

PRELIMINARY REPORT ON THE TOLOVANA DISTRICT.

By ALFRED H. BROOKS.

INTRODUCTION.

The Tolovana district¹ lies in the headwater region of Tolovana River, which flows southward into the Tanana, and in the upper basin of Hess Creek, which flows westward into the Yukon. (See map, Pl. IX.) In this region, notably within the Tolovana basin, gold placers have been found and are being developed. Production has thus far been confined chiefly to the placers of Livengood Creek, but some gold has been found on other tributaries of the Tolovana, as well as in adjacent creeks which flow into Hess Creek. Placer gold was found in the Hess Creek basin as early as 1892 by Mike Hess, after whom the creek was named, and this may have been near the scene of the recent discovery. The present importance of the region is due, however, to the discovery of placers on Livengood Creek by Jay Livengood and N. R. Hudson on July 24, 1914. Much excitement was aroused at Fairbanks and other Yukon camps by their discovery, and during 1914 and 1915 hundreds of people went to the district.

Systematic mining began in the summer of 1915. While there was a large amount of prospecting, only about 10 mines were commercially productive, but these made a gold output to the value of \$80,000. Considering the isolation of this new camp and the fact that much of the placer ground is deep, requiring boilers and hoists for proper development, the results of the first season's work are very encouraging.

The entire area within which gold placers and prospects are known was mapped topographically by Witherspoon and Oliver² in 1907 and 1908, and the geology of a part of the region has been studied by Prindle, Hess, and Katz,³ but these investigations did not

¹ Descriptions of boundaries of Tolovana recording precinct are not available at this writing.

² Witherspoon, D. C., and Oliver, R. B., Reconnaissance map of Fairbanks quadrangle: U. S. Geol. Survey Alaska map No. 642. Price, 50 cents.

³ Prindle, L. M., The Fairbanks and Rampart quadrangles, Alaska, with a section on the Rampart placers, by F. L. Hess: U. S. Geol. Survey Bull. 337, 1908.

Prindle, L. M., and Katz, F. J., A geologic reconnaissance of the Fairbanks quadrangle, Alaska: U. S. Geol. Survey Bull. 525, 1913.

cover the scene of the actual mining on Livengood Creek and its tributaries. A large amount of information is, however, available from the operators and prospectors, and it was the writer's good fortune to meet a number of these men. Therefore, while the following statements are not based on the actual observation of the geologists, they are believed to be accurate. The writer was the better able to interpret these statements because of his personal familiarity with the region lying immediately to the south of the scene of the discovery.¹

The information contained in the reports above referred to has been supplemented by more detailed notes furnished by Jay Livengood, N. R. Hudson, Harry Patterson, W. Allmark, J. P. Norich, Allister McMillan, Falcon Joslin, C. W. Joynt, and C. P. Keen.

TOPOGRAPHY.

The Tolovana district belongs topographically to the Yukon-Tanana upland, having the characteristic flat-topped ridges and interstream areas of that province. The general summit level stands at about 2,000 feet, and many flat-topped spurs, some of lesser altitude, radiate from the summits. Several rounded domes and ridges stand above the general summit level, with elevations of 2,100 to 2,600 feet. Of similar character, but of far greater relief, are the White Mountains, which lie about 20 miles east of the center of the district. This range, one of the most rugged features of the whole Yukon-Tanana region, being from 3,000 to nearly 5,000 feet in altitude, has a sharp crest line trending N. 20° E. In the Tolovana district proper there are no definite trends to the ridges, for these are irregular interstream areas blocked out by a complex drainage system.

The streams draining the area form an intricate system. The master streams, such as the Tolovana, occupy broad alluvium-filled valleys through which they flow in tortuous courses. The lower reaches of the Tolovana meander through a lowland which near the mouth of the river is over 25 miles in width, but which gradually narrows upstream, so that at the mouth of Livengood Creek the valley floor is less than 4 miles wide, and farther up it becomes still narrower. The tributary valley slopes rise gently from the Tolovana floor to the upland surface above. They are broken here and there by terraces, in part well defined, in part masked by talus.

