

The Black Duck Mine

Newfoundland's First Commercial Fluorspar Mine

Introduction:

The S.S. Gudmundra (operated by the Shaw Steamship Company of Halifax, NS) docked in St. Lawrence during the first week of March 1933. On board were a 100 cfm compressor, two Ingersoll Rand jackhammers, a jaw crusher, a trommel screen, two model A Ford dumping trucks, several pieces of drill steel, picks and shovels; equipment purchased from a bankrupt contractor in 1932 by Mr. Walter Seibert of Nutley, New Jersey for a reputed sum of \$2,500.

Seibert, with the aid of local resident Aubrey Farrell, had contracted 20 local people to mine approximately 2,000 tons of fluorspar to be sent to the Dominion Steel and Coal Corporation (DOSCO) works in Sydney, Nova Scotia. It was agreed the ore would be washed and hand picked to steel-grade specification and only when the ore was deemed suitable in the smelting of Bell Island iron ore would the 'miners' be paid.

Since the Black Duck Vein is situated over half a mile north east of St. Lawrence the dilapidated equipment was placed onto sleds and hauled over the frozen bog to the site. During the second week of March the compressor was hauled to the mine and mining started soon after. The construction of a permanent road began the following week. A makeshift mill using the trommel and picking tables was erected during the spring of 1933.

For more information on the history of Fluorspar Mining in St. Lawrence the reader is directed to [://www.heritage.nf.ca/environment/mine/ch6p1.html](http://www.heritage.nf.ca/environment/mine/ch6p1.html) "*Once Upon a Mine: Story of Pre-Confederation Mines on the Island of Newfoundland – chapter VI*", by Wendy Martin.

Since all accounts and drawings of mining on the Black Duck Vein are given in imperial units they are retained throughout this work.

The Black Duck Mine:

The vertical Black Duck Vein has a strike of N65°E, has a dip of 85° SE and is termed an east-west vein. The deposit is a lens type with a length of 600 feet averaging 4 feet in width. Initially two fluorspar outcrops were visible on the vein approximately 100 feet apart and some 50 feet in length. Black Duck Pond was approximately twelve feet below the western outcrop where a four foot wide vein of fluorspar was exposed. Extraction began in this area by building a landing from which under-hand stoping commenced. The muck was hoisted in pork barrels and taken by wheelbarrow to a stock-pile. – *Figure 1*.

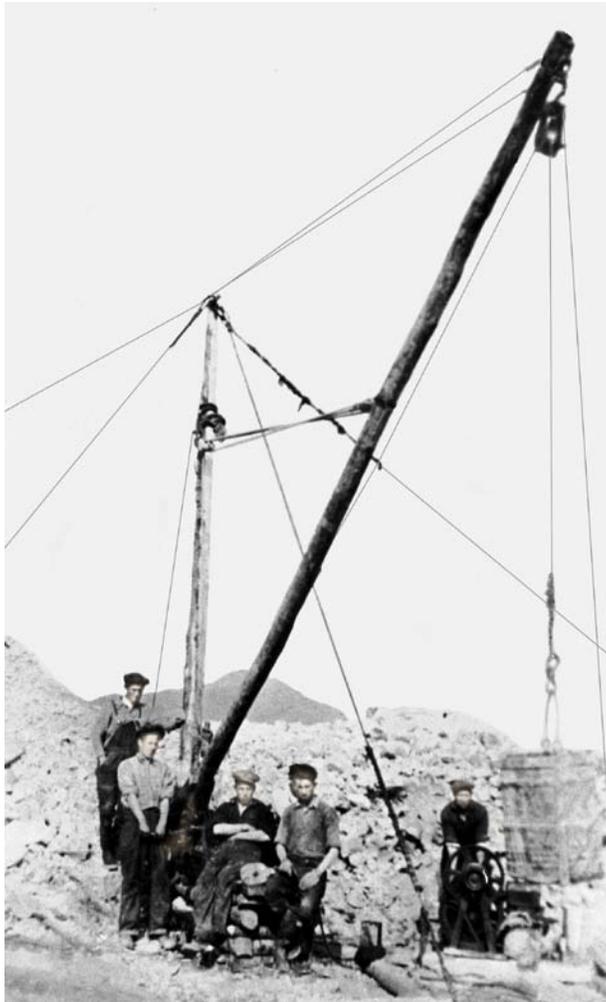


Figure 1: Hoisting muck at Black Duck Mine in 1933.

From the stockpile the ore was shoveled into horse-drawn carts and transported to the mill.

Beyond the pond the vein extended approximately 200 feet to the east at an average width of four and a half feet. At this point the first pinch was encountered being approximately 30 feet long and one and a half feet wide. Continuing east beyond the pinch the vein again widened but eventually split at an angle of about 20° becoming too narrow to mine economically, the northern limb dying out after a distance of 50 feet. Further east the granite host rock / argillite contact was evident. A dike / fault area could be seen close to the contact. – *Figure 2*.

