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FLUORITE RESERVES AT THE LOST RIVER TIN MINE, ALASKA

A preliminary report on fluorite reserves at the Lost River tin mine, Alaska, with a brief geologic description of the deposits, has been prepared by the Geological Survey, United States Department of the Interior, Director William E. Wrather announced today. The mine is in the valley of Lost River in the western part of Seward Peninsula about 80 miles northwest of Nome and 6 miles north of Bering Sea. The estimate of reserves has been prepared as a result of field examinations made during 1940, 1942, and 1943 of the tin and tungsten deposits with which the fluorite is intimately associated.

Present mine openings are in tin and tungsten deposits, chiefly in the altered portions of rhyolite-porphyry dikes that cut extensively altered limestone. Fluorite is one of the major constituents of numerous complex replacement veinlets in the altered limestone in the vicinity of the dikes, and of the marginal zones of altered limestone adjacent to the altered parts of the dikes. It is also a minor constituent of the altered rhyolite porphyry.

The field examinations indicate a block, containing at least 9,000,000 tons of altered limestone, cut by veinlets of fluorite rock that consists of about 40 percent of fluorite. The fluorite rock is estimated to constitute about 6 percent of this block. In addition, marginal zones along each side of the Cassiterite dike, one of the major dikes of the area, are estimated to contain as much as 30,000 to 50,000 tons of fluorite rock containing about 50 percent of fluorite.

Mining and recovery of the fluorite are probably contingent upon the development and operation of the deposits for the tin and tungsten that they contain.

A limited number of copies of the report are available to those directly interested and may be obtained upon application to the Director, Geological Survey, Washington 25, D. C.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington

FLUORITE RESERVES AT THE LOST RIVER TIN MINE

Seward Peninsula, Alaska

By

R. R. Coats and P. L. Killeen

The location, accessibility, and general geology of the Lost River area, Seward Peninsula, Alaska, have been described in several published and unpublished Survey reports. The most recent published report is by Steidtmann and Cathcart. 1/ Mertie and Coats have written several unpublished reports, covering work done in 1940 2/ and 1942 3/.

Geology

The country rock at the Lost River mine consists mainly of Ordovician limestone, which has been intruded by two major dikes of rhyolite porphyry, and by several smaller intrusive bodies. The Lost River mine is principally developed in one of the major dikes, the Cassiterite dike. Subsequent to the intrusion of the igneous rocks, both limestone and intrusive rocks have been intensively metasomatized, with the development of a wide variety of silicate minerals, of fluorite, and minor amounts of several ore minerals, including scheelite, wolframite, cassiterite, magnetite, arsenopyrite, pyrite, molybdenite, sphalerite, galena, chalcopyrite, and stannite.

1/ Steidtmann, Edward, and Cathcart, S. H., Geology of the York tin deposits, Alaska: U. S. Geol. Survey Bull. 733, 1922.

2/ Mertie, J. B., Jr., and Coats, R. R., Lode tin deposits of the Lost River Area, Alaska: Unpublished manuscript.

3/ Coats, R. R., Supplementary report on the lode tin deposits of the Lost River Mine, York district, Seward Peninsula, Alaska: Unpublished manuscript.

Fluorite has several modes of occurrence in the rocks of the area. Small amounts of massive, coarse-grained, nearly pure fluorite occur as limestone replacements, with irregular vein-like form; no such bodies large enough to be considered ore have been discovered.

A very large volume of limestone has been partly replaced by fluorite rock, which forms irregular, banded, veinlike replacements, too narrow for selective mining, commonly along complex systems of intersecting fractures. The fluorite in the individual veins is not pure, but is intimately intergrown with other minerals, principally fine-grained mica. Between the veins of fluorite rock are remnant blocks of unreplaced limestone, which range widely in size. The fluorite rock itself may be 40 per cent of fluorite.

Similar in genesis to the veins discussed in the preceding paragraph, but more regular in form, are the selvages of fluoritized limestone which adjoin the Cassiterite dike on both sides. This may have a fluorite content of 50 percent, and is also an intimate intergrowth of fluorite and mica. This intergrowth is very fine-grained.

The Cassiterite dike itself is extensively metasomatized by fluorite, topaz, mica, and clay minerals, as well as by several ore minerals. The fluorite content may be as much as 10 percent.

All of the foregoing estimates of grade are based on microscopic examination of a relatively small number of thin sections. As such metasomatized rock displays considerable differences in composition over short distances, the estimates are subject to considerable error.

Reserves

Most detailed information is available, from natural and artificial exposures, on a block of ground, mostly underlain by metasomatized limestone, but including a part of the Cassiterite dike, and having a surface area of about 489,000 square feet and a volume of about 106,000,000 cubic feet. Based on visual estimation by Survey geologists of mine workings, outcrops, and diamond drill cores recovered in 1943 for and under the direction of the Bureau of Mines, 6 percent of this volume is calculated to be fluorite rock. This block, exclusive of the Cassiterite dike and its selvages, then contains, on this basis, about 8,960,000 tons of rock, of which about 538,000 tons is fluorite rock, containing possibly 40 percent of fluorite, or about 215,000 tons of fluorite.

Of this volume of rock, the portion on the east side of Cassiterite Creek is apparently of somewhat higher grade. There, about 4,200,000 tons (part of the 8,960,000 tons listed above), may average 11 percent of fluorite rock, or 462,000 tons of fluorite rock, containing, on the basis of 40 percent of fluorite, about 184,500 tons of fluorite (part of the 215,000 tons listed above).

The length of the body of fluoritized rock forming the selvages of the Cassiterite dike is here taken as 1,500 feet, and the average total thickness of both selvages, 2 feet. The depth from the outcrop to the level of Cassiterite Creek

ranges up to several hundred feet and may average about 155 feet; a possible stope area is calculated to be about 233,000 square feet. The specific gravity of this rock is estimated to be about 3.0. From the outcrop to the level of Cassiterite Creek there will thus be about 44,000 tons of fluorite rock, which will contain about 22,000 tons of fluorite. Below the level of Cassiterite Creek, the depth to which the replacement extends is uncertain. It is here taken as 200 feet, which is probably conservative. To this depth, there would be a total of 50,000 tons of fluorite.

Above the level of Cassiterite Creek and over a similar length, it is estimated that the Cassiterite dike itself contains 170,000 tons of tin ore. If the fluorite content is 10 percent, then about 17,000 tons of fluorite are present in this block. To a depth of 200 feet below the creek, there will be an additional 20,000 tons of fluorite, or a total of 37,000 tons.

Recovery problems

The irregularly metasomatized limestone is too low grade to be considered as a source of fluorite unless the body of rock can be mined for its content of tin and tungsten. Too little is now known of the tin and tungsten content to permit any definite statement, but such an operation appears unlikely.

The fluoritic selvages of the dike could be mined selectively in conjunction with the mining of the dike itself. The fluorite rock as thus mined would constitute a low-grade fluorite product. It probably contains some tungsten and tin and might be advantageously milled to recover tungsten, tin, and fluorite separately.

The dike hitherto has been considered to constitute the principal tin reserves of the district. If it should be mined without the selvages and milled for the recovery of the tin, it might be possible to prepare a fluorite flotation concentrate as a by-product. The number of tons of fluorite recoverable per year from this type of limited operation would depend on the scale of tin and tungsten mining and might be about 5,000 tons annually.