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Rock and gravel resources of King Island — a supplementary report

by C. R. Calver

Summary

Three important sources of construction material on King Island will be closed in the near future. Gravel suitable for road construction, including road sealing, will continue to be available from the Grassy mine dump, but alkali reactivity testing needs to be undertaken to determine the suitability of this material for concrete aggregate.

Possible sites to replace the Pearshape pit in the south of the island are widespread. Acid drainage problems associated with quarrying in the Proterozoic sedimentary rocks would probably be lessened in sites with some degree of topographic relief. There are numerous such potential sites in the southeast (Naracoopa–Grassy area).

A new pit at Counsel Hill could satisfy road construction demand in the north of the island. Alternatively, weathered granite similar to that at the Reekara pit underlies most of the flat land around Reekara, and an alternative site could be found where drainage could be more easily managed, for example in the northwestern part of mining lease application 1663P/M.

There are a number of easily accessible potential hard-rock sources that would be suitable for concrete aggregate and other purposes, occurring in Tertiary basalt, amphibolite, and metasiltstone. Magnetometer traverses over a basalt knoll near Adams Road show that a large volume of rock is present in the form of a vertically extensive, cylindrical intrusion 150 × 250 m in area. Drilling and blasting would probably be necessary in extracting these sources.

Amphibolite near Pegarah is a potential source of dimension stone.

Introduction

The imminent closure of three operations that supply gravel on King Island — at Pearshape, Reekara and Whalebone Beach — has prompted a preliminary examination by Mineral Resources Tasmania of possible alternative sources.

Available information on the rock and gravel (construction material) resources of King Island was collated in an earlier report (Calver, 1998). This was followed up with five days of field investigations in June 1998. This field work, and the final conclusions and recommendations, are documented in this report.

Two of the pits to be closed — at Reekara and Pearshape — supply the bulk of the road-base and unsealed road construction material in the north and south of the island, respectively. Two or three new sources, that are widely distributed so as to minimise transport costs, would be advantageous.

The Reekara pit is in weathered Proterozoic granite, with the Pearshape operation in Proterozoic mudstone and siltstone. The acid drainage problems at these pits appear to result from downward excavation in sulphide-bearing rocks to levels well below the water table, in areas of low relief. Acid drainage in future operations may be avoided by restricting the depths of excavation in similar settings, by siting pits in areas of greater relief, or by quarrying in sulphide-free rock types.

Beach shingle derived from wave reworking of the Grassy mine sea dump has provided most of the material used for road sealing in recent years. The King Island Council has extracted the gravel under a sub-lease arrangement with Norths Limited, the holders of the mining lease over this area. This arrangement is currently being re-negotiated. This material, mostly beach cobbles composed of contact metamorphic rocks and skarn extracted from the abandoned open-cut mine at Grassy, is a useful hard-rock resource that needs no drilling or blasting in extraction. Including the overburden dump on the southwest side of the open cut, many millions of tonnes of material are available. Once crushed this resource is ideal for road sealing, but is not suitable to be used on its own as road base without mixing with

softer material such as that from the Pearshape or Millwood pits (Graham Conolly, personal communication). The presence of sulphide minerals in the Grassy mine waste rock suggests that the material may be unsuitable for use as concrete aggregate. In the past concrete aggregate has been sourced from beach shingle on the island's west coast , but extraction from these deposits is to be phased out by the year 2000. One or more alternative hard-rock sources suitable for concrete aggregate were therefore sought.

Construction material prospects

Proterozoic sedimentary rocks, southeastern King Island

Proterozoic siltstone and mudstone — the rock type quarried at the Pearshape and Millwood pits — makes up most of the southeastern part of King Island (see Figure 1 of Calver, 1998). These rocks crop out poorly in the interior of the island, but can also be seen in road cuts on the Grassy Road south of Pegarah, at the Grassy River Bridge on Grahams Road, and along the Naracoopa foreshore. The rocks are grey, rather soft, weakly cleaved mudstone, interbedded with harder, blocky, lighter-coloured quartz siltstone and fine-grained quartz sandstone. Mudstone is usually predominant, but either mudstone or siltstone may be predominant at any particular locality. The well-jointed, well-bedded and easily breakable nature of the rocks means that they can be excavated without blasting. The commonly pyritic nature of the rocks, particularly the mudstone, is the likely source of the acid drainage problems at Pearshape, with weathering leaching the pyrite out of surface outcrops (and rocks within 3–4 metres of the surface at the Pearshape and Millwood pits).

