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COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

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BAUXITE IN THE WESSEL ISLANDS, ARNHEM LAND, NORTHERN TERRITORY OF AUSTRALIA.

by

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SENIOR GEOLOGIST

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ADDENDUM

Since this record was written additional information in the form of analyses of composite samples from Baker, Easy, Red Cliff and Fox deposits has been received from the laboratory.

These composite samples do not represent precisely the same tonnages of bauxite which have been included in the reserves, and this fact explains, in part, the small discrepancies between the figures here given and the corresponding silica and available alumina figures set out in the body of this report.

Average compositions calculated from the analyses of composite samples are

Deposit		Baker	Easy	Red Cliff	Fox
Total SiO_2	per cent	9.6	8.7	11.5	7.4
Total Al_2O_3	"	53.3	51.9	48.9	47.7
Fe_2O_3	"	6.4	10.2	11.5	17.2
TiO_2	"	3.8	3.3	2.6	2.7
Quartz	"	3.0	2.2	5.5	2.6
Avail. Al_2O_3	"	46.0	44.8	42.6	42.9
Al_2O_3 by Autoclave extraction	"	45.7	44.6	42.2	42.5
Soda loss.	Cwt.	1.42	1.52	1.50	1.18

SUMMARY

Pisolitic bauxite containing between 40 and 50 per cent available aluminium was discovered on islands off the north-east coast of Arnhem Land in 1949, and after preliminary reconnaissance in 1951 a thorough exploration of the deposits on Marchinbar Island, Wessel group was undertaken by the Australian Aluminium Production Commission.

The island is 400 miles east-north-east of Darwin, approximately mid-way between Darwin and Thursday Island. One group of deposits contains 7,200,000 long tons of bauxite within 2½ miles of the west coast.

The island is composed of a gently tilted alternating sequence of sandstone, siltstone and shale of upper Proterozoic age bearing remnants of a lateritized surface which includes the bauxite occurrences. Bauxite has developed by lateritization of a sericite-quartz siltstone containing rather more than 50 per cent sericite. The rock contains 65 per cent total silica, 19 percent alumina and 6 percent potash.

Economic bauxite is mainly confined to the pisolitic zone which has a maximum depth of 16.5 feet and rests upon red or red and black tubular and massive laterite. Over limited areas high alumina values persist downwards into the red tubular zone for a few feet.

The deposits were proved by sampling pits sunk at the intersections of rectangular grids spaced at 400 feet by 200 feet, except for one deposit (Fox), which was tested on a wider scale.

Proved reserves are given in the following table, but the figures for Fox deposit are of a lower order of accuracy and should be regarded as indicated reserves.

Deposit:	Long tons of dry ore:	Total SiO_2 %	Quartz: %	Total Al_2O_3: %	Avail. Al_2O_3 %	Soda loss: cwt.
Baker	215,000	8.6	2.8	-	47.8	1.32
Sphinx Head	1233,000	6.5	2.5	48.0	43.5	1.00
Able	4627,000	4.1	1.1	51.4	47.1	0.71
Dog	1317,000	5.1	1.1	51.4	47.3	0.88
Easy	825,000	8.3	2.2	-	45.2	1.40
Red Cliff	763,000	8.8	3.8	-	43.9	1.31
Fox	800,000	6.8	2.4	-	42.8	1.07
Total:	9780,000	5.6	1.6	-	46.0	0.92

The total is equivalent to 4,500,000 tons of available alumina or 2,380,000 tons of aluminium metal.

INTRODUCTION

At the conclusion, early in 1949, of the Australian Aluminium Production Commission's prospecting and proving campaign throughout eastern Australia, the complete picture was not wholly satisfactory. Proved bauxite reserves in Tasmania, where the alumina and reduction plants are being established, are small and low grade, and would be better reserved against any emergency which might interrupt shipping from the mainland. The largest reserves that were then known are in the vicinity of Inverell, northern New South Wales, more than 400 miles by rail from the port of Newcastle. This long haul constitutes a very serious handicap to the use of this low grade ferruginous bauxite which averages only 35 per cent soda-soluble alumina.

In June, 1949 the writer visited Cobourg Peninsula, Northern Territory and examined laterite which had been described as siliceous bauxite by H.Y.L. Brown (Brown, 1908) early in this century. Although the laterite proved useless as a source of aluminium (Owen, 1949a) the maturity and great extent of the laterite was recognised, and it was thought that laterite that had developed on a favourably aluminous parent rock might be found in the region.

The writer was fortunate that he travelled from Darwin to Cobourg Peninsula on the Administration's patrol vessel "Kuru" commanded by Captain F.E. Wells, who knows the Arnhem Land coast intimately. Wells and F.J. Waalkes, a seaman who had had some experience prospecting, were shown specimens of pisolitic laterite and both agreed to continue the search as opportunity offered.

Before the end of 1949 many specimens of laterite had been received from Wells and Waalkes jointly and these included fair quality pisolitic bauxite from Truant and the Wessel Islands. Concurrently geologists on the Bureau staff collected laterite specimens from various inland localities in northern Australia, but all of these were too siliceous or too ferruginous to be of use. The writer collated all the information and recommended that the potential resources of Truant and the Wessel Islands should be determined (Owen, 1949b).

For various reasons the examination could not be made until October 1951, two years after the original discovery, and then only a hurried reconnaissance of part of Marchinbar Island and several points on the adjacent mainland coast was made by the writer accompanied by Captain Wells.

This was followed by a further short visit in April 1952, when the party comprised Messrs. J.V. Puckey and A.J. Richardson of the British Aluminium Company Ltd., Mr. J.M. Warrington of Australasian Civil Engineering Pty. Ltd. and the writer.

As a result of this visit and the wider reconnaissance that could be made, an earlier recommendation for a testing campaign was confirmed, and the work was then put in hand by the Aluminium Commission.

Messrs. Puckey and Richardson, who were seconded to the Commission, exercised supervision in the field and were responsible for the sampling of the deposits, and Australasian Civil Engineering was responsible for the establishment and maintenance of the camp, sinking of test pits, surveys, transport and communications.

Active work in the field began late in May and was completed by the end of October. During this time approximately 550 sampling pits were sunk (average depth 9 feet) and 27 miles of grid lines were surveyed and pegged. Of this length of line approximately half traversed heavy scrub, which necessitated use of a D4. bulldozer.

The total number of men engaged on the island comprised:-

Geologists -	2	
Surveyor -	1	
Assayer -	1	
Foreman-in-charge-	1	
Storeman-clerk-	1	
	6	
Miners	12	(later reduced to 10)
Bulldozer driver	1	
Fitter	1	
Driver-mechanic	1	
Cooks	2	
Survey Assistant	1	
Rouseabout	1	
	25	(23)

From 23rd. August a medical officer was engaged by Australasian Civil Engineering Pty. Ltd. and stationed at the camp.

Visits of inspection were made by J.M. Warrington and the writer during the course of the work.

LOCALITY AND ACCESS

The Wessel group forms a narrow, slightly arcuate, island chain trending north-easterly to north-north-easterly from Napier Point for a distance of 80 statute miles and dividing the Arafura Sea from the waters of the Gulf of Carpentaria. The northernmost point in the group is Cape Wessel (Lat. $11^{o}00'$S: Long. $136^{o}45'$E) on a small unnamed island separated from Marchinbar Island by a narrow strait. (See plate 1).

Marchinbar (or Erimbiga) Island, the largest of the group, is approximately 34 miles in length by a maximum width of 4 miles. The group consists of two other major islands, five small ones each of one or two square miles, and numerous low rocky islets.

Of the three major islands the southern two, separated from Marchinbar by Cumberland Strait and from each other by a narrow cleft called Hole-in-the-Wall, are not named on official maps and charts but are known to local natives as "Kullorunga" and "Irrakulla".

As Marchinbar is the island on which the bauxite reserves have been proved the following remarks about access, distances and anchorages refer to that island.

The nearest point on the mainland is Margaret Point in Malay Road, 30 miles south of Cumberland Strait and 2 miles north-west of Cape Wilberforce the north-easterly extremity of Arnhem Land.

Two airstrips for light aircraft have been cleared on the island and could be easily and quickly re-established when required.

Aerodromes for light aircraft are maintained by mission stations at Milimgimbi and Elcho Islands, and a wartime sealed runway 6000 feet in length at Gove (Yirrkala), Melville Harbour is in good condition. Melville Harbour is a nearly enclosed sheet of water forming a southerly extension of Melville Bay.

Distances in statute miles and directions from the northern airstrip on Marchinbar to Darwin and the places mentioned are:

From Marchinbar	True bearing	Distance
To Gove (Yirrkala)	176°	60 miles
Elcho Is.	232°	80 "
Milimgimbi	242°	110 "
Darwin	257°	400 "

Good anchorages for small craft exist along the west coast of the islands, but the east coast is rocky and unprotected except for a large embayment in the coast of Irrakulla.

Jensen Bay and Japanese Creek Bay offer good anchorages in close proximity to the groups of bauxite deposits, but both are open to north-westerly and westerly weather.

Access by sea presents no difficulties other than distance and the hazards presented by an unlighted coast to those unfamiliar with it. Distances from Jensen Bay to various points are:

Melville Harbour	via Cumberland Strait -	70	nautical miles
	via Cape Wessel -	95	" "
Thursday Island -		350	" "
Darwin -		400	" "
Port Moresby -		650	" "
Sydney -		2,200	" "
Bell Bay, Tasmania -		2,730	" "

If a port is to be developed at Marchinbar it will be desirable, if not essential, to establish a light at Cape Wessel. This point is used as a landfall by vessels sailing between Thursday Island and Darwin, and would be of greater use to mariners if lighted.

Communication between Jensen Bay and the group of bauxite deposits in the vicinity (Sphinx Head, Able and Dog) presents no great difficulties (See Plate 2). Jeep tracks used during the testing campaign are the most direct and practicable routes and could be developed into good roads of high load capacity. The descent of about 100 feet from the western end of Sphinx deposit is probably too steep for heavily laden vehicles and some minor relocation of the road or earth moving is indicated. The lowest points on the floors of the three deposits mentioned are 120, 140 and 120 feet above sea level respectively. These elevations provide useful down grades for loaded vehicles.

Roads to the outlying deposits, Baker, 3½ miles north-east of Jensen Bay, and the Red Cliff group 8 to 9 miles south-west of Dog may require some bridging of narrow ravines in the quartzite and over small creeks.

Lateritic gravel suitable for road surfacing is, of course, very abundant.

Approximate radial distances, directions and road distances from the camp site at Reef Point, Jensen Bay to mid-points of the deposits are given in the following table.

Deposit	Approximate Radial Distance Miles	Approximate Direction True Bearing. Degrees.	Approximate Road Distance. Miles.
Baker	3½	35	7 ø
Sphinx Head	1	125	1½
Able	1½	175	2
Dog	2	190	3
Easy	10	210	15
Fox	9	215	14½
Red Cliff	9	220	15½

ø Via Sphinx Head

SITES FOR PORT FACILITIES.

Whether it is decided to transport the bauxite by lighters to ships lying off-shore, as the Japanese did at Malacca, or to load direct into ships at a pier, detailed hydrographic survey of parts of the west coast of Marchinbar Island will be a necessary first step.

Other things being equal it is obvious from reference to Plate 2 that Jensen Bay offers the most suitable site. Proved reserves of bauxite totalling 7,200,000 tons lie within a radius of 2.5 miles of Reef Point, a rocky point in the Jensen Bay. There is little doubt that part of Margaret Reef, which extends seaward from Reef Point, for about half a mile, and is known to have deep water on the northern side at one point, would at least provide a suitable site for loading barges, and merits detailed examination.

At the northern end of the bay there is deep water (7 fathoms) within a quarter of a mile of Anna Head. This position is more sheltered than Reef Point but presents some difficulty of access to the bauxite.

Corrosion of steel piling can be very severe in northern waters and early tests should be made to ascertain whether it will be a serious problem at Marchinbar, and if so whether measures such as galvanic protection, can be taken to control it effectively.

There is no point in taking this discussion further until the type of facilities to be installed has been decided, and a detailed hydrographic survey of the appropriate area has been made.

PHYSIOGRAPHY

Topography.

The topographic form of Marchinbar Island is a simple reflection of geological structure.

The ideal cross section of the island is that of a thin wedge rising vertically from the sea on the east coast to a maximum height of 200 feet and sloping gently to sea level in a distance of 2 to 3 miles to the west. The surface is the dip slope of either of two relatively thin quartzite beds which dip north-westerly at about $1\frac{1}{2}$ degrees. This surface is not, however, as regular as this simplified picture suggests; it retains remnants of a former land surface now represented by residual hills of laterite, is somewhat dissected by the drainage system, and in places is buried beneath sand dunes.

The two quartzite beds which constitute the greater part of the present surface are separated by about 60 feet of uncemented sand, shale and soft to hard siltstone. Where streams have succeeded in cutting through the upper bed they have rapidly widened their valleys to expose large areas of the resistant lower bed.

The valleys have been blocked by sand dunes along the western shores with the fortunate result that useful bodies of fresh-water have been impounded.

The drainage pattern is largely controlled by rectangular jointing of the quartzite.

Erosion along these joint planes has provided a minor but important striking topographic feature. In many places the bare quartzite surfaces are divided into rectangular blocks by channels ranging from mere cracks to vertically incised water-courses as much as 10 feet wide by 15 feet deep.

Climate.

The climate is of a characteristic monsoonal type in which the year is sharply divided into wet and dry seasons. There is an almost complete reversal of wind direction from season to season. North-westerly winds prevail during the wet summer from about December to April, and dry cool south-easterlies blow during the greater part of the remainder of the year. On the Arnhem Land Coast the late phases of the north-westerly season in March or as late as April may be marked by violent tropical cyclones. These storms advance on a narrow front and are capable of much destruction.

No climatic records have been kept on the Wessel Islands, but rainfall figures for the three nearest reporting stations are given.(1) It is probable that the figures for Yirrkala (Gove) most nearly indicate the climatic conditions in the Wessel group.

Average Rainfall - points (100 points = 1 inch)

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year:
			1. Yirrkala - 8 years.									
913	966	900	950	443	111	64	7	5	8	212	493	5072
			2. Elcho Is. - 8 years.									
955	1261	902	548	96	35	1	0	11	52	81	892	4834
			3. Milimgimbi Is. - 19 years.									
1061	985	1059	347	68	23	1	0	1	19	167	482	4213

Monthly average temperatures for Milimgimbi and Groote Eylandt, compiled from records taken for 6 and 19 years respectively, range between the following figures:(1)

Station		Temperature Range Degrees Fahrenheit
Groote Eylandt	- maximum	91.7 (December) to 79.6 (June)
	minimum	78.3 (December) to 65.8 (August)
Milimgimbi	- 2.30 pm.	90.9 (November) to 81.1 (July)
	8.30 am.	83.9 (November) to 69.6 (July)

Groote Eylandt is approximately 200 miles south of Marchinbar Island.

Vegetation

Excluding very small areas of coastal mangrove swamp the vegetation on Marchinbar Island may be divided into four types, viz : (a) Spinifex, mainly along the cliff-top areas on the east coast, (b) light scrub dominated by casuarinas and with coarse tussocks on the sand-hills of the west coast, (c) dense stunted eucalypt scrub matted with vines on the laterite ridges, and (d) limited stands of tall eucalypts (white gums) interspersed with low scrub and grass along water-courses and marginal to fresh-water swamps.

