THE GEOLOGY OF THE FISHER RIVER AREA

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(With one text figure and 1 coloured map).

ABSTRACT

Folded Precambrian quartzites, phyllites and schists are unconformably overlain by Permian and Triassic sediments. Jurassic (?) dolerite occurs as a large transgressive sill-like intrusion into the Permian and Triassic rocks. Tertiary basalt occurs as a valley filling. The whole area is covered by scree and till with the development of terminal moraines in some areas.

INTRODUCTION

During the summer of 1955-56 a geological survey was undertaken of the area defined by the co-ordinates 420E. 860N, 420E. 870N, 430E. 870N, 430E. 860N on the 4-mile map of Tasmania. The topography is rugged with elevations ranging from approximately 1400 feet in the valleys to 4400 feet on the Central Plateau. The area is drained by three main streams. The major stream is the Mersey River, flowing approximately from south to north along the western boundary. The Fisher River, flowing through a gorge from Lake Mackenzie on the Central Plateau passes along the northern part of the area, then swings to the north-west and joins the Mersey. It is the most important tributary of the Mersey in this area. The third river is the Little Fisher which flows off the Central Plateau in a general north-westerly direction through the south-eastern corner of the area, eventually connecting with the Fisher River. An important tributary of the Mersey River is the Fish River which flows east-west off the Central Plateau about one and a half miles south of the area of interest. However, some important observations were made in this river valley.

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STRATIGRAPHY

The stratigraphy of the area may be summarised as follows. The section is composite and the thicknesses given are only approximate because of lack of suitable outcrop. On account of the lack of continuous outcrop in the particular area studied, the available material has been combined with a section measured in Kansas Creek, north-west of Western Bluff. Here the lower parts of the Permian succession are exposed. This section is only four miles north of the Fisher River and is not regarded as having any significant differences in thickness from that projected on to the map although the conglomerate and sandstone phases of the basal formation appear to be more dominant further to the south. The detailed section for the Permian Group, from the base to Liffey inclusive, is quoted by kind permission of Mr. M. R. Banks who has measured the section in Kansas Creek, in detail. Correlation has been suggested between Permian and Triassic rocks mapped in this area with formations established by Wells (1957) and McKellar (1957). The main evidence for these correlations lies in the presence of the Liffey Group and the conglomerates in the Ferntree Group.

Quaternary System
- Terrace materials 30′+
- Till and Talus + 100′ ±

Tertiary System
- Basalt 200′

Jurassic System
- Dolerite 600′-1000′ (variable)

Triassic System
- Knocklofty (?) Sandstone and Shale 600′ (maximum)

Permian System
- Ferntree Group 650′ (maximum)
- Woodbridge Glacial Formation 250′ (approx.)

Liffey Group 127′

23′	0″	Gap
5′	6″	Carbonaceous siltstone
11′	0″	Gap
87′	6″	Interbedded, well-sorted quartz sandstone with cross bedding and thinly bedded micaceous and carbonaceous siltstones; basal 6″ of sandstone has quartz, some feldspar, heavy minerals visible and boulders up to 2″ in diameter.

Golden Valley Group 214′

26′	0″	Dark grey, compact, brittle somewhat fissile siltstone with well rounded pebbles increasing towards the top (Macrae Mudstone).
66′	0″	Gap.
15′	0″	Alternate bands of dark grey siltstone and conglomerate with rounded pebbles and silty matrix. Beds about 15″ thick (Billopp Conglomerate).
18′	0″	Gap
29′	0″	Dark grey sandstone containing quartz, feldspar and mica. Fossils include *Dielasma, Keenia,* spiriferids and Aviculopectnidae.
59′	0″	Richly fossiliferous grey siltstone with numerous erratics. Impure limestone in parts. Erratics mainly quartzite and quartz mica schists. Fossils present include *Strophalosia* and Spiriferids, *Fenestella, Stenopora,* gastropods, pelecypods, ostracods, foraminifera including *Calcitornella, Ammodiscus* and *Hyperamminoides.* Gastropods include small euomphalids. *Eurydesma cordatum* is present but is rare and small. Bedding indistinct.
1′	0″	Impure limestone with erratics and spiriferids.

Quamby Mudstone 66′+

66′	0″	Grey irregularly fissile fine siltstone with rare erratics and small carbonaceous markings. Bedding poorly defined.

Basal conglomerate, sandstone and siltstone 45′ (max.)

25′	0″	Gap.
8′	0″	Quartzose conglomerate with variable amounts of boulders.
2′	6″	Siltstone.
1′	6″	Gap.
1′	6″	Dark grey sandstone.
4′	6″	Gap or sandy conglomerate.
1′	6″	Siltstone

Precambrian System

Quartzites, phyilites and schists 10,000′+

Precambrian

The Precambrian rocks in this area consist of quartzites, slates, phyllites and schists. These rocks have been sub-divided into the Fisher and Howell Groups by Spry (1958).

South of the Fisher-Mersey junction the sequence consists of massive white to pinkish glassy quartzites dipping to the south. With the massive quartzites are more finely laminated quartzites containing mica flakes and incompetent beds of black and white quartzite. Interbedded with these quartzites are some dark thinly bedded phyllites. The quartzites show " ripple marks " on the bedding planes. These have probably been formed as a result of superimposed forces rather than an original sedimentary feature. The dark phyllites interbedded with the quartzite show two prominent lineations, one of these is on the bedding plane (or cleavage surface), and the other one cuts obliquely across the bedding. The thickness of these is about 3,000 feet.

