Rept.Bk.No. 69/57
G.S. No. 4312

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

MINERAL RESOURCES DIVISION

RECONNAISSANCE SURVEY FOR ROADMETAL

Hds. Gregory, Telowie, Willowie, Wongyarra, Co. Frome

- District Council of Port Germein -

by

R. TARVYDAS
GEOLOGIST
NON-METALLIC SECTION

D.M.1505/69

2nd September, 1969

DEPARTMENT OF MINES
SOUTH AUSTRALIA

RECONNAISSANCE SURVEY FOR ROADMETAL

Hds. Gregory, Telowie, Wongyarra, Willowie, Co. Frome

- District Council of Port Germein -

by

R.K. TARVYDAS
GEOLOGIST
NON-METALLIC SECTION

CONTENTS

FIGURE

Rept.Bk.No. 69/57
G.S. No. 4312
DM. No. 1505/65

2nd. September, 1969

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No. 69/57
G.S. No. 4312
D.N. No. 1505/65

RECONNAISSANCE SURVEY FOR ROADMETAL

Hds. Gregory, Telowie, Wongyarra, Willowie, Co. Frome

- District Council of Port Germein -

ABSTRACT

New sources of roadmetal were sought in three areas of the Council district on a basis of regional stratigraphy and structure. On the Willowie Plains, lime-cemented Telford Gravel forms an excellent road surface, and several new sources of this material have been located but require subsurface testing. Along the Survey Road siltstones of the Willochra Formation may provide additional sources. In the Telowie area, potential sources were found in dolomitic slates (Skillogalee Dolomite) at the entrance to Back Creek (Pt. Germein) Gorge and in lime-cemented gravels (Telford Gravel) and sandstones (Rhynie Sandstone) located along the face of the Flinders Ranges to the south of the Gorge.

INTRODUCTION

In the past few years, the District Council of Port Germein has experienced considerable difficulty in finding new sources of road-making materials for unsealed roads. Several pits have been opened recently but the materials have not proved entirely satisfactory. New pits are required in some areas to reduce haulage costs.

The Department of Mines was approached for assistance in a letter from the District Clerk, dated 1st October, 1965. M.N. Hiern, then District Geologist at Port Pirie, spent three days in the field in October, 1965, and the present author continued the survey from 20th to 21st January and 28th January to 6th February, 1969. Existing pits were inspected with the Overseer and then, exposures such as watercourses, roadcuts, well-cuttings and dams within the required area were examined.

The roads requiring surfacing fall into three regions:

1. Willowie Plains - bounded by the Main North Road, the Melrose-Orroroo Road, and the northern District boundary.
2. The Survey Road from Melrose to the Back Creek (Port Germein) Gorge Road.
3. Telowie Plains - bounded by the Back Creek Gorge Road, the Flinders Ranges, the southern District boundary, and Highway No.1.

REGIONAL GEOLOGY

The areas investigated over the southwestern portion of the ORROROO 1:250,000 Geological Map Sheet, and the northwestern portion of the BURRA 1:250,000 Geological Map Sheet. Plan 69-214 accompanying this report has been compiled from these maps.

The Council district is dominated by the northerly trending Southern Flinders Ranges, together with lesser ranges towards the east and south. Between the two ranges is the Willochra Basin, of which the Willowie Plains portion is within the district. To the west of the main ranges, which may be traversed via the Back Creek Gorge Road, is the coastal plain adjacent to Spencer Gulf.

Basement rocks in the area of investigation are quartzites, sandstones, siltstones, slates, dolomites, tillites, minor intrusives and minor diapiric breccias equated in the Adelaide System of rocks. Most of these were laid down as sediments some 600-800 million years ago in an extensive trough. Later, due to compressive forces acting on the trough, the sediments were everted into mountain ranges, a part of which survive as the Flinders Ranges. These and later earth movements threw the sediments of the Adelaide System into a series of parallel folds whose axes today trend in an approximately northerly direction.

The boulders and cobbles flanking the ranges give way to the relatively young, unconsolidated, mostly fine-grained alluvium of the plains. Rare terraces, some 10-20 feet above the plains, are composed of lime-cemented gravels (Telford Gravels).

