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Petrology of some Specimens from the Cypress Creek - North Mainwaring River Area, S. W. Tasmania.

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075002

Petrology of Specimens from the Cypress Creek -N. Mainwaring River Area S. W. Tasmania

Twenty-nine specimens collected from bulldozed tracks in the Cypress Creek area of S. W. Tasmania have been sectioned and their petrology is described below.

The tracks cover and area of roughly N-S trending belts of Cambrian rocks - from W to E : Dundas Group (Pad 3 to coast), Mainwaring Group, Dundas Group, Lewis River Volcanics. The contact between the Lewis Group and basal Ordovocian beds is just W of Pad 1.

Specimen localities are shown on Fig. 1.

From mapping further south and preliminary sampling of Cypress Creek during the 1967-68 field season a belt of highly altered green volcanics was defined, and named the Mainwaring Group. It lies between argillites, greywackes and calc-alkaline volcanics of the Dundas Group and the acid volcanics of the Lewis Group. The belt has a maximum width of about four miles in the Mainwaring River and tapers to the north, disappearing ~~between~~ beneath Tertiary gravels south of the Wanderer River.

It was suggested (Corbett, 1968) the green volcanics might be altered equivalents of part of the Dundas Group, but there was no conclusive evidence for this. In spite of detailed mapping and sampling in the Cypress Creek area during the 1968-69 season the status of the Mainwaring Group is still in doubt.

The Mainwaring Group was originally defined on its metamorphism, the assemblage sodic plagioclase-tremolite-chlorite-epidote being characteristic of the Group. In particular, epidote is very abundant in many rocks from the southern part of the belt, and this distinguishes them from the Dundas Group.

The rocks in the Cypress Creek area, particularly those in the eastern part of the belt, are much less altered than those from further south, and it is difficult to find criteria by which to distinguish between individual specimens from the Mainwaring and Dundas Groups. However, it is probably valid to distinguish between assemblages using the characteristics listed below. Future work may show that it is appropriate to reduce the status of the Mainwaring Group to that of a Member of the very large "Dundas Group".

Dundas Group

(a) Great thicknesses of sediments, chiefly argillites and greywacke, with a few greywcke conglomerates. Limestones are very rare and ortho-quartzites are absent.

(b) Calc-alkaline volcanics, apparently restricted to one or more thick belts overlying(?) linear bodies of ultrabasic rocks and related basic intrusive Typical igneous rocks are pyroxenites (and serpentinites), andesine-gabbro and basalt, hematite-andesite (andesine, hematite and chlorite groundmass, andesine and sometimes clinopyroxene phenocrysts), felsic andesites containing plagioclase and chlorite only, and intrusive diorites with hornblende or actinolite and sometimes biotite as coloured silicates Dacites and granodiorite also occur, and are very poor in coloured silicates.

Tuffs and agglomerates are not usually abundant.

Some of the volanics are probably spilites, but secondary alteration of non-spilitic rocks to spilitic assemblages makes identification difficult.

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Mainwaring Group

(a) Sediments mainly confined to a basal(?) belt several thousand feet thick. They include very fine tuffs and sheared "conglomerates" composed of siltstone fragments as well as normal siltstones, some rich in lime. A greywacke conglomerate has been reported from Copper Creek.

All sediments are strongly sheared, and are often chloritised and deeply weathered. They are described as phyllites on the coast near Sassafras Creek.

(b) Green volcanics, consisting of about equal quantities of igneous and pyroclastic rocks. In the southern part of the belt all rocks are extensively altered, and epidote in particular is widespread. Igneous rocks are apparently intermediate in composition but this may be the result of metasomatism. Rare dacites have been described. In the northern part of the belt unaltered rocks include andesine gabbros and basalts (and pyroclastics of similar composition), andesites consisting of intergrown andesine and tremolite (phenocrysts are almost invariably clusters rather than single andesine crystals. Pyroxene phenocrysts occur in some specimens) and very characteristic "volcanic breccias" consisting of lava fragments in an epidote-chlorite-andesine-tremolite matrix which may be igneous.

Talc-schists are secondary and there are no known ultrabasic rocks.

Features common to Mainwaring and Dundas Groups include:

(1) widespread chloritisation

(2) absence of medium-grained siliceous sediments

(3) possible spilites associated with normal calc-alkaline volcanics

the plagioclase is andesine in all basic and intermediate rocks (labradorite was seen in only one out of several hundred specimens.

Late primary albite occurs in some of the basic rocks as rims on andesine crystals)

(5) tuffs containing crystals, lava fragments and glass shards.

No attempt has been made to ~~ascribe~~ assign the specimens described below to particular Groups, although in some cases their relations are obvious - e.g. breccias 79/107 and 79/~~109~~ 127 belong to the Mainwaring Group while hematite andesites lacking coloured silicates other than chlorite are characteristic of the Dundas Group and similar rocks have been described from Noddy Creek and Timbertops.

