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TITLE: REPORT ON LAPORTE NO.5 WATER BORE,
AUSTRALIND, W.A.

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by

C. Emmenegger.

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ABSTRACT

A large supply of excellent quality artesian water was intersected by Laporte No. 5 Water Bore, Australind. The bore, drilled to a depth of 700 feet, encountered the "Bunbury Basalt" from 358 feet to 436 feet. The aquifer, intersected below the basalt from 436 feet to 700 feet, consists mainly of coarser and conglomeratic sandstone occurring within a sequence of sandstone, siltstone and mudstone of Lower Cretaceous age. With a content of 350 parts per million (23 grains per gallon) of total dissolved solids and 158 parts per million (11 grains per gallon) sodium chloride, the water is of better quality than that produced from the other four Laporte bores.

The bore flowed at 19,000 gallons per hour with a static head of approximately 15 feet above ground level, and it was pump tested at the rate of 40,120 gallons per hour with a drawdown of approximately 34 feet.

INTRODUCTION

From March, 1961 to July, 1962 four bores were drilled by the Mines Department of Western Australia at Australind, about 6 miles north-east of Bunbury, for Laporte Titanium Ltd. A supply of 2 million gallons per day of good quality water was required. A complete analysis of the geological and hydrological results obtained from these bores is given by Passmore (1962).

Two of these bores have water of good quality, a third one is acceptable, but the water of the fourth is too high in sodium chloride content to be used for the proposed chemical processes. As the margin of safety from the other three acceptable bores did not enable a sufficient supply of good quality water to be assured, a fifth bore was required by Laporte Titanium Ltd.

The geological and hydrological information available from the Laporte Nos. 1 - 4 Water Bores, resulted in locating bore no. 5 near bore no. 2 from which the best quality water had

been produced so far, and which was only very slightly affected by pumping in the other bores (see Locality Plan, Plate 1). Only aquifers deeper than 250-300 feet and cut off from the top aquifer by a good aquiclude were to be considered, to avoid interference with shallow bores in the vicinity. On the other hand, drilling of bore no.5 was stopped at 700 feet, although the full thickness of the producing aquifer had not been penetrated, because in bore no.4 the bottom aquifer (868 - 1062 feet) was higher in salinity than the shallower producing section (688 - 791 feet).

Laporte No.5 bore was commenced on 1st November, 1962 and was completed on 17th December, 1962. It was drilled under contract by J. Grill, using the Mines Department's Failing M.I rotary rig. Wellsite geology and palynological examination of selected samples were carried out by the Geological Survey of Western Australia, whereas completion and testing of the bore was supervised by the Hydraulics Branch of the Public Works Department.

BORE HISTORY

General Data:

Name:	Laporte No.5 Water Bore, Australind.
Location:	South West Division. W.A. Lands Dept. Litho 441 A/40, Wellington Location 31. Lat. $33^{\circ}18'2''$ S (approx.), Long. $115^{\circ}42'3''$ E. (approx.).
Ground Elevation:	5 feet above S.L. (approx.).
Commenced:	1st November, 1962.
Drilling Completed:	27th November, 1962.
Testing Completed:	17th December, 1962.
Total Depth:	700 feet.
Status:	Producing from 6" casing slotted from 435-682 feet.

Drilling Data:

Drilling Contractor: J. F. Gill.
 Rig: Mines Department's Failing M.I. rig, rotary.
 Hole Size: 15"/0-66'; 12½"/66'-305'; 9"/305'-700'.
 Casing: 13½" I.D./0-66'; 10" O.D./0-305';
 6" O.D./251'-696'.
 13½" and 10" casing cemented. 6" casing
 sealed to 10" casing wall at 251'.
 Cement Plug: Set at 696'-700' (approx.).
 Perforation: 6" casing slotted from 435'-682',
 slots 12" x ½", approx. 60 slots
 per 20' length.

Hydrological Data:

Developed Aquifer Zone: 435 feet - 682 feet.
 Static Water Level: Approx. 15 feet above ground level.
 Flow: 19,000 gallons per hour.
 Date of Pump Test: 8/12/62 to 17/12/62.
 Yield: Pumped for 213 hours at 40,120 gallons
 per hour.
 Drawdown: 34 feet.
 Quality of Water: Total dissolved solids - 330 p.p.m.
 Sodium Chloride - 158 p.p.m.

