TR5-34-44

CAMBRIAN ROCKS OF THE DOLCOATH ANTICLINE

by K. L. Burns

INTRODUCTION

The Dolcoath Anticline is in Ordovician conglomerate and sandstone and extends from Tin Spur in the north to about 886N. in the Lorinna area. The general trend is east-south-east, although Elliston has mapped minor folds trending south-east on Olivers Hill.

GENERAL STRATIGRAPHY

The Cambrian rocks within the anticline consist of a great thickness of quartz porphyry, or 'porphyroid', with interbedded greywackes. The probable sequence is—

Upper Porphyry Member.—thickness at least 700 feet.

Geales Bridge Member.—about 500 feet of greywacke sandstone, conglomerate, and siltstone, interbedded with porphyry in places.

Lower Porphyry Member.—at least 300 feet thick, but possibly up to four times that thickness.

These members comprise the Bull Creek Formation, which is defined as those rocks outcropping in the Forth River between 8859N. and 8888N. Rocks correlated with this formation outcrop in the Iris River between Bifros and Hinman Creeks. Sediments described by Nixon from near the mouth of Hinman Creek may be the Geales Bridge Member. Similar rocks (field notes, Nixon) occur in the core of the anticline on Mt. Stormont. The quartz-felspar porphyry and greywacke sandstones in the Liena Gorge may belong to this formation. The formation underlies Ordovician conglomerates in the Iris River, on Mt. Stormont, and on the Lorinna Road at Tin Spur and the gravel quarry (8862N).

QUARTZ-FELSPAR PORPHYRIES

The dominant rock is a quartz-felspar porphyry, varying in colour from blue to black, green, or brown. It is described by G. Everard as medium to fine-grained, with corroded, rounded to euhedral fragments of glassy quartz, from 1 to 3 mm. diameter, which are almost invariably cracked. The felspar is euhedral, corroded, with cloudy alteration, and has been identified in specimen 45J2 as orthoclase. The matrix consists of chlorite, quartz and felspar, with hornblende, epidote and iron ore often present. Euhedral zircon occurs in 45J3.

The average composition from six analyses (20.2.57) is:—

	%
SiO_2	64.03
Al_2O_3	14.51
Fe_2O_3	1.80
FeO	4.33
MnO	0.12
TiO_2	0.64
P_2O_5	0.18
CaO	4.96
MgO	2.70
Na_2O	0.84
K_2O	4.15
H_2O-	0.21
H_2O+	0.42

Note.—K_2O/Na_2O is about 5/1.