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SPECIMEN LIST

075006

Tas.Cat.No.	Field No.	Name	Field Name
79/98	550	greywacke conglomerate	porphyry
79/99	551	siltstone	fine porphyry
79/100	552	plagioclase rock	granophyre
79/101	553	gabbro	gabbro
79/102	554	keratophyre	andesite
79/103	555	siltstone conglomerate	tuff-conglomerate
79/104	556	sheared tuff	speckled volcanic
79/105	557	basalt	basalt
79/106	558	banded pyroclastic	cherty andesite
79/107	559	volcanic breecia	agglomerate
79/126	564	pyroxene-schist	sheared porph. andesite
79/127	565	volcanic breccia	andesite
79/128	566	altered lava	andesite
79/129	567	altered lava	andesite
79/130	568	lithic-vitric-tuff (calcified)	calcirudite
79/131	569	argillite	tuff
79/132	570	pyroxene tuff (or gabbro)	basalt
79/133	571	chloritic siltstone	volcanic
79/134	572	andesite	syenogabbro
79/141	573	tremolite lava	andesite
79/142	574	quartz-andesite	basalt
79/143	575	spilite (basic lava)	basalt
79/144	576	chloritised tuff	sheared agglomerate
79/145	577	banded chloritised siltstone	tuff
79/146	578	rodingite(?)	talc
79/147	579	hematite amdesite	andesite
79/148	580	altered tuff	breccia
79/149	581	talc-schist	talc-schist
79/150	582	sheared gabbro	green talc

PETROLOGY of SPECIMENS FROM THE CYPRESS CREEK-N. MAINWARING RIVER AREA

79/98 (550) Greywacke-conglomerate

The rock is coarse-grained and poorly sorted with close-packed, angular fragments up to 1 cm. across. The sparse, sheared matrix is stained sericite. Clasts consist of large, cracked plagioclase crystals and fine-grained, altered lava fragments with plagioclase phenocrysts. The rock is rich in chlorite and sericite, which occurs as a fine-grained replacement of feldspar. There are chert pebbles but no large quartz grains.

The rock is a sediment, locally derived from the feldspathic calc-alkaline volcanics now outcropping to the west.

79/99 (551) Siltstone

This rock shows a very strongly bimodal grainsize distribution, with rounded grains up to 0.7 mm. across in a web of sericite. The sericite has recrystallised to give a strong flow direction, with "pressure shadows" on some clasts. Clasts are randomly oriented and often broken, with sericite separating the fragments. The sericite groundmass accounts for about 60% of the whole rock. Clastic grains are chiefly quartz but also fresh and serisitised plagioclase, rounded chert fragments, mica flakes and dark, shadowy patches which may have been fragments of fine, micaceous sediment.

The high percentage of quartz fragments, the lack of mafic minerals and the abundance of sericite all suggest this sediment has affinities with the acid volcanics or a sedimentary terrain and is not derived from the calc-alkaline volcanics.

79/100 (552) Plagioclase rock

The hand specimen is pale coloured, with white to pale grey, needle-like crystals randomly oriented in an unsheared, apparently fine groundmass.

The rock consists essentially of coarse to fine-grained, interlocking plagioclase crystals with fine interstitial, yellow-stained chlorite. Some of the chlorite has forms suggesting it replaces amphibole but much of it is probably primary. Idioblastic magnetite crystals up to 0.3 mm. across and very small grains of epidote are the only other minerals present.

The plagioclase is fresh (rare slight sericitisation) and much of it is well twinned, with twin planes bent in some of the elongate crystals. Single crystals commonly show two nearly normal sets of albite twins. The plagioclase is calcic andesine, with maximum extinction of 25° on albite twins and relief higher than balsam.

This is apparently an intrusive igneous rock, lacking primary ferromagnesian silicates (except chlorite) but containing about 5% magnetite and up to 15% interstitial chlorite. Thus it may be the intrusive equivalent of the hematite andesites - the intermediate composition of the feldspar suggests it is not an extreme differentiate of basic or ultrabasic rocks.

79/101 (553) Gabbro

The hand specimen is dark greenish-grey and massive. It consists of even-sized, interlocking dark and light grey crystals up to 1.5 mm. in length.

In thin section the rock consists of an ophitic intergrowth of pale brown clinopyroxene and altered plagioclase. Ilmenite forms straight

sided crystals but these have been altered to brown, semi-opaque oxide. Clear, untwinned albite(?) is interstitial to the altered plagioclase crystals and there are a few grains of primary apatite.

Secondary green chlorite is common as inclusions in pyroxene and plagioclase, sometimes forming masses up to 0.5mm. across. A little brown hornblende replaces pyroxenes and an unusual very strongly ~~pl~~e pleochroic brown chlorite forms fibrous sheaves in the feldspar and fringes on the pyroxene. Coarse crystals of epidote are early secondary minerals. Fine epidote, chlorite and muscovite are common inclusions in the early-formed plagioclase.

