

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

Hydrogeology Report No 1989/14

HARVEY LINE

BORE COMPLETION REPORTS

by

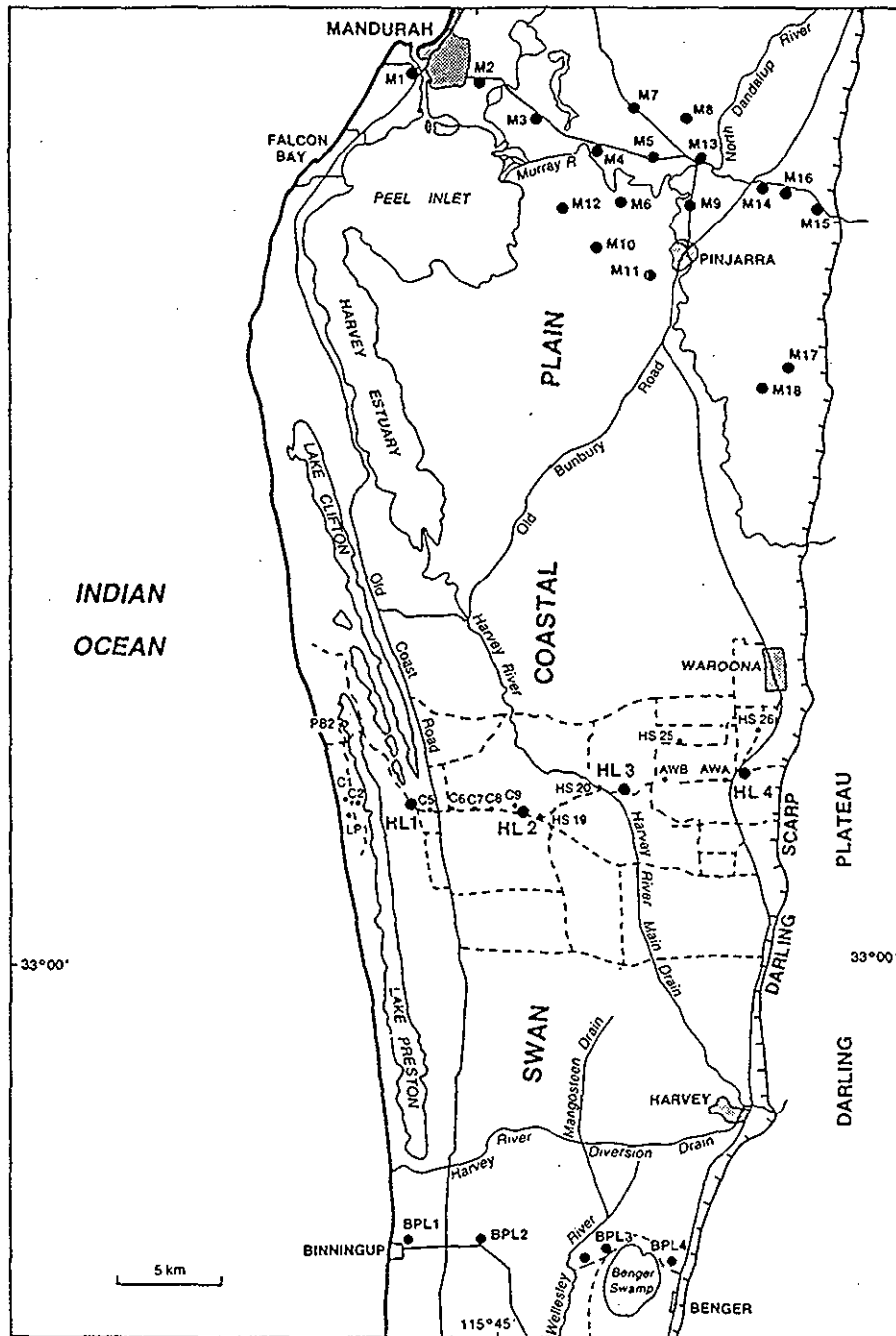
A C DEENEY

NOTE

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Perth, 1989

HL1B1 - 2032-III-B-32  
HL1B2 - 2032-III-B-33  
HL1B3 - 2032-III-B-34  
HL1W - 2032-III-B-38  
HL1A - 2032-III-B-39  
HL2A1 - 2032-II-C-145  
HL2A2 - 2032-II-C-146  
HL2A3 - 2032-II-C-147  
HL2W - 2032-II-C-148  
HL3A1 - 2032-II-C-149  
HL3A2 - 2032-II-C-150  
HL3A3 - 2032-II-C-151  
HL3W - 2032-II-C-152  
HL4A1 - 2032-II-B-242  
HL4A2 - 2032-II-B-243  
HL4B - 2032-II-B-244  
HL4W1 - 2032-II-B-245  
HL4W2 - 2032-II-B-246.



- HL1 Harvey line bore
- BPL1 Binningup line bore
- M1 Mandurah bore
- C1 Lake Clifton bore
- HS 20 Harvey shallow bore
- AWA Alcoa (Wagerup) A bore
- AWB Alcoa (Wagerup) B bore
- LP1 Lake Preston No 1 oil well
- PS2 Preston Beach No 2 bore

Figure 1. Location map

BORE COMPLETION REPORT  
HARVEY LINE SITE NO 1 (HL1)

LOCATION AND IDENTIFICATION

OWNER: Geological Survey of Western Australia

GSWA REF:    HL1A        SI50-2-2032-III-B-39  
              HL1B1      SI50-2-2032-III-B-32  
              HL1B2      SI50-2-2032-III-B-33  
              HL1B3      SI50-2-2032-III-B-34  
              HL1W       SI50-2-2032-III-B-38

LOCATION:    Wellington, Loc. 4079, adjacent to the south side of  
             Preston Beach Road and the east side of the track  
             running north-south.

             Owner: W A Government (Yalgorup National Park).

(Figure 1 - Location map)

AMG REF(Zone 50):    Eastings:    3787                    Northings:    63572

MAP SHEETS: 1:250000 Pinjarra (SI50-2)  
             1:100000 Pinjarra (2032)

PURPOSE:    HL1A - Exploratory  
              HL1B - Exploratory and observation  
              HL W - Water supply bore

STATUS:     HL1A - Abandoned  
              HL1B1 - perforated interval - 117 - 123 m bns - Observation  
              HL1B2 - perforated interval - 279 - 285 m bns - Observation  
              HL1B3 - perforated interval - 582 - 588 m bns - Abandoned  
              HL1W - screened interval    - 13 - 19 m bns - Observation

ELEVATION:   HL1B1 - top of 25mm GI pipe - 2.325 m AHD  
              HL1B2 - top of 80mm GI pipe - 2.219 m AHD  
              HL1W - top of casing        - 1.769 m AHD  
              Natural Surface-concrete base -1.617 m AHD

m bns = metres below natural surface  
GI     = Galvanised Iron  
NB     = Nominal Bore  
ID     = Internal Diameter

## BOREHOLE CONSTRUCTION AND DEVELOPMENT

Bore construction diagram (Figure 2)

DRILLED BY: Mines Department Drilling Section, Field Unit A.

RIG: Midway Skytop (Rotary)

MUD: Aquagel, Biopolymer, CMC, Quicktrol

### DRILLING COMMENCED:

HL1A - 25. 2.1983

HL1B - 14. 3.1983

HL1W - 16.11.1982

### DRILLING COMPLETED:

HL1A 10. 3.1983

HL1B 21. 3.1983

HL1W 17.11.1982

### DRILLED DIAMETER:

| Bore | Depth Interval (m bns) | Diameter (mm) |
|------|------------------------|---------------|
| HL1A | 0 - 62.5               | 350           |
| HL1B | 0 - 62.5               | 350           |
|      | 62.5 - 604.5           | 223           |
| HL1W | 0 - 21                 | 172           |

### TOTAL DEPTH:

HL1A - 62.5

HL1B - 604.5

HL1W - 21.0

### CASING (Drilling):

HL1A - None

HL1B - 260mm (ID) cemented in to 61.0 m bns

HL1W - None

### CASING (Completion):

| Bore | Depth Interval (m bns) | ID (mm)  |
|------|------------------------|--|
| HL1A | -                      | None   |
| HL1B | 0 - 61                 | 260  |
|      | 0 - 604                | 154  |
|      | 0 - 587                | 80 NB  |
|      | 0 - 6                  | 25 NB  |
| HL1W | 0 - 13.15              | 105  |
|      | 13.15 - 19.3           | 100 NB (Stainless steel screen 0.5mm aperture) |

### CEMENTING:

HL1A was cemented with 7m<sup>3</sup> of slurry.

HL1B - The 260mm sleeve welded steel conductor pipe was cemented in position with 3.5m<sup>3</sup> of cement slurry and 3.6m<sup>3</sup> of follow-up mud.

The 154mm sleeve welded steel casing was cemented using 15m<sup>3</sup> of cement slurry and 11.4m<sup>3</sup> of follow-up water.

Cement was drilled out from 524 to 600 m bns.

A cement block was cast around the top of the casing.

## OBSERVATION INTERVALS:

| Bore/Interval | Depth (m bns) | Formation                   |
|---------------|---------------|-----------------------------|
| HL1B1         | 117 - 123     | Leederville Formation       |
| HL1B2         | 279 - 285     | Cockleshell Gully Formation |
| HL1B3         | 582 - 588     | Cockleshell Gully Formation |
| HL1W          | 13 - 19       | Superficial formations      |

Remarks: Each interval in bore HL1BA was perforated with 3 shots per metre. The 80mm GI pipe was installed with a 6m section of flame-cut slots at approximately 280 m bns and two compressible packers were set at 253 and 554 m bns to seal the annulus between the 80mm pipe and the 154mm casing. HL1B1 is monitored in the 25mm pipe set in the annulus and HL1B2 is monitored in the 80mm pipe. HL1B3 was abandoned after development. HL1W was completed with 6m of 100mm NB, 0.5mm aperture, wire-wound stainless steel screen and the annulus packed with graded sand.

## CONSTRUCTION DIFFICULTIES:

Delays occurred during construction for the following reasons:

- (1) Mechanical breakdowns
- (2) HL1A had to be abandoned and cemented off due to the loss of the drill string stabilisers and an artesian flow. HL1B was drilled to replace it.
- (3) Loss and subsequent retrieval of part of airlifting string.
- (4) Packer became unsealed and was resealed.

## CONSTRUCTION COMPLETED:

HL1A - 11. 3.1983  
HL1B - 5. 4.1983  
HL1W - 18.11.1982

## DEVELOPMENT:

Artesian Flows occurred from each interval after perforation. Each interval was developed by airlifting and surging until the water cleared and the conductivity was constant. A sample was then taken for chemical analysis. HL1B3 was airlifted for 5 hours at 10m<sup>3</sup>/d before the other intervals were perforated. All three intervals were then airlifted at 930m<sup>3</sup>/d for 6 hours before the packers were installed. Combined artesian flow rate was 40m<sup>3</sup>/d. HL1B1 was then airlifted for 9 hours at 640m<sup>3</sup>/d and HL1B2 for 10 hours at 30m<sup>3</sup>/d. HL1W was developed by airlifting and jetting for 6 hours at 290m<sup>3</sup>/d. Subsequently it was pumped to supply water during the drilling of HL1A and HL1B.

SITE CLEARED: 8. 4.1983

## GEOLOGICAL DATA

SAMPLES: Rotary (ditch cuttings) at 3m intervals

SIDEWALL CORES: Using the gamma-ray log, 23 shale/siltstone targets were chosen in HL1B. 21 cores were recovered from the following depths (m bns) 89, 112, 146, 166, 174, 189, 194, 225, 249, 288, 347, 362, 423, 450, 486, 512, 548, 561, 590. No core was recovered from 263 m bns. No core was recovered from 174 m bns at the first attempt. Two cores were recovered from 189 and 561 m bns.

CORING OPERATORS: R Bulner and M A L'Herpinier

LOGGED BY: J W Hall and A C Deeney

REPOSITORY OF SAMPLES AND CORES: GSWA Core Library

### SUMMARY LOG:

| Depth Interval<br>(m bns) | Age                   | Formation   | Lithology                      |
|---------------------------|-----------------------|---|--------------------------------|
| 0-22.5                    | Quaternary            | Tamala Limestone                                      | Sand, sandy limestone          |
| 22.5-188                  | Early<br>Cretaceous   | Leederville<br>Formation                              | Sandstone, siltstone,<br>Shale |
| 188-605                   | Early-Mid<br>Jurassic | Cockleshell Gully<br>Formation<br>(Cattamarra Member) | Sandstone, siltstone,<br>Shale |

REMARKS: A log of the ditch cuttings is given in Appendix 1.  
A sidewall-core log is given in Appendix 2.

# GEOPHYSICAL DATA

LOGGING UNIT:      GO1 No 2 (Temperature log, first gamma-ray log and first Resistivity logs - GO1 No 1)

LOGGING OPERATORS: J Collier and T Collins

LOGS RUN: \_\_\_\_\_

| Log Type                      | Depth(m bns) | Date       |
|-------------------------------|--------------|------------|
| Gamma Ray                     | 0- 62.1      | 16. 3.1983 |
|                               | 0-592.1      | 20. 3.1983 |
| Neutron-Neutron               | 1.4-593.5    | 20. 3 1983 |
| Self Potential                | 62.5-593.1   | 20. 3.1983 |
| Short Normal Resistivity(16") | 17.5- 62.1   | 16. 3.1983 |
|                               | 62.5 593.1   | 20. 3.1983 |
| Long Normal Resistivity (64") | 17.5- 62.1   | 16. 3.1983 |
|                               | 62.5-593.1   | 20. 3.1983 |
| Caliper                       | 0-593.7      | 20. 3.1983 |
| Temperature                   | 0-526        | 20. 3.1986 |

REMARKS: (1) Log zeros were taken at the drilling pad surface.

(2) Apparent resistivities obtained from GO1 logs must be multiplied by a factor of 1.25 to give true formation resistivities.

(3) The temperature log was run approximately 3 years after completion of the bore to allow time for the natural geothermal gradient to be re-established.

(4) The first Gamma-ray log and the first LN & SN Resistivity logs were run prior to the installation of the conductor pipe.



# PALAEONTOLOGICAL DATA

## PALAEONTOLOGICAL REPORT:

Palynology of Harvey Line 1B. Pal. Rept. 12/1983 by  
J Backhouse (Appendix 3)

## SUMMARY OF RESULTS:

| Depth<br>(m bns) | Age                          | Zone                 | Environment                       | Formation   |
|------------------|------------------------------|----------------------|-----------------------------------|-------------|
| 89               | Valanginian                  | <u>B.Limbata</u>     | non-marine                        | Leederville |
| 166              | to Aptian                    |                      | (89m-deltaic,                     | Formation   |
| 174              | ?Hauterivian<br>to Barremian |                      | 166&174m lagoonal-<br>fluviatile) |             |
| 249              | Pliensbachian                | <u>C.Chateaunovi</u> | non-marine                        | Cattamarra  |
| 347              | to Aalenian                  |                      |                                   | Member of   |
| 423              | ?Upper Toarcian              |                      |                                   | Cockleshell |
| 486              |                              |                      |                                   | Gully       |
| 512              |                              |                      |                                   | Formation   |
| 561              |                              |                      |                                   |             |

REMARKS: Sidewall cores from 112, 146, 189, 194, 225, 450 and 548  
m bns were not processed for reasons of obvious oxidation or  
unsuitable lithology.

Sidewall cores from 288 and 362 m bns were barren of  
palynomorphs.

# HYDROLOGICAL DATA

## SUMMARY:

| Bore/Interval                                 | HL1B1                    | HL1B2                          | HL1B3                     | HL1W     |
|---|--------------------------|--------------------------------|---------------------------|----------|
| Interval (m bns)                              | 117-123                  | 279-285                        | 582-588                   | 13-19    |
| Formation                                     | Leederville<br>Formation | Cockleshell Gully<br>Formation | Superficial<br>formations |          |
| Airlift Rate <sup>a</sup> (m <sup>3</sup> /d) | 640                      | 30                             | 10                        | 290      |
| Water Level (m btc)                           | +0.895                   | +0.560                         | 9.71 <sup>c</sup>         | 1.100    |
| Water Level (m AHD)                           | 3.220                    | 2.779                          | -7.75                     | 0.699    |
| Date (W.L.)                                   | 5.8.1986                 | 5.8.1986                       | 28.3.1983                 | 5.8.1986 |
| Salinity <sup>b</sup> (TDS mg/L)              | 2360                     | 2270                           | 30500                     | 716      |
| Conductivity <sup>b</sup> (mS/m@25°C)         | 439                      | 418                            | 4650                      | 138      |
| Formation                                     |                          |                                |                           |          |
| Resistivity (ohm-m)                           | 16.3                     | 22.5                           | 3.8                       | -        |
| Formation Factor                              | 6.3                      | 9.4                            | 19.1                      | -        |

- REMARKS:
- (a) Approximate final airlift rate
  - (b) Values obtained from chemical analysis (Chemistry Centre of W A) of samples taken at the end of air-lifting (Appendix 4).
  - (c) Approximate static water level measured at completion.

m btc = metres below top of casing





HARVEY LINE BORE HL1B  
SLUDGE SAMPLE LOG

| Depth (m bns) | Description  |
|---------------|--|
| 0- 3          | CALCARENITE; cream, sandy, minor calcilutite, soil, ferruginised material and large shell fragments. Sand consists mainly of quartz, fine to medium grained subangular to subrounded.  |
| 3- 9          | SAND; cream-grey, orange-brown, medium to coarse grained, subrounded, with minor grey siltstone and large pebbles of cemented calcarenite containing quartz.<br>6-9m Orange-brown, quartz predominantly very coarse.   |
| 9-24          | SAND; cream, grey, medium to very coarse grained, subangular to subrounded, consists mainly of quartz with angular shell fragments, minor calcarenite and grey siltstone. Some quartz grains orange stained, percentage of orange stained grains decreases with depth.<br>15-24 Trace of heavy minerals.<br>21-24 Minor ferruginised material.   |
| 22-54         | SAND; grey to dark grey, medium to very coarse grained, angular to subrounded, poorly to moderately sorted mainly quartz sometimes green stained. Minor to trace of grey to dark grey, siltstone, mudstone and clay sometimes greenish-grey (glauconitic?).<br>Samples contaminated from above<br>36-39m Predominantly fine to medium grained.<br>42-45m Predominantly fine to medium grained with isolated very fine pebbles. |
| 54-60         | CLAY; dark grey, sandy micaceous.<br>57-60m Minor greenish clay.   |
| 60-63         | SAND; grey, ranges in grade from medium sand to very fine pebbles, angular to subrounded mainly quartz often green stained.  |
| 63-69         | CLAY; dark grey, minor green; with rare green tinted, coarse, subangular quartz grains.  |
| 69-72         | SAND; grey, medium to coarse, well sorted, clayey, with grey silty clay.   |
| 72-87         | SAND; grey, ranges in grade from medium sand to very fine pebbles, subangular to subrounded, poorly sorted, mainly quartz sometimes green tinted.<br>72-75m Very clayey with grey silty clay.<br>75-87m Minor fragments of cream, grey and black calcarenite and black silty sandstone.  |
| 87-93         | CLAY; dark grey, light grey-green, micaceous, with sand ranging in grade from fine sand to very fine pebbles, angular to subrounded, minor lignite.  |