Between 869N and 868N and apparently overlying the above rocks, the Precambrian rocks consist mainly of dark thinly-bedded phyllites and slates which have a banded appearance due to the alternation of black and white bedding laminae. The thickness of these varies in a manner characteristic of incompetent beds. These give way to massive white quartzites at approximately 868N. These appear to be about 2,000 feet thick.

South of 865N, the rocks consist of hard quartzites overlain by quartz-mica schists containing garnets. These are overlain by rocks consisting dominantly of glassy laminated quartzites. The laminae in the quartzites vary from one quarter of an inch to six inches in thickness. In these rocks a parting tends to develop parallel to the bedding, causing the formation of tabular scree material. The bedding appears as fine iron stained partings or as variations in texture, lustre, and colour in the massive rock.

Some of the quartzites contain bands of muscovite giving them a schistose appearance. Near the axial part of the synclinorium there is mainly contorted quartzite which further to the south becomes interbedded with garnet mica schists. The quartzites show much incompetent folding here particularly when micaceous bands are present. In some of the rock types well formed black garnets with crystal faces may reach a quarter of an inch in diameter. These occur in quartzitic and schistose rocks. The thicknesses cannot be determined accurately because of complex folding and possible faulting. The total thickness appears to be at least 10,000 feet.

Some brecciated material occurs in the scree of the hillside near the phyllite-quartzite contact at 421E 868N, indicating a possible fault in this area.

Thin sections of samples of the Precambrian rocks show generally that the schists consist essentially of sheared irregular quartz grains, and layers of muscovite, often bent round small rounded crystals of garnet. In the incompetent beds the microscopic section shows small drag folds developed in the muscovite bands. These run through the quartzose part of the rock and preserve their form as small shears along which muscovite is developed.

Permian System

The Permian rocks are found throughout the area but outcrop is poor hence a composite section has been compiled. The best section of the Permian occurs on the western slopes of Western Bluff along Kansas Creek which flows past the Tasmanian Board Mills mill. The beds below the Liffey Group have been called the Kansas Creek beds on the Department of Mines, Middlesex Sheet.

Conglomerate

Th basal conglomerate overlies the Eldon Group under Western Bluff (see Middlesex Sheet). It is rather variable in composition. About one and a half miles south of here at about the 2,200 feet level, the conglomerate appears to have a clay matrix. Further south at about 2,500 feet a good exposure shows the more typical conglomerate as a very coarse conglomerate containing rounded tabular pebbles of quartzite up to two inches in diameter. Some schist fragments are also present indicating that the material has not been transported very far. Small chips appear to have been knocked off many of the pebbles. The pebbles are set in a sandy, angular, quartzose matrix with an average grain size of about 0.5 mm. to 1 mm. with some large fragments. Along the east bank of Snake Creek the rock is a pebbly siltstone, the matrix being finer and darker. Under Clumner Bluff, east of Dublin Plain, and in the outlier south of the basalt, the basal formation is a white baked siliceous sandstone with some feldspathic material, larger pebbles not being as common as above. In the latter locality the remains of a crinoid column have been found. Unleached, the rock is iron stained. In the Fish River, south of the area the conglomerate is covered by other deposits. The maximum thickness of the conglomerate is about 45 feet. The conglomerate breaks down very readily to leave a loose scree of rounded quartzite pebbles on the ground surface.

Quamby Mudstone

The conglomerate at Western Bluff, exposed in Kansas Creek, is overlain by a dense, dark-grey mudstone containing small quartz erratics and occasional larger pebbles. This may be equivalent to the Quamby Mudstone of McKellar and has been mapped as such. The Stockers Tillite is missing and its equivalent is probably the basal conglomerate. In the Fish River a similar type of mudstone low in the sequence contains occasional *Eurydesma*, bryozoa and some fossil wood fragments. The Quamby Mudstone contains occasional erratics. Here there are also calcareous nodules present.

A mudstone overlies the basal conglomerate at the 2450 foot level two and a half miles south-west from Kansas Creek. At this locality a band of angular quartzose sandstone, with some large pebbles, occurs. It is about 10 feet thick but does not appear to outcrop in any other locality. It occurs about 70 feet above the base of the Permian. The sediments overlying this are also sandy and micaceous, but may represent drift. Micaceous shales occur where some trees have been uprooted above the sandstone.

Golden Valley Group

Where the Forestry Commission loop road crosses Kansas Creek on Western Bluff there is an outcrop about 30 feet thick of grey dense mudstone containing erratics and very rich in calcareous fossils, particularly brachiopods of which *Strophalosia* is important. Above this mudstone, large pebbles become very numerous leading to the formation of a conglomerate of large rounded quartzite erratics embedded in a matrix of very dark dense mudstone. This band is about five feet thick. Overlying this is about 150 feet of a dense dark-grey to black mudstone with occasional pebbles. These rocks are recorded as being equivalent to the Golden Valley Group. Dark mudstone is an approximately equivalent position in the Fish River contain pyrite nodules.

Liffey Group

Overlying the Golden Valley Group is a band of prominent cliff-forming sandstone which belongs to the Liffey Group. The sandstones are orange coloured and may be leached white. The grainsize is uniform being about one mm. The rock is made up of angular fragments of quartz with lesser amounts of feldspar and occasional flakes of muscovite. Thin bedding laminae are present. Numerous carbonaceous remains are present in parts of the rock. Coarser bands are present in the rock and finer grained micaceous thinly bedded sandstones may also be present. This group may be 130 feet thick, but the only outcrop is in Kansas Creek and this is covered in part. Liffey Group rocks were not seen to crop out in the Fish River.

