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YORKE PENINSULAR.

MINLATON & STANSBURY.

44/100

DEPARTMENT OF MINES

SOUTH AUSTRALIA

GEOLOGICAL SURVEY BRANCH

Report GS716

Palaeontological Report 6/57

TERTIARY MATERIAL FROM YORKE PENINSULA

By

N.H. Ludbrook

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C O N T E N T S

TERTIARY MATERIAL FROM YORKE PENINSULA

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ABSTRACT

Palaeontological examination of samples collected from Yorke Peninsula by the Hydrology and Regional Mapping Sections reveals that the Tertiary deposits of the peninsula are generally separable into 2 distinct areas - the northern part of the Peninsula with Upper Eocene sediments and Lower Miocene limestones, and the southern portion in the extensive Oligo-Miocene limestones equivalent to the Port Willunga Beds and Pliocene calcareous sandstones equivalent to the Hallett Cove Sandstone.

1. INTRODUCTION

The report covers palaeontological examination of material submitted by the Regional Mapping and Hydrology Sections during 1956 and 1957 from localities most of which were visited by the writer with C. Bleys (July, 1955 and May, 1957) and R. Horwitz (September, 1956). Additional field inspections will be necessary when detailed mapping is undertaken.

2. TERTIARY STRATIGRAPHY OF YORKE PENINSULA

So far as can be determined from general observations and the limited amount of material which has been collected, the Tertiary formations of Yorke Peninsula fall into two distinct areas: a northern area in which Upper Eocene paralic sediments and Lower Miocene limestones are exposed, and a southern area in which Oligo-Miocene limestones are extensively developed and Lower Pliocene calcareous sandstones and oyster beds occur.

3. NORTHERN YORKE PENINSULA

Eocene sediments are exposed around Clinton and along the coast between Pine Point and Ardrossan. The oldest of these, equivalent to the Maslin Sands, are exposed 6 miles north of Clinton (Samples F48/55 and F49/55). They are paralic and locally lignitic and known mainly from borings in Hundred of Clinton. In the coastal section, the lowest beds, the Muloowurtie Clays, rest on Cambrian limestone between Rogue's Point and Muloowurtie Point. The Clays are succeeded by sands and calcareous sandstones, more or less glauconitic, grading into silicified marls with Turritella aldingae. The lower part of the sequence is equivalent to the Tortachilla limestones of Maslin Bay. The sequence has previously been described by Tepper (1879) and Howchin (1918).

The beds are represented by samples F/78/57, F74/57, F75/57, F76/57, F77/57.

The beds with Turritella aldingae equivalent to the Blanche Point Marls of Maslin and Aldinga Bays are represented by samples previously collected around Clinton: F50/55, F51/55, F52/55.

Lower Miocene limestones and conglomeratic cross-bedded bryozoal limestones occur around Melton and Kulpara. In a large sinkhole on Section 388, Hundred of Kulpara, there is an important occurrence of conglomeratic sandy bryozoal cross-bedded limestone with abundant Lepidocyclina (Trybliolepidina) gippslandica Crespin. The presence of Lepidocyclina at this locality and of Austrotrillina howchini (Schlumberger) in other limestones around Kulpara established the age as Lower Miocene ("Batesfordian").

The limestones (unnamed) are represented in Samples F241/56, F242/56, F243/56, F85/57, F96/57, F97/57. It is likely that the Tertiary limestones at Wallaroo (F94/57) and Tickera (F6/55) are equivalent. The limestone at Tickera was formerly thought to be the same as that at Point Turton to which the northern limestones bear a physical resemblance. The northern limestones are, however, more gritty. Both are richly bryozoal, but the foraminiferal faunas are unrelated.

4. SOUTHERN YORKE PENINSULA.

Southwards from Port Julia to Wool Bay the cliffs bordering St. Vincents Gulf are mainly mid-Tertiary limestones of Oligo-Miocene age equivalent to the Port Willunga Beds of Aldinga Bay. These are older than the limestones of northern Yorke Peninsula and so far as the sampling indicates, are probably mostly of Oligocene age. They are important sources of limestone at Klein Point and Wool Bay and were penetrated in Stansbury Oil Bore from 30 to 134 feet. Limestone at Port Julia and Coobowie is probably low down in this part of the Tertiary sequence. Glauconite is fairly abundant in the limestone of these two localities.

The faunas are generally characterized by the presence of Sherbornina atkinsoni Chapman.

They are represented by samples F78/57, F79/57, F80/57, F81/57, F82/57, F5/55.

The Point Turton Limestone, with Victoriella plecte is of Oligocene ("Janjukian") age.

Around Edithburg and at Giles Point, 2 miles north of Coobowie, calcareous sandstones of Pliocene age occur. The mega- and micro- faunas are similar to those of the Hallet Cove Sandstone. Pliocene limestone is also developed in Hundred of Moorowie on Section 140, property of Mr. E.J. Carmichael, who is making a useful contribution to the knowledge of the fauna.

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6. DETAILED EXAMINATION OF SAMPLES.

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F73/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Cunningham, Section 40.

Distance and direction from nearest town or station - 3 miles west of Ardrossan.

Details: Collected from floaters in paddock.

Information required - Stratigraphic correlation.

Submitted by C. Bleys, Department of Mines. Date: 11/5/56.

PALAEONTOLOGIST'S REPORT

Glauconitic clayey calcareous sandstone, with polished subrounded quartz grains and abundant ovoid grains of limonite.

Fossils are identifiable from latex casts of moulds of mollusca.

A few indeterminate foraminifera are present. The lithology and fauna of the specimens permits correlation with the Tortachilla Limestones of Maslin Bay. These are of Upper Eocene age.

Mollusca

? Chlamys flindersi (Tate)

Chlamys sp. cf. eyrei (Tate)

Glycymeris lenticularis (Tate)

Antigona (Hina) cainozoica (T. Woods)

Dentalium sp.

Turritella aldingae Tate

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F74/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Muloowurtie, Section 2.

Distance and direction from nearest town or station - Hart's Mine.

Details: Collected from cliff section.

Depth: 3 feet above contact with Precambrian.

Information required: Stratigraphic correlation.

Collected by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 9/4/57.

PALAEONTOLOGIST'S REPORT

Yellow fossiliferous calcareous sandstone.

Washings consist of medium-coarse subangular to subrounded quartz grains with limestone fragments in about equal proportion, glauconite pellets, biotite.

Bryozoa - common.

Microfossils are poorly preserved, and the foraminifera include:-

Lenticulina sp.

Reussella sp.

Discorbis sp.

Glabratella sp.

Gyroidina sp.

Heronallenia sp.

Cibicides cf. lobatulus (Walker & Jacob)

Cibicides umbonifer Parr

Cibicides sp.

Planorbulina sp.

Crespinina kingscotensis Wade

Anomalina sp.

Sherbornina sp.

Anthozoa

Mopsea tenisoni Chapman

Echinoidea

Fibularia gregata Tate

Spines

Miscellaneous

Brachiopoda

Cirripedea Not identified

Bryozoa

The material is of Upper Eocene age.

(N.H. Ludbrook)
10/6/57 PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F75/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Muloowurtie, Section 2.

Distance and direction from nearest town or station - Hart's Mine.

Details: Collected from cliff section, 100 yards south of shaft.

Depth: 9 feet above base of Tertiary.

Information required: Stratigraphic correlation.

Collected by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 9/4/57.

PALAEONTOLOGIST'S REPORT

Sample taken in cream-yellow friable bryozoal calcareous sandstone with Fibularia gregata about 6 feet above sample F74/57 and 100 yards south.

Washings consist of angular to subrounded quartz grains, calcite fragments, dark olive-green glauconite grains, biotite and accessories.

Foraminifera

Textularia spp.

Dorothia sp.

Nodosaria sp.

Vaginulina cf. patens Brady

Lenticulina sp.

Bolivinella sp. cf. folia (Parker & Jones)

Sigmoidella cf. kagaensis Cushman & Ozawa

Sigmoidella sp.

Reussella simplex (Cushman)

Discorbis sp. cf. floridensis Cushman

Gyroidina sp.

Eponides sp.

Baggina philippinensis Cushman

Cibicides lobatulus (Walker & Jacob)

Planulina aff. sinuosa Sidebottom

Globigerina sp.

Planorbulina cf. mediterranensis d'Orbigny

Crespinina kingscotensis Wade

Heronallenia pusilla Parr

Nonionella sp.

Sherbornina sp.

Crespinella sp. nov. 1

Echinoidea

Fibularia gregata Tate (Common)

Brachiopods - small brachiopods, not identified.

Correlation

The foraminiferal assemblage is similar to that of the Polyzoal Limestone Member of the Tortachilla Limestone, of Upper Eocene age.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F76/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Muloowurtie, Section 2.

Distance and direction from nearest town or station 200 yards south of Hart's Mine, southern end of cove.

