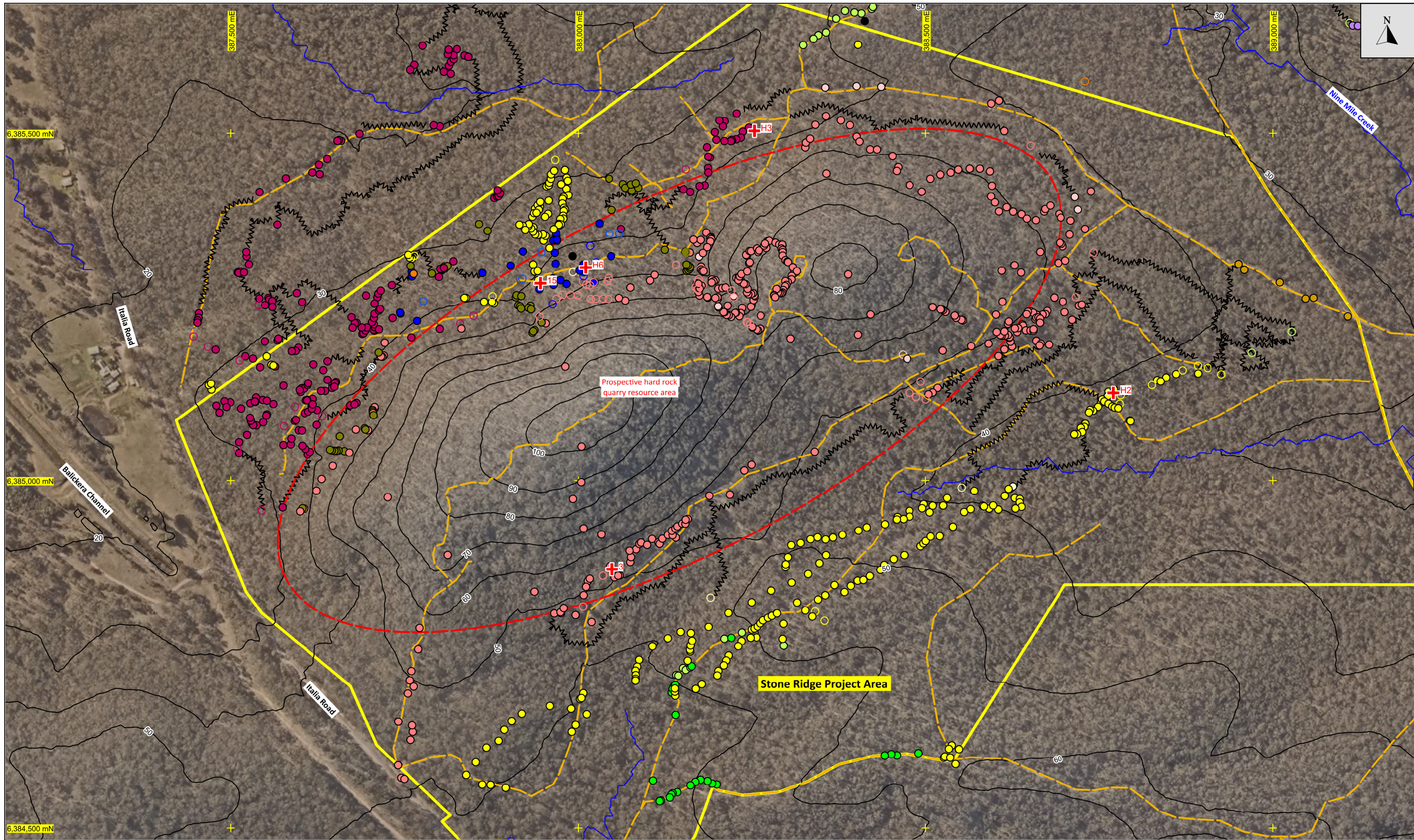


APPENDIX 4

Report on Quarry Resource Assessment Investigations



Legend	
	Stone Ridge Project Area Boundary
	Forest Tracks
	Topographic contour (10m contour interval)
	Drainage line (ephemeral)

Geology Legend	
	Outcrop / Subcrop
	Float
	Traverse with no outcrop or subcrop
	Outcrop petrographic sample
	Sandstone
	Conglomerate
	Rhyolitic vitric crystal tuff
	Rhyodacitic crystal lithic ignimbrite
	Dacitic ignimbrite
	Andesite - lithic fragmental
	Volcanic breccia
	Dolerite / basalt

Australian Resource Development Group

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Project:		STONE RIDGE QUARRY PROJECT			Figure 5		
Title:		Geological Outcrop, Subcrop and Float Mapping					
Author:	DMB	Date:	December 2019	Scale:	1:5,000 @ A3	Grid:	MGA Zone 56 (GDA94)
Source:		Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Geology: Geological mapping by Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) - 2017-2019					

Summary: Strongly porphyritic rhyodacite, containing abundant phenocrysts of quartz, K-feldspar and plagioclase, as well as a few partly altered grains of biotite, in a former glassy, fluidal groundmass. The rock also contained a few microphenocrysts of FeTi oxide (titanomagnetite) and another possible ferromagnesian phase, possibly pyroxene. The rock has experienced diagenetic alteration that has resulted in complete devitrification of the groundmass and replacement by fine grained alkali feldspar (commonly with radial growth texture) and minor quartz. Plagioclase phenocrysts are locally replaced by sericite, and biotite (and the other possible ferromagnesian phase) is commonly replaced by sericite and hematite. Slight clay clouding of K-feldspar phenocrysts and groundmass feldspar has occurred, but the amount of clay is minor. The rock remains strong and competent, there are no planar discontinuities.

Handspecimen: The sample is composed of a massive, strongly porphyritic, but otherwise fine grained felsic igneous rock, maybe representing a lava or shallow intrusive. It contains scattered grey quartz phenocrysts and pale pink feldspar phenocrysts, each up to a few millimetres across, and uncommon smaller black ferromagnesian phenocrysts (e.g. biotite) in a fine grained, pale pink quartzofeldspathic groundmass. Staining of the section offcut with sodium cobaltinitrite showed that the groundmass contains a moderate amount of K-feldspar and that some of the phenocrysts are also K-feldspar. The sample is moderately magnetic with susceptibility up to 220×10^{-5} SI.



Plate 1 – Blocky rubble outcrop of rhyodacite on Stone Ridge



Plate 2 – Sheet-like rhyodacite outcrop on southern side of Stone Ridge



Plate 3 – Typical rhyodacite outcrop sample from Stone Ridge (Sample 3)

Petrographic description

a) *Primary rock characteristics: In the section, it is apparent that the rock is strongly porphyritic (crowded porphyry texture), with about 50 volume % phenocrysts. There are scattered phenocrysts of quartz up to 3.5 mm across (commonly embayed), K-feldspar up to 4 mm, plagioclase up to 3 mm and less common (and smaller) phenocrysts of biotite up to 1.5 mm long. The rock also contains sparse microphenocrysts of FeTi oxide (titanomagnetite), uncommon pseudomorphic aggregates after another possible ferromagnesian phase (e.g. pyroxene) and rare zircon. The phenocrystal phases occurred in a formerly fluidal texture, glassy groundmass of quartzofeldspathic composition (Fig. 1). The mineralogical and textural characteristics of the rock indicate that it is a porphyritic rhyodacite.*

b) *Alteration and structure: The igneous rock experienced mild alteration, most likely of diagenetic (burial metamorphic) type. This has resulted in complete modification of the groundmass, with replacement of interpreted former glass by abundant fine to medium grained alkali feldspar (probably K-feldspar and albite) and minor quartz. The feldspars commonly form sub-radiating to radiating aggregates of acicular grains up to 1 mm across, as well as finely granular material. Imposed alteration also led to local replacement of plagioclase phenocrysts by fine grained sericite aggregates. Much original biotite and all interpreted microphenocrysts of the other possible ferromagnesian phase, were replaced by sericite and hematite. Similarly, there was considerable hematite replacement of FeTi oxide. K-feldspar (phenocrysts and groundmass) was lightly clouded by clay alteration (probably kaolinite). The rock remains massive and there are no planar structures on the scale of the section, and weathering effects are minimal.*

Mineral Mode (by volume): alkali feldspar 40%, plagioclase 30%, quartz 25%, sericite 2%, biotite, hematite and clay (kaolinite) each 1% and traces of FeTi oxide (titanomagnetite) and zircon.

