PAP. & PROC. ROY. SOC. TASMANIA, 1948 (15TH SEPTEMBER, 1949)

The Geology of the Country around the Great Lake, Tasmania

By

ALAN H. VOISEY

Senior Lecturer-in-Charge, Geology and Geography, at New England University College, Armidale

(Communicated by Professor S. W. Carey)

PLATES II, III and FIGS 1-3

This paper deals with the general geology and physiography of portion of the Central Plateau of Tasmania.

The accompanying map, Plate II, shows country which lies both east and west of the Great Lake.

GENERAL GEOLOGY

The only rocks in the area are dolerites, basalts and glacial deposits. Their boundaries were traversed in the field but much assistance was gained from the stereoscopic study of aerial photographs. The dolerite areas for the most part were not examined in detail but were crossed in several places.

A. JURASSIC DOLERITES

The principal rock type found is dolerite. Its differentiates have been described in some detail by Edwards (1942). Although he does not discuss examples from the Great Lake his remarks are certainly applicable to those from this locality. No petrological work was carried out on the basic rocks so there is little to add to his observations.

B. TERTIARY BASALTS

A most interesting series of rock types ranges from massive basalts to scoriaceous basalts, pumice and tachylyte breccias. The sequence is indicated on the map (fig. 2) and section (fig. 1) of Liaweene Hill. It comprises:—

	Feet
Columnar Basalt	20
Vesicular and massive basalts	15
Massive basalt	30
Vesicular and scoriaceous basalts	40
Columnar basalt	60
Tachylyte breccia, block lava, etc.	215
	380

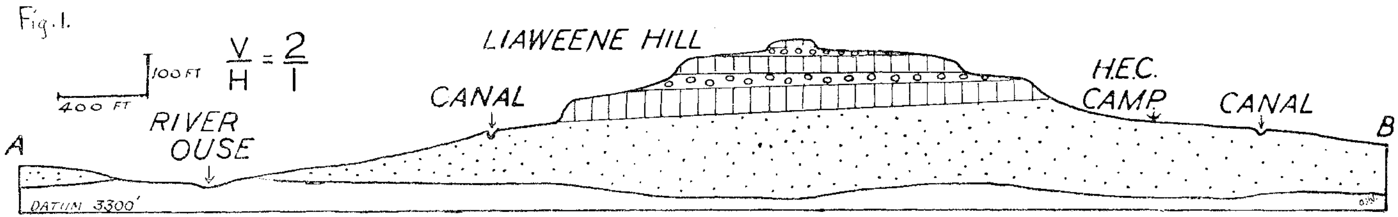

FIG. 1.—Liaweene Map.

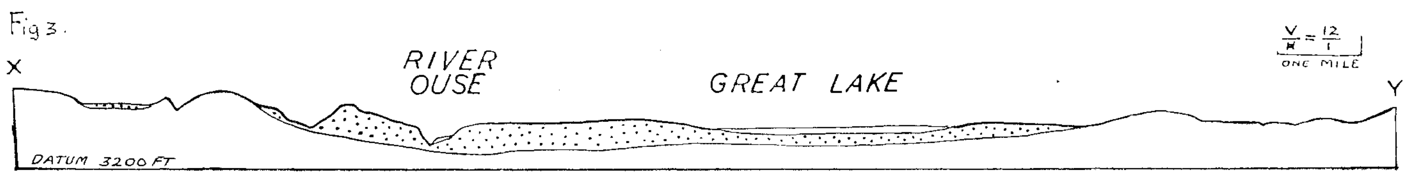

FIG. 3.—Section XY across Great Lake Area.

The lower beds are excellently exposed at places along the Liaweene Canal. Although a continuous sequence through the basal units was not examined it is thought that most of the likely variations of the unit have been revealed by excavations.

