granite and is used with the granite for road-making material. The granite is a grey, close-grained variety and should make excellent building stone. Near the surface the lateritic weatherings were observed, but in this case they differed from those on top of the hill in being kaolinised and stained with ferruginous matter.

(c) *Ironstone Deposit on Canning Railway, running from Ridge Hill to the Helena.*—This seems to be a concretionary stone, which is probably lateritic. It is ferruginous and is economically of no value, further than in road making. It is a fairly extensive deposit, which crosses the Helena Valley, and on the opposite side of the river from the Canning Railway, it has been weathered to produce a heavy, rusty, clayey loam.

3.—THE BASIC ROCKS OF THE WONGONG BROOK WEIR SITE, SOUTH-WEST DIVISION.

(Alex. G. D. Esson, M.A.)

In accordance with official instructions, a visit was paid to Wongong Brook, a tributary of the Canning River, and a geological survey of the surroundings of the proposed weir site and of the basic dyke system in its vicinity made. A map (21 A.1), showing the geological relations was prepared and a series of photographs (1770-3) taken of the dyke, through which the centre line of the proposed weir site passes.

Geology.—In this report the geology is briefly dealt with: (1) generally, and (2) particularly—in regard to its bearing upon the proposed weir.

The geological relations are somewhat obscured by débris and floaters, but field investigations show that the country is of igneous origin and consists of granite, threaded by fairly wide greenstone dykes. These greenstone dykes are joined to each other by narrow stringers and also by fairly wide dykes.

The greenstone is a hard epidiorite, which ranges in grain from fine to medium. It is younger than the granite, which is of the biotite-microcline variety, ranging from a medium to a coarse grain. In some places the granite becomes so coarse in texture as to resemble a pegmatite. The rock is largely decomposed on the surface and to some depth below, as we can see from the fact that one shaft had to be dug 40 feet before coming on to granite that was solid.

It is to be noted that although there has been a certain amount of metamorphism in the granite, in only two places has there been found evidence of fissuring, caused, probably, by the intrusion of the greenstone. In most cases the changes are due to weathering.

It may be concluded that the greenstone is intrusive and younger than the granite. There is no evidence of sills. Hence the surface of the original greenstone may have been much weathered in turn and worn down to its present levels. There is thus to be seen on the surface to-day what is probably a section of the old dyke system.

The soil produced by the weathering of the greenstone is a heavy clay loam which is extremely productive and admirably suited for intense horticulture. This, mixed with greenstone floaters, covers the lower slopes and obscures the geological relations.

The greenstone dykes can be divided into two main groups: (a) *main parallel dykes,* and (b) *connecting dykes.*

(a) These main dykes form the crests of the ridges and are more than 250 feet in width. They run roughly parallel to each other in a north and south direction.

(b) The connecting dykes join the main dykes and seem to run along any transverse line of fracture. They vary in direction but they run roughly east and west.

At present it is not at all clear whether the two types of dykes are of the same or of different geological ages, a point that is extremely difficult to determine especially as geological relations are by no means absolutely clear. It is generally recognised that when one dyke crosses another, that which has its fine-grained edge unbroken is younger than the other. Unfortunately, definite evidence of this kind was unobtainable.

All the dykes observed seemed to be of the same composition. In some cases the grain was finer than in others, but in the same dyke could be found both fine and coarse grained material quite close to each other. It was observed that the broader and longer a dyke, the coarser the grain.

In places inclusions of the felsitic material from the surrounding granite was found incorporated with the greenstone. This occurred near the edge of a dyke usually when the adjacent granite was found not to be much decomposed.

In shaft "f" the granite was found running up the side of the nearest dyke and giving evidence of being subjected to pressure from below.

The site marked out for the proposed weir is situated in a gorge, forming part of the valley of Wongong Brook and having very steep sides. On account of the steepness the bed of the brook is littered with loose boulders of granite and greenstone.

Upon arriving at the site of the proposed weir it was found that a number of shafts had been made under the direction of the Engineers of the Metropolitan Water Supply Department. Each of these shafts was carefully examined, and where necessary a number of them were extended and deepened on to solid bottom. In addition a few more shafts were sunk with the object of discovering any fissures which might be a danger to the weir or which might contribute to loss of water by seepage. Each shaft has been designated by a letter, thus, a, b, . . . z, and a description is dealt with in proper order.

Shaft

a. 5 feet deep on solid greenstone.
b. In this shaft there is a junction of the granite and greenstone. The edge of the latter seems to run at about 85 deg. from the horizontal. Here the granite shows slight indications of fissuring.
c. 22 feet deep on to a solid greenstone lying almost level.
d. This consists of a series of shafts lying in line and bearing 351 deg. and connected by drives, etc. All give granite at the bottom at about a depth of 12 feet.
e. 17 feet deep on to solid granite. Costeening has been commenced towards the solid greenstone dyke which outcrops solidly on the surface 35 feet from the edge of this shaft.
f. This consists of a long open cut, 13 feet deep. At 16 feet from the 100 foot peg there is a junction between the greenstone and the granite. Here the granite seems to have been subjected to some pressure and it runs up the side of the greenstone somewhat.
g. 10 feet 6 inches deep on solid granite. At the bottom there is a drive towards the south to the greenstone reef and this it meets at 7 feet from the shaft.

