

9/16/62

1942/27B

CHIEF GEOLOGIST

GEOLOGICAL RECORD OF THE GREAT CENTRAL COAST AREA, ALASKA

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EXPLANATION, MAPS OF THE GREAT CENTRAL COALFIELD

GENERAL NOTES

INTRODUCTION

The Great Central Workings were first examined in company with Mr. C. Fisher and Mr. F. P. Green on Sunday, July 12th. The surface and underground workings were mapped on July 16th and 17th, with the assistance of Mr. F. J. Maiting of the New South Wales Geological Survey, whose co-operation is appreciatively recorded. Mr. A. Hodge acted as guide while mapping was being carried out and furnished much useful information with regard to the past history of the mine and the state of the various workings. A further examination was made of the surface and of the mine on August 26 - 27th. At the time of this second visit sampling had crossed fresh faces along most of the drives and crosscuts, and workings in Maitland's and West Streets not previously accessible were inspected. Results of part of the sampling and of microscopic studies of the rocks in this section by Mr. H. F. Whitworth were also available at this time.

Although the surface was mapped on a scale of 80 feet to an inch and the mine on 60 feet to an inch because existing working plans were to these scales, the final plans were prepared on a scale of 100 feet to an inch, surface and longitudinal sections, and 30 feet to an inch, underground plans and sections, in conformity with the mapping of Mount Hope.

The Great Central lode outcrops on the lower southern slopes of a rounded hill which rises some 250 feet above the general level of the western plain. This hill is situated immediately west of the main North-South highway, which passes through Mount Hope and Maitland, 3 miles south of Mount Hope, and 3 miles north of the Sydney-Maitland hill railway at Maitland. The Great workings are at the northern end of the same hill, 1 mile north of the Great Central. The surrounding country is generally flat, 750-800 feet above sea level, and covered with alluvium, except for a series of rounded hills and ridges, similar to the Great Central hill, which owe their elevation to their association with intrusive porphyry.

The dominant timber in the neighbourhood of Great Central and Mount Hope is cypress pine, which has been used very successfully in the mines. Eucalyptus and other types of small eucalypts are plentiful in the district.

Water supply depends upon the mine, and upon conservation of surface water. A large dam, estimated to contain 8 - 10,000,000 gallons at present, but not nearly full, has been excavated about a mile to the south, and two smaller dams are in existence much closer to the mine (see surface plan plate 1). The water level in the mine is about R.L. 507, 220-240 feet from the surface.

The Great Central and Great workings occupy portions 23, 24, 25, 27 parish of Mount Hope, County of Maitland.

INTRODUCTION

The lode outcrop was discovered by a prospector named McDaniel about 1873. The mine was worked by the Great Central Mining Co. from 1883-84, and from 1887-90, and by contributors around about 1897-9. These operations appear to have been mostly confined to the line of lode running from Hedge's shaft to the Blue shaft, and to smaller veins of comparatively high grade ore near Holberg's and Holman's shafts and to the Cornet workings. In August 1902 the Great Central mine was taken over by the Canadian Development Company who spent a considerable amount of money during the next 2 1/2 years, but did not achieve any considerable production. They sank a new main shaft to 516 feet depth, deepened Holman's, the last shaft, and the Blue shaft, and carried out exploratory work on the 125' and 215' levels, Holman's shaft, and the 201' level, Hedge's shaft, which was connected to the new main shaft at the 320' level. The Cornet shaft was abandoned and lowered to 200', but the timber caught fire almost immediately, the shaft was completely burnt out, and no further work was done. At the Great Central, a treatment plant was installed at a cost of \$16,000, but operations ceased in December 1902, and the machinery was sold without ever having been put into motion. No work of any consequence has been done subsequently.

PRODUCTION TABLE. (From H. C. W. Mines Department Records.)

Year	Ore Raised Tons	Copper Produced Tons	Value	Remarks
1883	1130	187	\$ 8,700	Total ore up to date 2551 tons
1884	2221	336	\$14,784	
1885-6-7				Work suspended owing to low price of copper.
1888		112		Worked 11 months.
1889	2000	304	\$15,740	
1890	1855	220		1567 tons smelted.
1891-2-3				Mine closed.
1894				\$1000 ore raised.
1895	900	134	\$ 5,093	
1896	454	55	\$ 2,195	6 months work only.
1897	1200			Mine let on tribute, \$1500 ore raised.
1898	1100	110	\$ 5,800	

Total copper output of the property (G. C. W. Mines Dept. Mines, Page 220) amounted to 2170 tons of refined copper.

WORKINGS

The position of the shafts, Camps etc., including the Cornet section, the outcrop of the lode, and general geological details are shown on the surface plan, (Plate 1), scale 100 feet to an inch. The principal workings along the Blue shaft and Hedge's shaft sections, which will be referred to in this report as Hedge's lode, and on the Cornet lode, are shown on the longitudinal sections (Plate 9) also scale 100 feet to an inch. Details of stoping and of the Cornet workings on the longitudinal sections are taken mainly from a prospectus issued in 1900 and containing an array of romantic statements, so no responsibility can be taken for their accuracy, but they have been checked as far as possible from available reliable

knowledge. The principal accessible workings are driven and cross-cut through the main mineralized formations on the 115' and 215' levels, and these are shown in detail on a scale of 30 feet to an inch on Plates 2 & 3, together with the more important of the other workings. As the water level in the mine is about 240 feet, the 291' level could not be examined.

Five sections (Plates 4, 5, 6, 7 & 8) all on the scale 30 feet to an inch have been drawn through the workings. The position of the section lines is shown on the underground and surface plans. Some confusion exists on old plans with regard to the levels, as their depth from the surface has been measured down different shafts according to the section from which work was commenced. To clear up this point: the 215' and 115' levels, McKensie's shaft, are the same as the 172' and the 72' levels, West shaft; the 291' level Hodge's shaft is the 300' level Main shaft. The level of driven near Hodge's shaft has been measured from the collar of Hodge's shaft, and those of the Blue shaft from the collar of the Blue shaft.

The principal shafts on the property are:

New Main shaft, depth 516 feet vertical.
Hodge's Main shaft, depth 307 feet, underlies slightly to West.
Blue shaft, depth 332 feet, underlies slightly to West.
West shaft, depth 176 feet, underlies slightly to West.
McKensie's shaft, depth 223 feet vertical.
Connet shaft, depth 242 feet, underlies slightly to West.

All these shafts appear to be in reasonably good order except the Connet. The Main shaft is a particularly well-found, three-compartment shaft, net dimensions 5 by 14 feet, and should be very suitable for ore haulage. The other shafts are mainly two compartment, with McKensie's in the best condition.

GENERAL GEOLOGY

The ore bodies of the Great Central area are situated in or immediately adjacent to a mass of intrusive quartz-feldspar porphyry, one of a series which form prominent knobs and ridges just west of the main road, along a meridional strip of country parallel to the general orientation of the sedimentaries which they intrude. (Refer to report and map by A.C. Lloyd, Annual Report Dept. of Mines N.S.W. 1937, p. 121). The sedimentary rocks, slates, phyllites, sandstones and cleaved sandstones, have a persistent north-south strike, dip very steeply wherever observed, and are probably of Silurian age, identical with the Selkirk series. They are exposed just east of the Great Central hill, and in a quarry 600 to 700 yards southeast of the mine, and also as inclusions in the porphyry.

Surface mapping in the vicinity of the Great Central and Connet workings differentiates rhyolite, rhyolitic contact breccia, and porphyry. The rhyolite outcrops as a massive siliceous igneous rock over a considerable area west of the Connet workings. It weathers in granitic fashion, exfoliation is common, and large upstanding fragments with a sub-rounded upper edge are typical. On smooth faces a coarse brecciated structure is discernible and it is probable that brecciation preceded the intrusion of the later quartz-porphry, and that partial refusion by the heat attendant upon the actual intrusion, together with the accompanying silicification, cemented the fragments together. Examination in thin section confirms the brecciated character of the rock. Phenocrysts of quartz and feldspar are plentiful.

