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DARACON Group

Daracon Group Pty Limited

Martins Creek Andesite Quarry Geology Assessment

September 2015

Prepared by:

VGT Pty Ltd

For the:

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Acronyms and Terms Used Throughout the Report

Through this document, a number of Acronyms and reference terms are frequently used. To assist the reader, the following lists are provided.

ACRONYMS	
Daracon	Daracon Group Pty Ltd
AHD	Australian Height Datum

Geology Glossary

Word	Meaning
Alluvial Soil	Juvenile soils formed by deposition from still or moving water. Little pedological development beyond some accumulation of organic matter at the surface.
AHD – Australian Height Datum	A height of zero was assigned to the mean sea level determination at 30 tide gauges around the Australian Mainland coastline, measured over a three year period from 1966 to 1968 [Ref 2].
Aquifer	A soil or rock layer or group of layers that is sufficiently saturated and permeable to yield significant quantities of water.
Andesite	A fine grained volcanic igneous rock [Ref 3]. The term is derived from the series of mountains found along the west coast of South America, known as the "Andes". These general form along convergent plate margins.
Arenite	Arena means Sand in Latin, being the material they threw onto the arena before the Gladiators fought. Arenite is a general term meaning sand based rocks.
Bed Rock	The unweathered rock that lies below loose surface deposits of soil and alluvium.
Conglomerate	Is a rock consisting of individual clasts within a finer grained matrix.
Earthworks	The process of extracting, moving and depositing earth during construction.
Embankment	A mound or bank of earth or stone formed to support a roadway, serve as a protective barrier, or the like.
Erosion	The natural process where wind or water detaches a soil particle and provides energy to move the particle.
Excavation	The act or process of digging out earth during construction.
Feldspar	Most important rock forming silicate mineral, either Plagioclase or Alkali Feldspar Group [Ref 3].
Hydrology	The study of rainfall and surface water runoff processes.
Ignimbrite	New Zealand geologist Patrick Marshall derived the term 'ignimbrite' from 'fiery rock dust cloud' (from the Latin *igni-* (fire) and *imbri-* (rain)), formed as the result of immense explosions of pyroclastic ash, lapilli and blocks flowing down the sides of volcanoes. Or sometimes known as Welded Tuffs. An ignimbrite is the deposit of an extremely hot pyroclastic ash, such that the edges of fragments can be seen to weld together. This term describes how the rock is formed not the chemical composition of the rock. Ignimbrites can only form as a result of sub-aerial volcanic activity

Word	Meaning
	Ref 3. Ignimbrites can be Rhyolite, Rhyodacite or Dacite in composition. Sometimes the crystals can appear flat to show a flow effect but this is due to a layering of the material as the material compacts and presses down on the hot beds.
Indurated	Heat affected rocks that are harder than normal and maybe even partially melted and recrystallised.
Latite	Or Trachyandesite – Intermediate volcanic rock, between Trachyte and Andesite. Ref 3
pH	A measure of the degree of acidity or alkalinity expressed on a logarithmic scale of 1-14, on which 1 is most acid, 7 is neutral and 14 is most basic.
Plagioclase	A type of sodium and calcium feldspar.
Porphyry	Is an igneous rock with large crystals set in smaller crystals.
Quartz	Chemically SiO_2 this mineral is very resistant to weathering which allows it to be the most common mineral on the surface of the earth.
Rehabilitation	The restoration of a landscape and especially the vegetation following its disturbance.
Remnant vegetation	Native vegetation remaining after widespread clearing has taken place.
Rudite	A word derived from Latin word “Rudus” which means crushed stone, debris or rubble. This is a general term for a sedimentary rock composed of rounded or angular pebbles, cobbles and / or boulders. Rudites are mostly composed of siliciclastic gravel known as Conglomerates.
Sand	Are categorised as particles that range between 0.0625 mm to 2.00 mm. Ref 1. These can be made from quartz, limestone, feldspar, basalts, latites, organic particles and olivine. These deposits are found on beaches, dunes, rivers, glacial outwash and volcanic slopes.
Sediment	Material of varying sizes that has been or is being moved from its site of origin by the action of wind, water or gravity.
Sedimentation basin	An area where run-off is ponded to allow sediment to be deposited. The longer the period that run-off is held, the smaller the size of the sediment deposited. Such basins have to be cleaned regularly.
Silt	Are categorised as particles that range between 0.0625 mm to 0.0039 mm. Ref 1
Soil	That part of the upper weathered layer of the earth’s crust that can support plant growth. Any naturally occurring loose or soft deposit forming part of the earth’s crust and resulting from weathering or breakdown of rock formation or from the decay of vegetation.
Soil Texture Group	An important attribute of soils that affects the effectiveness of sediment retention structures is the proportion of particles finer than 0.02 mm. Particles that are finer than 0.02 mm are relatively difficult to trap in simple sediment retention basins, while those that are coarser are not.
Tuff	A pyroclastic ash, originated from volcanoes Ref 3.
T – Tonnes	Weight measurement being 1000 kilograms.
Volcano	A vent or fissure in the Earth’s crust through which molten magma, hot gases and other fluids escape onto the Earths surface.
Waste	Includes any matter (whether liquid, solid, gaseous or radioactive) that is discharged, emitted or deposited in the environment in such volume, constituency, or manner as to cause an alteration to the environment.

