DEPARTMENT OF MINES
SOUTH AUSTRALIA

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# PRELIMINARY REPORT ON WHITE CLAY DEPOSIT

## Mineral Claims 5071, 5072, Hesso Station County Manchester

- J&M. Spiers -

by

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## ABSTRACT

Laboratory testing of samples from dam and lake bank exposures has shown the clay to be a high quality plastic type suitable for use in whiteware manufacture.

Exposures are limited and a programme of exploratory mapping and drilling is recommended to select a quarry site.

The clay samples contain fine silica which cannot be removed by beneficiation and washing was necessary to remove salt.

Representative samples are required to determine the uniformity of the deposit in respect to silica and the salt content of the clay at depth.

## INTRODUCTION

White clay was exposed by Mr. Spiers during dam sinking operations on Hesso Station.

Preliminary testing, by the Australian Mineral Development Laboratories (AMDEL), of a sample submitted by Mr. Spiers showed the clay to be a ball clay of exceptionally high quality. (AMDEL report C.E. 2220/66 - unpublished).

Mineral claims 5071, 5072 were pegged by J. &M. Spiers on 14th August, 1966 and a geological survey of the deposit was requested in a letter, dated 24th August, 1966, to the Director of Mines.

On 31st August, 1966, the deposit was inspected by D.F. Holloway, Ceramics Section, AMDEL, R.K. Tarvydas, Geologist and

the author. A preliminary plane table survey of the claims was carried out by Tarvydas and the author and further samples were taken by Holloway.

During the inspection, white clay was found both in the floor and in low cliffs surrounding a lake, situated ¼ mile north of the dam excavation.

The lake area offered prospects of large tonnages of clay under considerably less overburden than at the dam but this advantage was offset by the probability of a much higher salt content in the lake bed clay. Samples were taken from the lake area.

Proving of reserves has been held in abeyance until the samples taken were evaluated by AMDEL.

Progress Report No. 2 on "Evaluation of South Australian Clays" was prepared by the Ceramics Section of AMDEL on 24th November, 1966, and as expected the results indicated that the clay at the dam excavation was superior in quality to that sampled at the lake.

Proposals for proving reserves and overburden are discussed in this report.

## PREVIOUS REPORTS

Gaskin and Samson (1951) investigated the ceramic properties of white clay samples taken from dams in the vicinity of Nesse Siding. Testing showed the clay to be a high grade plastic variety comparable to that being won from a deposit at Boocalla, 30 miles to the north.

## LOCATION AND MINERAL TENURE

Nesse is a siding located approximately 30 miles north-

west of Ft. Augusta on the Ft. Augusta-Kalgoorlie standard gauge railway. The main road from Ft. Augusta to Woomera is adjacent to the siding. This is a loose surface graded road which is passable to all types of road traffic except after heavy rains.

The pastoral property surrounding the siding, Nesso Station, is owned by the Spiers family. The homestead is situated 2 miles northwest of the railway siding and the dam excavation in which the clay occurs, lies ¼ mile north of the homestead.

The property comprises leasehold land on which minerals are reserved to the Crown.

## GEOLOGICAL SETTING

Nesso Station is located on the Augusta 1:250,000 map sheet and although this has not been covered by systematic geological mapping, the regional setting is known from work in adjacent areas.

Sedimentary rocks of the Precambrian Adelaide System underlie the area. On the adjoining Torrens and Andamooka 1:250,000 geological map sheets, Johns et. al. (1964, 1966) have defined the following sequence (in descending stratigraphic order)

TAPLOW HILL FORMATION

Arcoona Quartzite Member - red-brown cross bedded quartzite and sandstone.

Un-named - shaly sandstone, flaggy siltstone and shale, dolomite.

Woomera Shale Member - finely laminated purple, red-brown and green shale.

MIRANTY GAP - torrent bedded grit, arkosic sandstone, quartzite and conglomerate.

In the Ft. Augusta area, Thompson (1965) defined a type

section at South Tent Hill (15 miles N.W. of Pt. Augusta) in descending stratigraphic order as follows

TENT HILL FORMATION

Simmens Quartzite Member - quartzite and sandstone

Corraberra Sandstone Member - sandstone, interbedded shale and siltstone.

TREGOLANA SHALE - laminated chocolate-green shale with interbedded thin sandstone. 100' thick at the type section.

Thompson (op.cit) and Coats (1965) correlate the Arcoona and Simmens Quartzites and the Woomera and Tregolana Shales.