Where the laterite extends to the east coast the characteristic dense scrub thins out fairly abruptly within about ½ mile of the cliff-top and is replaced by spinifex. Apparently the dense vegetation of the ridges is not able to tolerate salt spray borne on the south-easterly wind. The dense scrub has a very uniform height of about 15 feet, exceeded by 10 feet or so by a few widely distributed white gums. This vegetation gave a great deal of trouble where grid lines had to be cleared through it during the testing campaign.

The presence of much dead wood rendered knives or slashers useless, and the scrub proved too green to burn.

Generally satisfactory clearing was performed with a D.4 bulldozer but there were places where the Bulldozer could not penetrate, and lines had to be offset or new positions chosen. The chief trouble was caused by vines in which the machine and the uprooted trees etc. became entangled and brought to a stop.

(1) Footnote. The climatological figures quoted above have been made available by the courtesy of the meteorological Branch, Dept. of the Interior, Melbourne.

The white gums mentioned in (d) above include many large trees of sound outward appearance but it is not likely that much useful timber could be obtained on the island.

GEOLOGY

Stratigraphy & Lithology of Units.

The following stratigraphic succession occurs on Marchinbar:

Recent: Beach and dune sand, stream gravel, talus, shingle, raised beach deposits.
Tertiary: Bauxite and laterite
Pre-Cambrian:
Upper Proterozoic: Quartzite and massive sandstone, sand, siltstone, shale.

Pre-Cambrian. The beds are high in the Pre-Cambrian and are shallow water deposits of the epi-continental seas which flooded the shield. The most complete exposure seen occurs in Philip Cliff on the east coast 1½ miles north of Sphinx Head (see Plate 3). The total thickness of beds above high water is approximately 140 feet.

The lowest component of the section has not been closely scrutinized. It consists of laminated hard grey siltstone with numerous seams and lenticular bodies of fine brownish quartzite. The quartzite bands are generally a few inches in thickness. The lenticular bodies are short and thick in cross sections, their under surface is convex and the top relatively plane. They appear to have considerable length and may represent the infilling with coarser sediment of small gutters or ripple troughs in off-shore silt.

The second member is a strongly cemented sandstone bed 19 feet thick at the locality of the section and very persistent. It was named "Sphinx Quartzite" in the field because this bed forms the prominent "nose" of Sphinx Head. Bedding is well marked by persistent partings formed by films of earthy matter. Near Sphinx Head the top of the bed bears large symmetrical ripple-marks with an amplitude of 2 to 3 inches and a wave-length of 12 inches.

In freshly broken specimens of the rock the fractures usually do not extend through the quartz grains which in almost all instances part from the interstitial cement, but the specimens tested were weathered and it is probable that the unweathered rock is more strongly cemented.

The third bed in the sequence is a band of shale (?) 12 inches thick weathered to soapy clay-like material. Either this bed has very little lateral extent or it is easily obscured as it was observed at one point only.

The next member consists of 10 feet of thin bedded quartzite and micaceous quartzite, with micaceous partings. Some ferromagnesian mineral is present also. The relative abundance of mica has brought about unusual slumping and slipping during compaction with the result that the rock has developed fine foliation with good cleavage parallel to the bedding. Specimens removed from their natural surroundings might be mistaken for products of moderately severe metamorphism.

The fifth unit in the sequence is of particular interest and importance as it is the parent rock from which part of the bauxite is derived. The bed has a total thickness of about 18 feet, but at the place examined the lower half is obscured by soil and talus. The rock is finely laminated, soft and when damp rather soapy to the touch.

One specimen was sectioned and a duplicate specimen was analysed by R.A. Dunt with the following result.

Silica	-	SiO_2	64.6 per cent.
Alumina	-	Al_2O_3	19.3 " "
Magnesia	-	MgO	1.5 " "
Ferric Oxide	-	Fe_2O_3	2.5 " "
Titania	-	TiO_2	1.3 " "
Potash	-	K_2O	5.9 " "
Soda	-	Na_2O	0.1 " "
Sulphur Trioxide	-	SO_3	0.1 " "
Ignition Loss	-		4.2 " "
			99.5

This analysis suggests that the rock consists of approximately 55 per cent sericite, (including the magnesia and some ferric iron, which appear to be invariable constituents of sericite), 42 percent quartz and the balance hydrous titania and limonite. This view is supported by microscopical evidence and the rock is therefore regarded as a sericite-quartz-siltstone. The majority of the quartz grains in the thin section examined were less than 0.03 m.m. in diameter but a few larger grains ranging up to 0.10 by 0.15 m.m. were noted.

The siltstone is overlain by the sixth member of the sequence which consists of a band two feet thick occupied by several quartzite seams separated by hard micaceous shale or siltstone and capped by a very persistent band of quartzite 6 to 9 inches thick.

The seventh member is completely obscured by fallen blocks of quartzite, boulders of laterite, finer talus and sand. From its topographic profile at Philip Cliff and from the evidence of its complete lateritization at Sphinx Head (1½ miles south along the strike and slightly up dip) it is assumed that the hidden bed is shale or siltstone similar to the fifth member.

A bed of loosely coherent white quartz sand slightly iron-stained in places constitutes the eighth unit. This weak bed has caused extensive undermining of the "Grid Quartzite", the ninth member, very large blocks of which have broken off along joint planes and slid down the steep slope to accumulate on the shelf formed by the Sphinx Quartzite.

The "Grid" bed, temporarily so named in the field because it outcropped across the Sphinx Head deposit testing grid with bauxite on either side, has many points in common with the Sphinx bed. It is composed of a dense sandstone in which fractures rarely break the composing quartz grains. At the point measured it is also 19 feet thick. It is persistent and forms the greater part of the present surface of the island.

The grains are of clear glassy quartz, rounded and of fairly uniform size - about 0.5 m.m. diameter.

Along the eastern side of the island the overlying formation is now represented by bauxite or ferruginous and siliceous laterite. On the western (down-dip) side of the island the "Grid" quartzite underlies about 50 feet of apparently lateritized beds which are strongly arenaceous near the base.

Tertiary. Laterite capped mesas and plateaux occur over very extensive areas of northern Australia, particularly in the region from south of Melville Harbour to the north coast and including the English Company's and Wessel Islands.

The conclusion that these laterite occurrences are contemporaneous in origin is inescapable.

The age cannot be determined with precision but by analogy with laterite in southern Australia and the bauxite at Bintan, Indonesia it is assumed that the Arnhem Land laterite is of Tertiary age. As it has developed upon Cretaceous sediments at Margaret Bay (2 miles west of Cape Wilberforce) it must be younger than these beds, but there is no stratigraphical evidence by which an upper age limit may be determined. However, the laterite developed to maturity before the breaking up of the peneplain on which it formed, and which is now reduced to relatively small remnants, therefore considerable time must have elapsed since its formation, and it is not unreasonable to ascribe it to early Tertiary time.

Clearly it cannot be a product of the present climatic cycle.

The entire laterite profile has not been observed in any readily accessible position but it may be glimpsed in cliff sections. The lateritic process had no effect upon the quartzite beds and consequently the total thickness of laterite (including leached zones) depended upon the thickness of suitable sediments which remained above the quartzite at the time of lateritization. Towards the western side of the island the present thickness probably exceeds 50 feet notwithstanding the fact that all the pisolitic zone has been eroded. The greatest thickness observed on the eastern coast is about 30 feet, but in many places the total thickness at no time exceeded about 20 feet. The maximum thickness of pisolitic bauxite encountered in test-pits is 16.5 feet.

Typical partial analyses of material from the upper (concretionary) part of the profile are given. The samples represent a vertical sequence near Sphinx Head, but do not all come from the same place.

Description:	Percentage Composition of material dried at 105°C. Total SiO_2 %	SiO_2 as Quartz %	Total Al_2O_3 %	Soda Soluble Al_2O_3 %	Fe_2O_3 %	Ignition Loss %
Pisolitic bauxite (1)	4.5	1.0	51.8	47.5	14.5	25.9
Red tubular bauxite (2)	2.5	1.3	48.4	47.8	19.6	26.2
Red tubular laterite (2)	6.3	2.4	30.5	25.9	43.7	17.8
Red and black laterite	6.8	3.2	-	24.1	46.1	-
Ferruginous, nodular laterite quartz grains common and fragments of doutfully recognisable siltstone present.	21.7	-	23.2	15.5	40.9	12.6

(1) A siliceous base to the pisolitic zone occurs in Easy deposit. A typical partial analysis of soft pisolitic material is 21.2% total SiO_2; 0.8% quartz; 17.0% available Al_2O_3.

(2) The distinction between "bauxite" and "laterite" here is purely economic.

Recent. Deposits of Recent origin have two important aspects. A thin cover of wind-blown sand, usually only a few inches thick covers part of the bauxite deposits and has penetrated into the bauxite down joints and spaces between pisolites. In the course of mining operations much of the superficial sand and soil may be removed when vegetation is cleared off the deposits, but extraction of the entrained sand will necessitate screening of the ore.

Penetration by sand is shown by analyses of a sample of pisolitic bauxite which was recovered from a depth of 4 feet to 5 feet 6 inches below the surface.

	Total SiO_2 %	SiO_2 as quartz. %	Total Al_2O_3 %	Fe_2O_3 %	Ignition Loss %
As received	18.[illegible]	6.7	43.0	19.7	22.5
Pisolites	1.7	0.5	48.1	21.8	25.6
Fine material	46.0	-	29.9	8.4	13.8

This aspect is further discussed in a later section of this report.

Dune sand driven inshore by north-westerly winds has blocked the mouth of a stream at Jensen Bay thereby impounding a body of fresh-water which is permanent.

Structure: (a) Regional. The Wessel chain of islands represents the upthrown edge of a narrow fault block trending north-easterly and gently tilted down to the north-west. Two nearly parallel lines of islands, those extending north-easterly from Elcho Island, and the English Company's Islands are similar narrow blocks, the structure of the latter area however, is slightly complicated by cross-faulting and some high dips on Cotton Island.

South-west of Cape Wilberforce near the northern head of Melville Bay, and near Flinders Point the siltstone - quartzite sequence rests with strong unconformity upon steeply dipping folded sediments which have a northerly trend.

The relationship between the north-easterly submarine step fault system and the large scale meridional faulting which can be traced from the north coast in the vicinity of the 136th. Meridian to the latitude of Blue Mud Bay is obscure at present.

The north-easterly system of submarine step faults, have developed by tension along the margin of the mainland block which has been uplifted. This uplift has been the cause of the breaking up and rejuvenation of the peneplain and consequent erosion of the laterite. The amount of uplift has been small, a few hundred feet at the most, consequently the throw of the faults is small and the wide stretch of water between the Wessel and the English Company's Islands is shallow (less than 20 fathoms).

(b) Marchinbar Island. Bedding of the siltstone and the quartzite is nearly horizontal: the highest angle of dip measured is 3 degrees in the vicinity of Jensen Bay, and the average dip is about 1½ degrees, but steeper dips may occur elsewhere. The direction of dip, difficult to measure with any exactness, ranges between N.50°W and N. 80°W and is commonly N.60°W.

Two sets of joints are exceedingly prominent and their effect on topographic detail has been mentioned elsewhere. One set trends N.45°W and the other N.40°E. On the northern slopes of Sphinx Head the trends of both sets are 5 degrees more easterly. On either side of the Red Cliff - Easy ridge a third system trending N.20° W is poorly developed. The joints persist vertically through the siltstone and continue to below sea-level.

Very gentle folding, which is perhaps a distant reflection of the disturbance in evidence at Cotton Island, is difficult to discern by eye but may be deduced from small regular changes in strike.

Gentle synclinal folding shows in the cliff face south of Sphinx Head. It is probable that the Sphinx Head and Red Cliff-

Easy ridges are partly structural in origin.

A fault striking north and with downthrow to the east obliquely traverses the northern end of the island.

The laterite dips gently to the north-west; in a distance of 4,400 feet in this direction across Able deposit the base of the economic bauxite falls only 32 feet. The laterite is necessarily less regular than the underlying sedimentary beds, and it is best described as sub-horizontal with a general dip of about half a degree to the north-west, with local variations caused by irregularities in thickness. Such variations are reflections of the type of underlying rock and the relief of the surface on which the laterite developed.

METHOD OF TESTING.

Grid layout. The first step consisted of clearing and pegging the base line along the longer axis of the deposit to be tested. Pegs were put in at intervals of 400 feet and transverse lines at right angles to the base line were then cleared from these points to the apparent edges of the deposit. Transverse lines were pegged at intervals of 200 feet.

Longitudinal lines additional to the base line were not cleared except for short distances to provide convenient access to transverse lines where scrub was thick. Longitudinal lines were distinguished by the letters of the alphabet prefixed by N or S according to the position north or south of the base (Z: Zero) line. Transverse lines were numbered from the eastern end of the grid, hence the origin of the grid would be point "Z1", and a pit with the coordinates "NB3" would be 800 feet west and 400 feet north of the origin.

Where required by the field geologists intermediate pegs were established. All pegs were levelled and the levels were reduced to a datum referred to approximate mean high water at convenient points on the east coast adjacent to each deposit.

Pits were sunk at grid intersections and intermediate sites through the pisolitic bauxite into red or red and black tubular laterite, using jack-hammers and explosives.

Channel samples, cut from the walls of the pits by the geologists, were weighed, screened dry on one-sixteenth inch mesh to remove sand, re-weighed, crushed and reduced to about 250 grammes for despatch to Bell Bay laboratory. The proportion of coarse material retained on the sieve was expressed as a percentage of the whole sample and quoted on the field logs as "recovery". All recovery figures have been taken into account in computing the reserves. Single samples were limited to a maximum thickness of 4 feet or to a lesser thickness where there was an apparent change in the bauxite.

To avoid overloading the Bell Bay laboratory doubtful samples were submitted to ignition on the island and material losing less than 20 percent was usually rejected without further test.

During the early stages of the campaign the Commission's laboratory, under R.A. Dunt, made the following determinations on all samples; total silica, silica as quartz, total alumina, available alumina (bomb method), ferric oxide, titania, ignition loss and soda consumption during extraction. Later the routine determinations were reduced to total silica, silica as quartz, available alumina and soda loss, which were sufficient to indicate the economic value of the ore, and the more complete analysis was reserved for composite samples each representing a group of several pits.

Density determinations by Puckey in the field and laboratory determinations of porosity and density by the writer using a suite of typical specimens collected for this purpose indicated an average density for ore in situ equivalent to 17 cubic feet per long ton of dry ore.

Porosity of pisolitic ore ranged as high as 22 percent and of tubular ore 12 percent.

THE BAUXITE DEPOSITS.

Introduction

Eight bauxite deposits ("deposit" including groups of narrowly separated bodies) have been tested; of these one - Charlie - contained no appreciable quantity of economic bauxite, another - Fox - has been defined by pits on grid lines spaced 1600 feet apart, and the remaining six have been proved by close testing.

The minor difficulty of providing names for the various deposits where there were no existing geographical names to use was solved by Puckey who used a "phonetic" alphabet for the purpose, but wherever prior names, e.g. Sphinx Head, could be used they were applied to nearby deposits.

Individual deposits are described in order from north to south.

The positions of the deposits in relation to each other and to Jensen Bay have been discussed in an earlier section and are shown in Plates 1 and 2, therefore notes on locality and access are not repeated here.

BAKER DEPOSIT. (See Plate 4).

