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PETROGRAPHIC REPORT

(Rocks from MAC-27)

for

ABERFOYLE RESOURCES Ltd
(attn. Andrew McNeill)

by

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SAMPLE NUMBER: 563711 225.1 m

SUMMARY:

This sample is a strongly carbonate-altered primitive olivine+augite basaltic lava or lapilli tuff.

HAND SPECIMEN:

This is a pale- to mid-grey mafic(?) lava cut by calcite veinlets and segregations.

THIN SECTION:

This sample was probably a basaltic lava or tuff with phenocrysts of augite and olivine. Its original texture and mineralogy has, however, been totally overprinted and largely destroyed by pervasive carbonate alteration. Relic mafic phenocrysts outlines are not well enough preserved to be diagnostic, but occasional replacement by chlorite-serpentine minerals and the common presence of large euhedral chromite inclusions suggests that most were likely to have been olivine. A few shapes reminiscent more of augite were also noted.

The groundmass of this sample was probably highly glassy. The obliteration of the primary texture by carbonate alteration renders accurate identification difficult, but in many places relic textures seem to me more like a former basaltic lapilli tuff than a lava. Abundant curved fractures define a discontinuous fairly weakly developed foliation that transects one generation of calcite veins but is itself cut by later calcite veins. The latter have relatively coarse-grained calcite crystals with finely-sutured grain boundaries, and make up most of the carbonate veins in the rock.

The abundant chromite and serpentine (?) or colourless chlorite that makes up most of this rock besides calcite suggest that it was a Cr-rich fairly primitive basalt compositionally. The texture, although not definitive due to strong carbonate alteration, is more suggestive of a basaltic lapilli tuff than a basaltic lava.

SAMPLE NUMBER: 563712 MAC-27, 415.45m

SUMMARY:

This sample is an autobrecciated andesitic lava with sparse albitized plagioclase and quartz phenocrysts in a matrix that has been strongly overprinted by albite alteration.

HAND SPECIMEN:

This is a strongly altered felsic or intermediate lava or lava breccia in which dark grey fragments of dacite(?) to at least 3cm long are set in a paler groundmass that has an almost cherty texture in places.

THIN SECTION:

This sample is a polymict andesitic lava breccia with a strongly recrystallized groundmass. The best preserved fragments are all identical texturally and mineralogically, and rather unusual in having albitized plagioclase (<5 modal%) and quartz phenocrysts in a groundmass charged with albite microlites set in abundant chlorite. The three or four quartz phenocrysts are strongly reacted and resorbed, but are definitely phenocrysts and not silica alteration. Albitized plagioclase phenocrysts are also rather rounded, rarely larger than 1mm, and show dirty brown clayey alteration in places. There is no clear evidence for the former presence of mafic phenocrysts.

The margins of most fragments merge imperceptibly into the matrix of this rock. The matrix is exceptionally heterogeneous texturally, although where best preserved it is little different texturally from the fragments. Most of the sample, however, is mainly fairly well-crystallized intergrowths of quartz and albite flecked with chlorite and dirty brownish calcite. Quite coarse-grained segregations of intergrown dusty brownish albite and calcite are abundant.

This sample is probably an autobrecciated andesitic lava that has been soaked with albite-forming hydrothermal solutions during regional alteration. It is unusual for Hellyer region lavas in having quartz phenocrysts (however uncommon).

SAMPLE NUMBER: 563713 MAC-27, 515.45m

SUMMARY:

This sample is a massive sparsely plagioclase+quartz (+rare augite) - phyric andesitic lava identical to the precursor lava of 563712.

HAND SPECIMEN:

This is a massive, uniform textured pale- to mid-grey finely porphyritic basaltic to andesitic lava.

THIN SECTION:

Despite the fact that it apparently comes from exactly 100m deeper in the drillhole than the previous sample (563712), this rock bears an astonishing similarity to 563712 petrographically; the only significant difference prior to alteration is that this rock is unbrecciated. It consists of around 2-3 modal % of dirty brownish somewhat rounded albite phenocrysts less than 1mm across, some of which are flecked with chlorite and granular pale yellow epidote. A few microphenocrysts of fresh augite are preserved. Two definite quartz phenocrysts (xenocrysts?) were noted, both rounded and reacted, with narrow high-temperature reaction rims of very fine-grained clinopyroxene.

The bulk of this sample is a relatively even textured groundmass composed of abundant albite laths set in a matrix of anhedral quartz, and abundant dirty brown extremely fine-grained epidote and chlorite. A few elongate fractures are filled by secondary quartz and pale green chlorite.