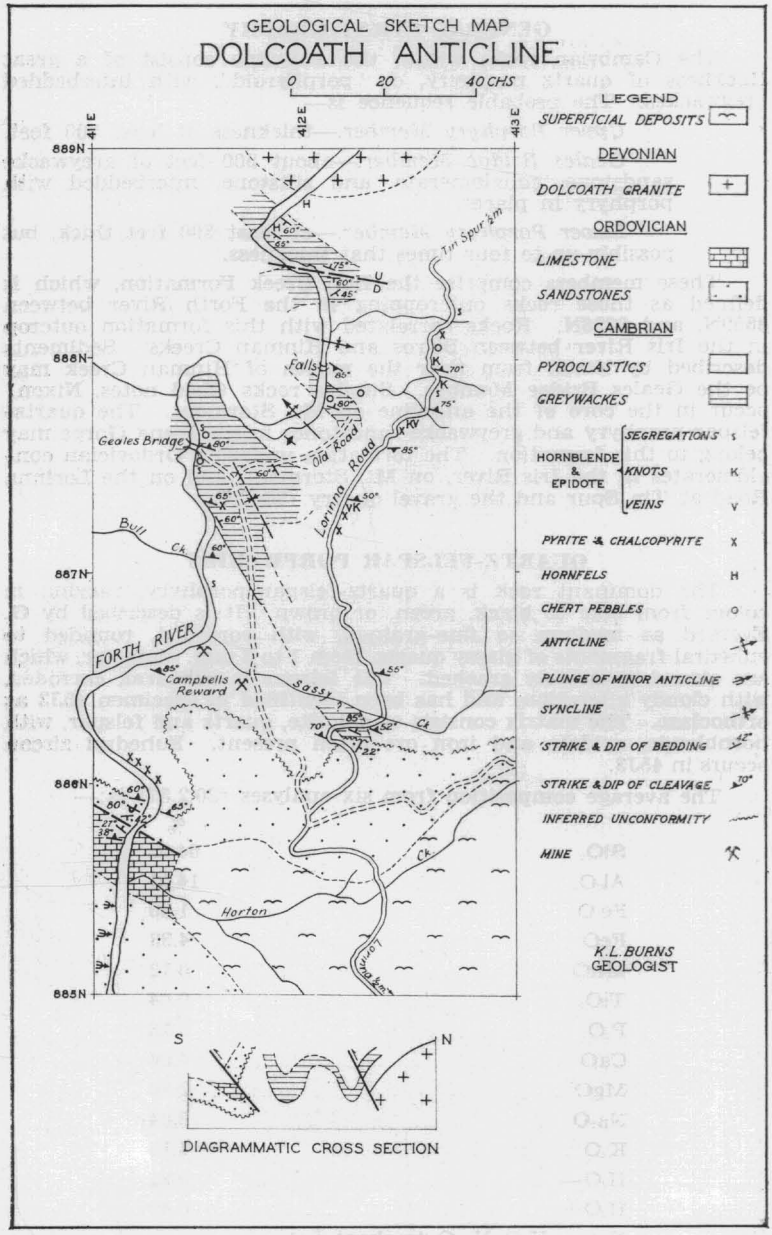

GEOLOGICAL SKETCH MAP
DOLCOATH ANTICLINE
0 20 40 CHS
411E
412E
413E
889N
888N
887N
886N
885N
Falls
Geales Bridge
Old Road
Lamma Road
Bull Ck
FORTH RIVER
Campbells Reward
Sassy
Ck
Horton
Tim Spur
LEGEND
SUPERFICIAL DEPOSITS
DEVONIAN
DOLCOATH GRANITE
ORDOVICIAN
LIMESTONE
SANDSTONES
CAMBRIAN
PYROCLASTICS
GREYWACKES
HORNBLENDE & EPIDOTE
SEGREGATIONS
KNOTS
VEINS
PYRITE & CHALCOPYRITE
HORNFELS
CHERT PEBBLES
ANTICLINE
PLUNGE OF MINOR ANTICLINE
SYNCLINE
STRIKE & DIP OF BEDDING
STRIKE & DIP OF CLEAVAGE
INFERRED UNCONFORMITY
MINE
K.L. BURNS
GEOLOGIST
S
N
DIAGRAMMATIC CROSS SECTION

FIGURE 6.

5 cm

The rocks are not homogeneous in thin section, some portions being mainly quartz-felspathic. This variation is visible macroscopically, a felspathic phase being prominent at 4122E/8873N. The content of quartz fragments visible in the field varies from 10 to 90 percent.

Agglomerate occurs on the Lorinna Road at 88762N, and consists of angular blocks up to six inches diameter of purple and green porphyritic lava in a matrix of the porphyry. A similar rock outcrops in the Forth River at 8869N. A specimen from the Lorinna Road at 8882N is described by G. Everard as having a matrix of fine, granular, quartzo-felspathic material with larger grains (up to 1 mm.) of quartz, altered felspar, irregular granular masses of epidote, and masses of fine acicular hornblende, sometimes altered to chlorite. Within this is a large, pebble-like inclusion consisting of phenocrysts of corroded quartz and semi-opaque felspar, in a matrix of finegrained quartzo-felspathic material showing flow texture. The matrix contains quartz, and quartz and epidote, as groups of fine granular crystals.

