Annual Report
OF THE
Mine Inspector
TO THE
Governor of Alaska

1922

BY
B. D. STEWART, Mine Inspector

ACCOMPANIED BY SPECIAL ARTICLES BY JOHN A. DAVIS, SUPERINTENDENT OF THE FAIRBANKS EXPERIMENT STATION AND NORMAN L. WIMMLER, PLACER MINING ENGINEER, U. S. BUREAU OF MINES.

PROPERTY OF
LIBRARY
STATE OF ALASKA
DIVISION OF
CONTENTS

Introduction .................................................................................................................. 7
General statement ......................................................................................................... 8
Metals ............................................................................................................................ 8
Coal .................................................................................................................................. 9
Petroleum ...................................................................................................................... 9
Review by minerals ...................................................................................................... 10
Copper ........................................................................................................................... 10
Gold ................................................................................................................................. 10
Lead gold ...................................................................................................................... 10
Placer gold .................................................................................................................... 11
Silver-lead .................................................................................................................... 11
Coal ................................................................................................................................ 12
Petroleum .................................................................................................................... 13
Transportation as affecting mining ............................................................................ 15
Prospecting and Mining within National Forest Areas ................................................ 16
Labor conditions .......................................................................................................... 16
Cost of a "Grubstake" ................................................................................................... 17
Assistance to the Alaska mining industry by the Department of the Interior .............. 18
Bureau of Mines organization ...................................................................................... 18
First aid and mine rescue service ................................................................................. 19
U. S. Geological Survey ............................................................................................... 20
Alaska Agricultural College and School of Mines ....................................................... 21
"Placer Mining in Alaska in 1922" by Norman L. Wimmler, Placer Mining Engineer, U. S. Bureau of Mines ................................................................. 22
Introduction .................................................................................................................. 22
Production ...................................................................................................................... 23
Placer mining operations in 1922 ................................................................................ 24
Table No. 1—Data on Gold Dredges in Alaska, 1922 .................................................... 24
Transportation ............................................................................................................... 25
Table No. 2—Alaska freight rates, 1922 ....................................................................... 25
Review of placer mining by districts .......................................................................... 31
Copper River region ................................................................................................... 31
Kenai Peninsula region ............................................................................................... 32
Girdwood district ....................................................................................................... 32
Sunrise district ............................................................................................................ 32
Hope district ............................................................................................................... 32
Susitna region ............................................................................................................. 33
Yentna district ............................................................................................................ 33
Valdez Creek district ................................................................................................ 34
Chulitna district .......................................................................................................... 35
Talachulitna district .................................................................................................. 35
Kantishna district ...................................................................................................... 35
Bonnifield district ..................................................................................................... 35
Fairbanks district ...................................................................................................... 35
Circle district .............................................................................................................. 36
Tokcana district ......................................................................................................... 39
Hot Springs district ................................................................................................. 40
Rampart district ........................................................................................................ 43
Ruby district .............................................................................................................. 44
Icy Bay district ......................................................................................................... 46
Chandalar district ..................................................................................................... 46
Iditarod district ......................................................................................................... 47
Kuskokwim district .................................................................................................. 48
Indian district ............................................................................................................. 49
Merrill (Wade Hampton) district ............................................................................. 49
Seward Peninsula ...................................................................................................... 50
## CONTENTS—(Continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of lode mining by districts</td>
<td>121</td>
</tr>
<tr>
<td>Northeastern Alaska</td>
<td>122</td>
</tr>
<tr>
<td>Hyder district</td>
<td>123</td>
</tr>
<tr>
<td>Prince of Wales Island</td>
<td>124</td>
</tr>
<tr>
<td>Wrangell district</td>
<td>125</td>
</tr>
<tr>
<td>Chichagof Island</td>
<td>126</td>
</tr>
<tr>
<td>Yakobi island</td>
<td>127</td>
</tr>
<tr>
<td>Admiralty Island</td>
<td>128</td>
</tr>
<tr>
<td>Juneau district</td>
<td>129</td>
</tr>
<tr>
<td>Bowers bay</td>
<td>130</td>
</tr>
<tr>
<td>Gastineau Channel</td>
<td>131</td>
</tr>
<tr>
<td>Windham Bay</td>
<td>132</td>
</tr>
<tr>
<td>Swettish</td>
<td>133</td>
</tr>
<tr>
<td>Copper River Basin</td>
<td>134</td>
</tr>
<tr>
<td>Prince William Sound</td>
<td>135</td>
</tr>
<tr>
<td>Willow Creek district</td>
<td>136</td>
</tr>
<tr>
<td>Iditarod district</td>
<td>137</td>
</tr>
<tr>
<td>Ruby district</td>
<td>138</td>
</tr>
<tr>
<td>“Lode mining in the Fairbanks district,” by Jno. A. Davis, Superintendent, Fairbanks Experiment Station, U. S. Bureau of Mines</td>
<td>139</td>
</tr>
<tr>
<td>Introduction</td>
<td>140</td>
</tr>
<tr>
<td>Drainage and topography</td>
<td>141</td>
</tr>
<tr>
<td>General geology</td>
<td>142</td>
</tr>
<tr>
<td>Description of gold mines and prospects</td>
<td>143</td>
</tr>
<tr>
<td>Antimony mines</td>
<td>144</td>
</tr>
<tr>
<td>Tungsten mines</td>
<td>145</td>
</tr>
<tr>
<td>Future of gold lode mining</td>
<td>146</td>
</tr>
<tr>
<td>“The Kantishia Region,” by Jno. A. Davis, Superintendent, Fairbanks Experiment Station, U. S. Bureau of Mines</td>
<td>147</td>
</tr>
<tr>
<td>Introduction</td>
<td>148</td>
</tr>
<tr>
<td>Mining districts</td>
<td>149</td>
</tr>
<tr>
<td>The Kantishia district</td>
<td>150</td>
</tr>
<tr>
<td>Placer mining</td>
<td>151</td>
</tr>
<tr>
<td>Lode mining</td>
<td>152</td>
</tr>
<tr>
<td>map of Quigley Hill</td>
<td>153</td>
</tr>
<tr>
<td>Quigley Hill</td>
<td>154</td>
</tr>
<tr>
<td>Eldorado Creek</td>
<td>155</td>
</tr>
<tr>
<td>Glacier Creek</td>
<td>156</td>
</tr>
<tr>
<td>Glen Creek</td>
<td>157</td>
</tr>
<tr>
<td>Spruce Creek</td>
<td>158</td>
</tr>
<tr>
<td>Transportation</td>
<td>159</td>
</tr>
<tr>
<td>Copper Mountain district</td>
<td>160</td>
</tr>
<tr>
<td>Lode mining</td>
<td>161</td>
</tr>
<tr>
<td>Little Moose Creek</td>
<td>162</td>
</tr>
<tr>
<td>Review of coal mining by fields</td>
<td>163</td>
</tr>
<tr>
<td>Matanuska field</td>
<td>164</td>
</tr>
<tr>
<td>Nenana field</td>
<td>165</td>
</tr>
<tr>
<td>Broad Pass region</td>
<td>166</td>
</tr>
<tr>
<td>Cook Inlet field</td>
<td>167</td>
</tr>
<tr>
<td>Bering River field</td>
<td>168</td>
</tr>
<tr>
<td>Freight rates Alaska (Government Railway, 1922—table showing)</td>
<td>169</td>
</tr>
<tr>
<td>Mineral production</td>
<td>170</td>
</tr>
<tr>
<td>Accident tables</td>
<td>171</td>
</tr>
<tr>
<td>Causes of fatalities</td>
<td>172</td>
</tr>
<tr>
<td>List of all accidents reported from gold mines of Alaska for the year 1922, classified as to causes and results of accidents</td>
<td>173</td>
</tr>
<tr>
<td>List of all accidents reported from copper mines of Alaska for the year 1922, classified as to causes and results of accidents</td>
<td>174</td>
</tr>
<tr>
<td>List of all accidents reported from copper mills of Alaska for the year 1922, classified as to causes and results of accidents</td>
<td>175</td>
</tr>
<tr>
<td>List of the fatal accidents which occurred in 1922</td>
<td>176</td>
</tr>
</tbody>
</table>
LETTER OF TRANSMITTAL

Juneau, Alaska.
May 26, 1923.

Hon. Scott C. Bone,
Governor of Alaska.

Sir:

Herewith, in accordance with the provisions of Section 6, Chapter 51, Session Laws of Alaska for 1917, I have the honor to submit to you the annual report of the Mine Inspector covering the calendar year 1922.

Respectfully,

B. D. STEWART,
Mine Inspector.

ANNUAL REPORT
OF THE
MINE INSPECTOR
1922

INTRODUCTION

The following report contains a general review of mining conditions in Alaska in 1922 as well as detailed data as to individual operations in all branches of mining in nearly every district of the Territory.

Through cooperation with the Department of the Interior, Bureau of Mines, several papers prepared by members of the staff of the Bureau of Mines in Alaska are made a part of this report. These papers include articles on Lode Mining in the Fairbanks District, the Kantishna Region, and the Nenana Coal Field by Mr. John A. Davis, Superintendent of the Fairbanks Experiment Station, and one on Placer Mining in Alaska in 1922 by Mr. Norman L. Wimmer, Placer Mining Engineer.

Acknowledgment is also to be made of the fact that, since the resignation of the Territorial Mine Inspector in July, 1922, the duties of his office, including the collection and preparation of much of the information contained in this report, has been cared for by the Supervising Mining Engineer for the Bureau of Mines, through the courtesy of the Department of the Interior.

Field examinations of mining properties and prospects were not as extensive in 1922 as was desired owing to the time necessarily devoted to other duties. It is planned to make such examinations and the preparation of reports from them a major feature of the work performed under the cooperative arrangement between the Territory and the Department of the Interior provided for by recent legislation enacted by the Territorial Legislature. By this means it is hoped to gradually build up in this office a record, available to the public, covering the essential data regarding as many as possible of the mining properties and prospects of Alaska. It is believed such data, based upon field examinations made by the staff of the Bureau of Mines in Alaska—such examinations to include whenever possible the taking of samples, which will be assayed at the Fairbanks Station—may be of much benefit alike to prospectors and prospective investors in Alaskan mining properties.
GENERAL STATEMENT

The feeling in Alaska with regard to the present situation in the mining industry is one of optimism.

METALS

The year past was noteworthy for the extensive exploratory and preliminary development work undertaken and planned by large mining corporations in both lode and placer fields and in widely separated sections of the Territory.

The mineral production of the Territory was greater than in 1921 by about one and one-quarter million dollars.

Results of development work done on lode properties in many sections of Alaska during the past year have been very encouraging. Investors with financial strength have become interested in new properties in several regions, specifically the Hyder, Willow Creek and Kantishna districts. In several instances the properties acquired have had little or no preliminary underground work done upon them. Acquisition of the ground and a decision to carry out expensive programs of development have evidently been based largely upon reports of examining geologists as to surface showings and upon the favorable outlook for better transportation facilities.

That large mining corporations in the Territory are showing a willingness to assume the expense and risks of preliminary development upon unproved properties is proving a stimulus to renewed activity on the part of prospectors such as could be brought into being in no other way.

That the lode-gold production of the Territory has been maintained at a level but slightly below that of the previous year, in spite of the loss sustained by the closing of two of the largest low-grade gold mines in Southeastern Alaska, the Perseverance mine of the Alaska Gastineau Co. and the Ready Bullion mine of the Alaska United Co., is most encouraging. This favorable situation has been brought about by increased production from properties mining relatively high-grade ores, notably in the Willow Creek district, by the milling of the output previously mined at the Nixon Fork property of the Alaska Treadwell Co., in the Kuskokwim district, and by the largely increased operations at the Alaska Juneau low-grade mine on Gastineau Channel.

By the skillful application of sound economic principles to the handling and reduction of the very low grade ores of the property and by improved mining methods worked out during the past year, together with rigid but intelligent economies practiced throughout its operations the management of the Alaska Juneau enterprise has scored a notable success. The progress being made by the Alaska Juneau Company toward the solution of the problem of successfully mining and reducing gold ores with an assay value of but $1.00 per ton is an achievement of profound significance. The ultimate outcome of this enterprise, which has been developed in the face of what appeared to be insuperable obstacles, will go far toward determining the future of the entire low grade gold belt of Southeastern Alaska.

In the field of placer mining pronounced features of the past year's activities were the expansion of the application of dredging methods to the recovery of alluvial gold; the success attending dredging operations, notably in the Iiako-Kuskokwim region; and the extensive exploration work undertaken on Seward Peninsula and in the Fairbanks region, with the purpose in view of determining the susceptibility of large areas of placer ground to the application of dredging methods.

COAL

Production of coal in 1922 was 104 per cent in excess of that in 1921. Private operators mined 90.2 per cent of the total output of 54,402 short tons. The remaining 5.8 per cent was produced by government operation on reserved units. The most pronounced new development of coal properties took place on Healy River in the Nenana field and along Moose Creek in the Matanuska field. The building of a railway spur from Healy to the coal fields at Suntrana, though not completed until October, 1922, enabled the Healy River Coal Corporation to mine and ship approximately 18,000 tons of coal from their Suntrana mine before the close of the year.

Surface development accomplished during the year along Moose Creek in the Matanuska field has served to reveal the outcrops of several coal seams whose existence was hitherto suspected but undemonstrated. These outcrops bear such relationships to one another as indicate a continuity of the seams along their strike much more pronounced than is characteristic of those portions of the Matanuska field heretofore explored. Sufficient work has not been done to determine the number of seams in the series exposed, their widths or minability.

Near Mile 341 in the Broad Pass field a coal seam has been discovered, samples of which indicate that it is of bituminous grade. The seam, where exposed, is of mineable width and within a few hundred feet of the tracks of the Alaska Railway. Underground development work upon the bed has proceeded during the past winter.

PETROLEUM

Field examinations of the prospective oil fields of the Alaska Peninsula, conducted during several years past, were followed by the commencement of actual drilling operations near the close of the year 1922. Three drilling rigs were placed on Pearl Creek dome in the West field of the Cold Bay district during the year, following the building of a 17-mile road from Kanatak to the drilling sites and the establishment at the latter places of permanent camps. Further surveys and field examinations were made in several other oil fields, including the Chignik, Liska Bay, Katalla and Yakataga districts.

Production of oil was confined to the Katalla field.
COPPER

The value of the copper output of Alaska in 1922 exceeded that of gold by approximately $1,800,000.

The tonnage of copper ore mined in 1922 exceeded that mined in 1921 by 79,140 tons, or 21.9 percent. From the total of 381,290 tons mined, approximately 67,000,000 lbs. of copper were recovered, having a value of about $9,000,000.00. The corresponding value of the 1921 output is $7,354,000.

The production in 1922 was made by the same mines that operated in 1921, namely the Kennecott group of the Kennecott Copper Corporation, in the Nizina district of the Copper River region; the Beatson mine of the same company on Latouche Island, in Prince William Sound; and the Rush & Brown mine on Prince of Wales Island.

With the exception of the work done on the Green group of copper claims in the Nizina district during the past two years, development of new copper properties in Alaska has been practically nil since 1918. The reason for this is better prices and improved conditions prevailing in the copper market.

Lode-Gold

Outstanding features of the situation in the lode-gold mining industry in 1922 are the increase in tonnage of low grade ores produced at the Alaska Juneau mine; the increased output from and the commencement of deep exploration on the lodes of the Willow Creek district; and the development in the Iditarod section of a gold lode that is reported to be one of much promise.

A revival of interest in the possibility of further successful gold lode mining in the Fairbanks district under improved transportation conditions has become evident.

One new stamp mill was put in operation during the year on Chichagof Island in Southeastern Alaska, and two others are being assembled in preparation for operation during the coming year.

Prospecting work was fairly active during 1922, particularly in the Willow Creek district and elsewhere along the line of the Alaska Railroad.

Lode-gold prospecting on quite a large scale is reported to have taken place throughout the past winter in the latter district.

The production of gold from lodes in Alaska in 1922 is estimated to have a total value of $3,600,000. (a)

This amount is about $200,000 less than the value of the output for 1921.


Placer Gold

The special paper on Placer Mining in Alaska in 1922, prepared by Mr. Norman L. Wimmeler, Placer Mining Engineer, U. S. Bureau of Mines, which is included in this report, furnishes a detailed survey of conditions in the Alaskan placer mining industry.

The following general statement as to placer production in 1922 is given by the U. S. Geological Survey. (a)

"About 560 Alaska placer mines, employing 1,900 men, were operated during the summer of 1922, and about 100, employing 300 men, during the previous winter. These mines produced gold to the value of $4,100,000. In 1922 a much larger number of men—about 600—were employed than have been employed for several years in the past in installing large mining plants that are as yet unproductive. For this reason the estimated reduction of $125,000 in the value of placer gold output in 1922 as compared with 1921 is not significant. It is certain that when the plants now being installed are operated the output of placer gold will be increased; it will be larger in 1923 than it was in 1922. Now that the means of transportation are improving and it is becoming recognized that there are large areas of dredging ground in Alaska, this form of mining is being more widely extended. In the summer of 1922, after two years of systematic prospecting, two dredges, the largest in Alaska, were built at Nome, with 9-cubic foot buckets and 40 and 60-foot ladders. A strong company was also engaged in extensive prospecting of dredging ground in the Fairbanks district. During the summer a dredge was being taken to Gaines Creek, in the Innoko district, and another to Minook Creek, in the Kivalina district. The dredges operated in 1922, 24 dredges produced gold worth about $1,530,000; in 1921, 24 dredges produced gold worth $1,532,520. Of the 23 dredges operated in 1922, 15 were in Seward Peninsula; 2 each in the Iditarod and Fairbanks districts; one each in the Innoko, Mount McKinley (Upper Kuskokwim), and Yentna (Susitna) districts. The dredges in Seward Peninsula produced about $650,000 worth of gold in 1922."

SILVER-LEAD

Marked activity in the Hyder district and the acquisition by the Kennecott interests of large holdings in the newly discovered silver-lead area.

in the Copper Mountain section of the Kantishna region have attracted particular attention to the possibilities connected with silver-lead mining in the Territory.

An effort will be made during the coming season to prospect the silver-lead bearing area known to exist at the headwaters of the Unuk River bordering Southeastern Alaska. This area lies east of Ketchikan and is in the northward extension of the “eastern contact belt” within which the ore bodies of the Poribans Canal section occur.

While the mineralized area is in British Columbia, the only feasible route by which it may be reached is through the Unuk River Valley, which lies almost wholly in Alaska. The region is therefore directly tributary to Ketchikan.

A small silver-lead property situated in the Kaliyah Mountains southwest of Ruby made a small production during the year. This property is described elsewhere in this report.

A small shipment of high grade silver-lead ore was made by Mr. Hawley Sterling from the Red Top lode in the Kantishna district upon which he holds a lease. This ore was mined during the winter and transported to Nome by the Alaska Railway by dog team and was shipped from there to the smelter at Tacoma.

The existing freight rate from Nome to Tacoma on silver-lead ore having a value of $50 per ton or less is $12.25 per ton.

The total output of silver in Alaska in 1922 is estimated at 730,000 oz (a)

The total output of silver in Alaska in 1922 is estimated at 730,000 oz.

That for 1921 was 761,685 oz.

COAL

The production of coal in the Territory in 1922 amounted to 24,483 tons. This tonnage exceeds that of the previous year by 8,118 tons and is to that extent the largest output for any one year since coal mining began.

Private operators produced 90.2% of the total output in 1922 as compared with 89.8% in 1921.

An underground fire in the Evan Jones mine that occurred in November, 1922, compelled the Alaskan Engineering Commission to reopen the Eska mine in order to insure an adequate supply of coal to the railway during the winter. Otherwise the percentage of coal mined by private operators would have been even higher than above indicated.

The most important event of the year affecting coal mining was the completion in October of the railway spur from Healy, on the Alaska Railway, to the coal beds at Suntrana, in the valley of the Healy Fork of the Nenana River. The coal beds made available by cheap transportation by this 4-mile spur line are destined to play an important part in the economic development of the entire interior of Alaska. The coastal


PETROLEUM

The occurrence of petroleum seepages and the existence of other conditions indicating the presence of oil at many places along the southern coast of Alaska have been known for many years.

As early as 1882 petroleum was secured at Oil Bay on the west side of Cook Inlet from seepages that had been known to the Russians for many years prior to that time (a). The region indicated is now known as the Inniskin Bay field. Some drilling was done at Oil Bay in 1898 and at Dry Bay in 1902. Operations continued until 1904. Oil was struck and gas under pressure was encountered but drilling difficulties compelled the abandonment of the wells and work was not afterward continued.

In the Controller Bay field, now known as the Kaktovik field, drilling was commenced in 1901. Several additional wells were drilled during 1902 and by September, 1904, "fifteen wells had been drilled or were drilling in this region."

Although no drilling has been done in the Yakataga field, formerly referred to as the Yakatagu region, seepages were known and surface explorations had been made prior to 1903.

Though the existence of seepages in the vicinity of Cold Bay was known to the early Russian occupants of Alaska, the presence of petroleum was recorded in print in 1869, wells were first drilled in the Cold Bay district of the Alaska Peninsula in 1903. Three wells were sunk during that year, one of which reached a depth of 1500 feet. Writing in 1905, Martin says: (a)

“They are located about 5 miles from the landing on the west shore of Cold Bay, at an elevation of about 750 feet above tide, and are distant about 9 miles in an air line from Becharof Lake.”

They were thus in the east field and approximately 20 miles distant from the site of the present drilling operations in the Pearl Creek section of the west field.

With the exception of the productive operations in the Katala field, which still continue, no underground exploration for petroleum has been conducted in Alaska since the cessation of the activities above noted.

In 1910 all unpatented oil lands in Alaska were withdrawn from entry. They so remained until the passage by Congress of the oil leasing act of 1926. Since that time there has been great activity in staking oil claims and in field examination in all the petroleum fields of Alaska. This activity culminated in the commencement of drilling operations on the Pearl Creek dome in the west field of the Cold Bay district shortly after the close of the year 1922.

During the month of August, 1922, two drilling rigs of the cable type were shipped to the Cold Bay field by the Associated Oil Company and one by the Standard Oil Company of California. These shipments were discharged at Kanatok, a small Indian village at the head of Portage Bay. All the material had to be lightered from ship to shore and during the landing operations there were many days when no cargo could be discharged on account of rough weather prevailing. From 14 to 17 days were required to land these shipments on the beach.

From Kanatok to the drilling site at Pearl Creek dome, the distance is 17 miles. After landing the equipment at Kanatok the working crews had to construct the road over which to haul the freight. This road was completed during October and the erection of camps was begun at the drilling sites.

Motor tractors were used as means of locomotion in hauling the freight. Considerable difficulty was experienced in the freighting operations, due principally to the steep gradients on the road in reaching the first summit out of Kanatok and to stormy weather. All obstacles were successfully overcome, however; permanent camps were constructed, the rigs were erected and drilling operations are in progress at the present time.

LABOR CONDITIONS

Experienced metal miners have been difficult to secure during 1922. Other labor was obtainable without difficulty.

