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Introduction

The discovery of the Horne volcanic-rock-hosted massive-sulphide deposit in 1923 was an outstanding event in the history of the Canadian mining industry, not only because of the size and grade of this giant base and precious metal deposit, but also because the exploration that ensued ultimately led to the discovery of the Noranda mining camp. In total, 20 massive-sulphide deposits have been mined in the camp (Gibson and Galley, 2007) and recent exploration success indicates that significant discoveries can still be made in one of Canada's most mature base-metal and gold camps.

The Horne deposit was mined between 1927 and 1976, with an additional later period of production between 1986 and 1989. The mine produced 260 t of Au and 1.13 Mt of Cu from 53.7 Mt of ore grading 6.1 g/t Au and 2.22% Cu (Kerr and Mason, 1990), making it the largest gold producer of its class in the world (Mercier-Langevin et al., 2011). The Horne deposit accounted for about 60% of the total ore reserves of the Noranda camp, and contained more than 80% of the total gold and 60% of the total copper (Kerr and Mason, 1990).

The present Geological Survey of Canada Open File represents an electronic archive of eleven historical maps that date to the early days of exploration and development at Horne. The maps have been scanned from originals stored at the exploration vault of Xstrata Copper Canada in Rouyn-Noranda, Quebec. They are important documents of the early Canadian mining history and are a testimony to the outstanding skills of the geologists and surveyors working at the Horne deposit between 1924 and 1929. The history of discovery and early development of the Horne deposit is summarized here from the accounts given by Price (1933), Wilson (1941), and Roberts (1956) to provide some historical background.

Early exploration

With the exception of occasional trappers and hunters, northern Quebec was largely uninhabited in the early 1900's.The first gold in the area was discovered in 1906 by prospectors Alphonse Olier and Auguste Renault at Lac Fortune, 20 km west of Rouyn-Noranda near the Ontario border. More significant exploration in the area only ensued following the spectacular discoveries of lode gold deposits in Larder Lake, Porcupine, and Kirkland Lake. In 1911, James-Joseph O'Sullivan and Hertel Authier struck gold on the shores of Lac de Montigny in Val d'Or. Other discoveries in the area followed, including Greene-Stabell in 1914, Siscoe in 1915, and Lamaque in 1923. However, due to the region's inaccessibility, gold mining only commenced about a decade later.

Without doubt, the discovery of the Horne deposit in remote northern Quebec can be attributed to the determination and abilities of one individual, Nova Scotia prospector Edmund H. Horne (Fig. 1). At the time, Edmund Horne was based in the mining town of Cobalt, Ontario. Following several prospecting seasons in the Cobalt, Gowganda, Porcupine, and Kirkland Lake areas, he decided to cross the interprovincial boundary into Quebec as he felt that the favourable geology would continue across the border. In 1911, his first prospecting expedition took him and his colleague Bob Bryden into the Quebec hinterland following the Ottawa and Kinojevis Rivers. The party camped on the shores of Lake Osisko for several days prospecting and searching for outcrops.

Edmund Horne spent the following three summers in Kirkland Lake, Porcupine, and Boston Creek, and the winters in New Liskeard. In 1914, he decided to conduct a second expedition to Quebec. He was accompanied by Bert Armstrong and Bert McDonell. To avoid the rigorous paddling on the

Ottawa and Kinojevis Rivers, the three men chose a route across a string of lakes, entering Lake Osisko following portage of their canoe from Lac Pelletier. During prospecting around Lake Osisko, they discovered altered and fractured rhyolite with abundant disseminated pyrite in an outcrop immediately south of the location where No. 1 shaft would be build later. They sampled the rhyolite and decided to wait for the assay results before making decisions on whether to stake the ground or not. Unfortunately, the assay results turned out to be disappointing with no indication of gold enrichment.

Fig. 1: Photograph of prospector Edmund H. Horne (Centre d'archives de l'Abitibi-Témiscamingue et du Nord-du-Québec, Bibliothèque et Archives Nationales du Québec).