The main considerations in siting a new pit in this rock type are land availability and proximity to the existing road network. It is suggested that areas with some topographic relief — such as the Millwood pit — be considered, because such areas should have a lower water table and a shorter residence time of groundwater in the near-surface phreatic zone. There are a number of potential sites in the Naracoopa–Millwood area and in the valleys of Yarra Creek and Grassy River. The disused pit opposite the Naracoopa Lodge [252 500 mE, 5 577 700 mN] is too close to existing dwellings, but a disused track extends 100 metres up the valley southwest of the pit and could be extended to a site further up the valley. Potential sites are probably also available in the northeastern part of the State Forest area west of Naracoopa, in the valleys of Poolta and Rafferty Creeks.

A cutting on the Grassy Road near Lymwood [244 500 mE, 5 567 000 mN] occurs at the crest of a gentle hill, and consists of blocky, thick-bedded siltstone-hornfels. A thin section shows this rock to be a fine-grained quartz-biotite-garnet hornfels. Contact metamorphism at this site is not expected, as it is five kilometres from the Grassy granite. The rock type appears to be highly suitable for construction materials including concrete aggregate. The topography is also favourable, but this site is on the main road and is in prime farming land.

Granite, Reekara

Weathered granite from the Reekara pit has provided road base and unsealed road material for northern King Island for many years. The geology and radiometric maps (Figures 1 and 4 of Calver, 1998) suggest that a similar weathered granite profile underlies most of the plains around Reekara, between the North Road and the eastern edge of the sand dunes. In view of the experience at the Reekara pit, drainage management would be a critical consideration in any new operation.

I was shown by Messrs Titford and Helbig fresh granite cropping out on the top of a gentle hill at about 232 300 mE, 5 594 100 mN, in the northwestern corner of Mr Titford's property. Colluvium and weathered granite on the flanks of this hill, an area presently vegetated by *Melaleuca*, could provide a readily extractable source of road base material. Any drainage outlet could be routed into Bungaree Creek below the troublesome swampy area west of the present Reekara pit. This area (Titford's property) is currently under lease application (1663P/M). Careful monitoring of the acidity of drainage would be a requirement of any development in this area.

A nearby ridge south of Yellow Rock Road [234 000 mE, 5 596 300 mN] was examined but was found to consist of quartz sand, probably belonging to the 'Old Dune' system.

Contact-metamorphosed siltstone, Counsel Hill

Metamorphosed siltstone forms Counsel Hill and the smaller hill to the southwest, which is covered by mining lease application 1M/98 by the King Island Council. The rock is well exposed in the cutting on Bicentennial Road [247 900 mE, 5 593 700 mN], where it is predominantly a massive to thick-bedded, tough, fine-grained quartzitic hornfels. Thin sections show typical fine-grained, quartz-biotite hornfels with quartz greatly predominant. Two (out of four) thin sections also show substantial sericite.

This should be a potential road base resource for the northern part of the island, although drilling and blasting would be necessary in extraction.

The sericitic nature of some of this rock has led to a suggestion that it may be less than ideal as a source of concrete aggregate (BFP Consultants, see Appendix of Calver, 1998). Parts of this rock may thus be relatively soft or fissile. This should not be a disincentive to undertaking trials of the rock as a concrete aggregate if the need arises. Segregation of the harder hornfels

beds from the softer material should be possible in quarrying this site.

Tertiary basalt, Adams Road

Tertiary basalt occurs on a gentle knoll, 200–300 m wide, about one kilometre north of Adams Road [241 200 mE, 5 579 300 mN] on Brian Crockett's property. Rounded lumps of basalt, 0.1–0.3 m in diameter and fresh except for a 5 mm thick weathered rind, are common over the surface of the knoll. A thin section shows a fresh, fine-grained (0.1 mm) basalt, comprising titanaugite, plagioclase and opaque minerals with phenocrysts of olivine and augite, with no vesicles or amygdules.