Wage scales have been changed but slightly during the year. Where changes have taken place the trend has been upward. In many cases, and important instances have reductions been made.

During 1922 the wage scale at the larger lode mines of the coastal region ranged as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Machine drillers</th>
<th>Road helpers</th>
<th>Blacksmith</th>
<th>Tramps</th>
<th>Cooks</th>
<th>Hostlers</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00 to 5:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>5:00 to 6:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>6:00 to 7:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>7:00 to 8:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>8:00 to 9:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>9:00 to 10:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>10:00 to 11:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>11:00 to 12:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>12:00 to 1:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>1:00 to 2:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>2:00 to 3:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>3:00 to 4:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
<tr>
<td>4:00 to 5:00</td>
<td>$4.00</td>
<td>$4.00</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$6.00</td>
<td></td>
</tr>
</tbody>
</table>

From the above wages deductions are made for board and room and for hospital fees and medical attendance. Deductions for board range from $1.00 to $1.50 per day, and for hospital and medical attendance from $1.50 to $2.00 per month.

Living costs in the coastal sections of Alaska are slightly higher than in the States of the Pacific Coast.

Wages and living conditions in interior Alaska are difficult to state in general terms owing to the wide fluctuation between localities. In the larger camps, such as Fairbanks and Iditarod, wages for placer miners are from $5 to $6 per day, in addition to which the operators furnish board. The item of board is estimated at from $2 to $3 per day. In more remote regions wages of from $7 to $10 per day and board are received.

The total wages distributed in the Alaska mining industry during 1922 are estimated to amount to approximately $4,740,000.00. The payrolls included in this total are distributed as follows:

Placer mines (estimated on the basis of 2,000 men, employed for an average of 150 days) $1,650,000.00
Gold-lead mines and mills 1,300,000.00
Copper mines and mills 1,281,000.00
Non-metal mines and quarries 128,000.00
Coal mines (estimated from number shifts worked) 400,000.00

TOTAL $4,740,000.00

There were about 4,000 men employed in all branches of the Alaskan mining industry during 1922, which is the same as the estimate for 1921. That this number has been maintained indicates that the general increase in the number of men employed throughout the Territory during the year was sufficient to offset the loss occasioned by the closing of the large low-grade gold mine of the Alaska Gastineau Mining Company in Southeastern Alaska, where an average of 450 men were employed.

Details as to the number of men employed and shifts worked in the various branches of lode mining will be found appended to the accident tables herein.

COST OF A "GRUBSTAKE"

Retail price-list of groceries, in amounts estimated to be such as would constitute a season's "grubstake" for a prospector, furnished by representative retail grocers at Juneau and Fairbanks:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Article</th>
<th>Juneau</th>
<th>Fairbanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 lbs</td>
<td>Apples, dried</td>
<td>$2.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Apples, fresh</td>
<td>$3.50</td>
<td>$4.00</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Apricots, dried</td>
<td>$4.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>50 lbs</td>
<td>Bacon</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Beans, lima</td>
<td>$1.25</td>
<td>$1.25</td>
</tr>
<tr>
<td>15 lbs</td>
<td>Beans, navy</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Beef, canned, 2 lb.</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Beef, roast, 2 lb.</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Butter, canned, 1 lb.</td>
<td>$3.50</td>
<td>$3.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Candles</td>
<td>$2.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Cans</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Cheese</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Coffee</td>
<td>$4.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Corn, canned</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Eggs</td>
<td>$11.25</td>
<td>$15.00</td>
</tr>
<tr>
<td>100 lbs</td>
<td>Flour, white</td>
<td>$5.25</td>
<td>$6.00</td>
</tr>
<tr>
<td>200 lbs</td>
<td>Flour, white</td>
<td>$10.50</td>
<td>$16.00</td>
</tr>
<tr>
<td>50 lbs</td>
<td>Ham</td>
<td>$7.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Keferose</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Lard</td>
<td>$3.50</td>
<td>$4.00</td>
</tr>
<tr>
<td>25 lbs</td>
<td>Logchop, canned</td>
<td>$7.50</td>
<td>$10.00</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Macaroni</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Matchets, candles</td>
<td>$1.85</td>
<td>$1.85</td>
</tr>
<tr>
<td>50 lbs</td>
<td>Meal, corn</td>
<td>$2.50</td>
<td>$4.00</td>
</tr>
<tr>
<td>45 lbs</td>
<td>Milk, canned</td>
<td>$2.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>1 gal</td>
<td>Molasses</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Onions, rolled</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>25 lbs</td>
<td>Onion, dried</td>
<td>$1.50</td>
<td>$2.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Oranges, fresh</td>
<td>$4.25</td>
<td>$4.25</td>
</tr>
<tr>
<td>1 box</td>
<td>Peaches, canned</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Peaches, dried</td>
<td>$1.25</td>
<td>$1.25</td>
</tr>
<tr>
<td>1 box</td>
<td>Peas, canned</td>
<td>$7.25</td>
<td>$7.25</td>
</tr>
<tr>
<td>1 box</td>
<td>Pineapple, canned</td>
<td>$7.25</td>
<td>$7.25</td>
</tr>
<tr>
<td>1 box</td>
<td>Pork, salt</td>
<td>$4.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>200 lbs</td>
<td>Potatoes, fresh</td>
<td>$2.25</td>
<td>$2.25</td>
</tr>
<tr>
<td>5 lbs</td>
<td>Powder, baking</td>
<td>$4.55</td>
<td>$4.55</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Prunes, dried</td>
<td>$2.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>20 lbs</td>
<td>Raisins, bulk</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>20 lbs</td>
<td>Rice</td>
<td>$2.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Salmon, 1 lb. cans</td>
<td>$4.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Salt</td>
<td>$4.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Sauce, L. &amp; P.</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>2 box</td>
<td>Soap, Ivory</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>10 lbs</td>
<td>Soda, baking</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Spices, assorted</td>
<td>$3.25</td>
<td>$3.25</td>
</tr>
<tr>
<td>1 box</td>
<td>Strawberries, canned</td>
<td>$4.25</td>
<td>$4.25</td>
</tr>
<tr>
<td>50 lbs</td>
<td>Sugar, granulated</td>
<td>$3.50</td>
<td>$3.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Tea</td>
<td>$4.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>1 box</td>
<td>Tomatoes, canned</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Syrup, Log Cabin</td>
<td>$12.50</td>
<td>$14.00</td>
</tr>
<tr>
<td>1 box</td>
<td>Vinegar, concentrated</td>
<td>$2.50</td>
<td>$2.50</td>
</tr>
</tbody>
</table>

TOTALS $293.90 303.50
ASSISTANCE TO THE ALASKA MINING INDUSTRY BY THE DEPARTMENT OF THE INTERIOR

In response to memorials submitted to Congress by the Territorial Legislature during its sessions of 1919 and 1921, provision has been made by the Department of the Interior to enlarge the scope of the service activities of its Bureau of Mines in Alaska.

This has been accomplished by the reorganization of the staff in the Territory whereby the work of the mining experiment station and Federal mine inspection service are consolidated and a first-aid and mine rescue service is established.

Bureau of Mines.

The work of the Bureau of Mines in Alaska, as at present organized, is conducted under two main divisions, namely:

(a) Field investigations and Service Work.
(b) Experiment Station Work.

The duties falling under these two divisions are allotted as follows:

Executive control over both divisions is vested in the Supervising Engineer who is also ex-officio Federal mine inspector and authorized representative of the Secretary of the Interior in the matter of coal, oil and gas leases and permits.

Field investigations and service work to miners, operators and prospectors are allotted to a placer mining engineer, a coal mining engineer, a special coal mining engineer and geologist, and a first-aid miner. Provision has also been made for the appointment of a coal sampler and analyst and also for a special petroleum engineer, when his services are required.

Lode mining investigations and service work to lode miners and prospectors are cared for by the Supervising Engineer with the assistance of other members of the staff.

A clerk is stationed at the Anchorage field office, which is the headquarters office for Alaska.

The work of the Experiment Station at Fairbanks embraces the assaying of ores and the quantitative and qualitative determination of mineral substances; the conduct of a reading room and reference library covering subjects related to mining and metallurgy; the analysis and utilization of coals; and the handling of all metallurgical problems that may be brought before the Bureau in Alaska for solution.

The staff of the Experiment Station consists of a Superintendent, who has direct supervision over all the work of the station; an analytical chemist and mineralogist; a mechanic, who cares for the mechanical equipment of the station and assists in making milling tests, etc.; and a clerk.

The station is equipped with complete laboratory facilities necessary for making tests of ores, etc. This equipment is available to the students of the Alaska Agricultural College and School of Mines.

Any special problems or investigations which, owing to lack of equipment or personnel, cannot be handled at the Fairbanks Station are assigned, through the Supervisor of Stations, to one of the many Bureau of Mines experiment stations in the States.

Identification of mineral substances, as distinguished from assaying and quantitative determination, is done for the public free of charge. A nominal fee, just sufficient to cover cost of materials used, is charged for assays and quantitative determinations.

Since July 1, 1922, the duties assigned to the Office of Territorial Mine Inspector have been cared for by the staff of the U. S. Bureau of Mines. Under this arrangement the expense of administering the act relating to the inspection of mines has been materially reduced and has resulted in an unexpended balance of $6,839.70 in the appropriation for the Office of Territorial Mine Inspector for the biennium 1921-1923. This sum reverted to the Treasury of the Territory March 31, 1923.

First Aid and Mine Rescue Service.

Of the new activities instituted during the past biennium by the Department of the Interior for the purpose of assisting the mining industry of the Territory, one of the most important is the inauguration of a permanent first-aid and mine rescue service.

A trained first-aid miner has been assigned to duty in Alaska, with headquarters at Anchorage. His duties consist of visiting all mining camps for the purpose of giving training in first-aid to injured persons. Where conditions warrant it, training is also given in mine rescue and recovery work.

First-aid work is particularly important in Alaska, where many small mining camps are situated in isolated localities, remote from hospital and medical service. First-aid work is being extended to these camps as well as to the larger mining communities, and prospectors and miners are being taught the proper care to be given injured persons.

During 1922 approximately 275 persons in Alaska received this training.

Mine rescue and recovery work, which includes the use of oxygent breathing apparatus, was taught to crews at the coal mines and at the larger metal mines.

The value of this work was demonstrated upon the occasion of the coal mine fire which occurred at the Evan Jones Mine in the Matanuska field in November, 1922. As soon as possible after this fire was reported a crew was assembled and trained in the use of oxygen-breathing apparatus. The work of this crew, trained by the first-aid miner, enabled the mine to be explored in the presence of noxious gases generated by the fire and resulted in ventilation being restored and the recovery of the mine to be effected promptly after the fire was extinguished.

Through the cooperation of the Alaskan Engineering Commission plans have been perfected for equipping a mine rescue car for use along the line of the Alaska Railway. This car will be furnished with ten sets of oxygen-breathing apparatus and other equipment necessary to effectively meet such emergencies as mine fires or other disasters.
The following table indicates the extent of the training given by the first-aid miner from July 1st to December 31st, 1922:

<table>
<thead>
<tr>
<th>District</th>
<th>Place</th>
<th>Qualified Certificates</th>
<th>Additional Training First Mine</th>
<th>Partial Training First Mine</th>
<th>Total First Aid Rescue Total Aid Rescue Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willow Creek</td>
<td>Gold Bullion</td>
<td>12</td>
<td>0 0</td>
<td>0 0</td>
<td>5</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>Lucky Shirt</td>
<td>10</td>
<td>0 0</td>
<td>0 0</td>
<td>5</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>Gold Mint</td>
<td>6</td>
<td>0 0</td>
<td>0 0</td>
<td>1</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>Mountain Home</td>
<td>1</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Kantishna</td>
<td>Copper Mine</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Kantishna</td>
<td>Wonder Lake</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Kantishna</td>
<td>Friday Creek</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Kantishna</td>
<td>Eureka Creek</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>Students A.A.C.&amp;E.</td>
<td>3</td>
<td>0 0</td>
<td>0 0</td>
<td>5</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>Mines</td>
<td>6</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>Short Course</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>Fire Men</td>
<td>6</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>Matanuska</td>
<td>Jonesville</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td>52</td>
<td>5 7</td>
<td>3 0</td>
<td>60</td>
</tr>
</tbody>
</table>

At Fairbanks 12 Boy Scouts and their Scout Master completed the regular course. Summary—First Aid

<table>
<thead>
<tr>
<th>Qualified for Certificates</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional training</td>
<td>3</td>
</tr>
<tr>
<td>Partial training</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summary—Mine Rescue</th>
<th>127</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualified</td>
<td>5</td>
</tr>
<tr>
<td>Partial training</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

U. S. GEOLOGICAL SURVEY

The work of the U. S. Geological Survey in Alaska was continued in 1922, as formerly, under the direction of Dr. Alfred H. Brooks.

Topographic surveys and geologic studies were made on the Alaska Peninsula over areas of interest primarily on account of their relation to petroleum deposits. Similar work was conducted along the west shore of Cook Inlet.

Other parties in the field investigated mineral resources in areas adjacent to the Alaska Railway, in the Yukon and Tanana basins, and in the Wrangell district in Southeastern Alaska.

During the coming season reconnaissance surveys will be made southward from Cook Inlet and northward from Cold Bay, both terminating at Katmai Park. Special geologic investigations will be made at Cold Bay and Chignik.

Investigation of the mineral resources in the Alaska Railroad region will be continued and additional studies will be made of the copper deposits in Prince William Sound. The mineral resources of the Chandalar region, north of the Yukon, will be studied, and in Southeastern Alaska geologic work will be carried on in the area lying between Wrangell and Juneau.

REPORT OF MINE INSPECTOR

The Alaska Agricultural College and School of Mines at Fairbanks was opened to students in the fall of 1922. The establishment of this institution in the Interior of Alaska has attracted wide attention.

Four-year courses in Civil Engineering and Mining Engineering are offered. Short courses in mining and mineralogy, designed primarily to meet the practical needs of prospectors and miners, are also being given. These short courses are proving popular and have been well attended.

The following information with regard to the location of the college and the expenses attached to attendance thereat is given in a bulletin issued by the college authorities:

LOCATION

"The site of the College is about four and one-half miles from Fairbanks on an elevation which commands a magnificent view of the Tanana Valley and the main Alaska Mountain Range. The College is easily reached either by train on the Government Railroad which passes at the foot of the campus, or by automobile on the road from Fairbanks to Ester Creek.

"On the four sections of land granted to the Territory as a site for the College is located the Government Experiment Station of the Department of Agriculture. At Fairbanks is located the Alaska Experiment Station of the United States Bureau of Mines.

"The natural advantages afforded the student of agriculture or of mining by virtue of selecting a site for the College in the Tanana Valley are of the greatest importance. This is the center of Alaska's agricultural activities. Within easy reach practically every known method of gold placer mining can be found in actual operation. Locally, quartz mining is developing. The Healy River and Matanuska coal fields can be reached by train, and both the Government Railroad and the Richardson Highway are available to reach quickly and easily the mining operations being carried on at Kennecott and in the Prince William Sound section.

TUITION

"Tuition in the College is free to both residents and non-residents of the Territory during the year 1922-23.

"Laboratory charges sufficient only to cover the costs of the material consumed will be assessed each semester.

"Text-books and stationery supplies can be purchased at the College.

EXPENSES

"The College is not prepared to furnish room and board for its students during this first year of its existence. It is hoped that by another year the institution will be equipped with a suitable dormitory and facilities for boarding those students who desire such service.

"Suitable rooms can be secured in the town of Fairbanks at a cost of from $15.00 to $25.00 per month. Board can be obtained at a cost of from $1.50 to $2.00 per day. These expenses can be reduced somewhat by
one who desires to rent a cabin and provide for himself. It is suggested that clubs can be organized and excellent room and board obtained in that way at a reasonable cost."

The faculty of the College is as follows:

CHARLES E. BUNNELL
Bucknell '00, A. B.; Bucknell, '02, A. M.
President.

CLINTON H. MORGAN
Kansas State Agricultural College, '22, B. S.; Kansas State Agricultural College, '22, M. S.
Professor of Agriculture and Instructor in Military Science.

ELIZABETH E. KIRKPATRICK
Kansas State Agricultural College, '20, B. S.; Kansas State Agricultural College, '22, M. S.
Professor of Home Economics and English.

HERBERT D. BRUCE
University of Nevada, '20, B. S.; Lafayette, '22, M. S.
Professor of Chemistry and Physics.

ARCHIE M. TRUESDELL
University of Washington, '15, B. S.
Professor of Mathematics and Civil Engineering.

ERNEST N. PATTY
University of Washington, '19, B. S.
Professor of Geology and Mineralogy.

EARL R. PILGRIM
University of Washington, '16, B. S.
Professor of Mining Engineering and Metallurgy.

REPORT OF MINE INSPECTOR

PLACER MINING IN ALASKA IN 1922

By

NORMAN L. WIMMLER
Placer Mining Engineer, U. S. Bureau of Mines.

Introduction.

This report is intended to give early publication to a review of placer mining operations and developments in Alaska during 1922, as well as touching briefly on economic features affecting the industry. In conducting field work during the past season, the writer visited Seward Peninsula and the Ruby, Hot Springs, Rampart and Fairbanks districts. Information on other districts has been obtained from many sources, but it is regretted that at the time of the preparation of this report more detailed data were not available.

The writer wishes to extend his thanks to the many Alaskans who have so kindly assisted him with information and for the many courtesies shown him in the field. The work of the U. S. Geological Survey has been liberally consulted and used in this report, for which special acknowledgment is made.

Production.

The Alaska placer mines in 1922, according to estimates based on early returns, produced gold to the value of $4,100,000 (1) or about 23% of the total value of the mineral production for that year. Final returns should increase this amount from $100,000 to $200,000. While this advance estimate of the output indicates a small decrease from the preceding year, it does not signify that a proportional lack of interest is being taken in the industry, for new plants are being installed which will be productive during the coming season.

In 1922, according to the U. S. Geological Survey, about 560 Alaska placer mines, employing 1900 men, operated during the summer and about 100 employing 300 men, during the previous winter. About 600 men were employed during the year installing large placer mining plants, which are as yet unproductive. This is a much larger number than has been employed in similar work for several years. Among the reported number of operations are many small mines which were operated for only a short time during the year and which produced but a few hundred dollars each.

The annual production of gold from dredges has increased in value from $20,000 in 1903 to $2,200,000 in 1913. Dredge building had been carried on very actively before the War. In spite of adverse conditions, the dredges that had been constructed continued to increase their output. This did not reach its maximum until 1916, when its value was $2,679,000. The output of gold from dredges thereafter steadily declined until in 1920 its value was $1,130,000. (1)

TABLE NO. 1.—DATA ON GOLD

<table>
<thead>
<tr>
<th>Name of Dredge</th>
<th>Location</th>
<th>Type</th>
<th>Size bucket Co. ft.</th>
<th>No buckets per Min.</th>
<th>H.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akaka-Kougarok</td>
<td>Taylor Cr.</td>
<td>Stacker</td>
<td>2½ open</td>
<td>15</td>
<td>70</td>
</tr>
<tr>
<td>Akaka Mines Co.</td>
<td>Wonder Cr.</td>
<td>Stacker</td>
<td>8 open</td>
<td>120</td>
<td>0</td>
</tr>
<tr>
<td>Arctic Cr. Dredge</td>
<td>Arctic Cr.</td>
<td>Flume</td>
<td>2½ open</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Bangor Dredging Co.</td>
<td>Anvik Cr.</td>
<td>Stacker</td>
<td>3½ close</td>
<td>140</td>
<td>0</td>
</tr>
<tr>
<td>Beiring Dredging Co.</td>
<td>Kougak R.</td>
<td>Flume</td>
<td>2½ close</td>
<td>24</td>
<td>100</td>
</tr>
<tr>
<td>Candle Cr. Dredge</td>
<td>Candle Cr.</td>
<td>Flume</td>
<td>1½ close</td>
<td>16</td>
<td>50</td>
</tr>
<tr>
<td>Center Cr. Dredge</td>
<td>Snake Cr.</td>
<td>Stacker</td>
<td>3½ close</td>
<td>26</td>
<td>112</td>
</tr>
<tr>
<td>Caspasia Dredge</td>
<td>Canyon Cr.</td>
<td>Flume</td>
<td>2½ open</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Crooked Cr. Dredge</td>
<td>Crooked</td>
<td>Flume</td>
<td>2½ open</td>
<td>16</td>
<td>65</td>
</tr>
<tr>
<td>Dexter Cr. Dredge</td>
<td>Dexter Cr.</td>
<td>Stacker</td>
<td>2½ open</td>
<td>12</td>
<td>85</td>
</tr>
<tr>
<td>Dobson Dredge</td>
<td>Burik Cr.</td>
<td>Stacker</td>
<td>2½ open</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Eskimo Gold Mfg. Co.</td>
<td>Solomon R.</td>
<td>Stacker(f)</td>
<td>6 close</td>
<td>21</td>
<td>200</td>
</tr>
<tr>
<td>Fries Dredge</td>
<td>Innianak R.</td>
<td>Flume</td>
<td>2½ close</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>G. &amp; O. Dredge</td>
<td>Warm Cr.</td>
<td>Flume</td>
<td>1½ close</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Glacier Cr. Dredge</td>
<td>Glacier Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Hammon Cons. Gold Co.</td>
<td>No. 56 Little</td>
<td>Stacker</td>
<td>9 close</td>
<td>592</td>
<td>0</td>
</tr>
<tr>
<td>Hammon Cons. Gold Co.</td>
<td>No. 54 Little</td>
<td>Flume</td>
<td>3 open</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Ivenson Johnson</td>
<td>Big Hurrah</td>
<td>Flume</td>
<td>1½ close</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Julian Dredge</td>
<td>Osborne Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>14</td>
<td>85</td>
</tr>
<tr>
<td>Kugruk Dredge</td>
<td>Keewak R.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>Northern Light</td>
<td>Ophir Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>16</td>
<td>70</td>
</tr>
<tr>
<td>Shovel Cr. Dredge</td>
<td>Shovel Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>15</td>
<td>70</td>
</tr>
<tr>
<td>Swanson Cr. Dredge</td>
<td>Swan Cr.</td>
<td>Flume</td>
<td>2 open</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Wild Goose No. 1</td>
<td>Ophir Cr.</td>
<td>Stacker</td>
<td>1½ close</td>
<td>17-33</td>
<td>140</td>
</tr>
<tr>
<td>Wild Goose No. 2(i)</td>
<td>Ophir Cr.</td>
<td>Stacker(f)</td>
<td>3 close</td>
<td>21</td>
<td>100</td>
</tr>
<tr>
<td>Uplift Dredge</td>
<td>Camp Cr.</td>
<td>Flume</td>
<td>2 open</td>
<td>60</td>
<td>0</td>
</tr>
</tbody>
</table>