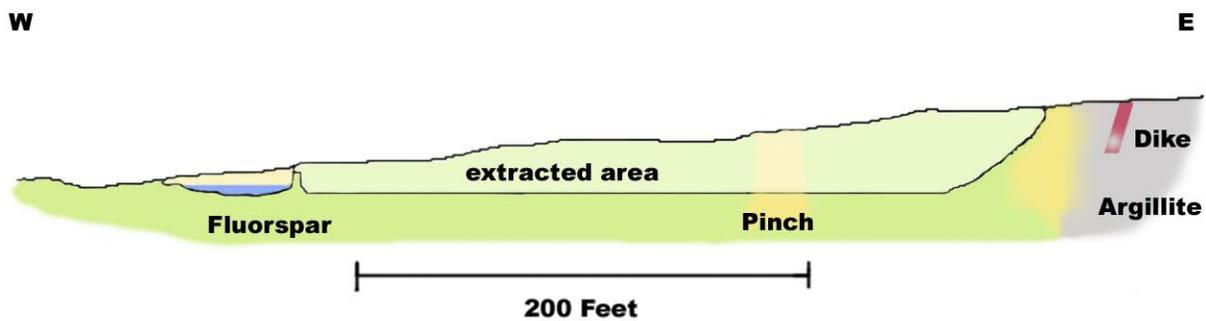


Figure 2: The open-cut by the end of September 1933.

The length of vein worked under contract was approximately 350 feet averaging three and a half feet in width. In the east the vein split and became too narrow to mine economically. Initially the water table was below the mining level but soon water became a problem and a 5hp Gould pump driven by a “hit and miss” stationary engine (previously used for fish washing) was used to dewater the open cut. This pump, removing water at a rate of 25gpm, allowed mining to reach a depth of 35 feet. At this point twenty men were employed at the mine in a three shift system producing around 250 tons per month. – *Figure 3.*

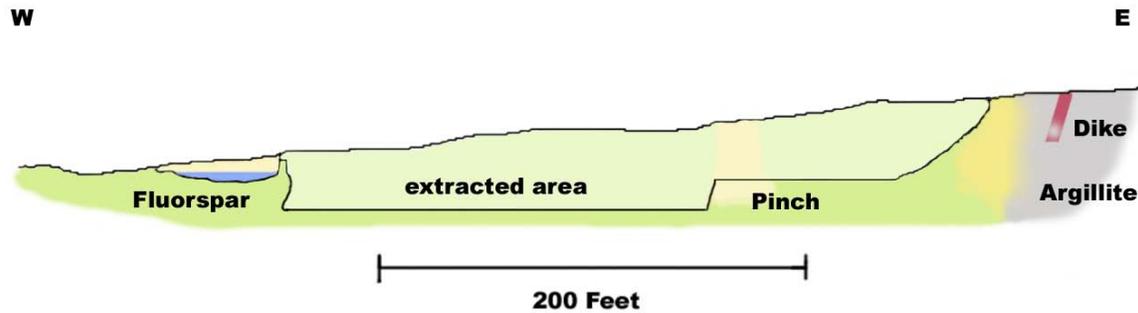


Figure 3: The open-cut by the end of November 1933.

In 1929 the United Towns Electric Company expanded their service to the Burin Peninsula and in 1933 extended their power line to the Black Duck Mine. A 5hp LeBour pump was then installed allowing mining to continue to a depth of 50 feet. During November 1933 some 1,850 tons of steel-grade fluorspar was shipped from St. Lawrence to the DOSCO. In December the first true head frame was constructed and a Ledgerwood hoist, driven by a 20hp electric motor was installed. A second LeBour pump was joined in series with the original allowing the open cut to reach a depth of 85 feet. To improve productivity all mining was discontinued in the pinch area (which persisted almost vertically) reducing the length of the open cut from 350 to 250 feet, confining work to the widest area of the vein. Production increased to 100 tons per week. – *Figure 4.*

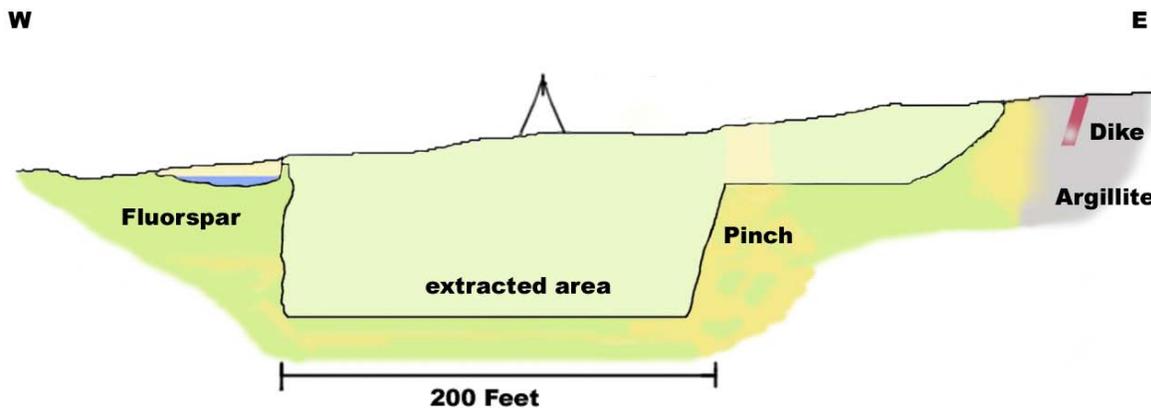


Figure 4: The open-cut by December 1933.

