes recrystallised to a dense limestone. In certain subsurface areas the basal part of the Glenelg Group consists of a glauconitic and sandy marl, named the Ettrick Formation by Ludbrook (1961). It may be interpreted as

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.4 Tertiary (Cont'd)

a facies variant of the Gambier Limestone.

Towards the close of the mid-Miocene period the sea regressed from most of the Murray Basin. During the regression covering the Mio-Pliocene time span the Loxton Sands were deposited in a shallow marine environment and in estuaries. They are confined to the east of the Padthaway Horst and consist in the main of cross-bedded, micaceous, sometimes calcareous sands, silty sands and granule conglomerates with yellow and red weathering colours in the upper part of the sequence. The lower part of the Loxton Sands is characterised by grey-brown, slightly clayey and micaceous, in part fossiliferous, fine grained quartz sand.

Overlying the Loxton Sand disconformably is the Upper Pliocene, Parilla Sand. Deposited in a fluvial and/or lacustrine environment it is predominantly a red-brown, fine to medium grained, clayey quartz sand with some minor coarse sand and grit. Although similar in character to the Loxton Sand it may be distinguished by its low mica content and a distinct bimodal texture. A weathering profile referred to as the Karoonda Surface developed on the Parilla Sand and is characterised by a ferruginous capping (ferricrete) with ferruginous pisolites. This profile is not always preserved as it has been dissected to some extent during the Pleistocene.

Volcanic activity commenced in the Mt. Gambier region in the late Pliocene and continued into the Pleistocene. The activity was entirely basaltic.

3.2.5 Quaternary

3.2.5.1 General

Towards the end of the Tertiary period minor differential faulting of the basement and overlying rocks occurred along the major lineaments aforementioned in Section 3.1. As a result a major marine incursion extended to the Kanawinka Lineament and, near Bordertown, and to its north, to the next en-echelon offset major fault, the Marmon-Jabuk Fault. The Coomandook Formation was deposited in this transgressive phase.

In the Middle Pleistocene the sea regressed in

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.5 Quaternary (Cont'd)

3.2.5.1 General (Cont'd)

a series of still-stand stages resulting in the deposition of the coastline deposits of the Bridgewater Formation. It is the Bridgewater Formation which is of economic interest in EL 169.

The Late Pleistocene to Recent Padthaway Formation (informal name at this stage) was deposited either disconformably or unconformably on the Bridgewater Formation in the interdune (or inter-strand) low lying areas.

An aeolian unit, the Molineaux Sand and the Yamba Formation were formed in Recent times.

3.2.5.2 Coomandook Formation

The marine Coomandook Formation consists of unfossiliferous sandy limestone, calcareous medium grained sandstone, calcareous sandstone with shelly fragments and foraminifera and grey shelly, pyritic clay. Petrographic evidence indicates that most of the material for the formation has been derived from reworking of the underlying Pliocene sands and Gambier Limestone.

The formation is mainly known from subsurface intersections but outcrops weakly at the top of the Naracoorte and at the base of the Pinaroo 1:250,000 sheets.

3.2.5.3 Bridgewater Formation

The Bridgewater Formation outcrops extensively on the south-east coastal plains and, of course, within EL 169. It is the name given to the extensive system of parallel to sub-parallel, generally N-W trending 'sand' ranges averaging 15-20 m in height above the coastal plain level. Each range is considered to represent a former still-stand of sea level regression at which point coastal dunes, beach ridges and beach rock units are deposited of which the dune environment is by far the most volumetrically important.

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (cont'd)

3.2.5 Quaternary (Cont'd)

3.2.5.3 Bridgewater Formation (Cont'd)

The 'sand' comprising the coastal deposits is mostly well sorted, medium grained quartz and carbonate. Shell fragments and foraminifera are sometimes abundant. There is a whole spectrum of rock types which vary according to bedding characteristics, fossil content, and quartz-carbonate ratios. Calcarenites and calcareous sandstones are dominant with only minor quartz sandstones. (Jennings petrographic studies contribute here and the reader is referred to Section 4.2.2.) The dominant calcareous nature of the formation is highlighted by the ubiquitous development of calcrete within the Bridgewater Formation. Calcrete is a hard, thick, (up to 2 m in places) travertinous material which has developed as a 'B horizon' soil profile over the calcareous sands of the Bridgewater Formation. The formation of the calcrete has greatly aided the consolidation and subsequent preservation of the 'dunal' Bridgewater systems by protecting the underlying weaker dune material from weathering and erosion. Further evidence of the calcareous nature of the Bridgewater Formation is the development of terra rossa soil in places and the abundance of solution channelling within the rocks.

The Bridgewater Formation has been subdivided into lower and upper members separated by a calcreted zone known as the Rippon Calcrete. The Rippon Calcrete is a characteristic marker horizon which is essentially pink, extremely hard cemented carbonate with carbonate breccia and black brecciated clastics and as such is ideally suited to subdivide the formation into upper and lower members. The Rippon Calcrete and the lower member Bridgewater Formation crop out mainly along the northern and inland margins of the Padthaway Ridge. Throughout the upper member are numerously randomly arranged calcrete layers referred to as calcretes of the Bakara soil by Firman (1973). The upper member thins eastwards and it is not uncommon to have Bakara calcrete overlying Rippon calcrete and Lower Bridgewater Formation in the eastern portion of the south east coastal plains.

A definite succession of the stranded coastlines

077

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.5 Quaternary (Cont'd)

3.2.5.3 Bridgewater Formation (Cont'd)

has not yet been established. On present evidence it would appear that the assumption that the most eastern strand is the oldest and strands become successively younger westward is too simplistic and erroneous. i.e., there is a suggestion that more than one transgression and regression is represented. Sprigg (1952) has demonstrated an 'Anadara High Sea Level' which in the Recent period transgressed the young Woakwine and Robe dune ranges and the interdune flats behind the Dairy ranges. Firman (1973) has demonstrated that the East Avenue Range is younger than the West Avenue Range on the evidence of volcanic ash near Mt. Muirhead, again indicating an anomaly in the progressive 'younging' westward theory.

The stranded coastlines are preserved on a coast of emergence due both to tectonic uplift and eustatic sea level change associated with glacial and interglacial periods. That tectonism is involved is clearly demonstrated by the tilting of strands near Mt. Gambier northwards due to the Mt. Gambier Upwarp. No absolute correlation has been made with world wide eustatic sea level change curves perhaps due to this tectonic influence. This is the subject of a present BMR study project.

Sprigg (1952) estimated the degree of northward tilt of the strands near Mt. Gambier as 1 ft. in 1 mile. Superimposed on this northerly tilt is a westerly dip due to sedimentary processes in sympathy with the gentle seaward slope of the present coastal plain. The older dunes within EL 169 may have formed prior to the uplift of the Mt. Gambier area and therefore suffer no northerly tilt. (After Rochow (1971).)

3.2.5.4 Mt. Gambier Volcanics

The Mt. Gambier Volcanics are late Pliocene to Pleistocene in age and are equivalent to the

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.5 Quaternary (Cont'd)

3.2.5.4 Mt. Gambier Volcanics (Cont'd)

Newer Basalts of Victoria. It occurred in two definite periods, a late Pliocene-early Pleistocene group of volcanics and a late Pleistocene group of volcanics. The earlier volcanics modified the Pleistocene coastline extensively whereas the later ones post-dated certain Pleistocene beach-dune accumulations over which they spread their ash.

The Mt. Gambier Volcanics outcrop to the south of EL 169.

3.2.5.5 Padthaway Formation

This is an informal name commonly used by South Australian Department of Mines personnel (J. M. Lindsay - personal communication) to describe the late Pleistocene to Recent interdunal deposits which rest either disconformably or unconformably on Bridgewater Formation or in places directly on Coomandook Formation. The interdunal deposits consist variously of swamp, marsh, lunette and lake deposits of clay, marl, silt and local peat and fresh and brackish water, dirty limestones, dolomitic limestones and dolomite.

3.2.5.6 Yamba Formation

This Recent formation is of limited ~~aerial~~ area extent and outcrops immediately to the north-west of EL 169 near Cookes Plains as well as further north in the Murray Basin. It consists of gypsiferous clays and gypsum deposited in playa lakes. The gypsum in places has been mobilised into dunes to form aeolian gypsum deposits. This has occurred at Cookes Plains where gypsum occurs in dunes up to 10 m high.

3.2.5.7 Molineaux Sand

This is the most recent formation in the area and consists of recently mobilized, aerially extensive, unconsolidated, siliceous, aeolian sand sheets.

3. GEOLOGY (Cont'd)

3.2 Detailed Stratigraphy (Cont'd)

3.2.5 Quaternary (Cont'd)

3.2.5.7 Molineaux Sand (Cont'd)

Crocker (1941) regarded the siliceous sands as a product of soil formation on the calcareous sands (of the Bridgewater Formation) which were then mobilised into the recent sand sheets (Molineaux Sand). Under the influence of strong westerly winds the sands are continually migrating inland and in some places they have drifted as far as the Little Desert of Western Victoria, 200 miles from their points of origin.

Firman (in Rochow) has recognised several stages of dune formation, each represented by a distinctive colour ranging from red-brown for the older sand to yellow for the Molineaux Sand and white for the most recent. He considered the progression toward paler colours with time to be due to successive removal of iron oxide coatings on the quartz grains. Firman has called the red-brown aeolian sand the Woorinen Formation. In our field studies we have found the yellow and white aeolian sand to be dominant with only minor red-brown aeolian sand in the Pinaroo 1:250,000 Sheet area and we have called all these sands; Molineaux Sand.

4. RESULTS OF WORK TO DATE

4.1 Drilling

The drilling programme was terminated in order to review the results of the surface mapping and sampling programme and subsequent petrographic studies.

Considerable penetration difficulties were encountered in carrying out the designed drilling programme due to ubiquitous calcrete, both Rippon calcrete and calcretes of the Bakara Soil, over the area. 70% of the 23 holes were abandoned short of the programmed depth due to impenetrable calcrete or strongly cemented Bridgewater Formation and only 39% of the holes could penetrate below 4.5 m depth.

With the exception of two, all samples were estimated visually to have a heavy mineral content less than ½%. Two samples; namely KTH 4/5-6/7.5-9.0 and KTH 4/6-11/15.0 - 16.5; were estimated visually to have approximately ½% heavy minerals. These samples (renumbered SE-A-3253, 3254 respectively) were

4. RESULTS OF WORK TO DATE (Cont'd)

4.1 Drilling (Cont'd)

submitted to AMDEL for a full breakdown and the results of these are discussed in Section 4.3.

4.2 Results of the Mapping and Sampling Programme and subsequent Petrographic Studies

4.2.1 Mapping

The mapping programme indicated the following mistakes in the 'morphostratigraphic' photogeologic mapping of C. E. Larson. Namely that ;

i) The Koopamurra Strand is a structural lineament in Gambier Limestone and not a Bridgewater Formation strand line. This is reflected in the linear, north-westerly extension of the Gambier Limestone outcrop near Naracoorte. (Refer Figure S-SE-2-11)

ii) The Frances 2, 3 and 4 strands are not Bridgewater Formation strand lines but are trend surfaces in thin Molineaux Sand overlying Parilla Sand.

iii) The south-eastern part of the Yumali Strand was found to be thin Molineaux Sand overlying Parilla Sand. It is most likely therefore that the Yumali Strand is a trend surface in Molineaux Sand perhaps reflecting a deeper structural lineament.

4.2.2 Lithofacies of the Bridgewater Formation

Binocular microscope petrographic examination of the sample suite discloses a whole spectrum of litho-types of the Bridgewater Formation dependent upon the amounts of quartz and carbonate allochems within the sediments. The carbonate allochems consist mainly of micrite and sparite (undifferentiated in Jennings petrographic work) and fossils or fossil fragments with only very minor oolites, pellets, pisolites, intraclasts and lumps. The types of fossils present are mainly bryozoal coral fragments, foraminifera and lamellibranch fragments with minor sponge spicules and very minor gasteropoda and echinodermata fragments.

The author adopted the following terminology which is a

4. RESULTS OF WORK TO DATE (Cont'd)

4.2 Results of the Mapping and Sampling Programme and subsequent Petrographic Studies (Cont'd)

4.2.2 Lithofacies of the Bridgewater Formation (Cont'd)

modification of Folk (1961) to classify the sediments of the area.

1) Quartz lithotype

Quartz %	
> 50%	quartz sand
40-50%	strongly quartzose
20-40%	quartzose
10-20%	slightly quartzose
< 10%	ignore

2) Carbonate allochem lithotype

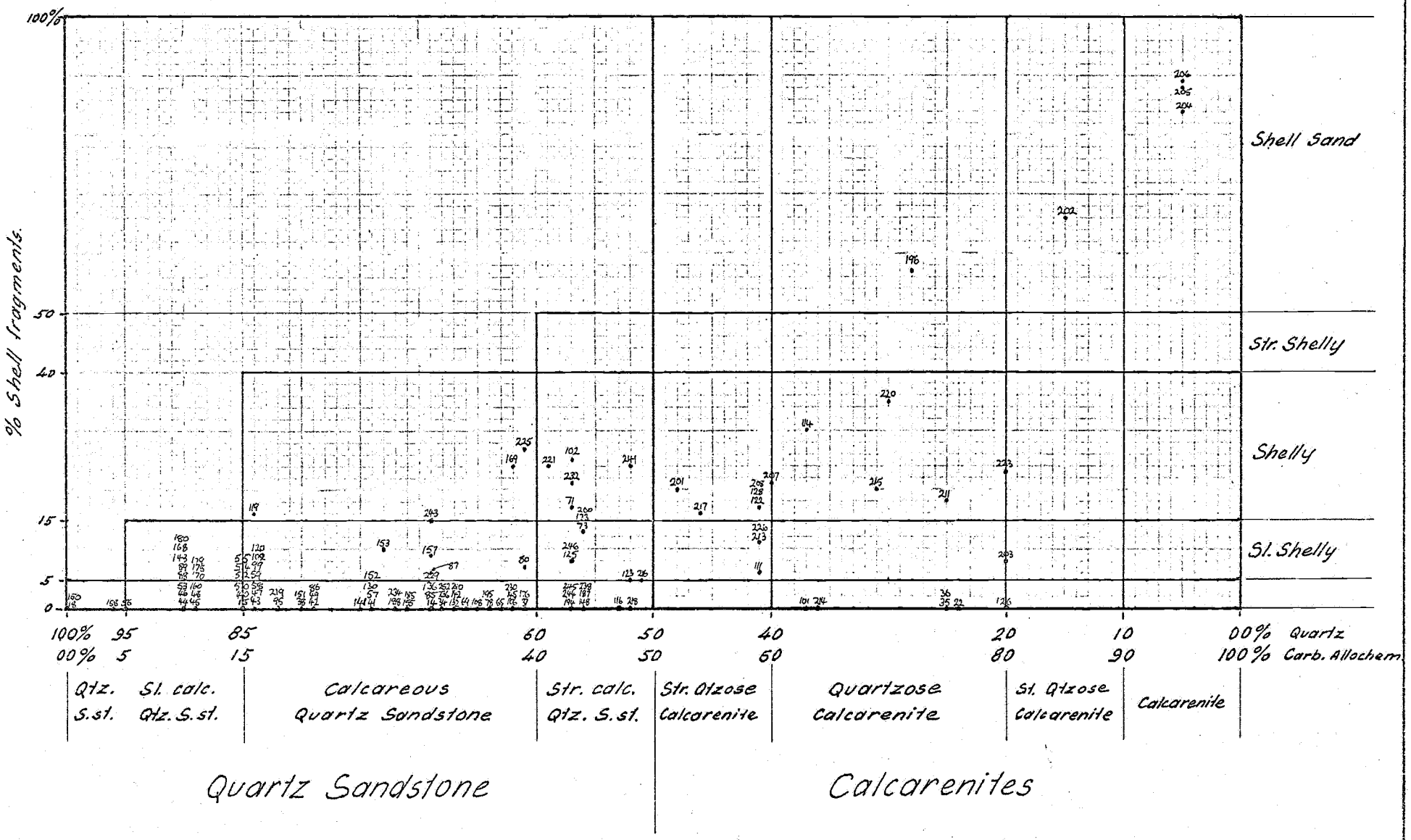
Carbonate Allochem %	
> 50%	calcarenite
40-50%	strongly calcareous
15-40%	calcareous
5-15%	slightly calcareous
< 5%	ignore

3) Fossils & Fossil Fragments lithotype

Shells %	
> 50%	shell calcarenite
40-50%	strongly shelly
15-40%	shelly
5-15%	slightly shelly
< 5%	ignore

Fossils and fossil fragments are a type of carbonate allochem but were felt to be sufficiently important to further help classify the sediments. Due to this lithotype dependence obviously a triangular classification diagram using the above lithotypes as end members could not be constructed and a rectangular plot has been made. (Figure S-SE-2-7.) It is possible using this classification terminology to define 30 different lithofacies, however, only 16 lithofacies were found to be present in the South East Coastal Plains rock suite. By judicial grouping of lithofacies the 16 types were reduced to 6 differing types. The six lithofacies and the number of samples found in each are ;

1.	Shell sand/calcarenite	5
2.	Quartzose calcarenite	12
3.	Strongly quartzose calcarenite	9
4.	Strongly calcareous quartz sandstone	20



JENNINGS MINING LIMITED
EXPLORATION DIVISION

Drawn	B.B.	
Ckd.		
Apprd.	D.H.	
Date	Feb 1975	

BRIDGEWATER FM.
PETROGRAPHY

SCALE: Chart
Drg. No. S.SE.2.7

4. RESULTS OF WORK TO DATE (Cont'd)

4.2 Results of the Mapping and Sampling Programme and subsequent Petrographic Studies (Cont'd)

4.2.2 Lithofacies of the Bridgewater Formation (Cont'd)

5.	Calcareous quartz sandstone	51
6.	Quartz sandstone *	24
	Total number of Bridgewater samples examined	121 **

The distribution of these lithofacies of the Bridgewater Formation is shown in Figure S-SE-2-8. An examination of this figure shows ;

i) The sediments in the Penola Area are calcarenites.

ii) The sediments associated with shallow basement near Mt. Boothby Peninsula are calcarenites.

iii) The sediments of the Ki Ki and Carcuma strands in the Coonalpyn Bay area are dominantly strongly calcareous quartz sandstone.

iv) Sediments south of the Ancestral Tatiara Creek and associated with the Frances 1 and Mundulla 1, 2 and 3 strands are dominantly quartz sandstones.

v) The Naracoorte and Black Range strands are mainly composed of calcareous quartz sandstone.

vi) The Coonalpyn strand is quite calcarenitic.

vii) The Keith Bay area has a range of lithofacies from quartzose calcarenites to calcareous quartz sandstone.

The results of our petrographic studies show that 80% of the studied rock suite have a carbonate content of > 15%. i.e. : The Bridgewater Formation is dominantly calcareous.

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* 83% of this facies is in fact slightly calcareous.

** Actually 127 'Bridgewater' samples were examined but six have been excluded since they were either subsurface samples or of doubtful stratigraphic classification.

4. RESULTS OF WORK TO DATE (Cont'd)

4.2 Results of the Mapping and Sampling Programme and subsequent Petrographic Studies (Cont'd)

4.2.3 Structures and Textures of the Bridgewater Formation

Texturally the Bridgewater Formation consists of fine to medium grained, moderately to poorly sorted sands. Only 3 of the total collected Bridgewater suite of 212 contained any gravel fraction.

Sedimentary structures afforded the best means of differentiating beach and dune deposits within the Bridgewater Formation. Large scale cross-bedding (5 - 6 m foreset to bottomset) characterises aeolian environments and small scale structures (lamina cross-bedding, topset to bottomset 0.10 m, small scale cut and fill structures) and flat-dipping units characterise beach environments. No petrographic differences between beach and aeolian environments were determined apart from a tendency towards greater cementation of beach sand units.

4.2.4 Results of Visual Heavy Mineral Estimates

The bulk of the 144 samples examined were estimated visually to have a heavy mineral content of $< \frac{1}{2}\%$ (by volume). Six samples were estimated to have a $\frac{1}{2}\%$ heavy minerals and one sample to have $\frac{1}{2}$-1% H.M. AMDEL detailed heavy mineral analysis shows that these estimates are reliable. (Refer Section 4.3.) The seven anomalous samples belong to the Bridgewater Formation. The Molineaux Sand, Parilla Sand and Loxton Sand samples that were examined contain $< \frac{1}{2}\%$ H.M.