Woodbridge Glacial Formation

The Woodbridge Glacial Formation overlies the Liffey Group and consists of grey and black shales, grey silty sandstone with pebble bands and some marly bands rich in fossils, e.g., brachiopods and bryozoa, particularly *Fenestella*. Massive, dirty feldspathic sandstones, containing brachiopods, occur. The thickness is about 250 feet.

Ferntree Group

The Ferntree Group consists of dense dark to light grey massively bedded mudstones. Some of the mudstones are dark and featureless while others are lighter in colour containing white markings giving the rock a spotted appearance. Small pebbles of slate and quartzite are present. Dark markings similar to those of the Ferntree rocks in the Hobart area, are common in the rocks of this area. A band of conglomerate occurs near the top of this group. It is very thin being only a few feet thick. The conglomerate consists of large pebbles of quartzite averaging one inch in diameter embedded in a ground mass of angular quartz fragments up to 2 mm. across. No matrix appears to be present. This member forms a prominent bench on the north-east limb of Clumner Bluff and also to the east of the Little Fisher Plain. This conglomerate may be equivalent to the Blackwood Conglomerate (McKellar, 1957). Four hundred feet below this to the east of the Little Fisher Plain is a 5-foot band of sandstone probably equivalent to the Palmer Sandstone. It is uniform in grainsize, about 1-2 mm., and contains large fragments of clear quartz. It is very hard. The base of the Triassic rocks occurs a few feet above the Blackwood Conglomerate and it is not known what rock types occur immediately below the Triassic sandstones.

Triassic System

Knocklofty (?) Sandstone and Shale

The maximum thickness of this formation is approximately 600 feet. It consists of a fine to very fine-grained thinly-bedded quartzo-feldspathic sandstone. It is generally yellowish in colour and shows cross-bedding on a limited scale. The bedding planes are covered by flakes of muscovite similar to those in the shales in the Hobart area. The remains of plants occur in the sandstone and shale bands. The Triassic occurs in the Little Fisher River, Fish River and under Clumner Bluff. It also occurs under Western Bluff.

Jurassic System

Dolerite

The dolerite covers the higher parts as a sill-like intrusion. It is mainly medium to coarse grained in texture and quite often shows platy jointing. This is particularly evident in the talus of the Devils Gullet and also under Clumner Bluff.

Tertiary System

Basalt

The basalt does not show obvious columnar jointing. The rock in the hand specimen is dense, dark, and fine-grained, but is not tachylytic in nature. Vesicular basalt and pumice is common showing the presence of at least two flows. Associated with the basalt are a few boulders of a very coarse breccia of quartzite fragments. These occur on the northern limb of the flow. They may represent original rubble picked up and cemented by the influence of material associated with the flow.

Quaternary System

Pleistocene

Till and Moraine.—A thin veneer of till covers the surface of the Permian and Precambrian rock on the hills south of 868N. Along the Mersey Valley erratics of dolerite boulders occur on the Precambrian in very unstable positions. The distribution of till is mainly in front of the north-west face of Clumner Bluff. It is not very thick (50 feet maximum) and consists of rounded dolerite pebbles in a sandy and clay matrix. The deposits in the Mersey Valley are probably of glacial origin, but their depth is unknown. The greatest thickness of till in the area is in the Little Fisher Valley where the maximum thickness is probably less than 200 feet. Material of glacial origin does not pass beyond the junction of the Little Fisher and Fisher Rivers. Some very big erratics of dolerite occur in the Little Fisher Valley. Many of these have a volume of at least 4,000 cubic feet. The Little Fisher has been incised in till revealing at least 50 feet of this material. Some of the finer material has a tendency to bedding; hence this may be of fluvioglacial origin.

The Little Fisher Plain consists of dolerite and quartzite pebbles embedded in a fine clay ground mass. This probably represents an old lake and fluvioglacial deposits built up behind the terminal moraines. Howells Plain in the Mersey Valley probably had a similar origin being deposited behind the Mersey Falls. In the Fish River, fluvioglacial material occurs in parts covering the Permian rocks. This is over 100 feet thick and occurs in pockets apparently gouged in the Permian rocks. Varves are also present here, at approximately 421E. 856N.

Recent

A mantle of dolerite scree covers the face of the Central Plateau throughout the area. Very few sedimentary blocks appear in this talus. On the steeper slopes of Clumner Bluff, this would not be greater than 50 feet. The average size of the blocks would be about one cubic yard. In the Devil's Gullet the blocks are very much larger. The blocks consist of fragments of large dolerite columns. The thickness of scree in this area is much greater than above. The scree slopes along the eastern edge of the Little Fisher River appear to be quite thick. Some of the talus may be older than Recent because of the great amount present and the fact that the dolerite must have been exposed to weathering in the early Tertiary. In this case the earlier talus would have been modified by the glaciation to become part of the till.

Terraces due to fluvial action occur in the lower Fisher River area. The terrace materials here show imbricate structure.

GEOLOGICAL STRUCTURE

Due to a heavy cover of scree the structure is not always apparent. Because of the availability of a reliable contour map it was found expedient to build up the map by extrapolating, using the strike line principle, from known outcrops.

The geological structure of the area may be covered by the following groups:

1. Structures in Precambrian rocks.
2. Structures in Permian and Triassic rocks.
3. Intrusive structures.
4. Post intrusive faulting and jointing.