In 1917, Horne and a younger prospector by the name of Dave Solomon returned to Lake Osisko choosing the same access route as in 1914. During this approximately one-month long expedition to Lake Osisko, both men discovered a number of additional altered rhyolite outcrops. On their return journey, they met two other groups of prospectors. As others started to make their way into Quebec's hinterland, Horne knew that he needed to raise money to stake the property to avoid it being discovered by others. Returning to New Liskeard, he attempted to raise money for another prospecting expedition and subsequent surface work. However, assays obtained on the new batch of samples again ran low and he found it difficult to find financial support for another journey into Quebec.

With faith in the favourable geology surrounding Lake Osisko, Horne managed to raise $225, sufficient funds for an expedition in the spring of 1920. Together with eleven other individuals, Horne formed the Tremoy syndicate at the Grand Union Hotel in New Liskeard. In August 1920, he and one of the syndicate members, Ed Miller, set out for Lake Osisko by the way of the Ottawa and Kinojevis Rivers. Horne and Miller revisited the previously discovered outcrops of rhyolite and then prospected in the vicinity for several days. Due to the thick overburden, they found nothing of significance. On

September 11, 1920, they staked a total of 70 acres, not realizing at the time that the claim would ultimately contain most of the ore exploited from the Horne mine. They returned to Ville Marie, where they recorded their ground.

The 1921 field season proved to be a turning point. Together with another syndicate member, J. Brett, Horne and Miller commenced with the stripping and trenching of rhyolite outcrops in the vicinity of the future No. 2 shaft. Half way through the summer, the three men travelled back to New Liskeard. Assays of the channel samples returned gold values of 5.0 to 8.3 g/t. During the second half of the summer, the three men continued stripping and trenching around the future site of No. 1 shaft. Realizing the potential of the area, they staked an additional 160 acres to the east and south of the original claim. Samples collected from those trenches returned 24.9 to 53.1 g/t Au. Encouraged by the assay results, the members of the Tremoy syndicate raised more money for the upcoming field season. Prescott Woodward was recruited as the thirteenth and final member of the Tremoy syndicate.

Horne, Miller, and Woodward left New Liskeard in March 1922 to Kirkland Lake and then continued onward by snowshoe. It was their aim to reach Lake Osisko to stake as much new ground as possible before the opening of the waterways would allow other prospectors to follow. After reaching the claims in late March, the three men immediately commenced staking an additional 400 acres. They then returned to New Liskeard and recorded the new stakes of the syndicate in Ville Marie in April. The Tremoy syndicate raised a sum of $3000 to resupply Horne and Miller, who went back to Lake Osisko in June 1922. During this expedition, they blasted a 25-m long trench in the principal rhyolite showing. The rhyolite assayed at around 6.6 g/t Au, although a section in the middle of the trench ran considerably higher. After accidently causing a dangerous bush fire, Horne decided to inspect the burned ground for any float. On a small ridge covered by some overburden, he discovered the first massive sulphides. Samples of the massive sulphides carried 16.6 g/t Au.

Horne's exploration results started to attract considerable attention, and word spread to the two well financed American mining engineers Sam C. Thomson and Humphrey W. Chadbourne, who had formed the Thomson-Chadbourne syndicate in February 1921. Chadbourne visited New Liskeard and Haileybury in July 1922 to enter into negotiations with the Tremoy partners for an option on their ground. The deal with the thirteen syndicate members was closed on August 11, 1922 whereby the Thomson-Chadbourne syndicate optioned a 90% interest in the Lake Osisko property for $320,000 in cash. The agreement required $5000 payable at the beginning of January 1923, followed by $5000 every six months until January 15, 1928, with $265,000 payable on the final option date. It was agreed that the remaining 10% interest would eventually take the form of shares in any operating company the Thomson-Chadbourne syndicate might incorporate to finance activities at the Lake Osisko property.

Discovery of the Horne deposit

Following optioning of the Lake Osisko property, Thomson and Chadbourne decided to send a crew into Quebec via the Kinojevis route to conduct a thorough geological assessment of the Horne property. The field crew, directed by Isaac H. Waite, established a camp on the shore of Lake Osisko by the end of August where they stayed until mid-October 1922, up until the freeze-up of the lake. Waite's crew commenced to clean out Horne's trenches and started to prospect the surrounding ground.