ECONOMIC GEOLOGY

General

For unsealed roads, material having the following properties is preferred:

1. It should have a coarse and a fine fraction so that the fines bind the coarse fragments.
2. The material should be easily quarried with a medium-sized bulldozer.
3. The coarse fraction should be sufficiently hard to withstand break-up in service but without sharp edges to cause undue wear on tyres.
4. Overburden over the deposits should be thin as possible.

The materials on the roads in the District so far include clayey siltstones, siliceous siltstones mixed with clay, and lime-cemented gravels. (See plates 1, 2, 4, 5). The latter have proved the most satisfactory in service, setting to a hard mass which is stable in all weather.

Roads with the clayey siltstones are satisfactory for summer use, but tend to float during winter. The siliceous siltstones are more stable; they are relatively easy to work and break up into small, angular fragments, which, however, need a binding material, which is sometimes present as a plastic grey clay in the top few feet of a deposit. The rock formations shown on the accompanying plan 69-214 are discussed below.

Suitability of Rock Units for Road Making

Plains Alluvium - Clays, silts, fine sands, rare gravles; near-surface lime-horizon present, but nowhere seen associated with gravels; unsuitable because of insufficient coarse fraction and poor binding ability.

Low-angle slope-deposits - Gravels, silts, sands and clays; only in a few places are the gravels lime-cemented and thus suitable for road-making.

High-angle slope-deposits - Gravels and boulders underlain by clay, flanking the edges of the main ranges; unsuitable for use as roadmetal because the coarse fraction is too large, and there is no binding material.

Telford Gravel - Hard pebbles of quartzite, sandstone, siltstone and slate in a matrix of lime; capped by calcrete (limestone deposited in soil); material excellent if the right proportion of lime and pebbles is present; pit operating on Section 79S Hundred of Willowie.

A.B.C. Quartzite - White quartzite with interbedded red-brown and grey-green siltstones near base of the formation; quarried from Mt. Ferguson by the Council, and reported to be satisfactory.

Brachina Formation - Reddish-brown, well-laminated, moderately hard siltstone, with interbeds of hard sandstone; appears too hard for use as road-metal.

Willochra Formation

1. Upper: Clayey silstone, sandy in places; light brown to off-white when weathered, pale purplish grey when less weathered; not seen unweathered; existing pit on Section 273, Hd. Wongyarra is too weathered and clayey; prospects at other places are discussed in a later section.
2. Lower: Flaggy, laminated, red-brown, well jointed siltstone; a little hard on tyres, but satisfactory if mixed with clay or lime; a siltstone-clay mixture occurs near the surface in the vicinity of small-scale folds at the Council quarry on Survey Road, adjacent to Part Section 100, Hd. Wongyarra.

Tapley Hill Formation - Well laminated blue-grey to grey-green siltstone, in some places calcreted near the surface and in the joints. Rock with calcrete in joints and on top of it isquarried from a Council quarry at Murraytown, and is satisfactory. In other areas the same rock appears unsatisfactory, because it is either too hard and unjointed, or too soft with little cohesion.

Apilla Tillite - Massive boulder tillite with interbedded siltstones and sandstones; not inspected because of unfavourable position in relation to requirements; considered unsatisfactory in Orroroo Council area (Hiern, 1964).

Saddleworth Formation Equivalent - Grey, green-grey laminated siltstone and dolomite; not inspected because of unfavourable position.

Undalya Quartzite - Pale grey, medium-grained to coarse-grained felds-pathic quartzite with minor siltstone and dolomite; not inspected because of unfavourable position.

Skillogalee Dolomite - Grey slate, grey to cream dolomite, minor quartzite; Council quarry in Back Creek Gorge (Section 246 or 247, Hd. Wongyarra) probably inthis formation, providing a satisfactory mixture of carbonaceous ?dolomitic shale, arkosic sandstone and soft, porous, dolomite.

Rhynie Sandstone - Pink, medium-grained feldspathic sandstone with minor siltstone; unsatisfactory because of resistance to weathering.

Diapiric Breccia - Rafts of siltstone, sandstone and dolomites in carbonate matrix; material examined at the Melrose Copper Mine is too micaceous and soft, powdering easily.