- 93-111 SAND, light grey, clayey, ranging in grade from coarse sand to very fine pebbles, angular to sub-rounded, poorly to moderately sorted, mainly quartz (clear and frosted), minor lignite.  
105-108m Minor rounded quartz grains which are white and tinted green (?glauconite), minor black silty sandstone.
- 111-118 CLAY: dark grey to grey, sandy, minor black siltstone.
- 118-138 SAND AND CLAY; Sand is grey, grey-green, ranges in grade from fine sand to very fine pebbles, sub-angular to subrounded, poorly to moderately sorted, mainly quartz (clear and frosted), clear quartz often tinted green, minor lignite, minor black siltstone. Clay is grey, dark grey, light grey-green, sandy, micaceous.
- 138-150 SAND; light grey, ranges in grade from medium sand to very fine pebbles, angular to subrounded, poorly sorted, mainly quartz (frosted and green tinted), minor black siltstone, a few fragments of lignite.
- 150-153 CLAY; dark grey to grey, sandy, micaceous.
- 153-162 SAND; as at 150-153m, with minor grey-black sandstone.
- 162-180 CLAY; as at 150-153m, with minor grey-black sandstone.
- 180-195 SAND AND CLAY; as at 118-138m.
- 195-604 (TD) SANDSTONE AND SHALE; Sandstone is grey, silty, weakly cemented, ranges in grade from fine sand to very fine pebbles, angular to subrounded, poorly to moderately sorted, mainly quartz (clear, frosted and milky), minor weathered feldspar, rare pyrite cemented sandstone, rarely micaceous (finer grained sandstones). Shale is grey, dark grey, olive green and brown, rarely orange-brown, silty, slightly sandy, micaceous, sometimes carbonaceous, trace of iron oxide cement in places.  
387-474m Sequence includes minor lignite and low grade coal.  
480-498m Sequence includes abundant lignite and low-grade coal.  
498-513m, 534-546m, 549-552m, 555-588m sequence includes minor lignite and low grade coal.  
198-225m, 234-246m, 255-291m, 294-318m, 330-333m, 351-363m, 372-375m, 378-474m, 477-480m, Sandstone predominates.

195-605(cont)      480-513m, 525-558m, 573-605m, percentage of sand-  
stone approximately equivalent to percentage of  
shale.

J W Hall and A C Deeney

Hydrogeologists

20 March 1983

APR 1962

HARVEY LINE - BORE HL1B

SIDEWALL CORE LOG

| <u>DEPTH (mbns)</u> | <u>DESCRIPTION</u>  |
|---------------------|---|
| 89                  | MUDSTONE; dark grey-olive, minor accessory mica and isolated quartz grains, medium to coarse subangular - subrounded, green stained.  |
| 112                 | SHALE; silty, sandy, brown-olive, micaceous, with isolated quartz grains as at 89m.   |
| 146                 | SAND; grey, fine to coarse, subangular to angular (with rare subrounded) quartz, (isolated very coarse sand and fine pebbles, angular to subrounded quartz) micaceous, trace of heavy minerals, some quartz green stained very slightly clayey, poorly-moderately sorted. |
| 166                 | SHALE; slightly silty, dark grey-olive, slightly micaceous with isolated quartz grains as at 89m.   |
| 174                 | SHALE; silty, dark grey, pyritic, with nodules ranging in grade from fine sand to very fine pebble, micaceous.  |
| 189                 | SAND; light grey, medium sand to very fine pebbles, subrounded to subangular, very poorly sorted, with fine pebbles of subangular to rounded quartz, minor nodules of cemented heavy minerals, minor pyrite, rare micas, very clayey.                                     |



| <u>DEPTH</u> | <u>DESCRIPTION</u>   |
|--------------|--|
| 194          | SAND; light grey, fine to very fine, well sorted, subangular to subrounded, micaceous, clayey with rare pyrite and heavy minerals (minor dark grey silty shale). |
| 225          | SHALE; silty, brown-olive, micaceous with isolated subrounded very coarse quartz grains, with common subrounded fine pebbles of silicified fine sandstone.       |
| 249          | SHALE; dark grey-green, very slightly silty, with isolated fine subangular quartz grains, very slightly micaceous.   |
| 288          | SHALE; as at 249m but very rare quartz.  |
| 347          | SHALE; dark grey (green), very slightly silty, very slightly micaceous.  |
| 362          | SHALE; dark grey-green, very slightly silty, micaceous with rare rounded very coarse quartz (milky).   |
| 423          | SAND; silty, very clayey (sandstone?), micaceous, fine, well sorted, subangular to subrounded.   |
| 450          | SAND; silty and clayey, light grey, fine sand to very fine pebbles, very poorly sorted, subrounded to angular, quartz clear, frosted and milky.                  |

| <u>DEPTH</u> | <u>DESCRIPTION</u>   |
|--------------|--|
| 486          | SHALE; dark grey, very slightly silty, micaceous with sand as at 450m but not clayey and mostly clear or frosted quartz.   |
| 512          | SHALE; dark grey-olive, micaceous silty.   |
| 548          | SAND; light grey, fine to medium, subangular to subrounded, well sorted, with isolated very coarse subrounded quartz grains, abundant heavy minerals, very slightly clayey in patches. |
| 561          | SHALE; very slightly silty, slightly micaceous, dark grey with orange oxidised patches.  |
| 590          | SHALE and SANDSTONE; Thinly interbedded (<3mm bands). SHALE is dark grey, silty, micaceous and possibly carbonaceous. SANDSTONE is grey, fine grained and micaceous.                   |

J. HALL  
GS 252/82  
15 March 1983

GE810VDP014

PALAEOLOGY REPORT NO. 12/1983

Date: 11.7.83

PALYNOLOGY OF HARVEY LINE 1B

MATERIAL AND LOCALITY: Twenty one sidewall cores  
from Harvey Line 1B, Location SI50-2 2032 (785, 575).

Sample No. 75727.

## DEPTH AND LITHOLOGY:

|              | DEPTH IN |  |
|--------------|----------|--|
| <u>F NO.</u> | <u>M</u> | <u>LITHOLOGY</u>                       |
| F46374       | 89       | Claystone, d.grey, silty               |
| -            | 112      | Claystone - millstone, yellowish brown |
| -            | 146      | Sst. m-c. gr., with drilling mud       |
| F46375       | 166      | Claystone, d.grey                      |
| F46376       | 174      | Ditto                                  |
| -            | 189      | Sst. c.gr., with drilling mud          |
| -            | 194      | Sst. f.gr., white                      |
| -            | 225      | Sst. f.gr., yellowish brown            |
| F46377       | 249      | Claystone m-d.grey, mottled, friable   |
| -            | 288      | Ditto                                  |
| F46378       | 347      | Ditto                                  |
| -            | 362      | Ditto                                  |
| F46379       | 423      | Siltstone/f.gr. Sst                    |
| -            | 450      | Sst. m-c.gr.                           |
| F46380       | 486      | Claystone, d.grey with sst. bands      |
| F46381       | 512      | Siltstone, m-d.grey                    |
| -            | 548      | Sst., m-c.gr.                          |
| F46382       | 561      | Shale, d.grey, silty                   |
| F46383       | 590      | Siltstone/Shale, cross bedded          |

REQUESTED BY : J Hall on Requisition No. 30297

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REPORT : The following sidewall cores were considered to be unsuitable for palynological treatment and were not processed: 112 m, 146 m, 189 m, 194 m, 225 m, 450 m, 548 m. Samples from 288 m and 362 m were barren of palynomorphs.

The remaining samples yielded assemblages of two distinct ages. Samples from 89 m to 174 m inclusive contained miospore assemblages of Early Cretaceous age, samples below 174 m were dominated by Classopollis pollen grains and are Early Jurassic in age. A distribution chart of miospores identified in each sample from this borehole is attached.

The samples from 166 m and 174 m also contained brackish or freshwater clinoflagellate cysts of the type provisionally assigned to a new genus "Moorodinium". Moorodinium-type cysts are usually associated with the Parmelia Formation (Backhouse, in press) but a number have also been located in sediments thought to belong in the Wambro Group. In this borehole they are associated with miospores with ranges restricted to the B. eneabbensis Zone, and also with miospores not known to range below the overlying B. limbata Zone. This suggests that the Moorodinium-type ~~d~~inoflagellate cysts may be present as a result of reworking from the Parmelia Formation.

The Early Jurassic assemblages appear to belong in Filatoff's C. chateaunovi Assemblage sub-zone of Hettangian to Toarcian age.

2.

The environment of deposition for the samples between 249 m and 590 m appears to be non-marine. The samples from 166 m and 174 m may represent a brackish water lagoonal or a non-marine fluviatile environment, and the sample from 89 m probably represents a deltaic back swamp-type environment.

*JB*

J Backhouse  
(Asst Palaeontologist)

JB:KR

July 14, 1983

GE764MVA388

Distribution: A Deeney

10/83

Pal Lab

Harvey Line 1B

# Miospore distribution in Harvey Line 1B

Sample depth in metres

| 590 | 561 | 512 | 486 | 423 | 347 | 249 | 174 | 166 | 89 | MIOSPORES  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|--|
|     |     |     |     |     |     |     | /   | /   |    | <u>Contiguisporites cooksonae</u> (Balme)            |
|     |     |     |     |     |     |     |     | /   |    | <u>Foveosporites canalis</u> Balme                   |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Dictyophyllidites equiexinus</u> Couper           |
|     |     |     |     |     |     |     | /   | /   |    | <u>Laevigatosporites belfordii</u> Burger            |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Classopollis chateaunovi</u> Reyre                |
|     |     |     |     |     |     |     | /   | /   |    | <u>Podocarpidites ellipticus</u> Cookson             |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Araucariacites australis</u> Cookson              |
|     |     |     |     |     |     |     | /   |     |    | <u>Aequitriradites acus</u> (Balme)                  |
|     |     |     |     |     |     |     | /   | /   |    | <u>Retitriteles austroclavatidites</u> (Cookson)     |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Baculatisporites comaumensis</u> Cookson          |
|     |     |     |     |     |     |     | /   |     |    | <u>Januasporites</u> sp.                             |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Callialasporites</u> spp                          |
|     |     |     |     |     |     |     | /   | /   |    | <u>Microcachryidites antarcticus</u> Cookson         |
|     |     |     |     |     |     |     | /   |     |    | <u>Nevesisporites dailyi</u> (Dettmann)              |
|     |     |     |     |     |     |     | /   |     |    | <u>Balmeiopsis limbata</u> (Balme)                   |
|     |     |     |     |     |     |     | /   |     |    | <u>Staplinisporites caminus</u> (Balme)              |
|     |     |     |     |     |     |     | /   |     |    | <u>Ischyosporites crateris</u> (Balme)               |
|     |     |     |     |     |     |     | /   |     |    | <u>Balmeiopsis</u> sp.                               |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Cadargasporites baculatus</u> de Jersey and Paten |
|     |     | /   | /   | /   | /   | /   | /   | /   | /  | <u>Nevesisporites vallalus</u> de Jersey and Paten   |
| /   | /   | /   | /   | /   | /   | /   | /   | /   | /  | <u>Ischyosporites variegatus</u> (Couper)            |

3. (Lab No. 83W5562-68)

H2243

H2181

|  |                       |       |       |      |
|--|-----------------------|-------|-------|------|
| Sample                                   | 78496                 | 78497 |       |      |
| Lab No. 83W                              | 3566                  | 3567  |       |      |
| pH                                       | 7.8                   | 8.5   |       |      |
| Appearance                               | clear, slight deposit |       |       |      |
| Colour (A.P.H.A. units)                  | 20                    | 5     |       |      |
| Odour                                    | nil                   |       |       |      |
| Conductivity (mS/m at 25C)               | 4500                  | 439   |       |      |
|  | me/L                  | mg/L  | me/L  | mg/L |
| Total dissolved solids (180C by calc)    | 31400                 |       | 2360  |      |
| Total hardness (as CaCO <sub>3</sub> )   | 5900                  |       | 800   |      |
| Total alkalinity (as CaCO <sub>3</sub> ) | 102                   |       | 227   |      |
| Calcium, Ca                              | 61.38                 | 1230  | 9.33  | 187  |
| Magnesium, Mg                            | 56.91                 | 692   | 6.66  | 81   |
| Sodium, Na                               | 415.65                | 9560  | 25.65 | 590  |
| Potassium, K                             | 3.68                  | 144   | 0.33  | 13   |
| Carbonate, CO <sub>3</sub>               | 0.00                  | <2    | 0.40  | 12   |
| Bicarbonate, HCO <sub>3</sub>            | 2.05                  | 125   | 4.15  | 253  |
| Chloride, Cl                             | 510.58                | 18100 | 34.41 | 1220 |
| Sulphate, SO <sub>4</sub>                | 33.54                 | 1610  | 2.42  | 116  |
| Nitrate, NO <sub>3</sub>                 | 0.00                  | <1    | 0.00  | <1   |
| Silica, SiO <sub>2</sub>                 | 9                     |       | 18    |      |
| Fluoride, F                              | 0.2                   |       | 0.2   |      |

4. (Lab No. 85W3562-68)

H21B2

Sample

78498

Lab No. 83W

3568

pH

8.3

Appearance

clear, slight deposit

Colour (A.P.H.A. units)

<5

Odour

nil

Conductivity (mS/m at 25C)

418

|  | me/L  | mg/L |
|--|-------|------|
| Total dissolved solids (180C by calc)    |       | 2270 |
| Total hardness (as CaCO <sub>3</sub> )   |       | 260  |
| Total alkalinity (as CaCO <sub>3</sub> ) |       | 277  |
| Calcium, Ca                              | 2.54  | 51   |
| Magnesium, Mg                            | 2.63  | 32   |
| Sodium, Na                               | 33.17 | 763  |
| Potassium, K                             | 0.66  | 26   |
| Carbonate, CO <sub>3</sub>               | 0.10  | 3    |
| Bicarbonate, HCO <sub>3</sub>            | 5.44  | 332  |
| Chloride, Cl                             | 30.75 | 1090 |
| Sulphate, SO <sub>4</sub>                | 2.60  | 125  |
| Nitrate, NO <sub>3</sub>                 | 0.00  | <1   |
| Silica, SiO <sub>2</sub>                 |       | 12   |
| Fluoride, F                              |       | 1.0  |



N. PLATELL

CHIEF

WATER SCIENCE LABORATORY





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Director  
Geological Survey of WA  
Mineral House  
66 Adelaide Terrace  
PERTH WA 6000  
Attention : Mr. Jon Hall

Address all correspondence to the Director

OUR REF

YOUR REF

ENQUIRIES TO

25 May, 1983. CM

MATERIAL One water sample from Harvey Line project, marked : "Sample No. 75728  
Bore identity HL1B".

LAB No 83W 1971

FROM WHOM RECEIVED AND DATE Geological Survey of WA on 11 April, 1983.

RESULT OF EXAMINATION.

|  |                  |        |                                   |
|--|------------------|--------|-----------------------------------|
| Sample                                   |                  |        | HL1B3                             |
| Lab No.                                  | 83W              |        | 75728                             |
| pH                                       |                  |        | 1971                              |
| Appearance                               |                  |        | 8.0                               |
| Colour (A.P.H.A. units)                  |                  |        | clear with a slight brown deposit |
| Odour                                    |                  |        | 20                                |
| Conductivity (mS/m at 25°C)              |                  |        | nil                               |
|  |                  |        | 4650                              |
|  |                  | me/L   | mg/L                              |
| Total dissolved solids (180°C by calc)   |                  |        | 30500                             |
| Total hardness (as CaCO <sub>3</sub> )   |                  |        | 4400                              |
| Total alkalinity (as CaCO <sub>3</sub> ) |                  |        | 115                               |
| Calcium                                  | Ca               | 27.74  | 556                               |
| Magnesium                                | Mg               | 59.46  | 723                               |
| Sodium                                   | Na               | 443.48 | 10200                             |
| Potassium                                | K                | 6.16   | 241                               |
| Carbonate                                | CO <sub>3</sub>  | 0.00   | <2                                |
| Bicarbonate                              | HCO <sub>3</sub> | 2.30   | 140                               |
| Chloride                                 | Cl               | 502.12 | 17800                             |
| Sulphate                                 | SO <sub>4</sub>  | 19.13  | 918                               |
| Nitrate                                  | NO <sub>3</sub>  | 0.00   | <1                                |
| Silica                                   | SiO <sub>2</sub> |        | 2                                 |

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*P. Jack*  
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OUR REF

YOUR REF

ENQUIRIES TO

8 February, 1983. CM

MATERIAL Three water samples from Harvey Line project, marked as below.

LAB No 82W7893-5

FROM WHOM RECEIVED AND DATE Geological Survey of W.A., on 8 December, 1982.