GEOLOGY

General

A gravity survey undertaken by the Bureau of Mineral Resources from 1949 - 1952, (Thyer and Everingham, 1956) showed that the Perth Basin has a graben-like structure, bounded by normal faults of great magnitude. The sediments filling this graben were estimated to be about 30,000 feet thick. It was also suggested that the Perth Basin should be divided into two deep troughs, the Dandaragan Trough in the north, and the Bunbury

Trough in the south. In the area west of Harvey, these two main structural units give rise to a saddle-like feature, where the thickness of sediments should probably be of 10,000-12,000 feet. In 1956, a seismic reflection traverse was surveyed in the region of Busselton, slightly south of the deepest part of the Bunbury Trough, and as a result (Lodwick, 1962), it was estimated that there is at least 8,000 feet of sediments in the deepest part of the Bunbury Trough, along this traverse. The sediments appear to be folded and faulted.

The Australind area is situated slightly north-north-east of the deepest part of the Bunbury Trough, near the gravity contour line of 70 milligals. Hence, it can be expected that the thickness of sediments here should be in the same order as that estimated from the seismic results in the eastern sections of the Busselton reflection traverse, that is, at least 6,000 - 8,000 feet.

The Australind area is covered with Quaternary deposits (described by McArthur and Bettenay, 1960) overlying Mesozoic sediments of the Capel River Group (Fairbridge, 1953). The latter sediments are mostly non-marine sandstone, siltstone and mudstone which range in age from Upper Jurassic to Lower Cretaceous. They may locally contain basalt flows. Such a flow was intersected in Laporte No. 5 bore at about the same depth as in bore No. 1, whereas no basalt was encountered in the other Laporte Bores.

Lithology

The sample log of Laporte No. 5 Water Bore is given in Appendix 1. For the purpose of establishing tentative correlations with other bores, it may be useful to divide the section intersected in bore no. 5 into minor lithological sequences, characterized by the predominance of shaly or arenaceous material and the frequency of accessory material like coal, pyrite, mica, felspar and boulders. From this point of view, the lithology of the bore can be subdivided as follows:

Table 1.

Laporte No. 5 Water Bore, Lithological Sequences.

From (feet)	To (feet)	Thickness (feet)	Lithological Sequences
0	60	60	Arenaceous sequence (Quaternary)
60	168	108	Interbedded sequence of sandstone and mudstone. Felspar, coal and mica fairly abundant. Minor pyrite.
168	277	109	Arenaceous sequence, with minor mudstone. Felspar, coal and mica fairly frequent. Minor pyrite. Numerous quartzite boulders.
277	358	81	Clayey sequence, with rare sandstone. Very rich in coal, pyrite and mica. Some boulders.
358	436	78	Basalt, with weathered zones above and below.
436	700	264	Arenaceous sequence. Very rare mica.

Some distinctive features are: the relative abundance of coal, pyrite and mica in the sequences above the basalt whereas the same material is almost completely absent from the section below basalt, the abundance of quartzite boulders in the interval 168-277 feet, and, of course, the presence of a basalt flow which is of great importance in lithological correlations.

Stratigraphy and Facies

Palynological conclusions after examination of samples by H.S. Edgell are given in Appendix 2.

Laporte No. 5 bore intersected Pleistocene sand and clays from 0-60 feet. These Quaternary deposits belong to the Bassendean Dune System (McArthur and Bettenay, 1960), which is thought to have formed during the Riss-Wurm Interglacial.

The sediments below the Quaternary deposits in the Australind area are correlated with the Capel River Group (Fairbridge, 1953), which is equivalent to the Yarragadee Formation of the northern part of the Perth Basin and the South Perth Formation and Claremont Sandstone of the Perth area. Laporte No. 5 bore, unlike bores

Nos. 1, 3 and 4 did not intersect any sediments of Upper Jurassic age: the whole section below the Quaternary is of Lower Cretaceous age, as in bore no.2. An unexpected result of the palynological examination is the fact that marine deposits (microfloral assemblage D of Balme) occur in the lower part of bore no.5, whereas the upper section is continental (except for weakly marine sequence at about 300 feet) with microfloral assemblage C of Balme. These features differ greatly from those in bores nos.1,2 and 4, where marine deposits of Lower Cretaceous age are located in the upper part of the bores. This confirms that the microfloral assemblages C and D of Balme are reflecting only differences in facies (Passmore,1962).

In the Capel River Group, four formations were distinguished by Fairbridge. Although correlations between these formations and sequences encountered in Laporte no.5 bore are uncertain, the clayey sequence between 277-358 feet, immediately overlying the basalt flow, is lithologically strongly similar to the Blackwood Shale Formation (Fairbridge,1953). According to McWhae and others (1958) this formation is probably present in the upper part of the Abba River bores, and the basalt flow which occurs in Abba River no.3 bore may lie within this unit. On a similar lithological basis, the arenaceous sequence from 60-277 feet could be correlated with the Donnybrook Sandstone, whereas the arenaceous sequence below the basalt (436-700 feet) could possibly be considered as partly equivalent to the Warren River Sandstone. The latter is also thought to be present in the lower part of the Abba River bores (McWhae and others,1958). However, these inferences are uncertain, as even in a small area like Australind, lithological correlations are difficult to establish from one bore to another.