In early September 1922, the field camp was visited by the prospector Tommy W. Powell who wanted to follow up on a report by the Geological Survey of Canada mentioning the occurrence of gold-bearing veins in an area located 5 km northwest of the Horne ground. He borrowed supplies from the

Waite crew and departed a few days later. Powell returned to the camp on September 20, 1922, and announced that he had found a quartz vein and staked the ground. Waite immediately optioned the Powell claims in the name of the Thomson-Chadbourne syndicate. He divided his crew, leaving some to continue the work at Horne, while the others started exploration at the Powell property near Rosebury Lake (now Lac Marlon). As the discovered quartz vein was highly prospective, the exploration focus rapidly shifted to the Powell option and claims staked by Waite's party in the Thomson-Chadbourne interest, which were located between the Horne and Powell discoveries and included the Chadbourne claim group to the southwest of Horne.

Reports of the findings at the Powell property triggered the Rouyn Gold rush, which lasted from 1922 to 1927. The gold rush ultimately led to the discovery of several other gold deposits in the area, including Francoeur, Astoria, Stadacona, Granada, and Beattie. In mid-October 1922, when the Waite party returned to civilization, a total of 6760 acres of land had been staked in Rouyn Township. Of this, the Thomson-Chadbourne syndicate controlled 1360 acres.

In December 1922, the assets of the Thompson-Chadbourne syndicate were taken over by the newly formed company called "Noranda", likely an abbreviation for "Northern Canada". The Toronto attorney James Y. Murdoch became the company's first president. He served in this function until 1956 and as chairman until his death in 1962.

In early 1923, it was decided to send a permanent crew of forty men under the leadership of L.K. Fletcher to Rouyn. On arrival, the party established eight log houses at the Powell option. Trenching, stripping, and sampling of the vein commenced in mid-April. A total of 15 km of rough roads and 5 km of trails were established to connect the claims of the Powell, Chadbourne, and Horne groups. The first two holes were drilled at Powell in July 1923 to determine the dip of the quartz vein. Following the successful drilling program, Noranda entered into negotiations with the Nipissing Mining Company, which resulted in the formation of the company Powell-Rouyn Gold Mines on October 20, 1923. With the negotiations under way, the exploration activity turned to the Chadbourne group of claims.

After successful drilling at the Powell option, the diamond drill was initially moved to the Chadbourne claims. However, during a visit of the claims, Sam Thomson decided to relocate the drill to the Horne option to test the known surface showings on the property that was costing the syndicate substantial option payments. The first diamond drill hole had a total length of 33.5 m. It intersected variably altered basalt and a short interval of rhyolite. The second hole had a length of 46.6 m and was collared about 300 m southwest of the first location. This hole intersected massive sulphides along its entire length that were cut by several variably altered basalt dikes.

Early development of the mine

Drilling at the Horne option continued throughout the autumn and winter of 1923-24. Headquarters of the Noranda operation were established at Horne, where several log buildings were erected. On July 12, 1924, operations at Chadbourne were discontinued to concentrate all work on the Horne option. Sinking of No. 1 shaft commenced in July 1924. At the end of the year, the shaft had reached a depth of 38 m. A station was established at 32 m from surface, from which drifting and cross-cutting were performed. Within 15 months of drilling the discovery hole, the combined partially developed and indicated ore reserves stood at 554,740 t of ore grading 9.2 g/t Au and 5.66% Cu.

The town of Rouyn began to take shape, with initial winter road access being constructed by the Quebec government from Macamic, on the National Transcontinental Railway in the north, and

Cheminis on the Ontario border in the west. Rouyn was incorporated as a village on June 26, 1926. Railway construction, connecting Rouyn to the National Transcontinental Railway, reached the outskirts of the village on October 25, 1926. A transmission line was established and started to power the mine site with electricity on December 7, 1926. Rouyn was incorporated as a town on April 1, 1927.

The Horne orebodies were aggressively explored and developed in the years following the discovery. The No. 1 shaft reached a depth of 100 m in 1925. Sinking of the No. 2 shaft was initiated and reached 48 m at the end of the same year. A working level was established at 43 m, which corresponded to the 32 m level in No. 1 shaft. Both were connected with a drift. This drift intersected the top of the Upper H orebody. However, because the grades encountered in this portion of the Upper H orebody were low, its economic importance was not recognized at the time. As of January 1, 1926, 856,860 t of ore were developed averaging 9.2 g/t Au and 6.7% Cu.

