Section 3 – Petrology

NOTES ON SPECIMENS COLLECTED IN VARIOUS LOCALITIES

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Petrological descriptions of various rock specimens examined for departmental purposes during the year are given below.

NOLAND BAY AREA

Specimen 65/220*A* *Wave cut platform of bedded sediments, East Double Sandy Point*

The hand specimen is a pale grey, fine grained, schistose rock with innumerable disseminated dark spots about .5 mm across. Cleavage planes parallel to the schistosity are stained brown with iron oxide and show laminae of very fine grained micaceous material.

In thin section the rock consists of a mass of minute oriented flakes of mica, pleochroic from colourless to reddish-brown, and angular grains of recrystallised quartz about .015 mm long. There are also disseminated dark opaque grains of similar size which are probably magnetite.

The dark spots seen in hand specimen appear as irregularly rounded or lenticular masses of apparently similar material, but finer grained and without orientation. Lines of schistosity curve around them, and these knotty patches appear to have been subject to some rotation.

The rock is a phyllitic schist.

65/220*B*. *East Double Sandy Point*

The hand specimen is a fine grained sheared, silver grey mottled rock. In thin section the knots seen in the specimen 65/220A are much more numerous. The minerals present are muscovite, biotite and recrystallised quartz, but the knots contain small granules of isotropic colourless garnet.

The rock is a phyllitic schist.

66/233 *A, B and C. Stony Head, Noland Bay*

In hand specimen these three rocks are very similar. They are fine grained, black, and contain numerous pale coloured and sparse black phenocrysts about 1 mm long.

In thin section they are also very much the same. 233B contained patches of green serpentinous material with cores of carbonate. Green serpentinous material was also present in A and C but there was less of it and no carbonate. The texture is intersertal and intergranular with granules of pale brownish hornblende and a little opaque black magnetite and brownish glass in the interstices of laths of labradorite about .25 mm long. Olivine is common in phenocrysts up to 1 mm long.

The rock is olivine basalt.

66/234 *A and B. Sea Cliffs, Stony Head, Noland Bay*

The hand specimens are black crystalline rocks with many small irregular phenocrysts, averaging about 1 mm long of serpentinised olivine.

In thin section the texture is intersertal and intergranular consisting of granules of very pale coloured augite and black glass filling the interstices of a network of lamellar twinned labradorite laths about .2 mm long. The black glass which partly encloses some feldspar crystals, is seen under high magnification to contain innumerable minute rounded granules of silicate minerals as well as magnetite.

The phenocrysts of olivine are largely altered to green serpentinous material, but when fresh are seen to be corroded and with infilling of the general rock material.

The rock is an olivine basalt.

66/235*A*. *Sea Cave, Stony Head, Noland Bay*

The hand specimen is a brownish black, fine grained rock with a specific gravity of 1.35. It has a smooth flat fracture and is very finely bedded. On heating it burns to a pale brownish yellow colour.

In thin section the rock is a porous fine grained laminated opaque mass containing angular fragments of quartz (some of it recrystallised) and feldspar and minute plates of mica averaging about .03 mm across. A lot of very fine grained clay material is hidden in the black matrix.

The rock is a carbonaceous mudstone.

66/235*C*. *Beach Boulders, Sandy Head, Noland Bay*

The hand specimen consists of rounded to subangular, slightly vesicular, black masses with minute white phenocrysts, in a matrix of soft yellow granular material.

In thin section the rock consists of yellow-brown glass containing cracked and sub-rounded phenocrysts of olivine about .2 mm long, twinned laths of labradorite and granules of augite. Vesicles are common and most of them are filled with radiating yellowish green nontronite and opaline silica.

The soft yellow material seen in thin section consists of the same rock with the glass devitrified and opaline silica and nontronite produced.

The rock is a glassy olivine basalt.

66/236. *Sea Cliff, Stony Head, Noland Bay*

The hand specimen is a dark grey, fine grained crystalline rock.