Lithological Correlations with Laporte Nos.1-4 Water Bores

As it appears that palynological results only reflect differences in facies and do not allow definite stratigraphical correlations between bores, a few correlations are attempted here, based on similar lithological sequences.

Correlation with bore No.1. The most important correlation is given by the basalt flow. The thickness of basalt, including weathered zones above and below the flow is 118 feet in bore no.1 and 78 feet in bore no.5. Taking into account the slight difference in elevation (approximately 3 feet) one can say that in

bore no.5, the bottom of the basalt is 19 feet higher than that in bore no.1, the top being 21 feet lower than that in bore no.1. These features are likely to be related to topographic irregularities when the flow occurred. Another good correlation may be established between the arenaceous sequences below basalt. In both bores, they consist mainly of sandstone with some conglomeratic beds and minor siltstone and mudstone. Coal, pyrite and mica are absent or very rare. In bore no.1, there is no clayey sequence above the basalt, but there is an arenaceous sequence with pebbles and minor coal and pyrite, similar to that from 60-277 feet in bore no. 5.

Correlations with bore no.2. The arenaceous sequence below the basalt in bore no.5 can be correlated with the arenaceous sequence which begins at a depth of 578 feet in bore no.2, whereas the clayey sequence of brown and black mudstone in bore no.5 (277-358 feet) very likely is the equivalent of a similar sequence, rich in coal, pyrite and mica, from 460-537 feet in bore no.2. Thus, the red-brown mudstone of bore no.2 (537-578 feet) lies quite probably at the same position as the basalt in bore no.5. These lithological correlations between the two bores show that the lithological sequences in bore no.2 are at least 100-130 feet deeper than their equivalents in bore no.5. This indicates the presence of a fault between the two bores.

Correlations with bore no.3. No definite lithological correlation is possible between this bore and bore no.5.

Correlations with bore no.4. "The sequences in bore nos. 2 and 4 are somewhat similar, consisting of upper and lower sections of predominantly sandstones, and middle sections of black and brown mudstone with minor sandstones" (Passmore, 1962). Good correlations are possible between bores nos. 5 and 2 and the red-brown mudstone of bore no.2 (537-578 feet) lies probably at the same position as the basalt in bore no.5. It is interesting to notice that in bore no.4, a red-brown clay is also present at a similar stratigraphical position. This red-brown mudstone is

rather rare and it may be related to the basalt.

Conclusions

Results of comparison between the stratigraphy, facies and lithology of Laporte no.5 bore and the other four Laporte bores may be summarized as follows:-

From palynological results it is established that, in the Australind area, marine interdigitations may lie within the continental sediments of Lower Cretaceous age and are not located strictly at the top of Lower Cretaceous sequences intersected in the Laporte bores, thus making stratigraphic correlations difficult on the basis of palynological criteria.

The only recognisable sedimentary sequence with a lateral extension in the Australind area is a sequence of coarse to conglomeratic feldspathic sandstone, with minor siltstone and mudstone. This section is located below the basalt in bores nos. 1 and 5, and below a red-brown mudstone in bore no.2. The depth to which it extends is 700 feet, 754 feet and 900 feet in bores nos. 5, 1 and 2 respectively (borehole depths). When compared with the lithology of the upper part of these bores, this arenaceous sequence contains no (or very rare) coal, pyrite and mica. The lithology does not seem to be affected by the marine influences noticed in bore no.5. The sequence is a good producing aquifer in bores nos. 1,2 and 5, possibly also in bore no. 4.

The basalt flow gives a good correlation between bores Nos.1 and 5. Its absence from the other bores is probably due to irregular topography when the flow occurred.

Structurally, it should be noted that Jurassic sediments are absent in bores nos. 2 and 5, and these two bores show a thickening of Lower Cretaceous sediments similar to that already encountered in bore no.4. It was shown previously, according to gravity and seismic results, that the Australind area is situated slightly north-north-east of the deepest part of the Bunbury trough. Therefore, a thickening of sediments towards west or south-south-west is to be expected, and is likely to be explained by more active

subsidence towards the axis of the troughs. This feature, and the presence, between bores nos. 2 and 5, of a fault, which obviously is younger than the basalt flow, show that subsidence and faulting were the main factors controlling sedimentation in this area in Lower Cretaceous times.

