DECLASSIFIED E.O. 12065 SECTION 3 (E), NARA

around the known outcrops. However, one structural feature is apparent on the detailed map that may be more than a coincidence; both the main ore zone and the Irishiken zone occur opposite small protuberances of the granite mass. The Hitachi district as a whole lies at the pointed southern end of a granite batholith. It is dated no closer than Mesozoic in age, and is considered to be related to the ore deposits.

8. The only other mine of consequence in the district is the Suwa, located several miles to the south of Hitachi. It is said to be similar in type to Hitachi, but consists mainly of pyrite. The favorable schist area at the south end of the batholith amounts to about 20 square miles. This area has been combed for outcrops but details of the structural geology remain to be studied.

9. Aerial photographs of the Hitachi-Suwa area have been secured and have been found very helpful in traversing the area. No reprints are used in this report because the photographs have not been de-classified.

## General Geology

1. The geology of the Hitachi Mine was described ~~very well~~ in English by Mr. M. Watanabe in ~~1942~~ 1924 (13). Another notable paper appeared in Japanese in 1929 written by T. Suzuki, (9), the mine manager. His description ~~It~~ has been summarized in English for this investigation by M. Watanabe and is presented here for the first time ~~some~~ to give the reader an opportunity to review another author's views. ~~Both~~ Watanabe and ~~Suzuki~~ supplement each other very well, the former presenting the mineralogic aspects chiefly.

(13) See bibliography in the Introduction

S 01181

DECLASSIFIED E.O. 12065 SECTION 3 (b), NARS Date

NEW PAGE

Geology and Ore Deposits of the Hitachi Mine

An abstract by M. Watanabe, of Part I

from ~~of~~ "Mining at Hitachi Mine" by

T. Suzuki

(Jour. ~~of~~ Ming. Inst. Japan. Vol 45, No. 531, 1929)

"Outline of Geology. The mining area is composed chiefly of gneiss, crystalline shists and Paleozoic sediments, intruded by igneous rocks. The Paleozoic formation is divided as follows:

1. Upper or Ayukawa Series. Strike N45°E, dip 40°SE.

   Upper Part: Siliceous slate, sandstone and limestone.

   Lower part: Green shists and limestone

2. Middle or Akazawa series. Strike N45°E, dip 70° - 80°NW.

   Amphibolite and many other crystalline shists.

3. Lower or Tamadare series. Strike N 45° E, dip 75° SE

   Amphibole gneiss.

"No distinct unconformity ~~is~~ has been detected between them, the change of dip being gradual. The whole complex is regarded as belonging to the Carboniferous period, judging by the fossil corals in the limestone. The igneous rocks are of two types, i.e. dikes and sheets of peridotite, diabase and quartz porphyries preceded a large batholith of granodiorite.

"Igneous rocks and ore deposits. The granodiorite changes in its nature from a massive normal type in the western part, through shistose varieties near the mine, to green sheared forms to the east without any sharp boundaries. These differences seem to have originated from the different effects of dynamometamorphism, according to depth. ~~Near the mine~~, The margin of granodiorite half encircles the mine area, and several apophyses and stocks of granodiorite, diorite, microgranite, pegmatite and aplite are found, suggesting high degree

DECLASSIFIED E.O. 12065 SECTION 3 NSC MEMO

of differentiation ~~at~~ this special area. Some of these igneous rocks are cut by irregular veins of sulphide ores, while others cut the ore bodies as dikes, thus indicating that igneous action continued even after ore deposition.

Metamorphism of rocks near the deposits. The amphibolite, prevailing near the mine, is a metamorphosed tuff and volcanic flow of Carboniferous age. Near the ore deposits, it was further metamorphosed by the intrusion of granodiorite, and the subsequent hydrothermal action, into many varieties of schistose rocks, containing diopside, garnet, cordierite, andalusite, sillimanite, anthophyllite, actinolite, biotite, sericite and chlorite. Among these, diopside and garnet are found only at the contact with granodiorite. Round grains of cordierite with biotite near the boundaries are common occurrences. Chlorite and sericite increase farther from the igneous rocks.

Ore zones. The ore deposits are distributed in this highly metamorphosed area in three zones as follows:

1. Main ore zone containing most of the workable deposits.
2. Oiwayama ore zone (between #1 and # 2)
3. Irishiken ore zone.

Distribution of deposits. The ore deposits are distributed in these zones in a great number of lenticular bodies, mostly parallel to the schistosity plane of the country rocks. They are arranged "en echelon", both horizontally and vertically, in seven groups. They have been named as follows:

Sasame, Chusei, Kanmine, Honko, Akazawa, Takaswan, (in Main zone)
and Irishiken.

Shape of deposits. Roughly speaking the deposits are lenticular, though some of them are rather vein-shaped while some others are irregularly massive. The ratios between extensions along dip and strike are variable. The Irishiken deposit stretches 150 meters along its strike and more than 1,000 meters along its dip.



S 01.81

DECLASSIFIED E.O. 12065 SECTION 3 NSC MEMO

Size of Deposits. The deposits vary in width from 0.5 to 80 meters, in horizontal extention from 40 to 450 meters and in vertical extension from 50 to 600 meters. For instance No. 4 deposit of the Akazawa group extends 400 meters along the strike with maximum width of 80 meters.

Characteristic variation of different groups. The deposits nearer to granodiorite are composed chiefly of coarse-grained aggregates of pyrrhotite and chalcopyrite, rarely with large cubes of pyrite, whereas those farther from the intrusives are made of fine-grained compact aggregates of pyrite and interlocking chalcopyrite, often with sphalerite. In general, the former is richer in copper than the latter, though the exceptional cases are not infrequent.

Relation between ore deposits and their country rocks. The ore bodies are always surrounded by one of the following rocks.

Biotite schist, as in Sasame, Chusei.

Chlorite schist, as in Kanmine, Honko

Sericite schist, as in Akazawa, Takasuzu

Anthophyllite schist, as in Irishiken.

Their location is often indicated by:

(1) Rounded grains of cordierite at Sasame and Chusei

(2) Chlorite schist at Kanmine at the top of the deposit

(3) Sericite schist at Akazawa and Takasuzu

(4) Anthophylllite schist at Irishiken

(5) Boundaries against epidiabase and other igneous rocks.

Nature of country rocks above and beneath the deposits. The top and bottom of each deposit generally ~~divides~~ splits into several branches, whether in sericite, chlorite or biotite schist. Especially these rocks beneath the deposits are either loose and brittle, or hard and silicified. The former is the case farther from the



S 01781

igneous rock and the latter nearer to it. They indicate the passage of ascending mineral solution.

Structure of ore. Most of the ores are intimate association of following minerals with some quartz, barite, sericite, chlorite or biotite.

Pyrite (predominating), pyrrhotite (near granodiorite), chalcopyrite (predominating in some portion; accessory in others), sphalerite (accessory in general), galena (minor accessory), arsenopyrite (rare) bismuthinite (very rare), magnetite (rare), marcasite (not infrequent), secondary.

Among these, pyrite was the first to crystallize; chalcopyrite and pyrrhotite followed.

Gold and silver contents in the ore. Gold is contained as minute grains, 0.02 - 0.1 mm in diameter, mostly in chalcopyrite to an extent of 0.8 - 0.9 ~~gr/m.t~~ grams per metric ton. Its fineness is 800 on an average. Silver content is ~~is contained~~ 10 times as ~~much~~ great as gold, possibly mostly in sphalerite.

Relation to the schistosity of country rocks. The deposits are developed mostly along schistosity planes, but some of them are found along sheared, fissured or faulted zones, which are oblique to the schistosity plane. Such is also the case with chloritization, sericitization and biotitization. Near the deposits, the country rock is often highly contorted. This is especially the case with rock fragments in the ore. Some of the ores are disseminated along such contorted places, but some are developed in irregular masses, irrespective of such structure. Such bodies of ore exhibit no indication of deformation after deposition. Hence we cannot believe in any severe deformation after the deposition of ores in this mine, though it might have taken place to some degree in and near the ore bodies, which were developed in rocks already deformed.

S 01781

DECLASSIFIED E.O. 12065 SECTION 3.4(b)

Summary of the Geologic History. Accompanied by severe crustal movement near the end of the Paleozoic era,* a large mass of granodioritic magma intruded the sediments, which had already been intruded by some basic and acidic dikes and had been dynamometamorphosed into amphibolite in deeper horizons. Owing to this intrusion, many contact minerals, such as garnet, cordierite, andalusite, anthophyllite, etc., were formed in certain zones of amphibolite near the granodiorite. Dynamic and igneous activities continued. From the residual liquid of the granodiorite, dikes and stocks of microgranite, pegmatite and aplite originated on one hand, while on the other hand the partly consolidated granodiorite was locally deformed into schistose and sheared varieties. As the consolidation of the magma advanced farther, the final residue gathered in the form of hydrothermal solutions. ~~They~~ These solutions entered the country rocks along their schistosity planes and shear zones. Thus the metamorphism of rocks into chlorite, sericite and biotite schists was followed by one deposition. As the solution penetrated farther into the country rocks, the lowering of temperature resulted in the formation of ores with different compositions and structures. However, this does not mean that the solutions traveled from the northeast end of the ore zone toward the south west. It is more probable that they originated at much deeper zones. Hence, further discoveries of new ore bodies in such deep zones may be expected.

* Other writers claim a Mesozoic age for this intrusion.

S 01781

DECLASSIFIED E.O. 12065 SECTION 3 NLJ/NARS

NEW PAGE

Production

Totals

Although Hitachi was discovered in the 17th century during one of Japan's copper booms, operations had been on a "gophering" scale, under the name of the Akasawa Mine, with no appreciable production until December, 1905, when Mr. F. Kuhara bought the mine. Since then it has become the third largest source of copper in Japan, being exceeded only by the Ashio and Besshi mines. For the 1925-1945 period it ranked ninth among Japanese gold producers.

In the last 40 years (1906-1945 inclusive) the Hitachi Mine has produced a total of 17,117,188 metric tons of crude ore containing a gross of 278,392 metric tons of copper. The average grade is ~~though~~ 1.63% copper, but it ranges from 4.41% in 1910, when selective mining was most effective, down to 1.05% in 1945 under the stress of war production. Copper has been recovered from mine waters also, but complete records are lacking. Probably it adds another ~~2000 to~~ 3000 tons to total copper production. Recovery began in 1909.

Other valuable materials contained in the ore are gold, silver, pyrite, and nickel. Selinium and platinum are recovered in the refinery but their presence in Hitachi ore has not been discovered even spectrographically. The crude ore contains almost as much sphalerite as chalcopyrite but no zinc concentrate has been made.

Exact data on gold and silver production are available only for the years 1941-1945, but approximate analyses are available for the

From the standpoint of total crude ore mined it is the third largest among all metal mines in Japan.

DECLASSIFIED E.O. 12065 SECTION 3 (b)

years 1922-1940 on the basis of mill data. Prior to 1922 the production has been estimated on the basis of proportions to copper. On this approximate basis the total production (1906-1945) would be in the neighborhood of 10,853 kg. of gold and 125,879 kg. of silver, averaging about 0.6 grams of gold and 7 grams of silver per ton of ore.

Pyrite has been recovered and sold since 1912 but the details of production are available only since 1923, and only in the form of mill production, ~~are available only since 1923, and only in the form of mill production~~. The recorded total up to 30 December 1945 was 1,711,579 metric tons of pyrite concentrates averaging 42.6% sulphur and 1.10% copper.

Several different grades and kinds of pyrite concentrates have been made, as follows:

| Concentrate | Years | Tons | Sulphur | Copper |
|---|---|---|---|---|
| 1. Lump and flotation | 1919 - 1945 | 1,005,122 | 44.20% | 0.76% |
| 2. Table | 1935 - 1945 | 502,791 | 42.78 | 1.65 |
| 3. Table | 1939 - 1945 | 203,766 | 34.35 | 1.45 |

The first type was sold to outside sulphuric acid plants. The third type either went direct to the Hitachi copper smelter or went to the company's local acid plant and the sinter then went to the Hitachi copper smelter. The second type alternates between the company's plant and outside plants, depending on market conditions. The amount of sulphur in the crude ore produced is estimated to have averaged about 25%, ranging from 34% in

DECLASSIFIED E.O. 12065 Section 3.4

1908 to 21% in 1945. Total gross sulphur content of the ore mined is calculated to be about 4,400,000 metric tons.

Total production of copper concentrates, including hand-sorted ore, table and jig products, and flotation concentrates, amounts to 9,038,296 metric tons averaging 2.71% copper. The total copper ~~content~~ recovered is thus 245,115 tons, or 88 percent of the ~~gross content of the ore~~ mill feed. This excludes the copper contained in the pyrite concentrates, which has totalled 18,864 tons, and much of which was recovered after treatment for sulphur. If this is taken into consideration the total ~~production of~~ recovery in all concentrates accounts for 95 percent of the copper in the ore, a remarkable record.

Although the ~~real~~ total income from this production could be ascertained accurately by means of considerable effort, it might satisfy ordinary interests simply to show what the gross value of the gross content of mine production would be, at ~~say~~ 1940 American prices. Of course the sale value of the extracted products which ~~reached~~ actually the industrial markets is a fraction of the following totals:

| | | |
|---|---|---|
| 281,000 | metric tons of copper at $0.12 per lb - | $ 74,000,000 |
| 10,853 | kilograms of gold at $35 per Troy oz. | 12,000,000 |
| 125,879 | kilograms of silver at $0.70 per Troy oz. | 3,000,000 |
| 4,400,000 | metric tons of contained sulphur in pyrite @12 ¢ per long ton unit | 53,000,000 |
| | Total | $ 142,000,000 |

The ~~following~~ accompanying graphs of the production history of the mine show that the grade of ore has declined steadily with the passing years while the ~~rate~~ scale of ~~production~~ operations has increased. This results partly from the lower grade of ore in depth and the practicality of treating lower grade ores with improving techniques.

S 01781

DECLASSIFIED E.O. 12065

It is worthy of note that the production grade in the last 13 years has been remarkably constant which ~~argues~~ augurs well for its continuance in the future. The last year of the war was the worst in the last 40 years of the mine because the exceptional war stresses caused temporary maladjustments between exploration, development and mining.

Maximum daily production has been 2500 tons but 1800 to 200 tons has been the average in recent years. In the spring of 1946 operations were at only 10 percent of capacity for lack of fuel at the smelter.

An indication of the healthy state of the mine has been the response in actual output of copper to rises in price and a resistance to drops in the price. except during The last two years of the war ~~were unusual periods however.~~

The accompanying ~~following~~ graphs show the mill production record ~~of the mine~~ for copper and pyrite so far as is known.

Insert Graphs 3 & 4 omit

S 01781

NEW PAGE

Mining

REVIEWED

reviewed

The Ore Bodies

Certain features of the geology should be ~~emphasized~~ preparatory to a discussion of mining. Fifty-nine ore shoots have been mined at Hitachi. They are variable in all dimensions but average ~~a few meters~~ about 10 feet in width, ~~about a hundred meters~~ several hundred feet in length, ~~and over a hundred meters in depth,~~ slightly more in depth and they dip steeply. The ore is massive pyrite with small amounts of chalcopyrite, pyrrhotite, and sphalerite. It occurrs in massive bodies, lenses, and seams as a bedded replacement and fissure filling in altered schist. The ore itself has sharp boundaries with the country rock, ~~but~~ generally an ore shoot consists of a number of parallel sulphide seams with waste rock between.

The whole mass sloughs and caves readily, therefore, considerable timber and prompt filling are required. Horizontal cut and fill is the usual stoping method, the fill coming from crosscuts and hand-sorted waste from the mill.

Exploration

Diamond core drilling has been used steadily since 1907 for exploration purposes at the Hitachi Mine. Suzuki 9/ says that the majority of the ore bodies have been discovered by diamond drilling. Up to 31 December 1945 a total of 45,319 meters (148,000 feet) had been drilled.

Depth of hole has averaged 150 meters (500 feet). The core size has been about 1 inch in diameter for most of the drilling in ore. Recoveries of core vary markedly depending on the type of rock. Massive sulphide ore usually yields a core recovery of 80 percent. Altered schist, which may also contain considerable ore, has averaged only 15-25 percent recovery. Hard, unmineralized schist averages about

45 percent core recovery.

On the other hand, sludge recovery has averaged 88 percent according to Suzuki 9/ The explanation for this high figure may rest in the two-stage sludge splitter which Suzuki pictured in his paper. ~~Only a quarter of the sludge is saved; hence, the overflow from an ordinary sludge box would entail that much less loss of material.~~ with it he retained one-quarter of the return water for complete settling of the finest material. This factor is important because he calculated that 90 percent of the sludge was minus 200 mesh in size.

Good sludge recoveries may have compensated for poor core recoveries, but a complication has been the deviation of drill holes. The extremely schistose character of the rock must have been a source of trouble. Suzuki 9/ mentions that one 10-foot width of ore cut in one drill hole never was located. No surveying of dip or strike of the holes has been done.

Most of the drilling has been done with Schram Harker electric machines bought in the period 1907-1916.

Geophysical exploration has been tried twice. In 1926-1927 an area measuring 1 x 3 kilometers, located southwest of the Irishiken deposit, was prospected by the ~~Lundberg~~ resistivity method. In May, 1946 the same area was tested by the spontaneous polarization method. The latter test has induced the mine management to consider drilling the area, but the negative anomolies recorded by this work could have been caused by a simple change in the country rock that this writer observed while checking the area. At the near-by Suwa Mine, electrical prospecting ~~of the "center method" type~~ is reported 9/to have been successful in 1925 in locating outcrops of ore of the Hitachi type.

S 01781

Development

From the surface to the 650 meter level is 800 meters (about 2600 feet) vertically. Levels have been spaced at 50 meter intervals, with sublevels

DECLASSIFIED E.O. 12065 Section ... By ... NARS, Date ...

halfway between. The drainage level is the 150 meter level, 500 meters from the bottom of the mine, and connected to the surface by an ~~crosscut~~ adit 2450 meters (8000 feet) long. In March 1946 the mine had filled with water up to the 350 meter level for lack of pumping capacity and lack of a demand for ore.

Four vertical shafts are in use, but one handles practically all the ore. Total development work to 31 December 1945 includes: 308,616 meters (192 miles) of crosscuts and drifts, 76,761 meters (47 miles) of shafts and raises. Considering the 17,100,000 tons of ore produced and 6,600,000 tons of developed reserves, the ratio is 61 metric tons of ore per meter of exploration-development work, or 20 short tons per foot. ~~Graph No.~~ The accompanying graphs demonstrates the remarkable parallelism between development and production until the war years. (insert Graph MnI) adit and Mn 2 This parallelism is considered a favorable sign for continued development of ore. ~~Graph member showing~~ The developed tonnage ~~by levels~~ is erratic below the 500 meter level probably because of the small amount of development works on the bottom levels. However the general trend is favorable for continued development of ore at depths below the 500 meter level.

Equipment

The mine equipment is about average for the United States as of twenty years ago, but everything is badly worn. About three-fourths of the pipe, rail, and cars are definitely worn out, and the management hopes to modernize all the equipment. Notably lacking at present are mucking machines and scrapers, which could be used to advantage. The traditional Japanese two-handled scoops look particularly incongruous in this mine with its considerable widths of heavy sulphide ore.

S 01781

DECLASSIFIED E.O. 12065 SECRET/

Following is a list of the main items of equipment at the Hitachi Mine:

Hoists, electric

2 single-drum, 5 double-drum, total 1125 HP
2 are 30 years old and need repair

Air Compressors

3 reciprocating horizontal duplex totalling 1100 HP
4 rotary totalling 1140 HP

Pumps

2 sinking, 15 and 50 HP built 1933 and 1943
8 turbine, totalling 1050 HP, dating from 1934

Core drills

5 Schram Harker electric, 150 meters, bought 1907-1916
1 Sullivan H, electric, 500 meters, dated 1918
1 Craelius X air, 100 meter, 1935
1 Tone N, 150 meter, 1938

Rock drills

91 drifters, D7L, H55, H140, and H35 dated 1937-1941
28 stopers, CA 31, DT44, CC11, dated 1941 and 1942
122 Jackhammers, H20, BAR 33, H5, R39, S49

Battery locomotives

10 underground, 1.5 ton, 1942
4 surface, 1.5 ton, 1942

Cars

2000 - 1 ton, 18 cu. ft.
50-0.6 ton, 12 cu. ft.
400 bodies

Pipe

33,800 meters of 2 inch
12,500 meters of 3 inch
500 meters of 8 inch
500 meters of 4 inch
2200 meters of 6 inch

Rail

79,800 meters of 12 lb.
25,800 meters of 18 lb.
2,400 meters of 25 lb.

DECLASSIFIED E.O. 12065 SECTION 3 NARS Date

Air pressure at the working faces of the Hitachi Mine is only about 60 lbs., whereas 85 lbs. would be average in the United States. Fortunately the country rock is soft and the sulphides, though massive, are generally well fractured. Advance in a 5 x 7 foot raise is 1 1/2 to 2 feet per 8-hour shift of two men, requiring two shifts to complete a round. Advance in an 8 x 13 foot drift averages one foot per shift of three men.

The maximum flow of water pumped from the mine has been about three cubic meters (792 gallons) per minute, pumped in four stages from the 650-meter level to the 150 meter level, a head of about 1700 feet.

Ventilation has not been a serious problem as the several shafts provide natural circulation, and natural rock temperatures are about 70° F. even on the bottom levels. These conditions are ideal for working new levels, but after the sulphide areas have been exposed to oxidation for many years they give off considerable heat. This condition makes the upper levels very warm.

Labor

Wages, as such, have always been low in Japan but the following tabulation shows that the average total payments for a miner are several times higher than the wage rate:

| Payments | January, 1947 ~~February '46~~ Day | Month | Pre-war Day | Month |
|---|---|---|---|---|
| 1. Base pay, underground | 7 yen x 25 = | 175 yen | 3 yen x 25 = | 75 yen |
| 2. Contract bonus, underground, plus ~~60~~ 85%, average | ~~3.60~~ 5.95 x 25 = | ~~90~~ 148.75 yen | 1.80 x 25 = | 45 yen |
| 3. "Full service" bonus 6 day week, Full month | ¥ ~~6~~ 7 x 4 = | ¥ ~~24~~ 28 ~~¥ 24~~ | ¥ 3 x 4 = | ¥ 12 |
| 4. Underground bonus | ¥ ~~4~~ x 25 = | ¥ ~~75~~ 100 | ¥ ½ x 25 = | ¥ 12 |
| 5. Family bonus per member | ¥ ~~20~~ 50 x 4 = | ¥ ~~80~~ 200 | ¥ 5 x 4 = | ¥ 20 |

DECLASSIFIED E.O. 12065 SECTION 3 NLJ/NARS

| | | | |
|---|---|---|---|
| 6. | Inflation bonus Base pay x 145% | ¥10.15 x 30 = ¥304.50 ~~¥ 80~~ | none |
| 7. | Semi-annual bonus | ¥ ~~7~~ x 15 = ¥ ~~90~~ 135 | ¥ 3 x 15 = ¥ 45 |
| 8. | Food at company stores | ¥ 20 | none |
| 9. | Sunday subsidy | ¥7 x 5 = ~~¥ 35~~ | none |
| 10. | City costs bonus Base pay x 27% | ~~¥ 633~~ ¥1.89 x 30 = 56.70 | ¥ 209 = $50.00 roughly |
| | Total | ¥1202.95 | |

It will be seen that the base pay, which is quoted ordinarily as the wage scale, ~~is really~~ was only a ~~quarter~~ third of the miner's ~~actual~~ real total income before the war, and is only one-sixth in the post-war period. In addition, everyone receives a regular annual increase in pay for ~~every~~ each year of service; also the company provides hospitalization and medical care in case of accidents and housing at sub-normal rates. ~~The effect of post-war inflation amounts to nearly 600% in wages.~~

Although the standard of living in Japan has been low compared with America, these income figures represent reasonable living conditions for Japan. In addition it has been customary for a company to give any employee a "separation bonus" if he was discharged. This amounted to nearly a month's pay for each year of service.

The miners have had their own "unions" for many years. Perhaps they should be called "guilds" because membership was granted as an honor to creditable workers. On the whole the system provided social security and a stable economy. Whether the system survives the post-war crises or not is a moot point. Aggressive national unions became the vogue after the war.