Hess Creek, the second important watercourse of the region, flows in a westerly course to the Yukon through a valley whose floor is some 5 miles in width. It receives numerous tributaries that also

¹ Brooks, A. H., The Mount McKinley region, Alaska: U. S. Geol. Survey Prof. Paper 70. 1911.

have broad valley floors. Prindle has mapped terraces along the slopes of Hess Creek and its tributaries, and others are reported by prospectors as occurring in the unmapped areas.

The upper basin of the South Fork of Hess Creek, called Goldstream by the miners (Pl. IX), lies directly east of the headwaters of Livengood Creek, and is a wide, flat-bottomed valley through which the stream meanders. Its valley slopes are gentle, but are said to be broken by benches. This part of the valley of Goldstream is a mile or more in width. About 2 miles above the mouth of Willow Creek the valley floor narrows to 600 or 800 feet, the walls are steep and lack benches, and the stream maintains a rather straight course. At the mouth of Willow Creek the valley widens again into a broad basin and the stream again takes a tortuous course. Here the valley slopes are broken by broad gravel benches. There is a very low, apparently gravel-filled divide, between the head of Pedro Creek, tributary to South Fork below Willow Creek, and the head of the west fork of Myrtle Creek, tributary to Livengood Creek. In fact, these streams head in the same flat with Excelsior and Lost creeks. Livengood Creek heads in a low, gravel-filled divide which separates it from Goldstream. Its valley, like many of the other stream valleys of this region, is unsymmetrical in cross section, having a gentle talus-covered slope on the northwest and an abrupt slope on the southeast. Below Myrtle Creek, a northerly tributary, the valley broadens. From this point to its junction with Tolovana River the stream meanders over a flat valley floor 2 miles or more in width.

There is a very low divide between the head of Pedro Creek, which flows into the South Fork of Hess Creek, and the head of the West Fork of Myrtle Creek. The facts in hand indicate that there have been extensive changes of drainage in this region. Alabam Creek may have been the former head of Livengood Creek, and a single creek may have occupied the valleys of what are now Myrtle and Pedro creeks. It appears probable that the Lost Creek basin formerly drained northeastward to the South Fork of Hess Creek. Whether the South Fork was then tributary to Hess Creek or found a more direct route northeastward to the Yukon Flats it is not possible to determine from the facts now known, but the latter interpretation of the old drainage lines seems the most likely. An alternate hypothesis is that at this time the West Fork of the Tolovana found an outlet through the Livengood Valley, across the low divide at its head, and into Goldstream. It is also suggested that a former watercourse connected the upper Tolovana and the Beaver Creek valley and probably discharged into the Tolovana Flats. This former drainage system, however, has not yet been sufficiently investigated to permit a definite statement. The direction of even the

master streams of the old drainage system is indeed by no means certain. If such differences of drainage were in existence at the times of the deposition of the deep placers, as they may have been, the former courses of the waterways become a matter of economic importance.

GEOLOGY.

Bedrock.—The oldest rocks of the Yukon-Tanana region are those of the Birch Creek schist, which occupies extensive areas in the Fairbanks, Birch Creek, and other placer districts. This formation is not represented in the Tolovana district. The Birch Creek schist is overlain by a great thickness of sediments, including feldspathic sandstones, conglomerates, and graywackes, with slates and some limestones and cherts. Interbedded with these sediments are some ancient lavas and deposits of volcanic ash which have been more or less altered and can now be collectively termed greenstones. This whole series, which on detailed surveys will undoubtedly be separated into several formations, has been placed together under the name Tatalina group and provisionally assigned to the Ordovician period. In the White Mountains there is a great series of heavy limestones that, so far as known, succeed the Tatalina group and range in age from Ordovician to Silurian. Some of these rocks are very siliceous, and they are in part highly crystalline. These limestones are believed to be separated by an unconformity from the older Tatalina group. They are in turn succeeded by a series of red, green, and black slates, sandstone, and conglomerates called by Prindle the Tonzona group. Middle Devonian blue limestones, with some slate, make up the next higher series, and these are succeeded by greenstones with some interbedded cherts and limestones, which are provisionally assigned to the Devonian. These rocks are overlain by Carboniferous gray and black shales and siliceous slates with some cherts. The whole Paleozoic sequence is cut by granitic and related igneous rocks, probably of Mesozoic age.