References

1. Pettijohn F.J, Potter, P.E. and Siever R. 1972 Sand and Sandstone.
2. G.C. Luton and G.M Johnson 2001
3. Penguin Geology Dictionary, Whitten and Brooks 1982

Section 1. Introduction

1.1. Introduction

Martins Creek Quarry is situated off Station Street, Martins Creek. Daracon extract Andesite from this site to produce aggregates for concrete, road, armour rock and manufactured sand applications.

VGT Pty Limited was engaged by Daracon to evaluate the geology of the Martins Creek Quarry, see *Figure One, Appendix A.*

The principal goal for this evaluation is to determine the lateral and vertical extent of the Volcanic Strata and undertake a volume assessment.

Martins Creek is well known in the industry and produces Andesite, the petrographic assessment found in *Appendix B* identifies the rock as a Latite Tuff. For the purposes of geological correctness the remainder of the report will call the product rock Latite.

1.2. Previous Geological Assessments

1.2.1. 1968 Exploration Program

A five hole drilling program was undertaken in 1968, with the approximate locations of the drill holes found on *Figure Two*. The logs and photographs of the drill core are located in Appendix C, as supplied by Daracon.

Summarised below is a table of the drill logs.

Hole Number	Collar (RL m)	Good Rock (m)	Bad Rock (m)	Total Depth (m)
BH1968 – 1	99	22.4	19.8	42.2
BH1968 – 2	70	7.2	8.5	15.7
BH1968 – 3	58	2.8	13.3	16.1
BH1968 – 4	82	21.1	6.3	27.4
BH1968 – 5	82	1.6	8.1	9.7

1.2.2. 1984 Exploration Program

No drill data could be found for this program.

1.2.3. 2006 Exploration program

Eleven core holes were sunk to evaluate the thickness and extent of the Latite, all logs are found in *Appendix D.* Locations are found on *Figure Two*.

Hole Name	Northings	Eastings	RL (m)
8086-1	6397788.650	370854.181	90.00
8086-2	6398000.558	370636.245	124.000
8086-3	6398448.194	370204.574	88.000
8086-4	6398270.972	370030.885	49.500
8086-5	6398202.695	370452.250	60.600
8086-6	6397663.987	370947.323	103.00
8086-7	6397722.605	371018.685	122.00
8086-8	6397654.294	370736.745	78.00
8086-9	6397877.234	370833.382	95.000
8086-10	6397866.988	370772.757	107.000
8086-11	6397846.791	370465.085	79.300