CACHÉ CREEK DISTRICT

<table>
<thead>
<tr>
<th>Name of Dredge</th>
<th>Location</th>
<th>Type</th>
<th>Size bucket Co. ft.</th>
<th>No buckets per Min.</th>
<th>H.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cache Cr. Dredging Co.</td>
<td>Cache Cr.</td>
<td>Flume</td>
<td>7 close</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>Berry Dredging Co.</td>
<td>Mammoth Cr.</td>
<td>Flume(e)</td>
<td>2½ close</td>
<td>25</td>
<td>150</td>
</tr>
<tr>
<td>Fairbanks Gold No. 1</td>
<td>Fairbanks</td>
<td>Stacker</td>
<td>4 close</td>
<td>21</td>
<td>220</td>
</tr>
<tr>
<td>Fairbanks Gold No. 2</td>
<td>Fairbanks</td>
<td>Stacker</td>
<td>2½ open</td>
<td>13</td>
<td>70</td>
</tr>
</tbody>
</table>

FAIRBANKS DISTRICT

<table>
<thead>
<tr>
<th>Name of Dredge</th>
<th>Location</th>
<th>Type</th>
<th>Size bucket Co. ft.</th>
<th>No buckets per Min.</th>
<th>H.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riley Inv Co.</td>
<td>Otter Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>22</td>
<td>119</td>
</tr>
<tr>
<td>Beaton &amp; Donnelly</td>
<td>Otter Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>30</td>
<td>119</td>
</tr>
</tbody>
</table>

IDITAROD DISTRICT

<table>
<thead>
<tr>
<th>Name of Dredge</th>
<th>Location</th>
<th>Type</th>
<th>Size bucket Co. ft.</th>
<th>No buckets per Min.</th>
<th>H.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flume Dredge Co.</td>
<td>Yankee Cr.</td>
<td>Flume</td>
<td>2½ open</td>
<td>14</td>
<td>80</td>
</tr>
<tr>
<td>Flume Dredge Co.</td>
<td>Little Cr.</td>
<td>Flume</td>
<td>2½ open</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Innokey Dredging Co.</td>
<td>Gimes Cr.</td>
<td>Flume</td>
<td>3½ close</td>
<td>150</td>
<td>0</td>
</tr>
</tbody>
</table>

KUSKOKWIM DISTRICT

<table>
<thead>
<tr>
<th>Name of Dredge</th>
<th>Location</th>
<th>Type</th>
<th>Size bucket Co. ft.</th>
<th>No buckets per Min.</th>
<th>H.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuskokwim Dredge</td>
<td>Candle Cr.</td>
<td>Stacker</td>
<td>2½ close</td>
<td>22</td>
<td>140</td>
</tr>
<tr>
<td>(a)</td>
<td>Operated 1922.</td>
<td>(b)</td>
<td>Under construction.</td>
<td>(c)</td>
<td>Moving to new location as given.</td>
</tr>
<tr>
<td>(e) Rev. Screen and two flumes.</td>
<td>(f)</td>
<td>Shaking screens.</td>
<td>(g)</td>
<td>Combination screen, flume and stacker.</td>
<td>(h)</td>
</tr>
</tbody>
</table>

DREDGES IN ALASKA, 1922

<table>
<thead>
<tr>
<th>FUEL USED</th>
<th>Kind</th>
<th>Consumption daily</th>
<th>Digging depth in yds. below water per 24 hrs.</th>
<th>Size of hull</th>
<th>Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distillate</td>
<td>11 ft.</td>
<td>34x60x5½</td>
<td>J. Kellner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil-electric</td>
<td>70 ft.</td>
<td>48x14</td>
<td>J. Keenan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>12 ft.</td>
<td>28x60</td>
<td>C. Mitchell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>200 gals.</td>
<td>2000</td>
<td>35x10</td>
<td>J. Matthews</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>15 ft.</td>
<td>20x50x5½</td>
<td>E. Pierce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>900</td>
<td>24x44x4½-1½</td>
<td>E. Pierce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>26 ft.</td>
<td>2000</td>
<td>35x14</td>
<td>A. Anderson</td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>100 gals.</td>
<td>2000</td>
<td>25x6</td>
<td>C. L. Peck</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>12 ft.</td>
<td>26x50</td>
<td>S. Fernagel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>200 gals.</td>
<td>1600</td>
<td>30x60</td>
<td>A. N. Kitterle</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>15 ft.</td>
<td>30x60x5½</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel-Elect.</td>
<td>200 gals.</td>
<td>3900</td>
<td>46x85</td>
<td>R. S. Oatesky</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>12 ft.</td>
<td>200</td>
<td>H. Fries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>5 gals.</td>
<td>50</td>
<td>A. N. Garrod</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>18 ft.</td>
<td>1800</td>
<td>26x50x1½</td>
<td>J. F. Gunne</td>
<td></td>
</tr>
<tr>
<td>Diesel-Elect.</td>
<td>40 ft.</td>
<td>8400</td>
<td>46x60x1½</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>12 ft.</td>
<td>60x50x5½</td>
<td>P. Iversen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel-Elect.</td>
<td>60 ft.</td>
<td>8400</td>
<td>55x40x1½</td>
<td>V. Julian</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>15 ft.</td>
<td>150</td>
<td>G. Russell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>100 gals.</td>
<td>500</td>
<td>25x55</td>
<td>A. Nolan</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>15 ft.</td>
<td>150</td>
<td>A. C. Mahle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>21 ft.</td>
<td>220</td>
<td>F. Ayer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>20 ft.</td>
<td>1800</td>
<td>32x65</td>
<td>F. Ayer</td>
<td></td>
</tr>
<tr>
<td>Distillate</td>
<td>13 ft.</td>
<td>100</td>
<td>24x4x4-1/3</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Hydro-Elect.</td>
<td>——</td>
<td>460</td>
<td>54x87</td>
<td>J. W. Boles</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td>3½ cords</td>
<td>250</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>16 ft.</td>
<td>2200</td>
<td>30x62½x5½</td>
<td>W. W. Heitman</td>
<td></td>
</tr>
<tr>
<td>Wood(k)</td>
<td>6 cords</td>
<td>2500</td>
<td>40x50x6</td>
<td>G. Aarons</td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>23 ft.</td>
<td>1000</td>
<td>35x60</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Crude Oil</td>
<td>15 ft.</td>
<td>2600</td>
<td>20x50x5½</td>
<td>M. Atwood</td>
<td></td>
</tr>
<tr>
<td>Distillate(l)</td>
<td>20 ft.</td>
<td>1000</td>
<td>35x60x5½</td>
<td>J. Beaton</td>
<td></td>
</tr>
<tr>
<td>Distillate(l)</td>
<td>12 ft.</td>
<td>2000</td>
<td>25x60x4</td>
<td>J. Beaton</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td>8 cords</td>
<td>2900</td>
<td>35x60x5½</td>
<td>T. Atwood</td>
<td></td>
</tr>
</tbody>
</table>

(*i) Old Three Friends Dredge. | (i) Old Blue Goose Dredge. | (k) Changing to Diesel crude oil. | (l) To install hydroelectric plant. | (m) Anticipated yardage. |
In 1921, 24 dredges were operated, handling 2,739,319 cubic yards of gravel from which the average gold recovery was 57 cents per cubic yard, or 37% of the placer gold produced. (2)

Placer Mining Operations in 1922.

The methods of placer mining used in Alaska are: Dredging; various forms of hydraulic mining; steam scraper and drag-line excavation; drifting, during both summer and winter, by shaft and in a few instances by adit; and the more primitive methods of ground-sluicing and shovelling-in.

In 1922, 23 gold dredges were operated, producing about $1,630,000 worth of gold. (1) This is about 37% of the total placer gold produced. During the year 15 dredges were operated on Seward Peninsula, 2 on Otter Creek in the Iditarod district, 1 on Candle Creek in the Kuskokwim region near McGrath, 1 on Yankee Creek in the Innoko district, 1 on Cache Creek in the Yentna region, 2 on Fairbanks Creek in the Fairbanks district, and 1 on Mammoth Creek in the Circle district.

The season of 1923 will show an important increase in the number of dredges operated. New construction is under way, and some of the dredges on the Seward Peninsula that have been idle for a number of years will again resume operations. As a result of investigations conducted over a period of several years, the two largest dredges in Alaska are being constructed near Nome. These dredges are equipped with 8-cubic-foot buckets, digging 40 feet and 60 feet below water level. Each one is expected to dig about 200,000 cubic yards per month. The operation of these modern dredges under up-to-date and systematic management will mark a new era in Alaska gold dredging.

While three of the small Seward Peninsula dredges finished operations during the season, it is reported that two will be moved to new locations. Three or four other Peninsula dredges, which have been idle, will resume operations during the coming season, some of them being moved to new locations.

The transportation of dredges to Little Creek and Gaines Creek in the Innoko district has met with much delay. The dredges are now, however, landed in the district and will be ready to start operations in 1923.

The accompanying table, No. 1, gives the important details concerning Alaska dredges.

Prospecting of placer ground was more active in 1922 than for several years past. The most important work of this kind was conducted on a large and systematic plan on Cleary and Goldstream Creeks in the Fairbanks district, where the dredging possibilities of these creeks were being investigated by strong California interests.

Hydraulic mining methods are being more generally adopted in most of the districts, although, unfortunately, favorable conditions for this kind of mining on anything but a small scale are generally lacking. Conditions for large scale operations, which require sufficient water supply under suitable head, proper stream gradients and extensive gravel deposits, are found mostly in the mountainous regions lying at a distance from the sea coast, as in the Copper River, Kenai Peninsula, Tentna and adjoining districts. On Seward Peninsula some large water supplies have been made available by extensive ditch systems dug in the early mining days, and, although stream gradients are generally not favorable, the district is still the scene of considerable hydraulic mining. Some form of hydraulic mining was conducted during 1922 in practically every placer district of the Territory. The principal operations of this type were in the Chistochina and Nazina districts in the Copper River Region, on Kenai Peninsula, in the Cache Creek, Kantishna and Circle districts, and on Seward Peninsula. The largest hydraulic elevator operations were conducted on Seward Peninsula, where one of the larger hydraulic elevator plants, long idle, has again been placed on the active list. Preparations are being made for future hydraulic operations in the Copper River and Kenai Peninsula Regions, and in the Yentna, Bonnifield, Chuitina and other districts. Many of the operations in districts not mentioned are conducted on a small scale and in some cases water supplies are so limited during the larger part of the season that water can only be obtained by storage and used in short intermittent periods.

Steam scraper operations and other somewhat similar mechanical operations are limited to those districts affording a fuel available at a reasonable cost. The principal scraper operations in 1922 were conducted in the Fairbanks, Tolovana, Hot Springs, Forty Mile and Iditarod districts. The largest operations were conducted on the Goldstream watershed in the Fairbanks district. The scrapers used are of the bottomless and the slip tooth types. Several cable way excavators and one small drag line excavator were operated in the Fairbanks district and a drag line excavator was operated in the Iditarod region.

Drift mining was conducted mainly in the Fairbanks and Tolovana districts and to a lesser extent in the Hot Springs, Chandalar and other Yukon Basin districts where deep gravels are found. But little drifting was done on Seward Peninsula on account of the high cost of fuel and timber. A few of the drifting operations in these districts fortunately struck some good ground and were able to make a good return. Most of the work, however, is in small isolated areas of ground left by former operators and these operations employ from 3 to 12 men each. Operations employing 15 men or more are rare. The day of drift mining is rapidly passing, although the past year has seen an increasing number of these small operations.

The more primitive methods of ground-sluicing and shovelling-in are used in all the districts, the work being conducted by one man or by groups of two or three men. The day when this form of small scale mining can be profitably conducted has practically passed in most of the districts, but such operations afford a meager livelihood for a large number of prospectors.

TABLE NO. 2.—ALASKA FREIGHT RATES, 1922

<table>
<thead>
<tr>
<th>Wharfage charge additional</th>
<th>Seattle to</th>
<th>Ketchikan</th>
<th>Juneau</th>
<th>Cordova</th>
<th>Seward (a)</th>
<th>Anchorage (b)</th>
<th>Nome (c)</th>
<th>Nome at anchorage (d)</th>
<th>Kotzebue at anchorage (e)</th>
<th>Seattle</th>
<th>Wharfage charge additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal in sacks per 2000 lbs.</td>
<td>4.50</td>
<td>5.00</td>
<td>7.50</td>
<td>8.50</td>
<td>9.00</td>
<td>11.00</td>
<td>13.50</td>
<td>$15.65</td>
<td>$6.00</td>
<td>$17.00</td>
<td>$23.60</td>
</tr>
<tr>
<td>High explosives—Dynamite</td>
<td>20.00</td>
<td>20.50</td>
<td>25.00</td>
<td>31.50</td>
<td>32.50</td>
<td>35.00</td>
<td>37.50</td>
<td>$83.00</td>
<td>$12.00</td>
<td>$20.00</td>
<td>$24.00</td>
</tr>
<tr>
<td>Freight N.O.S. ordinary</td>
<td>8.00</td>
<td>8.50</td>
<td>8.50</td>
<td>10.00</td>
<td>11.00</td>
<td>12.00</td>
<td>13.00</td>
<td>13.00</td>
<td>14.00</td>
<td>$20.00</td>
<td>$20.00</td>
</tr>
<tr>
<td>General merchandise</td>
<td>9.00</td>
<td>9.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>11.00</td>
<td>12.00</td>
<td>$13.00</td>
<td>$14.00</td>
<td>$15.00</td>
<td>$16.00</td>
</tr>
<tr>
<td>Lumber—common per M</td>
<td>8.00</td>
<td>9.00</td>
<td>10.00</td>
<td>12.00</td>
<td>15.00</td>
<td>18.00</td>
<td>21.00</td>
<td>23.00</td>
<td>$24.00</td>
<td>26.00</td>
<td>$28.00</td>
</tr>
<tr>
<td>Mining machinery in pieces</td>
<td>8.00</td>
<td>9.00</td>
<td>10.00</td>
<td>12.00</td>
<td>15.00</td>
<td>18.00</td>
<td>21.00</td>
<td>23.00</td>
<td>$24.00</td>
<td>26.00</td>
<td>$28.00</td>
</tr>
<tr>
<td>110 gal. drum at 24 cu. ft.</td>
<td>30.00</td>
<td>32.50</td>
<td>37.50</td>
<td>50.00</td>
<td>62.50</td>
<td>75.00</td>
<td>87.50</td>
<td>100.00</td>
<td>$100.00</td>
<td>125.00</td>
<td>$150.00</td>
</tr>
<tr>
<td>Oil—fuel, engine, etc.</td>
<td>8.00</td>
<td>9.00</td>
<td>10.00</td>
<td>12.00</td>
<td>15.00</td>
<td>18.00</td>
<td>21.00</td>
<td>23.00</td>
<td>$24.00</td>
<td>26.00</td>
<td>$28.00</td>
</tr>
<tr>
<td>Return or South Bound—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carriers, empty drums</td>
<td>3.50</td>
<td>3.50</td>
<td>4.25</td>
<td>4.75</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>$7.00</td>
<td>8.00</td>
<td>$8.50</td>
</tr>
<tr>
<td>Ore and concentrates—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25% added for each 100% of</td>
<td>4.00</td>
<td>4.00</td>
<td>4.25</td>
<td>4.75</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>$7.00</td>
<td>8.00</td>
<td>$8.50</td>
</tr>
<tr>
<td>over value of $50.00 ton</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rates are per ton of 2000 lbs. or 40 cu. ft., unless otherwise specified.

*Upper figure—less than carload lot rate. Lower—carload lot rate.
(a) Additional charge for pieces over 1,000 lbs.
(b) Transfer charge at Seattle.$3.50 per ton additional.
(c) Additional charge for pieces of over 1,000 lbs.
(d) Additional charge for pieces of 1,000 lbs.
(e) Additional charge for pieces of 1,000 lbs.
(f) Additional charge for pieces of 1,000 lbs.
(g) Additional charge for pieces of 1,000 lbs.

TABLE NO. 3.—ALASKA FREIGHT RATES—1922—YUKON RIVER POINTS VIA ST. MICHAEL

<table>
<thead>
<tr>
<th>Lesser Than Carload Lots</th>
<th>Seattle to</th>
<th>St. Michael</th>
<th>Marshall</th>
<th>Holy Cross</th>
<th>Iditarod</th>
<th>Kayukuk</th>
<th>Ruby</th>
<th>Tanana</th>
<th>Rampart</th>
<th>Beaver</th>
<th>Circle</th>
<th>Eagle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal in sacks per 2000 lbs</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
</tr>
<tr>
<td>High explosives—Dynamite</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
</tr>
<tr>
<td>General groceries, hardware, merchandise</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
<td>28.00</td>
</tr>
<tr>
<td>Lumber—common per 1000 ft. B. M.</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
<td>30.50</td>
</tr>
<tr>
<td>Mining machinery (a) pieces not over 2000 lbs. per ton</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
<td>24.50</td>
</tr>
<tr>
<td>Oil—fuel, engine 110 gal. drum at 24 cu. ft.</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
<td>32.50</td>
</tr>
<tr>
<td>Return or South Bound—Carriers, empty drums 110 gal. drum at 24 cu. ft.</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
</tr>
<tr>
<td>Ore and concentrates, value not over $250 per ton</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
<td>13.50</td>
</tr>
</tbody>
</table>

Rates are per ton, or 2000 lbs. or 40 cu. ft., unless otherwise specified.

(a) Additional charge for pieces weighing over 2000 lbs.

Wharfage and handling charges additional.
Transportation

Transportation conditions have always constituted a serious handicap to the Alaska mining industry. The completion of the Alaska (Government) Railroad connecting tidewater with Interior Alaska has been one of the greatest steps in improving interior transportation. It has placed the interior in a position to obtain supplies during the entire year at a reasonable cost and has made some of the districts more readily accessible. This had led to a reduction of mining costs and has been reflected in increased placer mining activities in the districts affected. However, with the completion of the railroad, transportation on the Yukon practically ceased. There were only four trips made during the 1922 season by a regular river boat. This service was augmented by weekly trips of the mail launches, which also carried passengers, from St. Michael to Tanana, and a trip every two weeks on the upper Yukon. On the Tanana, the only service furnished was by irregular trips of small river boats plying between Nenana and points down river as far as Holy Cross and from there to Nitarod, and weekly trips of launches between Nenana and Tanana. This condition will, however, be bettered in 1923, for the Alaskan Engineering Commission has been authorized to operate two river boats formerly assigned to the Army and will inaugurate a service in connection with the railroad between Nenana and Yukon River ports. In tables 2 and 3 the ocean and river freight rates from Puget Sound ports to the principal Alaska centers and joint rates to Fairbanks via the Alaska Railroad are given. Further mention of these rates and overland transportation costs are made in accompanying reports on individual districts. The high cost of transportation to these centers is further increased by the overland haul which in itself amounts in many cases to much more than the ocean freight, and, except in the case of a property located within a reasonable distance of a road system tributary to the main distributing point, this charge becomes prohibitive. For this reason the more isolated districts have experienced a rapid decline and have been slow in subsequent development. The urgent necessity of improving these conditions is one of the best arguments to be advanced for more road building; or at least for the construction of suitable trails. Seward Peninsula has been handicapped not only by high freight rates due mainly to heavy lighterage charges, but by natural conditions affecting coastal traffic. Storms along the coast make it difficult to reach many districts by water, and overland transportation facilities from Nome to distant points along the coast are lacking.

In the purchase of the Seward Peninsula railroad, which will be placed in condition to allow the haulage of light freight and passengers on flat cars drawn by dogs, the Kougarok and Fairhaven districts will be greatly helped.

To facilitate passenger travel and the dispatch of mail many communities have given serious consideration to the establishment of air transportation service. This is not a new idea, but the possible benefits to be derived make the plan worthy of early development.

REVIEW OF PLACER MINING BY DISTRICTS

The principal placer mining operations in the Copper River Region in 1922 were those conducted at the large hydraulic plants on Dan and Chititu Creeks, tributary to the Nenana River, south of Kennekott, and those conducted on Slate Creek, near Dempsey. In the Chistochina section the Slate Creek Mining Company operated its hydraulic plant on Slate Creek and another one was operated on Miller Gulch. The Dan Creek Mining Company operated one hydraulic plant on Dan Creek.

John E. Andrus, employing from 40 to 50 men, operated two hydraulic plants on Chititu Creek, where during 1922 approximately 24,500 square yards of ground, averaging 6 feet in depth, were handled at the No. 9 operations, and 4,600 square yards, averaging 15 feet in depth, on No. 1. According to the general manager, Mr. Hert Carvey, the ditch supplies an average of 4,000 miners' inches of water under a 360-foot head. Only creek gravels are now being handled. The average working season for hydraulicinking is from 125 to 150 days in extent, though in some years it lasts 150 days. The slate bedrock is soft and easily piped. Grade is sufficient for box grades but tailing is stacked by giant. A considerable number of large boulders are encountered, which are blasted or removed by donkey hoist. From 3 to 5 tons of powder are used each season in the blasting of the boulders. The pits worked average 1,000 feet in length and 300 feet in width. A 4-foot rock sluice is dug and blasted through the center of the new area for the entire length. A giant is set on each side of the sluice and the material is piped to and into the sluice and goes to the boxes, which are set at the lower end. In cleaning up this sluice a hose and small nozzle is used and the content is washed down and into the boxes.
Several small operations were conducted on Rex Creek and some drifting was done in bench deposits reached by adit. A number of outfits were working on a small scale and others were prospecting on Young Creek.

KENAI PENINSULA REGION

Placer mining was conducted during 1922 on Crow, Resurrection, Canyon, Mills and Bear Creeks. Six hydraulic plants are reported to have been operated, the largest being that on Crow Creek, in the Girdwood district. Numerous small ground-sluicing operations were conducted throughout the region, most of which were on Bear Creek. The gold output for 1922 was small. Placer labor receives $5.00 and board per day of 8 hours. It costs from $1.75 to $2.00 per day to board a man.

At several of the larger hydraulic plants that have been idle during the past season preparations are being made to resume operations the coming year.

Girdwood District.

Denhart and Holmgren operated the Crow Creek Hydraulic Mines, six miles from Girdwood, with a crew of about 20 men. They have given a "lay" to Erickson and Totland, who will operate the property next season.

Sunrise District.

The Canyon Creek Development Company, under the management of N. O. Anderson, is constructing a hydraulic filled timber dam on Canyon Creek. It is reported that this dam is to be 110 feet high. It will divert the water from the creek bed and thus allow the creek gravels downstream from it to be hydrauliclicked. It will also provide some of the water to be used in mining operations. The company expects to have this work completed and start mining next spring.

Allison and Plowman, working alone, operated a hydraulic plant on Canyon Creek and Bob Michaelson reports successful prospecting results on Mills Creek. No placer mining is reported on Lynx or Palmer Creeks.

Hope District.

The Matheson Brothers hydraulic plant has been idle, but will be actively operated the coming season. A half interest in the plant has been acquired by J. E. Ketchum of Cordova. Togstad, Beaswanger and Carlstrom operated their hydraulic plant on the Busy Bee Claims. The Russians hydrauliclicked on ground above the Pearson property, the latter being idle. Haun Brothers conducted hydraulic operations on the Carson ground and Capovich and McComb ground-sluiced on a bench near the mouth of Resurrection Creek. About 12 men were ground-sluicing on Bear Creek. Ed Belmont plans to install a hydraulic plant on this Creek.