The formations of the Tolovana district are believed to belong to the several series above named. It appears that the bedrock of the gold-bearing area consists chiefly of cherty crystalline limestone and black and red slates, with some chert beds. The greenstone is reported to be in part altered to serpentine. Quartz veins occur in the greenstones and are believed by many to be the source of the gold. Dikes of granitic rocks are common in the sediments, and there are some large stocks, as in the dome at the head of Amy Creek. The formations south of the Tolovana, including the Wilbur Creek basin, are said to consist of black shales, sandstone, and limestone.

The limestone disintegrates after being mined. It appears that the gold-bearing gravels are largely greenstone and chert, as well as

quartz. The cherts are reported to be black and reddish. These rocks appear to have puzzled some of the miners, who have misnamed them "argillites."

Alluvium.—The information at hand indicates that the alluvial deposits of the district belong to four different classes—deep gravels, bench gravels, creek gravels, and talus or slide material. The deep gravels are usually covered by a considerable thickness of muck or talus. Some layers of clay have been found with the deep gravels. The alluvium will be discussed in greater detail under the description of the placers.

GOLD PLACERS.

Auriferous gravels are widely distributed in the Tolovana district. The area in which gold prospects have thus far been found is about 10 miles square and includes Livengood Creek and its tributaries, some streams flowing into the Tolovana above the mouth of Livengood Creek, and the upper basin of the South Fork of Hess Creek.

The auriferous gravels occur in the beds of the present streams, in buried channels, and in bench gravels. Up to the present time most of the gold has been won from the deep channels of Livengood Creek, which have proved to be far richer than either the stream or the bench placers. Some shallow placers have also yielded gold, notably on Olive Creek, but only prospects have been found in the benches.

The only deep channel which has been opened is on Livengood Creek, where it lies underneath the talus slope on the north side of the valley. This channel is in general parallel to the axis of the valley. It appears to have been pretty definitely traced for at least 2 miles, and some evidence of it has been found along a distance of 4 miles or more. As in other districts claims are staked under two or more names. First there are the creek claims staked along the present watercourse. Parallel to them are the bench claims, which may be on the valley floor or on the talus slope. Where the valley is wide there may be one or two or even three or four tiers of bench claims. These so-called bench claims on Livengood Creek are not on stream terraces, as the name would imply, but on the talus slope of the valley, underneath which, it is suspected, lies a buried channel. The claims are numbered from Discovery claim up and down stream and are designated "No. 1 below," "No. 1 above," etc.

A shaft was sunk at "No. 9 below" to a depth of more than 200 feet without reaching bedrock. So far as known to the writer the farthest point downstream that gold has been found in the deep channel is at bench claim No. 4 below Discovery, where a shaft 125 feet deep was sunk to bedrock and was in gravel for the entire distance. At "No. 2 below" a shaft was sunk 230 feet, which did not reach

bedrock. This shaft also was chiefly in gravel but pierced three layers of sticky clay, or "gumbo," as the miners describe it. One of the layers was 17 feet, one 70 feet, and one 120 feet below the surface. Prospects of gold were found on these clay strata, the highest value being about 1 grain to the pan. At Discovery claim on Livengood Creek the valley is broken by a central ridge of hard rock which stands about 12 feet above the slope on the north and 40 feet above the present stream on the south. This ridge separates the deep channel from the present stream valley. It is traceable downstream for 1,000 to 1,500 feet and upstream for about 3,000 feet. At "No. 2 above" the ridge merges into the north slope of the valley, or, in other words, it is covered by talus above this point. Upstream from the upper end of this ridge the north slope of Livengood Creek is rather gentle, but there is some evidence near the creek that a rock scarp is buried under the talus. At Discovery claim Livengood Valley is about a mile wide. At "No. 5 above" it narrows to about half a mile, and farther upstream it broadens out again.

