

**PETROGRAPHIC REPORT**

**Rocks from South, Southwest and East of Mt Charter  
MAC 36**

**Attn: Steve Richardson 17/4/94**

**by  
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**SAMPLE: MAC 36 622293 128.4m**

**SUMMARY: This sample was a sparsely plagioclase-phyric glassy probably dacitic lava that has suffered moderate sericite-silica hydrothermal alteration, leading to total recrystallization of the formerly glassy groundmass.**

**HAND SPECIMEN:**

This is a grey-green intermediate to felsic probably formerly glassy lava with dark olive spots, 1mm across that don't appear to be either vesicle-filling or after small phenocrysts. They seem to define a weak flow(?) orientation, which is cut at high angles by hairline dark chloritic (?) fractures. The latter are transected by a set of narrow calcite veinlets that parallel the flow(?) orientation.

**THIN SECTION DESCRIPTION:**

This sample is a strongly sericite-silica-altered formerly sparsely plagioclase-phyric dacitic glassy lava. Plagioclase phenocrysts usually less than 1mm long made up about 3-5 modal% of this rock, and show a weak flow alignment; they are now represented by clots of colourless to pale yellow-green sericite, and former crystal shapes are often obliterated. There were a few former phenocrysts or microphenocrysts of FeTi oxide, and these are now altered to dark leucoxenitic material.

The once-glassy groundmass has devitrified, then strongly recrystallized to a patchy medium-grained quartzo-feldspathic mosaic with larger anhedral quartz grains growing in strongly sericitized albite, the whole lot being pervaded by discontinuous trails of sericite flecks and veinlets. The latter define a weak foliation evident in thin section but not obvious in the hand specimen. Very fine-grained magnetite or pyrite is quite common disseminated throughout the recrystallized groundmass. Narrow quartz-chlorite veinlets are cut by slightly wider calcite veinlets. Neither are associated with any pyrite or ore minerals.

The significant alteration of this sample is probably due to localized hydrothermal alteration rather than pervasive regional burial metamorphism.

**SAMPLE: MAC 36 622294**

139.2 m

**SUMMARY:** This sample is a low-grade burial metamorphosed and moderately carbonate-altered formerly glassy plagioclase+augite +FeTi oxide-phyric andesitic lava with common apatite microphenocrysts.

**HAND SPECIMEN:**

This is a dark grey-green formerly plagioclase+augite-phyric andesitic lava with streaky and patchy calcite alteration. Former mafic phenocrysts are clearly chlorite-altered, and plagioclase phenocrysts are altered to sericite and/or calcite.

**THIN SECTION DESCRIPTION:**

This sample is plagioclase-phyric andesite lava that has suffered moderate carbonate alteration. Former plagioclase phenocrysts to about 2mm long maximum make up around 10 modal% of the rock, and are totally replaced by massive calcite and/or very fine-grained sericite aggregates. Much less abundant were former augite phenocrysts, which are now thoroughly replaced by green chlorite. Former FeTi phenocrysts were not uncommon, and are either replaced by messy brown leucoxene, or by clots of small very well-crystallized crystals of sphene. This sample contains a notable number of apatite microphenocrysts.,

The groundmass of this lava was probably originally vitrophyric to glassy textured. It now consists of a strongly altered intergrowth of patchy messy buff-coloured calcite, probably after albite, and larger anhedral quartz grains and aggregates. A pervasive but not strongly developed mesh of sericite cuts the groundmass, and often contains streaks of chlorite intergrown with sericite. Veinlets of quartz-chlorite, or calcite are quite common, and calcite blebs and patches are common in the groundmass.

The alteration of this sample is probably more related to pervasive regional burial metamorphism than to local hydrothermal alteration, although carbonate is strongly developed. The abundance of apatite microphenocrysts may indicate affinities with the more shoshonitic lavas in the Hellyer region, and is a significant difference from the standard Que Footwall andesites.

**SAMPLE: MAC 36 62295**

153.0 m

**SUMMARY: This sample is a moderately hydrothermally-altered andesitic hyaloclastite or chill breccia derived from a plagioclase-phyric andesite lava.**

**HAND SPECIMEN:**

This is a dark green-grey andesitic lava breccia with strong alteration of the matrix enhancing the contrast between fragments (mainly < 1cm long) and matrix.