In 1926, No. 3 shaft, the mines first working shaft, was driven up from the 91 m level to surface. Surface construction of the smelter progressed rapidly (Fig. 2). Commercial production at the Horne mine started with the first pour of copper in the newly build smelter at 4 a.m. in the morning of December 17, 1927. At the end of 1927, the ore reserves were set to 1,087,150 t with an average of 9.0 g/t Au and 6.73% Cu.

Fig. 2: Photograph of Noranda with the Horne smelter complex in the back. The large headframe is No. 3 shaft. The photograph was taken in August 1927 (Noranda Mines, 1927).

The final landmark discovery took place in May 1928 during the deepening of the No. 3 shaft. At a depth of 260 m, massive-sulphide mineralization was encountered in the shaft walls and bottom. At a depth of 300 m, the shaft was entirely within massive sulphides running between 18 and 20% Cu from wall to wall. The shaft had intersected the massive sulphides of the Upper H orebody, which had previously been encountered along strike in the drift connecting the No. 1 and 2 shafts. Discovery of this orebody under the direction of Harry L. Roscoe made the Horne one of the largest massive-sulphide deposits in the world.

Historical Maps

The present Geological Survey of Canada Open File includes a set of eleven maps produced during the early development of the Horne mine.

Sheet 1: Surface map of the Horne property showing the Horne camp on Lake Osisko, prospecting trenches, and surface projections of drill holes. The location of No. 1 shaft is shown. The map is dated 1924.

Sheet 2: Sample plan of Trenches #1 to #4 and Trenches #7 to #10. The map shows the location of samples and the widths of the sampled intervals (in feet). No date is given on the map.

Sheet 3: Assay plan of two trenches located east of diamond drill holes DDH #45 and #47 (G orebody). The map shows the location of samples and the widths of the sampled intervals (in feet). Gold grades are given in $ per short ton and Cu grades are in weight percent. At the time, the New York gold price was fixed at $20.67 per ounce. The drawing is dated February 11, 1924.

Sheet 4: Assay plan of trenches between diamond drill holes DDH #42 and #52. The map shows the location of samples and the widths of the sampled intervals (in feet). Gold grades are given in $ per short ton and Cu grades are in weight percent. At the time, the New York gold price was fixed at $20.67 per ounce. The drawing is dated February 11, 1924.

Sheet 5: Surface map of the Horne property showing the Horne camp on Lake Osisko, prospecting trenches, and surface projections of drill holes. The locations of mine buildings and No. 1 to 3 shafts are shown. The map is dated November 2, 1925.

Sheet 6: Diamond drill hole and assay plan of trenches of the G orebody. Gold grades are given in $ per short ton and Cu grades are in weight percent. At the time, the New York gold price was fixed at $20.67 per ounce. No date is given on the map.

Sheet 7: Diamond drill hole and assay plan of trenches located in the northern part of the Horne property. The location of No. 2 shaft is shown. Gold grades are given in $ per short ton and Cu grades are in weight percent. At the time, the New York gold price was fixed at $20.67 per ounce. The map is dated November 18, 1925. Revisions have been made January 31, 1927.

Sheet 8: Section and surface projection of DDH #1. The drill hole intersected variably altered basalt dikes and a short interval of rhyolite. No significant mineralization was encountered. The drawing is dated July 5, 1929.

Sheet 9: Section and surface projection of DDH #2, the discovery hole of the Horne deposit. The drill hole intersected massive sulphides and several variably altered basalt dikes. The drawing is dated July 5, 1929.

Sheet 10: Detailed geological map of the northern part of the Horne property. The map also shows the location of mine buildings, including No. 4 shaft. Massive sulphides were outcropping in several locations. The map is dated August 1929. Several annotations have been made subsequently.

Sheet 11: Detailed geological map of the southern part of the Horne property. The map also shows the location of mine buildings including the No. 1 to 3 shafts. The map is dated August 1929. Several annotations have been made subsequently.