In the canal cuttings near the end of the fluming west of Liaweene Hill decomposed blocks of lava may be seen. These lie upon one another in a manner similar to the so-called 'pillow-lavas'. They are too altered to be studied at this point but further south in the canal similar blocks were found to consist of fine-grained basalt with a glassy margin. Most are rounded and between eight inches and a foot across. (See photographs, Plate III.) The tachylyte or glassy portions are up to half an inch thick. Associated with the blocks are pumice breccias in which much chabazite was seen. Crystals of this mineral line cavities or fill in the spaces between the pumice fragments. Elsewhere, tachylyte breccia also with the chabazite was abundant.

All kinds of variations in the size of fragments and proportions of tachylyte and pumice to basalt are to be seen along the canal. Particularly good exposures occur near the bridge where the Lake Highway crosses the canal.

At Liaweene Hill the breccias are overlain by massive, vesicular and scoriaceous basalts. The first flow makes a conspicuous feature particularly on the eastern side. Precipitous cliffs, which have resulted from the prismatic jointing are about 20 feet high. Above the cliffs is a flattish area with much vesicular and scoriaceous material scattered over it. This may represent the surface of the flow. Another massive flow with the prismatic jointing well developed gives rise to a second ring of cliffs. This also is followed by vesicular lavas.

A small outlier of massive basalt, again jointed, forms a small oval outcrop at the top of the hill.

The alternation of massive and vesicular lavas has produced the noticeable terracing of Liaweene Hill. It is not the site of a volcano as was indicated to previous observers by the presence of so much scoriaceous material on its sides. (Edwards 1939, p. 180.) (See Map (fig. 2) and Section (fig. 1).)

The same sequence of flows was found in a terraced hill very like Liaweene immediately west of the River Ouse. Further to the south the basalt terraces were found clinging to dolerite hills. Two such patches are isolated from the main mass of basalt west of Skittle Balls Plains.

The lavas cover a large area and much of this plain country is strewn with basalt pebbles, many being vesicular. This apparently led Edwards (1939) to the view that the plain was close to the original flat surface of the flow. While this may well be the case for a particular flow it is a reasonable inference that the massive basalts higher in the sequence once extended over the plain but have since been removed by erosion, re-exposing this surface.

A number of small basalt areas are shown on the map (Plate II), e.g.:—

(i) on the plateau between First Lagoon and the River Ouse,
(ii) South-east of Double Lagoon,
(iii) Reynolds Island,
(iv) Howell's Neck,
(v) Todd's Corner.

It would seem from the character of the lower unit that the volcanic eruptions were first of all explosive in character but later became quieter and the massive and vesicular flows were produced. The calculated thickness for the volcanic series is 380 feet but it may well have been greater as the highest flows identified are now only represented by very few outcrops and much erosion is therefore

