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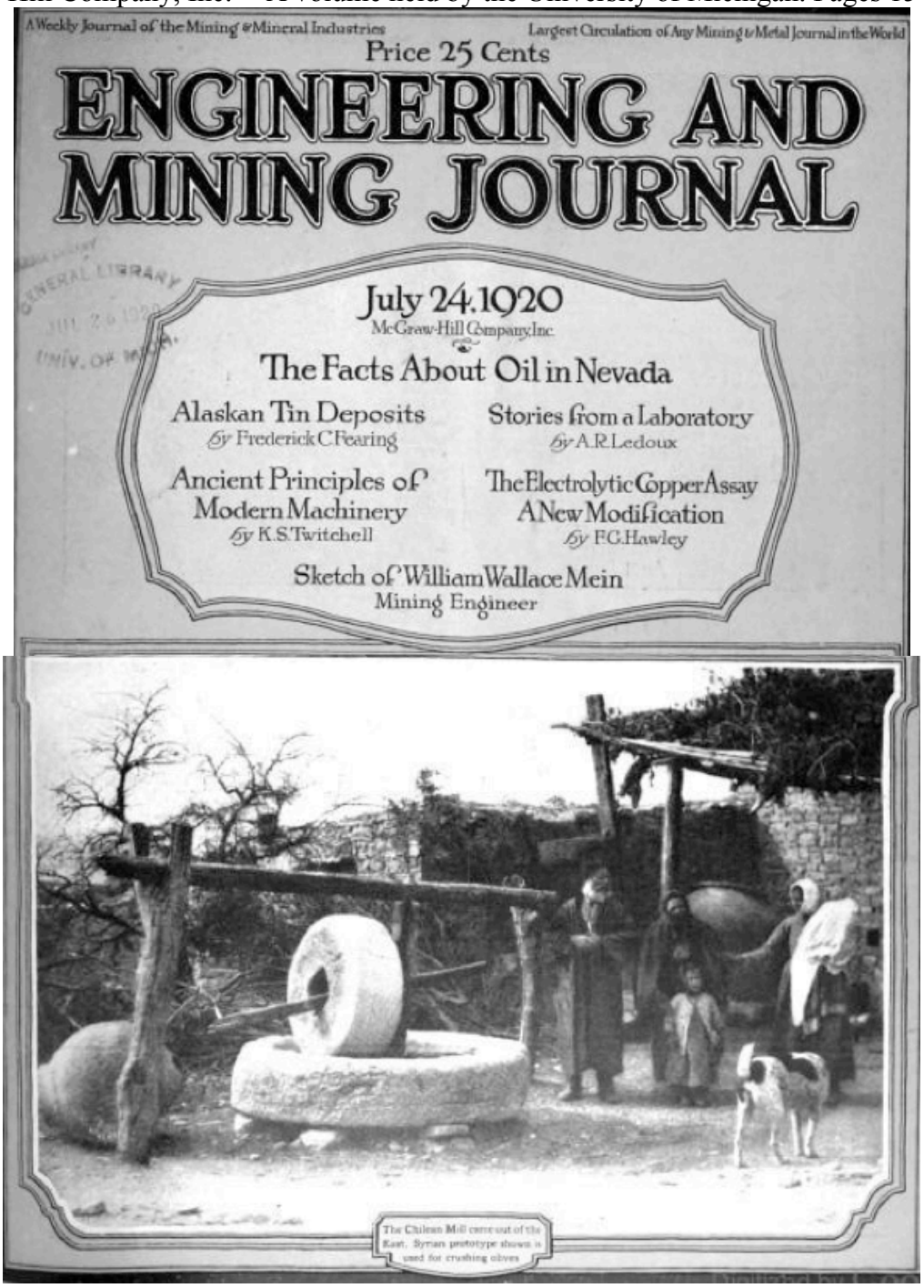
Document excerpt from *Engineering and Mining Journal, Vol. 110, No.4.* (24 July 1920). McGraw-Hill Company, Inc. -- A volume held by the University of Michigan. Pages 154-157.



LOOKING DOWN CASSITERITE CREEK TO THE LOST RIVER VALLEY

Alaska Tin Deposits

Steep-Dipping Quartz Porphyry Dikes in the York Mountain District Show Presence of Cassiterite Near Contacts—Deposits, Still in Prospective Stage, Are of Low Grade and Would Require Large-Scale Operations To Be Profitable

BY FREDERICK C. FEARING
Written for *Engineering and Mining Journal*

AMONG the raw materials sorely needed during the critical days of the war, tin should be placed among the most important, but despite this fact it is doubtful if more than a handful of laymen realized prior to 1914 how much modern civilization owes to this metal, whose early technical history is lost in the mists of antiquity.

