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An Investigation of the Harts Range and Plenty River Mica Mines

by

K. Rochow

Record 1962/34

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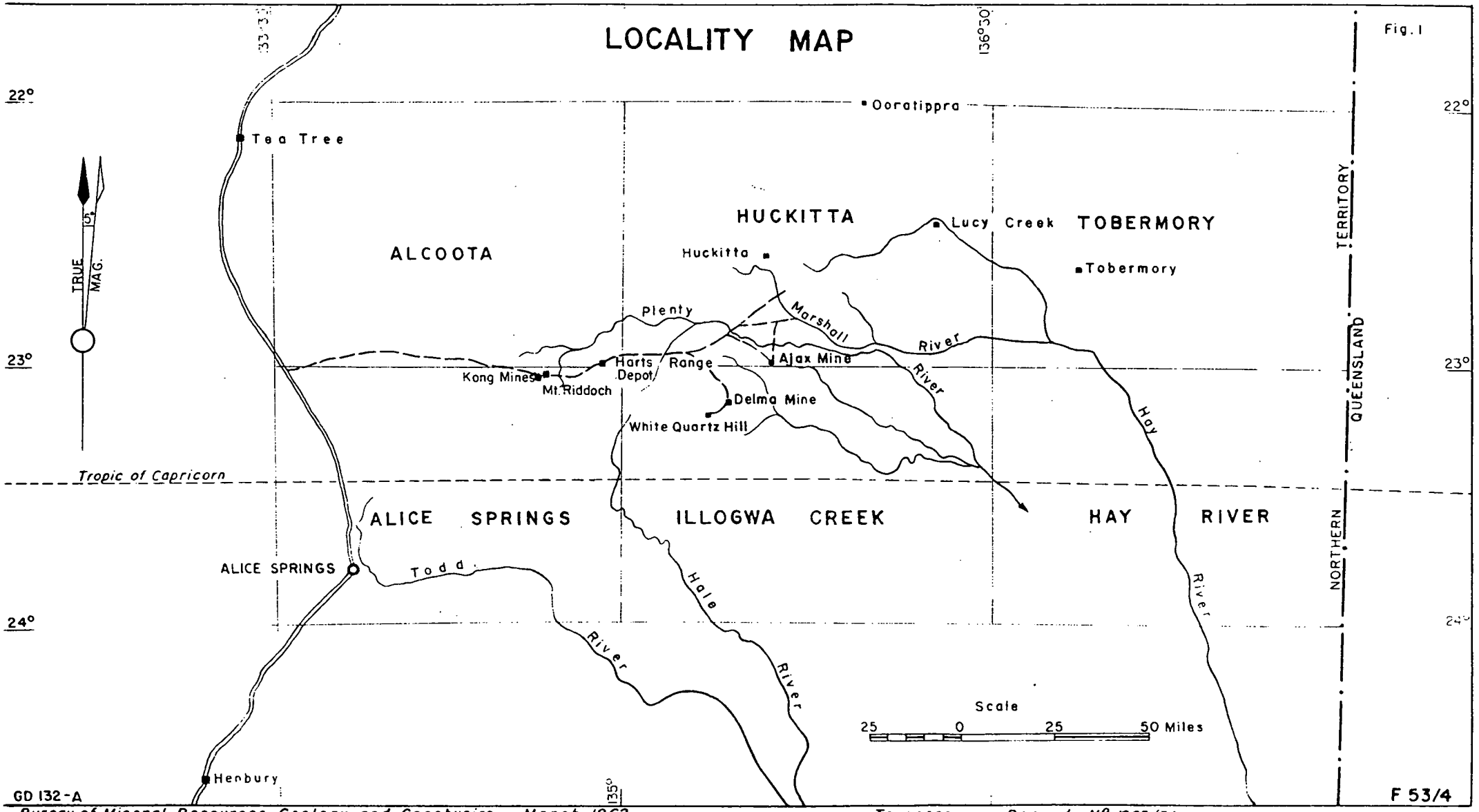
CONTENTS

Figure No. PLANS

LOCALITY MAP

Fig. 1



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SUMMARY

The last survey of the Harts Range and Plenty River Mica Mines was completed in 1951, since then there has been considerable development in many of the established mines, and some new mines have been opened. Production of mica since 1952 has exceeded 132 tons and ranged from 35.3 tons in 1954 to 14.7 tons in 1959. About 30 mines were worked, at different times, between the period 1951-1960.

Low prices and high costs continue to retard the industry; perhaps even more so than before 1952, because the average price obtained for mica remained fairly constant over the period, but costs increased considerably.

Ore reserves are difficult to estimate because of the random occurrence of mica within the pegmatites. The mining techniques adopted were in many cases unsystematic but this is largely due to the nature of the ore and the small size of some of the deposits. Only the larger pegmatites produced mica consistently and these for periods of only 2 or 3 years.

INTRODUCTION

The demand for Australian mica declined in 1959, and led to an exodus of miners from the Harts Range and Plenty River mica mines. The investigation was undertaken to examine and record the state of the mines at that time, and so provide a basis on which to plan future mining, should market conditions improve. The investigation was carried out during May and June 1960. The workings were mapped by chain and compass.

Location and Access

The Harts Range and Plenty River mica deposits lie within a 5000 square mile area centred about 120 miles north-east of Alice Springs (figure 1). Access is by a new, well-formed road which branches off the Stuart Highway 40 miles north of Alice Springs and extends east at present as far as Mt. Riddock. From Mt. Riddock a graded track to the Jervois Ranges passes through the area.

Previous Investigations

The last comprehensive account of the Harts Range Mica Field (Joklik, 1955) was based on surveys carried out during the years 1949-1951; consequently this report will only deal with developments since 1952.

Production and Mining

Production of mica began in 1892 and up to 1952 the field had yielded 859.5 tons of commercial mica. Since 1952 132 tons have been produced. Annual production has ranged from 35.3 tons in 1954 to 14.7 tons in 1959 and it is expected that the 1960 total will be even less. The mica produced in the seven years from 1953 to 1959 has an aggregate value of just over £400,000 and the average price of 28/- per pound, has remained almost constant throughout the period. Working costs have risen considerably, and there are now only two miners working on the field; they are J. Negri at the Ophir Mine and B. Gerutti at a new prospect in the same area. (see Figure 13).

The mines in the Harts Range are mostly within long, narrow fissure-vein pegmatites; these mines have provided the highest and most consistent production. In the Plenty River area many small pegmatites ("pegmatite pipes" of Joklik's classification) have been worked. These pipes are often irregular and difficult to follow at depth, so that many of the Plenty River Mines are little more than a series of pits which were abandoned as soon as the easily won near-surface material had been removed, e.g. Ragna Group (figure 20), Queen Group (figure 16), and Millers Knob Mine (figure 22).

The mining is generally haphazard because most of the operators lack both the skill and the capital necessary to follow systematic development programmes. Many pegmatites are abandoned at shallow depths (even though deeper mining could result in better production) because the present low price of mica discourages expensive development. Many of the Plenty River pegmatites are deeply weathered, and much of the otherwise good-quality mica near the surface has been spoiled by weathering.

The prospects of marketing the accessory minerals in these pegmatites are not encouraging. Beryl is the only accessory mineral of value, but it does not occur in sufficient quantity to warrant collecting. There are gem varieties of beryl, but they are too fractured to be of value.

Some scrap mica is being sold at present, but the market is limited. If the market for scrap mica could be developed, it would benefit the industry because a lot of the mica mined is now discarded.

General Geology

"The mica-bearing pegmatites occur in rocks of the Harts Range Group, which is a complex of metamorphosed igneous and sedimentary rocks probably of Archaeozoic age" (Joklik, 1955). In the Harts Range Area the majority of mica mines are within the Irindina Gneiss, a garnet, mica, feldspar, quartz rock. The host rock in the Plenty River Area is similar to the Irindina Gneiss, but the relationship of the metamorphic rocks of this area to the Irindina Gneiss is not known.

MICA MINES

Delma and Delma North Mines

The Delma Mine is on the old Mica Road 40 miles south-east of the Harts Range Depot (figures 1 and 2). It is on the plain, 2 miles east of the ranges, and is easily reached by road.

The Delma Mine produced continuously from 1953. It was only recently abandoned. The underground workings were inaccessible when inspected but the depths of the shafts were measured and found to be the same as in 1951. Mining during the latter years was probably confined to the levels mentioned by Joklik (1955).

The new workings (Delma North Mine) are about 700 feet north of the old main Delma Mine, and are in a pegmatite vein striking at 040 degrees. (figure 3). The mine is on an alluvial plain and the full extent of the vein is unknown.

A drive about 15 feet below ground surface follows the pegmatite for 177 feet (figure 3). The pegmatite exposed in the drive is partly weathered and a lot of the mica is spoiled.

The pegmatite is homogeneous and medium-grained; it is 9 feet thick in the central part of the workings, but thins out at each end. At the southern end it divides into several small veins separated by gneiss, and probably disperses in the country rock. Therefore the present workings may represent the economic length of the pegmatite.

Zoning is not apparent, but there is a tendency for large mica-books to be concentrated near the axis of the vein. The mica is clear green, and abundant, but weathering has rendered much of it unsaleable. Stoping from a new level below the drive could produce economic quantities of mica.

Production from Delma Group

Year	Quantity (lb.)	Value (£)
1953	1,316	1,535 (for half year only)
1954	9,696	12,405
1955	7,266	8,692
1956	2,850	3,554
1957	5,170	5,648
1958	6,529	6,783
1959	4,861	5,047
Total:	37,688	43,664

Mirror Finish Mine

This mine is 36 miles by road south-east of the Harts Range Depot.

Many pegmatites crop out in the area, but only the Mirror Finish vein has been worked. This vein is parallel to the foliation planes in the country rock except at its southern end where it branches off along joint planes (figure 6).

The pegmatite crops out on the side of a steep hill and has been mined from two adits (figures 4 and 5). No. 1 adit is 110 feet long and has been stoped to the surface; a pillar 25 feet long supports the hanging-wall. No. 2 adit 40 feet below No. 1 adit is more than 200 feet long; it has been stoped to the surface only up to the portal of No. 1 adit (figure 4). A winze, to test the grade of ore between the two levels, was sunk to No. 2 level from the southern end of No. 1 level.

Most of the pegmatite is homogeneous, fine to medium-grained, and has an average thickness of 6 feet; zoning is not prominent, but irregular concentrations of quartz appear near the centre of the thickest part of the vein. At the northern end of No. 2 level the pegmatite is 21 feet thick, and consists of a fine-grained hanging-wall zone, 6 feet thick, a coarse-grained quartz-feldspar core, 10 feet thick, and a poorly defined fine-grained footwall zone, about 5 feet thick. Southwards along this level the pegmatite narrows to less than 2 feet and then widens to 8 feet at the end of the drive.

On No. 1 level the vein is homogeneous, 6 to 10 feet thick, and contains a lot of ruby mica.

Practically all the pegmatite worth mining above No. 2 level has been removed, but a new level could be developed about 40 feet lower down the hill. Several shallow prospecting winzes from No. 2 level indicate that the pegmatite extends downwards without diminishing in size. The vein is irregular on No. 2 level, but there is no evidence to suggest that it is lensing out.

Production

Year	Quantity (lb.)	Value (£)
1954	1,652	3,727
1955	1,063	2,624
1956	2,215	2,590
1957	1,305	2,339
1958	1,918	3,683
1959	1,854	3,707
Total:	10,007	18,670

Flying Fox Mine

The Flying Fox Mine is 37 miles south-east of the Harts Range Depot on the eastern flank of the Harts Range (figure 2). The mine is about 500 feet above the plain on the side of a steep hill and was worked several years ago with the help of a flying fox cableway.

The nearly vertical pegmatite strikes at 030 degrees and is 20 to 25 feet thick. There is a zone, 2 feet wide of fine-grained quartz, feldspar, and muscovite on either side of the 20 feet wide quartz-feldspar core. These wall zones were prospected by two open cuts, each about 100 feet long and 2 to 15 feet deep. The wall zones are even-grained, and contain minor quantities of mica of commercial size. It is improbable that commercial quantities could be produced from this pegmatite. Several pegmatites crop out in the immediate vicinity, but these appear to be of similar composition and grain-size.

Production

Year	Quantity (lb.)	Value (£)
1956	242	426
1957	367	642
Total:	609	1,068

Kong Mine (South Workings)

This pegmatite crops out on the side of a steep hill about 5 miles west of Mt. Riddock Homestead. It was worked in the hanging-wall zone by open cuts and two drives. The average thickness of the vein is 30 feet and the length of the outcrop more than 2,000 feet (figures 7 and 8).

The pegmatite consists mainly of fine-grained to medium-grained quartz, orthoclase, and muscovite, with some tourmaline and beryl. Tourmaline is most common near the centre of the pegmatite where graphic intergrowths of quartz and feldspar are abundant. The mica is concentrated in a zone 5 feet thick along the hanging-wall, but it is not plentiful.

The mica is clear and green, and books up to 9 inches square are common. The footwall zone is too consistently fine-grained to yield much mica of economic size.

The hanging-wall is well defined and dips 80 degrees west, transgressing the foliation in the country rock which dips 80 degrees south. Adjacent to the footwall, the country rock is penetrated along foliations by pegmatitic material, mainly quartz and feldspar. Near the southern part of the workings, similar pegmatitic material extends for at least 40 feet beyond the wall of the pegmatite.

A large part of this pegmatite has not yet been prospected; this may be due to the paucity of mica found in the workings.

Production figures for this mine have been combined with the figures for the north workings.

Kong Mine (North Workings)

This mine is about 100 yards south-east of Kong Bore and 500 yards north of the southern workings. The pegmatite strikes at 010 degrees and dips steeply to the west, but lack of outcrop prevented measurement of its thickness and length.

