

GEOLOGY OF THE RISDON BROOK DAM SITEINTRODUCTION:

An area of nearly 2 square miles, centred on the proposed dam site at Risdon Brook, was investigated during October and November, 1963. Plane-table mapping with subsidiary compass and tape surveying was carried out and a base map on a scale of 200 feet to the inch was produced; a reduction to approximately 20 chains to the inch appear with this report. The survey was designed to accurately delineate all features which would determine the soundness of foundations and holding capacity of the proposed dam.

PHYSIOGRAPHY:

The Risdon area is part of a mature erosion surface bordering the Derwent River estuary. The physiography is generally simple although the larger creeks may have pre-Pleistocene rock floors buried under considerable alluvium. This may have resulted from the fluctuations in post-Tertiary sea level which culminated in the drowning of the Derwent Estuary.

Risdon Brook is a creek some 2 miles long which flows generally towards the south in a narrowly confined valley to a point $\frac{1}{2}$ mile north of the proposed dam site. From here it widens out to a gently sloping valley floor some 600 feet wide which narrows rapidly to approximately 120 feet at the proposed dam site and then widens to about 200 feet for the remainder of its course. The creek shows no apparent structural control in the lower parts although it may be influenced by a basalt mass to the west. The valley floor is covered with terraces composed of alluvium 5 to 20 feet thick above river level and in places an old gravel-filled channel occurs slightly below river level: this is up to 50 feet wide. There seems little possibility of a buried river channel, however, as in places the present alluvium is narrowly confined by low cliffs and out-cropping rock within the creek bed.

PREVIOUS LITERATURE:

The first report relating to the geology of the Risdon area appears to be that of Nye (1924) in connection with the water resources between Bridgewater and Sandford. A more detailed survey of the Bellerive - Risdon District was carried out by Carey and Henderson, (1945), again to determine water prospects in the area. Lewis, (1946) briefly describes the area in a general discussion of the geology of Hobart.

The most recent and comprehensive report on the area is by Spry (1963) in an unpublished report on the dam sites at Flagstaff Gully and Risdon Brook, dealing with the geology between Lindisfarne and Risdon.

GENERAL GEOLOGY:Stratigraphy -

The succession exposed in the Risdon Brook area is summarized below:-

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|-------------|-----------------|------|
| Quaternary: | alluvium | |
| Tertiary: | basalt | 80'+ |
| | hornblende tuff | 50'+ |

| | | |
|-----------|-----------------------|-------|
| Jurassic: | dolerite | |
| Triassic: | Springs (?) sandstone | 250'+ |
| Permian: | Ferntree Mudstone | 180'+ |
| | Risdon sandstone | 15' |
| | Malbina siltstone | 50'+ |

PERMIAN SYSTEM:

Malbina Siltstone -

This is the lowest formation of the Permian succession exposed in the area and crops out over a very restricted triangular area adjacent to the crossroads at Risdon Brook (Fig. 1). The maximum thickness exposed is 50 feet although the formation is probably considerably thicker: the formation is 300 feet thick at the type section in Jarvis Creek (Banks and Read, 1962).

The strata exposed comprise a sequence of alternating generally thinly bedded sandstones and siltstones with minor thickly bedded sandstones. Both lithologies contain sporadic pebbles which may be erratics. Carey and Henderson (1945) who termed these rocks the Lindisfarne mudstones, record abundant fossils from the Grasstree Hill Road and several brachiopods were found to the west of the East Risdon Road during this survey.

RISDON SANDSTONE:

The Risdon Sandstone conformably overlies the Malbina Siltstone and crops out boldly as low cliffs over much of its exposure. The thickness of outcrop varies from 10 to 15 feet but the actual thickness could be slightly greater than this as there is incomplete exposure.

The formation comprises pebbly siliceous sandstones and moderately well sorted massive quartz sandstone with some felspar. Muscovite flakes, graphite and sporadic rounded to sub-angular erratics are present. The lithology appears identical with that from well documented occurrences at Pontville-Dromedary (McDougall, 1959) and New Norfolk (Wooley, 1959).

FERNTREE MUDSTONE:

This formation conformably overlies the Risdon Sandstone and is by far the most common Permian stratum exposed in the area. The exposed thickness within the area is approximately 180 feet although the thickness of the formation is probably considerably greater. Complete sequences at Mt. Nassau (Banks and Hale, 1957) and Pontville-Dromedary (McDougall, 1959) are 600 and 620 feet thick respectively and Carey and Henderson (1945) estimate a minimum of 400 feet of mudstones in the Bellerive-Risdon area.