Petrographically a qualitative scale of $\frac{1}{2}$-1%, $\frac{1}{2}\%$, $\frac{1}{4}$-$\frac{1}{2}\%$, $< \frac{1}{4}\%$, $<< \frac{1}{4}\%$ and trace was adopted and the distribution of these heavy mineral values (for the Bridgewater Formation only) is shown on Figure S-SE-2-9.* This figure shows that the 'Keith Bay' area is better than most as is the Naracoorte 1 and 2 strands. The Coonalpyn Bay / Mt. Boothby Peninsula area is very low in heavy minerals.

Using only 59% of the heavy mineral determinations* a scatter diagram was constructed plotting H.M. qualitative percentage

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* Note, two different workers were involved in the petrographic work. One worker who did 59% of the Bridgewater samples adopted this scale, the other worker did not distinguish between $\frac{1}{4}$-$\frac{1}{2}$, $< \frac{1}{4}$, $<< \frac{1}{4}$ but referred to them all as $< \frac{1}{2}\%$.

4. RESULTS OF WORK TO DATE (Cont'd)

4.2 Results of the Mapping and Sampling Programme and subsequent Petrographic Studies (Cont'd)

4.2.4 Results of Visual Heavy Mineral Estimates (Cont'd)

against carbonate allochem percentage. (Figure S-SE-2-10.) A curve of best fit and a zone of maximum concentration indicates an inverse relationship between carbonate % and H.M. %. i.e. : highly calcareous units are more likely to be low in heavy minerals than non-calcareous units.

4.3 Results of Detailed Heavy Mineral Analysis

The AMDEL report is enclosed as Appendix III. None of the seven samples assayed contain as much as 1% heavy minerals as was predicted by visual estimate. Including the two auger hole samples in the following averages; the average total heavy minerals weight percentage is 0.45%. (This compares well with the visual estimate of 0.55%.)

The range and average content of the heavy mineral assemblage in weight percentages is ;

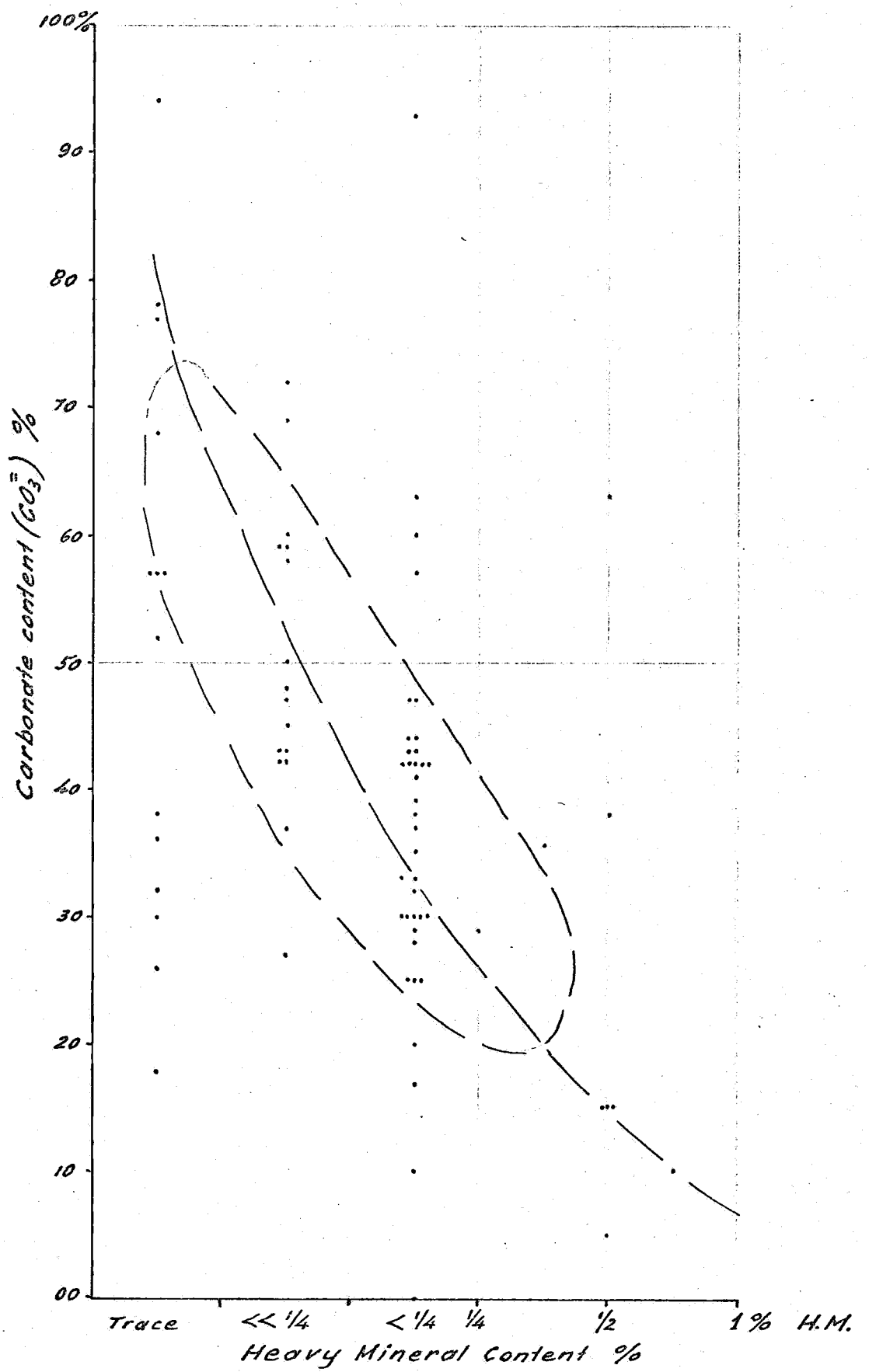
	High	Low	Average
Ilmenite (fresh and altered)	45	19	32
Leucoxene	11	4	8
Rutile	13	6	9
Zircon	13	4	9
Others	54	25	42

The others group contains with the exception of minor monazite and chromite valueless heavy minerals.

4.4 Other Investigations

Considerable consideration was given to the study of water bore data. Twenty 1:50,000 scale, Cadastral Mapping base maps showing water bore locations were purchased from the South Australian Department of Mines. An examination of these and water bore cards in the Department revealed the nature of the data available for a water bore study.

A large number of water bores have been drilled in the south-east coastal plains of South Australia resulting in a dense subsurface coverage of the area. The water bores drilled on the Keith



JENNINGS MINING LIMITED EXPLORATION DIVISION			
Drawn	B.B.	SCATTER DIAGRAM $CO_3^=$/H.M.	SCALE Graph
Ckd. Apprd.	D.H.		Drg No S-SE-2-10
Date	June 1975.		

4. RESULTS OF WORK TO DATE (Cont'd)

4.4 Other Investigations (Cont'd)

1:50,000 sheet area were taken as a model study. At a guess only 20 to 30% of bores have a driller's strata log and only a few (something less than 5% of the 20%) of these have any stratigraphic interpretation.

Fully realizing these limitations, the water bore data provides an excellent subsurface coverage. However, a detailed study of water bore data was shelved pending the results of other exploration activities.

5. HEAVY MINERAL POTENTIAL - A DISCUSSION

5.1 Introduction

The heavy mineral potential of the south east coastal plains area is discussed from a theoretical viewpoint and from the exploration results obtained to date.

5.2 General Theory of Formation of Commercial Heavy Mineral Deposits

The necessary parameters in the formation of economic heavy mineral deposits are ;

i) a sufficient supply of heavy minerals.

ii) a concentrating mechanism.

iii) a sediment trap area or mode of environment to suitably preserve the heavy mineral concentration.

The supply of heavy minerals is in turn dependent upon the area of source rocks exposed to erosion, the duration and severity of the erosion cycle and the mineral content of the exposed rocks. The heavy minerals are transported to the beach environment by the alluvial drainage systems and most, if not all, mineral sand deposits of economic significance are in close proximity to the mouth of such drainage systems.

5.3 Theoretical Considerations Regarding Heavy Mineral Potential of the Bridgewater Formation

5.3.1 General

Most workers agree that the extensive system of 'sand' ranges on the south east coastal plain represent former still-stands of a regressing sea. Accepting this, palaeogeographic reconstructions and 'form-line trend

5. HEAVY MINERAL POTENTIAL - A DISCUSSION (Cont'd)

5.3 Theoretical Considerations Regarding Heavy Mineral Potential of the Bridgewater Formation (Cont'd)

5.3.1 General (Cont'd)

surface analysis' of Larson (1974) are contended to be quite valid and these techniques have defined potential heavy mineral 'trap' areas. (As discussed in Section 2.2 and shown on Figure S-SE-2-2.)

In addition, the fact that beach environments have been recognised in these 'sand' ranges means that a concentrating mechanism (i.e., beaches) was operative on the south east coastal plains.

However, the results of our studies indicate a lack of sufficient supply of heavy minerals and also it is suspected that the concentrating mechanism is deficient in the important component of longshore drift.

5.3.2 Longshore Drift

There has been much speculative writing as to what direction the nearshore-longshore drift has been during the Pleistocene.

Photogeologic and (palaeo)-geomorphic evidence indicates that during the Pleistocene westerly winds were dominant and the fetch of waves on a NW-SE trending coastline would cause a SE nearshore-longshore drift.

Rochow (1971) and, according to Sprigg, others claimed a NW longshore drift. The basis for this argument may well have been the appearance of the Younghusband Peninsula developing as a sand spit growing north-westwards, however, this and the closing of the Coorong to the south are known to be due to northward tectonic tilting. (Refer Section 3.2.5.3)

Sprigg clearly states that longshore drift is minimal on today's coastline off the south-east plains as the prevailing winds are from the SW and are almost at right angles to the present coastline. Sprigg states 'The investigations in the S.E. have shown very clearly that littoral drift is not taking place on a large scale. The sands forming the backshore dunes are chiefly products of local shell destruction and at best there are only "tendencies" for littoral drift in particular directions'. As the emergent coastline has evolved through what can be anticipated as very similar conditions, this is a distinct possibility in the Pleistocene. It could help explain

5. HEAVY MINERAL POTENTIAL - A DISCUSSION (Cont'd)

5.3 Theoretical Considerations Regarding Heavy Mineral Potential of the Bridgewater Formation (Cont'd)

5.3.2 Longshore Drift (Cont'd)

the dominant calcareous section of the Pleistocene, any detritus in the absence of longshore drift being deposited on the outer continental shelf and beyond. This of course is not favourable for HM accumulation.

5.3.3 Provenance - the supply of Heavy Minerals

Theoretically, the area of source rocks exposed to erosion during the period of deposition of the Bridgewater Formation was extremely large (the Murray Basin watershed), however, due to the topographic maturity of the source area probably little detritus resulted from this large area. The main supply of detrital material to the Bridgewater Formation was most likely from local sources along the Kanawinka/Marmon Jabuk and associated fault scarps.

To assist in the study of provenance of the Bridgewater Formation a 'Pre-Bridgewater Formation Interpretative Solid Geology Map', Figure S-SE-2-11, has been constructed and the reader is also referred to Figure S-SE-2-6.

The mid-Tertiary Gambier Limestone was deposited over an extensive area of the Murray Basin and it developed largely in the absence of detrital material influx. This presupposes a mature physiography of the Murray Basin watershed as proposed by Sprigg (1952).

The Loxton Sand and Parilla Sand units were deposited unconformably on the Gambier Limestone during the late mid-Tertiary to late Tertiary regressive seas. Detrital influx could be expected to derive from rejuvenated drainage of rocks of the Murray Basin watershed and re-worked Gambier Limestone at this time.

In the late Tertiary - early Pleistocene the Marmon-Jabuk / Kanawinka and associated faults became active and with the subsidence of the western block the Coomandook Formation was deposited as a result of marine transgression. This fault activity would undoubtedly rejuvenate drainage elements across the fault scarp but this would be local for as is aforementioned the major part of the Murray Basin and surrounding watershed topography was quite mature at this time. The resulting source of 'Coomandook detritus' would thus be a wedge of rocks consisting of Parilla Sand / Loxton Sand and Gambier Limestone situated across the fault

5. HEAVY MINERAL POTENTIAL - A DISCUSSION (Cont'd)

5.3 Theoretical Considerations Regarding Heavy Mineral Potential of the Bridgewater Formation (Cont'd)

5.3.3 Provenance - the supply of Heavy Minerals (Cont'd)

scarps which would be eroded as the drainage elements attained a new profile of equilibrium. This is in agreement with Rochow (1971) who states that 'external contributions of sediment may have been quite small during this (Coomandook) marine phase because the volume and character of the deposits is consistent with a local source'. This is reflected sedimentologically in bryozoal fossils derived from the Gambier Limestone and relict bimodal texture after Parilla Sand in the Coomandook sediments.

The Bridgewater Formation was then deposited unconformably on the above units as the sea regressed in a series of still-stand stages. It seems valid to assume that the 'pre-Coomandook', rejuvenated drainage elements across the local fault scarps reached their profile of equilibrium during 'Coomandook' times and only minimal detritus was being fed to the coasts by these drainage elements in 'Bridgewater' time. i.e. : much the same situation as the Murray River in present times. (The Murray River is the most sluggish river in the world and today contributes very little detritus to the coast.) This is illustrated by the fact that not one of the pre-Coomandook creeks of the south-east coastal plains (namely, the Tatiara, Morambro, Mosquito and Naracoorte Creeks) had sufficient energy to survive Bridgewater Formation deposition and reach today's coast.

Accordingly, the source of 'Bridgewater detritus' has been local reworking of older rocks close to the deposition site. From oldest to youngest, these rocks are ; the Lower Ordovician granites, Gambier Limestone, Loxton Sand, Parilla Sand and Coomandook Formation. The detrital content (and subsequent H.M. content) of the 'Bridgewater source' sediments has been shown above to be low. This really only leaves the Lower Ordovician granites. The granites could have supplied zircon in particular to the 'Bridgewater detritus', however, their area of exposure is felt to be too small to provide an adequate (commercial) supply particularly as the Coomandook Formation covered the major part of the Padthaway Ridge (Refer S-SE-2-11).

5.4 Exploration Results

5.4.1 Sedimentology of the Bridgewater Formation

Jennings petrographic studies indicate that 80% of the

5. HEAVY MINERAL POTENTIAL - A DISCUSSION (Cont'd)

5.4 Exploration Results (Cont'd)

5.4.1 Sedimentology of the Bridgewater Formation (Cont'd)

Bridgewater Formation sediments have a carbonate content of > 15%. It is contended that large calcareous section is unfavourable for the formation and possible development of commercial beach sand deposits on two grounds :

a) Calcareous sediments (limestones and calcarenites) are formed in shelf environments and protected bay environments which are relatively free of detrital or arenaceous sediment (e.g., the Coorong, S.A.). This indicates that little stream laden, possibly heavy mineral containing, detritus is being fed into the seas and onto the subsequent beaches.

b) It is more likely to be indurated and therefore difficult to either drill or develop.

This contention is supported by the carbonate % /H.M. % scatter diagram Figure S-SE-2-10 discussed in Section 4.2.4.

5.4.2 Heavy Mineral Percentages

The heavy mineral percentage indicated (i.e. : approx. ½%) is very low and the associated heavy mineral assemblage (Section 4.3) is commercially unattractive.

6. CONCLUSIONS

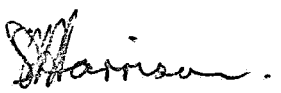
The South Eastern Coastal Plains Heavy Mineral Sands Project was a very conceptual one based upon ideas presented by Consulting Geologist, C. E. Larson to Jennings Mining Limited. Larson recognised what could be favourable heavy mineral 'trap' areas in the configuration of fossil strand lines on the south east coastal plains. These palaeogeomorphic concepts are probably quite sound, however, results of our current field programme indicate that there is little chance that commercial heavy mineral beach sand deposits exist in the area.

The best samples of a representative sample suite collected within EL 169 contained only an average 0.45% (by weight) heavy minerals with a mineral assemblage of 9% rutile, 9% zircon and 32% ilmenite.

6. CONCLUSIONS (Cont'd)

Other theoretical considerations strongly downgrade the project. These are the dominant calcareous nature of the Bridgewater Formation, an uninteresting likely provenance area and a suspected minimal longshore drift.

In addition, drilling within the area is extremely difficult using conventional drilling equipment used for beach sand exploration due to the ubiquitous hard calcrete layers. Any other drilling in the area would of necessity be of an alternate technique and subsequently be very expensive. This expense would not seem to be warranted considering the potential of the area.



D. M. HARRISON
Project Geologist
1st July, 1975

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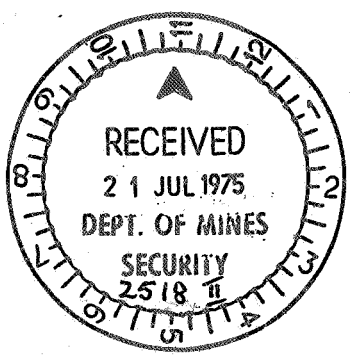
APPENDIX I

DRILL HOLE LOG SHEETS

Volume 2.



S.E. COASTAL PLAINS — DRILL LOG

Mundulla 1:50000 map 6760 N, 6045 E. HOLE No. MUN 1/1.

7025 535

Depth (m)	Formation	Est. B.H.	Log	Description
0	Molineaux Sand	<< ½		Clayey Sand, Light brown, ~~fine~~ coarse grained
1.0	Parilla Sand?	<< ½		Clayey Sand, Light brown, ~~fine~~ coarse grained
2.0		<< ½		Clayey Sand, Light brown, ~~fine~~ coarse grained
3.0		<< ½		Clayey Sand, Light brown, ~~fine~~ coarse grained
4.0		<< ½		Clayey Sand, Orange brown, ~~fine~~ coarse grained
5.0		<< ½		Clayey Sand, Yellow brown, ~~fine~~ coarse grained
6.0		<< ½		Clayey Sand, Yellow, ~~fine~~ medium grained
7.0		<< ½		Clayey Sand, Yellow, ~~fine~~ medium grained
8.0		<< ½		Clayey Sand, White, ~~fine~~ medium grained
9.0		<< ½		Clayey Sand, yellow, ~~fine~~ medium grained. Mica
10.0		<< ½		Clayey Sand, Brown, ~~fine~~ coarse grained. Mica
11.0		<< ½		Clayey Sand, Brown, ~~fine~~ coarse grained. Mica
12.0		<< ½		Clayey Sand, Very light brown, ~~fine~~ coarse grained. Slightly Cemented, (calcareous)
13.0		<< ½		
14.0	? ? ?			
15.0	Loxton Sand?	<< ½		
16.0		<< ½		
17.0		<< ½		
18.0		<< ½		
19.0		<< ½		

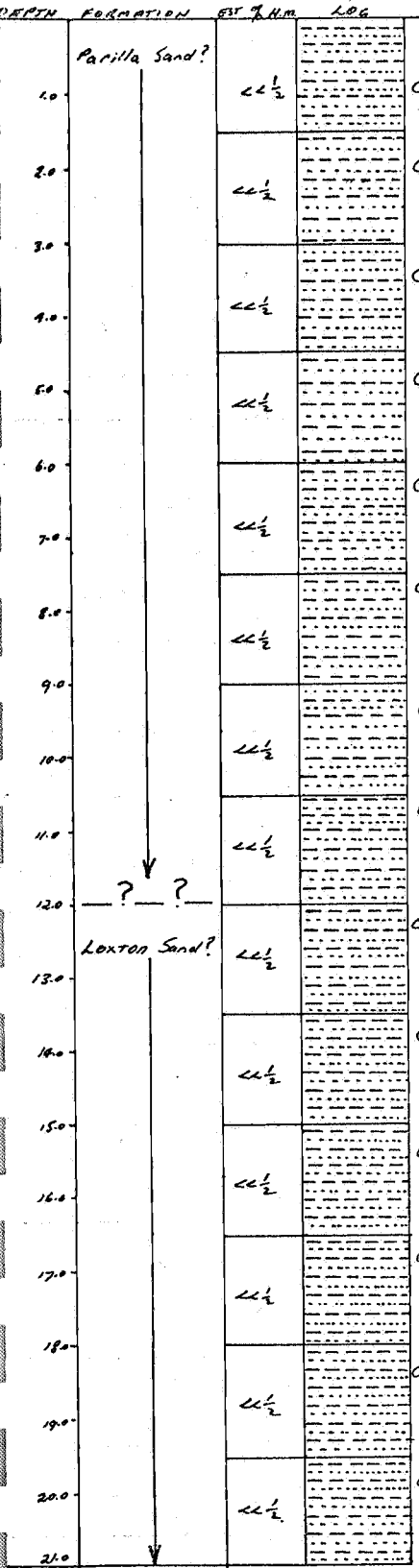
HOLE ENDED 19.5 m.