Before the war the United States consumed annually nearly half of the world's production without itself augmenting the supply by more than a few insignificant lots of medium-grade tin concentrates. Nowhere in this country are there producing tin mines of even passing consequence. It therefore soon became apparent to those in charge of war industries that every effort should be made to counteract this defect by finding and developing new deposits, if possible within the territorial boundaries of the United States.

Presence of Tin in Alaska Previously Known

The existence of tin outcrops in Seward Peninsula, northwestern Alaska, had been a matter of record with the U. S. Geological Survey since 1900, and by the time of this country's entry into the European conflict a point had been reached in the development of some of these prospects which made examination and study of marked importance and advantage. Accordingly, through the efforts of James F. Halpin, of Nome, Alaska, an extensive expedition was organized by private capital to examine and report upon the possibilities of the situation.

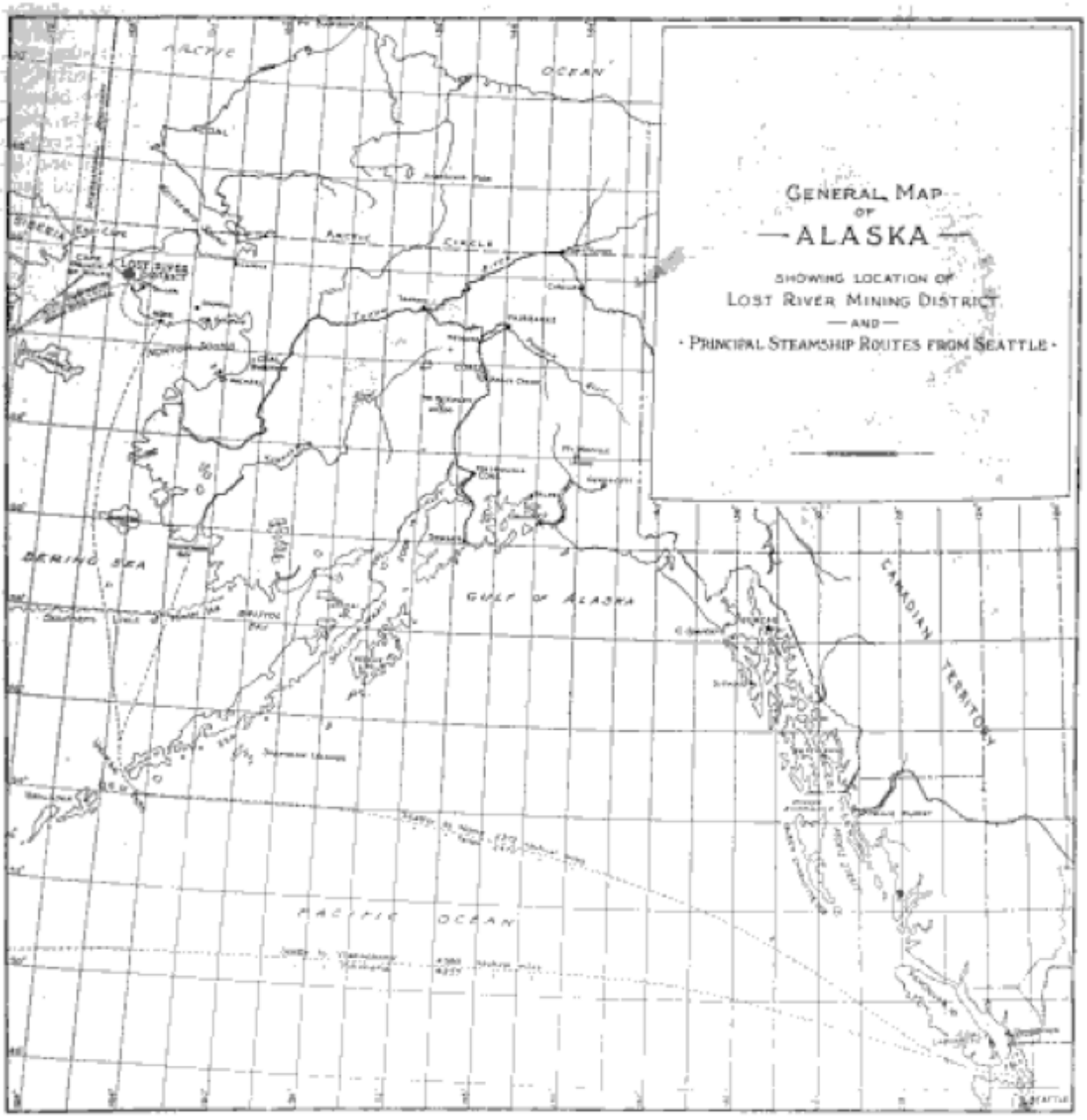
The tin areas which are the subject of this paper are located in the heart of the York Mountain district, Seward Peninsula, Alaska, about seven miles inland