Acknowledgements

We thank L. Martin and J. Goutier for fruitful discussions on the Horne deposit. We are grateful to Xstrata Copper Canada for permission to publish the historic maps and the photograph of the Horne smelter. The Centre d'archives de l'Abitibi-Témiscamingue et du Nord-du-Québec, Bibliothèque et Archives nationales du Québec, and Xstrata Copper Canada are thanked for allowing us to reproduce the photograph of Edmund Horne. Xstrata Copper Canada retains copyright to all graphic images in this Geological Survey of Canada Open File. This study was supported by the Geological Survey of Canada (Targeted Geoscience Initiative-3 Abitibi).

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MAP
— OF —
AREA UNDER DEVELOPMENT
— BY —
NORANDA MINES LTD.
— ON THE —
HORNE PROPERTY
ROUYN TOWNSHIP
QUEBEC
1924

Scale 100 ft. to the inch

— LEGEND —
- Diabase
- Rhyolite, Rhyolite Breccia, or Tuff, and associated greenstone

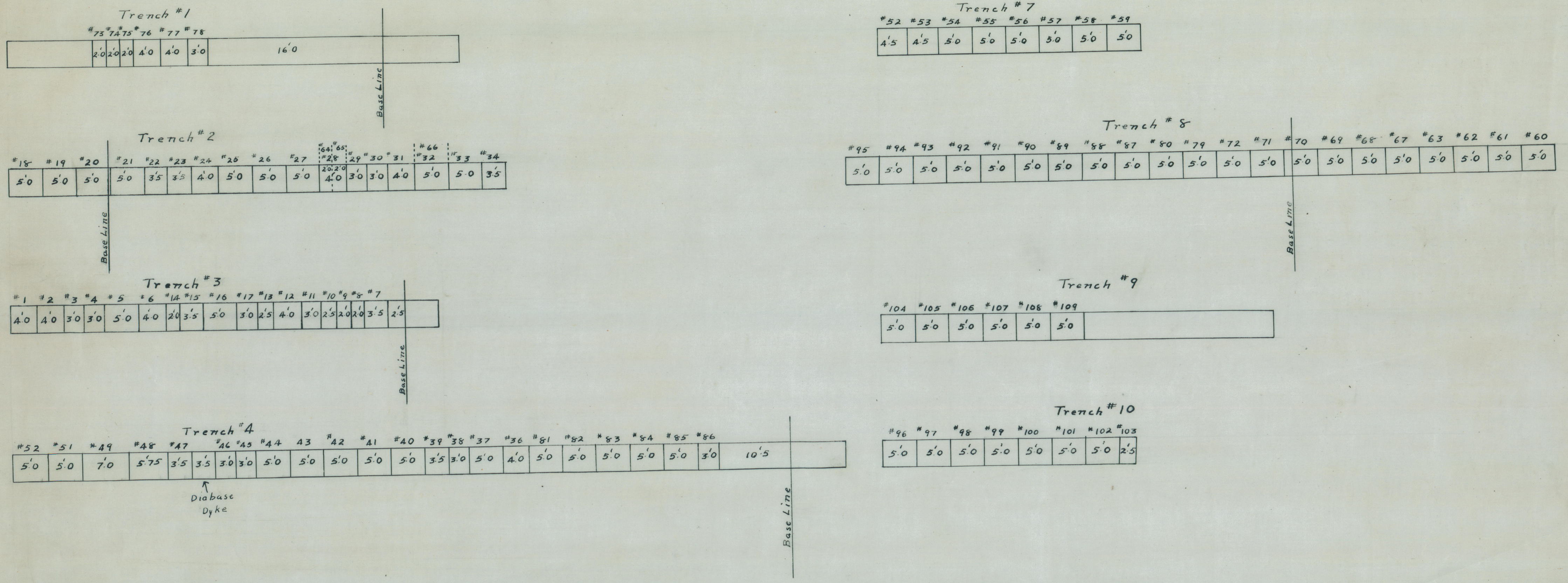
NOTE:- Areas covered by glacial drift, muskeg or vegetation are shown by lighter tint of the formation believed to exist at bedrock.

Lake Osisko

S.