HOLE : MUN 1/1.

S.E. COASTAL PLAINS — DRILL LOG.

Mundalla 1:50,000 map 6775 N, 6045 E, HOLE NO. MUN 1/2.

7025 536



DESCRIPTION

Clayey Sand, light brown, coarse grained.

Clayey Sand, brown, coarse grained.

Clayey Sand, brown, coarse grained

Clayey Sand, brown, medium grained.

Clayey Sand, light brown, medium grained

Clayey Sand, light brown, medium grained.

Clayey Sand, grey-brown, medium grained.

Clayey Sand, yellow-brown, medium grained.

Clayey Sand, yellow-brown, medium grained. Mica.

Clayey Sand, light brown, coarse grained.

Clayey Sand, light brown, coarse grained.

Clayey Sand, light brown, coarse grained.

Clayey Sand, light brown, coarse grained. slightly cemented

Clayey Sand, light brown-white, coarse grained, slightly (calcareous) cemented. damp.

HOLE ENDED 21.0 M.

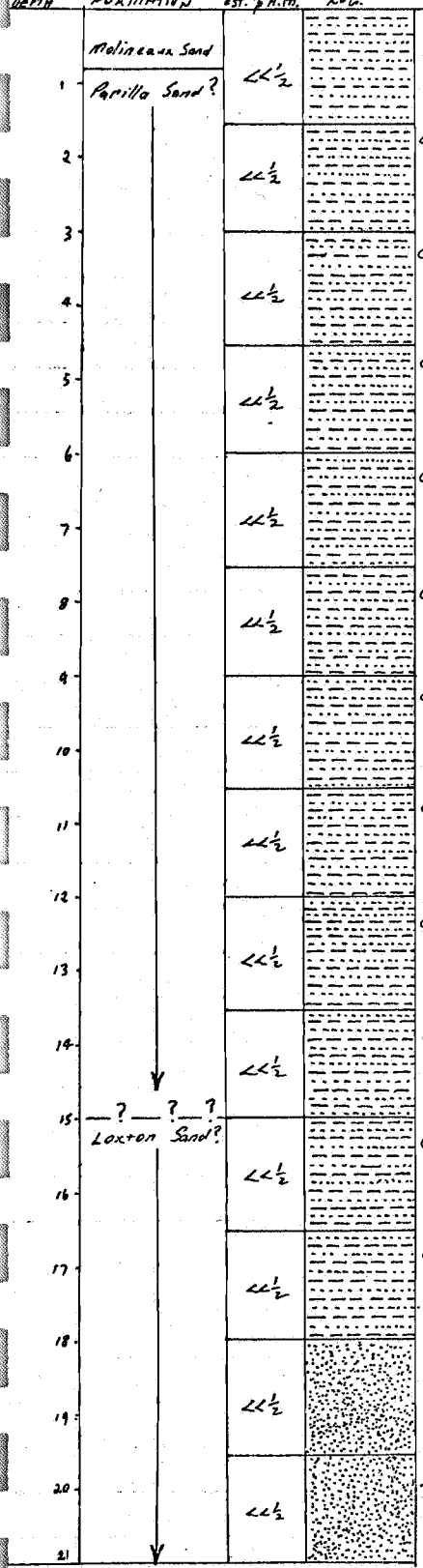
HOLE : MUN 1/2.

S.E. COASTAL PLAINS – DRILL LOG

098

Mundulla 1:50000 map 6790 N, 6045 E. HOLE No. MUN 1/3.

7025 2429



DESCRIPTION

Clayey Sand, grey – light brown, coarse grained

Clayey Sand, light brown, coarse grained.

Clayey Sand, light brown-grey, medium grained.

Clayey Sand, yellow-grey, med-coarse grained.

Clayey Sand, yellow, med-coarse grained.

Clayey Sand, yellow, med-coarse grained

Clayey Sand, yellow, med-coarse grained.

Clayey Sand, yellow, med-coarse grained.

Clayey Sand, yellow, med-coarse grained.

Clayey sand, yellow, med-coarse grained.

Clayey Sand, brown, med-coarse grained. mica

Clayey Sand, brown, medium grained. Slightly cemented (calcareous) mica.

Sand, brown, med-coarse grained, slightly cemented (calcareous) mica

Sand, brown, med-coarse grained, slightly cemented (calcareous)

HOLE ENDED 21.0 M.

HOLE : MUN 1/3

S.E. COASTAL PLAINS — DRILL LOG

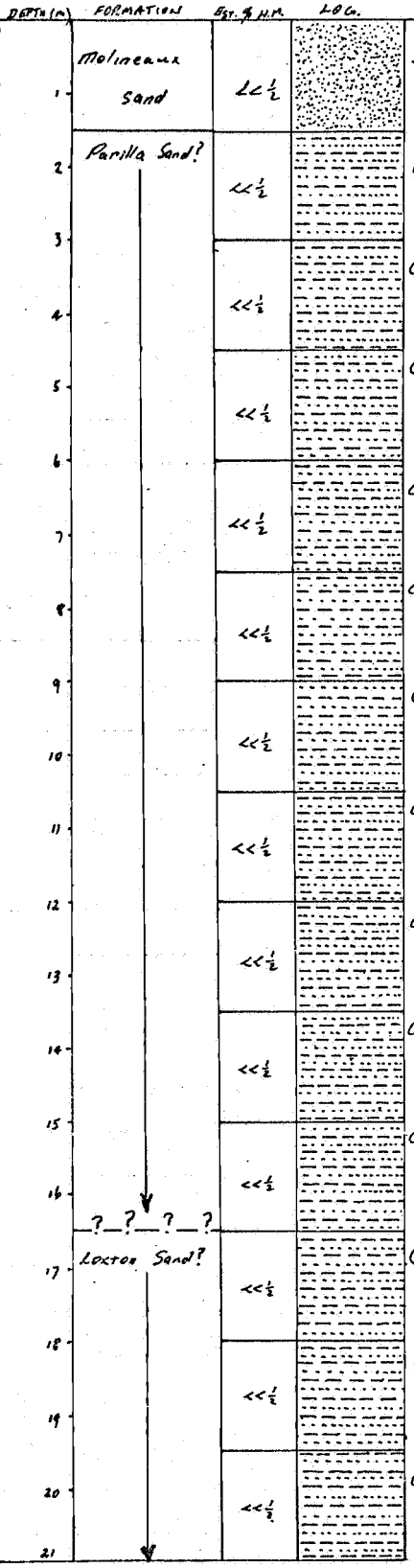
099

Mundulla 1:50,000 map

6805 N , 6045 E

HOLE NO. MUN 1/4

7025-537



DESCRIPTION.

Sand, light brown, med-coarse grained.

Clayey Sand, light brown, med-coarse grained.

Clayey Sand, light brown, medium grained.

Clayey Sand, grey-brown, medium grained.

Clayey Sand, grey-brown, medium grained.

Clayey Sand, light brown, medium grained.

Clayey Sand, light brown, med-coarse grained.

Clayey Sand, light brown, med-coarse grained.

Clayey Sand, brown, med-coarse grained.

Clayey Sand, brown, med-coarse grained.

Clayey Sand, yellow-brown, med-coarse grained.

Clayey Sand, brown, med-coarse grained. mica.

Clayey Sand, brown, med-coarse grained. mica

Clayey Sand, brown, med-coarse grained. Slightly cemented (calcareous).

HOLE ENDED 21.0 m.

HOLE : MUN 1/4.

SE. COASTAL PLAINS – DRILL LOG.

Maundulla 1:50,000 MAP

6900 N, 6045 E.

HOLE NO MUN 1/5

7025 538

DEPTH (m)	FORMATION	EST. % H.R	LOG	DESCRIPTION.
0	Molineaux Sand	≤½		Clayey Sand, light brown, med-coarse grained.
1	Parilla Sand?	≤½		Sandy Clay, brown, medium grained.
2		≤½		Clayey Sand, brown, f-med grained.
3		≤½		Clayey Sand, red-brown, medium grained
4		≤½		Clayey Sand, brown, medium grained
5		≤½		Clayey Sand, brown, medium grained
6		≤½		Clayey Sand, brown, medium grained.
7		≤½		Clayey Sand, brown, medium grained. mica.
8		≤½		Clayey Sand, brown, medium grained. mica.
9	~~Loxton Sand?~~	≤½		Clayey Sand, yellow. medium grained. (calcareous) cemented. mica.
10	? ? ? ? LOXTON SAND	≤½		Sand, light brown, medium grained, (calcareous) cemented. mica.
11		≤½		Sand, light brown, medium grained (calcareous) cemented. mica.
12		≤½		Sand, light brown, med-coarse grained. STRONGLY CEMENTED (calcareous).
13		≤½		
14		≤½		
15		≤½		
16		≤½		
17		≤½		
18		≤½		
19				

HOLE ENDED 19.5 m.

HOLE : MUN 1/5

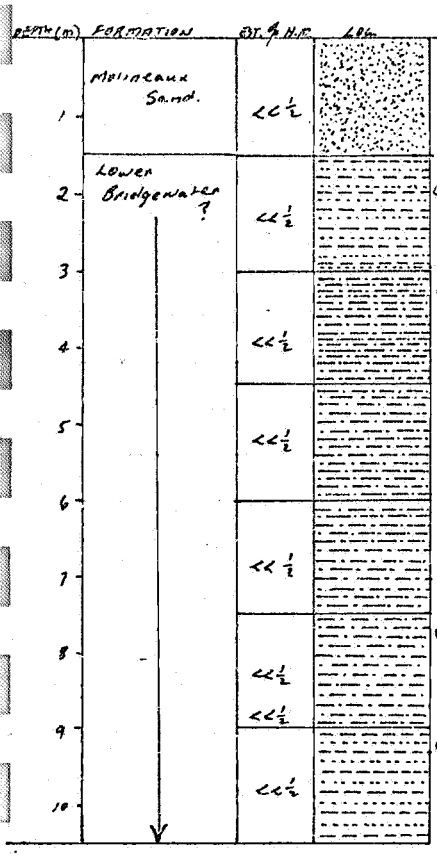
S.E. COASTAL PLAINS – DRILL LOG

KEITH 1:50000 MAP

600725 N 44825 E

HOLE NO. KTH 2/1

6925 1088



DESCRIPTION

Quartz Sand, Yellow, medium grained.

Clayey quartz Sand, light brown, med- coarse grained.

Quartz Sandy Clay, Red-brown, med-coarse grained.

Quartz Sandy Clay, Dark Brown, med-coarse grained.

Quartz Sandy Clay, Dark Brown, med-coarse grained.

Quartz Sandy Clay, grey-green, medium grained.

Clayey Sub intraclastic quartz sand, grey-green, med-coarse grained Slightly cemented (calcareous)

HOLE ENDED 10.5 m.

HOLE : KTH 2/1

S.E. COASTAL PLAINS – DRILL LOG.

KEITH 1:50 000 MAP 600725 N 448406 E HOLE NO. KTH 2/2.

6925 1089

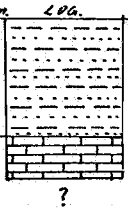
DEPTH(m)	FORMATION	EST %H.M	LOG	DESCRIPTION
1	Molineaux Sand	$< < \frac{1}{2}$		Clayey Quartz Sand, brown, med-coarse grained.
2	lower Bridgewater?	$< \frac{1}{2}$		Quartz sandy clay, light brown, med-coarse grained.
3		$< \frac{1}{2}$		Clayey sub intraclastic quartz Sand, light brown, med-coarse grained. Slightly cemented (calcareous).
4		$< \frac{1}{2}$		Clayey sub intraclastic quartz sand, light brown, med-coarse grained. slighty cemented (calcareous)
5		$< \frac{1}{2}$		quartz sandy sub intraclastic clay, light brown, med-coarse grained. slightly cemented (calcareous).
6		$< \frac{1}{2}$		Clayey quartz sand, light brown, medium grained.
7		$< \frac{1}{2}$		Clayey quartz sand, light brown, medium grained.
8		$< \frac{1}{2}$		Clayey sub intraclastic quartz sand, green-brown, medium grained. Slightly cemented (calcareous)
9		$< < \frac{1}{2}$		Quartz Sand, light green, medium grained.
10		$< \frac{1}{2}$		Quartz Sand, light brown, medium grained. WET
11		$< \frac{1}{2}$		Quartz Sand, light brown, medium grained, slightly cemented (calcareous). WET.
12		$< \frac{1}{2}$		
13		$< \frac{1}{2}$		
14		$< \frac{1}{2}$		
15		$< < \frac{1}{2}$		
16				

HOLE ENDED 16.5 m. DRILLING RATE 1.5 m / 20 minutes.

HOLE : KTH 2/2

KEITH 1:50000 | 600725 N, 448500 E | HOLE NO. KTH 2/3

6925 1090

DEPTH (m)	FORMATION	EST. % H.M.	LOG.	DESCRIPTION.
	Molineaux Sand			
1	Upper Bridgewater ? ↓	< ½		Clayey quartz sand, light brown, med-coarse grained.
2	Rippon Calcrete ? ↓ ?			STRONGLY CEMENTED (Calcareous).

Hole Ended 1.5 m. Impenetrable past 2.0 m.

HOLE : KTH 2/3.

S.E. COASTAL PLAINS – DRILL LOG

KEITH 1:50 000 | 600725 N | 428606 | HOLE No. KTH 2/4.

6925 1091

DEPTH (m)	FORMATION	? H.M.	LOG	DESCRIPTION
	Molineaux Sand			Quartz Sandy Clay, light brown, med-coarse grained.
1	Upper Bridgewater ?	<< ½		
2		<< ½		Quartz Sandy sub intraclastic clay, RED BROWN, med-coarse grained. Slightly cemented (calcareous).
3	Ripon Calcrete?			STRONGLY CEMENTED (calcareous)

HOLE ENDED 3.0 m. IMPENETRABLE.

HOLE : KTH 2/4.

S.E. COASTAL PLAINS — DRILL LOG.

KEITH 1:50 000 MAP 600745 N 44920 E HOLE NO. KTH 3/1

6925 349

DEPTH(m)	FORMATION	EST. % H.A	LOG.	DESCRIPTION
1	Upper Bridgewater?	<½		Clayey sub arkosic quartz sand, light brown, med-coarse grained. (calcareous) COMENTED
2	Ripon Calcrete?			STRONGLY COMENTED (calcareous)

HOLE ENDED 1.5m. IMPENETRABLE

HOLE : KTH 3/1

S.G. COASTAL PLAINS – DRILL LOG

KEITH 1:50,000 MAP 600745 N 44930 E HOLE No. KTH 3/2.

6925 350

DEPTH(M)	FORMATION	% H.M.	LOG	DESCRIPTION
1	Upper Bridgewater?	<<½		Clayey quartz sand, light brown, med-coarse grained.
2		<<½		quartz sandy clay, brown, medium grained.
3	Ripgen Calcrete?			STRONGLY CEMENTED (Calcareous)

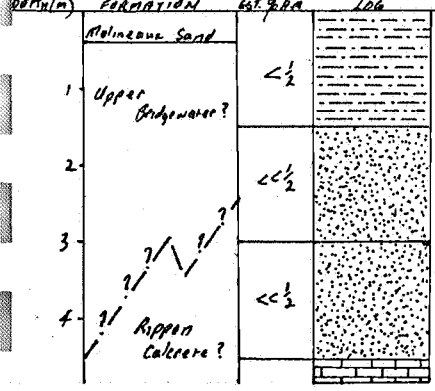
HOLE ENDED 3.0 M. IMPENETRABLE.

HOLE : KTH 3/2

S.E. COASTAL PLAINS — DRILL LOG.

KEITH 1:50000 MAP 600745 N 449500 E HOLE NO. KTH 3/3.

6925 359



DESCRIPTION

Quartz sandy clay, brown, med-coarse grained. &

Intraclastic quartz sand, brown, med-coarse grained. (calcareous) cemented.

Intraclastic quartz sand, brown, med-coarse grained. (calcareous) cemented.

STRONGLY CEMENTED (calcareous)

HOLE ENDED 4.5m. IMPENETRABLE.

HOLE : KTH 3/3

S.E. COASTAL PLAINS - DRILL LOG

KEITH 1:50000 600745N 49970 HOLE No. KTH 3/4

6925 360

DEPTH(m)	FORMATION	LITH	LOG	DESCRIPTION.
1	upper Bridgewater?	LL½		Intraclastic quartz sand, light brown, (calcareous) cemented.
2	Ripon calcrete?	LL½		Intraclastic quartz sand, light brown, (calcareous) cemented.
3				STRONGLY CEMENTED (calcareous)

HOLE ENDED 3.0m. IMPENETRABLE.

HOLE : KTH 3/4

S.E. COASTAL PLAINS — DRILL LOG

KEITH 1:50000 MAP

598830 N 450656 E

HOLE NO. KTH 4/1.

6925 451

DEPTH (M)	FORMATION	SY. % H.M.	LOG	DESCRIPTION
1	MOLINEAUX SAND / BRIDGEWATER	<< ½		Quartz Sandy Sub Intraclastic Clay, Red-brown, med-coarse grained. Slightly cemented (Calcareous)
2		<< ½		Quartz Sandy Sub Intraclastic clay, brown, med-coarse grained. slightly cemented (Calcareous).
3				STRONGLY CEMENTED (Calcareous).

HOLE ENDED 3.0 M. IMPENETRABLE

HOLE : KTH 4/1

S.E. COASTAL PLAINS – DRILL LOG

KEITH 1:50000 MAP

598850 N 45075 E

HOLE NO. KTH 4/2.

6925 482

DEPTH(m)	FORMATION	EST. % HR	LOG	DESCRIPTION
1	BRIDGEWATER	<<½		Intraclastic quartz sand, light brown, med-coarse grained, (calcareous) cemented.
2		<<½		Intraclastic quartz sand, light brown, med-coarse grained. (calcareous) cemented.
3				STRONGLY CEMENTED.

HOLE ENDED 3.0m. IMPENETRABLE.

HOLE : KTH 4/2.

S.E. COASTAL PLAINS — DRILL LOG.

KEITH 1:50 000 MAP | 598850 N | 45085E | HOLE NO. KTH 4/3

6925 453

DEPTH (m)	FORMATION	EST. % H.A.	LOG	DESCRIPTION
0	MOLINEAUX SAND			
	BRIDGEWATER	<<½		clayey sub intraclastic quartz sand, brown, med-coarse grained. slightly cemented (calcareous)
1				STRONGLY CEMENTED.

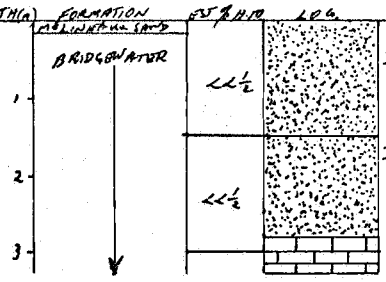
HOLE ENDED 1.5m. IMPENETRABLE.

HOLE: KTH 4/3

S.E. COASTAL PLAINS - DRILL LOG.

KEITH 1:50000 598850 N 450956 HOLE NO. KTH 4/4

6925 458



EST % RUN	LOG	DESCRIPTION
LL½		Intraclastic quartz sand, light brown, med-coarse grained. Slightly cemented (calcareous)
LL½		Intraclastic quartz sand, light brown, med-coarse grained. (calcareous) CEMENTED
		STRONGLY CEMENTED

HOLE ENDED 3.0m. IMPENETRABLE.