Interpretation and comment: It is interpreted that the sample is a porphyritic rhyodacite. Abundant phenocrysts of quartz and feldspars are accompanied by a few smaller biotite grains, enclosed in a formerly glassy, fluidal texture, quartzofeldspathic groundmass. Imposed diagenetic alteration led to devitrification of the groundmass and production of abundant alkali feldspar. There was also minor development of fine grained sericite, hematite and clay (e.g. kaolinite). The layer silicates do not have any preferred orientation and the rock does not exhibit any planar structures. It remains hard and competent and could be suitable for engineering and construction purposes.

4.3.2 Dacite

In contrast to the main ridge line, outcrop exposure on the lower gradient slopes to the north is more sporadic in nature. Initial mapping and sampling revealed that outcrop beyond the limit of outcropping rhyodacite is dominated by a medium grey, medium grained, feldspar dominated volcanic rock, confirmed by petrographic assessment as **dacite**.

Sample H3 (Plate 4) is a representative sample of dacite collected from northwest of Stone Ridge (GR: 388,250mE, 6,385,508mN) and has the following detailed hand specimen and petrographic thin section description.



Plate 4 – Dacite outcrop sample from immediately northwest of Stone Ridge (Sample H3)

Summary: Massive, strongly porphyritic hornblende-biotite dacite, showing moderate pervasive alteration of diagenetic type. The rock retains abundant phenocrysts of plagioclase and less common phenocrysts of quartz, hornblende and biotite, although the last phase is almost completely altered. There are also a few microphenocrysts of FeTi oxide (titanomagnetite) and rare clinopyroxene, with the phenocrystal phases occurring in what would have been a slightly fluidal, glassy or aphanitic feldspathic groundmass. Imposed alteration caused replacement of the groundmass, mostly by very fine grained alkali feldspar. Primary ferromagnesian phases were variably replaced by fine grained chlorite-smectite (particularly biotite) and minor hematite. Similarly, FeTi oxide was partly replaced by hematite, and plagioclase shows generally minor replacement by chlorite-smectite. The rock has no obvious planar discontinuities and although there is significant development of alteration-derived chlorite-smectite, there is no concentration of this phase in through-going structures, or development of preferred orientation. The rock could remain moderately suitable for construction purposes, although the occurrence of a smectite-type clay phase could be deleterious.

Handspecimen: The sample is composed of a massive, strongly porphyritic felsic volcanic rock. It contains abundant pale grey to grey-green, partly altered feldspar (plagioclase) phenocrysts as well as dark translucent quartz and a few black ferromagnesian phenocrysts, each up to a few millimetres across, set in a fine grained, brown-grey feldspathic groundmass. A couple of slightly darker grey, porphyritic enclaves up to 2 cm across occur. Staining of the section offcut with sodium cobaltinitrite showed that there is a moderate amount of K-feldspar in the groundmass. The sample is strongly magnetic with susceptibility up to 1790×10^{-5} SI, indicating that there is minor disseminated magnetite.

Petrographic description

a) *Primary rock characteristics: In the section, it is apparent that the rock is strongly porphyritic ("crowded phenocryst texture"), with an estimated 60% of phenocrysts and the remainder being fine grained groundmass. There are abundant blocky plagioclase phenocrysts up to 3 mm across, accompanied by less common quartz (up to 4.5 mm), khaki-green hornblende (up to 3.5 mm, but mostly < 1.5 mm) and biotite (up to 2 mm) phenocrysts, along with a few microphenocrysts of FeTi oxide (titanomagnetite, up to 0.7 mm across) and rare clinopyroxene. The groundmass enclosing the phenocrysts is very fine grained and locally has fluidal texture, suggesting that it was originally glassy to aphanitic. The groundmass contains traces of FeTi oxide and apatite and is likely to be of feldspathic composition, with considerable K-feldspar. From the preserved primary mineralogy and texture, the sample is interpreted as a strongly porphyritic hornblende-biotite dacite. There is no strong indication that the rock represents a pyroclastic product.*

b) *Alteration and structure: Moderate pervasive diagenetic alteration was imposed on the igneous rock, with this causing rather strong replacement of ferromagnesian phenocrysts (particularly biotite), local moderate alteration of plagioclase phenocrysts and FeTi oxide. The groundmass was pervasively replaced by very fine grained alkali feldspar (includes K-feldspar and albite), minor turbid greenish chlorite-smectite and a little dusty hematite pigmentation. Ferromagnesian grains were variably replaced (complete in the case of biotite) by khaki-green, fine grained chlorite-smectite and minor hematite. FeTi oxide was partly replaced by hematite and there has also been patchy replacement of plagioclase (mostly core zones) by chlorite-smectite and a trace of illite-sericite. The proportion of fine grained layer silicate material (mostly chlorite-smectite) in the sample is relatively minor and none appears to be concentrated on to through-going planar structures, or has a preferred orientation.*

Mineral Mode (by volume): *plagioclase 50%, alkali feldspar (probably K-feldspar and albite) 20%, quartz 13%, chlorite-smectite 10%, hornblende, FeTi oxide (titanomagnetite) and hematite each 2% and traces of clinopyroxene, illite-sericite and apatite.*

Interpretation and comment: *It is interpreted that the sample represents a massive, strongly porphyritic hornblende-biotite dacite. The rock does exhibit moderate diagenetic alteration that has resulted in formation of minor fine grained chlorite-smectite, derived from replacement of plagioclase, ferromagnesian material and the groundmass. The rock has no observed planar discontinuities, and no preferred orientation of the layer silicate phase. Generally, the rock is hard and competent, but the presence of minor smectite could be a deleterious factor for rock quality.*

4.3.3 Rhyolitic Vitric-Crystal Welded Tuff

Several linear, but often discontinuous outcrops of finer grained volcanic rocks occur within the Project Area that have been confirmed as '**vitric-crystal welded tuff** (ignimbrite)' of rhyolite or rhyodacite composition. The most prominent and most altered of these occurs southeast of Stone Ridge, beyond the limit of rhyodacite outcrop and at the interpreted top of the *Eagleton Volcanics* stratigraphy. In contrast, less continuous and less altered outcrops of rhyolitic tuff occur lower in the stratigraphy to the northwest of Stone Ridge.

Sample H2 (Plate 5) is a representative sample of the rhyolitic tuff band from southeast of Stone Ridge (GR: 388,767mE, 6,385,130mN) and has the following detailed hand specimen and petrographic thin section description.



Plate 5 – Altered vitric-crystal welded tuff of rhyodacite composition from outcrop south of Stone Ridge (Sample H2)

Summary: Medium to coarse grained vitric (-crystal) felsic tuff, probably of rhyodacite composition, and with pervasive alteration that has led to devitrification. The rock has well preserved vitriclastic texture, with abundant apparently non-welded vitriclasts, including a few larger, aligned fragments. There are also sparse phenocrystal grains, including plagioclase and less common quartz and K-feldspar. Devitrification has led to replacement of former glassy material to fine grained alkali feldspar (probably sodic plagioclase = K-feldspar), along with subordinate fine grained clay (e.g. illite-smectite) and quartz, with much of the former vitriclastic material being finely dusted by hematite and/or goethite. Feldspar phenocrysts are clouded by clay alteration (maybe kaolinite). Although the rock is relatively massive and has no mesoscopic fracturing, there is pervasive clay alteration and this factor would potentially reduce rock quality.

Handspecimen: The sample is composed of a relatively massive, slightly weathered, pink-brown, fine grained felsic volcanic rock, with an appearance suggesting that it is of pyroclastic type. It has a few elongate, pale creamy coloured vitriclasts up to 1.5 cm in length, and sparse phenocrystal grains of pale creamy feldspar (up to 3 mm) and a few dark quartz grains up to 1 mm across. The matrix is weakly foliated (?flow foliation) and probably of quartzofeldspathic composition and dominated by vitriclastic material. Staining of the section offcut with sodium cobaltinitrite showed that the matrix contains a moderate amount of K-feldspar and that some of the phenocrysts are also K-feldspar. The sample is essentially non-magnetic with susceptibility of $< 10 \times 10^{-5}$ SI.

Petrographic description

a) Primary rock characteristics: In the section, relict medium to coarse grained vitriclastic texture is well preserved (Fig. 5) although all original glassy material has been replaced. The rock formerly contained abundant, relatively tightly packed vitriclasts (glass shard texture, pumice bubble cavities) in the size range ~ 0.1 -2 mm), with a weak alignment in places. There are also larger, elongate and aligned vitriclasts up to 1.5 cm long, and a few phenocrystal grains,

occurring as isolated entities as well as being components of larger vitriclasts. The phenocrystal grains are mostly plagioclase (up to 2.5 mm across), but there are also a few quartz grains (up to 1.5 mm) and K-feldspar (up to 2 mm) and rare small altered ferromagnesian grains (e.g. biotite) and FeTi oxide. Relict textures of vitriclastic material are not convincing to indicate that welding has occurred (e.g. strong alignment, flattening effects) and hence the sample is interpreted as a felsic vitric (-crystal) tuff. It is probably of rhyodacitic composition.

b) *Alteration and structure:* The original pyroclastic rock experienced pervasive diagenetic (burial) alteration, resulting in all former vitric material being replaced by fine grained alkali feldspar (granular to sub-radiating textures are common), subordinate fine grained clay (e.g. illite-smectite) and quartz (e.g. filling pumice bubble cavities). Throughout much of the altered vitriclastic material, there is pervasive orange pigmentation by hematite and/or goethite. Feldspar phenocrysts are clouded by weak clay alteration, e.g. kaolinite. No through-going fractures are observed and there is no apparent preferred orientation of alteration minerals. Some of the clay development in the sample might be due to later imposed weathering effects.