The rhyolite was not observed in direct contact with the sedimentaries, as it is separated by porphyry on the east, and porphyry and alluvium to the south, but it seems from the association of shale bands and fragments with the contact breccia zone along its eastern edge that the original contact more or less coincided with this edge and that the quartz porphyry has been intruded along the junction. The constituents of this breccia zone, which are well exposed on the 115' level of the mine, have been intensely altered, silicified, and brecciated, principally by contact metamorphism consequent upon the intrusion of the porphyry. It outcrops as a long narrow strip running the complete length of the mineralised area, separating the two sections of the porphyry intrusive in the southern half, and occupying the contact of porphyry and rhyolite in the northern half. Where abutting against porphyry the contact is usually definite enough, but the rhyolite junction is ill-defined, as the contact breccia grades into the original rhyolite material. Average width of the breccia zone is about 180 feet; it tapers towards the north end past the Comet workings, and spreads laterally at the south end, to the west around the nose of that section of the porphyry. (See Surface Plan, Plate 1). Outcrops south and southwest are lost beneath alluvium.

The breccia zone underground is seen to consist of brecciated porphyry near the contact, rhyolite and rhyolitic tuff, with inclusions of shale, all more or less brecciated. The rhyolite here has not the massive character of the outcrop in the northwest sector but is fine-grained, with thin banding and definite flow structure, often minutely folded and contorted.

This banded rhyolitic material reaches its maximum development on the 115' level, where it occupies a peculiar bulge into the porphyry contact, (See Sections A-A' and B-B', Plates 4 and 5), and its dimensions decrease rapidly in depth. It was not definitely observed on the 215' level, though it may exist east of the workings. On the surface it is not possible to differentiate between the various constituents of the breccia zone except that the banded structure of the rhyolite is sometimes preserved in the silicified outcrop, and buffaceous phases are common.

The main quartz-felspar porphyry intrusion is divided into two sections by the breccia zone referred to above. The eastern section, the main body of the porphyry, is an elongated mass, from 700 to more than 2000 feet in width, with its eastern boundary nearly parallel to the strike of the adjacent sedimentaries. The western or mineralised section is probably sub-rectangular in shape, about 750 long by 4 - 500 feet across. Apart from the section between the surface and the 115' level, the porphyry contacts dip very nearly vertically wherever observed. Lamination due to shearing is not uncommon in the porphyry near the margin, and in most observed cases dips steeply to the west. Following is a description of the various rock types in this section, by Mr. H. F. Whitworth of the U.S.W. Dept. of Mines.

PETROLOGICAL NOTE ON ROCKS

FROM GREAT CENTRAL MINE, MOUNT HOPE.

No. 1. 215' Level

Quartz-felspar porphyry

A dark grey aphanitic rock, seen, under the microscope, to consist of a siliceous re-crystallised groundmass rich in chlorite material, and containing typically corroded phenocrysts of quartz, "ghosts" of former felspar crystals entirely altered to sericite, and chlorite pseudomorphs of some ferro-magnesian mineral, possibly hornblende.

Veinlets of secondary quartz are plentiful.

No. 2. East end 115' Level drive

Banded Rhyolite

A dark greenish grey aphanitic rock with a well marked banding and containing specks of sulphide minerals.

Under the microscope it is seen to be made up of alternating wavy layers of finely crystallised quartz, chlorite and stony material. A few apparent phenocrysts of quartz and chlorite are present.

It is probable that this rock represents a highly altered rhyolite, and that this banding is due to flow structure and not to schistosity.

No. 3. 115' Level, contact material

• Breccia

The two specimens A and B are so similar that separate descriptions are not necessary. They are dark grey in colour and their brecciated nature is clearly visible in hand specimen, some of the fragments being up to $\frac{1}{2}$ " in length.

Under the microscope most of the larger fragments are seen to consist of a slaty rock but many fragments of porphyry and altered rhyolite are present. The interstitial material is fine-grained, and for the most part siliceous, but chlorite is abundant, chiefly segregated into patches. Some quartz crystals, probably phenocrysts from either rhyolite or porphyry are present, and veinlets of secondary quartz are not uncommon.

No. 4. 115' Level, near wing in main crosscut.

Rhyolitic Tuff

This rock is dark greenish grey and aphanitic. It is highly altered, but appears to be a rhyolite tuff.

No. 5 & 6. Outcrop 1000' N.E. of Great Central workings.

Rhyolite

The sample submitted for comparison with the original No. 1 specimen differs in detail from it, but has some similarity in general appearance. The second rock submitted is a mottled aphanitic rock with easily seen phenocrysts of quartz and feldspar. The colour is dirty white, streaked and mottled with dark greenish grey.

The two sections were prepared for microscopic examination and one of these proved to be a typical rhyolite consisting of a devitrified groundmass showing distinct perlitic cracking, containing phenocrysts of corroded quartz, hornblende and sericitised feldspar and the chloritised remains of some ferro-magnesian mineral. The groundmass has been altered from its original vitreous condition into finely crystalline quartz and sericite, but shows little sign of having undergone much secondary silicification. A slight amount of mylonizing is visible in some of the quartz phenocrysts.

The second section cut includes portion of one of the darker portions of the rock and is made up principally of rhyolite, differing from the first slide in showing no perlitic cracking, and having recognisable flow structure and spherulitic structure.

The dark material consists mainly of secondary chlorite containing a large number of sub-parallel lath shaped crystals of highly altered feldspar in parts, and larger crystals and fragments of feldspar and quartz elsewhere. The dark material therefore probably represents altered trachyte, porphyry, and possibly also fragmental interstitial filling. Some signs of secondary silicification are present.

From the varied nature of the two slides and from the assortment of material in the second, it is apparent that the rock is some form of breccia, and the term rhyolite breccia best describes the specimens examined.

(Signed- H.F. Whitworth)

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ECONOMIC GEOLOGY

ORE DISTRIBUTION

Two distinct types of lode occur in the Great Central area. The principal production in the past has come from long, narrow, steeply dipping lodges in shear zones, with the ore apparently in sheets. Hedge's lode, extending more or less continuously from south of Hedge's main shaft to north of the Blue shaft, and the Comet lode, are of this character. The Great Central Main lode, in contrast, is an elliptical stockwork, with mineralization mainly in small veins distributed irregularly throughout the mass and becoming less plentiful towards the margins, but also a certain amount of copper mineralization disseminated through the rock itself. Some of the better individual veins have been worked near the surface, as for instance, one running north from Hilberg's shaft across the present open cut, and another, shown on the surface plan as having been stopped, south of McKenzie's shaft. Sporadic mineralization also occurs outside this main mineralized area, particularly to the north, where a number of costans and shafts have been put down, apparently without any economic results.

On the east side of Central hill two shafts have been sunk; one on a narrow shear zone containing a little copper, near the porphyry-sedimentary contact, and another on a ferruginous quartz lode up to 4 feet wide, about 100 feet in length, dipping vertically and containing very low copper and gold values. Another of barren quartz 2 feet or so in width is exposed on the surface in the porphyry near the breccia contact, just north-west of the Comet workings. Apart from these two occurrences, little quartz was seen on the property.

HEDGE'S LODGE

Although it was not traced continuously on the surface, and none of the underground workings on the lode was accessible for any length, little doubt exists that the lode worked from Hedge's shaft and that in the Blue shaft occupy the same fissure or shear zone, giving it a total length of over 500 feet. It lies centrally within the brecciated area, strikes north-south, and dips almost vertically. The Blue shaft which has followed the lode down, has an inclination of 87 degrees to the west, while Hedge's shaft presumably also on the lode, has a similar incline to the east.

were examined in the Blue shaft workings down to the 115' level, the lode consists largely of laminated shaly material of the type referred to by miners as "maclin", with copper carbonates and oxides occurring in sheets. Ore width is generally less than 2 feet, but bulges occur. Apparently the best shoots were extracted during mining and the lower grade ore left as pillars or as filling in the stages.