There are two shafts, the northern one is 100 feet deep and has one drive off it; the southern shaft is also 100 feet deep and has two drives, one at 70 feet and the other at 100 feet (figure 9). Both of these shafts are in the hanging-wall zone (about five feet thick) adjacent to the thick quartz core. This zone is made up of fine-grained quartz, weathered feldspar, and muscovite. Mica is abundant, especially next to the quartz core, but much of it is bent and unsaleable. Large quantities of good clear mica have come from this mine. The hanging-wall is poorly defined because the country rock is impregnated with pegmatitic material for at least 40 feet.

The rock exposed in the shaft is partly decomposed, possibly by weathering or kaolinisation of the feldspar. But the shaft has not been timbered and a cave-in has resulted in it being condemned.

It was noticed in this mine that mica is most abundant where the quartz core tapers off, both laterally and vertically.

Production

Year	Quantity (lb.)	Value (£)
1956	3,627	3,341
1957	81	239
Total:	3,708	3,580

Ajax Mine (South Workings)

This mine is on the southernmost of two low hills, 4 miles south of the Plenty River and 9 miles south-east of the Plenty River Crossing (figure 10).

The main workings consist of a hanging-wall drive at the base of 3 shafts, 19, 18 and 26 feet deep, and two large circular pits (figure 11). Prospecting shafts have been sunk about 60 feet east and west of these workings but neither of these intersected the pegmatite.

The pegmatite is about 26 feet thick in the workings, but the length may not be much greater than 120 feet because the eastern and western shafts are wholly within country rock. On the other hand, the thickness of the pegmatite does not diminish at either end of the underground workings, and it is possible that the strike of the vein changed and was missed by the shafts.

The pegmatite hanging-wall is well defined and follows a joint plane in the gneiss, it strikes at 110 degrees and dips 50 degrees south. Foliations in the gneiss dip 70° and strike 140 degrees. There is an irregular quartz core, 4 to 5 feet thick in the central portion of the underground workings, but most of the pegmatite consists of medium to coarse-grained quartz, feldspar, and muscovite. The footwall is not exposed, but there are horses of country rock on the west side of the drive, so this boundary is probably irregular. Only the hanging-wall zone has been mined, the mica in this zone is plentiful and of good quality.

The present workings could be extended for a few feet to the south and north, but any major renewal of activity in this mine would require the development of a new level below the present drive.

Several pegmatites crop out in the vicinity, and some recent prospecting with a bulldozer in areas of poor outcrop has revealed a promising dyke about 200 yards north-east of the Ajax. The area is not being prospected at present.

Ophir Mine

This mine is about 20 miles south-east of the Plenty River Crossing, and is at present being worked by J. Negri.

Several pegmatites crop out near the mine, and their orientation suggests that they occupy a joint system (figure 13).

When J. Negri took over the mine in 1957 there was an inclined stope, in the hanging-wall, from the surface to the base of the main shaft (80 feet deep). Since then another inclined stope, below and to the south of the main shaft, has been developed and abandoned. At the time of inspection (June, 1960) a drive was being worked northwards at the level of the bottom of the shaft.

The Ophir pegmatite strikes 345 degrees, and dips 45 to 50 degrees west, parallel to the foliation in the surrounding gneiss. A fine-grained hanging-wall zone, 5 to 8 feet thick, is currently being stoped at a depth of 80 feet. This zone has abundant ruby mica, but much of it is bent and stained. There is a lot of poor quality mica concentrated

within 3 inches of the hanging-wall. Adjacent to the thick quartz core is another concentration of mica of better quality, but most of the saleable material is distributed through the hanging-wall zone. The footwall zone does not contain economic amounts of good quality mica.

North of the main shaft the quality of the mica deteriorates, and the quantity diminishes. If production is to continue from this mine it will be necessary to try and locate another enriched zone. An east-trending pegmatite can be traced to within 50 feet of the north-trending Ophir pegmatite, and it is possible that the two intersect beneath the alluvial cover (see figure 13). Previous experience on the field has shown that zones enriched in mica commonly occur at the intersection of two pegmatites (e.g. Delma Mine).

The present operator intends sinking a shaft at the position of this inferred intersection, and even if the pegmatites do not intersect, they can both be worked in drives leading from this shaft.

Production

Year	Quantity (lb.)	Value (£)
1954	2,063	2,254
1955	No recorded production	
1956	" " "	
1957	1,270	1,463
1958	3,064	4,819
1959	13,668	16,579
Total:	20,065	25,115

Jubilee Mine

The Jubilee Mine is about 3 miles north-west of the Ajax Mine and is on the west side of a flat-topped hill capped by Tertiary limestones. A graded track from the Plenty River Crossing provides easy access.

The workings are more than 50 feet deep, and the most extensive development is on the 30 feet level (figure 15). Over-hand stoping in the hanging-wall zone is the main method used in working the mine and the roof of the stope is now within 10 feet of the surface.

The south-eastern shaft, 55 feet deep, could not be inspected closely but it does not appear to have any drives leading from it; this suggests that it does not intersect the pegmatite. The northernmost shaft is 20 feet deep and is wholly within pegmatite. It also has no drives leading from it. This shaft was sunk in deeply weathered rock, and this has probably discouraged development off it. The collar of the northernmost shaft is at least 20 feet above the collar of the south-eastern shaft.

The mica-bearing pegmatite is in weathered gneiss and strikes 195 degrees. The outcrop is limited by a cover of soil and limestone boulders and the surface dimensions of the dyke are not known; but underground it attains a thickness of 20 feet and is well zoned. There is a mica-rich zone, 18 inches to 2 feet thick, on the hanging-wall, and a similar but less well defined zone on the footwall. Quartz is the dominant mineral in the core, which also contains some book-mica and feldspar. Sericitisation of the feldspars is common near the footwall.

The hanging-wall follows a series of joint planes in the country rock; the most prominent of which dip east about 45 degrees. Near the surface, the footwall has a dip of about 70 degrees to the east, and is quite irregular.

Throughout the present workings the width of the vein vein and of its hanging-wall zone are nearly constant. Consequently, some mining could be resumed in the present stopes. The awkward layout of these stopes will necessitate the development of a new level if renewed production is to be assured.

Recorded Production

Year	Quantity (lb.)
1953	176
1954	1,613
1955	294
1956	105
Total:	2,188

Unnamed Mine near Jubilee Mine

300 yards south-east of the Jubilee Mine, a drive from an open cut, follows the hanging-wall of a thick but not fully exposed pegmatite. Tertiary limestones crop out 20 feet above these workings. Both the pegmatite and the surrounding gneiss are strongly weathered.

This pegmatite contains a muscovite-rich boundary zone, 4 feet thick, and a quartz core at least 3 feet thick. The muscovite is mostly weathered, but when unaltered it is of good quality. The mine has probably been abandoned because of this weathering, so deeper workings may reveal mica of economic grade. This dyke could be about the same size as the Jubilee pegmatite.

The mica exposed in the lower workings on the Jubilee pegmatite has been only slightly affected by weathering, but almost all the mica exposed in shafts higher up the hill is spoiled. The weathering profile in the area south-west of the Jubilee mine is similar, and probably the mica would be similarly affected.

Queen Group of Workings

There is some doubt about the correct name of this group which is situated approximately 2½ miles north of Prosser Soak and 12 miles north-east of the Plenty River Crossing. Millers Knob is 2¾ miles from these workings on a bearing of 268 degrees, and the bearing to the King Mine, 1½ miles away, is 35 degrees.

The western workings are 34 feet deep and the remainder are small pits in small irregular pegmatites (figure 16). The distribution of the pegmatites is random, as in the Ragna area, and in both places the pegmatites, even when more than 10 feet thick, may terminate along the strike within a few feet. Similar difficulty is experienced in following the veins down, because vertical lensing-out, and off-setting is common, Joklik (1955) classified these veins as "pegmatite pipes".

The western pegmatite is the only one to have been worked in the last few years. This pegmatite crops out for 65 feet, but the quartz core 2 to 3 feet thick, crops out over less than half of this length.

The pegmatite has a maximum thickness of 20 feet in the central section but it tapers off rapidly to the east. At its western end the pegmatite terminates abruptly in the shaft without any noticeable tapering off.

The wall zones consist of fine-grained quartz, plagioclase, and muscovite; large books of mica are scarce, and there is some tourmaline and beryl.

The pegmatite probably extends for some depth below the present workings, but its irregularity and the paucity of good mica would probably make further development unprofitable.

King Mine

The King Mine is about 12 miles north-east of the Plenty River crossing and ¾ mile south of the Jervois Road. The pegmatite strikes 100 degrees and crops out for more than 600 feet, with an average thickness of 5 feet (figure 17). The average dip is south at 50 degrees, transgressing the foliation in the country rock which dips 70 degrees north. There is a slight concentration of quartz and mica at the centre of the pegmatite with fine-grained wall zones of quartz, feldspar, and muscovite.

Two underlay shafts follow the pegmatite down dip for more than 50 feet, but the underground workings are at present inaccessible and their extent is unknown.

This mine was worked sporadically until about two years ago, and as the shafts are still in good condition production could be resumed with small initial expense.

Kiwi Mine

This mine is on an alluvial plain among low hills, 5 miles north-east of the Plenty River Crossing (figure 18). It was worked in 1958 and is still fully equipped, so that production could be resumed at short notice.

The pegmatite is fine-grained to medium-grained and contains books of mica commonly up to 9 inches square. It strikes040 degrees, dips 45 to 70 degrees to the east, and averages 6 feet thick (figure 19). The pegmatite has irregular boundaries and shows no marked zoning; although the inclined open cut follows the hanging-wall, which has a slightly higher concentration of mica, and is more regular than the foot wall. Weathering has stained most of the good quality clear mica and kaolinised most of the feldspar.

The pegmatite is partly obscured by alluvium, but it probably does not continue more than a few feet beyond the existing workings, because it narrows and interfingers with the country rock at both ends of the workings. The consistant thickness of the pegmatite exposed in the present workings suggests that exploration down beyond the zone of weathering may locate more good quality mica. However the economic working depth will be controlled by the short length of the pegmatite.

Ragna Group of Workings

These workings are described as a group, using the numbers on the accompanying plan (figure 20) for reference.

Old Workings

(1) An open cut 40 feet by 15 feet by 12 feet deep, strikes 050 degrees; it is wholly within a fine-grained pegmatite composed of quartz, potash feldspar, and ruby mica. The pegmatite boundaries are not exposed either in the workings or in outcrop, so its dimensions are unknown. The mica is weathered, so deep excavations would be needed to locate fresh material. The pegmatite contains some beryl.

(2) Two pits, 5 feet in diameter and 3 feet to 5 feet deep, have exposed a coarse-grained pegmatite. There are no other exposures.

(3) An open cut 60 feet long, 5 to 10 feet wide and 6 to 10 feet deep, dug in fine-grained to medium-grained pegmatite. The hanging-wall strikes 050 degrees and dips 65 degrees east. The foot-wall is irregular, and the vein is 5 to 10 feet thick. There is no zoning in this pegmatite, and it lenses out abruptly near the north face of the open cut.

New Workings

(4) Two pits, have been dug in the mica-rich marginal zone of a pegmatite pipe which crops out for 20 feet with a strike of 160 degrees. The quartz core is 6 feet thick in the centre and lenses out at either end of the outcrop.

(5) An open cut, 44 feet long and 15 feet deep, with a strike of 015 degrees, follows the hanging-wall of a medium-grained pegmatite. The hanging wall dips 65 degrees to the west. There is no quartz core and the pegmatite exposed in the open cut has a maximum thickness of 6 feet. The outcrop of the pegmatite is partly obscured by alluvium.

(6) A shaft, 12 feet deep has been sunk in a tourmaline-rich pegmatite pipe which is 4 to 5 feet thick. The feldspar is partly kaolinised, and the mica has also been spoiled by weathering. The pegmatite strikes 170 degrees and does not extend more than a few feet either side of the shaft.

(7) An irregular pit, up to 8 feet deep, has been dug into a complex mixture of pegmatite and gneiss. The pegmatitic material occurs as small lenses, up to 2 feet thick, separated by bands of gneiss of similar thickness.

Of the seven pegmatites in the group, only No. 5 and No. 1 are of sufficient size to warrant further investigation.

Recorded Production

Year	Quantity (lb.)	Value (£)
1953	1,897	3,721
1954	3,180	4,786
Total:	5,077	8,507

Marengo Mine

This is not the Marengo Mine described by Joklik (1955) and there is some confusion over the correct name because several mines of disputed identity occur within ½ mile of this locality. The workings described here are ½ mile east of the road to the Marshall Bore and 5 miles north of the Plenty River Crossing (figure 18).

There are several small pits in poorly outcropping pegmatites within 200 yards of this mine. The Marengo pegmatite is the largest and most promising; it has an average thickness of 35 feet and the length of the outcrop is 160 feet; (figure 21). At the northern end the width diminishes to 20 feet, suggesting that the pegmatite may be lensing out in this direction. However at the southern end of the exposure it is 35 feet wide and there is no indication of it tapering off.

There is a persistent quartz core, 2 to 7 feet thick, throughout the outcrop. It lies slightly west of centre of the pegmatite dyke. The wall zones are 5 to 15 feet thick, and consist of medium-grained quartz, feldspar and clear mica. The mica is plentiful and of good quality. Four shallow shafts and one open-cut are located in the wall zones and all of these workings reveal mica, apparently of economic grade.

This mine has been abandoned for some years but the shafts are still in reasonable condition. Mining could probably be resumed at little expense.

Princess Elizabeth Mine

Half a mile north-east of Millers Knob (figure 18) a pegmatite has been worked over a distance of 270 feet along the strike. The pegmatite strikes 090 degrees, but it crops out poorly and the length and thickness at the surface were not measured. The pegmatite has been mined from a series of open cuts, each about 10 feet deep (figure 22); in these workings the vein is about 18 feet thick, and dips south at angles ranging from 45 to 80 degrees. There is a thick quartz core in the western end of the vein but it lenses out west of the first open cut. There is no zoning in the pegmatite exposed in the open cuts. The pegmatite contains coarse-grained quartz and feldspar (including much microcline), with smaller amounts of tourmaline, and some apatite. Muscovite of good quality occurs throughout the pegmatite, but it is not plentiful. At an early stage in the development of this mine, Jensen (1943) noted "a fair amount of high-grade muscovite in medium sized books".