RESULT OF EXAMINATION

| Sample                                   | HL1W            |      | HL2W                 |      |
|--|-----------------|------|----------------------|------|
|  | 75288           |      | 75289                |      |
| Lab No. 82W                              | 7893            |      | 7894                 |      |
| pH                                       | 7.9             |      | 7.5                  |      |
| Appearance                               | clear           |      | very slightly cloudy |      |
| Colour (A.P.H.A. units)                  | 6               |      | 14                   |      |
| Odour                                    | ----- nil ----- |      |                      |      |
| Conductivity (mS/m at 25C)               | 138             |      | 87.5                 |      |
|  | me/L            | mg/L | me/L                 | mg/L |
| Total dissolved solids (180C by calc)    |                 | 716  |                      | 479  |
| Total hardness (as CaCO <sub>3</sub> )   |                 | 310  |                      | 280  |
| Total alkalinity (as CaCO <sub>3</sub> ) |                 | 252  |                      | 275  |
| Calcium, Ca                              | 4.49            | 90   | 4.49                 | 90   |
| Magnesium, Mg                            | 1.73            | 21   | 1.15                 | 14   |
| Sodium, Na                               | 6.52            | 150  | 2.96                 | 68   |
| Potassium, K                             | 0.10            | 4    | 0.10                 | 4    |
| Carbonate, CO <sub>3</sub>               | 0.00            | <2   | 0.00                 | <2   |
| Bicarbonate, HCO <sub>3</sub>            | 5.05            | 308  | 5.51                 | 336  |
| Chloride, Cl                             | 7.39            | 262  | 3.30                 | 117  |
| Sulphate, SO <sub>4</sub>                | 0.54            | 26   | 0.04                 | 2    |
| Nitrate, NO <sub>3</sub>                 | 0.00            | <1   | 0.00                 | <1   |
| Silica, SiO <sub>2</sub>                 |                 | 9    |                      | 16   |
| Boron, B                                 |                 | 0.08 |                      | 0.07 |
| Fluoride, F                              |                 | 0.3  |                      | 0.1  |

BORE COMPLETION REPORT  
HARVEY LINE SITE NO 2 (HL2)

LOCATION AND IDENTIFICATION

OWNER: Geological Survey of Western Australia

GSWA REF:      HL2A1    SI50-2-2032-II-C-~~139~~ 145  
                 HL2A2    SI50-2-2032-II-C-~~140~~ 146  
                 HL2A3    SI50-2-2032-II-C-~~141~~ 147  
                 HL2W    SI50-2-2032-II-C-~~142~~ 148

LOCATION:        Wellington, Loc. 3020, south side between the old and  
                 new road alignments. Owner: Waroona Pines Pty Ltd, c/o  
                 Tree and Plantation Services, 5/8 Clive Street,  
                 West Perth, W A 6005.

(Figure 1 - Location map)

AMG REF (Zone 50):    Eastings 3848            Northings 63567

MAP SHEETS:        1:250000 Pinjarra (SI50-2)  
                     1:100000 Pinjarra (2032)

PURPOSE: HL2A - Exploratory and observation  
          HL2W - Water supply bore

STATUS:    HL2A1 - perforated interval - 105-111 m bns - Observation  
            HL2A2 - perforated interval - 324-330 m bns - Observation  
            HL2A3 - perforated interval - 786-792 m bns - Abandoned  
            HL2W - screened interval    - 25- 31 m bns - Observation

ELEVATION:        HL2A1 - top of 25mm GI pipe - 13.712 m AHD  
                     HL2A2 - top of 80mm GI pipe - 13.843 m AHD  
                     HL2W - top of casing        - 13.175 m AHD  
                     Natural Surface - concrete base - 13.155 m AHD

m bns = metres below natural surface  
GI     = Galvanised Iron  
NB     = Nominal Bore  
ID     = Internal Diameter

## BOREHOLE CONSTRUCTION AND DEVELOPMENT

Bore construction diagram (Figure 2)

DRILLED BY: Mines Department Drilling Section, Field Unit A

RIG: Midway Skytop (Rotary)

MUD: Aquagel, Biopolymer, CMC

DRILLING COMMENCED:

HL2A 16. 5.1983  
HL2W 18.11.1982

DRILLING COMPLETED:

HL2A 28. 5.1983  
HL2W 18.11.1982

DRILLED DIAMETER:

| Bore | Depth Interval (m bns) | Diameter (mm) |
|------|------------------------|---------------|
| HL2A | 0 - 61.5               | 381           |
|      | 61.5 - 810             | 216           |
| HL2W | 0 - 31                 | 172           |

TOTAL DEPTH: HL2A - 810m  
HL2W - 31m

CASING (Drilling): HL2A - 260mm (ID) cemented in to 61.5m  
HL2W - None

CASING (Completion):

| Bore | Depth Interval (m bns) | ID(mm)   |
|------|------------------------|--|
| HL2A | 0 - 61.5               | 260  |
|      | 0 - 806                | 154  |
|      | 0 - 785                | 80 NB  |
|      | 0 - 85                 | 25 NB  |
| HL2W | 0 - 24.77              | 105  |
|      | 24.77 - 30.88          | 100 NB (Stainless steel<br>screen 0.5mm<br>aperture) |

CEMENTING: HL2A - The 260mm sleeve welded steel conductor pipe was cemented in position with 4m<sup>3</sup> of cement slurry and 3.2m<sup>3</sup> of follow-up mud.  
The 154mm sleeve welded steel casing was cemented using 14.5m<sup>3</sup> of cement slurry and 15.2m<sup>3</sup> of follow-up water.  
Cement was drilled out from 792 to 800 m bns.  
A cement block was cast around the top of the casing.

## OBSERVATION INTERVALS:

| Bore/Interval | depth (m bns) | Formation   |
|---------------|---------------|---|
| HL2A1         | 105-111       | Leederville Formation                               |
| HL2A2         | 324-330       | Cockleshell Gully Formation                         |
| HL2A3         | 786-792       | Cockleshell Gully Formation                         |
| HL2W          | 25-31         | Superficial formations and<br>Leederville Formation |

Remarks: Each interval in bore HL2A was perforated with 3 shots per metre. The 80mm GI pipe was installed with a 19m section of flame-cut slots at approximately 345 m bns and two compressible packers were set at 185 and 385 m bns to seal the annulus between the 80mm pipe and the 154mm casing. HL2A1 is monitored in the 25mm pipe set in the annulus and HL2A2 is monitored in the 80mm pipe. HL2A3 was abandoned after development. HL2W was completed with 6m of 100mm NB, 0.5mm aperture, wire-wound stainless steel screen and the annulus packed with graded sand. 9m

## CONSTRUCTION DIFFICULTIES:

Delays occurred during construction for the following reasons

- (1) Mechanical breakdowns
- (2) Bore blocked at about 747m bns after perforation of the three intervals. Drill string with 150mm bit run to bottom of hole to clear.
- (3) Annulus outside 154mm casing found to be open to about 125 m bns. This was sealed with pea gravel and 1.5m<sup>3</sup> cement slurry.

CONSTRUCTION COMPLETED: HL2A - 3. 6.1983  
HL2W - 19.11.1982

DEVELOPMENT: Each interval was developed by airlifting and surging until the water cleared and the conductivity was constant. A sample was then taken for chemical analysis.

HL2A3 was airlifted for 8 hours at 100m<sup>3</sup>/d before the other intervals were perforated. All three intervals were then airlifted at 1270m<sup>3</sup>/d for 6 hours before the packers were installed.

HL2A1 was then airlifted for 14 hours at 360m<sup>3</sup>/d and HL2A2 for 12 hours at 930m<sup>3</sup>/d.

HL2W was developed by airlifting and jetting for 4 hours at 460m<sup>3</sup>/d. Subsequently it was pumped to supply water during the drilling of HL2A.

SITE CLEARED: 16. 6.1983

## GEOLOGICAL DATA

SAMPLES: Rotary (ditch cuttings) at 3m intervals

SIDEWALL CORES: Using the gamma-ray log, 21 shale/siltstone targets were chosen in HL2A. 16 cores were recovered from the following depths (m bns) 97.5, 115.5, 146, 233.5, 254.5, 268.25, 305.5, 473, 584, 594, 606.5, 697.5, 708.5, 734.5, 755.5, 801. No cores were recovered from the following depths (m bns) 62, 212.5, 384, 539.5, 685.

CORING OPERATORS: R Bulner and M A L'Herpinier

LOGGED BY: A C Deeney

REPOSITORY OF SAMPLES AND CORES: GSWA Core Library

### SUMMARY LOG:

| Depth Interval<br>(m bns) | Age                | Formation                                       | Lithology                       |
|---------------------------|--------------------|---|---------------------------------|
| 0 - 18                    | Quaternary         | Guildford Formation                             | Sand, clayey sand, clay         |
| 18 - 26                   | Quaternary         | Jandakot Beds                                   | Sand, silt, clay, fossiliferous |
| 26 - 203                  | Early Cretaceous   | Leederville Formation                           | Sandstone, siltstone shale      |
| 203 - 241                 | Early-Mid Jurassic | Cockleshell Gully Formation (Cattamarra Member) | Sandstone, siltstone shale      |
| 241-810                   | Early-Mid Jurassic | Cockleshell Gully Formation (Eneabba Member)    | Sandstone, siltstone shale      |

REMARKS: A log of the ditch cuttings is given in Appendix 1  
A sidewall-core log is given in Appendix 2.

## GEOPHYSICAL DATA

LOGGING UNIT: GO1 No 2 (Temperature log - GO 1 No 1)

LOGGING OPERATORS: J Collier and J Watt

### LOGS RUN:

| Log Type          | Depth (m bns) | Date       |
|-------------------|---------------|------------|
| Gamma Ray         | 0 - 808.0     | 28. 5.1983 |
| Neutron-Neutron   | 1.4 - 809.4   | 28. 5.1983 |
| Self Potential    | 61.5 - 809.2  | 28. 5.1983 |
| Short Normal      |               |            |
| Resistivity (16") | 61.5 - 809.2  | 28. 5.1983 |
| Long Normal       |               |            |
| Resistivity (64") | 61.5 - 809.2  | 28. 5.1983 |
| Temperature       | 0 - 794.2     | 8. 4.1986  |

- REMARKS: (1) Log zeros were taken at the drilling pad surface.
- (2) Apparent resistivities obtained from GO1 logs must be multiplied by a factor of 1.25 to give true formation resistivities.
- (3) The temperature log was run approximately 3 years after completion of the bore to allow time for the natural geothermal gradient to be re-established.

## PALAEONTOLOGICAL DATA

### PALAEONTOLOGICAL REPORT:

Palynology of Harvey Line 2A. Pal. Rept. 15/1983 by  
J Backhouse (Appendix 3)

### SUMMARY OF RESULTS:

| Depth | Age        | Zone             | Environment                        | Formation                |
|-------|------------|------------------|------------------------------------|--------------------------|
| 97.5  | Barremian  |                  | lacustrine or<br>restricted marine | Leederville<br>Formation |
| 115.5 | ?Barremian |                  | non-marine                         | Leederville<br>Formation |
| 146   | Barremian  | <u>B Limbata</u> | lacustrine or<br>restricted marine | Leederville<br>Formation |

### REMARKS:

Sidewall cores from 305.5, 584, 697.5, 708.5, 734.5 and 755.5 m bns were not processed for reasons of obvious oxidation or unsuitable lithology.

Sidewall cores from 233.5, 254.5, 268.25, 473, 594, 606.5, and 801 m bns were barren of palynomorphs.

The palynomorph assemblages from 97.5 and 115.5 m bns were of low diversity and lacking zone-diagnostic species.



# HYDROLOGICAL DATA

## SUMMARY:

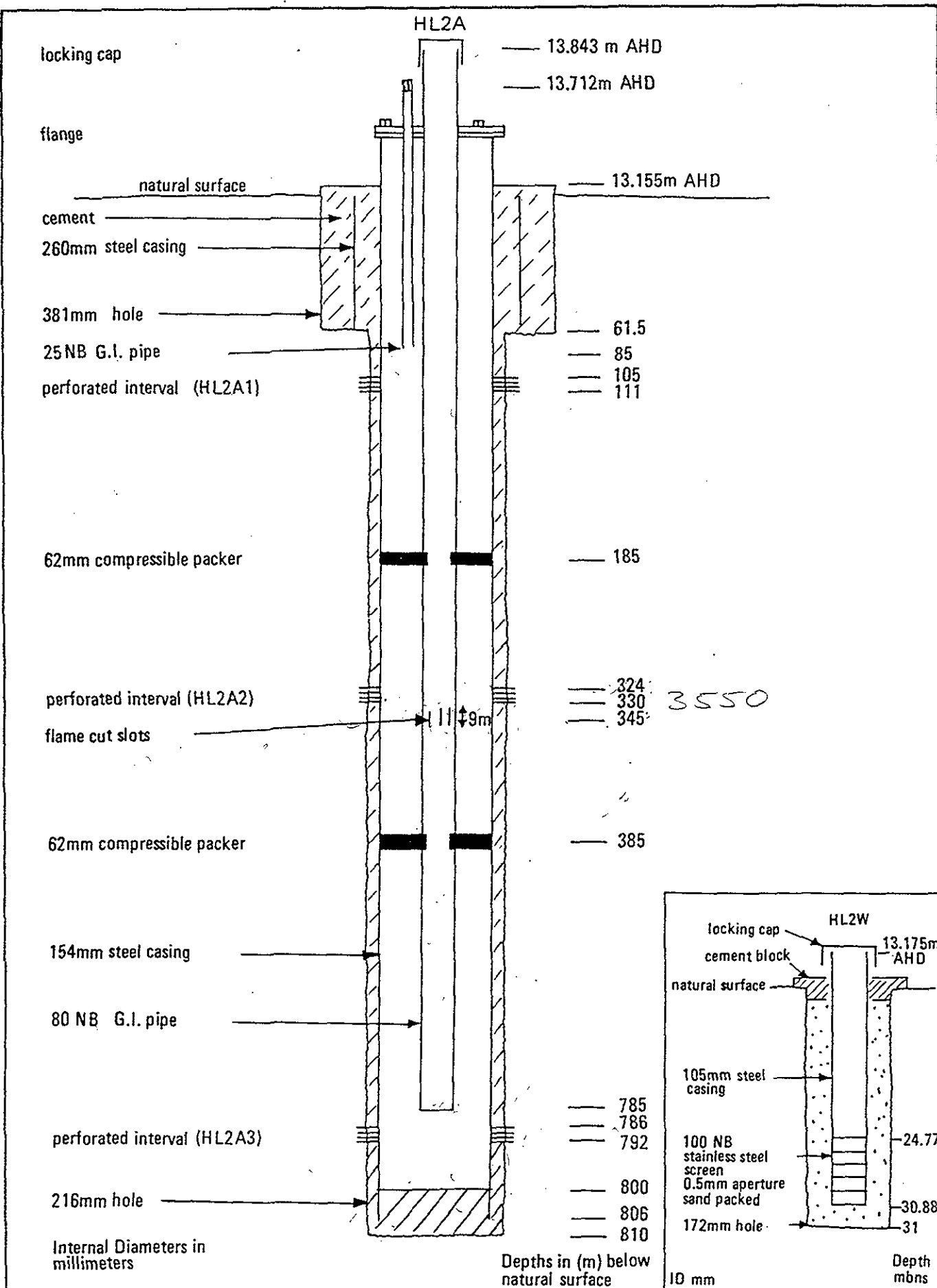
| Bore/Interval                                 | HL2A1                 | HL2A2                       | HL2A3                            | HL2W     |
|---|-----------------------|-----------------------------|----------------------------------|----------|
| Interval (m bns)                              | 105-111               | 324-330                     | 786-792                          | 25-31    |
| Formation                                     | Leederville Formation | Cockleshell Gully Formation | Superficial fms & Leederville Fm |          |
| Airlift Rate <sup>a</sup> (m <sup>3</sup> /d) | 930                   | 360                         | 100                              | 460      |
| Water Level (m btc)                           | 5.600                 | 7.230                       | 20.09 <sup>c</sup>               | 1.790    |
| Water Level (m AHD)                           | 8.112                 | 6.613                       | -6.39                            | 11.385   |
| Date (W.L.)                                   | 5.8.1986              | 5.8.1986                    | 2.6.1983                         | 5.8.1986 |
| Salinity <sup>b</sup> (TDS mg/L)              | 1390                  | 3550                        | 31400                            | 479      |
| Conductivity <sup>b</sup> (mS/m@25°C)         | 271                   | 644                         | 4500                             | 87.5     |
| Formation                                     |                       |                             |                                  |          |
| Resistivity (ohm-m)                           | 37.5                  | 23.8                        | 2.5                              | -        |
| Formation factor                              | 8.8                   | 15.3                        | 13.8                             | -        |

## REMARKS:

- (a) Approximate final airlift rate.
- (b) Values obtained from chemical analyses (Chemistry Centre of W A) of samples taken at the end of airlifting (Appendix 4).
- (c) Approximate static water level measured at completion.

m btc = metres below top of casing





# GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

|       | INITIAL | DATE |
|-------|---------|------|
| COMP  | ACD     | 9/86 |
| DRAWN | ACD     | 9/86 |
| CHKD  |         |      |
| APVD  |         |      |