**THIN SECTION DESCRIPTION:**

This sample is a strongly altered, weakly foliated andesitic hyaloclastite breccia. Fragments are more chloritic than the more silica-rich matrix, and most fragments, despite their alteration, retain a perlitic texture indicating that they were originally glassy. The andesitic lava was moderately plagioclase-phyric, with phenocrysts of albitized plagioclase to about 3mm across (mainly much smaller) being heavily calcite and sericite. A few calcite pseudomorphs after probable augite phenocrysts are present, and former FeTi oxide phenocrysts are leucoxene-altered.

The groundmass of the lava fragments has altered to a chlorite- and very fine-grained silica-dominated intergrowth with calcite and sericite defining perlitic cracks and cross-fractures, and also defining a moderately well-developed foliation. Matrix between fragments is almost unfoliated, and is composed of a heterogeneous sugary-textured quartzose intergrowth with common intergrown calcite and sericite, and minor disseminated pyrite. It is clearly a result of strong fluid interaction with the formerly glassy brecciated lava

This sample was a glassy andesitic hyaloclastite or chill breccia that has suffered moderate hydrothermal alteration. Chlorite-rich altered lava fragments developed a weak foliation during hydrothermal alteration, whereas the more silica-rich matrix resisted foliation development.

**SAMPLE: MAC 36 62296**

198.2m

**SUMMARY:** This sample was a glassy moderately plagioclase-phyric andesitic lava; weak hydrothermal alteration (calcite-sericite) overprinted a chlorite-quartz assemblage in the groundmass.

**HAND SPECIMEN:**

This is a dark green-grey, more massive altered plagioclase-phyric andesitic lava very similar to the protolith (or less altered fragments in) of the previous sample.

**THIN SECTION DESCRIPTION:**

This sample is a moderately altered plagioclase-phyric andesitic lava originally composed of around 15 modal% plagioclase phenocrysts, and a few augite and FeTi oxide phenocrysts in a formerly glassy groundmass. The albitized plagioclase phenocrysts are to about 3mm long, and most are totally replaced by calcite and sericite. The few identifiable former augite phenocrysts are altered to chlorite, and FeTi oxide phenocrysts are altered to either leucoxene, or clots of small euhedral sphene crystals. A number of apatite microphenocrysts were noted in this sample.

The groundmass of this rock was almost certainly glassy to sparsely vitrophyric. In places, tiny albitized plagioclase microlites occur in altered glass, but throughout most of the slide the groundmass is now composed of an even-textured intergrowth of yellowish green chlorite, sugary anhedral quartz, and leucoxenitized former FeTi oxides. Patchy sericite and chlorite overprints the chlorite-quartz alteration assemblage in places. A few irregular vesicles are filled by chalcedonic silica.

This formerly largely glassy andesitic lava is very similar to the previous sample 62295, which autobrecciated, and subsequently altered more intensely than this more massive coherent lava. Alteration in this sample is weak hydrothermal alteration (calcite-sericite) over an earlier chlorite-quartz-dominated burial metamorphic alteration.

**SAMPLE:** MAC 36 622297 263.5m

**SUMMARY:** This sample is a quite strongly plagioclase-phyric burial metamorphosed dacitic to evolved andesitic lava.

**HAND SPECIMEN:**

This is a dark brown finely plagioclase+augite-phyric andesitic to dacitic lava.

**THIN SECTION DESCRIPTION:**

This sample is a quite strongly plagioclase-phyric lava of probably dacitic composition, with a formerly vitrophyric texture. Plagioclase phenocrysts make up around 20 modal% of the rock, and occur as single crystals, or commonly crystal clots to about 2mm across; they are totally albitized, but occasionally they contain small granular inclusions of yellowish epidote and green chlorite. Former augite phenocrysts are rather rare, (<2 modal%) and are replaced by green chlorite; common FeTi oxide microphenocrysts are replaced by brown leucoxenitic aggregates. Apatite microphenocrysts are present, but are not nearly as abundant as in sample 622294.

The groundmass of this sample was originally composed of a very fine-grained vitrophyric intergrowth of tiny plagioclase microlites set in glass. The glass has recrystallized to a very patchy but extremely fine-grained quartzo-feldspathic intergrowth from which blebs of anhedral, often multi-crystalline quartz up to about 0.2mm across are growing. Spots of green chlorite and leucoxenitized tiny FeTi oxides are common throughout the altered groundmass. The sample is cut by a few hairline quartz-calcite veinlets.