The manager of the Option & Development Company, Mr. J. C. Armstrong, in his annual report for 1901, refers to the ore in the Blue shaft being in "floors dipping to south and east". In the shaft, about the 60' level, the hangingwall consists of hard breccia and the footwall of the laminated rhyolitic material. The association of shale with the lode is interesting, as exactly the same condition obtains in the East workings. The fissuring appears to have developed by differential movements during the intrusions and seams of shale were caught up along the fissures.

Little reliable information is available with regard to the lode in Hodge's shaft except that from this section most of the production in the early days appears to have come. Mr. Armstrong's report, referred to above, mentions a narrow seam of fair ore on the east side of the 291' level for 100 feet from the shaft. A. T. Brown's "Prospectus Report", 1900, gives the following assays, but little reliance can be placed upon them:-

HODGE'S SHAFT

Level	Position	Width	Grade	Assays	Assays
	11' N of shaft	11'	4	19	.6
	15' " " "	4'	6	23	.6
	18' S " "	23'6"	6.2	20	.4
	21' " " "	4'	6.1	20	tr.
21'	20' N " "	4'8"	4.6	14	tr.
22'	25' S " "	2'6"	6.6	19	tr.
22'	28' N " "	5'6"	7.2	6	tr.
23'	S. face of shaft	6'6"	2.7	11	tr.
264'	"	6'6"	6.6	8	tr.
282'	"	6'6"	6.6	16	tr.
303'	"	6'6"	2.4	1	tr.

No reports sulphides, with black oxide, from the 264' level down, and mentions that slugs of native copper up to several pounds in weight were being found in the bottom of the shaft at 307'.

Small steeply dipping veins were found on the surface in the porphyry near the New Main shaft and one of these was worked to a shallow depth. On the 500' level of the Main shaft a crosscut was driven west 100 feet and at sixteen feet from the shaft a 2' vein of malphides was struck and driven on 50 feet south.

Secondary enrichment in the oxidized section of Hodge's lode has probably been largely responsible for the occurrence of the commercial ore which has been extracted. This section offers no inducement to continue mining operations, especially in view of the disappointing results obtained by the Option & Development Company in their explorations during 1900-02, and while it is possible that some ore may be left in this part of the mine, it could only be considered as an adjunct to exploitation of the Main lode.

THE MAIN LODE

Copper staining is most conspicuous on the surface over an elliptical area 650 feet long in a N33-W direction, with a maximum width of 120 feet. Intensity of mineralization is greatest

near the eastern edge of the open cut, where the porphyry is covered with hard veins of oxidized iron and copper. One larger vein has been worked individually north from Halberg's shaft for 80 feet and another striking northwest-southeast just south of McKean's shaft. On the surface (Plate 1) the mineralization is entirely within the porphyry, but between the surface and the 115' level the contact retreats west at a shallow dip (sections A-A', B-B', Plates 4 & 5) and the mineralized area embraces the contact zone from above the 115' level downwards.

115' level

Unfortunately the most vital section of the 115' level (see plan, Plate 2) was inaccessible, so details of the ore occurrence have to be interpolated from other exposures and from the records. Mr. A. T. Brown's sampling of the crescent northeast from Halberg's shaft on the 115' level returned 6% Cu. over a width of 114 feet. Again little value can be placed on this figure, but the sum of the information available indicates that ore occurrence in this section is similar to that on the 235' level below.

The McKean's shaft crescent, 115' level, shows chalcopryite in veins and an irregular low grade mineralization through the porphyry, but little in the rhyolite, except for secondary copper staining along faults. Better values, (2 to 2.45% Cu) are noticeable in the drive to the west of the shaft and a vein here has apparently been stepped up to the surface. In the main crescent from the bottom of the North shaft to just south of the Blue shaft, occasional values up to 2% Cu are revealed near the contact in the contact breccia and in the porphyry, with lower values in the rhyolitic material. For 55 feet west from the contact the average value, based upon an assay plan supplied to the Mines Department, Sydney, was 3.2% Cu. West of the drive in this crescent 94 feet of sampling showed an average value of 2.65% Cu., but a persistent fracture dipping 18 degrees north forms a flat back to this drive and it is highly probable that the assay values obtained were at least partly due to deposition of secondary copper from solutions percolating along this fracture. The long southeast crescent showed low grade mineralization in porphyry throughout, averaging 1.5% Cu. The foregoing sections were very thoroughly checked sampled by Mine Corporation Ltd. and values were found to be only about one third of those shown on the old plan. Taking the average of samples over lengths corresponding to the above samples, the figures 3.2, 2.65, and 1.5 should be replaced by 1.2, 1.1, and .5% respectively. Average of McKean's shaft crescent as far as the first north caddy (see level plan, Plate 2) is only .65%.

The picture of the ore on this level according to the old assay plan was:- the main streak of undefined dimensions between McKean's and West shaft, with a broad offshoot following the contact zone north for 110 feet and an unknown distance further, but check sampling has shown that the values are very poor and irregular and that there is nothing in the accessible portion of the level which can be considered as ore. The section between West and Halberg's shaft was examined during the later visit and apart from one or two steeply dipping stringers, contains very little copper. In view of these facts it is very unlikely that any appreciable body of even 2% Cu ore exists upon the level. Mineralization east is limited by the rhyolite, which does not appear to be receptive to mineralizing solutions, and south by the contact zone, which is expected to curve around to the west in a manner similar to the surface outcrop (see Plate 1). Westward copper deposition would be defined by the intensity of mineralization dying out in the more solid porphyry away from the contact, as shown in the long southeast crescent. Apart from oxidation in some of the stronger veins, and in the immediate vicinity of faults, the copper in the porphyry and the contact zone occurs as chalcopryite, although water level in the mine is more than 100 feet below this level. Lack of oxidation may be due to the massive impervious character of the porphyry, which has not permitted active circulation of surface waters.

215' Level

The lode on the 215' level (see plan, Plate 3) could be more accurately defined, according to the old assay plan, as assays were available for the whole level, which is all in good order. One better than 2% Cu. was indicated in the drive for 150 feet and over a width in the prospect of 36 feet. Average of 12 samples embracing this section was 3 1/2 Cu. Check sampling (by Zinc Corporation) reduced this figure to about 1.6% Cu.

The mineralization occupies the contact breccia zone and percolates some 70 feet or more into the porphyry. It may reasonably be expected to extend north along the contact zone to at least opposite McNamee's shaft, and to the south should soon be cut off by the swinging around of the porphyry contact. (see Sections 3-3', 3-3' Plots 7 & 8). The chalcocite occurs as veins and stringers less than 1" in thickness and seldom persisting far in any direction. No dominant orientation of the stringers was observed, though several in the drive strike more or less at right angles across it and dip fairly steeply to the northeast. In addition to the veins, chalcocite also occurs disseminated sparsely through the porphyry in blisks or tiny veinlets. No other sulphide mineral was noticed, with the exception of some bornite in one of the solid chalcocite veins. Pyrite is recorded by the U.S. Mines Department in the primary ore, but it is not abundant in the workings on the Great Central Main lode.

Faulting is common on the 115' level, although only one of these faults was observed to persist to the 215' level. No displacements were observed, though some of the fault channels are quite conspicuously marked, and it is not known whether they preceded the mineralization or not. Apart from acting as avenues of water circulation they appear to have had little effect upon ore distribution. Secondary enrichment has not notably affected the main lode values, though a slight increase may be found in some of the oxidized ore above the 115' level.