Two ground magnetometer traverses were undertaken to determine the extent of the basalt beneath the soil cover. The traverses were aligned S-N and W-E (fig. 1). The measured magnetic susceptibility of the basalt was $8.3 \pm 1.5 \times 10^{-3}$ SI. Modelling of the magnetic profiles using a computer program developed by M. Roach (University of Tasmania) suggests that the basalt is a vertical, cylindrical intrusion about 150 × 250 m in area (fig. 2). A large volume of good quality hard-rock suitable for concrete aggregate is therefore present at this site. However, drilling and blasting would no doubt be necessary in extraction.

Tertiary basalt, Reekara

As discussed in the earlier report, a number of bullseye magnetic anomalies in the north of the island show the locations of Tertiary basalt pipes similar to that at Adams Road, although most show no topographic expression and are concealed by surface sand and soil.

The largest of these anomalies occurs at Reekara, just north of Tathams Lagoon. The peak of this anomaly is at 234 200 mE, 5 591 600 mN (fig. 3). A line of Gemco holes drilled by Geopeko Ltd passed south of the peak of the anomaly and basalt was intersected in several holes (depths not recorded; Brown, 1974). An area of basalt several hundred metres wide may be present here, shallowly buried beneath sand.

Amphibolite, Pegarah Road

Amphibolite, a massive, coarse-grained, black igneous rock, forms small knolls south of Pegarah Road at 246 900 mE, 5 574 250 mN; 247 000 mE, 5 574 050 mN; and 247 000 mE, 5 573 700 mN. Boulders at the surface are 0.5 to 1 metre in diameter. An outcrop at 247 050 mE, 5 573 900 mN displays randomly oriented, tight joints spaced 0.3–0.6 m apart. The amphibolite is a good potential hard-rock source that should be suitable for concrete aggregate and road sealing. Blasting would be necessary in extraction. Alternative sites could be sought in the Pegarah–Naracoopa area, using the geological map as a guide. Amphibolite boulders were also seen on Pinchgut Road in the State Forest area [248 900 mE, 5 578 000 mN].

The amphibolite is relatively weakly magnetic (magnetic susceptibility 0.7 ± 0.1 SI) and so (unlike the Tertiary basalt) its distribution cannot be easily inferred from aeromagnetic data.

On one of the knolls south of Pegarah Road [247 000 mE, 5 573 700 mN] the rock is relatively coarse-grained (10 mm) and the large hornblende crystals display an attractive schiller effect similar to larvikite, a decorative stone imported from Norway. If sufficient volumes of not too closely jointed rock are present, these amphibolites are a potential source of dimension stone of the 'black granite' variety.

Proterozoic basalt, Bold Head–Mt Stanley area

A large area of Proterozoic basalt extends inland from Bold Head. Boulders of basalt can be seen in the paddocks at the south end of Bold Head Road [around 251 000 mE, 5 564 800 mN]. A thin section shows that the rock consists mostly of green actinolite as poorly crystalline grains, 0.2 mm across, with fibrous margins. There is minor epidote and quartz in amygdules.

Proterozoic basalt also occurs in the Gentle Annie–Mt Stanley area. A thin section of a sample of altered basalt collected by G. Green [from 245 800 mE, 5 562 800 mN] consists almost entirely of fine-grained, fibrous tremolite-actinolite.

The fibrous (asbestiform) tremolite-actinolite minerals in these rocks are potentially hazardous if crushed, and the use of these rocks for construction materials is not recommended.

Conclusions and Recommendations

The Grassy mine dump and the derived beach shingle deposits are a large, low-cost gravel resource suitable for road construction and sealing. Alkali reactivity testing needs to be carried out on samples of aggregate from Grassy to determine its suitability for concrete. If such testing fails, there are a number of alternative hard-rock sites on the island, but drilling and blasting would be necessary in extraction.

Tertiary basalt is the best rock type available for concrete aggregate or road sealing. The absence of sulphide minerals means that acid drainage would not be a problem. Localities near North Road (Tathams Lagoon) and Adams Road are centrally located. Magnetic profiles over the Adams Road locality show that a sufficient volume of rock is present.

Amphibolite near Pegarah Road, granite near Reekara, and metasiltstone (hornfels) at Counsel Hill and Lymwood are also alternative hard-rock aggregate sources. Of these sites, only that at Counsel Hill is on Crown Land.