Alteration in this sample is not related to local hydrothermal system, but rather, is due to pervasive regional burial metamorphism at prehnite-pumpellyite facies. The sample is probably a dacite or evolved andesite composition.

**SAMPLE: MAC 36 62298**

338.0m

**SUMMARY: This sample is a very strongly epidote ( $\pm$  minor sphalerite)-altered plagioclase+augite+olivine-phyric evolved basaltic lava.**

**HAND SPECIMEN:**

This is a very strongly altered andesitic (?) lava that shows intense zones of pale very fine-grained epidote alteration with occasional spots and streaks of deep red-brown sphalerite to several mm across.

**THIN SECTION DESCRIPTION:**

This sample in its least-altered parts is a texturally well-preserved plagioclase+augite-phyric andesitic to evolved basaltic lava. Small augite phenocrysts are fresh but fractured, and make up around 5 modal% of the rock. Smallish (<1.5mm long) albitized plagioclase phenocrysts are slightly more common, and often contain small inclusions of epidote. FeTi oxide microphenocrysts are leucoxenitized. A few subhedral shapes now composed of very fine-grained sugary silica may have been small olivine phenocrysts.

The groundmass of the best-preserved parts of this rock was clearly originally glassy to vitrophyric, with tiny plagioclase microlites set in glass. The latter has recrystallized to a fine-grained quartzo-feldspathic intergrowth with spotty epidote and chlorite.

The intensely epidotized areas of this sample consist of perfectly preserved phenocrysts of fresh augite, albitized and epidotized phenocrysts of plagioclase, leucoxene-altered FeTi oxide, and tension gashes and fractures filled by quartz and chlorite all set in a matrix of dense, fine-grained yellowish epidote that has replaced in toto the original groundmass. Reddish anhedral small aggregates of sphalerite often occur adjacent to the margins of the intensely epidotized zones.

The coexistence of olivine and plagioclase phenocrysts in this lava suggest that it was probably an evolved basalt composition that has been strongly altered in an oxidizing fluid regime with low carbonate activity. Such alteration is often channelized, and may indicate proximity to a fault.

**SAMPLE: MAC 36 622299** 390.5m

**SUMMARY:** This sample was a moderately plagioclase-phyric glassy to vitrophyric-textured andesitic lava that has suffered weak hydrothermal alteration, producing a silica-chlorite-dominated assemblage.

**HAND SPECIMEN:**

This is a massive grey-green plagioclase-phyric andesitic lava not dissimilar to 622296.

**THIN SECTION DESCRIPTION:**

This sample is a quite strongly altered, plagioclase-phyric andesitic, sparsely vesicular lava with a formerly vitrophyric groundmass. Plagioclase phenocrysts make up about 10 modal% of this rock, and are all small (<1.5mm long) albitized crystals sometimes with a slight dusting of fine-grained sericite. There were probably a few former augite phenocrysts in this rock, but they are now replaced by quartz-chlorite-calcite intergrowths. Former FeTi oxide phenocrysts are not common, and are leucoxenitized.

Where best preserved, the groundmass of this sample consists of tiny albitized plagioclase microlites in a very fine-grained quartz-chlorite matrix after glass. However, the groundmass is extremely heterogeneous and contains abundant small pockets, discontinuous veins, and vesicle fillings composed of strained quartz. In some parts of the slide, small shear zones are defined by much more intense chlorite development and less sugary quartz than occurs in the remainder of the slide. Quartz-calcite veins transect all earlier alteration.

**SAMPLE:** MAC 36 622300 459.7 m

**SUMMARY:** This sample is an augite+olivine±plagioclase-phyric basaltic lava typical of the Hellyer basalt; it shows a low-grade burial metamorphic overprint best demonstrated by sericitization of plagioclase and alteration of glassy mesostasis to silica and chlorite.

**HAND SPECIMEN:**

This is a mid-grey homogeneous fine-grained and finely-augite-phyric basaltic lava.