Section 2. Geology

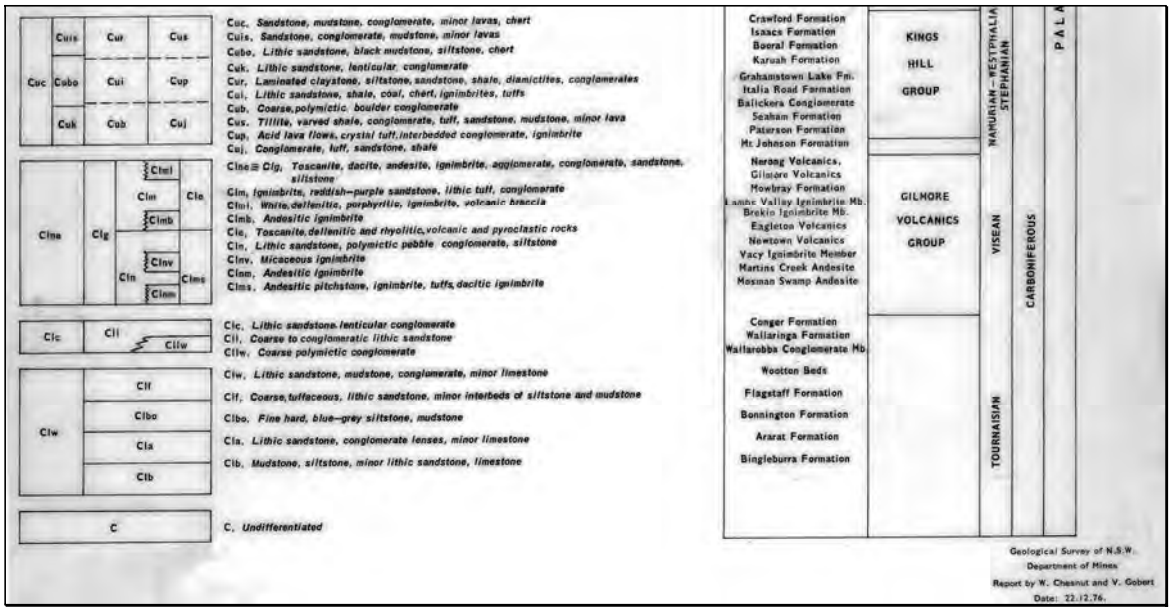
2.1. Regional Geology

The site is underlain by Carboniferous volcanic and sedimentary sequences. The quarry is underlain by the Martins Creek Andesite, identified as “Clnm” on the geology map see *Plate 2*. This unit terminates in the vicinity of the railway line to the north and the northwest where the overlying sequences of Cln (Newtown Volcanics) and Clnv (Vacy Ignimbrite Member) commence.

Plate 1 below shows the Newcastle 1:100,000 geology sheet overlying an aerial photograph map.

Plate 1 – Geology and Air Photograph

Plate 2 – Lithology codes for Carboniferous units for the Newcastle Geology Sheet



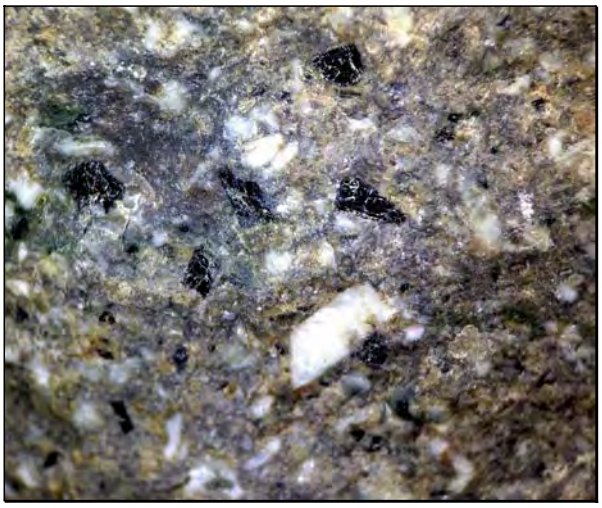
2.2. Quarry Geology

The quarry faces and floor is dominated by a volcanic rock locally known as Andesite, but the petrological assessments of this rock has identified this as a Latite Tuff (see sample in *Plate 4*). The large white rhombohedra crystal (plagioclase) is 3mm in length.

There are some exposures of underlying red sandstone and claystone in parts of the quarry floor, see *Plate 3* these are known as meta sediments. This underlying sequence is most likely to be Cll the Wallaringar Formation.

Plate 3 – View of Daracon Quarry Floor and Faces

Plate 4 – Microscopic view of Latite Tuff



Section 3. Exploration Methodology and Results

A site visit was undertaken on 27th February 2015, where a site inspection was undertaken and drill holes were determined, in conjunction with Daracon. Two programs were developed one with the onsite blast drill hole rig and the other to be drilled using *Total Drilling* exploration hammer drill rig. Drilling occurred in March 2015 and all samples were collected by Daracon representatives. Sample trays were logged and photographed by VGT. All logs are found in *Appendix E.*

Figure Two shows the drill hole locations.