HOLE : KTH 4/4

S. E. COASTAL PLAINS – DRILL LOG

KEITH 1:50 000

598850 N 45105 E

HOLE NO. KTH 4/5

6925 459

DEPTH (m)	FORMATION	EST. % RM.	LOG	DESCRIPTION
1	Molineaux Sand	40½		Quartz sandy clay. RED – BROWN, med-coarse grained.
2	Bridgewater	40½		Clayey sub intraclastic quartz sand, RED–BROWN, med-coarse grained. Slightly cemented (calcareous)
3		40½		Intraclastic quartz sand, LIGHT BROWN, med-coarse grained. cemented (calcareous
4		40½		
5		40½		Sub Intraclastic quartz sand, light Brown, med-coarse grained. Slightly cemented (calcareous)
6		40½		Sub Intraclastic quartz sand, light Brown, med-coarse grained. Slightly cemented (calcareous)
7		40½		
8		½		Quartz Sand, light Brown, med-coarse grained.
9		40½		Clayey quartz Sand, light Brown – green, med-coarse grained.
10		40½		
11		40½		Clayey quartz sand, light Brown – green, med-coarse grained.
12		40½		Quartz sand, light Brown, med-coarse grained WET
13		40½		
14		40½		Quartz Sand, light Brown, med-coarse grained, v. minor SHELL FRAGS ? WET
15				STRONGLY CEMENTED

HOLE ABANDONED 15.0m. IMPENETRABLE.

HOLE : KTH 4/5

S.E. COASTAL PLAINS – DRILL LOGS.

KEITH 1:50 000

598850 N 45115 E

HOLE NO KTH 4/6

6925 460

DEPTH(m)	FORMATION	EST. % CLAY	LOG	DESCRIPTION
1	MOLINEAUX SAND	$<<\frac{1}{2}$		Clayey quartz sand, light brown, medium grained.
2	BRIDGEWATER	$<<\frac{1}{2}$		Sub Intraclastic gtl sandy clay, Red-Brown, med-coarse grained
3		$<<\frac{1}{2}$		Quartz sandy clay, Red-Brown, med-coarse grained
4		$<<\frac{1}{2}$		Clayey sand, Red-Brown, med-coarse grained
5		$<<\frac{1}{2}$		Quartz sandy clay, Red-Brown, med-coarse grained
6		$<<\frac{1}{2}$		Clayey quartz sand, Brown, med-coarse grained
7		$<\frac{1}{2}$		Clayey quartz sand, Brown, med-coarse grained
8		$<\frac{1}{2}$		Clayey quartz sand, Brown, med-coarse grained
9		$<\frac{1}{2}$		Clayey quartz sand, Brown, med-coarse grained
10		$<\frac{1}{2}$		Clayey quartz sand, Red-Brown, med-coarse grained wet
11		$<<\frac{1}{2}$		Quartz sand, light Brown, med-coarse grained. wet
12		$\frac{1}{2}$		Quartz sand, light Brown, medium grained. wet
13		$<\frac{1}{2}$		Quartz sand, light Brown, medium grained. wet
14				strongly cemented (calcareous)
15				
16				
17				
18				

HOLE ENDED 18.0. IMPENETRABLE.

HOLE : KTH 4/6

APPENDIX II

BINOCULAR MICROSCOPE PETROGRAPHIC LOG SHEETS

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3014 Stratigraphic Unit Bridgewater Formation

Location Keppoch 38·95 N / 68·40 E Analysed by B.P. Date 30-5-75

Colour Yellow – White

Bedding/~~Lamination~~ Pebble Beds

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % 20 Sand % 78 Mud % 2

Modality Multimodal

Grain Size : Mean : ~ 1·25

16-84% Range : 2·24-0·125

Sorting : Poor

Roundness : Mean : 0·6

16-84% Range : 0·4 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·67 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Gravelly Sand

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter % 1
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts 20
Micrite/Sparite 10	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 95% Broken, 5 % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia 10	Decapoda
Gasteropoda	Coral Frags. 30
Echinodermata	Foraminifera 20
Sponge Spicules 40	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite.

(Only H.M. Discernable)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Gravelly, Calcareous Intraclastic Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3015 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 38.95 N / 68.40 E Analysed by B.P. Date 30-5-75

Colour Yellow - Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 2 Sand % 96 Mud % 2

Modality Bimodal

Grain Size : Mean : 0.25

16-84% Range : 1.25 - 0.063

Sorting : Poor

Roundness : Mean : 0.5

16-84% Range : 0.4 - 0.7

Qualitative : Sub Rounded

Sphericity : Mean : 0.81

16-84% Range : 0.73 - 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 83	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 70% Broken, 30 % Complete

Macrofossil % : Microfossil % = 20 : 80

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 80
Sponge Spicules 20	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F)
Staurolite (C) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S. E. COASTAL PLAINS

Sample No. 3016 Stratigraphic Unit Molineaux Sand

Location 6770N/8775E TATIARA Analysed by B. Penny Date 22/5/1975

Colour LIGHT BROWN

Bedding/Lamination NIL

Porosity POROUS

Hardness -

Cementation : degree NIL

: composition -

Reaction to HCl NIL

Mode of Disaggregation NIL

TEXTURAL CHARACTER

Method of Investigation

SIEVE AND PANNING

Gravel %5 Sand % 90 Mud % 5

Modality UNI MODAL ?

Grain Size : Mean : 0.125

16-84% Range : 0.063 - 0.56

Sorting : MODERATE

Roundness : Mean : .2

16-84% Range : 1 - .3

Qualitative : VERY ANGULAR

Sphericity : Mean : .83

16-84% Range : 0.79 - .87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 98	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay %
Rock Fragments %1 (LAT)	Mica %
Carbonate Allochem %	Organic Matter %1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES Ilmenite, Fe_2O_3, minor Rutile, Staurolite ? and others (magnetite, etc.). Prob. v. minor zircon (no u.v. lamp).

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3017 Stratigraphic Unit MOLINEAUX SAND

Location 6770N/8775E TATIARA Analysed by B. PENNY Date 23/5/'75

Colour LIGHT BROWN

Bedding/Lamination NIL

Porosity

Hardness

Cementation : degree NIL

: composition

Reaction to HCl NIL

Mode of Disaggregation NIL

TEXTURAL CHARACTER

Method of Investigation

SIEVE AND PANNING

Gravel % NIL Sand % 98 Mud % 2

Modality UNI

Grain Size : Mean : 0.125

16-84% Range : 0.56 - 0.063

Sorting : MODERATE-WELL

Roundness : Mean : 0.2

16-84% Range : 0.1 - 0.3

Qualitative : VERY ANGULAR

Sphericity : Mean : 0.81

16-84% Range : 0.73 - 0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 99	Heavy Minerals % <½
Feldspar %	Clay %
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES Ilmenite, Fe_2O_3. Minor Rutile, Staurolite, prob. some Zircon. V. minor Magnetite. Others.

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S. E. COASTAL PLAINS

Sample No. 3018 Stratigraphic Unit BRIDGEWATER

Location 6770N/8775E TATIARA Analysed by B. PENNY Date 23/5/'75

Colour GREY-BROWN

Bedding/Lamination VERY FAINT

Porosity POROUS

Hardness MODERATE

Cementation : degree CEMENTED

: composition

Reaction to HCl NIL

Mode of Disaggregation
MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation
SIEVE AND PANNING

Gravel % 1 Sand % 94 Mud % 5

Modality UNI

Grain Size : Mean : 0.125

16-84% Range : 0.56 - 0.063

Sorting : MODERATE-WELL

Roundness : Mean : 0.1

16-84% Range : 0.1 - 0.2

Qualitative : VERY ANGULAR

Sphericity : Mean : 0.85

16-84% Range : 0.79 - 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION SAND

PETROGRAPHIC CHARACTER

Quartz % 92	Heavy Minerals % $< \frac{1}{2}$
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others % 2

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES Ilmenite, rutile, staurolite. Prob. some zircon. Spinel, minor magnetite and others.

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3019 Stratigraphic Unit MOLINEAUX SAND

Location 6650N/8590E TATIARA Analysed by B. PENNY Date 23/5/'75

Colour YELLOW BROWN

Bedding/Lamination NIL

Porosity POROUS

Hardness -

Cementation : degree NIL

: composition

Reaction to HCl NIL

Mode of Disaggregation NIL

TEXTURAL CHARACTER

Method of Investigation
SIEVE AND PANNING

Gravel % 1 Sand % 97 Mud % 2

Modality UNI

Grain Size : Mean : 0.125

16-84% Range : 0.56 - 0.063

Sorting : MODERATE-WELL

Roundness : Mean : 0.3

16-84% Range : 0.2 - 0.4

Qualitative : ANGULAR

Sphericity : Mean : 0.75

16-84% Range : 0.69 - 0.85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION SAND

PETROGRAPHIC CHARACTER

Quartz % 98	Heavy Minerals % $< \frac{1}{2}$
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, rutile, staurolite.
Spinel, kyanite ? Minor magnetite and others.

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3020 Stratigraphic Unit PARILLA SAND ?

Location 6260N/7875E ~~TATIARA~~ Analysed by B. PENNY Date 23/5/'75

Colour ORANGE-BROWN

Bedding/Lamination

Porosity POROUS

Hardness SLIGHT

Cementation : degree WEAK

: composition CLAY

Reaction to HCl NIL

Mode of Disaggregation MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE AND PANNING

Gravel % - Sand % 75 Mud % 25

Modality BI MODAL ?

Grain Size : Mean : 0.125

16-84% Range : 0.56 - 0.063

Sorting : MODERATE

Roundness : Mean : 0.3

16-84% Range : 0.1-0.4

Qualitative : ANGULAR

Sphericity : Mean : 0.83

16-84% Range : 0.87 - 0.79

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION CLAYEY SAND

PETROGRAPHIC CHARACTER

Quartz % 74	Heavy Minerals % $< \frac{1}{2}$
Feldspar %	Clay % 25
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES Ilmenite, Rutile, Zircon (?), Staurolite, Kyanite, Spinel, Magnetite.

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE SUBGREYWACKE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3021 Stratigraphic Unit MOLINEAUX SAND

Location 6400N/1815E TATIARA Analysed by B. PENNY Date 23/5/'75

Colour YELLOW

Bedding/Lamination NIL

Porosity POROUS

Hardness -

Cementation : degree NIL

: composition -

Reaction to HCl NIL

Mode of Disaggregation NIL

TEXTURAL CHARACTER

Method of Investigation

SIEVE AND PANNING

Gravel % - Sand % 96 Mud % 4

Modality UNI MODAL ?

Grain Size : Mean : 0.125

16-84% Range : 0.56 - 0.63

Sorting : MODERATE

Roundness : Mean : 0.2

16-84% Range : 0.1-0.3

Qualitative : VERY ANGULAR

Sphericity : Mean : 0.83

16-84% Range : 0.87-0.79

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION SAND

PETROGRAPHIC CHARACTER

Quartz % 95	Heavy Minerals % $<\frac{1}{2}$
Feldepar %	Clay % 4
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES Ilmenite, Rutile, Zircon ? Staurolite, Leucoxene ? Spinel, very minor magnetite and others.

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S. E. COASTAL PLAINS

Sample No. 3022 Stratigraphic Unit Bridgewater

Location 7395N/8960E ~~TATIARA~~ Analysed by B. Penny Date 23/5/75

Colour WHITE

Bedding/Lamination -

Porosity POROUS

Hardness VERY HARD (CHERT NODULES)

Cementation : degree STRONGLY CEMENTED
: composition CALCAREOUS

Reaction to HCl STRONGLY CALCAREOUS

Mode of Disaggregation
MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation
PANNING

Gravel % 2 Sand % 93 Mud % 5
(Excluding $CaCO_3$)
Modality UNI

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : MODERATE

Roundness : Mean : 0.5

16-84% Range : 0.7-0.3

Qualitative : SUB ANG - SUB ROUND

Sphericity : Mean : 0.85

16-84% Range : 0.79-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 20	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 64	Organic Matter %
Chert % 10	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites 10
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

DIFFICULT TO DETERMINE DUE TO INSUFFICIENT QUANTITY

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY QUARTZOSE CALCARENITE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S. E. COASTAL PLAINS

Sample No. 3023 Stratigraphic Unit Parilla Sandstone

Location 7985N/9520E TATIARA Analysed by B. Penny Date 26/5/75

Colour DARK BROWN

Bedding/Lamination LAMINATED

Porosity SEMI POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition IRON

Reaction to HCl NIL

Mode of Disaggregation
MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation
SIEVE AND PANNING

Gravel % 60 Sand % 38 Mud % 2

Modality BIMODAL

Grain Size : Mean : 0.56

16-84% Range :2.24-0.63

Sorting : POOR

Roundness : Mean : 0.5

16-84% Range :0.3-0.6

Qualitative :
SUB ANGULAR

Sphericity : Mean : 0.81

16-84% Range :0.69-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SANDY GRAVEL

PETROGRAPHIC CHARACTER

Quartz % 76	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 2
Rock Fragments % 1	Mica %
Carbonate Allochem %	Organic Matter %
Chert % 1	Others % 20 (IRON)

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

DIFFICULT TO DETERMINE DUE TO IRON INTERFERENCE

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SANDY GRAVEL

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S. E. COASTAL PLAINS

Sample No. 3024 Stratigraphic Unit Parilla Sand

Location 7985N/9540E TATIARA Analysed by B. Penny Date 26/5/75

Colour BROWN

Bedding/Lamination NIL

Porosity POROUS

Hardness -

Cementation : degree -

: composition -

Reaction to HCl NIL

Mode of Disaggregation -

TEXTURAL CHARACTER

Method of Investigation
SIEVE & PANNING

Gravel % 2 Sand % 88 Mud %10

Modality BIMODAL

Grain Size : Mean : 0.063

16-84% Range : 0.56-0.125

Sorting : POOR

Roundness : Mean : 0.3

16-84% Range : 0.5-0.2

Qualitative :
SUB ANGULAR

Sphericity : Mean : 0.85

16-84% Range : 0.81-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 87½	Heavy Minerals %½
Feldspar %	Clay %10
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % 2

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, RUTILE, ZIRCON, STAUROLITE, SPINEL, MAGNETITE & Fe_2O_3 GARNET?

CHEMICAL OR AUTHIGENIC MINERALS

-

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S.E. COASTAL PLAINS

Sample No. 3025 Stratigraphic Unit Parilla Sand

Location 8080N/9505E TATIARA Analysed by B. Penny Date 26/5/75

Colour LIGHT BROWN

Bedding/Lamination -

Porosity POROUS

Hardness -

Cementation : degree -

: composition -

Reaction to HCl NIL

Mode of Disaggregation
MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation
SIEVE & PANNING

Gravel %2 Sand %88 Mud %10

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : MODERATE

Roundness : Mean : 0.3

16-84% Range : 0.2-0.5

Qualitative : ANGULAR

Sphericity : Mean : 0.83

16-84% Range : 0.79-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz %85	Heavy Minerals %½
Feldspar %	Clay %10
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 2
Chert %	Others % 2½

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, RUTILE, ZIRCON, SPINEL, STAUROLITE, MAGNETITE, LEUCOXENE

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S.E. COASTAL PLAINS

Sample No. 3026 Stratigraphic Unit Parilla Sand

Location 8290N/9210E TATNARA Analysed by B. Penny Date 26/5/75

Colour YELLOW BROWN

Bedding/Lamination -

Porosity POROUS

Hardness -

Cementation : degree -

: composition -

Reaction to HCl NIL

Mode of Disaggregation
MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation
SIEVE & PANNING

Gravel %2 Sand %88 Mud %10

Modality UNI? OR BI?

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : MEDIUM

Roundness : Mean : 0.2

16-84% Range : 0.1-0.3

Qualitative :
VERY ANGULAR

Sphericity : Mean : 0.85

16-84% Range : 0.79-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 89	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 10
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, RUTILE, ZIRCON, STAUROLITE, LEUCOXENE, MAGNETITE, Fe_2O_3

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S.E. COASTAL PLAINS

Sample No. 3027 Stratigraphic Unit Molineaux Sand

Location 8290N/9210E TATIARA Analysed by B. Penny Date 26/5/75

Colour YELLOW-WHITE

Bedding/Lamination -

Porosity POROUS

Hardness -

Cementation : degree -

: composition -

Reaction to HCl NIL

Mode of Disaggregation -

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING

Gravel %1 Sand %97 Mud %2

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : MODERATE

Roundness : Mean : 0.3

16-84% Range : 0.2-0.5

Qualitative : SUB ANGULAR

Sphericity : Mean : 0.87

16-84% Range : 0.83-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 97	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, RUTILE, ZIRCON, STAUROLITE, SPINEL, MINOR MAGNETITE

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S.E. COASTAL PLAINS

Sample No. 3028 Stratigraphic Unit Parilla Sand

Location 8295N/9195E TATIARA Analysed by B. Penny Date 26/5/75

Colour GREY-WHITE

Bedding/Lamination -

Porosity POROUS

Hardness SOFT-MEDIUM

Cementation : degree SLIGHTLY CEMENTED
: composition CLAY

Reaction to HCl NIL

Mode of Disaggregation

MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING

Gravel %1 Sand %69 Mud %30

Modality UNIMODAL

Grain Size : Mean :0.125

16-84% Range :0.25-0.063

Sorting : MODERATE

Roundness : Mean : 0.3

16-84% Range :0.2-0.5

Qualitative :ANGULAR

Sphericity : Mean : 0.83

16-84% Range :0.81-0.87

Qualitative :

Surface and/or Special Textures

RED STAINED QUARTZ

TEXTURAL CLASSIFICATION

MUDDY SAND

PETROGRAPHIC CHARACTER

Quartz % 69	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 30
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others %1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, SPINEL, STAUROLITE

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE SUBGREYWACKE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : S.E. COASTAL PLAINS

Sample No.3029 Stratigraphic Unit Molineaux Sand

Location 8575N/8795E TATIARA. Analysed by B. Penny Date 26/5/75

Colour YELLOW-WHITE

Bedding/Lamination -

Porosity POROUS

Hardness -

Cementation : degree -

: composition -

Reaction to HCl NIL

Mode of Disaggregation -

TEXTURAL CHARACTER

Method of Investigation
SIEVE & PANNING

Gravel % 1 Sand % 94 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : MODERATE

Roundness : Mean : 0.2

16-84% Range : 0.1-0.4

Qualitative : VERY ANGULAR

Sphericity : Mean : 0.81

16-84% Range : 0.75-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 93	Heavy Minerals % $<\frac{1}{2}$
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE, RUTILE, STAUROLITE, ZIRCON, SPINEL, KYANITE

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE QUARTZ SAND

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3030 Stratigraphic Unit Loxton Sand ?

Location TATIARA 8670 N / 8745 E Analysed by B.P. Date 26-5-75

Colour Grey

Bedding/Lamination Faint ?

Porosity Semi Porous

Hardness Medium

Cementation : degree Cemented

: composition Clay

Reaction to HCl Nil

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % 5 Sand % 85 Mud % 10

Modality Bimodal ?

Grain Size : Mean : 0·25

16-84% Range : 1·25 – 0·63

Sorting : Poor

Roundness : Mean : 0·1

16-84% Range : 0·1 – 0·2

Qualitative Very Angular

Sphericity : Mean : 0·79

16-84% Range : 0·73 – 0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 89	Heavy Minerals % < ½
Feldspar %	Clay % 10
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite. (Only H.M. Discernable.)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3031 Stratigraphic Unit Ettrick ? or Loxton

Location TATIARA 8670N / 8745E Analysed by B.P. Date 26-5-75

Colour Grey - Brown

Bedding/Lamination —

Porosity Semi Porous

Hardness Medium

Cementation : degree Slightly Cemented

: composition Clay

Reaction to HCl Nil

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % 2 Sand % 93 Mud % 5

Modality Bimodal ?

Grain Size : Mean : 0·125

16-84% Range : 1·25 - 0·063

Sorting : Poor

Roundness : Mean : 0·1

16-84% Range : 0·1 — 0·2

Qualitative : Very Angular

Sphericity : Mean : 0·85

16-84% Range : 0·81 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 93	Heavy Minerals % < ½
Feldspar % 1	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % 1 (inc. Glauconite?)

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, Rutile, Zircon, Kyanite, Staurolite, Spinel, Tourmaline

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3032 Stratigraphic Unit LOXTON ?