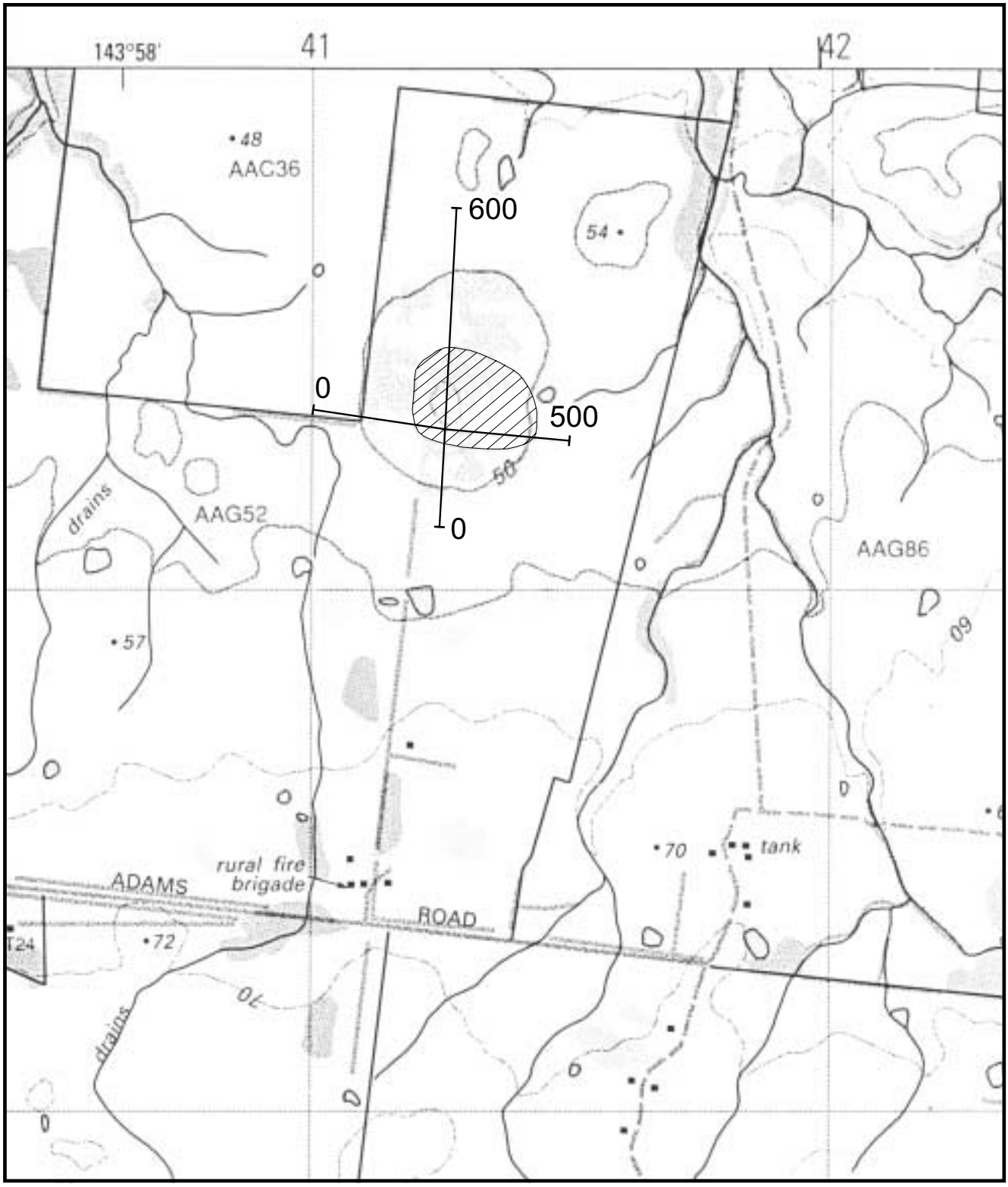

Figure 1

Location of ground magnetic traverses and inferred basalt subcrop area (cross-hatched) at site north of Adams Road. Base map: Naracoopa 1:25 000 scale.