The mine appears to have been abandoned when the percentage of mica in the pegmatite dropped. There are no indications that the size of the pegmatite diminishes with depth, and further development in this mine could again reveal mica in economic amounts. Production figures from this mine have been combined with the figures from the Millers Knob Mine.

Millers Knob Mine

An irregular pegmatite with a strike of 090 degrees, parallel to the foliation in the country rock (figure 23), is exposed in an open cut three hundred yards north of Millers Knob (figure 18). The open cut is 40 feet wide, 70 feet long and 10 feet deep. The pegmatite is a massive quartz-feldspar-muscovite rock, but tourmaline and apatite are common minor constituents; there is no zoning apparent. The pegmatite interfingers with the country rock on all sides of the open cut, so the present workings represent the lateral economic limits of the dyke. A shaft and stope have been filled with rubble so that the attitude of the pegmatite at depth is unknown, but the irregular surface boundaries suggest similar irregularity at depth. Consequently the reopening of this mine would be a greater-than-average risk.

A series of quartz reefs, containing tourmaline, crop out over a distance of 1,400 feet west of the open cut. The strike of the individual reefs is 085 degrees, but the strike of the whole zone is 090 degrees, indicating an en echelon pattern. These reefs are 5 to 10 feet thick, and mica-rich boundary zones are apparently absent. However, the outcrop is insufficient to be certain of this, and it is also possible that the quartz reefs may taper off and acquire mica-rich wall zones at depth.

Production statistics do not consistently distinguish between Millers Knob and Princess Elizabeth Mines, and the combined figures have been given.

Recorded Production

Year	Quantity (lb.)
1953	1,306
1954	4,103
1955	1,603
1956	245
Total:	7,257

Other Mines Worked Since 1953

(1) Spotted Tiger

The underground workings are unsafe, and no mica has been mined for about 6 years. The large dump was recently worked for scrap mica and some of the old workings were filled with waste material during this activity. The mine was idle when visited in May, 1960.

(2) Disputed

Production ceased in 1952, but some pillars were worked profitably in 1958. However, as a result of this work the mine became unsafe and has now been condemned.

(3) Rex

Regular production ceased in 1953, and in 1958 this mine was also condemned.

(4) Dinkum

This mine was reopened successfully for several months in 1957. At the same time, a new shaft was sunk 900 feet west of the main workings to a depth of 26 feet. Economic quantities of mica were not found.

(5) Paulina

The open cut was deepened by 20 feet over a short distance in 1958, but this mine is now abandoned. The workings are in excellent condition and production could readily be resumed.

CONCLUSIONS

Any attempt to estimate ore reserves is hazardous because:

(a) Many pegmatites have irregular boundaries and poor exposures, so that it is difficult to obtain measurements on which to base the calculations.

(b) Mica is not distributed uniformly throughout the pegmatites, but is usually concentrated in lenticular shoots.

Consequently the recommendations on the potential of individual mines given in this report are based on the following considerations:

(1) Previous Production.

A mine which has produced large amounts of high-grade mica is worth reopening subject to (2) and (3).

(2) Size of Pegmatite.

A large pegmatite, if not already extensively excavated, offers the best scope for large scale development and consequently more efficient mining methods. It also offers the possibility of repetition of lenses of payable material, either down dip or along the strike. (In this context, a pegmatite is considered large if it maintains a thickness of more than 10 feet for a length of at least 100 feet).

(3) Depth of Pegmatite.

Most pegmatites probably extend far below the shallow depths to which they have been mined, and the limiting depth of economic mining will be set by the grade of the ore, and the length and width of the vein.

These factors should be considered in conjunction with the suggestions for prospecting given by Joklik (1955, p.178).

He considered the following characteristics as indicative of potential economic pegmatites:

"(i) The pegmatite should be -
  (a) Discordant
  (b) Coarse-grained
(ii) The pegmatite should contain only small amounts of -
  (a) Graphic pegmatite
  (b) Biotite
(iii) The pegmatite should be well zoned.
(iv) The presence of a prominent tabular quartz core is desirable.
(v) The predominant feldspar in the pegmatite should be plagioclase, not microcline.
(vi) The presence of some book mica at the surface is desirable."

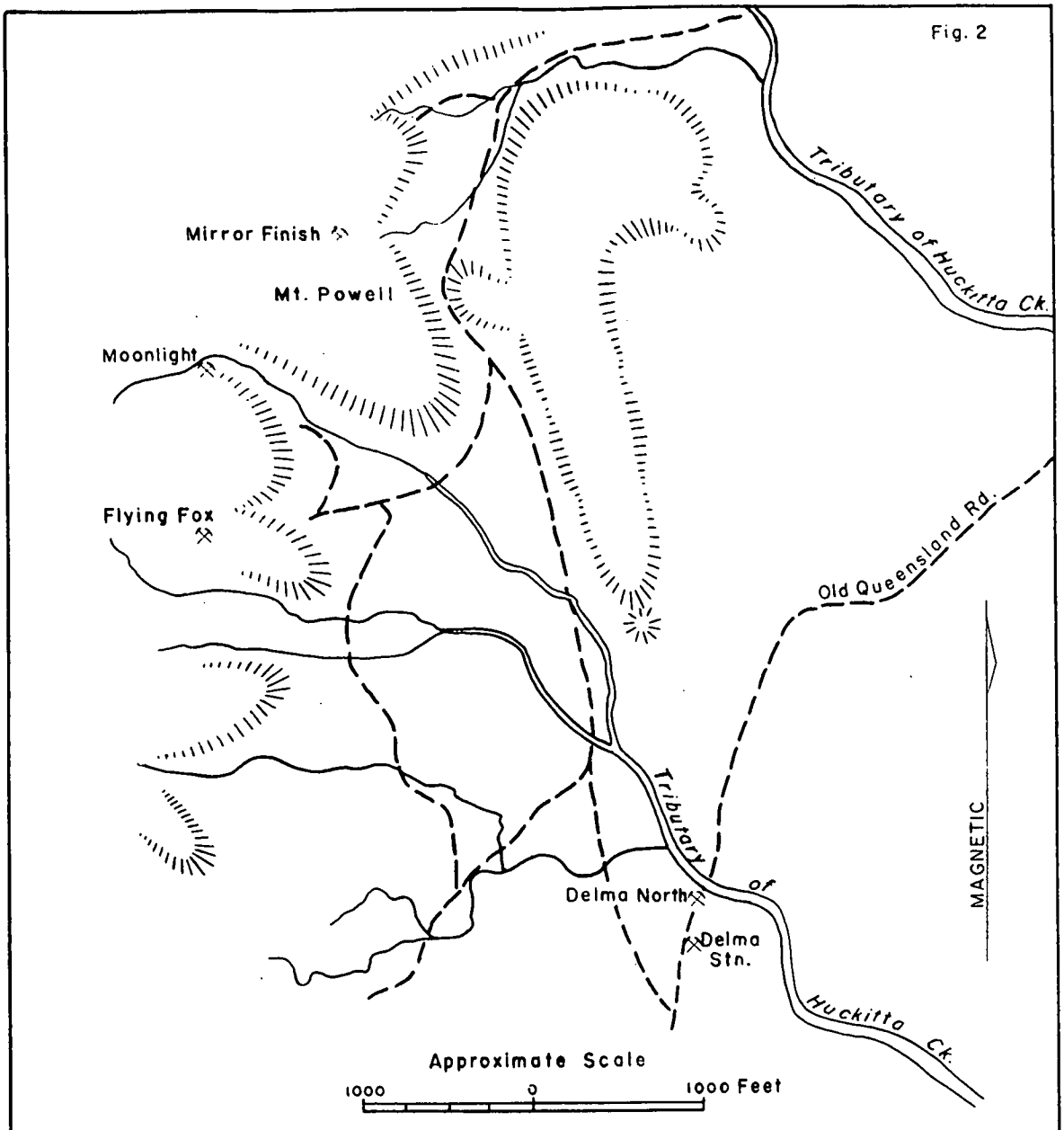
REFERENCES

JENSEN, H.I., 1943 - Plenty River Mica Mines. Bur.Min.Resour.Aust., Rec. 1943/4 (unpubl.)

JOKLIK, G.F., 1955 - The Geology and Mica Fields of the Harts Range, Central Australia. Bur.Min.Resour.Aust.Bull. 26.

WOOLLEY, D.R., 1959 - Pegmatites in the Huckitta 4-mile Sheet. Bur.Min.Resour.Aust., Rec. 1959/88 (unpubl.).

Fig. 2



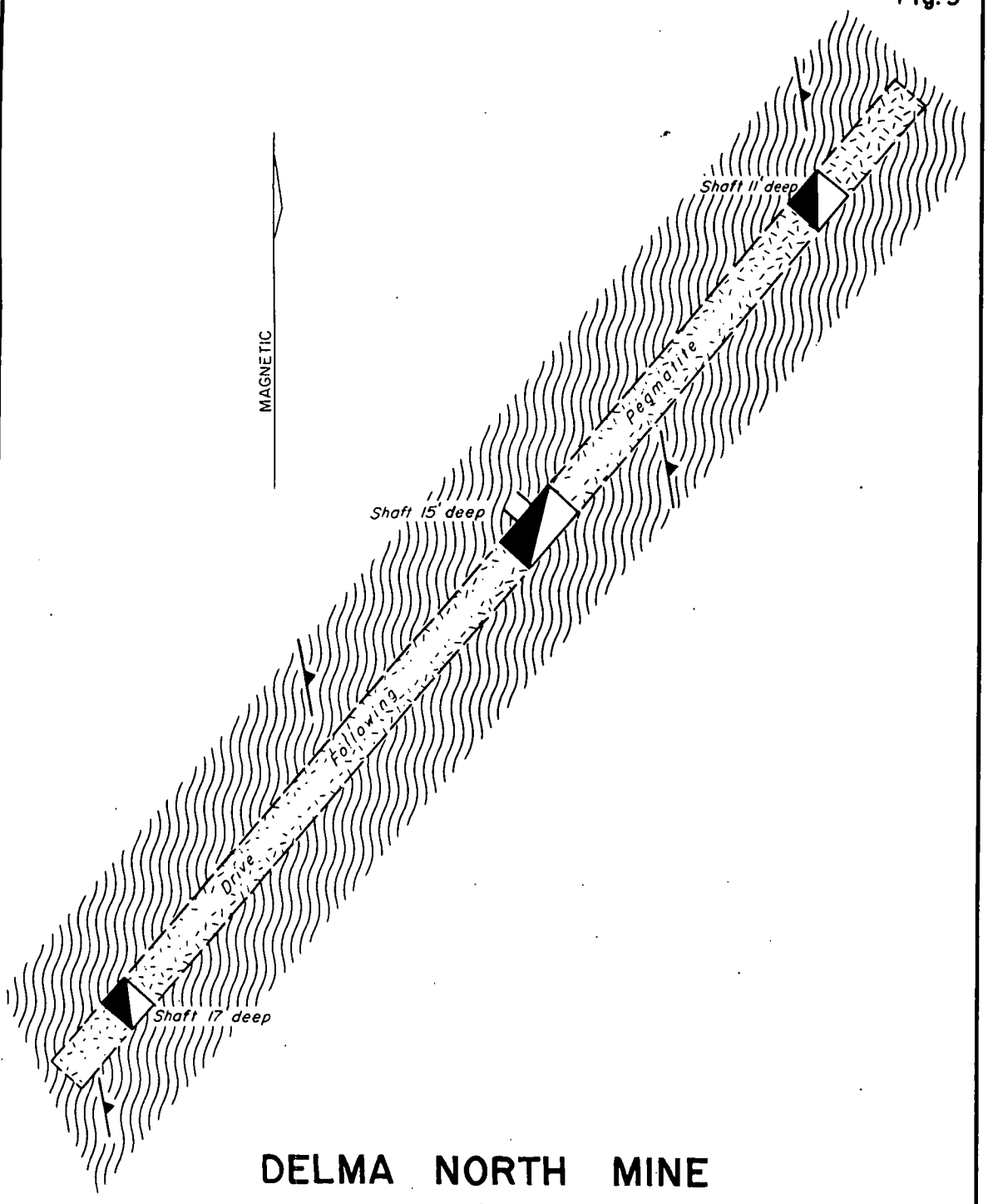
LOCALITY MAP - DELMA AREA

Bureau of Mineral Resources, Geology and Geophysics *March 1962* F53/15/1JK

GD 132- B

To accompany Record No 1962/34

Fig. 3



DELMA NORTH MINE

SURFACE PLAN

EASTERN HARTS RANGE AREA

Scale (approximately)