Structures in Precambrian rocks

Assuming that the phyllites and quartiztes represent original compositional variations, and layering now visible in the quartzite is due to bedding, then the main structural feature of the Precambrian rocks is very tight folding, with steeply dipping limbs. There are several orders of folding. Reversals of dip quite often occur along the strike, particularly in the incompetent slates and phyllites. The fold axes strike generally in an east-south-east direction and cleavage-bedding relations in the Mersey Valley near 865N indicate that the beds are not overturned. The general structure would appear to be a synclinorium with its axis in the vicinity of 864N with other folds developed in the limbs.

Along the Fisher River the dips are consistently in a southerly direction, the river itself following the strike of the rocks. South from the Mersey-Fisher junction the dips are southerly with a consistent dip reversal near 868N. This represents a large syncline which is however probably only a part of the larger structure. This structure is persistent because a traverse in square 423E. 867N shows a similar reversal along a direction consistent with this axis.

The complementary anticline occurs between 867N and 866N. This structure could not be located as accurately as would be desired because of the lack of outcrop. The axis passes near the basalt which fills a valley, originally carved in a limb or even near the core of this anticline. There is a prominent valley bearing approximately along the axis of this anticline.

South from this axis the dips along the River Mersey are generally southerly. However, on the hilltops, the dips are not as regular and many reversals, due to minor structures, are present. Minor structures near 865N indicate the existence of an anticline to the north and a syncline to the south. Near 8623N the axial portion of the major synclinorium is exposed. This is characterised by the presence of highly contorted and broken rocks. From here southwards the dip trends are to the north, the reversals being due to smaller structures. The southern limb of the synclinorium gradually disappears to the south, becoming covered by Permian rocks and Pleistocene (?) fluvioglacial material on Howell's Plains. The folds appear to pitch towards the east from cleavage-bedding relationships.

Structures in Permian and Triassic Rocks

These rocks rest on the Precambrian with angular unconformity. The formations have the same attitude as the surface of the unconformity, dipping at a low angle (approximately two degrees) to the south-east. The rocks do not outcrop extensively due to their being covered by till and talus. They are probably broken by small faults but these are not apparent and overall probably not important because the outcrop agrees well with the reconstruction using strike lines. Some of the joint directions well developed in the dolerite are continued as stream channels off the plateau but this may represent a case of superimposed drainage. In the Devil's Gullet, these rocks are transgressed by the dolerite.

Intrusive Structures

The Jurassic (?) dolerite forms a cap rock above 3600 feet throughout the area. The dolerite forms the main mass of the Central Plateau of Tasmania. It occurs in the main as a sill-like intrusion into the Permian and Triassic sediments. The thickness of the dolerite varies from 600 to 1,000 feet as measured on the fringes of the intrusion. The general form of the intrusion is that of a sill, but in detail the base of the dolerite is strongly transgressive. Thus on Western Bluff the base of the dolerite occurs at approximately 4,200 feet, overlying Triassic sediments. On going south from Western Bluff towards the Devil's Gullet the base of the dolerite becomes progressively lower to 3,200 feet on the northern edge of the Fisher Valley. The dolerite thus cuts out the Triassic between the Fisher River and Western Bluff. South of the Devil's Gullet on the eastern edge of the Little Fisher Valley the dolerite transgresses the Triassic rocks. On the air photographs (Mersey Run 3, no. 19) the bench representing the Triassic can be easily seen being transgressed by the dolerite. From south to north on the eastern edge of the Little Fisher River the base of the dolerite falls from about 3,800 feet to less than 3,200 feet on the southern edge of the Fisher Valley. Thus no Triassic sediments would be expected to occur in the Devil's Gullet. The dolerite in the Devil's Gullet is also strongly transgressive. The first dolerite occurring in situ in the Gullet is only a few hundred feet above the last Precambrian outcrop at about 2,100 feet, hence some hundreds of feet of Permian rocks have been transgressed. In this area the form of the dolerite intrusion would be that of a shallow inverted cone with the dolerite being transgressive in form outwards from the centre (cf. Carey (1958)). The dolerite appears to be more truly sill-like on Clumner Bluff and rises to the south in common with the dolerite south of the Fisher River. The dolerite is all part of the same continuous mass being highly dissected by the major streams. The base of the dolerite in the Fisher River appears to dip approximately 600 feet per mile in an easterly direction. The dolerite in the Fish River appears to have the same attitude but in the upper reaches of the Little Fisher Valley which is immediately east of the Fish Valley the dolerite base is higher. As no obvious faults of large throw cut the dolerite between these localities it would appear that the base of the dolerite must undulate somewhat.

The small area of basalt shown on the map has an important relationship with the Precambrian rocks. The basalt probably occurs as a valley filling, because of its outcrop to contour relationship. Its relation with the basalt to the west is not certain. No basalt occurs east of the creek flowing north from the Dublin Plain, although occasional pebbles of basalt may occur to this creek. The rock in situ is apparently much less widely distributed. To the west the basalt does not appear to have any connection with that west of the Mersey. No sign of basalt can be seen in the Mersey Valley. The southerly boundary of the basalt along 422E is in a saddle, the southern side of which is in Precambrian rocks and the northern side in basalt. One can ascend the northern side of the saddle for at least 300 feet and cross basalt all the way. On top of the hill near 867N. 422E the basalt merges in with the flat top of the hill, the maximum elevation of the basalt relative to this surface being about 20 feet. The basalt rises in a series of benches which may represent various flows, the heights being about 20 feet. These upper benches are certainly not due to landsliding, because they are persistent and do not have the characteristic arcuate shape of landslips. The basalt on the eastern edge rises abruptly from about the 200 feet contour above Dublin Plain. Below this level the surface is hummocky, and springs are present draining into Dublin Plain. To the west the basalt appears to be in situ to about 100 feet below the saddle. Below this the hummocky surface is again apparent probably indicating landslides but no springs were seen. This may indicate that the base of the basalt slopes eastwards. No basalt was found outcropping on the Mersey River, only Precambrian being found here. If a pre-basalt valley did extend to the west it has now been undercut by the present Mersey Valley.