POSSIBLE NEW QUARRY-SITES

Several potential sites found during the survey are discussed below. Site locations are shown on the accompanying plan. Bulldozing of test pits is recommended at all sites to enable a full evaluation of the material to be made.

A. Willowie Plains

Locality 1 Section 185, Hd. Willowie. About 6 ft. of calcrete nodules and clay are exposed in the southern bank of the stream, about 10 chains downstream from the road; this material may be suitable, although pebbles of basement rocks are lacking.

Towards the northwestern corner of the Section a terrace some 200ft. x 800 ft. rises about 10 ft. above the surrounding flood-plain. It is possible that it is underlain by Telford Gravel which elsewhere provides a satisfactory road material.

Locality 2 Section 93, Hd. Willowie. A disused pit in calcrete and gravel, on top of a rise in the northeastern corner of the Section, adjacent to the road; similar material probably exists in an area mapped as Telford Gravel, on the opposite side of the road, in Sections 92 and 107.

Locality 3 Section 101S, Hd. Willowie. A pit between the road and the fence of Section 184 contains in part suitable lime-cemented gravel; the gravel probably extends westward into Section 101S, where it should be explored by scout-boring or bulldozing. A former pit near the house-ruins on Section 184 appears to be exhausted of good material. (Plate 1).

Locality 4 Section 79S, Hd. Willowie. The Council is at present working a pit in Telford Gravel on this section, the gravel being to 5ft. thick and overlying pale green clay. (Plate 2.) Material with the right combination of pebbles and lime is almost exhausted. The occurrence of more suitable material within the area of Telford Gravel shown on the map is likely. It is recommended that scout-boring or bulldozing be carried out to the north of the gully in Section 73, especially on

high ground containing calcrete (limestone) float. The ridge of high ground on the opposite side of the road on Section 78 is also worth exploring.

Locality 5 Section 54, Hd. Willowie. Streambanks in the vicinity of a water-bore reveal gravels cemented with lime at various places; overburden is to 5 ft. thick in places, but not necessarily over the lime-cemented parts. Selective working may provide suitable material.

Locality 6 Section 358, Hd. Gregory. A lime-cemented gravel was located in a railway cutting below an overburden of up to 3ft. of sand and loose gravel. The cemented gravel has rounded pebbles of hard basement rocks, ¼" to 3" across. This is a promising locality and the high country to the east of this point should be scout-bored.

Alluvium in the bed of the stream running through the southeastern corner of the Section contains calcrete (limestone) nodules, but no basement pebbles. Scout-boring in this part of the Section may prove beneficial.

Locality 7 Section 74, Hd. Gregory. About 1ft. of solid calcrete (limestone) is developed over sand, as exposed in a disused dam. There is a possibility that the limestone extends for a limited distance towards the ranges where it may be developed in the gravel fans flanking the ranges.

Locality 8 Section 30, Hd. Willowie. Calcrete and lime-cemented quartzite pebbles are scattered on a sandy surface in scrub, near the southern boundary of the Section. Dams in the area reveal calcrete pebbles in sand.

Locality 9 Section 114, Hd. Booleroo. Roadcut through the scarp of a terrace, exposing gravel, part of which is lime-cemented. This is a continuation of the deposit at the former Council pit near the cross-roads, some 30 chains to the southeast. Costeaning of the scarp towards the south of the roadcut may reveal suitable material (Plates 3 and 4)

B. Survey Road

Locality 10 Pt. Section 100, Hd. Wongyarra (Melrose Copper Mine). The mullock surrounding the shafts and adits consists of grey, laminated siltstones and a very weathered crystalline, bluish micaceous rock, which powders easily. The material is considered unsatisfactory because of its

softness and apparent lack of binding material.

Locality 11 Part Section 100, Hd. Wongyarra. Saddle immediately east of the road is developed over calcrete on the southern side and over Lower Willochra Formation siltstone on the northern side. (Plate 6). A combination of the highly jointed, moderately hard siltstone and lime in the right proportions gives satisfactory results.