20 0 20 40 FEET

Reference

Pegmatite

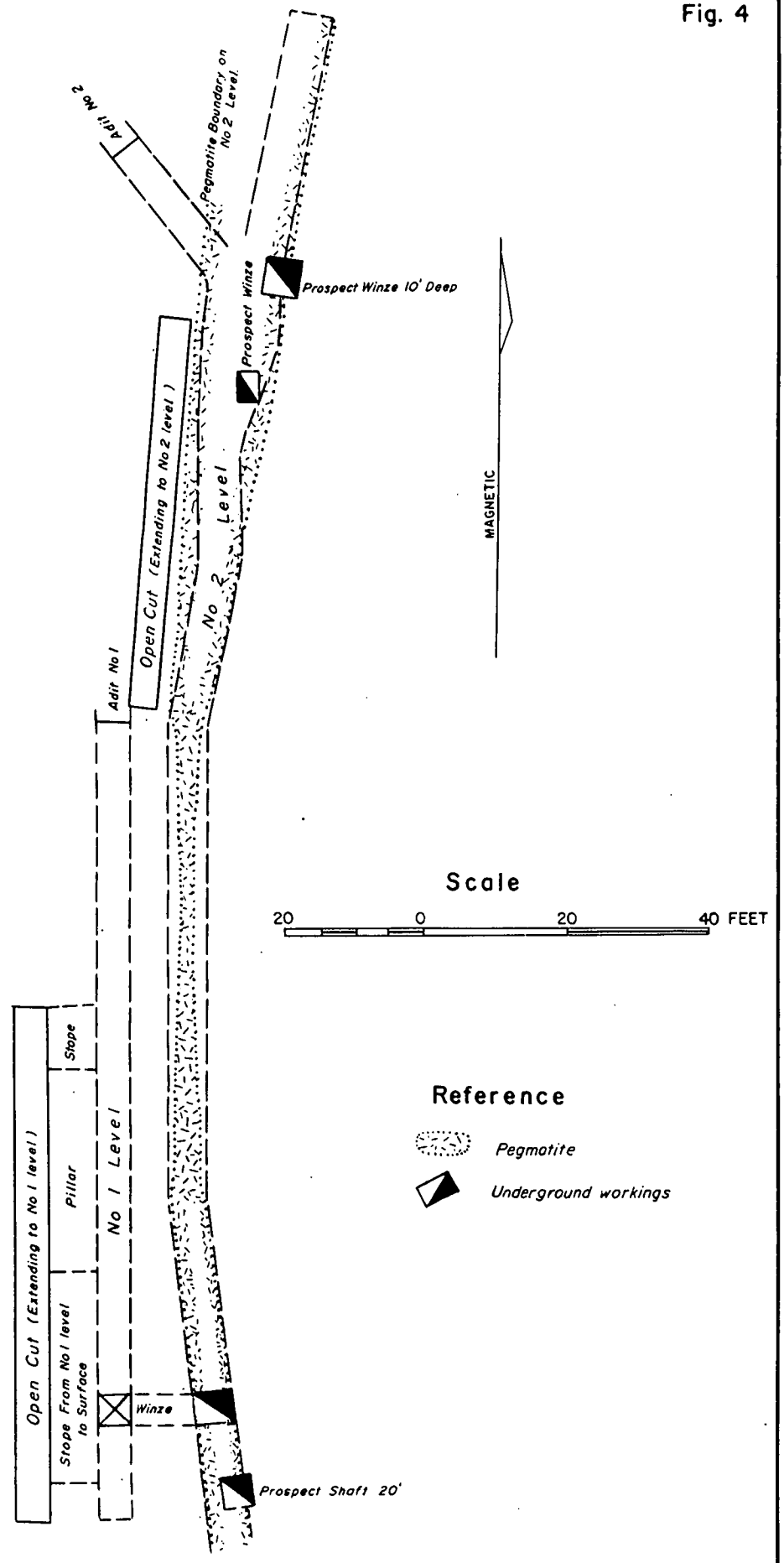
Gneiss

Strike & dip of foliations in country rock

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/15/3 JK

GD 132-C

Fig. 4



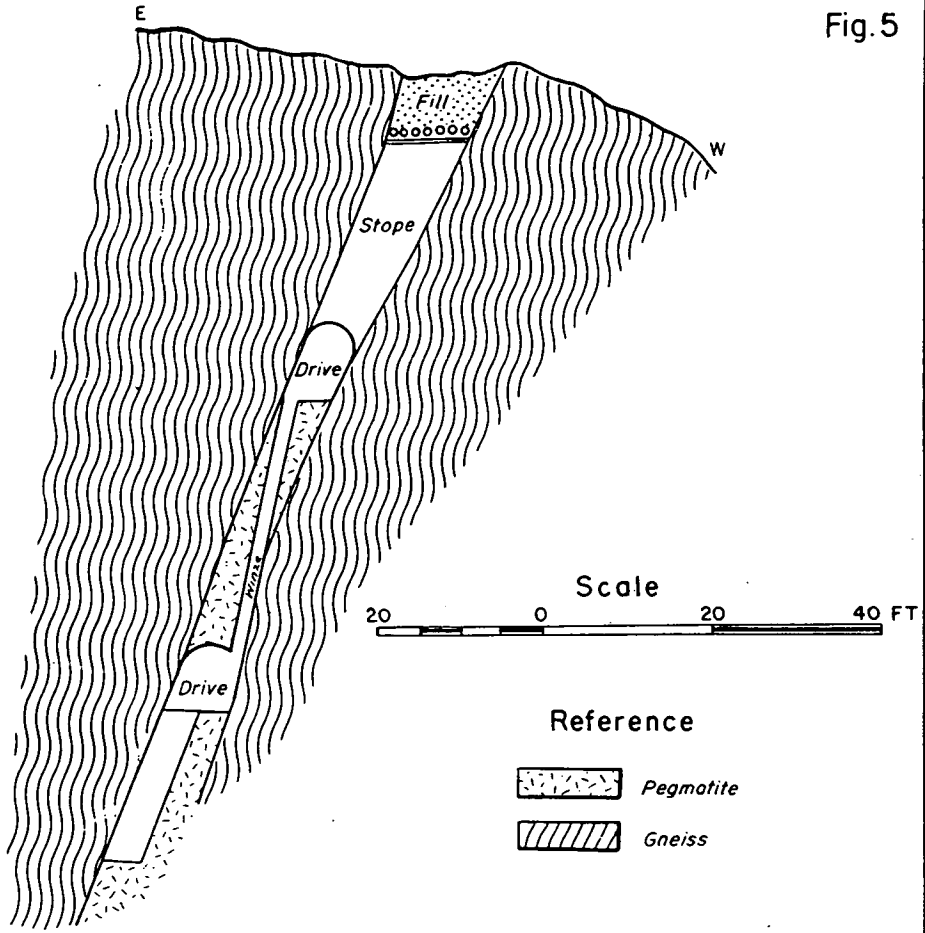
MIRROR FINISH MINE

COMPOSITE PLAN

Bureau of Mineral Resources, Geology and Geophysics. March 1962 To accompany Record No 1962/34 F 53/15/4 JK

GD 132-D

Fig.5

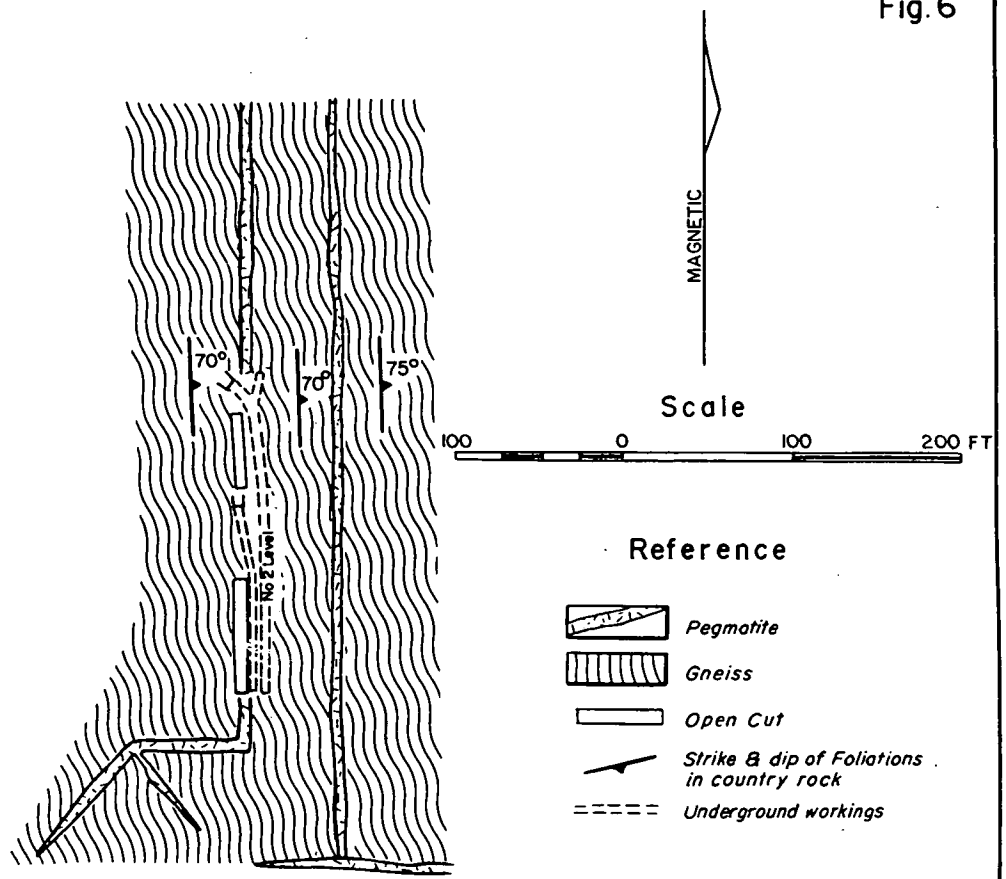


E-W SECTION THROGH SOUTHERN WINZE MIRROR FINISH MINE

Bureau of Mineral Resources, Geology and Geophysics. March 1962

GD 132-E

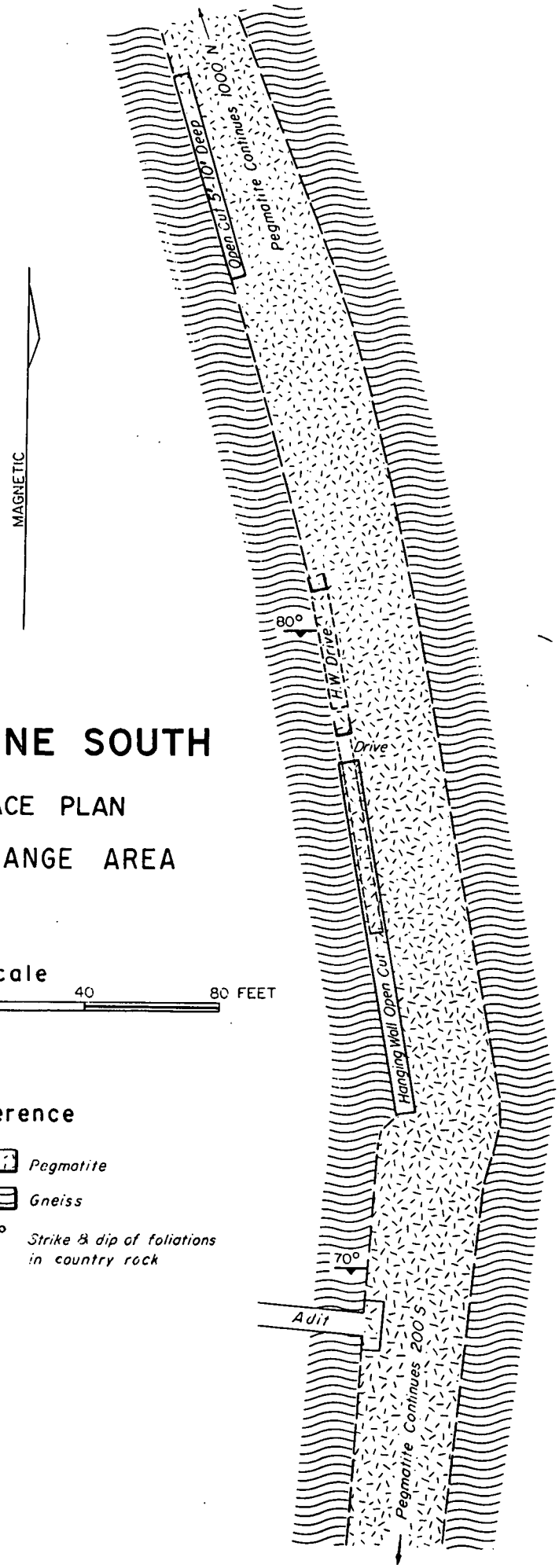
Fig.6



SKETCH PLAN-SURFACE AND UNDERGROUND WORKINGS MIRROR FINISH MINE

To accompany Record No 1962/34 F 53/15/5 JK

Fig. 7



KONG MINE SOUTH

SURFACE PLAN

HARTS RANGE AREA

Scale

40 0 40 80 FEET

Reference

Pegmatite

Gneiss

80° Strike & dip of foliations in country rock

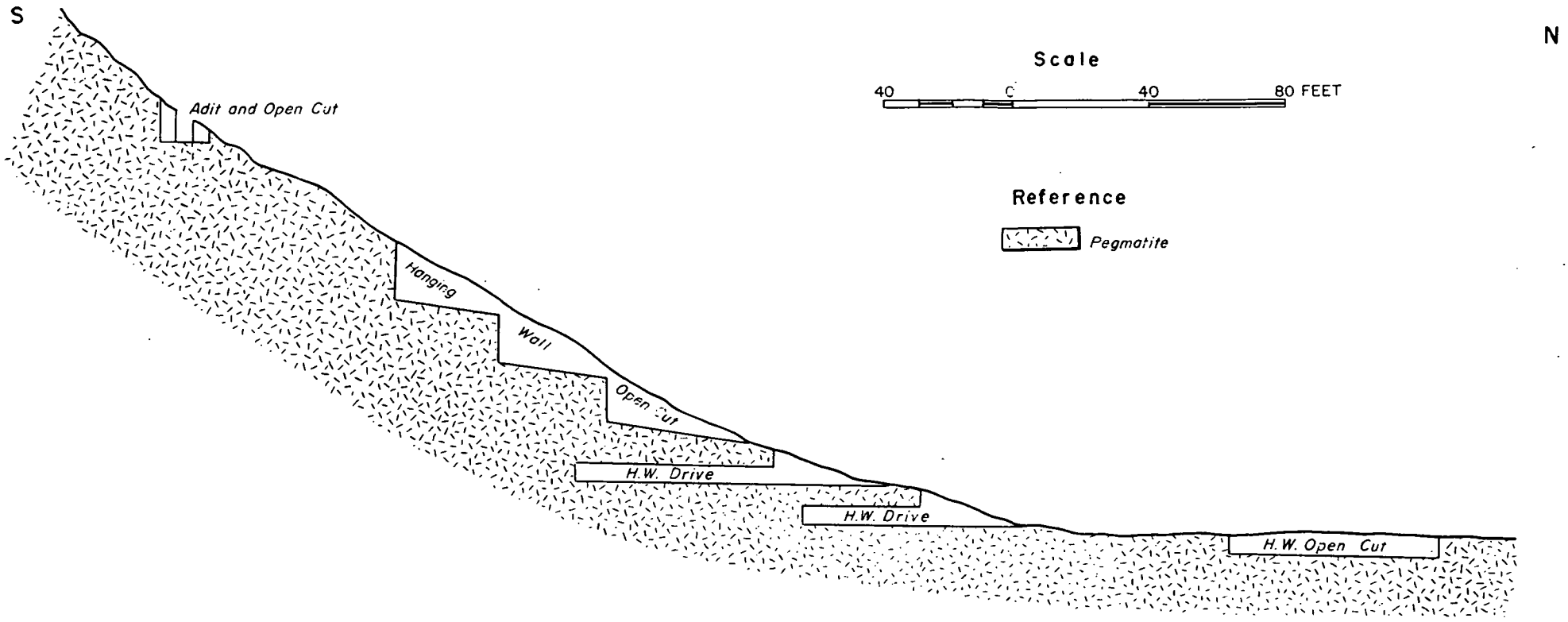
Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/14/13 JK