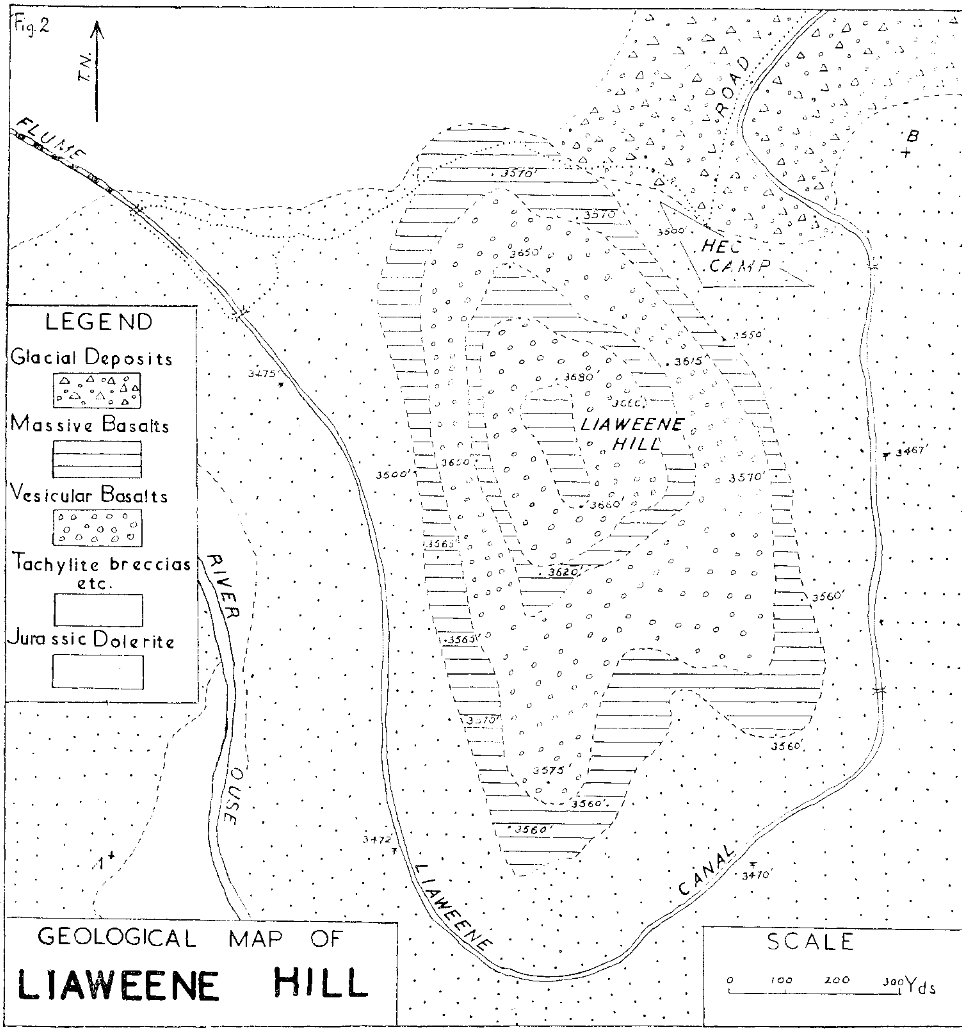

FIG. 2.—Liaweene Section.

indicated. It is probable too that the valley which now contains the basalt was not flat floored so quite a considerable thickness of lava may underlie the Great Lake.

Prider (1948) mentions a thickness of 330 feet of basalt from the valley of the River Nive and 600 feet from Wilson's Creek. Here as in the Great Lake area, the basalt fills in valleys in country which was deeply dissected at the time of the eruptions.

C. Pleistocene Glacial Deposits

Liaweene Canal exposes sandstones just east of the Hydro-Electric Commission's Camp. They are coarse-grained and laminated. Associated with them are boulders of dolerite which may well be related to the glaciation. They are indicated both on Plate II and fig. 2.

Other areas of angular boulders occur north of the canal but again it is not certain to what extent they have been moved by ice action.

A moraine partially blocks the entrance to the valley in which First Lagoon lies.

D. Recent Deposits

The alluvial deposits beside the River Ouse and other streams and the talus of dolerite on the slopes are post-glacial.

Physiography

The Great Lake occupies the central portion of the country mapped and extends some distance further to the north.

The water occupies a shallow depression and was said to average only twelve feet deep before the level was raised 30 feet by the building of the Miena Dam. This caused flooding of areas marginal to the lake. Howell's Neck and Reynold's Neck became islands; Pine Island was submerged. Dead trees in the water indicate other areas now incorporated into the lake.

The depression continues for about five miles to the west in the form of a flat treeless plain only a few feet higher than the level of the lake.

The low-lying area corresponds almost entirely with the occurrence of basaltic rocks which, in all probability, underlie most of the lake or have been stripped off the dolerite so that the water rests partly on the revealed pre-basalt surface.

This central depression is encircled by hills of variable height. On the western side is a plateau averaging about 350 to 400 feet above the level of the lake. In the vicinity of Split Rock there is a line of hills rising well above the plateau but falling very steeply into lower dolerite hills between them and the lake.