The Hitachi mine began using Koreans in 1940, and Chinese and prisoners of war in April 1944. The largest numbers actually working were about 1100 Koreans in 1943, and 365 Chinese, plus 265 prisoners of war in 1945. These comprised about one half of the underground labor force and one quarter of the surface force. Their departure in September 1945 was a blow to the labor supply of the mine, but not so serious as the departure

of the remaining Japanese workers in search of food supplies. The prisoners of war consisted of Americans until August 1944, at which time most of them were shifted to mines farther from the coast. They were replaced by 150 Indonesians and 80 Chinese from the Malay States, who were in poor health and made poor workers.

The following table shows the changes in the labor force by significant years. The percentage decline in production per shift by 1944 is equivalent to the percentage of over-time work in that year. Although a dearth of supplies and the number of untrained labourers contributed to the decrease in efficiency, it seems significent that the drop in productivity from 1935 to 1944 is about one-third, and the proportion of overtime work in 1944 is also about one-third.

The best tonnage per man shift is ~~low compared~~ only a half or a third of to what it would be in the United States where considerably more mechanization would be found in this type of mine. On the other hand total costs will be found to be somewhat in favor of the Japanese procedure.

Average Daily Distribution of Labor, Hitachi Mine

(in man-shifts actually worked, yearly average)

| Underground | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| Drillers | 217 | 268 | 326 | 293 |
| Timbermen | 176 | 230 | 291 | 289 |
| Muckers, trammers | 417 | 692 | 843 | 1,259 |
| Trackmen | 15 | 17 | 22 | 25 |
| Diamond drillers | 5 | 6 | 13 | 10 |
| Engineers | 4 | 6 | 12 | 10 |
| Total underground | 834 | 1,219 | 1,507 | 1,886 |
| Tons per shift, 8 hrs. | 1.56 | 1.66 | 1.43 | 1.03 |
| Overtime worked | 2 % | 4 % | 18 % | 32 % |

DECLASSIFIED E.O. 12065

| Surface (covers mill also) (9 hrs. = 1 shift) | | | | |
|---|---|---|---|---|
| Blacksmiths | 15 | 30 | 32 | 58 |
| Office | 46 | 54 | 83 | 51 |
| Total surface | 61 | 84 | 125 | 109 |
| Combined total | 895 | 1303 | 1632 | 1995 |
| No. Working days | 338 | 338 | 337 | 342 |
| Tonnage mined | 450,966 | 685,563 | 728,661 | 667,178 |
| Tons per total man shift: | 1.48 | 1.56 | 1.32 | 0.98 |

CONSUMPTION OF MATERIALS IN HITACHI MINE
Per Metric Ton of Crude Ore Mined
(1 metric ton = 1.1 short tons, 1 kg = 2.2 lbs., 1 liter = 0.26 gals.)

| Item | Unit | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|---|
| Crude Ore | metric ton | 450,966 | 685,563 | 728,661 | 667,178 |
| Dynamite | kg | 0.179 | 0.221 | 0.364 | 0.277 |
| Blasting caps | each | .8 | .9 | 1.0 | 1.3 |
| Fuse | meters | .6 | .8 | 1.1 | 1.1 |
| Oil | liter | .1 | .2 | .2 | .03 |
| Grease | kg | --- | --- | --- | .003 |
| Rail | meter | .02 | .03 | .03 | .01 |
| Pipe | meter | --- | --- | .01 | .01 |
| Drill steel | kg | .062 | .023 | .046 | .058 |
| Iron sheets & bars | kg | .007 | .012 | .0005 | .006 |
| Electric Power | k.w.h | 5.0 | 16.0 | 16.0 | 15.0 |
| Timber | cu. ft. | 2.7 | 2.1 | 2.1 | 1.4 |

S 01.81

This table indicated by the following table that the rock drills and breaks easily, so relatively little drill steel and dynamite are needed; but the rock needs considerable support, so timber consumption is high.

DECLASSIFIED E.O. 12065 SECRET

~~Hitachi Mining~~

## Costs

The number of accounts has increased so often at Hitachi that it is impossible to itemize costs consistently through the years. In general the changes ~~here~~ have resulted from breaking down "general expense" and transferring items from head office accounts to the mine accounts. Outstanding is the appearance of "workers welfare" under "administration" in 1944. ~~It is also notable that labor costs have about the same relation to total costs as in the United States.~~ The proportion of labor costs to total costs appears low in some years because welfare items are omitted. If completely tabulated labor would amount to more than 50% of total costs, which is close to American figures.

Obviously the war had an extremely adverse ~~advance~~ effect on the Hitachi Mine ø costs. What they are now in relation to American costs is impossible to figure for lack of a true exchange rate, ~~the tremendous inflation of prices, and the low rate of mining activity.~~ However, in pre-war years the costs were ~~a little~~ under what could have been obtained in the United States for this type of deposit. The exchange rate is based on yearly averages furnished by the Yokohama Specie Bank.

Costs of Mining in Yen per Metric Ton

| | 1930 | 1935 | Apr-Sept 1940 | 1944 |
|---|---|---|---|---|
| Labor ~~Wages & salaries~~ | ¥1.253 | ¥1.105 | ¥1.821 | ¥3.723 |
| Explosives | .208 | .189 | .454 | .528 |
| Supplies | .120 | .296 | .489 | .553 |
| Timber | .196 | .278 | .740 | 1.268 |
| Shop | .004 | .022 | .036 | .021 |
| Power | .076 | .258 | .412 | .377 |
| Repairs | .004 | .080 | .267 | .501 |
| General | .312 | .127 | .103 | 1.889 |
| Assaying | ~~---~~ | .001 | .031 | .002 |
| Supervision, engineering | ~~---~~ | ~~---~~ | .057 | .238 |

DECLASSIFIED E.O. 12065 Sec. 3.5 NARA Date 7/24/96

| | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| Office | nd | nd | .048 | nd |
| Administration, workers welfare, | nd | nd | nd | 3.515 |
| Total, Yen | ¥2.173 | ¥2.356 | ¥4.564 | ¥12.616 |
| Crude ore, metric ton. | 453,648 | 688,551 | 712,531 | 752,321 |
| $ value of Yen | $0.49 | $0.28 | $0.23 | ? nd |
| $ per short ton | $0.97 | $0.61 | $0.97 | ? nd |
| Grade of ore | 1.42% | 1.19% | 1.30% | 1.26% |
| $ per lb of copper | $0.034 | $0.026 | $0.037 | ? nd |

nd = no date

S 01781

DECLASSIFIED E.O. 12065 SECTION 3 NLJ, ____

MILLING

NEW PAGE

## ~~THE HITACHI MILL, IBARAGI PREFECTURE, JAPAN~~

General

The chief objective of the Hitachi mill has been to produce an economical copper concentrate ~~acceptable to~~ to suit the needs of the Hitachi Smelter. The second objective was a pyrite concentrate acceptable to sulphuric acid plants, particularly at Toyama, in Toyama Prefecture and Oji in Tokyo, where two-thirds of the output was shipped. In addition the mill yielded a mixed concentrate which went either to the copper smelter or to the company's acid plant at nearby Daioin. Hand-picking, tables, and flotation are employed.

The largest tonnage ever treated in one day at the Hitachi Mill was about 3,300 metric tons, ~~but~~ and the highest month's average was 2,500 tons daily, reached in 1943, the peak year for Japan's copper production. The average daily tonnage has been 1,800 to 2,000 tons. The flotation and tabling units have a rated capacity of 1050 tons daily, the balance was accounted for by hand-picking.

~~Ore~~ Mill Feed

The ore is massive pyrite-chalcopyrite which is easy to hand-sort from the waste rock, ~~but~~ whereas the differential flotation of pyrite and chalcopyrite is hindered by the intimate association of the minerals. Sphalerite goes with the copper flotation concentrate in appreciable quantities. ~~but the zinc has not been recovered.~~ Otherwise the ore is relatively simple. ~~one~~.

A complete analysis of the crude ore is available for the 6-month period ended March 31, 1945 and the analysis of flotation tailings is given for the same period by way of comparison.

| | Crude ore | Tailings |
|---|---|---|
| Gold | 0.5 grams | 0.1 gram |
| Silver | 6.0 " | 2.0 " |
| Copper | 1.20 % | 0.3 % |
| Iron | 20 % | 9.8 % |
| Sulphur | 21 % | 4.34 % |
| Zinc | 1 % | 0.29 % |
| Lead | trace | trace |
| Manganese | 0.1 % | 0.07 % |
| Lime | 1.52 % | 2.03 % |
| Magnesia | 4.21 % | 7.05 % |
| Alumina | 8.55 % | 14.44 % |
| Silica | 39.03 % | 50.98 % |
| T o t a l | 96.61 % | 89.30 % |

S 01.61

DECLASSIFIED E.O. 12065 Section 3 (b)

In order to check on the possible presence of unreported elements of commercial or strategic importance, special tests were made spectrographically for this investigation by the Chemistry Department of Tokyo Imperial University using samples of mill products whose identities were concealed. This was the first time spectrographic analyses had been made on Hitachi ore. The results follow:

Nickel was reported as present in all concentrates and the mill tailings, but a chemical analysis of the copper concentrates failed to disclose any. Gallium was reported ~~balliume appeared~~ in the flotation tailings sample. The presence of molybdenum and vanadium in the tailings was reported questionable and lacking in the concentrates. A chemical analysis for molybdenum showed a trace.

~~Also~~ Reported as absent were; antimony, arsenic, cadmium, tellurium, bismuth, tungsten, tin, cobalt, mercury, selenium, strontium, thallium, thorium, germanium, niobium, cesium, cerium.

Concentrates

The following are average anlyses of the various mill concentrates for the period 1936 to 1943, except that No. 4 is only for 1936 to 1937, and No. 5 is only for 1936 to 1941. Recent years are omitted because war-time shortages resulted in abnormal mill products.

| | Copper Concentrates | | | Pyrite Concentrates | | |
|---|---|---|---|---|---|---|
| | 1. Hand sorted | 2. Middling | 3. Flotation Conc | 4. Hand sorted | 5. Table Conc | 6. Flotation Conc |
| Gold | 1.0 grams | 0.7 | 2.3 | 0.6 | 0.6 | 0.7 |
| Silver | 11.0 grams | 7.1 | 32.4 | 7.0 | 7.0 | 7.4 |
| Copper | 2.67 % | 1.61 | 8.32 | 0.96 | 1.00 | 0.57 |
| Lead | tr | tr | .30 | tr | tr | tr |
| Iron | 34.05 % | 34.25 | 23.10 | 39.04 | 37.11 | 39.10 |
| Zinc | 1.62 % | 1.02 | 5.38 | 1.49 | 1.52 | 1.33 |
| Silica | 12.44 % | 14.71 | 18.84 | 6.17 | 6.94 | 6.53 |
| Alumina | 4.05 % | 4.23 | 7.18 | 2.61 | 2.21 | 2.77 |
| Barite | 1.57 % | 0.98 | .54 | 1.97 | 2.18 | .34 |
| Sulphur | 36.80 % | 37.07 | 24.79 | 44.11 | 43.05 | 43.59 |
| Lime | .79 % | .70 | 1.01 | .51 | .46 | .52 |
| Magnesia | 1.96 % | 1.80 | 4.08 | .68 | .93 | 1.35 |
| Manganese | .08 % | .08 | .12 | .06 | .06 | .08 |
| Total | 96.03 % | 96.45 % | 93.66 % | 97.60 % | 95.46 % | 96.18 % |

DECLASSIFIED E.O. 12065 SECTION 3(E)

Conc.

Treatment

For the sake of simplicity only the Nos. 2, 4 and 5 mills are represented by flow sheets here, since the No.1 is similar to No.2 and No.3 is similar to No.4. They are all located together. The cement-copper plant is located near the smelter, at the portal of the long drainage tunnel.

INSERT FLOW SHEET

The low grade of the hand-sorted concentrates (2.67% copper) is the outstanding feature of the analyses, especially when it is realized that this type constituted the great bulk of the copper concentrates. Shipments of flotation concentrates were a small part of the total, but even they were low grade (8.32% copper).

The Nippon Mining Company found it economical to handle such low-grade concentrates because the smelter's blast furnaces needed a coarse lump feed and its high sulphur content made pyritic smelting possible with economies in fuel consumption. Furthermore, the mill and smelter are so closely situated that transportation is no great item.

The future trend however, may be towards more emphasis on flotation products or heavy-media separation because of rising labor costs in the hand-picking section. The company is experimenting with briquettes made of flotation concentrates to make acceptable feed for blast furnaces.

NARA 01601

DECLASSIFIED E.O. 12065

## OPERATIONS

The Hitachi mill is notable for the amount of hand-sorting of ore. The No. 1 plant receives the relatively low grade ore (1.0% ~~Cu~~ copper) from the Sasame, Chusei, and Kamine ore bodies of the Hitachi Mine. About 12% of this is hand-sorted for direct shipment to the smelter 2500 meters (1½ miles) down the valley. About 18% goes back to the mines for filling, and about 70% is passed on to the No. 3 or No. 4 plants.

The No. 2 plant receives the relatively high-grade ore (1.4% ~~Cu~~ copper) from the Takasuzu, Honko, Irishiken, and Akasawa ore bodies of the Hitachi Mine. About 40% of this feed is hand-sorted and sent direct by aerial tram to the smelter. Approximately 20% is sorted out as waste and goes directly back to the mines by aerial trams for filling. The remaining 40% is passed on to the adjacent No. 3, 4 or 5 plants for tabling or flotation.

Spalling is done with five kg (11 lb.) hammers on thin willow handles. The picking belts are operated by the women who average two metric tons of ore and one ton of waste per shift of eight hours.

The No. 3 and No. 4 plants are similar but No. 3 has a rated capacity of 600 metric tons per day and No. 4 is rated at 300 tons. Both are open circuit plants. Minus 65 mesh ore is differentially floated, making both a chalcopyrite and a pyrite concentrate. Plus 65 mesh ore is tabled.

The No. 5 plant was set up in 1943-1944 for differential flotation of the minus 25 mm middlings from the No. 2 hand-sorting plant, and in order to treat the table tailings previously wasted from Nos. 3 and 4 plants. The plant has a 150 ton rated capacity.

The cement copper plant has yielded 51 to 91 metric tons of contained copper annually in recent years and consumed nearly double that amount of scrap iron.

S 01781

DECLASSIFIED E.O. 12065

The copper content of the water ranges from 0.011 to 0.0175 grams per liter.

The mill products are transported by five aerial trams, one each for copper and pyrite concentrates and three for waste. The tailings are stacked high on ridge-tops to reduce pollution of irrigation water.

S 61.81

DECLASSIFIED E.O. 11652 SECRET

Equipment

Since 1937 the Hitachi mill has suffered from serious mechanical handicaps. At the start of the "China Incident" in 1937 machinery was placed under a strict rationing system which made it difficult for Hitachi to procure equipment.

That situation persisted until 1941 when production of machinery for ordinary industrial purposes was stopped. However, the Hitachi operations ran well enough enough by drawing on spare parts in stock until 1943. After that date, if an item broke, it was finished. As a result the general appearance of most of the equipment at Hitachi suggests that replacement would be the best course, at least by American standards. ~~(Insert Table M I)~~

S 01781

DECLASSIFIED E.O. 12065

Performance

The following tables demostrate that the Hitachi mill has made normal recoveries of copper, but the total ratio of concentration has been unusually low. This is a result of the mill feed being chiefly massive copper-pyrite ore amenable to hand-sorting a lump product desired for the smelter blast furnaces.

Recovery of Copper in all concentrates

| Process | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| Hand-sorting | 79.27% | 59.09% | 46.31% | 47.52% |
| Jigs | 86.90 | 78.87 | 65.38 | 62.48 |
| Tables | 95.12 | 86.47 | 82.59 | 65.17 |
| Flotation | 89.24 | 88.73 | 91.96 | 90.45 |
| Total | 95.62% | 92.25% | 90.30% | 90.35 % |

Ratio of Concentration, all concentrates

| | | | | |
|---|---|---|---|---|
| Hand-sorting | 1.9 to 1 | 3.3 to 1 | 4.5 to 1 | 4.4 to 1 |
| Jigs | 1.8 to 1 | 2.3 to 1 | 3.1 to 1 | 2.5 to 1 |
| Tables | 1.2 to 1 | 1.4 to 1 | 1.5 to 1 | 2.0 to 1 |
| Flotation | 4.2 to 1 | 3.7 to 1 | 4.0 to 1 | 5.8 to 1 |
| Total | 1.6 to 1 | 1.8 to 1 | 2.0 to 1 | 2.2 to 1 |

Included in the concentration ratio are not only the high and low-grade copper concentrates, but also the pyrite concentrates, because all contain appreciable quantities of copper which are recovered eventually. Differential flotation has been a problem at Hitachi because of the intimate mixture of pyrite and chalcopyrite.

The accompanying graphs demonstrate that recoveries and concentration

S 01781

DECLASSIFIED E.O. 12065 SECTION 3.3(b)(1)(2)(3)(4)(5)(6)(7)

ratios have varied inversely but a slight improvement can be seen in copper concentration in recent years. The lack of reagents hurt recoveries in 1945. The graphs omit the copper in the pyrite concentrates so they cannot be compared directly with the above tables.

omit INSERT GRAPHS ML

S 01-01

DECLASSIFIED E.O. 12065 SECTION 3 (E)

Labor

Labor has been used plentifully at the Hitachi mill, probably bacause hand-sorting has been effective. However, the proportional part of labor in the total costs is ~~about equal to~~ nearly as high as American figures after all Japanese welfare items are added. A total of 600 men and 250 women were employed at the Hitachi mill under capacity operating conditions. In the future manual operations may be ~~changed~~ reduced, however, in view of the recent large wages increases in Japan.

The basic shift is nine hours. The following table shows that overtime for men amounted to 55% during the war, hence the average shift worked was nearly 14 hours, ~~indicating an acute labor shortage~~. The women ~~each~~ averaged nearly 12 hours a shift. ~~Their work was~~ chiefly on hand-sorting of the ore.

| Average | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| No. of men working * | 210 | 308 | 444 | 521 |
| No. of shifts worked | 222 | 339 | 625 | 806 |
| Over-time | 6 % | 10 % | 40 % | 55 % |
| No. of women working | 123 | 162 | 200 | 224 |
| No. of shifts worked | 124 | 172 | 220 | 292 |
| Overtime | 1 % | 6 % | 10 % | 30 % |
| Total employees | 333 | 470 | 644 | 745 |
| Total shifts | 346 | 511 | 845 | 1,098 |
| Metric Tons per shift. | 3.7 | 3.8 | 2.4 | 1.7 |

S 02.01

* Includes some surface labor more properly chargeable to the mine

The fact that a 12 and 14-hour working day was necessary during the war indicates an acute labor shortage. At the same time the output per man-shift of 9 hours dropped in half, indicating a great loss in efficiency. Some of this inefficiency was caused by shortages of supplies; a large part probably is attributable to the unwilling work of prisoners of war.

DECLASSIFIED E.O. 12065 DEPT. OF STATE

Supplies

The following table shows supplies consumed in indicative years. Consumption of some materials, notably lime, reagents, iron, and steel, declined towards the end of the war because they simply were not available. On the other hand consumption of balls and mill liners increased because more ordinary steel was required to compensate for the alloy steel which was unobtainable. The use of 1,400 to 1,800 gallons of water per ton of ore treated is typical of Japan but very high compared to American procedure.

Consumption of Supplies, Hitachi Mill
(per metric ton of ore treated)

| Item | Unit | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|---|
| Ore treated | ton | 454,536 | 688,879 | 738,985 | 667,470 |
| Oil | liter | 0.087 | 0.095 | 1.06 | 0.037 |
| Grease | Kilogram | .016 | .008 | .005 | .009 |
| Lime | " | .2 | .44 | .71 | .32 |
| Reagents | " | ND | .089 | .09 | .072 |
| Balls | " | ND | .2 | .3 | .4 |
| Liners | " | ND | .084 | .099 | .124 |
| Iron & Steel | " | 0.083 | .081 | .047 | .025 |
| Scrap Iron | " | ND | .038 | .019 | ND |
| Rail | meters | 0.066 | .011 | 0.022 | .015 |
| Pipe | " | ND | ND | .018 | .002 |
| Conveyor Belts | " | ND | ND | .002 | .003 |
| Electricity | KWH | 6 | 14 | 16 | 18 |
| Water | cu. meter | ND | 5.3 | 5.7 | 6.7 |

To convert metric tons to short tons add 10 %

To convert liters to gallons multiply by 3 3/4

To convert kilograms to pounds multiply by 2.2

To convert meters to feet multiply by 3.3

To convert cubic meters to gallons multiply by 264

In the summer of 1946, when pine oil was scarce and old tailings were an important part of the mill feed, the consumption of individual reagents was as follows in grams per ton:

| Reagent | | Copper Section | Pyrite Section |
|---|---|---|---|
| single space | Camphor | 19 | 14 |
| | Citronella oil | 39 | 28 |
| | Coal tar | 6 | 5 |
| single space | Na ethyl xanthate, | 0 | 0 |
| | liquid | 0 | 73 |
| | powder | 0 | 17 |
| Slaked lime | | 1,833 | 0 |

S 01781

DECLASSIFIED E.O. 12065 SECTION 3 (E), NARS DATE

## Costs

Costs for indicative years are shown on the accompanying tables. They are remarkably low, but the ratio of concentration is very low also. It is unfortunate that the accounting system has been changed in recent years, but the task of re-compilation does not seem warranted for this investigation.

Milling Costs in Yen per Metric Ton of Feed

| Operations | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| No. 1 plant | ¥ 0.117 | ¥ 0.132 | ¥ 0.391 | ND |
| No. 1 pyrite | 0.040 | .003 | 0.003 | ND |
| No. 2 plant | 0.077 | 0.048 | 0.134 | ND |
| No. 3 plant | .006 | .571 | 0.872 | ND |
| Flotation | .315 | | | |
| No. 4 plant | ND | ND | 0.416 | 0.676 |
| Transportation | .035 | .147 | 0.340 | 1.534 |
| Sampling | .022 | .009 | 0.041 | ND |
| Pumping | .007 | .007 | 0.051 | ND |
| Heating | .005 | .004 | 0.004 | ND |
| Testing | .029 | .039 | 0.056 | ND |
| Cement copper | .005 | .016 | 0.022 | 0.061 |
| Concentrate treatment | .004 | ND | 0.190 | ND |
| Aerial tram | ND | .202 | 0.306 | ND |
| Waste treatment | .007 | ND | | 0.904 |

S 01781

DECLASSIFIED E.O. 12065 SECTION 3 NSC MEMO

| | | | | |
|---|---|---|---|---|
| Crushing | ND | ND | ND | 0.225 |
| Grinding | ND | ND | ND | 0.667 |
| Gravity | ND | ND | ND | 0.562 |
| De-watering | ND | ND | ND | 0.200 |
| Picking | ND | ND | ND | 1.230 |
| Office | ND | ND | ND | 0.544 |
| Total | ¥ 0.670 | ¥ 1.178 | ¥ 2.826 | ¥ 6.603 |
| $ Value of yen | $ 0.49 | $ 0.28 | $ 0.23 | ND |
| $ per ton of ore treated | $ 0.31 | $ 0.33 | $ 0.65 | ND |

S 0.461

DECLASSIFIED E.O. 12065

M2

Direct Costs in yen per metric ton of mill feed

| Items | 1930 | 1935 | 1940 | 1944 |
|---|---|---|---|---|
| Labor * | ¥ 0.298 | ¥ 0.264 | ¥ 0.658 | ¥ 1.530 |
| Supplies | 0.077 | 0.200 | 0.323 | 0.407 |
| Timber | 0.010 | 0.013 | 0.062 | 0.082 |
| Shop | 0.005 | 0.002 | 0.030 | 0.166 |
| Power | 0.107 | 0.229 | 0.356 | 0.351 |
| Repairs | ~~ND~~ | ~~ND~~ | ~~ND~~ | ~~ND~~ |
| Machinery | 0.079 | 0.176 | 0.882 | 1.014 |
| Plant | 0.012 | 0.021 | 0.156 | |
| Assaying | 0.054 | 0.040 | 0.052 | 0.097 |
| Miscelaneous | 0.028 | 0.233 | 0.307 | 0.712 |
| Transportation | ND | ND | ND | 0.346 |
| Administration | ND | ND | ND | 1.898 |
| Total | ¥ 0.670 | ¥ 1.178 | ¥ 2.826 | ¥ 6.603 |
| Total per ton of concentrates | ¥1.049 | ¥ 2.107 | ¥ 5.557 | ¥ 14.633 |
| Cu grade of concentrate | 2.15% | 2.54% | 2.49% | 2.52% |
| $value of Yen | $ 0.49 | $ 0.28 | $ 0.23 | ND ND |
| $ per pound fo copper in concentrates | $ 0.011 | $ 0.011 | $ 0.024 | ND |

For convenience the whole cost of milling is shown as chargeable against the copper content of the concentrates because therecords do not distinguish between copper and pyrite ~~production~~ COSTS. Sulphur sales could be considered a credit against these charges.