## BORE CONSTRUCTION (Not to scale) HARVEY LINE SITE 2 (HL2)

TO ACCOMPANY BORE COMPLETION REPORT - HL2

### MAP INDEX



SI 50-2-2032

## HARVEY LINE BORE HL2A

## SLUDGE SAMPLE LOG

| Depth (m bns) | Description   |
|---------------|---|
| 0- 3          | CLAY; brown sandy to very sandy. Sand, fine to coarse, subrounded mainly quartz, minor weathered feldspar.  |
| 3- 6          | SAND; coffee brown, silty, partially cemented (coffee rock), fine to very coarse, subrounded, poorly sorted, mainly quartz, often coated with iron oxide, minor weathered feldspar, trace of heavy minerals.  |
| 6-12          | SAND; similar to 3-6m interval, but grey-brown, slightly clayey, grains coated with iron oxide are less abundant. Sample contaminated by material from gravel pad?  |
| 12-18         | SAND; light grey, medium to very coarse, moderately sorted, subrounded to well rounded, mainly quartz often frosted, minor weathered feldspar, trace of heavy minerals.   |
| 18-27         | SAND; light grey, medium to very coarse, moderately sorted, subrounded to well rounded, mainly quartz, often frosted, common shell fragments up to 1cm and shell debris (mainly gastropods and bivalves), minor to trace dark grey mudstone fragments of very coarse sand grade, trace of heavy minerals. |
| 27-60         | SAND; light grey, silty, fine to coarse, moderately sorted, subrounded to rounded, mainly quartz, minor weathered feldspar, trace of heavy minerals. 27-33m minor - trace, grey mudstone fragments. Sample contaminated with calcareous material from above.  |
| 60-63         | NO SAMPLE   |
| 63- 69        | CLAY; dark grey, silty, sandy, micaceous. Arenaceous material ranges in grade from fine sand to very fine pebbles subangular, mainly quartz, minor weathered feldspar, fragments of lignite, pyrite cemented sand and ?glauconitic sandy limestone, up to 2cm. 66-69m interval very sandy.                |
| 69-72         | SAND, grey, slightly silty and clayey, ranges in grade from fine sand to very fine pebbles, subangular, poorly sorted, mainly quartz, minor weathered feldspar, fragments of lignite, pyrite cemented sand and ?glauconitic sandy limestone.  |

|         |   |
|---------|---|
| 72-75   | CLAY, similar to 63-69m interval, but very sandy.   |
| 75-81   | LIMESTONE AND SAND, limestone is grey, sandy, ? glauconitic, well cemented. Sand is grey, grey-green, slightly silty, clayey, ranges in grade from fine sand to very fine pebbles, poorly sorted, subangular, mainly quartz, minor weathered feldspar, fragments of lignite and pyrite cemented sand. |
| 81-84   | SAND; similar to 69-72 m interval.  |
| 84-87   | CLAY, dark grey, micaceous, slightly silty and sandy.   |
| 87-90   | SAND; similar to 69-72m interval.   |
| 90-93   | CLAY; similar to 63-69m interval.   |
| 93-102  | SAND; light grey ? glauconitic, slightly silty and clayey, fine sand to very fine pebbles, subangular, poorly sorted, mainly quartz sometimes green stained, minor weathered feldspar. 99-102m interval very clayey with common fragments of lignite.   |
| 102-108 | CLAY; dark grey micaceous, silty, very slightly sandy.  |
| 108-111 | SAND; similar to 93-102m interval.  |
| 111-114 | SAND AND LIMESTONE, Sand similar to 93-102m interval. Limestone is dark grey-green, sandy, ? glauconitic. Sequence includes a few fragments of granitic rock.   |
| 114-120 | SAND; similar to 93-102m interval with a few fragments of dark grey-green sandy limestone, lignite and pyrite cemented sand.  |
| 120-123 | CLAY; dark grey, micaceous, silty and sandy.  |
| 123-132 | SAND; similar to 93-102m interval.  |
| 132-141 | CLAY; dark grey, micaceous, silty, sandy, with fragments of lignite, dark grey-green sandy limestone and light grey sandy limestone.  |
| 141-195 | CLAY; dark grey, micaceous, silty, very slightly sandy. 156-168m sandy with fragments of light grey sandy limestone.  |

|                                      |  |
|--------------------------------------|--|
| 195-198                              | SAND; grey, silty and clayey, ranges in grade from fine sand to very fine pebbles, poorly sorted, subangular, mainly quartz trace of black carbonaceous material, minor lignite and pyrite cemented sandstone.   |
| 198-207                              | CLAY; dark grey, micaceous, silty slightly sandy.  |
| 207-216                              | SAND; similar to 195-198m interval, no lignite   |
| 216-219                              | CLAY; similar to 198-207m interval   |
| 219-246                              | SAND; similar to 195-198m interval, no lignite, 222-228m Very clayey.  |
| 246-810 (TD)<br>(465-468m no sample) | <p>SANDSTONE, SILTSTONE, SHALE; Sandstone is light grey-green and light grey, rarely orange-brown, slightly clayey to clayey, weakly cemented, ranges in grade from fine sand to very fine pebbles, poorly to moderately sorted, subangular, mainly quartz, minor weathered feldspar.</p> <p>Siltstone is light grey-green, orange-brown, brick-red, brown, purple, white, generally variegated, moderately cemented, trace of mica to micaceous, slightly sandy, slightly clayey.</p> <p>Shale is grey, usually variegated (colours similar to siltstone), silty, micaceous, weakly cemented.</p> <p>246-258m Percentage of sandstone approximately equivalent to percentage of siltstone and shale.</p> <p>258-264m Sandstone predominates.</p> <p>273-288m Percentage of sandstone approximately equivalent to percentage of siltstone and shale.</p> <p>288-300m, 309-381m, 387-432m, Sandstone predominates.</p> <p>432-477m Percentage of sandstone approximately equivalent to percentage of siltstone and shale.</p> <p>477-576m Sandstone predominates.</p> <p>576-600m Percentage of sandstone approximately equivalent to percentage of siltstone and shale.</p> <p>600-660m Sandstone predominates.</p> <p>660-678m Percentage of sandstone approximately equivalent to percentage of siltstone and shale.</p> <p>678-756m, 765-810m Sandstone predominates.</p> |

A C Deeney

Hydrogeologist

28 May 1983

HARVEY LINE - BORE HL2A

SIDEWALL CORE LOG

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION   |
|-----------------|------------------|---|
| 62              | trace            | SAND; grey-orange, silty, slightly clayey, weakly cemented?, fine to very coarse grained, poorly sorted, subangular, mainly quartz, minor weathered feldspar.   |
| 97.5            | 42               | SAND; grey-green and black, silty, weakly cemented, very fine to medium grained, well sorted, subangular, common black carbonaceous material often in 1 mm bands, glauconite?, mainly quartz, minor weathered feldspar. |
| 115.5           | 40               | SAND; light grey-green, silty, clayey, weakly cemented, very fine sand to very fine gravel, poorly sorted, subangular, mainly quartz, minor weathered feldspar, common black carbonaceous material.                     |
| 146             | 44               | CLAY; dark grey, micaceous, slightly silty.   |
| 233.5           | 20               | SAND; light grey-green, silty, slightly clayey, weakly cemented, very fine sand to very fine gravel, poorly sorted, subangular, mainly quartz, minor weathered feldspar, minor black carbonaceous material, chloritic?  |
| 254.5           | 43               | CLAY; green-grey, orange-brown, purple, white, variegated, silty, trace of mica.  |
| 268.25          | 42               | CLAY; dark grey, variegated, silty, micaceous.  |
| 305.5           | 30               | SILTSTONE; light grey-green, and orange-brown, clayey, slightly sandy, micaceous, moderately cemented.  |

.... /2

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION  |
|-----------------|------------------|--|
| 473             | 42               | SILTSTONE; <i>dark grey, Variegated, slightly clayey, trace of mica, weakly cemented.</i>  |
| 584             | 20               | SANDSTONE; light grey-green and orange-brown, clayey, very fine to coarse grained, moderately sorted, subangular, mainly quartz, minor weathered feldspar, chloritic? weakly cemented. |
| 594             | 40               | SANDSTONE: light green, slightly clayey, very fine to medium grained, well sorted, subangular, mainly quartz, minor weathered feldspar, chloritic? weakly cemented.                    |
| 606.5           | 35               | SILTSTONE; light green-grey, clayey, sandy. Sand is very fine to medium grained, subangular, mainly quartz, minor weathered feldspar, weakly cemented.                                 |
| 697.5           | 25               | SANDSTONE; light grey-green and white, clayey, very fine sand to very fine gravel, poorly sorted, subangular, mainly quartz, minor weathered feldspar, weakly cemented, chloritic?     |
| 708.5           | 30               | SANDSTONE; light grey, clayey, very fine to coarse, poorly sorted, subangular, mainly quartz, minor weathered feldspar, weakly cemented.   |
| 734.5           | 24               | SANDSTONE; light grey-green, clayey, fine to very coarse, subangular, moderately sorted, mainly quartz, minor weathered feldspar, weakly cemented.                                     |
| 755.5           | 10               | SANDSTONE; light grey, clayey, fine to coarse grained, subangular, moderately sorted, mainly quartz, minor weathered feldspar, weakly cemented, sample consists mainly of wallcake.    |



| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION                                       |
|-----------------|------------------|---|
| 801             | 22               | CLAY; dark grey, variegated, silty,<br>micaceous. |

A C Deeney

ACD:KR  
GS 253/82  
August 8, 1983  
GE8100AC227

PALAEOLOGY REPORT NO. 15/1983

Date 15.8.1983

PALYNOLOGY OF HARVEY LINE 2A

MATERIAL AND LITHOLOGY : Sixteen sidewall cores.

Location : Pinjarra 2032 (1:100 000)  
849,568. Sample No 79741.

DEPTH AND LITHOLOGY :

| <u>F No.</u> | <u>Depth in m</u> | <u>Lithology</u>                       |
|--------------|-------------------|--|
| F46400       | 97.5              | Siltstone - f. gr. sst., carbonaceous. |
| F46401       | 115.5             | Sst. f-c.gr., carb. fragments.         |
| F46402       | 146               | Shale/Claystone, d.grey.               |
|              | 233.6             | Sst. f-c.gr., white, carb. fragments.  |
|              | 254.5             | Claystone, pale greenish-grey.         |
|              | 268.25            | Claystone, green, grey and brown.      |
|              | 305.5             | Claystone, red and yellow.             |
|              | 473               | Claystone green, grey and brown.       |
|              | 584               | Sst., m.gr. white.                     |
|              | 594               | Sst., f.gr. greenish/grey.             |
|              | 606.5             | Sst., white with millstone band.       |
|              | 697.5             | Sst., white.                           |
|              | 708.5             | Ditto                                  |
|              | 734.5             | Ditto                                  |
|              | 755.5             | Drilling mud                           |
|              | 801               | Claystone, red                         |

SUBMITTED BY : A Deeney on Requisition No 33203.

---

REPORT : The following sidewall cores were not processed:  
305.5 m, 584 m, 697.5 m, 708.5 m, 734.5 m and 755.5 m. Of  
the remaining samples only the three highest yielded

palynomorphs. These are described below:

97.5 m (F46400)

A palynomorph assemblage of low diversity and lacking zone-diagnostic spore species. A small number of epicystal non-marine dinoflagellate cysts were recovered, principally *Moorodinium quindalupense*. This species is also present in Quindalup 7A borehole at 141 m, and in Boyanup Line 1C borehole between 30 and 75 m. In Boyanup Line 1C it is associated with elements of the

*Cyclonephelium attadalicum* Association - considered to be Barremian in age. Dinoflagellate cysts of the Moorodinium type probably represent lacustrine or restricted marine deposition.

115.5 m (F46401)

This sample yielded a slightly more diverse assemblage of miospores including *Microcachrydites antarcticus* Cookson and *Retitriletes watherooensis* Backhouse. This sample is similar in age to the ones above and below, but unlike them<sup>it</sup> does not contain *Moorodinium*-type dinoflagellate cysts.

146 m (F46402)

Miospores present include: *Balmeiopsis limbata* (Balme) and abundant specimens of *Classopollis chateaunovi* Reyre and *M. antarcticus*. The sample is therefore clearly from the *B. limbata* Zone. It also contains abundant specimens of *Moorodinium quindalupense*. The comments on the age and environment of deposition provided for the sample from 97.5 m also apply to this sample.

Distribution : A Deeney                      GS 10/83  
                    Pal Lab                      Harvey Line 2A



J Backhouse

JB:KR

August 19, 1983

GE7640AS245

2. (Lab No. 83W3562-68)

HL2A1

HL2A2

|  |                       |      |       |      |
|--|-----------------------|------|-------|------|
| Sample                                   | 78494                 |      | 78495 |      |
| Lab No. 83W                              | 3564                  |      | 3565  |      |
| pH                                       | 8.4                   |      | 8.1   |      |
| Appearance                               | clear, slight deposit |      |       |      |
| Colour (A.P.H.A. units)                  | 5                     |      | 5     |      |
| Odour                                    | nil                   |      |       |      |
| Conductivity (mS/m at 25C)               | 271                   |      | 644   |      |
|  | me/L                  | mg/L | me/L  | mg/L |
| Total dissolved solids (180C by calc)    | 1390                  |      | 3550  |      |
| Total hardness (as CaCO <sub>3</sub> )   | 350                   |      | 280   |      |
| Total alkalinity (as CaCO <sub>3</sub> ) | 195                   |      | 217   |      |
| Calcium, Ca                              | 3.39                  | 68   | 2.94  | 59   |
| Magnesium, Mg                            | 3.70                  | 45   | 2.63  | 32   |
| Sodium, Na                               | 17.13                 | 394  | 53.91 | 1240 |
| Potassium, K                             | 0.41                  | 16   | 0.66  | 26   |
| Carbonate, CO <sub>3</sub>               | 0.30                  | 9    | 0.00  | <2   |
| Bicarbonate, HCO <sub>3</sub>            | 3.61                  | 220  | 4.34  | 265  |
| Chloride, Cl                             | 19.15                 | 679  | 51.90 | 1840 |
| Sulphate, SO <sub>4</sub>                | 1.15                  | 55   | 4.23  | 203  |
| Nitrate, NO <sub>3</sub>                 | 0.00                  | <1   | 0.00  | <1   |
| Silica, SiO <sub>2</sub>                 |                       | 13   |       | 13   |
| Fluoride, F                              |                       | 0.2  |       | 1.3  |

H2 293

H2 181

Sample

78496

78497

Lab No. 83W

3566

3567

pH

7.8

8.5

Appearance

clear, slight deposit

Colour (A.P.H.A. units)

20

5

Odour

nil

Conductivity (mS/m at 25C)

4500

439

me/L

mg/L

me/L

mg/L

Total dissolved solids (180C by calc)

31400

2360

Total hardness (as CaCO<sub>3</sub>)

5900

800

Total alkalinity (as CaCO<sub>3</sub>)

102

227

Calcium, Ca

61.38 1230

9.33 187

Magnesium, Mg

56.91 692

6.66 81

Sodium, Na

415.65 9560

25.65 590

Potassium, K

3.68 144

0.33 13

Carbonate, CO<sub>3</sub>

0.00 &lt;2

0.40 12

Bicarbonate, HCO<sub>3</sub>

2.05 125

4.15 253

Chloride, Cl

510.58 18100

34.41 1220

Sulphate, SO<sub>4</sub>

33.54 1610

2.42 116

Nitrate, NO<sub>3</sub>

0.00 &lt;1

0.00 &lt;1

Silica, SiO<sub>2</sub>

9

18

Fluoride, F

0.2

0.2

Department of Mines, Western Australia  
GOVERNMENT CHEMICAL LABORATORIES

30 Plain Street, Perth, Western Australia 6000  
Telephone: 325 5544



Director  
Geological Survey of W.A.  
Mineral House  
66 Adelaide Terrace  
PERTH W.A. 6000

Address all correspondence to the Director

OUR REF

YOUR REF

ENQUIRIES TO:

8 February, 1983. CM

MATERIAL Three water samples from Harvey Line project, marked as below.

LAB No 82W7893-5

FROM WHOM RECEIVED AND DATE: Geological Survey of W.A., on 8 December, 1982.

RESULT OF EXAMINATION.

Sample

HL1W

HL2W

75288

75289

Lab No. 82W

7893

7894

pH

7.9

7.5

Appearance

clear

very slightly  
cloudy

Colour (A.P.H.A. units)

6

14

Odour

nil

Conductivity (mS/m at 25C)

138

87.5

Total dissolved solids (180C by calc)

me/L

mg/L

716

me/L

mg/L

479

Total hardness (as CaCO<sub>3</sub>)

310

280

Total alkalinity (as CaCO<sub>3</sub>)

252

275

Calcium, Ca

4.49

90

4.49

90

Magnesium, Mg

1.73

21

1.15

14

Sodium, Na

6.52

150

2.96

68

Potassium, K

0.10

4

0.10

4

Carbonate, CO<sub>3</sub>

0.00

<2

0.00

<2

Bicarbonate, HCO<sub>3</sub>

5.05

308

5.51

336

Chloride, Cl

7.39

262

3.30

117

Sulphate, SO<sub>4</sub>

0.54

26

0.04

2

Nitrate, NO<sub>3</sub>

0.00

<1

0.00

<1

Silica, SiO<sub>2</sub>

9

16

Boron, B

0.08

0.07

Fluoride, F

0.3

0.1

BORE COMPLETION REPORT  
HARVEY LINE SITE NO 3 (HL3)

LOCATION AND IDENTIFICATION

OWNER: Geological Survey of Western Australia

GSWA REF:      HL3A1      SI50-2-2032-II-C-~~143~~ 149  
                 HL3A2      SI50-2-2032-II-C-~~144~~ 150  
                 HL3A3      SI50-2-2032-II-C-~~145~~ 151  
                 HL3W      SI50-2-2032-II-C-~~146~~ 152

LOCATION:      Wellington Loc. 247, northeast corner.  
                 Owner: Mr L M Tyler, PO Box 188, Waroona WA 6215

(Figure 1 - Location map)

AMG REF (Zone 50): Eastings      3905      Northings      63580

MAP SHEETS:    1:250000    Pinjarra (SI50-2)  
                 1:100000    Pinjarra (2032)

PURPOSE:      HL3A - Exploratory and observation  
                 HL3W - Water supply bore

STATUS:      HL3A1 - perforated interval- 61- 66 m bns - Observation  
                 HL3A2 - perforated interval-241-247 m bns - Observation  
                 HL3A3 - perforated interval-568-574 m bns - Abandoned  
                 HL3W - screened interval - 23-29 m bns - Observation

ELEVATION:    HL3A1                      - top of 25mm GI pipe - 13.301 m AHD  
                 HL3A2                      - top of 80mm GI pipe - 13.240 m AHD  
                 HL3W                        - top of casing        - 13.049 m AHD  
                 Natural surface - concrete base                - 12.794 m AHD

m bns = metres below natural surface  
GI = Galvanised Iron  
NB = Nominal Bore  
ID = Internal Diameter

## BOREHOLE CONSTRUCTION AND DEVELOPMENT

Bore construction diagram (Figure 2)

DRILLED BY: Mines Department Drilling Section, Field Unit A.