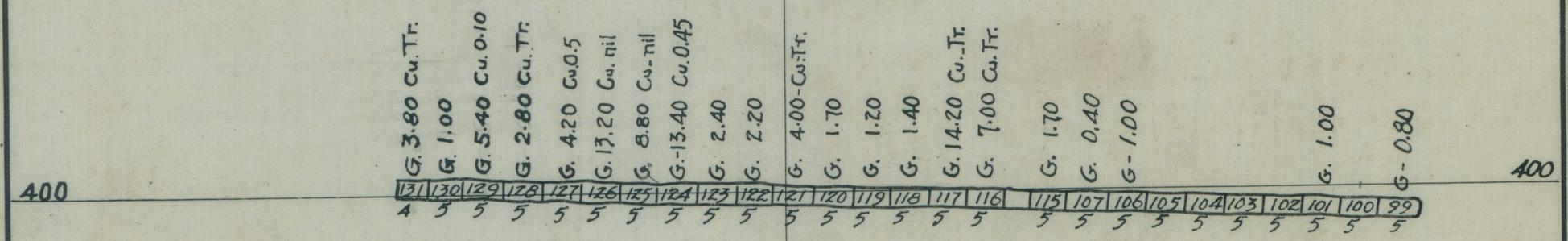
Samples, Horne Claims, Que.

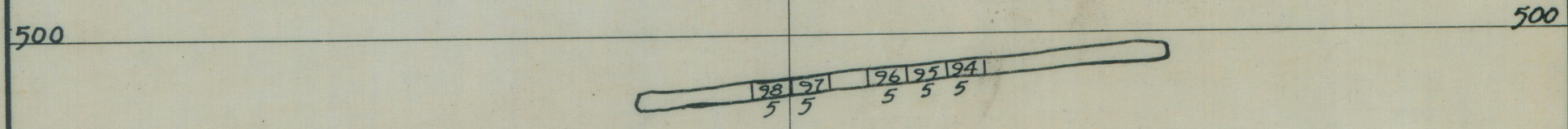
Scale — 100 ft. = 1 inch.



F Ore body?

NW. 1700 N.E.