In 1934 Dr. W.S. Smith became mine manager and a ditch was cut two hundred feet west of the open cut to facilitate drainage of the Black Duck pond. Once drained, striping began going west following the vein. Peat was found to a depth of twelve feet in which the trunks of 15 inch diameter fir trees were found. When the vein was reached it was found to be covered to a depth of four feet by float fluorspar which extended to a width of 25 feet. Single pieces weighed as much a 50 pounds and were oval in shape showing they had been glaciated. The surface of the vein below the float, once exposed, was also found to be glaciated.

During the year the open cut was extended by approximately 100 feet where the ore was found to average three and a half feet in width. At this point the first westerly pinch was encountered. Some 360 feet separated the pinches. – *Figure 5.*

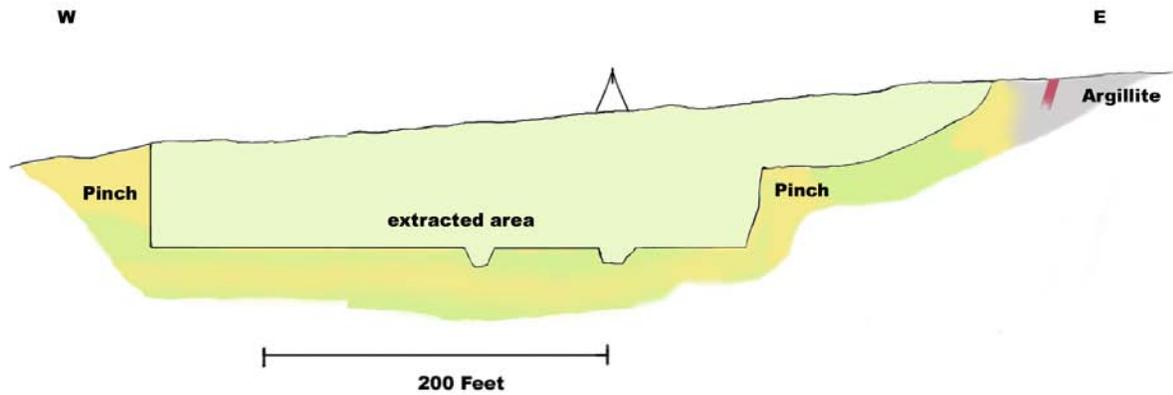


Figure 5: The open-cut in 1934.

In 1935 a drift was driven 175 feet west from the open cut where the vein averaged three and a half feet for a distance of 150 feet. A one foot pinch developed at the 150 foot mark and the drift was abandoned. This was the first underground Fluorspar mining in St. Lawrence. Drilling was conducted with jackhammers placed on stulls at the face, however this technique proved rather slow and the men often held the jackhammers in their arms or on their shoulders. Men worked in pairs, a driller and a helper. The old jackhammers had no provision for water and as a consequence all drilling was dry. The men wore a mask of cheesecloth over the nose and face in an attempt to reduce the dust hazard. A 5hp blower was used for ventilation. In 1935 carbide lamps were used for the first time. Prior to this storm lanterns and paraffin candles were used for lighting the mine. – *Figure 6.*

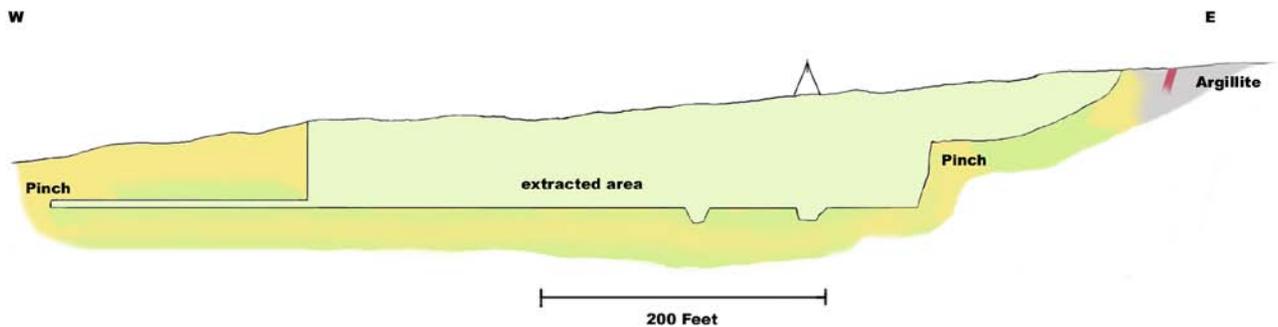


Figure 6: Showing the first drift.