In thin section the texture is intergranular, consisting of a network of laths of labradorite about .1 mm long with pale granular augite filling the interstices. Magnetite occurs in black rods and masses similar in size to the laths of feldspar around the ends of which it tends to be moulded. Phenocrysts of olivine up to 1 mm in length are common. They tend to be euhedral but may be cracked and broken and the cracks filled by olive-green alteration products.

Numbers 236B, C and D are all very similar to each other and to 236A from which they differ only in containing more magnetite, which has crystallised last with very fine granular silicate material. Some carbonate is present.

The rock is olivine basalt.

66/253A. *Wave Cut Platform, West Stony Head, Noland Bay*

The hand specimen is a fine grained, crystalline, medium grey rock, crowded with brown phenocrysts up to 1 mm long.

In thin section the texture is intergranular and intersertal. The rock is composed of a network of lamellar-twinned laths of labradorite averaging about .2 mm long, the interstices being filled by pale granular augite and a little glass darkened by clouds of microlites. Rods and small irregular masses of magnetite are common. Some alteration of the rock, probably by weathering, is indicated by patches of cloudiness due to opaque white material. A brown carbonate, probably siderite, is very common in irregular patches of up to .5 mm long showing curved cleavage, and partly enclosing feldspar crystals.

The rock is a tholeiitic basalt.

253. *Lower Cliffs, West Stony Head*

In the hand specimen this rock is a paler grey than 253A but the phenocrysts are darker and it is somewhat vesicular.

In thin section the texture is intergranular, with granular augite filling the interstices between laths of labradorite, but maggetite is less common and siderite has been replaced by semi-opaque dark reddish brown birefringent patches.

The rock is a tholeiitic basalt.

65/324. *Wave Cut Platform, West Sandy Point*

The hand specimen is a fine grained greenish-grey, finely banded, sheared rock with minute sparse red grains. The shearing is at a high angle to, and steeper than the bedding, showing that the beds are not overturned. This is confirmed by a thicker bed showing internal current bedding with the current laminae concave upwards, open at the top and crowded together at the bottom.

In thin section the rock consists of minute books of mica and grains of quartz ranging up to about 10 microns across. Shearing is shown by closely spaced sub-parallel dark lines about 100 microns long consisting of crumpled aggregates of micaceous plates. The rest of the mica does not show orientation; but recrystallisation is indicated by books of mica, including chlorite, transecting the lineation of the crumpled plates.

The red grains seen in the hand specimen are subhedral and euhedral crystals of magnetite altered to limonite.

The rock is a slaty mudstone.

65/221. *Wave Cut Platform, Ninth Island*

The hand specimen is a medium to fine grained greyish-green, somewhat mottled rock with crystals up to 2 mm long showing bright cleavage faces in a finer matrix.

Thin section shows clusters of phenocrysts of pale brown augite in a near-orthophyric matrix of labradorite laths and mesostasis. Minute grains of magnetite and longer irregular aggregates are common. The irregular margins of the augite crystals partly enclose much smaller laths of labradorite to give a sub-ophitic texture.

The rock is a dolerite.

68/2. *Shore Platform Ribs, West Sandy Cape*

In the hand specimen the rock is greenish grey, very fine grained, finely bedded and shows current bedding.

In thin section the rock consists mainly of quartz grains with undulose extinction averaging about .01 mm across, with greenish-brown to colourless micas in ragged books, colourless muscovite in recrystallised forms and scattered opaque black and red carbonaceous and haematitic particles.

Incipient slaty cleavage is strongly shown cutting across the bedding at 30° to 40°.

The rock is a siltstone.

68/3 *East Sandy Cape*

The hand specimen is a fine grained dark grey sheared rock.

In thin section the rock consists of quartz grains, mostly recrystallised, about .01 mm across together with some granular feldspar showing lamellar and simple twinning, reddish brown pleochroic biotite and colourless strongly birefringent muscovite. Scattered, fine grained, opaque iron ores and opaque white hydromicas and graphite are also plentiful. Shearing is very prominent.