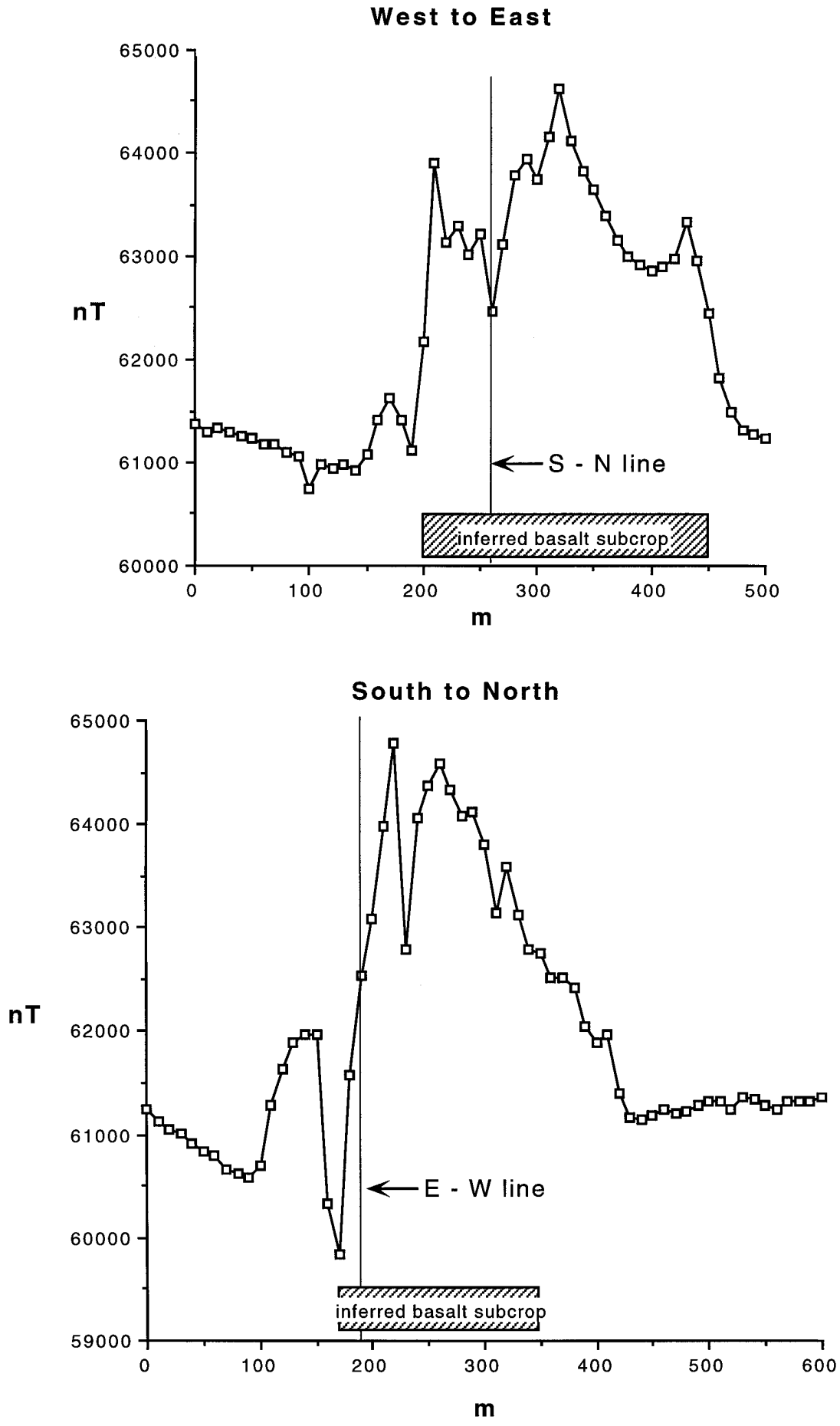

Figure 2

Magnetic profiles over basalt site north of Adams Road; for location see Figure 1. Inferred basalt subcrop from computer modelling: basalt contacts are vertical.