A stoppage occurred in June 1935 when a dam supplying water for the United Towns Electric failed. Power was not restored until November and consequently the mine began to flood. A decision was made to abandon the open cut and transfer operations east of the pinch. A dam was constructed on the pinch and supported by backfill. A second head frame was erected over the vein at a point 125 feet east of the original and, using a series of blocks and sheaves, the hoist cable was taken to the east head frame while leaving the hoist in its original location. The east shaft was built as a vertical, single compartment with the first 50 feet being completely enclosed by cribbing. – *Figure 7.*

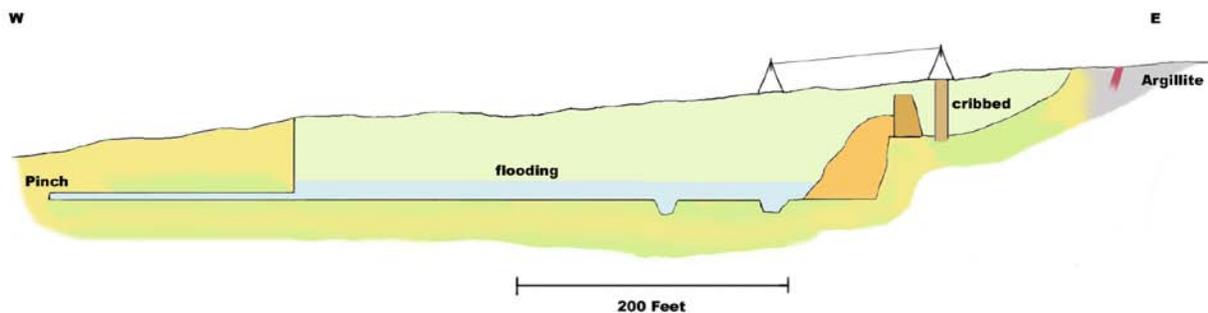


Figure 7: Showing flooding and the placement of the dam, backfill and east shaft.

Sinking was extended to a depth of 100 feet where a drift was driven east of the pillar. As sinking progressed 6 foot benches were drilled underhand and extended east to where the vein split. As the shaft was deepened stulls were driven in alignment and spaced at three foot centres. These were lagged on the inside using two by six inch boards. This practice continued until the area was completely mined. – *Figure 8*.

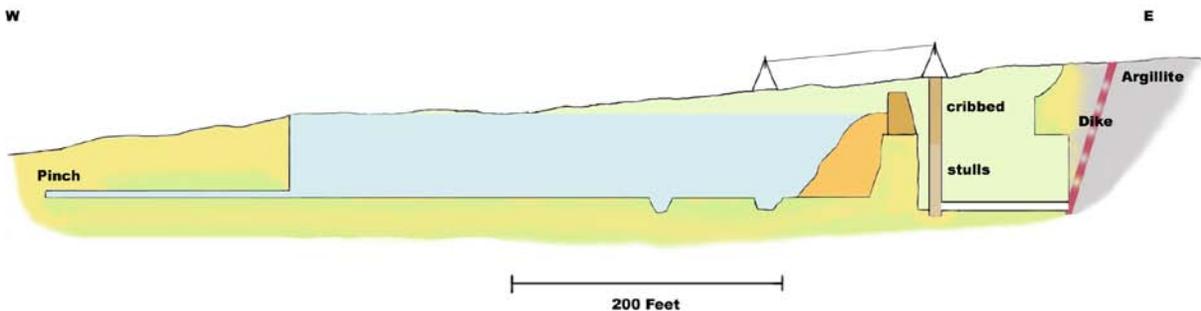


Figure 8: The open-cut worked out in the east.

On October 24th 1936 Edward Stapleton (32) of Little St. Lawrence was killed at the mine in a blasting accident.

The shaft was extended to a depth of 150 feet. A deep well turbine was installed to keep the open cut de-watered while drifting underneath. Here the vein was at its best with widths of up to 9 feet being encountered and never less than two and a half feet, averaging four feet. The drift was extended to 700 feet before a major pinch was encountered. East of the shaft the drift averaged about three feet for a distance of 80 feet where the granite was replaced by a dike. Here the vein persisted for approximately 15 feet before petering out. – *Figure 9*.

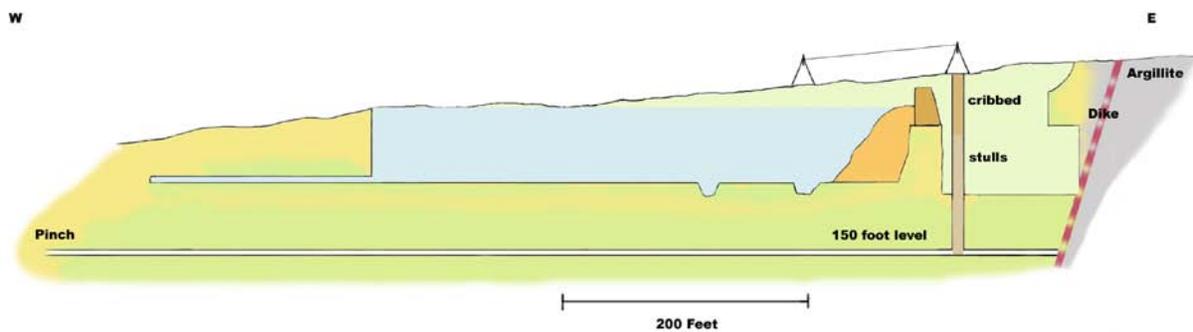


Figure 9: Showing the 150 foot level.