No direct R.I. readings are possible because of the abundance of high-relief inclusions in the plagioclase, but it seems likely that andesine was first to crystallise, with albite forming as the last primary phase.

79/102 (554) Keratophyre

The hand specimen is grey, fine-grained and slightly sheared. Dark green, irregular bodies up to 4mm. across are common and many of them are rimmed with pale green material. A few pale grey single crystals can be seen.

Cleavage is much more apparent in the thin section, and is parallel with the flow structures in the groundmass, Clusters of coarse plagioclase crystals are wrapped by a fine groundmass in which small plagioclase crystals and chlorite flakes are roughly aligned. The groundmass is very rich in finely divided iron oxide and also contains grains of epidote, though these may be secondary.

Groups of large epidote crystals are associated with feldspar phenocrysts and also occur alone. The relationship between these crystals

and the groundmass suggest the epidote is primary.

The dark patches noted in the hand specimen are masses of very fine chlorite with coarse epidote forming a rim round each patch. The groundmass also flows around these bodies.

The plagioclase in the phenocrysts appears to andesine and the groundmass is probably similar, but the presence of primary epidote is taken to indicate the rock belongs in the spilite suite. It is analogous to the henatite andesites described elsewhere.

79/103 (555) Siltstone-conglomerate

The hand specimen is pale green, soft and weathered. The cut surface shows interfingering lenses of coarse and fine sediment of various colours, all sheared. The thin section was taken through a large, coarse-grained lens.

Dark fragments of fine, sericitic siltstone, chert and fine, altered lava(?) are set in a very fine matrix of chlorite and clay, generally too fineOgrained for good identification. Most of the smaller clastic fragments are replaced by chlorite or heavily impregnated with iron oxides and are unrecogniseable. A few grains of feldspar occur as single crystals, but quartz is rare or absent.

The whole groundmass may be secondary, derived from the break-down of feldspathic material. The original rock was probably a banded sediment derived from the calc-alkaline volcanics, and the lenses of siltstone may have been broken up *in situ* by shearing before consolidation was complete. The predominence of siltstone over lava fragments or crystals precludes the possibility that this rock is an altered tuff.

79/105 (556) ~~Basalt~~ Sheared Tuff

The specimen is medium-grained, sheared and rather weathered.

The thin section shows a series of sheets and discrete thin plates of chlorite piled up and gently bent round irregular layers of feldspar, chlorite and amphibole. Heavy iron staining outlines a number of rounded and angular forms.

There is little evidence as to the original nature of the rock - granular and crystalline plagioclase is probably primary and the amphibole and rare epidote is secondary. Chlorite may be partially recrystallised.

The original rock may have been a tuff, probably composed largely of plagioclase and chlorite.

79/105 (557) Basalt

The specimen is very hard and massive, with a fine, even-grained texture interrupted by scattered dark green patches several mm. across.

The rock consists of granular fresh clinopyroxene in a background of coarse, interlocking plagioclase crystals. Some plagioclase crystals penetrate the pyroxene grains and the pyroxene is generally subordinate in texture. Angular ilmemite crystals are interstitial to both silicates. Coarse epidote occurs in some places and is often difficult to distinguish from pyroxene. It appears to be primary.

Fine chlorite, sericite and a little fine epidote replace feldspar, and chlorite also forms a few large masses. A few feldspar crystals are very large (up to 6mm. long) and clusters of large crystals form glomerophenocrysts. Alteration obscures albite twinning in many cases and few sections are suitable for determination. Afew values near 20° were obtained and the plagioclase is probably andesine - relief is

apparently positive but determination is difficult due to the large number of high-relief inclusions. A few altered plagioclase crystals have clear rims of albite(?) and these rims also occur on some chlorite grains. High-relief, semi-opaque brown grains are thought to be epidote.

The rock is called basalt because of its richness in pyroxene, but the presence of plagioclase phenocrysts and the intermediate composition of the feldspar are features found in the andesites from this area.

79/106 (558) Banded pyroclastic

The hand specimen is pale grey and very fine-grained. There is no cleavage but a faint colour lamination is present. Bands of dark grey material occur parallel to the lamination but individual coloured patche are elongated normal to the lamination. In thin section the laminations are due to grainsize changes and the varying abundance of iron-staining in the finer material.

The fine-grained, grey-green bands which make up most of the section consist of small, ragged fragments of feldspar with less common quartz and pyroxene in a cleaved matrix of fine epidote, some of it heavily stained. Cleavage throughout the rock is normal to the laminatio and is marked in thin section.