This sample is undoubtedly identical to the precursor lava of the preceding sample. It is unusual and distinctive in having both rounded dusty albite phenocrysts and rounded quartz phenocrysts or xenocrysts. I have not seen similar samples in other drillholes in the region, although I have not looked at MCH-1. The chemistry of this sample would be interesting. I suggest that it is andesitic.

SAMPLE NUMBER: 563714, MAC-27, 607.45m

SUMMARY:

This sample is a well-preserved, sparsely augite+plagioclase -phyric basaltic lava breccia; it contains similar reacted quartz xenocrysts to those noted in the previous samples.

HAND SPECIMEN:

This is an intensely brecciated and quartz(?)-veined dark grey basaltic (?) lava.

THIN SECTION:

Despite the brecciation, this rock is texturally and mineralogically very well-preserved within fragments. It is clearly a plagioclase+augite-phyric basalt, and, as for the two preceding samples, is unusual in containing (in this case) quite common rounded and resorbed quartz phenocrysts or xenocrysts. Augite and albitized plagioclase phenocrysts each make up about 3-5 modal% of the sample, although the albite phenocrysts are invariably much larger (mainly 0.5-1.5mm long), and more rounded. The small squat augite microphenocrysts are mainly fresh and grade into equidimensional groundmass prisms. Quartz phenocrysts or xenocrysts are almost as abundant as albite in this sample. They are invariably rounded and reacted, with occasional high-temperature reaction rims of augite; a few have brown melt inclusions, and several show prominent internal strain features such as tiny parallel microshears. They are, as in the previous sample, quite clearly out of equilibrium with the host magma (in this case, basaltic), and therefore best identified as xenocrysts.

The groundmass of this lava breccia, within fragments, was very fine-grained to glassy and charged with randomly orientated tiny albite microlites. Patchy development of secondary quartz is common, and several large segregations composed of intergrown radiating sheaves of secondary albite and minor intergrown prehnite and calcite are also present.

This sample is a relatively evolved basaltic lava; it is more primitive, however, than the preceding two samples, in which augite never was a significant primary phase.

SAMPLE NUMBER: 563715, MAC-27, 667.7m

SUMMARY:

This sample is a fine-grained poorly sorted quartz sandstone that has been strongly carbonate-altered. It is derived largely from pelitic metamorphic detritus, and resembles strongly the Animal Ck greywacke.

HAND SPECIMEN:

This is a uniform (unbedded in the small hand spec) dark grey fine-grained silty sandstone.

THIN SECTION:

This is a poorly sorted and strongly altered fine-grained sandstone in which about 3 modal% of small (<<1mm across) angular detrital quartz grains, and flakes of detrital muscovite to 1.4mm long, are set in a heavily carbonate-altered matrix. The quartz grains include both monocrystalline (volcanic?) and polycrystalline (metamorphic) quartz; the latter are sometimes schistose intergrowths with muscovite.

The matrix of this rock is uncleaved and was probably clayey, but it has been pervasively overprinted by murky very fine-grained calcite. Veinlets of calcite with scattered euhedral opaque minerals (pyrite or pyrrhotite) are not uncommon cutting this rock.

The sample shows obvious strong similarities to the Animal Ck Greywacke petrographically, and clearly is derived in large part from a nearby pelitic metamorphic source.

SAMPLE NUMBER: 563716 MAC-27, 713.5m

SUMMARY:

This sample is a strongly augite-phyric basaltic lava that also contains about 3 modal% of altered olivine phenocrysts.

HAND SPECIMEN:

This is a massive pale- to medium grey finely porphyritic and weakly vesicular basaltic lava in which the vesicles (to 1cm long) are filled by either calcite or chlorite or both.

THIN SECTION:

This is a distinctive basaltic lava that contains around 20 modal% of well-formed augite phenocrysts and about 3-5 modal% of totally carbonate-altered former olivine phenocrysts, set in a very fine-grained matrix that was originally largely glassy. The augite phenocrysts vary from 4mm long to groundmass microlites; most are euhedral to subhedral and are perfectly fresh, and show minimal optical zoning. A few small euhedral chromite inclusions were noted, but these are more abundant in the altered olivines. The augite crystals commonly occur in multi-crystal clots of 10-20 crystals, especially the smaller grainsize (micro)phenocrysts. Former olivine phenocrysts are mainly <1mm long and are replaced by calcite.

The groundmass of this sample is very murky and fine-grained and charged with tiny acicular albite and augite microlites. It was probably quite glassy. Calcite occurs as polygonal crystal aggregates filling vesicles, and as occasional veins and patches through the rock.

This is a distinctive augite-rich (ankaramitic) basaltic lava.