Diamond Drill

To test the behaviour of the principal mineralized section below the 215' level a diamond drill hole was put down from a point on the surface 22 feet west of Hedge's shaft (see Plate 1), bearing 44° W of N, angle of depression 47°. This hole passed through breccia to 326 feet, where the porphyry was encountered, and at 395 feet passed out of uncontacted porphyry into slate-porphry contact breccia, showing that the porphyry boundary here dips from the surface to the north east. Specimens of mineralization were not at 204-207 feet and 250-270 feet, and the main lode formation at 311 to 418 feet, the sections averaged averaging .6% Cu. From 418 feet to the end of the hole at 611 feet, the only mineral observed in the core was a little iron pyrites. Stringers of quartz were recorded at 435 feet, 493 feet and 546 feet.

ORE GENESIS & CONTROLS

There can be little doubt that the ore-bearing solutions originated in the magma which was also responsible for the porphyry bodies. Intrusion of the porphyry was accompanied by intense shearing stress, the zone of mylonite, mylonitic tuff and slate caught up between the two main porphyry masses was brecciated, laminated and silicified, and the porphyry itself brecciated near the contact and sufficiently fractured throughout the rounded "mass" at the south end to allow at a later stage access of vein-forming ore solutions. Fracturing in the porphyry

dies away northward as stress is taken up along the contact, but southward is localized in the porphyry zone by the curving around of the igneous boundary. The principal shear plane is the nearly vertical north-south line of Hedge's and the Great Lode and of the associated zone generally. This is parallel to, and probably partly pre-determined by, the general attitude of the intruded sedimentary series. The combination of this steep fissuring with the fractured zone of porphyry, together with the known general steep dip of the porphyry contact as far as exposed in the workings, might be taken to suggest persistence in depth of the ore, but this would also depend upon the behaviour of the porphyry contact below the 215' level. If, as is not unlikely, the eastern and western portions of the porphyry should unite underground to form one continuous body, leaving the rhyolitic breccia zone as a near-surface wedge only, the mineralization would probably die out.

The Great Central Main lode appears to be typical in a small way, of the deposits of disseminated copper ores in porphyry as described by Dawson (Min. & Met. Mag., Vol. LXXV, 1927, p. 797), with the exception that development of the higher grade zone of secondary sulphides has not taken place. The genetic and structural relationships correspond very closely to his description and by analogy it would be expected that the values in depth would be low - he specifies that the copper content of the primary ore in such deposits is rarely more than 1%, and generally not more than $\frac{1}{2}$ %. The results obtained in the diamond drill hole cutting the lode formation 65 to 143 feet below the 215' level (average .6% Cu.) certainly confirm this figure. The values on the 215' level, therefore, which, though only about half that calculated from the earlier assays, are still the highest in the main lode, must be regarded as a primary sheet due probably to structural relationships favouring more complete fracturing of the porphyry around at that horizon. No chalcocite or other evidence of secondary sulphide enrichment was observed.

ORE RESERVES

Accepting the old assay figures, and allowing a length of 200 feet and a minimum width of 30 feet on the 215' level, and a conversion factor of 14 cubic feet per ton, estimation of ore, mainly sulphide, between the 215' and the 115' levels, amounted to 100,000 tons of nearly 5% ore, or 1000 tons per vertical foot. On this basis a sampling programme was recommended and carried out, and a diamond drill hole put down to test the lode formation below the 215' level. The results, which have been discussed earlier, have been disappointing and have proved conclusively that no large body of commercial ore exists.

The mineralized section of the drill hole averaged only .6% Cu. and the 215' level 1.0% Cu. No reliable figure is available for the 115' level. With regard to the surface, the general manager F.C. Armstrong, in his Annual Report for 1901, records that 7135 tons removed from the main open cut averaged 1.78% Cu., and was picked to 2030 tons averaging 4.46% Cu., and 5100 tons discarded at .701 % Cu. This tonnage accounts fairly well for the whole of the open cut, not all of which is in the mineralized section, so it might be assumed if these figures were accurate that the bulk value of the outcrop would be nearly 2%, but in view of the unreliability of the early underground samples and their consistent exaggeration of values, one hesitates to believe that the method of dump sampling adopted was any more accurate, so that little weight can be given to this figure.

Channel samples cut by Zinc Corporation Ltd. along the north side of the open cut averaged only .3% Cu.

A.F. Brown's average values of 5% Cu. for 114 feet of greenstone on the 115' level from the bottom of Malberg's shaft, and 4.1% Cu. across 44 feet of surface outcrop 30 feet north of Malberg's shaft, are abnormally high.

THE COMET WORKINGS

The Comet lode is a typical fissure vein dipping 60 degrees west to vertical, striking 8 degrees east of North and exposed for a length of over 500 feet. Its width is usually 1 to 3 feet, and it is characterized by the presence of a little shale caught up in the porphyry along the fissure. The strike of the lode is more or less a continuation of the direction of the contact breccia zone, which branches off to the northwest at an acute angle and appears to die out not much farther on. A smaller vein to the Comet, evidently a branch or parallel vein (see surface plan, Plate 1) is exposed on the surface and has apparently been worked underground. Mineralization seems to have been in sheets, as with Hodge's lode. Levels were driven at 44' (adit level) 90' 150' 180' 230' (see longitudinal section, Plate 2). None of these is now accessible except the adit as far as the drift. Mineralization observed consists mainly of green carbonate minerals; malachite and pyrite were identified in a siliceous fragment on one of the dumps. The following information is taken from Mr. A. T. Brown's Prospecting Report. All statements regarding values and widths should be duly watered down.

Comet Shaft: Depth. 240', slight underlie west.

Adit Level: (44'); driven about 400' south of shaft in oxidized ore and partially stopped to surface. At the south end of the drive a crosscut 60' west proved two parallel veins of ore up to 3' in width. These have been driven on about 200' and a good quantity of ore taken out.

90' Level: Driven north about 60' and south about 335'; ground overhead partially stopped up to 10' in width; crosscut 60' wide at south end of level cut parallel veins of ore as in adit level, which have been partially stopped.

150' Level: Driven north about 140' and south 250'; ground overhead partially stopped. Face of the north drive is small and poor. At 150' south of the shaft a crosscut was driven west 94' to a parallel vein which has been driven on south 90' and partially stopped overhead. About 10' south of the crosscut a blaze has been sunk 70', from which very good ore (black oxide) is said to have been won.

180' Level: Driven north about 150' south 60'; partially stopped overhead 5 to 6 feet wide. The ends of the drive are poor and in hard rock.

230' Level: has been worked 30' north of the shaft. Lode in face said to be sulphide 6' wide averaging 8% Cu. This level is under water.

Like Hodge's lode the Comet lode could only be considered worthy of attention if the Main Grant Central lode had justified the recommendation of mining operations. In that case examination of the workings might have revealed sections of variable ore, or indicated lines of exploration.

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The Great Central as a potential copper producer offered the following advantages:

1. Cheap mining costs.
2. Probable cheap milling, as concentration appeared to be merely a matter of separating chalcocite from porphyry.
3. Comparatively little development would have been necessary to put the mine into production.

