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32. Groundwater investigation, 'Lennonville', Bruny Island.

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A groundwater investigation of the property 'Lennonville', North Bruny Island [EN250234] was undertaken at the request of A.R. Campbell. The property extends along the southern shores of Barnes Bay, west from Sykes Cove to Lennonville Point and south-west to Roberts Point and Apollo Bay.

Most of the property is steep hill country, underlain by dolerite. A zone of more moderate relief is present south of Lennonville Point and Alexander Bay extending south-west to Apollo Bay. This is thought to be due to the presence of a narrow NE-SW inlier of soft Permo-Triassic sediments surrounded by dolerite (fig. 102). As the sediments are considered a more likely source of groundwater than the dolerite, the chief aim of the investigation was to determine the areal extent and thickness of these sediments. Furthermore, a bore sited in the vicinity of the homestead would be most advantageous to the property owner.

GEOLOGY

Coastal exposures are excellent but inland outcrops are few. The lack of outcrops in the suspected sedimentary areas and the widespread occurrence of dolerite talus near the contact between these sediments and the dolerite make geological interpretation uncertain.

Very closely jointed dolerite crops out on the southern shore of Alexander Bay. The contact between this dolerite and the baked Permian siltstone cropping out on the western shore is not exposed, although from the trace of the outcrops and intense jointing in the dolerite near the contact zone the contact is at a high angle and possibly faulted.

Dolerite forms Lennonville Point north of the Permian siltstone. The contact between the dolerite and sediments appears to be a low-angle intrusive contact. Coarsely crystalline dolerite forms much of the cliffed coast south-west of Lennonville Point. A thick deeply weathered dyke of what is taken as a syenite intrudes this dolerite. The boundaries between this dolerite and the Permian sediments to the north-west and Triassic sandstone to the south-east are high-angle intrusive contacts. The Triassic sandstone is faulted against the dolerite which forms Roberts Point.

Triassic sandstone boulders and sandy soil occur to the top of the ridge between Apollo Bay and Alexander Bay and poor outcrops of Triassic sandstone occur in the small streamlet that flows from the saddle on this ridge to Apollo Bay. Dolerite talus covers much of the west bank of this stream and talus consisting of dolerite boulders and sandstone blocks occurs in the saddle area. In a small water hole on the track from the homestead on the northern side of the saddle is a deeply weathered clay which appears to have been derived from the Permian siltstone. The Permian siltstone exposed on the shores of Alexander Bay appears to be high in the Permian sequence and is thought to belong to either the Ferntree or Malbina Formation.

GEOPHYSICAL WORK

To determine the extent and thickness of the Permo-Triassic sediments it appeared necessary to try to answer the three following questions:

(1) What is the nature and location of the dolerite contacts at Alexander Bay?

(2) Is there a dolerite sill at a shallow depth connecting the dolerite body at Lennonville Point with the main Roberts Hill sill to the south?

(3) Does the coarsely crystalline dolerite exposed in the cliffs along the coast between Roberts and Lennonville Points continue across the saddle separating the Triassic sediments of Apollo Bay from the Permian sediments of Alexander Bay?

Five seismic spreads were fired with a geophone spacing of 8 m (fig. 102). Three spreads formed a continuous traverse west of the homestead stream onto the dolerite at Lennonville Point. The fourth spread was fired in the saddle on the north side overlooking Alexander Bay. The fifth spread is located between the traverse and the saddle spread.

Two magnetometer traverses were run using the Elsec proton magnetometer. One of the traverses was made from the dolerite outcrop on the track near the homestead north-westwards to an old farm shed where some dolerite boulders were found. The other traverse was made from the same dolerite outcrop near the homestead track to the Lennonville Point dolerite and was parallel to the seismic traverse. A 183 m resistivity probe using a Wenner configuration was carried out in the paddock above the shearing shed (fig. 102).

The seismic results are summarised in Table 1.