RIG: Midway Skytop (Rotary)

MUD: Aquagel, Biopolymer, CMC

### DRILLING COMMENCED:

HL3A 8. 4.1983  
HL3W 22.11.1982

### DRILLING COMPLETED:

HL3A 28. 4.1983  
HL3W 22.11.1982

### DRILLED DIAMETER:

| Bore | Depth Interval (m bns) | Diameter (mm) |
|------|------------------------|---------------|
| HL3A | 0-55                   | 350           |
|      | 55-602.5               | 216           |
| HL3W | 0-30                   | 172           |

TOTAL DEPTH: HL3A - 602.5  
HL3W - 30

CASING (Drilling): HL3A - 260mm (ID) cemented in to 55m  
HL3W - None

### CASING (Completion):

| Bore | Depth Interval (m bns) | ID (mm)  |
|------|------------------------|--|
| HL3A | 0 - 55                 | 260  |
|      | 0 - 579                | 154  |
|      | 0 - 599                | 80 NB  |
|      | 0 - 6                  | 25 NB  |
| HL3W | 0 - 1.5                | 154  |
|      | 0 - 23.27              | 100 NB PVC                                     |
|      | 23.27 - 29.41          | 100 NB (Stainless steel screen 0.5mm aperture) |

### CEMENTING:

HL3A - The 260mm sleeve welded steel conductor pipe was cemented in position with 4m<sup>3</sup> of cement slurry and 3m<sup>3</sup> of follow-up mud. The 154mm sleeve welded steel casing was cemented using 14m<sup>3</sup> of cement slurry and 10.8m<sup>3</sup> of follow-up water.

Cement was drilled out from 357 to 602 m bns.

A cement block was cast around the top of the casing.



#### OBSERVATION INTERVALS:

| Bore/Interval | Depth (m bns) | Formation                   |
|---------------|---------------|-----------------------------|
| HL3A1         | 61-66         | Leederville Formation       |
| HL3A2         | 241-247       | Cockleshell Gully Formation |
| HL3A3         | 568-574       | Cockleshell Gully Formation |
| HL3W          | 23-29         | Leederville Formation       |

Remarks: Each interval in bore HL3A was perforated with 3 shots per metre. The 80mm GI pipe was installed with a 19m section of flame-cut slots at approximately 250 m bns and two compressible packers were set at 200 and 400 m bns to seal the annulus between the 80mm pipe and the 154mm casing. HL3A1 is monitored in the 25mm pipe set in the annulus and HL3A2 is monitored in the 80mm pipe. HL3A3 was abandoned after development. HL3W was completed with 6m of 100mm NB, 0.5mm aperture, wire-wound stainless steel screen and the annulus packed with graded sand.

#### CONSTRUCTION DIFFICULTIES:

Delays occurred during construction for the following reasons:

- (1) Mechanical breakdowns
- (2) Due to obstructions in the bore (initially at 379m bns) caused by formation collapse and/or swelling of clays and/or small steps in bore walls due to differing competancies together with slight inclination of bore, it was not possible to run the logging tools to TD. After two runs, each followed by reaming of the bore to TD, a full suite of logs was obtained to 486 m bns (Caliper to 379m bns) and sidewall cores were taken. Casing was run in to 384m bns after the first logging run. The bore was then cased and cemented to 579m bns. After drilling out the cement to TD, gamma-ray and neutron logs were run to TD and sidewall cores taken from the bottom uncased section of the bore.

CONSTRUCTION COMPLETED: HL3A - 11. 5.1983  
HL3W - 24.11.1982

DEVELOPMENT: Each interval was developed by airlifting and surging. In the case of HL3A1 and HL3A3 this continued until the water cleared and the conductivity was constant. Samples were then taken for chemical analysis. The yield from HL3A2 was insufficient to to fully develop this interval. HL3A3 was airlifted for 13 hours at 1270m<sup>3</sup>/d before the other intervals were perforated. All three intervals were then airlifted at 1300m<sup>3</sup>/d for 4 hours before the packers were installed. HL3A1 was then airlifted for 7 hours at 50m<sup>3</sup>/d and HL3A2 for 23 hours at less than 1m<sup>3</sup>/d. HL3W was developed by airlifting and jetting for 4 hours at 110m<sup>3</sup>/d. Subsequently it was pumped to supply water during the drilling of HL3A, HL4A and HL4B.

SITE CLEARED: 16. 5.1983

## GEOLOGICAL DATA

SAMPLES: Rotary (ditch cuttings) at 3m intervals

SIDEWALL CORES: Using the gamma-ray log, 26 shale/siltstone targets and 1 sandstone target, located in an interval under consideration for perforation were chosen in HL3A. 27 cores were recovered from the following depths (m bns) 61, 66, 78.5, 97.5, 130.5, 145, 150.5, 182, 193, 193.5, 204, 228.5, 257, 271, 292, 321.5, 358, 397.5, 437, 456, 483.5, 582.5, 583, 593, 593.5, 594, 598.6.

CORING OPERATORS: R Bulner and M A L'Herpinier

LOGGED BY: A.C. Deeney

REPOSITORY OF SAMPLES AND CORES: GSWA Core Library

### SUMMARY LOG:

| Depth Interval<br>(m bns) | Age                | Formation                                       | Lithology                        |
|---------------------------|--------------------|---|----------------------------------|
| 0-10.5                    | Quaternary         | Guildford Formation <sup>Gg</sup>               | Clay, sandy clay, sand.          |
| 10.5-21                   | Quaternary         | Jandakot Beds <sup>Ta</sup>                     | Sand, silt, clay, fossiliferous. |
| 21 - 204                  | Early Cretaceous   | Leederville Formation                           | Siltstone, sandstone, shale      |
| 204 - 602.5               | Early-Mid Jurassic | Cockleshell Gully Formation<br>(Eneabba Member) | Sandstone, siltstone, shale      |

REMARKS: A log of the ditch cuttings is given in Appendix 1  
A sidewall-core log is given in Appendix 2

# GEOPHYSICAL DATA

LOGGING UNIT: GO1 No 2 (Temperature Log - GO1 No 1)

LOGGING OPERATOR: J Collier

LOGS RUN: \_\_\_\_\_

| Log Type                       | Depth (m bns) | Date       |
|--------------------------------|---------------|------------|
| Gamma Ray                      | 0 - 410.6     | 28. 4.1983 |
|                                | 0 - 485.1     | 3. 5.1983  |
|                                | 0 - 597.4     | 6. 5.1983  |
| Neutron-Neutron                | 1.4 - 412     | 28. 4.1983 |
|                                | 1.4 - 486.5   | 3. 5.1983  |
|                                | 1.4 - 598.8   | 6. 5.1983  |
| Self Potential                 | 55.5 - 378.5  | 29. 4.1983 |
|                                | 381 - 485.8   | 3. 5.1983  |
| Short Normal Resistivity (16") | 55.5 - 378.5  | 29. 4.1983 |
|                                | 381 - 485.8   | 3. 5.1983  |
| Long Normal Resistivity (64")  | 55.5 - 378.5  | 29. 4.1983 |
|                                | 381 - 485.8   | 3. 5.1983  |
| Caliper                        | 0 - 381       | 29. 4.1983 |
| Temperature                    | 0 - 603.6     | 8. 4.1986  |
| Dipmeter Survey                | 0 - 588       | 10. 6.1986 |

## REMARKS:

- (1) Log zeros were taken at the drilling pad surface.
- (2) Apparent resistivities obtained from GO1 logs must be multiplied by a factor of 1.25 to give true formation resistivities.
- (3) The temperature log was run approximately 3 years after completion of the bore to allow time for the natural geothermal gradient to be re-established.
- (4) The gamma-ray and neutron logs run on 6. 5.1983 were run in casing from 0-579 m bns.
- (5) Depth errors may exist in the case of the caliper and temperature logs.
- (6) The dipmeter survey showed that the bottom of the bore was 7m southeast of the top of the bore.

# PALAEONTOLOGICAL DATA

PALAEONTOLOGICAL REPORT: Palynology of Harvey Line 3A. Pal.  
Rept.19/1983

## SUMMARY OF RESULTS:

| Depth<br>(m bns)                    | Age                                    | Zone             | Environment                                 | Formation                |
|-------------------------------------|--|------------------|---|--------------------------|
| 61,78.5,<br>130.5,145,<br>182,193.5 | mid Neocomian<br>to earliest<br>Aptian | <u>B.Limbata</u> | non-marine<br>(182 and 193.5m<br>backswamp) | Leederville<br>Formation |

REMARKS: Sidewall cores from 97.5, 150.5, 193, 204, 228.5, 257, 271, 292, 321.5, 358, 397.5, 437, 456, 483.5, 582.5, 583, 593, 593.5, 594 and 598.6m bns were not processed for reasons of obvious oxidation or unsuitable lithology.

The sidewall core from 66m bns was barren of palynomorphs.

# HYDROLOGICAL DATA

## SUMMARY:

| Bore/Interval                                 | HL3A1                    | HL3A2                          | HL3A3                    | HL3W                     |
|---|--------------------------|--------------------------------|--------------------------|--------------------------|
| Interval (m bns)                              | 61-66                    | 241-247                        | 568-574                  | 23-29                    |
| Formation                                     | Leederville<br>Formation | Cockleshell Gully<br>Formation | Leederville<br>Formation | Leederville<br>Formation |
| Airlift rate <sup>a</sup> (m <sup>3</sup> /d) | 50                       | <1 <sup>c</sup>                | 1270                     | 110                      |
| Water Level (m btc)                           | +0.620                   | 0.060                          | 8.45 <sup>d</sup>        | 0.415                    |
| Water Level (m AHD)                           | 13.921                   | 13.18                          | 4.73                     | 12.634                   |
| Date (W.L.)                                   | 5.8.1986                 | 5.8.1986                       | 10.5.1983                | 5.8.1986                 |
| Salinity <sup>b</sup> (TDS mg/L)              | 1560                     | 11700 <sup>c</sup>             | 32500                    | 2310                     |
| Conductivity <sup>b</sup> (mg/m@25°C)         | 290                      | 1900 <sup>c</sup>              | 4330                     | 420                      |
| Formation                                     |                          |                                |                          |                          |
| Resistivity (ohm-m)                           | 23.8                     | 6.3                            | <2 <sup>e</sup>          | -                        |
| Formation Factor                              | 6.2                      | 11.9                           | -                        | -                        |

## REMARKS:

- (a) Approximate final airlift rate.
- (b) Values obtained from chemical analyses (Chemistry Centre of WA) of samples taken at the end of airlifting (Appendix 4).
- (c) Insufficient supply to fully develop the interval. Water sample probably is representative of formation water.
- (d) Approximate static water level measured at completion.
- (e) Formation resistivity could not be accurately determined and hence a formation factor was not calculated.

m btc = metres below top of casing.

File No. 1347/63

G.S.W.A.

Bore Hole No. HL3

Locality S.W. OF WAROONA

Elevation m. above A.H.D.

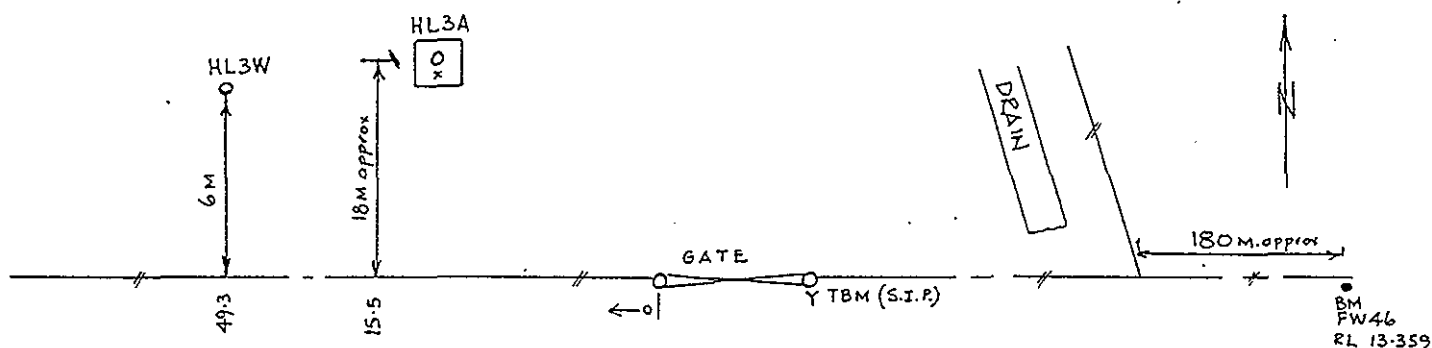
Surveyor C.E. FARRELL  
S. HARRAP Field Book 18 Date 15.7.85

Index Plan Calculation Folder

### SITE SKETCH

| BORE        | TOP    | CONC. BASE | T.B.M  |
|-------------|--------|------------|--------|
| HL 3A       | -      | 12.794*    | 12.727 |
| HL 3A: 75mm | 13.240 | -          |        |
| HL 3A: 25mm | 13.301 | -          |        |
| HL 3W       | 13.049 | NIL        |        |

Marked with yellow chalk.



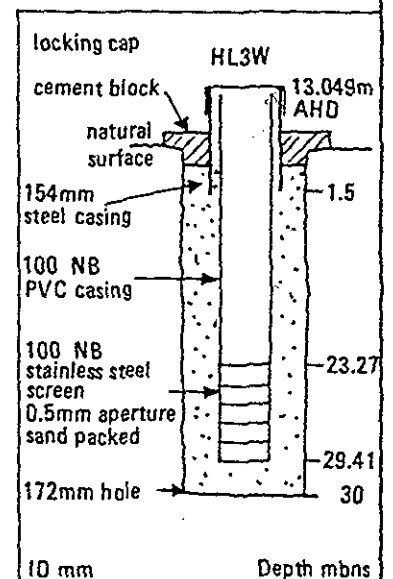
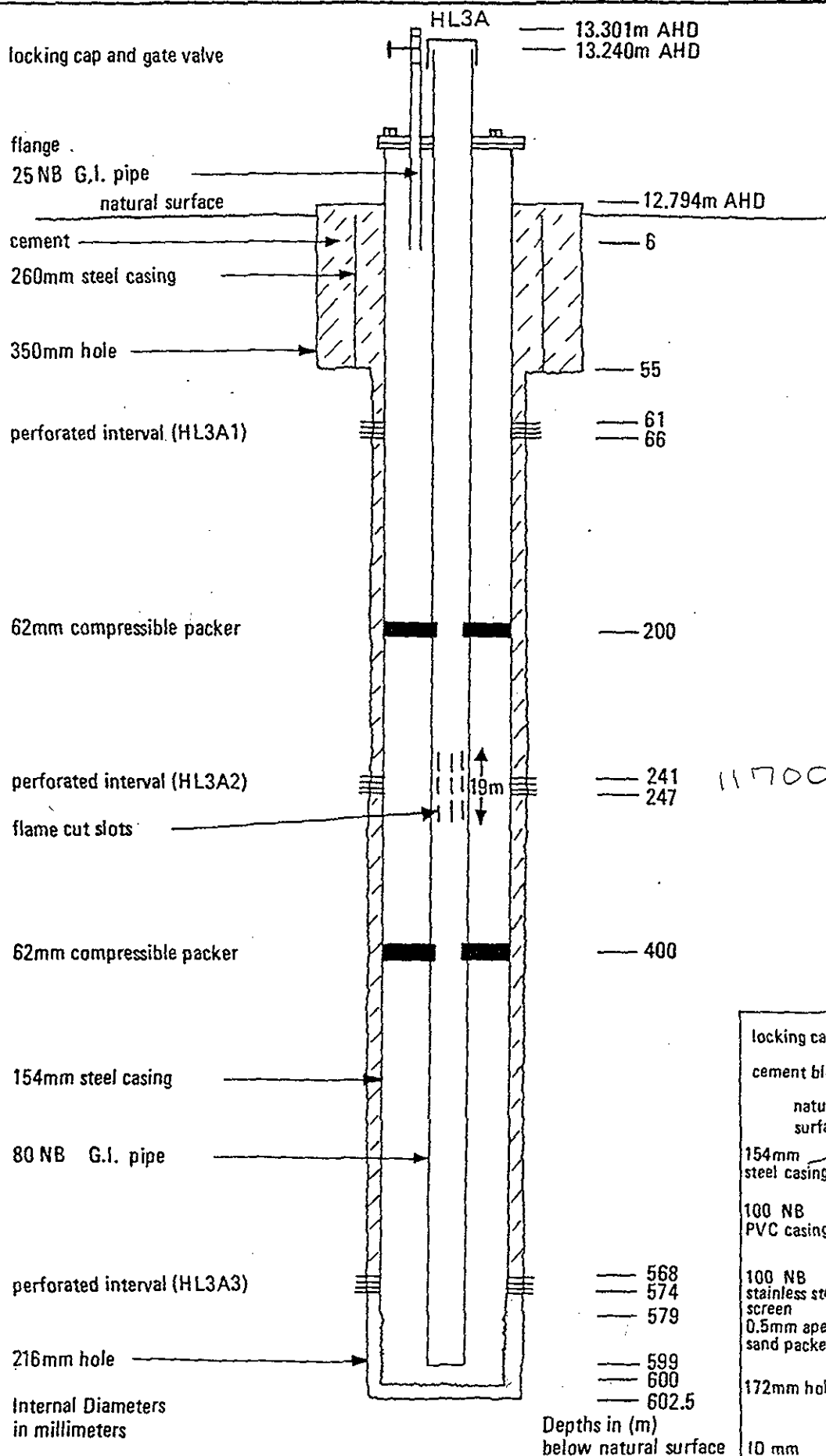
BRISTOL ROAD

→ 1.7K TO  
SOMMERS RD.