Details: Collected from cliff section, 4 feet above decomposed aplite.

Information required: Stratigraphic correlation.

Collected by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 9/4/57.

PALAEONTOLOGIST'S REPORT

The sample was taken in yellow-brown sandy clay with white nodular bands of ? alunite, the lower 1" thick, the upper ¼" thick, 4 inches above. The horizon is stratigraphically about 10 feet below F75/57 and 100 yards to the south.

For more detailed description, the material needs looking at again in the field.

Residue after washing consists of subrounded to angular quartz grains, ochreous clay, occasional glauconite grains and white nodules of ? alunite.

No fossils were obtained. The age may be upper Eocene.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F77/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Muloowurtie, Section 42A.

Distance and direction from nearest town or station - 1½ miles north of Pine Point, ¾ mile south of Hart's Mine.

Details: Collected from cliff section.

Depth: Greenish sands at base of Tertiary section.

Information required - Correlation.

Collected by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 9/4/57.

PALAEONTOLOGIST'S REPORT

Sample was taken on greenish coarse sands at base of 10 feet of yellow Tertiary sandy limestone over weathered chocolate shales.

The bed is shown on sections accompanying report by J.E. Ridgway on Kaolinized Aplite near Ardrossan (Min. Rev. No. 93, p. 94).

Washings consist of medium coarse subangular to subrounded quartz grains, with some ironstaining, mica. Green colour is in the clay matrix, no glauconite grains were observed.

A few poorly preserved foraminifera are present including Angulogerina sp., Cibicides sp.

Correlation

The sands may be either:-

(1) a remnant of Maslin Sands, or

(2) a sandy bed at the base of the Tortachilla Limestone,

either would be of upper or at the oldest Middle Eocene age.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F78/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Curramulka, Section 101.

Distance and direction from nearest town or station - at Port Julia.

Details: Collected from outcrop at beach shacks, interbedded limestones and soft calcareous sandstones.

Information required: Stratigraphic correlation.

Collected by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 9/4/57.

PALAEONTOLOGIST'S REPORT

Sample is a cream-yellow glauconitic limestone, showing considerable secondary calcification, with abundant Sherbornina atkinsoni Chapman.

Foraminifera

Textularia sp.

Frondicularia sp.

Guttulina irregularis (d'Orbigny)

Reussella simplex Cushman

Cassidulina subglobosa Brady

Discorbis floridana Cushman

Rotorbinella sp. indet.

Gyroidina sp.

Eponides sp.

Cibicides pseudoungerianus Cushman

Cibicides vortex Dorreen

Cibicides spp.

Anomalina sp.

Crespinina kingscotensis Wade

Nonion spp.

Elphidium sp. indet.

Notorotalia sp.

Sherbornina atkinsoni Chapman

Correlation

The assemblage permits correlation with the base of the Port Willunga Beds, currently considered to be of Oligocene age.

10/6/57 PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F79/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Dalrymple, Section 8.

Distance and direction from nearest town or station - Klein Point Quarry, 2½ miles south of Stansbury.

Details: Collected from base of quarry section, red ferruginous band.

Information required: Stratigraphic correlation.

Submitted by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 10/4/57.

PALAEONTOLOGIST'S REPORT

Sample was taken from the red ferruginous band at the base of the section in the limestone quarry at Klein Point (Adelaide Cement Company). It is a pinkish red bryozoal limestone consisting almost entirely of the remains of bryozoa.

Foraminifera are poorly represented and preserved, and include:-

Textularia sp.

Lagena hexagona Williamson

Lagena sulcata Walker & Jacob

Fissurina sp.

Globulina gibba d'Orbigny

Guttulina irregularis (d'Orbigny)

Sphaeroidina bulloides d'Orbigny

cf. Stomatorbina torrei (Cushman & Bermudez)

Eponides cf. repandus Fichtel & Moll

Cibicides refulgens (Montfort)

Cibicides pseudoungerianus Cushman

Cibicides sp.

Globigerina bulloides d'Orbigny

Correlation

The limestone is to be correlated with the Port Willunga Beds, of Oligo-Miocene age.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F80/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Dalrymple, Section 8.

Distance and direction from nearest town or station - Klein Point Quarry, 2½ miles south of Stansbury.

Details: Collected from 4 feet above base of quarry section.

Information required: Stratigraphic correlation.

Submitted by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 10/4/57.

PALAEONTOLOGIST'S REPORT

Bryozoal limestone 4 feet above base of quarry section, with a similar fauna to F79/57.

Foraminifera

Lagena hexagona Williamson
Lagena sulcata Walker & Jacob

Fissurina sp.

Globulina gibba d'Orbigny

Guttulina problema d'Orbigny

Stomatorbina torrei (Cushman & Bermudez)

Eponides cf. repandus (Fichtel & Moll)

Baggina philippinensis (Cushman)

Cibicides lobatulus Walker & Jacob

Cibicides pseudoungerianus Cushman

Cibicides refulgens Montfort

Anomalina glabrata Cushman

Correlation

As for F79/57 - with Port Willunga Beds.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F81/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Dalrymple, Section 8.

Distance and direction from nearest town or station - Klein Point Quarry, 2½ miles south of Stansbury.

Details: Collected from quarry section.

Information required: Identification.

Submitted by employees of Adelaide Cement Company, Stansbury. Date: 10/4/57.

PALAEONTOLOGIST'S REPORT

The sample consists of a number of megafossils presented mainly by Mr. Cliff Bowman of Adelaide Cement Company. Others were donated by Mr. Charlie Natt (quarry manager) and Mr. Merv. Hoyle (quarry foreman). An attempt will be made to identify the echinoids later. The large brachiopods are Magellania sufflata (Tate).

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample F82/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality; County Fergusson, Hundred Melville, Section 319.

Distance and direction from nearest town or station - Giles Point, 2 miles north of Coobowie.

Details: Collected from low cliff section, at base under Pleistocene red clays.

Information required: Stratigraphic correlation.

Submitted by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 10/4/57.

PALAEONTOLOGIST'S REPORT

Calcareous sandstone with oysters, of Pliocene age.

Mollusca

Ostrea arenicola (Tate)

Chlamys antiaustralis (Tate)

cf. Notocallista (Striacallista) sp. indet.

Foraminifera

Cribrobulimina polystoma (Parker & Jones)

Triloculina trigonula Lamarck

Discorbis dimidiatus (Jones & Parker)

Elphidium adelaidense Howchin & Parr

Elphidium rotatatum Howchin & Parr

Elphidium sp.

Rotalia beccarii (Linne)

Marginopora vertebralis Blainville

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample F83/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Wauraltee, Section 96.

Distance and direction from nearest town or station - 2 miles east of Urania.

Details: Collected from loose blocks on roadside.

Information required: Stratigraphic correlation.

Submitted by C. Bleys, Department of Mines. Date: 19/7/56.

PALAEONTOLOGIST'S REPORT

Hard fairly dense recrystallized yellowish limestone with glauconite and large polished quartz grains.

A few miliolidae may be recognized, but diagenesis has proceeded too far for any opinion to be given as to which of the mid-Tertiary limestones this belongs. The mode of the occurrence suggests that they have been transported to the locality.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F84/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Wauraltee, Section 54.

Distance and direction from nearest town or station - 1 mile southwest of Urania.

Details: Collected from large blocks on roadside.

Information required: Stratigraphic correlation.

Submitted by C. Bleys, Department of Mines. Date: 19/7/56.

PALAEONTOLOGIST'S REPORT

Mottled pink and white crystalline limestone with remains of echinoid spines.

Recrystallization makes it difficult to determine to which of the mid-Tertiary limestones this belongs. It bears a close physical resemblance to the Point Turton limestone and may possibly have been transported from there.

Age of the Point Turton limestone is "Janjukian" (Oligocene).

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F85/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Daly, Hundred Kulpara, Section 388.

Distance and direction from nearest town or station - 1½ miles north of Melton.

Details: Collected from sinkhole.

Information: Stratigraphic correlation.

Submitted by C. Bleys and N.H. Ludbrook, Department of Mines. Date: 10/4/57.

PALAEONTOLOGIST'S REPORT

Sample collected in large sinkhole on paddock on Section 388 where crossbedded conglomeratic to coarse sandy bryozoal quartzose limestone is exposed. The material was previously reported on from samples F242/56 and F243/56. It is of particular interest for the abundance of Lepidocyclina (Tryblioleplidina) gippslandica Crespin, with which are associated Gypsina howchini Chapman, Operculina victoriensis Chapman and Parr, Amphistegina lessoni d'Orbigny, Carpenteria rotaliformis Chapman and Crespin.

The limestone is of Batesfordian (Lower Miocene) age.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F06/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Melville, Section 335.

Distance and direction from nearest town or station - 1½ miles west of Coobowie.

Details: Collected from Lane Industries quarry (disused).

Submitted for information of Department.