The Ferntree Mudstone in this area comprises a sequence of massive to well bedded, regularly jointed, mottled grey mudstones and siltstones which are particularly resistant to weathering and in places stand out as near-vertical cliffs up to 50' high. Shaley horizons are subordinate but do occur at the proposed dam site. Pebbles and erratics are rare but small rock fragments are extremely common and avoid cavities up to several feet in diameter are present along particular horizons. These occur extensively in the cliffs to the east of the proposed dam site, and may be due to weathering out of original concretions.

TRIASSIC SYSTEM:

Springs (?) Sandstone -

The relationship between the uppermost Permian stratum exposed, the Ferntree Mudstone, and the Triassic rocks is obscure as only fault contacts exist between the two formations in the area. However, similar sandstones to those exposed at Risdon Brook overlie the Ferntree at Sugarloaf Hill and probably belong to the lowest formation in the Triassic System; i.e. Springs Sandstone in the Hobart area. Previously Nye, (1924) had correlated the sandstones with the Ross Sandstone and Carey and Henderson (1945) and Spry (1963) with the Springs Sandstone.

The Springs (?) Sandstone in this area comprises a succession of at least 250 feet of quartzose sandstones and rare shales. The sandstones, which are white to yellow in colour are fairly well sorted and contain dominantly quartz with feldspar, muscovite and minor graphite. They are generally massive, poorly jointed and probably permeable. Large scale cross bedding and small slump structures are common. Minor pebbly sandstones beds occur, with sub-rounded pebbles, and yellow-brown fissile mudstones occur at two localities.

JURASSIC SYSTEM:

Dolerite -

Dolerite occur abundantly in the Risdon area to the north of the dam site e.g. at Mt. Direction. It occurs generally as thick, slightly transgressive sheets intruding the Permian and Triassic Systems but locally it is probably faulted against both successions. Dolerite outcrop is poor and boundaries between the dolerite and sedimentary successions are obscured by dolerite scree. The contact between the dolerite and sedimentary rocks trends just west of south in the area mapped and appears to be near-vertical fault contact. Further south the relationship becomes more obscure and the contact appears at least in part intrusive.

The dolerite is generally medium grained although coarser grained varieties occur on the hill slopes and fine-grained dolerite is common to the south of the area mapped where it forms a probable intrusive contact. It is cut by numerous irregular joints which vary in spacing and direction, although the finer grained variety appears to be more closely jointed.

TERTIARY SYSTEM:

Hornblende Tuff -

A pale brown, friable, coarse tuff containing numerous crystals of black, vitreous hornblende and abundant rock fragments up to 1/2 inch across, overlies the Ferntree Mudstone to the south of the basalt mass. It outcrops sporadically over an area of some 400 square yards and a vertical distance of approximately 50 feet. It appears locally to underlie the basalt which caps the hill to the north.

BASALT:

At least 80 feet of basalt caps the hill to the west of the proposed dam site. Outcrop is extremely limited although large boulder and near outcrops are common. The rock appears to be dark grey, fine-grained olivine-rich basalt which is common in the Hobart area. It is strongly vesicular in places and forms an extensive talus which tends to cover the sedimentary units exposed in the area.

QUATERNARY SYSTEM:

Alluvium -

A thin layer of alluvium covers the floors of all creeks examined in the area, but rarely exceeds 20 feet in thickness. The alluvium shows all gradations from fine muds and sands to river-gravels comprising a high proportion of dolerite pebbles and boulders.

STRUCTURE:

Regional Structure -

Throughout the Lindisfarne - Risdon area the Permian and Triassic successions generally dip at a few degrees to the west. These sequences have been cut by concordant to discordant intrusions of dolerite, with contemporaneous faulting. However, the area is dominated structurally by a series of persistent NW - trending faults which have been described in detail by Carey and Henderson (1945) and are considered to be Tertiary in age by Spry (1963).

The Lindisfarne Fault is the most persistent and can be traced for at least 6 miles from Bellerive to Risdon Brook, where it is possibly the main structural feature. Carey and Henderson also describe the Howrah and Bellerive Faults which are subparallel to the Lindisfarne Fault. Lewis (1946) recognized this NW trend but also described several large faults trending just north of west which were largely contemporaneous with the NW-trending set.

RISDON BROOK:

The dominant structural feature of the southern portion of the area is a thin NNW-trending wedge of Springs (?) sandstone downthrown between blocks of Permian mudstones and sandstones.

