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COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF SUPPLY AND SHIPPING.
MINERAL RESOURCES SURVEY.

REPORT No. 1944/45 .

Plan No. 1130.

REPORT ON
RED OCHRE DEPOSITS, OPHTHALMIA RANGE,
WINDELL DISTRICT, NORTH-WEST DIVISION
WESTERN AUSTRALIA.

By

H.B. Owen, Geologist.

8th December, 1944.

CANBERRA.

DEPARTMENT OF SUPPLY & SHIPPING.

MINERAL RESOURCES SURVEY BRANCH.

REPORT ON
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Report No.1944/45 - Plan No.1130.

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Plan No.1130

Geological Plan of Vicinity of Ochre Deposit on Mining Lease
370H, Ophthalmia Range, Western Australia.

REPORT ON RED OCHRE DEPOSITS,
OPHTHALMIA RANGE, WINDELL DISTRICT
NORTHWEST DIVISION, WESTERN AUSTRALIA.

(Report No.1944/45 - Plan No.1130.)

I. INTRODUCTION.

A. General - Red ochre of high quality has been produced from deposits in Ophthalmia Range since 1937. The bulk of the production has been derived from one lease, No.37OH, the deposits on which are the subject of this report. Small quantities have been won from at least one other deposit in the same locality, and several undeveloped deposits are known and await testing.

Individual bodies of ochre are small and future production must depend upon prospecting and development of additional deposits.

The locality was visited in company with Mr. R.S. Matheson, a member of the Geological Survey of Western Australia, in June, 1944, and the accompanying geological map of a small area in the vicinity of the workings on lease 37OH was prepared jointly by means of compass, tape and clinometer.

B. Access - The lease lies to the west of the road between Meekatharra and the Marble Bar, and is about 12 miles south from Poondah homestead. Tracks lead to the mine from points on the main road near Ethel Creek and Roy Hill homesteads. These tracks meet at the entrance to a gorge in the north front of Ophthalmia Range and from this point to the mine, a distance of about 4 miles, the track is rough and hilly. The nearest point on the Western Australian Railways system (excluding the line from Port Hedland to Marble Bar) is Meekatharra, 336 miles by rail from Geraldton, and 600 miles by rail from Perth. The distance by road from the ochre deposit to Meekatharra is about 360 miles.

C. Topography - The northern portion of the Ophthalmia Range in the vicinity of the ochre deposit is a much dissected plateau with the higher points standing about 400 feet above the level of the plain to the north, or about 1700 feet above sea level.

The drainage pattern is rectangular with streams flowing along the strike of the sediments, i.e. N.65°W, and cutting across in steep-walled gorges at right angles to this direction. The ochre deposit, which is about 3 miles south of the northern front of the range, occurs on the head of a creek which flows south and east to join Kalga Creek a tributary of the Fortescue River.

D. Geology - The geology and petrology of the area has been described by H.W.B. Talbot and R.A. Farquharson in G.S.W.A. Bulletin 83, Perth, 1919.

Ophthalmia Range consists of a strip of metamorphosed sediments and interbedded volcanics of Nullagine age bounded on the south by Older Greenstones of the Warrawoona Series and on the north by the lacustrine deposits known as the Fortescue Beds, and tentatively classed as of Tertiary age by A. Gibb Maitland in G.S.W.A. Bulletin 89. These beds underlie a thin cover of sand on the plain which stretches north from the range as far as Roy Hill homestead, a distance of 38 miles.

Towards the eastern end of the northern side of the range the sediments are invaded by a medium-grained rock with the appearance of an altered acid intrusive. This rock has been described by Farquharson as quartz dolerite. According to Talbot the rocks along the steep southern scarp of the range are relatively undisturbed and the intrusive rock is absent.

Near the ochre deposit the sediments comprise slate, quartzite and sandstone with hematite-bearing bands, finely banded jasper and seams of ochreous hematite. Bands of sheared and knotted rock are believed to be highly altered tuff. No calcareous bands were noted.

The intrusive is a grey, fine grained holocrystalline rock which weathers to a soft yellow and white earthy mass. The rock is well exposed at the top of the hill to the north of the mine, where an outcrop of rounded boulders of fresh rock extends from north to east over a wide area, at least 200 acres.