On the eastern side of the Great Lake the dolerite hills are higher, more rugged, and closer to the water than on the west. The general terrain is that of a dissected plateau. Flat floored, marshy valleys separate boulder-strewn rocky ridges and the country is difficult of access.

The hills on the east swing round towards Miena where the lake drains into Shannon Lagoon.

A basalt plain extends from Todd's Corner southwards and the country opens out in that direction. The land-forms could be dealt with conveniently under the following headings:—

(1) The Western or Liaweene Plateau.
(2) The Eastern Uplands.
(3) The Basalt Lowlands.
(4) The Islands and Peninsulas.
(5) The Miena Area.
(6) The Valley of the Little Pine River.

(1) The Eastern or Liaweene Plateau

This surface is extraordinarily level and is characterised by low rises consisting of masses of dolerite boulders separated by marshes or lakes. The map shows only part of this extensive plateau and the larger lakes such as Augusta, Ada, Chipman and Kay are beyond its limits.

The lakes shown are portion of Double Lagoon, Second Lagoon and First Lagoon. The margins of these lakes are notable for the masses of closely packed dolerite boulders which Carey (verbal communication) explains as having been due to the expansion of the lake area on freezing during the winter. The ice pushes the boulders forward along the margins. Elsewhere low brown sandhills form the shores of the lakes. The sand could be regarded as being of glacial origin accumulating during Pleistocene time.

Extending south-eastward from Double Lagoon is a low swampy area beside a patch of basalt and evidently worn out of it. North of First and Second Lagoons is another area of basalts.

The association of the lakes and the basalt does not appear to be accidental. The water seems to have accumulated in hollows caused by the action of ice in eroding the softer basalt. Glacial debris has also contributed to the interruption of the drainage as in the case of First Lagoon which is in a small glacial valley blocked by a sand bar. The valley contains much glaciated material. Its sides steepen as it descends from the plateau and the remains of a moraine of large angular dolerite boulders partially crosses it.

Other relics of the ice age are to be seen in the large boulders which are strewn through the marshes and which could not have been carried by the small water-courses which prevail.

The River Ouse traverses the plateau. In the north-western corner of the map it is in a shallow valley less than 50 feet below the general level but it gradually deepens towards the south-east. Terraced basalt cliffs form a noticeable feature where the river follows the boundary between this rock and the dolerite. The stream is deeply incised into the plateau margin forming a V-shaped gorge. A small dam diverts the water into the Liaweene Canal.

The Ouse does not show any glacial features in the section described. It flows in a valley which has the characteristics of one which has been shaped by fluvial erosion. It is interesting to note its position in close proximity to the basalt. This is a feature of many of the streams on the Central Plateau. The basalt has apparently filled its older valley and the stream is displaced laterally. This would make the Ouse not only pre-glacial but pre-basalt. Since the melting of the ice sheet there has been time for fluvial erosion to destroy the shallow glacial valley which may have been developed at the higher level.

The Plateau in places has a raised margin along the southern boundary and extending for a distance of about two miles is a steep escarpment probably due to faulting. A study of the shape of the basalt area and its margins suggests that this faulting is pre-basalt in age.

Between Double Lagoon and the Valley of the Little Pine River the country is less level and marshes are separated by rocky dolerite hills.

An interesting glacial valley with basalt on its floor has an insignificant stream in it. The suggestion is made that here again the ice sheets scooped out the softer lava which filled an earlier tributary of the ancestral Ouse.

(2) The Eastern Uplands

This country is very rugged. High ridges, some with precipitous sides, rise steeply from the Great Lake. Angular dolerite boulders are spread over the slopes and make access very difficult. Through the maze of dolerite hills run flat-floored marshy valleys.

As may be seen from an examination of the map the directions of the valleys are related in a majority of cases to structures, possibly shear zones, in the dolerite. This connection between marshes and structure lines was noted also by Prider in the Tarraleah area (Prider 1948, p. 128). In both places the usual trend is N.W.-S.E.