Baker is the northernmost and smallest of the deposits. It consists of three detached bodies containing;

Body A.	34,000 tons
B.	166,000 tons
C.	15,000 tons
	215,000 tons

With minor exception the economic bauxite is confined to the pisolitic zone.

Bodies A and B occupy the crest of a narrow steep-sided ridge which trends north and is covered with dense scrub and jungle. Overburden consists of bauxite rubble mixed with a little sandy topsoil and containing to an average depth of 1.8 feet 83 percent of recoverable economic bauxite.

Body C occurs on the cliff edge in clear spinifex country and underlies an area of 54,000 square feet and is covered to an average depth of 1.7 feet by sandy soil and rubble containing 81 percent bauxite.

The highest grade ore in the deposit occurs in body C along the cliff edge, where ore 7'6" thick averaged 2.8 percent total SiO_2, 1.2 percent SiO_2 as quartz, and 53.8 percent available Al_2O_3.

Salient details of the deposits are summarized in the following tables.

Baker Deposit.

Body	Area Acres	No. of Pits in Bauxite.	Bauxite Thickness, Range	feet Average	Recovery factor %
A	2.9	3	4 to 6	4.7	98
B	9.85	10	4 to 12	7	94.5
C	1.25	2	2.25 to 7.5	5	93.5

Reserves - Economic Bauxite

Body	Long Tons	Total SiO_2 %	Composition SiO_2 as quartz %	Avail. Al_2O_3	Soda Loss (1) cwt.
A	34,000	9.4	2.6	46.0	1.51
B	166,000	9.0	3.1	47.8	1.35
C	15,000	3.8	1.4	51.7	0.58
Total	215,000	8.6	2.8	47.8	1.32

(1) "Soda loss. Cwt." means the amount of alkali expressed as hundredweights of Na_2O which is lost per ton of available alumina extracted. This irrecoverable alkali passes into the red mud and is a measure of the soda-soluble silica in the ore.

CHARLIE DEPOSIT.

A few pits were sunk along a low narrow ridge capped with boulders of pisolitic bauxite, and proved the deposit to be very small and consist mainly of residual boulders. No samples were sent for analysis and reserves contained in the deposit have not been assessed. It is possible that a few thousand tons of bauxite could be recovered from Charlie deposit when nearby Baker deposit is being worked.

SPHINX HEAD DEPOSIT. (See Plates 5 and 6).

This deposit consists of five large and two very small bodies which lie on the broad crest of a ridge trending north-westerly from Sphinx Head. The easternmost body ("A" on plate 5) which extends westwards from the cliff edge is separated from the remainder by the "Grid Quartzite", and is therefore derived from beds which underlie it, while on the other hand the more westerly bauxite bodies are developed upon beds stratigraphically above it. This different parentage has not resulted in any significant differences in composition of the bauxite and it is assumed therefore that the parent rocks in each case are similar. It is noteworthy that bodies A and B, although separated by the quartzite, each contain an appreciable amount of red tubular bauxite beneath the pisolitic zone, and in this respect they differ from the remaining six bodies. Because the dividing line between bauxite (whatever its physical form) and uneconomic laterite is an arbitrary one it must not be assumed that the difference between the tubular or massive bauxite and laterite of similar form is necessarily one of minor or insignificant degree; there is not much tubular material which is on the borderline; generally it is well within economic limits or hopelessly without.

The presence of tubular bauxite in bodies which are derived from different, though probably not lithologically dissimilar beds, suggests that more effective local leaching is responsible for the high alumina content rather than original constitution of the parent rock.

Descriptions of other deposits which follow show that tubular ore occurs at or towards the eastern end of several of them also, and it is reasoned that position in its relation to effective drainage (i.e. juxtaposition to the east coast cliff) is the controlling influence in the development of bauxite below the pisolitic zone. Further, it is considered that this development is a secondary effect brought about by reduction and leaching of iron from what is normally an iron-rich zone.

An important practical aspect of the presence of tubular bauxite is that the sharp boundary between pisolitic and tubular zones cannot be used as an easily recognisable depth limit for quarrying.

Two logs of pits, one from each of bodies A and B are quoted:

Co-ords.	Depth Feet.	Description	Total SiO_2 %	Quartz %	Avail. Al_2O_3 %	Soda loss Cwt.
NB.6	0-1.5	Bauxite rubble	10.3	6.1	35.4	1.2
	1.5-5.5	Pisolitic bauxite	5.6	2.0	47.2	1.0
	5.5-8.5	ditto	9.4	3.8	41.3	1.4
	8.5-9.5	Red massive bauxite	3.0	1.2	40.5	0.4
	9.5	Black laterite	not sampled			
NB.7	0-1.5	Sandy rubble	7.0	3.3	29.6	-
	1.5-4	Bauxite rubble	4.4	1.5	34.2	1.0
	4-7	Rubble with boulders of pisolitic bauxite	4.0	1.3	46.0	0.6
	7-10	Red massive "	2.4	0.8	46.8	0.4
	10-	Massive blue-black laterite	not sampled			

As discussed elsewhere the parent of body "A" is known to be a sericite - quartz - siltstone, but the higher bed has not been found yet except in a thoroughly lateritized condition.

The upper part of the bauxite is contaminated with wind-blown sand, but there is no overburden in the ordinary sense of the word. All contaminated samples were screened and recovery factors (percentage of coarse material retained on sieve) for the separate bodies averaged:

The highest grade ore is contained in E which averaged 47.2 per cent available alumina for 214,000 tons.

Principal details of the deposits and the reserves are contained in the tables which follow:

Body	Area: acres	No. of pits in bauxite.	Bauxite thickness - feet Range			Average	Recovery factors %
A	38.4	28	2.5	to	16.5	5.3	95
B	4.1	3	4	to	8.5	6.6	90
C	9.0	6	3	to	5.5	4	90
D	24.0	15	2.5	to	9	6	92
E	15.1	10	2	to	10	5.8	95
F	0.6	2	2	to	12	7	88
G	1.4	2	4	to	5.5	5	90

Reserves - Economic Bauxite

Body	Long Tons (recoverable dry ore).	Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Avail Al_2O_3 %	Fe_2O_3 %	TiO_2 %	Ign. loss %	Soda loss Cwt.
A	490,000 (1)	5.4	2.4	44.1	40.9	23.8	2.7	23.6	0.82
B	63,000 (2)	5.3	2.0	43.8	39.4	23.9	2.0	24.3	0.90
C	84,000	6.8	3.0	45.7	45.2	19.7	2.6	25.2	0.95
D	357,000	7.8	2.9	51.2	45.1	10.0	3.1	27.3	1.20
E	214,000	6.8	2.0	52.5	47.2	9.9	3.2	27.2	1.08
F	10,000	5.4	1.4	47.1	43.5	18.7	2.9	26.4	1.14
G	15,000	9.3	2.7	51.6	43.8	10.3	2.9	26.4	1.58
Total	1,233,000	6.5	2.5	48.0	43.5	17.0	2.9	25.6	1.00

(1) Includes 160,000 tons of massive and tubular red bauxite underlying the pisolitic zone. This bauxite contains approximately 40.5 percent available alumina extractable with soda loss of 0.6 hundredweight of Na_2O per ton of alumina.

(2) Includes 13,000 tons of massive red bauxite containing approximately 45.0 percent available alumina extractable with soda loss of 0.6 hundredweight.

ABLE DEPOSIT. (See Plates 7, 8 and 9)

Able deposit is the largest on the island; it occupies an area of 220 acres and contains 4,627,000 long tons of bauxite.

The thickness of the ore included in the reserves ranges from the cut-off figure of 2.5 feet to 16.5 feet and averages approximately 8 feet.

With the exception of 125,000 tons of massive and tubular red bauxite which underlies the pisolitic ore towards the eastern end of the deposit, economic values are confined to the pisolitic zone. The position of the massive ore adjacent to the eastern coast if analogous to that of the similar bodies at Sphinx Head, and this circumstance suggests that conditions of leaching rather than original differences in the parent rock are responsible for its development.

Generally the grade of the pisolitic ore improves slightly below a depth of 4 feet and declines again towards the base, but such distribution is not invariable. The surface impoverishment is caused mainly by entrainment of sandy and clayey soil, but a small part of it may be due to resilication of the bauxite. Results of sampling 4 pits are quoted to illustrate variation of grade with depth.

Depth Feet.	Total SiO_2 %	Quartz %	Avail. Al_2O_3 %	Depth Feet	Total SiO_2 %	Quartz. %	Avail. Al_2O_3 %
		Pit H.12				Pit F.11	
0 - 4	2.8	1.3	48.6	0 - 1 S.	13.6	9.3	40.3
4 - 8	2.5	0.8	51.5	1 - 5	3.7	0.9	48.3
8 -12	1.4	0.3	49.6	5 - 9	3.1	0.7	48.2
12 -13	1.6	0.3	43.8	9 -13	4.2	0.7	48.4
13 -		laterite		13 -15	4.5	0.3	40.2
				15 -16 L.	11.6	0.3	17.9
		Pit Z.7				Pit E.6	
0 - 1.5S	12.8	8.1	38.6	0 - 4	3.4	0.6	50.3
1.5 - 5.5	3.4	1.1	47.6	4 - 6	3.5	0.7	47.9
5.5 - 7	5.0	1.0	38.2	6 -10	4.2	0.6	44.7
7 - 8 L	12.5	0.9	15.3	10 -11 L.	8.5	0.7	26.8

S = Soil contamination.

L = Laterite

On approximately half the area of the deposit, mainly on the eastern side, the surface of the bauxite is contaminated with quartz sand and fine detrital material amounting to 10 to 25 per cent to depths of 2 and 3 feet. The area, free from this contamination, lies to the west of grid line 6 and is shown on Plate 7. Overburden of sandy soil a few inches deep occurs in patches on either area.

Dry screening of contaminated samples gave an average recovery factor of 96 per cent for the whole deposit.

The ore included in the reserves ranges in available alumina content from 31 to 53 per cent, but of 354 samples of economic grade 307 (87 per cent) contained more than 40 per cent of available alumina. The lower grade samples generally represent thin bauxite near the margins of the deposit and have little effect on the mean value. The following frequency table shows the distribution of values between the 354 samples.

Percent Available. Al_2O_3	Frequency. (No. of Samples)
30 to 31.9	2
32 " 33.9	6
34 " 35.9	9
36 " 37.9	14
38 " 39.9	16
40 " 41.9	30
42 " 43.9	60
44 " 45.9	64
46 " 47.9	72
48 " 49.9	52
50 " 51.9	20
52 " 53.9	9

Total proved reserves amount to <u>4,627,000 tons</u> of the following average composition.

Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Available Al_2O_3 %	Fe_2O_3 %	TiO_2 %	Soda loss Cwt. %
4.1	1.1	51.4	47.1	15.7	3.3	0.71

The total includes 125,000 tons of massive and tubular red bauxite containing 43.0 per cent available Al_2O_3 extractable with soda loss of 0.6 hundredweight.

Further details of the distribution of values throughout the deposit are shown on the assay plan (Plate 8).

In addition to determinations of available alumina with small assay samples, autoclave extractions on a larger scale to simulate plant practice more closely, were also carried out in the laboratory. Results of the latter tests showed small deviations from the available alumina figures but generally were in close agreement. The averages of available and autoclave figures for samples representing 3,114,000 tons of ore are -

Available Alumina 48.1 per cent
Autoclave Alumina 47.8 per cent

DOG DEPOSIT (See Plates 10 and 11)

Dog deposit occupies an area of about 69 acres and contains 1,317,000 tons of economic bauxite the thickness of which ranges to 16.5 feet and averages 7 feet. Tubular and massive red bauxite occurring within and at the base of the pisolitic ore (see sections on Plate 10) totals 165,000 tons containing 44.3 per cent available alumina extractable with a soda loss of 0.5 hundredweight Na_2O per ton.

The deposit has many features in common with Able deposit of which it is an outlier. The remarks descriptive of vertical distribution of values within the latter deposit apply with equal force to Dog.

Contamination of the surface bauxite with sand to a depth that rarely exceeds 2 feet occurs over the central portion and part of the eastern end of the deposit.

The reserves computed from the results of analysis of 129 samples include ore ranging from 33.9 to 53.3 percent available alumina, however 119 (92 per cent) of the samples yielded results exceeding 40 per cent available alumina.

Total proved reserves amount to 1,317,000 long tons of the following average composition.

Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Available Al_2O_3 %	Fe_2O_3 %	TiO_2 %	Soda loss Cwt.
5.1	1.1	51.4	47.2	13.2	3.3	0.88

This total includes 165,000 tons of massive red bauxite mentioned above.

Details of the distribution of values throughout the deposit are given in the accompanying assay plan (Plate 11).

EASY DEPOSIT (See Plate 12)

Three deposits viz. Easy, Fox and Red Cliff constitute the southern group which forms a nearly continuous ridge trending north-westerly across the island from a point 9 miles south-south-west from Dog deposit.

All three deposits are thinner and of lower grade than the members of the northern group.

Easy deposit has an area of 71 acres not including small outlying areas and the ore averages 4.9 feet thick with maximum thickness 11.5 feet. Total reserves which amount to 825,000 tons include about 27,000 tons of tubular red bauxite beneath pisolitic ore at the eastern end of the deposit.

Up to the time of writing no composite samples have been analysed in detail and consequently only partial analyses are available.

For convenience the deposit has been divided into five blocks of which details are as follow:

Easy Deposit

(see Table and note on page 18a)

	Long tons	Total SiO_2 %	SiO_2 as quartz %	Avail. Al_2O_3 %	Soda loss Cwt.
A	143,000[X]	7.9	2.0	45.6	1.4
B	161,000	9.2	1.9	42.7	1.8
C	123,000	8.3	1.8	42.1	1.5
D	168,000	10.1	3.4	45.4	1.47
E	230,000	6.6	2.0	48.5	1.07
Total	825,000	8.3	2.2	45.2	1.40

X Includes 27,000 tons of tubular red bauxite of composition - 7.9% total SiO_2, 0.8% quartz, 45.6% available Al_2O_3 with soda loss of 1.76 cwt.

RED CLIFF DEPOSIT

Red Cliff deposit occupies the north-western end of the Easy-Red Cliff ridge adjacent to the west coast of the island. The bauxite is wholly of the pisolitic type and much of the surface is weathered to rubble mixed with more or less sandy soil.

The total area of the deposit is 81 acres, the maximum thickness 8 feet and the average thickness 4.6 feet.

The economic reserves which total 763,000 tons have been computed from 72 samples which yielded results ranging between 35.6 and 51.2 per cent available alumina. Of these samples 61 (or 85 per cent) contained 40 per cent or more of available alumina.

Reserves have been calculated in a manner that distinguishes between higher grade ore occurring over an irregular area of 25 acres towards the northern end of the area and the lower grade and thinner ore which encloses the former on north, west and south. The respective areas are shown on Plate 13 and details are given hereunder (p.19).

Easy Deposit.

Block	Area Acres	No. of pits in bauxite	Bauxite thickness feet Range	Average	Recovery Factor %
A	11.5	8	2 to 11.5	5.4	90.5
B	15.5	9	1 " 8	4.5	92.0
C	11.6	6	2 " 7	4.2	93.5
D	16.4	9	3 " 5.5	4.5	88.7
E	16.1	9	2 " 11	5.9	92.6
	71.1	41	1 " 11.5	4.9	-

The tonnage and grade of reserves in Easy deposit have been computed from the results of analysis of 78 samples which yielded available alumina ranging between 35.2 and 54.4 per cent. Seventy-two (92 percent) of the samples contained more than 40 percent available alumina.