Post-intrusive Faulting and Jointing

Although no post-intrusive faulting has been established in the area a feature of the map is the large number of linear structures which have been recognised and plotted. Many of these persist for some miles across the dolerite and can be observed in the underlying sediments; however no measurable displacement of beds has been observed on them. For example one prominent linear is responsible for a creek west of the Little Fisher plain, but the floor of the creek is made of solid Permian mudstones. East of the same area a prominent linear has caused the formation of a creek, but the sediments exposed here are undisturbed. Prominent directions on the north and south sides of the Devil's Gullet may be faults, but the base of the Permian does not appear to be displaced by them. A very distinct linear occurs east of Western Bluff, running approximately north and south and has been responsible for the formation of Marakoopa Creek to the north and Snake Creek to the south. Once again the base of the Permian is not noticeably displaced. Many of these linears on the surface of the Central Plateau are filled with superficial deposits. The linears in the Precambrian may be faults. It is hard to prove these because the rocks are generally highly contorted in this area. The dolerite on the plateau is very strongly jointed. Joints run in many directions, but the most prominent ones tend to have the following trends: north-west, north-east, north and east.

PHYSIOGRAPHY

The area has a rugged topography due to the action of glacial and fluvial agents. Several levels may be recognised in the area. These are:

a. Pre-Permian surface;
b. Floor of the Tertiary basalt;
c. Surface of the Central Plateau.

Pre-Permian Surface

The Pre-Permian surface, representing the unconformity between Permian and Precambrian rocks, is exposed between the Mersey River and the Western Tiers as a result of removal of overlying Permian sediments. The surface has now been dissected by the Fisher and Mersey River valleys. The Little Fisher valley in part has also been cut through this surface. Between the Permian basal outlier and Clumner Bluff, the surface has also been gouged slightly by glaciation. It would then appear that the surface has not been exposed for very long. It was also not extensively covered with ice because of the lack of dolerite erratics north of the Fisher River. It might be expected that the dip to the north-east may have been caused by recent erosion, but the basal Permian sediments also have a similar orientation which is not due to erosion. Since this surface has approximately the same attitude as the basal Permian sediments there is no reason to assume it has been very much modified by erosion since its exposure in this area. The flat-topped hills north and south of the Fisher junction are part of this surface. However from this area the surface has a low angle of dip north-eastwards thus it falls approximately 100 feet per mile from the Fisher junction towards the Tasmanian Board Mills camp, west of Western Bluff. The true dip of this surface is no more than two degrees in an east-south-easterly direction. The attitude of this surface beneath the dolerite may not be the same as indicated above, depending on the origin of its dip. The attitude could be due to:

a. Permian peneplanation.
b. Disruption due to faulting.

(a) Permian Peneplanation

While the surface itself has a general perfection, in detail it can be quite hummocky in parts, suggestive of *roches moutonnées* caused by a predepositional glaciation. However, the Permian sediments deposited on this are conglomeratic rather than tillitic in most cases and occasional marine fossils (e.g. *Eurydesma*) occur low in the sequence suggesting some marine action at least, in the formation of the surface. Thus the surface may represent a surface of marine erosion with the source of the sediments to the west from a glaciated area; the area to the east being the basin of deposition of Permian sediments.

(b) Disruption due to faulting

The dip of the surface could be due to tilting associated with epeirogenic movements or faulting. The variation in attitude across the Fisher River would suggest a fault approximately along this line. No reliable positive proof exists of a fault through the Precambrian rocks in this area. A tilted fault block as a result of pre- or post-dolerite faulting somewhere in the plateau or to the west of the area may have caused the tilt.

It would appear that the first proposition is the best explanation although epeirogenic tilting may have had some influence.

Floor of Basalt

It is not certain which is the direction of dip of the basalt floor. Prominent seepages flow east towards Dublin Plain, but the remainder of the basalt flows are to the west (Spry, 1958), hence the main affinities are in a westerly direction. It would then appear that this basalt originally flowed in from the west and the remaining patch seen now, fills the divide between a stream flowing into the Mersey and an old channel draining north-east towards the Little Fisher River. The base of the basalt appears to be about 150 feet below the existing saddle. The southern limb of the basalt dips steeply north and the northern limb dips about 50 degrees south.

Central Plateau

The plateau consists mainly of dolerite and is of an undulating nature with local areas of fairly sharp relief. The north-west corner of the plateau is saucer-shaped with the highest areas on the rim. This form is suggestive of the presence of a continental ice cap on the plateau (*cf.* Greenland). The ice has scooped out the rock near the less resistant joint directions, and many rock basin lakes and moraine dammed lakes due to small mounds of morainal material, have been formed. The movement of ice on this surface must have been essentially south-east away from Western Bluff. Ice movements in detail have been shown by Jennings and Ahmad (1957). Small spillover glaciers are suggested by the topography each side of the Devil's Gullet. The edge of the plateau in the vicinity of the Little Fisher valley has many places where small glaciers have spilled over. South-west of Clumner Bluff, a small glacial valley shows ice movement in the north-westerly direction. The persistence of the scarp of the Central Plateau does not suggest that the ice flowed over the edge on a large scale, but was confined to certain areas. A *roche moutonnée* and striations are present in the small valley south-west of Clumner Bluff.