from Bering Sea, on Cassiterite Creek, a tributary of Lost River. The location of the district and the available steamship route are shown on the accompanying map of Alaska.

History of Claims in Lost River District

Soon after the discovery of tin in the York region, three prospectors, Leslie L. Crim, Charles Randt, and William O'Brien—with a horse, worked their way through the defile just above the mouth of Lost River and finally staked a group of claims. They found themselves in a country entirely devoid of timber and capable of supporting only a few sporadic patches of rank Arctic grasses and reindeer moss in some portions of the valleys. Sharp, frost-cracked rubble covers the slopes of the mountains, which look as though some giant crusher had been at work throughout the region. Arctic hurricanes of breathless suddenness, long duration, and extreme violence, with wind velocities as high as 120 miles an hour, frequently sweep down from the North. During the summer months, when the slope detritus has thawed out, wind erosion can be observed hard at work moving tons of debris from the heights down into the valleys. Except when frozen, many portions of the hillsides are continually on the move.

Nevertheless, the district is a decidedly healthful one, with excellent water and good drainage. Often, in June, July, and early August, come wonderful days, when the sun eats up the last remaining snowdrifts, and the streams are flooded and the deep violet tones characterizing the Arctic landscape make one forget that the distant hills are not forest-clad. There are still other compensations, for even the athletic Alaskan


GENERAL MAP
OF
ALASKA
SHOWING LOCATION OF
LOST RIVER MINING DISTRICT
AND
PRINCIPAL STEAMSHIP ROUTES FROM SEATTLE
ARCTIC OCEAN
BERING SEA
GULF OF ALASKA
CANADIAN TERRITORY
PACIFIC OCEAN
ARCTIC CIRCLE
LOST RIVER DISTRICT
SEATTLE

mosquito finds the Lost River "chow" exceedingly scarce, and in consequence makes himself conspicuous by his comparative absence.

A small cabin, shown in one of the photographs, was erected by the three prospectors from driftwood packed in from the Bering Sea beach, and mine timbers were similarly obtained. Powder, fuse, caps and supplies were brought from Nome, and development work was started by means of adits and carried on under the most difficult conditions of hardship and financial strain.

One day in 1908, in the dead of winter and while an Arctic blizzard was raging, O'Brien went up the side of Cassiterite Mountain to No. 1 adit, leaving Randt in the cabin and Crim at work on the greenstone. While O'Brien was kneeling over the thawing kettle, eleven sticks of 40 per cent gelatine exploded. It blew out one eye and temporarily blinded the other; it tore the flesh from the thigh to ankle; it crippled one hand. Why it did not kill him Heaven only knows. In this condition he managed to grope his way back down the mountain through the storm, and was finally found by his partners and taken to the cabin. Then followed a 120-mile journey to Nome strapped to a dog sled, and months in the hospital there, with more months recovering later in Seattle; but O'Brien finally returned to the mines

to begin again. Crim died, Randt died, and their heirs began a legal battle for control of the property. The old horse which had accompanied the original prospecting party was finally pensioned off. Without adequate financial backing, but with grit enough to spare, O'Brien fought it out alone. By the time of our visit nearly 2,000 ft. of underground work had been accomplished entirely by hand, in spite of all obstacles covering a period of 18 years, and O'Brien was still on the job.

still the hopeful, determined, dignified, and honorable gentleman that the mining engineer not infrequently meets on the frontiers of civilization and remembers always with pleasure and respect.

