

GEOLOGICAL REPORT ON UPPER PORTION  
OF THE ARTHUR RIVER HYDRO ELECTRIC  
WATER CONSERVATION SCHEME

Introduction

The lower portion (as far upstream as the Victory Mine) of the Arthur River scheme was visited in November last and reported on. Since then it was proved by survey that the water would bank further upstream than the Victory Mine, so that further geological examination was necessary. This was especially so on account of the references to large bodies of limestone and dolomite in two previous reports dealing with parts of the district.

Location and Access

The district examined consisted of the country along the Arthur River in the vicinity of the Victory Mine and upstream therefrom. The only means of access at present is by road and track from Wynyard. The Wynyard-Waratah road (also known as the Mt. Hicks road) is followed as far as the township reserve of Henrietta in a general southerly direction. A good branch road then leads in a south-westerly direction to Takone and a short distance beyond. This road continues as far as the property of Mr. L.A. Barrett, but is merely formed and not metalled. From this property an old pack track, four miles in length, which has been recently opened again, leads along the summit of the Campbell Range and then down to the Victory Mine on the banks of the Arthur River.

Geology

Pre-Cambrian Schists

The oldest rocks occurring within the district are a series of mica and quartz mica schists. These rocks have been fully described in the previous report. They outcrop from a point several chains upstream from the Victory as far upstream as will be affected by the proposed scheme. The general strike of the schists is  $310^{\circ}$  -  $360^{\circ}$  and they dip to the north east at angles up to  $40^{\circ}$ . These are different from those recorded downstream, viz. a strike of  $0^{\circ}$  to  $40^{\circ}$  with a dip to the west of  $50^{\circ}$  to  $90^{\circ}$ .

Pyroxenites and Dolomite

Some of the adits of the old Victory Mine have been driven through a dark green igneous rock. No felspar can be detected in hand specimens and the rock appears to consist entirely of ferro-magnesian minerals, and the exact nature of which cannot be ascertained. The rock type is probably a pyroxenite which name has been already used for it by Waller (1901). In places the pyroxenite is impregnated with iron pyrite, and in others it appears to have been "dolomitised", the resulting rock being a greyish white colour. Adjacent to the pyroxenite and dolomitised pyroxenite large bodies of a white crystalline dolomite occur. The formations which were followed in the mining operations are of varied natures and occurred both in the dolomite and the pyroxenite, but will not be further discussed here.

On the bank of the Arthur River the crystalline dolomite is approximately 50 feet wide, but in the valleys of the small creeks to the north its width is several hundreds of feet. On the river bank it is bounded on the west by pyroxenite and on the east by schists. To the north it is bounded on the west by Permo-Carboniferous rocks, and on the east and north is overlain by rocks of similar age.

The pyroxenite is generally similar to others of Devonian age in Tasmania and is probably of the same age. Further than this, the alteration to dolomitised pyroxenite and crystalline dolomite and the introduction of metallic minerals of copper, iron, lead etc. is also typical of processes which operated in Devonian times by the action of mineralising solutions on previously intruded Devonian ultrabasic rocks. It would appear certain, therefore, that the pyroxenite intrusions and the alterations thereof occurred in Devonian times.

#### Permo-Carboniferous

Strata of this system outcrop at river level opposite the mine hut and downstream for one to one and a half miles. They consist of horizontally bedded mudstones with smaller amounts of argillaceous sandstones and mudstone conglomerates. They are fossiliferous, but to a very limited extent. These rocks constitute the hills which rise to the north of the river near the mine hut and extend in that direction for several miles. They probably also extend some distance at least up the valley of the Keith River to the south.

To the west these strata abut against and perhaps also overlie the Pre-Cambrian Schists. To the east they abut against the pyroxenite and dolomite in the valley of the creek and its branches north of the mine hut. In places the strata are dipping vertically as though faulted.