Mineral Mode (by volume): alkali feldspar (probably K-feldspar = sodic plagioclase) 60%, clay minerals (illite-smectite >> kaolinite) 20%, quartz 18%, hematite/goethite 2% and a trace of FeTi oxide.

Interpretation and comment: It is interpreted that the sample represents a devitrified, former rhyodacite composition, medium to coarse vitric (-crystal) tuff. The alteration process has led to replacement of former glassy material by abundant alkali feldspar, subordinate clay (probably illite-smectite) and quartz. Slight weathering effects have also occurred. The clay phases do not have any preferred orientation and there no planar structures recognised. Although the rock is massive and relatively hard, the amount of clay development could have a deleterious effect on rock quality.

Sample 15 (Plate 6) is representative of rhyolitic tuff exposures northwest of Stone Ridge (GR: 387,942mE, 6,385,288mN) and has the following detailed hand specimen and petrographic thin section description.

Summary: Fragmented vitric-crystal welded tuff (ignimbrite) of rhyolite composition, showing overprinting diagenetic alteration effects and mild weathering. There are rather sparsely scattered small phenocrystal grains of quartz (commonly shattered), K-feldspar and minor biotite in a matrix dominated by small vitriclastic particles (including former glass shards) that have been welded. The rock was subsequently evidently fragmented to form generally angular fragments enclosed in a finely vitriclastic matrix. Imposed alteration led to replacement of former vitric material by fine grained alkali feldspar (perhaps with K-feldspar > albite) and quartz, with minor celadonite. A little sericite and hematite have developed from biotite and K-feldspar grains, and with slight hematite dusting and clay development in the matrix. Slight weathering effects are indicated by a little fracture-controlled goethite staining. The rock remains massive, hard and competent, with no alignment of the small amount of layer silicate material and only a couple of minor fractures.



Plate 6 – Vitric-crystal welded tuff of rhyolite composition from outcrop north of Stone Ridge (Sample 15)

Handspecimen: The sample is composed of a massive, porphyritic felsic volcanic rock. It contains scattered small (< 2 mm) pink feldspar and translucent grey quartz and a few black biotite phenocrysts in a fine grained grey quartzofeldspathic groundmass. The latter has a diffusely fragmental texture, with angular to sub-rounded fragments up to several millimetres across. The sample shows slight weathering effects with a little orange-brown goethite on exterior surfaces and thin fractures. Staining of the section offcut with sodium cobaltinitrite showed that the groundmass contains abundant K-feldspar and that some of the phenocrysts are also K-feldspar. The sample is weakly magnetic with susceptibility up to 70×10^{-5} SI.

Petrographic description

a) Primary rock characteristics: In the section, the rock is relatively sparsely porphyritic, with scattered quartz phenocrystal grains up to 1.5 mm across (that are commonly shattered), K-feldspar up to 2 mm and a few, mostly altered biotite grains up to 1.5 mm across. There are also uncommon microphenocrysts of FeTi oxide (titanomagnetite) up to 0.2 mm and rare zircon. These phases occur in a now devitrified fine grained vitriclastic matrix. In the latter, relict texture is moderately preserved and shows that there were small glass shards and other small vitriclasts (< 0.3 mm) that were associated with small feldspar grains and trace FeTi oxide, with all being welded together. Subsequently, the rock was evidently fragmented, with formation of irregular, sub-rounded and angular fragments up to several millimetres across of vitric-crystal welded tuff (ignimbrite) incorporated into a finer grained vitriclastic-dominated matrix that occupies about half of the sample. The preserved primary characteristics indicate that the rock is a fragmented ignimbrite (vitric-crystal welded tuff) of rhyolite composition.

b) Alteration and structure: The original pyroclastic rock evidently experienced diagenetic (burial metamorphic) alteration, leading to devitrification of the vitriclastic matrix component and replacement by abundant fine grained alkali feldspar (probably with K-feldspar > albite), subordinate quartz, minor celadonite and trace hematite. Most biotite was replaced by sericite and hematite, and there was a small amount of sericite and hematite developed from K-feldspar

phenocrysts, and hematite also formed from FeTi oxide. Possible slight clay alteration (e.g. kaolinite) of feldspar also occurred (e.g. clouding effect). Effects of local mild weathering are restricted to a little goethite staining, mostly along a couple of late, thin fractures.

Mineral Mode (by volume): alkali feldspar (probably K-feldspar > albite) 65%, quartz 30%, celadonite 2%, sericite and hematite each 1% and traces of biotite, FeTi oxide (titanomagnetite), zircon, clay (kaolinite) and goethite.

Interpretation and comment: It is interpreted that the sample represents a fragmented rhyolitic composition vitric-crystal welded tuff (ignimbrite) that has undergone diagenetic alteration such that former vitric material was replaced by fine grained alkali feldspar, quartz, a little celadonite, sericite and hematite. A trace of possible clay (kaolinite) and goethite have also developed. The layer silicates do not have any preferred orientation and there are very few planar structures. It remains hard and competent and could be suitable for engineering and construction purposes.

4.3.4 Volcanic Breccia

Several highly weathered exposures of coarsely fragmental **volcanic breccia** were observed in gullies on the lower northwest slopes of Stone Ridge, directly west of the Stone Ridge saddle. The most prominent of these (**Plate 7**) (GR: 387,937mE, 6,385,216mN) occurs immediately below the base of the rhyodacite and is a clast-supported fragmental unit comprised of abundant large sub-rounded to rounded volcanic boulders / clasts. The weathered and unconsolidated nature of the breccia in surface samples prevented the collection of a sample suitable for petrographic assessment.

4.3.5 Andesitic Lithic-Crystal Tuff

The most mafic rock types identified during initial mapping were associated with minor subcrop and float confined to the lower northwest flank of Stone Ridge, directly west of the Stone Ridge saddle. Thin section analysis confirmed these to be lithic-crystal tuff of andesitic composition. The **andesite** occurs in the same general vicinity as the coarse volcanic breccia (refer Section 4.2.4) and may represent a coarse fragmental component of the latter.

Sample H6 (Plate 8) is a sample of the andesitic tuff (GR: 388,007mE, 6,385,310mN) and has the following detailed hand specimen and petrographic thin section description.

Summary: Moderately altered, coarse lithic-crystal tuff, likely to be of andesitic composition. The rock has scattered fragments of porphyritic andesitic rock and disaggregated individual mineral grains in a fine grained tuffaceous material. Prior to fragmentation, it is evident that the original rock contained phenocrysts of plagioclase and less common pyroxene, in a fine grained feldspathic groundmass, with sparse microphenocrysts of FeTi oxide (titanomagnetite). Fragmentation led to development of irregular to elongate volcanic lithic fragments and individual mineral grains (plagioclase, pyroxene, a little FeTi oxide and traces of quartz, K-feldspar and apatite), hosted in a fine, tuffaceous matrix. Pervasive alteration probably a result of diagenesis and slight weathering, caused replacement of interpreted pyroxene by celadonite, hematite and goethite. FeTi oxide was partly replaced by hematite and plagioclase by celadonite and a little illite-sericite. The fine grained tuffaceous matrix was replaced by very fine alkali feldspar (includes albite and K-feldspar), a chlorite-smectite phase and hematite. The rock remains massive and hard, with no planar discontinuities or alignment of layer silicates, but rock quality could be degraded by the possible presence of minor smectite.

Handspecimen: The sample is composed of a massive, dark grey, porphyritic and apparently fragmental intermediate volcanic rock (e.g. of andesitic type). It contains scattered irregular to angular porphyritic volcanic lithic fragments up to 1.5 cm across that appear to be of similar composition to the remainder of the rock. Throughout, there are scattered whitish plagioclase phenocrystal grains and small black grains up to 1 mm of a likely ferromagnesian phase, in a fine grained matrix. Locally, lithic fragments have a reddish-brown colour due to hematite pigmentation. Staining of the section offcut with sodium cobaltinitrite showed that there is a minor amount of K-feldspar in the groundmass. The sample is moderately magnetic with susceptibility up to 270×10^{-5} SI.