HYDROLOGY

General

Laporte no.5 Water Bore produced artesian water from the arenaceous sequence below basalt. When the bore was being developed, removal of fine particles took a long time, because the aquifer contains numerous beds of siltstone and because some unconsolidated sections probably caved between the 9" diameter bore wall and the 6" diameter slotted casing. After development, a flow of approximately 19,000 gallons per hour was measured. The true static water level is difficult to estimate as, during the pump test on this bore, pumping was still being carried out in the other bores. However the apparent static water level in bore no.5 before the pump test started was approximately 15 feet above ground level, i.e. 15 feet lower than the static water levels in bores nos. 1 and 2, and 10 feet lower than those in bores nos. 3 and 4. The fact that the apparent water level in bore no.5 was 15 feet below the static water level in the nearest bore (no.2) is probably explained by interference. It is also possible that the hydrological conditions are somewhat influenced by the presence of the fault mentioned previously between these two bores.

The lithological analysis showed that the arenaceous sequence which constitutes the producing aquifer in bores nos.1,2 and 5 (and possibly also no.4) has a lateral extension, and this should be kept in mind if it is planned to drill other bores of similar depth in the vicinity of the Australind area. On the other hand, it can be expected from the general geological conditions, that bores nos. 2 and 5 will compare more closely, from an hydrological

viewpoint, with the conditions existing in the Bunbury area, whereas bores nos. 4, 1 and 3 are increasingly distant from the deepest part of the Bunbury trough.

Yield

Laporte no.5 bore was pump tested for 213 hours at 40,120 gallons per hour, with a drawdown of approximately 34 feet below the static water level. The test was carried out using an airlift pump. An analysis of the pump test by D. Collett, of the Hydraulics Branch, Public Works Department, showed that after pumping for one year at 40,000 gallons per hour, the water level would be drawn down to 27 feet below ground level. He stated also that the maximum yield of the bore, using a centrifugal pump on the surface, would be 40,000 gallons per hour, but a turbine-type pump down the bore would allow it to be pumped at higher outputs. As it can be expected that the aquifer will be replenished during winter, the drawdown should not increase noticeably over a number of years.

Quality

The water in Laporte no.5 bore is of excellent quality, containing 330 parts per million (23 grains per gallon) of total dissolved solids with a low chloride content of 158 parts per million (11 grains per gall.). The salinity did not rise during the pump test and it is likely to remain steady with continuous pumping. This will be checked by long-term pumping using an electrically-powered pump.

The results of a chemical analysis of the water by Government Chemical Laboratories are given in Appendix 3. They show that the pH value of water in bore no.5 (6.9) is lower than in any of the other Laporte bores. This is probably due to the fact that the relatively low concentration of cations (Ca, Mg, Na, K) leaves an excess of the higher concentration bicarbonate anion. Following Schoeller (1962), this low value of pH allows a relative high amount of iron (Fe) to be dissolved, as it is the case in bore no.5. However, this iron content does not significantly affect the quality of water in this bore; because of its extremely low content of sodium chloride, it remains excellent.

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LAPORTE NO.5 WATER BORE, AUSTRALIND.

SAMPLE LOG.

From (feet)	To (feet)	Thickness (feet)	Description
0	10	10	<u>Sand</u> : quartz, clayey, yellow, poorly consolidated, medium to very coarse grained, poorly sorted.
10	25	15	<u>Sand</u> : quartz, yellow and whitish, poorly consolidated, coarse to very coarse grained, well sorted, felspathic.
25	30	5	<u>Clay</u> : silty and sandy, brown and light grey.
30	40	10	<u>Sand</u> : quartz, slightly clayey, grey and whitish, medium to very coarse grained, moderately sorted, felspathic, with kaolin and abundant lignitic material.
40	45	5	<u>Sand</u> : quartz, brown, lightly consolidated, coarse to very coarse grained, very well sorted, felspathic, ferruginous.
45	60	15	<u>Sand</u> : quartz, slightly clayey, grey-yellowish, poorly consolidated, coarse to very coarse grained, moderately to well sorted. Abundant feldspar, partly decomposed to white kaolin. A few granules and pebbles of chert and quartzite.
60	70	10	<u>Mudstone</u> : silty and sandy, light grey and dark grey, micaceous, with coal and pyrite.
70	78	8	<u>Sandstone</u> : quartz, clayey, grey, unconsolidated, medium to very coarse grained, poorly sorted, felspathic.
78	86	8	<u>Mudstone and sandstone interbedded</u> : <u>Mudstone</u> : silty, grey-greenish and black, micaceous, carbonaceous. <u>Sandstone</u> : quartz, clayey, light grey, coarse to very coarse grained, felspathic, with a few subangular granules of yellow chert and reddish quartzite.
86	92	6	<u>Mudstone</u> : slightly silty and sandy, dark grey, with abundant carbonaceous material and mica.
92	100	8	<u>Sandstone</u> : quartz, clayey, grey and light grey, unconsolidated, coarse to very coarse grained, moderately sorted, felspathic, micaceous, with abundant carbonaceous material.
100	110	10	<u>Sandstone</u> : quartz, slightly clayey, grey, in places consolidated, coarse to very coarse grained, felspathic.
110	144	34	<u>Sandstone and mudstone interbedded</u> : <u>Sandstone</u> : quartz, clayey, grey, lightly consolidated, medium to very coarse grained, felspathic, with a few subangular to subrounded granules of quartz and quartzite, pink and yellow. <u>Mudstone</u> : silty and sandy, grey and black, micaceous, carbonaceous, with minor pyrite.