In 1937 two Winzes were driven west of the shaft and one to the east where three underhand stopes were developed. The ore was hoisted by Little Tugger Ingersoll Rand air hoists in 600lb ore buckets to a timber deck with 12 lb mine rail (*see Figure 18*), at a track gauge of 18 inches. Here they were placed on flat cars for tramping to the shaft and hoisting to the surface. Once on the surface the buckets were trammed to the mill on 20 lb rail at a track gauge of 24 inch (*see Figures 12 & 18*). As the east stope progressed downwards it became progressively shorter due to the dike tilting from the east. A depth of 200 feet was reached and a new L74 Ingersoll Rand drifter and an 85 Ingersoll Rand stoper were added to the mining equipment. The drifter was first used to connect the east and west stopes under the shaft. The stoper was used to drive a vertical raise to extend the shaft to the 200 foot level. – *Figure 10*.

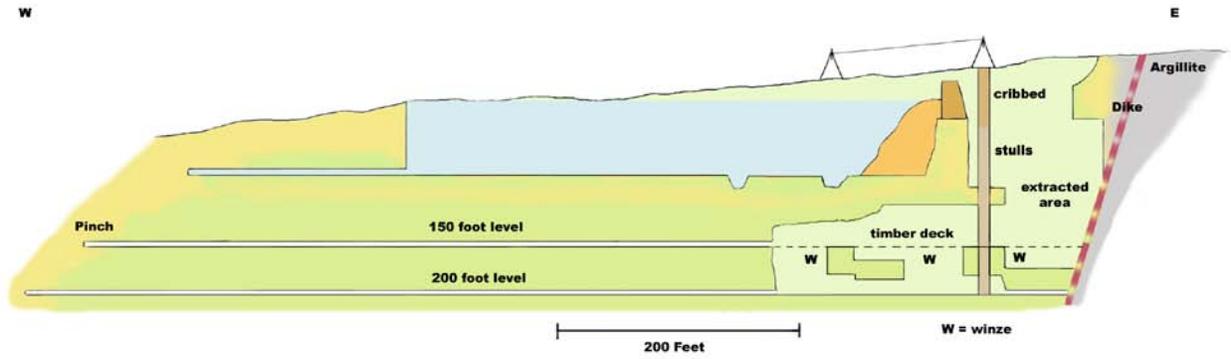


Figure 10: Showing the location of the three winzes and rail track timber deck.

Once on surface the buckets were transferred to the mill using flat cars on 20lb rail. – *Figures 11 and 12 & 18.*



Figure 11: Black Duck Mine in 1937

The road at the top-right of the photo leads to Doctor's Pond where a low grade fluorspar vein was found. Ore from this vein was hauled to the mill to be blended with the richer Black Duck ore.



Figure 12: Black Duck open-cut on right and tramway to the mill.

During 1938 and 1939 stopes were laid out and worked between the 150 and 200 foot levels. – *Figure 13.*

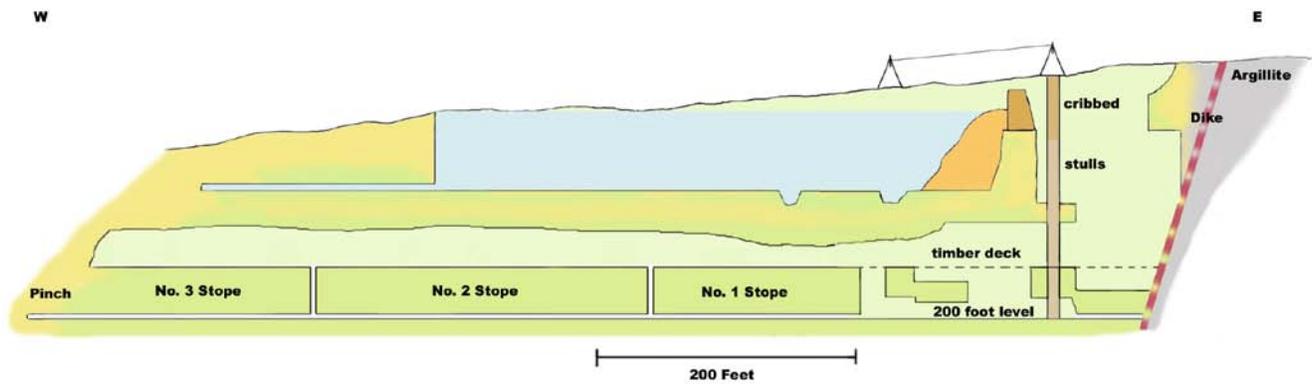


Figure 13: Showing the stopes worked between 1938 and 1939.

As the underhand benches moved west a major pinch developed at approximately 700 feet from the shaft. This extended from the floor of the 200 foot level to the sill pillar below the open cut and averaged one foot in width. Mining of the No. 3 stope terminated at the pinch. – *Figure 14*

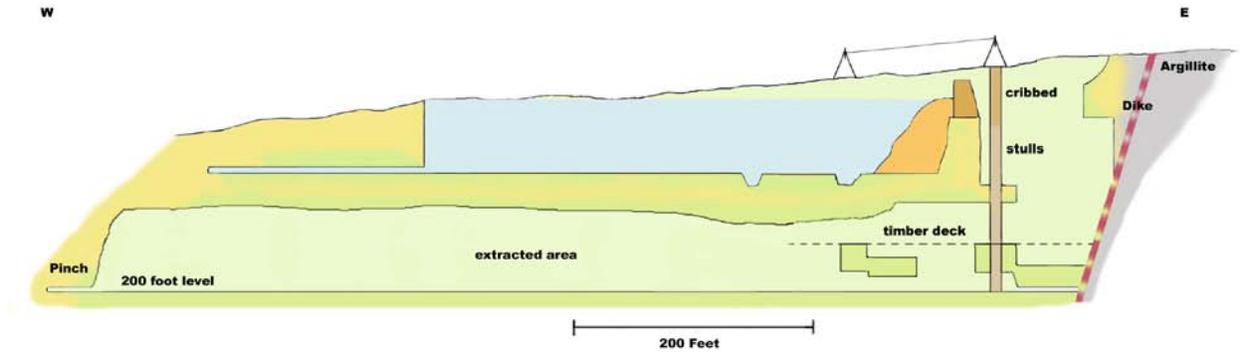


Figure 14: Showing the area extracted to the end of 1939.