Petrographic description

a) *Primary rock characteristics:* In the section, it is apparent that the sample is a rather coarse volcanic fragmental, with a matrix-supported texture. It contains scattered irregular to elongate lithic fragments up to 1.5 cm across of porphyritic andesitic rock as well as abundant discrete mineral grains up to 2.5 mm across, in a finer grained matrix of probable tuffaceous character. The mineralogy of the porphyritic fragments and the enclosing host rock is the same, with scattered phenocrystal grains of plagioclase, a former ferromagnesian phase, a few microphenocrysts of FeTi oxide (e.g. titanomagnetite, up to 0.4 mm) and rare grains of quartz, K-feldspar and apatite (Fig. 9). The ferromagnesian phase was probably pyroxene, judging by relict shape (grains up to 2 mm), but the phase is now completely altered. The fine tuffaceous matrix is now altered and finely recrystallised, but would have been of feldspathic type (e.g. plagioclase > K-feldspar), with minor ferromagnesian material and FeTi oxide. From the relict characteristics, the rock is interpreted as a lithic-crystal tuff of andesitic composition.

b) *Alteration and structure:* The rock has experienced pervasive moderate diagenetic alteration, as well as mild weathering effects. All former ferromagnesian material was pseudomorphically replaced by aggregates of fine grained celadonite, commonly fringed by hematite and/or goethite. Plagioclase has also been mildly replaced by celadonite and a little illite-sericite, and FeTi oxide by hematite. In the matrix, there was recrystallization to very fine grained alkali feldspar (probably albite > K-feldspar) and minor pale greenish chlorite-smectite and hematite dusting. Although there is minor development of fine grained layer silicate material developed as part of the imposed alteration, none occurs concentrated along planar structures, or exhibits a preferred orientation. Generally, the rock remains hard and massive.

Mineral Mode (by volume): plagioclase (includes albite) 75%, alkali feldspar (probably K-feldspar) 10%, celadonite 5% chlorite-smectite and hematite each 3% quartz, FeTi oxide (titanomagnetite), goethite and illite-sericite each 1% and a trace of apatite.

Interpretation and comment: It is interpreted that the sample is a massive, rather coarse andesitic composition lithic-crystal tuff. It has moderate pervasive diagenetic alteration and mild weathering effects, but alteration products that include the layer silicate phases celadonite and chlorite-smectite do not have any preferred orientation, or are concentrated along any planar discontinuities. Generally, the rock is hard and competent, but the presence of minor smectite could be a deleterious factor for rock quality.



Plate 7 – Exposure of volcanic breccia in washout gully directly west of the Stone Ridge saddle and immediately below the base of rhyodacite



Plate 8 – Lithic-crystal tuff of andesitic composition from subcrop west of the Stone Ridge saddle (Sample H6)

5. MAGNETIC SUSCEPTIBILITY AND GROUND MAGNETIC SURVEY

5.1 Background and Objectives

Initial visual analysis of different rock types obtained from surface outcrop and preliminary diamond drilling revealed that the magnetic mineral *magnetite* (Fe_3O_4) is a common accessory mineral within most of the different rock types examined. The magnetite generally occurs as fine disseminations within the volcanic rocks and is of a primary igneous nature. In contrast, magnetite present within the sedimentary units was observed to be of a secondary nature, occurring as thin bedding-related bands.

During the initial stages of the resource assessment work program, magnetic susceptibility measurements were undertaken on outcrop and core samples collected for petrographic work. This confirmed that the magnetic susceptibilities of different rock types generally contrast as a result of differing magnetite contents, making the use of magnetic geophysical survey methods worth considering for mapping the lateral extent of the different rock types within the Project Area.

A high-resolution ground magnetic survey was subsequently undertaken over the *Eagleton Volcanics* within the Project Area during September 2018, with the objective of more accurately mapping the lateral extent of different geological units defined by surface mapping, as well as any cross-cutting structural zones (*e.g.* faults, shears) defined by contrasting magnetic signatures.

Magnetic susceptibility measurements were also undertaken on all diamond core, with measurements taken at 1 metre depth intervals for the full length of each drill hole.

5.2 Methodology

Fender Geophysics was commissioned to undertake the ground magnetic survey and correct the survey data to account for diurnal drift in the Earth's magnetic field.

The ground magnetic survey commenced on the 17 September 2018 and was completed on the 23 September 2018. The survey covered an area of approximately 125 hectares between Italia Road and Nine Mile Creek, centred on Stone Ridge. East-west oriented survey traverses were nominally spaced at 20m intervals, and survey data was collected using two Geometrics 859AP Mineral MagTM caesium vapor mobile magnetometers with a cycle time of 0.2 seconds and resolution of 0.1 nT resolution. A Geometrics 856 base magnetometer with a cycle time of 15 seconds and resolution of 0.1 nT was established to record the diurnal fluctuation in the Earth's magnetic field. All data was positioned by internal TallysmanTM GPS.

A total of 348,836 magnetic readings were recorded by the mobile magnetometers along approximately 52 survey traverses (**Figure 6**). Survey data was subsequently corrected to remove the diurnal fluctuation in the Earth's magnetic field recorded by the base magnetometer, thereby generating a data set that reflects the magnetic character of the underlying geology.

The corrected data was then imaged by ARDG using gridding functionality in Datamine MapInfo Discover software.



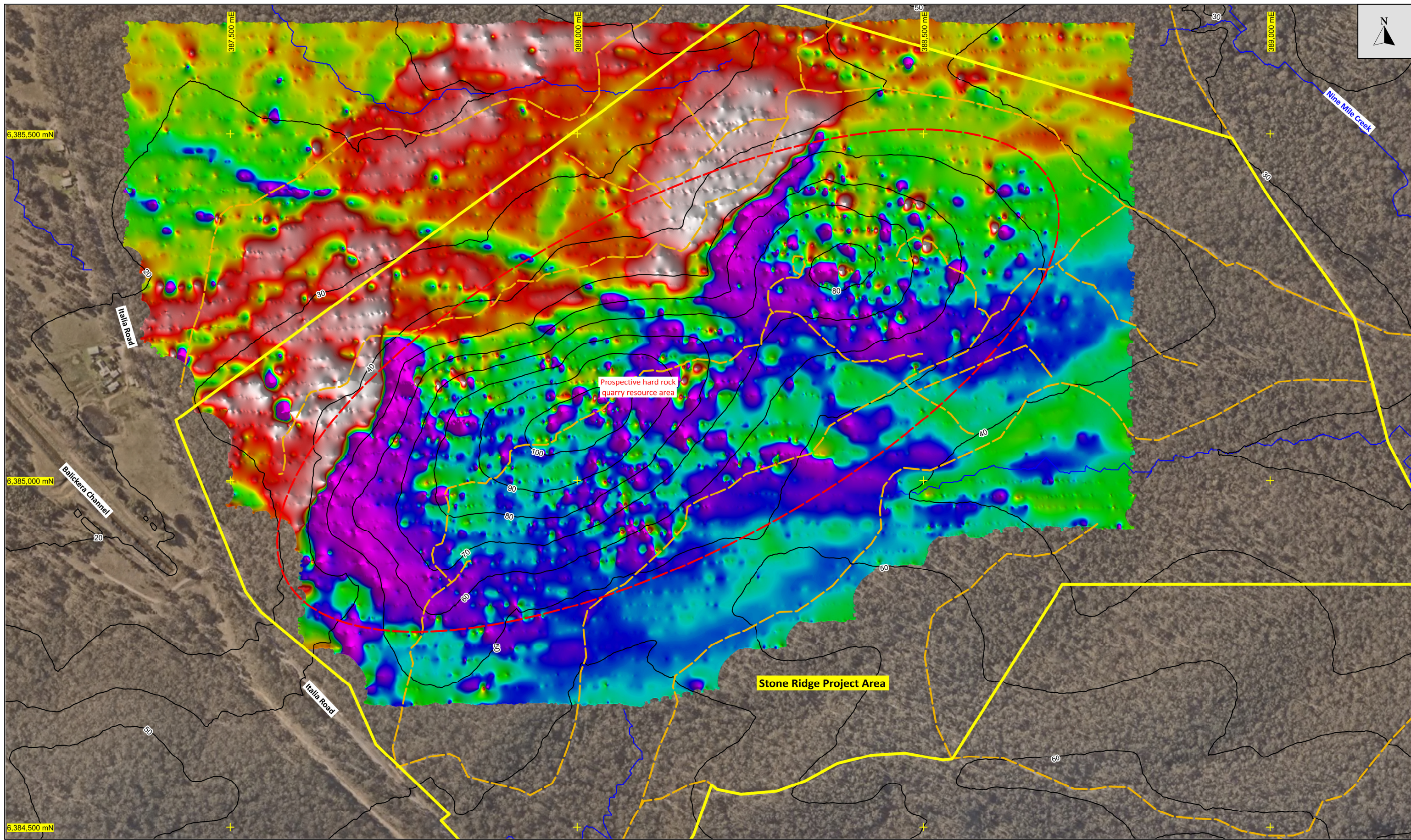
Legend

- Stone Ridge Project Area Boundary
- Forest Tracks
- Topographic contour (10m contour interval)
- Drainage line (ephemeral)
- Magnetic survey traverses / reading locations