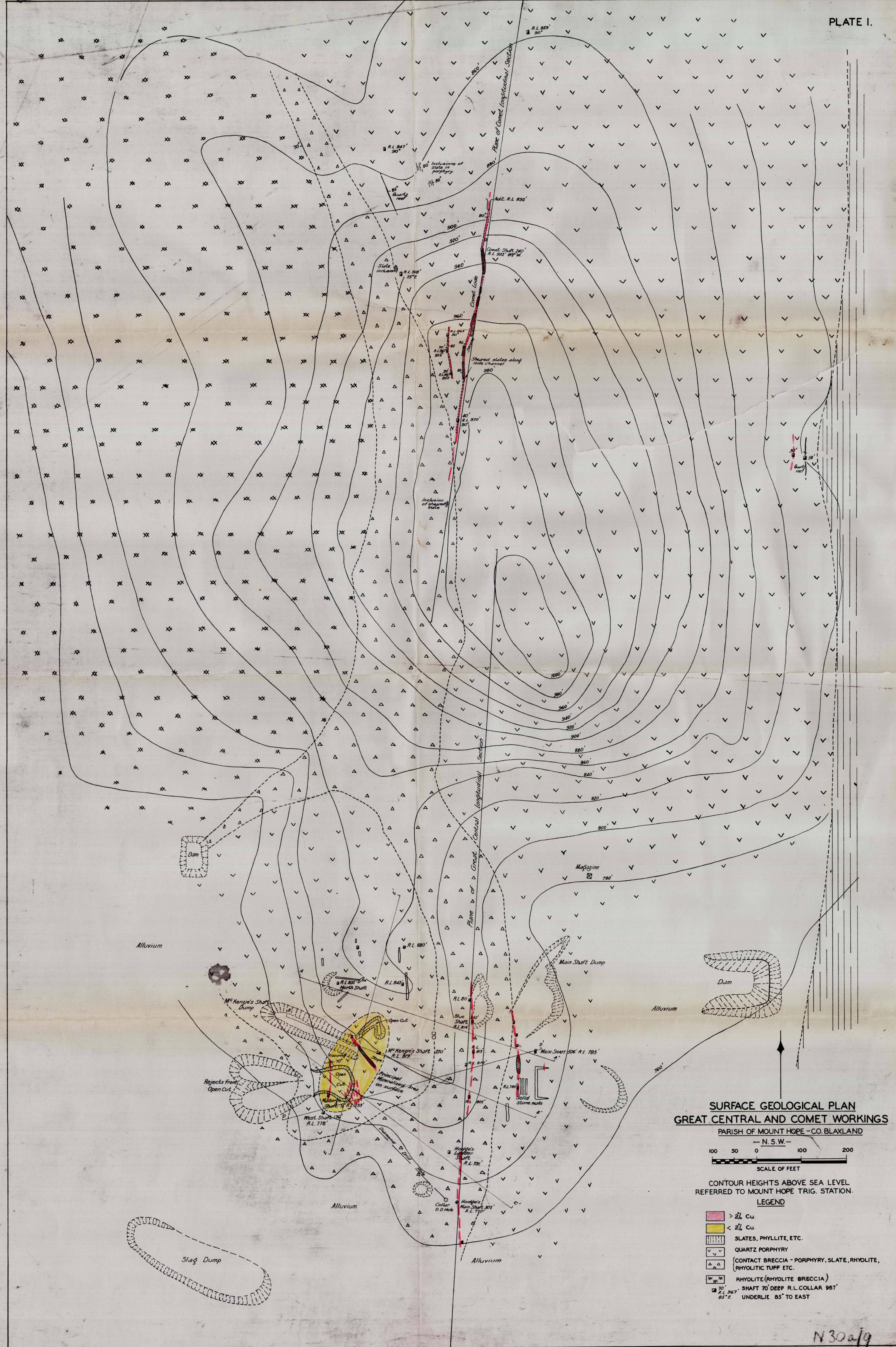
However, as the diamond drill showed no values and underground check sampling failed by such a wide margin to confirm the original figures, and the probable grade of ore which would be realized by any large scale mining operation has dropped as a result, from 2-3% Cu. to less than 1.6% Cu., it is impossible to recommend any further work at the Great Central, particularly as the tonnage of sulphide ore from which over 1% Cu. might be extracted, is now known to be limited to probably not more than 100,000 tons.

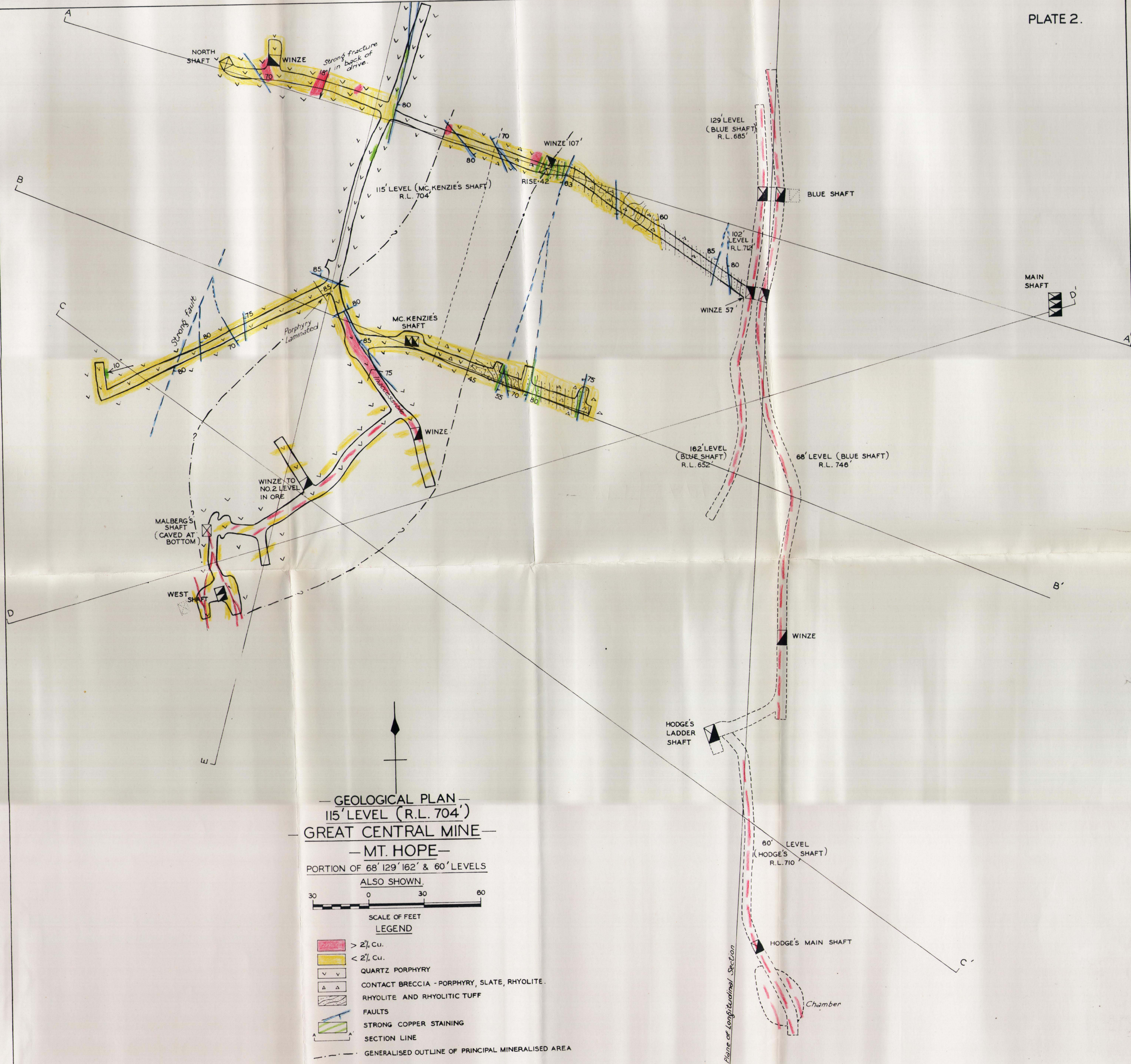
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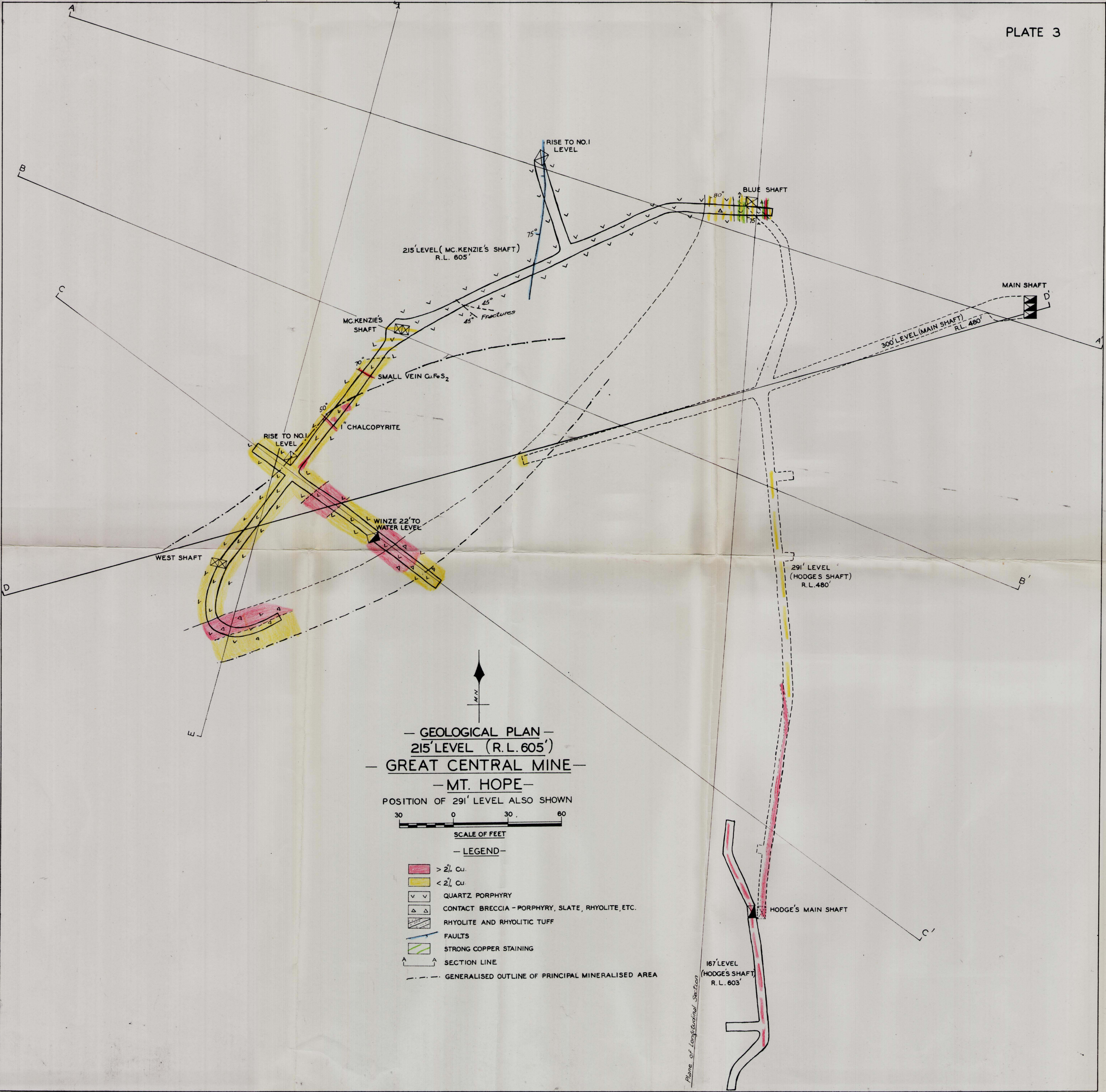
The Great Central and Great ore bodies are contained in quartz-sulphur porphyry, near its contact with a silicified breccia zone, consisting of rhyolite, rhyolitic tuff, tuff and porphyry, which occupies the junction between the porphyry and the earlier rhyolite, and which, in the southern portion of the mineralized area, divides the porphyry into two sections. Hedge's Lake actually occurs in the breccia zone between the two porphyry masses. The lakes are of two distinct types:- Hedge's Lake and the Great Lake are long, narrow, steeply dipping fissure zones from which sheets of calcite and other have been extracted down to about 100 feet depth. The Main Lake is an elliptical stockwork with copper minerals in small veins disseminated through the porphyry, and very low grade mineralization is irregularly distributed elsewhere within the porphyry. Below the surface the mineralized area includes the porphyry-breccia contact but does not persist far into the rhyolite. Earlier individual veins in the porphyry have been worked to shallow depths from the surface.