Submitted by Mr. J.L. Lane, Lane Industries, 141 East Terrace, Adelaide.

Date: 18/4/57.

PALAEONTOLOGIST'S REPORT

Sample of building stone brought in by Mr. J.L. Lane of Lane Industries. Quarry opened up on Mr. Murray Vigar's property, 1½ miles west of Coobowie, for building stone, using same methods as employed at Mount Gambier. Stone is too flinty for the purpose as it rips tungsten carbide tips from saws. Could be profitably used in small way by using hand saw. 91% $CaCO_3$ - useful for lime, whiting, putty; air-floated makes good stock calcium. Wool Bay Lime said to be interested (information J.L. Lane).

The limestone is a white somewhat glauconitic bryozoal limestone partially recrystallized. Pale green glauconite, grains and sharp angular fine quartz grains are present.

Diagenesis has proceeded too far for satisfactory identification of the microfauna, which includes the following foraminiferal species:-

Lagena hexagona Williamson

Fissurina sp.

Glabratella globigeriniformis (Heron-Allen & Earland)

Glabratella sp.

Baggina philippinensis (Cushman)

Heronallenia lingulata (Burrows & Holland)

Heronallenia wilsoni (Heron-Allen & Earland)

Parvicarinina altocamerata (Heron-Allen & Earland)

Cibicides lobatulus Walker & Jacob

Cibicides refulgens (Montfort)

Cibicides sp.

Planorbulina mediterranensis d'Orbigny

Globigerina bulloides d'Orbigny

Elphidium howchini Cushman

Elphidium sp.

Anomalina spp.

Anomalina glabrata Cushman

Sherbornina atkinsoni Chapman

Echinoidea

Fibularia gregata Tate - common

Correlation

This is closely related to the limestone outcropping at Port Julia (F78/57) - correlated with the basal past of the Port Willunga Beds.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F94/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Daly, Hundred Wallaroo, Section ? Pt. 350.

Distance and direction from nearest town or station - 1 mile south of Wallaroo.

Details: Collected on coast.

Information required: Stratigraphic correlation.

Submitted by R. Horwitz, Department of Mines. Date: 2/4/57.

PALAEONTOLOGIST'S REPORT

Partially recalcified and recrystallized gritty bryozoal limestone. Diagenesis has proceeded too far for identification of most of the microfossils, which, apart from bryozoa and echinoid spines, consist of miliolidae many of which are infilled with limonitic ochre.

No diagnostic fossils were observed to permit a firm opinion to be offered on the age of the limestone which is probably a marginal, shallow water representative of the limestones of Lower Miocene (Batesfordian) age occurring near Melton and Kulpara.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F95/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: Hundred Kulpara, Section 300.

Distance and direction from nearest town or station - 6 miles E.N.E. of Kulpara.

Details: Collected from outcrop.

Submitted by R. Horwitz, Department of Mines. Date: 2/4/57.

PALAEONTOLOGIST'S REPORT

Grey indurated rock consisting of small pebbles and grit of heterogeneous origin in a silty-quartz sand matrix. The rock is probably Permian tillite, but as its identification is less a palaeontological than a petrological matter, it is suggested that if the interpretation is unsatisfactory, the sample be referred to the Petrology Laboratory.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F96/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Daly, Hundred Kulpara, Section 146.

Distance and direction from nearest town or station - 2 miles west of Kulpara.

Details: Collected from outcrop etc.

Information required: Stratigraphic correlation.

Submitted by R. Horwitz, Department of Mines. Date: 2/4/57.

PALAEONTOLOGIST'S REPORT

This is a recrystallized yellow limestone with limonitic ochre infilling the small cavities and moulds of organic remains.

The presence of Marginopora vertebralis Blainville and Austrotrillina howchini (Schlumberger) indicate a Lower Miocene age for this as for other Tertiary limestones in the Kulpara area.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F97/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Daly, Hundred Kulpara, Section 337.

Distance and direction from nearest town or station - 4½ miles west of Melton.

Details: Collected from outcrop etc.

Information required: Stratigraphic correlation.

Submitted by R. Horwitz, Department of Mines. Date: 2/4/57.

PALAEONTOLOGIST'S REPORT

Gritty limestone with Marginopora vertebralis Blainville and abundant miliolidae.

It is of Lower Miocene age, deposited in warm shallow waters.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA Sample No. F93/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Cunningham, Section 193.

Distance and direction from nearest town or station - 3½ miles W.N.W. of Ardrossan.

Details: Collected from loose blocks in paddock.

Information required: Stratigraphic correlation.

Submitted by C. Bleys, Department of Mines. Date: 11/5/56.

PALAEONTOLOGIST'S REPORT

Green clayey sandstone, with polished subrounded quartz grains and ovoid limonite grains in a green matrix.

It is the same material as that reported in F73/57.

Specimen has been sent to Petrologist for diagnosis of green colour.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES

SOUTH AUSTRALIA . Sample No. F99/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Muloowurtie, Section 71.

Distance and direction from nearest town or station - 6 miles N.W. of Pine Point.

Details: Collected from outcrop.

Information required: Stratigraphic correlation.

Submitted by C. Bleys, Department of Mines. Date:

PALAEONTOLOGIST'S REPORT

Gritty sandstone.

It is impossible to diagnose the formation from which this was taken without seeing the occurrence in the field.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES — Sample No. F100/57

SOUTH AUSTRALIA — Reference D.M.1112/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Kilkerran, Section Balgowan Township.

Distance and direction from nearest town or station - Balgowan.

Details: Collected from sea cliffs north of jetty.

Depth: H.W.S.T.

Information required: Stratigraphic correlation.

Submitted by W. Johnson, Department of Mines.

PALAEONTOLOGIST'S REPORT

Red clayey sandstone with worm burrows. It is impossible to give a reliable diagnosis without seeing the exposure, but the material appears to be of Pleistocene age.

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES — Sample No. F101/57

SOUTH AUSTRALIA — Reference D.M.1112/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Koolywurtie, Section Port Rickaby.

Distance and direction from nearest town or station - at Port Rickaby.

Details: Collected from limestone cliff with travertine at jetty.

Information required: Stratigraphic correlation.

Submitted by W. Johnson, Department of Mines.

PALAEONTOLOGIST'S REPORT

The sample is of nodular travertine (kunkar).

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES — Sample No. F5/55

SOUTH AUSTRALIA — Reference D.M.1112/57

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Fergusson, Hundred Para Wurlie, Section 70.

Distance and direction from nearest town or station - Point Turton.

Details: Collected from outcrop.

Information required: Stratigraphic correlation.

Submitted by E.P. O'Driscoll, Department of Mines. Date: 3/11/55.

PALAEONTOLOGIST'S REPORT

Supplementary to previous report dated 26/5/55.

Friable bryozoal limestone, with Victoriella plecte (Chapman).

The presence of this foraminifer permits diagnosis of the age of the Point Turton Limestone as "Janjukian" (Oligocene).

10/6/57

(N.H. Ludbrook)
PALAEONTOLOGIST

DEPARTMENT OF MINES
SOUTH AUSTRALIA

MICROPALAEONTOLOGICAL EXAMINATION OF SOIL SAMPLES, NORTHERN YORKE PENINSULA (C.S.I.R.O.).

by

M. N. Ludbrook,
Senior Palaeontologist,
Palaeontology Section,
Geological Survey.

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

MICROPALAEONTOLOGICAL EXAMINATION OF SOIL SAMPLES, NORTHERN YORKE PENINSULA (C.S.I.R.O).

ABSTRACT

Thirty-one samples taken during a soil survey of northern Yorke Peninsula were examined for the C.S.I.R.O. to obtain information on depositional environment and age. Twelve of them contained marine foraminifera or molluscan fragments, most of which were probably transported by wind.

INTRODUCTION

Thirty-one samples taken in Hds. of Valleroo, Tiparra, Kadina, Kulpara and Tickera were submitted by Mr. R. W. Jessup, of the Division of Soils, C.S.I.R.O., for palaeontological examination in order to gain information on the age of the material and the depositional environment. Depth of samples varied from 0-4" to 180". Material was washed free of clay over a 200-mesh screen, and material from some of the samples was concentrated with carbon tetrachloride.

All but 9 of the samples contained organic remains. Of the remainder, 10 contained fragments of land shells, too broken for identification, and 12 contained fragments of marine molluscs or foraminifera. Samples containing fragments of marine molluscs and foraminifera are A767(3), A782(1), A782(2), A782(3), A782(4), A782(5), A783(3), A784(2), A884(6), A936(2), A939(3), A941(3). Samples containing land shell fragments are A781(2), A851(3), A856(1 A875(1), A880(4), A880(5), A884(5), A894(3), A935(2), A937(2). Samples apparently barren are A794(2), A851(6), A871(4), A878(2), A879(3), A892(2), A904(4), A938(2), A938(4).