GD 132-F

Fig. 8

SECTION ALONG HANGING WALL

KONG MINE SOUTH



Scale

40 0 40 80 FEET

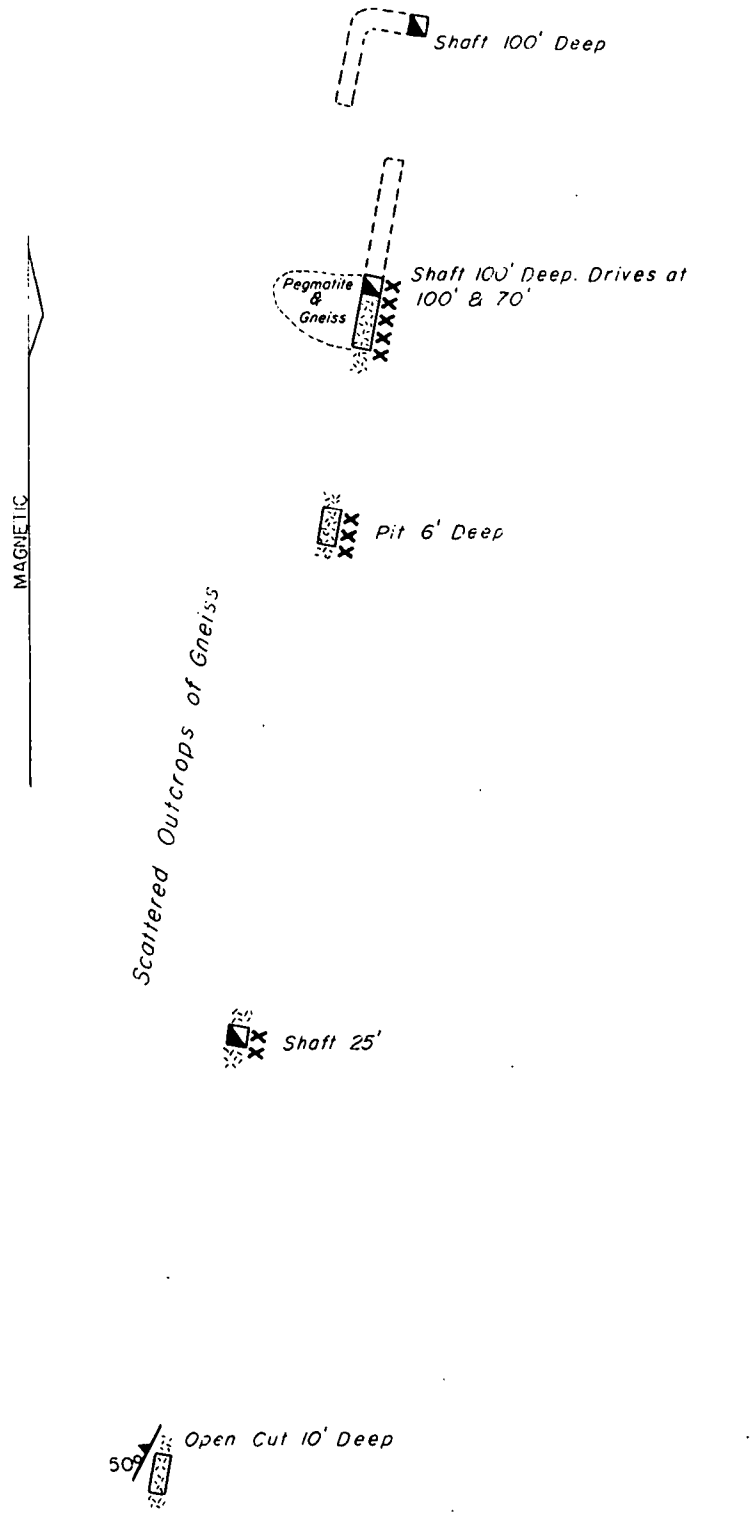
Reference

Pegmatite

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/14/14 JK

GD 132 - G

Fig. 9



KONG MINE NORTH

SURFACE PLAN

HARTS RANGE AREA

Scale

60 0 60 120 FEET

Reference

Pegmatite XXX Quartz

Bureau of Mineral Resources, Geology and Geophysics April 1962 To accompany Record No 1962/34 F 53/14/12 JK

GD 132 - H

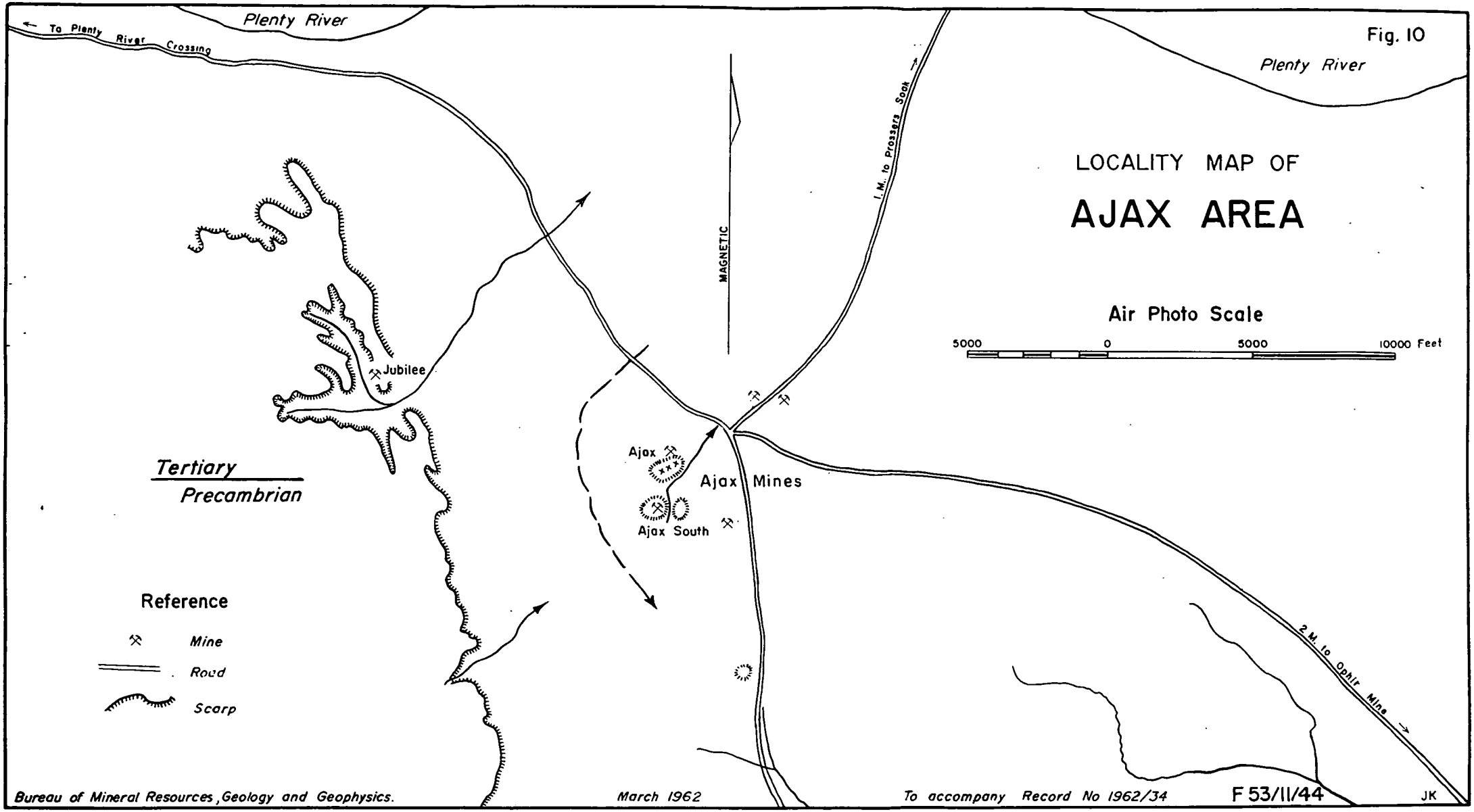
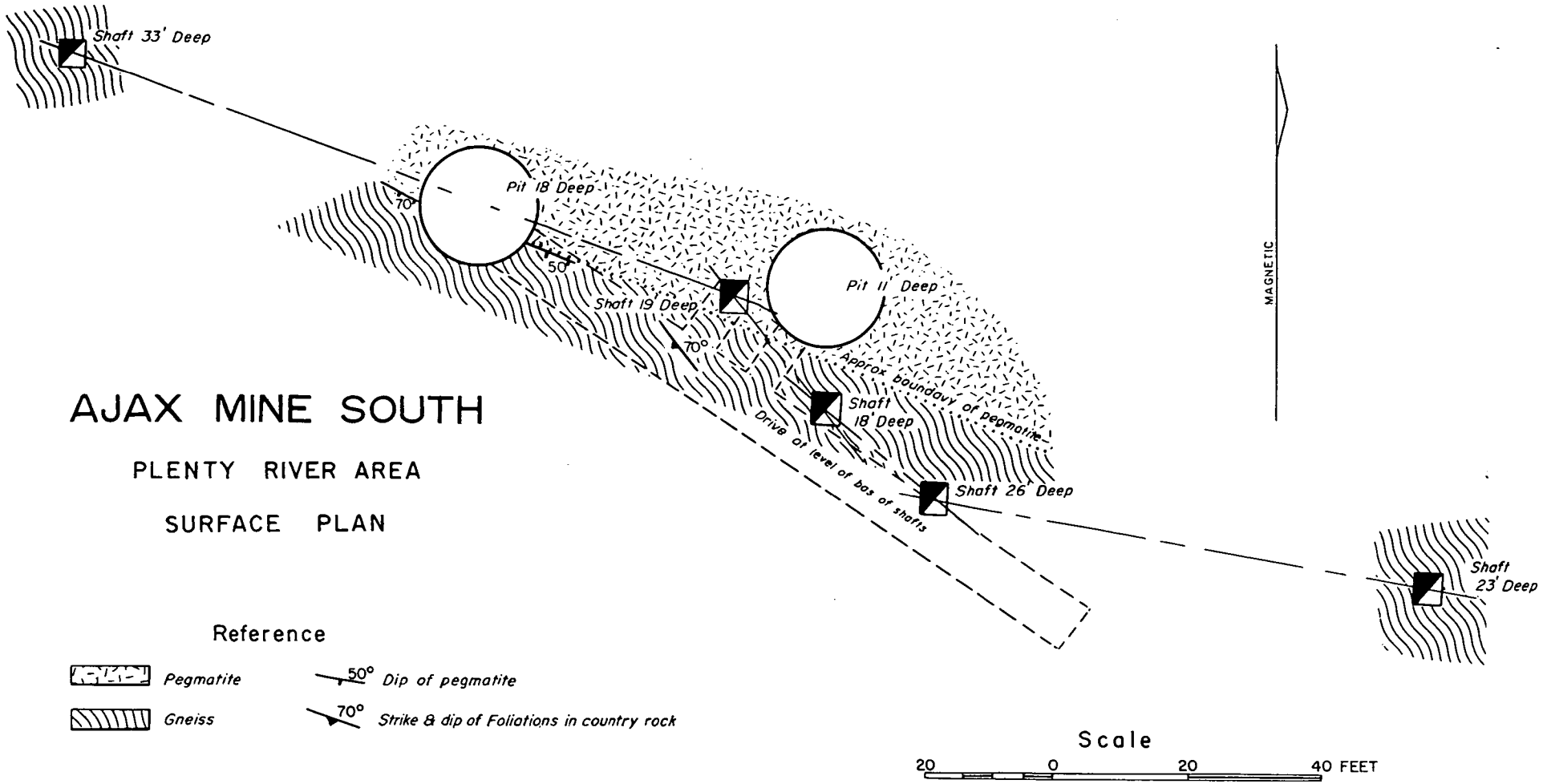


Fig. 10
Plenty River
← To Plenty River Crossing
Plenty River
LOCALITY MAP OF
AJAX AREA
Air Photo Scale
5000 0 5000 10000 Feet
MAGNETIC
1 M. to Prossers Soak →
Jubilee
Ajax
Ajax Mines
Ajax South
Tertiary
Precambrian
Reference
Mine
Road
Scarp
2 M. to Ophir Mine →
Bureau of Mineral Resources, Geology and Geophysics.
March 1962
To accompany Record No 1962/34
F 53/11/44
JK