SUSITNA REGION

Yentna District.

The gold production for 1922 from the Yentna or Cache Creek District will show a large increase over that of 1921. The increased output is due to the successful season experienced in the operation of the Cache Creek dredge and to the good water supply, which, owing to the wet season, was available to the 14 hydraulic plants operated on Cache and Peters Creeks and their tributaries. Operators of hydraulic plants all report a fine season, and plans are being made at several properties to enlarge the scale of operations. Five of these hydraulic plants are being worked on a very limited scale, using water under low head through canvas hose; the others have standard equipment. Using, as a rule, No. 1 Giants with water up to 210-foot heads.

The gravels of this district are frozen only during the occurrence of seasonal frosts. In general the creek deposits mined are from a few feet to 12 feet in depth and contain coarse gold. Deep bench ground is hydrauliclicked on Dollar, Falls, Thunder and Bird Creeks. About 100 men were engaged in mining. This district was formerly reached via the Susitna River, but since the completion of the Government Railroad, Talkeetna is the point of access. It is 45 miles from Talkeetna to Cache Creek. Fifteen miles of fine wagon road has been completed, the rest of the distance being covered by trail. This piece of road has been under way for the past three or four years and it is hoped will be rushed to an early completion. Freighting cost from Talkeetna to Cache Creek during the summer is 20 cents per pound. Winter freight is $65 per ton. The benefit of a completed road can be readily seen. Wages are $5.00 and board per 5-hour shift. Board costs $2.00 per day. Lumber at Talkeetna sells for $35 per thousand.

Cache Creek.

The Cache Creek Dredging Company reports a very successful season regardless of two floods which stopped operations for 26 days. Dredging started May 17th and continued to November 5th. The ground removed averaged 9 feet in depth and a total of 356,823 cubic yards were dug. This dredge was formerly steam operated, using lignite fuel mined close by. The dredge is now electrically operated, the hydro-electric plant having been completed in 1921. This change has brought about a big saving in power cost as well as improving conditions on the dredge. The plant consists of a 23-inch double discharge Leffel turbine water wheel, operating a 300 KW alternating current General Electric generator delivering current at 2,300 volts.

On upper Cache Creek, Dick O'Rowke and one man are piping in 6 to 10 feet of gravel with a No. 1 Giant.

Dollar Creek.

Hillman and Barhenberg conducted successful hydraulic operations in deep bench ground on the B & B claim, operating from June 7 to
October 20, with a crew of nine men. Work this summer was carried on along a 1500-foot cut having a bank from 175 to 200 feet high. Water under 200-foot head is piped against the face, the material washed down being piped into the boxes. A string of 140 boxes is used, dumping the tailing in the canyon below. Plans are under consideration to hydraulic shallow creek gravel at the mouth of the creek.

Short Creek.
H. Price and two men using water under low head through canvas hose equipment piped in shallow creek gravel.

Falls Creek.
Joe Anderson, with about eight men, using two giants piped in four to eight foot creek gravel. Frank Irvin, with six men, hydraulicked deep bench ground.

Thunder Creek.
Al Wolf, with a crew of six men, hydraulicked deep bench ground. Plans are reported to be under way to more than double the scale of operations next summer.

Nugget Creek.
The Nugget Creek Hydraulic Company, with 7 men, worked shallow creek gravels. An abundant supply of water is obtained through 3 miles of ditch at a 200-foot head. One No. 1 Giant is used for stacking tailing.

Peters Creek.
Harper Brothers, with a crew of 7 men, continued their hydraulic operations after digging 3 miles of ditch. The natural grade of Peters Creek averages 2½%. A short string of 20-inch boxes, composed usually of not over 3 lengths, are set on 6-inch grade. The gravel is of medium size with but few boulders and averages 5 feet in depth. The conglomerate bedrock is readily cleaned with the giant. A No. 1 Giant under 210-foot head is used to pipe into the head of the boxes and a No. 2 giant with 3-inch nozzle is used to stack the tailing. An operating cost of 6 cents per square foot is reported.

Shell, McDonald and others have purchased the Harper Bros. interests and plan to operate next summer on an enlarged scale.

Elmer Carlson and one man hydraulicked with one giant on lower Peters Creek.

Other Creeks.
Among those operating on other creeks, hydraulicking shallow ground with the use of canvas hose outfits were Chris. Hammersmith on Bird Creek; Frank Jenkins, and Rice and Hatch on Willow Creek; Cast and Mack on Poorman; Andreasen and Wetherell on Gold Creek. Bedar, Gray and Vest were ground-sluicing on Clear Creek.

Valdez Creek District.
The largest operations to be conducted in the Valdez Creek District this year were those of the McKinley Placer Mining Company on Valdez Creek. This Company operated its large hydraulic plant, although the season's operations are stated to have been handicapped by the excessive number of boulders encountered.

Chulitna District.
The Three Forks Mining Company have been prospecting the gravels of the Chulitna River at Mile 287½ on the Government Railroad. It is reported that about 15 men will be employed during the winter sinking prospect shafts and that a large hydraulic plant will be installed next spring.

Talachulitna District.
This district lies at the headwaters of the Skwentna River, in the Rainy Pass country. Prospectors returning from this district report the finding of extensive, deep, auriferous gravel banks along several of the larger creeks. Conditions are reported very favorable for hydraulic mining.

Kantishna District.
For a description of placer mining operations in the Kantishna District the reader is referred to the special article on the Kantishna Region by Mr. John A. Davis, in the latter part of this report.

Bonnifield District.
This district, while in part a portion of the Nenana coal field, has been placer-mined more or less for the past 20 years, producing in 1921 about $16,000. While the gravels are of low grade, some extensive areas are reported that would justify prospecting. The district is difficult of access owing to lack of roads, and, while the Government Railroad has now made it more accessible, the creeks being worked are from 20 to 40 miles east of the railway line. The gravels are in creek deposits and, while frozen in places, are mostly thawed. The average season is from June 1st to October 1st.

Fairbanks interests have taken over the Keevey ground on Gold King Creek and are installing a hydraulic plant and expect to be ready to operate during the coming season.

Val. Diebold installed a small hydraulic plant on Platte Creek during the past season and operated to the close of the season with a crew of five men. Further ditch construction is planned to increase the water supply. This property is reached by trail from Honeana on the railroad from which it is 22 miles distant. Heilig and Smith on Thistle Creek are preparing to hydraulic, and ground-sluicing was done on Margaret Creek and on the headwaters of the Totalanika River and on the Tatlanika River.
FAIRBANKS DISTRICT

Placer mining in the Fairbanks district has shown a marked increase during the past year, both in the number of operations conducted and the gold output. It is estimated from early reports that the placer gold production for 1922 will show an increase of about $200,000 over that of the preceding year, when a production of $570,000 was reported. This advance is attributed mostly to the increased production from drift mines at Dome, Little Eldorado, Gold Hill and Ester Creeks, where some small blocks of high grade gravels were mined, and also to the successful dredging operations on Fairbanks Creek. The steam scraper plants as a whole have had a bad year, because of the cold wet weather that prevailed during the summer and greatly retarded the natural thawing of the gravels.

The Government Railroad has made Fairbanks an "all-the-year" camp, as it is now possible to obtain supplies from the States at all times on short notice. The operation of the railway has also demonstrated its beneficial effects in many other ways. Locally, the cost of supplies is still high: probably higher than is justified. Freight rates via the railroad are being reduced. A new joint tariff has been made on carload lots, providing for a rate of $42.00 per ton on mining machinery, oils and general groceries, between Puget Sound ports and Fairbanks. See table 2. For transfer across the Tanana River at Nenana a charge of $3.00 per ton is added on freight and $.50 per ton on coal. This charge will be abolished on completion of the Nenana bridge early this spring. The narrow gauge branch of the railroad as well as auto stages complete the haul from Fairbanks to the Creeks.

Very little coal has so far been used in the placer operations. As a better quality of lignite is now being mined at Healy, which is delivered in carload lots at Fairbanks for $4.50 per ton, its use will be more generally adopted.

Most of the wood used for mine power purposes is cut on lower Goldstream Creek, where it costs $8.00 per cord on the car. At most of the properties, the cost of wood is from $10 to $14 per cord, which includes freight and hauling from the siding. Wages for labor amounts to $5.00 per day and board, on an 8-hour basis. Pointmen and nozzlemen receive $6.00. Steam scraper engineers receive $8.00 to $10.00 per day and board. Board costs from $1.75 to $2.50 per day.

More prospecting is being done than for some years past, and of particular interest is the drilling which has been done on Cleary and Goldstream Creeks by the Humphries-Bigelow Co., representing the foremost California dredging interests.

The following are the principal placer operations conducted during the year:

Goldstream.

H. Atwood, F. C. Bleecker, Henry Wagner, Rögge-Wagner and Chas. Grill operated Bagley scraper plants on Goldstream, a total of 60 men being employed in their operations. A. Hanot on Discovery with a crew of 12 men took out a small pit with a cableway or trolley excavator. A similar outfit was operated by A. Zimmerman on Twin Creek. Both of these operations contended with unusually adverse conditions.

Gilmore Creek.

James McPike on No. 3 below Gilmore operated a 2-yard Bagley scraper plant with a crew of 12 men. An old pit was completed. A new pit, 360 x 600 feet, was opened but only partly cleaned up before cold weather set in.

Pedro Creek.

Guis and Krize on No. 7 below installed a hydraulic plant and were able to take out several cuts before the freeze-up. A total of 10 men were employed.

Nelson and Zimmerman on No. 2 above continued hydraulic operations up to the first cold spell, September 25th. The ground worked averaged about 15 feet, with a creviced and blocky gneiss bedrock which required cleaning by hand. Two No. 2 giants are used under 120 feet head for "piping in" and two No. 1 giants for stacking tailing, only one of each being operated at one time. About 24,000 sq. ft. of ground was worked at an operating cost of $3.90 per sq. ft.

Fairbanks Creek.

The Fairbanks Gold Dredging Company operated its two dredges, employing about 30 men. A most successful season is reported. The old Risdon dredge is being overhauled and will be changed from steam to Diesel power. This dredge, using steam, consumed 5 cords of wood per day at a cost of $130.00, the long, heavy tractor haul from Gilmore Railroad station bringing the cost to $25.00 per cord. The new plant will consist of two 60 H. P. Werkspoor Diesel engines estimated to consume about 135 gals. of crude oil per day at $40 per gal., or $54.00 per day.

Cleary Creek.

Ten small operations, consisting of three small drift and seven ground-sluicing operations, were conducted on upper Cleary Creek and its tributaries, Wolf, Chatham and Bedrock Creeks. A steam scraper was operated for a short time at the mouth of Bedrock, and Pearson and Johnson did a little drifting on No. 6 below Cleary. Sam Weiss with a crew of 8 men on No. 16 below Cleark took out about 16,000 sq. ft. of gravel, mining from an old 80 ft. shaft. Two levels of "pay" were found. Schaup and Larsen with a crew of 5 men drifted on the Hope and Totem claims on Chatanika Bench. Three Keystone drills were operated on Cleary Creek and around Chatanika by the Humphries-Bigelow Co.

Little Eldorado.

The Idaho Mining Co. on the Idaho Association claim conducted drifting operations with a crew of 11 men. The ground is 150 feet deep and
the gravel is tightly packed. A small air compressor is being operated to deliver air to a Jackhammer drill-type BCRW 430. With this outfit one man drills on an average of 20 9-ft. holes in 8 hours and sets the swatters in these holes. Before adopting this system it took 2 men 8 hours to set from 4 to 6 of these points.

- Rehn and Freeman with 11 men, Hans Hess & Co. with 7 men and Andresen & Co. with 10 men were drifting "side pay" and old pillars.
- Three or four small outfits drifted on ground farther up the creek. Some drifting is also being done on the creek this winter.

Dome Creek.

- Kinney and Gillis did some drifting and additional drilling. They are sinking a new shaft this winter and will drift on ground prospected on the Diamond C. Claim.
- Cameron and Hansen with a crew of nine men are drifting on an overlooked block on No. 4 above. The shaft is 100 feet deep and in a block stated to contain about 30,000 sq. ft. of ground averaging close to $2.00 a sq. ft.
- Magnuson and Anderson and Shermer Bros. were "sniping" side pay in 180 ft. ground on the Niggerhead Association at the mouth of Dome Creek.

Vault Creek.

- Honkamen, Niemi & Co. were drifting on the Alabama Claim at the mouth of Vault, and several other small outfits were working farther up the Creek.

Engineer Creek.

- Sanson, Gove and Hughes continued drifting on Engineer Creek, employing 9 men. A new shaft is being sunk this winter.

Ester Creek.

- Sholseth & Co. operated on Gold Hill in 110-foot ground which was thawed and dry. A Benson tried underground sluicing on Pioneer No. 2. Excess water and fine material was conducted through a bedrock drain, the coarser material being hoisted by a self dumper. Difficulty was encountered in holding the roof.
- Driscoll & Co., Ed. Hess & Co., Nylaad & Co., and Swanson & Co. conducted drifting operations on a small scale on Ester Creek. Six or more operations were to be carried on this winter. Kinney and Cosgrove are drifting on Happy Creek this winter.

Nome Creek.

- McClelland and Opdyke operated a small locally constructed drag-line line excavator with a 40-foot boom and ¾-yard bucket. A 20 H. P. boiler produced the power. Three men were engaged in the operations and satisfactory results are reported.

REPORT OF MINE INSPECTOR

CIRCLE DISTRICT

Early reports from the Circle district show that the district had a very successful season and a large increase in gold production was made. This increase is due to the resumption of the Berry dredge operations and the unusually wet season, which was of great aid in open cut operations.

- The Berry dredge, at its new location on Mammoth Creek, started dredging on July 2nd. In the 92 days operated, 187,132 cu. yds. were dredged. Frost encountered delayed the operations.
- The C. J. Berry hydraulic plant was operated with a crew of 10 or 12 men on Eagle Creek, and Jack Anderson with about 20 men operated two hydraulic plants on Mastodon Creek. Most of the other operations, including a few winter drift mines, were small.

TOLOVANA DISTRICT

Reports from the Tolovana district for 1922 indicate that the gold output will be about the same as produced in 1921, when the production reported was $285,000. The unusually wet season has been a great help to the district, which has in average years suffered from a lack of water for mining operations. From 150 to 200 men have been engaged in mining during the season. While the drift mines are rapidly diminishing in number, several comparatively large mines are still being operated on Amy and Livengood Creeks. For the most part drift-mining has reached a point where small outfits are working ground left behind by former operations. More attention is being given to the mining of the shallower creek and bench gravels by ground-sluicing and small hydraulic operations.

Livengood or Brooks is the main camp of the district and receives the summer freight for the district via the Tolovana River. At ordinary stages of water, freight is brought from Nenana by small boat and scow. It is transferred around the "Log Jam" by tram, delivered to another fleet and taken upstream to Trappers Cabin, or to West Fork, if water permits. It is then transported by trail to Livengood. Freight is delivered in this way for 10¢ per lb. Winter freighting is done from Ones or Dunbar at a rate of from 5 to 8¢ per lb. Even with this high freight charge, with labor at $5.00 per day and board (cost of board $2.50 to $3.00 per day per man) and with wood costing from $8.00 to $9.00 per cord, the cost of drifting 80 ft. ground, as reported by operators, varies from 60¢ to $1.00 per sq. ft., the average being 75¢ sq. ft.

The following are some of the operations conducted during the season:

Amy Creek.

- Arndt and Moran with about 15 men drifted on a new block of ground during the summer and will continue during the winter. J. Nelson operated an open cut at the head of Amy Creek this summer and will do some drifting this winter.
Livengood Creek.

Jurick and Radak with about 15 men will mine on No. 16 above this winter. The ground is reported to be easy to work. The "pay" occurs in "chicken feed" gravel and averages about $1.00 to the sq. ft.

Tony Silva is sinking a new shaft on ground struck this summer and will work 7 or 8 men this winter. This block of ground is stated to be 60 ft. wide and to yield an average of about $1.00 per sq. ft.

J. McClelland with a small crew conducted hydraulic operations. Several other outfits mined by drifting method and prospected on the creek. Drilling was done on Ready Bullion Creek and lower Livengood.

Lillian Creek.

M. Begler with one man hydraulic bench ground on No. 1 above Discovery, using a canvas hose outfit with intermittent splashes of water. Barker and Godfrey and Chas. Lynn also operated.

Olive Creek.

There were two summer operations on this creek. J. B. Hudson operated a steam scraper plant. The gravels at the mouth of Olive Creek are being considered for dredging.

Gertrude Creek.

Ground-sluicing operations were conducted on two properties during the summer.

Wilbur Creek.

Several open cuts were worked this summer and some prospecting was done. Last winter Enstrom Bros. and Patterson, Wurzbacher, Healy and Koda and Brown Bros. operated. There will be several underground operations on the creek this winter.

HOT SPRINGS DISTRICT

During 1922 there were 30 mining operations conducted in the Hot Springs district in connection with which about 80 men were engaged. There is great diversity in the mining methods used in the district, most of the Alaskan methods in some form, excepting dredging, being in evidence.

In the Tofty section, where some of the gravels carry a considerable amount of tin concentrate, operations will be materially assisted by the increase in the price of tin. The district has produced as a by-product of gold mining, about 300 tons of tin concentrate containing about 60% tin. Hitherto, as a result of the low price of the metal and the high freight rates prevailing but little attention has been given to the presence of tin.

The Hot Springs district now obtains its supplies through Nenana. Freight from Nenana to Hot Springs Landing is carried by small launch and scow at a cost of from $20.00 to $30.00 per ton. American Creek receives its supplies from Tanana via Fish Lake at a freight cost of 3c per lb. From Hot Springs Slough there is a wagon road, 11 miles in length, to Tofty, with a branch road 5 miles farther to Woodchopper. Freight rates from the slough to Tofty are 2½c per lb. and to Woodchopper 3c per lb.

A first class road connects Hot Springs and Eureka, a distance of 24 miles. Eureka is practically a separate district. The freight to Eureka is hauled by tractor at a cost of $55.00 per ton.

The wet season of 1922 been anticipated by the operators much benefit would have been derived from the increased water supply. Provision had not been made, however, to take advantage of the unusually favorable conditions that the season afforded and, unfortunately, the operators failed to profit greatly from them.

Wages for labor in the district are $5.00 per day and board. Board costs $2.50 to $3.00 per day.

Tofty Section.

Cleveland and Howell, employing 8 men, have opened one of the largest hydraulic pits in the district, on the benches back of Tofty. The ground, part of which was formerly drifted, averages 50 feet in depth; interbedded layers of frozen muck and silt overlying the 7 to 5 ft. of gold and tin bearing gravel. This muck and silt was formerly removed by the aid of ground-sluicing in deep cuts with the assistance of four giants, and by the undercutting and caving of the banks; the fine material and water being carried off through a long open drain. Last spring some 10 ft. points using cold water were tried and with the combined nozzle and thawing action of this water under pressure the muck was quickly honeycombed and could then be more easily removed with the giants. The results obtained by this experiment were so satisfactory that the same principle will be adopted next spring on a larger scale using 20 and 40 ft. points. The spacing of the points and time required are still matters for experiment.

After the muck has been stripped off, the gravel is piped to a small Hendy elevator, elevated 15 ft. to sluices, the tailing being stacked with a giant. There is an insufficient water supply during the larger part of the season. Future operations will dispense with the elevator and the system of "piping over the side" will be adopted.

American Creek.

Ed. Nees with a crew of 6 men operated the only steam scraper plant in the district. The ground mined averages 9 feet in depth. About 5½ ft. of muck and light gravel is stripped by ground-sluicing, the "pay" gravel being dug and conveyed directly to the elevated sluice by a one-yard slip tooth scraper. One cut just an acre in size was taken out during the season and a new area stripped for the next season.

Others mining on American Creek were M. Murray, who was ground-sluicing with an automatic gate: Gallon & Miller, who were drifting, and H. Besonen and partner, who were ground-sluicing and prospecting.
Other Creeks.

L. Anderson, A. Mathoone, and Fredlund and Nursten conducted open cut operations on Boulder Creek. Otto Hovelly drift-mined on Cache Creek. Hansen and Lindenberg with 2 men drifted during winter and summer in 115 ft. ground on Hokesley Creek. Hosler and Albrecht drifted on a small block of ground on the Mohawk Claim at Woodchopper. Jno. Radovich and 2 men, using a small portable prospecting outfit, did some drifting on Miller Creek and will continue through the winter.

Early reports were to the effect that 5 or more small drifting operations would be conducted during the winter on the Bock ground near Woodchopper.

Eureka Section.

The Eureka section is characterized by its small hydraulic plants and ground-sluicing operations, most of which depend on an intermittent water supply regulated by automatic dumping or hand operated gates.

The largest of the hydraulic operations was conducted by Frank & Co. on Pioneer Creek. Seventeen men were employed during the spring, but owing to a period of low water, this crew was cut to 6 men and upon a return of better water conditions additional help was not available. Operations at this property consisted principally of the hydraulic mining of shallow bench gravels, averaging 7 ft. in depth, on the right limit of the creek. When sufficient water is available two No. 1 giants are used in the pit, with a head of from 60 to 80 ft. and the gravel is piped into head of the boxes. Otherwise, two 3-inch fire nozzles attached to canvas hose are used. Three pits totaling 150,000 sq. ft. were taken out this season. It is stated that twice this amount is handled when water is plentiful. Owing to a cold spell of weather and lack of water, operations at the Frank property were suspended September 7th.

Similar operations were conducted by Johnson, Sondstedt and Johnson near Glenn Gulch; Lane and Lund, on Rhode Island Creek; Sidney Ridge; Farmer and Jones on Eureka Creek, and Frank Stevens on Excelsior Bar. The first four of these operations mined 210,000 sq. ft. of ground varying from 2 to 12 ft. in depth and carrying from 5 to 10 cents in gold per sq. ft. For the greater part of the season they have water only in intermittent splashes of from 5 to 10 minutes at a time. The ditches are used as reservoirs, the water in them being released by automatic or hand operated gates upon reaching a certain level. The average cost of four operations of this type during 1922, including depreciation and interest charges on plant, was 6e per sq. ft. for an average depth of 6 ft.; or 27c per cu. yd.

On Omega Creek, Olsen and Evenson, with a hand operated gate, ground-sluiced and shovelled in 8 ft. ground at a cost of 37c a sq. ft. Erickson and McLeod also ground-sluiced with an automatic gate. A little drift mining was also done on this creek during the winter.

Others mining in the district were Chas. Smith on Alameda Creek, Louis Siler on Thanksgiving Creek, Frank Stevens, J. R. Green and Jno. Malin on Eureka Creek.

RAMPART DISTRICT

In 1922, nine open cut operations employing 19 men and three winter drifting operations employing 6 men were conducted in the Rampart District. It is estimated that the gold production for the year will not exceed $20,000.