AGE AND ENVIRONMENT OF THE ORGANIC REMAINS

Most of the foraminifera are heavily recalcified. They are all shallow water forms, mostly of Elphidium. All the molluscs are fragmentary. Both foraminifera and molluscs are most frequent in the samples taken in sandridges near the coast, namely

A762(1-5), A764(2), A939(3) and A941(3). Sample A767(3) contained fragments of microscopic colonies which appear to be adherent bryozoa, but their identification would need to be confirmed by a specialist in bryozoa. If they are correctly identified, they would have been adhering to seaweed. While most of the molluscan fragments and foraminifera associated with the colonies are recalcified, the bryozoa and fragments of land molluscs are fresh. The general impression given by this material is that it has been transported by wind.

The species are all living species, some of which are known to occur as far back as the Pliocene. In the present state of our knowledge of the microfaunas sequence in the Quaternary, it can only be stated that the assemblage appears to be of Pleistocene to Recent age.

The land shells in the samples not containing marine organisms are fragmentary and bleached but not recalcified. They are of Recent origin.

DESCRIPTION OF THE SAMPLES

A767(3). co. Ealy, hd. Eadina, sec. 23B, 3 miles east of Eadina 9"-12", below kunkar sheet. Marl with nodular kunkar, angular to subangular quartz, fresh bryozoa (?) and fragments of land molluscs, some recalcified molluscan fragments and foraminifera: Elphidium sp. cf. E. advenum, Elphidium crispum.

A761(2). co. Ealy, hd. Vallaroo, sec. 19A, 2½ miles west south west of Moonta, 24" sandridge, with subangular to subrounded quartz, kunkar, lime coating of quartz grains.

A762(1). co. Ealy, hd. Vallaroo, sec. 127, coast cliff, Barry's Point, Moonta Bay, 12" sandridge with kunkar granules, subrounded to subangular quartz, shell fragments and one recalcified specimen of Elphidium crispum.

A762(2). Locality as above. 48", sandridge, with kunkar-coated quartz grains with pitted surfaces, marine shell fragments and recalcified foraminifera - Elphidium crispum, E. macellum, Discorbis sira.

A762(3). locality as above, 105', sandridge, with coarse sub-angular quartz marine shell fragments and recalcified foraminifera - Elphidium crispum, Discorbis sp., Venerupis sp.

A762(4). locality as above, 144', sandridge, with coarse sub-angular quartz, marine shell fragments, recalcified foram-inifera - Discorbis sp., Venerupis sp., and fragment of a trochoid gastropod.

A762(5). locality as above, 150', sandridge, with coarse sub-rounded to subangular quartz, rare molluscs and foramin-ifera - Elphidium crispum, Discorbis sp., gastropod frag-

A763(3). co. Daly, hd. Wallaroo, sec. 327, 4 miles south of Wallaroo, 24'-27', marl, with nodular kunkar, subangular quartz, mostly lime-coated shell fragments, gastropod protoconch and a recalcified test of Elphidium crispum.

A784(2). co. Daly, hd. Tickera, sec. 3, near coast 2 miles north Point Riley, 60', sandridge, with angular quartz, kunkar fragments and a beach fauna of shell fragments, gastropod fragments, Elphidium crispum, Discorbis mira, echinoid spines.

A794(2). co. Daly, hd. Kadina, sec. 142, Williamulka R.S., 18'-21', marl, with iron stained subangular to subrounded quartz with pitted surfaces, some calcite.

A851(3). co. Daly, hd. Wallaroo, sec. 11, 4 miles south east of Noonta, 12'-17', marl, with ironstained quartz grains, kunkar and fragments of land shells.

A851(6). locality as above 60-63', lime-free clay, with subangular to angular quartz grains, iron oxide.

A856(1). co. Daly, hd. Tiparra, sec. 169, 4 miles south east of Noonta, 0-4', sandridge, with subrounded quartz, some calcite, clay and organic matter, few indeterminate molli-usc fragments.

A871(4). co. Daly, hd. Tiparra, sec. 476, 6 miles south of Noonta 6'-10', sandridge with evensized subrounded quartz grains, some plant material.

A873(1). co. Daly, hd. Kulpara, sec. 322, Kulpara, 0-5', sandy clay with subrounded to subangular quartz, much iron staining, brown organic matter and occasional land shell fragments.

A878(2). co. Daly, hd. Kadina, sec. 672, Paskeville, 3'-11', clay with medium to coarse subangular quartz, much iron oxide.

A879(3). co. Daly, hd. Wallaroo, sec. 1047, 7½ miles east south east of Moonta, 16'-24', marl with angular quartz and calcareous clay.

A880(4). co. Daly, hd. Tiparra, sec. 1, 9 miles east south east of Moonta, 22'-35', marl with illsorted angular quartz grains, calcareous clay and land shell fragments.

A880(5). locality as above, 40'-45', lime-free clay with illsorted angular quartz grains, and land shell fragments.

A884(3). co. Daly, hd. Kadina, sec. 305, 1 mile south east of Cunliffe, 43'-65', marl, with subangular to rounded quartz grains, calcareous clay. The quartz grains are often pitted. Occasional land shell fragments.

A884(6). locality as above, 80-83', lime-free clay with illsorted quartz grains, subrounded and fairly well polished, tourmaline, shell fragments, recalcified sponge spicules, and a fresh example of Planulinoides biconcava.

A892(2). co. Daly, hd. Kadina, sec. 713, Thrington D.S., 2½'-7', clay with iron-stained quartz and iron oxide, fine to medium grains, angular to subrounded.

A894(3). co. Daly, hd. Kulpara, sec. 357, 4 miles south east of Paskeville, 16'-30', marl with angular fine to medium quartz grains, much iron staining, rare land shell fragments.

A904(4). co. Daly, hd. Kulpara, sec. 56, 4 miles south east of Paskeville, 33'-52', marl, with kunkar pellets, subrounded quartz grains some of which are milky.

A933(2). co. Daly, hd. Wallaroo, sec. 288, 6 miles south west of Wallaroo, 3"-8", loam, with fine to medium angular iron stained quartz, brownish clay material.

A936(2). Co. Daly, hd. Wallaroo, sec. 308, 4 miles south west of Wallaroo, 2"-6", calcareous loam with subrounded quartz, brown loamy matter some recalcified marine gastropod fragments.

A937(2). co. Daly, hd. Wallaroo, sec. 308, 4 miles south west of Wallaroo, 3½"-10", calcareous loam with subangular quartz, calcareous grains and ferruginous matter. Fragments of marine gastropod and land shells.

A938(2). co. Daly, hd. Tipurra, sec. F, 3 miles south of Noonie, 1"-3½", sandy loam, with ironstained quartz grains of uniform size.

A938(4). locality as above, 72", clayey sand, with subrounded quartz grains with pitted surfaces.

A939(3). co. Daly, hd. Tipurra, sec. D, 9 miles south west of Noonie, 15"-30", sandridge with calcite-cemted quartz grains, marine gastropod fragments, recalcified foraminifera - Discorbis nitu, Triloculina tricarnata.

A941(3). locality as above, with recalcified foraminifera, Spiroloculina sp. cf. S. antillarum, Elphidium crispum, echinoid spines, marine shell fragments.

N. H. LUDBROOK,
SENIOR PALAEONTOLOGIST,
PALAEONTOLOGY SECTION.

NHL:END
16.3.65

MINLATON AND STANSBURY STRATIGRAPHIC BORES, SUBSURFACE STRATIGRAPHY AND MICROPALAEONTOLOGY

by

N. H. Ludbrook
Palaeontologist

18th August, 1961.

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MINLATON AND STANSBURY STRATIGRAPHIC BORES

SUBSURFACE STRATIGRAPHY AND MICROPALAEONTOLOGY

by

N. H. Ludbrook

ABSTRACT

Minlaton Bore intersected 596 feet of Lower Permian (?lowermost Sakmarian) glacigenes and then a lower Middle to Lower Cambrian succession 2459 feet thick consisting in downward sequence of Ramsay Limestone (105 feet), red bed clastics (456 feet), Parara Limestone (934 feet) Kulpara Limestone (964 feet). From 3075 feet depth to the bottom at 3261 feet the well is considered to have passed through beds transitional between the Lower Cambrian and the Pound Quartzite.

Stansbury Bore intersected 119 feet of Oligocene calcareous sandstone and bryozoal limestone equivalent to the lower part of the Port Willunga Beds, before passing into Lower Permian (?lowermost Sakmarian) glacigenes 776 feet thick. At 910 feet the well entered a red-bed sequence of current bedded sandstones and chocolate shales considered to be Upper Proterozoic (Marinoan Series). Boring ceased in these beds at 1370 feet.

1. INTRODUCTION

Minlaton No. 1 and Stansbury No. 1 Stratigraphic Bores were drilled in 1956 by the South Australian Department of Mines as part of an oil exploration programme which has been reviewed by Johnson (1960). The Permian sequence in Minlaton Bore was studied by the present writer who reported (Ludbrook, 1957) the occurrence of foraminifera in these sediments, giving the first evidence of marine influence in the South Australian Permian.