Across the stream in the next saddle to the south a similar situation probably exists also. A costean on the southern side of this saddle shows weathered siltstone overlain by about 5 feet of calcrete limestone which appears too soft. A little to the north on the same saddle the ground may contain less calcrete, and therefore, be more acceptable,

Between the two saddles there is probably again a similar situation i.e., thick limestone occuring on the southern side and lime-free bedrock on the northern side. The right combination of calcrete and bedrock exists probably only over a relatively small area. Where the right combination does not exist naturally, it may be necessary to mix the two ingredients to provide the correct consistency.

Locality 12 Section 372, Hd. Wongyarra. A hillside about ¼ mile from the road shows outcrops of a soft, light brown, fractured, clayey siltstone of the Upper Willochra Formation. The extent of formation in this area is great relative to the immediate needs. Overburden is of the order of 1ft., but a further 1 foot or so of the siltstone near the surface may have to be discarded also as it appears to be very clayey.

Locality 13 Section 387, Hd. Wongyarra. In a roadcut on the Rosslyn-Murraytown Road stretching over the whole of the Section there are exposures of siltstone similar to that on Section 372, (Locality 12). About the same hardness as at locality 12, the rock hardens around the middle of the exposure. The site would be best worked into the hill, i.e, in a sourtherly direction.

Localities 14 and 14a. Section 363, Hd. Wongyarra. This area was not visited, but geologically it seems promising because it is the site of a fold in the Lower Willochra Formtion, i.e. the reddish siltstone could be fractured and may even contain clay similar to that at the Council Pit on Section Pt. 100, Hd. Wongyarra, as shown on Plate 5. This area may have to be explored if the material on Section 387, Hd. Wongyarra,

proves unsuitable.

C. Telowie Plains

Locality 15 Back Creek (Port Germein) Gorge.

At the entrance to the gorge near-vertical beds of well jointed blue-grey dolomitic slate crop out in steep stream walls. Although, the rock varies in hardness, selective quarrying may produce suitable material.

On section A, Hd. Telowie, immediately north of the entrance to the gorge, localised erosion of the flanks of the ranges has exposed sandstone, argillite, and slate similar to the dolomitic slate in the gorge. In parts the slate appears to be sufficiently soft for road use. Overburden is about 1 foot thick.

Some 10 chains to the north, in Section B, Hd. Baroota, creek-banks are cut in the same slate as on Section A, Hd. Telowie; in the southern bank, the slate has lime-cemented joints near the surface.

Locality 16 Section 337, Hd. Telowie.

The lower sandstone-slopes of the main ranges in the vicinity of this Section are in places capped with about 1 ft. of calcrete which also penetrates joints of the sandstone. A pit, probably in Section 438, produces calcreted sandstone blocks 1 to 6in. across, to a maximum depth of about 3ft.

Whyte Track, a fire-fighters' track starting in the southeastern part of the Section, reveals 1-2ft. of calcrete and lime-impregnated sandstone for a distance of some 200ft. Calcrete also crops out in the southern bank of the watercourse immediately north of Whyte Track. The spur on the northern side of this watercourse is grass-covered, but should be investigated by scout-boring or bulldozing as the sloping site would be easy to work.

Locality 17 Section 208, Hd. Telowie.

A pit formerly worked for the Morgan-Whyalla Pipeline in the northern part of this Section contains pebbly limestone at least 3ft. thick; the pit may have extensions.

Locality 18. Section 16N, Hd. Telowie.

The southern stream-bank near the boundary with Section E has at the surface about 3 ft. of soft, powdery calcrete, which contains about

30% quartzite pebbles and boulders. Similar material is revealed in a costean on the northern side of the stream, about 10 chains up the section-boundary fence. This material by itself has too much lime, but mixed with loose river-gravel should make a good combination.

Locality 19 Section 16S, Hd. Telowie.

A bank at the junction of two watercourses in the southeastern part of the section provided material for the maintenance-track of the Morgan-Whyalla Pipeline. At this locality about 1ft. of calcrete is underlain by about 2ft. of red-brown sand; under this is another 2ft. of two-to-eight-inch lime-cemented pebbles and boulders of quartzite Below the above there is about 2ft. of ¼ to ½ in. bedrock-pebbles in sand the pebbly material, mixed with lime, say from Section 16S, may prove satisfactory.

SUMMARY AND CONCLUSIONS

1. The District Council of Port Germein needs new sources of road-metal in the following areas:

   (a) Willowie Plains, northward of the Melrose-Orroroo Road.