GD 132-J

Fig. 11



AJAX MINE SOUTH

PLENTY RIVER AREA

SURFACE PLAN

Reference

Pegmatite

Gneiss

50° Dip of pegmatite

70° Strike & dip of Foliations in country rock

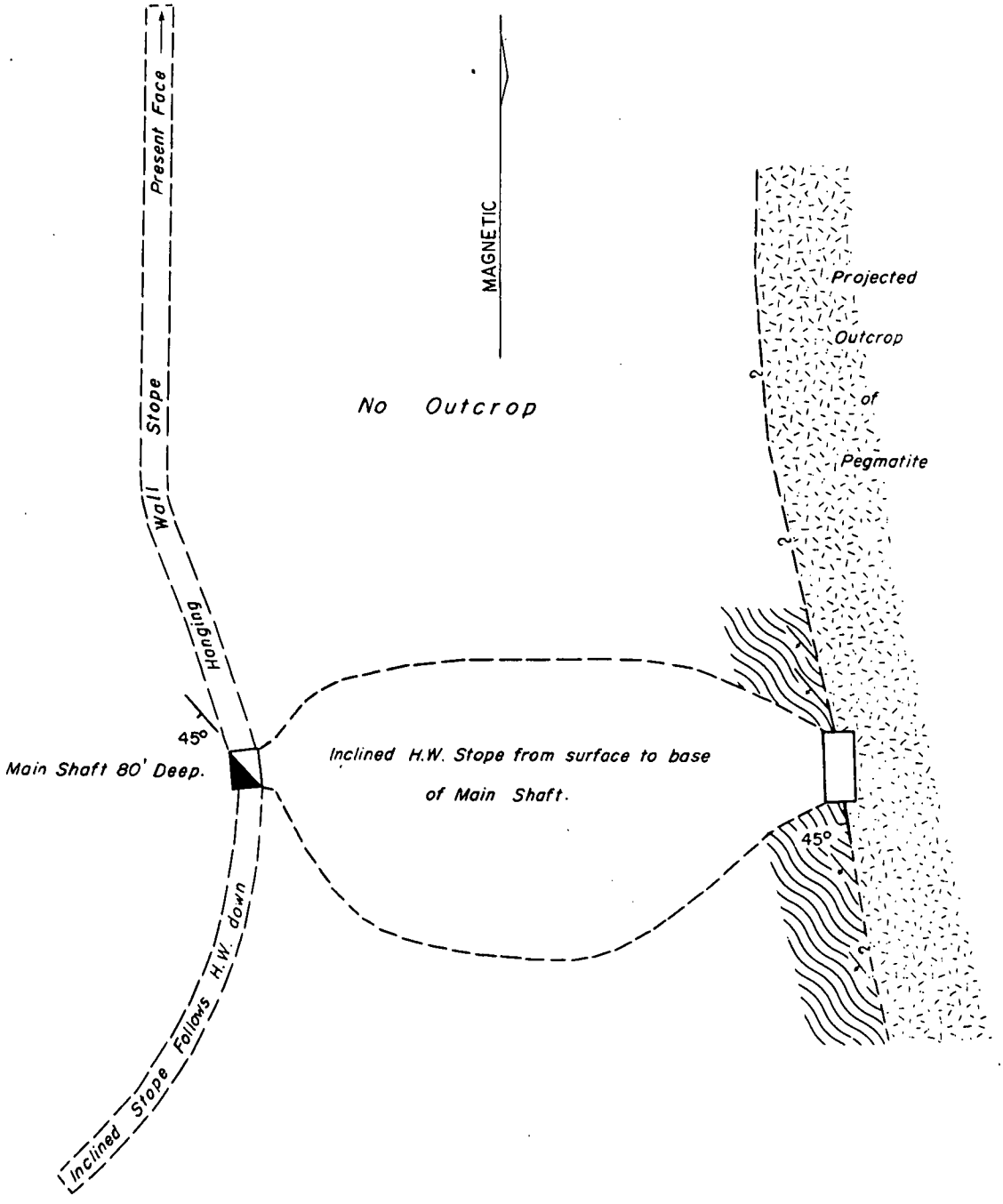
Scale

20 0 20 40 FEET

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/11/45 JK

GD 132-K

Fig. 12



OPHIR MINE

SURFACE AND UNDERGROUND PLAN

PLENTY RIVER AREA

Scale

20 0 20 40 FEET

Reference

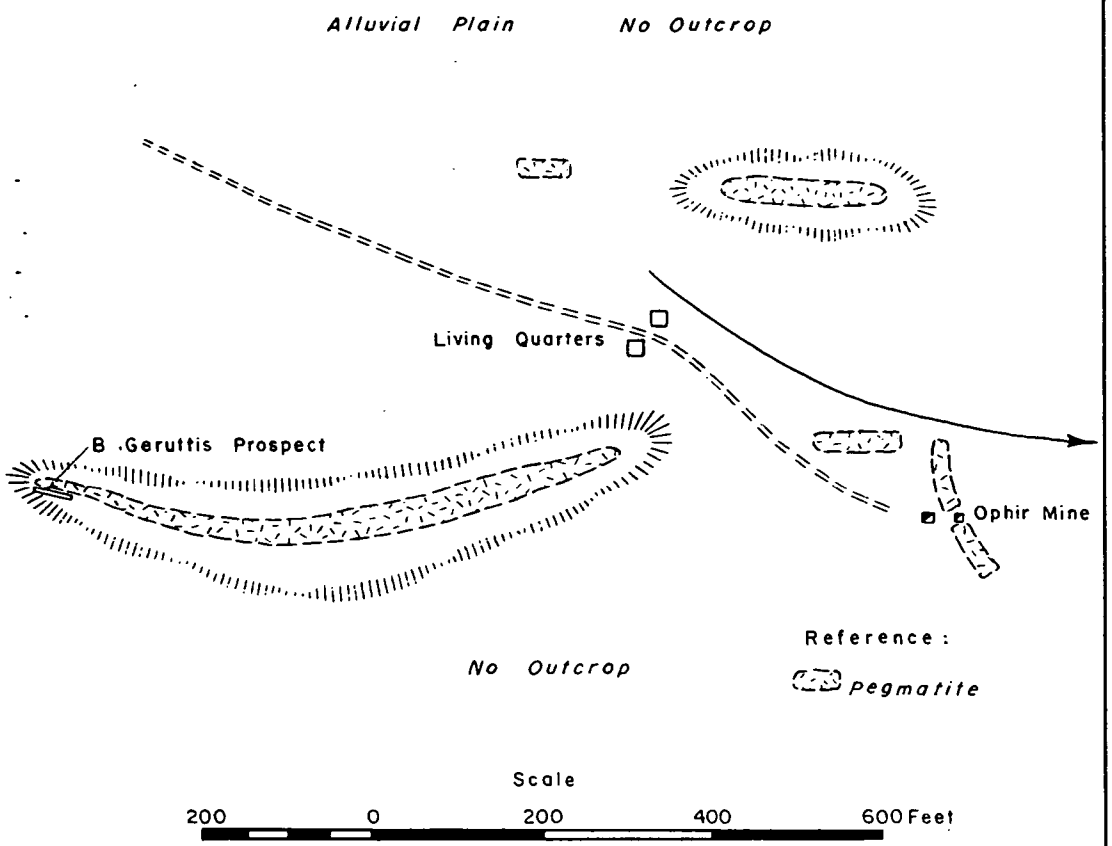
Pegmatite Gneiss 45° Dip of Pegmatite

F 53/15/6

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 JK

Fig. 13

OPHIR MINE & ENVIRONS

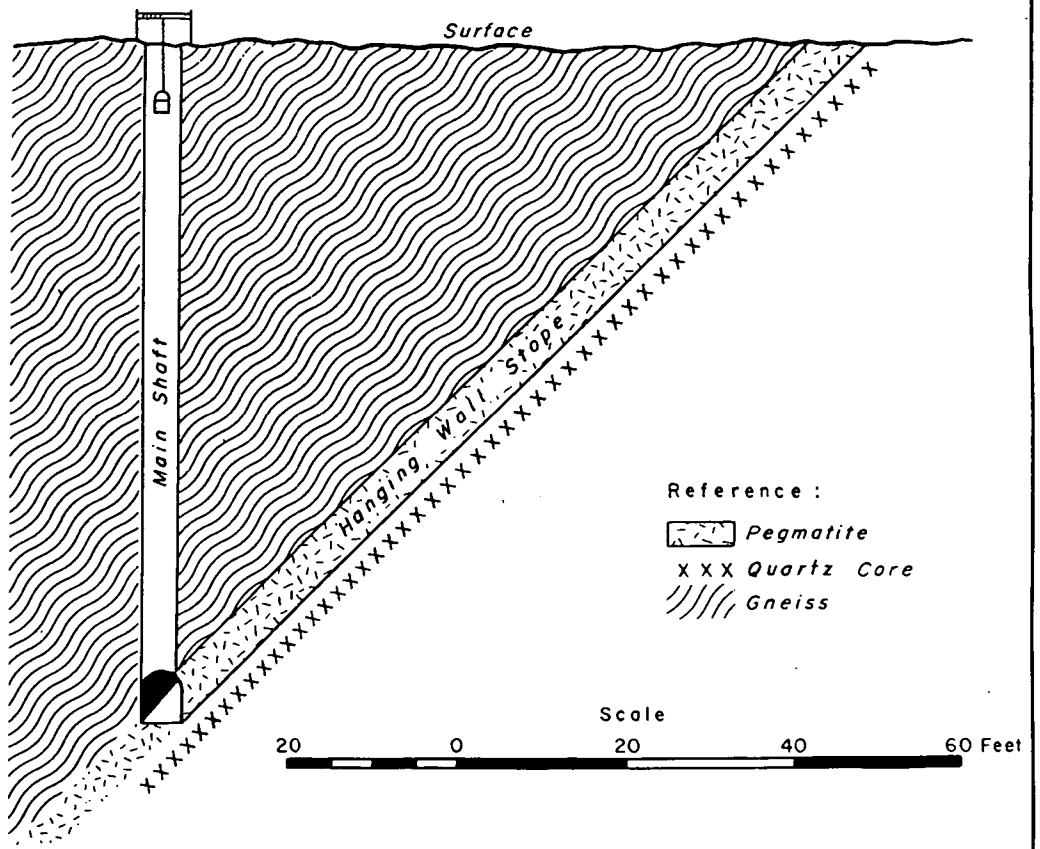


Bureau of Mineral Resources, Geology and Geophysics March 1962

GD 132 - M

Fig. 14

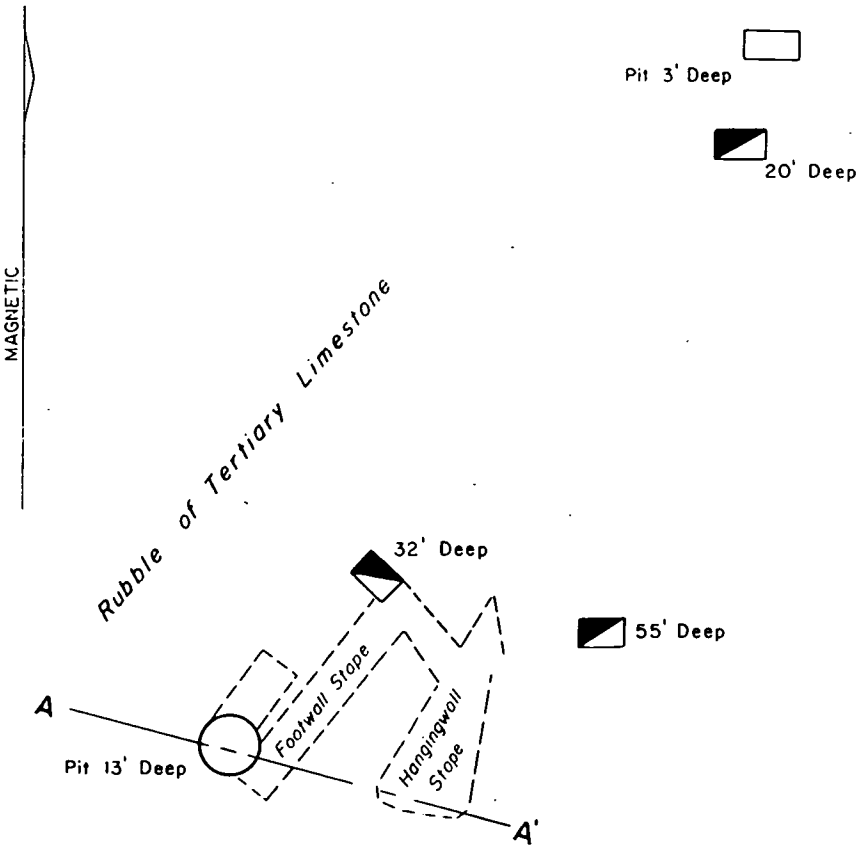
E-W SECTION THROUGH MAIN SHAFT OPHIR MINE



To accompany Record Nº 1962/34

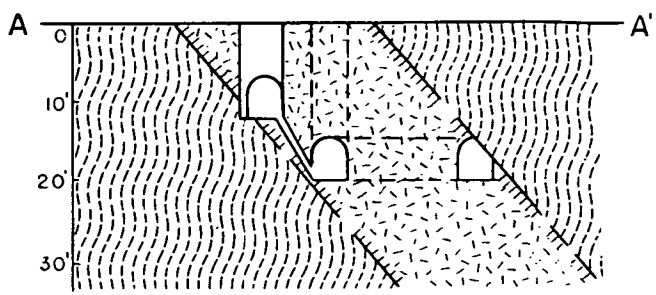
F 53/15/2 JK.

