

TIN RESOURCES OF ALASKA.

By FRANK L. HESS.

The peculiar deficiency of the United States in tin deposits and the great quantity of tin used in the country, amounting to between 40 and 50 per cent of the world's production, make the possible domestic sources of supply a subject of perennial interest.

Tin was first discovered in Alaska on Buhner Creek, near York, on Seward Peninsula, in 1900. It occurred here as stream tin, or rolled pebbles of cassiterite, and was found in sluicing for gold. The next year stream tin was found on Buck Creek, which is separated from Buhner Creek by a low divide.

In 1903 cassiterite (tin oxide) was found in place in granite porphyry dikes cutting limestones on Cassiterite Creek, a tributary of Lost River, about 100 miles northwest of Nome. Later, stream tin was found in small quantity in the gold placers on Gold Bottom Creek, 20 miles north of Nome; at Ear Mountain, in the northern part of Seward Peninsula; with rutile in the gold placers of Cleary, Fairbanks, and other creeks near Fairbanks; with wolframite in the placers of Deadwood Creek, near Circle; and in the placers on Sullivan Creek, near Hot Springs, on the lower Tanana River.

About the time that tin was discovered on Lost River, float ore was found on Cape Mountain, near Cape Prince of Wales, and later was found in place. Constant prospecting effected the discovery of tin in place at the head of Buck Creek; in small quantity on Ear Mountain; and in 1907 Adolph Knopf,¹ of the United States Geological Survey, discovered on Brooks Mountain, near the head of Lost River, two new tin-boron minerals which he named paigeite and hulsite. Paigeite occurs also on Ear Mountain.²

Of the placers, none have shown importance except those of Buck Creek, and, in a much less degree, those of Sullivan Creek. From the tin in place the Bartels Tin Mining Co. produced 10 tons of concentrates in 1906 after expending a disproportionately large amount of money, and on Lost River a fair quantity of tin ore is reported to have been exposed.

¹ Knopf, Adolph, *Geology of the Seward Peninsula tin deposits, Alaska*: Bull. U. S. Geol. Survey No. 358, 1908, p. 23.

² *Op. cit.*, p. 32.

Buck Creek, on which are the best tin placers now known in Alaska, is about 4 miles long and is about 16 miles north of York and a little greater distance northeast of Cape Prince of Wales. The creek flows southeastward throughout most of its course. The country rock is a dark sedimentary rock ordinarily called slate, though scarcely as highly altered as the term would imply, and in places contains beds which are rather coarsely sandy. The slate is cut by a few quartz porphyry and greenstone dikes. Into these rocks Buck Creek has cut a comparatively broad valley, which has a long tundra-covered slope on its southwest side. On its northeast side the ground is steep and the creek flows close against the hills along much of its course.

The gravel is probably nowhere over 9 feet deep, and extends under the tundra for some distance from the creek. It is all small as compared with that of many placer fields. Very few pebbles are over 4 or 5 inches in diameter, and most of them are much smaller. Here and there is a boulder of greenstone a foot or more in diameter, but such boulders probably form less than one twenty-fifth of 1 per cent of the whole number.

In the creek bed the content of stream tin carrying in the neighborhood of 65 per cent metallic tin has been found to be as high as 400 pounds per cubic yard in rich spots, though the average is much lower. The writer saw one trench dug which gave 28 pounds per cubic yard, and Mr. F. P. Kendall, who was at one time in charge of operations on the creek, stated that a season's work gave about the same figure. One large pit gave 25 pounds per yard. In figures furnished the United States Geological Survey the gold in the gravels has been estimated at 40 cents per cubic yard, at \$60 per ton of stream tin, and at other amounts. Nuggets of gold in value up to \$20 have been found. When compared with the Australian and Malayan gravels, where the "black tin" content is in many places from 1½ pounds to 5 pounds per cubic yard, with perhaps a heavy overburden not only of soil but, as in Tasmania, of basalt, the gravels of Buck Creek appear very rich, but the climate makes the conditions hard for placer working. The season is short, little or nothing can be done before June 15, and the freeze-up is apt to come by September 15, although the season may open early enough and close late enough to allow between four and five months' work. There are many storms, with cold, heavy rains, but, on the other hand, the country is very healthful.

From the time of their discovery until 1911 the gravels were worked first by hand or horse scrapers, then by steam drag shovels, and again by hand until 1911, when a small dredge was put in by the York Dredging Co. The conditions are wholly against hydraulicking, and dredging seems to be the best means of working the gravels.

