end the lode runs into the main granite mass and dies out close to the margin.

The second lode is situated in the northern portion of the United lease. It strikes approximately north-northwest. At the surface it is separated into two portions by a long wedge of granite which has been dragged back along the lode channel. The western branch consists mainly of greenstone schist, the eastern in part of granitic material.

The lode has been worked for a length of about 280 feet, chiefly from a large but shallow open cut and from a shaft about 140 feet deep, 350 feet southwest of the northeast corner of the lease. At the southern end of the open cut the lode appears to be narrowing. The lode probably dies out to the north, in granite, near the northern boundary of the lease. As with the previously mentioned lode a fair amount of oxidised ore has been extracted, but little work has been done below water-level, which is said to be at about 100 feet in the shaft.

Summary and Conclusions.

The Yuanmi mining centre is situated near the eastern margin of an extensive greenstone belt, enclosed by granite, and comprising rocks of three types and of two, possibly three, ages.

The eastern portion of the belt consists of fine-grained schistose epidiorites, largely chloritised, probably corresponding in age to the older fine-grained greenstones of Kalgoorlie; the western of coarse-grained gabbroid or doleritic epidiorites similar in appearance to certain of the younger Kalgoorlie greenstones. The third type, which is possibly younger than either, is a massive fine-grained amphibolite occurring about four miles north of Youanmi.

The eastern portion of the belt is cut by numerous granite dykes.

The principal ore bodies are situated in a comparatively narrow zone of intense shearing in the older fine-grained greenstones along the granite margin. They include the lodes of the Yuanmi Mine, of which the most important are the Main Lode in G.M.L. 863B and P Shaft Lode in G.M.L. 864B, and those of the United and Hill End leases.

The continuity of the ore shoots is much affected by the presence of numerous granite dykes, causing impoverishment at the point of intersection, and by a number of later shear zones of several series, which have shattered and dissipated the ore bodies in places. Of these the most serious are the steeply-dipping shear zones owing to their strike being practically identical with that of the lodes and to their great width in places.

The Yuanmi Main Lode has been worked to a depth of 778 feet, the P Shaft Lode to a depth of about 300 feet. That payable ore bodies occur below these depths there is little doubt, but to predict the positions of such ore bodies at any given depth, accurate projections of the dykes and shear zones encountered at the levels above would be necessary. At a level put in from the main shaft at a depth of 880 feet the Main Lode would probably be free from the steeper shear zones that affected it at the 778 feet level, but would be affected at intervals by those of the flatter series—a less serious matter—and to some extent by granite dykes.

2.—ALLUVIAL AND LATERITE DEPOSITS OF THE HELENA RIVER, BETWEEN DARLINGTON, BOYA, ZIG-ZAG, EAST GUILDFORD, SOUTH-WEST DIVISION.

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

Upon March 9th, 10th, 20th and 23rd, 1922, a reconnaissance was made of the valley of the Helena River for the purpose of plotting the Helena alluvial deposits from a point on the river bearing about 207 deg. from Darlington Station, down to East Guildford, where Morrison's bridge crosses the river. I also made an examination of the laterite deposits at Boya and near to the Zig-Zag, on the Canning Jarrah Timber Company's railway line.

1. *Helena Valley Alluvium*:

It is to be noted that the term alluvium has two applications. It may be applied to river deposits, which, in the case of the Helena, would be largely flood deposits or flood plains. On account of the economic importance of these, I have taken this application of the term in making this report.

Alluvium is deposited on the old worn-out valley of the Helena, a valley cut out when the river was much younger and probably flowed faster. In places a difference of eight or ten feet in the height of the two banks was noticed. This could probably be explained as being due to the fact that the river when younger deposited an alluvial plain consisting largely of sand and clay. The river then cut into this plain, forming a fairly wide, new bed, upon one side of which it again deposited alluvium at a much lower level than the older plain. In some places a difference in the deposits on either bank can be seen, although both are distinctly alluvial.

In no case does the alluvium extend to more than ten or twelve chains from the river, and in places lateritic ironstone and granitic rocks border the present bed of the river.

Economically, these alluvial flats are of great importance, on account of their depth and productiveness, especially in connection with intensive agriculture or market gardening. I am informed by a resident of one of the flats that the depth of alluvium varies from twenty-seven or thirty feet in the middle of the valley to nothing on the extreme edge. The alluvium is largely good loam, very finely divided. In places, however, it seems to be composed mostly of clay.

In some places it is possible that the deposit is covered by æolian deposits of dune sand and in such a case, in the short time available, it was impossible to estimate exact boundaries.

(2.)—*Laterite Deposits*:

It was impossible to make more than a superficial examination of these. I examined them:

(a) *On Greenmount Hill, from Boya Siding.*—Here the deposits seem to begin at a height of forty feet or less from the summit and extend all over the hill top. They are highly ferruginous.

A distinct difference in the character of the vegetation on and off the laterite deposits was noticed.

Lower down the hillside, the rock was more or less weathered granite, while, lower down still, everything was covered with the detritus from this weathering.

(b) *Boya Quarries.*—Granite and diorite are quarried here from the sides of small spurs of Greenmount Hill. The diorite seems to be intrusive into the

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.