The intrusions appear to be sills in form but they break across the bedding in places. The sediments forming the northern face of the range dip to the north off a thick sill of the intrusive.

A specimen from a quarter of a mile north of the ochre workings was sectioned and found to contain a small amount of interstitial quartz, spherulites of radiating fibres of felspar and quartz, brown amphibole, laths of felspar (weathered) and a few twisted shreds of biotite. Apatite, leucoxene (?) and kaolinitic material are also present. Some of the amphibole is fibrous and probably results from the alteration of augite. The ferromagnesian minerals are present in only small amounts, and at least some of the felspar is orthoclase. The ophitic structure common to dolerites is almost absent.

II. ECONOMIC GEOLOGY.

A. General. - The sediments contain rocks with a wide range of granularity and consist of alternating bands of quartzite, jasper, slate and altered tuff. They contain narrow bands rich in hematite and it is from these bands that the ochre has been derived where other conditions have also been favourable. One necessary condition appears to be proximity to an intrusive contact.

The accompanying geological plan shows a small area in the northwest corner of the lease including the northern and southern workings.

B. Description of Deposits - The ochre deposits have the form of lenticular beds and the northern body shown on the plan is divided into pockets by transverse zones containing narrow ramifying veinlets of limonite which reduces the value of the ochre. These limonitic zones, which average about 6 feet wide are left standing as pillars in the open-cut.

This northern body, which is being worked at present, maintains a width of about 6 feet from the greater part of its length and narrows towards each end of the cut. At the southern end the ochre is cut off by the intrusive which lies flatly beneath the sediments near this point, and at the northern end the ochreous band is narrower and of poorer quality. At the time of the visit the deepest part of the excavation was only 15 feet and good ochre was showing underfoot.

The ochre is parallel to the contact of the intrusive and about 12 feet from it for the greater part of its length. It dips to the southwest and the dip steepens towards the northern end of the cut.

The southern workings consist of a pit of irregular outline with a short drive to the west from its lowest point. Three well-defined bands of ochre were developed in the pit which was opened on the axis of a gentle syncline plunging south. The northernmost ochre band strikes N.80°E and is two feet wide and of poor quality. It was mined for 50 feet along the strike to a depth of only 7 feet and then presumably became too poor or too narrow to warrant further work. A second band, striking N.75°E and 8 feet south from the

first, appeared to have been about 3 feet wide but may have been wider near the centre of the pit, and was followed down for 11 feet for a length of rather less than 100 feet. The main bed is about 35 feet further south again; it strikes N.85°E and dips south at 50°. This has been extracted to a depth of 35 feet down the dip on an average length of 25 feet. In the drive, which has been stoped up nearly to the floor of the pit, the ochre is mainly of good quality but contains some gritty patches.

On the eastern side of the pit, that is across the synclinal axis, an ochre band striking N.50°W has been exposed, and a narrow band of limonitic ochre parallel to this and 22 feet north-east from it crosses the entrance to the pit. These bands were not traced west as far as the others mentioned above and it is not certain whether they are continuous or interfingered with them.

C. Description of the Ochre.- The ochre consists essentially of hematite as red earthy powder and in micaceous, specular flakes together with a small amount of argillaceous matter. The pulverulent variety of hematite is present in greater proportion than the specular type. Partial analyses of four specimens of ochre from Ophthalmia Range are summarised here and repeated, together with the results of pigment tests in an Appendix to this report.

Partial Analyses of Ochre
from Ophthalmia Range.

Sample from	Fe ₂ O ₃ %	Free SiO ₂ %	Combined SiO ₂ %	Quality of Pigment.
M.L. 370H (Best Grade)	90.16	2.41	1.83	Excellent
M.L. 370H (Poorest Grade)	85.66	5.44	1.55	Poor
P.A.825H	90.00	2.30	0.88	Excellent
Nelly's	86.08	1.63	1.57	Excellent

Analyses by Government Analyst and Mineralogist, Perth, W.A.

D. Origin of the Ochre - The following conditions appear to have been necessary for the formation of bands of ochre of economic value.

1. The presence of richly hematitic seams of sufficient width to provide bodies of suitable width for mining.
2. The absence of siliceous gritty sediment in the band.
3. Close proximity to an intrusive contact.
4. Weathering without the formation of limonite, but to a degree sufficient to disintegrate slaty material.