The pinkish-grey bands are relatively coarse-grained and unstained. They contain close-packed, very irregular grains of quartz, plagioclase and an unidentified mineral. The texture is difficult to interpret and minerals are difficult to identify - in the coarse bands the texture appears to be granular igneous, but in the fine bands it is almost certainly clastic.

The unidentified mineral occurs in granular crystals which are generally brownish and turbid in the centres and clear near the edges.

Crystal forms are uncommon but rhombic shapes are sometimes seen. There is no visible cleavage though there may be cracks, and extinction is wavey, suggesting fibrous structure. Interference figures are positive with 2V varying from nearly 0° to about 40°. Birefringence is low - up to first order orange - and relief is fairly low. The mineral may be one of the zeolites, possibly heulandite.

While the main mineral remains unidentified it is impossible to classify the rock. Textures in the finer parts suggest it is a pyroclast

79/107 (559) Volcanic Breccia

This specimen is a good example of undeformed volcanic breccia which outcrops extensively in the middle part of the area. It consists of irregular, dark green, fine-grained fragments from 1mm. up to several cm. long, roughly aligned in a very fine, pale, grey-green matrix. Unlike specimens from Green Point, the fragments are not greatly altered.

The groundmass consists of very fine granular epidote (strongly iron-stained) and fine feldspar. The feldspar is generally untwinned and anhedral, but sometimes occurs as thin needles. Chlorite content varies from little to abundant. The texture is difficult to interpret because of very fine grainsize, but it might be a primary igneous one, in which case the epidote would be primary.

Single crystals of clinopyroxene and feldspar are abundant in the groundmass. Rock fragments include several varieties of lavas and coarse crystal aggregates. A few quartz-chlorite fragments appear to be detatched vesicles and other curved fragments composed of epidote, chlorite and iron ore may have a similar origin. Several rounded fragmen consist entirely of interlocking clinopyroxene crystals (with very minor alteration and sometimes a little associated chlorite and epidote),

and large, rounded single or multiple carbonate crystals, often with coarse epidote inclusions, are common. Aggregates of plagioclase and needles of tremolite are lava fragments and may also contain pyroxene and sometimes epidote or chlorite.

Several lava fragments have a most unusual texture. They consist chiefly of large pyroxene crystals and interstitial quartz in a groundmass of glass. The glass has mostly been replaced by chlorite but contain bands and swirls of iron oxide outlining the original texture. An interesting variation of this type occurs in one large fragment where clinopyroxene and subordinate feldspar crystals have been broken up and the fractures filled with chlorite. Slices of individual pyroxene crystals are quite unaltered and this appears to be a primary igneous texture.

The rock may be considered to sample a terrain consisting of two main (and related) lava types. The most common type has a rough flow texture produced by small, aligned needles of actinolite in a background of anhedral plagioclase. Clinopyroxene may be present. Less common is glassy lava with an intricate, swirling texture, containing large pyroxene crystals and sometimes quartz. Intermediate between these two are lavas with pyroxene, plagioclase, amphibole (sometimes) and chlorite which may replace glass. Most lava fragments have a little secondary epidote (crystals cut across flow textures etc.), often concentrated at the edges of the fragment.

Classification of the whole rock depends on whether the groundmass is igneous, and as this is uncertain the rock will be called ambiguously "volcanic Breccia".

79/126 (564) Pyroxene schist

This rock has a very strongly developed schistosity, giving a texture in some ways similar to that found in Older Precambrian rocks. Schistosity is produced by thick bands of fibrous actinolite and chlorite (the chlorite may be altered actinolite) which wrap large, broken and roteted clinopyroxene crystals. Altered feldspar forms small lenses and rare interstitial material. There are a few cross-cutting spidote crystals and clouds of very fine, stained materail which may be epidote. Iron oxide lies in streaks along the cleavage and is either remobilised primary material or introduced by weathering.

Clinopyroxene crystals are generally about 0.4mm. across but range up to 2mm.. Most of them are only remnants, having been largely replaced by chlorite and/or amphibole. Chlorite fibres are generally parallel with the foliation but the amphibole tends to follow the cleavage of the pyroxenes, indicating that it is an intermediate stage in the alteration of pyroxene.

The original rock was probably igneous, with basic composition, but only pyroxene and a little undeterminable feldspar remain.

79/127 (565) Volcanic Breccia

The hand specimen is hard, massive and dark green. The cut surface shows a breccia texture which is not apparent on other surfaces, and it also reveals cracks filled with pale green minerals.

Breccia texture is not very obvious in the thin section, which is altered and heavily stained. Lava fragments are feathery plagioclase-amphibole intergrowths with minor chlorite and a few grains of pyroxene. Aggregates of coarse plagioclase crystals form multiple phenocrysts. Fractures are lined with epidote and secondary epidote crystals are scattered in the lavas.