This wedge is banded on the west by the Lindisfarne Fault and the east by the Flagstaff Fault, both names used in the sense of Spry (1963). The Lindisfarne Fault downthrows the Springs (?) Sandstone against the top of the Malbina Siltstone, this involving a throw of at least 250 feet and greater than 600 feet if the thickness of the Ferntree Mudstone is comparable to other areas around Hobart. The movement on the Flagstaff Fault is indeterminable as it throws Springs (?) Sandstone against Ferntree Mudstone in a Permian block in which the Risdon Sandstone marker horizon is not exposed. An estimated throw based on the elevation of the contact between Ferntree Mudstone and Springs Sandstone at Sugarloaf Hill would be greater than 400 feet, although there is a possibility of faulting within the Permian between Risdon Brook and Sugarloaf Hill.

This wedge of Triassic sandstone widens considerably to the north of the Richmond Road, due to strong WNW faults which downthrow the Triassic sandstone to the north. The most westerly of these faults, with a probable throw of several hundred feet, intersects the Lindisfarne Fault just north of the proposed dam site. It is extremely doubtful whether the Lindisfarne Fault as such continues to the north of this intersection as the Triassic sandstones to the north of the

strike
dam site/ across the projected fault whereas throughout the remainder of the area the orientation of the strata is largely controlled by the faults in their vicinity. Two possibilities suggest themselves: (a) that the W.N.W. fault is springing off the Lindisfarne Fault and is an extension of it to the west or (b) that the W.N.W. fault cuts off the northern extremity of the Lindisfarne Fault.

The Flagstaff Fault is also intersected just north of the Grasstree Hill Road by an E-W trending fault again downthrowing Triassic sandstone to the north. This fault then turns and trends N.W.-S.E., downthrowing the Triassic sandstones to the N.E. It seems probable that these E-W to NW-SE faults are in fact part of the same major fault which cuts off the northern extremity of the thin Triassic wedge. This proposed fault would correspond approximately to the Birt Fault of Lewis, (1946).

A further W.N.W. fault probably occurs some 200 feet south of the proposed dam site. A small crush zone is evident in the Fernree Mudstone on the road to the east of the dam site but is not present in the cliff sections above the creek. The mudstones to the south of the crush zone dip 30° to the north but are horizontal to the north of the zone, suggesting at least some movement. Thus, the proposed dam site is banded by a major fault to the north and a minor structure to the south.

The dolerite is at least partially faulted against the Permian and Triassic rocks to the north and west of the dam site. This fault trends just east of north and apparently cuts the W.N.W. - trending fault to the NW of the dam site. Further faults are also suggested within the Triassic succession because of marked changes in orientation of the sandstone from north to south (Fig. 1). The joint patterns within the Permian and Triassic successions are of little practical use in interpretation of the fault systems as no constant relationship between the faults and joints has been established.

The faults throughout the area appear to be steep although changes in trend suggest that some shallowing may occur in places.

SUMMARY:

The NE portion of the area investigated comprises a large NW - trending block of Triassic sandstones downthrown against an extensive block of Permian mudstones. A narrow graben containing Triassic sandstones, bounded by the Lindisfarne and Flagstaff Faults, abuts against the northern block just north of the Grasstree Hill Road. The Triassic and Permian successions are in turn cut to the NW by a fault bringing dolerite in contact with the sedimentary series. The area is essentially a zone of interference between NNW and WNW trending structures which have produced the unusual distribution pattern of Triassic sandstones and Permian sediments in the area.

REFERENCES:

Banks, M.R. and Hale, G.E., 1957: - A Type Section of the Permian System in the Hobart Area. Pap. Proc. Roy. Soc. Tas. Vol. 91, pp 41-65.
Banks, M.R. and Read, D.E., 1962: - The Malbina Siltstone and Sandstone. Pap. Proc. Roy. Soc. Tas. Vol. 96 pp. 19-32.
Carey, S.W. and Henderson, Q.J., 1945: - Report on the Prospects of Underground Water Supply in the Bellerive-Risdon District. Tas. Geol. Survey. Typewritten Reports, 1945 (unpublished).

- Lewis, A.N., 1946: - The Geology of the Hobart District. The Mercury Press, Hobart, Tasmania.
- McDougall, I., 1959: - The geology of the Pontville - Dromedary Area, Tasmania. Pap. Proc. Roy. Soc. Tas. Vol. 93. pp 59-71.
- Nye, P.B., 1924: - The Underground Water Resources of the Richmond - Bridgewater - Sandford District. Tas. Dept. Mines. Underground Water supply Pap., 3.
- Spry, A.H., 1963: - Preliminary Geological Report on Dam Sites at Flagstaff Gully and Risdon Brook. Private Report to Gutteridge, Haskins and Davey. (unpublished).
- Woolley, D.R., 1959 - The Geology of the New Norfolk - Black Hills District. Pap. Proc. Roy. Soc. Tas Vol. 93., pp 97 - 110.

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December, 1963.