Chert pebbles occur sporadically throughout the porphyry on the Lorinna Road at 8881N, on the old road at 8878N, in the Forth River at 8870N, and at Geales Bridge. These vary from one inch to three inches in diameter.

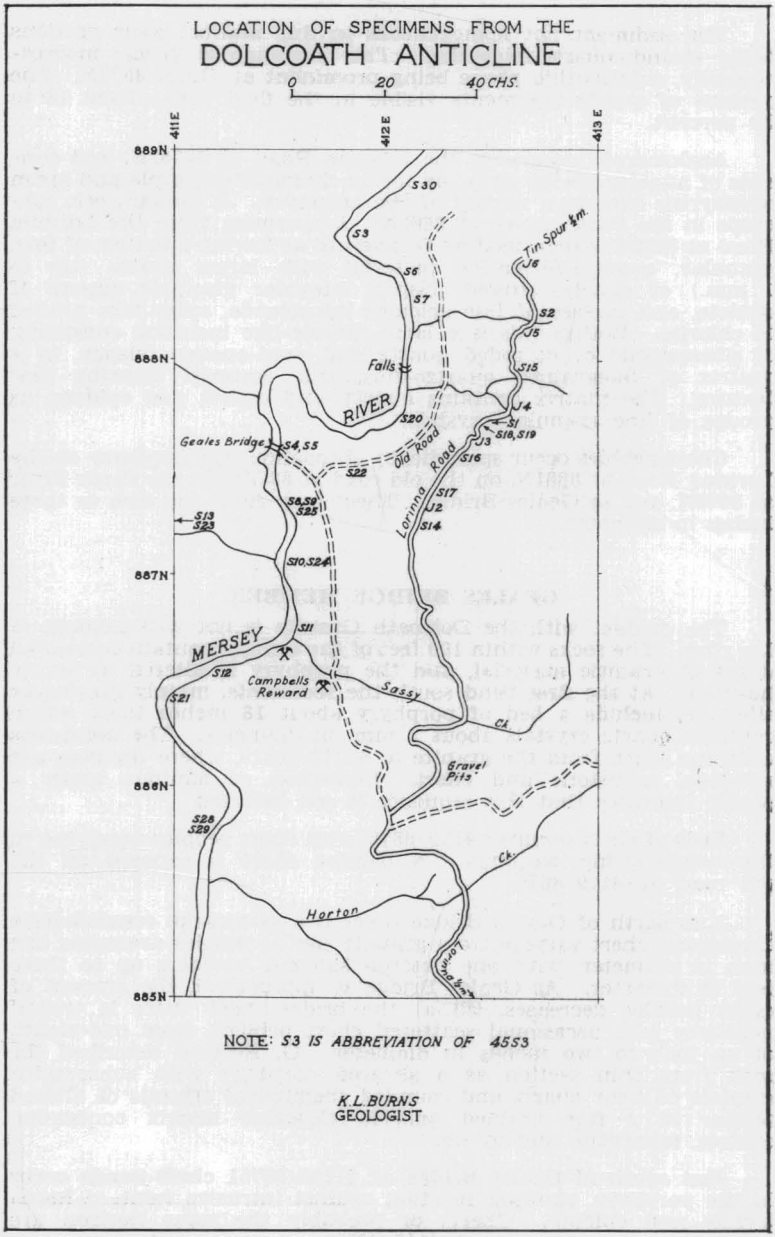
GEALES BRIDGE MEMBER

The contact with the Dolcoath Granite is not well exposed in the river. The rocks within 100 feet of the contact contain occasional dykes of granitic material, and the porphyry is altered to biotite hornfels. At the first bend south the sediments, mainly greywacke siltstone, include a bed of porphyry about 18 inches thick which contains quartz crystals about 3 mm. in diameter. The sediments continue south from the granite to 41213/88819, where the beds are siltstone, sandstone and chert. Deflection of laminae under a pebble indicates that this sequence is not inverted.

