AN INTERESTING FORM OF SUB-SURFACE DRAINAGE.

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(With Plate xlv.)

During the autumn and winter of 1915 my attention was attracted by certain features of minor drainage, at two widely separated points on the Darling Range, W.A., namely, in the Greenmount District, east of Perth, and at Roelands, 102 miles further south. There has been no opportunity of examining other parts of the range at the same time of the year, but it is highly probable that the type of drainage to be described is of wide occurrence. I have been informed that it is familiar to residents of the Donnybrook District.

In the regions examined, the soil covered slopes of the range, and the piedmont deposits, exhibited, in places, a dangerous series of small holes, of varying sizes, up to one foot in diameter and three feet in depth. They were frequently spaced irregularly along definite lines, which suggested a certain connection between holes on the same line. Their true relation to one another was shown on the steeper soil-clad slopes. Here the lines consisted partly of a series of holes, and partly of varying lengths of trench-like depressions which terminated in a tunnel at either end. The walls of the depressions were generally steep, even at the ends. They had obviously been formed by the breaking away of the surface soil, which was extremely liable to collapse if trodden on between the holes.

It was evident that the holes and trenches indicated lines of sub-surface drainage, which were found in all stages of development, from strings of widely separated holes, to long, deep rifts, separated by narrow bridges of soil, through or under which the water would run, as under a culvert. All were dry when examined (Pl. xlv., Fig. 2). At Roelands, a small gully with steep sides and a cirque-like termination appeared to represent an extreme stage of development.

The sub-surface channels had no rational relation to contour such as that of ordinary surface drainage. The collapsed roof soil had in many cases been completely removed from the chan-

nel along great lengths of the course, though no trace of outwash material at lower levels could be found at any point. At Greenmount, in one instance, a small tree on the course had been completely undermined and uprooted (Pl. xlv., Fig. 1). This would indicate a considerable strength of flow.

The formation of lines of sub-surface drainage in the Darling Range is to be attributed not to any peculiarity of the soil, which is derived from granites and laterite (1), but to the climate of the region (2), which is characterised by marked seasonal rainfall (3). During the hot, dry summer, fissures form in the sub-soil, but do not extend to the soil, owing to its binding of vegetation. During the heavy, winter rains, much of the water sinks straight into the dry ground, which soon becomes saturated. Relief is afforded by flow along the sub-soil fissures, which soon become widened into definite underground channels. Pressure causes the surface soil to burst at the weakest spots, with the formation of pot-holes. As the channel is deepened and widened, the roof tends to collapse more or less along the whole length of the original fissure.

This form of sub-surface drainage (distinct from underground drainage in general) has a certain minor physiographic importance. By ignoring the steepest natural slopes it initiates erosion in unlikely places, thereby hastening the process of denudation. It is probably a factor in the artesian intake of the coastal basin of Western Australia, as by its means, a large volume of rainfall is taken at once into the deeper layers of the piedmont apron of the range during the winter rains.

REFERENCES.

1. Jutson, J. T.—An Outline of the Physiographical Geology of Western Australia. Geol. Surv. W.A., Bull. No. 61, 1914, pp.41-46.
2. Taylor, T. Griffith—The Australian Environment. Advisory Council Sci. and Ind., Commonwealth of Aust., Mem. No. 1, 1918, pp.59-66.
3. Official Yearbook, Commonwealth of Austr., No. 11, 1918, p.67.

EXPLANATION OF PLATE XLV.

Fig. 1. Trench formed by sub-surface drainage, Greenmount, W.A. Looking downhill. Shows sapling undermined.

Fig. 2. The same, looking uphill. Shows collapsed roof in foreground, earth bridge (remnant of roof) in centre, and continuation of trench in background.