The rock is an altered carbonaceous siltstone or semischist.

68/4 *Tenth Island*

The hand specimen is a finely banded, pale greyish yellow, medium grained rock with visible grains of quartz and feldspar and platlets of white mica up to .7 mm across.

In thin section the rock consists of grains of quartz and minor feldspar showing peripheral granulation and sometimes partial recrystallisation. Some grains being rounded, others angular or elongated, and all marked by intersecting cracks. These larger grains are embedded in a copious matrix of compacted and partly recrystallised quartz and possibly a little feldspar. Yellowish muscovite is drawn out into crinkled platy masses which give the rock its schistose texture. A little magnetite partly oxidised to brown limonite and possibly some graphite occurs with the mica.

The rock is a sheared arkosic sediment.

68/5. *Foreshore, Stony Head*

The hand specimen is an extremely fine grained, dark silver-grey rock with a silky lustre. The rock is very finely laminated and the laminations are minutely folded and crenulated. Relatively impersistent joints normal to the laminations are filled with opaline silica.

In thin section the laminations, about .02 mm thick are well shown, marked by black graphitic material. The most abundant mineral is sericite in minute flakes about .0004 mm long and very strongly oriented so as to give the rock an aggregate polarisation effect. A little quartz is also present in equant grains, and sparsely disseminated zircon.

The rock is a phyllite.

68/6. *Granite Point, N of Bridport*

The hand specimen is a medium grained, leucocratic, holocrystalline rock, with feldspar, quartz and biotite showing prominently.

In thin section typical hypidiomorphic texture is shown. The minerals present are zoned plagioclase in euhedral crystals, short prismatic crystals of oligoclase showing lamellar and simple twinning, adhedral quartz with undulose extinction and largely sericitised orthoclase, irregular plates and prisms and ragged aggregates of biotite and green hornblende.

Minor constituents include traces of pyrite and minute crystals of magnetite, zircon and topaz.

Secondary minerals include sericite and epidote.

Approximate proportions are plagioclase (mainly oligoclase) 50%, Quartz 15%, Orthoclase 5%, Hornblende 15%, Biotite 15%.

The rock is a granodiorite.

68/7A. *Forehore East Tam O'Shanter Bay*

The hand specimen is a fine grained, crystalline vesicular dark grey rock. A few of the largest vesicles are up to three or four millimetres across and these are mostly filled with fine grained pale greenish material.

In thin section the texture is intersertal and intergranular, consisting of lamellar twinned laths of labradorite about .5 mm long enclosing pale granules of augite interspersed with enclosing patches of black glass, and thin rods of magnetite. Secondary minerals include irregular patches of brown siderite with curved rhombohedral cleavage and a green laminated faintly birefringent mineral.

The rock is a tholeiitic basalt.

68/7B. *Foreshore. East Tam O'Shanter Bay*

Is similar to 7A. It is paler in colour and more coarsely vesicular and the vesicles which measure up to 5 or 6 mm across are mostly filled with brownish red siderite.

The rock is very similar to 7A in thin section also differing mainly in the larger vesicles filled with siderite with a pronounced curved cleavage. In some vesicles the siderite is in the process of being replaced by radiating needles of goethite.

7C. *Foreshore, East Tam O'Shanter Bay*

This rock is darker and more vesicular than the other two. A few vesicles are filled with carbonate stained by haematite.

In thin section the rock consists mainly of labradorite laths in black glass, with subordinate granules of pyroxene and greenish yellow secondary material.

68/8A. *Xenolith in granite, Granite Point N of Bridport*

The hand specimen is a dense, fine grained, yellowish brown rock.

In thin section the rock is a mosaic of minute golden-brown crystals of siderite with rare minute rounded grains of quartz, and a small group of spherules of pyrite.