(3) THE BASALT LOWLANDS

Apart from the basalt on the Liaweene plateau it could be stated that in the area as a whole the basalt occupies the low land, the dolerite the high. A few basalt hills are present such as Liaweene Hill and other terraced spurs close to the plateau.

The basalt plain is treeless and gently undulating. Edwards (1939, p. 180,) regards the surface as 'distinctly youthful' and regarded it as the surface of a flow which he considered to be post Malanna and pre-Yolande.

The present writer considers that the plain has resulted from the action of an ice-sheet and, on account of the Liaweene section through the basalts, believes that these were very much thicker and that there may have been two hundred feet or more of extrusive rock above the level of the plain.

The River Ouse, after leaving the Liaweene Plateau, cuts down deeply into the basalts, its bed being well below the level of the Great Lake. It has developed small alluvial flood plains and terraces on its sides as it has descended.

The development of the valley has been post glacial as the stream is now below the level of the glacially cut plain and, again, all its features are obviously the result of a fluvial erosion.

The Ouse cuts through a dolerite bar near Skittle Balls Plains. In order to do this the stream must have been superimposed—flowing over a basalt surface and then cutting through the basalt into the dolerite. It is deeply entrenched beside the dolerite—basalt junction where it is crossed by the 'Missing Link' Road just beyond the limits of the map. The fact that the basalt appears to be in an older valley suggests that the Ouse in this section occupies a position close to the course of its ancestor. It is possible that the basalt did not completely fill the former valley and we have an example of a confined lava field.

(4) THE ISLANDS AND PENINSULAS

There are a number of islands in the lake. The larger ones are low lying and composed of basalt. They were originally peninsulas but were converted into islands when the height of the lake was raised by the building of the Miena Dam.

The dolerite islands—Helen's Island, Brandon's Island and Maclanachan's Island are smaller and rougher. Legge (1904) described columnar basalt at water level at Helen's Isle. This was not observed but may now be below water level. The higher rocks are apparently fine-grained dolerite which is also broken by jointing. The peninsulas in the southern part of the Great Lake are generally composed of basalt. They are all low-lying.

North of Lake Elizabeth a dolerite peninsula on which are low rocky hills projects far into the lake, restricting its width to about two miles.

(5) THE MIENA AREA

The outlet to the Great Lake at Miena is through dolerite into the Shannon Lagoon thence to the Shannon River. Lewis (1934, p. 25,) made the suggestion that 'the Great Lake once drained to the Lagoon *via* Todd's Corner'. The basalt is filling an old valley and would be well below the level of the lake. The present writer prefers to believe that a pre-glaciation and therefore a pre-Great Lake stream occupied the valley and that the dolerite ridge was exposed by the ice-sheet which scooped out the basalt behind it and rode over the harder rock. The lake then spilled over at the lowest point and cut downwards. The projecting dolerite mass north of Todd's Corner may have protected the more easily eroded basalt in that neighbourhood.

(6) The Valley of the Little Pine River

The Little Pine River, east of Lake Fergus which lies just beyond the western margin of the map, flows in a typical glacial valley. The floor is flat and marshy and the river has a number of small bends. It takes an almost right-angled turn near Skittle Balls Plains and flows south through wide marshes.

Terraced basalt outcrops lie high up on the western side of the valley suggesting that it too was once partially filled with the lava.

Physiographical History

The writer's interpretation of the physiography involves the following series of events.

The dolerites which were injected into Triassic and Permian sediments in Jurassic times were exposed by erosion and during early Tertiary times were eroded by streams which made their greatest progress along planes of weakness.

As pointed out by Carey (1946, p. 34) the lower Tertiary peneplain was broken up during the early Miocene by faulting, the Central Plateau was formed, fringed by the Great Western Tiers.

Within the Plateau there was some faulting and it is possible that there was some structural background leading to the development of a stream system in the Great Lake area during the late Tertiary.

