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PETROGRAPHIC DESCRIPTION OF 17 ROCK SPECIMENS

FROM MUSWELLBROOK, N.S.W.

by

J. E. GLOVER.

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The following report contains descriptions of thin sections of 17 rocks collected from cores and outcrops in the Muswellbrook area. This report is for information of officers in the area, who have retained duplicate hand-specimens. Specimens are numbered 1 to 18, and description of one specimen collected (No. 13) is not given here. Discussion of this rock is of academic interest only, and time has prevented its incorporation in the following report.

Specimen No. 1 (two thin sections)

The two thin sections show the contact between coal and a strongly altered igneous rock. The latter consists essentially of a network of interlocking plagioclase laths, locally altered to sericite, and varying in length from 0.25 to 1 mm., and carbonate. In places, carbonate is so abundant that no relict of igneous texture is preserved. A little chalcedonic quartz accompanies the carbonate, and was introduced with it: both minerals are also found in the coal. The igneous rock is thought to have originally been a dolerite.

Specimen No. 2 (two thin sections)

Two rocks are present in these sections - a black rock (coal) and a grey feldspathic, calcareous rock of igneous origin. Much of the igneous rock is made up of grey, turbid material impossible to resolve under the microscope, and scattered throughout it are abundant, randomly oriented plagioclase lathes varying in length from 0.03 mm. to 1 mm. Carbonate is present as small granules, as irregularly shaped aggregates, up to 3 mm. in diameter, and commonly as laths, that have clearly replaced plagioclase. Chalcedonic quartz has also been introduced, but compared with carbonate, is relatively rare. Both minerals are also found in the coal fragment in this slide. The precise nature of the igneous rock is difficult to determine here: it seems to have been an intermediate to basic intrusive, probably a dolerite.

Specimen No. 3

Essential minerals in this rock are plagioclase (basic labradorite) and augite. The texture in general is intergranular, but there is considerable variation in grain size, with plagioclase laths locally having a mean length of 1 mm., elsewhere 0.2 mm. Augite varies correspondingly in grain size, is pale mauve with $ZAC = 50^\circ$, and is probably titaniferous. Green serpentine replaces interstitial material in fine grained parts of the rock, but in the coarse grained parts there is some suggestion from the shape of serpentine clots that phenocrysts of a pre-existing mineral (perhaps olivine) have been replaced. The serpentine clots commonly contain small grains of carbonate. Black iron ore as irregularly shaped, elongate grains is a common accessory.

The rock is a serpentinitised dolerite that may once have contained olivine.

Specimen No. 4.

The rock has an intergranular texture, with a network of plagioclase laths (An_{55}) of average length 1 mm. enclosing diopsidic augite ($ZAC = 42-45^\circ$). Finely granular carbonate and small serpentine clots are scattered throughout. In places a little fine grained quartz is present with carbonate as aggregates that appear to have replaced an earlier ferromagnesian mineral, perhaps olivine. In other places however, such aggregates seem only to have replaced material interstitial between plagioclase laths, so that diagnosis of original olivine must be regarded as very tentative. Black iron ore (mainly ilmenite) is an accessory.

The rock is a dolerite that has been partly replaced by carbonate.

Specimen No. 5

The rock consists of plagioclase (labradorite as nearly as can be determined), carbonate and minor secondary quartz. Plagioclase falls into two size groups, phenocrysts approximately 1 mm. long, and finer grained, more numerous laths 0.2 mm. long. Phenocrysts have a poor but discernable preferred orientation. The remainder of the rock (perhaps 60%) has been replaced by carbonate and minor quartz, and all stages in such replacement of the last mineral to be attacked, plagioclase, are clearly visible. Alteration of the rock prevents exact diagnosis of its original nature: it is an intermediate to basic igneous rock whose relict texture is suggestive of basalt rather than dolerite.

Specimen No. 6 (Two thin sections)

The rock is composed of mainly fine paste that cannot be resolved microscopically, and abundant, minute, pale brown carbonate granules (possibly siderite). A red to black, poorly anisotropic mineral found as "stains" and irregularly shaped, elongate grains is hematite: other black, apparently opaque grains with metallic lustre and probably also hematite, but some black grains may be carbonaceous. Angular quartz fragments of average diameter only 0.05 mm. are sprinkled sparingly throughout.

A fibrous, very fine grained colourless mineral of fair relief and birefringence, occurring as rosettes or streaky aggregates parallel to bedding, has not been precisely determined. The mineral is probably illite, a "mica-like" or "sericite-like" clay mineral. Appearance of the mineral, especially in rosettes, suggests its recrystallization in the sediment.

This rock is a calcareous (or possibly sideritic) claystone.

Specimen No. 7

A colourless, cryptocrystalline base forms about 75% of this rock. In plane polarized light 20% of the rock is seen to be composed of randomly oriented, narrow, "scimitar-like" shards of vitreous and cryptocrystalline material: under crossed nicols the shards are indistinguishable from the base. Angular quartz chips, a few subhedral quartz grains, and rare feldspar of undetermined composition make up 5% of the rock and black iron ore (pyrite, ilmenite and leucoxene) and small aggregates of cloudy carbonate are also present. All minerals are randomly oriented.

The rock is a vitric, rhyolite tuff.