* Some general welfare items are omitted because they have not been segregated between mine, mill, and smelter workers.

S 01781

Products of the Hitachi Mine itself have been especially remunerative as

NEW PAGE

## Costs & Income

According to data submitted by the head office of the Nippon Mining Company, the combined Hitachi operations have been consistently ~~very~~ profitable in the period 1930-1944. ~~P~~profits amounted to 100% of costs in many years. The accompanying graphs ~~Graph No. C-1~~ shows the available data in succinct form. A point to remember is that the Hitachi mine, mill, smelter, acid plant and refinery are all located within a few miles of each other and form a well-integrated unit. Copper from the Hitachi Mine alone has accounted for 28 ~~to~~ 60% of total refinery production and 34 to 67% of smelter production during the period 1930-1945.

Insert Graph No. C-1

The Company has endeavored, on request, to segregate income and expenses in terms of the products from the Hitachi Mine itself, although the records are complicated by the presence of custom ore in the Hitachi smelter, acid plant, and refinery. ~~Hence~~ The figures are not expected to be precisely accurate; so they are not yet they should serve to give a fairly close ~~picture~~ idea on a graph of ~~of the mines~~ recent profits and losses. Tabulated data ~~carriage~~.

Total sales for the Hitachi Mine itself include all by-products derived from the mine, such as pyrite, gold, silver, nickel, platinum, copper sulphate, and sulphuric acid, in terms of yen per kilogram of refined copper. Costs correspond. Costs include all the usual items of a complete Tabulation ~~expenses of the company applicable to Hitachi operations~~ except depletion, which is not a Japanese account. ~~Amortization of the capital investment was written off prior to 1930. Interest on loans is omitted also, being a financial matter pertaining more to other businesses~~ of the Company. finance enterprises

The effort to segregate Hitachi items from the Company's general affairs may not have been entirely successful, but the figures presented here should give a fair idea of the situation.

Contrary to popular foreign opinion, subsidies have been relatively unimportant to the Hitachi Mine, as shown on Graph No. C-2. Following are the details of payments received to compensate for the rigidly controlled national price scale. The Company officials insist this is complete.

DECLASSIFIED E.O. 12065

Subsidies in yen per kilogram of refined copper produced

| | Gold | Exploration | Smelting | Pyrite freight | Total |
|---|---|---|---|---|---|
| 1941 | ¥ 0.01 | ¥ 0.009 | 0 | 0 | ¥ 0.019 |
| 1942 | .015 | .009 | 0 | 0 | .024 |
| 1943 | .014 | .009 | 0 | ¥ 0.001 | .024 |
| 1944 | .013 | .062 | ¥ 0.07 | 0 | .143 |
| 1945 | .028 | 0 | 0.123 | 0 | .151 |

In addition the Company received a subsidy of ¥ 31,100 in 1941 to buy electric and battery locomotives. More important was the receipt of ¥ 1,050,000 in 1945 as a 2/3 payment for ~~to subsidize~~ the enlargement of the mill. This was the equivalent of ¥ 0.469 per kilogram of refined copper produced in that year and is the chief item in the graph of subsidies.

Gold was subsidized at the rate of ¥ 1.00 per gram in 1941 and ¥ 0.80 per gram from 1942 to the end of the war. Exploration and development work was subsidized to the extent of 30 to 50 yen per meter of drifts and crosscuts and 150 yen per meter of shafts. These are were about a fifth of actual costs. Hitachi received a subsidy of ¥ 5.00 per ton of sulphide ore sintered and ¥ 4.70 per ton of ore smelted. Some of the distant pyrite ore shipments received a freight bonus of ¥ 2.00 per ton.

More important to remeber is the value of by-products at Hitachi. The income from them has effected as much as a two-thirds reduction in net costs of producing refined copper. Even without the sale of by-products, Hitachi would have been profitable, but their presence accounts for roughly 40% of the sales for many years, as shown on Graph No. C-2.

INSERT GRAPH NO C-2

S 01781

Graph No. C-3 shows that Hitachi copper was so cheap following the devaluation of the yen that it could actually have entered the United

DECLASSIFIED E.O. 12065 [illegible]

States market from 1933 to 1938 inclusive despite the American tariff of 4 ¢ per pound of copper. The obvious restraining factor was the greater profitability of the Japanese market, but it is noteworthy that the net cost of Hitachi copper was less than 3 ¢ per pound

INSERT GRAPH C-3

So impressive is the record of Hitachi in the 1930-1944 period that it presages well for the future of the mine. The foregoing chapters on mining, milling, production, and reserves substantiate this conclusion. However the years 1945 ~~and~~ 1946 ~~are~~ were critical as far as company finances are concerned. The general economic chaos of post-war Japan may ruin the Nippon Mining Company but the mine's inherent profitability can be expected to return when economic conditions become stable again.

Meanwhile the ~~price of electrolytic copper in Japan in 1946 was fixed at 20,000 yen per metric ton and~~ preliminary estimates of gross costs of producing refined copper from Hitachi in September 1946, were 26,000 yen per metric ton, less 4700 yen for the value of by-products. If the exchange rate were 50 yen to $1.00 the net cost would be equal to 19.3 ¢ per pound of copper. Such a figure is introduced only for general comparisons as a free commercial exchange has not been set up and any rates used now are purely speculative. The free market price of copper in the United States after the abolition of price controls in November, 1946, was 19 ¢ per pound ~~also.~~ by way of comparison.

S 01781

VI No.1

Hitachi

No.

# Annual Ore Production Since Its Beginning (Calender Year)

昭和　年　月　日

(Hitachi Mine)

| Calendar Year | Mine Production Amount | Cu. Grade | Cu. Amount | Au Grade | Au Amt | Ag Grade | Ag Amt | S Grade | S Amt |
|---|---|---|---|---|---|---|---|---|---|
| | m.t | % | m.t | gr/ton | gr. | gr/ton | gr. | % | m.t |
| 1906 | 11386 | 3.35 | 381 | 0.8 | 9109 | 9.0 | 102474 | 32.20 | 3666 |
| 1907 | 30550 | 3.12 | 953 | 0.8 | 24440 | 9.0 | 274950 | 31.70 | 9684 |
| 1908 | 58284 | 4.11 | 2396 | 0.8 | 46628 | 9.0 | 524565 | 34.00 | 19817 |
| 1909 | 98514 | 4.03 | 3969 | 0.8 | 78815 | 9.0 | 886671 | 33.60 | 33102 |
| 1910 | 105644 | 4.41 | 4658 | 0.8 | 84515 | 9.0 | 950796 | 34.70 | 36658 |
| 1911 | 126155 | 3.87 | 4877 | 0.8 | 100924 | 9.0 | 1135395 | 33.40 | 42136 |
| 1912 | 162571 | 3.53 | 5733 | 0.8 | 130062 | 9.0 | 1463195 | 32.60 | 53000 |
| 1913 | 207387 | 3.50 | 7249 | 0.8 | 165918 | 9.0 | 1866573 | 32.50 | 67404 |
| 1914 | 289754 | 2.58 | 7471 | 0.8 | 231803 | 9.0 | 2607786 | 30.30 | 87795 |
| 1915 | 405936 | 2.47 | 10021 | 0.8 | 324749 | 9.0 | 3653424 | 30.00 | 121781 |
| 1916 | 460288 | 2.25 | 10359 | 0.7 | 322202 | 8.0 | 3682304 | 29.60 | 136245 |
| 1917 | 497229 | 2.05 | 10183 | 0.7 | 348410 | 8.0 | 3981832 | 32.34 | 160966 |
| 1918 | 529649 | 2.16 | 11433 | 0.7 | 370754 | 8.0 | 4237192 | 31.36 | 166098 |
| 1919 | ~~443190~~ 453190 | ~~3.10~~ 3.10 | ~~9520~~ 9520 | 0.7 | 317233 | 8.0 | 3625520 | 29.47 | 133585 |
| 1920 | 362511 | 2.07 | 7491 | 0.7 | 253758 | 8.0 | 2900088 | 29.26 | 106053 |
| 1921 | 271488 | 2.13 | 5794 | 0.7 | 190042 | 8.0 | 2171904 | 29.26 | 79437 |
| 1922 | 294224 | 1.98 | 5842 | 0.7 | 206447 | 8.0 | 2359382 | 28.85 | 85086 |
| 1923 | 324161 | 2.13 | 6914 | 0.8 | 259329 | 7.0 | 2269127 | 29.26 | 94850 |
| 1924 | 301843 | 1.84 | 5543 | 0.7 | 211290 | 7.0 | 2112301 | 28.36 | 85603 |
| 1925 | 305645 | 1.85 | 5668 | 0.7 | 213952 | 8.0 | 2445160 | 26.65 | 81454 |
| 1926 | 280803 | 1.84 | 5167 | 0.6 | 168482 | 8.0 | 2247224 | 25.64 | 72058 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1916 | 460238 | 205 | 10387 | 0.7 | 324042 | 8.0 | 3823304 | 21.26 | 180.03 | |
| | 1917 | 497729 | 205 | 10183 | 0.7 | 348410 | 8.0 | 3981832 | 32.34 | 160966 | |
| | 1918 | 529649 | 216 | 11433 | 0.7 | 370254 | 8.0 | 4237192 | 31.36 | 166098 | |
| | 1919 | 453190 | 210 | 9520 | 0.7 | 317233 | 8.0 | 3625520 | 29.47 | 133555 | |
| | 1920 | 362511 | 207 | 7491 | 0.7 | 253788 | 8.0 | 2900088 | 29.26 | 105853 | |
| | 1921 | 271488 | 213 | 5797 | 0.7 | 190042 | 8.0 | 2171904 | 29.26 | 79437 | |
| | 1922 | 294924 | 198 | 5942 | 0.7 | 206447 | 8.0 | 2359392 | 28.5 | 85086 | |
| | 1923 | 324161 | 213 | 6214 | 0.8 | 259329 | 7.0 | 2268127 | 29.26 | 94850 | |
| | 1924 | 301843 | 184 | 5843 | 0.7 | 241290 | 7.0 | 2112901 | 28.36 | 85603 | |
| | 1925 | 305645 | 185 | 5668 | 0.7 | 213952 | 8.0 | 2445760 | 26.65 | 81454 | |
| | 1926 | 308922 | 184 | 5697 | 0.6 | 185353 | 8.0 | 2471376 | 25.60 | 79084 | |
| | 1927 | 327502 | 111 | 5814 | 0.7 | 228300 | 7.0 | 2283004 | 25.84 | 84872 | Compensating Error |
| | 1928 | 365245 | 132 | 5553 | 0.6 | 219147 | 8.0 | 2921960 | 24.10 | 88024 | |
| Bottom of deposit | 1929 | 428793 | 136 | 5819 | 0.6 | 257276 | 7.0 | 3001551 | 22.82 | 98.279 | |
| | 1930 | 453648 | 142 | 6417 | 0.6 | 272189 | 6.0 | 2721888 | 21.67 | 98.306 | |
| | 1931 | 469441 | 136 | 6312 | 0.5 | 231726 | 7.0 | 3244157 | 22.03 | 102.98 | |
| | 1932 | 507060 | 132 | 6574 | 0.6 | 304236 | 6.0 | 3042360 | 24.57 | 124585 | |
| | 1933 | 626528 | 144 | 7798 | 0.6 | 375917 | 8.0 | 5012224 | 29.98 | 187833 | |
| | 1934 | 671461 | 126 | 8454 | 0.6 | 402877 | 8.0 | 5371688 | 29.50 | 188081 | |
| | 1935 | 688341 | 119 | 8218 | 0.6 | 443131 | 7.0 | 4818857 | 24.23 | 166836 | |
| | 1936 | 698827 | 124 | 8446 | 0.6 | 419296 | 8.0 | 5590616 | 24.48 | 171073 | |
| | 1937 | 703087 | 118 | 8285 | 0.6 | 424852 | 7.0 | 4924609 | 22.24 | 156367 | |
| | 1938 | 705010 | 118 | 8317 | 0.6 | 423006 | 7.0 | 4935070 | 21.44 | 151154 | |
| | 1939 | 674613 | 119 | 7034 | 0.6 | 404768 | 8.0 | 5396904 | 22.18 | 149629 | |
| | 1940 | 712431 | 130 | 7248 | 0.6 | 427458 | 7.0 | 4985717 | 22.56 | 160747 | |
| | 1941 | 791604 | 121 | 9586 | 0.6 | 458723 | 6.0 | 4807923 | 22.94 | 181629 | |
| | 1942 | 839444 | 119 | 9969 | 0.6 | 503277 | 7.0 | 5631846 | 22.38 | 187840 | EXACT |
| | 1943 | 834773 | 128 | 10724 | 0.6 | 486052 | 6.0 | 5367644 | 23.13 | 183.111 | |
| | 1944 | 752321 | 126 | 9462 | 0.5 | 398525 | 6.0 | 4530556 | 21.95 | 165106 | |
| full yr ? | 1945 | 266116 | 105 | 2850 | 0.5 | 128710 | 5.0 | 1458231 | 20.82 | 55402 | |
| Totals | | 17 108 401 | | 278 350 | | | | | 2684 | 4404376 | Grade makes |
| | | 17 117 188 | 163 | 278392 | 0.6 | 10853260 | 73 | 142898525 | | | |

Too low for

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1931 | 464441 | 136 | 8312 | 0.5 | 231.726 | 7.0 | 3244157 | 22.03 | 102.098 | |
| | 1932 | 509260 | 122 | 6670 | 0.6 | 304.236 | 6.0 | 3042360 | 24.57 | 124.585 | |
| | 1933 | 626528 | 144 | 7298 | 0.6 | 375.917 | 8.0 | 6012224 | 29.98 | 187.833 | |
| | 1934 | 671461 | 126 | 8454 | 0.6 | 402.877 | 8.0 | 5371688 | 29.50 | 188.081 | |
| | 1935 | 688751 | 119 | 8218 | 0.6 | 413.131 | 7.0 | 4819857 | 24.23 | 166.836 | |
| | 1936 | 698827 | 124 | 8446 | 0.6 | 419.296 | 8.0 | 5590616 | 24.48 | 171.073 | |
| | 1937 | 703087 | 118 | 8285 | 0.6 | 421.852 | 7.0 | 4924609 | 22.24 | 156.367 | |
| | 1938 | 705010 | 118 | 8317 | 0.6 | 423.006 | 7.0 | 4935070 | 21.44 | 151.154 | |
| | 1939 | 674613 | 119 | 8034 | 0.6 | 404.768 | 8.0 | 5396904 | 22.18 | 149.629 | |
| | 1940 | 712531 | 130 | 9248 | 0.6 | 427.518 | 7.0 | 4987117 | 22.56 | 160.747 | |
| | 1941 | 791604 | 121 | 9586 | 0.6 | 458.723 | 6.0 | 4807923 | 22.94 | 181.629 | |
| | 1942 | 839444 | 119 | 9969 | 0.6 | 503.277 | 7.0 | 5631946 | 22.38 | 187.840 | |
| | 1943 | 834773 | 128 | 10724 | 0.6 | 486.052 | 6.0 | 5367641 | 23.13 | 193.111 | |
| | 1944 | 742321 | 126 | 9462 | 0.5 | 398.525 | 6.0 | 4530556 | 21.95 | 165.106 | |
| full yr ? | 1945 | 266116 | 105 | 2850 | 0.5 | 128.710 | 5.0 | 1448231 | 20.82 | 55.402 | |
| Totals | | 17 108 401 | | 278 350 | | | | | | 2684 44046376 | Grade mates no allowance for loss in millers |
| | | 17 117 188 | 163 | 278392 | 0.6 | 10853260 | 73 | 112899525 | | | |

Too low for a/n's in some cases

0.65 H .029 T

7.5 H .229 T

7.1

(work)

no ?

high-gr block mined out

6582

+4.1

23 700 000 ÷ 385,249 = 61.5

DECLASSIFIED E.O. 12065 SECTION 3 NARS

DECLASSIFIED E.O. 12065 SECTION 3 102, MAR

G

NO 1 PLAN

⑤ Tipplers

- ⑤ 70 m/m Inclined

+70 m/m

Spalling with Sorting

Waste — Middling

③ Ore Bins ② 30" x 20" Blake Crushers

① 24" x 12" "

① 30" x 15" "

+35 m/m

④ Ore Bins

④ 15 m/m - Shaking Screen

+15 m/m — -15 m/m

④ 24" - Picking Belts

Cu - Concentrate — Middling — Waste

④ Ore Bins — ④ Ore Bins — ④ Ore Bins

② Drag - Belt

Fine Sand

① Drag - Belt Classifier

Sand — Slime

DECLASSIFIED E.O. 12065 SECTION 3 (E)

# GENERAL FLOW-SHEET OF HITACHI CO

Run of Mine Ore

Electric Locomotives

Weighing & Sampling

NO 1 PLANT

⑤ Tipplies

⑤ 70 m/m Inclined Grizzlies

+70 m/m

Spalling with Sorting

Waste

Middling

Ore Bins ③ 30"×20" Blake Crushers

① 24"×12" "

③ 30"×16" "

-70 m/m

⑤ Ore Bins

⑤ Shaking Feeders

① 25"-Belt Conveyor

① Ore Bin

① Skips

① Hopper

① Apron Feeder

③ 24"-Belt Conveyors

④ 35 m/m-Inclined Grizzlies

+35 m/m

④ Ore Bins

④ 15 m/m-Shaking Screen

+15 m/m

ing Belts

Waste

④ Ore Bins

-15 m/m

② Drag-Belt Conveyors

Fine Sand

① Drag-Belt Classifier

Sand

Slime

Coarse Sand

① 6"-Bucket Elevator

+150 m/m

Spalling with Sorting

Cu-Concentrate

③ Ore Bins

Middling

① Ore Bin

Waste

① Ore Bin

⑩

Cu-Con

⑩ Ore

④ Ore Bins

① 24"-Belt Conveyor

① Skips

① 18"-Belt Conveyor

① 25 m/m-Trommel

+25 m/m

② Ore Bins

② 15 m/m Shaking Screen

-25

① 16"-Belt

① 24"-Belt

① Ore B

+15 m/m

② 24"-Picking Belts

Cu-Concentrate

② Ore Bins

Middling

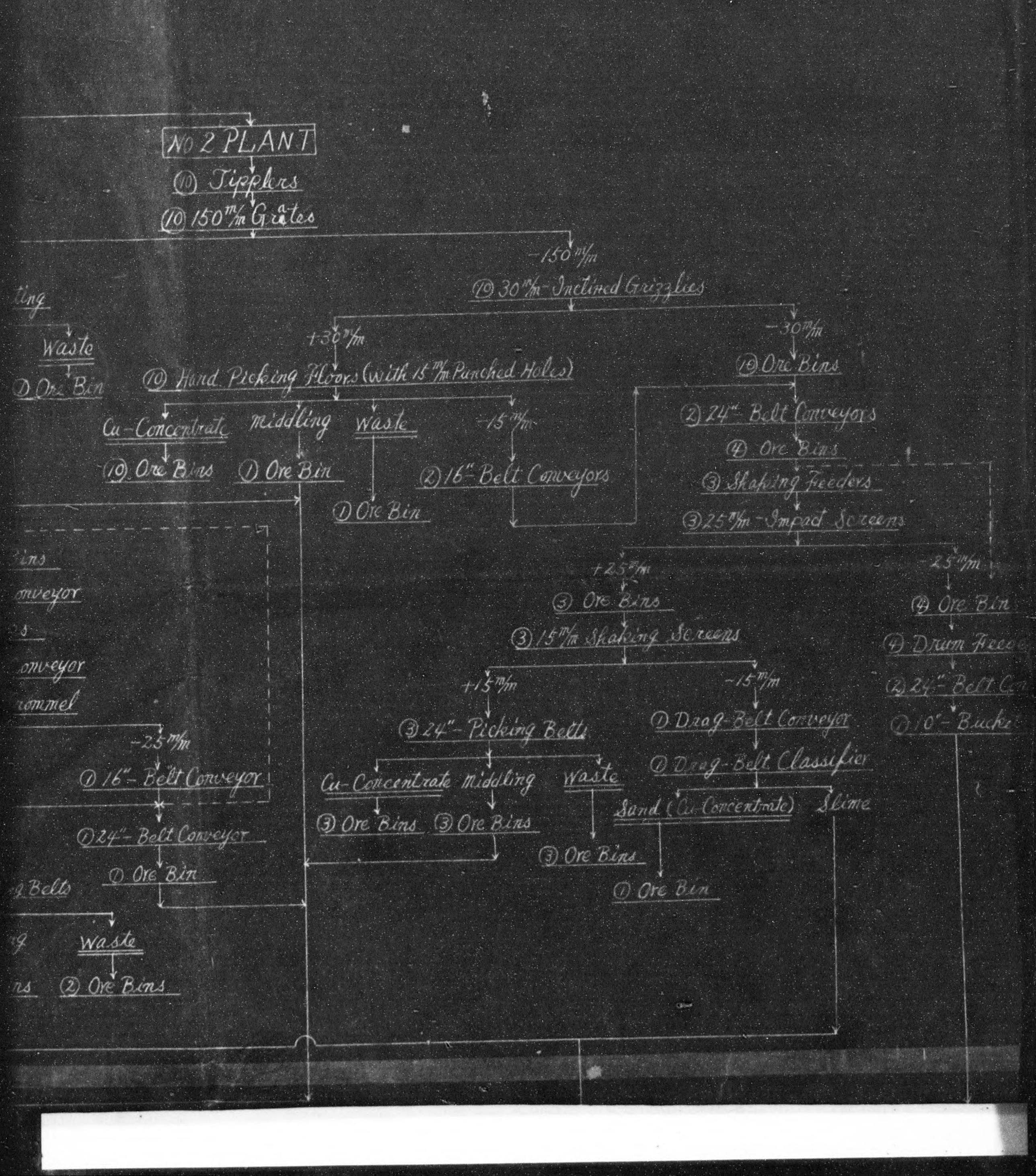
② Ore Bins

Waste

② Ore Bins

DECLASSIFIED E.O. 12065 SECTION 3 (b)

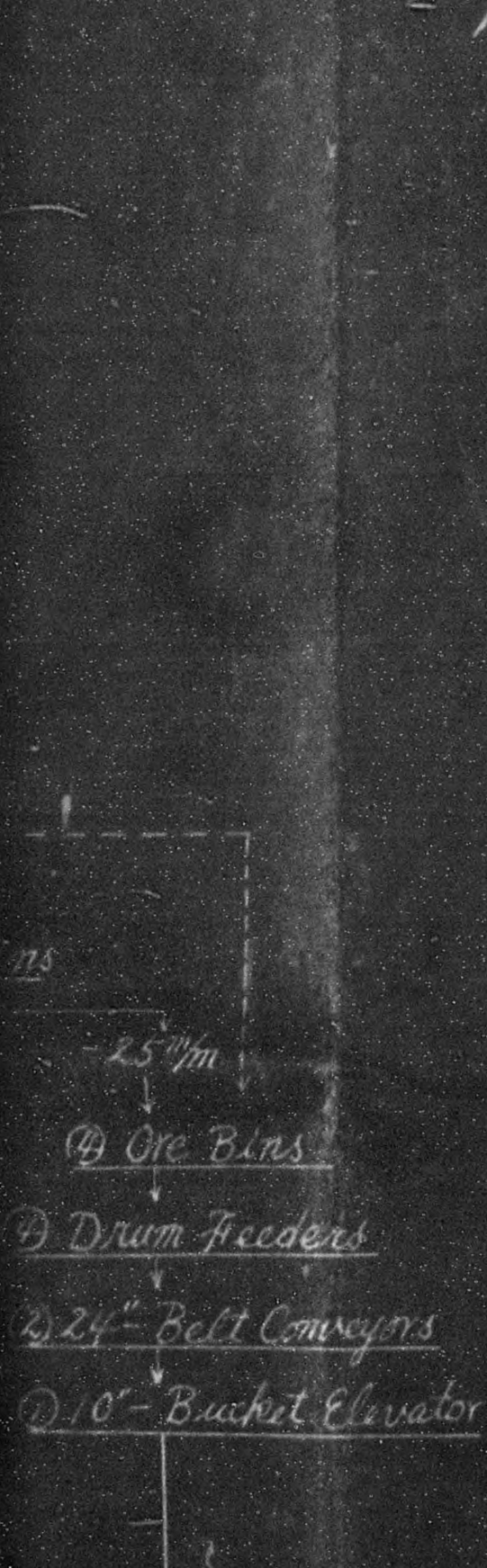
# ACHI CONCENTRATOR —Oct. 1945— Mine



DECLASSIFIED E.O. 12065 SECTION 3 (b)

Mining Dep. Hitachi Mine

- NOTE: 1) Figures written in the marches of ○ denote no. of machines equipped there.
2) No. 3 Plant is divided into two almost same sections. Equipment of both are given together.
3) All kinds of Concentrates produced are transported down to the smelter and the sulphuric acid factory at Daisen by two sets of ropeway. Some of them—mainly Pyritic Concentrates—are directly shipped to Markets.
4) Wastes and tailings are rejected by Mine sets of ropeway and some of them are used as filling material in the underground of the Mine.