Beds of chert occur at 4122/8878, with chert pebbles occurring in the neighbouring porphyry. A banded chert is exposed on the old road at 4119/8876.

Just north of Geales Bridge there is a greywacke conglomerate containing chert varying from granule size to pebbles averaging one inch in diameter, with one outcrop showing boulders up to three feet in diameter. As Geales Bridge is approached, the amount of chert pebbles decreases, till at the bridge itself there is typical porphyry with occasional scattered chert pebbles, from one-eighth of an inch to two inches in diameter. G. Everard described the rock from thin section as a sheared porphyry with subrounded crystals of clear quartz and rounded rhomboidal crystals of altered felspar in a fine grained quartzo-felspathic matrix containing epidote, magnetite and pyrite.

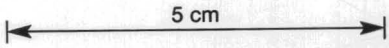
Just south of Geales Bridge at 41150/88751 chert bands occur in the porphyry, showing reaction against intrusive veins of hornblende and epidote. Cherts of probably the same horizon are exposed on the old road at 4117/8873.



NOTE: S3 IS ABBREVIATION OF 4553

K.L. BURNS
GEOLOGIST

FIGURE 7.



The sediments at Geales Bridge have a total thickness of about 500 feet and consist of conglomerate, sandstone, siltstone and chert, with bands of porphyry. Mapping indicates that the outcrops downstream are the same horizon repeated by folding and faulting.

ORIGIN OF THE BULL CREEK FORMATION

Although petrological reports indicate that the material is of igneous origin, despite careful search no evidence of lava flows has been found—no vesicles or pillow structure, and no columnar jointing. At the same time there is no evidence, such as discontinuities, against a common origin for all the porphyry of the area. As described above, the porphyry contains chert pebbles in places, and at Geales Bridge grades upwards into greywacke conglomerate. Just south of the granite are beds of porphyry interbedded with laminated greywacke siltstone, and on the Lorinna Road are agglomerates containing boulders of pink lava. All these considerations taken together imply that the porphyry lithology in this formation has a common origin which is sedimentary, probably pyroclastic.

METAMORPHIC SEGREGATIONS

Numerous oval patches of dark green material with a white border, occur in the porphyry, notably at Geales Bridge, on the Lorinna Road near 88762N, and in the Forth River near 8869N. These also occur in greywacke north of Geales Bridge. They were first observed by Nixon (field notes) on the west side of the Liena Gorge. The bodies average two to three inches long, and are ellipsoidal in shape with long and intermediate axes in the plane of schistosity. The shape in the schistosity plane is very nearly circular. The petrology of specimen 25S4, from Geales Bridge, is described by G. Everard. The brown host rock is a sheared quartz-felspar porphyry. The green centre of the segregation consists largely of hornblende and epidote in confused masses of fine crystals, together with phenocrysts of quartz and felspar and irregular masses of quartzo-felspathic matrix. The white rim of the segregation is similar to the country rock but the matrix is fresher and whiter and there is more epidote present. The three types merge into one another.

At Geales Bridge a joint running oblique to the schistosity intersects a segregation, and the segregation is locally elongated along the joint. Another joint in the same locality has narrow elongated segregations along its length.

Hornblende and epidote knots occur in Bull Creek (4096/8877), on the Lorinna Road at 88772N, and in the Forth River near 8870N. The hornblende occurs as large rounded knots up to 12 inches long and rarely less than six inches. Smaller knots, one inch to two inches in diameter, are usually epidote. The country rock is usually porphyry, but knotted greywacke boulders are found in the river at Geales Bridge, possibly washed out of Bull Creek.

Veins of hornblende and epidote occur in Bull Creek, on the Lorinna Road between 88726 and 88772, and in the Forth River at 88751N. A vein from the Lorinna Road is stated by G. Everard to consist of a central portion of hornblende and magnetite, with an outer portion of anhedral felspar, anhedral to euhedral quartz, and epidote.