The Cambrian section was examined by Daily (1957, unpublished) who selected fossiliferous core samples for further study.

The present report is the result of re-logging of both bores by B.P. Thomson and N.H. Ludbrook in the light of recent further discoveries of marine Permian strata in South Australia (Ludbrook, 1961) and studies of the transition beds between the Lower Cambrian and Upper Proterozoic principally by B.P. Webb, R. Horwitz, and B.P. Thomson (Webb and Horwitz, 1959; Horwitz, Thomson, and Webb, 1959; Thomson, 1961 unpublished).

Both the Tertiary and Permian sections of Stansbury Bore have been examined in detail for microfaunas, an important result of which is the confirmation of the occurrence of marine Permian on Southern Yorke Peninsula by the recovery of foraminifera over two main intervals between 205 and 855 feet in Stansbury Bore.

2. STRATIGRAPHIC SUMMARY

Stratigraphic units intersected in the two wells are

	Minlaton Depth(feet)	Stansbury Depth(feet)
Port Willunga Beds (Oligocene)	-	15 - 134
Lower Permian glacigenes (lowermost Sakmarian)	20-616	134 - 910
Ramsay Limestone (Lower Middle Cambrian)	616-721'6"	-
Red bed clastics (Lower Cambrian)	721'6"-1177	?
Parara Limestone (Lower Cambrian)	1177-2111'9"	-
Kulpara Limestone (Lower Cambrian)	2111'9"-3075'	-
Transitional beds (Lower Cambrian)	3075-3261'3"	-
? Marinoan Series (Upper Proterozoic)	-	910-1370

3. PORT WILLUNGA BEDS - OLIGOCENE

Stansbury Bore intersected 119 feet of fossiliferous calcareous sandstone and sandy bryozoal limestone under 15 feet of surface cover. Foraminifera are common, generally consisting of a few individuals of many species. The assemblages over the interval 30-130 feet are generally characterized by the presence of Sherbornina atkinsoni in association with Notorotalia crassimura, Cibicides vortex, Eponides repandus and Anomalina perthensis. They are of Oligocene age, representing the lower part of the Port Willunga Beds.

4. LOWER PERMIAN GLACIGENES

Both Minlaton and Stansbury intersected Permian boulder clays and clayey sands in which quartz grains ranging from angular to rounded and often with etched and pitted

surfaces are abundant with accessories usually garnet, pyrite, biotite, chlorite. Small pebbles of varying sizes and of diverse origins are usually present; these are commonly granite, schist, limestone, quartzite, sandstone. The matrix is either bluish white clay or chocolate clay, the latter presumably derived from chocolate shales of the Precambrian in a similar way to the chocolate clay bands in the glacial sequence at Hallett Cove.

Foraminifera occurred in Minlaton Bore abundantly between 500 and 535 feet and sporadically between 535 and 594 feet, at the base of the glacial sequence. In Stansbury Bore foraminifera occurred abundantly between 205 and 230 feet, between 361 and 375 feet and less abundantly near the base of the glacigenes between 770 and 855 feet. Only arenaceous forms are present, principally Hyperammina acicula, Ammodiscus oonahensis, Ammovertella inclusa and Tolypammina undulata. So far no plant spores have been found associated with the foraminifera. The additional evidence of the presence of foraminifera in the glacigenes combined with their discovery in the glacigenes elsewhere in the state (Ludbrook, 1961) permits the dating of the Permian sediments as Lower Sakmarian. Conditions of deposition were suggested earlier (Ludbrook 1957) as deltaic, but it now appears more probable that on Yorke Peninsula they were, in part at least marine, with piedmont glaciers shedding their loads into the sea.

Identification of the foraminifera has been aided by Crespin's (1958) monograph of Permian foraminifera of Australia. The assemblage appears to be most nearly related to that recorded by Crespin (pp. 14, 27) from a section in the Lower Permian Quamby Mudstone from near Oonah, Tasmania.

The glacigenes were 596 feet thick in Minlaton and 776 feet thick in Stansbury Bore.

5. CAMBRIAN

Most of the Cambrian sequence in Minlaton Bore was determined by Daily (1957) before drilling ceased and the bore

still in progress correlated with other Cambrian sections (Daily, in Glaessner & Parkin, 1958 fig. 14 p. 54). A general interpretation of the section was published by Johnson (1960, p. 130). The present report reinterprets principally the lowest part of the section below 3075 which is considered to have intersected transitional beds and not the Pound Quartzite.

(1) Ramsay Limestone - Lower Middle Cambrian

Between 616 feet and 721'6" the bore intersected grey mainly concretionary limestone with stylolites. Redlichia was reported in this interval by Daily.

(2) Red bed clastics - Lower Cambrian

Below 721'6" occurred 455'6" of chocolate and grey siltstones, grey limestone with clastic bands and gypsum interbeds to 1088 feet.

A conglomerate band was intersected between 1088 to 1116'6".

(3) Parara Limestone - Lower Cambrian

The grey concretionary fossiliferous Parara Limestone occurred between 1177 and 2111'9" with fossils including Pararia selected by Daily for further study between 1177 and 1254 feet. Archaeocyatha occurred abundantly between 1254 feet and 1288'6" and between 1304 feet and 1485 feet. Splashes of pyrite in massive limestone characterized the lower part of the Parara Limestone from 1721 to 2111'9".

Fossils were recorded by Daily at the following depths:

1687'6": Pararia sp., Pelagiella sp., Conchostraca, brachiopods, hyolithids

1740feet: Yorkella sp., Hyolithes sp., brachiopods, Pelagiella, Helcionella tatei.

1931feet: Yorkella australis, Ophileta subangulata, Helcionella tatei, Hyolithes sp.

Calcite veins occur at 2111'9" where the contact of the Parara and Kulpara Limestones is interpreted.

(4) Kulpara Limestone

Below 2111'9" Minlaton Bore passed into light grey dense limestone with abundant stylolites, which are highly carbonaceous when broken open. From 2360 feet the bore passed downwards through darker grey limestone with splashes of galena, stylolites, and calcite veinlets, to grey dolomitic limestone and dolomite with abundant carbonaceous stylolites and calcite veinlets. No fossils were observed in the dense dolomitic limestone.

(5) Transitional beds

From 3075 feet the bore intersected a sequence of dense dolomite, dolomitic limestone, dolomitic arkose and grey arkose with carbonaceous partings. These are considered to be transitional beds at the base of the Cambrian.

Minlaton Bore was terminated in these beds at 3261'3".

6. ?MARINOAN SERIES - UPPER PROTEROZOIC

Below 910 feet Stansbury Bore entered a red bed sequence of cross-bedded sandstone, buff fine-grained sandstone and chocolate shale in which the bore was terminated at 1370 feet.

These are considered by Thomson and Ludbrook to be Upper Proterozoic rocks of the Marinoan Series, but as suggested by Johnson (l.c. p. 128-129) and by the columnar sections at the end of this report, they may be equivalent to the red bed clastics between 721'6" and 1177 feet in Minlaton Bore. The thickness penetrated in Stansbury Bore, as will be seen from the sections, was insufficient to determine with certainty the correlation of the red beds with the Marinoan.

7. MINLATON BORE - LITHOLOGICAL LOG

MINLATON NO. 1 BORE — Bore Serial 861/56

Section 153 — Hundred of Ramsay

LITHOLOGICAL LOG

Depth (feet)	Percussion drill
0 - 10	Pale buff sandy marl
10 - 20	Red slightly calcareous and ochreous sandy clay.
20 - 34	Red clayey sand
34 - 45	Red brown sandy clay
45 - 55	Buff medium clayey sand with some grit, consisting of quartz grains mostly medium sized and subrounded, the larger grains subrounded and polished, the fine to medium grains sometimes cemented with limonitic ochre.
55 - 64	Pale buff gritty and clayey sand with medium subrounded quartz grains either polished or pitted; limonitic ochre staining.
64 - 75	Pale buff clayey sand with medium subrounded quartz grains and some rounded, mostly with finely pitted surfaces and rather flat faces; some ironstaining. Granite pebble at 65 feet, fragment of sandstone, mica, black mineral.
75 - 85	Yellow coarse gritty sand with pebbles up to 8 mm. diameter derived from various sources: granite, gneiss, sandstone, quartz, etc., the quartz grains all worn and facetted with dull finely pitted surfaces. Some ironstaining.
85 - 100	Yellow coarse gritty sand with large ill-sorted grains to pebble size. Pebbles facetted and of various origins: granite, quartz schist etc.
100 - 110	Pinkish brown medium quartz sand, the quartz grains worn and facetted with dull surfaces; ironstaining.
110 - 117	White to grey gritty sand with pink felspar grit and pebbles as above.
117 - 120	Pale grey gritty clay.
120 - 126	Pale blue-grey gritty clay
126 - 132	Blue-grey gritty sand and clay with broken fragments of pebbles of various origins - granite, quartz, etc. - up to 10 mm. diameter.
132 - 140	Blue-grey clayey sand with pebbles up to 15 mm. of quartz, sandstone, quartz-mica schist etc., all worn with dull surfaces and mostly facetted. Medium quartz grains subrounded to rounded with dull surfaces.