DECLASSIFIED E.O. 12065

DECLASSIFIED E.O. 12065 SECTION 3 NLZ/NARS DATE

Tray - Belt Conveyors

Coarse Sand

Classifier

① 6"- Bucket Elevator

Slime

Cu- Concentrate

Middling

Waste

② Ore Bins

② Ore Bins

② Ore Bins

Storage-Battery Locomotives

① Shaft

① 16"- Belt Conveyors

NO. 4 PLANT

① Tippler

① Apron Feeder

① No. 5- Gyratory Crusher

① 24"- Belt Conveyor

① 36"- Symons Cone Crusher

① 12"- Bucket Elevator

① 24"- Belt Conveyor

② 16"- Belt Conveyors

① Ore Bin

① 24"- Belt Conveyor

① 24"- Belt Conveyor

① 24"- Belt Conveyor

① 8'x48"- Conical Ball mill

① 8'x27'- Duplex Hitachi Classifier

Sand

Bucket Elevators

3 m/m - Trommels

+3 m/m

Belt Classifiers

Sand

Willfley Tables

trate Middling

⑫ Willfley Tables

Concentrate Tailing

Duplex Hitachi Filtrating Classifiers

trate Tailing Slime Filtrate

Sand

② 12"- Bucket Elevators

① 3 m/m - Trommel

+3 m/m

-3 m/m

① 24"- Drag Belt Classifier

Sand

Slime

⑩ Willfley Tables

Concentrate Middling

⑨ Willfley Tables

Concentrat Tailing

① 5'x23' Duplex Hitachi Filtration- Classifiers

Concentrate Tailing Slime Filtrate

Slime

① Agitatio

① 4"- Sand

② Surge

② 18"- S.W. F

Concentrate

① 14'- S.W. Filte

Middling Concent

① K & K- Fil

Cu- Concentrate

DECLASSIFIED E.O. 12333 SECTION 3.4

(1) Ore Bin

(1) 24"-Belt Conveyor

(3)

(2) L

(1) 8'x L

(1) 8'x 24'-D

Sand

Crusher

eyor

usher

ator

ator

ator

Ball mill

Classifier

(20)

Taile

(1) Condi

(35) 7 Cells x 5 sets Flakier

S-Concentrate

( Slime Flotation )

(2) 6"-Krogh Sand Pumps

(1) 60'-Dorr Thickener

Spigot Overflow

(3) 2"-Krogh Sand Pumps

(1) Drag-Belt Classifier

Sand Slime

(1) Conditioner

(2) 18'-S.W. Flotators

Concentrate Middling

(1) 18'-S.W. Flotator (1) 18'-S.W. Flotator

Concentrate Middling Middling Tailing

(2) 3"-Sand Pumps

Slime

(1) Agitation Tank

(1) 4"-Sand Pump

(2) Surge Tanks

(2) 18'-S.W. Flotators

Concentrate Middling

(1) 14'-S.W. Flotator (1) Conditioner

Middling Concentrate (2) 15'-S.W. Flotators

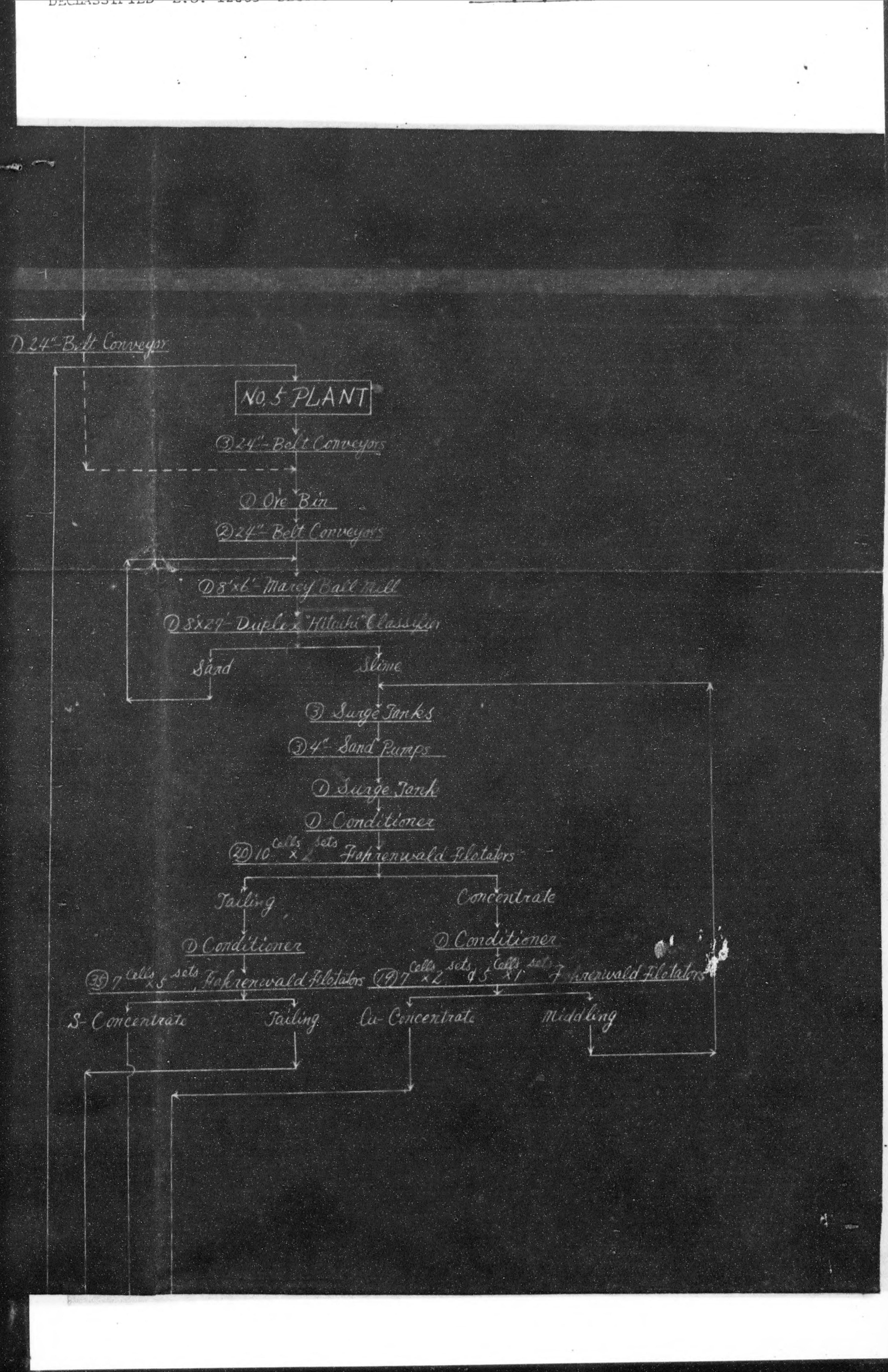
(1) K & K-Flotator Tailing Middling

Ca Concentrate Middling

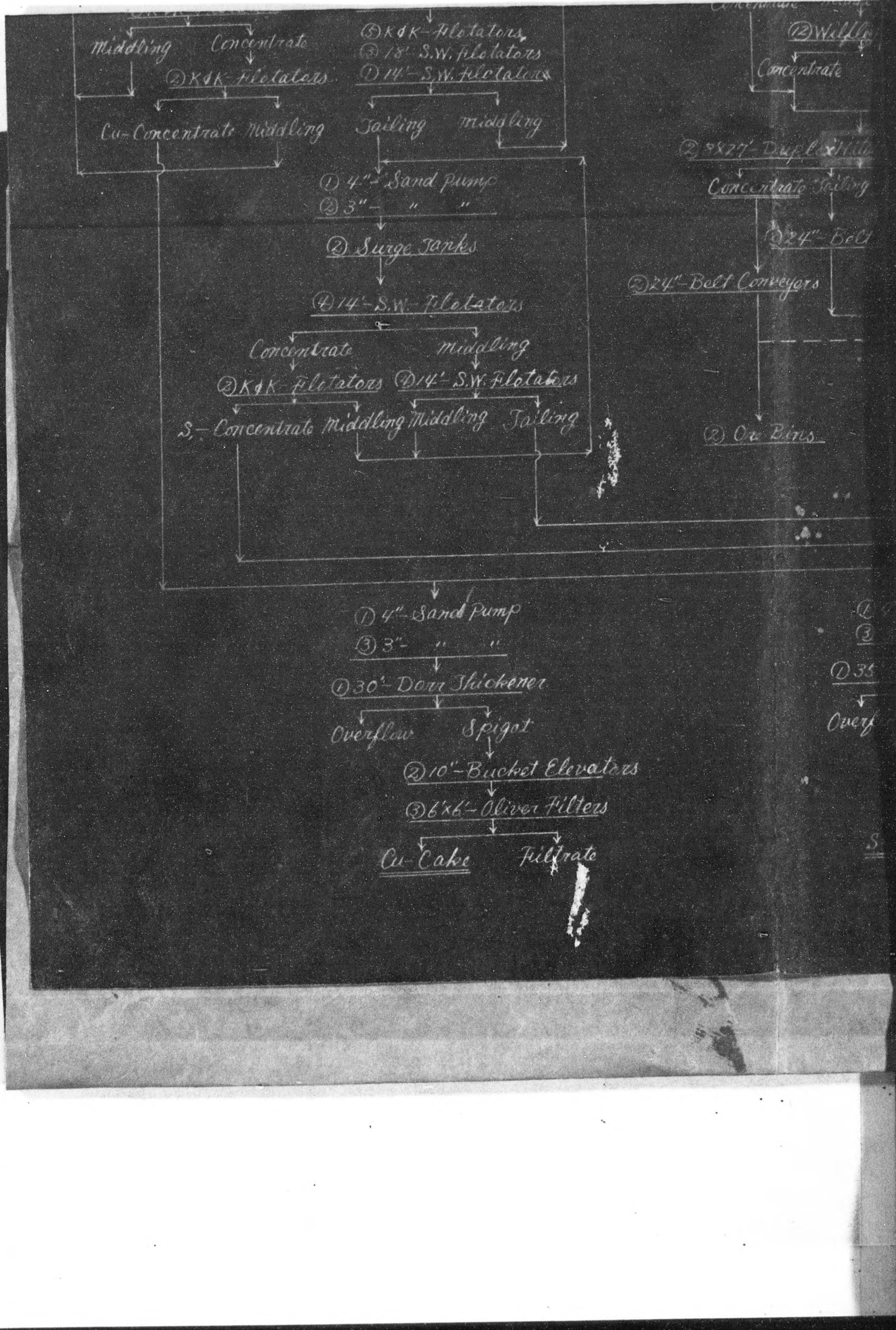
(1) 4"-Sand Pump

(1) Surge Tank

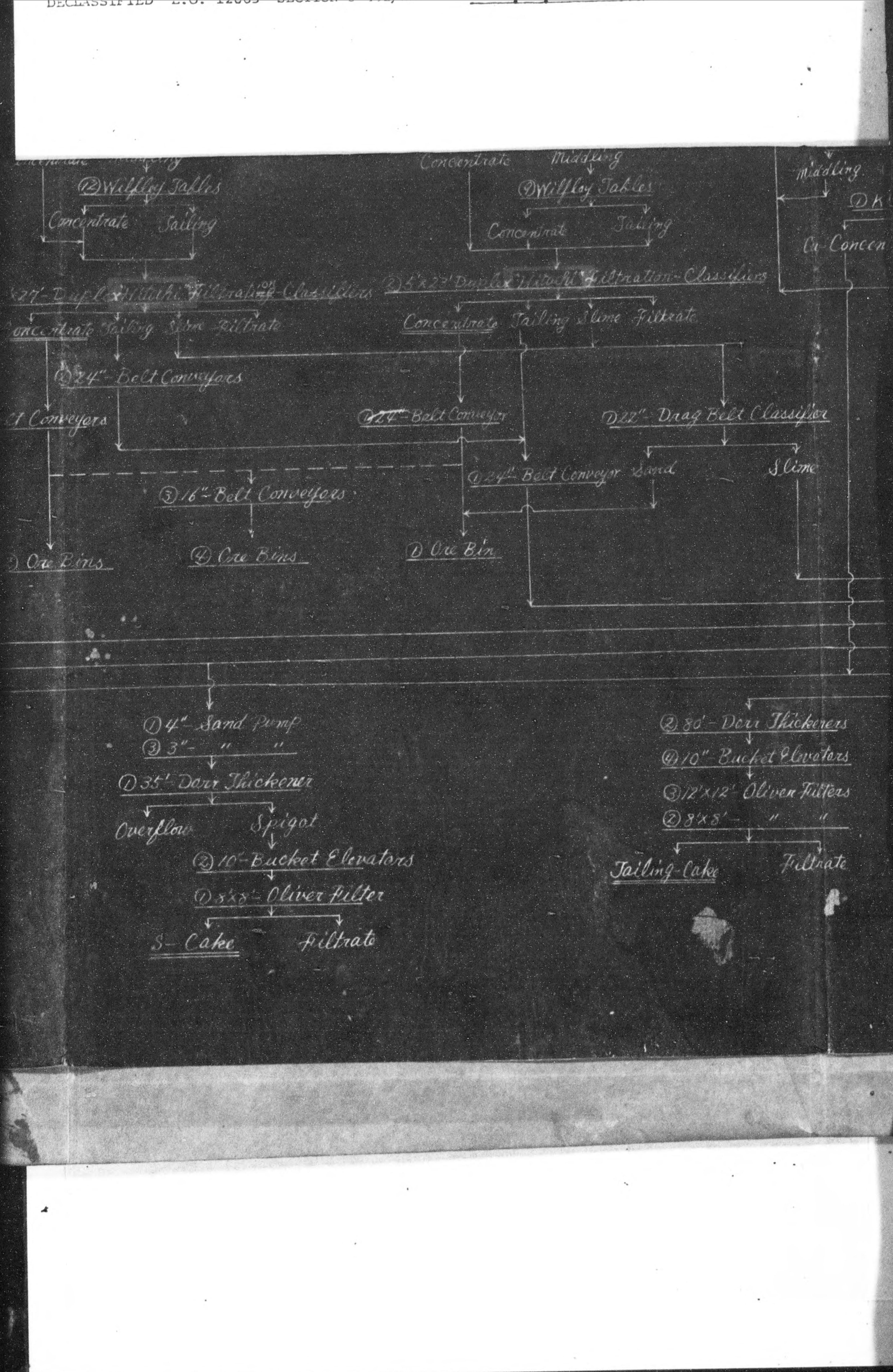
DECLASSIFIED E.O. 12065



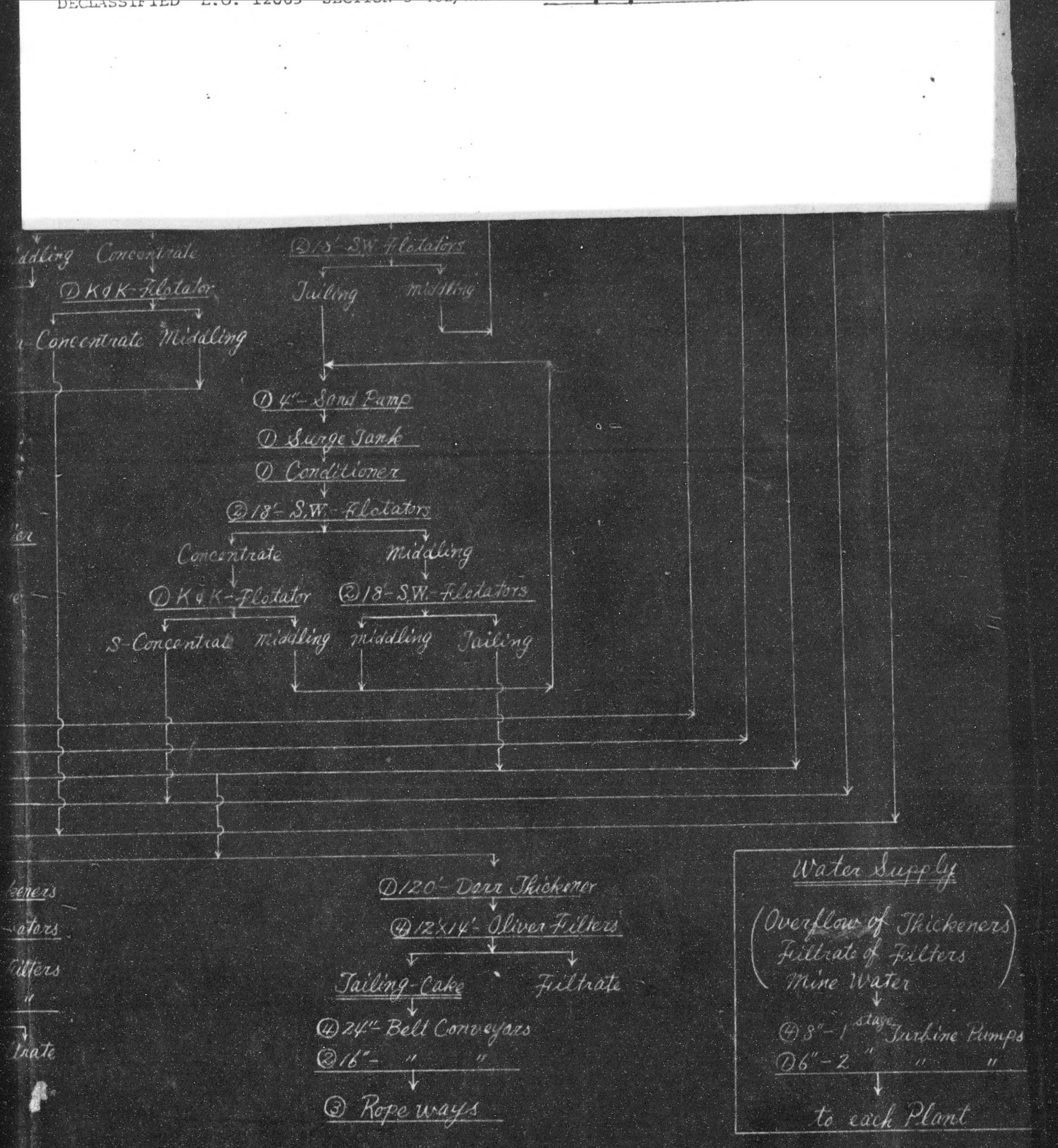
DECLASSIFIED E.O. 12065 SECTION 3.5



DECLASSIFIED E.O. 12065 SECTION 3 NLJ



DECLASSIFIED E.O. 12065 SECTION 3 NLZ/NARA DATE 12/31/96



DECLASSIFIED E.O. 12065 SECTION 3, 5

## Water Supply

(Overflow of Thickeners
Filtrate of Filters
Mine Water)

↓

④ 8"–1 stage Turbine Pumps
① 6"–2 " " "

↓

to each Plant

## Accessory Equipments for S.W. Flotators

① 463 m/m Rotean-Fun
① 283 m/m Turbo-Blower
① 565 m/m " "

## Accessory Equipments for Filters

① 710 m/m × 254 m/m Reciprocating vacuum pump
② 750 m/m × 300 m/m " "
① 14" × 8" " "