Table 3.1 – Drill hole co-ordinates

Hole Name	Northings	Eastings	RL (m)
PBH1	6398174	370106	50
PBH2	6398119	370174	50
PBH3	6398041	370301	51.5
PBH4	6397989	370295	50
PBH5	6397960	370339	53.5
PBH6	6397852	370302	50
PBH7	6397702	370233	50
PBH8	6397734	370112	50
PBB9	6397759	370013	50
PBH10	6397851	369999	49
PBH11	6398027	370098	50
PBH12	6398172	370172	61
PBH13	6398013	370338	61.5
PBH14	6397906	370372	61
PBH15	6397908	370612	111
PBH16	6397665	371044	136.6
PBH17	6397608	371014	113.2
E2	6397876	370775	109
E3	6397514	370827	59
E4	6397578	370334	92
E5	6398188	370272	75
E6	6397731	371118	132
E7	6397711	370978	120
E8	6397540	370791	59

Table 3.2 – Latite thickness and Base of RL

Hole Name	RL (m)	Thickness of Latite	Base of Latite (RL m)
PBH1	50	22.0*	28 +
PBH2	50	19.5	30.5
PBH3	51.5	7.5	44.0
PBH4	50	8.0	42.0
PBH5	53.5	4.0	49.5
PBH6	50	4.0	46.0
PBH7	50	12.5	37.5
PBH8	50	26.5	23.5
PBB9	50	29.0*	21+
PBH10	49	29.0*	20+
PBH11	50	26.5	23.5
PBH12	61	29.0*	32+
PBH13	61.5	11.0	50.5
PBH14	61	7.5	53.5
PBH15	111.0	29.0*	82+
PBH16	136.6	11.1	125.6 **
PBH17	113.2	8.5	104.7
E2	109	10.0**	99
E3	59	5.5	54.0
E4	92	42.5	49.5
E5	75	37.0	38.0
E6	132	0.0	None
E7	120	5.0	115.0
E8	59	29.0	30.0
8086-1	90.0	30.25	59.75
8086-2	124.0	31.5	92.5
8086-3	88.0	38.0	50.0
8086-4	49.5	40.9	8.6
8086-5	97.5	36.4	60.6
8086-6	115.5	13.3	103.7
8086-7	122.0?	0.0	None
8086-8	78.00	50.3	27.7
8086-9	95.000	0.0	None
8086-10	107.000	6.2	100.8
8086-11	79.300	6.8	72.5

Note *Hole terminated in the Latite

** Weathered Latite, not product.

+ not reached basement

Latite thickness data presented in Table 3.2 is shown on *Figure Three.a and Figure Three.b* and the base RL plans are shown on *Figure Four.a* and *Figure Four.b*.

Section 4. Latite Resource Assessment

4.1. Site Geological Review

The base of the Latite is dipping to the west at a range of dips from 5 to 8 degrees; this interestingly seems to be mimicking the dip of the existing topography. The underlying stratigraphy is made up of meta-sediments, mostly sandstone and some clays.

Latite at the contact of the meta-sediments mostly appears to be red / brown as reflected by the fine grained matrix of the rock, the outcrop of these appear toward the east as can be seen in Figure Five.

4.2. Resource Calculations

4.2.1. Discussion

Drilling in the west pit area, which includes the current extraction area, and areas to north (to 8086-3) and south (to E4) and east (to 80862) provided enough base of Latite intersections and the correlation of the these has been presented in Figure Six *D, Six E and Six F*. *Figures Six A, Six B and Six C* conversely show the variations of the deposit in this region.

The base of Latite has been contoured to assist with volume assessments; this contour plan is found in *Figure Five.*

4.2.2. Volume Assessment

The geological and resource assessment of this deposit was undertaken using the following data:

- Site survey (Daracon),
- Drill site locations provided by Daracon,
- Hand held GPS co-ordinates for final drill hole locations for E and PBH series,
- Total drilling provided samples for E series,
- Precision drilling (blast hole rig) provided samples for PBH series,
- Daracon supplied 8086 series logs,
- Samples were collected by Daracon,
- Drill samples provided samples for E and PBH series were logged by VGT,
- Volumes calculated using SURPAC 3D modelling software,
- Density of Latite is 2.7 g/cm^3 (Daracon),
- The base of the Latite resource has been determined and interpolated from the drilling,
- Proposed hard rock quarry faces are 1H : 0.3V as identified in the quarry now, and
- A single batter face has been modelled to determine insitu volume.

Figure Seven shows the extraction of the Latite down to the westward sloping floor and the cross sections presented in *Figure Eight* shows the pre and post mining of the Latite.

The calculated volume of Latite is 14.1 million cubic metres or 38.07 million tonnes.

Appendix A: Figures