Specimen No. 8

The rock consists of angular, lithic and mineral fragments of average diameter 0.25 mm. cemented by abundant carbonate, the latter comprising about 65% of the rock. Of the clastic material, lithic fragments comprise about 65%, mineral fragments 35%. Lithic fragments fall into four main categories as described immediately below:

- (1) Volcanic fragments. These have randomly oriented, euhedral, plagioclase phenocrysts in a colourless to pale brown, cryptocrystalline and glassy ground-mass containing granules of accessory iron ore. Composition seems mainly andesitic.
- (2) Chert fragments. Chert is present as cryptocrystalline, and to a lesser extent, flaring, chalcedonic quartz, and forms the majority of lithic fragments in the rock.
- (3) Metamorphic fragments. These include quartz, sericite schist, and very rarely, shale fragments.
- (4) Rare fragments showing granophyric intergrowth of quartz and kaolinized feldspar.

Quartz forms 70% of the mineral grains, plagioclase (sodic andesine where determined) 25%, and microcline, orthoclase, epidote and black iron ore 5%.

Mineralogy and texture suggest that the rock originally contained angular, lithic, quartz and feldspar fragments, probably set in an abundant, fine, cementing paste (greywacke of most workers, micrite of Condon). The cementing paste has been replaced by carbonate.

Specimen No. 9

Randomly oriented plagioclase lathes of average length 0.2 - 0.3 mm. make up perhaps 70% of this rock. Carbonate has replaced almost all other constituents of the original igneous rock, and can be seen replacing some plagioclase. A few grains of black iron ore are present. The rock was originally a dolerite.

Specimen No. 10

Much of this rock has been selectively replaced by carbonate but relict textures show its original igneous origin. Feldspar lathes of variable length but commonly around 0.5 mm. long form 60% of the rock, and are randomly oriented. Nearly all the remainder is carbonate: this has been stained red brown by iron solutions in an area comprising about half the slide. Here and there larger aggregates of carbonate appear to have pseudomorphed subhedral grains, perhaps of ferromagnesian minerals. Plagioclase (calcic labradorite) is fresh, and has been replaced only slightly by carbonate. The rock was most likely a dolerite.

Specimen No. 11 (two thin sections)

The rock is composed essentially of pale brown, finely granular carbonate, the pale brown colour suggesting siderite. Possibly 5% is made up of angular quartz grains with an average diameter of 0.02 mm., and very rare plagioclase grains. The rock is a silty and possibly sideritic limestone.

Specimen No. 12

The rock is porphyritic, and in places where plagioclase phenocrysts are grouped together in a striking fashion,

it is glomeroporphyritic. Phenocrysts of augite and black iron ore (ilmenite, leucoxene) are commonly grouped with the plagioclase, but they show an equally strong tendency to occur as isolated phenocrysts. The plagioclase is strongly zoned and hence of variable composition (grains varying from An₅₇ to An₇₀ were determined), and average length of phenocrysts is 0.78 - 1 mm. Augite is commonly pseudomorphed by carbonate, and no grains suitable for exact determination of the angle ZAC remain. It is colourless to very pale mauve, and has high dispersion with ZAC > 47°.

The matrix is very fine grained to cryprocrySTALLINE, and is made up of plagioclase where it can be resolved: iron ores (ilmenite, leucoxene, pyrite) and carbonate granules are scattered throughout, and here and there narrow carbonate veinlets persist. Pale green, serpentinous patches, also visible in the hand-specimen, seem to be infilled vesicles: many such patches have cores of carbonate.

The glomeroporphyritic texture, presence of amygdals and mineralogy of the rock show that it is an amygdaloidal basalt slightly metasomatized by carbonate.

Specimen No. 14

This rock has a coarse intergranular texture, with a network of plagioclase lathes (3 mm. long) enclosing augite and green to brown serpentine. Plagioclase (sodic labradorite where tested) is converted locally to sericite and kaolin, and here and there is replaced by granular carbonate. Augite is pale mauve with ZAC > 46°. Skeletal black iron ore (probably ilmenite), and a little brown biotite are present as accessories. The serpentine, apparently a variety of bowlingite, is found as anhedral aggregates of fibrolamellar structure between plagioclase lathes.

The rock is a coarse grained dolerite.

Specimens 15, 16 and 17

Thin sections show specimens 15, 16 and 17 to be of the same rock. This rock is made up of kaolinized, strongly zoned plagioclase (85%), quartz (8%) and limonite (7%). Euhedrism of the plagioclase is striking, particularly in specimen 16 where it forms bladed crystals 2 - 3 mm. wide and up to 3 cm. long. Most grains contain a core of plagioclase with either simple twinning, multiple twinning or combined albite and pericline twinning, that is surrounded by a pronounced outer zone. The outer zone is generally, but not universally, more strongly kaolinized than the core: it invariably has a relief less than that of quartz, and, where comparison is possible, less than that of the core. The outer zone has only rare, narrow twin lamellae, and is probably albite or sodic oligoclase. Measurement of extinction angles of plagioclase in the core reveals a fairly constant composition (An₂₉ ± 3). Quartz is interstitial, and limonite is either interstitial or mainly confined to the outer plagioclase zone.

The rock is a sodic, quartz bearing leuco-syenite.

Specimen No. 18

About 60% of the rock is composed of randomly oriented plagioclase laths with an average length of 0.5 mm. The remaining 40% is made up of red iron oxide, apparently mainly limonite, and carbonate. The rock appears originally to have been a dolerite.