② 35 HP Rotary Compressor
① 50 HP Reciprocating Compressor

DECLASSIFIED E.O. 12065 SECTION 3.5

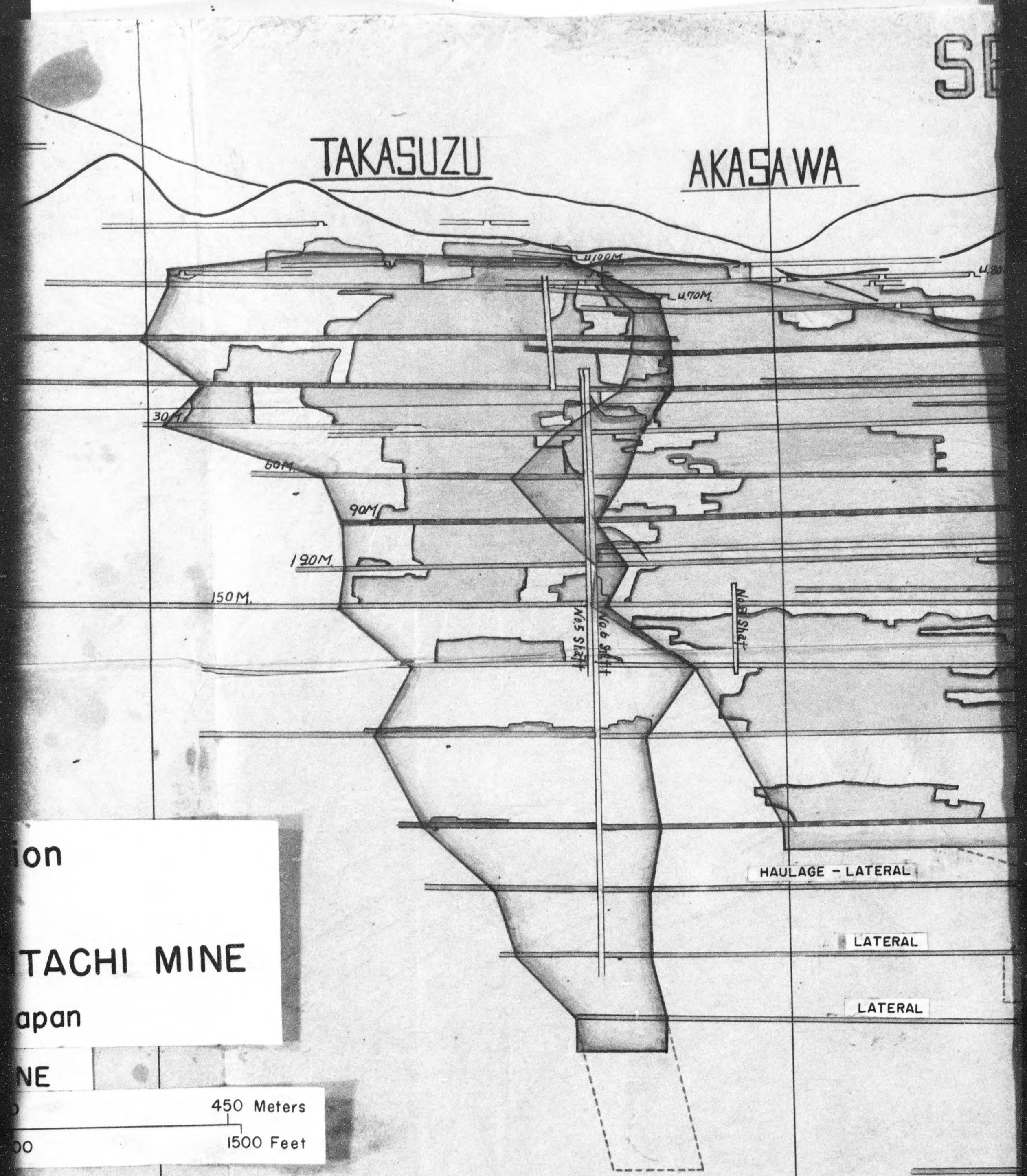



# Vertical Projection of the ORE DEPOSITS of the HITACHI MINE

## Ibaraki Prefecture Japan

DECLASSIFIED E.O. 12065 SECTION 3 (b) NARS DATE

# SE




on

TACHI MINE

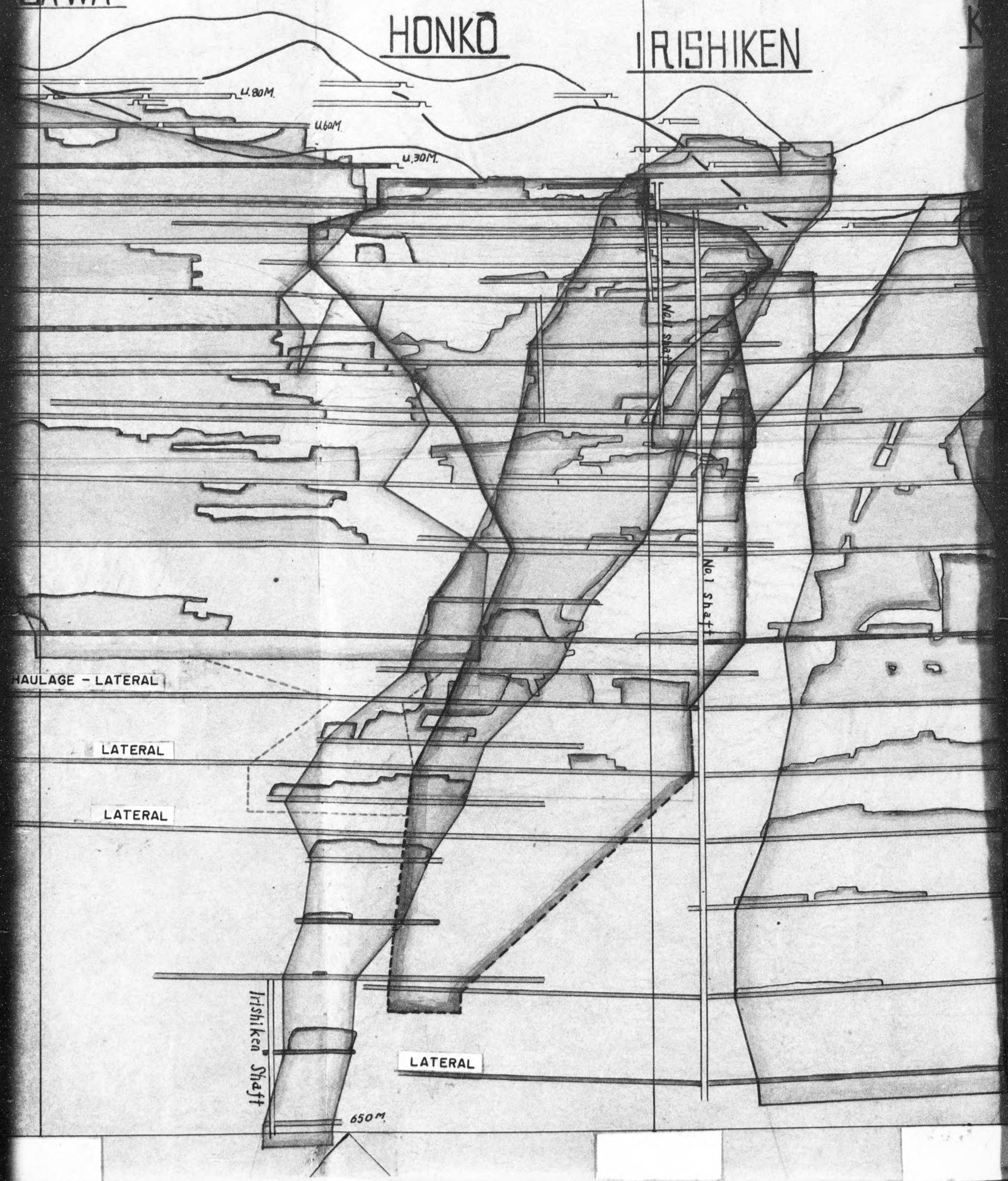
apan

NE

0 450 Meters

00 1500 Feet

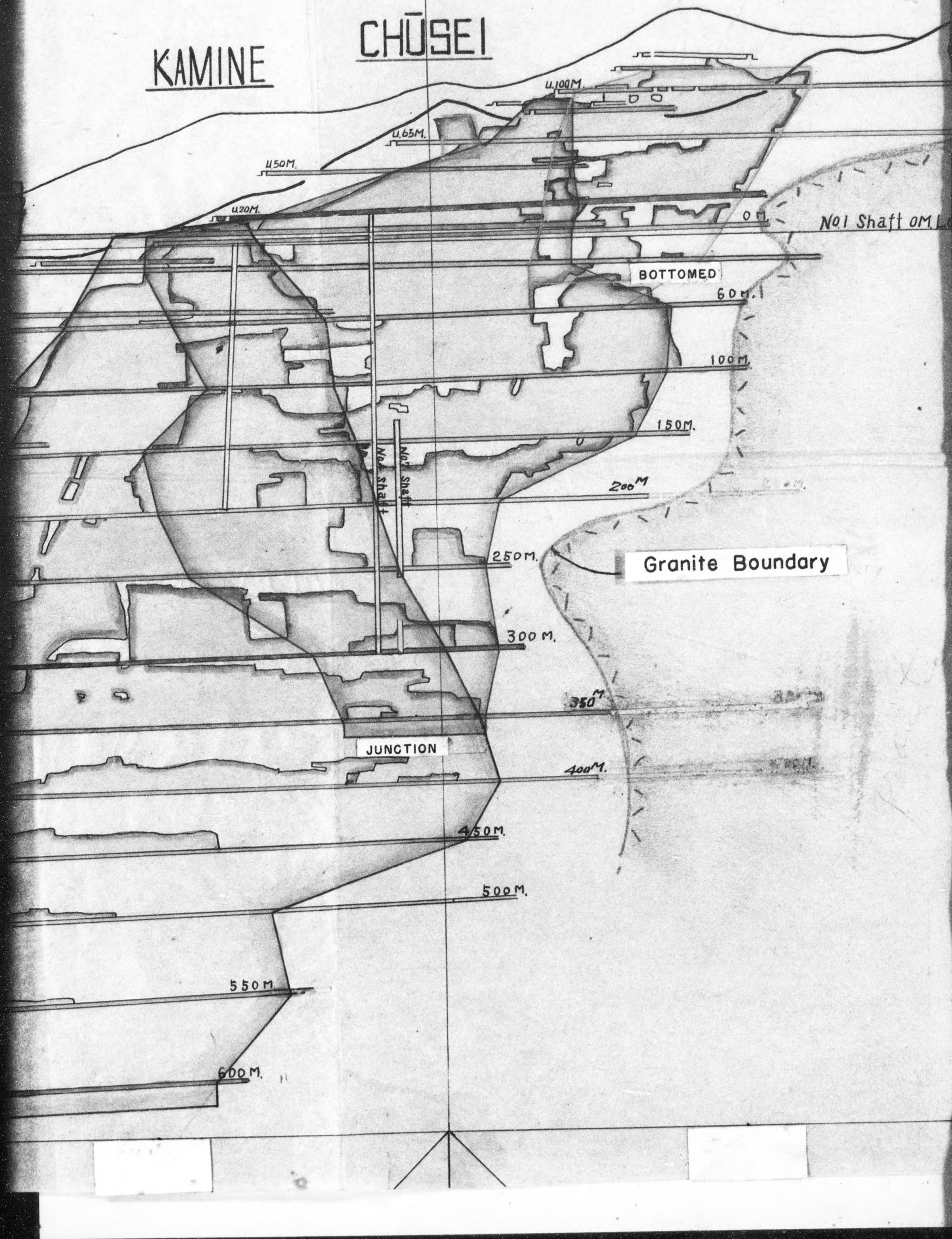
# SECTION


SAWA
HONKŌ
IRISHIKEN
K
4.80M.
4.60M.
4.30M.
No.1 Shaft
HAULAGE - LATERAL
LATERAL
LATERAL
Irishiken Shaft
650M.
LATERAL

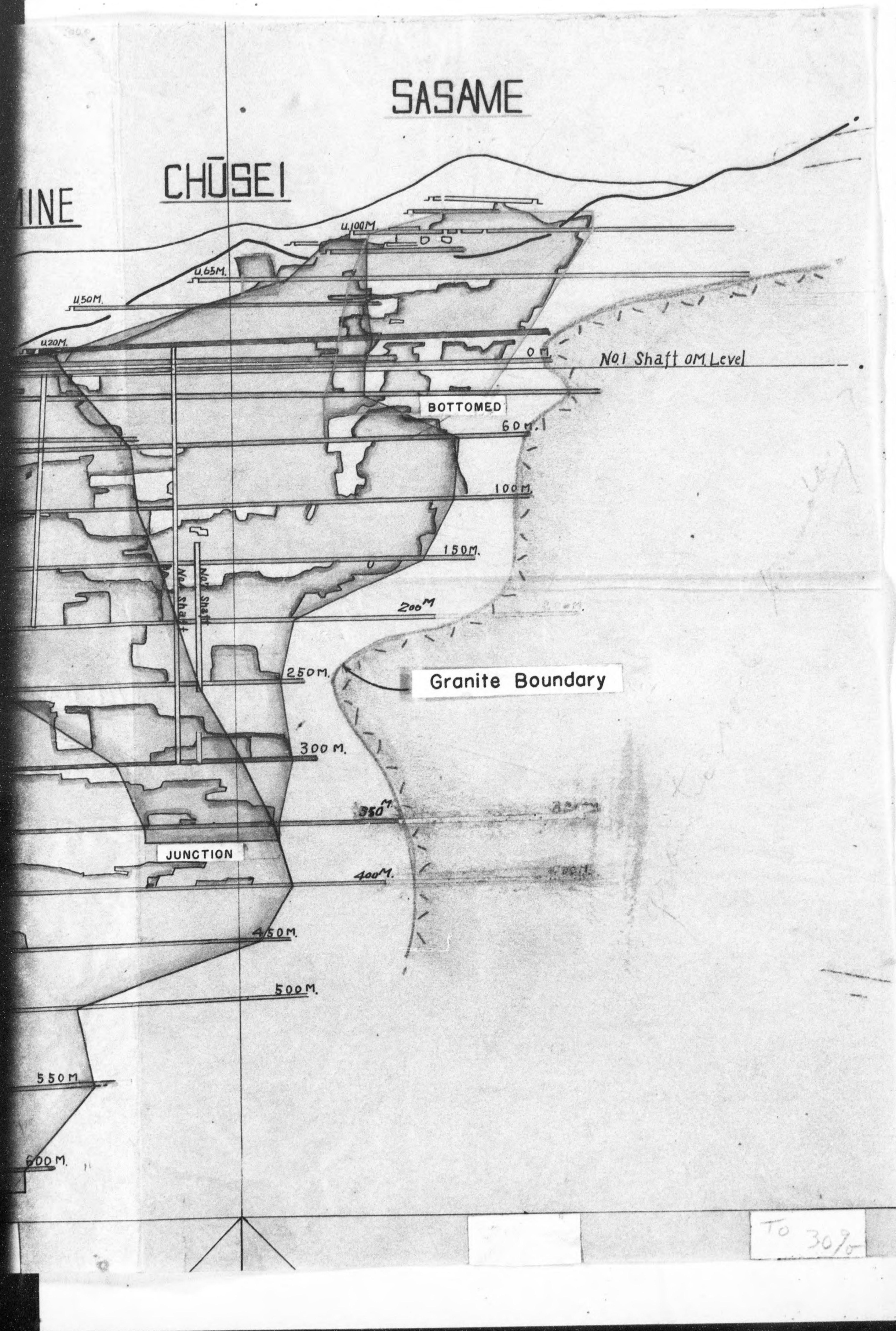
SASAME

KAMINE

CHŪSEI



DECLASSIFIED E.O. 12065




TO 30/0

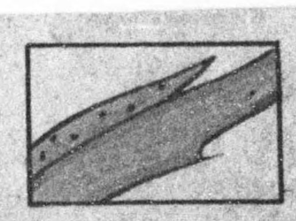
DECLASSIFIED E.O. 12065

# GEOLOGIC MAP OF 15

## HITACHI

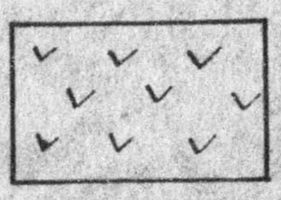
SCALE 0 100 200 300
0 250 500 750 100

EXPLANATIO

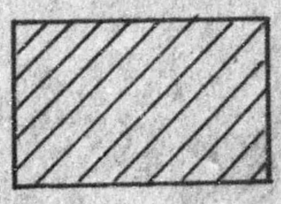


ORE

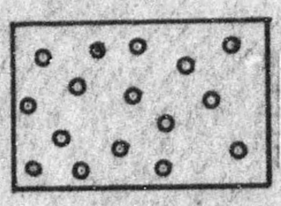
GRANO-DIORITE &



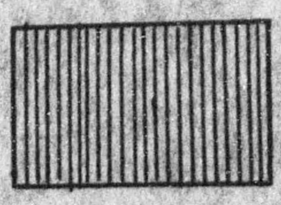
DIABASE



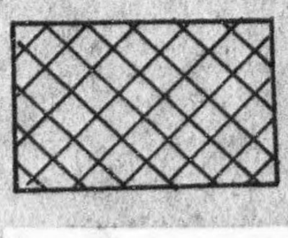
AMPHIBOLE SCHIS



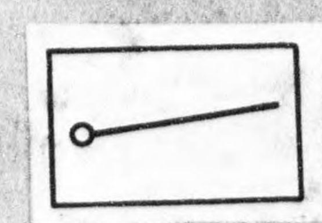
BIOTITE SCHIST



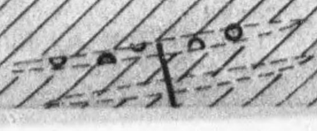
CHLORITE SCHIST



SERICITE SCHIST

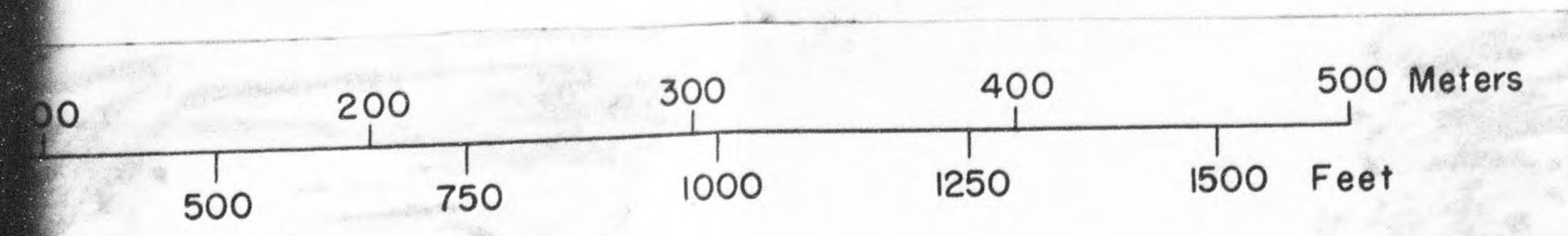


DRILL HOLE



DECLASSIFIED E.O. 12065 DEC 1978

# P OF 150 METER LEVEL
# TACHI MINE




## EXPLANATION

ORE

GRANO-DIORITE & DIORITE

DIABASE

AMPHIBOLE SCHIST

BIOTITE SCHIST

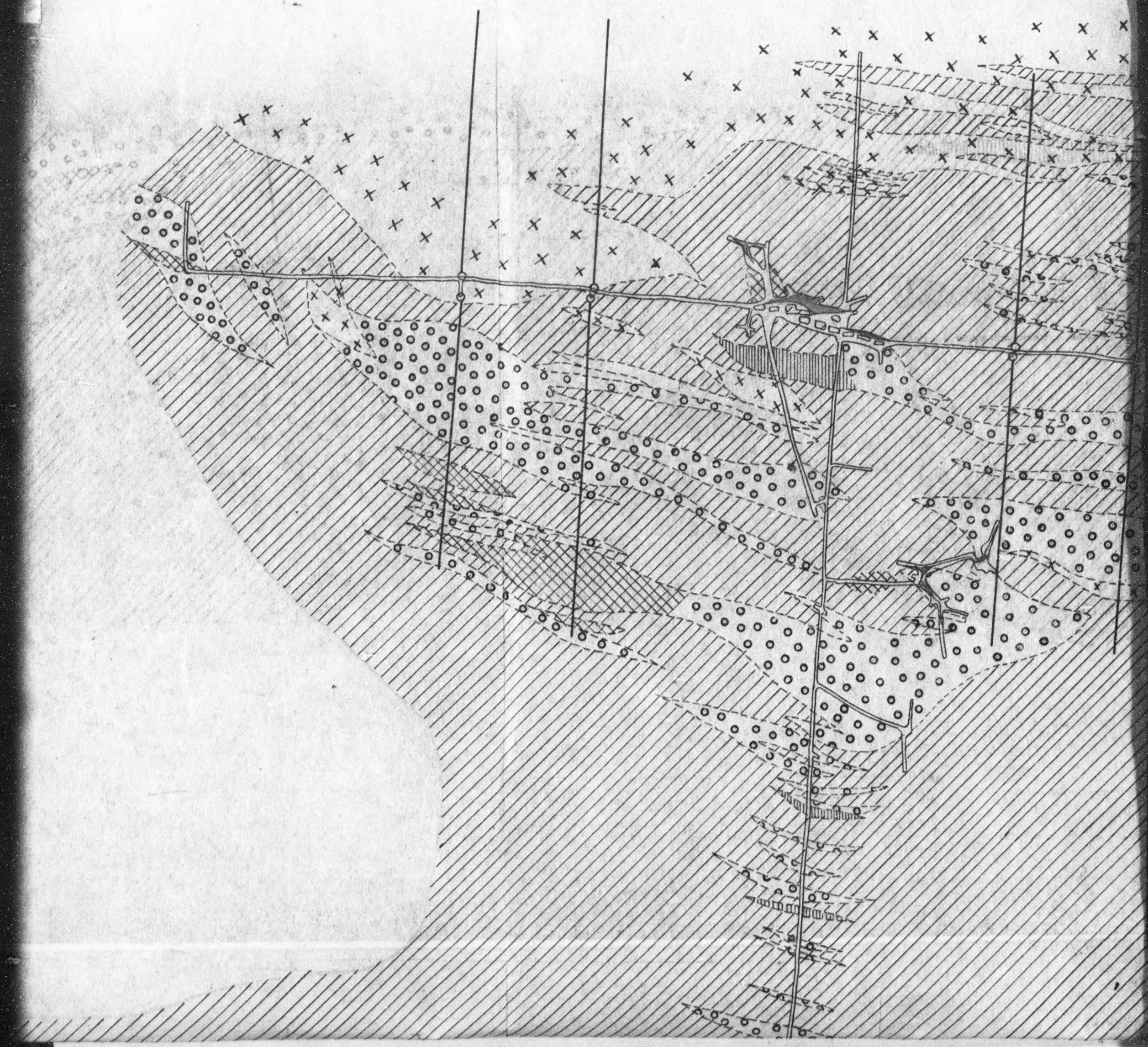
CHLORITE SCHIST

SERICITE SCHIST

DRILL HOLE

DECLASSIFIED E.O. 12065 SECRET/SENSITIVE

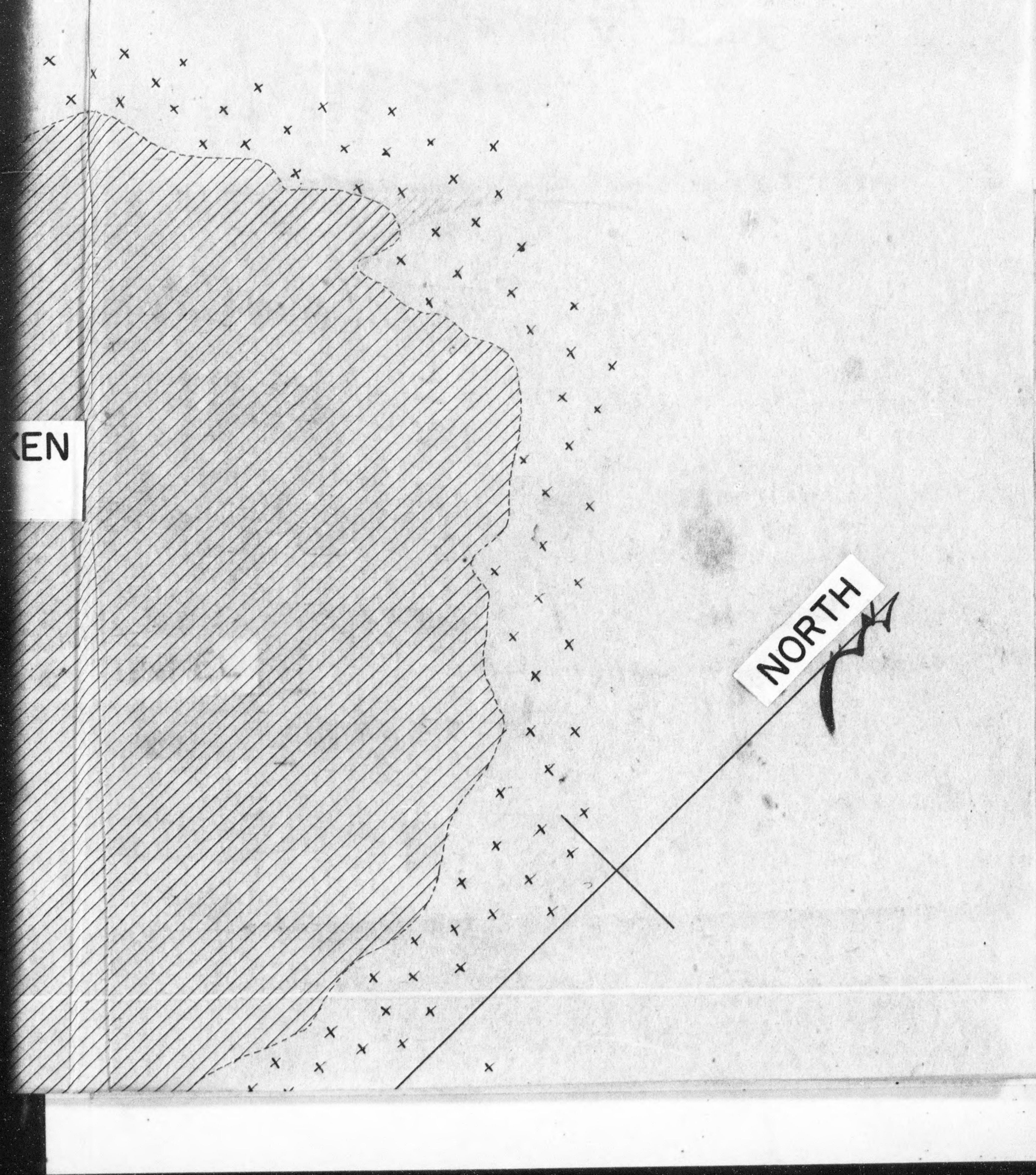
LEVEL



DECLASSIFIED E.O. 12065 [illegible]