Table 1. SEISMIC RESULTS

Spread No.	Seismic velocities (m/s)	Depth to V_0/V_1 Interface (m)	Slope of Interface	Geological Interpretation
1	V_0 915-1500 V_1 3050-3700	7-10 at East End, 16-18 at West End	Down to west	V_0 Weathered sediment V_1 Unweathered Permian sediments or possibly dolerite.
2	V_0 915-1200 V_1 3050-3600	9-14	Down to east	V_0 Weathered Permian sediments. V_1 Unweathered Permian sediments or possibly dolerite.
3	V_0 1200-1500 V_1 3800-4600	8-10	Very stepped	V_0 Weathered dolerite V_1 Dolerite.
4	V_0 1200-1500 V_1 3500-4600	12	None	V_0 Weathered Triassic sediments V_1 Unweathered Triassic sediments or, more likely, dolerite.
5	V_0 1200-1500 V_1 3000	18-22	None	V_0 Weathered Permian sediments V_1 Unweathered Permian sediments.

In the seismic traverse from the stream at the homestead to Lennonville Point the highest velocities were recorded in Spread 3. This spread was fired on dolerite as shown from the material from the shot holes and the outcrops below along the shore line. Although the velocities in the V_1 layer of the other spreads of the traverse are within the velocity range of dolerite they show no stepped increases. A strong slope exists on the V_0/V_1 interface of these two spreads which could produce the higher V_1 velocities of

these two spreads. Thus it appears a reasonable possibility that sediments rather than dolerite form the V_1 layer of these two spreads. This possibility appears more likely as in Spread 5, uphill from Spreads 1 and 2 no velocities greater than 3000 m/s were recorded. In the saddle area, the seismic velocities of the V_1 layer are similar to those of Spread 3 and it is likely that the dolerite of the Roberts Hill sill is connected to the dolerite cropping out along the coast to the north.

The magnetometer traverses show that both contacts at Alexander Bay are steep and are probably vertical. Because of the influence of these contacts and of dolerite talus the presence of sediments between these two contacts could not be definitely determined from the magnetometer profiles.

The results of the resistivity probe are of a three layer type. The resistivity curve is interpreted as indicating two upper layers of well-jointed sediments separated by the water table at a depth of 3 m. The joints become tighter and are closed below a depth of 21-24 m, forming a third layer. The apparent resistivity values of this third layer appear to be too low for unweathered dolerite. The low values of the second layer make the water quality somewhat suspect.

GEOHYDROLOGY

The department has details of only four bores on North Bruny Island. Two of these bores are situated on Dennes Point and are both classified as dry holes with the quality of water given as very poor with 4000 ppm. The other two bores are located on the eastern shore of Barnes Bay near the ferry terminal. One of these bores is dry. The other gave 15 *l*/m (200 gal/h) with a salt content of 2400 ppm. The successful bore reported to exist on the neighbour's property (pers. comm. Mr Campbell) is not listed on the departmental records. A further successful bore is reported by Mr P.C. Stevenson (pers. comm.) who sited the bore 150 m north-east of the ferry terminal in Permian sediments similar to those present at Alexander Bay. This bore (on Hume's property) is reported to have yielded 46 *l*/m of good quality water.

CONCLUSION

With few existing bores and in the absence of a systematic groundwater investigation of North Bruny Island, any new bore drilled must be associated with a high risk factor. Of the existing bores on the departmental records the two at Dennes Point are at too great a distance to be of any significance to the Alexander Bay locality. The two at Barnes Bay appear to be sited so close to the shore that the low yields and high salt content could be anticipated at these sites.

The two verbally reported successful bores appear to be located on inliers of Permian sediments surrounded by dolerite with similar geological features as at Alexander Bay.

Accepting the risks associated with the likelihood of encountering dolerite and possible water quality problems the best drilling site near the 'Lennonville' homestead appears to be in the paddock above the shearing shed near the junction of seismic Spreads 1 and 2. If an assumed third velocity layer exists in these spreads a calculated adequate thickness of greater than 30 m of Permian sediment is likely. The Permian sediments are considered a low yielding, although reliable rock aquifer in south-east Tasmania which usually produces groundwater of good quality.