The veins crosscut schistosity, and appear to be controlled by shear joints symmetrically related to schistosity. They form resistant crosses on weathered surfaces. On Bull Creek some veins are multiply banded with epidote and hornblende, while some poorly exposed epidote veins may be infilled tension gashes. The veins often contain a central portion of chalcopyrite, as between 8872 and 8882N on the Lorinna Road.

Mineral veins of calcite, quartz and chalcopyrite occur at 8872N on the road, while disseminated pyrite is abundant in the Forth River at 8858 to 8865N, and just north of Geales Bridge.

STRUCTURE

The dominant structural feature is a strong schistosity which reaches maximum intensity at the south side of the regional anticline. There the rock is in places a sericite schist with the schistosity lensing around the quartz crystals. The Ordovician limestone in the Forth River at 8859N shows strong shear folding with the cleavage planes parallel to those in the porphyry, so the shearing is of Devonian age. This is confirmed by observations at the Cethana unconformity, where the cleavage in the Cambrian siltstones continues into the Ordovician conglomerates.

It appears that the schistosity fans slightly in the anticline, from dipping north at 30° on the south limb to vertical or overturned in the axial portion. Drag folds have only been seen in three places, with their axial planes parallel to the schistosity.

The Cambrian rocks are folded into several second order folds, trending oblique to the major structure. The divergence is somewhat less than 45°. The schistosity appears to be related to the first order folds.

The oblique shear joints noted crosscut the schistosity, and while strongly controlling the hornblende and epidote veins, they have only a minor effect on the ellipsoidal segregations which are schistosity controlled. Thus the veins are later than the segregations, and (if the chalcopyrite originated from the granite) it appears that the granite emplacement was later still.

Appendix I

by G. Everard.

The following descriptions apply to rocks collected by Regional Geologist I. Jennings in areas adjacent to the Lorinna Road, and covered by aerial photographs Mersey Run 5/61/52-57.

Mersey Run 5/61/52—*Quartz-felspar porphyry, Lorinna Road*

Medium to fine grained dark green rock. The colour is not quite uniform as there is an occasional patch of paler felspathic material. Visible crystals consist of irregular glassy quartz and white rectangular felspar about one mm. across.

In thin section the texture is porphyritic with euhedral or rounded or irregular and corroded quartz crystals, cloudy crystals of felspar, and confused masses of uralitic hornblende in a quartzo-felspathic groundmass, with chlorite and epidote.

The felspars show alteration and may have sericitic inclusions, but simple twinning along 001 and extinction parallel to the twin plane indicate orthoclase. Occasional crystals show fine multiple twinning with low extinction angles. Accessory minerals are ilmenite and magnetite.

53. *Quartz-felspar porphyry—Lorinna Road*

Fine-grained greenish-black rock with glassy phenocrysts of quartz.

In thin section shows rounded and euhedral crystals of quartz, all slightly corroded, and lath-like and irregular remains of hornblende crystals, partly chloritic, and partly altered to iron ore minerals. In between the size of the phenocrysts and the very fine groundmass is much quartz in angular and irregular grains. The groundmass is greenish and seems to consist of chlorite, quartz, epidote and felspar. There are patches of iron ore and euhedral crystals of zircon. Original felspar crystals are absent or exist only as very shadowy and irregular patches.

54. *Quartz-felspar porphyry, Lorinna Road*

Greenish black rock with phenocrysts of glassy quartz. The groundmass is very fine grained but the rock is not uniform as there are xenoliths of lighter coloured siliceous material which seem to be associated with epidote, and some xenoliths consist almost entirely of epidote.

In thin section the rock shows plastic flow structure. There are lenticular inclusions of quartzo-felspathic material containing corroded quartz grains, multiple twinned felspar crystals and aggregates of uralitic hornblende. The very fine grained groundmass seems to consist of chlorite and epidote.

55. *Quartz felspar porphyry with pyrite nodules*

Dark greenish rock with phenocrysts of quartz, and large single crystals and coarse grained aggregates of pyrite.