   (b) Vicinity of the Survey Road.

   (c) Telowie Plains.

2. The material needs to have the right proportion and size of coarse fraction, accompanied by a binding agent; it should be quarriable by a medium-sized bull-dozer.

3. Examination of existing pits showed the following materials to be suitable for road construction: hard and fractured or clayey siltstones, lime-cemented gravels, lime-cemented soft sandstones. These materials have been correlated with the rock-stratigraphic units as established by regional mappin and the reconnaissance prospecting was carried out on this basis.

4. On the whole, prospects of finding large deposits of suitable materi are not good, but the following sections should be examined; at localities described in the text.

   Sections 79S, 101S, 18S, Hd. Willowie.

Sections 358, Hd. Gregory.

Sections 372, 387, Hd. Wongyarra.

Sections A, 168, Hd. Telowie.

5. In the Willowie Plains area scout-boring or bulldozing will be necessary to prove deposits of suitable material.

R. Tarvydas

RT:JKD
2.9.1969

R. TARVYDAS
GEOLOGIST
NON-METALLIC MINERALS SECTION

REFERENCE

HIERN, M.N. 1965. Report on Survey of Roadmetal Deposits, Portion of County Dalhousie. Unpublished report, S.A. Department of Mines; Rept.Bk.No. 55/139.

Plate 1. (D.M. Photo No. 19333)

Pit in Telford Gravel, between road and Section 184, Hd. Willowie. Pebbles of quartzite and argillite, usually ½ to 2 in. across (maximum 5 in. across) are in a matrix of limestone.

Plate 2. (D.M.Photo No.19334)

Face in Council Pit, Section 79S, Hd. Willowie.

0-1ft. Hard calcrete.
1-3ft. Lime-enveloped pebbles of hard, basement rocks and calcrete nodules, all about ½ in. across, in matrix of lime.
3-5ft. Pebbles of hard basement rocks to 2 in. across, only partly lime-enveloped; Matrix red, calcareous clay.
5ft. Pale grey clay.

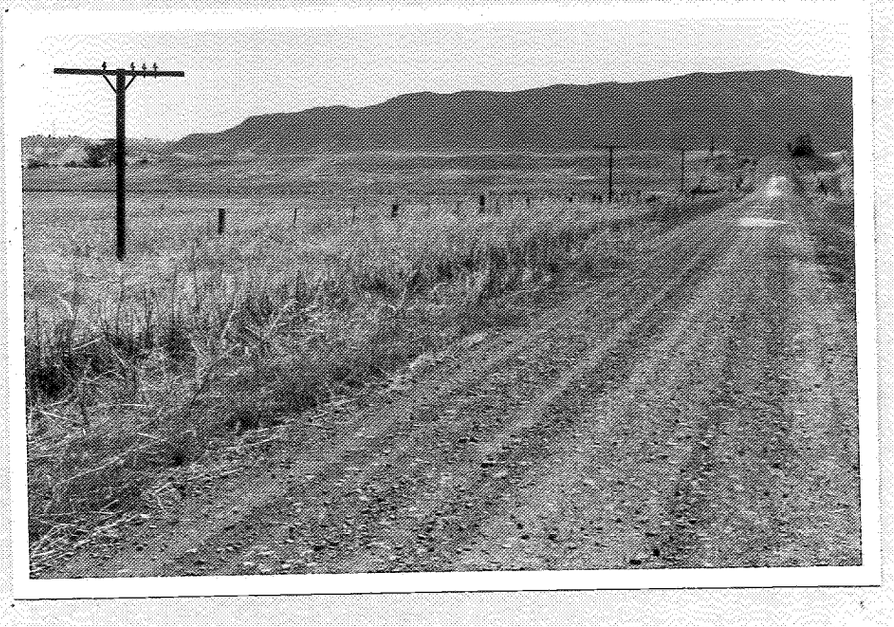


Plate 3. Scarp developed in Telford Gravel over Section 1, Hd. Willowie and Section 114, Hd. Booleroo. View looking west towards Melrose. (D.M. Photo No. 19331).

Plate 4. Southern face of roadcut shown in Plate 3.. Most of the rounded masses are calcrete nodules to 1 in. across; some are lime-enveloped basement pebbles up to 3 in. across. (D.M. Photo No. 19330.)