Red Cliff Deposit.

Block	Area: acres	No. of pits in bauxite	Bauxite thickness: feet Range	Average	Recovery factor.
A	35	15	4 to 8	6	80
B	56	32	1.5 " 7	4	

Reserves

	Long tons	Total SiO_2 %	SiO_2 as quartz %	Avail Al_2O_3 %	Soda Loss Cwt.
A	348,000	8.3	3.7	46.8	1.10
B	415,000	9.2	3.9	41.6	1.48
Total	763,000	8.8	3.8	43.9	1.31

FOX DEPOSIT (See Plate 14)

Fox deposit lies along a sinuous flattened ridge, which extends for 8,500 feet between Easy and Red Cliff deposits. The crest of the ridge falls from an elevation of 200 feet above sea level at its south-eastern end to 156 feet at the north-western extremity where it is separated from Red Cliff deposit by a shallow gap approximately 1,000 feet wide.

Attempts to clear a base line along the ridge were frustrated by dense scrub which could not be effectively handled by the bull-dozer and the line was off-set in places. Five transverse lines were cleared at intervals of 1,600 feet and the deposit was tested with pits sunk at intervals of 200 feet along them.

This testing disclosed that the bauxite extends along the crest of the ridge as a strip averaging approximately 550 feet wide. The bauxite which is pisolitic in character is shallow; it has a maximum thickness of 6.5 feet and the upper 2 to 3 feet is much admixed with sand and fine bauxite rubble.

The average grade indicated by the somewhat limited testing is rather lower than that of either Red Cliff or Easy but the lower alumina is partly offset by lower silica content than at either of the other two occurrences.

Reserves, which can be regarded only as indicated rather than proved in the absence of more closely spaced test points, amount to 800,000 tons of the following grade;

Total SiO_2 %	SiO_2 as quartz %	Available Al_2O_3 %	Na_2O loss %
6.8	2.4	42.8	1.07

This statement does not include small outlying areas, but it is unlikely that additional testing would add or detract materially from these figures.

PETROLOGY OF THE BAUXITE

The pisolitic bauxite is a handsome reddish brown rock which breaks cleanly across the closely-packed pisolites and cement to yield fairly flat faces. The pisolites, thus seen in section, range between about 1 mm. to 22 mm. in maximum dimension but the great majority of them measure less than 10 mm. across. In shape they may be spherical, oval, reniform or irregular sub-angular forms.

To the unaided eye the pisolites, which are coated with a thin whitish skin, appear to be composed of homogeneous brown material with a resinous lustre, or of a light brown, pink or whitish granular substance. Some pisolites have a relatively thick shell of brown resinous material surrounding a granular core.

The cementing material is invariably lighter in colour than the pisolites and forms only a very small proportion of the rock as it incompletely fills the small voids between the more or less spherical concretions.

The tubular bauxite which underlies the pisolitic zone on Able deposit is also a reddish brown rock with a dully waxy to finely earthy texture on fresh faces. The solution cavities which give the rock the typical appearance of tubular or "vermicular" laterite are lined with a cream-coloured skin about 0.1 to 0.5 mm. thick. Examination of the wet rock with a hand lens reveals that it is composed of pinkish-brown oolites up to 1 mm. diameter set in a darker matrix. The lining of the tubes is also finely oolitic.

Thin sections of two selected specimens were prepared for microscopical examination. Specimens were chosen to represent granular and resinous pisolites respectively and duplicates were analysed with the following results.

No.	Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Avail. Al_2O_3 %	Fe_2O_3 %	TiO_2 %	Ign. loss %
1/52	6.6	1.1	58.0	48.2	3.8	3.4	28.3
2/52	9.2	3.7	52.3	48.4	4.8	2.3	27.7

The section of the specimen 1/52, which came from Sphinx Head, showed pisolites from 2.5 to 7 mm. in diameter, oval to circular in form and with a narrow red-brown rim enclosing a coarsely granular core. The rims ranged from 0.1 to nearly 1 mm. wide and were composed of alternating concentric bands of lighter and darker brown isotropic cliachite. The granular core contained rounded grains of a crystalline aggregate of gibbsite; the individual grains measured from 0.2 to 0.4 mm. across. Very narrow (0.01 mm.) veinlets of crystalline gibbsite extended radially across the rims and into the cores.

The matrix between the pisolites was white, isotropic and oolitic. It contained rare quartz grains partially replaced by gibbsite.

Specimen 2/52 came from the Red Cliff deposit; the section contained white-rimmed pisolites of diameter 1 to 5 mm. with brown cores. The smaller pisolites consisted wholly of concentric shells of isotropic material (cliachite) surrounding a nucleus consisting of a single quartz grain. The larger examples have a core of several or many quartz grains embedded in cliachite and surrounded by a rim of white or light brown cliachite about

0.15 mm. wide. The quartz grains were commonly 0.2 mm. in diameter with a few as large as 0.5 mm. Many of the pisolites were traversed by radial veinlets of gibbsite, and the quartz grains might be replaced by gibbsite or have needles of gibbsite extending into them. In some instances the whole grain retained the original rounded outline but only a central irregular remnant of quartz surrounded by gibbsite remained.

The matrix contained a few quartz grains more or less replaced and embedded in nearly opaque white oolitic cliachite.

Chemical analyses indicate that the bauxite, is composed essentially of aluminium hydroxide $Al(OH)_3$ and is a tri-hydrate ore. The probable mineralogical composition calculated from three typical analyses is given below, but it is not possible to distinguish between gibbsite $Al(OH)_3$ and cliachite or "amorphous bauxite" which is essentially $Al(OH)_3$ with more or less hydrated iron oxide intimately associated. The calculations are based on two assumptions, viz: that all combined silica is present as kaolin and that "Available alumina" represents all alumina present as hydroxide. In a few instances, as for example the second example below, there is not sufficient combined silica to satisfy the "fixed" alumina, i.e. the difference between total and available alumina figures. The discrepancies are small, however and may be due to vagaries of the laboratory extraction process.

	Total SiO_2	SiO_2 as quartz	Total Al_2O_3	Available Al_2O_3	Fe_2O_3	TiO_2	Ign. loss
1.	6.1	1.1	48.0	43.5	17.2	2.8	25.8 = 99.9
2.	3.8	0.5	49.1	45.0	17.9	3.0	26.4 =100.2
3.	2.4	1.3	45.4	44.3	25.0	2.4	24.9 =100.1

1 and 2. Pisolitic bauxite. 3. Hard red tubular bauxite.

Probable Mineralogical Constitution.

	1.	2.	3.
Quartz	1.1 per cent	0.5 per cent	1.3 per cent.
Kaolin	11.0 " "	7.1 " "	2.5 " "
$Al(OH)_3$ (Cliachite and gibbsite)	66.5 " "	68.8 " "	67.8 " "
Al_2O_3 excess	-	1.3 " "	-
Limonite (Mainly goethite)	18.5 " "	19.5 " "	26.1 " "
Titania	2.8 " "	3.0 " "	2.4 " "
	99.9 " "	100.2 " "	100.1 " "

Beneficiation

Lengthy discussion of potentially useful methods of beneficiation is beyond the scope of this report, but it is hoped that the following brief notes, which touch on the salient features of the problem as they apply to Marchinbar bauxite, may be useful.

The purpose of concentration of bauxite is primarily to reduce the amount of soda-soluble silica. Increase in alumina content is only a secondary consideration in that it reduces the bulk of material to be transported to the plant, and lightens the load on washing, filtering and settling sections of the plant.

Bauxite is low-value material and therefore it is improbable that elaborate methods of mechanical concentration could be applied economically, and in any event bauxite is not usually amenable to gravity concentration or flotation.

Soft earthy bauxites, which consist largely of friable cliachite with more or less clay, offer no reasonable prospect of concentration by mechanical means, but where marked physical difference exists between the valuable aluminous constituent and the impurity a cheap method of separation may become possible.

In Malaya and Indonesia, where the bauxite consists of hard tough gibbsitic nodules embedded in clay, separation is effected by washing (commonly with sea-water) on trommels. The method is simple and effective. (Owen, 1948; 1949 (c)).

Marchinbar bauxite bears no physical resemblance to the Malayan variety. It consists of moderately coherent to compact pisolitic ore which is in places partly disintegrated and contaminated with quartz sand to depths of 2, 3 or 4 feet where weathering has removed the interstitial cement between pisolites and provided access for the sand.

Dry screening of samples on a sieve with one-sixteenth inch mesh provided fairly effective separation as the following assays show. The first group refers to samples screened in the field, and the second to samples which were treated in the laboratory to separated pisolites from matrix. In the former case, the reject fine material was not submitted to assay, and in the latter instances where both fractions were analysed the respective proportions of each and the method of separation are not known to the writer.

1. Screened on 1/16 inch mesh, dry.

Sample No.	Coarse material per cent.	Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Avail. Al_2O_3 %	Fe_2O_3 %
7088	90	2.4	0.6	45.1	42.8	24.9
7094	82	5.5	2.3	50.0	44.4	16.7
7080	79	3.0	0.2	46.4	45.4	21.6
7104	84	8.0	4.1	47.2	38.8	20.1

2. Separated in laboratory.

Sample No.	Fraction	Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Avail. Al_2O_3 %	Fe_2O_3 %
7032	Original Ore	6.0	2.8	50.3	45.4	15.2
	Pisolites	2.7	0.9	51.3	46.5	16.2
	Matrix	46.3	-	28.4	-	8.9
7043	Original ore	14.4	9.3	42.7	38.0	17.0
	Pisolites	6.7	3.4	47.1	39.8	19.5
	Matrix	44.2	-	24.6	-	9.4
7039	Original ore	12.7	6.7	43.0	37.0	19.7
	Pisolites	1.7	0.5	48.1	46.6	21.8
	Matrix	46.0	-	29.9	-	8.4

The above figures suggest at least a starting point for experimental attack on the problem.

Acknowledgments

The writer is deeply indebted to J.V. Puckey and A.J. Richardson of The British Aluminium Company Ltd. for excellent and willing service often performed under trying circumstances, and for concise and clear progress reports.

The value of the work by R.A. Dunt, Chief Chemist, Aluminium Commission, and his staff is gratefully acknowledged. Many hundreds of samples were handled by the laboratory with the minimum delay.

The organisation created by Australasian Civil Engineering Pty. Ltd. on the island worked smoothly and speedily under the local direction of J. Cosstick with the result that the exploratory programme was completed in remarkably short time.

References.

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Brown, H.Y.L., 1908 Geological reconnaissance from Van Dieman Gulf to McArthur River, etc. Rep. Gov. Geol. Adelaide.

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________., 1949(a) Examination of a supposed bauxite bearing area on Cobourg Peninsula, Northern Territory of Australia. Bur.Miner.Resour.Aust. Rep. 1949/41.

________., 1949(b) Present status of the search for bauxite in the Northern Territory, November, 1949. Ibid.Rep. 1949/21.

________., 1949(c) Notes on bauxite in Riau Archipelago, N.E.I: Ibid. Rep. 1949/78.

APPENDIX.

Notes on other bauxite occurrences within the region.

Bauxite occurs at Gove aerodrome between Yirrkala Mission and the eastern shore of Melville Harbour, and near Cato River about 8 miles south-west of Melville Harbour, and also on Truant Island. An occurrence on the eastern shore of the Gulf of Carpentaria has been reported.

A visit of a few hours duration was made to the first locality by the writer on 24th August, 1952, and the Cato River occurrence was subjected to more detailed reconnaissance by J.V. Puckey and A.J. Richardson who spent several days in the area during November, 1952. Although Truant Island (30 nautical miles south-south-east from Sphinx Head) is the scene of the first discovery of economic bauxite in the region it has not yet been examined.

GOVE. At Gove pisolitic bauxite containing upwards of 50 per cent alumina was observed throughout a traverse of 5½ miles easterly from the airstrip. This bauxite, which rests on tubular laterite may exceed 6 feet in thickness. The bauxite and laterite are developed upon sedimentary rocks which are arenaceous in places and overlie coarse garnetiferous granite. On the Eastern coast of the peninsula at Yirrkala Mission, and near Drimmie Head on the western shore, the granite is lateritized.

Specimens of bauxite and laterite from Gove have been examined at the Commission's laboratory with the following results:-

Mark	Total SiO_2 %	SiO_2 as quartz %	Total Al_2O_3 %	Avail. Al_2O_3 %	Fe_2O_3 %
(a)	5.5	1.9	52.6	45.3	13.0
A.4016	8.9	3.2	-	36.3	-
A.4015	5.5	0.7	-	42.4	-
A.4013	10.6	2.8	-	43.6	-
A.4014	34.9	0.5	-	11.5	-

(a) Surface boulder near airstrip.
A4016 Collection of surface boulders north of airstrip.
A4015 Loose pisolitic bauxite, surface to 1.5 feet, north of airstrip
A4013 Pisolitic bauxite, base of bauxite in shallow quarry north of airstrip.
A4014 Laterite, floor of same quarry.

In general the pisolitic bauxite closely resembles that of Marchinbar Island, but most specimens seen are rather darker in colour probably because of higher iron content. Quartz grains are visible in some specimens. Some of the ore (A.4015 above) is only weakly cemented and consequently on handling it breaks down to a mass of loose roughly spherical pisolites.

The laterite formation of which the pisolitic bauxite forms a part occupies an area of approximately 25 square miles, and it is very probable that bauxite persists over the greater part of this area, and that systematic testing would indicate very substantial tonnages.

Access to the area is good. The western side of the peninsula is bounded by Melville Harbour with deep and sheltered water. A short jetty, still in a fair state of repair, was built at Drimmie Head by R.A.A.F. during the war and is connected with Gove aerodrome and Yirrkalla Mission by metalled, and in part sealed, roads. The airstrip, 6,000 feet long, is sealed and in good condition. Existing sealed roads provide access to approximately 2 square miles of laterite and bauxite bearing country.

CATO RIVER.

The following notes are taken from a report to the Aluminium Commission by Tuckey and Richardson written in December, 1952. The authors were unable to await the results of analyses of the samples they forwarded to Bell Bay, but relied upon visual estimations of grade. Unfortunately, the chemical results were very disappointing.

The area investigated is roughly bounded by the Giddy River which runs north into the head of Melville Harbour, and the Cato River which drains northerly and westerly into Arnhem Bay. The area is occupied by the remnants of a dissected peneplain some 50 square miles in area. (Remnants of the lateritized surface occur over a much larger area and may be traced north to the Arafura Sea coast, and round the head of Melville Harbour to Gove).

The laterite forms a plateau of some 30 square miles in area, and is 20 to 30 feet thick. It consists generally of about 10 feet of coarsely pisolitic or tubular laterite underlain by massive laterite. In places a gradation to laterized shale can be seen.

On all the larger areas of laterite examined "bauxite" was found covering 50 to 75 per cent of the laterite areas.

In general bauxite was found to be thickest on the ridge centres, thinning towards the edges and generally absent in the scarps. Natural sections at the heads of gullies and occasionally in scarp sections gave good evidence of the thickness of the bauxite.

The underlying rocks consist of a relatively undisturbed sequence of shales, sandstones, grits and conglomerates. The lateritized horizon appears to be a more prominent (thicker?) shale bed. Fragments of altered shale, generally silicified, are common at the base of the laterite.

Two typical sections are quoted below. Analyses which were completed only after the report was written, have been inserted.