North of Pt. Augusta and south of the Arcoona Platform the main road and railway run through generally flat but at times undulating country which is underlain by the Tregolana and Woomera Shales and the Pernatty Grit. These sediments are flat lying on a regional scale but local areas of accentuated folding and small scale puckering have been observed.

Prominent mesas and minor tablelands which flank the Mango Area to the east and west are capped by the Arcoona Quartzite Member.

Intense leaching of the basement sequence in the Tertiary Period converted the dark coloured shale to white and pale grey and yellow claystones. Siliceous duricrust also developed at this time and forms a hard resistant capping to the present day mesas and tablelands.

Several clay deposits are known to occur in the leached profile of the stratigraphically equivalent Woomera and Tregolana Shales. These are the Woodhills, Summan, Paul and Gordon's and Tregolana deposits.

## THE CLAY DEPOSIT

Plan 67-1 accompanying this report shows the two areas which were sampled.

The dam excavation and sample locations are shown in detail on plan 67-1. Both excavations were filled with water at the time of the inspection and white clay was exposed for a few feet above water level in each. The excavations are reported to be 10 feet deep and in white clay to the full depth.

A 50 feet wide band of brown stained clay outcrops on opposite banks of the upstream excavation.

No bedding is visible in the cutting faces, but it is likely that the brown band referred to above represents a stained bed in the sequence.

Up to 10 feet of overburden was removed during the excavation of the dam. On the north bank this consisted principally of red drift sand and on the south bank, transported stoney soil.

Veins of coarsely crystalline gypsum occur in the clay in the portion visible above water level,and chemical analyses (shown in full in Appendix 1) indicate a high salt content.

At the lake ½ mile north of the dam, a band of white clay is exposed in the sides of a peninsula extending from the northern bank of the lake. Here bedding dips at a low angle to the northwest and the clay is overlain by clayey fine grained sandstone. White clay was also exposed in a shallow hole dug in the lake floor.

Overburden on the peninsula is approximately 6 feet thick and consists of red drift sand lying on a few feet of siliceous duricrust and underlain by gypsiferous clay.

Mineral claims 5071 and 5072 were pegged to cover the ground surrounding the dam excavation . In the southwestern

corner of claim 5071, partially indurated claystone is exposed in drainage gutters to the main creek and it is likely thatq overburden will be at a minimum here. These conditions pertain southwesterly beyond the claim boundary. Mineral claim 5072 lies downstream of the dam; the surface is covered entirely by red drift sand and light scrub.

White sediments are visible in erosion gullies on the edge of a low plateau to the west of the claims and lake. These require detailed examination.

## CERAMIC TESTING

The more exhaustive testing of the samples taken during the preliminary inspection confirmed the high quality of the clay indicated by the original tests.

The AMDEL report will be reproduced in full in a later report but the discussion of results is quoted below:

"Hesso Deposit

All the samples are high in quartz, but the proportion does not vary greatly from sample to sample, except for Sample 1928, in which the exceptionally high quartz content has caused cracking in the fired specimens. This quartz in finely divided and therefore not likely to be removed by physical methods of beneficiation. The presence of fine quartz does not preclude the use of the material as a ball clay, provided the quartz content is reasonably constant. Samples 1927-1929 have a high salt content, and accordingly show extensive salt glazing and blistering on firing above 1100°C. This effect is only slight in Samples 1930 and 1931, which contain much less salt. The

samples begin to vitrify at about 1100°C, owing to the appreciable illite content. The colour of the fired specimens, while not good, is sufficiently light at 1100°C to permit the use of this material in white ware.

The most promising localities for further examination of this deposit are the dam sites represented by samples 1930 and 1931, which are relatively low in salt. Samples 1927 and 1929, from the lake island, contain much more salt, but are otherwise similar to Samples 1930 and 1931, and if washed should give a useable clay. Sample 1928, taken from just below the surface of the lake bed, is evidently contaminated, and contains too much free silica to be useable. Drilling of this deposit, particularly at the dam sites, might reveal material of higher grade. The value of the deposit would be considerably increased if clay could be located having a soluble salt content low enough to obviate washing."

From this, exploration should be directed towards

1) determining the range of variation of the finely divided quart to show whether a uniform feed can be maintained from a quarry.
2) investigating the salt content of the clay at depth and in relation to surface drainage lines.

## SUMMARY AND CONCLUSIONS

White clay at Hesso has been derived from dark coloured Precambrian shales by intense leachingin the Tertiary Period.