8B. *Xenolith in granite, Granite Point, N of Bridport*

The hand specimen is a fine grained vesicular grey rock. In thin section the rock resembles Specimen 7A but without any carbonate. It also contains glassy patches resembling specimen 7C. In addition it contains crystals of pale brown augite up to 2 mm long and clumps of crystals of augite.

The rock is a tholeiitic basalt.

68/9A *Xenoliths in granite, Granite Point, N of Bridport*

The hand specimen is a mesocratic, somewhat foliated rock consisting of quartz, feldspar and biotite; the last in roughly oriented flakes up to .25 mm across. Small masses of rather coarser grained quartz are strung into thin bands and lenses up to 3 cm and more in length.

In thin section the quartzose lenticles consist of a mosaic of irregularly shaped quartz grains up to 2 or 3 mm long showing strain and recrystallisation. Pale coloured cloudy inclusions are common and rare minute zircons are present. Parallel lines of bubbles cross grain boundaries and there is a net work of fine cracks. Flakes of biotite occur along grain boundaries.

The rest of the rock consists of quartz grains averaging .2 mm long, plates of greenish brown biotite of similar size and rarer grains of feldspar showing simple and lamellar twinning. The grains are oriented.

The rock is a metamorphosed siliceous sediment.

9B. *Xenoliths in Granite, Granite Point, N of Bridport*

The hand specimen is a fine grained, mesocratic, somewhat friable crystalline rock, vaguely banded and somewhat uneven in colour.

In thin section the rock is a mosaic of clear lamellar twinned albite, sericitised plagioclase, hornblende and biotite with a little yellowish epidote and quartz.

The paler patches as seen in the hand specimen consist largely of sericitised plagioclase whereas the darker parts contain fresh albite.

Veinlets of plagioclase (andesine) transect the section. Some of them contain crystals of colourless zoisite.

The rock is a microgranodiorite.

9C. *Xenoliths in Granite, Granite Point, N of Bridport*

The hand specimen is a coarse grained rock consisting of white quartz and feldspar and black ferro-magnesian minerals, with a darker medium grained rock on one edge of the specimen.

In thin section the coarse grained rock is a grandiorite consisting of plagioclase, a little orthoclase and quartz and plentiful hornblende and some biotite. The texture is hypidiomorphic and the rock is a granodiorite. The fine grained rock is much the same except for grainsize and a higher proportion of ferromagnesian minerals. It is a typical basic segregation.

9D. Xenoliths in Granite, Granite Point, N of Bridport

A granodiorite very similar to 9C with a finer grained, roughly banded darker rock running through it in a vein about an inch wide.

The fine grained vein rock is a micrograndiorite similar to 9B. The lighter colour bands contain sericitised feldspar and the darker ones fresh albite.

Thus the xenoliths of 68/9 are altered sediments (9A) basic segregations (9C) and microgranodiorites (9B, 9D) the last injected as small veins into the coarser granodiorite.

STANHOPE COAL MINE

Specimens collected at the Stanhope coal mine have been examined with the following results:—

Specimen 1

A soft, black, brittle, fine grained rock with innumerable white, elongate spots. The spots are nearly all less than 1 mm long but in the larger ones sparkling cleavage faces are visible. On heating, the rock becomes almost white, by combustion of carbonaceous material.

In thin section the rock is opaque black, except for the white spots, which consists of kaolin in curved and rectangular books of thin flakes showing a refractive index greater than that of balsam and low birefringence colours. Some hydromuscovite with higher birefringence is interleaved with the kaolin. Associated with the kaolin are anhedral remnants of oligoclase broken by networks of irregular cracks. Some pieces however show cleavage.

When the carbonaceous matter is removed by heating, the former black parts of the rock consist of angular fragments of oligoclase, very fine grained clay minerals, sparse rounded grains of quartz.

Specimen 2.

This is a banded specimen consisting of (A) carbonaceous mudstone, (B) limestone, and, (C) an intermediate band consisting of type (A) spotted with type (B).