Depth: feet.	Field descriptions.
0 - 6	Soft, red, pisolitic bauxite with ferruginous tubular concretions. (24.3% SiO_2; 0.4% Quartz; 21.3% Avail Al_2O_3; 19.8% Ign. loss).
6 - 14	Soft amorphous bauxite with ferruginous concretions. (41.6% SiO_2; 0.2% Quartz; 2.5% Avail. Al_2O_3; 14.3% Ign. loss)
14 - 18	Similar to 6' - 14' with probably higher iron content. (41.2% SiO_2; 0.4% Quartz; 2.6% Avail Al_2O_3; 14.8% Ign. loss)
18 +	Coarse pisolitic laterite covered with scree.

0 - 3	Soft amorphous bauxite (?) (39.5% SiO_2;0.2% Quartz; 2.0% Avail. Al_2O_3; 13.6% Ign. loss)
3 - 15	Tubular laterite
15 - 24	Massive laterite with lateritized shale.
24 +	Altered shale.

Altogether 13 samples were submitted for analysis; three quoted below exceeded 30% available Al_2O_3.

No.	Description	SiO_2 %	Quartz %	Avail. Al_2O_3 %	Ign. loss %
1.	Surface boulder	10.7	1.8	33.6	22.8
10	0.5 to 2.5 feet in pit; hard massive pisolitic bauxite.	14.8	1.8	32.8	22.5
12	Cliff section, 0-6 feet soft pisolitic bauxite	13.7	1.4	32.0	22.1

(1 & 10 are from same locality on small outlier).

Although these results are very unfavourable they should not be regarded as conclusive. Only two samples, 11 and 12, were taken from the main body, and the remainder were collected from outliers on the eastern side. Also most samples were taken from natural exposures in cliffs or gullies where it might be expected that the upper part of the bauxite would be eroded or weathered, and at least 20 square miles of the laterite plateau could not be sampled or examined owing to lack of time and adequate facilities.

The high proportion of combined silica in the samples suggests that the laterite developed on a bed or beds which are not suitable parent rocks, but if the sedimentary sequence is tilted a considerable thickness, possibly including more amenable rocks as on Marchinbar and at nearby Gove would have been lateritized, and in such circumstances economic bauxite might occur towards the western side of the plateau - an area that has not been examined.

This possibility can be tested only by a line of sampling pits across the deposit, but before this work is put in hand the structure of the underlying sedimentary sequence should be worked out so that the test pits can be located to best advantage.

<u>TRUANT ISLAND</u>. A specimen of pisolitic bauxite from Truant Island, forwarded by Captain F.E. Wells in August, 1949, yielded on analysis:

SiO_2	2.9	per cent
Al_2O_3	43.5	" "
Fe_2O_3	26.6	" "
TiO_2	2.3	" "
P_2O_5	0.1	" "
V_2O_5	0.02	" "
Cr_2O_3	0.06	" "
Ign. loss	23.8	" "
	99.28	" "
Avail. Al_2O_3	40.8	" "

The island is less than one square mile in area and air photos indicate that only a small portion of it is covered with laterite or bauxite. An examination of the island should be made when opportunity offers.

<u>PERA HEAD, CAPE YORK PENINSULA, QUEENSLAND.</u>

Bauxite has been reported on the western coast of Cape York Peninsula where the earliest charts show the presence of "low red cliffs". One specimen from the vicinity of Pera Head (Latitude 13° 00'S; Longitude 141° 40'E) submitted to analysis by the Geological Survey of Queensland in 1949 yielded:

Alkali - soluble Al_2O_3	38.8 per cent
Total iron as Fe_2O_3	22.9 " "

The economic significance of this single specimen cannot be determined until an examination of the locality has been made.

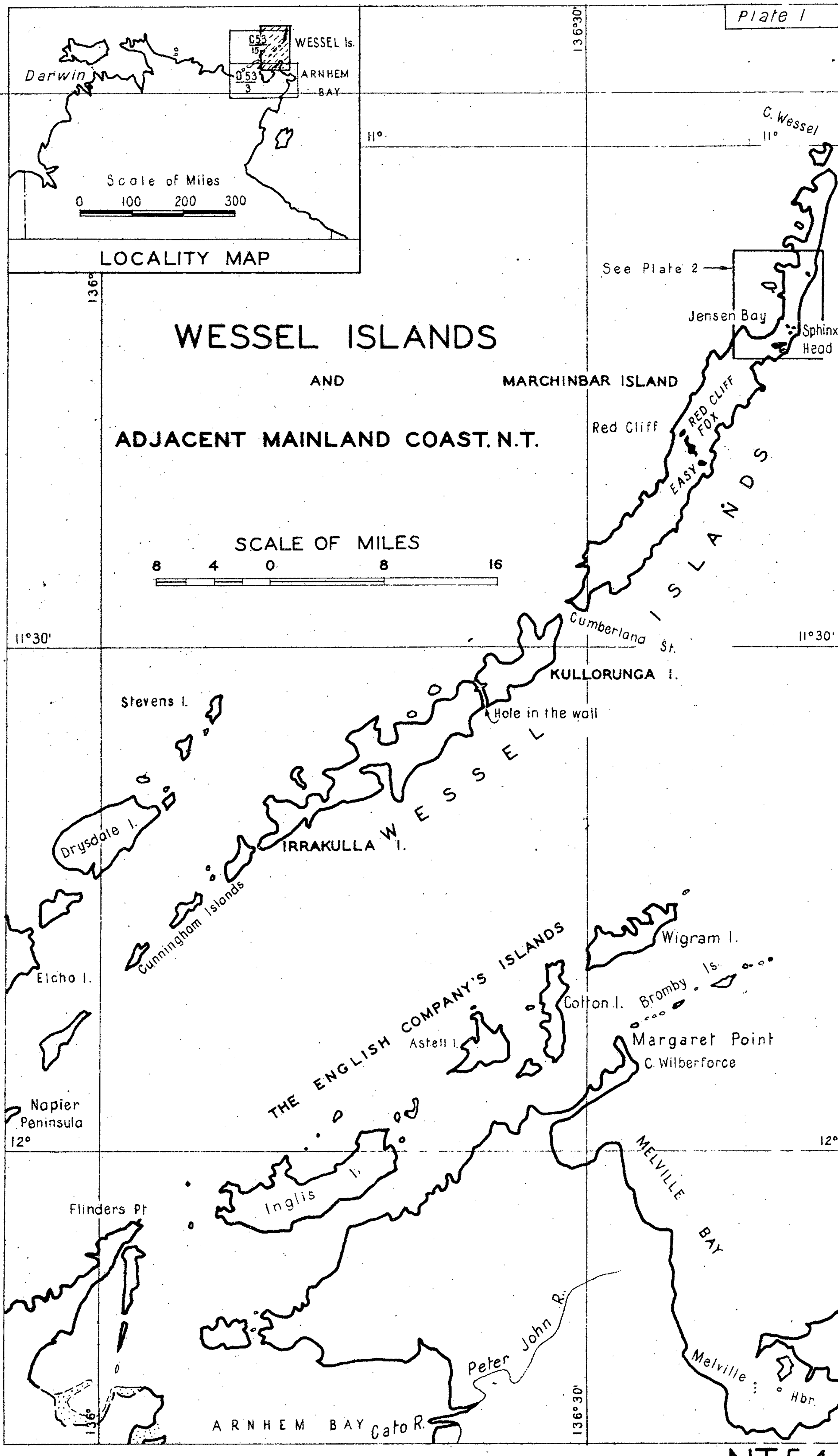
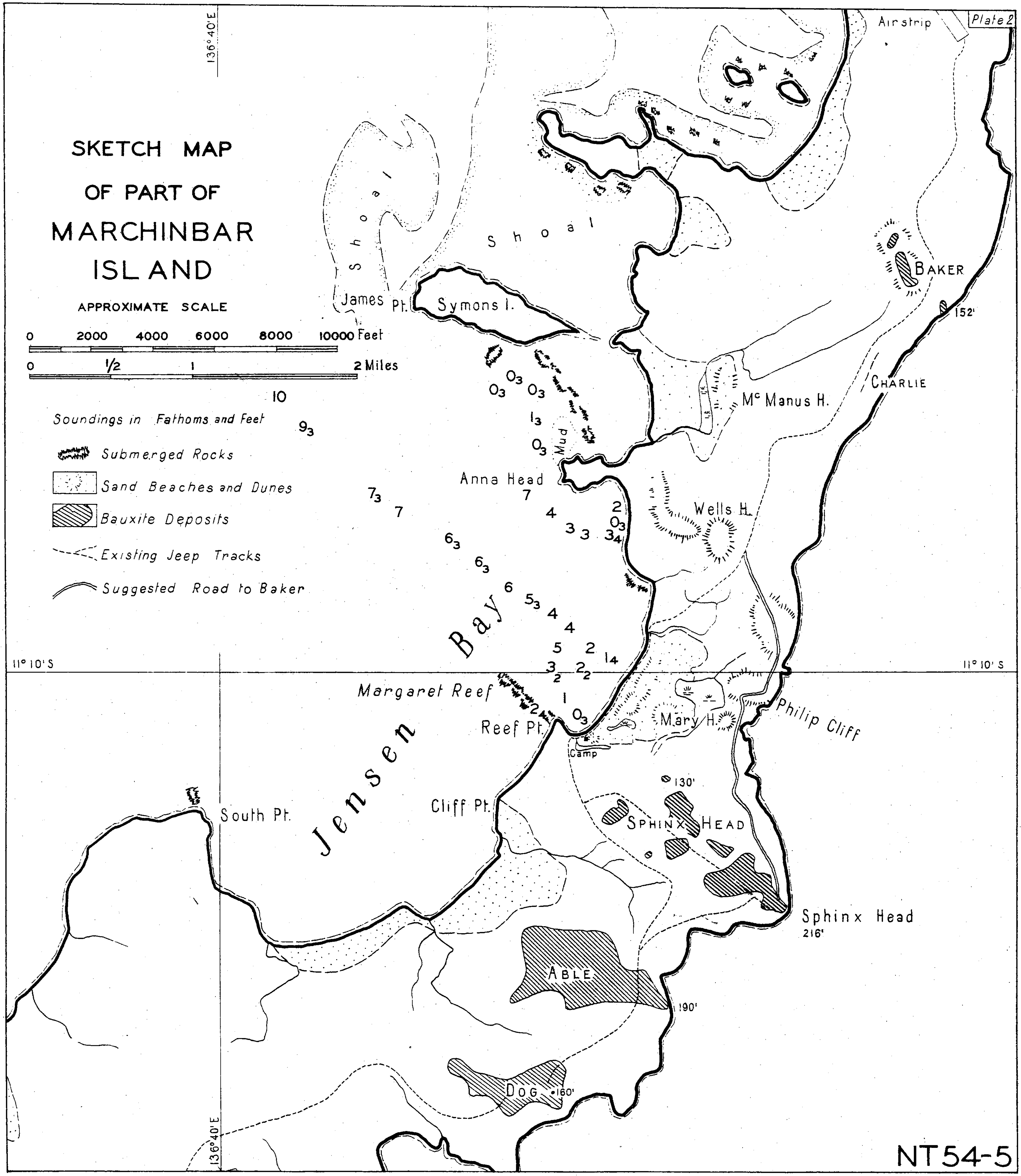


Plate I
LOCALITY MAP
Darwin
C53 15
D53 3
WESSEL Is.
ARNHEM BAY
Scale of Miles
0 100 200 300
WESSEL ISLANDS
AND
ADJACENT MAINLAND COAST. N.T.
MARCHINBAR ISLAND
SCALE OF MILES
8 4 0 8 16
136°
136°30'
11°
11°30'
12°
C. Wessel
See Plate 2
Jensen Bay
Sphinx Head
Red Cliff
RED CLIFF
FOX
EASY
WESSEL ISLANDS
Cumberland St.
KULLORUNGA I.
Hole in the wall
Stevens I.
Drysdale I.
IRRAKULLA I.
Cunningham Islands
Elcho I.
Napier Peninsula
Wigram I.
THE ENGLISH COMPANY'S ISLANDS
Cotton I.
Bromby Is.
Astell I.
Margaret Point
C. Wilberforce
Inglis I.
Flinders Pt
MELVILLE BAY
Peter John R.
Melville Hbr.
ARNHEM BAY
Cato R.



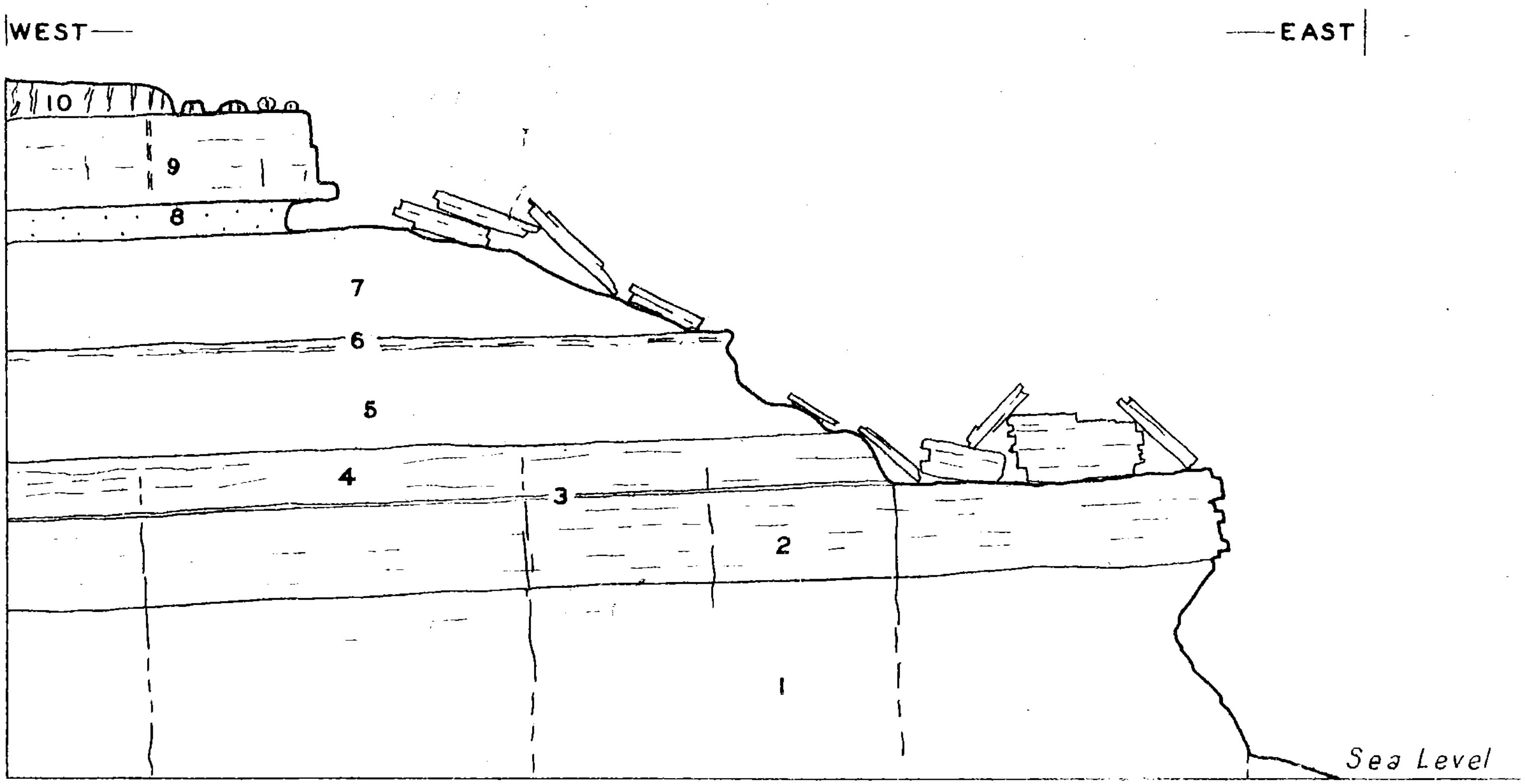
Bureau of Mineral Resources, Geology and Geophysics

Plate 3.