A prominent feature of the edge of the plateau in this area is the Devil's Gullet, a gorge approximately 1,800 feet deep through which passes the Fisher River. It would appear that originally a small stream passed along this course then during the glaciation a glacier may have begun to enlarge the valley by removing the dolerite. The glacier then melted and the remaining erosion was carried out by the post-glacial Fisher River. A section across the Fisher shows that the river has cut its course in a small part of a larger valley indicating that the Fisher was probably originally a misfit river cut in a broad glacial valley. The river as it exists today is youthful and is controlled largely by the structure of the Precambrian rocks, and shows no signs of glacial action. The section does not show any sign of a U-valley but this may be due to the fact that the valley is now choked with large blocks of dolerite scree. By the end of the glaciation, the dolerite and most of the Permian sediments would have been removed leaving the river to cut through Precambrian rocks controlled by the structure, during post-glacial times. The Fisher River has a very steep V-valley and tortuous course from the Devil's Gullet to the Mersey River. Along its course terraces are present, probably formed as a result of redistribution of scree, and glacial material. Material in these shows imbricate structure near the Mersey River.

Pleistocene Glaciation

The distribution of glacial features is shown in Figure 1. The presence of till, dolerite erratics, and large boulders often perched in unstable places shows that the area has been glaciated. The Little Fisher Valley is the largest glacial feature in this square. The valley has a contour distribution characteristic of a U-valley. Glaciers moved into the Little Fisher Valley through numerous small valleys off the plateau. Ice moved into this valley from the west, east and south and a fairly large glacier moved northwards along the valley. Till occurs in the Little Fisher Valley as far as the Fisher River. Lineations in the till to the east of Dublin Plain in the Little Fisher Valley are probably due to glaciation. The glacier flowed as far as the junction of the Fisher River beyond which till is absent. Two, and possibly three, terminal moraines occur at the northern end of the Little Fisher Plain marking the retreat stage of the glaciation. A small moraine occurs on the edge of the Plateau near 4295E. 8645N. This is responsible for the damming of a small lake further to the east. The water from this lake seeps through the moraine to form the creek flowing westwards down the Tiers. There is no evidence of glaciation north of the Fisher River because here the Pre-Permian surface is laid bare, apparently unmodied and no dolerite erratics exist. In some places one may find rounded quartzite pebbles weathered from the overlying Permian rocks. In comparing the Fisher and Little Fisher rivers it can be seen from the map that the Little Fisher is a misfit stream whereas the Fisher has its own characteristic youthful valley.

The material south and south-west of Dublin Plain has been probably deposited by ice moving north-west from the scarp bearing north-east from Clumner Bluff. The Pre-Permian surface has been gouged by Pleistocene glacial movement. The limit of the ice is shown on the map by the distribution of till. Dublin Plain probably represents outwash from this glacier, flowing into the Little Fisher Valley. The actual divide between the two streams, in the valley running south-west from Dublin Plain, is a ridge of poorly sorted dolerite boulders having the form of a terminal moraine. North-east of this is a small circular lake in a swampy area. This could well be a kettle hole. Material nearer the Mersey River than the divide appears also to be another terminal moraine. This part of the valley has a distinct hanging valley relationship with the Mersey Valley suggesting movement into the latter. The Mersey Valley has the characteristics of a glacial valley, with truncated spurs, extending northwards as far as its junction with the Fisher River. Thus it would appear that a sheet of ice moving north-west off the Tiers gouged the Pre-Permian surface at the foot of the Tiers and developed a piedmont type of glacier which tended to spill excess ice into the Mersey valley via the valley south-west of Dublin Plain. Outwash from this glacier probably caused the formation of Dublin Plain.

The Fish River south of the area occupies the valley of a glacier which flowed from east to west into the Mersey and has since been deepened by the river in the soft Permian rocks. Ice moved south from the Clumner Bluff part of the area (Jennings and Ahmad 1957) into this valley and also from the south-east higher on the plateau. The mouth of the Fish where it enters the Mersey is in an alluvial fan former by redistribution of glacial and Permian sediments from higher up the valley. Till and varves occur extensively, overlying Permian sediments in the Fish River.