Hematitic bands occur fairly commonly throughout the sediments and those which lie at some distance from the intrusive contact are hard and composed of flakes of micaceous hematite without the powdery type which appears to result from contact alteration and is characteristic of the ochre.

The effect of weathering is more problematical but it is probable that softening of the argillaceous material under the influence of weathering is beneficial to the formation of good ochre. The presence of limonite is deleterious as it imparts a brownish tinge to the ochre when ground.

E. Reserves - If the ochre owes its formation solely to contact alteration it may be expected to continue to a depth commensurate with the thickness of the intruded sill, but on the other hand the vertical extent of commercial ochre may be limited to a comparatively shallow zone of catamorphic weathering. Apart from these

observations it is not possible to make any definite statement on the subject of reserves owing to the lack of development at the mine and to the possibility of objectionable impurities occurring in the ochre in an unpredictable manner, but the following remarks may serve to show the order of the quantity of ochre that may be recovered from the body being exploited at the northern workings.

If it be assumed that the ochre and the zones contaminated with limonite persist in undiminished volume to a depth of 30 feet (that is double the depth at present excavated and rather less than the greatest depth of the southern workings) the total volume remaining at 17th June, 1944, was 9,500 cubic feet or 580 long tons. (Specific gravity of ochre equals 2.2, equivalent to 16.3 cubic feet per ton.)

III. PRODUCTION AND VALUE.

Production of ochre from all other localities in Western Australia has been very small. The total recorded production from 1937 to 1943 inclusive amounted to 1,291 tons, divided as follows -

	<u>Tons</u>	<u>Value</u>
From lease 37OH	1,182	£11,802
From other leases in Ophthalmia Range	86)	
All other localities	23)	870
	<u>1,291</u>	<u>£12,672</u>

Production from Lease 37OH to 17th June, 1944 is -

To end of 1943	1,182	11,802 /
Carted in January, 1944, but mined in 1943	100	1,000 /
Mined January to 17th June, 1944	<u>280</u>	<u>2,800 /</u>
	<u>1,562</u>	<u>£15,602</u>

/ According to Commonwealth Prices Branch, Perth, the price of the ochre has been £12 per ton, f.o.b. Fremantle since 31.3.43.

Ochre has been produced from two other nearby localities, namely Howard's (Prospecting Area 825H) and Nelly's. These are situated at approximately 14 miles south and 3 to 4 miles north-northwest respectively from M.L.37OH.

IV. CONCLUSION.

Production of ochre at Ophthalmia Range has been hampered by the low price of the product combined with the high standard demanded by the consumers. The latter condition necessitates much hand-picking of the ochre at the mine and the rejection of otherwise good material containing limonite which may amount to very much less than one per cent of the whole.

The price was £12 per long ton f.o.b. Fremantle until the beginning of August, 1944, when the Prices Commissioner approved an increase to £14.10. 0. f.o.b. Fremantle. Prior to this increase the margin of profit to the owners (Messrs. Smith and Dods, of Meekatharra) was insufficient to enable them to finance prospecting. In fact it is probable that the owners actually made a loss on the mining venture but recouped themselves by carrying the ochre to Meekatharra as back-loading on their own trucks which transport station stores from the railway to pastoral holdings between Meekatharra and Nullagine. Costs involved in the mining of the

ochre and its transport to Fremantle are stated to be -

	£. s. d
	Per long ton
Contract Mining	2.10. 0
Bags, string etc. not less than	1. 0. 0
Cartage to Meekatharra: 360 miles (low rate for back-loading)	6.10. 0
Rail freight: Meekatharra to Fremantle (612 miles)	1. 8. 0
Other charges: Wharfage, Agency etc. not more than	<u>13. 6</u>
	<u>£12. 1. 6</u>

It has been pointed out that individual deposits are likely to be small and continued production of ochre from the field will depend on successful prospecting and development of newly discovered deposits. The increased price will provide funds for prospecting and an added stimulus to production.

It is desirable that an outlet should be found for the lower grade ochre which is being rejected at present.

H.B. Owen.
(H.B. Owen,)
Geologist.

CANBERRA.
8/12/44.

APPENDIX.