There has been much prospecting near Discovery claim, and holes have been sunk on the creek claims as well as on the first and second tiers of bench claims. It is said that by this work and by the discoveries in creek gravels some gold has been found over a width of 3,400 feet. At Discovery bench the deep channel is from 100 to 110 feet below the surface. Of this about 50 to 60 feet is silt or muck. The shafts sunk on the first and second tiers of bench claims near Discovery show the bedrock to be from 40 to 90 feet deep. Here the overburden consists of muck, which contains fragments of wood and some vertebrate remains. At "No. 5 above, fourth tier bench," there has been considerable mining. Here the ground is 90 feet deep. Productive mining has also been done on "No. 5 above, first tier"; on "No. 4 above, third tier"; on "No. 3 above, third tier"; and on "No. 19 above."

Halfway between Wonder and Franklin creeks a hole 78 feet deep was sunk to bedrock, and 300 feet away, higher on the slope, another shaft 28 feet to bedrock; still higher it is only 7 feet to bedrock. The deep hole contained no "slide" material; the shallow holes considerable. On "No. 19 above" on Livengood Creek some deep ground has been found, but the writer did not learn the depth to bedrock.

On the "fourth tier bench No. 5 above," the bedrock on the north is said to rise by a series of benches with 2 to 3 foot scarps. A shaft was sunk on the "third tier bench No. 3 above," where the alluvium is 40 to 50 feet deep. On the Red claim, a short distance above Wonder Creek, a hole has been sunk 60 feet to bedrock. This is the farthest up Livengood Creek that holes had been put down to bedrock in September, 1915.

Not enough work has been done on other tributaries of Tolovana River to indicate the presence of deep channels. On the South Fork of Hess Creek, however, two localities of deep ground have been found. Just across the divide from Livengood Creek, about half a mile below Alabam Creek, a hole has been sunk 100 feet to bedrock. This is on the upper part of South Fork of Hess Creek, here called Goldstream, on claim "No. 7 above." It is probable that 40 or 50 feet of this 100 feet was gravel. About $1\frac{1}{2}$ miles below this point three holes have been sunk. In one no gravel was found, only talus; in the other two about 25 feet of gravel with no gold. Below this locality the gravels do not seem to exceed 25 feet in depth except at the mouth of Pedro Creek, where the depth to bedrock is 90 feet. Of this, 80 feet is gravel, all carrying colors of gold, and the top 10 feet is muck. At this locality there seems to be no concentration of gold on bedrock. Above this deep ground is the narrow part of the valley, and here the alluvium is only 20 to 25 feet deep. A hole has been sunk on Alabam Creek, on No. 1 below Discovery, about 1 mile above the mouth, where it is 52 feet to bedrock. Half a mile above, on the slope, a hole was sunk 125 feet. It was said to be chiefly in gravel, but bedrock was not reached.

Information about the bench gravels is not very definite, except that they occur at several localities. Thick beds of gravel have been found on the east side of Hess Creek below Willow Creek, as high as 200 feet above the stream, and are said to carry gold. It is reported that there are at least four well-marked benches on the south side of Livengood Creek, but no gravels have yet been found on them.

The present stream gravels include those of the main stream and the tributary gulches. On Livengood Creek the creek gravels are separated from the deep gravels by the bedrock rim already described. At Discovery claim the creek gravels are 18 to 20 feet deep. The section includes 6 to 10 feet of green silt or clay and 10 to 12 feet of gravel. The gravels in the creek seem to be of the same character as those on the bench, but the gold is brighter. Many of the tributaries of Livengood Creek carry workable placers, and so do some of the streams flowing directly into the Tolovana from the divide between Livengood Creek and Tolovana River. In the opinion of the miners the streams flowing over the bench ground north of Livengood may have derived a part of their gold from deep placers. As a matter of fact, however, this can be true only where the workings have actually reached the depth of the old channel, in which case they are not properly creek placers, but deep placers.