**Australian
Resource
Development
Group**

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Project: STONE RIDGE QUARRY PROJECT		Figure 6	
Title: Ground Magnetic Survey Traverses			
Author: DMB	Date: December 2019	Scale: 1:5,000 @ A3	Grid: MGA Zone 56 (GDA94)
Source: Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Ground Magnetic Survey: Fender Geophysics - 2018			



Legend

- Stone Ridge Project Area Boundary
- Forest Tracks
- Topographic contour (10m contour interval)
- Drainage line (ephemeral)

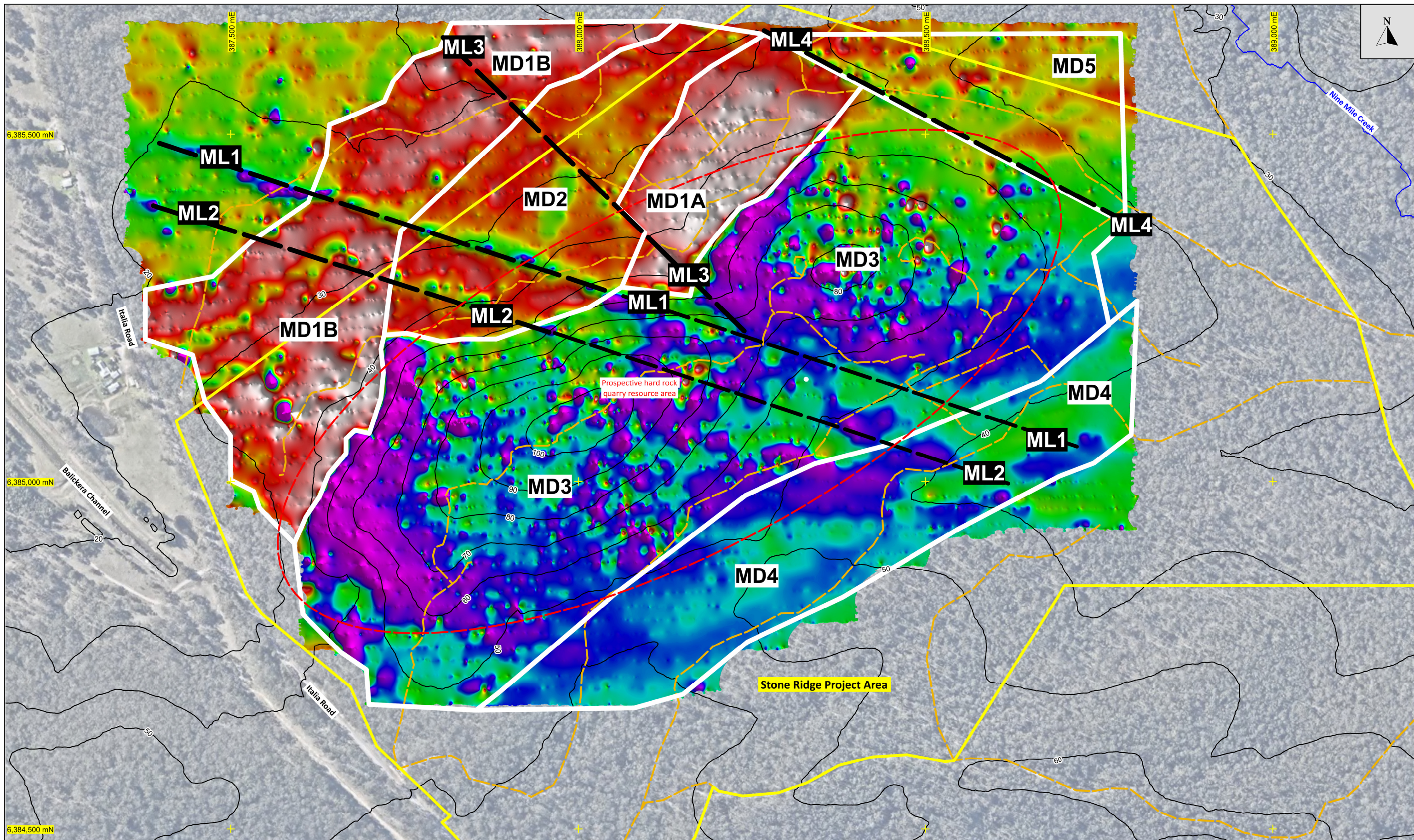
Magnetic Intensity Scale (nT)

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-652
-1,020
-1,240
-1,320
-3,340

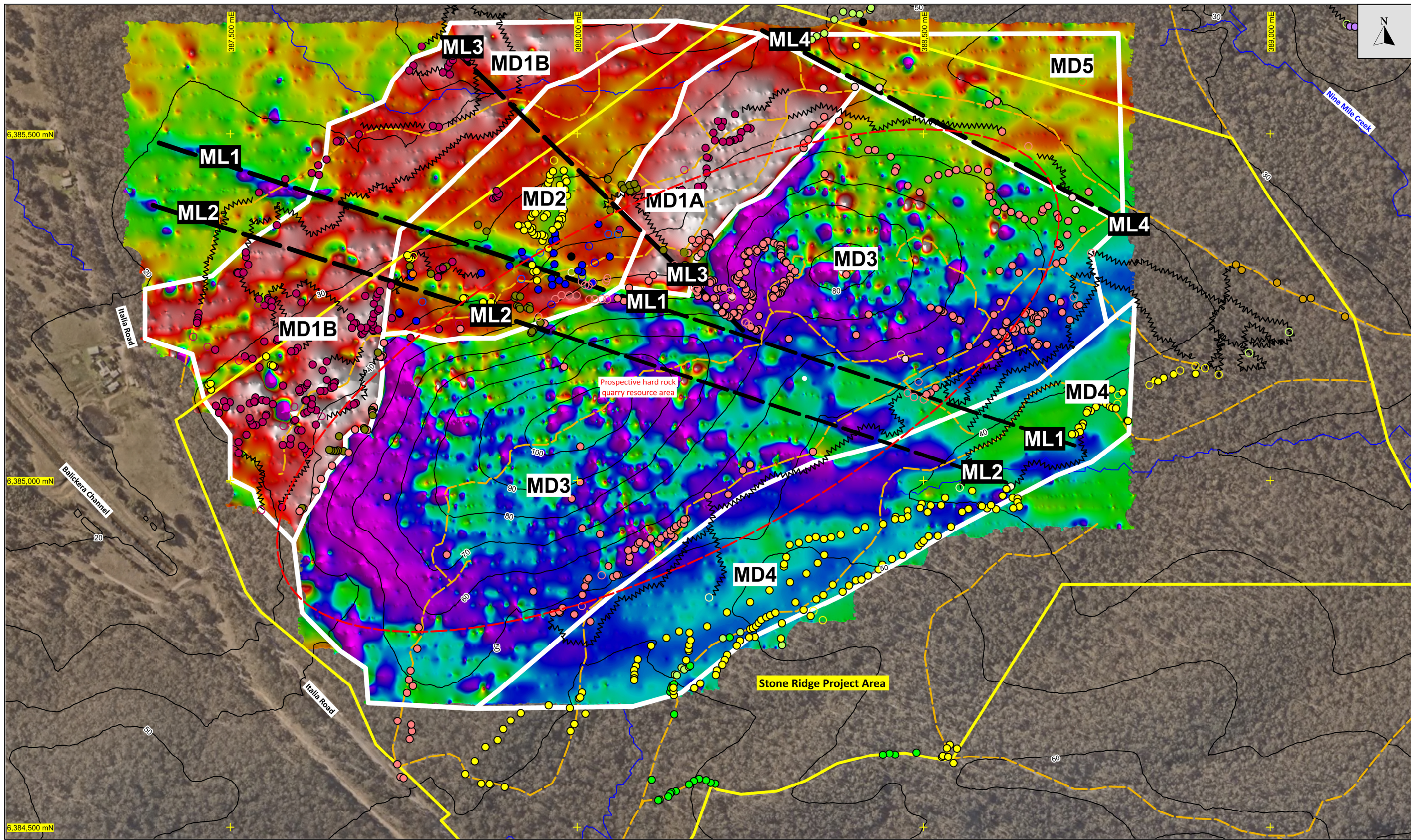
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Project: STONE RIDGE QUARRY PROJECT		Figure 7	
Title: Ground Magnetic Survey - Total Magnetic Intensity (TMI) Image - SW Sun Angle			
Author: DMB	Date: December 2019	Scale: 1:5,000 @ A3	Grid: MGA Zone 56 (GDA94)
Source: Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: - 10m contour interval - generated from LIDAR 0.5m contour data Ground Magnetic Survey: Fender Geophysics - 2018			