From (feet)	To (feet)	Thickness (feet)	Description
144	156	12	<p><u>Sandstone with minor mudstone:</u></p> <p><u>Sandstone:</u> quartz, clayey, grey, moderately consolidated, medium to very coarse grained, with feldspar partly decomposed to white kaolin. Minor thin beds of hard sandstone, fine grained, micaceous, yellow and grey.</p> <p><u>Mudstone:</u> silty, grey-greenish, micaceous.</p>
156	168	12	<p><u>Mudstone with minor sandstone:</u></p> <p><u>Mudstone:</u> silty and sandy, black, grey and light grey, micaceous, carbonaceous.</p> <p><u>Sandstone:</u> clayey, lightly consolidated, medium to very coarse grained, feldspathic, with coal and a few granules of reddish quartzite.</p>
168	176	8	<p><u>Conglomeratic sandstone:</u> feldspathic, with numerous granules of quartzite, reddish, pink, yellow and grey. Quartzite boulder at 171 feet. Minor thin layers of grey and black, silty, micaceous and carbonaceous mudstone.</p>
176	179'6"	3'6"	<p><u>Mudstone:</u> slightly silty, black, grey and brown, carbonaceous, micaceous and pyritic.</p>
179'6"	180	6"	<p><u>Quartzite:</u> hard, reddish and pink, cobble.</p>
180	183	3	<p><u>Sandstone:</u> coarse to conglomeratic, feldspathic, micaceous, with abundant coal and pyrite. Minor black and brown mudstone.</p>
183	224	41	<p><u>Sandstone:</u> quartz, grey, lightly consolidated, coarse to very coarse grained, mostly well sorted, feldspathic, with kaolin from decomposed feldspar. Boulders of reddish and pink quartzite at 192', 196', 200', 205', 223'. Minor thin layers of mudstone, slightly silty and sandy, light grey, grey, greenish and black (especially from 215-224 feet).</p>
224	232	8	<p><u>Mudstone:</u> silty and sandy, in places micaceous and carbonaceous, with kaolin and a few granules of quartz and reddish quartzite (224-225 feet: grey and brown mudstone. 225-226 feet: light grey and brownish. 226-228 feet: yellow and brown. 228-232 feet: light grey and brown).</p>
232	245'6"	13'6"	<p><u>Sandstone with minor mudstone:</u></p> <p><u>Sandstone:</u> quartz, clayey, grey, moderately consolidated, medium to very coarse grained, moderately sorted, with rare feldspar and pyrite.</p> <p><u>Mudstone:</u> silty and sandy, grey, brown and black. White kaolin.</p>
245'6"	253	7'6"	<p><u>Sandstone:</u> quartz, grey, coarse to conglomeratic, feldspathic, with kaolin. Pebbles of pink and grey quartzite at 245'6", 249 feet and 251 feet. Minor pyrite, coal and mica. A few thin layers of mudstone, black, grey, and brown, rarely red.</p>

From (feet)	To (feet)	Thickness (feet)	Description
253	257	4	<u>Mudstone</u> : slightly silty and sandy, grey, light grey and yellowish.
257	277	20	<u>Sandstone with minor mudstone and siltstone</u> : <u>Sandstone</u> : quartz, clayey, grey, poorly to moderately consolidated, medium to very coarse grained. Minor coal and pyrite. Quartzite pebbles at 257', 259', 263'. <u>Mudstone</u> : sandy, grey, brownish and black, rarely red. White kaolin from decomposed feldspar. <u>Siltstone</u> : sandy, grey, micaceous.
277	300	23	<u>Mudstone</u> : silty and sandy, brown, grey, black and greenish, micaceous, carbonaceous. Abundant coal and pyrite. Thin intercalations of very fine to fine sandstone, silty, carbonaceous, micaceous, fairly consolidated. A few granules of quartz and quartzite.
300	303'6"	3'6"	<u>Mudstone and Sandstone</u> : <u>Mudstone</u> : sandy, brown, pyritic and carbonaceous. <u>Sandstone</u> : a) clayey, grey, medium to coarse grained. b) silty, grey, fine grained, carbonaceous and micaceous.
303'6"	305	1'6"	<u>Mudstone</u> : silty and sandy, grey, with frequent coal and pyrite. A few granules of reddish and pink quartzite.
305	306	1	<u>Mudstone</u> : yellow-brown, with minor pyrite and coal. A few pebbles of pink and reddish quartzite.
306	309	3	<u>Mudstone</u> : light grey.
309	312	3	<u>Mudstone</u> : dark grey and yellow-brown. Bed of coal and pyrite at 309 feet. Numerous granules of pink and reddish quartzite.
312	314	2	<u>Mudstone and sandstone interbedded</u> . <u>Mudstone</u> : silty, dark grey and black. <u>Sandstone</u> : clayey, moderately consolidated, medium to coarse grained, carbonaceous, micaceous.
314	316	2	<u>Sandstone</u> : grey, slightly clayey, unconsolidated, coarse to very coarse grained, fairly well sorted, feldspathic.
316	322	6	<u>Mudstone</u> : very slightly sandy, dark grey, slightly pyritic and carbonaceous. At 321 feet: thin intercalation of sandstone, medium to coarse grained, carbonaceous. A few granules of quartz and quartzite.