Going northerly and easterly up the eastern branches of this creek the dolomite is passed over and is overlaid by Permo-Carboniferous strata. Also on ascending the track from the hut to the summit of the Campbell Range, the Permo-Carboniferous strata overlie the schists at an altitude of 600 feet above the river. These strata are continuous throughout the greater length of the Campbell Range and the Preolenna coalfield. They are generally horizontally bedded and are only slightly fossiliferous.

#### Upper Mesozoic Diabase

Though not included in the area covered by the water scheme, diabase was noted along the road from Takone up the valley of the Rattler Creek. It is also prominent near the summit of the Wynyard-Waratah road above the Hellyer River. It seems probable, therefore, diabase extends continuously along the northern flank of the Campbell Range.

#### Tertiary Sands, Grits

A small area of this formation was noted at the summit of the Waratah-Wynyard road above the Hellyer River.

### Tertiary Basalt

Basalt of this age covers the greater part of the country from the sea coast to the summit of the Campbell Range and thus occurs at altitudes varying from sea level to 1900 feet above it. The basalt flows of the Campbell Range were probably continuous with those of the Magnet Range, Waratah and Parrawee plateaux. The flows of the Campbell Range were 100 to 200 feet thick.

### Water Storage

The only viewpoint from which this portion of the proposed scheme need be considered is that of its capacity for holding water. If rocks are present which will permit the escape of water underground from the storage basin of any conservation scheme, it is, of course, a serious disadvantage, and the scheme would not be an efficient one. Rocks liable to cause such leakage are soluble ones like limestones and dolomites in which caverns etc. are readily formed. Porous rocks such as sandstones and sands also permit the escape of water. The Pre-Cambrian Schists, Permo-Carboniferous strata, the pyroxenites and dolomites are the only rocks which actually occur within the storage basin. Of these the dolomite is the only one which need be considered, the others being quite satisfactory from the point of view of not permitting the passage of water.

The dolomite is like limestone, a carbonate rock and one which is soluble in water containing carbon dioxide so that caverns and channels are formed in it by the action of percolating water. That these have been formed can be readily seen by traversing the creeks to the north of the mine huts where tortuous passages and underground caves are everywhere visible in the huge bodies of dolomite which outcrop.

Further, in the middle branch of the creek the water at first flows over Permo-Carboniferous rock, but immediately on coming in contact with the underlying dolomite it disappears and runs underground. On reaching the western edge of the dolomite it once more comes to the surface and flows along the bed of the creek. Altogether the water moves underground for about 15 chains.

The "warm spring" on the bank of the Arthur River is nothing more than surface water which enters the dolomite and traverses it to the lowest point where the dolomite is exposed at the surface.

It is therefore apparent that were other circumstances favourable the dolomite might permit the escape of large quantities of water from the storage basin. Fortunately, however, these conditions are not favourable.

Firstly, the dolomite has almost certainly been formed by mineralising agencies and will therefore be of limited extent. As a result it is not anticipated that it will extend far to the north below the cover of Permo-Carboniferous rocks. Rocks which would permit little or no passage of water would then be encountered and so stop further movement of the water.

Secondly, the only direction in which water could migrate and leak into catchment areas outside that of the Arthur River is to the north. At the Victory mine the water level of the proposed scheme will be approximately 650 feet above the sea. Any water moving underground

would only reach the surface at localities where altitudes are slightly less than this figure. Such altitudes are not found until the valleys of the Jessie and Flowerdale Rivers, 4 to 6 miles north of the Arthur River are reached. Any leakage through such a thickness of rock as would be encountered is inconceivable.

Thirdly, as so far developed the movement of the water through the dolomite is towards the Arthur River due to the present topography. To facilitate leakage from the proposed storage, the movement would have to be reversed and the conditions are probably not suitable for this.

### Conclusions

From the above geological considerations it is seen that although rocks like dolomite are present which might permit of escape of water from the storage basin, the geological structure and the topography are such that it is improbable that there will be any such leakage. The upper part of the storage basin is therefore considered satisfactory from a geological viewpoint.

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1 March 1925