A wagon road which follows the Big Minook Creek from Rampart is kept in repair to the Six Mile post. There is a branch road going about one mile up Hunter Creek and a good branch road to the head of operations on Little Minook Creek. Most of the mining is from 5 to 9 miles out of Rampart, the main operations being on Hunter and Little Minook Creeks. Freight from Rampart to the camps costs during the summer from 1 to 2½ cents per pound. Winter freight costs from ½ to 1½ cents per pound.

Hunter Creek.

A. Ott with one man is operating a hydraulic plant on shallow bench gravels on the left limit of Discovery claim.

The largest operations in the district are those of Chas. Swanson, who is operating a hydraulic plant on the left limit bench on No. 21 above, which is just below Dawson Creek. The ground is all frozen and in the face of the present pit there is 30 feet of muck and 9 feet of gravel. The average size of pits mined is about 200x100 feet. Water supply is obtained from Upper Hunter Creek, being conducted through 4000 ft. of ditch, 600 feet of flume and 5400 feet of pipe line from 19 inches to 7 inches in diameter, with an effective head at the pit of 180 feet. The gravel is stripped of the muck by using two giants on top and one in the pit for under-cutting. Powder is used occasionally to break down the bank. Gravel is piped into the head of 18-inch boxes. The many boulders encountered are carried and piled to one side. Owing to lack of sufficient dump room, a No. 1 Giant with a 2½-inch nozzle must be kept in almost constant operation, stacking tailing. When running full shift six men are hired. Only one pit was opened this season, and, owing to lack of water from July 10th until the first frost in early September, one corner of the pit was not completed. Operations were first started by Mr. Swanson in 1903. The plant was enlarged in 1917.

Little Minook Creek.

Markoff and Ross, on No. 3 below, completed their first cut, this year, by booming with an automatic boxgate and shovelling-in.

Climie, La Porte and Nelson, on No. 7, using similar methods, took out a cut 600 ft. long by 12 ft. wide, in ground formerly drifted upon and averaging 20 ft. in depth. While drifting on No. 9 claim last winter these men found a nugget valued at $350.

Others mining in the district are Thos. Gamble, on Hoosier Creek; Thos. Antonsen, on Little Minook, Jr.; Frank Hawley and Geo. Pride, on Slate Creek. All these operators were using booming-gates. O. C. Clemens
of drift mining (exclusive of cost of plant) as determined from figures
steam thawing costs are 45 cents per cubic yard. The cost of sluicing is
strict. The ground being drifted upon varies from 60 to 50 ft. in depth
operations on Trail Creek. One drift mine was worked during the summer
in the district, engaging 75 men. Most of the production came from drift-
mined. This cost is equivalent to about $5.00 per cubic yard. The average
During the winter, when most
obtained at 6 plants. varies from 60 cents to $1.00 per square foot, and
conditions add materially to the cost of mining. The average value of the
gold content of the gravel mined is from 7.5 cents to $1.25 per square foot.

Mining conditions vary considerably on the different creeks. The cost
drill of the jackhammer type is used to make holes for the steam sweaters.

Spruce Creek.
M. D. McCarty and 3 men conducted successful drifting operations on
Spruce Creek last winter and continued their work until early summer. The ground mined is 55 feet deep. It is easy to mine, being composed of
free-washing gravel. Conditions on Spruce Creek and Tamarack Creek are
similar in character and afford the cheapest mining costs in the
district. Prospecting on these creeks has been done during the summer
and one new shaft will be sunk this winter.

Poorman Creek.
Dennis Coyle with 7 men conducted one of the largest drifting operations
during the winter. The ground on his property is 80 ft. deep and the
gravel contains much ice. Some heaving ground and water encountered
in one portion of the workings have added materially to the cost of mining.
True Manuel and 2 men operated during the winter and summer on a
small block of ground adjoining Coyle. Some heaving and wet ground
was also encountered on their property.

McGedigan & Company drifted on 60 ft. ground on Duncan Creek, a
tributary of Poorman.

Solomon Creek.
At the Big Four property on Solomon Creek 7 men were engaged in
drifting in ground 60 feet deep. The gravel here also contains much ice
with occasional thawed streaks. The maximum width of "pay" is from 60
to 70 feet.

Fulkisson and Mossy with 2 men were "drifting" further up the
Creek in ground of similar depth but easier to mine. The gravel is free of
ice streaks and is solidly frozen. The pay channel is 25 ft. wide, and is
said to carry $3.00 to the square foot.

Flat Creek.
Wm. Midgley, Morton and McDonald, Wilkey, Ferry and Cannon, Gil-
man and McKeIvey, Powers and Bailey were drifting-ground and prospecting
in a small way on Flat Creek.

On Tamarack Creek, Bettles and Pilke were drifting-profitable
drifting operations. On Long Creek, Chas. Walker with 4 men was "snip-
ing" a corner of ground, using a No. 3½ Keystone drill as a hoisting and
steam plant. B. J. Bowers and 2 men were ground-sluicing and shovelling-
in on Greenstone Creek, and small open cut mining was conducted on
Bear Pup, Swift, Trail, Nowitna and Ruby Creeks.

RUBY DISTRICT

Early reports indicate that the gold production of the Ruby District
for 1922 was about $120,000, which is a considerable decrease from that of
the preceding year. During the year there were about 25 outfits at work
in the district, engaging 75 men. Most of the production came from drifting
operations on Spruce, Poorman, Flat and Solomon Creeks and from the
operations on Trail Creek. One drift mine was worked during the summer
on Meketchum Creek and one on Long Creek and several outfits operated
on Tamarack and Glacier Creeks. Open cut methods by ground-sluicing
and shovelling-in were conducted on Greenstone, Swift, Bear Pup, Trail,
Nowitna and Ruby Creeks.

Freight costs in the district are unusually high. A small amount of
freight still comes up the Yukon via St. Michael, but, by reason of better
service, most of the freight now comes down river by small launch from
Nenana. The freight rate from Nenana to Ruby is $25.00 per ton. See
Table 3. There is a good wagon road from Ruby to Long, a distance of
29 miles. All mining operations are being conducted within 25 miles of
Long. Those on Flat and Solomon Creeks are the most remote. From
Long, an old winter sled trail is used for summer hauling by team and
wagon. Much of this trail is through low swampy country and travel over
it is exceedingly difficult. From Ruby the summer freight rate to Long is
3 cents per pound; to Greenstone Creek, 5 miles beyond, 10 cents per
pound, and to Flat and Solomon Creeks 20 cents to 25 cents per pound.
During the winter, when most of the general supplies are taken in, the
rate to Long is 2 to 3 cents per pound, and 5 cents to the most remote
areas.

Drifting is the principal mining method employed in the Ruby dis-
trict. The ground being drifted upon varies from 60 to 80 ft. in depth and carries narrow and comparatively short "pay" channels. These
conditions add materially to the cost of mining. The average value of the
gold content of the gravel mined is from 75 cents to $1.25 per square yard.

Mining conditions vary considerably on the different creeks. The cost
drill mining (exclusive of cost of plant) as determined from figures
obtained at 6 plants, varies from 60 cents to $1.00 per square foot, and
averages 85 cents per square foot when from 4 to 5 feet of gravel is
mined. This cost is equivalent to about $5.00 per cubic yard. The average
steam thawing costs are 45 cents per cubic yard. The cost of sluicing is
33 cents per cubic yard. Wood costs from $8.00 to $12.00 per cord at
the mines. Wages are $6.00 and board for an 8-hour shift. The average
cost of board is $3.00 per day.

The principal operations in the district are as follows:

Meketchum Creek.
Farrell and Warren with four men are drifting in ground 80 ft. deep. The
pay channel here is from 50 to 75 ft. in width, most of the gold occurring in clayey "sediment" on a blocky greenstone bedrock. Owing to
the presence of angular blocks of bedrock in this ground, much difficulty
has been encountered in setting the thawing points. To overcome this, a
drift of the jackhammer type is used to make holes for the steam sweaters.
KOYUKUK DISTRICT

There are about 75 men in and around Nolan, which is the principal camp of the Koyukuk district. While there is still a little drift mining going on in the district, attention is now centered principally upon bench deposits. The mining of such deposits is handicapped, however, by lack of water at sufficient elevation. Most of the operations are small, many of them being conducted by partnerships of two or three men.

The district is one of high costs. Freight is brought up the Koyukuk River from the mouth to Bettles in from 6 to 7 days by small boats at a cost of 4 cents per pound. At Bettles it is transferred to shallow, horse-drawn, or poling, boats and taken to Nolan, a distance of 70 miles, at a cost of from 6 to 7 cents per pound.

Wages are $6.00 per 8-hour day and board, which costs from $3.50 to $4.00 per day. Wood costs $16.00 to $17.00 per cord at Nolan.

Most of the operations in the district are on Nolan Creek. Seven small outfits were working the bench deposits, which are reported to be extensive. Good pay was found on the third tier bench. What little drift mining was done was mostly of a "sniping" nature.

Workmen, Dow, Foley and Wool, and Wassamaker, all of whom were sluicing on the left-limit benches, report a successful season.

Watts and Brady, and Pingle and Neeb mined on the Hammon River benches. Jensen and Larsen mined on Wild Creek; Matthews, with several men, ground-sluiced and shoveled-in shallow creek ground on Rye Creek.

There was very little mining on Emma, Porcupine and Slate Creeks, or in the Hog River section. Gilbert and Ellington, on Jim Pup, report good "pay," and James Kelly was mining on Bettles River.

A report was received during the summer that Ben Sirr has discovered coarse gold on the benches on Sixty Mile Creek about 60 miles up John River.

CHANDALAR DISTRICT

The Chandalar district, which lies north of the Yukon River and east of the Koyukuk district, is one of the most isolated of the placer camps of Alaska. From Beaver on the Yukon, it is 75 miles to Caro, the main settlement of the district. It is 40 miles from Caro to Little Squaw Creek, where most of the mining is being done. Freighting into the district from Beaver is practically all done during the winter by dog team. The rate for such haulage is 15 cents per pound to Little Squaw Creek.

Cost of wood and timber is excessive, as it is obtained at a distance of from 22 to 49 miles from the camps. Last winter the cost of wood at camp was from $9.00 to $50.00 per cord.

Prevailing wages for labor are $6.00 per day and board. Cost of boarding men is reported to be $4.00 per day per man.

Otter Creek.

The Riley Investment Company operated its dredge on Otter Creek from May 20th until some time in November. A very successful season is reported. About 30 men were employed.

The Beaton-Donnelly dredge operated all season. It was being worked downstream toward ground owned by the dredge operators, on lower Flat Creek. This ground will probably be dredged next season. Though working downstream, a creditable gold recovery has been made. About 15 men were employed on and about the dredge.

On Granite Creek, the Finn boys were hydraulicicking creek gravels. Three men were ground-sluicing on the Malamute Pup, and at the mouth of Glenn Gulch the Richardson Bros. with 2 men were ground-sluicing shal-
low creek gravels. A small hydraulic plant is being installed at this locality. Four men have been ground-sluicing on the Pack Mule Association. Flat Creek.

D. Strandberg with a crew of about 20 men operated a steam scraper plant on the bench at the head of Flat Creek and on the Upper claim he conducted hydraulic operations with a crew of about 30 men.

Thomas, Myrtle and Johnson are installing a hydraulic plant and will be ready to operate in the spring.

Hydraulic operations were conducted on the Summit Claim, where the water is stored in small reservoirs and is supplied intermittently. Ground worked here this year is reported to have been 8 feet deep and to have averaged $1.50 to the square foot.

Pete Givovich with 6 men conducted hydraulic elevator operations on ground averaging 20 feet in depth.

Chicken Creek.

Mathison Bros. with 6 men hydraulic-ed with intermittent water supply at the head of Chicken Creek, which flows into Bonanza Creek. A very good clean-up is reported. The ground is rich but the water supply is very limited.

Willow Creek.

Hanley and Olson with 18 men conducted winter drifting operations in ground 24 feet deep and continued operations through the summer. The French boys, employing about 20 men, operated three hydraulic elevator plants on ground 8 ft. to 10 ft. in depth. While a fair supply of water is available at their properties, all three plants cannot be successfully worked at the same time. Loranger & Company operated their steam scraper plant. Harry Johnson and Mechtcher Bros., with 7 men, operated their drag line excavator on Willow Bench. This Bucyrus excavator has a 60-foot boom with a 1½ cubic yard bucket. The 60 H. P. boiler burns about 1½ cords of wood per day. The coal costs $14.00 per cord. The ground worked is from 22 feet to 24 feet in depth, of which about 18 feet is muck. This muck is ground-sluiced off; the gravel is dug by excavator and dumped into a movable hopper that runs on a track and dumps into the boxes. It is reported that ground running as low as 16 cents per square foot will pay expenses, and that 100,000 square feet of ground has been removed by the excavator in six weeks time.

KUSKOKWIM DISTRICT

The placer gold production for 1922 in the Kuskokwim district will show an increase over the preceding year, and is estimated to have a value of about $550,000. The increase in production over that of the previous years is due to the very successful season enjoyed in the operation of the Candle Creek dredge rather than to the fact that additional dredges have been erected in the district. Numerous small open cut mines and a few small drift mines are being operated on many scattered creeks in the district, but prospecting and mining is handicapped by high costs. Wages are $6.00 to $7.00 and board per 10-hour day. The average cost of board is $3.00 per day per man.

The lower Kuskokwim has experienced a quiet season. A little sluicing was done on Bear, Mabel and Canyon Creeks. The hydraulic plant of the Tuliksak Mining Company on Spruce Creek, a tributary to Bear Creek, is reported to have operated with a crew of 5 or 6 men. Further drilling is reported to have been done on the Tuliksak River.

In the Georgetown section, a new hydraulic plant has been installed on Crooked Creek by Al. Walsh and will start operations in the spring. Harry Stevens, with several men, has been ground-sluicing on a tributary of Crooked Creek and some drift-mining was done. A little sluicing was done on the Holita, although most of the work was of a prospecting nature.

In the upper Kuskokwim, a few men were conducting small open-cut and drift operations on Ruby Creek. Prospecting was also conducted on the Tatulina River. The Kuskokwim Dredging Company operated its dredge on Candle Creek for 128 days out of a total available time of 145 days. 144,250 cubic yards were dredged, and the gold production is estimated at about $435,000. The ground dredged averaged 14.2 feet in depth. Floods handicapped the operations.

INNOKO DISTRICT

Increased attention was given to dredging in the Innoko District in 1922, although several small hydraulic plants were operated during the season on Little Creek. Several open cuts and a number of small winter drift mines were worked on Ophir Creek.

The Flume Dredging Company operated successfully on Yankee Creek. This company started its first season's dredging operations in 1921. The dredge is digging ground averaging 12 feet in depth. There is about 2 feet of overburden, which is ground-sluiced off. By keeping the ground stripped well ahead, the gravel thus exposed becomes thawed. The machinery and material for the Little Creek dredge, owned by the same company, has been hauled by tractor from Tacotna, and the dredge will be ready to start operations in the spring. The company will install a 300 H. P. hydro-electric plant on the Innoko River for the operation of these dredges.

The Innoko Dredging Company shipped the machinery of the old Greenstone dredge from Ruby this summer, via St. Michael. The dredge has been landed at McGrath, and is being hauled to the property to be dredged on Gaines Creek. It is reported that this dredge will be ready for operation early in the coming season.

MARSHALL (WADE HAMPTON) DISTRICT

Placer operations were conducted on a small scale in the Marshall or Wade Hampton district, on Willow, Disappointment, Elephant, Buster
and Stuyak Creeks. The main operations were on Willow Creek, about 12 miles from Marshall or Fortuna Ledge. A hydraulic plant employing 4 to 6 men was operated and five outfits, employing a total of about 25 men, were ground-sluicing and shovelling-in. Local interests have been drilling and sinking shafts on Lower Willow Creek for the past few years and plan to install a hydraulic plant.

On Disappointment Creek, 5 men were engaged at a hydraulic operation, and one man was hydraulicking on Elephant Creek.

On Buster Creek, near Russian Mission, it is reported five men were shovelling-in, and on Stuyak Creek, which enters the Yukon about 8 miles above Russian Mission, seven men were shovelling-in.

**SEWARD PENINSULA**

Within a period of 25 years ending in 1921, Seward Peninsula has produced gold which, together with the silver recovered as a by-product, has an estimated value of $2,400,000. In 1921, the production was valued at $1,462,000. During that year a total of 126 placer mines employing about 622 men were operated during the summer. During the previous winter 14 mines were worked, employing 64 men. Included in these operations were 16 dredges, employing 182 men. These dredges dug 1,699,000 cu. yds. of gravel, yielding about $600,000, or 47.2% of the total gold production for that year.

Early reports indicate that the production for 1922 was about $1,250,000. While this amount represents a decrease as compared with the previous year, it is a creditable output considering the unusual cold, rainy, backward season that greatly delayed the start of placer operations throughout the Peninsula. Commencement of summer placer operations on Seward Peninsula await the arrival at Nome of the first boat from Seattle. This year the date of such arrival was June 14th. At that time there had been but little thawing of the ground. No appreciable water supply was available until the latter part of June. Most of the hydraulic operations did not get under way until early in July. Dredging operations were greatly handicapped by the delayed natural thawing of the gravels. Later in the season floods caused considerable trouble and delay in some localities. Very little drift mining was done. Most of the gold production came from the Nome and Council districts. It is estimated that over 65% of the gold output was produced by dredges and by large hydraulic elevator plants conducted at Little Creek near Nome.

As a result of the success attending the thawing of frozen gravels by the cold water method, a new field has been opened to gold dredging on Seward Peninsula. This fact is evidenced by the recent important activities of the Hammon Consolidated Goldfields Company. This company has acquired the holdings of the Pioneer Mining Company and is now having constructed at Little Creek the two largest dredges in Alaska. An electric power plant equipped with Diesel engines is being erected at Nome to supply the necessary power. The total cost of the enterprise is said to be about $1,250,000. All construction work on the project is being done by the Yuba Manufacturing Company. The dredge hulls and housing have been completed, and the machinery is being installed this winter. It is expected that everything will be in readiness to start dredging operations by June, 1923. The dredges will have 9 cu. ft. buckets on a close-connected line and it is estimated that each dredge will dig from 6000 to 7500 cu. yds. per 24-hour day, or about 200,000 cu. yds. per month. The hull, trusses, and gantries are of steel; the bottoms, sides and decks are of wood. This type of construction is considered superior to all-steel construction for northern conditions. One dredge is designed to dig 40 feet, the other 60 feet, below water level. The revolving screens are 7 feet in diameter and 40 feet long, with 1% inch holes in the nuggest section. The screen openings are 1% to 5% inch tapered holes. One stacker is 150 ft. long, the other 142 ft. The stacker belt is 36 inches wide. The gold-table area is 400 sq. ft. Five pumps will supply 12,000 gals. of water per minute. The main drive for the bucket line is equipped with 2 250 H. P. motors. The pump motors are of 150 H. P. The total power horse power provided is 592 H. P. The power plant consists of three 525 H. P. Wkp-spoor full-Diesel engines directly connected to three 538 K. W. General Electric generators. Current will be generated at 2200 volts, stepped up to 11,000 volts, and transmitted 3½ miles to the dredges. The ground to be dredged contains much clay and muck and varies from 30 feet to over 76 feet in depth. Bedrock is composed largely of schist, which is easily dug. In order to bring the deeper ground within the digging depth of the dredges, the overlying muck will be removed by ground-sluicing. The dredges will be steam heated, and, by keeping the ground thawed well in advance, it is expected operations may be extended over a season of from 6 to 7 months. Several acres of ground were thawed with a 150-point cold water plant this fall and improvements in the practice were worked out. A 1500-point plant will be placed in operation early in the spring.

Another attempt to prospect for and work the erroneously reported rich gravels lying off the Nome beach was made this summer by Seattle interests. With a small 25 H. P. gasoline launch capable of travelling 6 miles per hour and containing a pump to operate a combination water jet and suction tube in which the gold saving device was enclosed, it was hoped to dredge offshore, running to cover when the storm came up. Rough weather kept the boat within the jetty most of the time. The riches were not found and the operations were finally postponed indefinitely.

The first boat of the season, the "Victoria," arrived at the Nome roadstead on June 14th, but, due to shore ice, freight could not be discharged until about 4 days later. Ice conditions also interfered with coastwise boats so that operators were delayed in reaching their properties with supplies. Operators in the Fairhaven district were unable to reach their properties until about July 5th. There were four sinkings of the "Victoria" during the season, the last sailing from Nome being October 24th.
The clothing was prepared in the United States and was shipped from New York to Alaska. The cost of the clothing was approximately $1.50 per suit. The clothing was packed securely and was transported by ship to Alaska. The clothing was then distributed to the miners in the gold mines.

The miners were provided with clothing that was suitable for the cold weather conditions. The clothing included coats, hats, gloves, and boots. The miners were also provided with food and other supplies.

The clothing was distributed to the miners in the gold mines on a regular basis. The miners were paid for their work and were provided with housing and other amenities.

The clothing and supplies were supported by the United States government and were funded by the miners. The miners were required to contribute a portion of their earnings towards the cost of the clothing and supplies.

The clothing and supplies were delivered to the miners in the gold mines by ship. The ships were equipped with facilities to handle the clothing and supplies.

The clothing and supplies were essential for the survival of the miners in the cold and harsh conditions of the gold mines.
on a 12-hour basis, and, in most cases, transportation from and to the States each season is also paid by the operator.

Dredging.

In 1922, 15 gold dredges were operated on the Peninsula, and, while details of these operations are still incomplete, it is estimated that about $650,000 worth of gold was produced. One dredge was operated in the Kouragok District; six in the Nome District; three in the Solomon District, and five in the Council District. (See Table 1). About 145 men were engaged in the dredging operations. The Arctic Creek dredge operated for only 2 or 3 weeks. The Bangor dredge, at its new location on Anvil Creek, started operations in August and, in the 53 days operated, recovered over $1,100 per day. About $5,000 cu. yds. were dredged. The Behring dredge dug downstream through old tailing all season. It has now reached its “ground” and will resume regular operations in the spring.

The largest producers on Seward Peninsula were the two dredges on Ophir Creek operated by the Wild Goose Mining Company. The No. 1 dredge of this company operated for about 115 days, which is the longest operating season reported for any of the dredges in 1922. The length of the average operating season this year was about 56 days. The season was unfavorable for dredging, because of the retarded thawing of seasonal frost. Trouble and delays from floods were also experienced by some of the dredges. The Warm Creek and Crooked Creek dredges are reported to have completed the dredging of their ground. The former may be removed to Dine Creek and the latter to the Niniluk River. Two other dredges will finish dredging operations in 1923, and in 1924 dredging on Ophir Creek will be finished. It is reported that the Kugruk dredge is being taken to the Keewalik River at Candle and is to be operated there next season. The Casadepaenga dredge is being moved this winter to a new location, 2½ miles down-river, at Canyon Creek.

Dredging Costs.