The groundmass is difficult to distingiush from the lava fragments, and generally has an igneous texture, consisting in many places of aligned small crystals of plagioclase and chlorite. Elsewhere the texture is more like that in 79/107, i.e. granular epidote and chlorite in a plagioclase background. In a few cases some of the groundmass is fine secondary quartz.

The specimen is more altered than 79/107 but provides a little more evidense for an igneous matrix. Lava fragments are altered and this rock is not so useful for determining the original terrain as 79/107.

79/128 (566) Altered Lava

The hand specimen is massive and grey-green with scattered light green patches, Surfaces have a fine-grained felted or fibrous appearance.

The rock is fine-grained with an even texture of interlocking fibrous actinolite prisms, small plates and irregular grains of chlorite, rounded epidote crystals and sub-hedral plagioclase. Coarse epidote crystals apparently disrupt the texture.

The light patches (several mm. across) seen in the hand specimen are irregular masses of epidote and plagioclase. The outer edges of the masses are formed by single or multiple epidote crystals fringed with stained brown material. In the centres the epidote may form an irregular grid, the spaces being filled with clear plagioclase. These masses are apparently an advanced stage in the alteration of phenocrysts, representi groups of plagioclase crystals which have been replaced by epidote and albite.

The rock is an altered porphyritic lava originally consisting of plagioclase (andesine 0) phenocrysts in an andesine-actinolite groundmass

79/129 (567) Altered Lava

The rock is massive and light greenish-grey with a medium-grained interlacking texture obscured by alteration. The cut surface shows areas of fine grey-green material surrounded by coarser, interlocking dark and pale green grains.

In thin section the rock is similar to 78/128, but phenocrysts are a lit le less altered - the original plagioclase persists but is rimmed by masses of fine epidote. As in 78/128 the groundmass consists of fibrous actinolite, plagioclase and chlorite. Crystal forms are often well developed in the plagioclase and in some cases epidote is subordinate to these forms.

Epidote is abundant as masses of fine granules, much of it stained and semi-opaque. It is unevenly distributed, some parts of the groundmass being relatively free of it - these are the parts which appear fine and grey-green in the hand specimen. Most or all of the epidote is secondary. Very small quantities of primary quartz occur in the groundmass.

This rock is an altered lava, probably basaltic in composition but with scattered andesine (?) phenocrysts.

79/130 (568) Lithic-Vitric-Tuff

The rock is pale and hard with a slightly sheared conglomeratic texture which is obvious on the cut surface but less apparent on other surfaces. Pale yellow and grey fragments up to 1cm. long are slightly rounded ~~fr~~ and elongate fragments may be aligned in the cleavage. Large fragments are not common, the average size being about 1mm. in diameter. Concentrated HCl reacts vigorously on the cut surface.

In thin section the rock is very heavily iron-stained and textures are often obscure. The rock is composed almost entirely of calcite and

chlorite but textures are well preserved so that the nature of the original rock can be determined - the carbonate is almost certainly secondary and probably the chlorite is also.

"Clastic" fragments consist of large to small, slightly rounded bodies. Remnants of iron ore which surround the original crystals preserve the texture of interlocking plagioclase laths although the plagioclase has been completely replaced by calcite. Angular feldspar phenocrysts are pseudomorphed by chlorite.

Many of the "clasts" which are almost wholly chlorite have preserved textures which indicate they were once glass. There are a few chert grains and a few pseudomorphs after single crystals, but the original rock was mostly composed of lithic (lava) and glassy fragments.

79/131 (569) Argillite

The rock is red-brown and very fine-grained. It has an indistinct wavey cleavage marked by uneven patches of weathered chlorite. In appearance it is a typical maroon argillite.

The thin section is very fine-grained and heavily stained with fine reddish iron oxide. Most of the rock consists of single tiny crystals of chlorite with fibrous habit, set in cloudy clay and opaque iron oxide with a few small quartz grains. Some of the clay is montmorillonite or illite, but it is difficult to distinguish between clay and chlorite in many cases and R.I. measurements cannot be made. If montmorillonite were confirmed it would suggest the rock was derived from the volcanics, but this cannot be proved in this specimen.

79/132 (570) Pyroxene Tuff (or Gabbro)

The rock is light grey and massive, with an uneven fragmental texture. Plates of chloritic material up to 1cm. across are set at random in a medium-grained green and grey groundmass.

In thin section the rock is fine-grained, with an uneven granular texture rather obscured by alteration. Essential primary minerals are clinopyroxene, in granular crystals up to 0.5mm. across, in a groundmass of formless, cloudy plagioclase. Some pyroxene is partially altered to amphibole and chlorite, and chlorite and iron ore are abundant in the groundmass. Epidote is uncommon. Small angular shapes outlined by iron ore and filled in with chlorite are pseudomorphs of single crystals, possibly olivine. (Olivine has never been identified as such in the calc-alkaline siute).