In 1940 after more than 6 years of working underground, Edison mine lamps were introduced along with mine hard hats, belts, safety boots and safety glasses. Prior to this miners had used fisherman's sou'westers and oilskins. At this time an electrical signal system was installed.

An attempt was made to extend the shaft a further 50 feet but a watercourse was intercepted at a depth of 30 feet. A winze was then sunk west of the shaft and access gained by drifting and raising. A second winze was sunk 125 feet west of the shaft. A drift was extended 250 feet west of the winze where the ore width was 5 feet at the face.

East of the shaft after drifting about 15 feet a round broke into a cavity within the dike zone. It extended about 25 feet with a width of approximately nine feet. The walls on either side had between six and twelve inches of fluorspar. In between these walls the area was taken up by pug in which fluorspar crystals were embedded. Some of the crystal beds weighed as much as 200lbs with cubes of up to 18 inches across the face. The area yielded optical fluorspar and possibly as much as 200 tons of cube specimens. – *Figure 15.*

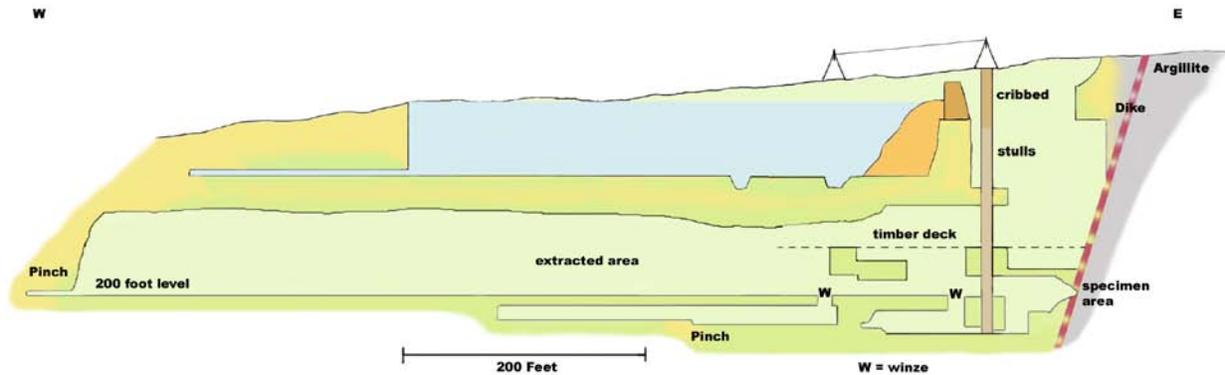


Figure 15: Showing the second winzes and pinch on the lowest level in 1940.

During 1941 the mine was deepened and a depth of 55 feet was reached at the bottom of the west winze. As this underhand stope progressed a major pinch developed where the ore disappeared altogether. A total of 3,000 tons of ore was removed in this, the mine's final year of operation. At its closure the main dewatering equipment consisted of a 40hp 3-RVH Ingersoll Rand pump located 150 feet below the surface and a 25hp 3-RHV pump located 230 feet down the shaft. The final flow rate was approximately 250 gpm. As mentioned earlier, a deep well turbine was used at intervals to keep the worked-out open cut de-watered at a rate of approximately 50 gpm. Only two 5hp blowers were used for ventilation.

The majority of the original open-cut was backfilled during the life of the mine however most of the lower workings and open-cut to the east the second shaft appear to remain open at depth and will therefore be flooded. Backfill is supported by wooden timbers. – *Figure 16.*