SECTION
PHILIP CLIFF
MARCHINBAR ISLAND

SCALE OF FEET

20 10 0 20 40 60 80



10. Laterite
9. Sandstone; quartzite in part ("Grid Quartzite"). 19 feet.
8. Quartz sand. 5 feet.
7. Obscured. Probably siltstone. About 20 feet.
6. Quartzite & siltstone. 2 feet.
5. Sericite-quartz-siltstone, partly obscured. About 18 feet.
4. Thin-bedded siliceous siltstone with micaceous partings. 10 feet.
3. Soapy shale. 1 foot.
2. Sandstone, quartzite in part ("Sphinx Quartzite") 19 feet.
1. Hard siltstone with seams of quartzite. > 45 feet.

NOTE:

Bands 5, 6 & 7 are parental to bauxite at Sphinx Head, 1½ miles south of Philip Cliff.

NT 54-6

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Plate 4.

PLAN OF BAKER DEPOSIT
MARCHINBAR ISLAND-WESSEL GROUP NORTHERN TERRITORY

Topographical Survey by P. Phelan
Australasian Civil Engineering Pty. Ltd., Sydney 1952.

SCALE OF FEET

200 100 0 200 400

TABLE OF RESERVES

BODY	Long Tons	COMPOSITION: Total SiO_2 %	Quartz %	Avail. Al_2O_3 %	Soda loss Cwt
A	34,000	9·4	2·6	46·0	1·51
B	166,000	9·0	3·1	47·8	1·35
C	15,000	3·8	1·4	51·7	0·58
Total	215,000	8·7	2·8	47·8	1·32

Reference

Datum Mean High Water R.L. 00·00

Sampling Pits Shown Thus ▫ 128·2 / 5·5

Where 128·2 is R.L. of Natural Surface and 5·5 is Thickness of Economic Bauxite } in feet

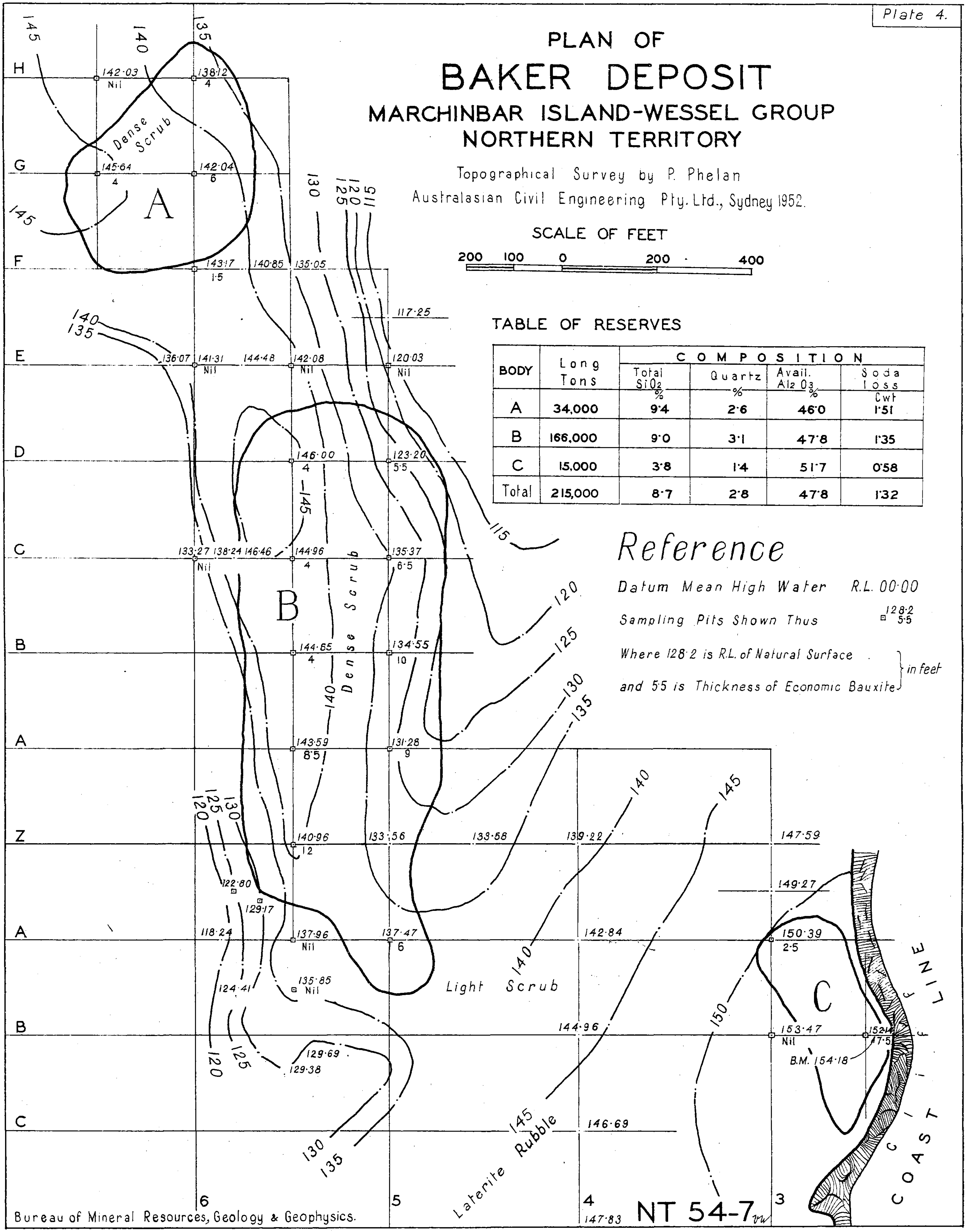

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TABLE OF RESERVES

Body	Long. Tons	Composition Total SiO_2 %	Quartz %	Avail. Al_2O_3 %	Soda loss cwt.
A	490,000	5·4	2·4	40·9	0·82
B	63,000	5·3	2·0	39·4	0·90
C	84,000	6·8	3·0	45·2	0·95
D	357 000	7·8	2·9	45·1	1·20
E	214,000	6·8	2·0	47·2	1·08
F	10,000	5·4	1·4	43·5	1·14
G	15,000	9·3	2·7	43·8	1·58
Total	1,233,000	6·5	2·5	43·5	1·00

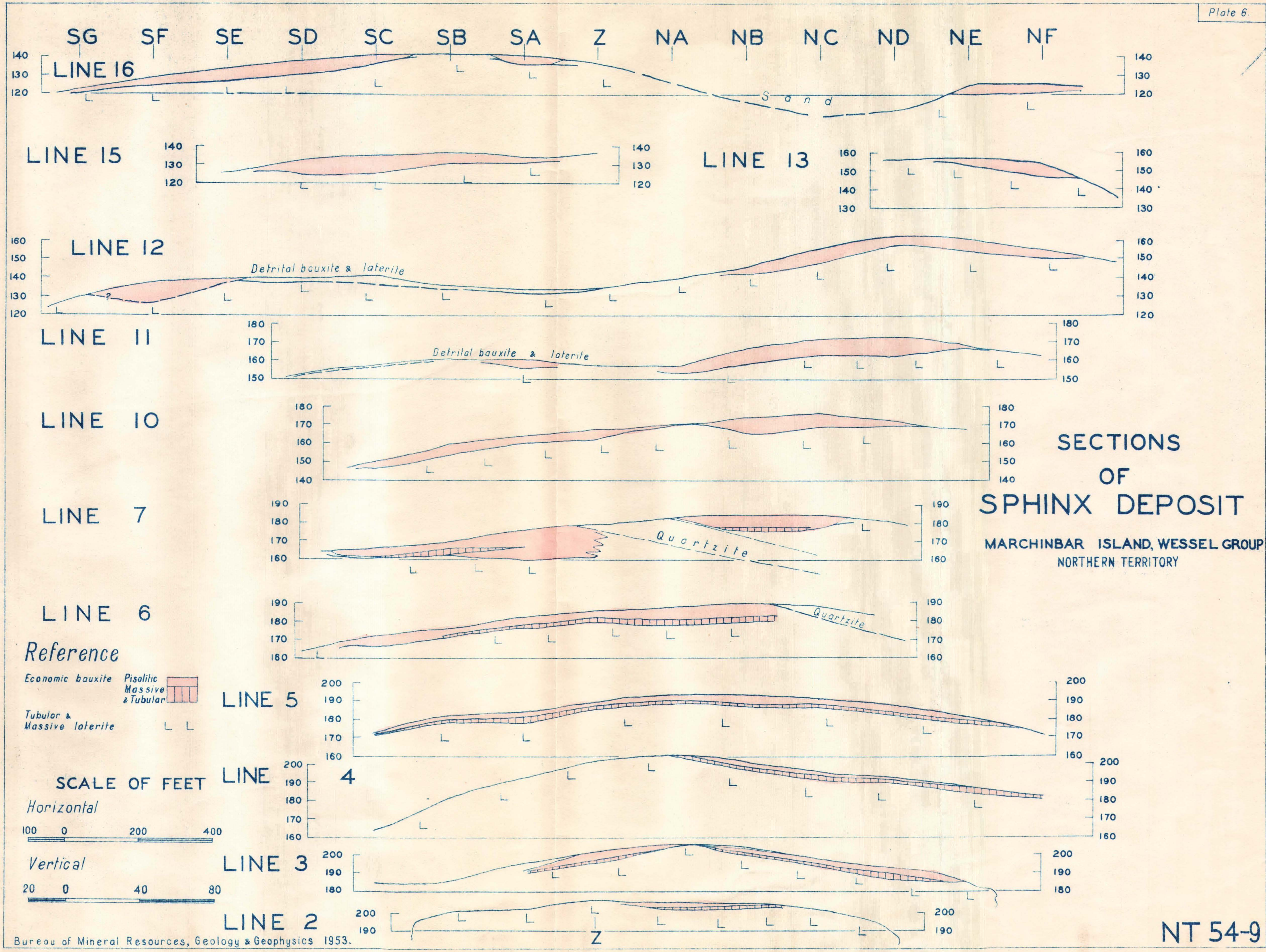


Plate 6.
SECTIONS OF SPHINX DEPOSIT
MARCHINBAR ISLAND, WESSEL GROUP
NORTHERN TERRITORY
SG SF SE SD SC SB SA Z NA NB NC ND NE NF
LINE 16
Sand
LINE 15
LINE 13
LINE 12
Detrital bauxite & laterite
LINE 11
Detrital bauxite & laterite
LINE 10
LINE 7
Quartzite
LINE 6
Quartzite
LINE 5
LINE 4
LINE 3
LINE 2
Z
Reference
Economic bauxite
Pisolitic
Massive & Tubular
Tubular & Massive laterite
SCALE OF FEET
Horizontal
100 0 200 400
Vertical
20 0 40 80
Bureau of Mineral Resources, Geology & Geophysics 1953.
NT 54-9


Plate 7
ABLE
BAUXITE DEPOSIT
MARCHINBAR ISLAND, N.T.
SCALE OF FEET
200 100 0 200 400
Reference
150 Topographic contours in feet
10 Thickness of economic bauxite in feet
155.67 / 6.5 Sampling pits, where 155.67 indicates R.L. of natural surface and 6.5 indicates thickness of economic bauxite-both in feet.
Area, where bauxite is free from contamination with quartz sand.
Topo survey by P. Phelan Australasian Civil Engineering Pty. Ltd., Sydney 1952.
2·5 - 5
5 - 7·5
7·5 - 10
10 - 12·5
12·5 - 15
15 - 17·5
Magnetic North
Quartzite Outcrop
Laterite Breakaway
Light Scrub
Dense Scrub
Quartzite Outcrops
Bureau of Mineral Resources, Geology & Geophysics. August 1953.
NT54-10