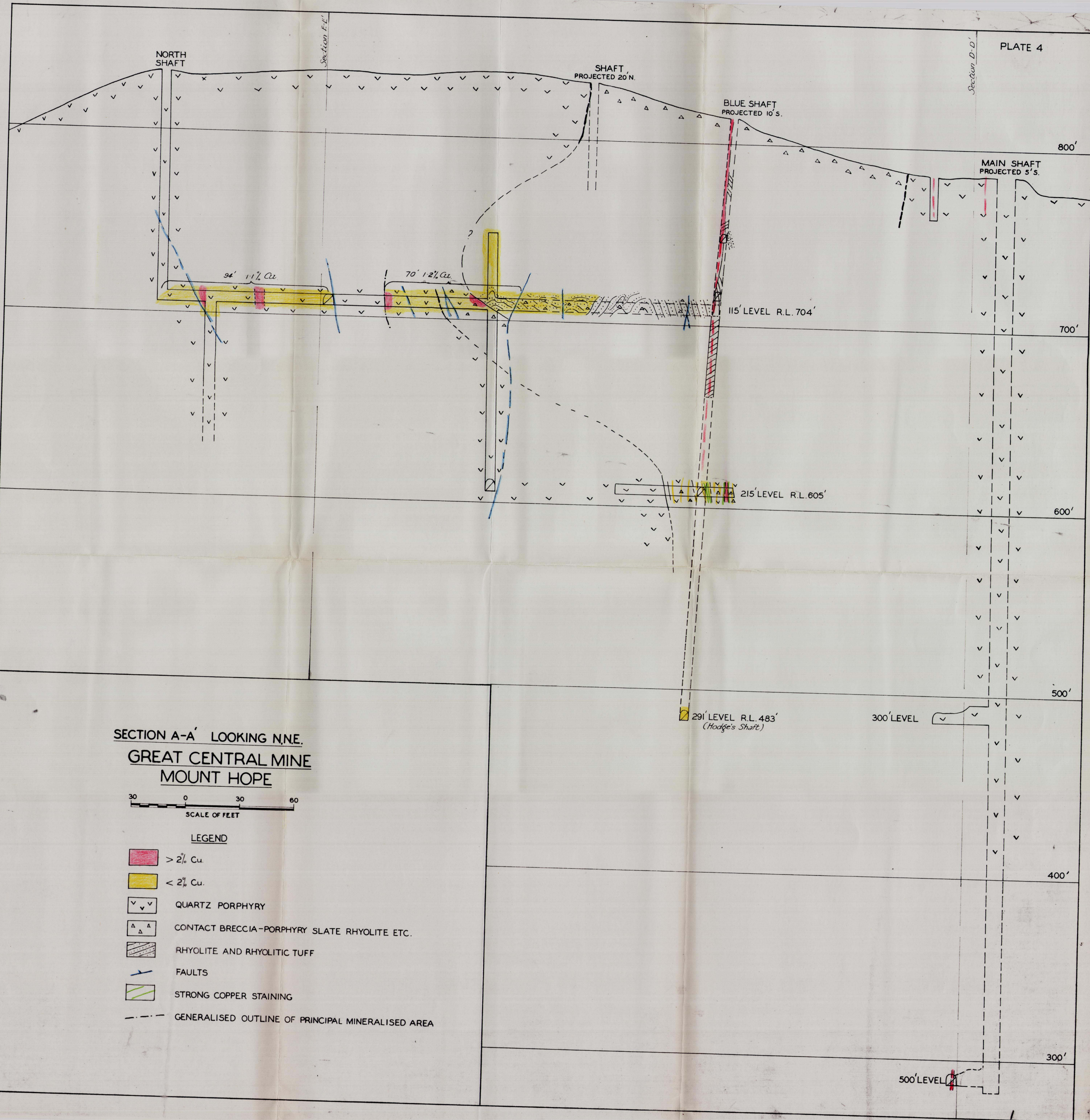
The Main Lake has been developed by levels at 115 and 215 feet, Holladay's Shaft, and has contained, at the best, 100,000 tons of up to 1.6% Cu. sulphide ore between the levels, with a similar amount of oxidized or semi-oxidized ore of probably even lower grade above. Extension below the 215' level was tested by diamond drill and proved disappointing. Check sampling failed entirely to confirm the values upon which the original grade determinations were made. In spite of possessing the advantages of low development, mining and milling costs, the property can no longer be considered attractive as a potential source of copper and it is recommended that no further work be carried out.