Band 2A is a fine grained black rock much the same as Specimen 1. It becomes somewhat lighter in colour towards the underlying band. It consists of books of kaolin and angular fragments of feldspar and rare grains of quartz in a matrix of structureless fine grained clay and black carbonaceous material.

Band C is similar to band A but contains as well, irregular pale brownish masses of very fine grained carbonate.

Band B consists largely of interlocking crystals of calcite elongated in a vertical direction. Imperfectly horizontal and impersistent narrow bands of dark organic and argillaceous material containing crystalline kaolin intersect the carbonate.

Underlying band B, bands C and A are repeated in that order.

Specimen 3

The hand specimen is a fine grained, bedded, black rock with a subconchoidal fracture and a resinous lustre on fracture faces. On heating the rock burns white without other apparent alteration.

In thin section the rocks show minute angular sparsely disseminated grains of quartz and feldspar in an irresolvable matrix of clayey and carbonaceous material showing aggregate polarisation.

The rock is a fine grained carbonaceous claystone.

Specimen 5

The hand specimen is the central section of a small boulder. It consists of a grey rock made up of angular fragments of fine grained rock, euhedral crystals and angular fragments of feldspar and grains of quartz.

In thin section the rock consists of angular fragments of porphyrite, porphyritic latite, and feldspar crystals in a matrix of finely comminuted similar material and glass. The fragments are generally outlined by very fine grained white opaque material possibly produced by atmospheric weathering of ash during deposition.

The feldspars are in the oligoclase-andesine range.

The rock is a volcanic breccia.

EPPING

The following is a description of a rock specimen collected by Geologist, W. L. Matthews about a mile and a half along the road branching to the SW of the Midland Highway at Epping.

The specimen is a fine grained black rock with visible sparkling prismatic crystals and some granular honey-coloured masses. In thin section the texture is intersertal consisting of laths of labradorite up to 1 mm long and prisms of titanaugite with interstitial black glass and a little granular olivine. Olivine is also present as occasional larger euhedral crystals, about 1 mm long showing alteration along irregular cracks.

The titanaugite and labradorite tend to be in ophitic relationship. A little brownish carbonate is also present.

The rock is a basalt.

FRIENDLY BEACHES AREA

68/177. *Friendly Beaches*

The hand specimen is a medium to fine grained rock, greyish in colour but with a brownish tint due to iron oxides. The rock is fossiliferous and in addition to shelly fragments contains round to sub angular glassy grains of quartz, semi-opaque altered feldspars, small black irregular carbonaceous fragments and rounded pale green grains of glauconite in a very fine grained dark matrix.

In thin section the rock is a dense non-porous sandstone with a high proportion of matrix for its type. Although there is some rounding of the larger grains, it is poorly sorted and contains a high proportion of grains below .1 mm.

Quartz is the most prominent mineral and makes up about 60% of the total grain content of the rock. Some quartz grains show undulose extinction and most have become extensively cracked in the preparation of the section. Feldspar, showing simple and lamellar twinning, is common, making up about 25% of total grains. The larger feldspar grains, showing simple or no twinning, are partly altered to carbonate. Glauconite is commoner than appears in hand specimen and comprises about 10% of total grains. It is mainly in small rounded masses with aggregate polarisation. Lithic fragments, carbonaceous material and carbonates make up the rest of the rock.

The rock consists of unsorted and immature sedimentary material accumulating in shallow water close to a source.

The rock is a glauconitic feldspathic sandstone.

TAMAR AREA

68/178. *Middle Arm*

The hand specimen consists of angular fragments up to about 1 cm long, mainly of carbonate, but occasionally of chert, in a fine grained grey matrix of carbonate containing irregular patches and veinlets of quartz. Concretionary structures 1 to 3 mm across are common.