C.E. Farrell  
S. Harrap

Checked

Date



# GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

|       | INITIAL | DATE |
|-------|---------|------|
| COMP  | ACD     | 9/86 |
| DRAWN | ACD     | 9/86 |
| CHKD  |         |      |
| APVD  |         |      |

BORE CONSTRUCTION (Not to scale)  
HARVEY LINE SITE 3 (HL3)

TO ACCOMPANY BORE COMPLETION REPORT - HL3

MAP INDEX



SI 50-2-3032

# HARVEY LINE BORE HL3A

## SLUDGE SAMPLE LOG

| Depth (m bns) | Description  |
|---------------|--|
| 0- 9          | CLAY; grey-brown and black; very sandy. Arenaceous material fine to very coarse, subrounded, mainly quartz, often frosted, minor weathered feldspar.   |
| 9-12          | CLAY; green, grey and black, very sandy. Arenaceous material, similar to 0-9m interval.  |
| 12-15         | SAND; green, grey and dark grey, clayey, common shell fragments, mainly bivalves and gastropods, up to 2cm. Sand is fine to very coarse, moderately sorted, subrounded to rounded, mainly quartz often frosted, minor weathered feldspar.  |
| 15-18         | CLAY; green-grey, and dark grey, sandy, common shell fragments, mainly bivalves and gastropods up to 2cm. Arenaceous material similar to 12-15m interval.  |
| 18-21         | CLAY; grey-green and dark grey, very sandy, common shell fragments, mainly bivalves and gastropods up to 2 cm. Arenaceous material similar to 12-15m interval. Few fragments of hard, dark grey calcareous mudstone.   |
| 21-24         | CLAY; grey-green and dark grey, very sandy, micaceous. Common shell fragments, mainly bivalves and gastropods up to 2cm. A few fragments of cream lime cemented sandstone and hard dark grey calcareous mudstone.  |
| 21- 24 cont.  | Arenaceous material, fine sand to very fine pebbles, subrounded to rounded, mainly quartz, minor weathered feldspar. Sample contaminated from above.   |
| 24- 57        | CLAY; dark grey-green, olive green and black, micaceous, ?glauconitic slightly silty and sandy, often stiff, common fragments of black lignite and low grade coal, minor fragments of pyrite cemented sand. Sand is fine to medium, subangular to angular, mainly quartz, minor weathered feldspar. A few larger quartz grains occur up to very fine pebble grade. |



|         |  |
|---------|--|
| 57- 60  | SAND; dark grey, silty, clayey, fine to very coarse, poorly sorted, subangular to angular, mainly quartz, sometimes green stained, minor weathered feldspar, with fragments of well cemented sandstone (pyrite and carbonate). Clay is grey, micaceous, soft.      |
| 60-63   | CLAY; dark grey, silty, micaceous, slightly sandy. Arenaceous material similar to 57-60m interval.   |
| 63-69   | SAND; dark grey, clayey, fine sand to very fine pebbles poorly sorted, subangular to subrounded, mainly quartz, often green stained. Clay is micaceous. Abundant fragments of dark grey and cream, carbonate cemented sand also fragments of pyrite cemented sand. |
| 69-72   | CLAY; as at 60-63m interval.   |
| 72-75   | SAND; as at 57-60m interval.   |
| 75-78   | CLAY; as at 60-63m interval.   |
| 78-81   | SAND; as at 63-69m interval, but carbonate cemented sand perhaps more abundant.  |
| 81- 84  | CLAY; as at 60-63 interval.  |
| 84- 90  | SAND; as at 57-60m interval.   |
| 90- 93  | CLAY; as at 60-63m interval.   |
| 93- 96  | SAND; as at 57-60m interval but fewer fragments of cemented sand.  |
| 96-102  | CLAY; as at 60-63m interval but grey, yellow-grey and light green, greater percentage of sand.   |
| 102-111 | SAND; dark grey, silty, clayey, fine sand to very fine pebbles, poorly sorted, subangular to angular, mainly quartz sometimes blue minor weathered feldspar. Clay is micaceous. Contains occasional fragments of pyrite cemented sand.                             |
| 111-114 | LIMESTONE; light grey-green, sandy, glauconitic, with minor clay.  |
| 114-123 | SAND; similar to 102-111m interval with traces of low grade coal.  |
| 123-126 | LIMESTONE; as at 111-114m interval.  |
| 126-129 | SAND; as at 102-111m interval with fragments of limestone and dark grey siltstone.   |

|                      |   |
|----------------------|---|
| 129-135              | CLAY; dark grey, micaceous, sandy.  |
| 135-138              | SAND; as at 102-111m interval.  |
| 138-141              | CLAY; as at 129-135m interval.  |
| 141-150              | CLAY; grey, green, purple-red, silty, sandy, micaceous. Arenaceous material, ranges in grade from fine sand to very fine pebbles, mainly quartz, minor weathered feldspar rare fragments of pyrite cemented sandstone, calcareous mudstone and siltstone. 144-150m very sandy and gravelly.   |
| 150-153              | SAND; light grey, silty, clayey (purple and light grey) angular to subrounded, poorly sorted, fine sand to very fine pebbles, mainly quartz, sometimes pink, minor weathered feldspar, rare fragments of pyrite cemented sand and dark grey-green calcareous mudstone. Minor-common fragments of siltstone.   |
| 153-159              | CLAY; as at 141-150m interval.  |
| 159-162              | SAND; as at 150-153m interval.  |
| 162-168              | CLAY; as at 144-150m interval but predominantly purple.   |
| 168-171              | SAND; as at 150-153m interval.  |
| 171-210              | CLAY; as at 141-150m interval but with varying amounts of sand. Sand content increases with depth.  |
| 210-603(TD)<br>602.5 | <p>SANDSTONE, SILTSTONE, SHALE; Sandstone is light grey and light green-grey, slightly silty, slightly clayey, weakly cemented, ranges in grade from fine sand to 7mm pebbles, poorly to moderately sorted, subangular, mainly quartz, minor weathered feldspar, rare fragments of pyrite cemented sandstone, trace of mica (finer grained sandstones).</p> <p>Siltstone is grey, blue-grey, dark grey, green, yellow, purple, red-brown, slightly clayey, sandy, generally micaceous, weakly cemented.</p> <p>Shale is variegated (colours similar to siltstone), silty, slightly sandy, micaceous, weakly cemented.</p> <p>210-312m percentage of sandstone similar to percentage of siltstone and shale.</p> |

210-603(cont.)

324-344m, 363-378m, 381-393m 411-435m, 447-459m, 465-480m, Sandstone predominates.  
480-507m percentage of sandstone similar to percentage of siltstone and shale.  
507-513m, 534-603m, Sandstone predominates.

A C Deeney

Hydrogeologist

28 April 1983

HARVEY LINE - BORE HL3ASIDEWALL CORE LOG

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION   |
|-----------------|------------------|---|
| 61              | 43               | SANDSTONE; grey and dark grey, slightly clayey, micaceous. Weakly cemented, very fine to fine grained, well sorted, subangular, mainly quartz, exhibits small scale cross-bedding (bed thickness 1-2 mm), common black carbonaceous material. |
| 66              | 44               | CLAY; dark grey, silty, slightly sandy, micaceous. Sand ranges in grade from very fine to coarse, is subangular and consists mainly of quartz with minor weathered feldspar.  |
| 78.5            | 42               | CLAY; dark grey, silty, slightly sandy, micaceous. Sand ranges in grade from very fine to coarse, is subangular and consists mainly of quartz with minor weathered feldspar.  |
| 97.5            | 43               | CLAY; yellow-green and light green, silty, sandy. Arenaceous material ranges in grade from very fine sand to very fine gravel, is subangular and consists mainly of quartz with minor weathered feldspar.                                     |
| 130.5           | 40               | CLAY; dark grey, silty, micaceous.  |
| 145             | 44               | CLAY; dark grey, silty micaceous.   |
| 150.5           | 24               | SANDSTONE; light grey, light green and purple, variegated, silty, clayey, fine to very coarse, poorly sorted, subangular, mainly quartz, minor weathered feldspar, weakly cemented. A few grains of quartz up 6 mm occur.                     |

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION  |
|-----------------|------------------|--|
| 182             | 46               | CLAY; light grey-green, silty, very sandy. Arenaceous material ranges in grade from very fine to medium sand, is subangular and consists mainly of quartz.   |
| 193             | 25               | SANDSTONE; light grey-green, slightly clayey, fine to coarse, subangular, moderately sorted, mainly quartz, minor weathered feldspar, moderately cemented.   |
| 193.5           | 44               | SANDSTONE; dark grey-green, silty, slightly clayey, micaceous, moderately cemented, very fine to coarse grained, subangular to subrounded, poorly sorted, mainly quartz, minor weathered feldspar, trace of black carbonaceous material. |
| 204             | 37               | CLAY; light grey-green, purple, yellow, variegated, silty, slightly sandy. Arenaceous material ranges in grade from very fine to very coarse sand, is subangular and consists mainly of quartz.  |
| 228.5           | 27               | SILTSTONE; light grey-green, sandy, slightly clayey, moderately cemented. Arenaceous material ranges in grade from very fine to fine sand, is subangular, mainly quartz.   |
| 257             | 35               | SANDSTONE; light grey-green, silty, micaceous, moderately cemented, very fine to fine grained, subangular, moderately sorted, mainly quartz, minor weathered feldspar, with a few coarse grains of quartz.                               |
| 271             | 36               | SILTSTONE; purple, mottled light grey-green, sandy, clayey, weakly cemented. Arenaceous material ranges in grade from very fine to fine sand and consists mainly of quartz.  |

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION   |
|-----------------|------------------|---|
| 292             | 30               | SILTSTONE; purple-red, brown, yellow, variegated, sandy, slightly clayey, micaceous moderately cemented. Arenaceous material ranges in grade from very fine to fine sand with occasional coarse to very coarse, subangular, grains of quartz. |
| 321.5           | 43               | CLAY; purple, light grey-green, yellow, variegated, slightly silty.   |
| 358             | 41               | CLAY; light grey-green, purple, yellow, brown, variegated, silty, sandy. Sand is very fine to fine grained, subangular, and consists mainly of quartz.  |
| 397.5           | 43               | SILTSTONE; purple, light grey-green, yellow, brown, variegated, clayey, slightly sandy, weakly cemented. Sand is very fine to fine grained, subangular, and consists mainly of quartz.  |
| 437             | 38               | CLAY; purple, yellow, brown, light grey-green, variegated, silty, slightly sandy. Sand is very fine to fine grained, subangular, and consists mainly of quartz.   |
| 456             | 32               | SANDSTONE; grey, slightly silty, very fine to very coarse, subangular to subrounded, poorly sorted, weakly cemented, mainly quartz, minor weathered feldspar.   |
| 483.5           | 45               | SILTSTONE; light grey, variegated, sandy, clayey, weakly cemented. Sand is very fine to fine, subangular, mainly quartz.  |
| 582.5           | 27               | SANDSTONE; light grey, slightly silty, fine to very coarse, subrounded, moderately sorted, very weakly cemented, mainly quartz, minor weathered feldspar.   |

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION   |
|-----------------|------------------|---|
| 583             | 30               | SANDSTONE; light grey, slightly silty, fine to very coarse, subrounded, moderately sorted, very weakly cemented, mainly quartz, minor weathered feldspar.   |
| 593             | 30               | SANDSTONE; light green-grey, slightly clayey, weakly cemented, very fine to medium grained, well sorted, subangular to subrounded, mainly quartz, minor weathered feldspar, trace dark green mafic mineral, trace of mica.  |
| 593.5           | 30               | SANDSTONE; light grey-green, slightly clayey, moderately cemented, predominantly very fine to medium with a few larger grains of quartz (up to very fine pebble grade), poorly sorted, subangular to subrounded, mainly quartz, minor weathered feldspar, trace of dark green mafic mineral, trace of mica. |
| 594             | 40               | SANDSTONE; light grey, slightly clayey, moderately cemented, very fine to very coarse, subangular, poorly sorted, mainly quartz, minor weathered feldspar, trace of mica.   |
| 598.6           | 15               | SANDSTONE; light grey, slightly silty, very weakly cemented, fine to very coarse, subangular, moderately sorted, mainly quartz, minor weathered feldspar.   |

A C Deeney

ACD:KR  
GS 254/82  
August 8, 1983  
GE8100AC227

PALAEOLOGY REPORT NO. 19/1983

September 6, 1983

PALYNOLOGY OF HARVEY LINE 3A

MATERIAL AND LOCALITY: Twenty-seven sidewall cores from  
 Harvey Line 3A borehole, location: Pinjarra 2032  
 (1:100 000) 907 580. Sample No. 79742.

## DEPTH AND LITHOLOGY:

| <u>F. No.</u> | <u>Depth in m</u> | <u>Lithology</u>                            |
|---------------|-------------------|---|
| F46411        | 61                | Siltstone, l. grey, carbonaceous lamina     |
| --            | 66                | Claystone, m-d. grey, sl. gritty            |
| F46412        | 78.5              | Ditto                                       |
| --            | 97.5              | Claystone, greenish grey, with drilling mud |
| F46413        | 130.5             | Shale, d. grey, carbonaceous                |
| F46414        | 145               | Claystone, silty, m. grey, sl. bedded       |
| --            | 150.5             | Sst., red and grey                          |
| F46415        | 182               | Sst., f. gr. l. grey                        |
| --            | 193               | Sst. f-c. gr., l. grey                      |
| F46416        | 193.5             | Sst. f-c. gr., clayey, m-d. grey            |
| --            | 204               | Claystone, red and grey                     |
| --            | 228.5             | Ditto                                       |
| --            | 257               | Ditto                                       |
| --            | 271               | Ditto                                       |
| --            | 292               | Ditto                                       |
| --            | 321.5             | Ditto                                       |
| --            | 358               | Ditto                                       |
| --            | 397.5             | Ditto                                       |
| --            | 437               | Ditto                                       |
| --            | 456               | Sst., red                                   |
| --            | 483.5             | Claystone, purple and yellow                |
| --            | 582.5             | Sst., white                                 |
| --            | 583               | Ditto                                       |
| --            | 593               | Ditto                                       |
| --            | 593.5             | Ditto                                       |
| --            | 594               | Ditto                                       |
| --            | 598.6             | Ditto                                       |


SUBMITTED BY: A Deeney on Requisition No. 33204



REPORT: Most samples were unsuitable for palynological preparation and were not processed. Of these samples which were processed only the sample from 66 m proved to be barren of palynomorphs. The distribution of miospores in the remaining productive samples is set out in the accompanying chart. Microplankton were not encountered in any sample.

Assemblages from all the productive samples (61 m - 193.5 m) are considered to belong in the *Balmeiopsis limbata* Miospore Zone, of mid Neocomian - earliest Aptian age.

The sample from 182 m has a very restricted diversity, suggesting a back swamp type of environment of deposition. The 193.5 m assemblage is somewhat similar, and contains a high proportion of *D. equiexinus* and *M. florida*, but is generally more diverse than the 182 m sample. The four higher samples all contain generally diverse, non-marine assemblages of miospores.

  
J Backhouse  
(Asst. Palaeontologist)

DISTRIBUTION:  
A Deeney  
10/83  
Pal. Lab. File  
Harvey Line 3A

JB:RMW

Attach.

| <u>Depth</u> |       |       |         |        |      | <u>Miospore<br/>Species</u>                                |
|--------------|-------|-------|---------|--------|------|--|
| 193.5 m      | 182 m | 145 m | 130.5 m | 78.5 m | 61 m |  |
| /            |       |       |         |        |      | <i>Ischyosporites crateris</i> Balme                       |
| /            | /     |       |         |        |      | <i>Nevesisporites dailyi</i> (Dettmann)                    |
| /            | /     | /     | /       | /      |      | <i>Dictyophyllidites equiexinus</i> Couper                 |
| /            |       |       |         |        |      | <i>Foveosporites canalis</i> Balme                         |
| /            | /     | /     | /       | /      | /    | <i>Classopollis</i> sp.                                    |
| /            | /     | /     |         |        |      | <i>Murospora florida</i> (Balme)                           |
| /            |       |       |         |        |      | <i>Januasporites multispinus</i> sp. nov.                  |
| /            | /     | /     | /       | /      | /    | <i>Contignisporites cooksonae</i> (Balme)                  |
| /            |       | /     |         |        |      | <i>Matonisporites crassiangulatus</i> Balme                |
| /            |       | /     |         |        |      | <i>Laevigatosporites belfordii</i> Burger                  |
| /            |       |       |         |        |      | <i>Neoraistrickia</i> sp. Cf. <i>N. levidensis</i> (Balme) |
| /            |       |       |         |        |      | <i>Cicatricosisporites australiensis</i> Cookson           |
| /            | /     | /     | /       | /      |      | <i>Baculatisporites comaumensis</i> Cookson                |
|              | /     | /     | /       | /      |      | <i>Araucariacites australis</i> Cookson                    |
|              | /     | /     | /       | /      |      | <i>Retitriletes eminulus</i> (Dettmann)                    |
|              | /     |       |         |        |      | <i>Aequitriradites acusus</i> (Balme)                      |
|              | /     | /     |         |        |      | <i>Osmundacidites dubius</i> Burger                        |
|              | /     |       |         |        |      | <i>Cyathidites concavus</i> Balme                          |
|              | /     |       |         |        |      | <i>Callialasporites</i> spp.                               |
|              | /     | /     |         |        |      | <i>Microcachryidites antarcticus</i> Cookson               |
|              | /     | /     |         |        |      | <i>Retitriletes circolumenus</i> (Dettmann)                |
|              | /     |       |         |        |      | <i>Triletes tuberculiformis</i> Cookson                    |
|              | /     |       |         |        |      | <i>Gleicheniidites senonicus</i> Ross                      |
|              | /     |       |         |        |      | <i>Reticuloidosporites arcus</i> Balme                     |
|              | /     |       |         |        |      | <i>Retitriletes watherooensis</i> Backhouse                |
|              | /     |       |         |        |      | <i>R. clavatoides</i> (Couper)                             |
|              | /     |       |         |        |      | <i>Staplinisporites telatus</i> (Balme)                    |
|              |       |       |         |        | ?    | <i>Balmeiopsis limbata</i> (Balme)                         |



Appendix 4

Department of Mines, Western Australia  
**GOVERNMENT CHEMICAL LABORATORIES**  
30 Plain Street, Perth, Western Australia 6000  
Telephone: 325 5544

Director  
Geological Survey of W.A.  
Mineral House  
66 Adelaide Terrace  
PERTH WA 6000  
Attention: Mr. A.C. Deeney.

Address all correspondence to the Director

OUR REF

YOUR REF

ENQUIRIES TO

4 August, 1983. CM

MATERIAL Seven samples of water from the Harvey Line Project, marked "GS 78492-98".

LAB No 83W3562-68

FROM WHOM RECEIVED AND DATE Geological Survey of W.A. on 14 June, 1983.