IRISHIKEN
AREA

DECLASSIFIED E.O. 12065 SECTION 3 NLJ/NARA DATE 11-14-91

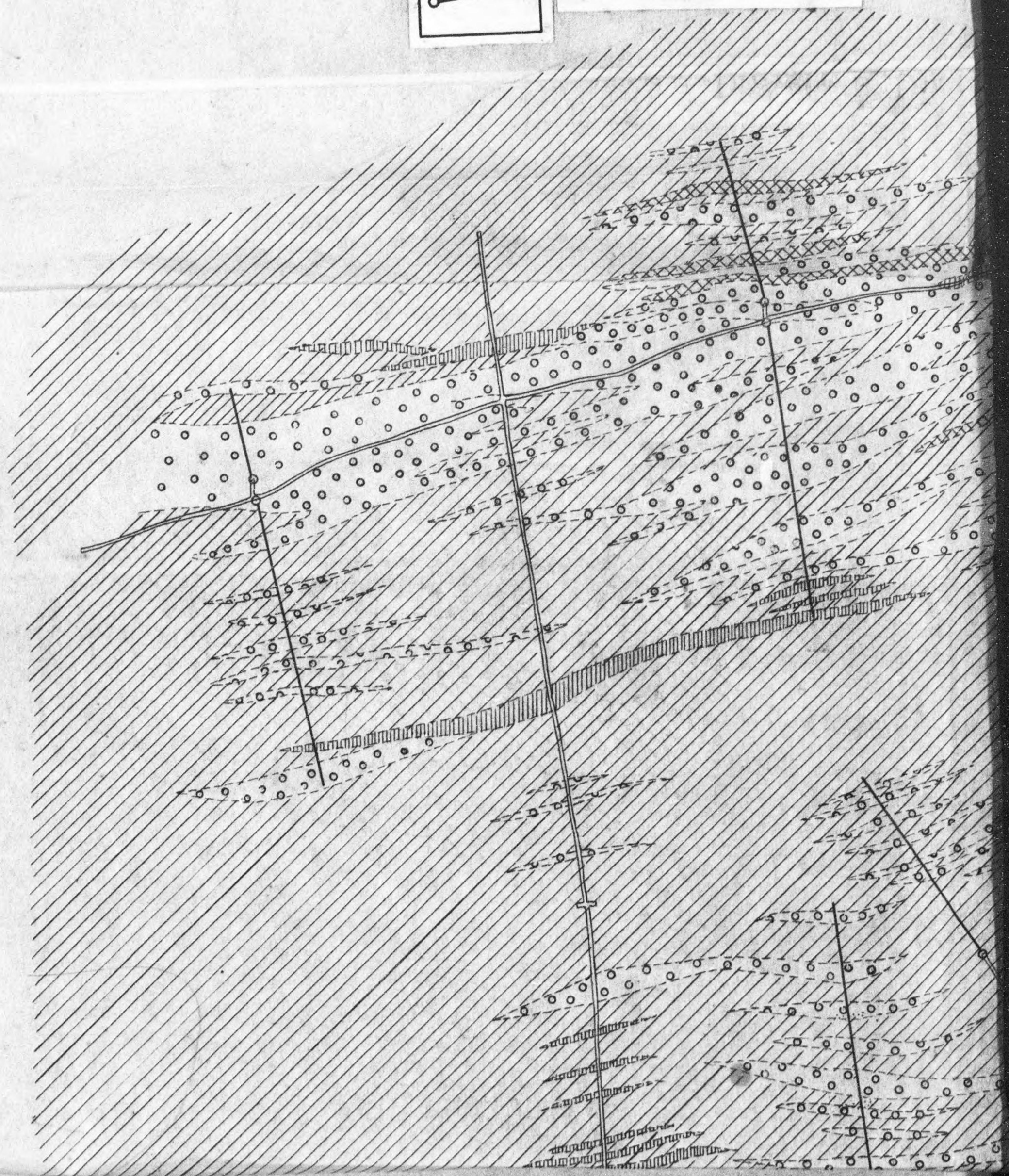


DECLASSIFIED E.O. 12065 SECTION 3 (E)

CHLORITE SCHIST

SERICITE SCHIST

DRILL HOLE



DECLASSIFIED E.O. 12333 SECTION 3.4(b)

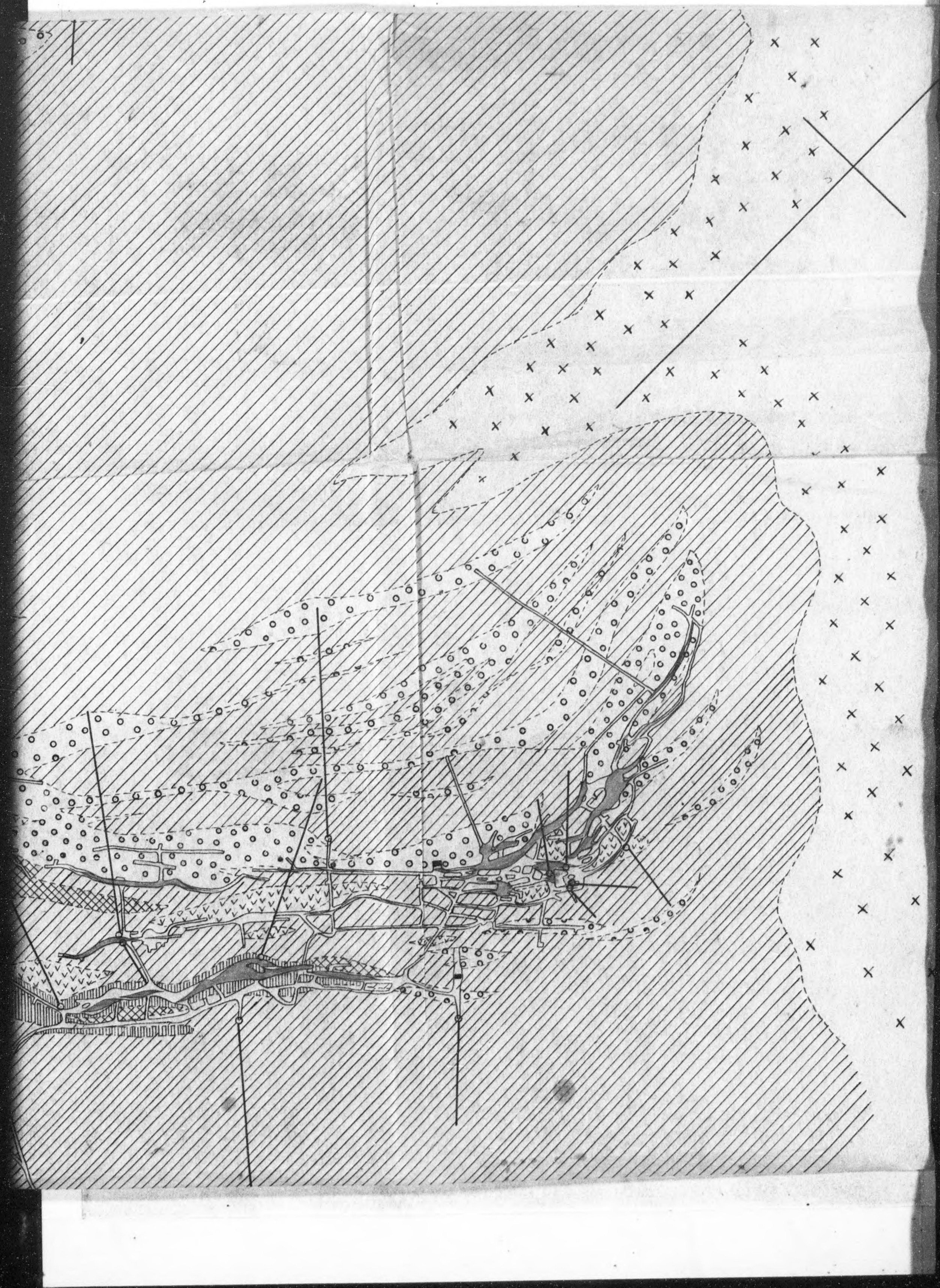
RITE SCHIST

ITE SCHIST

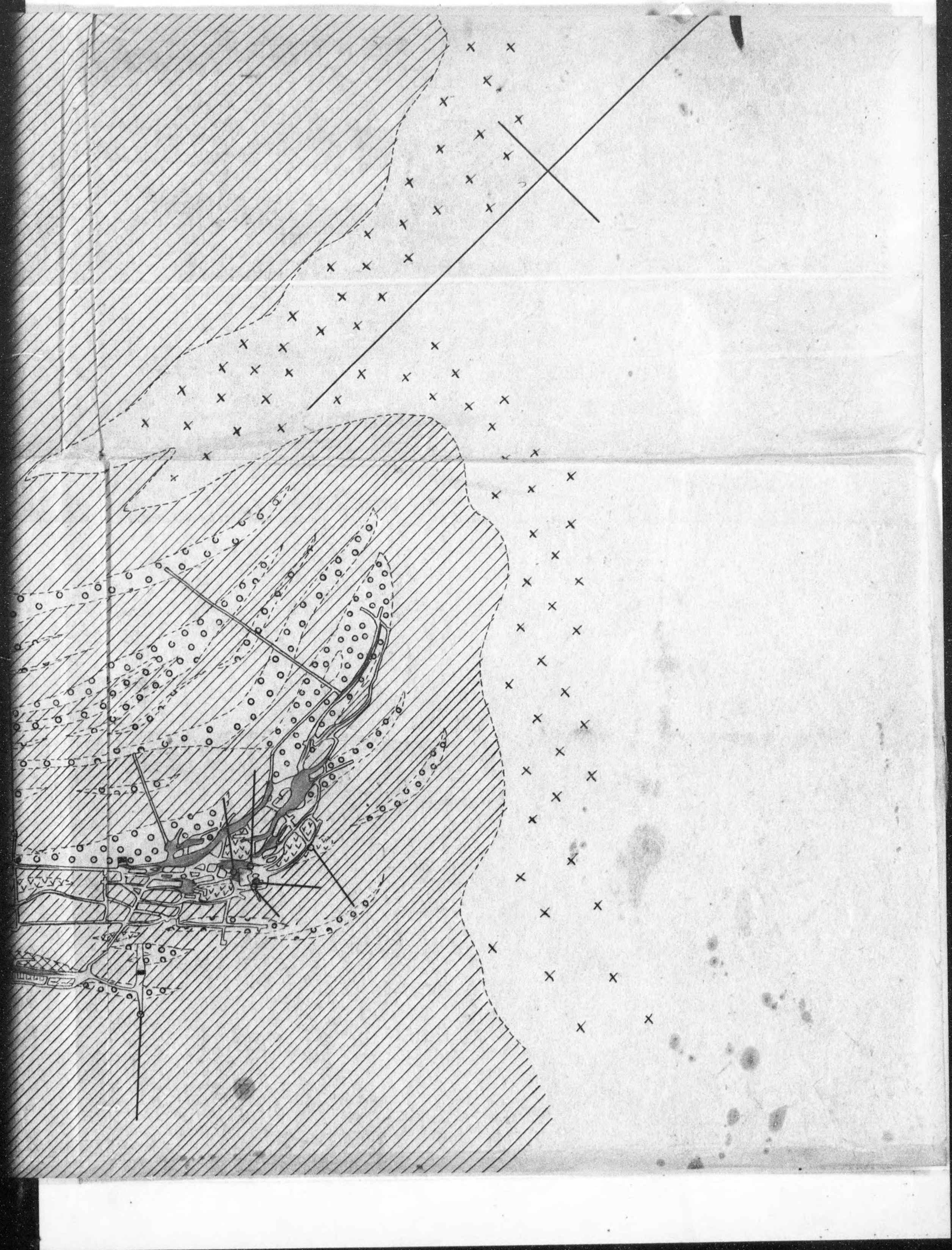
HOLE

DECLASSIFIED E.O. 12065 SECTION 3.4(b)

DECLASSIFIED E.O. 12065 SECTION 3.4



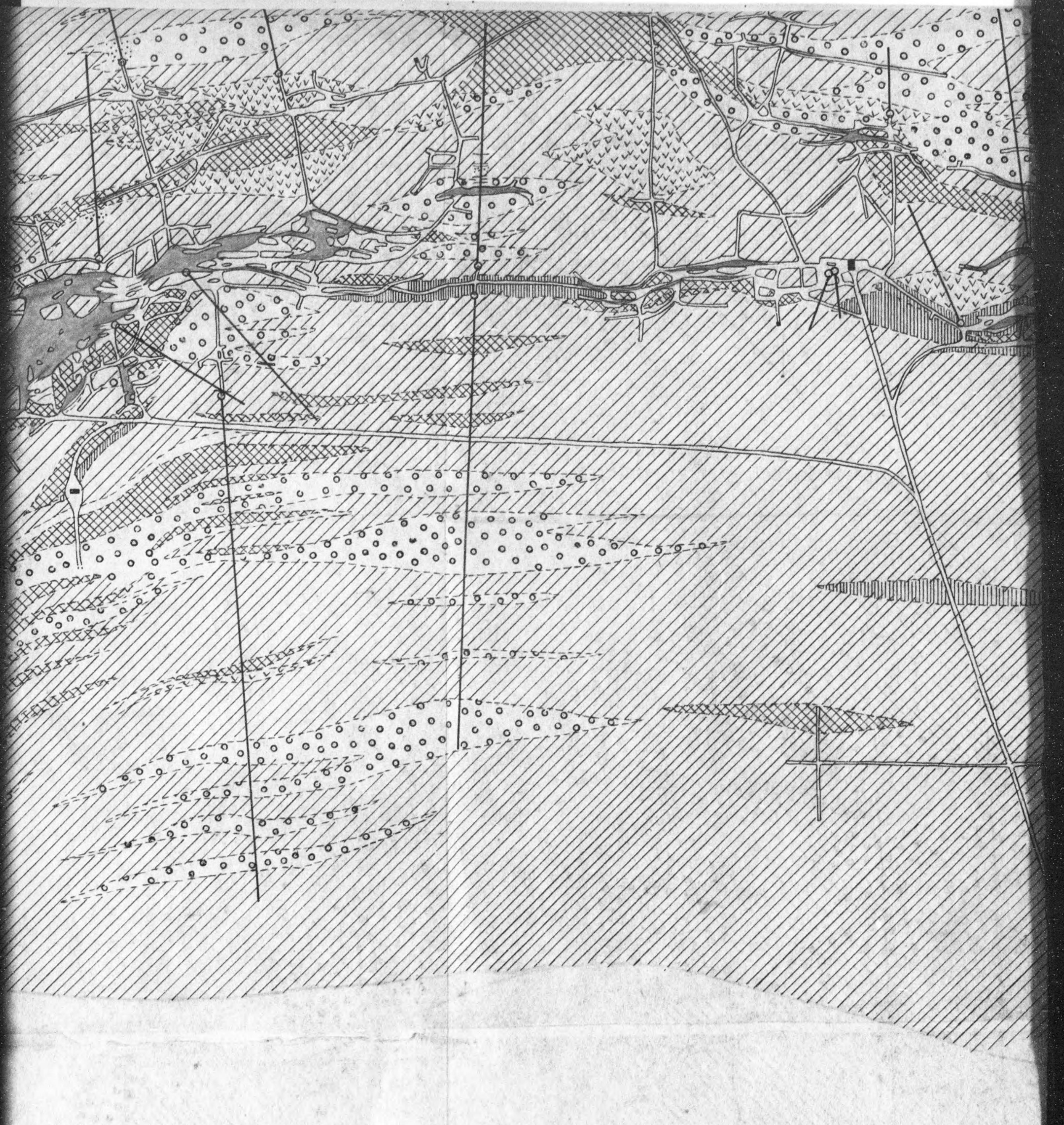
DECLASSIFIED - E.O. 12065 - SECRET



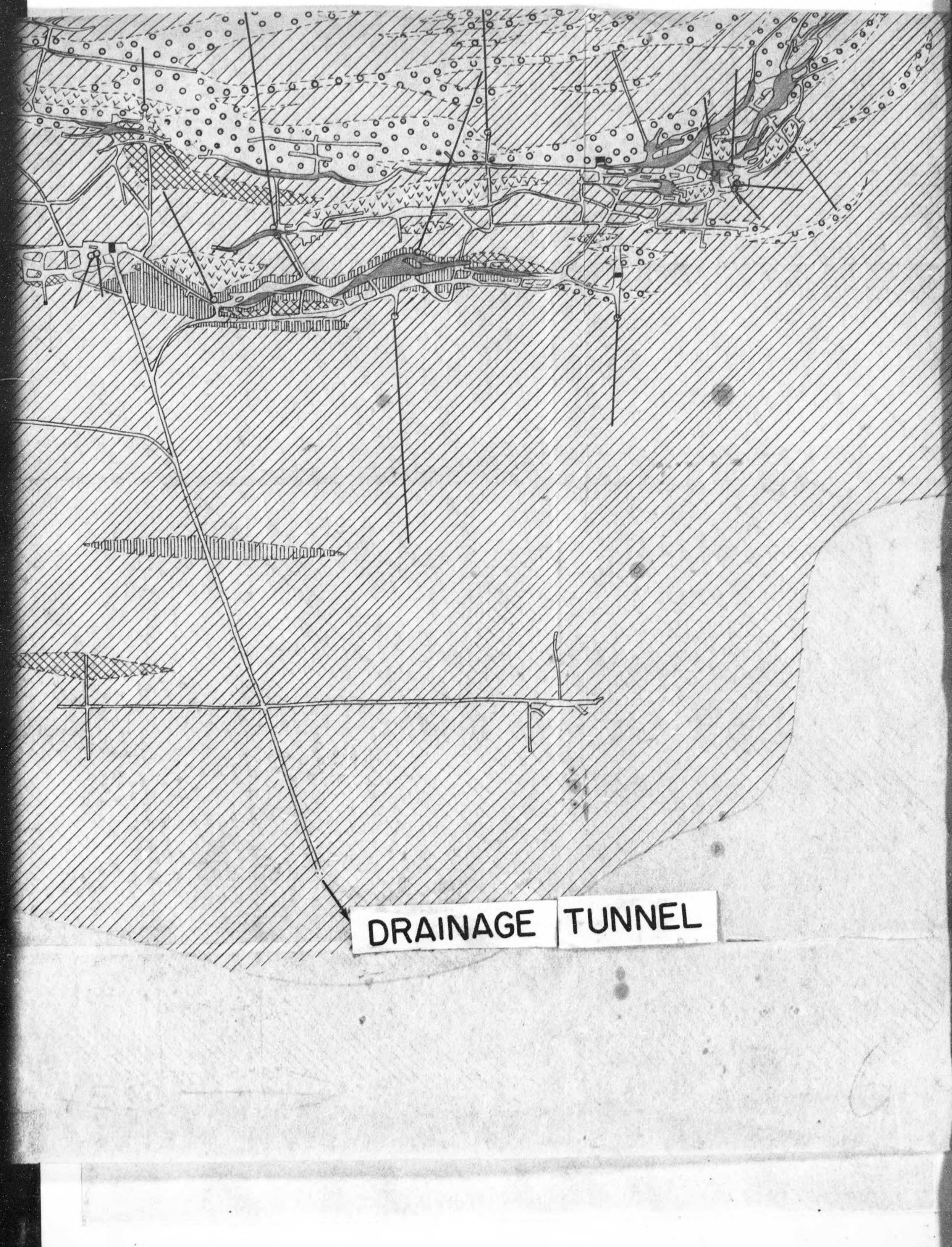
DECLASSIFIED E.O. 12065 SECTION 3.4(b)

DECLASSIFIED E.O. 12958, Sec. 3.5

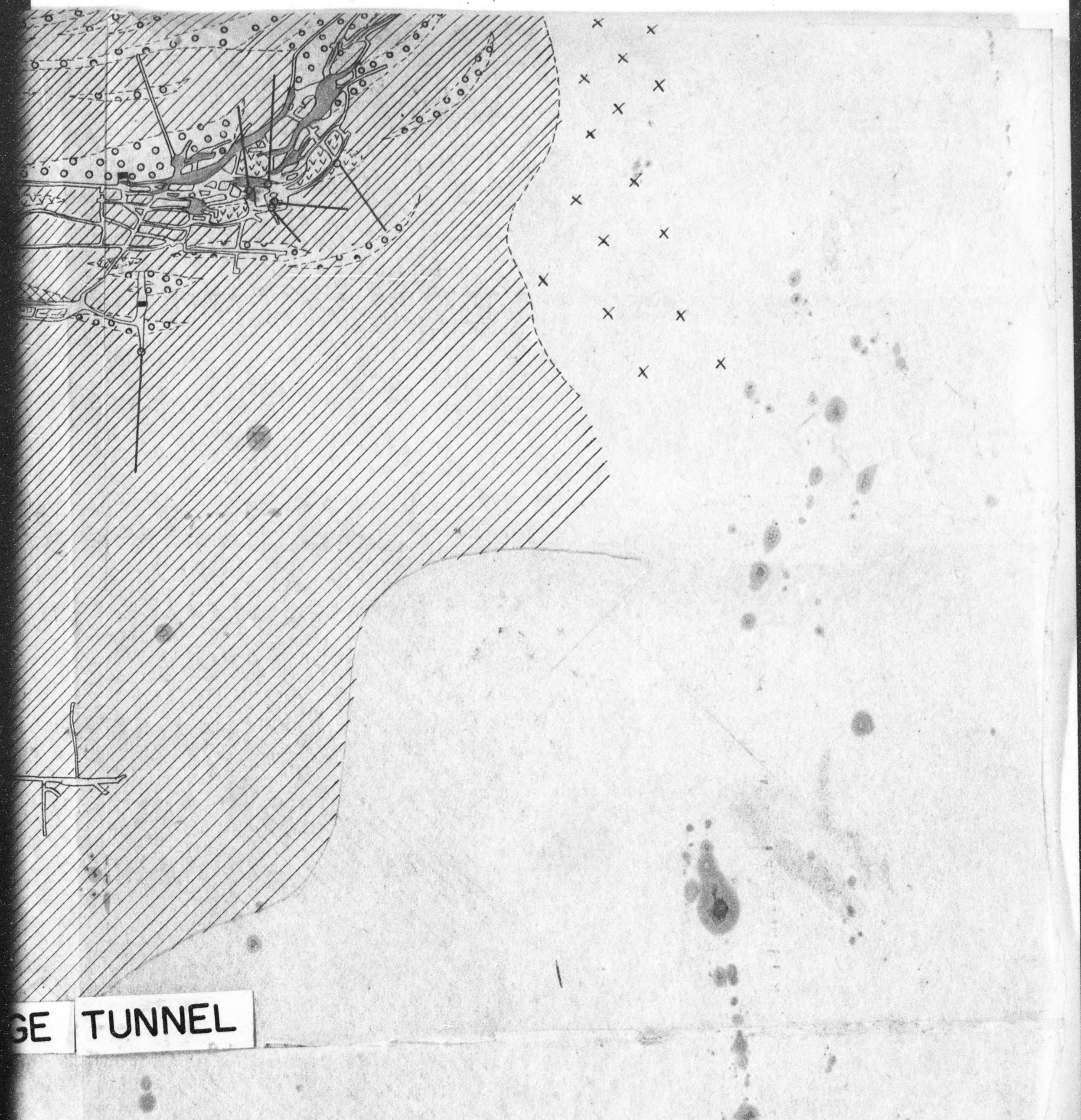
DECLASSIFIED



DECLASSIFIED - E.O. 12356



DECLASSIFIED E.O. 12065

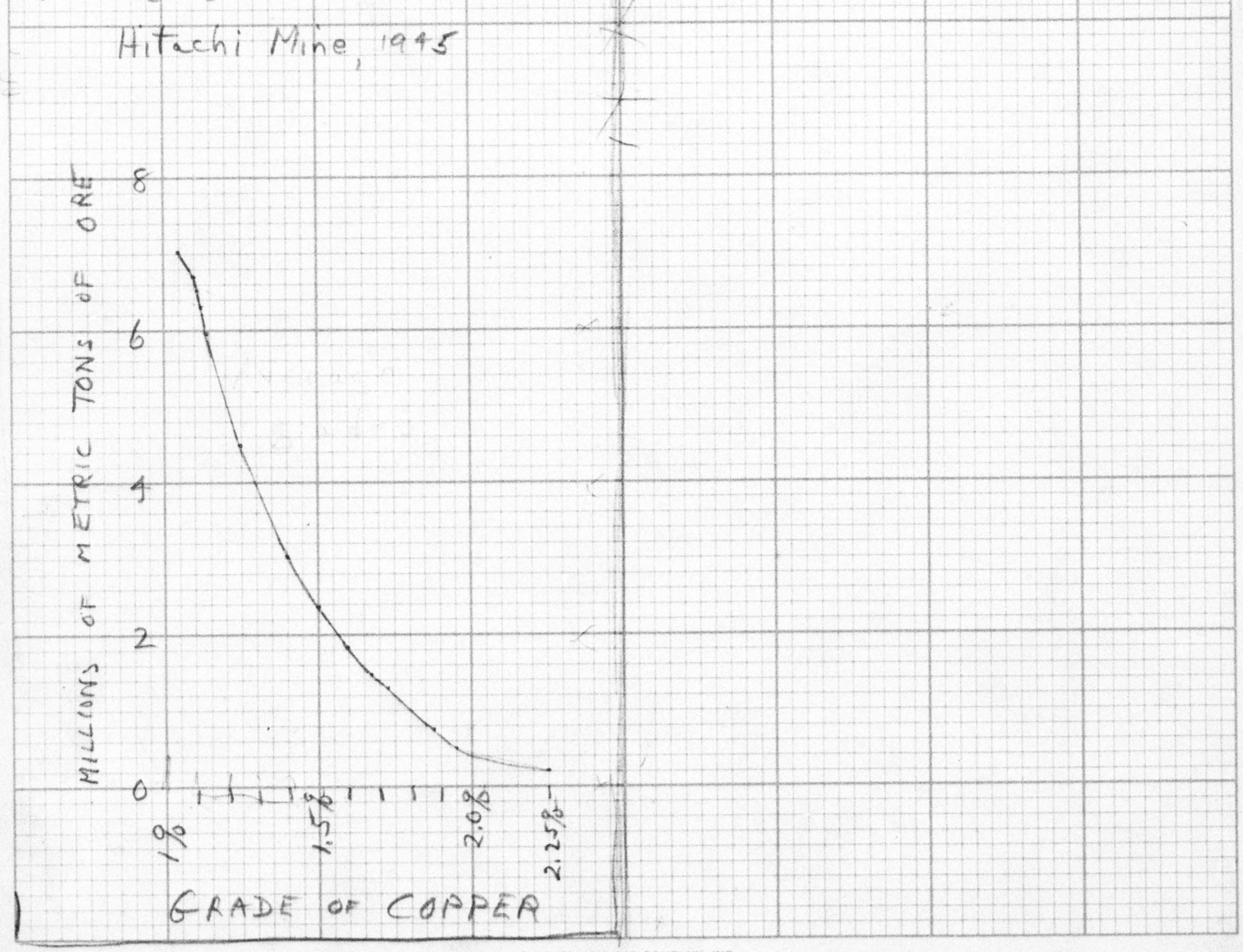


GE TUNNEL

DECLASSIFIED E.O. 12065 SECTION 3 (b)

R 30

AVERAGE GRADES
of the ORE RESERVE
Hitachi Mine, 1945




CHARLES BRUNING COMPANY, INC.