**THIN SECTION DESCRIPTION:**

This sample is an exceptionally well-preserved (texturally) finely porphyritic basaltic lava with pervasive low-grade burial metamorphic alteration at prehnite-pumpellyite facies. The sample is dominated by small (<1mm long) fresh subhedral augite phenocrysts that make up around 10 modal% of the sample and more commonly than not occur as clots of intimately intergrown crystals. Most augite phenocrysts show strong compositional zoning. Former olivine phenocrysts (~3-5 modal%) are now composed of sugary aggregates of chlorite and calcite. The few plagioclase microphenocrysts present are totally pseudomorphed by rather coarsely crystalline sericite.

The groundmass of this sample was composed originally of an intersertal aggregate of rather large plagioclase laths and smaller granular augite and altered equidimensional FeTi oxides, with glassy mesostasis. The latter has altered to chlorite and silica, and small anhedral blebs of quartz are common growing in the groundmass. As for the plagioclase microphenocrysts, the groundmass plagioclase laths are replaced by coarsely crystalline sericite.

This is a fairly typical, if not slightly evolved, Hellyer basaltic lava, with a typical regional burial metamorphic alteration overprint.

**SAMPLE: MAC 36 622367 557.5m**

**SUMMARY: This sample is another plagioclase-phyric formerly glassy andesitic lava with a chloritized groundmass that has been flooded in places by strong silica-dominated alteration..**

**HAND SPECIMEN:**

This is a dark grey-green massive plagioclase-phyric andesitic lava with irregular bleached patches to several cm across with considerably less chlorite development.

**THIN SECTION DESCRIPTION:**

This sample is a quite strongly plagioclase-phyric andesitic lava very similar originally to 622299. The sample consists of around 20 modal% of mainly small euhedral and subhedral albitized plagioclase phenocrysts that often occur in clots of 10 or more crystals. Many have a faint reddish tinge presumably due to submicroscopic hematite dust. A few small augite phenocrysts have been replaced by chlorite, and FeTi oxide microphenocrysts are all leucoxene-altered.

The less altered parts of the groundmass of this sample consist of a fine-grained chlorite-quartz intergrowth after glass. Small chlorite blebs are surrounded by rims of quartz giving the appearance of small vesicle-fillings. However, in large areas of the section, corresponding to the more bleached parts of the hand specimen, chlorite is considerably reduced in abundance, and the matrix is flooded by a fine-grained intergrowth of ragged quartz and feldspar, with common tiny dots of leucoxene. Common stylolitic seams of insoluble material indicate significant volume loss accompanied alteration of this sample.

**SAMPLE: MAC 36 622368**

643.9m

**SUMMARY: This sample is moderately altered plagioclase-phyric andesitic lava breccia in which the inter-fragment matrix is composed of fine-grained epidote-quartz aggregates.**

**HAND SPECIMEN:**

This is a strongly altered andesitic lava breccia or false breccia in which dark grey fragments of plagioclase-phyric andesite to several cm long are set in a cream-pink intensely altered matrix..

**THIN SECTION DESCRIPTION:**

This sample is quite distinctive petrographically, being a monomict lava breccia composed of fragments of moderately plagioclase-phyric formerly glassy andesitic lava, set in a matrix dominated by exceptionally fine-grained epidote-quartz intergrowths. The lava fragments are essentially identical to samples 622367 and 622299, being composed of about 15 modal% of small albitized plagioclase phenocrysts, often occurring in clots of more than 4 or 5 crystals, and often containing epidote granules, set in a recrystallized formerly glassy groundmass. Quite common small leucoxenitized FeTi oxide phenocrysts are present, and a few chloritized augite phenocrysts are also present. The latter is a formerly vitrophyric intergrowth of tiny albitized plagioclase microlites in a very even-textured fine-grained quartz-feldspar-chlorite intergrowth after glass.

The matrix between the lava fragments is composed of generally very fine-grained quartz-epidote intergrowths, and the more the epidote, the more opaque and isotropic becomes the matrix. The abundance of epidote in this sample relative to the other petrographically similar plagioclase-phyric andesitic lavas and lava breccias in this hole is interesting, and presumably indicates significantly more oxidizing fluids moving at this level compared with higher in the hole.

**SAMPLE: MAC 36 622369**

728.8 m

**SUMMARY:** This sample is an autobrecciated plagioclase-phyric glassy andesitic lava that has suffered hydrothermal alteration that enhanced the brecciated appearance of the sample, depositing fine-grained silica±pyrite in inter-fragmental matrix.