ASSAY PLAN OF TRENCHES

EAST OF D.H. 45 & D.H. 47

HORNE OPTION

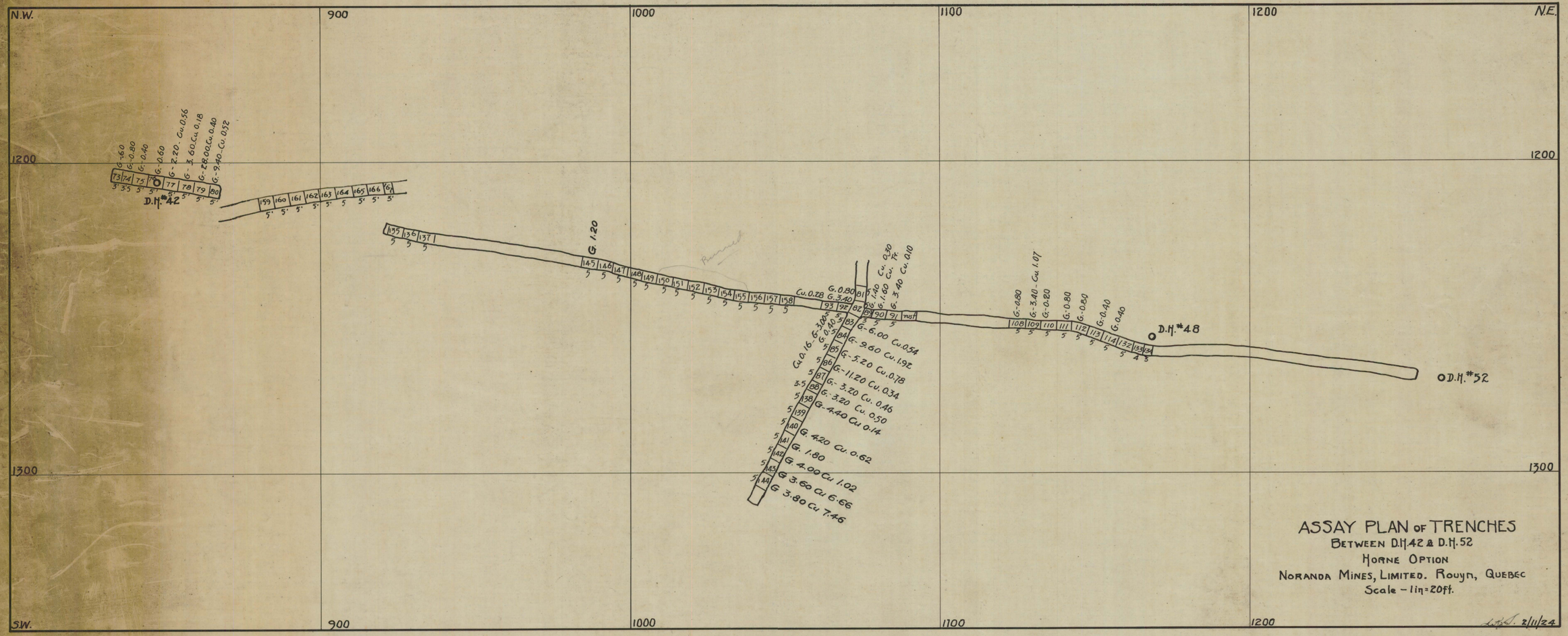
NORANDA MINES, LIMITED: ROUYN, QUEBEC

Scale – 1 in. = 20 ft.

S.W. 1700 L.K.S. 2/11/24

Gr de Area

#7



ASSAY PLAN OF TRENCHES

BETWEEN D.H.42 & D.H.52

HORNE OPTION

NORANDA MINES, LIMITED. ROUYN, QUEBEC

Scale - 1in=20ft.

2/11/24

H. Ore-Body

A


MURRAY
MILLER
Edge of Muskeg
WOODWARD
HORNE
HORNE
FRACTION
MILLER
MILLER
FRACTION
HORNE
No. 2 SHAFT
No. 3 SHAFT
No. 1 SHAFT
BAGSHAW
HORNE
FRACTION
HORNE
OSISKO
LAKE
MILLER
FRACTION
HORNE
HORNE
FRACTION
HORNE
FRACTION
HORNE
BAGSHAW
ADSIT
Edge of Muskeg
N
NORANDA MINES LIMITED.
ROUYN LAKE, QUEBEC.
MINE~ HORNE.
SHAFT~
LEVEL~
SUBJECT~ SURFACE PLAN.
SCALE~ 1" = 100'
DATE~ Nov. 2-25.
TRACED~ M.W.H.
APPROVED~
No. G-H.
REVISED TO DATE
BY
REVISED TO DATE
BY
REVISED TO DATE
BY

NORANDA MINES. LIMITED.

DIAMOND DRILL HOLE SURFACE ASSAY PLAN

"G" ORE BODY.

CO-ORDINATES : LAT. 0 to-1200

DEP. +1000 to 2200

HORNE OPTION.

PLATE ·

Scale : 1 in = 30 ft

Traced by W.T.H

Checked by T.G.O.

Noranda Mines, Limited.
Rouyn Lake, Quebec.

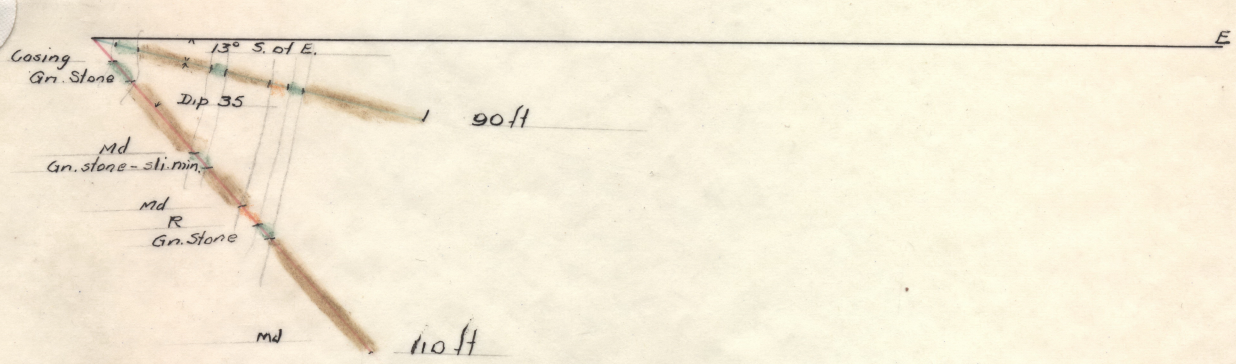
Mine ~ Horne.
Shaft ~ Trenches and Horizontal
Subject ~ Projections of D. D. Holes.