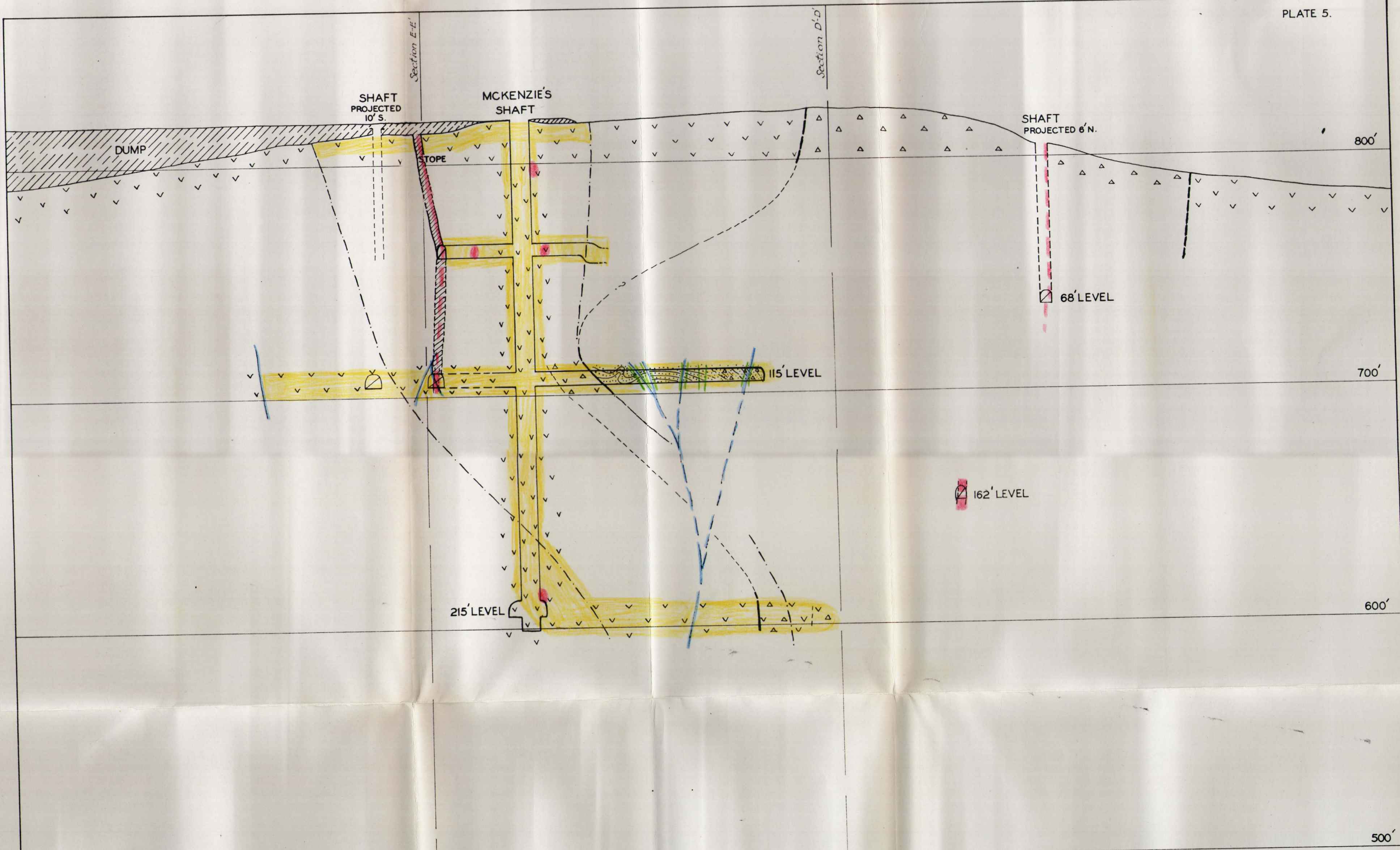
M.H. Fisher
(U.S. Miner)
CONFIDENTIAL
22. October 1912.



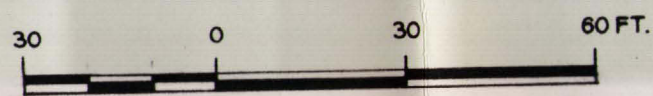








SECTION B-B'
LOOKING NORTH-NORTH-EAST
GREAT CENTRAL MINE
MT. HOPE

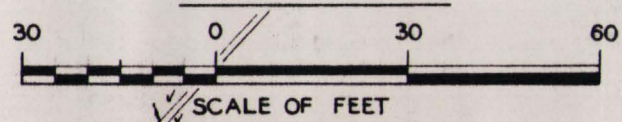


LEGEND

- > 2% Cu.
- < 2% Cu.
- v v QUARTZ PORPHYRY
- Δ Δ CONTACT BRECCIA, CONSISTS OF PORPHYRY, RHYOLITE, RHYOLITIC TUFF, SLATE.
- / / RHYOLITE AND RHYOLITIC TUFF.
- > FAULTS
- > STRONG COPPER STAINING
- GENERALISED OUTLINE OF PRINCIPAL MINERALISED AREA