Large chlorite bodies are common. Some are angular, with lines of iron ore apparently marking the cleavages of the original mineral - possibly pyroxene. Other chlorite bodies form curved whisps and bands or bodies with curved edges and these probably represent glassy material- certainly they are not pseudomorphed crystals.

The whole composition is remarkably rich in pyroxene but the texture is difficult to interpret and the rock may be igneous (gabbro) or pyroclastic (pyroxene tuff).

79/133 (571) Chloritic Siltstone

The rock is a light greenish-grey with a strong cleavage and lineation. The cut section shows poorly defined yellowish lenses up to 2cm. long separated by fine chloritic bands.

In thin section the rock is very fine-grained except for a few quartz crystals up to 0.5mm. across. These large grains are surrounded by chert

to form lenses which are wrapped by the foliation.

Most of the rock consists of tiny plates of muscovite and chlorite roughly aligned in the cleavage and wrapping round occasional small quartz grains. The interstitial material may be clay, fine quartz or possibly zeolite and generally occurs as groups of small grains with undulose extinction. Iron ore is confined to large, oxidised grains which disrupt the foliation.

From the hand specimen alone the rock would probably be called a tuff; however it shows no volcanic affinities in thin section and quartz and muscovite are present although both are generally rare in rocks derived from the volcanics. The rock appears to be a siltstone, very rich in micaceous minerals and poor in obvoius clastic material.

79/140 (572) Andesite

The rock is pale and coarse-grained with crystals (showing cleavage faces) up to 4mm. across in a medium-grained groundmass. There is little shearing and crystals are randomly oriented.

The rock is medium-grained with an uneven texture in thin section. It is composed of interlocking plagioclase laths and less abundant ragged tremolite crystals with interstitial chlorite and a little secondary epidote. Feldspar crystals contain numerous tiny grains of chlorite and needles of secondary amphibole (?) but are not sericitised. Multiple albite twinning is common and is used with R.I. determinations to give a composition of sodic andesine. There is a bimodal grainsize distribution and the larger grains may be called phenocrysts - they account for over half the total plagioclase by volume.

The amphibole is pale brown or green with low extinction angles and low second order birefringence. The crystals are sometimes replaced by

chlorite and are always ragged and incomplete, usually having feldspar inclusions.

There are a number of very large crystals composed largely of amphibole but having inclusions of albite, and chlorite and epidote as alteration products. These crystals are heavily stained and are so ragged on the edges that they appear to be out of equilibrium with the surrounding rock. They are well formed and large, and were probably carried as solid grains in the liquid lava.

The rock is igneous with an intermediate composition and an uneven texture which suggests it is an extrusive.

79/149 (573) Tremolite Lava

The specimen is light green, cleaved and weathered. The cut surface shows a very fine-grained rock with small, aligned dark green flakes outlining a slightly folded cleavage. Fractures cutting the cleavage are deeply weathered.

The rock consists of a very fine-grained intergrowth of fibrous tremolite and chlorite, with tremolite predominating. Large streaks and patches of chlorite are clearly secondary. Rare feldspar crystals are present.

The"fractures" seen in the and specimen are highly disturbed areas where crystallisation of coarse epidote (crystals 1mm. across) and associated coarse chlorite in sinuous bands has disrupted the foliation in the groundmass. The vein is tightly folded, the epidote cleavages themselves beinf folded in places, and the foliation in the groundmass is drawn into the embayments and compressed against crests of the folds.

As chlorite and epidote are clearly younger than the amphibole it is assumed the amphibole is primary, although there is no other evidence.

The grainsize is too small and the rock too sheared for textures to be diagnostic.

This rock was probably a very fine-grained lava consisting mainly of tremolite (possibly with primary chlorite) and is probably related to the lavas in which tremolite and plagioclase are equally abundant. This is supported by the presence of rare plagioclase crystals. The rounded patches filled with a double layer of chlorite crystals may have been vesicles, but this is doubtful.

79/142 (574) Quartz-andesite

The rock is loght grey-green, slightly cleaved and weathered. It is fine-grained except for a number of pale, irregular patches, some of them 3mm. long. A magnet was passed over the finely ground rock but no magnetic fraction ~~separated~~ appeared.

Plagioclase and less common small quartz phenocrysts are scattered in a fine, foliated groundmass of plagioclase, hematite and chlorite with a little quartz and rare muscovite. The chlorite is always interstitial and at least some of it replaces feldspar, so there was apparently no primary ferromagnesian silicate, all the iron appearing as iron oxide. A number of large plagioclase crystals have serrated rims of fine chlorite and clear albite(?), and some clusters of crystals forming phenocrysts are invaded by masses of fine chlorite and quartz(?) and similar material is sometimes found in the groundmass.

Quartz phenocrysts reach 0.5mm. in diameter. They are usually rounded with margins corroded by chlorite and fine secondary quartz, but the phenocrysts themselves are primary.. All quartz grains have undulose extinction.