Scale ~ 1" = 50'	Traced ~ L.K.S.	No. 7-8.
Date ~ Nov. 18, 1925	Approved ~	

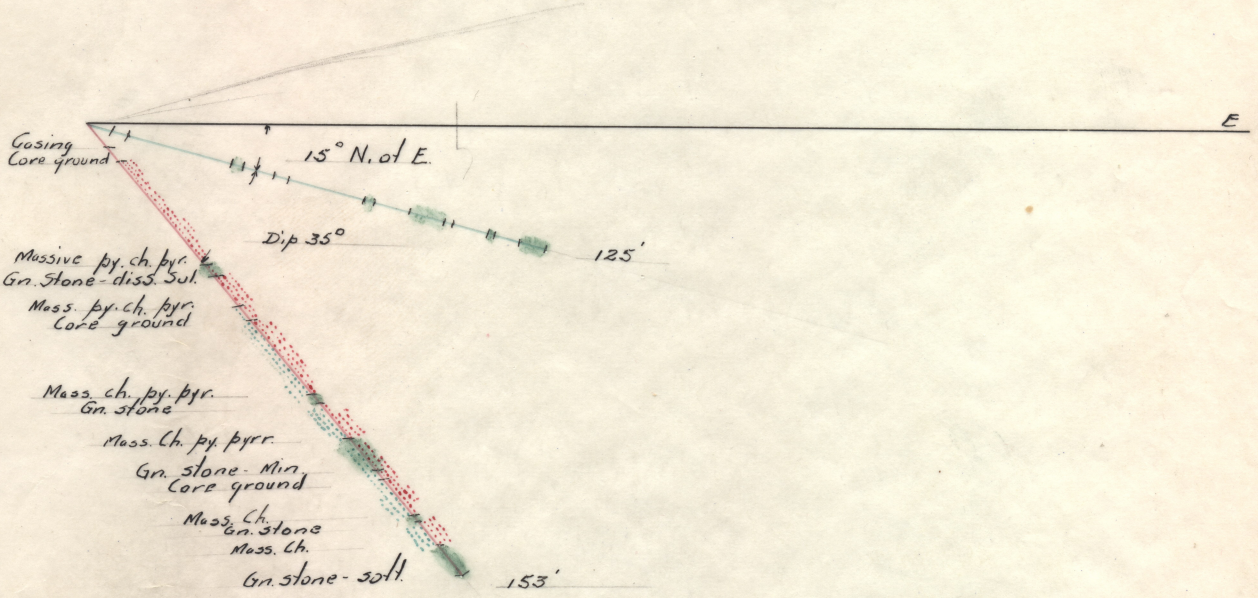
Revised to Date	By	Revised to Date	By	Revised to Date	By.
Jan. 31-1927	L.M.B				

T.83

H-5-83-82-Surface-942



D.D.H. #1
Section and Surface Projection.
Scale 50 ft. = 1 in. 7/5/29



D.D.H. "2

Section and Surface Projection

Scale 50ft = 1in 7/5/29

Ore Body No.

E-7

OSISKO LAKE

Murray Road

ROAD TO POWDER MAGAZINE.

No. 4 SHAFT

CONE CRUSHER BLDG.

ROLLS PLANT

HOIST

16400

16200

16000

15800

15600

15400

15200

HORNE MINE BLOCK E-7.

DETAIL GEOLOGIC PLAN
SURFACE Sc. 1" = 50'

August 1929.

GERMANY

HORNE MINE BLOCK F-7.

DETAIL GEOLOGIC PLAN

SURFACE Sc. 1" = 50'

August 1929.

H-E-83-83-SURFACE-941

T.82