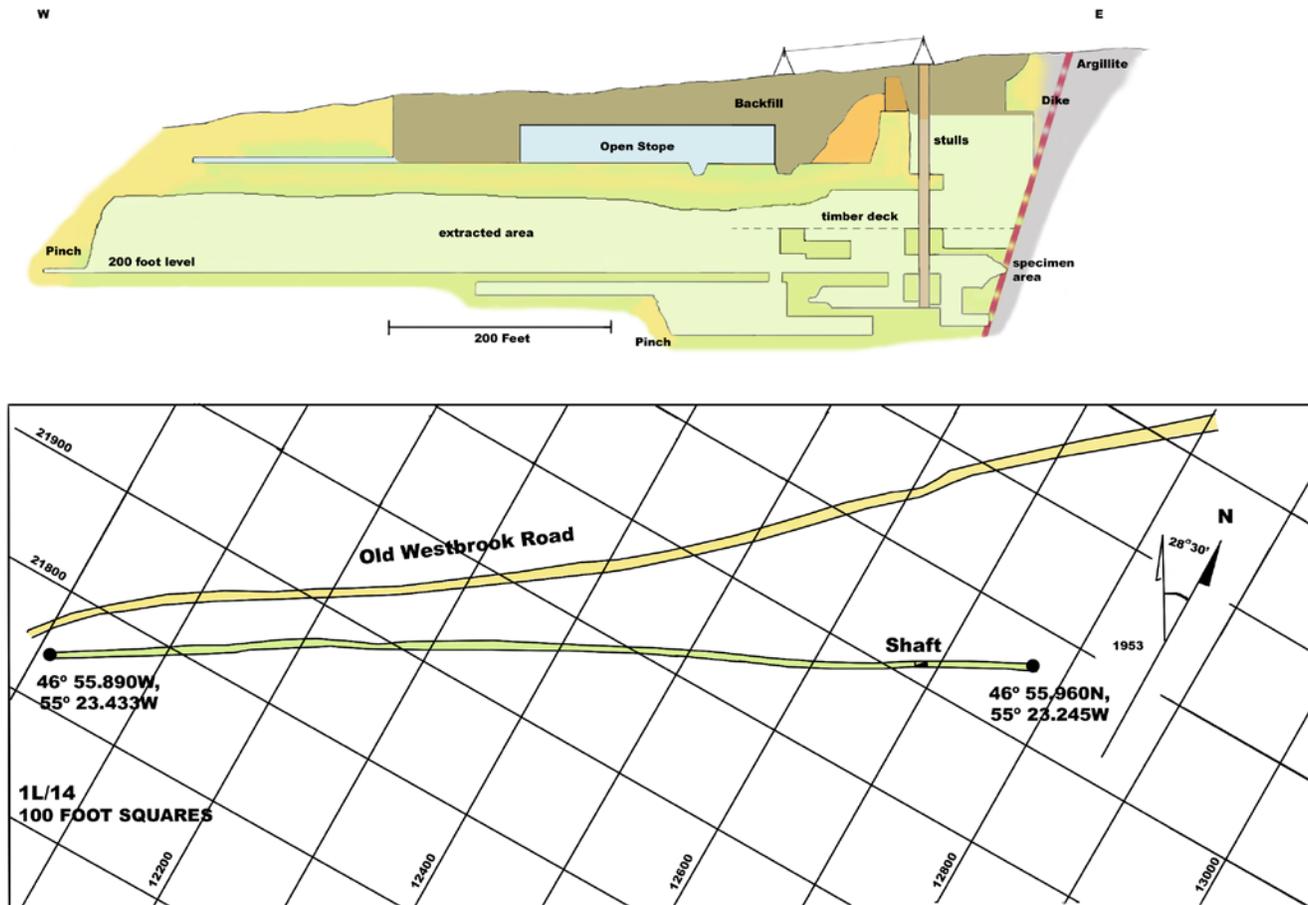


Figure 16: Showing the final longitudinal section and surface plan for the mine in 1941.

The overall length of Black Duck Mine was 875 feet. The deepest level from which ore was removed was 275 feet. At a depth of 200 feet down the shaft there was evidence of a fault where the vein was practically cut off by an apparent diagonal movement from the southwest to the northeast. The walls in this area were slickensided.

Between 1933 and 1941 the mine produced a total of 46,000 tons of ore. Since the ore pinched at depth in the west and the dike narrowed the vein in the east it was decided to close the mine in May 1941; all work being transferred to the Blue Beach and Iron Springs mines. The official reason for the mine's closure was "unacceptable pumping costs".

Milling:

Fluorspar was washed then treated by passing the ROM through a three section trommel consisting of compartments of ½ inch, ¾ inch and 1 inch rings. Material passing through the trommel screens was used for steel and Cyanamid grades. The oversize flowed onto hand picking tables and was reclaimed for acid grade. Little quartz, calcite and no barite existed in the ore from the mine. At the time the grades of fluorspar (fluorite – CaF₂) produced with accompany quartz (silica – SiO₂) impurity were:

Steel grade (now termed metallurgical grade):

CaF₂ ≥ 85%, SiO₂ ≤ 5.0%

Granular size:

< 1.0 inch with ≤ 15% 'fines'

Cyanamid Grade:

CaF₂ 93 to 95%, SiO₂ 2 to 4%

Acid Grade (so called since it is used in the manufacture of Hydrofluoric Acid)
 $\text{CaF}_2 > 98\%$, $\text{SiO}_2 < 1.0\%$

Black Duck Mine Today (2010)

The extent of the mine can still be seen on the surface of the ground and pieces of 20 lb tramming rail and fluorspar can be found in the woods. – **Figure 17.**



Figure 17: ‘Google Earth’ map showing the position of the Black Duck Mine relative to the Town of St. Lawrence.