Four samples of ochre from Ophthalmia Range were submitted to the Western Australian Government Analyst and Mineralogist by Mr. Matheson for pigment tests. The results of the tests are set out below -

1. G.S.W.A. Registered No.2/2882.

Lab.No.2803/44.

Description - Best grade ochre from northern workings, M.L.370H.

Composition.

Fe ₂ O ₃	(ferric oxide)	90.16%
SiO ₂	(silica) free	2.41%
SiO ₂	(silica) combined	1.83%

Colour of Fine Ground Raw Pigment.

With light raw oil - Ridgeway's 5, between Morocco Red & Claret Brown
With water - " 3¹ m, Diamine Brown.

Colour of Fine Ground Roasted Pigment.

With light raw oil - Ridgeway's 5k, Morocco Red.
With water - Ridgeway's 3¹m, Dark Indian Red.

Body and Covering Capacity.

The raw roasted pigments have a very dense body both in oil and water and spread well giving an opaque covering.

Conclusions.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. It is improved by roasting in air, the pigment is redder, and gives a brighter and redder paint with oil. The distemper formed by grinding in water is considerably darker than oil colour and somewhat purplish. The purplish tinge is largely removed by roasting.

2. G.S.W.A. Registered No.2/2883.

Lab. No.2804/44.

Description - Reported poorest grade ochre being marketed from northern workings, M.L.370H.

Composition.

Fe ₂ O ₃	(ferric oxide)	85.66%
SiO ₂	(silica) free	5.44%
SiO ₂	(silica) combined	1.55%

Colour of Fine Ground Raw Pigment.

With light raw oil - Ridgeway's 5¹m, Hessian Brown.
With water - Ridgeway's 5¹m, Haematite Red.

Colour of Fine Ground Roasted Pigment.

With light raw oil - Ridgeway's 5m, Claret Brown.
With water - Ridgeway's 3¹m, Diamine Brown.

Conclusions.

This sample lacks the redness and brightness of the previous sample, and these properties are little improved by roasting in air. It forms opaque paints with oil, but of darker shade, and duller in lustre. The distemper formed by mixing with water is dense but rather dull; it is appreciably improved by roasting in air.

3. G.S.W.A. Registered No.2884.

Lab.No.2805/44.

Description - Reported average grade ochre from Howard's Show, P.A.825H, situated 26 miles south of Poonda Homestead.

Composition.

Fe ₂ O ₃	(ferric oxide)	90.00%
SiO ₂	(silica) free	2.30%
SiO ₂	(silica) combined	0.88%

Colour of Fine Ground Raw Pigment.

With light raw oil - Ridgeway's 5 k, Morocco Red.
With water - Ridgeway's 3"m, Dark Indian Red.

Colour of Fine Ground Roasted Pigment.

With light raw oil - Ridgeway's 5k, Morocco Red.
With water - Ridgeway's 3"m, Dark Indian Red.

Conclusions.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. It is not improved by roasting in air. The distemper formed by grinding in water is much darker than the oil colour. The colour is not changed by roasting.

4. G.S.W.A. Registered No.2/2885.

Lab. No.2806/44.

Description - Reported average grade ochre from Nelly's show 3 to 4 miles N.N.W. of M.L.370H.

Composition.

Fe ₂ O ₃	(ferric oxide)	86.08%
SiO ₂	(silica) free	1.63%
SiO ₂	(silica) combined	1.57%

Colour of Fine Ground Raw Pigment.

With light raw oil - Ridgeway's 5 k, Morocco Red.
With water - Ridgeway's 5 , between Morocco Red and Claret Brown.

Colour of Fine Ground Roasted Pigment.