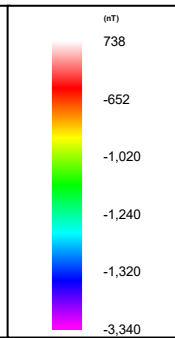


Legend Stone Ridge Project Area Boundary Forest Tracks Topographic contour (10m contour interval) Drainage line (ephemeral)		Australian Resource Development Group <small>130 Young St, Carrington, NSW, 2294 E: admin@ardg.com.au W: www.ardg.com.au</small>		Project: STONE RIDGE QUARRY PROJECT			Figure 8
		Title: Interpreted Magnetic Domains and Lineaments over TMI Image - SW Sun Angle					
		Author: DMB		Date: December 2019	Scale: 1:5,000 @ A3	Grid: MGA Zone 56 (GDA94)	
		Source: Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Ground Magnetic Survey: Fender Geophysics - 2018					



Legend	
	Stone Ridge Project Area Boundary
	Forest Tracks
	Topographic contour (10m contour interval)
	Drainage line (ephemeral)

Geology Legend	
	Outcrop / Subcrop
	Float
	Traverse with no outcrop or subcrop
	Sandstone
	Conglomerate
	Rhyolitic vitric crystal tuff
	Rhyodacitic crystal lithic ignimbrite
	Dacitic ignimbrite
	Andesite - lithic fragmental
	Volcanic breccia
	Dolerite / basalt



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Project: STONE RIDGE QUARRY PROJECT		Figure 9	
Title: Geological Outcrop, Subcrop and Float Mapping over Interpreted TMI Image			
Author: DMB	Date: December 2019	Scale: 1:5,000 @ A3	Grid: MGA Zone 56 (GDA94)
Source: Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Ground Magnetic Survey: Fender Geophysics - 2018			

5.3 Magnetic Domains

The Total Magnetic Intensity (TMI) image (**Figure 7**) was generated from the corrected magnetic survey data. **Figure 8** presents a magnetic domain and lineament interpretation of the TMI imagery, whereas **Figure 9** overlays geological mapping data over the TMI image and interpretation.

The magnetic character of the *Eagleton Volcanics* within the Project Area can be divided into five (5) contrasting domains that directly reflect different geological units. These domains are cut and/or offset by several prominent, structure-related magnetic lineaments (*i.e.* faults).

5.3.1 Magnetic Domain 1

Magnetic Domain 1 (MD1) comprises two separate areas (MD1A, MD1B) of relatively high magnetic intensity that correspond with mapped areas of outcropping dacite northwest of Stone Ridge. These sub-domains are separated by Magnetic Domain 2 which appears to underlie MD1A and overlie MD1B. MD1A is disrupted by two magnetic lineaments (ML1 and ML3), with ML1 truncating the southern end of this sub-domain. The northeast end of MD1A appears truncated by magnetic lineament ML4.

The magnetic signature of MD1A is particularly uniform and coherent, suggesting the dacitic rocks in this location are massive and unaltered. Several areas of lower magnetic intensity occur within MD1B and in part can be attributed to outcrop of non-magnetic rhyolitic vitric-crystal tuff. The highest magnetic intensity areas within MD1 occur where MD1A and MD1B are in contact with overlying rhyodacite of Magnetic Domain 3. The magnetic gradient across the contact supports the interpretation that dacitic rocks dip beneath the rhyodacite.

Magnetic susceptibility measurements on petrographic samples of dacite (surface outcrop and drill core) from Magnetic Domain 1 are presented in **Table 5-1** and reflect the typically high magnetic signature of this domain. The dacite samples typically have magnetic susceptibilities in the range $1800\text{-}2600 \times 10^{-5}$ SI units. In contrast, occasional narrow zones of variably altered crystal-vitric rhyolitic tuff have magnetic susceptibilities in the range $< 10\text{-}70 \times 10^{-5}$ SI units.

TABLE 5-1			
Magnetic Susceptibility Measurements for Petrographic Samples – Magnetic Domain 1			
Sample Details	Petrographic Report	Magnetic Susceptibility (x 10⁻⁵ SI)	Lithology
Dacitic Volcanics			
Sample H3	1028	1790	Massive, strongly porphyritic hornblende-biotite dacite
ARDG-DDH03 - 38.60-38.70m	1038	2130	Crystal-lithic felsic tuff, dacite-rhyodacite composition
ARDG-DDH03 - 41.70-41.80m	1038	1920	Crystal-lithic felsic tuff of dacite composition
ARDG-DDH15 - 48.42-48.50m	1096	2600	Crystal-lithic-vitric tuff of rhyodacite composition. Top of dacite stratigraphy
ARDG-DDH18 - 48.42-48.50m	1096	2610	Crystal-vitric-lithic felsic tuff of dacite composition
Rhyolitic Tuff			
Sample 15	1028	70	Fragmented vitric-crystal welded tuff of rhyolite composition
ARDG-DDH05 - 28.02-28.12m	1050	< 10	Strongly altered felsic tuff, probably of vitric-crystal type
ARDG-DDH05 - 23.00-23.10m	1050	< 10	Crystal-lithic-vitric tuff of rhyolite composition

Table 5-2 summarises the magnetic susceptibility information obtained core for all drill core intervals through unweathered dacitic volcanic rocks within this domain. The data is consistent with the data obtained from petrographic samples, with magnetic susceptibilities for these rocks typically much higher than most other volcanic rock types (excluding dolerite dykes) across the Project Area.

TABLE 5-2						
Summary of Magnetic Susceptibility Measurements for Drill Core Intervals – Magnetic Domain 1						
Drill Hole No.	Depth From (m)	Depth To (m)	# Readings	Magnetic Susceptibility ($\times 10^{-5}$ SI)		
				Minimum	Maximum	Average
Dacitic Volcanics (slightly weathered and unweathered)						
ARDG-DDH03	10	71.8	63	239	2940	1853
ARDG-DDH15	114	129	16	906	3640	2846
ARDG-DDH18	4	49	46	353	2820	1584
ARDG-DDH19	5	26	22	724	3620	2835

5.3.2 Magnetic Domain 2

Magnetic Domain 2 (MD2) is an area of moderately high magnetic intensity that separates MD1A and MD1B. This domain is associated with gently undulating topography to the north of the central ridgeline and is coincident with surface exposure of volcanic breccia and andesitic volcanics. The magnetic signature of this domain is relatively flat and is cut by three (3) structure-related linear magnetic anomalies (ML1, ML2, ML3). Minor outcrops of crystal-vitric rhyolitic tuff also occur within the footprint of this domain, the most significant of which is associated with a prominent north-south trending magnetic 'low' between ML1 and ML3.

Magnetic susceptibility measurements on petrographic samples of volcanic breccia and andesitic volcanics (surface outcrop and drill core) from this domain are presented in **Table 5-3**. These measurements are consistent with the TMI image, with MD2 rocks being less magnetic than those from MD1, but significantly more magnetic than rocks from all other domains.