DECLASSIFIED E.O. 12065 SECTION 3, 5(b)

R3A

# DISTRIBUTION of ORE RESERVES by GRADE
## Hitachi Mine, 1945




CHARLES BRUNING COMPANY, INC.

# PRODUCTION of COPPER ORE
## HITACHI MINE, ~~Ibaraki Prefecture, Japan~~

metric tons

Graph No 1

Put red+copper black line on 1 graph (#1)

Put green & blue on another (#2)
also lower black line

| Grade of Copper | Tons of Ore |
|---|---|
| 4% | 800,000 |
| 3% | 600,000 |
| 2% | 400,000 |
| 1% | 200,000 |
| 0 | 0 |

Percent of copper in crude ore

Copper content of crude ore

Tons of ore

Price of copper

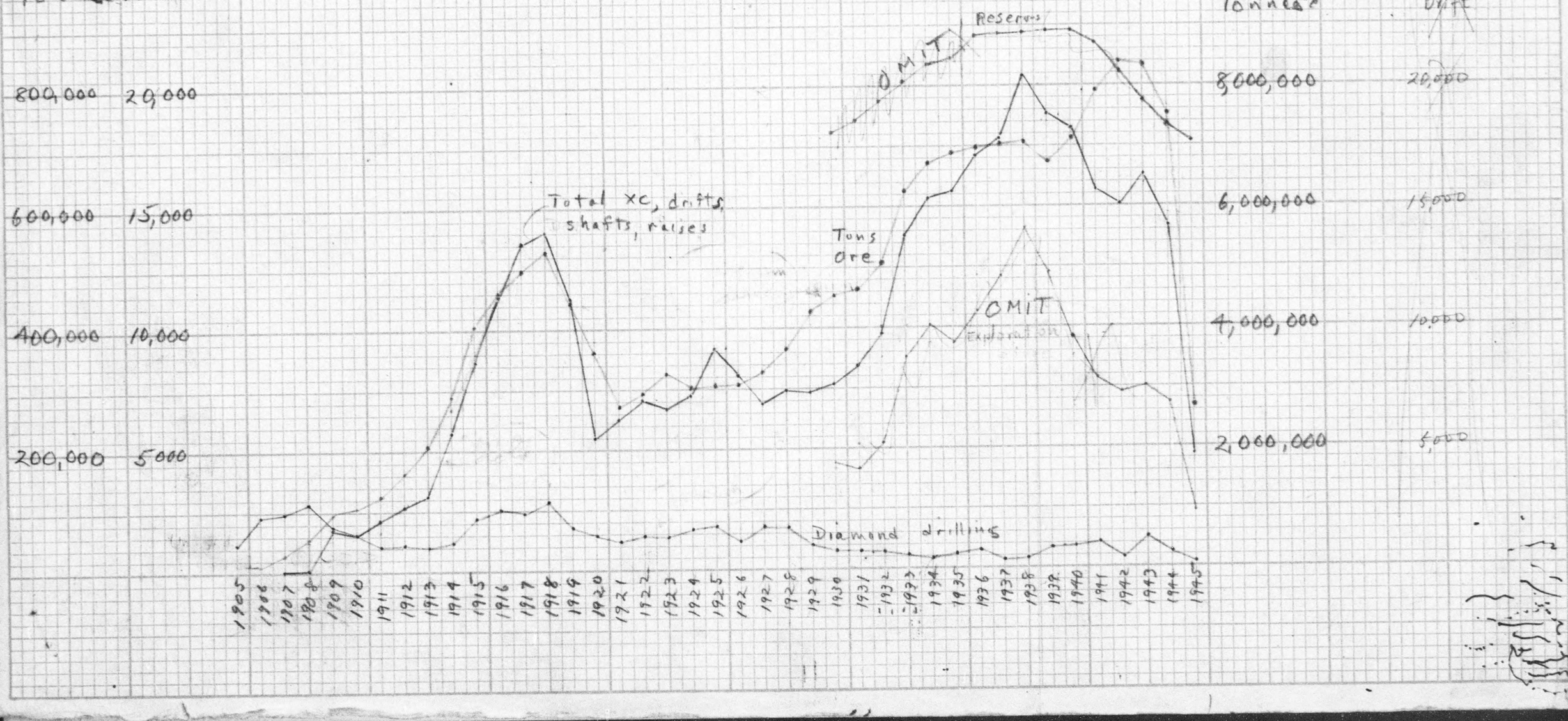
Precipitated copper exaggerated 10 times

| Aver. Price of Copper yen/ton ×2000 | Tons Contained Copper |
|---|---|
| 1500 | 9,000 |
| 1000 | 6,000 |
| 500 | 3,000 |
| 0 | 0 |

1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945

C. Relationship of Exploration, and Development to Production, at the HITACHI MINE, ~~Ibaraki Pref., Japan~~

Showing annual Totals in meters for all underground headings, also diamond drillings in relation to production in metric Tons.



# ANNUAL SHIPMENT of PYRITE CONCENTRATES,
Hitachi Mine, ~~Ibaraki Prefecture, Japan~~

TYPE

Grand Total
1,714,579 tons conc.
1.10 % Cu, 42.64 % S
18,864 Tons Cu
729,878 tons S.

Metric Tons of Concentrates

Grade of Sulphur

Grade of Copper

150,000 — 100,000 — 50,000 — 0

40 % — 30 % — 20 % — 10 %

2 % — 1 % — 0

Grade of Sulphur

Tons of Concentrates

Grade of Copper

1925 1930 1935 1940 1945

CHARLES BRUNING COMPANY, INC.

# ANNUAL SHIPMENT of PYRITE CONCENTRATES,
## Hitachi Mine, ~~Ibaraki Prefecture, Japan~~

TYPE

Grand Total
1,714,529 Tons conc.
1.10 % Cu, 42.64 % S
18,864 Tons Cu
729,878 Tons S.

Metric Tons of Concentrates

Grade of Sulphur

Grade of Copper

150,000 — 40 %
100,000 — 30 %
50,000 — 20 %
0 — 10 %
0 — 0

Grade of Sulphur

Tons of Concentrates

Grade of Copper

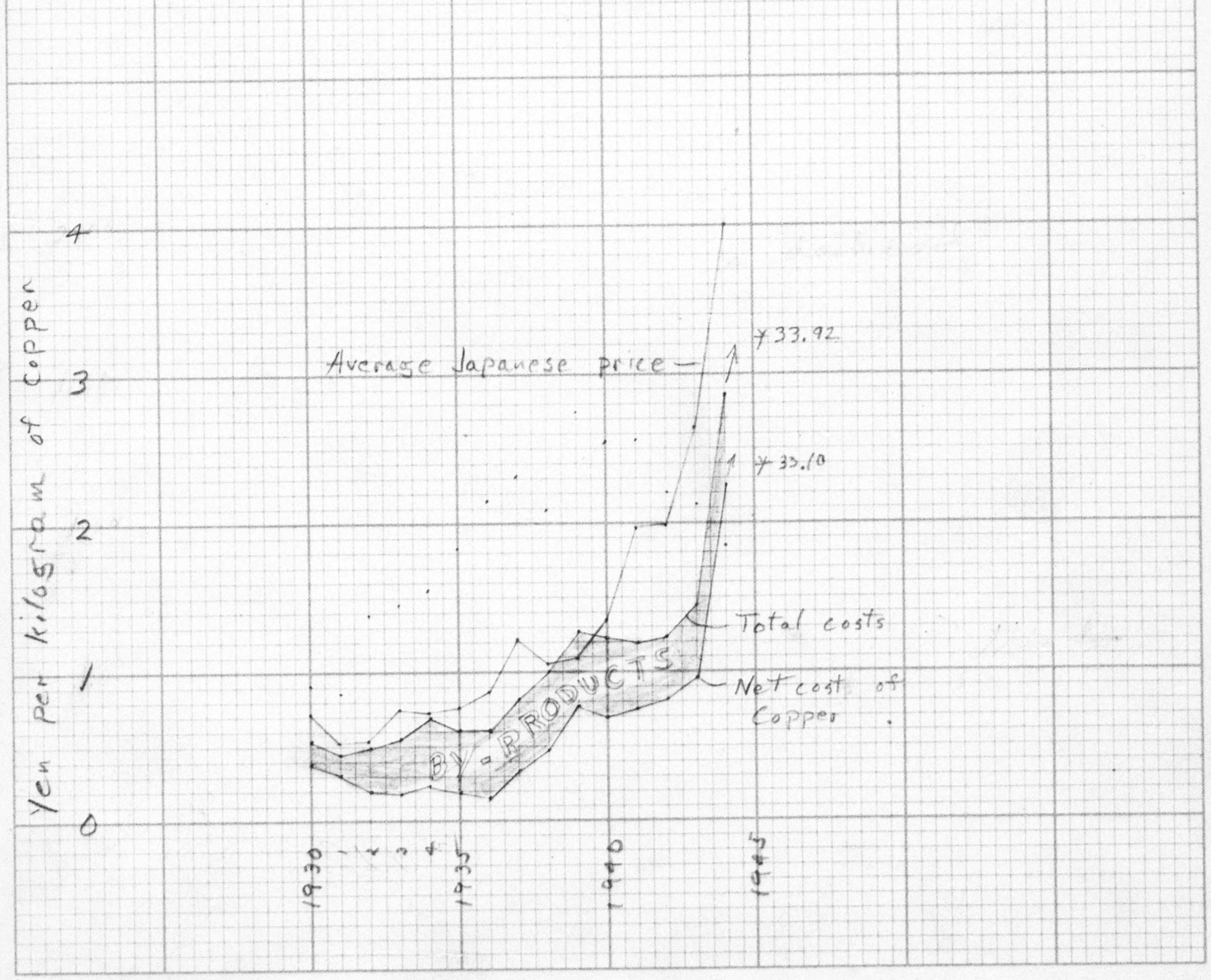
1925 1930 1935 1940 1945

CHARLES BRUNING COMPANY, INC.

DECLASSIFIED E.O. 11652 SECTION 5 (B)

# Japanese Price of Copper Compared with Total and Net Costs of Refined Copper from the HITACHI MINE, ~~Ibaraki Prefecture, Japan~~

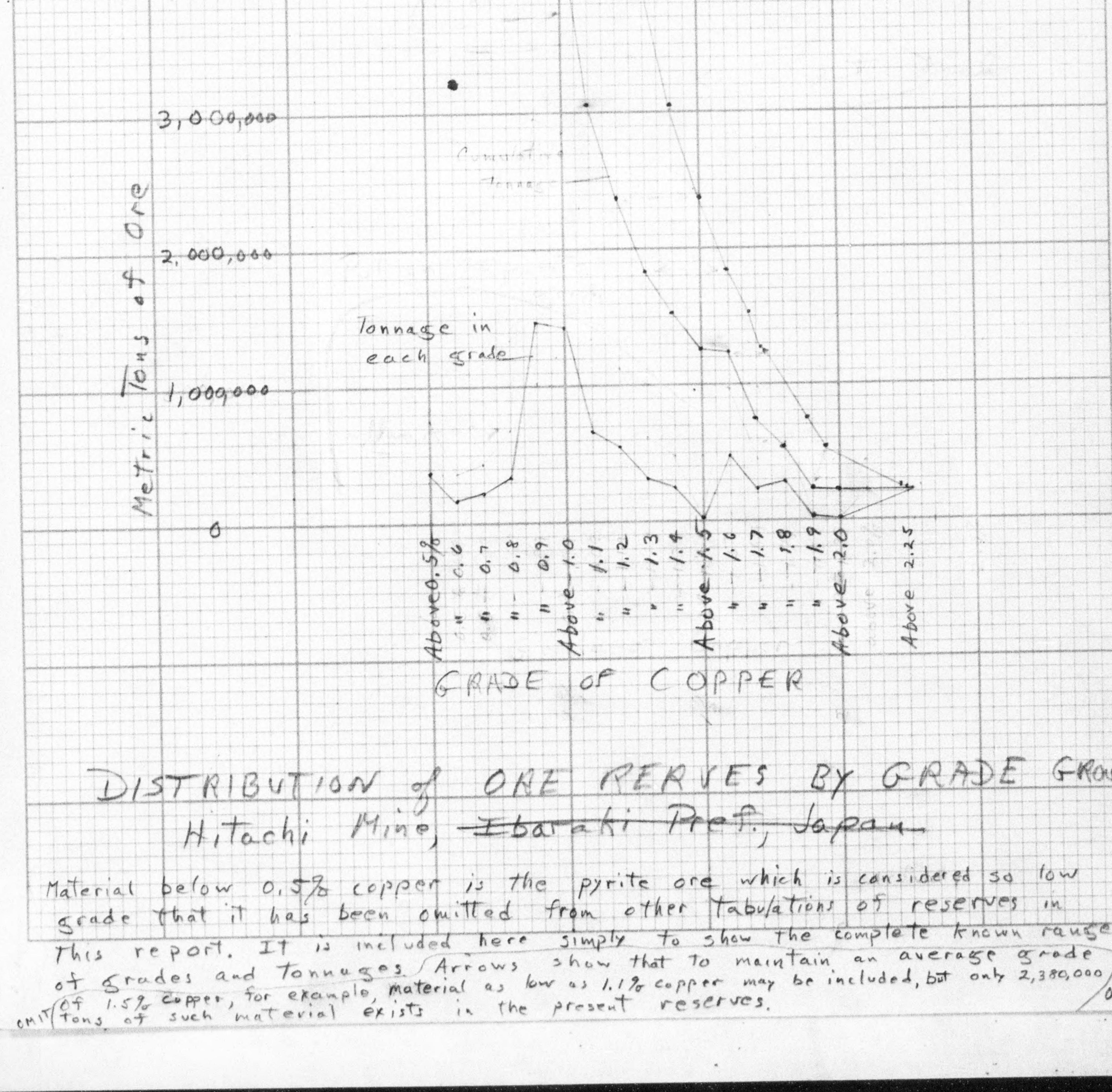
in yen per kilogram of copper produced




CHARLES BRUNING COMPANY, INC.

DECLASSIFIED E.O. 12065 SECTION 3 NLJ/NARS DATE

R 3




# DISTRIBUTION of ORE RERVES BY GRADE GROUPS

## Hitachi Mine, ~~Ibaraki Pref., Japan~~

Material below 0.5% copper is the pyrite ore which is considered so low grade that it has been omitted from other tabulations of reserves in this report. It is included here simply to show the complete known range of grades and tonnages. Arrows show that to maintain an average grade of 1.5% copper, for example, material as low as 1.1% copper may be included, but only 2,380,000 tons of such material exists in the present reserves.

OMIT

OMIT

DECLASSIFIED E.O. 12065 SECTION 3 NLJ, NARA

# INDEX MAP

(A)

139° 140° 36° 37°

Nikko Refinery

ASHIO MINE Town

Road

Utsunomiya

LIMESTONE

Omama

Railroad

Oyama

HITACHI MINE Town

HIGHWAY

N

Kumagaya

HIGHWAY

TOKYO

TOKYO BAY

Yokohama

OCEAN

PACIFIC

36°

35°

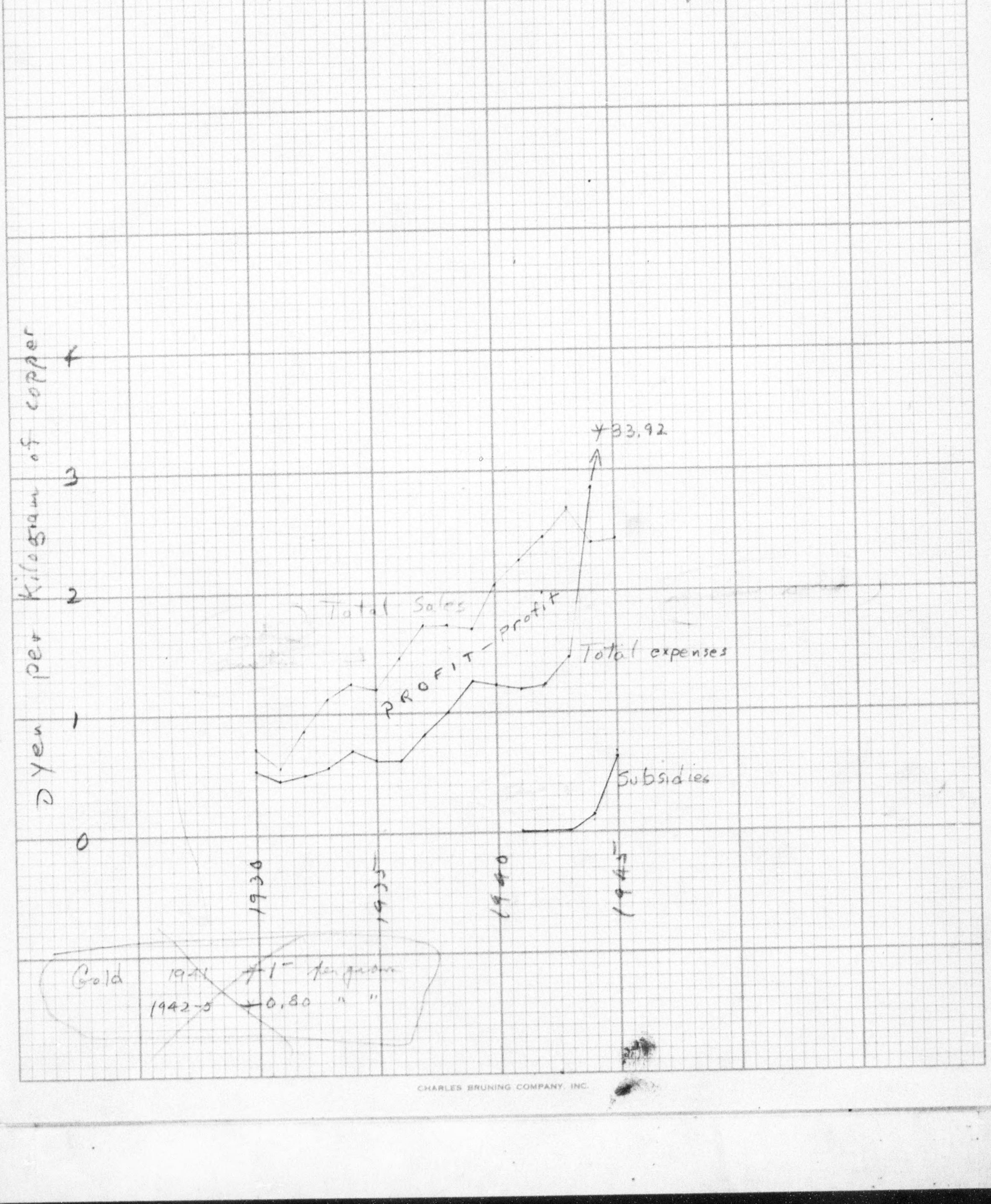
0 10 20 30 40 50 60 70 80 90 100 Miles

0 50 100 150 Kilometers

Highway Road Railroad

DECLASSIFIED E.O. 12065 SECTION 3 (E)

# Sales and Corresponding Expenses for Hitachi Mine Products in yen per kilogram of copper refined



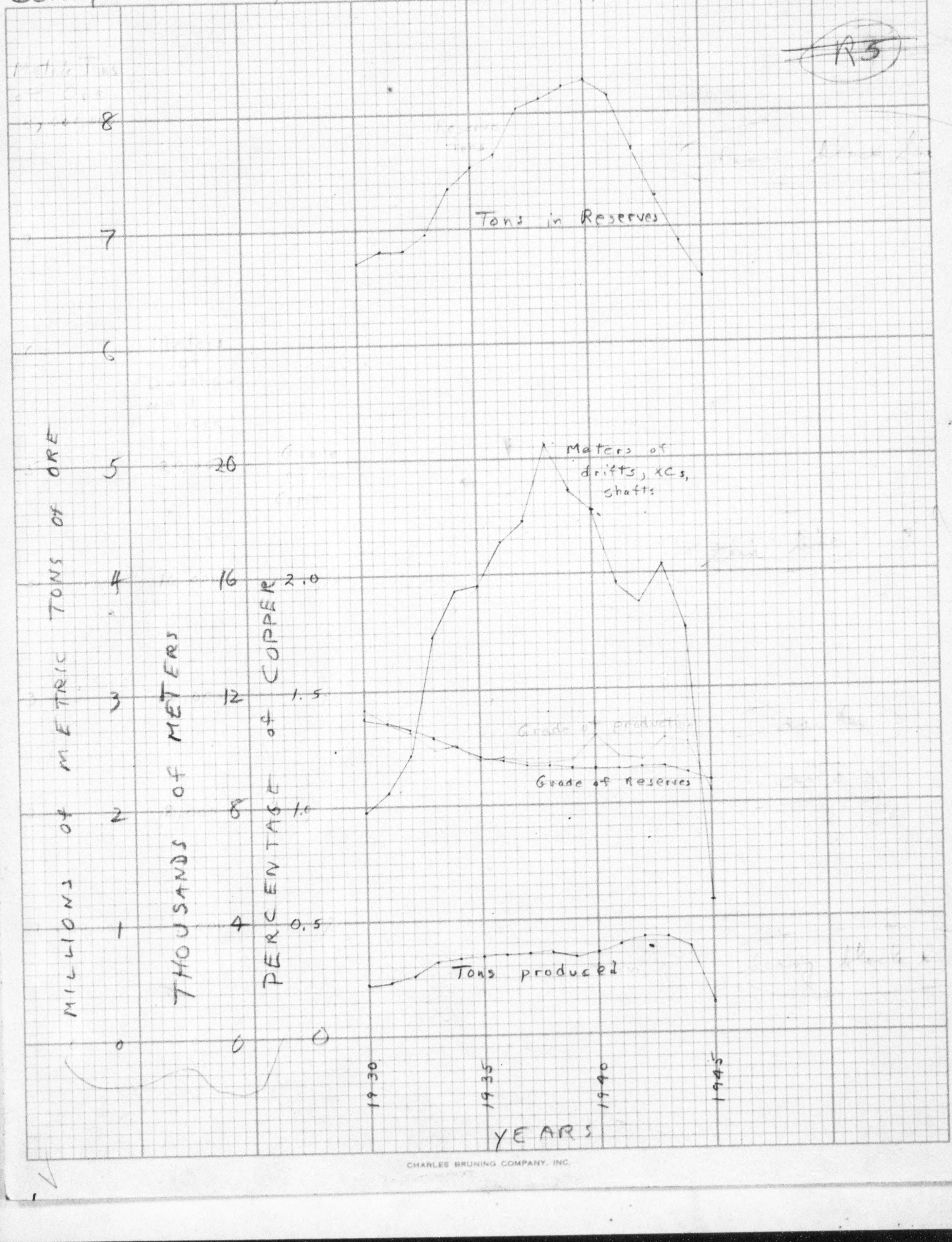

Gold 1941 ¥1 - for gram
1942-5 ¥0.80 " "

CHARLES BRUNING COMPANY, INC.