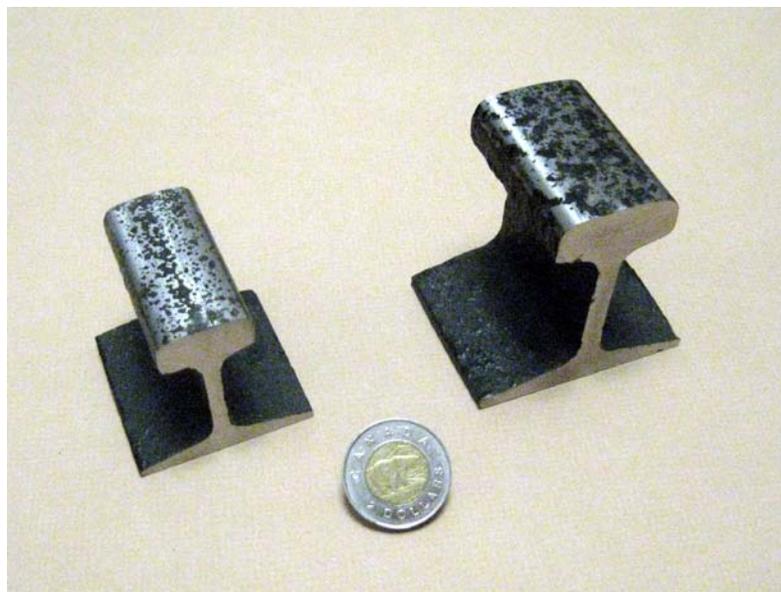


Figure 18: 12lb and 20lb Rail Sections from the Black Duck Mine.

Glossary

Argillite:

A rock derived from slitstone, claystone or shale. That has undergone induration (hardening by heat in the case of the rocks overlying the St. Lawrence Granite).

Bench:

A shelf or ledge where the upper section is cut back. A method of extracting ore in strips.

Blocks and Sheaves:

Grooved pulleys encased in a shell or frame and used to change the direction of the pull of a rope or cable. When used in pairs used to exert increase mechanical force.

Dike:

A discordant tabular body of igneous rock cutting across the structure of adjacent country rock usually having a high angle of dip.

Fault:

A fracture or fracture zone along which there has been some displacement of the two sides relative to one another parallel to the fracture.

Float:

Fragments of ore carried away from the original source by some force e.g. glacial action, water or gravity alone.

Granite:

Coarse grained igneous rock containing megascopic quartz (averaging 25%), feldspar and mica. St. Lawrence granite also contains the comparatively rare ferromagnesian minerals riebeckite and aegirine. (The riebeckite granite known as ailsite, found on the island of Ailsa Craig in western Scotland, is prized for its use in the manufacture of curling stones.)

Level:

A main underground roadway or passage used to connect stopes or workings.

Muck:

Broken ore.

Pinch:

The St. Lawrence Fluorspar veins are true fissure fillings located in the tension cracks that developed as a result of regional movements and contraction during cooling of the granite. As a result the veins are not uniform in nature and the thickness varies both along the strike of the vein and with depth. The narrowing of the vein is termed a pinch.

Pug:

Crushed strata or clay often caused by the movement of a fault. Can fill cavities by being carried by and deposited from flowing water.

Raising:

The driving of a vertical or inclined hole from the bottom up. Used to connect one level with the one above.

ROM:

Run-of-mine, raw ore at average mine grade.

Round:

A series of shots fired simultaneously or with timed delay periods, used to break ore by drilling, charging the hole with explosive and blasting.

Sinking:

Extending excavations downwards.

Slickensided:

A polished surface on the walls of a vein produced by rubbing during faulting.

Strike:

The horizontal length of a vein.

Stope:

An excavation from which ore has been excavated in a series of steps. (*See underhand stoping*)

Stull:

Timber prop set between the walls of a stope. A timber platform.

Trommel:

A revolving cylindrical screen used to grade coarsely crushed ore. The material to be separated is delivered inside the trommel at one end. Fine material passed through the holes and the coarse is delivered from the other end.

Tramming:

The practice of pushing tubs or mine cars by hand.

Underhand Stoping:

Mining ore from an upper level to a lower, underhand. Mining downwards. The stope may start below the floor of a level and be extended by successive horizontal slices, in a series of downward steps.

Winze:

A vertical or inclined opening or excavation, connecting two levels in the mine. A Winze is sunk underhand.

References:

Farrell, H.; 1967: Report on Mining Properties of St. Lawrence Corporation; NF. Miner. Dev. Div. Assess. File 1L/14/0084.

Fowler, H.S.; and West, P.W.; 1954: Engineering report on fluorspar investigations in the St. Lawrence Area, Newfoundland; NF Miner. Dev. Div. Assess. File 001L/14/0032

Smith, W.S.; 5th December 1941: Morris Prospecting. Internal document for Newfoundland Fluorspar Limited.

Smith, W.S.; 1957: Fluorspar at St. Lawrence, Newfoundland. Newfoundland Fluorspar Ltd.; NF. Miner. Dev. Div., Assess. File 001L/14/0016.

Van Alstine, R.E., 1944: The Fluorspar Deposits of St. Lawrence, Newfoundland. Econ. Geol., Vol. 39, No. 2, pp.109-132. (GSB# 001L/14/0009)

Van Alstine, R.E.; 1948: Geology and Mineral Deposits of the St. Lawrence Area, Burin Peninsula, Newfoundland. Nfld. Geol. Surv. Bull. No. 23, 73 pages. (GSB# 1L/14/10)

(GSB# = file number at Geological Survey Branch, Dept. of Mineral Resources, St. John's.)

© Norman Wilson, January 2010.