TABLE 5-3			
Magnetic Susceptibility Measurements – Magnetic Domain 2			
Sample Details	Petrographic Report	Magnetic Susceptibility ($\times 10^{-5}$ SI)	Lithology
Volcanic Breccia			
ARDG-DDH08 - 30.40-30.65m	1054	930	Coarse volcanic breccia
ARDG-DDH08 - 36.29-36.41m	1054	500-1070	Coarse volcanic breccia. Clasts more magnetic than matrix
ARDG-DDH08 - 44.06-44.21m	1054	1220	Coarse volcanic breccia
ARDG-DDH08 - 52.40-52.49m	1054	950	Volcanic breccia
ARDG-DDH08 - 87.07-87.27m	1054	1210	Volcanic breccia
Andesitic Volcanics			
Sample H6	1028	270	Moderately altered, coarse lithic crystal tuff andesitic comp
ARDG-DDH08 - 40.58-40.68m	1054	1780	Pyroxene porphyritic andesite
ARDG-DDH08 - 44.34-44.42m	1054	2390	Pyroxene porphyritic andesite
ARDG-DDH08 - 50.27-50.34m	1054	1520	Pyroxene porphyritic andesite
ARDG-DDH08 - 78.97-79.06m	1054	2260	Massive coarse andesite fragmental
ARDG-DDH08 - 95.09-95.19m	1054	1280	Pyroxene porphyritic andesite

TABLE 5-3 (continued)			
Magnetic Susceptibility Measurements – Magnetic Domain 2			
Sample Details	Petrographic Report	Magnetic Susceptibility (x 10⁻⁵ SI)	Lithology
Rhyolitic Tuff			
ARDG-DDH08 - 56.01-56.09m	1054	110	Vitric crystal tuff

Samples of volcanic breccia with a significant matrix component typically have magnetic susceptibilities in the range 900-1200 x 10⁻⁵ SI units. Samples of massive andesite (that possibly represents large clasts within the volcanic breccia, up to several metres in size) as well as andesitic volcanoclastics, typically have much higher magnetic susceptibilities in the range 1500-2400 x 10⁻⁵ SI units. This contrasts with very low magnetic susceptibilities associated with rhyolitic crystal-vitric tuff.

Table 5-4 summarises the magnetic susceptibility information obtained for all drill core intervals through the unweathered volcanic breccia, andesite and rhyolitic tuff within this domain. The data is consistent with the that obtained from petrographic samples.

TABLE 5-4						
Summary of Magnetic Susceptibility Measurements for Drill Core Intervals – Magnetic Domain 2						
Drill Hole No.	Depth From (m)	Depth To (m)	# Readings	Magnetic Susceptibility (x 10⁻⁵ SI)		
				Minimum	Maximum	Average
Volcanic Breccia (slightly weathered and unweathered)						
ARDG-DDH08	23	54	32	599	2080	1092
ARDG-DDH08	58	60	3	1130	1300	1233
ARDG-DDH08	62	68	7	1070	1830	1426
ARDG-DDH08	82	89	8	26.5	1330	800
ARDG-DDH08	90	92	3	775	837	804
ARDG-DDH16	135	139	5	544	1280	930
ARDG-DDH18	50	54	5	38	1880	1296
ARDG-DDH19	27	36	10	767	2330	1487
Andesitic Volcanics (slightly weathered and unweathered)						
ARDG-DDH08	61	61	1	1930	1930	1930
ARDG-DDH08	76	81	6	1500	2220	1948
ARDG-DDH08	93	99	7	866	2600	1525
Rhyolitic Tuff (slightly weathered and unweathered)						
ARDG-DDH08	55	57	3	169	214	188
ARDG-DDH08	70	70	1	154	154	154

5.3.3 Magnetic Domain 3

Magnetic Domain 3 (MD3) is an area of generally much lower magnetic intensity that is directly associated with outcropping rhyodacitic volcanic rocks on Stone Ridge. The noisy, stippled magnetic signature of this domain on the TMI imagery is a direct influence of extensive surface outcrop and absence of a significant weathering profile. The northwest side of MD3 is in contact with MD1 and MD2, and with the exception an area to the immediate west of the Stone Ridge saddle, the TMI image suggests the contacts between these domains are stratigraphic, rather than structural, in nature. The northwest contact of MD3 with MD1A and MD1B is characterised on the TMI image by strong negative

dipolar anomalies caused by the significantly higher magnetic intensity of rocks in MD1. As indicated previously, the steep magnetic gradient along this contact suggests the rhyodacite is underlain by dacitic rocks of MD1. MD3 is impacted in the vicinity of the Stone Ridge saddle by three (3) structure-related linear magnetic anomalies (ML1, ML2, ML3). The northeast limit of this domain is truncated by magnetic lineament L4.

Magnetic susceptibility measurements on petrographic samples of unweathered rhyodacite (surface outcrop and drill core) from this domain are presented in **Table 5-5**. Samples have been broadly grouped according to their interpreted position within the rhyodacite stratigraphy.

TABLE 5-5			
Magnetic Susceptibility Measurements – Magnetic Domain 3			
Sample Details	Petrographic Report	Magnetic Susceptibility (x 10⁻⁵ SI)	Lithology
Rhyodacite – Lower Stratigraphic Sequence			
ARDG-DDH15 - 83.55-83.67m	1096	1870	Crystal-vitric-lithic felsic tuff of likely rhyodacite composition.
ARDG-DDH15 - 91.56-91.61m	1096	1490	Crystal-vitric-lithic felsic tuff of likely rhyodacite composition.
ARDG-DDH15 - 100.04-100.12m	1096	1450	Crystal-vitric felsic tuff of likely rhyodacite composition.
ARDG-DDH15 - 104.51-104.64m	1096	690	Massive crystal vitric felsic tuff of ? dacite composition.
ARDG-DDH15 - 105.58-105.68m	1096	820	Massive crystal vitric felsic tuff of ? dacite composition.
ARDG-DDH15 - 108.21-108.29m	1096	1060	Massive crystal vitric felsic tuff of ? dacite composition.
ARDG-DDH16 - 25.60-25.71m	1096	730	Porphyritic rhyodacite
ARDG-DDH16 - 55.77-55.91m	1096	150	Porphyritic rhyodacite
ARDG-DDH16 - 59.00-59.12m	1096	720	Porphyritic rhyodacite
ARDG-DDH16 - 129.61-129.72m	1096	780	Porphyritic rhyodacite
ARDG-DDH16 - 132.72-132.79m	1096	340	Porphyritic rhyodacite
ARDG-DDH16 - 132.84-132.89m	1096	190	Porphyritic rhyodacite
Rhyodacite – Middle Stratigraphic Sequence			
ARDG-DDH01 - 28.56-28.65m	1038	1050	Porphyritic rhyodacite
ARDG-DDH01 - 49.85-49.95m	1038	1240	Porphyritic rhyodacite
ARDG-DDH04 - 20.95-21.00m	1038	840	Rhyodacite
ARDG-DDH04 - 22.70-22.79m	1038	170	Rhyodacite
ARDG-DDH04 - 49.54-49.59m	1038	1510	Rhyodacite
ARDG-DDH04 - 59.40-59.50m	1050	530	Coarse lithic crystal breccia of rhyodacite composition
ARDG-DDH04 - 75.60-75.72m	1050	1140	Porphyritic rhyodacite
Rhyodacite – Upper Stratigraphic Sequence			
Sample 3	1028	220	Porphyritic rhyodacite
ARDG-DDH05 - 21.00-21.08m	1050	< 10	Porphyritic rhyodacite – moderate pervasive alteration
ARDG-DDH05 - 27.17-27.27m	1050	80	Porphyritic rhyodacite – moderate pervasive alteration
ARDG-DDH05 - 30.77-30.87m	1050	50	Porphyritic rhyodacite – moderate pervasive alteration
ARDG-DDH06 - 25.95-26.02m	1050	700	Coarse crystal lithic vitric tuff of rhyolitic composition.
ARDG-DDH06 - 30.00-30.07m	1050	390	Crystal lithic vitric tuff of rhyolitic to rhyodacitic composition
ARDG-DDH06 - 40.01-40.09m	1050	360	Porphyritic rhyodacite
ARDG-DDH06 - 49.92-50.01m	1050	430	Coarse fragmental volcanic rock of rhyodacitic composition
ARDG-DDH06 - 60.32-60.42m	1050	360	Porphyritic rhyodacite

Rhyodacite samples have a broad range of magnetic susceptibilities (< 10-1870 x 10⁻⁵ SI), consistent with the greater range in magnetic intensity reflected in the TMI image. However, the overall average of rhyodacite magnetic susceptibilities is significantly lower than rocks associated with MD1 and MD2.

The grouping of samples by approximate stratigraphic position indicates that the magnetic susceptibilities of rhyodacite samples from the upper stratigraphy are notably lower than those samples at middle and lower depths in the stratigraphy. This relationship is less evident for all drill core intervals through unweathered rhyodacite (**Table 5-6**), although the general range in results is broadly consistent with the results in **Table 5-5**.