Sampling has shown that high quality plastic clay occurs at widely separated locations. However, clayey sandstone has also been observed in the lake area. Dune sand and stoney soil blanket most of the surface and it cannot be assumed that white clay

underlies all of the area.

The overburden varies both in type, from sand and stoney soil to siliceous duricrust, as well as in thickness. The claims were pegged to secure the ground around the dam excavation and the preliminary investigation has shown that this may not be the best site for quarrying.

Laboratory investigation has shown that the clay contains a proportion of finely divided quartz which cannot be removed by beneficiation. Although good quality white ware has been made from the samples collected, commercial production will depend upon a uniform product, in respect to silica, being available.

The samples tested to date are all from near the surface and required washing to remove salt. Processing plant design will depend on the salt content of the clay at depth from where the bulk of the raw materials will be won.

Further exploration of the deposit is recommended.

## RECOMMENDATIONS

Two phases of exploration are required to evaluate the deposit for commercial operation.

1. Reconnaissance mapping and preliminary scout drilling to determine the aerial extent of the clay and variations in overburden thickness.

2. Pattern drilling of a selected site to prove the depth of clay and to provide samples for determination of silica and salt content.

Siting of drill holes will be influenced by results as the exploration programme proceeds, but in general terms the following drilling footage is specified.

Phase 1. - scout drilling. 50 holes of 20 feet each. Total 1,000'.

Phase 2. - pattern drilling, initially on a 200 feet grid. 12 holes to 50 feet, if all in clay, will prove 300,000 cubic yards of clay.

The exploratory programme should be conducted under close geological supervision.

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MNH:CM
9.1.1967

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## APPENDIX I

### Chemical Analyses of Hesse Clay

| | 1. | 2. | 3. |
|---|---|---|---|
| $SiO_2$ | 59.70 | 64.1 | 65.4 |
| $Al_2O_3$ | 23.65 | 22.6 | 22.5 |
| $Fe_2O_3$ | 0.91 | 0.45 | 0.64 |
| FeO | - | 0.15 | 0.17 |
| MgO | 0.40 | 0.67 | 0.90 |
| CaO | Nil | 0.07 | 0.20 |
| MnO | - | 0.01 | 0.01 |
| $Na_2O$ | 0.51 | 1.13 | 0.39 |
| $K_2O$ | 1.24 | 1.38 | 1.55 |
| $TiO_2$ | 0.85 | 0.84 | 0.87 |
| $SO_3$ | 0.16 | 0.28 | 0.14 |
| Cl | 0.70 | 1.23 | 0.25 |
| $CO_2$ | - | 0.36 | 0.35 |
| $H_2O^+$ | 6.93 | 7.15 | 6.45 |
| $H_2O^-$ | 5.53 | - | - |
| TOTAL | 101.58 | 100.42 | 99.82 |

1. Analysis in Gaskin and Samson Bulletin 28.
2. Sample 1929. Lake area. Northern arm 6' face.
3. Sample 1931. S.E. corner large dam. M.C. 5071.

LEGEND

Survey station △
Claim peg □
Reduced level (arbitrary) 92

Claim peg approx. position

Silicified white clay in gutters

Red sand

Dune crest

Red sand

Levelled bench

Water level RL 78

Sample CE 1931

Sample CE 1930

Brown Water Level Standing RL 76

White clay Dosco spoil Area

CREEK

MC 5071

MC 5072

DRAIN

Old Woolshed Dam

Sample C.E. 1930

Sample C.E. 1930

White Clay

Sample C.E. 1931

DAM EXCAVATION Samples C.E. 1930 1931

HESSO No. 2

No. 1 DAM

ROAD TO WOOMERA

HESSO SIDING

MAIN

To Pt. Augusta

LEGEND

Main road
Railway
Track
Creek
Erosional breakaway

LOCALITY PLAN

Scale : approx 1 inch to 60 chain

DEPARTMENT OF MINES — SOUTH AUSTRALIA

# WHITE CLAY DEPOSIT HESSO STATION

MINERAL CLAIMS 5071, 5072. PRELIMINARY PLAN

| | | | |
|---|---|---|---|
| Plane table survey by M.N. Hiern and R.K. Torrydae | | Drn. M.N.H | SCALE: 1 inch = 100 feet |
| | | Tcd. J.E. | 67 - 1 Eb |
| Director of Mines | | Chd. | |
| | | Exd. | DATE: 5-1-67 |