The creek placers of Livengood Creek proper have been opened at Discovery claim, but have not been mined on a commercial scale. Their gold content seems to be too low to warrant exploitation under

the conditions existing in 1915. As a result the creek has been but little prospected. Several of the tributaries, however, have yielded workable placers in ground that was shallow enough to work by open cuts.

At "No. 4 above" the creek has been crosscut and the pay streak is reported to be 60 feet wide. Shallow placers have been mined on Lillian, Gertrude, and Franklin creeks, tributary to Livengood Creek.

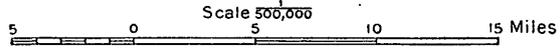
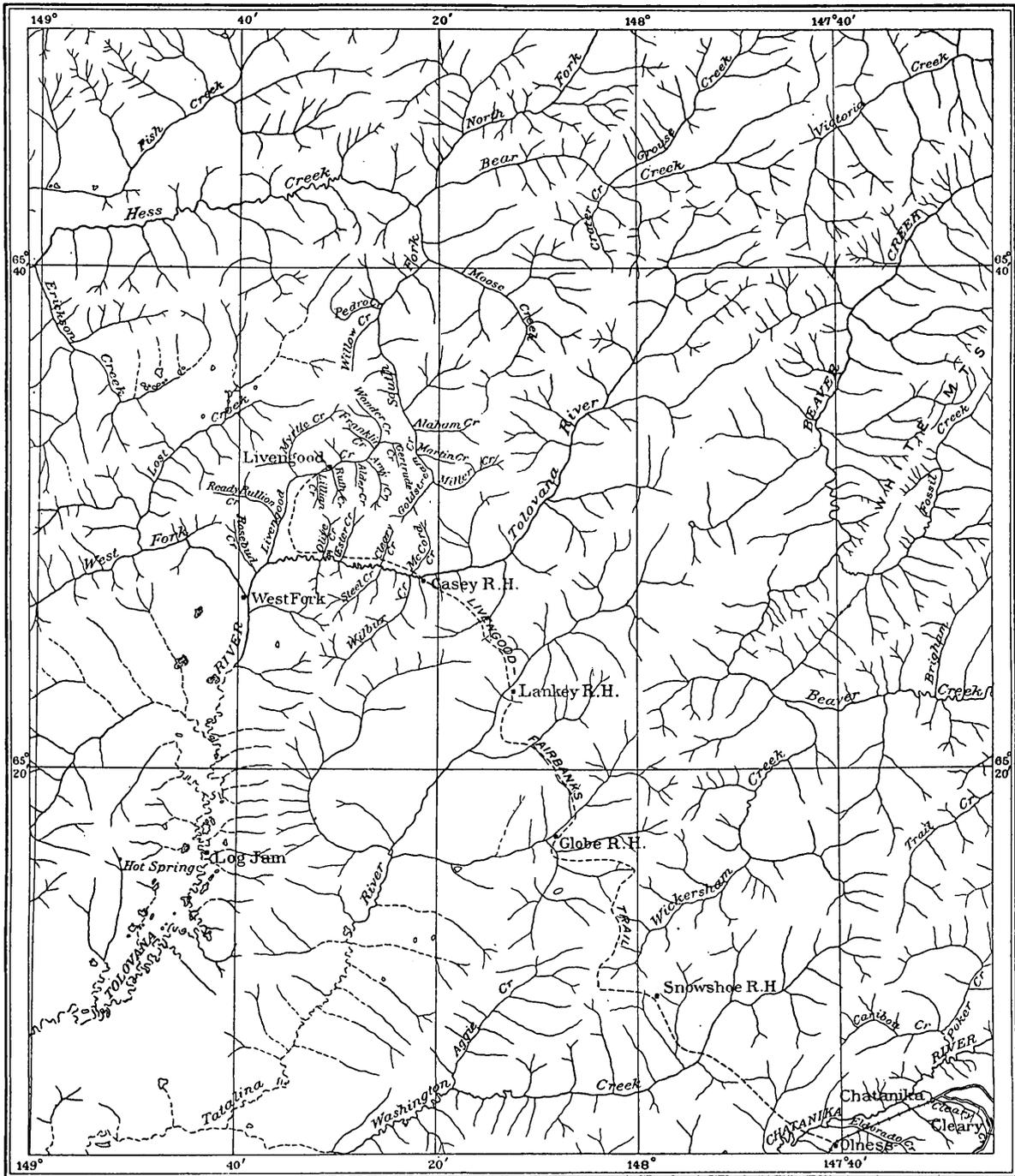
The gravels on the streams flowing directly into Tolovana River above Livengood Creek are shallow. In 1915 productive mining was done on Olive Creek, and prospects were found on Ester, Cleary, and Wilbur creeks.