Location 8670N / 9745E TATIARA Analysed by B.P. Date 26-5-75

Colour Yellow — Grey

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Slightly

: composition Clay

Reaction to HCl Nil

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 90 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate — Well

Roundness : Mean : 0·2

16-84% Range : 0·1 — 0·4

Qualitative : Angular

Sphericity : Mean : 0·85

16-84% Range : 0·81-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 89	Heavy Minerals % < ½
Feldspar %	Clay % 10
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % ½

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, Rutile, Zircon, Staurolite, Tourmaline, Spinel

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3033 Stratigraphic Unit Molineaux Sand

Location TATIARA 8250 N / 7760 E Analysed by B.P. Date 27-5-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness —

Cementation : degree Nil

: composition —

Reaction to HCl Nil

Mode of Disaggregation —

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate – Well

Roundness : Mean : 0.2

16-84% Range : 0.1 – 0.3

Qualitative : Very Angular

Sphericity : Mean : 0.83

16-84% Range : 0.77 – 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 94	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, Rutile, Zircon, Staurolite, Kyanite, Tourmaline, Spinel, Very minor

CHEMICAL OR AUTHIGENIC MINERALS Magnetite

ROCK TYPE

Quartz Sand

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3034 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 7980 N / 7475 E Analysed by B.P. Date 27-5-75

Colour Grey

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 89 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25 — 0·63

Sorting : Moderate — Well

Roundness : Mean : 0·3

16-84% Range : 0·3 — 0·5

Qualitative : Sub-Angular

Sphericity : Mean : 0·85

16-84% Range : 0·77 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	64	Heavy Minerals %	< ½
Feldspar %		Clay %	5
Rock Fragments %		Mica %	
Carbonate Allochem %	30	Organic Matter %	
Chert %		Others %	1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites		Pisolites	
Pellets	5	Intraclasts	
Micrite/Sparite	95	Lumps	

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F)
Staurolite (C) Zircon (P)
Tourmaline (C) Fe_2O_3 (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3075 Stratigraphic Unit Bridgewater Formation

Location Mundulla 8480N / 7150E Analysed by B.P. Date 27-5-75

Colour White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate

Roundness : Mean : 0.4

16-84% Range : 0.3 — 0.5

Qualitative : Sub-Angular

Sphericity : Mean : 0.81 — 0.89

16-84% Range : 0.85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 25	Heavy Minerals % < ½
Feldspar %	Clay %
Rock Fragments %	Mica % ½
Carbonate Allochem % 74½	Organic Matter %
Chert %	Others % ½

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets 5	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (C) Staurolite (F)

Rutile (P) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartzose Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3036 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 9490 N / 7165 E Analysed by B.P. Date 27-5-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 89 Mud % 10

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate

Roundness : Mean : 0.4

16-84% Range : 0.3 – 0.5

Qualitative : Sub-Angular

Sphericity : Mean : 0.31

16-84% Range : 0.75 – 0.37

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	25	Heavy Minerals %	< ½
Feldspar %		Clay %	
Rock Fragments %		Mica %	TR.
Carbonate Allochem %	74	Organic Matter %	
Chert %		Others %	1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites		Pisolites	
Pellets	5	Intraclasts	
Micrite/Sparite	95	Lumps	

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia		Decapoda	
Gasteropoda		Coral Frags.	
Echinodermata		Foraminifera	
Sponge Spicules		Ostracoda	
Algae		Others	

HEAVY MINERAL TYPES

Ilmenite, Staurolite, Tourmaline

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartzose Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3037 Stratigraphic Unit BRIDGEWATER Fm.

Location MUNDULLA 8160 N / 6045 E Analysed by B P. Date 27-5-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.25 - 0.63

Sorting : Moderate — Well

Roundness : Mean : 0.4

16-84% Range : 0.3 - 0.5

Qualitative : Sub-Angular

Sphericity : Mean : 0.83

16-84% Range : 0.79 - 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	60	Heavy Minerals %	< ½
Feldspar %		Clay %	
Rock Fragments %		Mica %	TRACE
Carbonate Allochem %	38	Organic Matter %	
Chert %	2	Others %	

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites		Pisolites	
Pellets	5	Intraclasts	
Micrite/Sparite	9	Lumps	

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100:00

Lamellibranchia		Decapoda	
Gasteropoda		Coral Frags.	100
Echinodermata		Foraminifera	
Sponge Spicules		Ostracoda	
Algae		Others	

HEAVY MINERAL TYPES

Ilmenite	(A)	Staurolite	(F)
Rutile	(C)	Tourmaline	(F)
Zircon	(P)	Leucoxene	(P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3038 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 8160N / 6045E Analysed by B. P. Date 27-5-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium – Hard

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·3

16-84% Range : 0·2 – 0·4

Qualitative : Angular

Sphericity : Mean : 0·85

16-84% Range : 0·81 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	79	Heavy Minerals %	< ½
Feldspar %		Clay %	
Rock Fragments %		Mica %	Trace
Carbonate Allochem %	20	Organic Matter %	
Chert %		Others %	1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites		Pisolites	
Pellets		Intraclasts	
Micrite/Sparite	95	Lumps	

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia		Decapoda	
Gasteropoda	10	Coral Frags.	20
Echinodermata		Foraminifera	
Sponge Spicules	70	Ostracoda	
Algae		Others	

HEAVY MINERAL TYPES

Rutile (C) Ilmenite (A) Monazite ?? (P)
Spinel (F) Tourmaline (C)
Zircon (F) Staurolite (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3039 Stratigraphic Unit Bridgewater ? Soil Development

Location MUNDULLA 7730N/6240E Analysed by B.P. Date 27-5-75

Colour Brown

Bedding/Lamination —

Porosity Porous

Hardness Soft - Medium

Cementation : degree Slightly

: composition Clay and Carbonate

Reaction to HCl Weak

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 74 Mud % 25

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.25-0.063

Sorting : Moderate — Good

Roundness : Mean : 0.3

16-84% Range : 0.2 — 0.4

Qualitative : Angular

Sphericity : Mean : 0.85

16-84% Range : 0.79 — 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Clayey Sand

PETROGRAPHIC CHARACTER

Quartz %	65	Heavy Minerals %	< ½
Feldspar %		Clay %	25
Rock Fragments %		Mica %	
Carbonate Allochem %	10	Organic Matter %	
Chert %		Others %	

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites		Pisolites	
Pellets		Intraclasts	
Micrite/Sparite	50	Lumps	50

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (C) Rutile (C)
Staurolite (C) Spinel (P)
Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Sub Greywacke

(Due to Weathering Soil Development)

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3040 Stratigraphic Unit Bridgewater Fm.

Location MUNDULLA 7730 N / 6240 E Analysed by B.P. Date 27-5-75

Colour Light Brown

Bedding/Lamination —

Porosity Slight

Hardness Very Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

Unable To Disaggregate

TEXTURAL CHARACTER

Method of Investigation

Nil

Gravel % Sand % Mud %

Modality Unimodal

Grain Size : Mean : ~ 0·125

16-84% Range :

Sorting : Moderate

Roundness : Mean : 0·3

16-84% Range : 0·2 – 0·4

Qualitative : Angular

Sphericity : Mean : 0·85

16-84% Range : 0·79 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 84	Heavy Minerals % ~ ½
Feldspar %	Clay %
Rock Fragments %	Mica % ½
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % ½

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 15	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Unable To Determine

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3041 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 7260N / 5900E Analysed by B.P. Date 28-3-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar + Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Moderate – Good

Roundness : Mean : 0·5

16-84% Range : 0·4 – 0·6

Qualitative : Subrounded

Sphericity : Mean : 0·85

16-84% Range : 0·81 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 72	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 25	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps 5

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. 100
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Kyanite (P) Staurolite (C
Rutile (C) Spinel (P) Tourmaline (F
Zircon (P) Magnetite (P) Monazite ?? (P

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3042 Stratigraphic Unit Bridgewater Formation

Location Mundulla 6300 N / 6325 E Analysed by B.P. Date 28-5-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium - Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate - Well

Roundness : Mean : 0·3

16-84% Range : 0·2 - 0·4

Qualitative : Angular

Sphericity : Mean : 0·83

16-84% Range : 0·77 - 0·37

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	77	Heavy Minerals %	< ½
Feldspar %		Clay %	2
Rock Fragments %		Mica %	
Carbonate Allochem %	20	Organic Matter %	
Chert %		Others %	1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, Tourmaline, Fe_2O_3

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3043 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6250N / 6335E Analysed by B.P. Date 28-5-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·063

Sorting : Moderate

Roundness : Mean : 0·2

16-84% Range : 0·1 – 0·3

Qualitative Very Angular

Sphericity : Mean : 0·77

16-84% Range : 0·69 – 0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION Sand

PETROGRAPHIC CHARACTER

Quartz %	80½	Heavy Minerals %	< ½
Feldspar %		Clay %	5
Rock Fragments %	½	Mica %	Trace
Carbonate Allochem %	15	Organic Matter %	
Chert %		Others %	1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites		Pisolites	
Pellets		Intraclasts	
Micrite/Sparite	95	Lumps	5

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (F)
Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3044 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6595 N / 6840 E Analysed by B.P. Date 28-5-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium Hard

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate — Well

Roundness : Mean : 0.3

16-84% Range : 0.2-0.4

Qualitative : Angular

Sphericity : Mean : 0.83

16-84% Range : 0.77-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 87	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments % ½	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % ½

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 100	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Rutile (F)
Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3045 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6760N/7060E Analysed by B.P. Date 28-5-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium – Hard

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate – Good

Roundness : Mean : 0·6

16-84% Range : 0·5–0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·83–0·93

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz %	82	Heavy Minerals %	< ½
Feldspar %		Clay %	2
Rock Fragments %	1	Mica %	
Carbonate Allochem %	10	Organic Matter %	
Chert %	5	Others %	

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites		Pisolites	
Pellets		Intraclasts	
Micrite/Sparite	90	Lumps	5

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 95 % Broken, 5 % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	10	Decapoda	
Gasteropoda		Coral Frags.	
Echinodermata		Foraminifera	
Sponge Spicules	90	Ostracoda	
Algae		Others	

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F)

Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3046 Stratigraphic Unit Bridgewater Formation

Location MONDULLA 6770 N/7070 E Analysed by B.P. Date 28-5-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Medium - Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range :

Sorting : Moderate

Roundness : Mean : 0·3

16-84% Range : 0·2—0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·85

16-84% Range : 0·81—0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 87	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 100	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite, Tourmaline,

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3047 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6070 N / 7690 E Analysed by B.P. Date 28-5-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 89 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate — Good

Roundness : Mean : 0·5

16-84% Range : 0·4 - 0·6

Qualitative : Sub Angular - Sub Rounded

Sphericity : Mean : 0·83

16-84% Range : 0·77 - 0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 79	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Zircon (P) Staurolite (C)
Rutile (C) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3048 Stratigraphic Unit Bridgewater Formation

Location MUNDOLLA 6070N 7690E Analysed by B.P. Date 28-5-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 89 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·063

Sorting : Moderate

Roundness : Mean : 0·3

16-84% Range : 0·2 – 0·4

Qualitative : Angular

Sphericity : Mean : 0·79

16-84% Range : 0·73 – 0·87

Qualitative :

Surface and/or Special Textures Some Larger Grains Frosted

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 84	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets 10	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F)
Staurolite (C) Zircon (P)
Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3049 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6070 N / 7640 E Analysed by B.P. Date 29-5-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Soft - Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·3

16-84% Range : 0·2- 0·4

Qualitative : Angular

Sphericity : Mean : 0·83

16-84% Range : 0·77-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 77	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 20	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A)

Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3050 Stratigraphic Unit Bridgewater Formation

Location MUNDOLLA 6060N/7690E Analysed by B.P. Date 29-5-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate

Roundness : Mean : 0.4

16-84% Range : 0.3 - 0.6

Qualitative : Sub Angular

Sphericity : Mean : 0.83

16-84% Range : 0.77-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 82	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Spinel (C)

Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3051 Stratigraphic Unit Molineaux Sand

Location MUNDULLA 6200N / 7735E Analysed by B.P. Date 29-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree —

: composition —

Reaction to HCl Nil

Mode of Disaggregation Nil

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.25–0.063

Sorting : Moderate — Good

Roundness : Mean : 0.2

16-84% Range : 0.1 — 0.3

Qualitative Very Angular

Sphericity : Mean : 0.77

16-84% Range : 0.69–0.97

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 96	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter % 1
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

CHEMICAL OR AUTHIGENIC MINERALS

Ilmenite (A) Rutile (F) Leucoxene (P

Staurolite (C) Zircon (P)

Tourmaline (C) Spinel (P)

ROCK TYPE

Quartz Sand

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3052 Stratigraphic Unit Bridgewater Formation

Location MUNDULLA 6365N / 7605E Analysed by B.P. Date 29-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.25-0.063

Sorting : Moderate

Roundness : Mean : 0.5

16-84% Range : 0.4-0.6

Qualitative : Sub Angular - Sub Rounded

Sphericity : Mean : 0.85

16-84% Range : 0.79-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 82	Heavy Minerals % < 1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets 10	Intraclasts
Micrite/Sparite 80	Lumps 10

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Tourmaline (C), Spinel (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3053 Stratigraphic Unit BRIDGEWATER FORMATION

Location KEPPOCH 5870 N / 7630 E Analysed by B.P. Date 29-5-75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness SOFT — MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE AND PANNING

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25 - 0·063

Sorting : MODERATE

Roundness : Mean : 0·3

16-84% Range : 0·2 - 0·4

Qualitative : SUB ANGULAR

Sphericity : Mean : 0·85

16-84% Range : 0·79 - 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 97	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps 10

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (F) MONAZITE ?? (F
STAUROLITE (C) ZIRCON (F) MAGNETITE (P
RUTILE (C) SPINEL (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3054 Stratigraphic Unit Bridgewater Formation

Location Keppoch 5870 N / 7640 E Analysed by B. P. Date 29-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 2 Sand % 93 Mud % 5

Modality Unimodal ?

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate — Poor

Roundness : Mean : 0·4

16-84% Range : 0·3 — 0·6

Qualitative Sub Angular To Sub Rounded

Sphericity : Mean : 0·85

16-84% Range : 0·77 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 82	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. 50
Echinodermata	Foraminifera
Sponge Spicules 50	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (C) Leucoxene (F)
Staurolite (C) Zirlon (F) Monazite ?? (P)
Tourmaline (C) Spinel (F) Magnetite (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3055 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 5650 N / 7690 E Analysed by B.P. Date 29-5-75

Colour Yellow - White

Bedding/Lamination Minor x Bedding

Porosity Porous

Hardness Soft - Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·3 - 0·6

Qualitative Sub Angular To Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·69-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 82	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 50
Sponge Spicules 50	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Tourmaline (F), Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3056 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 5650N / 7690E Analysed by B.P. Date 29-5-75

Colour White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Nil

: composition

Reaction to HCl Slight

Mode of Disaggregation

Nil

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % 3 Sand % 92 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 1·25-0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·4-0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·69-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 91½	Heavy Minerals % ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 5	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Zircon (C) Leucoxene (F)
Staurolite (C) Kyanite (F) Spinel (P)
Rutile (C) Tourmaline (F) Garnet ?? (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sand

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3057 Stratigraphic Unit Bridgewater Formation

Location Keppoch 5650 N / 7690 E Analysed by B.P. Date 29-5-75

Colour Grey-White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Nil

TEXTURAL CHARACTER

Method of Investigation Microscope

Gravel % 1 Sand % ~94 Mud % ~5

Modality ~ 1·25

Grain Size : Mean :

16-84% Range :

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·3 — 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·81

16-84% Range : 0·75 — 0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % ~ 72	Heavy Minerals % < ½
Feldspar %	Clay % ~ 2
Rock Fragments %	Mica %
Carbonate Allochem % 25	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps 10

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 40	Decapoda
Gasteropoda 20	Coral Frags.
Echinodermata	Foraminifera 20
Sponge Spicules 20	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Unable To Determine

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3058 KEPPOCH Stratigraphic Unit Bridgewater Formation

Location 5560 N / 7545 E Analysed by B.P. Date 29-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 2 Sand % 93 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·3 - 0·6

Qualitative : Sub Rounded

Sphericity : Mean : 0·93

16-84% Range : 0·75-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 81	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A)	Zircon	(F)
Staurolite	(C)	Tourmaline	(F)
Rutile	(C)	Kyanite	(P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3059 Stratigraphic Unit Bridgewater Formation

Location Keppoch 5520 N / 7480 E Analysed by B.P. Date 29-5-75

Colour Yellow-White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·3 — 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·81

16-84% Range : 0·75—0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 81	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (C) Leucoxene (P)
Tourmaline (C) Spinel (P)
Staurolite (C) Zircon (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3065 Stratigraphic Unit Bridgewater Formation

Location Keppoch. 55·40 N / 64·00 E Analysed by B.B. Date 17-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 93 Mud % 7

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·2—0·6

Qualitative : Sub-Angular

Sphericity : Mean : 0·81

16-84% Range : 0·73-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % Trace
Feldspar %	Clay % 4
Rock Fragments %	Mica %
Carbonate Allochem % 36	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Tourmaline (A)
Ilmenite (A)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3069 Stratigraphic Unit Bridgewater Formation

Location Keppoch. 53·95 N / 59·25 E Analysed by B.B. Date 17-6-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·2 – 0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·77

16-84% Range : 0·63 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 65	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 33	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 70 : 30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F) Tourmaline (C)
Leucoxene (A) Zircon (F) Monazite (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3071 Stratigraphic Unit Bridgewater Formation

Location Keppoch 51·90N / 57·30 E Analysed by B.B. Date 17-6-75

Colour Pink – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·2 – 0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·77

16-84% Range : 0·63 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 40

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 60	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80 % Broken, 20 % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (C) Zircon (F)
Leucoxene (A) Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Strongly Calcareous, Shelly, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3073 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH. 48·70N / 58·40E Analysed by B.B. Date 17-6-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56–0·125

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·2 – 0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·83

16-84% Range : 0·75 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % << ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 43	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Leucoxene (A) Ilmenite (A) Rutile (F)
Tourmaline (C) Hornblende (F) Zircon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly, Strongly Calcareous, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3078 Stratigraphic Unit Bridgewater Formation

Location Keppoch 44·70 N / 66·85 E Analysed by B.B. Date 4-6-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·125

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·83

16-84% Range : 0·79-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 63	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 35	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Staurolite (F) Zircon (F

Rutile (C) Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3080 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 42·65N / 59·85E Analysed by B.B. Date 17-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition
Partially Siliceous
Mostly Calcareous

Reaction to HCl Strong

Mode of Disaggregation
Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation
Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·2—0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·79

16-84% Range : 0·63—0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 38	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 70 : 30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Leucoxene (A)? Zircon (C) Rutile (C) Staurolite (C) Monazite (F) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE Slightly Shelly, Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3082 Stratigraphic Unit Bridgewater Formation

Location Keppoch. 34·85 N / 66·70 E Analysed by B.B. Date 18-6-75

Colour Yellow-White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·81

16-84% Range : 0·75-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 38	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Leucoxene (A) Tourmaline (A)
Rutile (C) Zircon (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3085 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 3895 N / 6840 E Analysed by B.P. Date 29-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 056-0063

Sorting : Poor

Roundness : Mean : 0·3

16-84% Range : 0·2 – 0·4

Qualitative : Angular

Sphericity : Mean : 0·81

16-84% Range : 0·71–0·89

Qualitative :

Surface and/or Special Textures Larger Grains Rounder

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 30 : 70

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 70
Sponge Spicules 30	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Rutile (F), Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3086 Stratigraphic Unit Bridgewater Formation

Location Keppoch 3895 N / 6840 E Analysed by B. P. Date 29-5-75

Colour Yellow

Bedding/Lamination Faint

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Uni ? or Bi ?