In thin section the rock is seen to consist of a quartzo-felspathic groundmass, not entirely uniform, some parts being of coarser grain than others, containing patches of epidote and iron ores. The quartz phenocrysts are rounded and peripherally corroded.

56. *Quartz porphyry*

Medium to fine grained dark greenish rock with glassy phenocrysts of quartz and a trace of sulphides.

In thin section the quartz crystals appear corroded and have inclusions of other minerals. The groundmass is quartzo-felspathic and contains in addition innumerable small granules of epidote. Uralitic hornblende also occurs in confused aggregates. Flow structure is prominent.

57. *Porphyry—Lorinna Road*

Dark greenish rock with glassy phenocrysts of quartz and fewer cloudy phenocrysts of felspar.

In thin section the texture is porphyritic and glomeroporphyritic, with single crystals of felspar and quartz somewhat corroded, and groups of crystals comprising quartz, felspar, uralitic hornblende, epidote and iron ores. The matrix is very fine grained, consists of quartz, felspar and epidote, and shows plastic flow structure.

From the evidence of the above sections it is apparent that these rocks have a complex origin and a complicated history. Metamorphic textures and structures are plainly shown. However, the minerals present indicate an igneous origin. Such an origin would be indicated by a high ratio of potash relative to soda. A high silica content in such melanocratic rocks is anomalous; but under the microscope evidence appears for a high silica percentage in the groundmass. In addition the rocks in some instances are shown to be far from homogeneous and some portions are mainly quartzo-felspathic. There is evidence that the rocks are hybridised, and composed of a mixture, rather incomplete, of quartz porphyry and doleritic magmas, metamorphosed under conditions of moderate temperatures and pressures.

Note.—

Mersey Run 5/61/52: Specimen 45J2 (88726N/41215E).
Mersey Run 5/61/53: Specimen 45J3 (88767N/41246E).
Mersey Run 5/61/54: Specimen 45J4 (88773N/41260E).
Mersey Run 5/61/55: Specimen 45J5 (88808N/41259E).
Mersey Run 5/61/56: Specimen 45J6 (88857N/41263E).
Mersey Run 5/61/57: Specimen 45J7 (88881N/41270E).

The following petrographic descriptions apply to rocks collected by Geologist K. Burns.

Lorinna Road—45S1

Fine grained, dark grey rock with glassy phenocrysts about one mm. across. The specimen is cut by a complex vein about half an inch wide, consisting principally of quartz with an irregular centre up to quarter of an inch wide, consisting principally of hornblende needles.

In thin section the rock consists of a fine grained ground mass of quartzo-felspathic mosaic with disseminated, minute books of yellowish mica. The ground mass in general has a rather mottled appearance due to palimpsest structure. In this matrix are crystals of quartz and felspar. The quartz is somewhat cracked and distorted and the felspar is corroded. Opaque rounded iron ore minerals are fairly common and there are patches of yellow mica.

The vein boundary is in most places quite sharp, but there are places where minerals from the vein have penetrated into the rock. As stated, the middle of the vein consists of hornblende. The mineral is strongly coloured, intensely pleochroic, and arranged in radial and sheaf like masses of prismatic crystals. Euhedral crystals of magnetite arranged in strings and irregular patches tend to be associated with the hornblende. The outer parts of the vein contain anhedral crystals of felspar up to 0.5 mm. across. Most of the crystals show no twinning, but irregular coarse lamellar twinning is sometimes seen. Granulation that may be due to recrystallisation is also common. Quartz is present in equal or greater quantity. The quartz is mainly in irregular grains, but some euhedral crystals are present. The anhedral quartz contains much included material, including minute drops of liquid with mobile bubbles. Yellowish epidote is common, as small irregular grains and masses.

Lorinna Road—45S2

Dark greenish fine grained rock with subrounded quartz phenocrysts, and irregular patches of pink felspathic material. A large pebble-like inclusion of pinkish felspathic material containing quartz grains also occurs.