**HAND SPECIMEN:**

This is a another plagioclase-phyric andesitic lava breccia similar to the previous sample, but in this rock the inter-fragment matrix is not epidotized.

**THIN SECTION DESCRIPTION:**

This sample is an autoclastic lava breccia in which the original brecciated nature of the sample has probably been amplified and exaggerated by subsequent hydrothermal alteration. The lava fragments are of a plagioclase-phyric andesite, less porphyritic than the previous few samples, but with probably around 5-8 modal% of sericite-calcite-altered small plagioclase phenocrysts. Occasional ovoid vesicles are filled by fine-grained silica, and uncommon FeTi oxide microphenocrysts are replaced by messy brown leucoxenitic material.

The groundmass of the andesitic lava was glassy to very finely vitrophyric , and well-preserved perlitic cracks are present in several places. The glass has devitrified to a very fine-grained, dark quartzofeldspathic material in which tint to submicroscopic granules of epidote are developed, but never as abundantly as in the previous sample.

The matrix between fragments, which often show well-developed jigsaw-fit textures, is a very fine-grained, rather clear, sugary quartzose intergrowth containing disseminated but uncommon small pyrite crystals.

**SAMPLE: MAC 36 622370**

784.4 m

**SUMMARY:** This sample is probably a plagioclase-phyric formerly glassy andesitic lava from close to the base of a flow, which has caught up diverse small lithic fragments during flow. It has suffered oxidative hydrothermal recrystallization producing a sericite-silica-hematite±epidote alteration assemblage.

**HAND SPECIMEN:**

This is a dark grey probably polymictic andesitic lava breccia with fragments up to about 1cm across of dark grey and black lava in a quite altered grey matrix that contains significant disseminated pyrite.

**THIN SECTION DESCRIPTION:**

This sample is an unusual andesitic lithic tuff or relatively fine-grained lava breccia. The large part of the sample consists of plagioclase-phyric andesitic lava with albitized small plagioclase phenocrysts that are totally replaced by sericite, and a formerly glassy groundmass that now contains common small epidote granules and abundant fine-grained hematite and sericite in a quartzose matrix. This dominant part of the rock shows no obvious lava breccia texture. However, around 5 or 6 obvious lithic fragments mainly around 2-3mm across are present in this rock, and are mainly recrystallized formerly glassy felsic lavas, with perlitic cracks well preserved in at least one of them.

The origin of this rock is difficult to diagnose with certainty. It may be a typical plagioclase-phyric andesite lava taken from close to the base of a flow, which has caught up diverse small lava fragments during eruption and flow. The texture is not typical of a lithic tuff, nor is it really a lava breccia texture. Whatever its original protolith, this sample has suffered moderate oxidative hydrothermal alteration producing a silica-sericite-hematite±epidote-dominated assemblage.

**SAMPLE: MAC 36 622371**

791.5m

**SUMMARY:** This sample is a siltstone with common fine-grained pyrite and hematite, sparse small devitrified lava clasts, and some angular quartz of uncertain derivation. The strongly recrystallized matrix may have had a significant vitric ash component.

**HAND SPECIMEN:**

This is a dark grey, weakly laminated siltstone or very fine-grained greywacke.

**THIN SECTION DESCRIPTION:**

This sample is a weakly bedded siltstone with the banding defined by slight changes of average grain size and variations in the intensity of development of secondary oxides and pyrite. The only discernible lithic clasts are occasional angular grains of quartz of uncertain derivation, and one or two small lithic clasts that are devitrified felsic lava, in one case bearing a single sericitized plagioclase phenocryst. The matrix is a very fine-grained and thoroughly recrystallized quartzose material peppered with tiny opaques in darker layers, and lesser opaques and abundant tiny epidote granules in lighter bands. Secondary calcite is quite abundant overprinting all the bands or layers in this thin section. Some narrow bands have quite a concentration of disseminated perfectly euhedral pyrite that have grown in situ during alteration-recrystallization. Abundant finer-grained opaques are less well-formed and may be magnetite or hematite. It is likely, but difficult to prove, that much of the 'matrix' of this fine-grained sedimentary rock was comminuted vitric ash.