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate — Poor

Roundness : Mean : 0·3

16-84% Range : 0·2 — 0·4

Qualitative : Angular

Sphericity : Mean : 0·83

16-84% Range : 0·75 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 77	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 20	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 15

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 85	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 10 : 90

Lamellibranchia 10 ?	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 70
Sponge Spicules 20	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Staurolite (C), Spinel (P)
Tourmaline (C), Rutile (F), Zircon (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3087 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 38·95 N / 68·40 E Analysed by B. P. Date 30-5-75

Colour Yellow

Bedding/~~Lamination~~ Thin Parallel

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 3 Sand % 92 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·3—0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·83

16-84% Range : 0·77—0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 15 : 85

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 85
Sponge Spicules 15	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A),	Zircon	(P)
Staurolite	(C),	Kyanite	(P)
Rutile	(F),	Magnetite	(P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3088 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 3895 N / 6840 E Analysed by B.P. Date 30-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 5 Sand % 90 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·25

16-84% Range : 1·25 — 0·125

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·3 — 0·5

Qualitative : Sb Angular

Sphericity : Mean : 0·81

16-84% Range : 0·73 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 87	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 50 % Broken, 50 % Complete

Macrofossil % : Microfossil % = 20 : 80

Lamellibranchia 5 ?	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 80
Sponge Spicules 15	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

CHEMICAL OR AUTHIGENIC MINERALS

Ilmenite

(Only H.M. Discernable)

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3089 Stratigraphic Unit Bridgewater Formation

Location KEEPOCH 3895 N / 6240 E Analysed by B. P. Date 30-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 5 Sand % 93 Mud % 2

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 1·25 — 0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·4 — 0·6

Qualitative : Sub Angular To Sub Rounded

Sphericity : Mean : 0·81

16-84% Range : 0·73 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 88	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90% Broken, 10 % Complete

Macrofossil % : Microfossil % = 30 : 70

Lamellibranchia 5 ??	Decapoda
Gasteropoda	Coral Frags.
Echinodermata 5 ??	Foraminifera 70
Sponge Spicules 20	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Tourmaline (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3095 Stratigraphic Unit BRIDGEWATER FM.

Location CANNAWIGARA. 00-00N/6295E Analysed by B.B. Date 10/6/75

Colour YELLOW

Bedding/Lamination -

Porosity POROUS

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition

MAINLY SILICEOUS

PARTIALLY CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation

MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE + PANNING.

Gravel % Sand % 97 Mud % 3

Modality BIMODAL.

Grain Size : Mean : 0·25

16-84% Range 0·57-0·03

Sorting : MODERATE.

Roundness : Mean : 0·7

16-84% Range 0·5-0·9

Qualitative : ROUNDED

Sphericity : Mean : 0·75

16-84% Range : 0·61-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 80	Heavy Minerals % TRAC
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 18	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

LEUCOXENE (A)
ILMENITE (C)
GARNET (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3099 Stratigraphic Unit BRIDGEWATER Fm.

Location CANNAWIGARA 95·00N/63·60E Analysed by R.B. Date 11/6/75

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS.

Hardness MEDIUM

Cementation : degree CEMENTED.

: composition

MOSTLY SILICEOUS.

PARTIALLY CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation

MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 0·2-0·8

Qualitative SUBROUNDED

Sphericity : Mean : 0·75

16-84% Range : 0·61-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 81	Heavy Minerals % < 1/2
Feldspar %	Clay % 4
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) GARNET (C) RUTILE (P)
LEUCOXENE (A) ZIRCON (F) KYANITE (P)
TOURMALINE (C) MONAZITE (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3101 Stratigraphic Unit BRIDGEWATER Fm.

Location CANNAWIGARA. 96·35N/59·10E Analysed by B.B. Date 11/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 90 Mud % 10

Modality UNIMODAL

Grain Size : Mean : 0·25

16-84% Range : 0·37-0·125

Sorting : MODERATE

Roundness : Mean : 0·5

16-84% Range : 0·3-0·8

Qualitative SUBROUNDED

Sphericity : Mean : 0·81

16-84% Range : 0·75-0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

MUDDY SAND.

PETROGRAPHIC CHARACTER

Quartz % 35	Heavy Minerals % 2½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 60	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite / 00	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C) ZIRCON (F
LEUCOXENE (C) STAUROLITE (C)
GARNET (C) RUTILE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3102 Stratigraphic Unit BRIDGEWATER FM.

Location CANNAWIGARA. 58·4ON/62·70E Analysed by B.B. Date 11/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·125-0·063

Sorting : WELL.

Roundness : Mean : 0·5

16-84% Range : 0·3-0·8

Qualitative : SUBANGULAR

Sphericity : Mean : 0·71

16-84% Range : 0·57-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % 2 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 60

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 40	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80 % Broken, 20 % Complete

Macrofossil % : Microfossil % = 70:30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	STAUROLITE	(F)
RUTILE	(F)	LEUCOXENE	(F)
TOURMALINE	(C)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY, STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3104 Stratigraphic Unit ? WATER BORE SAMPLE - DEPTH UNKNOWN

Location CANNAWIGARA 92·40N/59·60E Analysed by B.B. Date 12/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness VERY SOFT

Cementation : degree —

: composition —

Reaction to HCl WEAK.

Mode of Disaggregation

—

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 99 Mud % 1

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : MODERATE

Roundness : Mean : 0·6

16-84% Range : 0·3 - 0·9

Qualitative : ROUNDED

Sphericity : Mean : 0·81

16-84% Range : 0·73-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 78	Heavy Minerals % ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 20	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50:50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C) MONAZITE (P)
RUTILE (C) ZIRCON (F)
STAUROLITE (C) GARNET (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SAND.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3106 Stratigraphic Unit UPPER BRIDGEWATER Fm.

Location KEITH. 05·40N/44·60E Analysed by B.B. Date 11/6/75

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition

PARTIALLY SILICEOUS
PARTIALLY CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation

MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE + PANNING

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0.125

16-84% Range : 0.25-0.063

Sorting : POOR

Roundness : Mean : 0.4

16-84% Range : 0.2-0.6

Qualitative : SUBANGULAR

Sphericity : Mean : 0.81

16-84% Range : 0.75-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz %60	Heavy Minerals %¼-½
Feldspar %	Clay %3
Rock Fragments %	Mica %
Carbonate Allochem %36½	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: /0

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : /00 % Broken, % Complete

Macrofossil % : Microfossil % =100:00

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	ZIRCON	(F)
RUTILE	(F)	GARNET	(C)
TOURMALINE	(C)	STAUROLITE	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3108 Stratigraphic Unit LOWER BRIDGEWATER FM.

Location KEITH. 06·60N/44·55E Analysed by B.B. Date 11/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition

MOSTLY CALCAREOUS

PARTIALLY SILICEOUS.

Reaction to HCl STRONG.

Mode of Disaggregation

MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 90 Mud % 10

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·52 - 0·06

Sorting : POOR.

Roundness : Mean : 0·4

16-84% Range : 0·2 - 0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·77

16-84% Range : 0·67 - 0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

MUDDY SAND.

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < 1/2
Feldspar %	Clay % 7
Rock Fragments %	Mica %
Carbonate Allochem % 33	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (C) KYANITE (P)
RUTILE (C) TOURMALINE (C)
ZIRCON (C) GARNET (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3109 Stratigraphic Unit LOWER BRIDGEWATER FM

Location KEITH. 06-50N/47.40E Analysed by B.B. Date 11/6/75

Colour YELLOW-WHITE.

Bedding/Lamination —

Porosity POROUS.

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : MODERATE.

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative SUBROUNDED

Sphericity : Mean : 0·77

16-84% Range : 0·67-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 79½	Heavy Minerals % ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites.	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

LEUCOXENE (A) STAUROLITE (F) ZIRCON (F)
ILMENITE (A) TOURMALINE (C)
RUTILE (C) MAGNETITE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3111 Stratigraphic Unit LOWER BRIDGEWATER Fm.

Location KEITH. 10.40N/51.50E Analysed by B.B. Date 12/6/75

Colour PINK - WHITE.

Bedding/Lamination -

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : MODERATE

Roundness : Mean : 0·4

16-84% Range : 0·2-0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·77

16-84% Range : 0·67-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % 2½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 57	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 60:40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C)
RUTILE (C) STAUROLITE (F)
ZIRCON (C) GARNET (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3114 Stratigraphic Unit BRIDGEWATER Fm.

Location KEITH 12·05N/40·80E Analysed by B.B. Date 12/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : POOR.

Roundness : Mean : 04

16-84% Range : 0·2–0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·71

16-84% Range : 0·57–0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 35	Heavy Minerals % << 1/2
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 60	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 90:10

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C) STAUROLITE (P)
LEUCOXENE (A) ZIRCON (F)
RUTILE (C) GARNET (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3116 Stratigraphic Unit BRIDGEWATER Fm.

Location KEITH 09·80N/33·70E Analysed by B.B. Date 12/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS

Hardness MODERATE

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2 – 0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·81

16-84% Range : 0·75-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 50	Heavy Minerals % << 1/2
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 45	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

TOURMALINE (A) RUTILE (F)
ILMENITE (A) STAUROLITE (F)
LEUCOXENE (C) GARNET (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3119 Stratigraphic Unit Bridgewater Formation

Location KEITH 99·90N / 45·80E Analysed by B.P. Date 30-5-75

Colour Pink – White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 90 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·4 – 0·6

Qualitative : Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·83 – 0·93

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 78½	Heavy Minerals % ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites.	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 70 % Broken, 30 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 20	Decapoda 5
Gasteropoda 30	Coral Frags. 5
Echinodermata	Foraminifera 20
Sponge Spicules 20	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Kyanite (F) Leucoxene (P)
Staurolite (C), Zircon (F) Spinel (P)
Rutile (C) Magnetite (F) Garnet (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3120 Stratigraphic Unit Bridgewater Formation

Location KEITH 99·90 N / 45·80 E Analysed by B.P. Date 30-5-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Soft – Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 90 Mud % 10

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·4-0·6

Qualitative : Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·83-0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 79	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 15

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 85	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 20 ?	Decapoda
Gasteropoda 30 ?	Coral Frags.
Echinodermata	Foraminifera 20
Sponge Spicules 30	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Staurolite (C), Rutile (F)
Zircon (P), Tourmaline (P), Kyanite (P)
Spinel (P) Leucoxene (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3121 Stratigraphic Unit Bridgewater Formation

Location Keith. 99·90 N / 45·80 E Analysed by B. P. Date 30-5-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Soft – Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 90 Mud % 10

Modality Unimodal ?

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·3 – 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·87

16-84% Range : 0·81 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 78½	Heavy Minerals % ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 15	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts 30
Micrite/Sparite 60	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 00

Lamellibranchia 50 ?	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 50 ?	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Rutile (C), Spinel (P)
Staurolite (C), Kyanite (F), Magnetite (P)
Tourmaline (C) Zircon (F) Garnet (P)

CHEMICAL OR AUTHIGENIC MINERALS Leucoxene (F)

ROCK TYPE

Sub. Intraclastic, Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3122 Stratigraphic Unit BRIDGEWATER Fm.

Location KEITH. 96.65N/53.55E Analysed by B.B. Date 12/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS.

Hardness HARD.

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0.125

16-84% Range 0.25-0.063

Sorting : POOR.

Roundness : Mean : 0.4

16-84% Range : 0.2—0.6

Qualitative SUBANGULAR

Sphericity : Mean : 0.77

16-84% Range : 0.67-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % << 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 57	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80 % Broken, 20 % Complete

Macrofossil % : Microfossil % = 80:20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules ✓	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) GARNET (C) LEUCOXENE (F)
TOURMALINE (A) STAUROLITE (F)
RUTILE (C) ZIRCON (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

QUARTZOSE SHELLY CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3123. Stratigraphic Unit BRIDGEWATER FM.

Location KEITH. 94.20N/57.60E Analysed by B.B. Date 12/6/75

Colour WHITE

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 0.25 – 0.063

Sorting : POOR.

Roundness : Mean : 0.4

16-84% Range : 02 – 06

Qualitative SUBANGULAR

Sphericity : Mean : 0.81

16-84% Range : 073 – 089

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 50	Heavy Minerals % 1½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 47	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

LEUCOXENE (A) RUTILE (F) MONAZITE (P)
ILMENITE (A) ZIRCON (F)
TOURMALINE (C) HORNBLENDE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3125 Stratigraphic Unit BRIDGEWATER Fm

Location KEITH. 89·00N/51·70E Analysed by B.B Date 12/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·79

16-84% Range : 0·69–0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % << 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20	
Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80:20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) – GENERALLY COATED WITH LEUCOXENE.
RUTILE (C) ZIRCON (F) GARNET (P)
TOURMALINE (F) LEUCOXENE (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE SLIGHTLY SHELLY, STRONGLY CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3126 Stratigraphic Unit BRIDGEWATER Fm.

Location KEITH. 89·40N/48·75E Analysed by B.B. Date 13/6/75

Colour WHITE-BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl VERY STRONG

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 90 Mud % 10

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·067

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·1–0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·73

16-84% Range : 0·63–0·83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

MUDDY SAND.

PETROGRAPHIC CHARACTER

Quartz % 20	Heavy Minerals % TRACE
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 77	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (F)
LEUCOXENE (C)
TOURMALINE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY QUARTZOSE CALCARENITE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3128 Stratigraphic Unit BRIDGEWATER FM.

Location KEITH 92.35N/42.66E Analysed by B.B. Date 12/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS

Hardness SOFT.

Cementation : degree SLIGHTLY CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : MODERATE

Roundness : Mean : 0·3

16-84% Range : 0·1-0·6

Qualitative SUBANGULAR

Sphericity : Mean : 0·77

16-84% Range : 0·67-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % TRACE
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 57	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80 % Broken, 20 % Complete

Macrofossil % : Microfossil % = 80:20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules ✓	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

LEUCOXENE (A)
ILMENITE (C)
TOURMALINE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3130 Stratigraphic Unit BRIDGEWATER Fm.

Location KEITH. 90·15N/34·55E Analysed by B.B Date 17/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR + PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING

Gravel % Sand % 90 Mud % 10

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·067

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2-0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·78

16-84% Range : 0·69-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

MUDDY SAND

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % < 1/2
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 25	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) ZIRCON (C) LEUCOXENE (F)
TOURMALINE (A) HORNBLENDE (C)
GARNET (C) RUTILE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3132 Stratigraphic Unit Bridgewater Formation

Location LAFFER. 92.05N / 26.90E Analysed by B.B. Date 17-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

—

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 93 Mud % 7

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.25–0.063

Sorting : Poor

Roundness : Mean : 0.4

16-84% Range : 0.2—0.6

Qualitative : Sub Angular

Sphericity : Mean : 0.79

16-84% Range : 0.69–0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 65	Heavy Minerals % Trace
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 32	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (A) Zircon (F)
Hornblende (C)? Leucoxene (C)?

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3136 Stratigraphic Unit Bridgewater Formation

Location LAFFER 09·65 N / 20·55 E Analysed by B. B. Date 17-6-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 93 Mud % 7

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·83

16-84% Range : 0·73–0·93

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % << ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (A) Zircon (C) Garnet (F) Hornblende (F)? Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3141 Stratigraphic Unit Bridgewater Formation

Location TINTINARA C. 59·00N / 0·6·20 E Analysed by B.B. Date 17-6-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation —

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 93 Mud % 7

Modality Bimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate

Roundness : Mean : 0.4

16-84% Range : 0.2 — 0.6

Qualitative : Sub Angular

Sphericity : Mean : 0.77

16-84% Range : 0.67 — 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 72	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 25	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (A) Leucoxene (C) ?
Rutile (F) Monazite (F) Hornblende (F) ?
Garnet (F) Zircon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3142 Stratigraphic Unit Bridgewater Formation

Location LAFFER. 12·60 N / 10·55 E Analysed by B.B. Date 4-6-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 80 Mud % 20

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·3 — 0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·79

16-84% Range : 0·69 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Muddy Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < ½
Feldspar %	Clay % 10
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A)	Rutile	(C)
Tourmaline	(C)	Staurolite	(C)
Zircon	(P)	Monazite	(P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous, Clayey, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3143 Stratigraphic Unit Bridgewater Formation

Location LAFFER. 06·80N / 15·90E Analysed by B.B. Date 17-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Weak

Mode of Disaggregation

—

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·83

16-84% Range : 0·73–0·93

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 88	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (A) Garnet (C)
Rutile (C) Monazite (F)
Zircon (F) Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3145 Stratigraphic Unit BRIDGEWATER Fm.

Location WILLALOOKA 53·70N/52·50E Analysed by R.B. Date 13/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.03

Sorting : POOR

Roundness : Mean : 0.5

16-84% Range : 0.2-0.8

Qualitative SUBROUNDED

Sphericity : Mean : 0.77

16-84% Range : 0.67-0.87

Qualitativa :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 37	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) ZIRCON (C) GARNET (P)
TOURMALINE (C) STAUROLITE (F) MONAZITE (P)
RUTILE (C) LEUCOXENE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3148 Stratigraphic Unit BRIDGEWATER FM.

Location WILLALOOKA. 84·05N/48·55E Analysed by B.B Date 12/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS.

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR + PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 0·2–0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·79

16-84% Range : 0·69–0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % 2 1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 43	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 70:30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) LEUCOXENE (F)
RUTILE (C) ZIRCON (F)
TOURMALINE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3149 Stratigraphic Unit 'Alluvial Drainage Sample'

Location Willalooka 77·70N / 41·30E Analysed by B.B. Date 6-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree —

: composition —

Reaction to HCl Very Weak

Mode of Disaggregation

Nil

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 99 Mud % 1

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·3 — 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·69-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 95	Heavy Minerals % ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 4	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Zircon (C) Leucoxene (C)
Rutile (C) Staurolite (C) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sand

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3150 Stratigraphic Unit Bridgewater Formation

Location Willalooka 77·70 N / 41·30 E Analysed by B.B. Date 4-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree —

: composition —

Reaction to HCl Nil

Mode of Disaggregation

—

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Well

Roundness : Mean : 0·3

16-84% Range : 0·2–0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·73

16-84% Range : 0·6–0·83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 97	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem %	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (F)
Rutile (F) Zircon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sand

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3151 Stratigraphic Unit Bridgewater Formation

Location. Willalooka - 77·70N / 41·30E Analysed by B.B. Date 5-6-75

Colour Yellow - White

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Well

Roundness : Mean : 0·4

16-84% Range : 0·2 — 0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·83

16-84% Range : 0·77-0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 78	Heavy Minerals % < 1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 20	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F) Zircon (F) Staurolite (F) Tourmaline (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3152 Stratigraphic Unit Bridgewater Formation

Location Willalooka. 77·70 N / 41·30 E Analysed by B.B. Date 4-6-75

Colour Yellow-White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 93 Mud % 7

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Well

Roundness : Mean : 0·5

16-84% Range : 0·2–0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·67–0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 25	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (C)

Rutile (F) Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3153 Stratigraphic Unit Bridgewater Formation

Location Willalooka 77·70 N / 41·30 E Analysed by B.B. Date 4-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Well

Roundness : Mean : 0·5

16-84% Range : 0·2 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·83

16-84% Range : 0·75–0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % << ½
Feldspar %	Clay % 3
Rock Fragments %	Mica % 1
Carbonate Allochem % 26	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 40

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 60	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80% Broken, 20 % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Rutile (F), Zircon (P)
Tourmaline (C), Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous, Slightly Shelly, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3155 Stratigraphic Unit Bridgewater Formation

Location Willalooka. 77·25 N / 36·30 E Analysed by B.B. Date 18-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation —

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·2—0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·75

16-84% Range : 0·63—0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % 1/4
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 29	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (C) Zirion (F)
Rutile (A) Staurolite (F) Garnet (F)
Leucoxene (C) Hornblende (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3157 Stratigraphic Unit Bridgewater Formation

Location 70·80 N / 41·45 E Willalooka Analysed by B. P. Date 30-5-75

Colour Brown

Bedding/Lamination —

Porosity Porous

Hardness Soft - Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 1 Sand % 94 Mud % 5

Modality Bimodal ?