Depth (feet)	Percussion drill
140 - 160	Pale grey clayey sand as above.
160 - 170	Grey pebbly sandy clay with pebbles to 15 mm. diameter of various kinds, worn and facetted with dull surfaces; medium grain similar to 132-140 feet.
170 - 190	Brown pebbly clay.
190 - 193	Buff clay with some fine sand.
193 - 225	Blue grey and chocolate sandy and pebbly clay with broken pebbles up to 18 mm. diameter of various kinds - granite etc. - facetted, with dull surfaces.
225 - 260	Blue-grey pebbly clay.
260 - 349	Chocolate gritty and pebbly clay and clayey sand with pebbles of diverse origins.
349 (core)	Chocolate pebbly sand with a little clay, consisting mainly of medium quartz grains with pebbles of diverse kinds, many broken by the drill, otherwise facetted and worn, with dull surfaces; the chocolate colour originates from the clay which appears to be derived from glaciation of Precambrian chocolate shales.
349 - 450	Chocolate sandy and pebbly clay as above.
450 (core)	Chocolate sandy clay with small pebbles, mostly facetted with flat surfaces, of diverse kinds - granite, quartz-mica schist, quartz, etc. Fine fraction mainly of clear quartz grains with uneven pitted surfaces.
450 - 500	Chocolate sandy and pebbly clay as above.
500 - 530	Dark bluish grey siliceous claystones with abundant arenaceous foraminifera. The washed residues consist almost entirely of broken and deflated tests of Hyperammina and Ammovertella, with medium subrounded to subangular quartz grains, mostly pitted on the surface, pyrite, garnet, rutile.
530 - 535	Bluish grey sandy claystone with chocolate brown bands, medium subangular to subrounded quartz grains, grains of miscellaneous rock material, garnet,, rutile. Foraminifera dominated by Hyperammina acicula.
535 - 543	Greenish grey and grey claystones, less arenaceous than above, with small pebbles including one of dark blue grey limestone. A single broken test of Hyperammina.
543 - 552	Light chocolate claystone with irregular arenaceous partings, miscellaneous pebbles and a single test of Hyperammina
552 - 554	As above
554 - 565	Claystones as above.
565 - 566'2"	Green-grey claystones as above, with

Depth (feet)	Percussion Drill
	Hyperammina acicula.
566'2" - 567	Medium white calcareous quartz sandstone with abundant heavy minerals mostly garnet and rutile with accessories chalcopyrite, biotite, epidote, azurite, magnetite, zircon, biotite, limonite.
567 - 575	White gritty, quartz sand with limestone and chocolate shale pebbles and heavy minerals as above. Hyperammina present 567-570'.
575 - 595'6"	Light brown gritty calcareous fine sand and grit, with heavy minerals as above and foraminifera.
595'6" - 605	Light brown fine calcareous sand and grit.
	Diamond drilling commenced at 616 feet, continuous core being recovered below this depth.
CORE	
616'0" - 620'	Dark grey dense crystalline limestone, irregularly banded in light and dark grey with abundant stylolites.
620 - 629'9"	Dark grey and grey finely banded concretionary dense limestone.
629'9" - 632	Dark grey concretionary finely banded limestone.
632 - 634	As above, with calcite vein.
634 - 639	Dark grey dense concretionary limestone.
639 - 640'3"	
640'3" - 655'	Dark and light grey finely bedded dense limestone with stylolites.
655 - 659'3"	Dark and light grey concretionary limestone.
659'3" - 664'10"	Dark and light grey finely banded limestone
664'10" - 681'5"	Dark and light grey finely banded limestone with stylolites.
681'5" - 721'6"	Banded concretionary limestone as above, with bands of gypsum interbedded with dolomite at 711 feet (Petrological Report A1364/56).
721 - 742	Grey argillaceous limestone with pyrite on the laminae; sandy in places with small slump structures; red in colour and more arenaceous at 725 feet.
742 - 743	Red and grey mottled limestone.
743 - 748'10"	Grey argillaceous and somewhat cellular limestone.
748'10" - 750'8"	
750'8" - 766'2"	Grey finely laminated argillaceous limestone.

Depth (feet) Core			
766'2"	-	772	Grey banded argillaceous limestone and calcareous shale with gypsum bands and dolomite; some barite. (Pet. Rep. P69/60).
772	-	810	Chocolate banded dense siltstone with calcite dolomite and gypsum bands (P. 70/60).
810	-	815'11"	Grey fine siltstone, slightly calcareous in bands; some irregular bedding.
815'11"	-	864'6"	Grey fine siltstone as above, with lighter coloured calcareous bands (Pet. Rep. A.1369/56).
864'6"	-	871	Dark grey impure cellular limestone with white flecks of calcite; some small vughs. Galena at 864'6" and 871'.
871	-	884	Dark reddish grey and grey finely irregularly bedded dense siltstone.
884	-	884'6"	Dark red and reddish grey clastic arkosic band.
884'6"	-	898'10"	Dark reddish and greenish grey siltstone; red at 886-887'6"; small slump structures at 888' and 897'. Evidence of cross bedding at 898'.
898'10"	-	915'7"	Siltstone as above; grey colour continues to 902' and then reddish with occasional small slumps to 909'6", then light brown and grey with fine cross bedding for 3', then fine-grained mottled greenish grey dense siltstone.
915'7"	-	928'	6 feet reddish, then banded light and dark grey with calcareous band.
928	-	938	Reddish, then grey cross-bedded with clastic band at 935'.
938	-	941'6"	Reddish-grey dense (not bedded) very fine massive siltstone with traces of pyrite.
941'6"	-	945'8"	Siltstone as above with well marked calcareous bands.
945'8"	-	948'9"	Massive siltstone.
948'9"	-	982'4"	18" laminated and somewhat irregularly banded siltstone with minor clastic bands ½" at 963' becoming massive and faintly banded to 982 feet in alternating red and green.
982'4"	-	1053'6"	6 feet banded as before, with calcareous zones; minor clastics at 989'; greenish to 994'6" then reddish only to 1053'6" with minor clastic bands and some cross-bedding and slumping (P87/59).

Depth (feet) Core		
1053'6"	- 1088'	Chocolate banded siltstones with 2" band of coarse clastics at 1053', 1055' (gradual increase in grain size), 1062'6", 1066', 1067', 1070', 1070'6", 1071'6", 1076', 1077', 1080'6", 1081'6", 1085'9".
1088	- 1116'6"	Coarse conglomerate with light grey-white and pink pebbles of quartzite, limestone (some fossiliferous) of various sizes with interbedded red finer clastic bands grading to siltstone.
1116'6"	- 1151	Chocolate fine-grained fissile shale braking into ¼" laminae - well laminated, becoming greenish-grey and mottled at 1140'9" and then passing into greenish-grey shale at 1151'.
1151	- 1177	Green-grey laminated shale.
1177	- 1194	Grey dense limestone
1194	- 1254	Grey and light grey concretionary limestone with occasional stylolites.
1254	- 1288'6"	Grey to pink limestone with abundant Archaeocyatha; solution cavities; pyrite at 1279'.
1288'6"	- 1303'6"	Grey irregularly banded limestone changing to green and pink-buff.
1303'6"		Pale green shale - 3" band.
1304	- 1485	Light grey massive limestone with abundant Archaeocyatha and occasional stylolites.
1485	- 1504	Pinkish, mottled massive limestone.
1504	- 1573	Dark and light grey concretionary limestone; calcite veins at 1560'6", limestone coarsely crystalline with numerous calcite veins to 1578'.
1578	- 1721	Concretionary limestone as above.
1721	- 2111'9"	Lighter grey massive, less concretionary than above, becoming banded 1742'-1746'. Splashes of pyrite at 1818-1819, 1828, 1907.
2111'9"	- 2118'3"	Only 2 feet recovered, mainly calcite veins.
2118'3"	- 2360	Light grey dense limestone with abundant stylolites, intermittently irregularly banded with carbonaceous material at 2137', 2153', purple colour of fluorite at 2209' - pyrite traces 2210', slump and sedimentary breccia structures at 2221', calcite flecks at 2230', darker colour at 2234', sedimentary breccia at 2316', grey and dark grey banded with breccia zones at 2320', continuing to 2360 feet.