RESULT OF EXAMINATION

|  |                       |       |        |      |
|--|-----------------------|-------|--------|------|
| Sample                                   | 78492                 | 78493 |        |      |
| Lab No. 83W                              | 3562                  | 3563  |        |      |
| pH                                       | 8.5                   | 7.3   |        |      |
| Appearance                               | clear, slight deposit |       |        |      |
| Colour (A.P.H.A. units)                  | <5                    | 10    |        |      |
| Odour                                    | nil                   |       |        |      |
| Conductivity (mS/m at 25C)               | 290                   | 1900  |        |      |
|  | me/L                  | mg/L  | me/L   | mg/L |
| Total dissolved solids (180C by calc)    | 1560                  |       | 11700  |      |
| Total hardness (as CaCO <sub>3</sub> )   | 320                   |       | 1700   |      |
| Total alkalinity (as CaCO <sub>3</sub> ) | 230                   |       | 98     |      |
| Calcium, Ca                              | 2.50                  | 50    | 32.34  | 648  |
| Magnesium, Mg                            | 3.87                  | 47    | 0.99   | 12   |
| Sodium, Na                               | 20.04                 | 461   | 166.96 | 3840 |
| Potassium, K                             | 0.49                  | 19    | 1.28   | 50   |
| Carbonate, CO <sub>3</sub>               | 0.10                  | 3     | 0.00   | <2   |
| Bicarbonate, HCO <sub>3</sub>            | 4.51                  | 275   | 1.95   | 119  |
| Chloride, Cl                             | 21.13                 | 749   | 189.28 | 6710 |
| Sulphate, SO <sub>4</sub>                | 1.73                  | 83    | 8.71   | 418  |
| Nitrate, NO <sub>3</sub>                 | 0.02                  | 1     | 0.00   | <1   |
| Silica, SiO <sub>2</sub>                 | 13                    |       | 3      |      |
| Fluoride, F                              | 0.2                   |       | 0.2    |      |

*A. Deeney*



## GOVERNMENT CHEMICAL LABORATORIES

30 Plain Street, Perth, Western Australia 6000  
Telephone: 325 5544

Address all correspondence to the Director

Director  
Geological Survey of W.A.  
Mineral House  
66 Adelaide Terrace  
PERTH 6000

OUR REF

YOUR REF File 254/82

ENQUIRIES TO

30 June 1983 SD

Attention: A.C. Deeney

MATERIAL One water sample from Harvey Lime - Yarloop, marked "Sample No. 75865, Bore Identity HL3A".

LAB NO 83W2669

FROM WHOM RECEIVED AND DATE

Geological Survey of W.A. on 12 May 1983.

RESULT OF EXAMINATION

HL3A3

|  |                       |       |
|--|-----------------------|-------|
| Sample                                   | GSWA 75865            |       |
| Lab No. 83W                              | 2669                  |       |
| pH                                       | 7.2                   |       |
| Appearance                               | clear, slight deposit |       |
| Colour (A.P.H.A. units)                  | 20                    |       |
| Odour                                    | nil                   |       |
| Conductivity (mS/m at 25C)               | 4330                  |       |
|  | me/L                  | mg/L  |
| Total dissolved solids<br>(180C by calc) |                       | 32500 |
| Total hardness (as CaCO <sub>3</sub> )   |                       | 8800  |
| Total alkalinity (as CaCO <sub>3</sub> ) |                       | 33    |
| Calcium, Ca                              | 158.68                | 3180  |
| Magnesium, Mg                            | 16.86                 | 205   |
| Sodium, Na                               | 394.35                | 9070  |
| Potassium, K                             | 0.87                  | 34    |
| Carbonate, CO <sub>3</sub>               | 0.00                  | <2    |
| Bicarbonate, HCO <sub>3</sub>            | 0.66                  | 40    |
| Chloride, Cl                             | 538.79                | 19100 |
| Sulphate, SO <sub>4</sub>                | 18.96                 | 910   |
| Nitrate, NO <sub>3</sub>                 | 0.00                  | <1    |
| Silica, SiO <sub>2</sub>                 |                       | 15    |
| Fluoride, F                              |                       | 0.2   |

*N. Platell*  
N. PLATELL  
CHIEF  
WATER SCIENCE LABORATORY

2.

(Lab No. 82W7893-5)

423W

Sample

75290

Lab No. 82W

7895

pH

7.6

Appearance

clear with a  
slight brown  
deposit

Colour (A.P.H.A. units)

6

Odour

nil

Conductivity (mS/m at 25C)

420

|  | me/L  | mg/L |
|--|-------|------|
| Total dissolved solids (180C by calc)    |       | 2310 |
| Total hardness (as CaCO <sub>3</sub> )   |       | 700  |
| Total alkalinity (as CaCO <sub>3</sub> ) |       | 307  |
| Calcium, Ca                              | 5.19  | 104  |
| Magnesium, Mg                            | 8.72  | 106  |
| Sodium, Na                               | 27.22 | 626  |
| Potassium, K                             | 0.26  | 10   |
| Carbonate, CO <sub>3</sub>               | 0.00  | <2   |
| Bicarbonate, HCO <sub>3</sub>            | 6.15  | 375  |
| Chloride, Cl                             | 31.59 | 1120 |
| Sulphate, SO <sub>4</sub>                | 2.90  | 139  |
| Nitrate, NO <sub>3</sub>                 | 0.00  | <1   |
| Silica, SiO <sub>2</sub>                 |       | 15   |
| Fluoride, F                              |       | 0.2  |

N. PLATELL  
CHIEF  
WATER DIVISION

BORE COMPLETION REPORT  
HARVEY LINE SITE NO 4 (HL4)

LOCATION AND IDENTIFICATION

OWNER: Geological Survey of Western Australia

GSWA REF:        HL4A1        SI50-2-2032-II-B-~~236~~ 242  
                  HL4A2        SI50-2-2032-II-B-~~237~~ 243  
                  HL4B         SI50-2-2032-II-B-~~238~~ 244  
                  HL4W1        SI50-2-2032-II-B-~~239~~ 245  
                  HL4W2        SI50-2-2032-II-B-~~240~~ 246

LOCATION:        Murray Loc. 621, northside, 150 metres east of the South  
                  Western Highway. Owner: Mr M Wills, Operations Manager  
                  (Wagerup), Alcoa Australia, PO Box 84, Waroona, WA 6215

(Figure 1 - Location map)

AMG REF (Zone 50):    Eastings    3977                                  Northings 63592

MAP SHEETS:        1:250000 Pinjarra (SI50-2)  
                    1:100000 Pinjarra (2032)

PURPOSE:        HL4A - Exploratory and observation  
                  HL4B - Exploratory and observation  
                  HL4W1- Water supply bore  
                  HL4W2- Water supply bore

STATUS:         HL4A1 - perforated interval-273-282 m bns-Observation  
                  HL4A2 - perforated interval-459-465 m bns-Observation  
                  HL4B   - perforated interval- 38-48 m bns -Observation  
                  HL4W1 - screened interval   - 18-24 m bns -Abandoned  
                  HL4W2 - screened interval   - 14-50 m bns -Abandoned

ELEVATION:        HL4A1 - top of 25mm GI pipe - 33.464 m AHD  
                  HL4A2 - top of 80mm GI pipe - 33.672 m AHD  
                  HL4B   - top of casing        - 33.471 m AHD  
                  Natural Surface - concrete base - 33.042 m AHD

m bns = metres below natural surface  
GI = Galvanised Iron  
NB = Nominal Bore  
ID = Internal Diameter

# BOREHOLE CONSTRUCTION AND DEVELOPMENT

Bore construction diagram (Figure 2)

DRILLED BY: Mines Department Drilling Section, Field Unit A

RIG: Midway Skytop (Rotary)

MUD: Aquagel, Biopolymer, CMC

## DRILLING COMMENCED:

HL4A 14. 3.1984  
HL4B 14.12.1984  
HL4W1 24.11.1982  
HL4W2 29.11.1982

## DRILLING COMPLETED:

HL4A 16. 4.1984  
HL4B 17.12.1984  
HL4W1 25.11.1982  
HL4W2 29.11.1982

## DRILLED DIAMETER:

| Bore  | Depth Interval (m bns) | Diameter (mm) |
|-------|------------------------|---------------|
| HL4A  | 0 - 55                 | 350           |
|       | 55 - 600               | 216           |
| HL4B  | 0 - 50                 | 216           |
| HL4W1 | 0 - 50                 | 172           |
| HL4W2 | 0 - 50                 | 172           |

TOTAL DEPTH: HL4A - 600  
HL4B - 50  
HL4W1 - 25  
HL4W2 - 50

CASING (Drilling): HL4A - 260mm (ID) cemented in to 55 m bns  
HL4B - None  
HL4W1 - None  
HL4W2 - None

## CASING (Completion):

| Bore  | Depth Interval (m bns) | ID (mm)                             |
|-------|------------------------|-------------------------------------|
| HL4A  | 0 - 55                 | 260                                 |
|       | 0 - 599                | 154                                 |
|       | 0 - 596.6              | 80 NB                               |
|       | 0 - 78.3               | 25 NB                               |
| HL4B  | 0 - 38.24              | 100 (CL.6PVC)                       |
|       | 38.24 - 48.0           | 50 (GI Screen<br>0.5mm aperture)    |
| HL4W1 | - Casing removed       | ---                                 |
| HL4W2 | 0 - 14                 | 100 NB (PVC)                        |
|       | 14 - 50                | 100 NB (PVC slotted -<br>1mm slots) |

CEMENTING: HL4A - The 260mm sleeve welded steel conductor pipe was cemented in position with 3.5m<sup>3</sup> of cement slurry and 3m<sup>3</sup> of follow-up mud.  
The 154mm sleeve welded steel casing was cemented using 19m<sup>3</sup> of cement slurry and 12m<sup>3</sup> of follow-up water.  
Cement was drilled out from 356 to 599m bns.  
A cement block was cast around the top of the casing.  
HL4B was tremi-cemented from 0-30m bns with 1.5m<sup>3</sup> of cement slurry.

## OBSERVATION INTERVALS:

| Bore/Interval | Depth (m bns) | Formation                   |
|---------------|---------------|-----------------------------|
| HL4A1         | 273-282       | Cockleshell Gully Formation |
| HL4A2         | 459-465       | Cockleshell Gully Formation |
| HL4B          | 38- 48        | Leederville Formation       |
| HL4W1         | 18- 24        | Superficial formations and  |
| HL4W2         | 14- 50        | Leederville Formation       |

Remarks: Each interval in bore HL4A was perforated with 3 shots per metre. The 80mm GI pipe was installed with two 6mm sections of flame-cut slots at approximately 465 and 595m bns and a compressible packer was set at 370m bns to seal the annulus between the 80mm pipe and the 154mm casing. HL4A1 is monitored in the 25mm pipe set in the annulus and HL4A2 is monitored in the 80mm pipe. HL4B was completed with 100mm Class 6 PVC coupled to 50mm NB galvanised iron screen (0.5mm aperture). The annulus was packed with graded sand in the observation interval. HL4W2 was completed with 36m of 100mm NB slotted PVC (1.0mm aperture) and the annulus packed with graded sand.

## CONSTRUCTION DIFFICULTIES:

Delays occurred during construction for the following reasons.

- (1) Mechanical breakdowns.
- (2) The 154mm casing string parted during installation. It was successfully retrieved and re-inserted.
- (3) Work at the site ceased on 16. 4.1984 when HL4A had been cased and cemented. The rig was moved to another job. Work restarted on 6.12.1984. The construction and development of HL4A was then completed and HL4B drilled and cased. Work was again interrupted on 19.12.1984. Development and testing of HL4B was carried out when work restarted on 19.4.1985.

CONSTRUCTION COMPLETED: HL4A -13.12.1984  
HL4B -19.12.1984  
HL4W1- 2.12.1982  
HL4W2- 2.12.1982

DEVELOPMENT: Each interval in HL4A and bore HL4B was developed by airlifting and surging. In the case of HL4A1 this continued until the water cleared and the conductivity was constant. Samples were then taken for chemical analysis. The yields from HL4A2 and HL4B were insufficient to allow full development of these intervals. Both intervals in HL4A were airlifted together at 350m<sup>3</sup>/d for 5 hours before the packer was installed. HL4A2 was then airlifted for 4 hours at less than 1m<sup>3</sup>/d and HL4A1 for 2 hours at 350m<sup>3</sup>/d. HL4B was developed by airlifting and surging for 2 hours at less than 1m<sup>3</sup>/d. Airlifting was discontinued because of the very low yield. Airlifting of HL4W1 and then HL4W2 produced very low yields (<1m<sup>3</sup>/d), insufficient for drilling water supplies and both bores were abandoned.

SITE CLEARED: 22. 4.1985



## GEOLOGICAL DATA

SAMPLES: Rotary (ditch cuttings) at 3m intervals

SIDEWALL CORES: Using the gamma-ray logs, 15 shale/siltstone targets and 7 sandstone targets located in intervals under consideration for perforation, were chosen in HL4A and 4 shale/siltstone targets in HL4B. Cores were recovered from all targets in both bores. The depths (m bns) are as follows. HL4A: 56, 58, 65, 81, 112, 173.5, 233, 285, 292, 324.5, 347, 410, 460, 509, 547, 563, 568, 571, 583.5, 584, 585, 586.5; HL4B: 11, 19, 35.5, 48.

CORING OPERATORS: R Bulner and M A L'Herpinier

LOGGED BY: A C Deeney

REPOSITORY OF SAMPLES AND CORES: GSWA Core Library

### SUMMARY LOG:

| Depth Interval<br>(m bns) | Age                   | Formation  | Lithology                     |
|---------------------------|-----------------------|--|-------------------------------|
| 0 - 15.5                  | Quaternary            | Guildford<br>Formation                             | Clay, sandy clay,<br>sand     |
| 15.5 - 20                 | Quaternary            | Yoganup<br>Formation                               | Sandy clay, clay,<br>sand     |
| 20 - 57                   | Early<br>Cretaceous   | Leederville<br>Formation                           | Siltstone, sandstone<br>shale |
| 57 - 600                  | Early-Mid<br>Jurassic | Cockleshell<br>Gully Formation<br>(Eneabba Member) | Siltstone, sandstone<br>shale |

REMARKS: A log of the ditch cuttings is given in Appendix 1  
A sidewall-core log is given in Appendix 2

# GEOPHYSICAL DATA

LOGGING UNIT: HL4A-G01 No2 (Temperature Log-G01N01)  
HL4B-SIE

LOGGING OPERATOR: J Collier

LOGS RUN:

| Log Type          | Depth (m bns) | Date       |
|-------------------|---------------|------------|
| HL4A              |               |            |
| Gamma Ray         | 0 - 590.6     | 6. 4.1984  |
| Neutron-Neutron   | 1.4 - 592     | 6. 4.1984  |
| Self Potential    | 55 - 594.1    | 6. 4.1984  |
| Short Normal      |               |            |
| Resistivity (16") | 55 - 594.1    | 6. 4.1984  |
| Long Normal       |               |            |
| Resistivity (64") | 55 - 594.1    | 6. 4.1984  |
| Caliper           | 0 - 592.3     | 6. 4.1984  |
| Temperature       | 0 - 573.3     | 8. 4.1986  |
| HL4B              |               |            |
| Gamma Ray         | 0 - 50        | 17.12.1984 |
| Short Normal      |               |            |
| Resistivity (16") | 0 - 50        | 17.12.1984 |
| Long Normal       |               |            |
| Resistivity (64") | 0 - 50        | 17.12.1984 |

REMARKS: (1) Log zeros were taken at the drilling pad surface.

(2) Apparent resistivities obtained from G01 logs must be multiplied by a factor of 1.25 to give true formation resistivities.

(3) The temperature log was run approximately 2 years after completion of the bore to allow time for the natural geothermal gradient to be re-established.

PALAEONTOLOGICAL DATA

PALAEONTOLOGICAL REPORT: Palynology of Harvey Line 4. Pal. Rept.  
18/1983 by J Backhouse (appendix 3)

SUMMARY OF RESULTS:

None of the sidewall cores were processed for  
reasons of obvious oxidation or unsuitable  
lithology.