The dredge, which was specially built for shallow digging, has buckets holding $2\frac{1}{2}$ cubic feet; has gasoline engines for power, and digs from 950 to 1,000 cubic yards each 24 hours. It is equipped with two sluice boxes, so that one can be operated while the other is being cleaned up. The dredge was started on September 10 and, as the season was unusually open, ran until October 15. The ground dug is said to have been partly worked before, and the present yield was between 6 and 7 pounds of stream tin per cubic yard. The total output was 92 tons of stream tin averaging 66 per cent tin, or an equivalent of 101 tons carrying 60 per cent tin, and sold for \$52,000.

This brings the total production of tin from Buck Creek up to about 320 or 325 short tons of stream tin on a basis of 60 per cent tin.

During the short run of the dredge a strip 115 by 950 feet was cut out, and it is estimated¹ that there is $3\frac{1}{2}$ miles of such channel. It is also estimated that about three times as much work can be done (100 days' run) in future seasons. Should these figures prove good, and they seem reasonable from the observations of the Survey's representatives, the dredge should have profitable work for a number of years. There is also tin-bearing ground below the point where the dredge started and probably some under the tundra that can not be worked with the dredge.

Placer tin has been reported from a number of the small creeks running into the Arctic Ocean from the hills on the northeast side of Buck Creek and from the creeks draining the west side of Potato Mountain, at the head of Buck Creek, but so far no great quantity has been shown to exist.

From present showings, no production is to be expected from the veins around Buck Creek.

On Cape Mountain, behind Tin City, a granite boss intrudes limestones, and cassiterite is found in quartz veins; in veins in granite, accompanied by tourmaline and arsenopyrite; and in narrow veins, almost or wholly cassiterite, cutting the limestones. The quantity of tin present has been greatly overestimated by some of the persons mining, and there is no immediate prospect of great production. In 1906 the Bartels Tin Mining Co. milled 10 tons of concentrates, the only production up to this time.

On Lost River tin occurs in veins accompanying intrusions of granite porphyry and impregnates the porphyry itself. There is much variation in the veins. Some cut limestones and show nothing but cassiterite and quartz; others carry cassiterite, fluorite, and quartz; fluorite and molybdenite; cassiterite, muscovite, and fluorite; stannite, wolframite, topaz, and quartz; cassiterite, tourmaline, danburite, and calcite; and there are also other combinations.

¹ Eddy, Lewis H., Dredging for placer tin in Alaska: Eng. and Min. Jour., New York, vol. 92, Dec. 23, 1911, p. 1227.

Options for the sale of the property have been given several times, and much work and money have been expended upon it. It is now said to show several thousand tons of ore that will pay to work. There has been no production except a few hundred pounds of tin from unimportant placers formed by the breaking down of the veins.

On Brooks Mountain, at the head of Lost River, hulsite and paigeite are found in limestone metamorphosed by granite intrusions. They are iron-tin borates, containing 15 to 20 per cent of tin. Some prospecting has been done upon the deposit, but the minerals themselves are low in tin, and only a small quantity has been found, so that the deposit does not seem likely to prove of value as a producer of metallic tin. Even were the minerals in large quantity, it is probable that the metallurgical treatment of an iron-tin mineral would prove very difficult.

The only other deposit which promises to be productive is that found in connection with the gold placers on Sullivan Creek, Tofty Gulch, and Cache Creek, in the Hot Springs district of the lower Tanana. The pebbles are very smooth and show the effects of a great amount of water wear. The alluvium is widely and deeply spread over the rocks, and their source has not yet been found.¹

The occurrence is of great interest mineralogically. The pebbles show that the cassiterite has been deposited in cracks in a quartz vein. The cassiterite has also replaced fragments of some rock of which nothing is now left but a cloudy material resembling clay, suspended in the cassiterite. The cassiterite is very fine grained, appearing so even under the microscope. In this respect it is totally different from any other American tin ore and resembles some of the ore from the Itos mine, near Oruro, Bolivia. Green and brown tourmaline, topaz(?), in exceedingly fine needles piercing the grains of cassiterite and later quartz accompanying it, and fluorite are associated with the cassiterite.

Most of the stream tin has been thrown away, but 1,200 pounds, carrying 55 per cent tin, was shipped at the end of 1911 by Joseph Eglar, and is said to have netted \$209. It seems probable that a small production may be made from the deposits.

¹ See article by H. M. Eakin, in this bulletin.