TABLE 5-6						
Summary of Magnetic Susceptibility Measurements for Drill Core Intervals – Magnetic Domain 3						
Drill Hole No.	Depth From (m)	Depth To (m)	# Readings	Magnetic Susceptibility ($\times 10^{-5}$ SI)		
				Minimum	Maximum	Average
Rhyodacite (slightly weathered and unweathered) – Lower Stratigraphic Sequence						
ARDG-DDH07	3	111	109	34.1	1340	790
ARDG-DDH15	45	113	69	26.3	1840	1264
ARDG-DDH16	6	14	9	0	717	458
ARDG-DDH16	17	134.19	118	59.5	1210	757
Rhyodacite (slightly weathered and unweathered) – Middle Stratigraphic Sequence						
ARDG-DDH01	14	50	37	120	1200	951
ARDG-DDH04	8	130	123	30	1650	944
ARDG-DDH13	9	66	58	303	1330	1022
ARDG-DDH14	20	104	85	175	1500	1062
Rhyodacite (slightly weathered and unweathered) – Upper Stratigraphic Sequence						
ARDG-DDH05	38	40	3	459	659	544
ARDG-DDH05	58	98	41	238	1290	636
ARDG-DDH06	25	78	54	150	880	329
ARDG-DDH09	9	119	111	20.1	876	442
ARDG-DDH10	19	120	102	65.8	628	336
ARDG-DDH11	6	98	93	52.3	1310	583
ARDG-DDH12	18	114	97	48.4	1350	461

5.3.4 Magnetic Domain 4

Magnetic Domain 4 (MD4) is an area of relatively low magnetic intensity that runs parallel to the southeast flank of Stone Ridge. This domain corresponds with the upper extent of the *Eagleton Volcanics* and extends in width from the downslope extent of rhyodacite outcrop (*i.e.* approximate upper limit of rhyodacite) through to and including the prominent altered rhyolitic vitric-crystal tuff outcrop that strikes northeast-southwest, parallel to Stone Ridge.

Outcrop within this domain is limited to the altered rhyolitic tuff. The mapped extent of the tuff closely correlates with a linear zone of very low magnetic intensity on the southeast edge of this domain. A magnetic susceptibility measurement (**Table 5-7**) on a surface outcrop sample of rhyolitic tuff produced a reading of $< 10 \times 10^{-5}$ SI, indicating the sample is effectively devoid of magnetite.

Diamond drilling has confirmed that the geology between the rhyodacite (MD3) and altered rhyolitic tuff of MD4 is characterised by an interbedded sequence of volcanic sandstone, siltstone, tuff and minor conglomerate (refer **Section 7.2.3**).

TABLE 5-7			
Magnetic Susceptibility Measurements – Magnetic Domain 4			
Sample Details	Petrographic Report	Magnetic Susceptibility (x 10⁻⁵ SI)	Description
Rhyolitic Tuff			
Sample H2	1028	< 10	Coarse grained vitric-crystal felsic tuff of rhyodacite composition, pervasively altered

Table 5-8 summarises the magnetic susceptibility information obtained for all drill core intervals through the volcano-sedimentary units (including subordinate rhyolitic tuff bands) within MD4. The data shows that the sedimentary units have a broad range in magnetic susceptibilities, with peak figures that can be attributed to sporadic bands of bedding-parallel magnetite. However, the overall average susceptibilities range from 135-608 x 10⁻⁵ SI and appear to explain the slightly higher magnetic intensity on the TMI image, compared with the adjacent altered rhyolitic tuff horizon.

TABLE 5-8						
Summary of Magnetic Susceptibility Measurements for Drill Core Intervals – Magnetic Domain 4						
Drill Hole No.	Depth From (m)	Depth To (m)	# Readings	Magnetic Susceptibility (x 10⁻⁵ SI)		
				Minimum	Maximum	Average
Volcano-Sedimentary Units (including Rhyolitic Tuff)						
ARDG-DDH02	1	26	26	3.1	765	307
ARDG-DDH06	4	25	21	20	446	135
ARDG-DDH17	13	39	27	3.1	2340	300
ARDG-DDH20	1	14	14	19.6	1190	267
ARDG-DDH20	27	36	10	4.7	1990	608

5.3.5 Magnetic Domain 5

Magnetic Domain 5 (MD5) is an area of moderate to high and variable magnetic intensity beyond the northern end of Stone Ridge and MD1A and MD3. It is associated with flat topography that drains towards Nine Mile Creek and outcrop within this domain is limited to minor exposures of volcanic sandstone and rhyolitic tuff on a low ridge near the northern edge of the ground magnetic survey area. The southern edge of this domain corresponds with a magnetic lineament (L4) and is therefore interpreted to be of a structural nature.

5.4 Magnetic Lineaments

Several prominent magnetic lineaments, defined by linear zones of contrasting magnetic intensity, have been identified within the TMI imagery. Two of these (ML1 and ML 4) have since been confirmed by drilling as structural zones that have been the focus of faulting, shearing, brecciation, alteration and dolerite dyke emplacement. Several of the magnetic lineaments appear to truncate and/or horizontally offset several magnetic domains.

5.4.1 Magnetic Lineament 1

Magnetic Lineament 1 (ML1) is a northwest-southeast (288° grid) oriented feature defined on the TMI image by a combination of negative magnetic anomalism through MD1B and MD2; and more subtle magnetic contrast through MD3 and MD4.

ML1 passes through Stone Ridge in the approximate position of the saddle and can be traced across the Project Area for approximately 1400m, through the entire *Eagleton Volcanics* sequence. It defines the southwest limit of MD1A and the northeast side of a 95-metre-wide gap in outcrop exposure that extends across the Project Area. This gap is most clearly observed within the rhyolitic tuff horizon at the top of the *Eagleton Volcanics*.

Diamond drilling (refer **Section 6, Table 6-11**) has since confirmed that ML1 is associated with a major zone of faulting, shearing, brecciation and dyke emplacement – now referred to as the Central Fault.

Magnetic susceptibility measurements of dolerite core samples from hole ARDG-DDH05 that intersected ML1, are presented in **Table 5-9**. These confirm the dolerite exhibits some of the highest magnetic susceptibilities of any rocks within the Project Area. Their spatial association with a zone of apparent negative magnetism in the TMI image suggests these dyke rocks display magnetic remanence and have reversed polarity.

TABLE 5-9			
Magnetic Susceptibility Measurements – Magnetic Lineament 1			
Sample Details	Petrographic Report	Magnetic Susceptibility (x 10⁻⁵ SI)	Description
Dolerite			
ARDG-DDH05 - 47.45-47.59m	1050	2780	Dolerite
ARDG-DDH05 - 56.50-56.55m	1050	5170	Dolerite

Table 5-10 summarises the magnetic susceptibility information obtained for a drill core interval through unweathered dolerite. Again, the magnetic susceptibilities are consistently high and average in excess of 3000 x 10⁻⁵ SI.

TABLE 5-10						
Summary of Magnetic Susceptibility Measurements for Drill Core Interval – Magnetic Lineament 1						
Drill Hole No.	Depth From (m)	Depth To (m)	# Readings	Magnetic Susceptibility (x 10⁻⁵ SI)		
				Minimum	Maximum	Average
Dolerite (slightly weathered and unweathered)						
ARDG-DDH05	41	57	16	818	4170	3207

5.4.2 Magnetic Lineament 2

Magnetic Lineament 2 (ML2) is located approximately 90 metre south of and parallel to ML1. It is defined on the TMI image by more subtle discontinuous negative magnetic anomalism through MD1B and MD2; and more subtle features through MD3 and MD4.

ML2 can also be traced across the Project Area for approximately 1000m, through the entire *Eagleton Volcanics* sequence. It defines the southern side of the 95-metre-wide gap in outcrop exposure that again, is best observed within the rhyolitic tuff horizon at the top of the *Eagleton Volcanics*.

More recent drill testing across ML2 has failed to identify any evidence of faulting, shearing or brecciation. Accordingly, ML2 (the Central Fracture) may be a subsidiary structure related to the Central Fault, but one that has not experienced any major deformation and displacement.

5.4.3 Magnetic Lineament 3

Magnetic Lineament 3 (ML3) is a northwest-southeast (314° grid) oriented feature defined on the TMI image by subtle discontinuous negative magnetic anomalism through MD1A, MD1B and MD2.

ML3 can be traced from the northern edge of the TMI image at the base of the *Eagleton Volcanics*, through to the Stone Ridge saddle, where it appears to terminate against ML1. ML3 defines an apparent sinistral offset of the southern end of MD1A dacite, as well as the northern edge of rhyolitic tuff outcrop within MD2.

The orientation of ML3 and its relationship to ML1, suggests it may define a splay fault off the Central Fault.

5.4.4 Magnetic Lineament 4

Magnetic Lineament 4 (ML4) is a southeast-northwest (298° grid) oriented feature defined on the TMI image by negative magnetic anomalism defining the northern edge of MD1A with MD5, and a change in magnetic signature between MD3 and MD5.

ML4 can be traced from the northern edge of the TMI image where it defines the southern limit of a northeast-southwest oriented sandstone outcrop of MD5. It approximately defines the orientation of the extent of rhyodacite outcrop at the northeast end of Stone Ridge.