From (feet)	To (feet)	Thickness (feet)	Description
322	326	4	<u>Sandstone</u> : grey, unconsolidated, coarse to very coarse grained, with granules. Felspar, pyrite and mica frequent. Minor mudstone, light grey, dark grey, rarely blue-green.
326	330	4	<u>Mudstone and Sandstone</u> : <u>Mudstone</u> : yellow-brown, grey, brown, blue, rarely blue-green. White kaolin. <u>Sandstone</u> : coarse to very coarse grained, feldspathic, with subrounded quartz granules.
330	350	20	<u>Mudstone</u> : in places silty and sandy, partly shaly, dark grey, black and pink, rarely blue, pyritic, carbonaceous, micaceous. Bed of coal at 337 feet. Thin layers of sandstone, grey-brown, fine grained. Rare granules of quartz and quartzite.
350	358	8	<u>Mudstone</u> : brown, black, and dark grey. Rare pyrite and carbonaceous material.
358	388	30	<u>Clay and mudstone</u> : blue-green, soapy, with particles of weathered basalt. Minor thin beds of brown mudstone, silty, in places shaly.
388	389	1	<u>Sandstone and mudstone</u> : <u>Sandstone</u> : very coarse, with granules of quartz, pink quartzite and red chert. Pyrite frequent. <u>Mudstone</u> : silty, brown.
389	394	5	as for 358-388 feet.
394	432	38	<u>Basalt</u> : hard, black-greenish, very fine grained, with numerous veins of fibrous aragonite at 394-395 feet, and veins of chalcedony with hematite between 394 - 420 feet. Minor thin layers of blue-green, grey and brown mudstone.
432	436	4	<u>Clay and mudstone</u> : blue-green, rarely brown, soapy, with particles of soft, weathered basalt.
436	460	24	<u>Sandstone, mudstone and siltstone interbedded</u> . Thickness of beds: 5"-6". <u>Sandstone</u> : quartz, clayey, grey, unconsolidated, coarse to very coarse grained, moderately sorted, with granules of quartz and chert. White kaolin. <u>Mudstone</u> : silty, yellow and grey. <u>Siltstone</u> : sandy, micaceous.
460	510	50	<u>Sandstone and siltstone interbedded, with minor conglomerate and mudstone</u> . <u>Sandstone</u> : quartz, grey, unconsolidated, coarse to very coarse grained, fairly sorted, feldspathic with kaolin. Minor thin intercalations of sandstone, fine grained, hard, grey and yellowish.