Violent outbursts of volcanic activity gave rise to a thickness of some hundreds of feet of basaltic material. This may have almost filled the depression and the subsiduary streams. I would not be inclined to regard the basalts on the Liaweene Plateau as 'older' and the Great Lake basalts as 'younger' as indicated by Lewis (1946; p. 45) though they are separated by 300 to 400 feet. The plateau lavas appear to be merely higher flows in the series or to have arisen from the outpouring of basalt at higher levels. Consequent upon the filling of the earlier depressions there was much disorganisation of drainage. A stream system developed on what was predominantly a basalt surface in the vicinity of the Great Lake.

Probably before the onset of glaciation fluvial erosion had cut valleys into the soft basalt deposits in preference to the dolerite. Ice action further lowered the basaltic areas re-exposing in parts the pre-basalt surface. Along the western margin of the plain what are probably pre-basalt fault-scarps have been revealed.

It is probable that a major ice sheet in the present position of the Great Lake moved southward, over-deepening the land in places and riding over dolerite ridges such at that at Miena. When it melted, water accumulated in the depression, flowing over the Miena ridge at its lowest point.

Streams on the Liaweene Plateau had to fall over an escarpment to the lower basaltic area. As they occupied different positions from those which they had prior to the volcanic eruptions they cut gorges into the plateau margins. The River Ouse is an excellent example of this. Some rejuvenation is apparent almost everywhere that there is a dolerite-basalt contact.

CONCLUSION AND ACKNOWLEDGEMENTS.

This paper is the outcome of geological work carried out for the Hydro-Electric Commission of Tasmania during January and February, 1948, and I desire to thank the Commission for permitting its publication. I am also grateful to Professor S. W. Carey for his helpful advice, hospitality and many kindnesses.

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PLATE II

Map of the Great Lake Area.