Grain Size : Mean : 0·125

16-84% Range : 0·56 - 0·63

Sorting : Poor

Roundness : Mean : 0·3

16-84% Range : 0·2 - 0·4

Qualitative : Angular

Sphericity : Mean : 0·85

16-84% Range : 0·83 - 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclaets
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80% Broken, 20 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 30	Decapoda
Gasteropoda 20	Coral Frags. 5
Echinodermata	Foraminifera 20
Sponge Spicules 25	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A)	Tourmaline	(F)
Staurolite	(C)	Rutile	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3158 Stratigraphic Unit Bridgewater Formation

Location Willalooka. 63.75 N / 44.03 E Analysed by B.P. Date 30-5-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft – Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.125

16-84% Range : 0.56–0.063

Sorting : Moderate – Good

Roundness : Mean : 0.3

16-84% Range : 0.2 – 0.4

Qualitative : Angular

Sphericity : Mean : 0.81

16-84% Range : 0.69 – 0.91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 92	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 4	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 95 : 5

Lamellibranchia 20 ?	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 5
Sponge Spicules 75	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Tourmaline (F)
Staurolite (C), Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3160 Stratigraphic Unit Bridgewater Formation

Location Willalooka. 61·40N / 46·25 E Analysed by B.P. Date 2-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Good

Roundness : Mean : 0·4

16-84% Range : 0·3 – 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·87

16-84% Range : 0·81 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 85	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 2

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 15

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 85	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 70 : 30

Lamellibranchia 40 ?	Decapoda
Gasteropoda 20 ?	Coral Frags.
Echinodermata	Foraminifera 30
Sponge Spicules 10	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A)	Rutile	(F)
Staurolite	(C)	Zircon	(P)
Tourmaline	(C)	Spinel	(P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3168 Stratigraphic Unit Bridgewater Formation

Location HYNAM. 09·00 N / 79·15 E Analysed by B. P. Date 2-6-75

Colour Yellow - Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Medium

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·4 - 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·83

16-84% Range : 0·73 - 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 86	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter % 1
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 40 ?	Decapoda
Gasteropoda	Coral Frags. 10
Echinodermata	Foraminifera 10
Sponge Spicules 40	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

CHEMICAL OR AUTHIGENIC MINERALS

Ilmenite (A)

Tourmaline (C)

ROCK TYPE

Slightly Calcareous, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3169 Stratigraphic Unit Bridgewater Formation

Location HYNAM. 09·00N / 79·15 E Analysed by B.P. Date 2-6-75

Colour Yellow - Green

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % 5 Sand % 90 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·56

16-84% Range : 1·25 – 0·125

Sorting : Poor

Roundness : Mean : 0·7

16-84% Range : 0·6 – 0·8

Qualitative : Sub Rounded To Round

Sphericity : Mean : 0·87

16-84% Range : 0·77 – 0·95

Qualitative :

Surface and/or Special Textures

Some Polishing and Frosting

TEXTURAL CLASSIFICATION

Slightly Gravelly Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 37	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 65

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 35	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 95 : 5

Lamellibranchia 8	Decapoda
Gasteropoda	Coral Frags. 30
Echinodermata	Foraminifera 2
Sponge Spicules 60	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Tourmaline (F)
Rutile (P), Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Shelly, Calcareous, Slightly Gravelly Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3170 Stratigraphic Unit Bridgewater Formation

Location HYNAM. 09·00N / 79·15E Analysed by B.P. Date 2-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness —

Cementation : degree Nil

: composition —

Reaction to HCl Strong

Mode of Disaggregation

Nil

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 90 Mud % 10

Modality Unimodal ?

Grain Size : Mean : 0.125

16-84% Range : 0.56-0.063

Sorting : Moderate

Roundness : Mean : 0.5

16-84% Range : 0.4 – 0.6

Qualitative : Sub Rounded

Sphericity : Mean : 0.83

16-84% Range : 0.77 – 0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 84½	Heavy Minerals % ½ – 1
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 00

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 100	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Zircon (C) Spinel (F
Staurolite (C), Tourmaline (F) Garnet (P
Rutile (C), Leucoxene (F) Magnetite (P

CHEMICAL OR AUTHIGENIC MINERALS Monazite (P

ROCK TYPE

Slightly Calcareous, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3173 Stratigraphic Unit Bridgewater Formation

Location Naracoorte. 13·20 N / 77·25 E Analysed by B.B. Date 18-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·2—0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·77

16-84% Range : 0·67-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 44	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Leucoxene (A) Ilmenite (A) Zircon (C) Tourmaline (C) Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Strongly Calcareous Slightly Shelly, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3176 Stratigraphic Unit Bridgewater Formation

Location Naracoorte 24·10 N / 71·25 E Analysed by B.B. Date 18-6-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·125

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·3 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·75

16-84% Range : 0·65–0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % < 1/2
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 39	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Leucoxene (A) Ilmenite (A) Rutile (C)
Tourmaline (F) Zircon (F) Garnet (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3178 Stratigraphic Unit Bridgewater Formation

Location NARACOORTE 25·45 N / 74·45 E Analysed by B.P. Date 2-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation

Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56 - 0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·4 — 0·6

Qualitative : Sub Angular to Sub Rounded

Sphericity : Mean : 0·85

16-84% Range : 0·79 - 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 82	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 90 : 10

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera 10
Sponge Spicules 90?	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A), Rutile (F)
Staurolite (C), Zircon (F)
Tourmaline (F), Spinel (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3179 Stratigraphic Unit Bridgewater Formation

Location NARACOORTE 25·45 N / 74·45 E Analysed by B.P. Date 2-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Soft - Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate

Roundness : Mean : 0·6

16-84% Range : 0·4 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·85

16-84% Range : 0·81 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 87	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 00

Lamellibranchia 20 ?	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 80	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (F) Leucoxene (
Staurolite (C) Spinel (F) Magnetite (
Rutile (C) Zircon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous, Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3180 Stratigraphic Unit Bridgewater Formation

Location Naracoorte 25·45N / 74·45E Analysed by B.P. Date 2-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate – Good

Roundness : Mean : 0·4

16-84% Range : 0·7 – 0·5

Qualitative : Sub Angular To Sub Rounded

Sphericity : Mean : 0·85

16-84% Range : 0·91 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 86	Heavy Minerals % << ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 10	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Leucoxene (P)
Tourmaline (C) Rutile (P)
Staurolite (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3185 Stratigraphic Unit Bridgewater Formation

Location HYNAM. 16·60N / 77·90E Analysed by B.B. Date 18-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0.25

16-84% Range : 0.56-0.063

Sorting : Poor

Roundness : Mean : 0.5

16-84% Range : 0.3—0.7

Qualitative : Sub Rounded

Sphericity : Mean : 0.81

16-84% Range : 0.73—0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 29	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Leucoxene (A) Ilmenite (A) Zircon (F) Tourmaline (C) Rutile (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3187 Stratigraphic Unit Bridgewater Formation

Location KEPPOCH 09·60N / 76·90E Analysed by B.B. Date 18-6-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 97 Mud % 3

Modality Unimodal

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·3 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·77

16-84% Range : 0·65-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % < ½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 44	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 40 : 60

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (C) Hornblende (F
Leucoxene (A) Staurolite (F)
Tourmaline (C) Zircon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Strongly Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3188 Stratigraphic Unit Bridgewater Formation

Location STRUAN. 01·02 N / 80·60 E Analysed by B.B. Date 18-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Hard

Cementation : degree Strongly

: composition Siliceous and Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·75

16-84% Range : 0·65–0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 28	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 95	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = —

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Leucoxene (A) Tourmaline (C
Rutile (C) Staurolite (F) Zirlon (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3193 Stratigraphic Unit Bridgewater Formation

Location Struan. 94·70N / 81·55E Analysed by B. P. Date 3-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·25

16-84% Range : 1·25—0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·3—0·6

Qualitative : Sub Angular

Sphericity : Mean : 0·85

16-84% Range : 0·77— 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 36	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica % 1
Carbonate Allochem % 60	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 60 % Broken, 40 % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia 10	Decapoda
Gasteropoda	Coral Frags. 10
Echinodermata	Foraminifera 40
Sponge Spicules 40	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (C)

Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly. Quartzose Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3194 Stratigraphic Unit BRIDGEWATER FM.

STRUAN

Location 94·25N/82·85E Analysed by B.B Date 13/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : POOR.

Roundness : Mean : 0·5

16-84% Range : 0·2–0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·75

16-84% Range : 0·65–0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % 1½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50·50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

LEUCOXENE	(A)	RUTILE	(F)
ILMENITE	(A)	STAURLITE	(F)
TOURMALINE	(A)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3195 Stratigraphic Unit Bridgewater Formation

Location STRUAN. 89·55N / 8720 E Analysed by B.P. Date 2-6-75

Colour Light Brown

Bedding/Lamination Faint

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 5 Sand % 90 Mud % 5

Modality Bimodal ?

Grain Size : Mean : 0·25

16-84% Range : 2·54 – 0·063

Sorting : Poor

Roundness : Mean : 0·4

16-84% Range : 0·3 — 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·85

16-84% Range : 0·79 — 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 61	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica % 1
Carbonate Allochem % 35	Organic Matter %
Chert %	Others % 1

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 5

Oolites	Pisolites
Pellets	Intraclasts 30
Micrite/Sparite 65	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 00

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 100	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (C) Magnetite (P)
Staurolite (C) Zircon (F)
Tourmaline (C) Garnet (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Sub-Intraclastic Calcareous Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3196 Stratigraphic Unit Bridgewater Formation

Location STRUAN 89·55 N / 87·20 E Analysed by B.P. Date 2-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness —

Cementation : degree Nil

: composition —

Reaction to HCl Strong

Mode of Disaggregation

Nil

TEXTURAL CHARACTER

Method of Investigation

Sieve and Panning

Gravel % Sand % 85 Mud % 15

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Good

Roundness : Mean : 0·5

16-84% Range : 0·4 — 0·6

Qualitative : Sub Angular To Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·85 — 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Muddy Sand

PETROGRAPHIC CHARACTER

Quartz % 25	Heavy Minerals % ½
Feldspar %	Clay % 10
Rock Fragments %	Mica % 2
Carbonate Allochem % 63	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 90

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 10	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 65% Broken, 35 % Complete

Macrofossil % : Microfossil % = 65 : 35

Lamellibranchia 5 ?	Decapoda
Gasteropoda	Coral Frags. 20
Echinodermata	Foraminifera 35
Sponge Spicules 25	Ostracoda
Algae 15	Others

HEAVY MINERAL TYPES

Ilmenite (A) Leucoxene (P) Zircon (C)
Rutile (C) Monazite (P)
Staurolite (C) Tourmaline (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Quartzose Shell Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3200 Stratigraphic Unit BRIDGEWATER FM

PENOLA.

Location 75.70N/94.45E Analysed by B.B. Date 13/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·77

16-84% Range : 0·67-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % <1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 43	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 90 : 10

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	RUTILE	(C)
LEUCOXENE	(A)	ZIRCON	(F)
TOURMALINE	(C)	MAGNETITE	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3201 Stratigraphic Unit BRIDGEWATER Fm.

Location NANGWARRY. 40.05N/90.60E Analysed by R.B. Date 5/6/75.

Colour YELLOW

Bedding/Lamination -

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 95 Mud %5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : WELL

Roundness : Mean : 0·4

16-84% Range : 0·2-0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·77

16-84% Range : 0·63-0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz %47	Heavy Minerals %<<1
Feldspar %	Clay %3
Rock Fragments %	Mica %
Carbonate Allochem %50	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 40

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 60	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda ✓	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	TOURMALINE	(C)
RUTILE	(C)	LEUCOXENE	(C)
STAUROLITE	(C)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY QUARTZOSE SHELLY CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3202 Stratigraphic Unit Bridgewater Formation

Location NANGWARRY. 30·00N / 88·80 E Analysed by B.P. Date 3-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56 – 0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·4 – 0·6

Qualitative : Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·83 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 15	Heavy Minerals % $< \frac{1}{2}$
Feldspar %	Clay % 2
Rock Fragments %	Mica % 1
Carbonate Allochem % 82	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 80

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 20	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 95 : 5

Lamellibranchia 10 ?	Decapoda
Gasteropoda	Coral Frags. 45
Echinodermata	Foraminifera 5
Sponge Spicules 40	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite	(A)	Staurolite	(F)
Rutile	(P)	Tourmaline	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Quartzose, Shell Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3203 Stratigraphic Unit BRIDGEWATER FM.

Location NANGWARRY. 23.40N/85.20E Analysed by B.B. Date 13/6/75

Colour BUFF

Bedding/Lamination –

Porosity POROUS.

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl VERY STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING

Gravel % Sand % 95 Mud %5

Modality UNIMODAL.

Grain Size : Mean : 0·25

16-84% Range : 0·56–0·063

Sorting : POOR.

Roundness : Mean : 0·3

16-84% Range : 01–0.6

Qualitative SUBANGULAR

Sphericity : Mean : 0·71

16-84% Range : 0·57–0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 20	Heavy Minerals % TRAC
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 78	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80:20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules ✓	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A)
TOURMALINE (C)
RUTILE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY, SLIGHTLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3204 Stratigraphic Unit Bridgewater Formation

Location NANGWARRY 24·20 N / 82·05 E Analysed by B.B. Date 3-6-75

Colour Yellow – White

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Slightly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·2

16-84% Range : 0·56 – 0·063

Sorting : Moderate

Roundness : Mean : 0·6

16-84% Range : 0·4 – 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·33

16-84% Range : 0·79 – 0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 5	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 93	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 90

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 10	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % = 85 : 15

Lamellibranchia 10 ?	Decapoda
Gasteropoda	Coral Frags. 50
Echinodermata	Foraminifera 15
Sponge Spicules 10	Ostracoda
Algae 15	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (F)

Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Shell Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3205 Stratigraphic Unit Bridgewater Formation

Location Nangwarry 24·02 N / 81·35 E Analysed by B.P. Date 3-6-75

Colour Yellow

Bedding/Lamination —

Porosity Porous

Hardness Soft

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0.25

16-84% Range : 1.25 – 0.063

Sorting : Difficult To Determine

Roundness : Mean : 0.6

16-84% Range : 0.5 – 0.7

Qualitative : Sub Rounded

Sphericity : Mean : 0.87

16-84% Range : 0.83 – 0.91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 5	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 93	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 95

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 5	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90% Broken, 10 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia 5 ?	Decapoda
Gasteropoda	Coral Frags. 40
Echinodermata	Foraminifera 20
Sponge Spicules 30	Ostracoda
Algae 5	Others

HEAVY MINERAL TYPES

Ilmenite.

(Only H.M. Discernable)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Shell Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3206 Stratigraphic Unit BRIDGEWATER FM

Location NANGWARRY. 33.25N/83.25E Analysed by B.2. Date 23/6/75

Colour BUFF.

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0.125

16-84% Range : 0.25-0.063

Sorting : POOR

Roundness : Mean : 0.2

16-84% Range : 0.1-0.4

Qualitative : ANGULAR

Sphericity : Mean : 0.65

16-84% Range : 0.55-0.75

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 5	Heavy Minerals % TRAC
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 94	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 95

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 5	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda ✓	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (P) ZIRCON (P)
TOURMALINE (P)
RUTILE (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELL CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3207 Stratigraphic Unit BRIDGEWATER Fm

Location PENOLA 68·05N/95·50E Analysed by B.B. Date 13/4/75

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS

Hardness SOFT.

Cementation : degree SLIGHTLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation —

TEXTURAL CHARACTER

Method of Investigation

SIEVE + PANNING.

Gravel % Sand % 97 Mud % 3

Modality UNIMODAL.

Grain Size : Mean : 0·25

16-84% Range : 0·56 – 0·125

Sorting : MODERATE

Roundness : Mean : 0·3

16-84% Range : 0·1 – 0·5

Qualitative : SUBANGULAR

Sphericity : Mean : 0·73

16-84% Range : 0·63 – 0·83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % 1½
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 59	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 35

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 65	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 50:50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C)
LEUCOXENE (A) MAGNETITE (P)
RUTILE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 32058 Stratigraphic Unit BRIDGEWATER Fm.

Location TINTINARA C. 71.60N/20.45E Analysed by B.B. Date 13/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS.

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0.125

16-84% Range : 0.25-0.063

Sorting : MODERATE.

Roundness : Mean : 0.4

16-84% Range : 0.2—0.6

Qualitative SUBANGULAR

Sphericity : Mean : 0.77

16-84% Range : 0.67-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % << 1
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 58	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 90 % Broken, 10 % Complete

Macrofossil % : Microfossil % = 60:40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C) ZIRCON (F)
RUTILE (C) GARNET (F)
LEUCOXENE (F) STAUROLITE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

QUARTZOSE SHELLY CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3211 Stratigraphic Unit BRIDGEWATER FM.

Location TINTINARA A. 76-05N/20-80E Analysed by B.R. Date 13/6/75

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl VERY STRONG.

Mode of Disaggregation MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 90 Mud % 10

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·73

16-84% Range : 0·63–0·83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

MUDDY SAND.

PETROGRAPHIC CHARACTER

Quartz % 25	Heavy Minerals % 1½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 72	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 25

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 75	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 80 % Broken, 20 % Complete

Macrofossil % : Microfossil % = 60 : 40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) ZIRCON (F)
TOURMALINE (A) STAUROLITE (F)
RUTILE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3213 Stratigraphic Unit Bridgewater Formation

Location Culburra - B. 72·85 N / 83·45 E Analysed by B. B. Date 5-6-75

Colour Buff

Bedding/Lamination —

Porosity Porous

Hardness Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : Poor

Roundness : Mean : 0·5

16-84% Range : 0·3 — 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·81

16-84% Range : 0·75 — 0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % << 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 57	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Tourmaline (F)
Staurolite (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Shelly, Quartzose Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3214 Stratigraphic Unit BRIDGEWATER FORMATION

Location COLBURRA D. 71·50N / 81·30E Analysed by B.B. Date 6-6-75

Colour CREAM

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE AND PANNING

Gravel % Sand % 95 Mud % 5

Modality BIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 0·3—0·7

Qualitative : SUB ROUNDED

Sphericity : Mean : 0·83

16-84% Range : 0·77—0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 35	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 63	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (C) GARNET (A)
RUTILE (F) STAUROLITE (F) ZIRCON (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

QUARTZOSE CALCARENITE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3215 Stratigraphic Unit BRIDGEWATER FORMATION

Location CULBURRA D. 69·75 N / 78·60 E Analysed by B. B. Date 6-6-75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness HARD

Cementation : degree STRONGLY

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR AND PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE AND PANNING

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2—0·6

Qualitative : SUB ANGULAR

Sphericity : Mean : 0·73

16-84% Range : 0·63-0·83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 30	Heavy Minerals % TRACE
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 68	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 70 : 30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ?	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) GARNET (F) ZIRCON (F)
TOURMALINE (C) STAUROLITE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY, QUARTZOSE CALCARENITE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3216 Stratigraphic Unit BRIDGEWATER Fm.

Location COLBURRA B. 79·05N/86·75E Analysed by B.B. Date 6/6/75

Colour BUFF

Bedding/Lamination –

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·63

Sorting : POOR.

Roundness : Mean : 0·4

16-84% Range : 0·3 – 0·6

Qualitative SUBANGULAR

Sphericity : Mean : 0·81

16-84% Range : 0·71 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 50	Heavy Minerals % << ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 48	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. √
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) TOURMALINE (F)
RUTILE (F) STAUROLITE (F)
GARNET (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3217 Stratigraphic Unit BRIDGEWATER Fm.

Location CULBURRA B. 78·80N/80·60E Analysed by B.B. Date 6/6/75

Colour YELLOW-WHITE.

Bedding/Lamination –

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR.

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·77

16-84% Range : 0·69-0·85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 45	Heavy Minerals % TRACE
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 52	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 50 % Broken, 50 % Complete

Macrofossil % : Microfossil % 100 : 0

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera
Sponge Spicules ✓	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (F) GARNET (P)
MONAZITE (A)? STAUROLITE (F)
TOURMALINE (C) ZIRCON (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY QUARTZOSE SHELLY CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3218. Stratigraphic Unit BRIDGEWATER Fm.

Location CULBURRA A 79.65N/70.10E Analysed by B.B. Date 6/6/75

Colour YELLOW-WHITE.

Bedding/Lamination —

Porosity POROUS.

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL.

Grain Size : Mean : 0.125.

16-84% Range : 0.56-0.063

Sorting : POOR

Roundness : Mean : 0.5

16-84% Range : 0.3-0.7

Qualitative SUBROUNDED

Sphericity : Mean : 0.79

16-84% Range : 0.69-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 50	Heavy Minerals % <1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 47	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (F)
RUTILE (F) MONAZITE (P)
TOURMALINE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3219 Stratigraphic Unit BRIDGEWATER Fm

Location CULBURRA A. 55·50N/66.55E Analysed by B.B. Date 6/6/75.