Most of the data relating to the distribution of gold in the other creeks are contained in the account of the alluvial deposits already presented. Auriferous gravels seem to be widely distributed in the Hess Creek basin, but in 1915 no definitely workable placers had been located. Good prospects of fine gold are reported on Alabam Creek, and gold has been found in the bars of Hess Creek 40 miles below its forks. On "No. 7 above," on the South Fork of Hess Creek, "pay streak" gold with 7 to 8 cent nuggets is reported.

The gold of the deep channel on Livengood Creek is dark colored. Although nuggets worth as much as \$20 have been found, the average of the gold thus far mined is not coarse. It has the appearance of what the miners call "pay-streak" gold and includes both rounded and flat nuggets. The finer gold from this source is flat, but not flaky. Its fineness ranges from 0.907 to 0.914, and its value is therefore from \$18.75 to \$18.90 an ounce. The gold from the present stream channels is brighter colored and appears to be not so coarse. Nuggets worth \$4 and \$5 have been found. But little gold has been mined from the present creek channel, and therefore it is not possible to give the fineness, which appears to be less than that of the gold from deep placers.

COMMERCIAL CONDITIONS.

The town of Livengood, near Discovery claim on Livengood Creek, is the commercial center of the district. It has a post office, a wireless station, the recording office of the district, and a United States commissioner's office. A settlement at the mouth of the West Fork of Tolovana River contains two sawmills. The region is well timbered, but the water for sluicing is not abundant. Livengood Creek is said to carry three sluice heads of water. Plans have been made for bringing water in from adjacent drainage basins to mine the placers on Livengood Creek. Water is more abundant in the Hess Creek basin.



MAP OF THE TOLOVANA DISTRICT.

A winter sled and summer horse trail has been built from Olness, a station on the Tanana Valley Railroad, to Livengood, a distance of about 55 miles. Road houses have been built along this trail. Another route of approach is by launch or small steamer up Tolovana River, a deep, winding, sluggish stream. It is reported that small steamers can be taken within 10 or 15 miles of the new camp. Livengood is about 40 miles due east of the Yukon at the mouth of Hess Creek, which can be ascended in small boats to points within about 15 miles of the camp.

Though the district is not very difficult of access, it will be rather expensive to reach with heavy machinery. In the summer of 1915 the freight rate from Fairbanks to Livengood by launch up the Tolovana was about \$110 to \$140 a ton. It is probable that the winter freight rate by way of Olness will be lower.

SUMMARY.

The deep channel on Livengood Creek seems to constitute the most continuous placer deposit which has been developed in this district. It has by no means been traced continuously, but what seem to be parts of the same channel have been opened at several places for 3 to 4 miles. The richest gravels thus far developed lie in this deep channel and in the streams cutting across it. The present channel of Livengood Creek also carries placers which will be mined when the conditions become a little more settled. Outside of Livengood Creek and its tributaries there has been no productive mining except on Olive Creek, but prospects have been found on several other tributaries of the Tolovana. Interest of the prospectors is at present centered in what they call the "Promised Land," including the basin of upper Hess Creek. On the South Fork of Hess Creek some excellent prospects have been found but not much coarse gold. Only a few holes have been sunk to bedrock. It is fair to say that this region was practically unprospected in the fall of 1915, except for surface pannings. Prospects are also reported on Moose and Grouse creeks, which lie northeast of the Livengood region.