h. 9 feet 6 inches deep on to granite.
i. 12 feet deep on to granite.
j. 11 feet deep on decomposed granite. Work was discontinued here on account of the incoming of water.
k. 5 feet deep on greenstone.
l. 7 feet deep on greenstone.
m. Obtuse angle trench with dyke crossing it in two arms of the trench.
n. 2 feet 6 inches to 5 feet deep. At its south end the greenstone and granite meet.
o. 12 feet deep on granite.
p. 11 feet 6 inches deep on greenstone.
q. 9 feet 6 inches deep on granite. There is a junction here on the north end of the shaft.
r. 6 feet deep on solid granite.
s. 7 feet deep on granite.
t. 23 feet deep on granite dipping about 45 deg.
u. 10 feet 6 inches deep on granite. There is a junction on the north side of the shaft.
v. 17 feet deep on to granite.
w. 23 feet deep on to solid granite dipping 45 deg.
x. 35 feet deep on to solid granite.
y. 40 feet deep on to granite wash. This and "z" are old shafts.
z. Old shaft on to decomposed granite.

In most cases the shafts bottoming on granite have had the granite covered up with greenstone floaters and pug. In shafts "b" and "f" there is slight evidence of fissuring.

The centre line of the proposed weir passes through various portions of a narrow winding dyke connecting up two main dykes which form the crests of the ridges making the watershed at that point.

Conclusions.—Observations have shown that in this district there is a somewhat complicated system of greenstone dykes which intrude the much older granitic rocks. On the higher slopes at about 700 or 750 feet above sea-level we find the laterite commencing and obscuring the dyke systems. On the lower slopes alluvial soil has been deposited, and this, when formed from greenstone, is very productive, and less so when formed from granite. Soil formed from the laterite generally consists of an ironstone gravel which is of little value in growing crops.

Although no evidence of the occurrence of gold and other useful minerals was detected, it is understood that they have been found in the district.

I am much indebted to Mr. Lawson, the Engineer for Metropolitan Water Supply, and the late Mr. Hillman, his assistant, for their courtesy and assistance in supplying maps and in lending me two of their most capable miners, McGuigan and Sandercott.

4.—NOTES ON YALGOO, NOONGAL AND MUGGA MUGGA, YALGOO GOLDFIELD.

(Alex. G. D. Esson, M.A.)

Yalgoo.—In the main the country to the south of Yalgoo is obscured by recent superficial deposits. In places there are outcrops of the underlying rocks and these, combined with other observations, lead one to conclude that in this district there is a junction between the acid granite rocks and the basic greenstones.

In the area examined—from Yalgoo about 9 miles south and about 3 miles on either side of Rabbit-proof Fence No. 2—practically the same main types of rocks were found as at Melville later on. From Morrissey Creek, which runs south in a line somewhat west of the town of Yalgoo, crush-quartzite specimens [1/3452] were obtained forming the bed of the creek. A quarter of a mile eastwards of the creek shearing was again observed. It is probable that the creeks follow zones of shearing in this district.

No indications of metalliferous deposits were noted, although gold has been found farther southeast at the Joker, a prominent hill southeast of Yalgoo, where (*vide* Woodward, Appendix 2, Annual Report, Department of Mines, 1895) "A series of rich veins strike off from a large dyke." This working was abandoned by the company and apparently did not prove of any great value.

Noongal.—Noongal is one of the earlier abandoned mining centres of the Yalgoo Goldfield. A draw well with a good supply of fair water is located in the townsite near to the hotel, but otherwise potable water is hard to obtain except in a good season.

Up to December, 1921, the total amount of gold produced was 2,146.54 ounces, which includes alluvial, dollied and specimen gold, and the total tonnage of ore treated up to that date was 3,380.70 tons (of 2,240 lbs.). A slight revival occurred in 1921. A small 5-head battery has been established by Messrs. Neville and it is probable that this action may induce more prospectors to go to the district. The highest gold output is 571 ounces in the year 1897 and the bulk of that came from the Victorian United vein. Between 1915 and 1918, 1,932½ lbs. of bismuth, of a value of £472, were produced and marketed.

Generally, it can be said that Noongal lies upon an extremely rugged junction of acid and basic rocks. In the north, the acid intrusives have caught up large fragments of greenstone and occasionally have in part assimilated these. In the south the granites have intruded into the greenstones in the form of dykes and veins. In addition in the south there are many jasper bars which also have been intruded by porphyries. The whole centre then is a zone of contact between the acid and basic rocks and this zone constitutes the basis of deposition of gold and other minerals such as pyrites, molybdenite, scheelite, and bismuth.

The gold deposits, as would be expected, are patchy and do not seem to have any great continuity, but, where found, they seem to give fair values.

The rocks of Noongal are igneous in origin in the main, but there are also a number of superficial deposits which may have been originally lateritic and which are sometimes consolidated.

The igneous rocks are subdivided into acid and basic rocks. The basic rocks can be subdivided into greenstones and gabbroids. Mr. Farquharson, commenting on the basic rocks, says that the gabbros are metamorphosed forms of either basaltic dolerites with amphibolised augite or micropegmatitic quartz epidiorites. The greenstones are:

(a) metamorphosed dolerites, quartzose, granulated or foliated;
(b) metamorphosed gabbros;
(c) tremolite chlorites.

The acid rocks are various phases of biotite microcline granite. The intrusive dykes and veins take the form of quartz porphyries, granite porphyries, pegmatites and quartz.

The whole mass of greenstones has a dip westwards, which varies from 30° to 70°, and the strike is approximately north and south.

As has already been stated the minerals found are gold, bismuth ores, molybdenite, scheelite, pyrites, and also lepidolite.