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM.

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality BIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·58–0·063

Sorting : MEDIUM.

Roundness : Mean : 0·5

16-84% Range : 0·3–0·7

Qualitative SUBROUNDED

Sphericity : Mean : 0·81

16-84% Range : 0·73–0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 80	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 17	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) ZIRCON (F)
RUTILE (C) TOURMALINE (F)
STAUROLITE (C) MONAZITE (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3220 Stratigraphic Unit BRIDGEWATER Fm.

Location CULBURRA A. 84·25N/73·35E Analysed by B.B. Date 9/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS.

Hardness HARD.

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 97 Mud % 3

Modality UNIMODAL

Grain Size : Mean : 0·25

16-84% Range : 056-0·063

Sorting : MEDIUM.

Roundness : Mean : 0·4

16-84% Range : 0·2-0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·71

16-84% Range : 0·55-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 30	Heavy Minerals % << 1/2
Feldspar %	Clay % 1
Rock Fragments %	Mica %
Carbonate Allochem % 69	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 60·40

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	ZIRCON	(F)
TOURMALINE	(C)	LEUCOXENE	(C)
GARNET	(F)	RUTILE	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

QUARTZOSE SHELLY CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3221 Stratigraphic Unit Bridgewater Formation

Location CULBURRA A. 96·80 N / 75·20 E Analysed by B. P. Date 3-6-75

Colour Light Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % 2 Sand % 93 Mud % 5

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56 — 0·063

Sorting : Poor

Roundness : Mean : 0·6

16-84% Range : 0·5 — 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·87

16-84% Range : 0·83 — 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 58	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 40	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 60

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 40	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 95% Broken, 5 % Complete

Macrofossil % : Microfossil % = 95 : 5

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags. 5 ?
Echinodermata	Foraminifera 5
Sponge Spicules 80	Ostracoda
Algae 10 ?	Others

HEAVY MINERAL TYPES

Ilmenite (A)

Tourmaline (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Strongly Calcareous, Shelly Quartz Sandstone

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3223 Stratigraphic Unit Bridgewater Formation

Location Tintinara A. 32·40 N / 10·10 E Analysed by B.P. Date 3-6-75

Colour Light Brown

Bedding/Lamination —

Porosity Slightly Porous

Hardness Hard

Cementation : degree Strongly

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 95 Mud % 5

Modality Unimodal

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·63

Sorting : Moderate

Roundness : Mean : 0·4

16-84% Range : 0·3 – 0·5

Qualitative : Sub Angular

Sphericity : Mean : 0·85

16-84% Range : 0·79 – 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Sand

PETROGRAPHIC CHARACTER

Quartz % 20	Heavy Minerals % < ½
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 78	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 30

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 70	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 100 : 00

Lamellibranchia 15	Decapoda 15
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules 70	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (P)
Staurolite (C) Garnet (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Slightly Quartzose, Shelly Calcarenite

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3225 Stratigraphic Unit BRIDGEWATER Fm

Location COONALPYN C. 78·30N/63·90E Analysed by B.B. Date 9/6/75.

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL.

Grain Size : Mean : 0.25

16-84% Range : 0·56 – 0·125

Sorting : MEDIUM.

Roundness : Mean : 0.4

16-84% Range : 0·2 – 0·6

Qualitative SUBROUNDED

Sphericity : Mean : 0·75

16-84% Range : 0·59 – 0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % TRAC
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 38	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 70

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 30	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 80:20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ?	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (F)
GARNET (C)
TOURMALINE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE SHELLY, CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3226. Stratigraphic Unit BRIDGEWATER FM.

Location COONALPYN C 97.65N/63.45E Analysed by B.B. Date 9/6/75.

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 056-0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 03-0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·73

16-84% Range : 0·59-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 40	Heavy Minerals % TRACE
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 57	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (F)
GARNET (C)
TOURMALINE (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY QUARTZOSE CALCARENITE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3229. Stratigraphic Unit BRIDGEWATER Fm

Location COONALPYN D. 97·50N/89·90E Analysed by B.B. Date 9/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL.

Grain Size : Mean : 0·25

16-84% Range : 0·56-0·063

Sorting : MEDIUM.

Roundness : Mean : 0·5

16-84% Range : 0·3-0·8

Qualitative SUBROUNDED

Sphericity : Mean : 0·81

16-84% Range 0·73-0·91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 67	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite %	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50:50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	RUTILE	(C)
GARNET	(A)	STAUROLITE	(F)
TOURMALINE	(C)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3230 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN D. 00·45N/95·25E Analysed by B.B. Date 9/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS.

Hardness HARD

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·25–0·063

Sorting : POOR

Roundness : Mean : 0·4

16-84% Range : 0·2–0·6

Qualitative : SUBANGULAR

Sphericity : Mean : 0·77

16-84% Range : 0·69–0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 60	Heavy Minerals % << ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 37	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (C)
GARNET (A)
TOURMALINE (A)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3234 Stratigraphic Unit BRIDGEWATER Fm

Location COONALPYN D. 99.40N/84.00E Analysed by B.B. Date 9/6/75

Colour YELLOW-WHITE

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL.

Grain Size : Mean : 0.25

16-84% Range : 0.56-0.063

Sorting : POOR.

Roundness : Mean : 0.5

16-84% Range : 0.3-0.7

Qualitative : SUBROUNDED

Sphericity : Mean : 0.81

16-84% Range : 0.73-0.91

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 70	Heavy Minerals % << ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 27	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (C)
GARNET (A)
TOURMALINE (A)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3232 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN D. 00·CON/89·50E Analysed by B.B. Date 9/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : MODERATE.

Roundness : Mean : 0·5

16-84% Range : 0·3-0·7

Qualitative : SUBROUNDED

Sphericity : Mean : 0·81

16-84% Range : 0·73-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % 1½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (C)
GARNET (A) STAUROLITE (F)
TOURMALINE (A)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY, STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3236 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN B. 05-20N/81-00E Analysed by B.B. Date 10/6/75.

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness HARD.

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality UNIMODAL.

Grain Size : Mean : 0·125

16-84% Range : 0·56–0·063

Sorting : POOR

Roundness : Mean : 0·5

16-84% Range : 0·3–0·8

Qualitative : SUBROUNDED

Sphericity : Mean : 0·77

16-84% Range : 0·69–0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 65	Heavy Minerals % <1½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (C) MONAZITE (F)
GARNET (A) STAUROLITE (C)
TOURMALINE (A) ZIRCON (F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3238 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN B. 03.30N/76.10E Analysed by B.B. Date 10/6/75

Colour YELLOW

Bedding/Lamination -

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation

SIEVE & PANNING.

Gravel % Sand % 97 Mud % 3

Modality BIMODAL

Grain Size : Mean : 0.25

16-84% Range : 0.56 - 0.125

Sorting : MODERATE

Roundness : Mean : 0.5

16-84% Range : 0.3 - 0.7

Qualitative SUBROUNDED

Sphericity : Mean : 0.71

16-84% Range 0.61 - 0.83

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % << 1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 43	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50 : 50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	RUTILE	(C)
GARNET	(A)	STAUROLITE	(F)
TOURMALINE	(A)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3240 Stratigraphic Unit BRIDGEWATER Fm

Location COONALPYN B. 10.30N/88.10E Analysed by B.B. Date 10/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0·125

16-84% Range : 0·56-0·063

Sorting : POOR

Roundness : Mean : 0·6

16-84% Range : 0·4 - 0·8

Qualitative : ROUNDED

Sphericity : Mean : 0·75

16-84% Range : 0·65-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 65	Heavy Minerals % < ½
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 32	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 10

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 90	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 50:50

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	RUTILE	(C)
GARNET	(A)	STAUROLITE	(C)
TOURMALINE	(A)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS

Sample No. 3241 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN B. 11.95N/84.30E Analysed by B.B. Date 16/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0.125

16-84% Range : 056-0063

Sorting : POOR.

Roundness : Mean : 0.4

16-84% Range : 03 — 0.6

Qualitative : SUBANGULAR

Sphericity : Mean : 0.71

16-84% Range 0.57-0.85

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 50	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 47	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 90 : 10

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) RUTILE (F) KYANITE (F
GARNET (A) STAUROLITE (F)
TOURMALINE (A) LEUCOXENE (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SHELLY, STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3243 Stratigraphic Unit BRIDGEWATER FM.

Location COONALPYN B. 09·00N/81·10E Analysed by B.B. Date 10/6/75

Colour YELLOW

Bedding/Lamination —

Porosity POROUS

Hardness SOFT.

Cementation : degree SLIGHTLY CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 97 Mud % 3

Modality UNIMODAL.

Grain Size : Mean : 0·25

16-84% Range : 0·56–0·063

Sorting : POOR.

Roundness : Mean : 0·5

16-84% Range : 0·3–0·8

Qualitative : SUBROUNDED

Sphericity : Mean : 0·71

16-84% Range : 0·55–0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 68	Heavy Minerals % < 1/2
Feldspar %	Clay % 2
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 50

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 50	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100 % Broken, % Complete

Macrofossil % : Microfossil % = 70:30

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata ✓	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE	(A)	RUTILE	(F)
GARNET	(A)	STAUROLITE	(F)
TOURMALINE	(C)	ZIRCON	(F)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY, CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3244 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN B. 13·15N/78·30E Analysed by R.B. Date 10/6/75

Colour YELLOW.

Bedding/Lamination —

Porosity POROUS.

Hardness SOFT

Cementation : degree SLIGHTLY CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 95 Mud % 5

Modality BIMODAL

Grain Size : Mean : 0·25

16-84% Range : 0·51-0·08

Sorting : POOR

Roundness : Mean : 0·6

16-84% Range : 0·4 - 0·9

Qualitative : ROUNDED

Sphericity : Mean : 0·81

16-84% Range : 0·73 - 0·89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % < 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (C) MONAZITE(
GARNET (A) RUTILE (C)
TOURMALINE (C) ZIRCON (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3245 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN A. 14.45N/75.50E Analysed by B.B. Date 10/6/75

Colour BUFF

Bedding/Lamination —

Porosity POROUS

Hardness MEDIUM

Cementation : degree CEMENTED

: composition CALCAREOUS.

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR & PESTLE

TEXTURAL CHARACTER

Method of Investigation SIEVE & PANNING.

Gravel % Sand % 93 Mud % 7

Modality BIMODAL.

Grain Size : Mean : 0.25

16-84% Range : 0.56-0.063

Sorting : POOR.

Roundness : Mean : 0.6

16-84% Range : 0.4-0.8

Qualitative : ROUNDED

Sphericity : Mean : 0.81

16-84% Range : 0.73-0.89

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % < 1/2
Feldspar %	Clay % 4
Rock Fragments %	Mica %
Carbonate Allochem % 41	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: —

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

ILMENITE (A) STAUROLITE (F)
GARNET (A) ZIRCON (F)
TOURMALINE (A)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

STRONGLY CALCAREOUS.
QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : SOUTH EAST COASTAL PLAINS.

Sample No. 3246 Stratigraphic Unit BRIDGEWATER Fm.

Location COONALPYN A. 11.25N/70.30E Analysed by B.B. Date 10/6/75

Colour YELLOW-WHITE.

Bedding/Lamination —

Porosity POROUS.

Hardness HARD.

Cementation : degree STRONGLY CEMENTED

: composition CALCAREOUS

Reaction to HCl STRONG.

Mode of Disaggregation MORTAR + PESTLE.

TEXTURAL CHARACTER

Method of Investigation SIEVE + PANNING.

Gravel % Sand % 95 Mud % 5

Modality UNIMODAL

Grain Size : Mean : 0.25

16-84% Range : 0.56-0.063

Sorting : POOR

Roundness : Mean : 0.6

16-84% Range : 0.4-0.8

Qualitative : ROUNDED

Sphericity : Mean : 0.77

16-84% Range : 0.67-0.87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

SAND.

PETROGRAPHIC CHARACTER

Quartz % 55	Heavy Minerals % << 1/2
Feldspar %	Clay % 3
Rock Fragments %	Mica %
Carbonate Allochem % 42	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments: 20

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 80	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : 100% Broken, % Complete

Macrofossil % : Microfossil % = 80 : 20

Lamellibranchia ✓	Decapoda
Gasteropoda	Coral Frags. ✓
Echinodermata	Foraminifera ✓
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

GARNET (A) STAUROLITE (C)
ILMENITE (A) RUTILE (P)
TOURMALINE (A) ZIRCON (P)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

SLIGHTLY SHELLY, STRONGLY CALCAREOUS QUARTZ SANDSTONE.

JENNINGS MINING LIMITED

SCHEDULE FOR BINOCULAR MICROSCOPE EXAMINATION OF CRUSHED ROCK SAMPLES

Project : South East Coastal Plains

Sample No. 3252 Stratigraphic Unit Bridgewater Formation

Location Moorlands B. 33·20 N / 97·15 E Analysed by B.B. Date 4-6-75

Colour Yellow-Brown

Bedding/Lamination —

Porosity Porous

Hardness Medium

Cementation : degree Cemented

: composition Calcareous

Reaction to HCl Strong

Mode of Disaggregation Mortar and Pestle

TEXTURAL CHARACTER

Method of Investigation Sieve and Panning

Gravel % Sand % 85 Mud % 15

Modality Bimodal

Grain Size : Mean : 0·125

16-84% Range : 0·25-0·063

Sorting : Moderate

Roundness : Mean : 0·5

16-84% Range : 0·3 — 0·7

Qualitative : Sub Rounded

Sphericity : Mean : 0·79

16-84% Range : 0·71-0·87

Qualitative :

Surface and/or Special Textures

TEXTURAL CLASSIFICATION

Muddy Sand

PETROGRAPHIC CHARACTER

Quartz % 65	Heavy Minerals % < ½
Feldspar %	Clay % 5
Rock Fragments %	Mica %
Carbonate Allochem % 30	Organic Matter %
Chert %	Others %

TYPE OF CARBONATE ALLOCHEMS

Fossils or Fossil Fragments:

Oolites	Pisolites
Pellets	Intraclasts
Micrite/Sparite 100	Lumps

TYPES OF FOSSILS OR FOSSIL FRAGMENTS

Preservation : % Broken, % Complete

Macrofossil % : Microfossil % =

Lamellibranchia	Decapoda
Gasteropoda	Coral Frags.
Echinodermata	Foraminifera
Sponge Spicules	Ostracoda
Algae	Others

HEAVY MINERAL TYPES

Ilmenite (A) Rutile (F) Zircon (C)
Staurolite (C) Tourmaline (C)

CHEMICAL OR AUTHIGENIC MINERALS

ROCK TYPE

Calcareous, Quartz Sandstone

APPENDIX III

AMDEL LABORATORY REPORT - STANDARD QUANTITATIVE EVALUATION OF BEACH SAND SAMPLES

amdel
The Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone Adelaide 79 1662, telex AA82520

Please address all correspondence to Frewville.
In reply quote: MP3/587/2/0

26th June, 1975

Exploration Manager,
Jennings Mining Limited,
690 Springvale Road,
MULGRAVE, Vic 3170

REPORT MP 4168/75

YOUR REFERENCE:	Letter dated 9/6/75
MATERIAL:	Disaggregated rock samples (7)
IDENTIFICATION:	SE-R-3196, 3056, 3119, 3121, 3170 and SE-A-3253, 3254
DATE RECEIVED:	10/6/75
WORK REQUIRED:	Detrital heavy mineral analysis

Investigation and Report by: M.J.W. Larrett

Officer in Charge, Mineralogy/Petrology Section: Dr K.J. Henley

K. J. Henley

for F.R. Hartley
Director

mhb

RECEIVED
- 1 JUL 1975

DETRITAL HEAVY MINERAL ANALYSIS OF SEVEN DISAGGREGATED ROCK SAMPLES

1. INTRODUCTION

Seven samples of disaggregated rock were received from the Victorian office of Jennings Mining Limited for quantitative mineralogical assessment.

2. PROCEDURE

Initially, the seven samples were split by riffling, weighed, oven-dried and deslimed by wet sieving at 300 mesh B.S.S. The minus 300 mesh material was then dried and weighed, and the plus 300 mesh material subjected to standard heavy mineral separations in tetrabromoethane of specific gravity 2.96. The resultant seven heavy mineral fractions were then riffled to obtain representative subsamples for microscopic examination, and these were prepared both as polished briquettes (P.S.23775-781), and as temporary oil-mounts. Point-counting (approximately 400 points) was carried out on the polished briquettes under reflected light conditions in order to quantify the opaque minerals present. The transparent mineral phases were determined by means of microscopic examination of temporary oil-mounts under transmitted light conditions.

3. RESULTS

Table 1 gives the weight percentages of plus 300 mesh material, slimes (minus 300 mesh), and heavy minerals (>2.96 sp.gr. - expressed as % of +300 mesh fraction) contained in each of the seven samples. Table 2 gives the overall mineralogical composition of each of the seven heavy mineral concentrates as determined by point-counting results (opaques, rutile and zircon). The values given are expressed as weight percentages having been recomputed from volume percentages using the appropriate specific gravities of the various minerals present.

TABLE 1: MINERAL SEPARATION

Sample No.	Slimes Wt.% (-300 mesh)	Deslimed Head Wt.% (+300 mesh)	Heavy Minerals (Wt.% >2.96 sp.gr.+300 mesh)
SE-R-3196	1.14	98.86	0.65
SE-R-3056	0.93	99.07	0.21
SE-R-3119	4.24	95.76	0.51
SE-R-3121	10.91	89.09	0.39
SE-R-3170	3.81	96.19	0.91
SE-A-3253	1.33	98.67	0.31
SE-A-3254	0.16	99.84	0.17

APPENDIX IV

DISTRIBUTION OF SAMPLES WITHIN STRATIGRAPHIC UNITS

FORMATION	SAMPLE NUMBERS (Prefixed by SE-R-)
YAMBA FORMATION	3249
MOLINEAUX SAND	3016, 3017, 3019, 3021, 3027, 3029, 3033, 3051, 3092, 3139, 3197, 3198, 3224.
RIPPON CALCRETE	3090, 3107.
BRIDGEWATER FORMATION	'All other sample numbers up to and including SE-R-3252'.
PARILLA SAND	3005, 3010, 3020, 3023, 3024, 3025, 3026, 3028, 3060, 3076, 3091, 3164, 3182.
LOXTON SAND/ ETTRICK FORMATION	3030, 3031, 3032.
GAMBIER LIMESTONE	3165, 3166, 3167, 3186.
GRANITE	3127, 3129, 3154, 3212.

Jennings Mining Limited

690 Springvale Road, Mulgrave,
Victoria, Australia, 3170
Telephone: 561 8888 Telex: 31532
Telegrams and Cables: "Jenningsco".

LRB:LF

23rd July, 1975

The Director of Mines,
Department of Mines South Australia,
169 Rundle Street,
ADELAIDE, S.A. 5000

Dear Sir,

Re : Exploration Licence No. 169 - South East Coastal Plains

We refer to our letter of 16th July and have pleasure in attaching Statement of Expenditure for the quarter ended 30th June, 1975.

No expenditure was incurred between 1st July and 20th July, 1975, being the expiry date of the licence.

We trust this matter is now in order.

Yours faithfully,
JENNINGS MINING LIMITED

L. R. BROWN
Commercial Manager -
Exploration

Encl.

STATEMENT OF EXPENDITURE

QUARTER ENDED 30TH JUNE, 1975

EXPLORATION LICENCE NO. 169 - SOUTH EAST COASTAL PLAINS

		$
ITEM 1	Geological & Geophysical Costs	530
ITEM 2	Drilling Costs	130
ITEM 3	Logistics	17,148
ITEM 4	Depreciation	131
		$17,939

L. R. Brown
Commercial Manager -
Exploration

EXPENDITURE STATEMENT
PERIOD ENDING 31ST MARCH, 1975
EXPLORATION LICENCE 169

ITEM 1	Geological & Geophysical costs	$6,642
ITEM 3	Logistics	3,769
ITEM 6	Other Costs - Registration & Rental Fees	3,843
		$14,254

Note : No costs have been incurred by 31.3.1975 under items 2, 4 or 5.