Depth(feet) Core		
2360	- 2362	Light pinkish grey dense finely banded limestone.
2362	- 2384	Darker grey limestone with traces of galena at 2370'6" to 2371' in small quartz-calcite veinlets; fluorite at 2364'6", lighter band with stylolites 2373-2384'.
2384	- 2386'9"	Dark grey concretionary limestone.
2386'9"	- 2409'9"	Dark grey limestone with sedimentary breccia at 2405 and irregular calcite veinlets.
2409'9"	- 2415'9"	Vertical irregular calcite vein of varying width containing brecciated limestone fragments.
2415'9"	- 2426	Dark grey limestone with calcite veinlets.
2426	- 2432	Recovered 1 foot dark grey dense limestone.
2432	- 2443	Recovered 3 feet dark grey interbedded with light pinkish grey dense banded limestone.
2443	- 2461'9"	Light pinkish grey irregularly banded limestone with stylolites.
2461'9"	- 2469	Dark grey limestone with calcite veinlets, changing to light grey limestone with some breccia at 2465 and trace of pyrite at 2469'.
2469	- 2480	Dark grey limestone with calcite veinlets
2480	- 2518	Darkmgrey dolomitic limestone with lighter grey band 2496-2498'6", calcite vein at 2498'6", carbonaceous material on stylolite parting at 2506'9".
2518	- 2530	Mostly dark grey dolomitic limestone with calcite veinlets, trace of pyrite at 2526'.
2530	- 2547'3"	As above, with light dolomitic bands and small slump-breccia structures - 2' at 2530', 1 foot at 2540', band at 2541'.
2547'3"	- 2558	Very pale grey well banded dolomite with darker bands.
2558	- 2578	Dark grey brecciated dolomite with solution cavities at 2565'6"-2567', calcite veins at 2573'.
2578	- 2583	Light grey dolomite or dolomitic limestone.
2583	- 2594	Dark grey confused dolomite becoming fairly well bedded at 2591'.
2594	- 2597'6"	Dark grey flaggy dolomite with small cavities.
2597'6"	- 2635	Light grey changing gradationally to dark grey dense dolomite with trace of pyrite at 2599; carbonaceous material on stylolite parting at 2602'; calcite veinlets at 2610, 2630'; cavities with quartz and calcite at 2598', 2616', 2639', 2656' (P.33/58).

Depth (feet)

Core

2611 - 2630'	7 feet	recovered
2630 - 2637'	6 "	"
2637 - 2654'	6 "	"
2654 - 2664	5½ "	"

2635 - - 2816'3" Grey dense dolomite with small cavities containing carbonaceous material and calcite; calcite veinlets at 2741'8", 2744'4", trace of pyrite at 2734'6"; carbonaceous material on stylolite parting at 2746', 2748', 2761'; breccia zones at 2759', 2764'; black material in breccia zones at 2789'; splash of pyrite in calcite veinlet at 2810'9", 2813'9" (P.32/58).

2816'3" - 2840'9" Light grey and grey dolomite with stylolites masked by carbonaceous material at 2816'3", 2817'3" and between 2818' and 2834'3"; micro-faulting at 2840'.

2840'9" - 3029 Dark grey dense dolomite with calcite veinlets, carbonaceous matter relatively rare and occurring at 2861', 2867', 2880'6", 2900', 2925', 2933'6", 2934'6", 2943', 2950'6"; galena at 2895'7"; at 2895'10", a ¼" vein of carbonaceous material with calcite and pyrite specks; 2 slightly shaly bands between 2896' and 2898'; fine crowded stylolites with traces of carbonaceous material, on the partings at 2918'; slump structures at 2984'5"; fractured, brecciated and carbonaceous at 2990'6",

2968' - 2973'6"	2'	recovered
2973'6" - 2977'6"	1'6"	"
2981'3" - 2983'5"	4"	"
2993'2" - 3001'9"	2'6"	"
3001'9" - 3004'4"	2'3"	"
3004'4" - 3013'5"	1'3"	"
3013'5" - 3018'5"	1'3"	"

3029 - 3075 Light grey massive irregularly bedded dolomite with stylolites becoming very abundant at 3046'. (P.213/58).

3075 - 3096 Light grey grading to pinkish grey dense dolomite with thin grey partings at 3079'; pyrite at 3083', colour light pinkish grey to 3096'.

3096 - 3121 Pinkish grey hard massive banded, dolomite with red and grey shale band at 3104'; pink bands of fine arkose with pink pellets and pyrite at 3118'6". (P214/58, P215/58).

3121 - 3141'9" Pink and grey irregularly banded dolomitic arkose with coarse dolomitic limestone at 3125'6", 3131-3131'8" and 3133-3134'9"; pyrite scattered in small flecks at 3137'; dolomitic sandstone 3130-3138; grit 3139-3141'9".

3141'9"	- 3174	Fine or medium grained irregularly banded arkose with pyrite at 3143', locally calcareous and dolomitic; coarse band 3147-3147'6" with large pink felspars to 10mm. (P216/58).
3174	- 3176	Dark grey calcareous and carbonaceous siltstone.
3176	- 3184	Grey coarse to medium grained arkose with pink felspars.
3184	- 3261	Grey arkose-finer grained- becoming coarse again at 3193' and then medium to fine at 3196'; carbonaceous at 3191; coarse grained with carbonaceous pellets at 3214'9", continuing fine to medium grained arkose with black irregular banding and pink felspars abundant again at 3255; dark carbonaceous partings at 3255'6", 3256-3258' arkose as above with carbonaceous shale partings.
3261'3"		Coarse grained grey arkose with pink felspars to 4mm. length and grit quartz to 4mm.
3261'3"		End of hole.

Australian Mineral Development Laboratories Petrology Reports have been issued for the intervals indicated above by sample numbers e.g. 2656' (P33/58).

8. STANSBURY BORE - LITHOLOGICAL LOG

STANSBURY NO. 1 BORE — Bore Serial 1232/56

Section 117 — Hundred of Dalrymple

LITHOLOGICAL LOG

Depth (feet)			Percussion drill
0	-	6"	Brown sandy loam soil and surface kunkar
6"	-	15'	Buff sandy marl and nodular kunkar.
15	-	20	Buff calcareous sand and kunkar with sub-rounded to angular quartz grains, nodules of kunkar, calcite fragments, occasional garnet grain. Elphidium advenum present.
20	-	25	Buff calcareous sand and kunkar with Cibicides refulgens.
25	-	30	Buff calcareous sandstone and kunkar with a few foraminifera.
30	-	35	Yellow calcareous sandstone with abundant foraminifera and bryozoa. Sherbornina atkinsoni and Notorotalia crassimura dominant.
35	-	40	Yellow sandy bryozoal limestone with abundant foraminifera of many species including Sherbornina atkinsoni and Cibicides vortex.
40	-	45	Yellow sandy bryozoal limestone with abundant foraminifera of many species, dominated by Sherbornina atkinsoni, Cibicides vortex, Notorotalia crassimura.
45	-	50	Yellow sandy bryozoal limestone, with similar micro-fauna.
50	-	55	Yellow sandy bryozoal limestone with microfauna as above.
55	-	75	Yellow sandy bryozoal limestone with Sherbornina atkinsoni, Cibicidella variabilis, Planorbulina mediterranensis, Heronallenia lingulata.
75	-	80	Yellow sandy bryozoal limestone with Eponides repandus, Stomatorbina concentrica, Cibicides umbonifer.
80	-	85	Yellow sandy bryozoal limestone with abundant foraminifera dominated by Stomatorbina concentrica.
85	-	90	Yellow fairly hard partially recrystallized bryozoal limestone; meagre foraminiferal assemblage.
90	-	100	Yellow bryozoal limestone with some glauconite, rutile; foraminifera include Cibicides umbonifer, Anomalina perthensis.