From more or less incomplete data obtained from the operators of 11 dredges on the Seward Peninsula for the year 1921, an attempt has been made to estimate the cost of dredging for that year. Each operation has been separately estimated and the average dredging cost derived. Included in these estimates are figures covering the operations of 4 dredges in the Nome District, 3 in the Solomon District and 4 in the Council District, operating under greatly varying conditions. While in two cases a very small amount of ground was thawed during the season’s operation, this item can be disregarded and the estimates given are for naturally thawed or unfrozen gravels.

These 11 dredges dug 1,323,500 cu. yds. at an average operating cost of 21.6c per cu. yd. Where there was superintendence or management this item has been included in the operating cost. The individual operating costs range from 15c to 33c per cu. yd. Three of the dredges referred to dug 740,000 cu. yds. Many of the dredges have been acquired by the present owners at a nominal cost. The total capital invested in these eleven dredges and their equipment is estimated at $590,000. They could not now be duplicated for twice this amount. In considering costs, the amortization of the invested capital must be considered. The average depreciation charge amounts to 4.64c and simple 6% interest to 2.67c per cu. yd., or a total of 7.31c per cu. yd. For individual operations this item ranges from 2c to 20c per cu. yd. The cost of land, royalty, etc., has not been considered. The number of operating days varied from 75 to 159—the average was 100 days.

It should be noted that the season of 1921, to which the above figures apply, was longer and operating conditions were more favorable than the average. Were it possible to obtain dredging costs over a period of years, the resulting figures would be materially higher than those given for 1921. The cost of power in most cases, particularly where distillate is used for its generation, is a large and serious item. The following table gives estimates that have been made of the cost of the power used in the operation of the eleven dredges above considered. Only the cost of fuel and lubricating oil and the cost of labor in attendance has been taken into consideration. On most of the distillate dredges, the engineer devotes only a portion of his time to the engines.

<table>
<thead>
<tr>
<th>No. and type of Dredges</th>
<th>Cu. Yds. dug in Season</th>
<th>Total H. P.</th>
<th>Per H. P. Day</th>
<th>Per Cu. Yd. Dredged</th>
<th>Per H. P. Day</th>
<th>% of operating cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Distillate</td>
<td>209,700</td>
<td>320</td>
<td>$441.00</td>
<td>$.312</td>
<td>$.138</td>
<td>48.6%</td>
</tr>
<tr>
<td>4 Semi-Diesel (24&quot; oil)</td>
<td>475,250</td>
<td>342</td>
<td>331.50</td>
<td>.099</td>
<td>.096</td>
<td>33.1%</td>
</tr>
<tr>
<td>1 Diesel-electric (24&quot; oil)</td>
<td>78,000</td>
<td>200</td>
<td>$7.75</td>
<td>.034</td>
<td>.14</td>
<td>20.0%</td>
</tr>
<tr>
<td>1 Hydro-electric 2020 per day 140</td>
<td>140</td>
<td>$6.80</td>
<td>.092</td>
<td>.15</td>
<td>12.9%</td>
<td></td>
</tr>
<tr>
<td>Total-11 dredges</td>
<td>1062</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average-11 dredges</td>
<td>12,470 per day</td>
<td></td>
<td>$910.24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The average cost of distillate is 63c per gal.; of semi-Diesel oil, 36c per gal., and of Diesel oil, 80c per gal.

In the above estimate the charge of $50.00 per day for hydro-electric power includes only the proportional ditch maintenance and labor cost. The plant considered is operated about 100 days each season, an auxiliary distillate engine being used when water supply is low.

Hydraulic and Other Open Cut Mines.

The largest placer mining operations conducted in Alaska are those of the Pioneer Mining Company at their hydraulic elevator plants on Little Creek. These operations were taken over this year by the Hammon Company. Four pits were operated and a total of 400,000 cu. yds. were mined. About 100 men were employed. The first elevator was started June 12th, although there was hardly enough water for it at that time. Operations continued until October 14th, the ditch remaining open until the 19th.
Drift Mining.

Owing to the high cost of fuel and timber, only a very small amount of drift mining was done on Seward Peninsula in 1922. Practically all the drifting done was confined to the winter season. The largest drifting operations were those of Mebas & Company on the Submarine beach west of Nome, where about 25 men were employed and about 6,000 cu. yds. of gravel was mined during the winter.

Five or six small outfits did some “sniping” at the head of Dexter Creek, on the “Third Beach Line” and on Anvil Creek. A small number of similar operations were conducted in other sections. Most of the drifting was done at Dime Creek in the Koyuk District, where wood is obtainable. As a whole, the above operations are reported as not having been very successful, and several of the Dime Creek operations were flooded out. Early reports state that an increased number of drifting operations are being carried on around Nome this winter.

Drifting is still being conducted under the lava capping in the Inmachuk district. Good indications have been found in these buried gravels, although no “pay” has as yet been reported.

Other hydraulic elevator plants operated were those of Lee and Swanberg on Osborne Creek, and those of the Wild Goose Mining Company on Ophir Creek. Two were also reported as having been operated in the Kougarok District and three in the Inmachuk District. A Cordavada company has acquired the old Fairhaven Ditch Company holdings in the Inmachuk District. This company, employing 22 men, operated for 59 days, and will operate on a larger scale next season. A Rydeen on Boar Creek is the Candle Section operated a rubble elevator plant with a crew of 14 men. The Keewalik Mining Company near Candle operated a rubble elevator on the old Candle Ditch Company property, employing 18 men. The company reports its most successful season. It operated for 100 days and mined 35,000 cu. yds. of high grade ground

Thirty-five or more hydraulic plants, some of them very small, were operated in various districts. About 12 or more plants were operated in the Nome section; 4 in the Kougarok district; 2 in the Inmachuk district; 3 in the Solomon district; 2 at Dime Creek; 3 at Candle; 1 in the Casadepaga district, and 4 at Bluff. It was an unusually good season for the hydraulic miners.

One steam scraper plant is reported to have been operated on Dime Creek by Wallace Porter.

Numerous small ground-sluicing and shovelling-in operations were conducted in the various districts, although the amount of gold produced by this form of mining was very limited. A few men were also engaged in mining on the Nome and Bluff beaches, where the work still made good wages.

The prosperity of the Hyder region is reflected in the improved transportation facilities recently made available. During the year just closed a dock, capable of accommodating ocean-going steamers, was built at the American town of Hyder, which is now a regular port of call on the northbound trips of the steamer Jefferson, plying between Seattle and Southeastern Alaska. This arrangement enables mining operators and others to ship equipment and supplies direct from the States to Hyder and deliver them to any point within the district without the necessity of passing customs inspection. Heretofore the necessity has existed of either landing all materials in Canadian territory or of billing them to Ketchikan and then trans-shipping them by gasboat to the small-boat landing at Hyder. Unloading facilities were very poor there and the landing was approachable only by shallow-draft lightering craft operated during periods of high tide.

The town of Hyder is the supply point for all the mining district. Several hotels, a bank and a number of general merchandise stores afford facilities for outfitting and securing supplies locally. The town is also provided with a lumber mill and with livery stables, where arrangements for freighting to outlying points may be made. A wagon road maintained by the U. S. Bureau of Public Roads extends from Hyder up the valley of Salmon River, a distance of thirteen miles to the Canadian boundary. Practically all mining properties within the Hyder District are reached by short trails leading from this road and several are almost immediately adjacent to the road.

For a description of the geographic and geologic features of the region and those of individual mining properties reference is made to “Ore Deposits of the Salmon River District, Portland Canal Region, Alaska,” by Lewis G. Westgate, contained in U. S. Geological Survey Bulletin 725, Mineral Resources of Alaska, 1920. This description is accompanied by a geologic sketch map of the district and list of reports that have been published relating both to the Alaskan and Canadian sections of the Portland Canal region. An interesting description of the region and of conditions existing in the fall of 1922 has been given by Mr. Geo. J. Young in the
Fish Creek Mining Company.

The property of the Fish Creek Mining Company was operated throughout the year 1922, with an average of 9 men employed, and about 600 feet of underground development work was completed. Most of the work done during the year was confined to the Olympia Extension Vein, initial development of which was done during 1921. A description of this work is given in our report for the year 1921 following a visit to the property in November of that year. At that time a crosscut tunnel 140 feet in length had just cut the vein at a depth of approximately 50 feet from the outcrop. Subsequently a drift 100 feet in length was run on the vein in a southeasterly direction, a shallow winze was sunk, and some stoping was done above the drift. Following the completion of this drift a new camp, consisting of a bunkhouse, a mess house and a blacksmith shop, was erected on the Single Rose claims just east of Skookum Creek on the opposite side of the ridge upon which the old camp was situated and across the summit of which the outcrop of the Olympia Extension vein extends. With this new camp as a base a drift tunnel 100 feet in length was driven northwesterly upon the vein at an elevation of 2,675 feet. There was also started on the outcrop another tunnel, known as the "lower tunnel," 150 feet lower in elevation than that above described and just west of and 25 feet in elevation above Skookum Creek. The portal of this tunnel is on the Single Rose claim.

Surface stripping and the discovery of natural outcrops are said to indicate the continuity of the Olympia Extension vein for a distance of approximately 2,000 feet along its strike. The vein is a quartz-filled fissure. The valuable ores are argentiferous galena and tetrahedrite. During the past winter a small tonnage of ore was produced. The output was sacked and prepared for "rawhiding" to the wagon road.

The property has recently been acquired by the American Mining and Milling Company and further extensive development work has been planned.

Titan Group.

The Titan group of claims is situated at the head of Fish Creek and lies east of the property of the Fish Creek Mining Company and between it and the International Boundary. Operations upon it were begun in July, 1922. Since that date from 6 to 8 men have been employed, a camp has been erected, and a tunnel 150 feet in length has been driven.

At the present time the property is quite difficult of access as the pack trail from the Salmon River road extends only as far as the Fish Creek Mining Company's ground. From there to the Titan group supplies and equipment have to be packed on the backs of men.

Hovland Property.

The Hovland property adjoins that of the Fish Creek Mining Company on the south and consists of five claims owned by John Hovland, of Hyder. The horse trail leading from the Salmon River road to the Fish Creek Mining Company's group traverses the Hovland property from south to north and crosses the outcrop of the vein upon which most of the development work has been done. Tunnels have been driven on separate veins found on three claims of the group. These tunnels and the mineralization disclosed by them are described by Westgate in U. S. Geological Survey Bulletin No. 722, Mineral Resources of Alaska, 1920, pp. 138-139.

Riverside or Seven Mile Group.

Development work has proceeded actively during 1922 on the Riverside group of claims, owned by Lindeborg Brothers and situated at Seven Mile station on the Salmon River road. A crew of approximately 15 men has been steadily engaged in driving a drift tunnel on the vein. This tunnel is now 300 feet or more in length.

During the year a compressor driven by a Diesel engine was placed upon the property and machine drills have been used in the tunnel work. The mine camp has also been improved by the erection of a two-story bunk and mess house.

The work above described followed the bonding of the property to H. C. Strong, of Ketchikan, who is now in control of the mining operations.

The Daly-Alaska Group.

The Daly-Alaska property, situated just south of Eleven Mile station on the Salmon River road, has formerly been referred to as the New Alaska group.

In 1921 the property was bonded to Mr. Pat Daly and associates, who formed a company called the Daly-Alaska mines. This company proceeded with development work upon the claims throughout the year 1922, the expenditures involved amounting to approximately $30,000.00. Recent press reports indicate that the property has again changed hands and that work upon it will be continued upon an enlarged scale and with much additional equipment.

Stoner Group.

The Stoner group of claims lies between the Daly-Alaska group and the International Boundary. A small amount of development work was done on the property during the past year.

Alaska Premier Property.

Development work has progressed during 1922 on the Alaska Premier group, which adjoins the Daly-Alaska and Stoner groups and is owned by the Alaska Premier Mining Co., Alaska Building, Seattle, Wash.
**PRINCE OF WALES ISLAND**

Mining on Prince of Wales Island in 1922 was on about the same scale as during the previous year, when production was limited to the output of one small copper mine. The present advanced price of copper should offer encouragement for further development work on several properties that have been idle since the close of the War.

Rush and Brown Mine.

The Rush and Brown copper mine at the head of Kasaaan Bay, on the east coast of Prince of Wales Island, has been a steady producer for many years and made about its usual output in 1922. The property is operated by Mr. U. S. Rush.

Considering the handicaps under which operators of small copper mines in Alaska have labored for many years, the Rush and Brown mine has made an admirable record. Active operations have been continued throughout the period of depression and high costs following the War. This fact is evidence of praiseworthy economy, determination and faith.

Salt Chuck Mine.

The copper-platinum-palladium property known as the Salt Chuck Mine is now owned by the Platinum-Palladium Producing Corporation of Seattle, Wash. Financial entanglements and reduced market value of the minerals produced caused a suspension of operations at this property in 1920. It has remained idle since that time. The ore deposits of the Salt Chuck property are of an interesting type. A detailed description of them is given by J. B. Mertie, Jr., in "Mining in the Juneau and Ketchikan Districts," published by the U. S. Geological Survey in Mineral Resources of Alaska, 1919, pp. 121-127.

Kassan Gold Mine.

The property now called the Kassan Gold Mine has hitherto been variously referred to as the Dunton, Julia and Harris Creek mines. It is situated on the north side of Harris Creek about a mile from the point where that stream enters the head of Twelve Mile Arm. The property is now held by the Kassan Gold Co., of 510 Andrus Building, Minneapolis, Minn.

Mining operations conducted during 1921 were described in the report of the Mine Inspector for that year.

An output of 425 tons of ore is reported for the year 1922. During the year drifts and levels were extended an aggregate of 150 feet. From 3 to 4 men were employed underground and from 5 to 6 men on the surface.

The ore is chiefly valuable for its gold content, though some silver is also recovered.

Writing of the region in which the Kassan mine is situated, Chapin says: (a) "South of Karta Bay and northwest of Twelve Mile Arm, including the vicinity of Hollis, is a mineralized area in which gold lodes predominate. The country rock is a complex assemblage of igneous and sedimentary rocks. The bedded rocks include tuff, breccia, schist, limestone, black slate, argillite, and graywacke, and are cut by a large boss of quartz diorite and associated porphyritic dikes. The lodes are quartz veins that occur in the intrusive and the bedded volcanic rocks as well as in the sediments."

"A number of lodes have been opened in this gold quartz belt and several small plants installed, but none has made a large production. This strongly mineralized region has never received the attention which it has deserved, and no doubt will be developed in the future. One large company might consolidate a number of these small properties and operate them to advantage."

Moonshine Property.

The Moonshine property is located west of the South Arm of Chilkoundeley Sound on the east coast of Prince of Wales Island.

After a long period of idleness, development work was resumed upon it during 1921 and has been continued steadily since that time by the Chonley Mining Company of Ketchikan.

A description of the work done in 1921 is contained in the report of the Mine Inspector for that year—p. 38.

During 1922 an average of 4 men were employed underground and 3 men on the surface. The amount of development work done totaled 1,150 feet, of which 1,050 feet were in tunneling and 100 feet in raising.

A statement by the manager of the Company, Mr. N. S. Sweetser, formerly in charge of the K and Mamie mines of the Granby Consolidated Mining Company at Kasaaan Bay, says that at the Moonshine property "Silver lead ore occurs in lenses along a fissured zone in limestone. Sorted ore averages 6.5% lead and runs 40 oz. of silver per ton."

"The ore has been proven for a distance of 75 feet down the shaft, which is at an elevation of 5,000 feet. A tunnel 1,050 feet in length has been driven at an elevation of 2,650 feet and has intersected the fissure. A raise has been started on the fissure and will be driven to connect with the bottom of the shaft."

"An aerial tramway, 6,000 feet in length, has been built and connects the workings with the beach."

"Shipments of ore will start in the spring of 1923."

Jumbo Mine.

The Jumbo Mine, also referred to as the Sulzer Property, situated near the head of Ketaa Inlet on the west coast of Prince of Wales Island, has been idle since 1919. There recently took place a reorganization of

the company which controls this property. It is now held by the Jumbo Copper Mines, Inc., 115 Broadway, New York.

No operations were conducted during 1922.

Shakan Molybdenite Lode.

The Alaska Treadwell Gold Mining Company owns a molybdenite property at Shakan, near the northwest end of Prince of Wales Island. Assessment work only has been done for several years past and the property is now being carried to patent.

Vermont Marble Company Quarries.

The report of the Collector of Customs for the year 1922 indicates that 4,995 tons of marble valued at $152,046.00 were shipped to the States from Alaska during the past year. This is more than double the amount exported in 1921. This output was derived from the quarries of the Vermont Marble Company at and near Tokeen on the northwest coast of Prince of Wales Island. These quarries supply much of the marble used on the Pacific Coast of the United States.

A complete description of the marble deposits of the Territory is given in "Marble Resources of Southeastern Alaska," by E. F. Burchard, Geologic Survey Bulletin 682.

CLEVELAND PENINSULA

Mining operations have been conducted on a small scale intermittently over a period of years on several properties on Cleveland Peninsula in the vicinity of Helm Bay, north of the junction of Behm Canal with Clarence Strait above Ketchikan.

Prospecting work was continued on one or two properties during 1922, but the activity was less than in 1921.

WRANGLELL DISTRICT

The Wrangell district embraces a narrow strip of the mainland and the outlying islands from Cleveland Peninsula on the south to Farragut and Thomas Bays, north of Petersburg.

The geology of the district has recently been described by A. F. Buddington in U. S. Geological Survey Bulletin 739-D, issued in 1922. This bulletin contains a geologic map of most of the district, which also shows the location of mining properties within it.

A wide variety of metallic minerals have been found within the district, including zinc, lead, silver, gold, and copper. Mining on a commercial scale has not as yet been successfully undertaken on any property within the district.

Non-metallic minerals, including barite, garnet, marble and graphite are also found in various sections of the district.

Of these only garnet has been mined.

CHICHAGOF ISLAND

The zones within which productive ore bodies have been found on Chichagof Island lie within a belt from 5 to 15 miles wide, extending along the entire west coast of the island.

Gold is the predominant metal in the ores found within this belt and such ore bodies as have proven mineable are characterized by local occurrences of unusually high grade material.

The productive gold lodes of the coastal or western section of the zone are accompanied by sheared zones in graywacke. Those of the inner section are found as quartz filled fissures within the body of an extensive mass of diorite. Other gold lodes of the western section are found within a belt of metamorphic rocks that lie adjacent to the graywacke series that occupies the coast line and near the contact.

In addition to the gold lodes, copper and nickel deposits are found in both divisions of the western section. These deposits appear to lie in the general vicinity of local occurrences of basic rocks.


Chichagoff Mine.

The tonnage produced by the Chichagoff mine during 1922 was about 15% in excess of the output for 1921.

Development work proceeded on approximately the same scale as during the previous year.

An average of 156 men were employed in 1922, of whom 93 were engaged in underground work, 65 on the surface and 28 at the mills.

Hirst-Chichagof Mine.

Operations at the Hirst-Chichagof mine in 1922 were continued throughout the year.

The erection of the ten-stamp mill was completed and milling operations were conducted during 260 days of the year. Underground operations were confined to stoping and the retimbering of old workings.

No new underground development work was undertaken. The production amounted to 2,700 tons of ore.

An average of 10 men were employed underground; one at the mill, and five on surface work, which consisted mostly of new construction.

Falcon Mining Company.

The claims of the Falcon Mining Company are at the head of Ford Arm, about twelve miles southeast of Chichagof. Development of these claims has been in progress several years past and was continued during 1922.

An average of about 15 men were employed up to October, at which time an accident to the engine that furnishes power for the compressor...
occasioned a shutdown. The property has been idle since that time, though an official of the company states work will be resumed in May, 1923.

During 1922 the tunnel that has been under construction for the past three years was extended a distance of 900 feet. This tunnel is a crosscut designed to intersect veins outcropping on the surface. Its total length now exceeds 2,200 feet.

Brown Bear Group.

The Brown Bear group is the property of Cox Brothers of Chichagof. The claims lie between the head of Deep Bay and Dredge-sock Bay, which are indentations on the east side of Portlock Harbor, and approximately 6 miles in an air line northwest of the Chichagof mine.

Preliminary development work was begun in 1921 when a permanent camp was established and the outcrop of the vein was exposed for several hundred feet along its strike.

Work was continued throughout 1922. A crosscut tunnel was driven intersecting the vein at approximately 60 feet below the outcrop. This tunnel is now 140 feet in length. Open cut work was also continued, an aggregate of 50 feet being completed.

The Brown Bear vein is a quartz-filled fissure in graywacke. The quartz averages 2 feet in width where exposed at the outcrops. The vein strikes N. 50° W. It is said to carry free gold, some specimens yielding high assays.

Golden Copper Group.

The Golden Copper group lies at the head of Pinta Bay, about 20 miles north of Chichagof and at the northern extremity of Portlock Harbor. This group consists of six claims now controlled by the Pinta Bay Mining Company of Chichagof.

Development work was prosecuted during 1922 on this and other properties owned by the same company in the vicinity of Pinta Bay. An average of 16 men were employed. The completion of 140 feet of open cut work and crosscut tunneling is reported by the company.


Three other claims held by the Pinta Bay Mining Company are reported by them to show deposits of free-milling gold ore. Some work was done upon them during 1922 and further development is planned for the coming year.

Apex Group.

Very little work was done in 1922 on the Apex group, which adjoins the El Nido group on the west.

Following the discovery of the Apex vein and until the fall of 1921 the Apex group was held under option by the Chichagof Mining Co., who carried on an active program of development work.
**YAKOBI ISLAND**

Nickel Prospect.

Two groups, known respectively as the Bohemia and the Tasmania, comprising a total of 40 or more claims, have been located on Yakobi Island. This island is situated just west of the northerly portion of Chichagof Island and forms the west shore of Lisianski Inlet and of Lisianski Strait.

A tunnel 60 feet in length was driven beneath a portion of the outcrop of one of the ore bodies in 1921. No work is reported as having been done in 1922.

Samples of the ores have been submitted to the U. S. Bureau of Mines for analysis and tests, with the purpose of having the susceptibility of the ore to commercial exploitation determined.

The exposures of nickeliferous ore on Yakobi Island are of similar type to those found and developed on the West Coast of Chichagof Island. The Chichagof Island deposits are about 14 miles southeast of those on Yakobi Island. A full description of them, including a comparison of them with the nickel deposits of Sudbury, Canada, is given by R. M. Overbeck in U. S. Geological Survey Bulletin 692, Mineral Resources of Alaska, 1917, pp. 125-134.

**ADMIRALTY ISLAND**

Peckovich Mine.

Work at the Peckovich mine of the Admiralty-Alaska Gold Mining Company, situated at Funter Bay, was confined to surface development on the vein known as the Heckler Blanket.

Numerous veins on this property have been under development for several years past.

A full description of the veins, accompanied by a map of the holdings of the company, is given by J. B. Merite, Jr., in U. S. Geological Survey Bulletin 714, Mineral Resources of Alaska, 1919, pp. 115-118.