Fig. 15



Surface Plan

Vertical Section Through A A'



JUBILEE MINE

PLENTY RIVER AREA

Scale

20 0 20 40 FEET

Reference

Gneiss
Pegmatite
Shaft
Drive

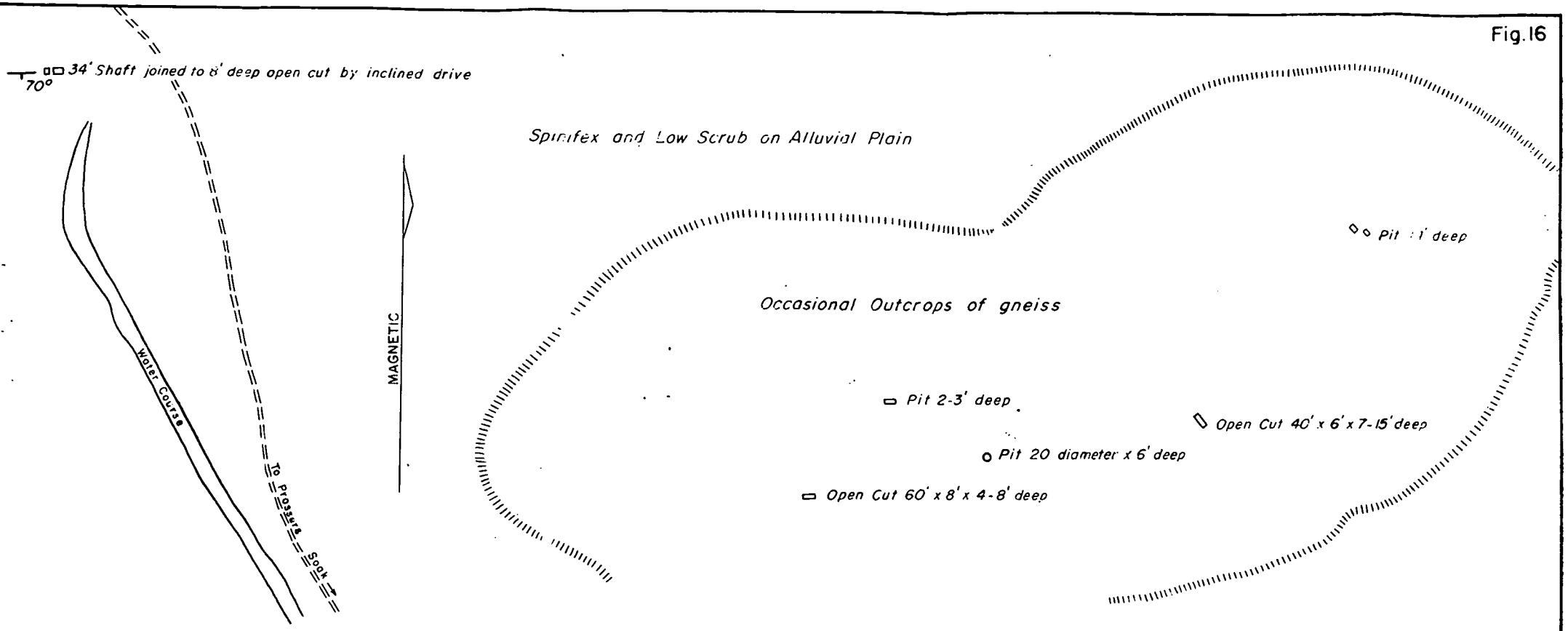
Bureau of Mineral Resources, Geology and Geophysics *March 1962*

To accompany Record No 1962/34

F 53/11/46 JK

GD132 - N

Fig.16



PLAN OF WORKINGS 1½ MILES S-W OF KING MINE

(? QUEEN GROUP)

Scale

200 0 200 400 FEET

Bureau of Mineral Resources, Geology and Geophysics. March 1962 To accompany Record No 1962/34 F 53/11/47 JK

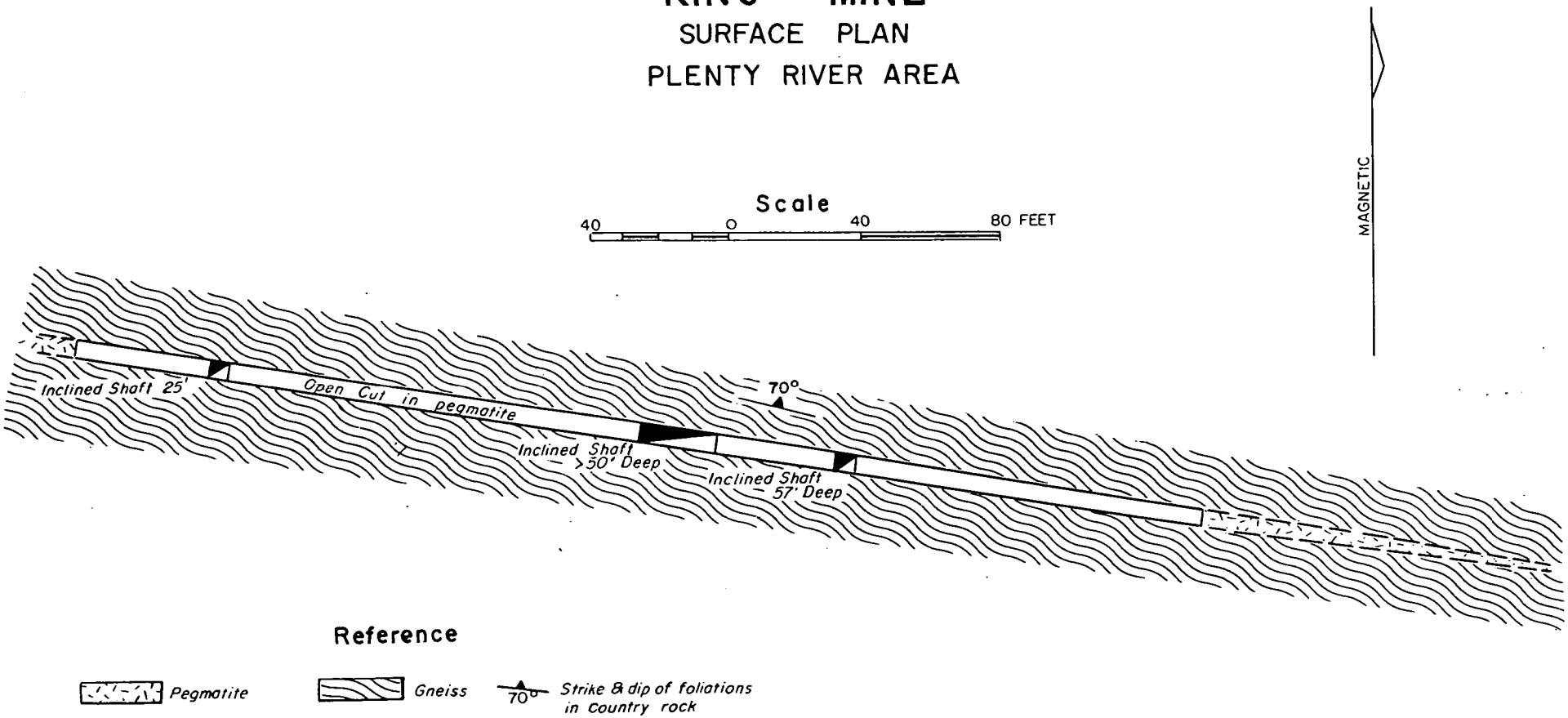
GD 132 - P

Fig. 17

KING MINE

SURFACE PLAN

PLENTY RIVER AREA

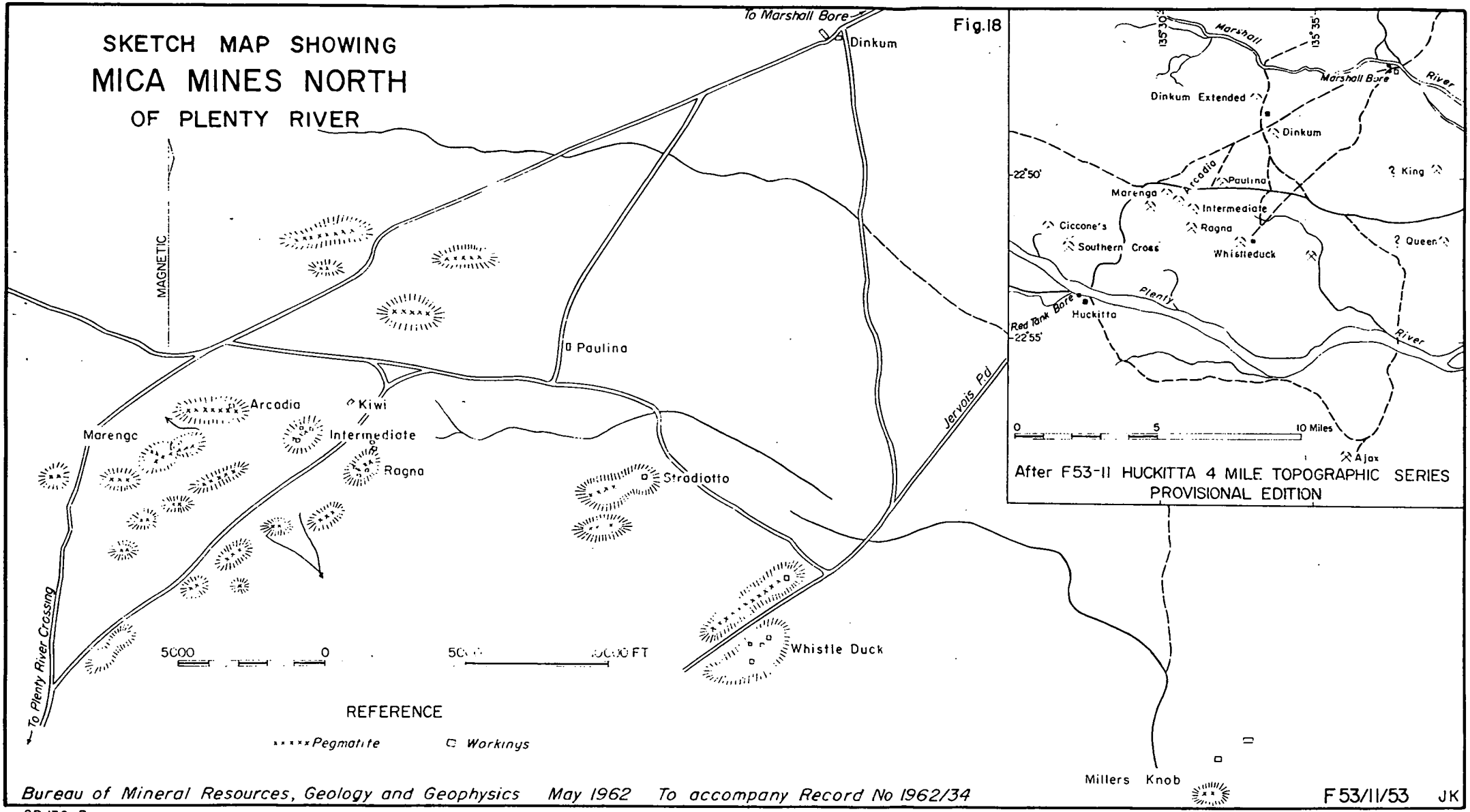


Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/11/48 JK

GD 132-Q

Fig.18

SKETCH MAP SHOWING MICA MINES NORTH OF PLENTY RIVER



Bureau of Mineral Resources, Geology and Geophysics May 1962 To accompany Record No 1962/34