Depth (feet)	Percussion drill
100 - 115	Brown-yellow ferruginous sandy limestone with fragments of ironstained calcite, bryozoa etc., polished quartz grains stained with limonite, garnet. Cibicides umbonifer, C. vortex and associated species of Cibicides, Angulogerina,
115 - 125	Brown yellow ferruginous limestone with polished quartz grains. Echinoids Fibularia and Scutellina.
125 - 130	Yellow brown calcareous grit with sub-rounded and polished quartz grains of grit size, abundant limonite; few foraminifera.
130 - 134	Yellow brown calcareous gritty sandstone with worn bryozoa subangular mostly polished quartz grains, grains of limonite, few isolated foraminifera. Fragments of schist.
134 - 145	Brown-grey gritty clay. Sludge workings consist of a mixture of water-worn quartz sands, bryozoa etc. with fragments of schist, polished quartz grains, limonite.
145 - 171	Brown-grey sandy to gritty clay with limonitic polished subrounded to sub-angular quartz grains, pink garnet, biotite, grey quartz, granite, schist and cavings from overlying Tertiary.
171 - 171'9" (Core)	Grey sandy to gritty boulder clay with clear quartz grains, angular to sub-rounded with flat faces, opalescent quartz grains, quartz-mica schist, pyrite, biotite, garnet, opaque minerals, quartzite and granite pebbles.
171'9" - 185	As core above.
185 - 190	Brownish grey boulder clay with subrounded or subangular quartz, mainly with etched surfaces, grit size pebbles of various origins, garnet, biotite.
190 - 190'9" (Core)	Brownish grey sandy boulder clay with intergrowths of pyrite and gypsum and some calcite. Pebbles of various origins, pyrite dodecahedra.
190'9" - 205	As core above.
205 - 210	Brown grey sandy boulder clay with pebbles of various origins, pyrite, garnet, opaline quartz, chlorite-schist. First Permian foraminifera dominated by Hyperammina acicula and Ammodiscus conahensis

Depth (feet)	Percussion drill
210 - 225	Grey sandy clay with angular to rounded clear quartz grains with etched and pitted surfaces, garnet, pyrite, biotite, rutile, schist particles, opaline quartz, abundant arenaceous foraminifera dominated by Ammodiscus oonahensis, which is sometimes replaced by pyrite; pyritized wood.
225 - 250	Dark grey clay with pebbles of Cambrian limestone and grey sandstone, abundant pyrite, white calcite aggregates, quartzitic limestone with pyrite intergrowths, garnet.
250 - 258	Brown-grey sandy clay, as core below.
258 - 258'8" (Core)	Brown-grey sandy clay with subangular to rounded quartz, opaline quartz, garnet.
258'8" - 262'6"	Brown grey sandy clay as above.
262'6" - 270'	Grey sand with patches of blue-grey calcareous sandy clay.
270 - 285	Greenish sandy clay with fine to medium coarse angular to rounded quartz grains mostly with etched and pitted surfaces, pyrite, rutile, garnet.
285 - 365	Light greenish sand and light grey sandy clay with pockets of blue-grey clay, abundant rounded to angular clear quartz and pyrite, grey limestone, garnet, quartz mica schist.
365 - 365'9"	Blue grey sandy clay with pyrite nodules, pebbles, garnet etc. Abundant Hyperammina acicula; Ammovertella encrusting pebble.
365 - 370	Blue grey sandy clay
370 - 375	Blue grey sandy clay with Hyperammina acicula.
375 - 385	Blue grey sandy clay with assorted pebbles, coarse rounded to subrounded clear quartz, fine angular clear quartz, pyrite, garnet, rutile, quartz-pyrite nodules, biotite.
385 - 390	Light grey sandy bedded clay with angular to subrounded medium to coarse quartz, garnet, pyrite, chlorite, miscellaneous pebbles and grit, pyrite and quartz intergrowths.
390 - 390'9" (Core)	Light grey bedded clay and sand with white specks, angular to subangular quartz grains with etched surfaces. Small pebbles of miscellaneous origins, garnet, biotite, rutile.
390'9" - 400	Grey fine sandy clay
400 - 401 (Core)	Light grey bedded sand and clay with pebbles

Depth (feet)	Percussion Drill
401 - 410	Grey sandy clay
410 - 411'6" (Core)	Grey sandy clay with medium and some fine clear quartz, subrounded and of uniform size with etched and pitted surfaces; garnet, rutile, pyrite, granite and schist pebbles. Scratched pebble.
411'6" - 420	Light grey sandy clay.
420 - 420'9" (Core)	Grey sandy boulder clay with medium to coarse rounded to subangular quartz to grit size, pebbles of various origins, sometimes facetted.
420'9" - 430	Boulder clay as above.
430 - 430'6" (Core)	Grey sandy boulder clay with pebbles of greywacke, schist, etc.; spherical pyritic nodules, garnet, rutile.
430'6" - 445	Boulder clay as above.
445 - 445'6" (Core)	Grey sandy boulder clay with assorted pebbles.
445'6" - 464'6"	Grey sandy boulder clay as above.
464'6" - 465 (Core)	Grey sandy boulder clay.
465 - 466'3"	Grey silt, clay and fine sand with assorted pebbles.
466'3" - 466'11" (Core)	Grey sandy clay and fine sand with subangular to subrounded medium coarse quartz grains, various pebbles, opaline quartz, garnet, rutile, pyrite.
466'11" - 483	Core at 470'4" - 471' and 482'6" - 483'. Sandy boulder clay as above.
483 - 505	Light grey clayey sand with pebbles.
505 - 506'6" (Core)	Light grey clayey sand with medium rounded to subrounded quartz, garnet, rutile, abundant pyrite, pebbles of pyritic sandstone, granite.
506'6" - 515	Light grey clayey fine sand.
515 - 535	Brownish-grey clayey sand with coarse rounded quartz grains, some small granite pebbles, chlorite, medium subangular to subrounded quartz grains.
535 - 536'1"	Light grey and light brown clayey sand with some small grey sandstone pebbles, medium rounded to subrounded quartz grains, pyrite, garnet, rutile, matrix kaolinitic.
536'1" - 600	Light blue-grey boulder clay as above with medium coarse subrounded fairly well sorted quartz grains, occasional pink garnet, pyrite, occasional granite and quartz pebbles.

Depth (feet)	Percussion drill
600 - 619	Light blue grey sandy boulder clay as above with rounded to subrounded polished and angular quartz, grit size grains of various origins - schist, granite, quartzite, garnet, pyrite.
619 - 624	Light blue grey sandy boulder clay as above with pyrite nodule 20 mm. long.
624 - 657	Light blue grey sandy boulder clay.
657' (Core)	Brown grey boulder clay, with chocolate coloured clay matrix.
657 - 664	Brownish grey boulder clay, chocolate matrix.
664 - 669	Brownish grey boulder clay with pebbles of granite, quartz, etc.; pyrite; chocolate matrix.
669 - 684	Boulder clay as above.
684 - 689	Grey boulder clay with dark grey pebbles, calcareous and pyritic.
689 - 714	Boulder clay as above with grit size pebbles.
714 - 770	Grey sandy boulder clay as above with mainly granite and quartzite pebbles.
770 - 775	Grey sandy boulder clay with few small pebbles of granite and other rocks, coarse to medium rounded to subangular quartz, pyrite, pink garnet. Abundant foraminifera dominated by Tolypammina undulata and Ammovertella inclusa.
775 - 800	Grey sandy boulder clay with abundant dark grey pebbles, medium to coarse subrounded quartz, garnet.
800 - 810	Brown grey sandy boulder clay with abundant pebbles of granite and dark grey metamorphic rocks, quartz and others of diverse origins, medium to coarse subangular quartz grains, garnet. Matrix chocolate coloured.
810 - 815	Grey sandy boulder clay with small pebbles of various kinds, much ferruginous matter, pyrite, subrounded coarse to medium quartz; few tests of Ammovertella inclusa and Hyperammina acicula
815 - 825	Boulder clay as above with abundant quartzite and granite pebbles.
825 - 830	Boulder clay as above with foraminifera dominated by Ammovertella inclusa.
830 - 840	Pale grey boulder clay with Hyperammina acicula, Ammovertella inclusa, Tolypammina undulata.

Depth (feet)			Percussion Drill
840	-	845	Pale grey boulder clay as above with abundant foraminifera, principally Hyperammina acicula and Ammovertella inclusa.
845	-	855	Boulder clay as above; one ostracode.
855	-	920	Grey sandy boulder clay with abundant pebbles of various kinds, rounded to subrounded quartz, pyrite, garnet.
			End of percussion drilling.
			Diamond drilling commenced at 920 feet, below which the well was cored.

CORE

920	-	932	Reddish fine-grained sandstone with ½ inch calcite band at 921'6".
932	-	952'9"	Reddish buff sandstone, calcareous at 934'6"; green band below with green clay flakes at 952'9".
952'9"	-	1003'9"	Red and buff cross-bedded sandstone grading to alternating green and red sandstone with chocolate and green clay flakes at 964'; calcite vein at 965'; finer grained and cross bedded at 991'. 971 - 993'3" 2' core recovered.
1003'9"	-	1072	Banded red and buff fine-grained sandstone, cross-bedded in places; calcite vein at 1050'.
1072	-	1135	Buff fine-grained sandstone with green clay flakes at 1076'; arkosic and slightly calcareous at 1091 and 1097' becoming redder and somewhat mottled below 1111 feet.
1135	-	1150'6"	5'6" recovery - slightly inclined to bedding. Chocolate shale, highly crushed and brecciated.
1150'6"	-	1164	6" core recovery.
1164	-	1181	Reddish brown well banded slightly calcareous sandstone.
1181	-	1234	1181 - 1201' 5½' core recovered. 1201 - 1210 1'6" " 1210 - 1220 1' " 1220 - 1234 1'6" "
1150	-	1210	Sludge samples - chocolate shale.
1210	-	1370	Reddish buff fine to medium sandstone with fine mica flakes and chocolate shale band at (?)1345'.
1370			End of hole.

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