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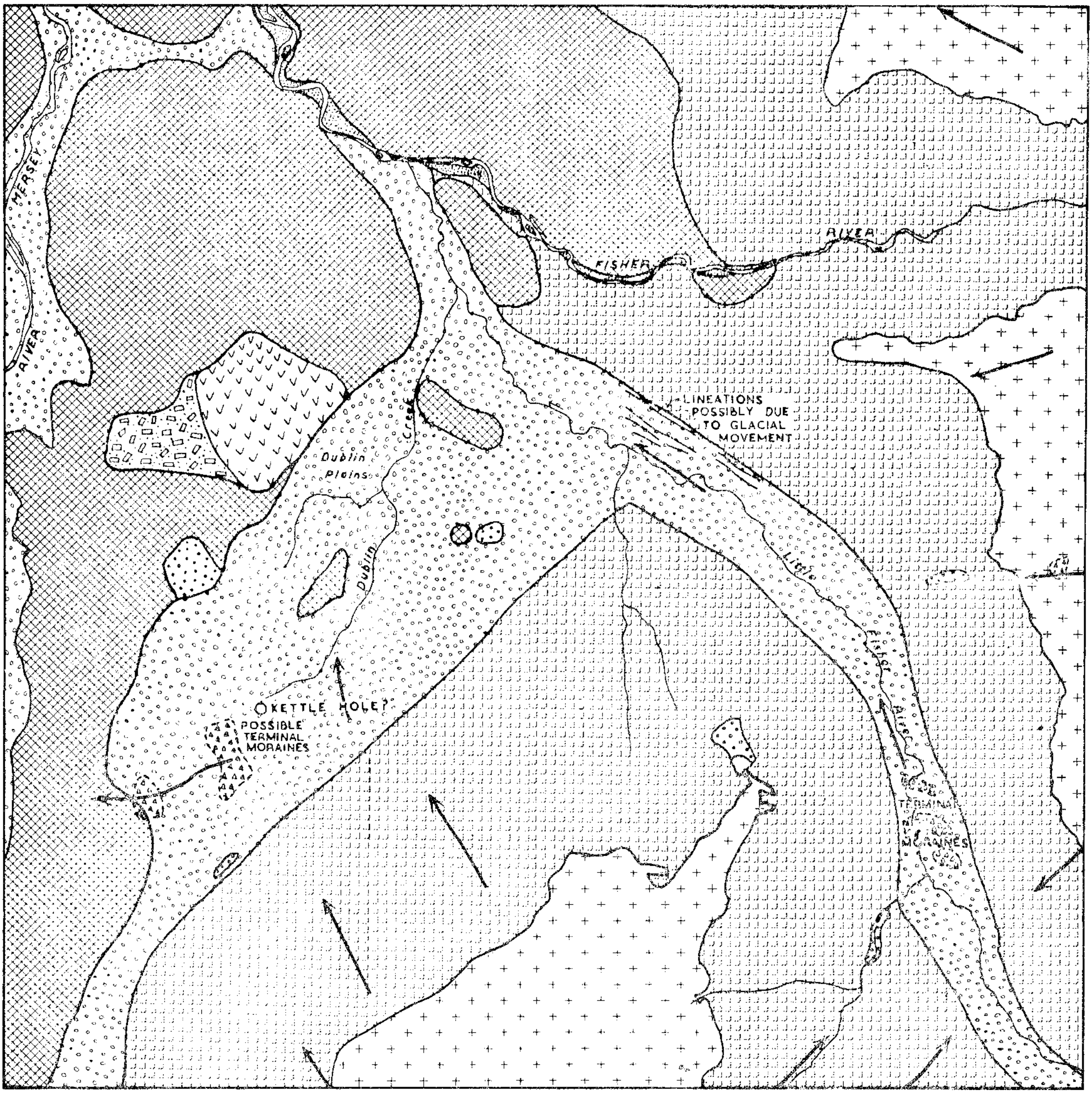