**Alaska-Dano Mines Company.**

Contract work was continued on the Winona claim of the Alaska-Dano Mines Company during a portion of the past year. Upon the completion of the contract, work at the Winona vein was temporarily suspended. The results obtained by the work done are said by the owners to be very encouraging. During the fall of 1922 a winze was sunk in a tunnel formerly driven on a vein near the beach at Funter Bay. The numerous free-gold bearing veins that occur on the Alaska-Dano property, also known as the Nowell-Otteson group, are described by J. B. Mertie, Jr., in U. S. Geological Survey Bulletin 714. Mineral Resources of Alaska, 1919, at pp. 116-118, incl.

**Williams Property.**

Work has proceeded for several years on the development of a group of claims belonging to Chas. Williams and situated on the south or Hawk Inlet side of Mt. Robert Barron, upon the north side of which are located the Nowell-Otteson and Peckovich groups.

In 1922 this work was continued with from 3 to 8 men employed.

A rough trail was built leading from the beach at the head of Hawk Inlet to the Williams No. 4 claim, a distance of 1½ miles. Three open cuts, 36 feet, 45 feet and 60 feet, respectively, in length, were dug to a depth of 5 feet, exposing the outcrop of a gold-bearing vein. A tunnel 36 feet in length was also driven on the vein.

A frame cabin has been constructed in the vicinity of the workings.

Development of this property on an enlarged scale is planned for the coming season.

**JUNEAU DISTRICT**

Alaska Endicott Mining and Milling Co.

Work was continued throughout the past year on the property of the Alaska Endicott Mining & Milling Company at William Henry Bay, on Lynn Canal.

The erection of a mill building was accomplished and the machinery was placed in position. Other improvements made during the year include the construction of an assay office, the installation of a steam heating plant and the wiring of the mill building for electric lighting.

The milling equipment consists of fifteen stamps and a six-cell flotation machine, together with the necessary coarse crushing machinery. It is announced by the manager of the company that a ball mill for fine grinding and a Dorr thickener will be added during the coming season, and that milling operations will start about May 1, 1923.

Underground development work during the year included the opening of two small stopes.

**BERNERS BAY**

Jualin-Berners Mining Company.

A reorganization of the Jualin-Alaska Mines Company was effected near the close of the year and a new company was formed, known as the Jualin-Berners Mining Company. This company has resumed the work of continuing the driving of the 7,000-foot adit tunnel.

This tunnel was approximately one-half completed when work upon it was suspended in 1920. A crew of 45 men is employed at the present time.

Yankee Basin and Eagle River.

No work other than that necessary to meet annual assessment requirements, was done on properties at Yankee Basin and Eagle River during 1922.
The Peterson Mine at Pearl Harbor was operated during 1922. A small production was made. The property is equipped with a three-stamp mill and Wilfley table, operated by water power. The ore is secured principally from open-cut work in veins outcropping on the Pararie claim.

Alaska-Juneau Mine.

The tonnage output of the Alaska-Juneau mine on Gastineau Channel in 1922 exceeded that of 1921 by 43 percent, and amounted to 2,310,550 tons. Of this amount 1,108,559 tons was milled. The balance was rejected as tailing after coarse crushing.

The tonnage mined and tramned in 1922 amounts to approximately 32 per cent of the total output of the property since 1913, and was greater by 141 per cent than that of 1920.

The annual report of the company states that “Of the ore trammed to the mill last year (1922), 10.6 percent came from the south half of the mine and 89.4 percent came from the north half of the mine,” and “Of the total tonnage milled up to the first of this year 96 percent has come from the north half and 4 per cent from the south half of the mine.”

Extensive underground development work was done during the year, designed primarily to prepare the south ore body for enlarged stoping operations.

Drifts, crosscuts and raises were driven, of which the aggregate length was 5,563 feet.

The mine crew was increased in May, 1922, in order to provide for tramming operations on three shifts. Therefore but two shifts had been engaged in underground operations.

An average of 321 men were employed during 1922. Of this number 129 were engaged in underground work; 62 on the surface; and 129 at the milling plant.

Construction work done during 1922 included remodeling operations that provide permanent offices in Juneau, and the erection of a new carpenter shop adjacent to the wharf.

Ready Bullion Mine.

Operations at the Ready Bullion mine of the Alaska United Company, on Douglas Island, during the past year were confined largely to hoisting ore previously broken. This mine, which was the only one of the Treadwell group not affected by the cave-in and flood of 1917, was permanently shut down December 15, 1922. The mill ceased operations two days later.

During the year the average number of men employed was as follows: Underground, 36; on surface, 7; at the mill, 20.

Kenneecott Mines.

The Kennecott group of mines, consisting of the Bonanza and Jumbo mines of the Kennecott Copper Corporation, and the Mother Lode mine of the Mother Lode Coalition Mines Company, were operated throughout 1922 on a scale approximately 22 per cent in excess of that of the previous year's operations. The Kennecott company also operated their Glacier mine during about 106 days of the year and did a small amount of development work at their Erie mine.

An average of 540 men were employed at the Kennecott mines and mill during 1922, 309 of these being employed at the mines and 231 at the milling plant and associated works. The average number employed in 1921 was 455 men.

Major improvements completed at the Kennecott mines during 1922 included additions to the power plant and mill. Two 600 H. P. McIntosh-Seymour engines of full Diesel type were installed. The capacity of the mill was increased by 6,000 tons per month by the erection of an additional unit to the existing plant.

Green Butte Copper Company.

The Green Butte Copper Company continued development work on its property situated on McCarthy Creek about 8 miles above the town of McCarthy.

This property lies east of the Kennecott mines and is on a continuation of the limestone-greenstone contact adjacent to which the Kennecott ore bodies are found. Work has been in progress on this group for several years and approximately 100 tons of ore have been shipped from
it to the smelter at Tacoma. In the fall of 1922 an additional 50 tons of high grade ore had been accumulated from exploratory workings and made ready for shipment. The high grade ore occurs in the form of chalcocite, bornite and covellite.

An aggregate of approximately 2,375 feet of underground work had been done upon the property at the end of the year. This work has been done upon four claims of the group, the Green Contact, the Green Ore, the Green Fissure and the Green Stone.

On the Green Contact claim four tunnels have been driven, two of which are ten feet and two thirty feet in length. Tunnel No. 4 is in limestone above the contact and exposes a shoot of chalcocite ore along a fault plane cutting the contact.

On the Green Ore claim a series of open cuts at and near the discovery point exposes a shoot of chalcocite ore. A tunnel 270 feet in length and one 534 feet have been driven on this claim, which develop considerable high grade ore along the contact. In addition to this tunnel work there is on the Green Ore claim a crosscut 134 feet in length, a raise 90 feet high and a shaft 65 feet in depth, together with 190 feet of open cut work on the surface.

The main tunnel on the property, known as the Barrett tunnel, is on the Green Fissure claim and extends into the Green Stone claim. This tunnel is 554 feet in length and has attached workings aggregating 310 feet in length, making the total amount of underground work on the claim 864 feet in length. Several well defined fissures intersect the ore body exposed on the Green Fissure claim and good ore shoots lead off into the limestone above the contact.

The property is provided with a permanent mine camp of log buildings, an aerial tramway, and all mine tools and equipment necessary for extensive development work.

The group comprises nineteen lode claim and four mill sites. Application is being made for patent to the ground.

Placer Mining.

Data concerning placer mining in the Copper River Basin during 1922 will be found elsewhere in this report in the special article on Placer Mining in Alaska by Mr. Norman L. Wimmler of the U. S. Bureau of Mines.

PRINCE WILLIAM SOUND

The Beatson Mine of the Kennecott Copper Corporation was the only producer of copper ore in the Prince William Sound region during 1922, although development work on a small scale was done on several small copper properties in the region. A small production of gold was made from lode properties under development in the "Gold Belt" of the Valdez section.

Improvement in the copper market is causing renewed interest in the copper resources of the Prince William Sound district and there will be greater activity during the coming year in the search for and development of copper properties than has obtained since the close of the War.

Beatson Mine.

The operations at the Beatson Mine of the Kennecott Copper Corp., situated on Latouche Island, were materially greater in 1922 than during the previous year. The tonnage of ore mined in 1922 was approximately 63 percent greater than in 1921. Difficulty was had in securing the desired number of experienced miners and the output from the mine would have been greater had this handicap not existed.

Extensive underground development work was done during the year. The total footage of crosscuts, winzes and raises completed amounted to 7,155 feet.

An average of 171 men were employed during the year, of whom 67 worked underground, 76 on the surface and 28 at the mill.

It is authoritatively announced that the property of the Ladysmith Smelting Corporation, otherwise known as the Girdwood mine, has been purchased by the Kennecott Copper Corporation. This property adjoins the Beatson mine on the east.

Rua Mine.

Development work was done at the Rua copper property, on Knight's Island, by the owner, Mr. W. A. Dickey. Four men were employed and 250 feet of tunnel work was completed.

Big Four Property.

The property of the Big Four Mining Company is on Mineral Creek in the Valdez district. Operations in 1922 consisted of mining and milling a small tonnage of ore. Four men were employed. The mill, which is of the Gibson type, was operated 20 days during the year.

Mining and prospecting in the Mineral Creek section are handicapped by the lack of proper trails. This area is deserving of consideration in the matter of trail construction.

Culross Mine.

The property of the Culross Island Mining & Milling Company, on Culross Island in the Fort Wells section, was being developed during 263 days of the past year. Fifteen men were employed, four of whom were working underground. New tunnel work was completed to the extent of 165 feet and 400 feet of old tunnel was enlarged and regraded.

The property was provided with a new Ingersoll-Rand compressor with a capacity of 650 cubic feet per minute and the mine was equipped with air drills.
WILLOW CREEK DISTRICT

GENERAL STATEMENT AS TO LOCATION, PRODUCTION, ETC.

The Willow Creek Mining District lies approximately forty miles, in an air line, northeast of Anchorage and twenty miles east of the Alaska Railway at Mile 190. It has proven to be the most important lode mining area yet discovered tributary to the Alaska Railway and ranks among the most productive of the Territory.

The ore bodies of the district are almost exclusively free-milling gold deposits of a high average tenor. Dr. A. H. Brooks, of the U. S. Geological Survey, states that up to and including 1920 “Since mining began, in 1908, the district has produced 66,053 tons of ore, from which the average value of the gold recovered has been $27.70 per ton and the silver recovery 0.1 ounce per ton. These figures do not, however, represent the whole value of the ores, for the gold is largely free gold, recovered by rather crude milling practice.”

This excellent record has been maintained and probably exceeded during the year 1922.

Complete information is not at hand as to the production for 1922, but it is known that it was at least $275,000.00, which is more than double that for 1921. (a) This output brings the total gold production of the district to date up to approximately $1,322,000.00. In addition to the gold production, silver to the value of approximately $6,000.00 has been recovered during the same period.

It has been a matter of repeated comment among competent observers that the advancement of mining in the Willow Creek district has been seriously hindered by the conspicuous lack of orderly and well planned development work and of properly considered and carefully conducted milling practice. This condition is fortunately changing for the better. Much of the development work now in progress and contemplated is in the hands of experienced operators, who are working with competent engineering advice.

During the past two years, and particularly during the past year, there has been a gratifying increase in the interest manifested in the district on the part of investors of substantial type. This has provided stimulus for accelerated activity on the part of prospectors and several new “finds” of a promising nature resulted during 1922.

The outlook for a substantial growth of mining activity in the district during the coming year is most promising.

For the first time in the history of the district there was commenced during 1922 underground development work designed to explore lodes at considerable depths. Work of this type is being conducted by at least two companies and is being observed with keen interest. The results obtained will have an important bearing on the future of the district.

ACCESSIBILITY AND MINING CONDITIONS

During the open season, the period when snow does not interfere with automobile and wagon traffic, the entire district is reached by way of Wasilla, a station on the railway at Mile 160. From here to Fish-hook Inn on the Little Susitna River, a distance of 18 miles, there is a well constructed automobile road maintained by the Alaska Road Commission and suited to all types of vehicular traffic. The average grade of this road is but slightly over one percent.

Satisfactory road-house accommodations are available at both Wasilla and Fish-hook. An automobile stage meets all trains and serves to transport passengers promptly to the southerly edge of the mining district at Fish-hook.

From Fish-hook Inn roads and trails radiate to all sections of the district.

The divide between the waters that drain into Willow Creek and those tributary to Little Susitna River separates the district naturally into western and eastern sections. The western section, which embraces the drainage basins of Craigie Creek and Upper Willow Creek, is much the more inaccessible of the two. Prior to the fall of 1922 there existed no road connection between that portion of the district and the railway. During the summer of 1922 a road was built by the Alaska Road Commission connecting at a point on the Fish-hook Creek road, near the mouth of Hatcher Creek and approximately 3 miles from Fish-hook Inn, and extending up Hatcher Creek across the divide near the head of Willow Creek, down Willow Creek and terminating on the low divide separating Willow and Craigie Creeks. The present westerly terminus of this road is approximately one mile from the Lucky Shot mill of the Willow Creek Mines Company. While this road renders the western section of the Willow Creek district much more readily accessible from Fish-hook than heretofore, its usefulness is limited by the steep gradients occurring at several places and by the altitude of the summit of the pass crossed in reaching the Willow Creek drainage. This pass has an elevation of approximately 4,000 feet above sea-level and will therefore be blocked by early snows.

The necessity still exists of freighting supplies in quantity and heavy machinery into the Craigie-Willow Creek section from Houston, at Mile 179 on the railway, only by means of sleds during the winter. This necessity materially increases the cost of mining and is the determining factor that limits the scale of operations possible in the region and also the grade and consequently the tonnage of ore that can be profitably extracted.

Problems connected with accessibility and transportation are much less serious in the eastern section of the Willow Creek District. Roads
have been constructed from Fish-hook Inn to within a reasonably short distance of all mining properties on Fish-hook and Reed Creeks and on Sydney, Archangel and Fairangel Creeks, tributaries of the latter. Gradients on these roads are quite high, however, and they have not, as yet, been surfaced and otherwise perfected sufficiently to afford means of cheap transportation. Heavy hauling is still delayed until the arrival of satisfactory sledding conditions in the winter time.

A small pack train of horses operated from the terminus of the automobile road at Fish-hook Inn serves to supply the current needs of most of the small camps of the eastern section of the district throughout the year.

The timber supply for the entire Willow Creek District while plentiful and of fairly satisfactory character is unfortunately so located as to necessitate for its delivery to the mines, an up-grade haul of from seven to ten miles. The area within which mining is conducted is wholly devoid of tree growth, being well above the local timber line.

Fortunately, reliance does not have to be placed upon wood for fuel. A winter road from Fish-hook Inn to the Moose Creek section of the Matanuska coal-field renders accessible to the district the excellent coal of that region. "Double-ender" sleds are employed to transport the coal from the mines. The distance from the coal mines to Fish-hook Inn is approximately ten miles, with practically a water grade the entire distance.

Power for mining purposes is, to a large extent, supplied by the streams of the district. Owing to the shortness of the open season, however, it is necessary to provide auxiliary power for operations conducted throughout the year. Even the larger streams, such as Willow Creek and Little Susitna River, during several months of the year are frozen to such an extent as to render them useless as sources of power. During this period those continuing operations utilize gasoline engines and these have proven satisfactory.

The erection of a plant at the Moose Creek coal mines and transmission from it of electrical power to the Willow Creek district would, no doubt, solve the power problem in the event that mining development proceeds sufficiently to warrant the expenditure involved. Steps have been taken looking toward the erection of a large hydro-electric power plant on the Eklutna River. This stream enters Knik Arm near Mile 140 on the Alaska Railway. Preliminary work on the project was done and estimates as to the capacity of the stream, etc., were prepared by the Alaskan Engineering Commission at a time when they contemplated utilizing the power in connection with their railway and coal mining operations.

The project was abandoned by the Commission but has recently been taken over by citizens of Anchorage. If it is carried to completion such a plant will, no doubt, be capable of supplying power to the Willow Creek district. The utilization of power from the Eklutna project would entail the construction of a transmission line between 30 and 40 miles in length.

MINING OPERATIONS AND DEVELOPMENT IN 1922

Gold Bullion Mine.

The Gold Bullion mine of the Willow Creek Mines Company was operated throughout the year. Mining operations during the year centered principally about workings reached through No. 5 tunnel. This tunnel is the most westerly of those driven on the lode. The results of development in this section of the property have been very encouraging.

A new mine camp, capable of accommodating 14 men, was constructed at the No. 5 workings.

The Gold Bullion property, located in 1907 by E. H. and W. E. Bartholf, has been producing steadily for many years. The following description of the property is given by Chapin:

"The mine is at an elevation of 4,500 feet on the divide between Craigie and Willow Creeks, and the mill is on Craigie Creek, 1,500 feet below the mine.

"The mine is developed on a single vein that follows a very persistent fissure, which strikes about S. 10° W. and dips 14° NW. The vein filling, however, is less regular and in some places pinches to a mere stringer and in others splits up into three veins. The vein is broken by three main faults, which strike from S. 10° E. to S 30° E. and dip 40°—55° N. These faults have produced normal step faulting of small displacement."

The faults above described have not given serious trouble in mining operations, though their presence has, at times, been vexations and has increased the cost of mining. The mine workings are in frozen ground.

The mill equipment consists of a 6×10-inch crusher; two Hallidie batteries of five 1,000-lb. stamps each; one Joshua Hendy battery of two stamps: a Dorr classifier; and a Wilfley table. Plate amalgamation is used. The tailing from the Wilfley table is treated in a cyanide plant consisting of six sand leaching vats operated on a five-day cycle. A slime vat was tried but is said to have proved unsuccessful. The capacity of the milling plant is 60 tons per day. The entire plant is operated by three men.

Lucky Shot Mine.

The Lucky Shot property is also operated by the Willow Creek Mines Company. It was located June 25, 1915, by Ralph Bartholf and shortly afterward acquired by the Willow Creek Mines Company.

The ore thus far recovered from the Lucky Shot vein is of high grade and the mining operations conducted during 1922 were very successful.

The mine is situated on the steep south-facing slope of the ridge separating Shorty and Craigie Creeks, north of the latter and approximately 2½ miles below the Gold Bullion mill. It is developed by two tunnels separated by a vertical interval of about 85 feet. The lower of

these tunnels, known as the Hogan tunnel, is at an elevation of approximately 3,500 feet above sea-level, and is the main working tunnel. The two tunnels aggregate about 800 feet in length, about 600 feet of which is drift on the vein. A stope about 100 feet in length has been opened above the upper tunnel and has been carried through to the surface in several places. Between the Hogan tunnel and the upper tunnel are two small stopes, one 35 feet and the other 30 feet in length.

The vein, as described in the above described workings, is well defined. The gangue material consists of fractured and decomposed quartz diorite, which is the country rock in which the lode occurs. The auriferous portions of the vein accompany plate-like bodies of quartz lying for the most part approximately parallel with the lode, and varying in thickness from a few inches to several feet. The quartz bodies do not occupy uniform positions relative to the walls of the vein, appearing in some places on or near the footwall, in other places on or near the hanging wall, and in others within the body of the vein. Cross-veining between the walls was observed locally. The separating gangue material is made up of fragments that vary greatly in size, ranging from large horses to finely comminuted material and sticky gouge.

Mineralization is not confined to the quartz itself. Finely divided gangue-matter bearing a light blue tinge and locally known as "blue filling" frequently yields high assays in gold. Notable features of the mineralization of the Lucky Shot and Gold Bullion veins are the small particles of material and sticky gouge.

During the summer of 1921 a mill equipped with a Mine and Smelter Supply Co. battery of three 500-lb. stamps was placed on the property at the north bank of Craigie Creek and at the base of the ridge below the Hogan tunnel. An aerial tramway of the Riblet type was also erected to connect the Hogan tunnel with the mill. The tramway is equipped with two buckets of 500 lbs. capacity each. Delivery of a bucket of ore from mine bin to mill bin is accomplished in 95 seconds.

During 1922 an Alaska "Treadwell battery of five 1,250-lb. stamps was added to the mill and the housing of the plant was completed. The stamps drop a distance of 6 inches 105 times per minute. The discharge screens are of from 30 to 49 mesh, the latter being used when high grade ore is being crushed. Concentration on a Wilfley table, placed in the mill during the fall of 1922, follows plate amalgamation. The plates are dressed twice daily. The capacity of the plant is 30 tons per day. Power is supplied by a Pelton wheel driven by water from Craigie Creek and by a 10 H. P. Fairbanks-Morse gasoline engine. A 10 H. P. generator for furnishing electric light was placed in the mill building during the past fall.

Tailing from the mill is impounded in pools constructed along the banks of Craigie Creek.

The erection during the present year of a氰ide plant is contemplated. The tailing bears a high gold content not subject to amalgamation.

War Baby Property.

The War Baby property lies adjacent to and east of the Lucky Shot group. The four claims of this group were located in 1917 by Chas. Barthold and Duke Miller. Development work was commenced in 1918. During 1919 the erection of a 10-stamp Straub mill was completed and the mine produced a small output of ore, which was milled.

In 1918 Chapin described the vein as follows. (a)

"Surface stripping has exposed a mineralized zone about 33 feet across containing four or five parallel quartz veins that strike N. 50° E. and dip 15°-60° NW. The footwall of the lode is altered granite with 9 inches of quartz. Above this through an interval of over 30 feet are three quartz veins from 1 to 5 inches thick cutting quartz diorite. The hanging wall of the lode appears to be of red-stained fissure parallel to the quartz veins and dipping steeply northwest toward the canyon wall. About 600 feet to the southwest what appears to be the same lode is exposed. At this place a lode from 3 to 4 feet thick carries a quartz vein 15 inches thick and stringers of quartz in altered granite." In 1923 development work was being carried on by the Willow Creek Mines Company, who hold the property under option.

This work was being done by contract in the lowest of the three tunnels that have been driven on the vein, and progress was being made at the rate of about 100 feet per month. The vein was being drifted upon in a westerly direction with the plan in view of projecting the tunnel to a point beneath the workings of the adjoining Lucky Shot mine, thus establishing the relationship between the veins on the two groups. It is thought the War Baby vein may be an easterly portion of the Lucky Shot lode, although a cross-fault of some magnitude is known to intervene between the workings on the two properties.

Come-Back Group.

The Come-Back group of claims is situated on the same ridge as are the Lucky Shot and War Baby properties and lies about three-fourths of a mile east of the latter. A tunnel 60 feet in length is said to have been driven on a vein exposed at an elevation of approximately 4,000 feet. This tunnel was not visited and details with regard to the ore exposures are lacking. Three men were at work on the group during the summer of 1922.

Rainbow Group.

The Rainbow group lies east of the War Baby claims. It was discovered and located by B. S. Bartholf on September 5, 1921. The claims of the group occupy a portion of the valley of Craigie Creek and the lower slopes of the hills below the Gold Bullion property. Float quartz of very high grade was found in material believed to be the overburden covering an underlying lode. This belief is said to be supported by the fact that the float is traceable along a practically straight line across the flat-lying bottom land adjacent to Craigie Creek.

The property was under option to a substantial mining concern during 1922 and much surface trenching and open cutting was done in an endeavor to locate the lode believed to be the source of the float.

Drumhurnoon and Mazuma Claims.

The Drumhurnoon and Mazuma claims occupy the interval between the west end of the Gold Bullion group and the east end of the Rainbow group. They were located in 1922 by J. B. Garver.