The rock is a fine granular quartzo-felspathic matrix, containing larger grains (up to 1 mm.) of quartz, altered felspar, irregular granular masses of epidote, and masses of fine acicular hornblende, sometimes altered to chlorite.

The pink area has a matrix of quartzo-felspathic material of even finer grain, and it shows flow texture. Phenocrysts of corroded quartz grains and semi-opaque felspar crystals are common. Quartz, and quartz and epidote, occur as groups of fine granular crystals in the finer grained matrix.

Forth River—45S3

Fine grained dark greyish or brownish rock with indefinite porphyroblastic patches. One part of the specimen is thickly studded with somewhat rounded quartz crystals about 3 mm. across.

The rock is a very fine, even grained aggregate of quartz, felspar, sericite and biotite. Irregular areas consisting mainly of sericite become visible under crossed nicols and may be the ghosts of felspar crystals. The large quartz crystals show rounding and embayment.

Geales Bridge—45S4

Dark brownish grey rock with numerous white phenocrysts. It contains a rounded flattened inclusion greenish in colour and surrounded by a white border.

In thin section the rock appears as a sheared quartz-felspar porphyry with subrounded crystals of clear quartz and rounded rhomboidal crystals of altered felspar showing simple or no twinning, in a very fine grained quartzo-felspathic matrix. A little epidote, magnetite, and pyrite is present.

The green inclusion consists largely of hornblende and epidote in confused masses of fine crystals, together with phenocrysts of quartz and felspar and irregular masses of quartzo-felspathic matrix.

The white band is similar to the sheared porphyry but the matrix is fresher and whiter and there is more epidote present. the three different types merge gradually into one another.

Note.—

Specimen 45S1: Lorinna Road (88772N/41245E) is a hornblende vein in the porphyry.

Specimen 45S2: Lorinna Road (88820N/41270E) is considered to be a lava (quartz keratophyre) pebble in porphyry.

Specimen 45S3: Forth River (88855N/41180E) is within 1000 feet of the Dolcoath Granite and is interbedded greywacke siltstone and coarse arenite.

Specimen 45S4: Geales Bridge, Forth River (88752N/41148E) is considered to be a segregation in porphyry (pyroclastic, that here contains chert pebbles).

Appendix 2

by W. St.C. Manson

CERTIFICATE OF ANALYSIS

The samples of porphyries received from Mr. I. B. Jennings on the 21st January, 1957, stated to be from Lorinna District, have been examined with the following results:—

Reg. No.	40	41	42	43	44	45
Mersey Run 5/61	52	53	54	55	56	57
SiO_2	64.14	64.08	65.16	63.20	66.36	63.24
Al_2O_3	14.53	15.37	14.67	14.36	12.57	15.59
Fe_2O_3	1.79	1.07	1.86	3.07	1.47	1.32
FeO	4.11	3.99	3.99	4.50	5.11	4.28
MnO	0.12	0.13	0.08	0.12	0.18	0.08
TiO_2	0.60	0.75	0.65	0.73	0.57	0.55
P_2O_5	0.16	0.19	0.19	0.20	0.16	0.16
CaO	4.07	4.49	4.74	4.64	6.20	5.60
MgO	2.75	2.75	2.52	2.42	2.85	2.90
Na_2O	2.30	0.53	0.48	0.53	0.80	0.39
K_2O	3.84	5.45	4.54	3.89	2.72	4.44
H_2O—	0.16	0.21	0.22	0.38	0.16	0.15
H_2O+	1.39	1.44	1.58	1.87	1.14	1.10

Note.—

Run 5/61/52: Specimen 45J2 (88726N/41215E).
Run 5/61/53: Specimen 45J3 (88767N/41246E).
Run 5/61/54: Specimen 45J4 (88773N/41260E).
Run 5/61/55: Specimen 45J5 (88808N/41259E).
Run 5/61/56: Specimen 45J6 (88857N/41263E).
Run 5/61/57: Specimen 45J7 (88881N/41270E).