— SECTION C-C —
LOOKING NORTHEAST
— GREAT CENTRAL MINE —
— MT. HOPE —



SCALE OF FEET

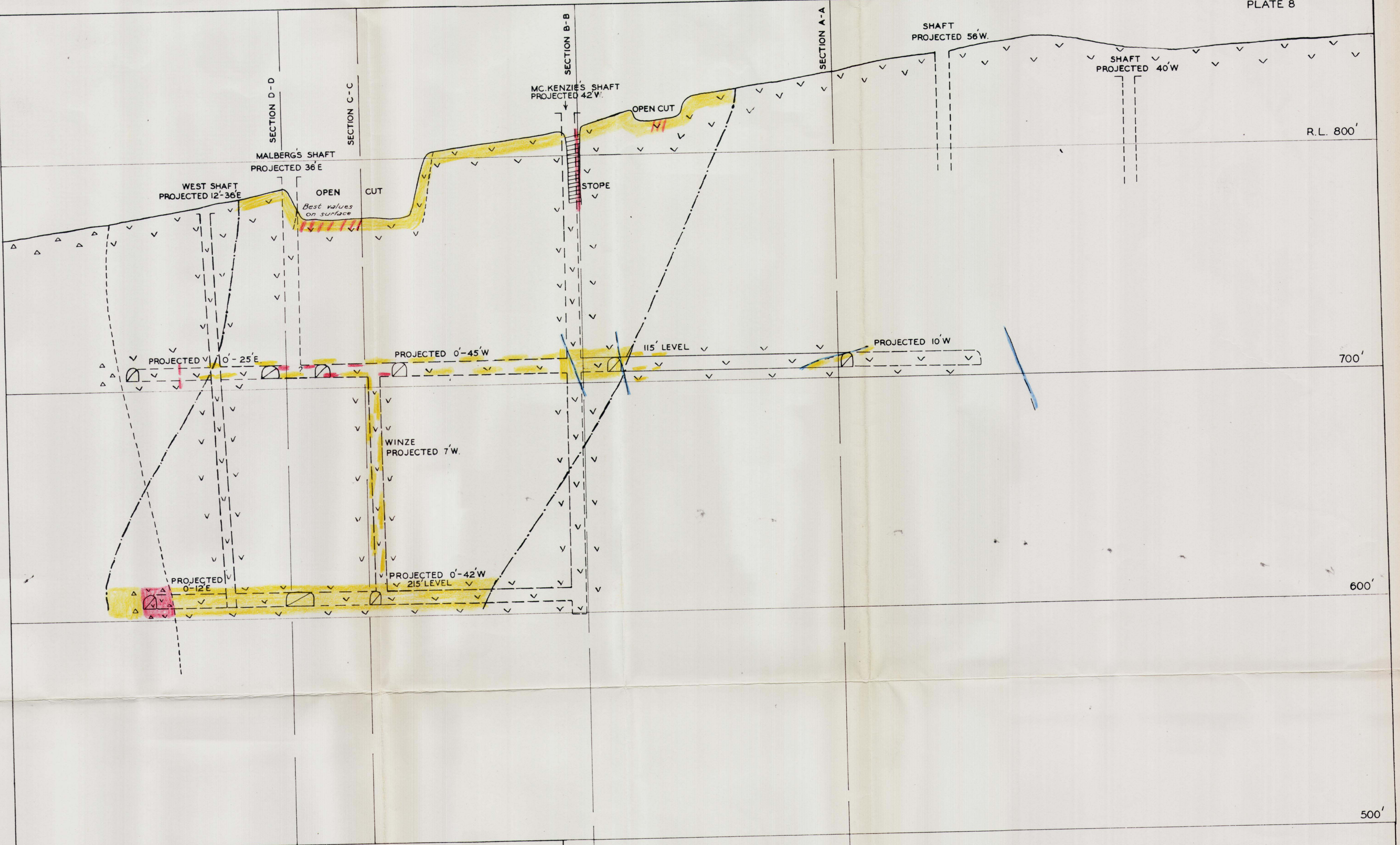
LEGEND

- > 2% Cu.
- < 2% Cu.
- QUARTZ PORPHYRY
- CONTACT BRECCIA, CONSISTS OF PORPHYRY, SLATE, RHYOLITE, ETC.
- RHYOLITE AND RHYOLITIC TUFF
- FAULTS
- STRONG COPPER STAINING
- GENERALISED OUTLINE OF PRINCIPAL MINERALISED AREA

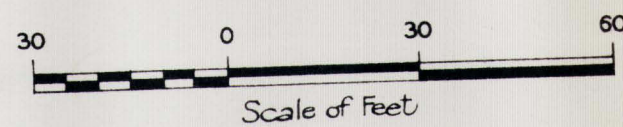
SECTION D-D

R.L. 300'





— SECTION E-E —
— LOOKING W.N.W. —
— GREAT CENTRAL MINE —
— MT. HOPE —



LEGEND

- > 2% Cu.
- < 2% Cu.
- v v QUARTZ PORPHYRY
- Δ Δ CONTACT BRECCIA - PORPHYRY, SLATE, RHYOLITE, ETC.
- RHYOLITE AND RHYOLITIC TUFF
- FAULTS
- STRONG COPPER STAINING
- GENERALISED OUTLINE OF PRINCIPAL MINERALISED AREA

R.L. 1000'

900'

800'

700'

600'

500'

400'

300'

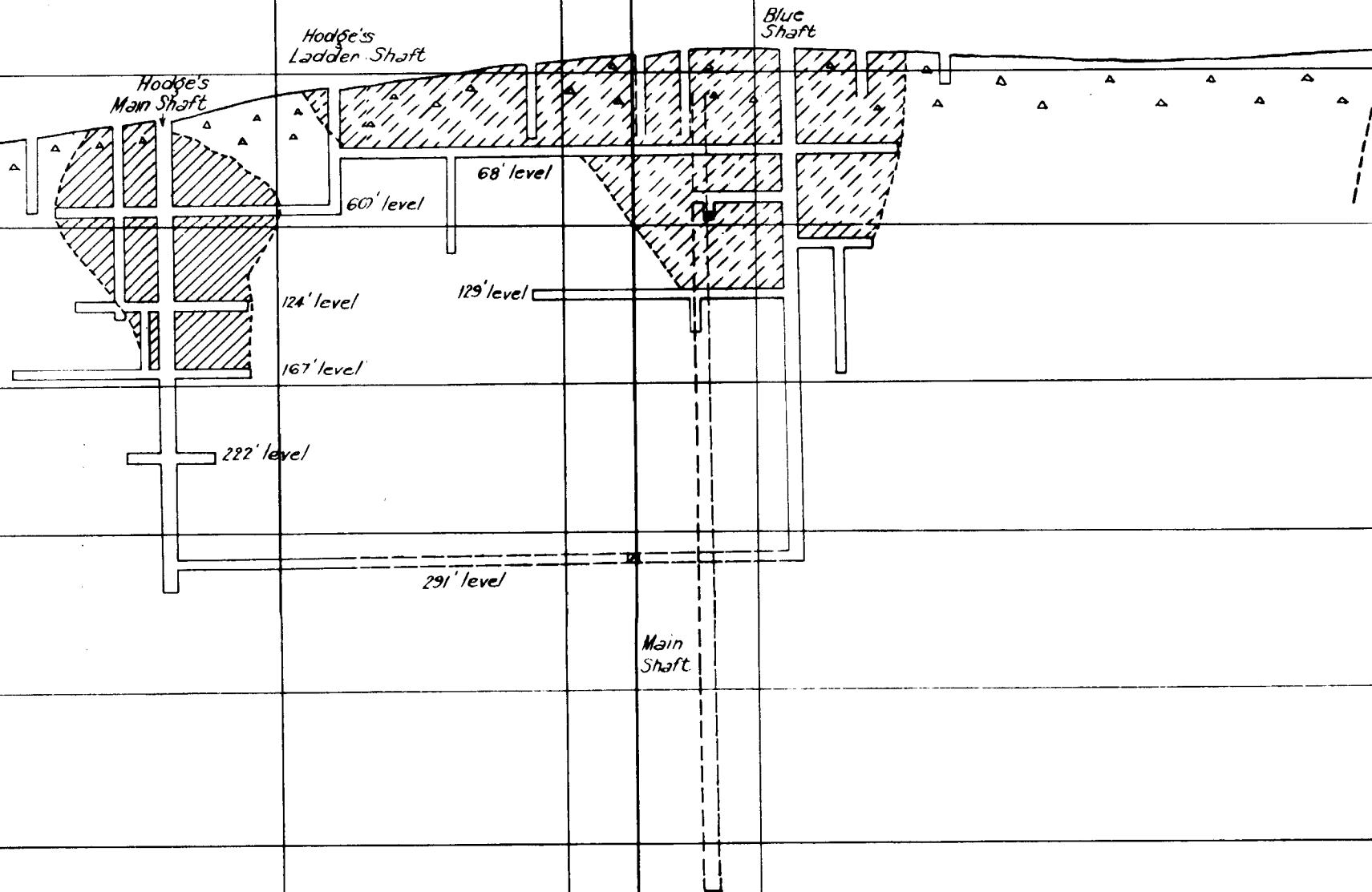
200'

SECTION CC'

SECTION BB'

SECTION DD'

SECTION AA'



LONGITUDINAL SECTIONS
GREAT CENTRAL MINE
MT. HOPE
HODGE'S LODGE - UPPER SECTION
COMET LODGE - LOWER SECTION

LOOKING WEST

DOTTED WORKINGS OFF THE LODGE

LEGEND

-  STOPED AREAS
-  PARTIALLY STOPED AREAS
-  QUARTZ PORPHYRY
-  CONTACT BRECCIA



R.L. 1000'

900'

800'

700'

600'

500'

400'

300'

200'