As in other lavas from this area, feldspar phenocrysts occur as

clusters of large crystals. The plagioclase is generally fresh although it has chlorite inclusions, and its composition is andesine, determined on extinction angles (up to 19°) and R.I..

Although some fine quartz in the groundmass is late primary or secondary, quartz is a significant primary mineral as phenocrysts and in the groundmass and thus the rock is a quartz andesite.

79/143 (575) Spilite (Basic Lava)

The rock is grey-green, massive and heavy. Most of it is very fine-grained but there are a few speckled pale and dark green patches of coarser grains.

In thin section the rock is very fine-grained, consisting of small, interlocking flakes of actinolite in a background of untwinned feldspar and minor chlorite and iron oxide. Epidote is an abundant secondary mineral, occurring as small stained grains. There are a number of ill-defined patches consisting of feldspar and chlorite or feldspar and epidote and these may be altered remnants of original large feldspar crystals.

There are a number of clusters of pyroxene grains - each crystal 0.1-0.2mm. long and separated from the others by a thin seam of chlorite. These are glomerophenocrysts, representing the only certain primary minerals. Epidote also forms large crystals fringed with brown, stained material. Individual epidote crystals are not setarated by chlorite seams but may be associated with clear plagioclase so that their habit is different from that of the pyroxenes.

The amphibole of the groundmass may be primary but it seems likely that primary plagioclase has been replaced by albite plus epidote. The composition is basic but the rock can hardly be called a basalt and "spilite" may be appropriate.

79/144 (576) Chloritised Tuff

The rock is green and well cleaved, with an uneven fragmental texture. The thin section is composed almost entirely of very fine, stained chlorite and iron oxide, but lenses of harder material have been lost during sectioning. The textures do not show out well in thin section so there is little evidence as to the original nature of the rock. In order to obtain such complete chloritisation the original fragments must have been rather basic in composition, and in the absence of any quartz or chert fragments it seems likely that the rock was a tuff rather than a normal conglomerate.

79/145 (577) Banded Chloritised Siltstone

The specimen is light yellowish-brown, strongly cleaved and well banded, with bands from 1 to 20mm. thick. The thinner bands are fine-grained and grey, while the thicker ones are medium-grained and yellowish due to weathering. The banding undulates slightly and some bands die out over distances of a few cm..

In thin section the only difference between bands appears to be grainsize, but the coarse bands have a large number of voids where resistant grains have been lost. The rock is composed largely of very fine chlorite with a little quartz preserved in thicker parts of the section. The whole rock is recrystallised and the banding is the only clue to its origin. Similar hand specimens occur in the Dundas Group but the expected clastic texture is completely lacking in this thin section.

On the evidence of the texture seen in the hand specimen the rock is considered to have been a banded sediment.

79/146 (578) Rodingite(?)

The rock is hard and massive, dark grey and medium-grained. The cut surface shows an even-grained texture with several large areas of fine, pinkish-grey and green material - apparently zones of alteration. One of these areas is present in the thin section.

The texture and composition of this rock as seen in thin section is very complicated. The dominant textural element is a strong foliation, expressed as thick, undulating bands of chlorite and talc, streaked with iron oxides. The foliation wraps lenses formed by large, broken clinopyroxene crystals and secondary minerals.

The pyroxene initially alters to amphibole, and intergrowths of actinolite and pyroxene parallel with the pyroxene cleavages are seen in some places. Complete large actinolite crystals may be the end-product of this process. Rather more common are fringes of fibrous amphibole growing normal to the margins of pyroxene crystals. These fringes are often randomly oriented with respect to the foliation, suggesting they formed before it. Some pyroxene is replaced directly by chlorite in fibrous masses generally parallel with the foliation.

In many cases the "pressure shadow" area is occupied by talc, with or without chlorite and amphibole. In a few areas there may be a little plagioclase enclosed in actinolite and chlorite. Some very fine, stained material is associated with the secondary minerals and may be epidote.

Some lenses and some broad chlorite bands are occupied partly or wholly by a pinkish, isotropic mineral with fairly high relief, possibly garnet. In the lenses this mineral forms coarse-grained , rounded masses but elsewhere it is present as swarms of tiny round grains. This mineral is possibly an isotropic variety of epidote, since similar material in 79/148 is closely associated with and has a similar appearance to normal epidote.

If the identification of garnet is correct this would indicate complete transformation of the feldspar. Such alteration is characteristic of some gabbros associated with ultrabasic rocks, the altered rock being called rodingite.

79/147 (579) Hematite Andesite

This rock is grey, hard and massive. The cut surface shows it to be fine-grained except for a few dark green patches several mm. across. It has a slightly mottled appearance and many indistinct green veinlets.