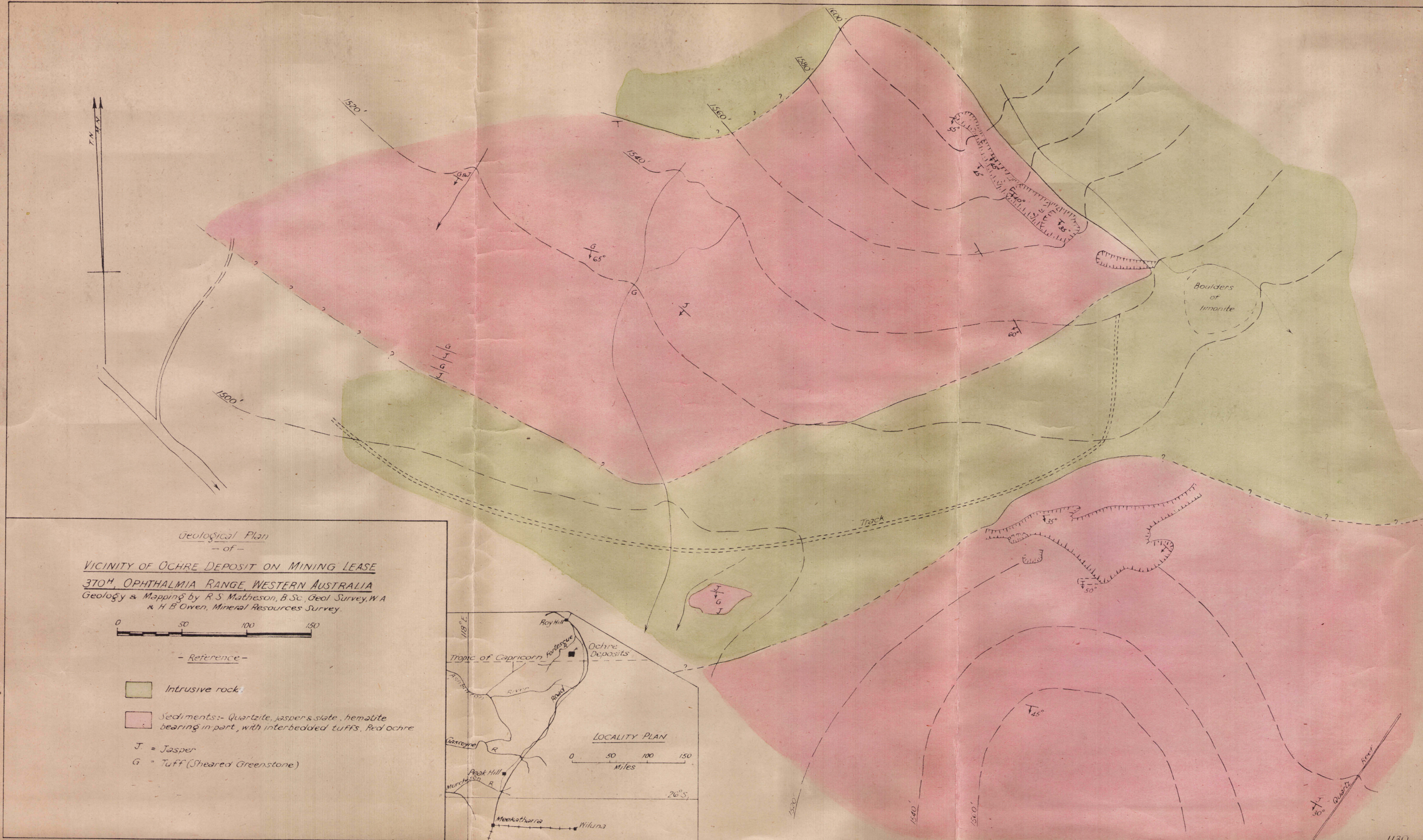
With light raw oil - Ridgeway's 5 , between Morocco Red and Claret Brown
With water - Ridgeway's 5" , between Haematite Red and Prussian Red.

Body and Covering Capacity.

The raw and roasted pigments have a very dense body both in oil and water, and spread well giving an opaque covering.

Conclusion.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. The oil paint prepared from the roasted pigment is of darker colour. The distemper formed by grinding in water is very bright of good red colour and very dense. The distemper from the roasting pigment is much duller.



Geological Plan
- of -

VICINITY OF OCHRE DEPOSIT ON MINING LEASE

370H, OPHTHALMIA RANGE, WESTERN AUSTRALIA

Geology & Mapping by R.S. Matheson, B.Sc., Geol. Survey, W.A.
& H.B. Owen, Mineral Resources Survey.



- Reference -

Intrusive rocks

Sediments:- Quartzite, Jasper & slate, hematite bearing in part, with interbedded tuffs. Red ochre

J = Jasper

G = Tuff (Sheared Greenstone)