From (feet)	To (feet)	Thickness (feet)	Description
510	565	55	<p><u>Siltstone:</u> sandy, micaceous.</p> <p><u>Conglomerate:</u> Minor beds at: 60-62', 70-72', 94-96'. Rounded to subrounded pebbles of chert, quartz, and quartzite.</p> <p><u>Mudstone:</u> slightly silty, yellow, grey, rarely blue.</p> <p><u>Sandstone with minor siltstone and rare mudstone:</u></p> <p><u>Sandstone:</u> quartz, grey, generally unconsolidated, occasionally consolidated, mostly very coarse grained with some conglomeratic sections, moderately to well sorted, feldspathic with abundant white kaolin. Thin beds of fine to medium grained, hard sandstone, cemented partly by feldspathic cement, partly by fine particles of magnetite.</p> <p><u>Siltstone:</u> sandy, micaceous.</p> <p><u>Mudstone:</u> slightly silty, grey, yellow, rarely blue.</p>
565	586	21	<p><u>Claystone, Mudstone, Siltstone and Sandstone:</u></p> <p><u>Claystone:</u> light grey to whitish.</p> <p><u>Mudstone:</u> slightly silty, black, brown, grey yellow and blue, rarely pink and red-brown.</p> <p><u>Siltstone:</u> sandy, micaceous.</p> <p><u>Sandstone:</u> quartz, light grey, unconsolidated, coarse to very coarse grained, moderately sorted, feldspathic, in places conglomeratic (567-68'; 585-86'). Abundant white kaolin. Thin beds of fine, hard sandstone.</p>
586	646	60	<p><u>Sandstone:</u> quartz, light grey, unconsolidated, coarse to very coarse grained, moderately to well sorted, feldspathic, with conglomeratic sections (598-602'; 610-615'; 635-640'). Granules of quartzite and chert. Rare thin beds of fine, hard, micaceous sandstone. Rare beds of siltstone.</p>
646	655	9	<p><u>Sandstone, Claystone and Mudstone interbedded:</u></p> <p><u>Sandstone:</u> quartz, light grey, unconsolidated, coarse to very coarse grained, moderately sorted, feldspathic. Rare fine grained, hard sandstone intercalations. A few granules of quartzite and chert.</p> <p><u>Claystone:</u> white kaolin.</p> <p><u>Mudstone:</u> silty, blue and grey.</p>
655	700	45	<p><u>Sandstone with minor conglomerate, siltstone and mudstone:</u></p> <p><u>Sandstone:</u> quartz, light grey, unconsolidated, coarse to very coarse grained, moderately to well sorted, feldspathic, with conglomeratic sections (658-660'; 670-674'; 692-94'). Rare intercalations of fine grained, hard sandstone, grey and brownish, micaceous. White kaolin abundant.</p>

From (feet)	To (feet)	Thickness (feet)	Description
			<u>Siltstone</u> : sandy, micaceous. <u>Mudstone</u> : slightly silty and sandy, brown and grey, rarely blue.

TOTAL DEPTH: 700 feet.

PALYNOLOGICAL CONCLUSIONS ON LAPORTE NO.5 WATER BORE

by

H. S. Edgell.

Age and facies determinations of the spore, pollen and microplankton assemblages in samples from Laporte No.5 Water Bore have established the following descending stratigraphic sequence:

Geological Age	Depth	Microfloral Assemblage	Facies
Quaternary (Pleistocene to Recent)	0 ft. to 60 ft.	<u>Myrtaceidites</u> Assemblage	Non-Marine

u n c o n f o r m i t y

Lower Cretaceous (Aptian to Neocomian)	65 ft. to 690 ft. T.D. 700 ft.	<u>Microcachrydites</u> Assemblage	180 ft. Non-Marine
			230 ft. Non-Marine
			300 ft. weakly Marine
			350 ft. Non-Marine
			450 ft. Non-Marine
			570 ft. weakly Marine
			690 ft. Marine

Detailed palynological data on which these conclusions are based are available in Palaeontological Reports No.30/1962 and No. 33/1962 and provide additional information and remarks on taxonomic and facies problems.

Laporte No. 5 Water Bore did not reach Upper Jurassic strata which were encountered in Laporte No.1, No.3 and No. 4. It penetrated a thickness of 60 ft. of Quaternary sediments and over 630 ft. of Lower Cretaceous beds. Assuming no great difference in surface elevation, Laporte No.5 is structurally lower than Laporte No. 1 and No.3, and perhaps similar to Laporte No. 2 and No.4. There is no clear correspondence with the lettered assemblages used by Balme which reflect only facies differences, and alternating marine and non-marine conditions are explained by interfingering.

References

Edgell, H.S., 1962, Palynology and Age of Samples from Laporte No.5 Water Bore: Palaeontological Rept. 30/1962, Geol. Survey West Aust. file 86/62.

Edgell, H.S., 1962, Palynological Age Determination of Additional Samples from Laporte No.5 Water Bore: Palaeontological Report 33/1962. Geol. Survey West. Aust. file 86/62.

WATER ANALYSIS

by Government Chemical Laboratories.

Bore: Laporte No.5 Water Bore.
 Aquifer Interval: 435 to 682 feet.
 Date Collected: 11 a.m., 14/12/62.
 Conditions: After 143 hours of pump test.
 Sample No.: 8701
 Lab. No.: 10347
 Specific Conductivity
 at 20°C: 688 micromhos.
 Reaction: Neutral.
 pH: 6.9

<u>Mineral Matter:</u>	parts per million
Calcium, Ca	18
Magnesium, Mg	12
Sodium, Na	71
Potassium, K	17
Bicarbonate, HCO_3	122
Carbonate, CO_3	nil
Sulphate, SO_4	14
Chloride, Cl	111
Nitrate, NO_3	less than 1
Silica, SiO_2	24
Iron, Fe	12
Total (by summation)	401
Total (by evaporation)	330

Assumed Combination on Evaporation at N.T.P.