Fig 1 GLACIAL FEATURES OF FISHER RIVER AREA

QUATERNARY
- LANDSLIDE DEBRIS (BASALT SCREE)
- TALUS
- TILL
- TERRACE & ALLUVIUM
- MORAINE

TERTIARY
- BASALT

JURASSIC
- DOLERITE

TRIASSIC
- SEDIMENTS

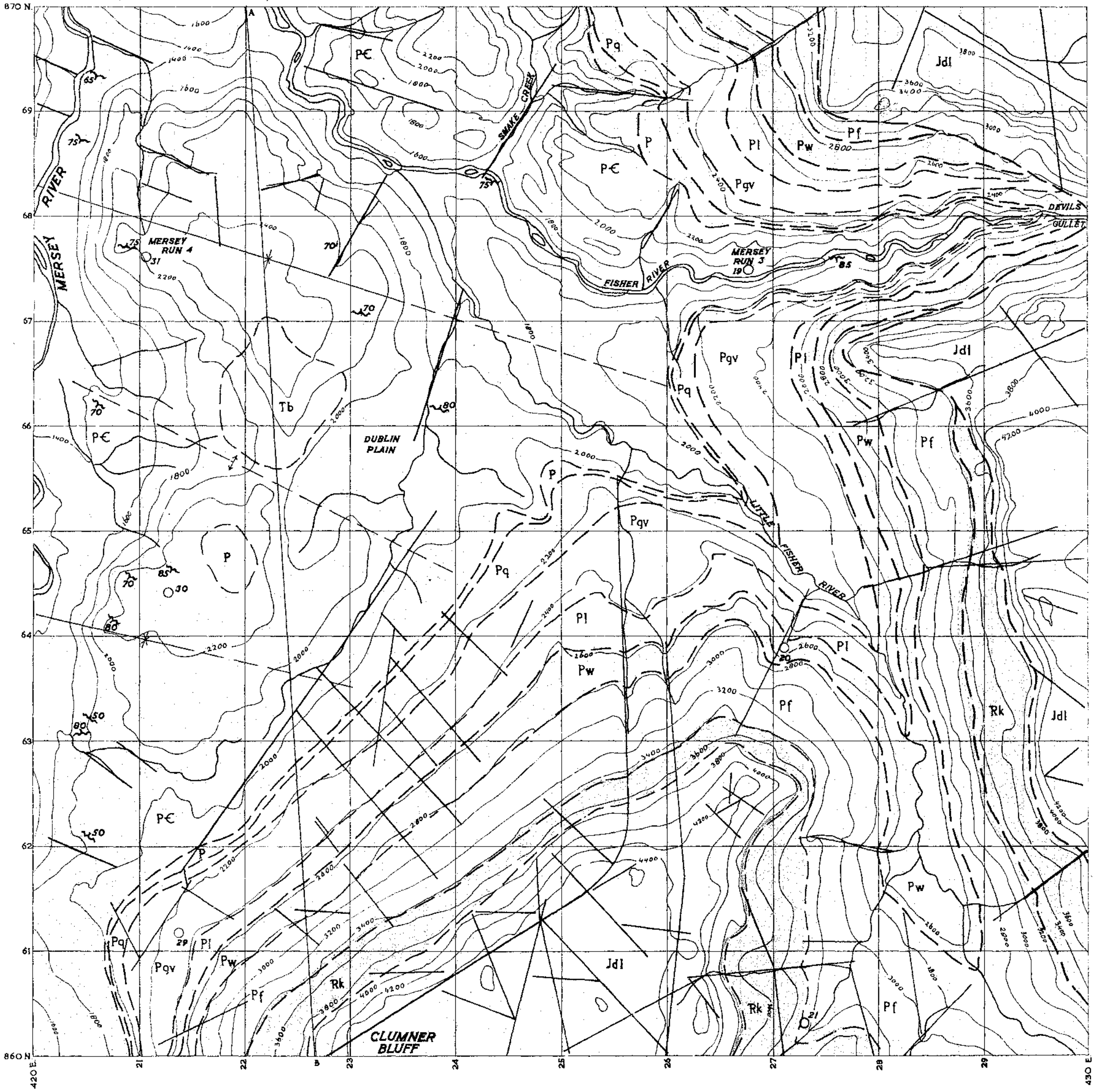
PERMIAN
- SEDIMENTS

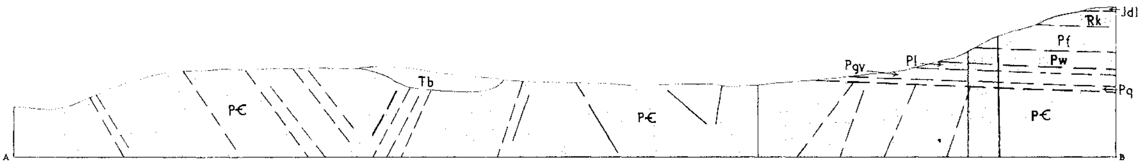
PRECAMBRIAN

ICE MOVEMENT

— SCALE —
0 1 MILES

FISHER RIVER





LEGEND

LINEAR
FORMATION BOUNDARY INTERPRETED
ANTICLINAL AXIS
SYNCLINAL AXIS
VARIABLE DIP

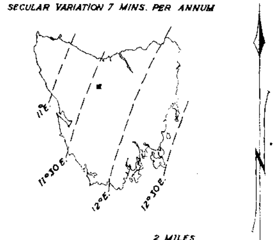
IGNEOUS ROCKS
Tertiary System
Tb — BASALT
Jurassic(?) System
Jdl — DOLERITE

Triassic System
Rk — KNOCKLOFTY SANDSTONE AND SHALE
Permian System
Pf — FERNTREE GROUP
Pw — WOODBRIDGE GLACIAL FORMATION
Pl — LIFFEY GROUP
Pgv — GOLDEN VALLEY GROUP
Pq — QUAMBY MUDSTONE
P — CONGLOMERATE
Precambrian System
PЄ — QUARTZITES, PHYLLITES AND SCHIST

Compilation from Aerial Photographs. Trigonometric Station Control by courtesy Lands and Surveys Department. Origin of co-ordinates 400,000 yds. West and 1,800,000 yds. South of True Origin of Zone 7 of the International Grid.

MAPPED AND COMPILED BY
R.J. FORD 1956

KEY MAP SHOWING MAGNETIC DECLINATIONS
SECULAR VARIATION 7 MINS. PER ANNUM



SCALE
0 — 1 — 2 MILES
0 1 2 3 4 5,000 10,000 FEET

GEOLOGY OF FISHER RIVER AREA

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2. STRATIGRAPHIC TABLE:

SYSTEM	GROUP	FORMATION	ROCK TYPE	THICKNESS
		GLACIATION AND EROSION		
Tertiary			Basalt flow filling old valley	200'+
		STRONG EPEIROGENY AND FAULTING PENEPLANATION AND UNCONFORMITY		
Jurassic ?			Dolerite sills	600'+
Triassic		Knocklofty shale	Yellow fine grained well-sorted quartzose sandstone and micaceous shales. Some carbonaceous remains.	400'+
		DISCONFORMITY		
Permian	Ferntree		Dark mudstone with some erratics and lands of conglomerate and mudstone	approx. 650'
	Woodbridge		Dark mudstones and sandstones with Brochiopods and Bryozoa	approx. 250'
	Liffey		Massive cliff-forming fine grained quartzo-feldspathic sandstones with carbonaceous markings	approx. 130'
	Golden Valley		Dark mudstone with occasional bands of erratics. Calcareous brachiopod fossils in a marl	approx. 185'
	Quamby		Massive dense dark shales with small quartz erratics. Occasional larger ones present.	approx. 100'
			Conglomerate	30'
		UNCONFORMITY		
Precambrian			Quartzites schists and phyllites. Tightly folded	10,000'+

3. IMPORTANT LOCALITIES:

Terminal Moraines: 428500E.862250N 429500E.864750N