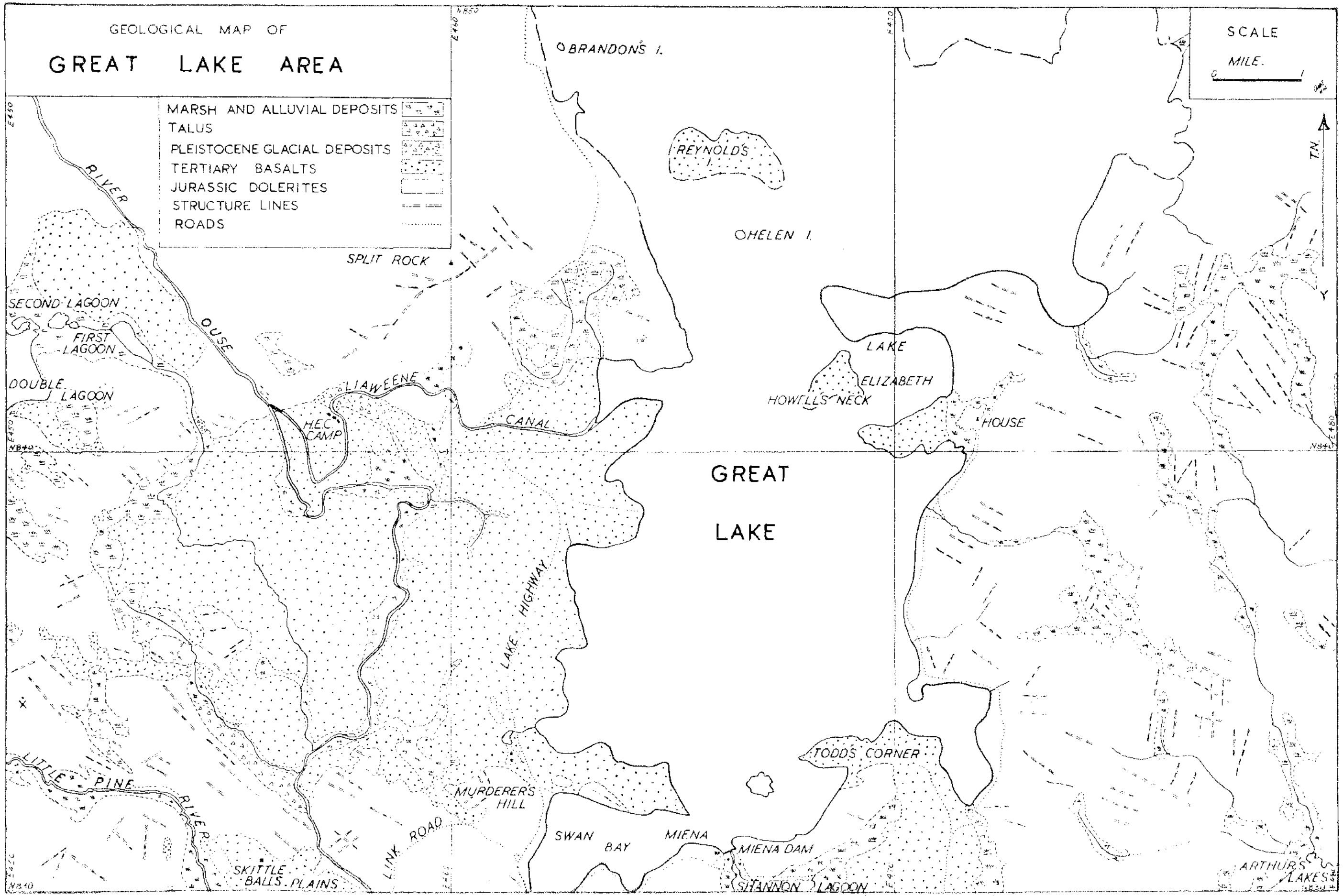
PLATE III

FIG. 1.—' Block ' lavas exposed by canal near end of fluming, Liaweene.

FIG. 2.—' Block ' lavas, etc., exposed by canal with overlying columnar basalts above half a mile south of dam, Liaweene.

FIG. 3.—River Ouse in shallow valley on Liaweene Plateau.

FIG. 4.—Entrance to canal shown looking south from Liaweene Plateau through Ouse gorge. Hills in foreground are dolerite. Liaweene Hill in the middle distance is basalt.


GEOLOGICAL MAP OF
GREAT LAKE AREA
MARSH AND ALLUVIAL DEPOSITS
TALUS
PLEISTOCENE GLACIAL DEPOSITS
TERTIARY BASALTS
JURASSIC DOLERITES
STRUCTURE LINES
ROADS
SCALE
MILE.
0
1
T.N.
BRANDON'S I.
REYNOLD'S I.
HELEN I.
RIVER
OUSE
SPLIT ROCK
SECOND LAGOON
FIRST LAGOON
DOUBLE LAGOON
LIAWEENE
CANAL
HEC CAMP
LAKE
ELIZABETH
HOWELLS NECK
HOUSE
GREAT
LAKE
LAKE HIGHWAY
LITTLE PINE RIVER
MURDERER'S HILL
LINK ROAD
SKITTLE BALLS PLAINS
SWAN BAY
MIENA
MIENA DAM
SHANNON LAGOON
TODDS CORNER
ARTHURS LAKES

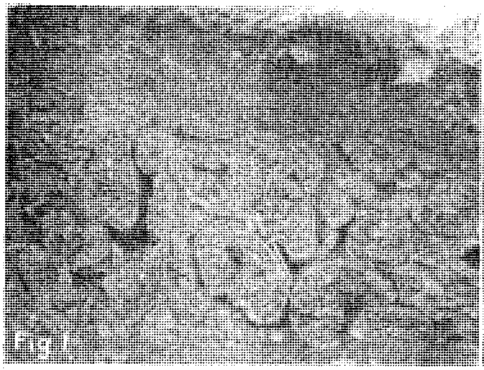


Fig 1

Fig 2

Fig 3

Fig 4