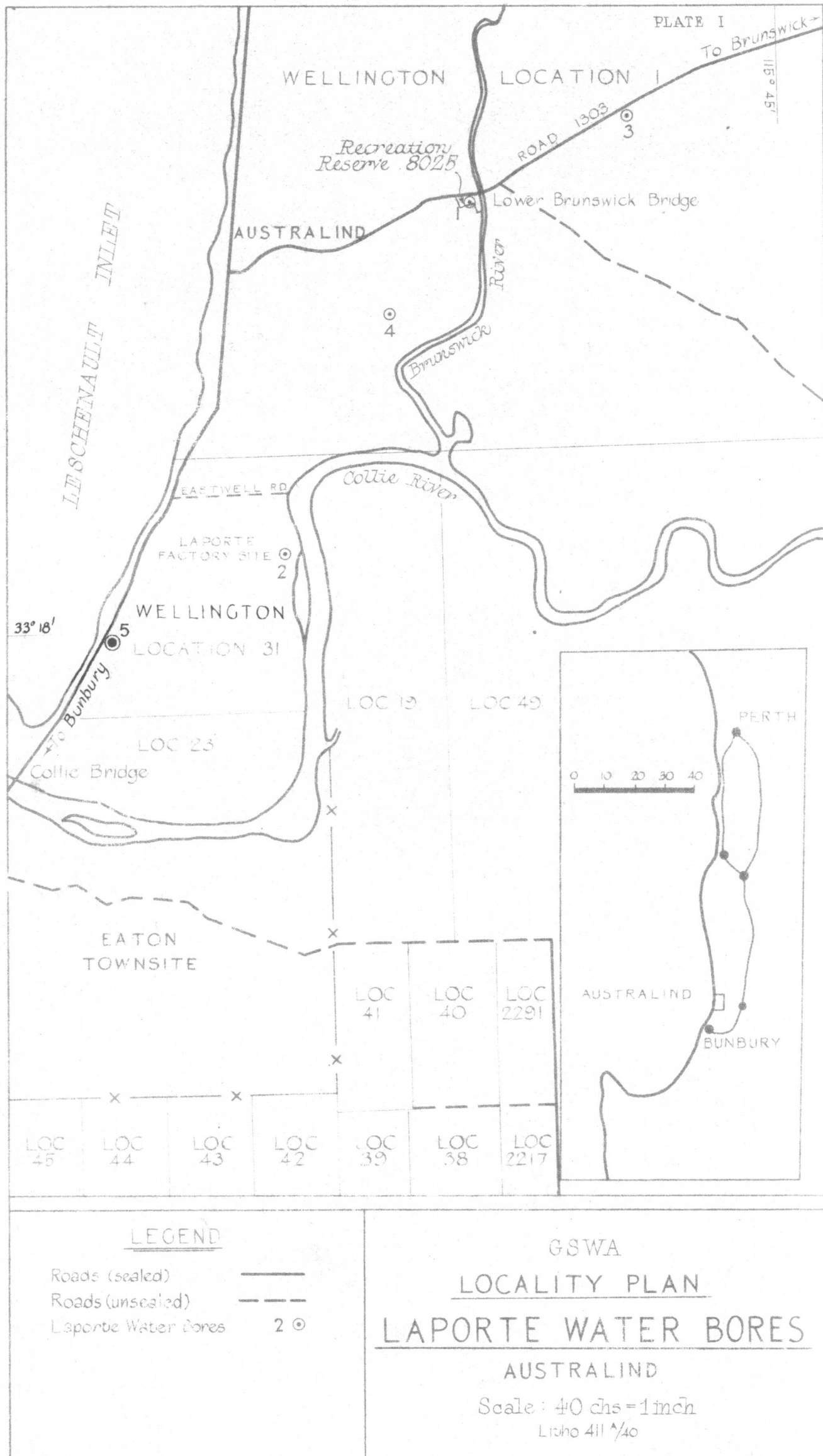
	parts per million
Calcium Carbonate, CaCO_3	45
Magnesium Carbonate, MgCO_3	42
Sodium Carbonate, Na_2CO_3	6
Sodium Sulphate, Na_2SO_4	21
Potassium Chloride, KCl	32
Sodium Chloride, NaCl	158

WATER ANALYSIS (contd.)

Hardness calculated as Calcium Carbonate

Parts per million

Total Hardness	94
Bicarbonate (temporary) hardness	94
Non-Carbonate (permanent) hardness	nil
Calcium hardness	45
Magnesium hardness	49



COMPOSITE LOG

LA PORTE N°5 WATER BORE AUSTRALIND

RIG : Failing M.I. Rotary
DRILLED FOR : Laporte Titanium Ltd
DRILLER : J. F. Griffl
COMMENCED : 1st November 1962
COMPLETED : 17th December 1962
LOGGED BY : C. Emmenegger
OTHER LOGS : Nil.