SAMPLE NUMBER: 563717, MAC-27, 833.8m

SUMMARY:

This sample is a well-preserved olivine+augite-phyric fairly primitive basaltic lava typical of many of the Hellyer basalts.

HAND SPECIMEN:

This is a massive pale- to medium grey finely porphyritic basaltic lava cut by narrow calcite veinlets, and with common tiny blebs of black chlorite in the groundmass.

THIN SECTION:

This is a texturally well-preserved olivine+augite-phyric basaltic lava. Former olivine phenocrysts are entirely replaced by very fine-grained polygonal silica and minor calcite, and make up about 7-10 modal% of this sample. They are up to 3mm long, euhedral, and commonly contain tiny red euhedral chromite inclusions. Augite phenocrysts are equally as abundant as olivine, mainly finer-grained (0.5-1.5mm long), perfectly fresh and unzoned. Unlike olivine, they usually occur as clusters of crystals, often intergrown.

The groundmass of this sample is very similar to that in the previous sample. It is murky, very fine-grained and charged with tiny albite and augite microlites. In places, small sheaves of intergrown albite and augite represent quenched spherulitic crystallization, typical of the margins of pillowed units. Fractures through the groundmass are filled by pale green chlorite and lined by tiny blebs of quartz. Narrow meandering calcite veinlets transect this sample.

SAMPLE NUMBER: 563718, MAC-27, 841.35m

SUMMARY:

This sample is a weakly plagioclase-phyric dacitic lava breccia.

HAND SPECIMEN:

This is a mid-grey-green weakly autobrecciated felsic lava in which altered plagioclase phenocrysts are quite common.

THIN SECTION:

This is a plagioclase-porphyritic dacitic lava in which albitized plagioclase phenocrysts make up about 5 modal% of the rock, and are partially altered to sericite. Most albite phenocrysts are 0.5-1mm long, and vary from euhedral to subhedral. No mafic phenocrysts were present in this sample.

The groundmass of this sample was not entirely glassy, like most Hellyer dacites that I have seen. It is composed of a matrix of interlocking tiny laths and microlites of albite and subordinate anhedral chlorite in which are set abundant almost perfectly round albite blebs to about 0.2mm across. These presumably crystallized from interstitial glass, and are not spherulites. In inter-fragment areas, the matrix is much cleaner-looking, more silica-rich and chlorite-free. Dispersed wave-fronts of small opaque grains (magnetite?) form trails through the rock, but are not abundant. This is clearly a lava breccia of probable dacitic composition; the texture (relatively 'glass-poor') suggests that it comes from within, rather than from the margins of, a dacitic cooling unit.

SAMPLE NUMBER: 563719, MAC-27, 865.3,

SUMMARY:

This sample is a massive sparsely plagioclase-phyric dacitic lava with a few chloritized augite phenocrysts.

HAND SPECIMEN:

This is a massive, pinkish-green almost aphyric felsic lava.

THIN SECTION:

This is a sparsely plagioclase-phyric dacitic lava that is similar to that above in most respects except for the following points:

1: this sample contains two or three small chloritized augite phenocrysts.
2: this sample is unbrecciated, and has a generally finer-grained groundmass than 563718, lacking the microlitic plagioclase and rounded blebs of albite that characterize that rock.
3: this sample contains a 1.5mm diameter inclusion composed of shallow magma chamber or counduit during ascent.

This is a texturally well-preserved dacitic lava, and is perhaps unusual in that former FeTi oxide phenocrysts are apparently absent; this is not a common feature of Hellyer sequence dacites.

SAMPLE NUMBER: 563720 MAC-27, 882.2m

SUMMARY:

This sample is an olivine+augite-phyric quite primitive basaltic lava quite similar petrographically to sample 563717.

HAND SPECIMEN:

This is a vesicular porphyritic mafic lava cut by calcite veinlets; the vesicles are also calcite veined.

THIN SECTION:

This is a texturally well-preserved augite+olivine-phyric vesicular basaltic lava. The augite and olivine phenocrysts are approximately equally modally abundant, around 10-15 modal%, and mainly less than 1.5mm long. Whereas augite is entirely fresh, all olivine is altered to fine-grained polygonal intergrowths of quartz. Small euhedral red chromite inclusions are present in many altered olivines. Augite phenocrysts are euhedral to subhedral and frequently occur in multi-crystal clots; they are unzoned.

The groundmass of this sample is murky brown and charged with tiny acicular albite microlites. It was probably quite glassy, and contains small angular patches of green chlorite. Vesicles reach almost 1cm in diameter, and make up around 10 modal% of the sample. They are filled by radiating to polygonal intergrowths of secondary quartz; calcite veinlets are not uncommon.