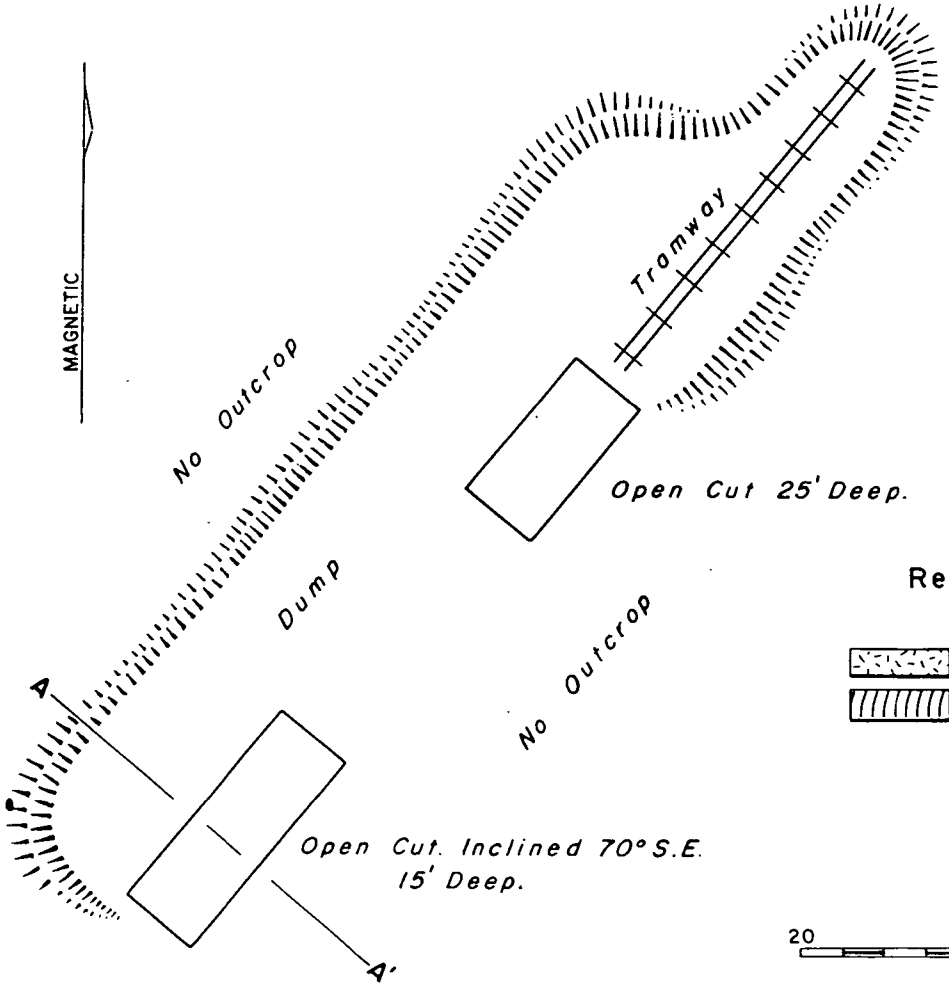
F 53/11/53 JK

GD 132-R

Fig. 19

KIWI MINE - SURFACE PLAN & SECTION

PLENTY RIVER AREA



Surface Plan

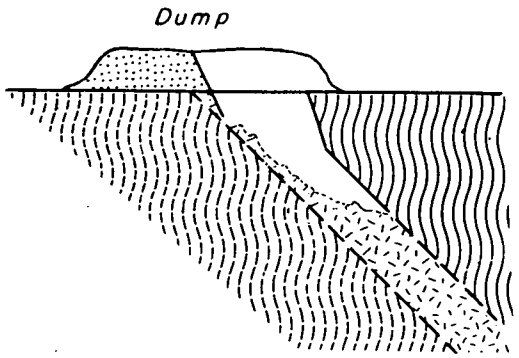
Reference

Pegmatite

Gneiss

Scale

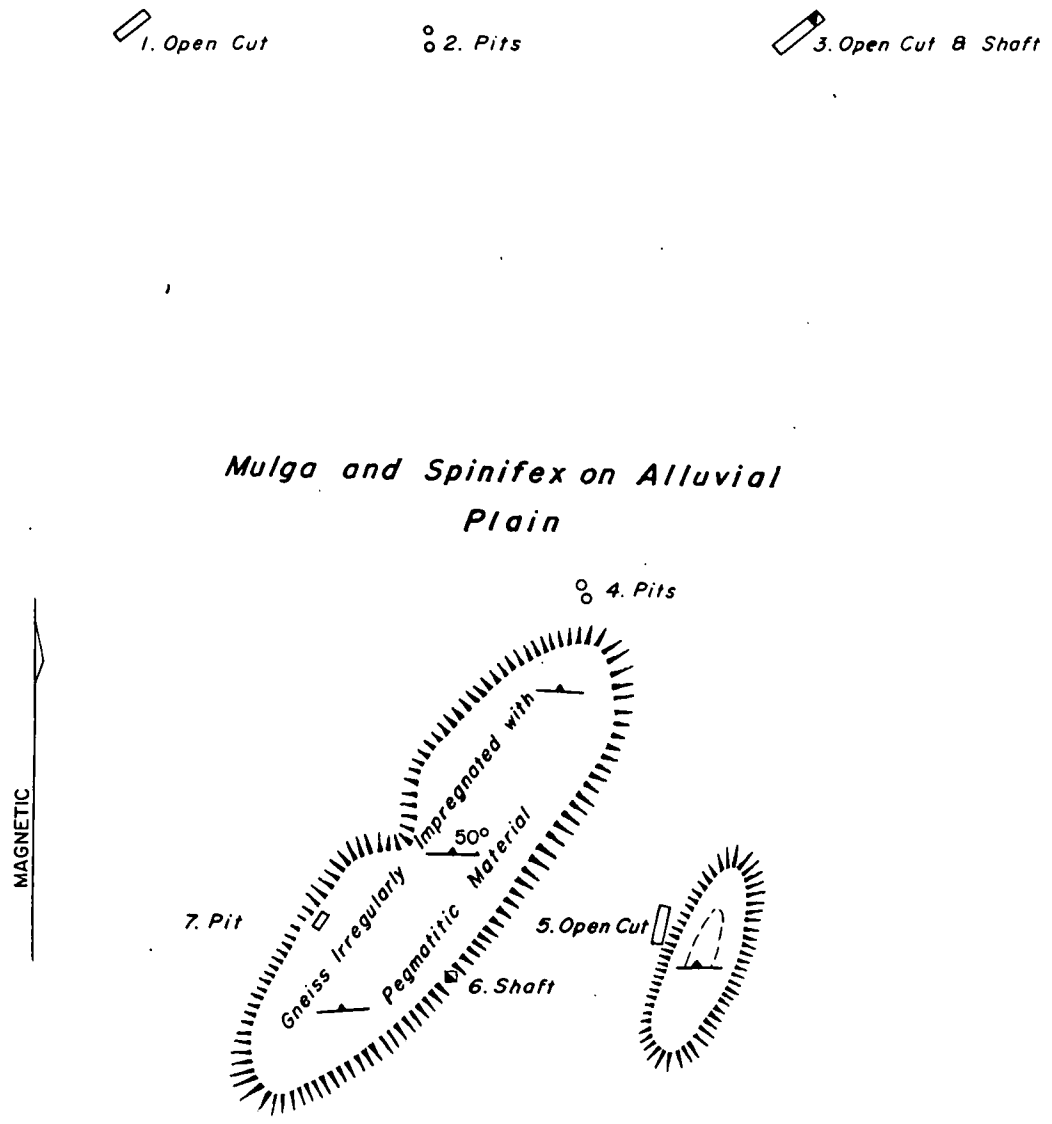
20 0 20 40 FEET



Vertical Section A.A'.

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/11/43 JK.
GD 132 - S

Fig. 20



SKETCH PLAN OF RAGNA GROUP OF WORKINGS

PLENTY RIVER AREA

Scale

200 0 200 400 FEET

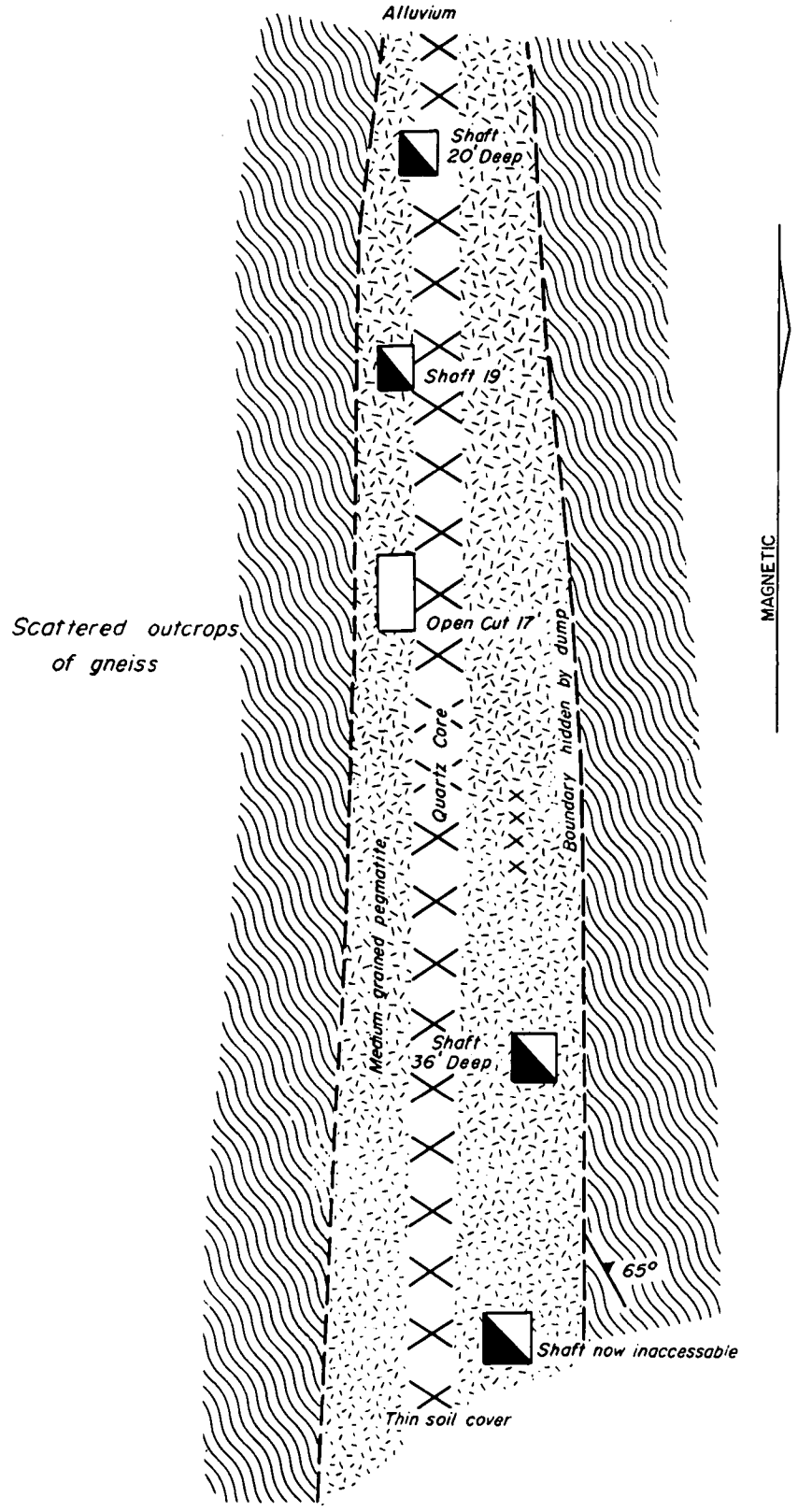
Reference

Strike & dip of foliation in country rock

F 53/11/49

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accomany Record No 1962/34 JK
GD 132 - T

Fig. 21



MARENGO MINE

SURFACE PLAN

Scale

20 0 20 40 FEET

Reference

Pegmatite

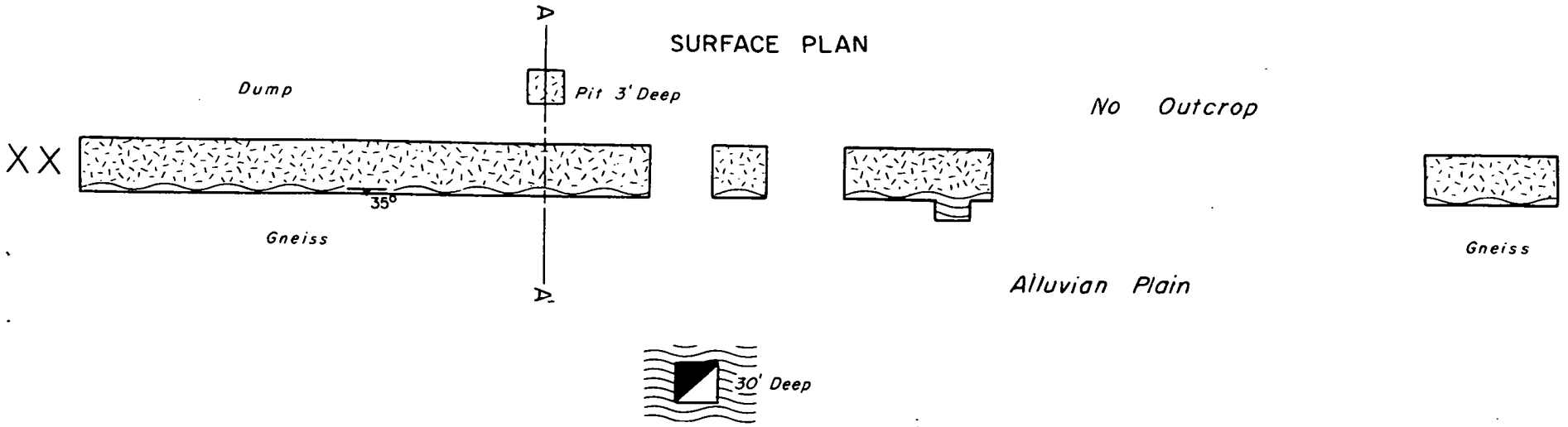
XXX Quartz

Gneiss

Strike & dip of foliations in country rock

Bureau of Mineral Resources, Geology and Geophysics. March 1962 To accompany Record No 1962/34 F 53/11/50 JK

Fig. 22

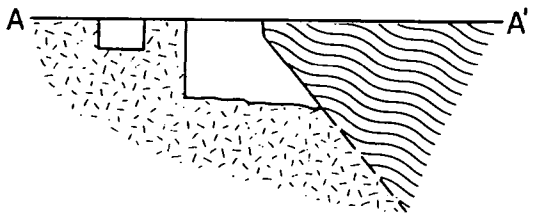


PRINCESS ELIZABETH MINE

PLENTY RIVER AREA

SURFACE PLAN AND SECTION

SECTION A.A'



Scale

20 0 20 40 FEET

MAGNETIC

Reference

Pegmatite
Gneiss
Foliation of gneiss
Open Cut
Shaft
XX Quartz Reef

Bureau of Mineral Resources, Geology and Geophysics March 1962 To accompany Record No 1962/34 F 53/11/51 JK

GD 132 - W

Fig.23

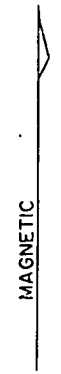
SKETCH MAP SHOWING

MILLERS KNOB MINES

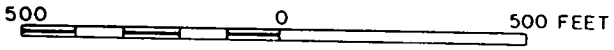
PLENTY RIVER AREA

Gidyea Scrub on Alluvial Plain

Occasional Outcrops of Gneiss

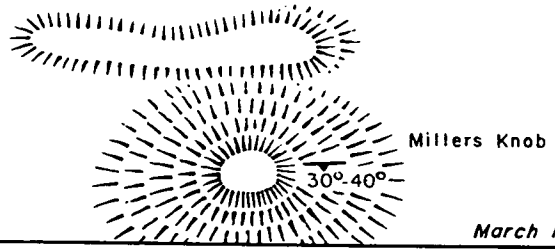


Scale



Reference

- *Foliation of Gneiss*
- XXX *Quartz Reef*
- *Pit.*



Bureau of Mineral Resources, Geology and Geophysics

GD 132-Z

March 1962 *To accompany Record No 1962/34*

F 53/11/52 JK