GEOLOGICAL FORMATIONS IN THE LOST RIVER DISTRICT

The sedimentary rocks of the district consist primarily of the Port Clarence limestones, of Ordovician Age, whose thickness has been estimated by Knopf[1] at 2,000 ft. That this figure should not be increased is probably wise, for the reason that greater estimates have been found subsequently to have been based on traverses wherein considerable faulting was overlooked. The Port Clarence limestones rest comformably upon a series of older slates, into which argillaceous, banded horizons comprising the more basal limestones, appear to grade. These slates, however, have not yet been encountered in any development work at Lost River,

HEADQUARTERS, ON CASSITERITE CREEK. CABIN OCCUPIED BY THE THREE PROSPECTORS FOR MANY YEARS, SHOWN AT RIGHT

and no outcrops of them are known to exist in the immediate vicinity.

Igneous rocks have invaded these sediments at many points, of which the most important are a series of quartz-porphyry dikes, striking generally east and west and having steep dips. A few of these carry tin, but the majority are entirely barren. They are persistent, however, and vary in width from a few feet up to thirty feet. Some of them have been found to intersect, and hence they cannot all be considered as of strictly contemporaneous origin. One of these dikes, named the Cassiterite Lode, has cut through an older feldspar-porphyry along a portion of its course.

Throughout the world, tin ores are closely associated with granitic rocks, and the top of such a formation, laid bare by erosion, is found southeast of the mine cabin. Here, tin occurs in veins in the limestone, near the contacts, but in small amounts only. As the area of contact metamorphism is not great, and as this

[1]U. S. Geological Survey Bull. No. 358, p. 12.

granite[1] itself contains 0.3 per cent of tin and, further, as the intrusive is cut by a later quartz-porphyry dike showing considerable marginal chilling and devoid of mineralization, it is thought probable that this particular granite body is of small size; that it was subjected to rapid cooling through contact with the invaded limestones, and that consequently all but a small amount of its dissolved tin content was "frozen" in the original magma without having had a chance to separate from it and form orebodies.

trusive rock, from which some tungsten-bearing veins reach out into the limestones, has re-cemented the breccia of a fault outcropping along the bed of Cassiterite Creek. Again, a quartz-muscovite dike has occupied a reverse fault. One slip, of normal type, which is probably of small displacement, has cut off the mineralized intrusive rock exposed in the greenstone workings, and is the only one observed. It is thought that the larger slips, which might otherwise have caused dislocation and high development costs, being older than the tin mineralization, should not be expected to have an adverse effect upon the economical extraction of the ores.

The probable order in which the igneous rocks were intruded in this region were: First, the granites, or perhaps the feldspar-porphyries, and finally, the basalts.

Though reverse faulting of some magnitude characterizes the district, none of it has been observed as having offset any tin-bearing occurrences. In one instance, a tin vein cuts directly across a well-defined fault plane without showing displacement. Similarly, an in-

Variety of Minerals Abundant

The locality exhibits a surprising number of minerals. Fifty-two varieties, of which sixteen had not been found previously in Alaska, were reported by Knopf in 1908, and two of these were then new to science. All but a

[5]U. S. Geological Survey Bull. No. 339, p. 32.

few on the list have already been identified within the Lost River area. Such a variety as this not uncommonly accompanies tin deposits. In the area under discussion the ore-forming solutions were unusually rich in fluorine, chlorine, boron, lithium and potassium, arsenic, sulphur, aluminum, iron, manganese, silicon, calcium, tin, and tungsten, and carried also small amounts of copper, lead, zinc and, in one case, a considerable amount of silver.

These elements gave rise to abundant topaz, fluorite, tourmaline, sericite, albite, cassiterite, and wolframite, which are representative of intense hydrothermal and pneumatolitic genesis. Many of the crystals, especially the quartz, contain liquid and gaseous inclusions. Fluorite and tourmaline are usually intimately interwoven, and sericite mica is prominently developed in close association with both topaz and fluorite.

Thin sections from the more highly mineralized areas invariably show that the original constituents have been completely destroyed, leaving but the faintest pseudomorphic outline, and that this took place before the advent of the tin mineralizer epoch. Other evidence of more than one stage of mineralization was obtained from the veinlets cutting the limestones. Many of these are of contact metamorphic origin, containing principally fluorite and topaz, with no tin, and some were noted to have been cut by a later veinlet rich in tin and carrying also some tungsten. In this further connection the Geological Survey has noted similar contact phenomena elsewhere in the Seward Peninsula tin region—at Ear Mountain—where contact limestones exhibit large quantities of fluorine, chlorine and boron minerals, originally unaccompanied by tin, the metal coming in at a later date.