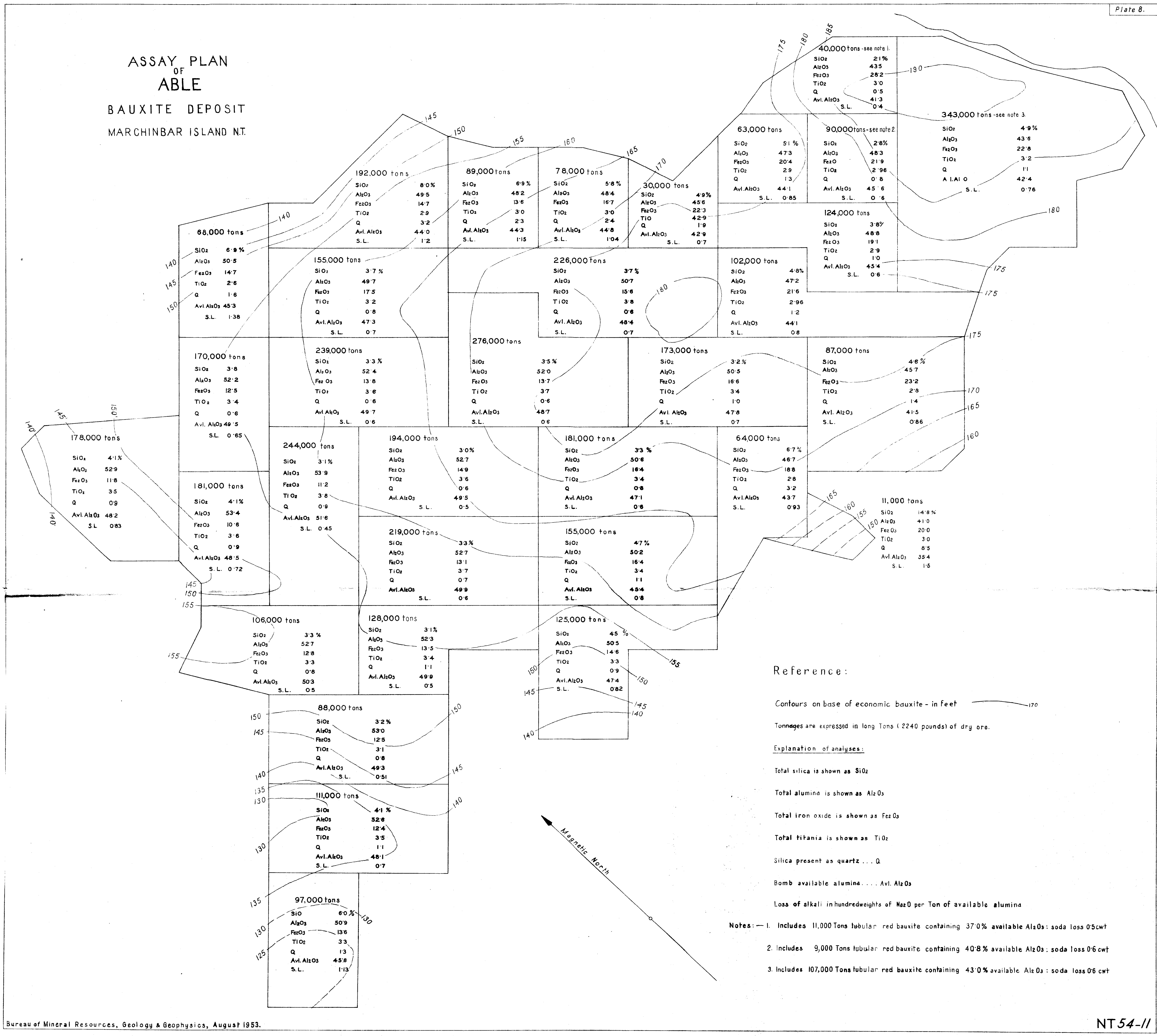


Plate 8.
ASSAY PLAN OF ABLE
BAUXITE DEPOSIT
MARCHINBAR ISLAND N.T.
40,000 tons - see note 1. SiO2 2·1% Al2O3 43·5 Fe2O3 28·2 TiO2 3·0 Q 0·5 Avl. Al2O3 41·3 S.L. 0·4
343,000 tons - see note 3. SiO2 4·9% Al2O3 43·6 Fe2O3 22·8 TiO2 3·2 Q 1·1 Avl. Al2O3 42·4 S.L. 0·76
63,000 tons SiO2 5·1% Al2O3 47·3 Fe2O3 20·4 TiO2 2·9 Q 1·3 Avl. Al2O3 44·1 S.L. 0·85
90,000 tons - see note 2. SiO2 2·8% Al2O3 48·3 Fe2O 21·9 TiO2 2·96 Q 0·8 Avl. Al2O3 45·6 S.L. 0·6
192,000 tons SiO2 8·0% Al2O3 49·5 Fe2O3 14·7 TiO2 2·9 Q 3·2 Avl. Al2O3 44·0 S.L. 1·2
89,000 tons SiO2 6·9% Al2O3 48·2 Fe2O3 13·6 TiO2 3·0 Q 2·3 Avl. Al2O3 44·3 S.L. 1·15
78,000 tons SiO2 5·8% Al2O3 48·4 Fe2O3 16·7 TiO2 3·0 Q 2·4 Avl. Al2O3 44·8 S.L. 1·04
30,000 tons SiO2 4·9% Al2O3 45·6 Fe2O3 22·3 TiO 42·9 Q 1·9 Avl. Al2O3 42·9 S.L. 0·7
124,000 tons SiO2 3·8% Al2O3 48·8 Fe2O3 19·1 TiO2 2·9 Q 1·0 Avl. Al2O3 45·4 S.L. 0·6
68,000 tons SiO2 6·9% Al2O3 50·5 Fe2O3 14·7 TiO2 2·6 Q 1·6 Avl. Al2O3 45·3 S.L. 1·38
155,000 tons SiO2 3·7% Al2O3 49·7 Fe2O3 17·5 TiO2 3·2 Q 0·8 Avl. Al2O3 47·3 S.L. 0·7
226,000 tons SiO2 3·7% Al2O3 50·7 Fe2O3 15·6 TiO2 3·8 Q 0·6 Avl. Al2O3 48·4 S.L. 0·7
102,000 tons SiO2 4·8% Al2O3 47·2 Fe2O3 21·6 TiO2 2·96 Q 1·2 Avl. Al2O3 44·1 S.L. 0·8
170,000 tons SiO2 3·8 Al2O3 52·2 Fe2O3 12·5 TiO2 3·4 Q 0·6 Avl. Al2O3 49·5 S.L. 0·65
239,000 tons SiO2 3·3% Al2O3 52·4 Fe2O3 13·8 TiO2 3·6 Q 0·6 Avl. Al2O3 49·7 S.L. 0·6
276,000 tons SiO2 3·5% Al2O3 52·0 Fe2O3 13·7 TiO2 3·7 Q 0·6 Avl. Al2O3 48·7 S.L. 0·6
173,000 tons SiO2 3·2% Al2O3 50·5 Fe2O3 16·6 TiO2 3·4 Q 1·0 Avl. Al2O3 47·8 S.L. 0·7
87,000 tons SiO2 4·6% Al2O3 45·7 Fe2O3 23·2 TiO2 2·8 Q 1·4 Avl. Al2O3 41·5 S.L. 0·86
178,000 tons SiO2 4·1% Al2O3 52·9 Fe2O3 11·8 TiO2 3·5 Q 0·9 Avl. Al2O3 48·2 S.L. 0·83
244,000 tons SiO2 3·1% Al2O3 53·9 Fe2O3 11·2 TiO2 3·8 Q 0·9 Avl. Al2O3 51·6 S.L. 0·45
194,000 tons SiO2 3·0% Al2O3 52·7 Fe2O3 14·9 TiO2 3·6 Q 0·6 Avl. Al2O3 49·5 S.L. 0·5
181,000 tons SiO2 3·3% Al2O3 50·6 Fe2O3 16·4 TiO2 3·4 Q 0·8 Avl. Al2O3 47·1 S.L. 0·8
64,000 tons SiO2 6·7% Al2O3 46·7 Fe2O3 18·8 TiO2 2·8 Q 3·2 Avl. Al2O3 43·7 S.L. 0·93
11,000 tons SiO2 14·8% Al2O3 41·0 Fe2O3 20·0 TiO2 3·0 Q 8·5 Avl. Al2O3 35·4 S.L. 1·5
181,000 tons SiO2 4·1% Al2O3 53·4 Fe2O3 10·6 TiO2 3·6 Q 0·9 Avl. Al2O3 48·5 S.L. 0·72
219,000 tons SiO2 3·3% Al2O3 52·7 Fe2O3 13·1 TiO2 3·7 Q 0·7 Avl. Al2O3 49·9 S.L. 0·6
155,000 tons SiO2 4·7% Al2O3 50·2 Fe2O3 16·4 TiO2 3·4 Q 1·1 Avl. Al2O3 45·4 S.L. 0·8
106,000 tons SiO2 3·3% Al2O3 52·7 Fe2O3 12·8 TiO2 3·3 Q 0·8 Avl. Al2O3 50·3 S.L. 0·5
128,000 tons SiO2 3·1% Al2O3 52·3 Fe2O3 13·5 TiO2 3·4 Q 1·1 Avl. Al2O3 49·9 S.L. 0·5
125,000 tons SiO2 4·5% Al2O3 50·5 Fe2O3 14·6 TiO2 3·3 Q 0·9 Avl. Al2O3 47·4 S.L. 0·82
88,000 tons SiO2 3·2% Al2O3 53·0 Fe2O3 12·5 TiO2 3·1 Q 0·8 Avl. Al2O3 49·3 S.L. 0·51
111,000 tons SiO2 4·1% Al2O3 52·6 Fe2O3 12·4 TiO2 3·5 Q 1·1 Avl. Al2O3 48·1 S.L. 0·7
97,000 tons SiO 6·0% Al2O3 50·9 Fe2O3 13·6 TiO2 3·3 Q 1·3 Avl. Al2O3 45·8 S.L. 1·13
Magnetic North
Reference:
Contours on base of economic bauxite - in feet 170
Tonnages are expressed in long Tons (2240 pounds) of dry ore.
Explanation of analyses:
Total silica is shown as SiO2
Total alumina is shown as Al2O3
Total iron oxide is shown as Fe2O3
Total titania is shown as TiO2
Silica present as quartz ... Q
Bomb available alumina .... Avl. Al2O3
Loss of alkali in hundredweights of Na2O per Ton of available alumina
Notes: — 1. Includes 11,000 Tons tubular red bauxite containing 37·0% available Al2O3: soda loss 0·5cwt
2. Includes 9,000 Tons tubular red bauxite containing 40·8% available Al2O3: soda loss 0·6 cwt
3. Includes 107,000 Tons tubular red bauxite containing 43·0% available Al2O3: soda loss 0·6 cwt
Bureau of Mineral Resources, Geology & Geophysics, August 1953.
NT 54-11

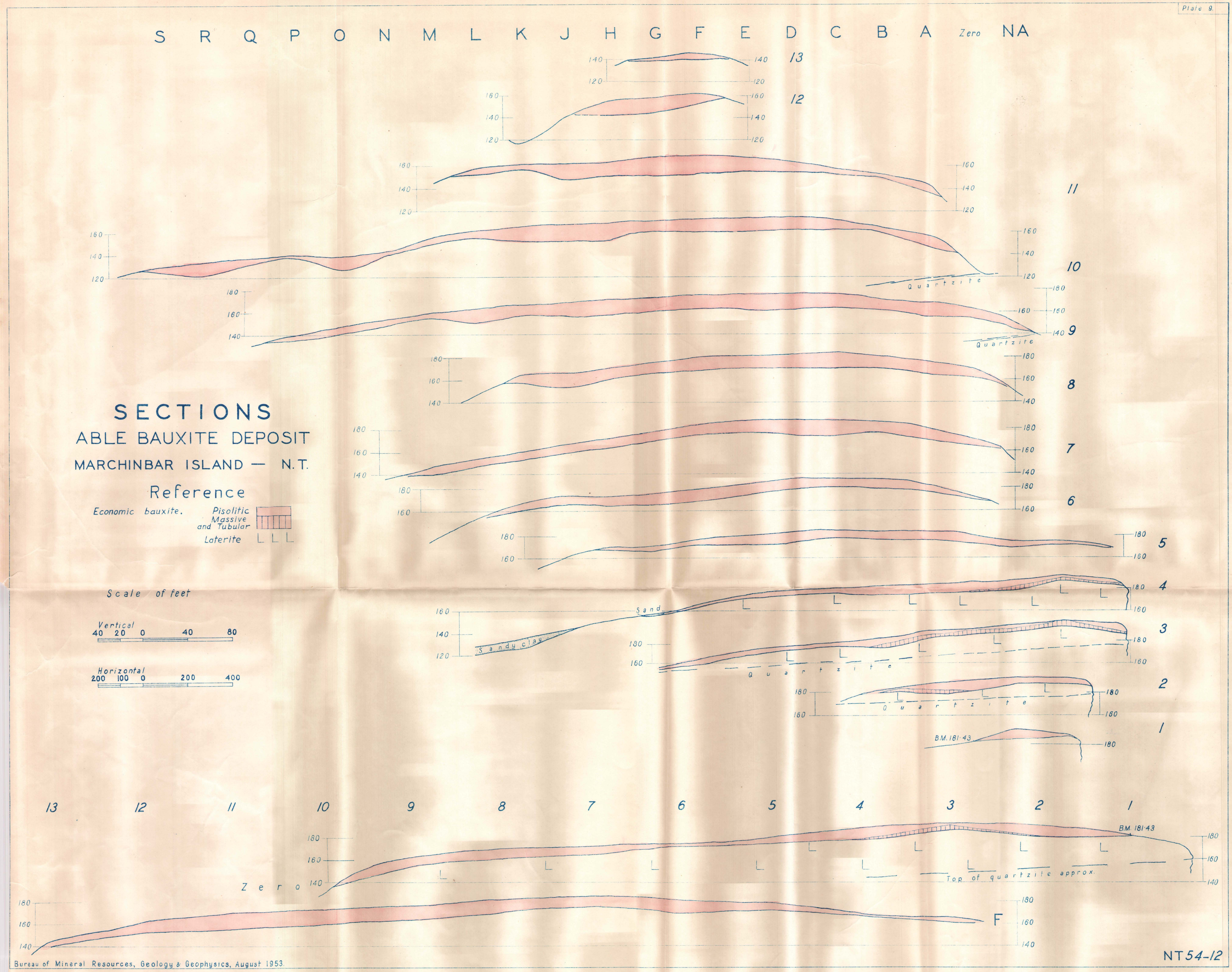
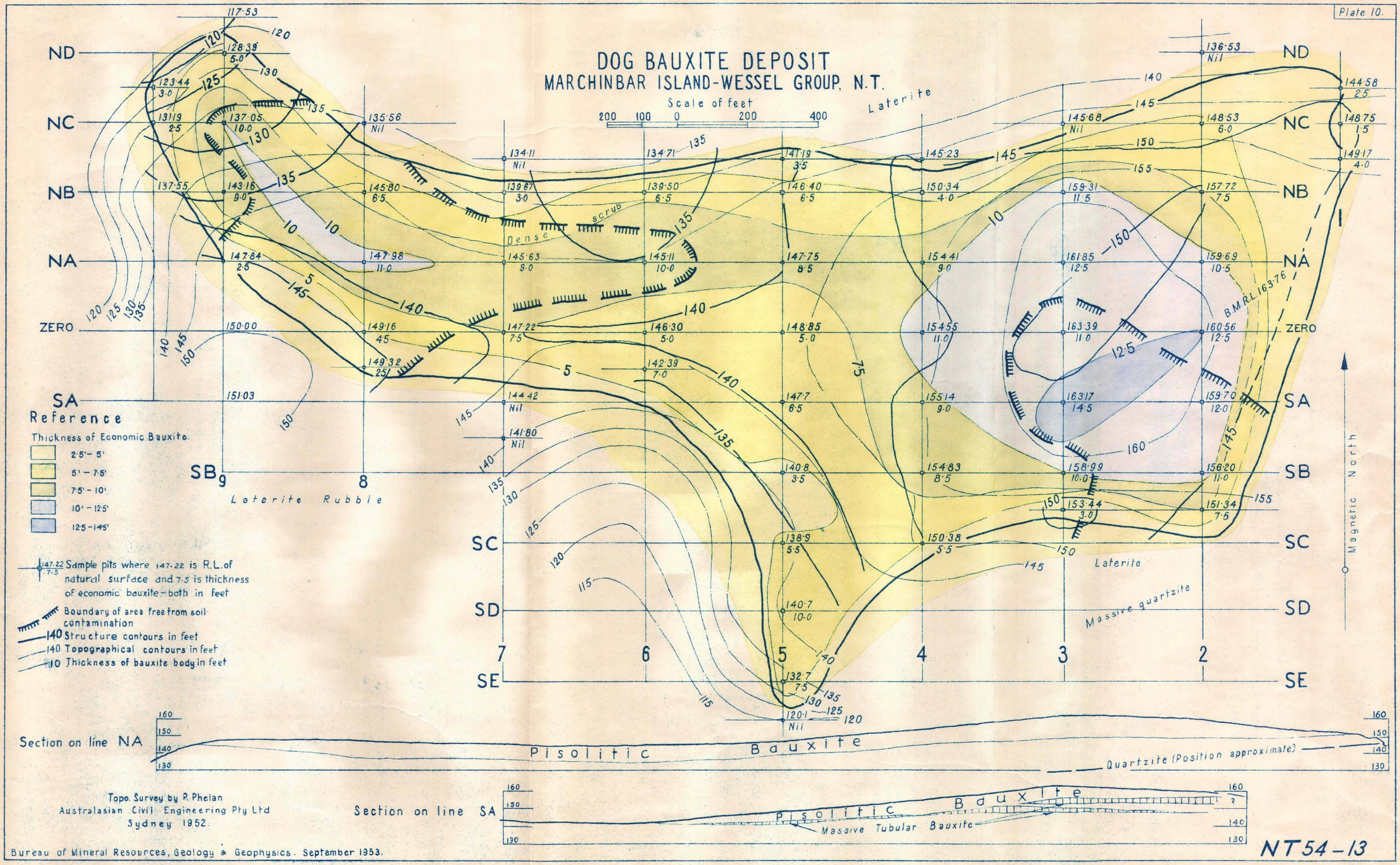


Plate 9.
S R Q P O N M L K J H G F E D C B A Zero NA
13
12
11
10
9
8
7
6
5
4
3
2
1
Quartzite
Sand
Sandy clay
Top of quartzite approx.
B.M. 181·43
Zero
F
SECTIONS
ABLE BAUXITE DEPOSIT
MARCHINBAR ISLAND — N.T.
Reference
Economic bauxite.
Pisolitic
Massive and Tubular
Laterite
Scale of feet
Vertical
40 20 0 40 80
Horizontal
200 100 0 200 400
Bureau of Mineral Resources, Geology & Geophysics, August 1953.
NT54-12

Plate 10.