In thin section the angular fragments appear as very fine grained, semi-opaque ragged masses of granular calcite surrounded by aureoles of redeposited, transparent, crystalline calcite. The interstices between the aureoles are filled with crystalline quartz or calcite or mixtures of the two. The rock was possibly, originally a cherty carbonate doposit which was brecciated and cemented by percolating solutions containing dissolved silica and carbonate. Interchange of these two substances has occurred and the interstices have been peripherally eroded and the material redeposited in regular encircling layers. The smallest fragments have almost completely disappeared to be replaced by concretionary structures.

The rock is a recemented limestone breccia.

FINGAL AREA

The following are descriptions of rock types selected from D.D.H. No. 6, Fingal, by Geologist V. Threader.

68/173A

The hand specimen is a fine, even-grained, grey bedded rock with small black lenses parallel to the bedding and spotted with innumerable white opaque grains of altered feldspar averaging about .15 mm across.

In thin section the rock is a mosaic of angular grains averaging .125 mm across, with black carbonaceous interstitial material which also tends to obscure the grains. This constitutes approximately 12% of the whole.

If all the grains make 100% then quartz = 65%, feldspar 30% and lithics 5%.

The rock is a carbonaceous arkose.

68/173C

The hand specimen is a very fine grained pale grey rock with very fine grained irregular dark inclusions. The rock effervesces very readily with acid, the dark portions somewhat less so.

In thin section the rock consists of massive carbonate so fine grained as to be semi-opaque. Small angular grains of quartz and feldspar up to 0.2 mm across are sparsely disseminated together with minute flakes of clay minerals. These impurities are more common in the darker portions which also contain brown translucent carbonaceous matter.

The rock is a calcilutite.

68/173D

The hand specimen is a pale grey rock with barely visible grains of quartz and feldspar and minute black specks in a pale matrix.

In thin section the rock consists of angular to sub-rounded quartz, feldspar, and rock fragments in the proportion of 40% quartz, 10% feldspar and 50% rock fragments were 100% = total grains.

The matrix and cement have been totally replaced by very fine grained brownish crystalline carbonate.

The rock is a carbonated lithic sandstone.

68/173E

The hand specimen is a pale grey, fine grained, granular rock. It consists of grains, about .25 mm across, of clear glassy quartz, opaque white altered feldspar and dark lithic fragment embedded in grey calcite.

In thin section the rock is largely allotromorphic crystalline calcite showing characteristic cleavage.

Angular quartz grains are common but are exceeded in numbers by dark lithic fragments. The most common grains are feldspars altered to white opaque clay minerals or replaced by carbonate with remains of lamellar twinning.

The rock is a carbonated arkose.

68/173F

The hand specimen is a fine grained greyish rock, effervescing freely with acid. Dark carbonaceous flakes up to 5 mm long are common and indicate the bedding by their orientation.

In thin section the rock is a fairly well sorted aggregate of sub-angular to sub-rounded fragments from .05 mm to .02 mm across of quartz, feldspar and lithic fragments with interstitial crystalline calcite filling all voids.

Calcite comprises about 40% of the rock. Clear feldspar showing multiple twinning is not abundant, but opaque white grains of kaolinised feldspar are. Quartz makes up about 30% of total grains and lithics about 15%.

The rock is a carbonated arkose.

68/173G

The hand specimen is a fine grained greyish granular rock with visible fragments of quartz, feldspar, dark lithics and black carbonaceous material. The rock effervesces with acid.

In thin section the rock is a well sorted granular aggregate with grains of lithics, quartz, partly altered feldspars showing simple and lamellar twinning, black carbonaceous masses and micas with about 25-30% of interstitial calcite.

The grains average .15 mm across and consist of about 60% lithics, 25% feldspar and 15% quartz of total grains.

The rock is a lithic sandstone.

68/173H

The hand specimen is a very fine grained tough, pale grey rock, effervescing with acid.

In thin section it consists mainly of massive crystalline calcite showing characteristic cleavage in places and undulose extinction.

Particles of quartz and carbonaceous material averaging about .01 mm across are very sparsely disseminated but the rock contains a fine network of opaque white material, possibly of very fine grained clay minerals.

The rock is a recrystallised calcilutite.