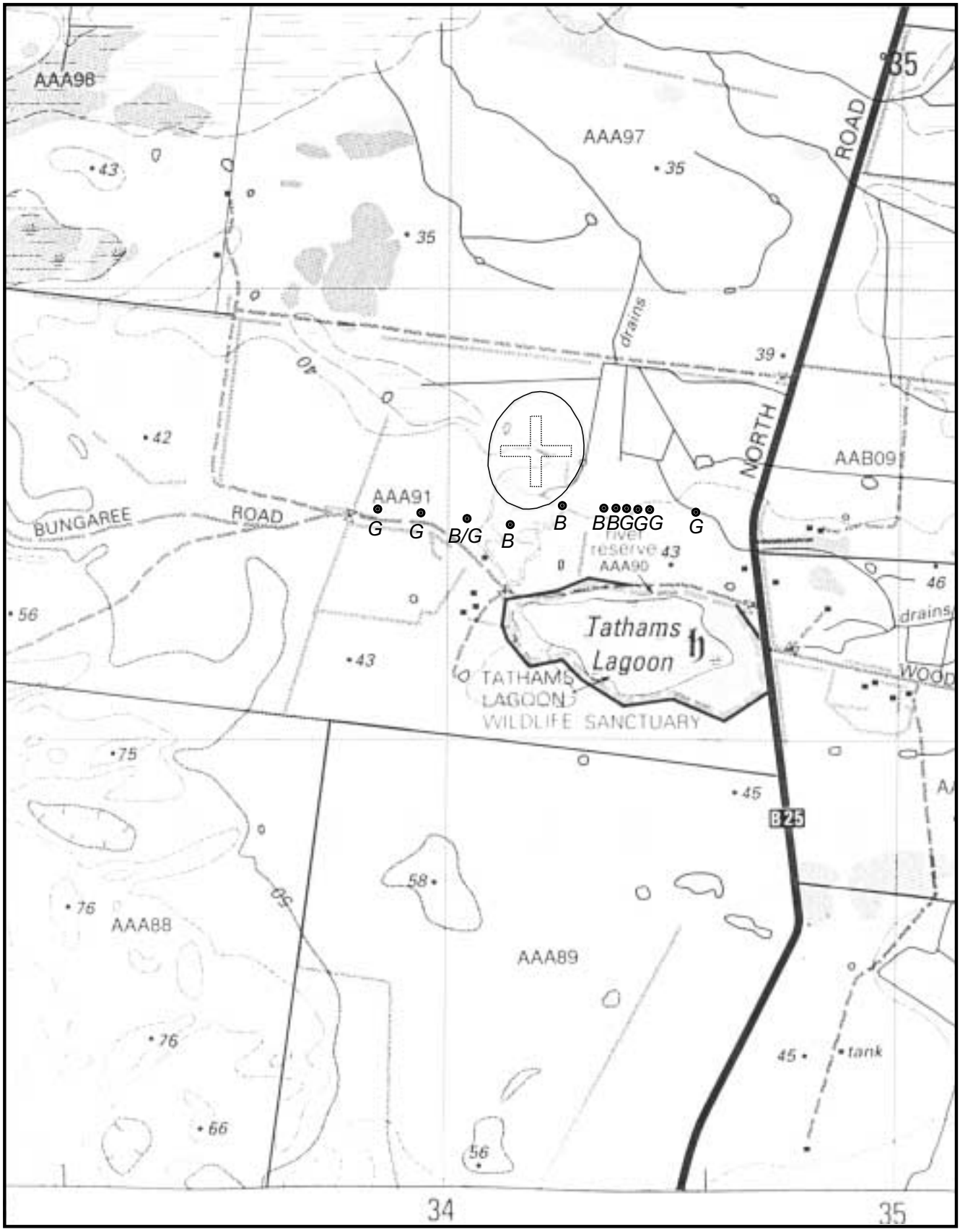

Figure 3

Location of centre of magnetic anomaly related to Tertiary basalt, and shallow drill holes near Reekara (B = basalt; G = granite). Base map: Reekara 1:25 000 scale. Drill hole data from Brown (1974).

The rock types sourced for road base in the past at Pearshape and Reekara are widespread, and new sites in these rock types — which can be extracted without blasting — are potentially widespread. Land availability, transport, drainage management and other planning considerations are the main factors to be considered in selecting new sites.

It is suggested that problems of drainage management, and acid drainage in particular, would be mitigated in sites with some degree of topographic relief — for example, Millwood pit. There are a number of other potential sites in Proterozoic siltstone in the Naracoopa–Millwood area, in the valleys of Yarra Creek and Grassy River, and in the northeastern part of the State Forest area west of Naracoopa, in the valleys of Poolta and Rafferty Creeks.

Weathered granite profiles similar to that at the Reekara pit probably underlie most of the flats in the Reekara area between North Road and the eastern edge of the sand dunes. Some of this material may soon be available from dam excavations on 1663P/M. A new pit in the northwest of 1663P/M should be relatively free of the drainage problems experienced in the old pit, if acidity is monitored during development.

Acknowledgements

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