# HYDROLOGICAL DATA

## SUMMARY:

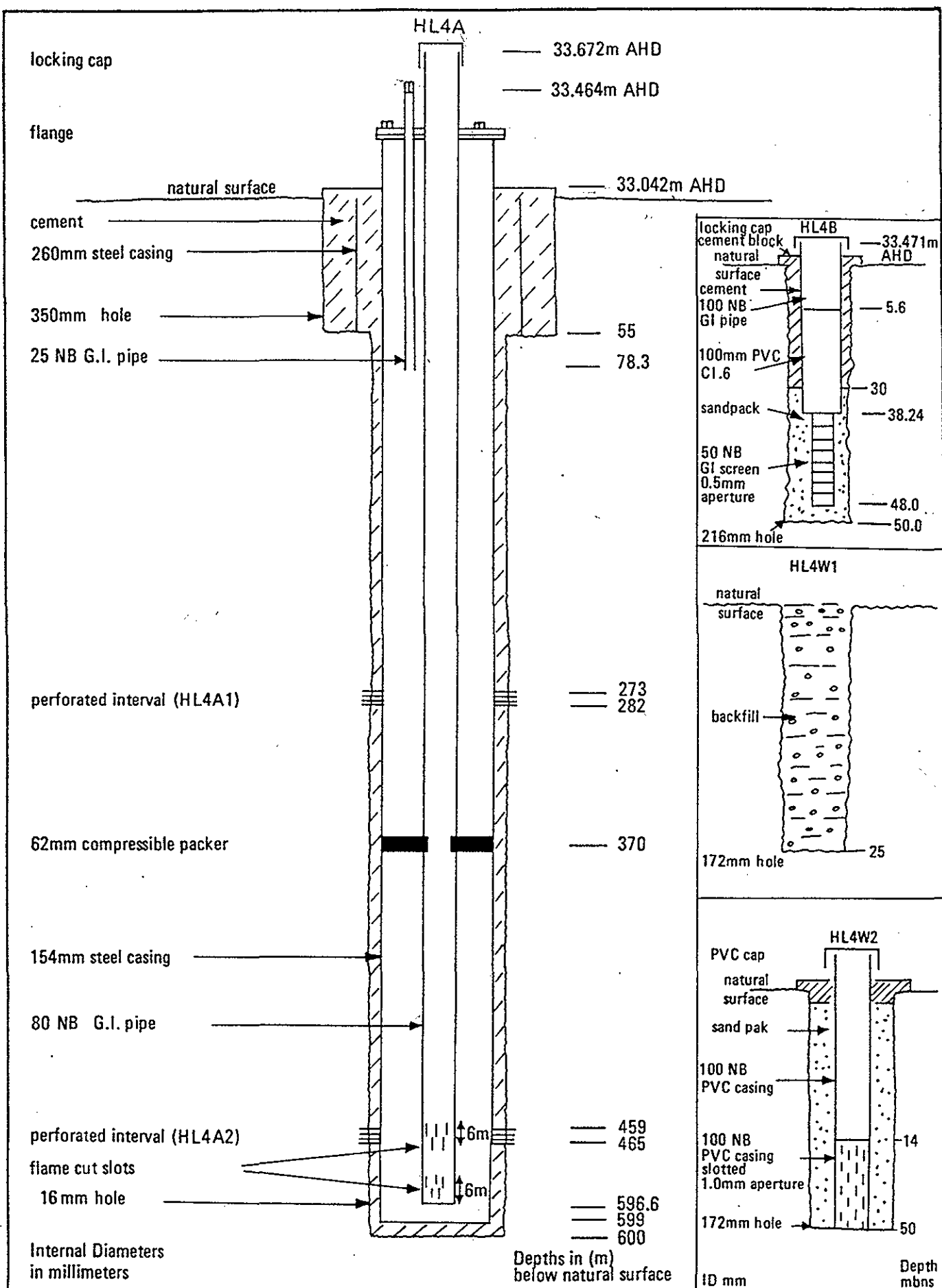
| Bore/Interval                                 | HL4A1                       | HL4A2             | H14B                  | HL4W1  | HL4W2 <sup>c</sup> |
|---|-----------------------------|-------------------|-----------------------|--|--------------------|
| Interval (m bns)                              | 273-282                     | 459-465           | 38-48                 | 18-24  | 14-50              |
| Formation                                     | Cockleshell Gully Formation |                   | Leederville Formation | Superficial formations and Leederville Formation |                    |
| Airlift rate <sup>a</sup> (m <sup>3</sup> /d) | 350                         | <1 <sup>d</sup>   | <1 <sup>d</sup>       | <1 <sup>d</sup>                                  | <1 <sup>d</sup>    |
| Water Level (m btc)                           | 16.620                      | 11.290 X          | 7.470 ✓               | 8.1 <sup>e</sup>                                 | 8.1 <sup>e</sup>   |
| Water Level (m AHD)                           | 16.844                      | 21.752            | 26.001                | 24.9   | 24.9               |
| Date (W.L.)                                   | 5.8.1986                    | 5.8.1986          | 5.8.1986              | 2.12.1982  | 2.12.1982          |
| Salinity <sup>b</sup> (TDS mg/L)              | 4790                        | 2750 <sup>d</sup> | 1690 <sup>f</sup>     | 479 <sup>d</sup>                                 | -                  |
| Conductivity <sup>b</sup> (mS/m@25°C)         | 859                         | 506 <sup>d</sup>  | 318 <sup>f</sup>      | 78 <sup>d</sup>                                  | -                  |
| Formation                                     |                             |                   |                       |  |                    |
| Resistivity (ohm-m)                           | 6.9                         | 26.3 <sup>g</sup> | 26.3 <sup>g</sup>     | -  | -                  |
| Formation Factor                              | 5.9                         | -                 | -                     | -  | -                  |

## REMARKS:

- (a) Approximate final airlift rate.
- (b) Values obtained from chemical analyses (Chemistry Centre of WA) of samples taken at the end of airlifting (Appendix 4).
- (c) Sample from this bore not submitted for analysis.
- (d) Insufficient supply to fully develop the interval. Water sample probably is representative of formation water.
- (e) Approximate static water level measured at completion.
- (f) Sample taken using bailer.
- (g) Formation resistivity could not be accurately determined and hence a formation factor was not calculated.

m btc = metres below top of casing.

S.H. 1



# GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

|       | INITIAL | DATE |
|-------|---------|------|
| COMP  | ACD     | 9/86 |
| DRAWN | ACD     | 9/86 |
| CHKD  |         |      |
| APVD  |         |      |

## BORE CONSTRUCTION (Not to scale) HARVEY LINE SITE 4 (HL4)

TO ACCOMPANY BORE COMPLETION REPORT - HL4

### MAP INDEX



SI 50-2-2032

# HARVEY LINE BORE HL4A

## SLUDGE SAMPLE LOG

| Depth (m bns) | Description   |
|---------------|---|
| 0-15          | CLAY; variegated, light grey, orange-brown, purple-red, silty, sandy to very sandy, lateritised, few fragments of weathered granite and subangular quartz up to 7mm. Sand is fine to medium, subangular to subrounded, mainly quartz.   |
| 15-21         | CLAY; similar to 0-12m intervals but very sandy, abundant fragments of weathered granite and subangular quartz up to 1cm. Sand is fine to very coarse, subangular to subrounded, mainly quartz.   |
| 21-24         | CLAY; variegated, dark green, grey-green, purple-red, orange-brown, predominantly olive-green, silty, sandy, micaceous, fragments of weathered granitic material and quartz, subangular to angular, up to 5mm. Sand is fine to medium, subangular to angular.                 |
| 24-27         | GRAVEL; purple-red, dark green, orange brown, grey variegated, sandy clayey. Largely composed of fragments of weathered granitic material and quartz which are angular to subangular, up to 2 cm. Sand is fine to very coarse, subangular to angular. Sample poorly sorted.   |
| 27-45         | SILT; purple-red, variegated, light grey-green and orange brown, clayey, sandy, micaceous. Sand ranges in grade from fine sand to 1cm pebbles, angular to subangular, quartz, weathered feldspar and weathered granitic material. Intervals 27-30m and 33-36m are very sandy. |
| 45-48         | CLAY; purplish-red, variegated, silty, sandy, micaceous. Sand ranges in grade from fine sand to 5mm pebbles, angular to subangular.   |
| 48-51         | CLAY; dark green-grey, variegated, silty, sandy.  |
| 51-54         | SILT; purplish red, variegated, light grey-green and orange-brown, slightly clayey, sandy. Sand ranges in grade from fine sand to 5mm pebbles, mainly quartz, weathered granitic rock fragments, weathered feldspar, subangular to angular.                                   |

54-57 SAND; grey-brown, silty, slightly clayey, ranges in grade from fine sand to 5mm pebbles, subangular to angular, poorly sorted, mainly quartz, minor weathered feldspar and granitic rock. Quartz often green stained.

57-60 CLAY; grey-brown, mottled purplish-red and orange-brown, silty, sandy, trace of mica. Sand is fine to very coarse, angular to subangular, mainly quartz.

60-78 SAND; similar to 54-57m interval.

78-93 CLAY; grey-brown, mottled purplish-red and dark grey-green, silty, slightly sandy to sandy, trace of mica. Sand is fine to very coarse, angular to subangular, mainly quartz, often green stained.

93-99 CLAY; similar to 78-93m interval, but very sandy.

99-102 CLAY, red-brown, mottled dark grey-green, slightly silty and sandy.

102-600(TD) SANDSTONE, SILTSTONE (AND SHALE); Sandstone is generally light grey, light grey-green, sometimes multicoloured, very fine to very coarse grained, often very fine to fine grained, poorly to moderately sorted, mainly quartz, sometimes micaceous (finer grained sandstones), slightly silty weakly cemented.  
Siltstone is grey, yellow-brown, light green, purple, slightly sandy to sandy, slightly clayey, micaceous, moderately to well cemented.  
Shale is variegated (colours similar to siltstone), slightly sandy, micaceous, moderately cemented, much less abundant than siltstone. Sequence sometimes includes fragments of weathered granite and large quartz up to 40mm. Sequence very hard from 550-600m. Percentage of sandstone approximately equivalent to siltstone and shale.  
276-307m Sandstone predominates.

A C Deeney

Hydrogeologist

6 April 1984

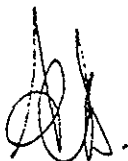


HARVEY LINE - BORE HL4A+48  
SIDEWALL CORE LOG

| DEPTH<br>(mbns) | RECOVERY<br>(mm) | DESCRIPTION  |
|-----------------|------------------|--|
| 11              | 35               | SILT; light grey-green, sandy, slightly clayey sand is very fine to medium grained, subangular, mainly quartz. Trace of dark fines.                    |
| 19              | 30               | SAND; light grey-green, silty, very fine to coarse, subrounded, poorly sorted, mainly quartz, trace of dark fines.                                     |
| 35              | 35               | GRANITE; slightly weathered granite in contact with dark green-brown sandy clay.   |
| 48              | 35               | SILTSTONE; brown variegated yellow, green and purple micaceous, very sandy, poorly cemented. Sand very fine to very coarse, subangular, mainly quartz. |
| 56              | 35               | GRANITE; highly weathered, composed mainly of quartz and kaolinite.  |
| 58              | 41               | SILTSTONE; yellow-brown, mottled light green, micaceous, slightly sandy, slightly clayey, poorly cemented.   |
| 65              | 43               | SILTSTONE; light grey, slightly sandy, slightly clayey, micaceous, moderately cemented.  |
| 81              | 43               | SANDSTONE; light grey-green, slightly silty, fine to very fine, subrounded, well sorted, micaceous, poorly cemented.                                   |
| 112             | 18               | GRANITE; highly weathered, mainly quartz and kaolinite.  |
| 173.5           | 41               | SILTSTONE; purple-grey, mottled yellow, micaceous slightly sandy, moderately cemented.   |
| 233             | 40               | SILTSTONE; light grey, mottled yellow, micaceous, sandy, slightly clayey, moderately cemented.   |

|       |    |   |
|-------|----|---|
| 285   | 40 | SANDSTONE; light grey, slightly silty, fine to coarse moderately sorted, subangular, mainly quartz, poorly cemented.  |
| 292   | 35 | SANDSTONE; light grey, slightly silty, very fine to coarse, moderately sorted, subangular, mainly quartz, poorly cemented.  |
| 324.5 | 40 | SILTSTONE; dark grey, micaceous, slightly sandy, moderately to well cemented.   |
| 347   | 43 | SANDSTONE; variegated, brown, white, grey, green and purple, silty, fine to very coarse, subangular to angular, poorly sorted, mainly quartz. Occasional large (20mm) fragments of quartz, moderately cemented. |
| 410   | 40 | SILTSTONE; variegated, grey, yellow-brown, purple, slightly sandy, slightly clayey, micaceous, moderately to well cemented.   |
| 460   | 41 | SILTSTONE; variegated, purple, yellow, brown, dark green, slightly sandy. Occasional fragments of 8mm quartz, moderately to well cemented.  |
| 509   | 35 | SILTSTONE; variegated, purple, yellow and grey, micaceous, moderately to well cemented.   |
| 547   | 40 | SILTSTONE; variegated, grey, yellow and purple, micaceous, slightly sandy, moderately to well cemented.   |
| 563   | 40 | SILTSTONE; variegated, purple, green and grey, micaceous sandy, moderately to well cemented.  |
| 568   | 40 | SILTSTONE; variegated, grey, yellow and purple, micaceous sandy, moderately to well cemented.   |

|       |    |  |
|-------|----|--|
| 571   | 40 | SILTSTONE; variegated, purple, yellow green, grey, sandy, micaceous, moderately to well cemented.  |
| 583.5 | 35 | SANDSTONE; variegated, grey, purple, brown, light green, silty, very fine to very coarse, predominantly very fine to fine, poorly sorted, subangular, mainly quartz, minor weathered feldspar, micaceous, moderately cemented. |
| 584   | 38 | SILTSTONE; variegated, purple, light green and yellow-brown, sandy, micaceous, moderately to well cemented.  |
| 585   | 40 | SILTSTONE; variegated, grey, green, purple, yellow, sandy, slightly clayey, micaceous, moderately to well cemented.  |
| 586.5 | 37 | SILTSTONE; variegated, purple, green, yellow, sandy, micaceous, moderately to well cemented.   |



GSWA File No.10/85  
Harvey Line 4

Palaeontology Report 18/1985

PALYNOLOGY OF HARVEY LINE 4

by

J. Backhouse

NOTE

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Western Australia

Geological Survey

Perth, 1985

PALYNOLOGY OF HARVEY LINE 4


MATERIAL: Twenty six sidewall cores between 11 m and  
86.5 m.

LOCATION: Australian metric grid 3977, 63592.

REQUESTED BY: A. Deeney on requisition No. 34285.

REPORT: After an examination of all the sidewall core  
samples submitted from this borehole it was decided that  
none of them were suitable for palynological processing.

All the samples showed clear signs of oxidation such  
as brown, purple or yellow colouring. Even the highest  
sample (11 m) was a slightly yellow pale grey clay. It  
was therefore reluctantly concluded that all organic  
matter would have been removed by the oxidation, and that  
processing would be merely a waste of technician's time  
and of chemicals.

  
J. Backhouse  
(Palaeontologist)

3 January 1986

GE764SSB080

Government Chemical Laboratories  
125 Hay Street, Perth  
Western Australia 6000

Telephone: 325 5544

Director  
Geological Survey of W.A.  
Mineral House  
66 Adelaide Terrace  
Perth 6000

2 water sample(s), received 3 May 85 - Lab numbers 85X 801 to 802  
HARVEY LINE PROJECT

Lab number

*HL4A1*  
85X 801

G.S.W.A. No.

79767

pH

7.7

Colour (A.P.H.A. units)

< 5

Conductivity (mS/m at 25C)

859

me/l

mg/l

Total dissolved solids (180C by calc)

4790

Total hardness (as CaCO<sub>3</sub>)

420

Total alkalinity (as CaCO<sub>3</sub>)

102

Calcium, Ca

6.34

127

Magnesium, Mg

2.06

25

Sodium, Na

73.91

1700

Potassium, K

0.20

8

Carbonate, CO<sub>3</sub>

0.00

< 2

Bicarbonate, HCO<sub>3</sub>

2.05

125

Chloride, Cl

77.29

2740

Sulphate, SO<sub>4</sub>

2.27

109

Nitrate, NO<sub>3</sub>

0.00

< 1

Silica, SiO<sub>2</sub>

14

Boron, B

0.2

Fluoride, F

1.3

HL4A2

Lab number

85X 802

S.W.A. No.

79768

pH

9.8

Colour (A.P.H.A. units)

< 5

Conductivity (mS/m at 25C)

506

me/l

mg/l

Total dissolved solids (180C by calc)

2750

Total hardness (as CaCO<sub>3</sub>)

16

Total alkalinity (as CaCO<sub>3</sub>)

186

Calcium, Ca

0.15

3

Magnesium, Mg

0.16

2

Sodium, Na

44.35

1020

Potassium, K

2.51

98

Carbonate, CO<sub>3</sub>

2.37

71

Bicarbonate, HCO<sub>3</sub>

1.34

82

Chloride, Cl

41.47

1470

Sulphate, SO<sub>4</sub>

0.81

39

Nitrate, NO<sub>3</sub>

0.00

< 1

Silica, SiO<sub>2</sub>

1

Boron, B

0.13

Fluoride, F

0.4

*HL4A2*

J. Platell

Chief

Water Science Laboratory

7 Jun 85

NOTE. Sample considered not to be representative of formation water.

Government Chemical Laboratories  
125 Hay Street, Perth  
Western Australia 6000

Telephone: 325 5544

Director  
Geological Survey of W.A.  
Mineral House  
66 Adelaide Terrace  
Perth 6000

1 water sample(s), received 13 Feb 86 - Lab numbers 86X 335 to 335  
HARVEY DEEP

Lab number

*HL4B*  
86X 335

G.S.W.A. No.

16774

pH

7.6

Colour (A.P.H.A. units)

10

Conductivity (mS/m at 25C)

318

|  |                  | me/l  | mg/l |
|--|------------------|-------|------|
| Total dissolved solids (180C by calc)    |                  |       | 1690 |
| Total hardness (as CaCO <sub>3</sub> )   |                  |       | 186  |
| Total alkalinity (as CaCO <sub>3</sub> ) |                  |       | 170  |
| Calcium,                                 | Ca               | 1.75  | 35   |
| Magnesium,                               | Mg               | 1.97  | 24   |
| Sodium,                                  | Na               | 24.57 | 565  |
| Potassium,                               | K                | 0.36  | 14   |
| Carbonate,                               | CO <sub>3</sub>  | 0.00  | < 2  |
| Bicarbonate,                             | HCO <sub>3</sub> | 3.39  | 207  |
| Chloride,                                | Cl               | 24.82 | 880  |
| Sulphate,                                | SO <sub>4</sub>  | 1.25  | 60   |
| Nitrate,                                 | NO <sub>3</sub>  | 0.00  | < 1  |
| Silica,                                  | SiO <sub>2</sub> |       | 8    |
| Boron,                                   | B                |       | 0.36 |
| Fluoride,                                | F                |       | 0.4  |

*KI brown for*  
P.N. Jack  
Acting Chief  
Water Science Laboratory  
7 Mar 86



Lab No. 82W8407-14

HL4W1

|                             |            |
|-----------------------------|------------|
| Sample                      | 77903      |
| Lab No.                     | 8411       |
| pH                          | 4.2        |
| Appearance                  | cloudy     |
| Colour (A.P.H.A. units)     | 6          |
| Odour                       | paraffinic |
| Conductivity (mS/m at 25°C) | 78         |

|  | me/l | mg/l |
|--|------|------|
| Total dissolved solids (180°C by calc)   |      | 479  |
| Total hardness (as CaCO <sub>3</sub> )   |      | 170  |
| Total alkalinity (as CaCO <sub>3</sub> ) |      | <2   |
| Calcium, Ca                              | 1.75 | 35   |
| Magnesium, Mg                            | 1.56 | 19   |
| Sodium, Na                               | 2.17 | 50   |
| Potassium, K                             | 0.08 | 3    |
| Carbonate, CO <sub>3</sub>               |      | <2   |
| Bicarbonate, HCO <sub>3</sub>            |      | <2   |
| Chloride, Cl                             | 1.66 | 59   |
| Sulphate, SO <sub>4</sub>                | 6.38 | 306  |
| Nitrate, NO <sub>3</sub>                 |      | <1   |
| Silica, SiO <sub>2</sub>                 |      | 7    |
| Boron, B                                 |      | 0.21 |
| Fluoride, F                              |      | <0.1 |

This analysis is out of balance due to the low pH. Aluminium was found to be present at 24 mg/l and this brings the ions into acceptable balance.