If a bore is drilled it should be geologically logged and if dolerite is encountered at a shallow depth a new drilling site should be chosen further up the hill above seismic Spread 5.

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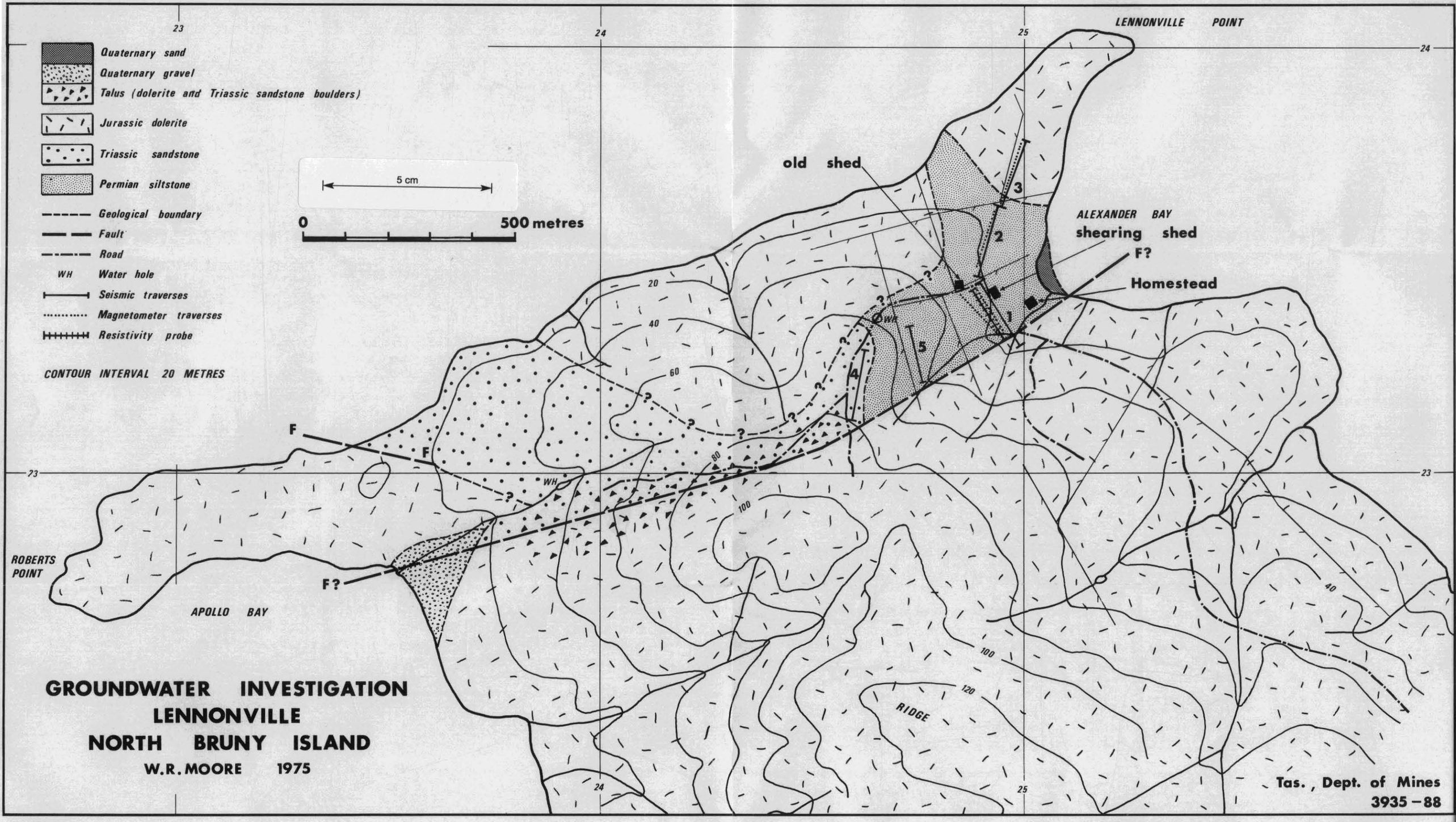

FIGURE 102