DECLASSIFIED E.O. 12065 SECTION 3 (E)

Annual Relationship of Copper Reserves to Production and Development Work, ~~at the~~ Hitachi Mine, ~~Ibaraki Prefecture, Japan~~

~~R5~~




CHARLES BRUNING COMPANY, INC.

DECLASSIFIED E.O. 12065 SECTION 3.3

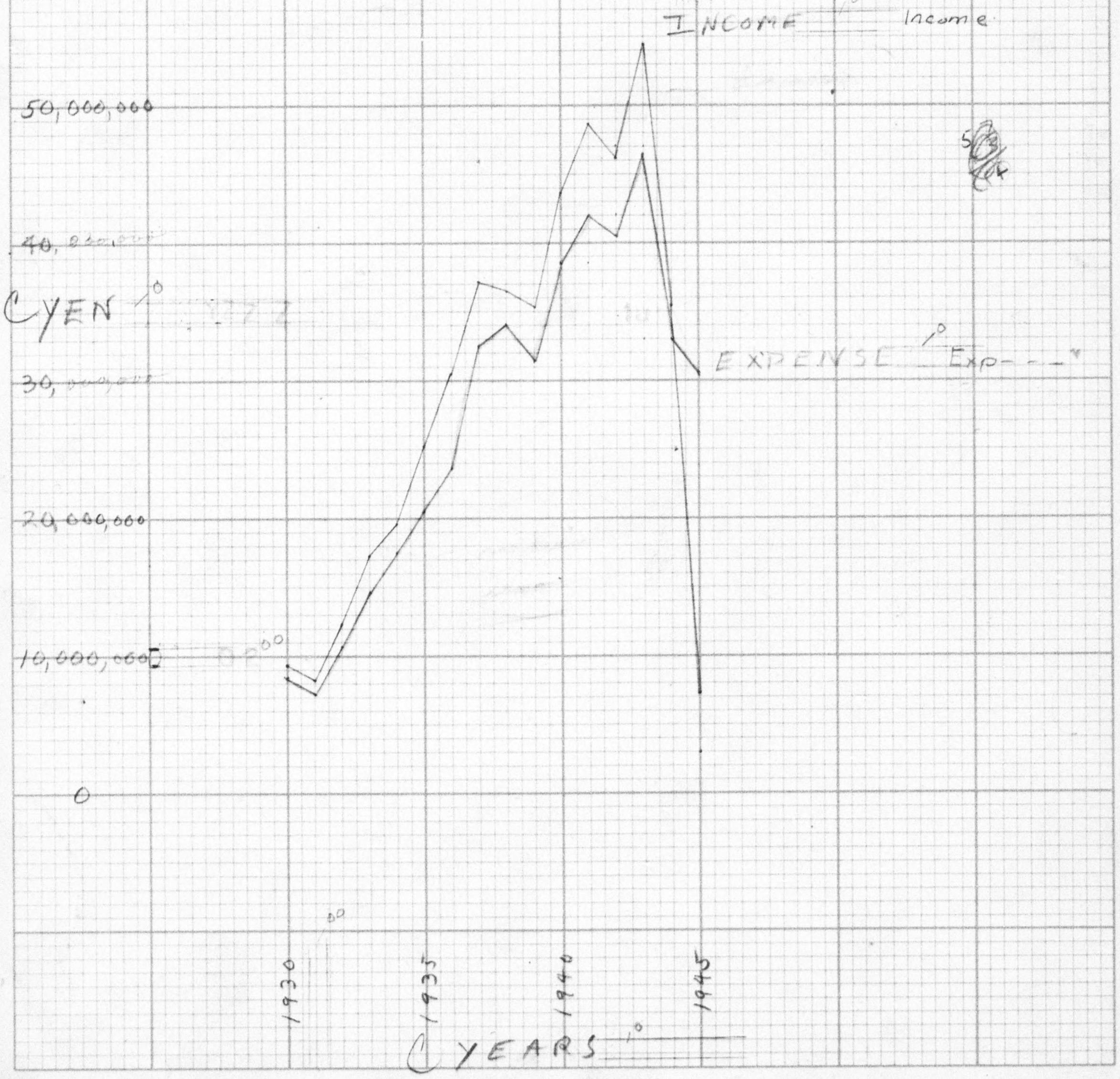
V

CIA

in YEN

Total INCOME and EXPENSE of ALL COMPANY ACTIVITIES in the HITACHI DIVISION of the NIPPON MINING COMPANY

The Treatment of custom materials has resulted in a large volume, but smaller percentage of profit than that derived from the products of the Hitachi Mine alone.



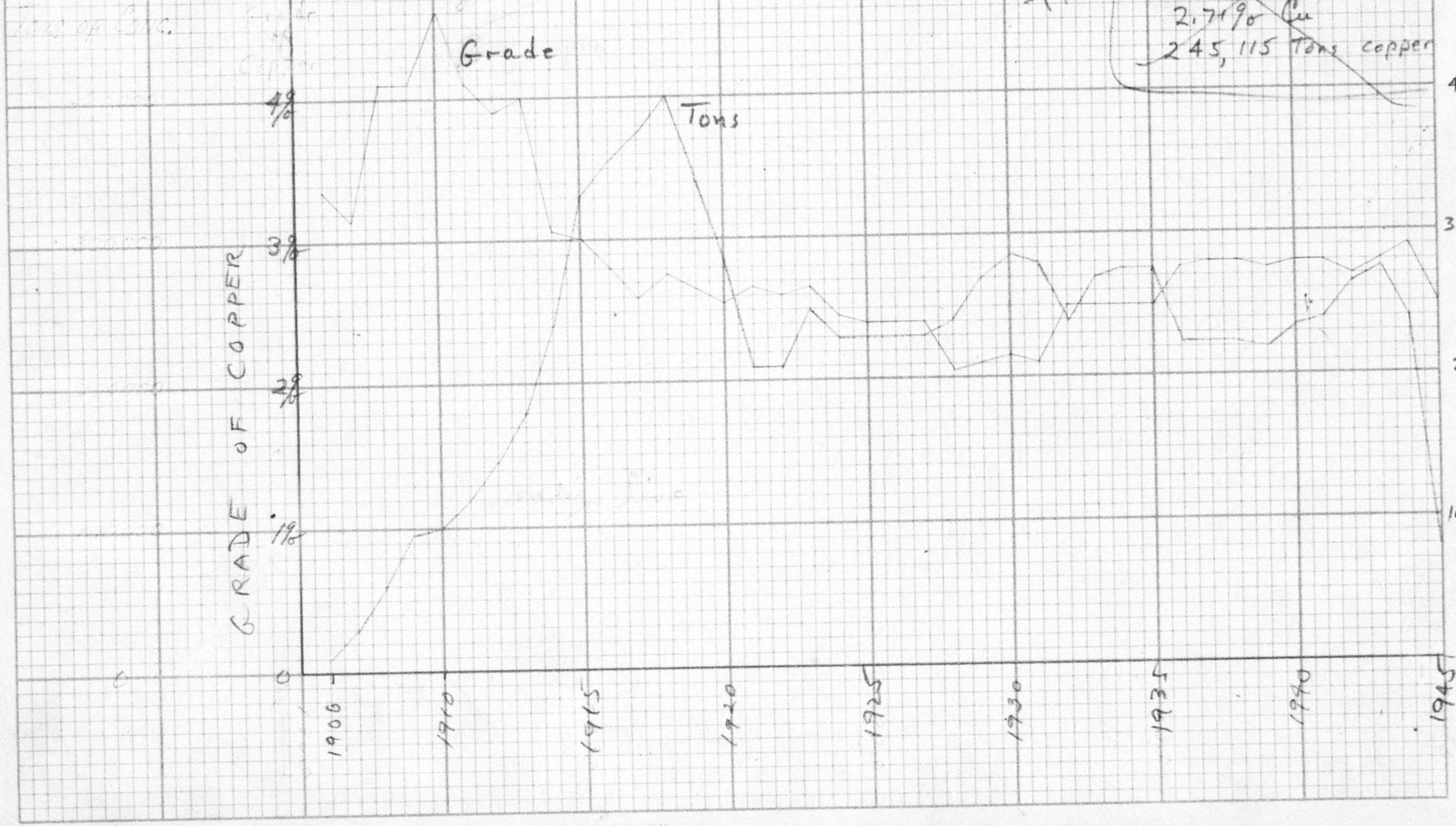

CHARLES BRUNING COMPANY, INC.

#3

# Annual Shipment of Copper Concentrates,

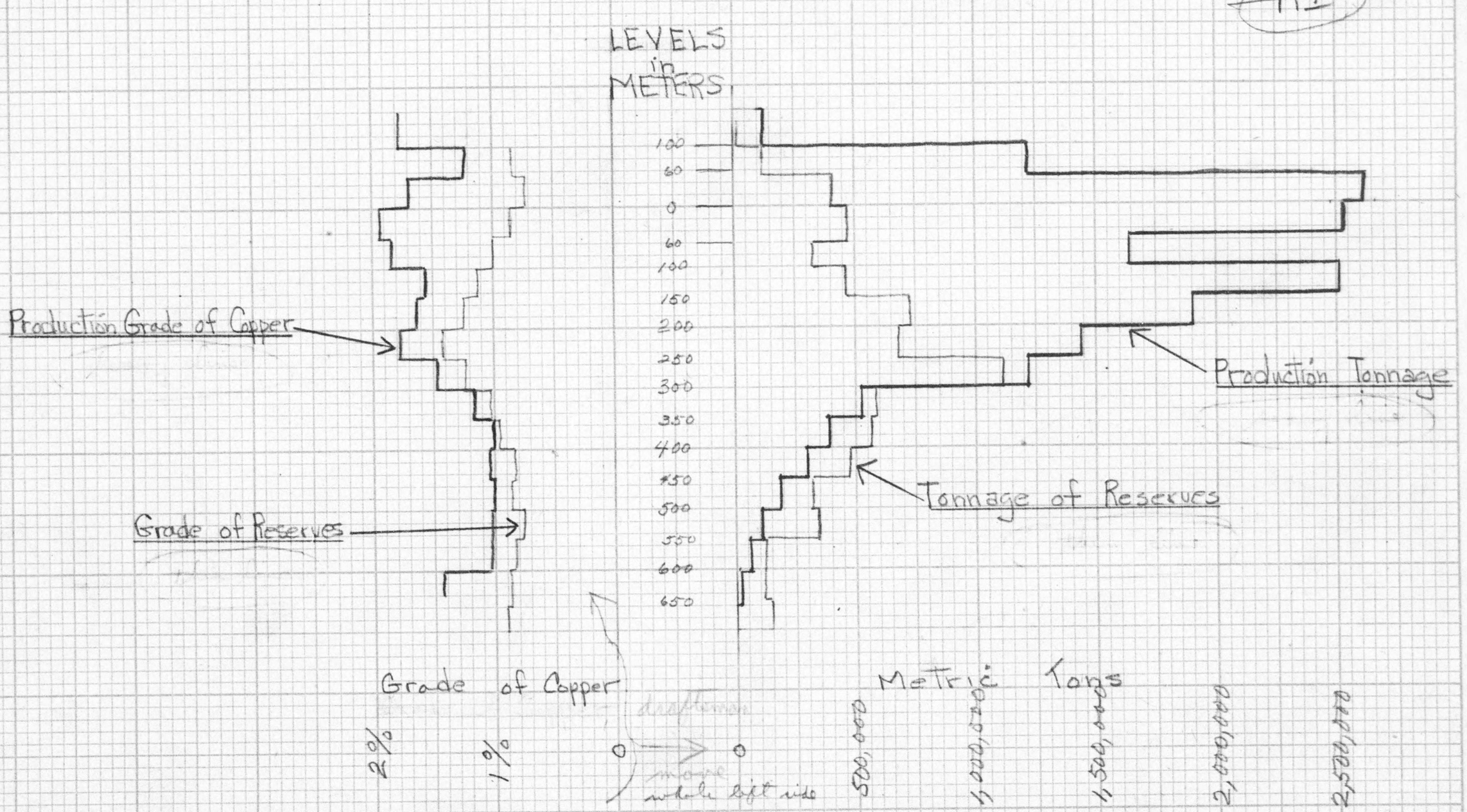
## Hitachi Mine & Mill, ~~Ibaraki Prefecture, Japan.~~

GRAND TOTAL.
9,038,296 Tons ore
2.719% Cu
245,115 Tons copper




CHARLES BRUHING COMPANY, INC.

RI

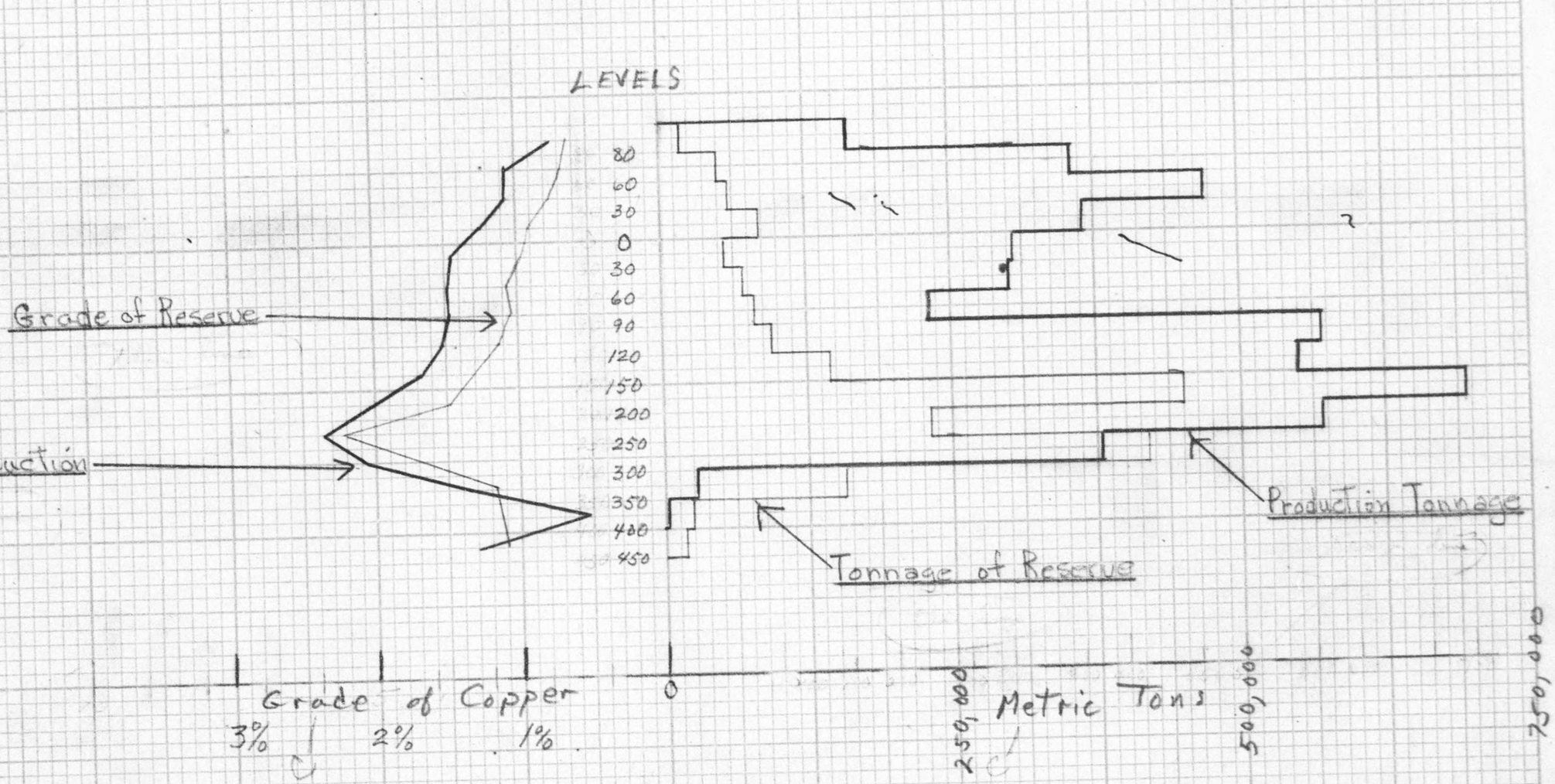



# DISTRIBUTION of ORE by LEVELS,

showing tonnage and grade of copper for both production and reserves, ~~in metric tons~~, as of 1 January 1945

HITACHI MINE,

R2

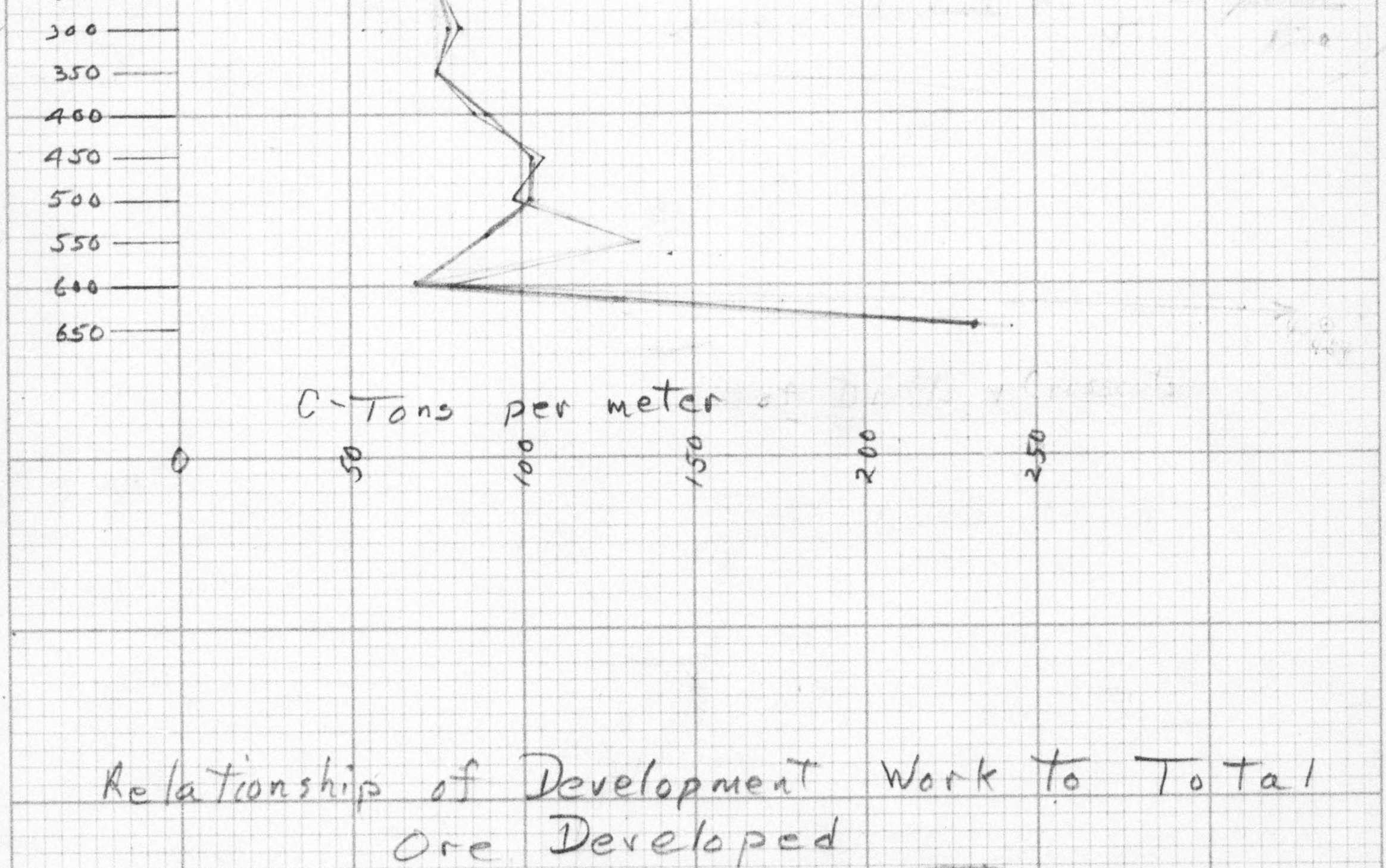



Distribution of Ore Reserves in the Akasawa Deposit
Hitachi Mine, ~~Ibaraki Prefecture, Japan~~

DECLASSIFIED E.O. 12065

CHARLES BRUNING COMPANY, INC.

Mn 2




Relationship of Development Work to Total Ore Developed

Hitachi Mine, ~~Ibaraki Pref., Japan~~

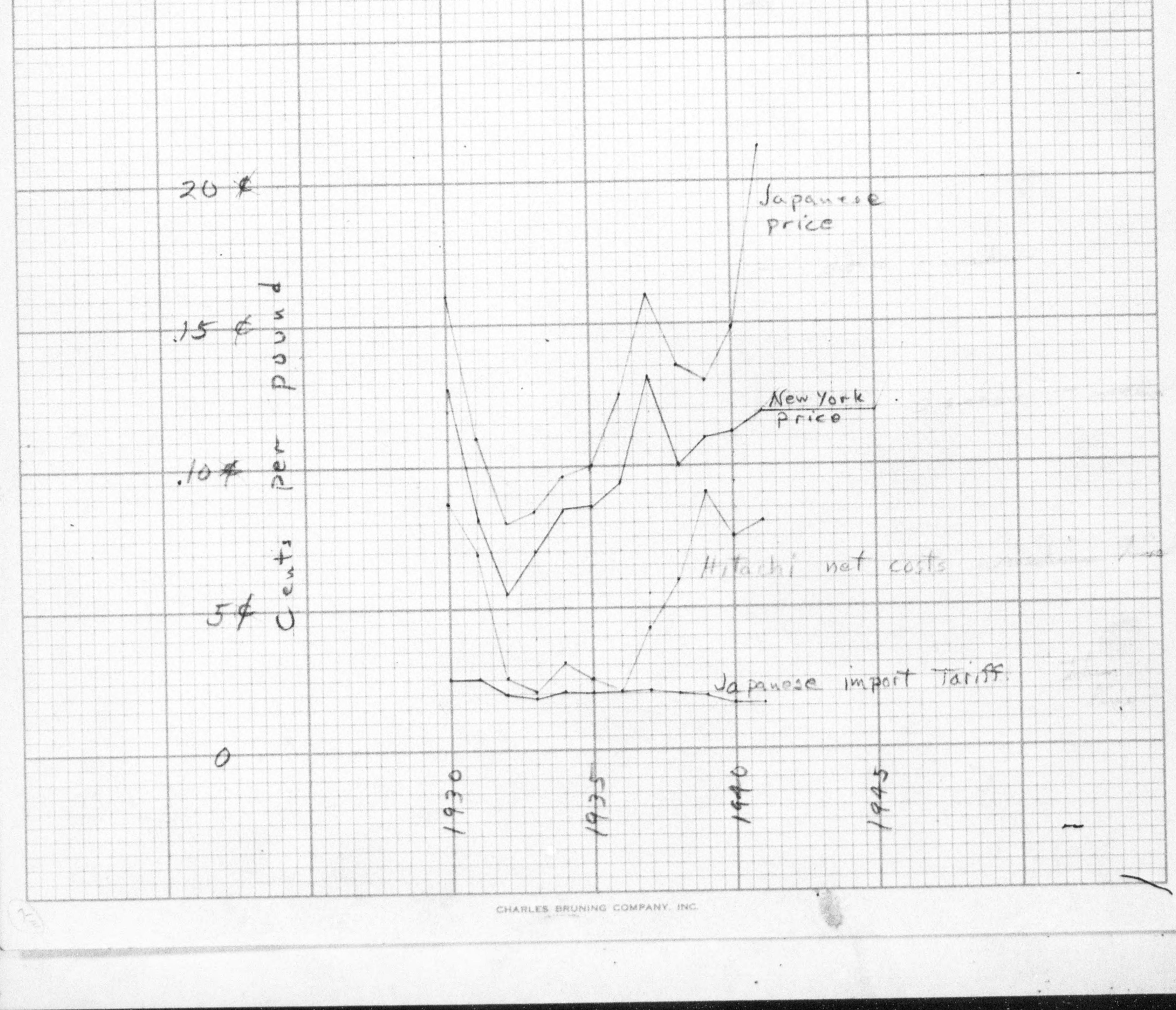
Includes all ~~drifts and~~ crosscuts in all orebodies and combined tonnage of production and reserves.

proved

DECLASSIFIED E.O. 12065 SECTION 3 NSC MEMO



# Cost of Hitachi Electrolytic Copper Compared to New York Domestic and Average Japanese Prices Converted to Cents per Pound




CHARLES BRUNING COMPANY, INC.