In thin section the rock consists of interlocking fine plagioclase laths with interstitial bright green ~~hematite~~ chlorite and hematite. The powdered rock yielded a very small magnetic fraction. Crystal outlines are blurred and the whole appearance is rather altered. There is no preferred orientation of the elongate grains. Epidote and fibrous amphibole are very minor secondary minerals.

Individual plagioclase crystals are less than 0.5mm. long but glomerophenocrysts may be 1mm. across. As in the groundmass the plagioclase is cloudy and altered. Inclusions of chlorite are common but no sericite is seen, although the cloudiness is probably due to incipient sericitisation.

Masses of chlorite with associated coarse epidote crystals are fairly common. Sometimes they have partial polygonal outlines and they may be pseudomorphs after pyroxene. Chlorite in the groundmass has two forms - small, brownish-green, prismatic crystals which may penetrate the feldspar and have first order birefringence, and shapeless, bright green masses which are almost isotropic. The second type appears to be later than the first and is often associated with epidote.

The rock is a typical hematite andesite, with glomerophenocrysts of ~~plagioclase andesine~~ and possibly rare pyroxene. The plagioclase is albite or ~~andesine~~ or sodic andesine, and chlorite is the only possibly primary ferromagnesian silicate.

79/148 (580) Altered Tuff

The hand specimen is green and massive, with an extremely irregular welded fragmental texture. Much of the material is fine to very fine-grained.

The rock is heavily stained and secondary minerals are abundant, making textures difficult to interpret. Large fragments of highly altered igneous rocks are set in a groundmass of secondary minerals showing a variety of swirling and concentric ~~textures~~ structures. Some areas of the groundmass consist of a coarse mixture of muscovite and plagioclase while others are rich in secondary quartz. Epidote is abundant and many irregular areas are lined with a thin selvedge of pink isotropic material which is apparently a form of epidote. In many cases there is an inner layer of pale green, almost isotropic chlorite and the central portion is dark green, strongly pleochroic chlorite, coarse epidote, plagioclase and muscovite. Brown material with low birefringence and spherulitic structure is common, and might be devitrified glass. It often forms rims on bodies of secondary quartz.

Lava fragments are generally altered or very fine-grained. They consist of interlockinf fine plagioclase crystals (with chlorite and iron ore) but may comtain phenocrysts of pyroxene and somstimes feldspar. In one fragment numerous vesicles are lined with a quartz selvedge, followed by pale chlorite with muscovite and feldspar in the centre. Another has epidote-chlorite vesicles and a few phenocrysts - altered plagioclase and fresh pyroxene. In another fragment feldspar phenocrysts are replaced by quartz in a groundmass of epidote and chlorite.

The rock almost defies description, but can perhaps be summed up as a tuff containing fragments of vesicular, feldspathic and glassy lavas in a very complicated groundmass consisting of secondary quartz, epidote, muscovite, feldspar (some derived from glass) and two types of chlorite.

79/149 (581) Talc-Schist

This rock is pale grey-green with a strong platy cleavage and a soapy feel which indicates it is rich in talc. The cleavage surfaces are glossy with a well-developed crenulation lineation.

The rock is strongly foliated in thin section, with remnants of lenticular bodies wrapped by thick bands of micaceous minerals. Most of the foliated material is talc and chlorite with talc predominating in elongat, felted masses. In parts of the rock alternate bands are rich in actinolite, with actinolite crystals sometimes pseudomorphed by talc. most of the lenses are occupied by prismatic crystals not parallel with the foliation - some of these crystals are actinolite but more often the amphibole has been replaced by chlorite or talc. Some lenses appear to have been feldspar, and feldspar occurs as remnants almost completely replaced by chlorite.

The original rock probably consisted of amphibole and feldspar (possibly plus chlorite) and thus was probably a lava. Strong shearing and the introduction of talc probably occurred together.

79/150 (582) Sheared Gabbro

The specimen is massive and greenish-grey with a medium-grained even texture.

The thin section is stained and has a slight foliation produced by alignment of secondary fibrous minerals. Large crystals of clinopyroxene are surrounded by their alteration products, tremolite and chlorite. Large, irregular areas of fine chlorite and feldspar(?) are common and are apparently an intermediate stage between altered plagioclase in which the original lath-shaped form is preserved and irregular areas filled with very fine granular chlorite. Some altered plagioclase crystals (now feldspar plus

actinolite and chlorite) cut through pyroxene grains, indicating an original ophitic texture, which is the strongest evidence that this rock was once a gabbro.

It is difficult to decide whether the fragmental texture in this rock was produced by shearing and chloritisation of a crystalline gabbro or by deposition as a pyroclastic, the rock then being described as a basic crystal tuff. On the textural evidence cited above the rock is considered to be igneous.

79/150 is similar in texture and composition to several specimens described from the Wanderer River, and these specimens ~~were~~ are considered to belong to the Dundas Group, since the typical Mainwaring Group ~~al~~ alteration (notably enrichment in secondary epidote) is not present.