NT54-13

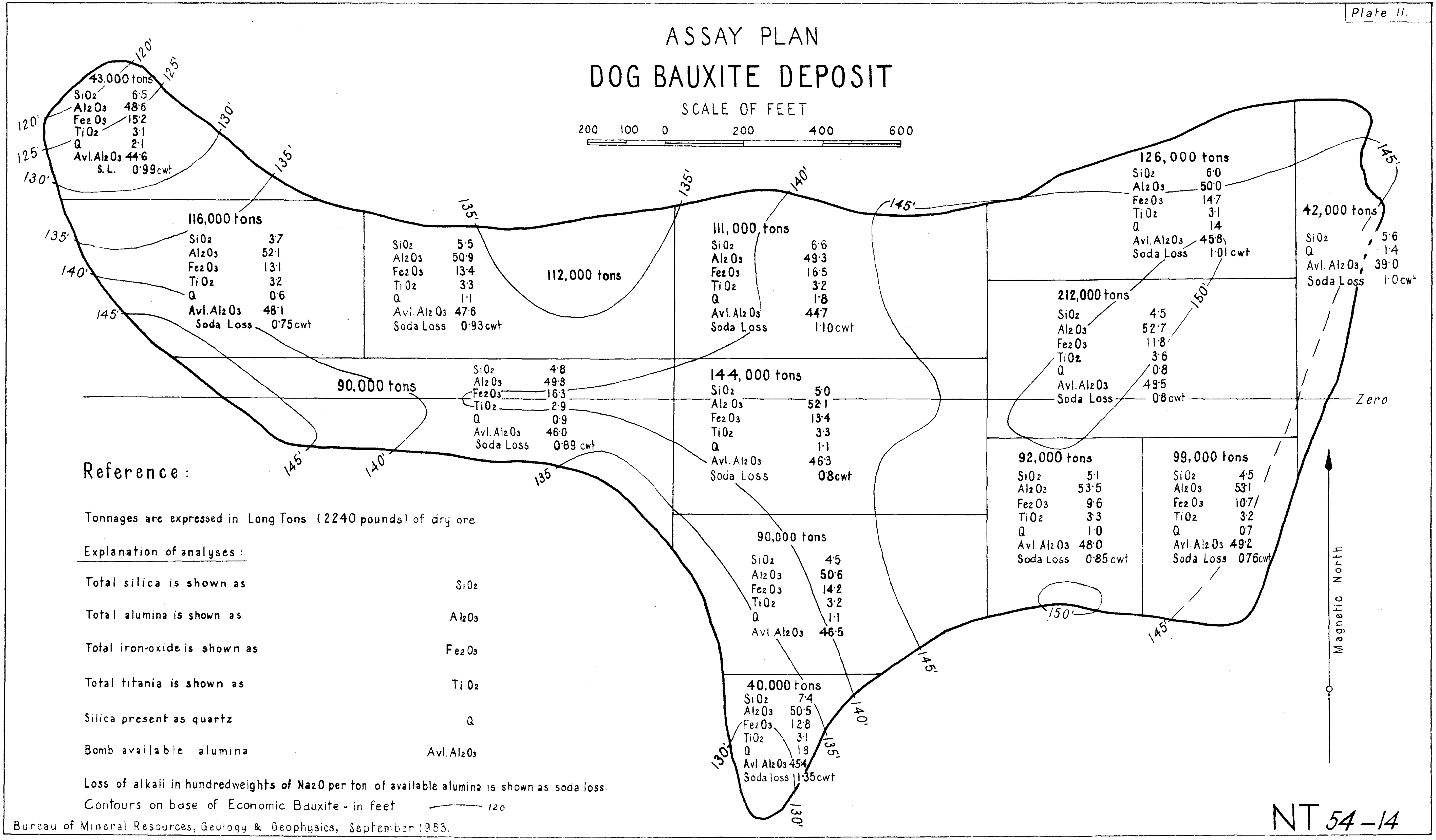


Plate II.
ASSAY PLAN
DOG BAUXITE DEPOSIT
SCALE OF FEET
200 100 0 200 400 600
43,000 tons
SiO2 6·5
Al2O3 48·6
Fe2O3 15·2
TiO2 3·1
Q 2·1
Avl.Al2O3 44·6
S.L. 0·99cwt
116,000 tons
SiO2 3·7
Al2O3 52·1
Fe2O3 13·1
TiO2 3·2
Q 0·6
Avl.Al2O3 48·1
Soda Loss 0·75cwt
SiO2 5·5
Al2O3 50·9
Fe2O3 13·4
TiO2 3·3
Q 1·1
Avl.Al2O3 47·6
Soda Loss 0·93cwt
112,000 tons
111,000 tons
SiO2 6·6
Al2O3 49·3
Fe2O3 16·5
TiO2 3·2
Q 1·8
Avl.Al2O3 44·7
Soda Loss 1·10cwt
126,000 tons
SiO2 6·0
Al2O3 50·0
Fe2O3 14·7
TiO2 3·1
Q 1·4
Avl.Al2O3 45·8
Soda Loss 1·01cwt
42,000 tons
SiO2 5·6
Q 1·4
Avl.Al2O3 39·0
Soda Loss 1·0cwt
212,000 tons
SiO2 4·5
Al2O3 52·7
Fe2O3 11·8
TiO2 3·6
Q 0·8
Avl.Al2O3 49·5
Soda Loss 0·8cwt
90,000 tons
SiO2 4·8
Al2O3 49·8
Fe2O3 16·3
TiO2 2·9
Q 0·9
Avl.Al2O3 46·0
Soda Loss 0·89cwt
144,000 tons
SiO2 5·0
Al2O3 52·1
Fe2O3 13·4
TiO2 3·3
Q 1·1
Avl.Al2O3 46·3
Soda Loss 0·8cwt
92,000 tons
SiO2 5·1
Al2O3 53·5
Fe2O3 9·6
TiO2 3·3
Q 1·0
Avl.Al2O3 48·0
Soda Loss 0·85cwt
99,000 tons
SiO2 4·5
Al2O3 53·1
Fe2O3 10·7
TiO2 3·2
Q 0·7
Avl.Al2O3 49·2
Soda Loss 0·76cwt
90,000 tons
SiO2 4·5
Al2O3 50·6
Fe2O3 14·2
TiO2 3·2
Q 1·1
Avl.Al2O3 46·5
40,000 tons
SiO2 7·4
Al2O3 50·5
Fe2O3 12·8
TiO2 3·1
Q 1·8
Avl Al2O3 45·4
Soda loss 1·35cwt
120'
125'
130'
135'
140'
145'
150'
Zero
Magnetic North
Reference:
Tonnages are expressed in Long Tons (2240 pounds) of dry ore
Explanation of analyses:
Total silica is shown as SiO2
Total alumina is shown as Al2O3
Total iron-oxide is shown as Fe2O3
Total titania is shown as TiO2
Silica present as quartz Q
Bomb available alumina Avl.Al2O3
Loss of alkali in hundredweights of Na2O per ton of available alumina is shown as soda loss.
Contours on base of Economic Bauxite - in feet 120
Bureau of Mineral Resources, Geology & Geophysics, September 1953.
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Plate 12.

EASY BAUXITE DEPOSIT
MARCHINBAR ISLAND, WESSEL GROUP, N.T.

Topographic Survey by P. Phelan Australasian Civil Engineering Pty Ltd, Sydney 1952.

Scale of Feet

Block	Tons	Total SiO_2 %	Quartz %	Available Al_2O_3 %	Soda-loss cwt
A	138,000	7·9	2·0	45·6	1·4
B	161,000	9·2	1·9	42·7	1·8
C	123,000	8·3	1·8	42·1	1·5
D	168,000	10·1	3·4	45·4	1·47
E	230,000	6·6	2·0	48·5	1·07
Total	820,000	8·3	2·2	45·2	1·4

TABLE OF RESERVES

Bureau of Mineral Resources, Geology & Geophysics. September 1953.

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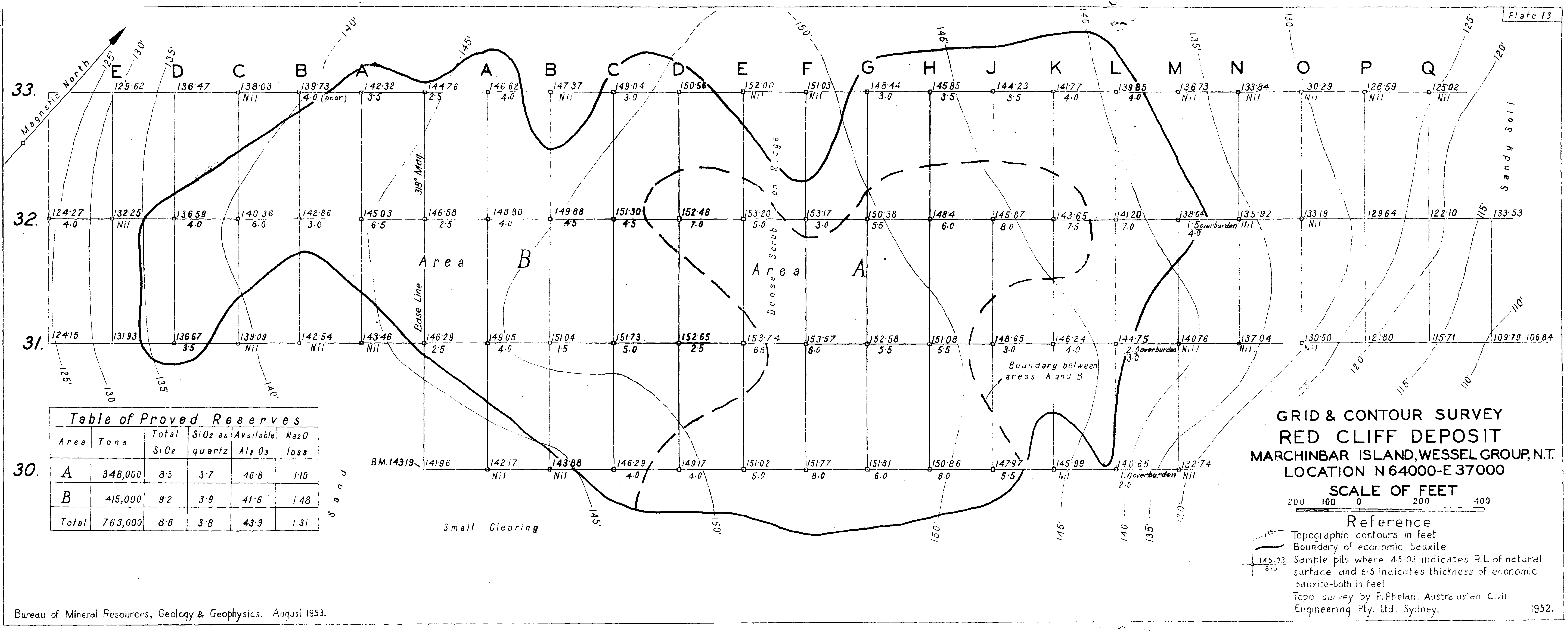

Table of Proved Reserves

Area	Tons	Total SiO_2	SiO_2 as quartz	Available Al_2O_3	Na_2O loss
A	348,000	8·3	3·7	46·8	1·10
B	415,000	9·2	3·9	41·6	1·48
Total	763,000	8·8	3·8	43·9	1·31

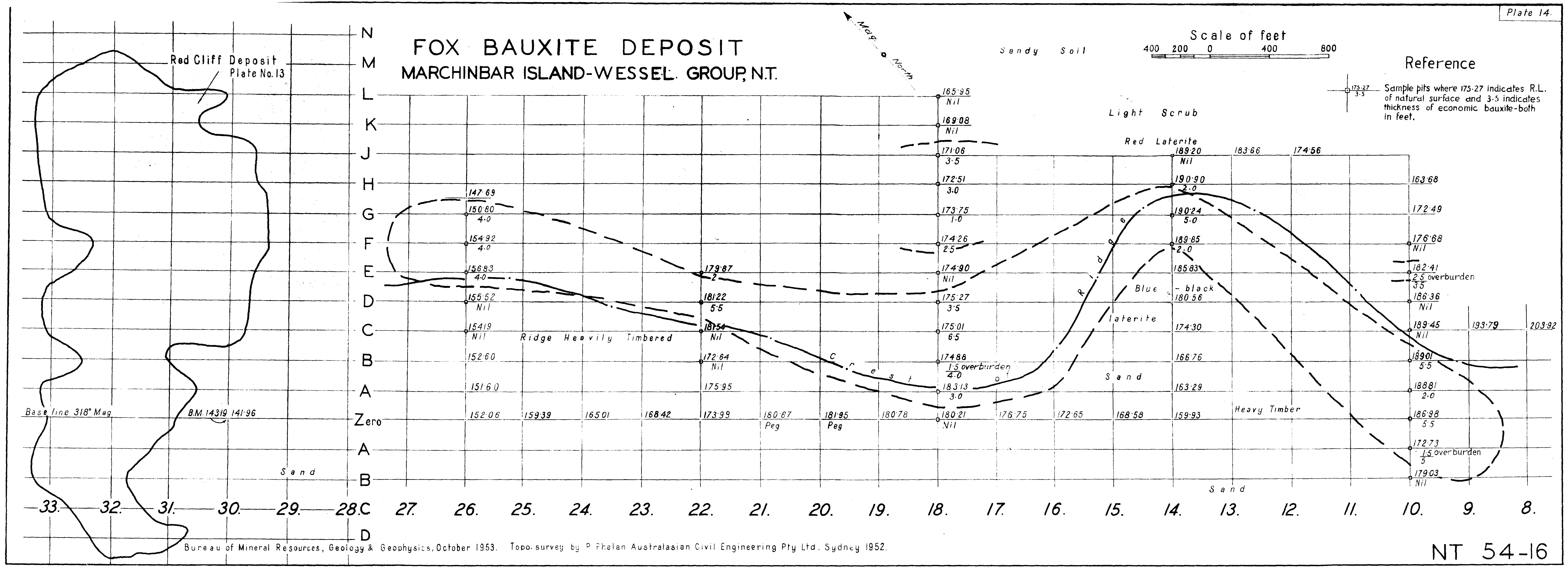

Plate 14.
FOX BAUXITE DEPOSIT
MARCHINBAR ISLAND-WESSEL GROUP, N.T.
Mag. North
Scale of feet
400 200 0 400 800
Reference
Sample pits where 175·27 indicates R.L. of natural surface and 3·5 indicates thickness of economic bauxite-both in feet.
Red Cliff Deposit
Plate No. 13
Sandy Soil
Light Scrub
Red Laterite
Ridge Heavily Timbered
Crest of Ridge
Blue - black laterite
Sand
Heavy Timber
Base line 318° Mag
B.M. 143.19 141.96
Bureau of Mineral Resources, Geology & Geophysics, October 1953. Topo. survey by P. Phelan Australasian Civil Engineering Pty Ltd. Sydney 1952.
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