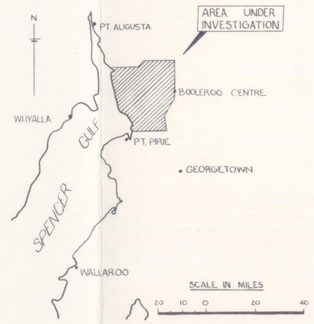
Plate 5. Face in Council pit, Pt. Sec. 100, Hd. Wongyarra adjacent to road, Small-scale folds in weathered fractured reddish siltstone of the Lower Willochra Formation. These folds are often associated with clay, ('crumb' material of photo). (D.M. Photo No. 19325).

Plate 6. Looking southeasterly of Council Pit, Pt. Sec. 100, Hd. Wongyarra (to the east of Survey Road). Treeless parts of saddles on right of photo are underlain by about 5 ft. of soft calcrete, which lies over weathered siltstone of the Lower Willochra Formation. On opposite sides of saddles (scattered trees) the same siltstone occurs within 1 ft. of the surface. Note costean in calcrete in the middle right of photo. (D.M. Photo No. 19326)

T.N.

SCALE

MILES 2 1 ½ 0 2 4 6 8 10 MILES



LOCALITY PLAN

LEGEND

- MODERN COASTAL DEPOSITS: gravels, sands, coastal dunes; swamp-deposits; lagoon deposits.
- PLAINS ALLUVIUM: clays, silts, fine sands, rare gravels.
- LOW-ANGLE SLOPE-DEPOSITS: gravels, sands, silts and clays.
- HIGH-ANGLE SLOPE-DEPOSITS: gravels and boulders over clay.
- MOLINEAUX SAND: fixed siliceous aeolian sand-sheets and sief-dune fields.
- TELFORD GRAVEL: gravels pebbles of basement quartzites, sandstones, siltstones and slates in a lime matrix; calcrete-capped.
- A. A.B.C. RANGE QUARTZITE: white quartzite with interbedded siltstones near base.
- BRACHINA FORMATION: reddish, well laminated siltstone with interbeds of sandstone.
- UPPER WILLOCHRA FORMATION: buff-weathering clayey siltstone, sandy in places.
- LOWER WILLOCHRA FORMATION: flaggy, laminated, well jointed, red brown siltstone.
- TAPLEY HILL FORMATION: well laminated blue-grey to grey-green siltstone.
- APILLA TILLITE: massive boulder-tillite with interbedded siltstones and sandstones.
- BELAIR SUBGROUP: green-grey laminated siltstone; pale grey, partly laminated quartzites.
- SADDLEWORTH FORMATION EQUIVALENT: grey, greenish grey, laminated siltstone and dolomite.
- M. MINBURRA QUARTZITE: pale grey to brownish cross-bedded quartzite.
- C. CRADDOCK QUARTZITE: pale grey, clayey and feldspathic quartzite with siltstone and silty dolomite.
- U. UNDALYA QUARTZITE: pale grey, medium-to coarse-grained feldspathic quartzite with minor siltstone and dolomite.
- SKILLOGALEE DOLOMITE: grey dolomitic slate, grey to cream dolomite, minor quartzite.
- R. RHYNIE SANDSTONE: pinkish, medium-grained feldspathic sandstone with minor siltstone.
- DIAPIRIC BRECCIA: in carbonate matrix; rafts of siltstones, sandstones, dolomites

- Sealed Road
- Unsealed Road
- Railway Track
- Watercourse
- Geological Boundary
- Fault
- •9 Road-Metal Prospect referred to in report RB

Geology from Orroroo, Burra and Port Augusta 1:250,000 published map sheets.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ROAD – METAL PROSPECTS
PORTION OF COUNTY FROME
DISTRICT COUNCIL OF PORT GERMEIN

NON – METALLICS MINERALS SECTION	GEOLOGIST	Tra. R.T.	SCALE: 1INCH — 2 MILES
		Ted. A.R.	69-214 Fh
		Ckd. L.V.W.	
Director of Mines	SUP. GEOLOGIST	Ead.	DATE: 22nd APRIL 1969