Brassel Bros. Claims.

Assessment work only was done on the claims of Brassel Brothers that are situated near the head of Craigie Creek about 1/4 miles above the Gold Bullion Mill.

The vein on this property is described by Chapin as follows: (a) "A large fissure vein, which is said to have been traced for six claim lengths, is 19 feet across. The walls are well defined, with 6 inches of gouge on the footwall and 18 inches on the hanging wall. The vein is composed of altered quartz diorite with stringers of quartz. It strikes N. 77° E. and dips 26° NE. About 100 feet below it is a parallel quartz-feldspar dike which carries a little gold. On the Gold King No. 7 and Leona claims a number of surface workings show several small veins of rich quartz, and a tunnel is now being driven to open these veins."

Long and Holland Prospect.

A tunnel 50 feet in length was driven on the Long and Holland prospect during the spring and early summer of 1922. This property was not visited. Chapin describes the vein as follows:

A description of the property may be found in U. S. Geological Survey Bulletin No. 712—Mineral Resources of Alaska, 1918.

Work was continued during a portion of the summer of 1922 on the Rae-Wallace claims, situated on the east side of Fish-hook Creek Valley, and a small tonnage of ore was milled. Operations were discontinued early in the fall.

Mabel Mine.

The Mabel mine is situated on the eastward-facing slope and near the summit of the divide separating Reed Creek on the east from Sydney Creek on the west. The mine workings lie at an elevation of approximately 3,800 feet above sea-level and about 1,500 feet above the mill, which is on the gently sloping bench immediately west of Reed Creek.

In 1918 Chapin described the workings and ore bodies as follows: (a) "The vein has been exposed on the surface for a claim length by short tunnels and open cuts. The vein strikes north and dips west at a low angle. The mine is being developed by two parallel tunnels known as tunnels 2 and 3, driven northward to intersect the vein. The principal work has been done on tunnel 2, which follows a joint plane. About 20 feet from the mouth the tunnel encountered a fault striking north to northwest and dipping 45°-50° W. A drift extended northward along this fault plane exposing the quartz vein abutting against it. The portion of this extension from this fault to the surface has been stopeu out and milled for a part of the distance between the two tunnels. At the face of tunnel 2 a short drift was turned off to the north and a much longer one to the south, following the intersection of another fault and quartz vein. Both strike about N. 30° E. and dip northwest. The quartz vein dips 30°, but the fault is much steeper and exposes the quartz vein in the northwest wall of the drift. The quartz here is a whole of rather low grade but carries stringers of very rich ore.

"Tunnel 3 extends northward about parallel to tunnel 2. Near the face a flat-lying vein of quartz was cut and followed southward by a drift. The vein is about 4 feet wide but is barren. A crosscut to the east cut a small quartz vein with some very rich pockets. This vein, which is also cut off by a fault, resembles the eastern vein in tunnel 2 in character, but correlations between the veins exposed in the different workings have not been established.

"The ore is transported by an aerial tramway to a 15-ton Denver mill operated by water power. The tailings are ponded for future treatment."

Since the above was written development work has been continued from year to year but in a manner that has not resulted in the progress that should have been made.

During the summer of 1922 the milling equipment was increased by the addition to the plant of two mills, one a Straub and the other a


Gibson. There were thus provided three distinct types of mills within the same building, the original one being a 15-ton Denver mill. The difficulties arising from the attempted use of such a variety of equipment, in cramped quarters and with inadequate power, were inevitably such as might have been anticipated.

In spite of conditions such as above indicated, the Mabel property has been quite productive and gives promise of having a successful future. During the summer of 1922 an option upon it was obtained by Barthol and Horning. These experienced prospectors carried forward development work and milled a small output of ore. Later in the year their option was taken over by individuals identified with the Guggenheim interests. It is understood the new holders will carry on development of the property during the coming season.

Talkeetna Mine.

The Talkeetna mine, formerly operated successively by the Matanuska Gold Mining Co., the Talkeetna Gold Mining Co., and W. F. Rock, has been quite productive and gives promise of having a successful future. During the summer of 1922 an option upon it was obtained by Barthol and Horning. These experienced prospectors carried forward development work and milled a small output of ore. Later in the year their option was taken over by individuals identified with the Guggenheim interests. It is understood the new holders will carry on development of the property during the coming season.

in the granite, the ore being found chiefly in stringers of quartz in the shear zone. The strike is N. 60° E., the dip 50° N. The richer ore is apparently found in shoots which pitch to the northeast.

During the summer of 1922 a crew of from 15 to 20 men were employed at the property, and during the fall and winter from 5 to 7 men.

The property is equipped with a comfortable camp, situated near the workings, and a mill located in the valley of Fairangel Creek, below the mine. An aerial tramway serves to convey the ore to the mill. On this tramway, at 1,500 feet from the mine, is an angle station, from which the distance to the mill is 500 feet. The milling plant contains a No. 1 Denver quartz mill with a rated capacity of 15 tons per 24 hours and is provided with two bins having a combined storage capacity of 50 tons. There is also at the milling plant a small Ingersoll-Rand compressor driven by a 15 H. P. Pelton wheel. This compressor supplies air for driving two jack-hammer drills used at the mine during the season while water-power is available. The mill is closed down in the fall when the freezeup occurs, and hand drilling is done in the mine development work during the winter.

The present manager states that the company intends placing a new Marcy rod mill in a plant to be erected during the coming summer near the confluence of Fairangel and Archangel Creeks. The company also proposes to erect a new power plant, which is to be situated on Reed Creek, preparatory to starting a lower crosscut working tunnel at a point about 250 feet in elevation below the present adit.

Fern Mine.

The Fern Mine, heretofore referred to as the Fern and Goodell prospect, is situated on the west side of Archangel Creek about ½ mile above its confluence with Fairangel Creek and approximately 5½ miles from Fishhook Inn. The property is now owned by the Fern Gold Mining Co., of Spokane, Wash. The following description of the ore zone and mine workings is given by J. A. Davis of the U. S. Bureau of Mines, who visited the property in the fall of 1922:

"The ore is free milling gold ore in a gangue of quartz and gosse and carries some pyrite and arsenopyrite. It occurs in a shear zone from 7 to 16 feet in width which accompanies a well-defined fault and contains a number of smalt quartz stringers. These usually occur in groups, one of which is generally found near the foot wall, one near the middle of the shear zone and one near the hanging wall. The entrance to the mine is by means of a tunnel at an elevation of approximately 4,900 feet. This tunnel follows the vein close to the foot wall, which is fairly well determined but owing to the narrowness of the tunnel the hanging wall was not observed. The strike at the breast of the tunnel is N. 50° E., the dip 50° N. The country rock on both sides of the shear zone is granite. The tunnel is 3 feet wide at the top, 4 at the base and 6 feet high, and on November 18, 1922, had been driven for a distance of 465 feet.

"A six-inch Buffalo blower driven by a gasoline engine was being installed to force air to the face for ventilation through a six-inch canvas air pipe. The muck from the tunnel is trammed to the surface by hand in 16-cubic-foot steel cars on an 18-inch gage track composed of 12-lb. rails. The native spruce used for the tunnel sets is secured in the valley of Knik Arm, 8 or 9 miles distant. The average size of the timbers is approximately 6 inches. No stopes or other levels have been driven as yet, although on November 18, 1922, a raise for a stope was being started at a point 565 feet from the portal. Carbide lamps are used for illumination. It is planned to use the "filled stope" method of mining, in which the ore will be sorted roughly under ground and the waste thrown back into the stope.

"At the time of examination the mine was producing from 15 to 20 tons of ore per day, all of which was conveyed to the mill by an aerial tramway 1,300 feet long. The two carrier cables were ½-inch in diameter, the pulley cable ¾-inch. The buckets hold 500 pounds and it required about 2 minutes to load them and 1½ minutes to travel from the mine down to the mill. On this basis the capacity of the tram would be approximately four tons per hour. The mill is operating one 12-hour shift at present but it is planned to initiate two shifts later.

"The ore is treated by amalgamation, the milling equipment consisting of an eight by ten-inch Denver jaw crusher, a plunger feeder, a No. 2 Denver quartz mill and an amalgamation plate 4½x12 feet set at an 8-degree slope. The flow sheet is as follows:

1. Inclined tramway.
2. Ore bin, capacity 114 tons.
4. Ore bin, capacity 25 tons.
5. Plunger feeder.
6. No. 2 Denver quartz mill crushing to 40 mesh.
7. Amalgamating plate.

"The amalgam from the plate goes to a retort and the tailings go to a settling pond.

"The mill is driven by a Fairbanks-Morse, type Y. H., single cylinder oil engine rated at 25 H. P. and operating at 325 r. p. m. The value of the feed to the mill is reported at $25 to $30. The loss in the tailings is quite high, the sample from one run assaying over $8 per ton."

Opal Prospect.

The Opal prospect, owned by Skarstad and Lahnber of Anchorage, is situated on the west side of Reid Creek and about one mile above its confluence with Archangel Creek. It is easily reached by road from Fishhook Inn.

The following description of the veins on this property is given by Chapin: (a)

Anchorage, and lies just northeast of the Opal group, above described. Will be intersected by this crosscut at a distance of about 350 feet from machinery upon the ground preparatory to driving a new crosscut tunnel. Stripping and open-cutting along the outcrops of the veins.

Tunnel No. 2, also known as the "upper" tunnel, is at an elevation of 3,125 feet above sea-level and is several hundred feet east of the workings above described and on a separate vein. This tunnel was commenced in 1920. At the time of visit in August, 1922, it was approximately 150 feet in length and was being driven ahead. A small amount of stoping was done above the tunnel during the year and the ore produced was milled. A tram line was built connecting the portal of the tunnel with the mill. The zone within which occurs the vein upon which No. 2 tunnel has been driven has been faulted with the result that the vein filling has been broken up and rendered discontinuous. The material penetrated is fragmental, the larger pieces being separated by streaks of gouge and finely divided country rock. The tunnel requires careful timbering. The zone of fracturing is seven or more feet in width and is characterized by a reddish-brown coloration due to the presence of oxides of iron. Oxidation extends to the present limits of exploration.

Tunnel No. 5 was driven in the spring of 1922. It is situated between tunnel No. 2 and the "lower" workings and is at an elevation of 2,700 feet.
almost exclusively to placer operations, although some prospecting has been done for lode deposits and a little development work performed on outcrops discovered in several places within the district.

Renewed interest in the possibility of successful lode mining in this region was awakened during the past year by the development of an auriferous quartz vein that was discovered in the fall of 1921.

Golden Horn Property.

The discovery above mentioned was made by Jerome Warren and Rasmus Nielsen, who have located six claims along the outcrop. The property is now held by the Golden Horn Mining Company, recently incorporated.

The discovery of the vein was made at a point on the left limit of Otter Creek, about 3 miles above Flat and near the point where the trail leading from Flat to Ophir and Tacoma crosses the stream. 1/2 mile above the placer camp Discovery. The group extends from the above described point along the vein southwesterly across the slopes of Black Butte and toward the head of Flat Creek.

Mr. Warren states that the vein averages 3 feet in width and is composed of banded quartz in granite country rock. The vein is said to lie parallel with the contact of the enclosing granite with black slate and at an average distance of 300 feet from the contact.

Mr. Warren also states that the mineralization of the quartz is uniform, that is, not "pocketty" and that the ore carries from 7% to 8% sulphides, the balance being free-milling gold. Returns upon samples said to be representative of the average of the ore exposed by present development work indicate ore that can be profitably mined even with the high costs at present obtaining.

During 1922 extensive development work was done upon the property. A crosscut tunnel, 300 feet in length, was driven to an intersection with the vein; the vein was drifted upon for a distance of 340 feet; a winze 50 feet in depth was sunk from the drift; and a shaft was sunk from the surface a distance of 48 feet to an intersection with the drift.

At a distance of several hundred feet southwesterly from the above described workings another shaft was sunk upon the vein from the outcrop to a depth of 35 feet. At that point water was encountered and work was discontinued. Numerous open cuts and trenches were also dug along the outcrop.

During the year approximately 1,500 tons of ore are said to have been produced, of which 48 tons were shipped to the smelter at Tacoma. The existing freight rate on ore from Flat to Tacoma is $51.00 per ton.

The property is at present equipped with a boiler, hoist and a 700-foot steellrail tram.

Thrift Quicksilver Property.

The quicksilver property of the Thrift Mining Company, situated about 20 miles southwest of Iditarod, near the head of Iditarod River, was idle during 1922.

RUBY DISTRICT

Lode mining development in the Ruby district during the past year was limited to a small area in the Kylau Mountains, about 20 miles southwest of Galena, formerly known as Loudun. Galena is a river landing and small town on the left bank of the Yukon River, approximately 50 miles below Ruby. A trail leads from this point to the mining properties.

Perseverance Property.

The following description of the mining properties was obtained by Mr. Norman L. Wimmler, of the U. S. Bureau of Mines, from Mr. Trick of Kincaid and Trick, owners of the Perseverance claim:

"The ore deposits occur in small lenses found within a fissure in light green schist. The hanging wall of this fissure is "free." A lime-
stone formation is found in the near vicinity of the present workings. There is a deep overburden. Lenses of ore are found to be small, averaging from 80 to 100 tons of high-grade galena to the lens. The width of the ore ranges from 2 inches to 35 inches. One lens averaged 16 inches in width. The ore deposit has been traced a distance of 300 feet on the Perseverance claim.

Farrell & O'Brien Claim.

Farrell and O'Brien have found, on an adjoining claim, a small ore showing which is thought to occur on the same fissure as that exposed on the Perseverance claim. On this claim there are two shafts, 40 feet and 39 feet deep, respectively, from which 70 feet of drift tunnel has been driven.

There is also an adit tunnel, 50 feet in length, which is now caved.

Aitken and Price, who held the property under option in 1921, shipped from it 141 tons of ore that is said to have averaged 107 oz. in silver per ton.

In the spring of 1922 the owners of the claim shipped 50 tons of ore to the smelter at Bradley, Idaho. Returns from this shipment are said to have been 107.1 oz. silver per ton and an average of 72.15% lead. The cost of transporting the ore during the winter from the property to the Yukon River at Galena was $20 per ton. Freight charges from Galena to Bradley, Idaho, were $87 per ton.

LODE MINING IN THE FAIRBANKS DISTRICT, ALASKA

By JOHN A. DAVIS

Superintendent, Alaska Experiment Station, U. S. Bureau of Mines.

INTRODUCTION

The Fairbanks district comprises an area of approximately 500 square miles in the vicinity of the town of Fairbanks, which is situated on a branch of the Tanana River at Lat. 64° 51' N. and Long. 147° 58' W. Although there was a determined effort as early as 1905 to find the gold-bearing quartz veins which were believed to exist as the source of the extensive placer deposits of the district, it was not until 1916 that discoveries of any importance were made. From that time until 1915 lode mining had a rapid growth and attained a production valued at $350,000 per year in spite of the difficulties caused by climate, by the large amount of overburden (most of which is perpetually frozen and makes the uncovering of solid rock an arduous task), by costly and inadequate transportation on river boats able to operate but four or five months during the summer, and by lack of fuel due to the rapid exhaustion of standing timber in the more favorable districts. Beginning with 1916 the steadily mounting cost of supplies caused by war conditions was added to these other difficulties. Prospecting eventually stopped; many of the mines were forced to suspend operations and the production of gold from lode mining dropped to $20,000 per year. In 1921, however, the Alaska (Government) Railroad was completed from Tidewater at Seward to its northern terminus at Fairbanks except for a bridge now under construction across the Tanana River, and the better shipping facilities thus afforded (despite the transfer across the Tanana) not only for supplies from the States but also for cheap fuel from the coal mines in the Nenana field, have caused a revival of lode mining which is steadily gaining headway. In view of the renewed interest thus aroused it has been deemed advisable to compile and publish at this time the information available on the subject of lode mining in the Fairbanks district.

DRAINAGE AND TOPOGRAPHY

The Tanana River, one of the principal streams in Interior Alaska, flows west along the southern edge of the district and joins the Yukon about 225 miles below Fairbanks. The rivers next in importance within the district are the Chatanika, near the northern edge, and Goldstream, near the center, both flowing west into Telovana River, which empties into the Tanana 80 miles above its junction with the Yukon. The eastern portion of the district is drained by tributaries of Chena River which flows through the town of Fairbanks and joins the Tanana 11 miles below. South of Fairbanks the broad, flat Tanana valley extends for 25 to 40 miles until it reaches the northern foothills of the Alaska Range. North of the town the surface rises to an upland or plateau which is intimately dissected by the alluvium-filled valleys of the larger streams and their tributaries whose walls usually rise by gentle slopes to the rounded crests of the hills. 1,500 to 2,000 feet higher than the level of the Tanana valley.

GENERAL GEOLOGY

Throughout the Fairbanks district the greater portion of the bedrock is formed by a variety of metamorphic rocks which have been grouped together geologically and named Birch Creek schist. In addition to various types of schists this group also includes quartzites, crystalline limestones, altered calcareous rocks, and some granitic gneiss. The rocks are closely folded, and faults are numerous. No fossils have as yet been found, hence the age is not definitely determined, but judging from structural relations it is supposed to be wholly or in large part Cambrian.

Several varieties of intrusive rocks belonging chiefly to the granite and diorite groups are associated with the schist, and are in all likelihood not only the source of the mineralization of the district, but also are
the cause of the shattering of the schist which afforded channels for the circulation of mineral-bearing solutions.

ACKNOWLEDGEMENTS

The writer wishes to express his appreciation of the cooperation and assistance in the preparation of this report he has received from mine owners and prospectors in the Fairbanks district, and to acknowledge his indebtedness to the several authors of the bulletins of the United States Geological Survey listed below (a); especially since it has been impossible to give credit in individual instances for information obtained from these published reports which have been freely drawn upon for data of early lode mining activity.

DESCRIPTION OF GOLD MINES AND PROSPECTS

There are two principal areas in the Fairbanks district where gold lode mining has been particularly active, the first centering around Pedro Dome, which lies about 18 miles northeast of Fairbanks; the second around Ester Dome, which lies 9 or 10 miles west of the town. For convenience the descriptions of the various mines will be grouped according to the creeks in whose watershed the mines are located. Near Pedro Dome these include: Fairbanks Creek, which is one of the headwaters of the Chena River; Cleary, Little Eldorado, Dome and Vault Creeks, which are tributaries of Chatanika River, and Pedro Creek, which is one of the main headwaters of Cripple Creek, which joins Chena River a few miles below Fairbanks.

Hiyu Group.

The Hiyu group consists of ten claims, including the Helen S., Teddy R., Hiyu and Nars, situated on the ridge between Too Much Gold and Moose Creeks, both of which are short tributaries of Fairbanks Creek.

The property is two miles northwest of Meehan, the nearest postoffice, and twenty-five miles northeast of Fairbanks. The most accessible railroad station is Gilmore, on the Chatanika (narrow gauge) branch of the Alaska Railroad. It is thirteen miles by wagon road from the property. The owners and operators of the mine are Clarence M. Critics and Henry Fiedman.

The ore is free-milling gold-bearing quartz ranging in value from $25 to $35 per ton. The associated minerals are chiefly antimony sulfide (stibnite) although sulfides of lead, iron and zinc occur sparingly. The stibnite often occurs in lenses or kidneys but the amount of sulfides rarely exceeds five per cent of the total vein material. In the surficial portions the ore is oxidized and frequently stained to a greenish color due to antimony oxide. No distinct ore shoots have been observed, and if secondary enrichment has taken place it is not a prominent characteristic of the deposit. Two distinct periods of mineralization have been recognized, the first resulting in the deposition of the bulk of the quartz and some of the gold, the second in the deposition of the sulfides, the remainder of the gold and a small amount of quartz. There is no "barren zone," the values being found practically at the grass roots.

The ore occurs in fissure veins which cut the laminations of the Birch Creek schist country rock. Four principal veins have been discovered, one on the Helen S. claim and three on the Hiyu and Nars claims. The Helen S. vein has been traced (by underground workings and prospect pits) for a distance of 2,000 feet from the level of Moose Creek across the Helen S. and Teddy R. claims to the Hiyu, which is situated near the top of the ridge between Moose and Too Much Gold Creeks. It ranges in thickness from 5 to 15 inches, the average being approximately 9 inches. The general trend of the Helen S. vein is N. 65° W., although local variations from this strike have been observed; it is practically perpendicular and intersects the veins on the Hiyu claim. The main vein on the Hiyu claim has been traced into the Nars claim, which is situated on the Too Much Gold Creek slope of the ridge, and was formerly owned by Nars, Anderson and Gibbs. It is from 10 to 12 inches thick and has a strike of N. 80° W. with a vertical dip. At a point approximately 1,000 feet from the east end of the claim a smaller vein ranging from 4 to 6 inches in thickness, branches from the main Hiyu vein. It has a strike of N. 75° W. and the dip is nearly vertical. A third vein has been discovered on the Hiyu claim having an east and west strike and a steep dip to the north. It should intersect the other Hiyu veins on the Nars claim. It is 1 to 16 inches thick, but the gold values it carries are lower than those in the other two Hiyu veins. On the Nars claim the extension of the main Hiyu vein ranges from 6 inches to 2 feet in thickness although
in a few places, due to mineralization of the wall rock, as much as 6 feet might be mined profitably.

The ore is not generally "frozen" to the walls, but gouge which might indicate subsequent movement along the direction of the vein is not common. Two intersecting faults have been observed, however, one on the Helen S. with a comparatively small displacement to the north, and one on the Hiyu, with a displacement of 30 feet to the south.

In addition to numerous prospect pits the development work on the Hiyu group consists of three tunnels and a raise on the Helen S. claim, a tunnel and a shaft on the Hiyu claim and a shaft on the Nars claim with two short drifts at the bottom. The main tunnel on the Helen S. claim starts at a point about 50 feet above the level of Moose Creek and extends northwest along the strike of the vein for a distance of 1,000 feet. At the 250-foot station a raise has been driven to the surface. A second tunnel at the level of the creek also extends along the vein for a distance of 500 feet. A third tunnel starting on the vein at a point approximately 175 feet above the main tunnel has been driven a distance of 40 feet. It will be extended through the Teddy R. claim and beneath the workings on the Hiyu claim. The tunnel on the Hiyu starts near the eastern end line of the claim at a point about 500 feet above the level of Moose Creek and extends westward along the main vein for a distance of 1,300 feet. An additional 200 feet has been driven along the branch vein described above. A shaft, which is now used for ventilation but through which a considerable tonnage of ore was hoisted during the prospecting stage of development, extends from the surface to the 800-foot station of the Hiyu tunnel. On the Nars claim the shaft is 100 feet deep and two drifts, one 50 feet and the other 60 feet in length, have been turned off at the 600-foot level.

Overhead stoping is employed. The stopes are just wide enough to permit work in them, the average being about 2 feet. Chutes are spaced 50 feet apart. Ore is delivered through them to 17-cubic-foot steel mine cars and trammed to the surface on an 18-inch, 5-pound track. The waste is sorted underground and used to fill the worked-out stopes. On the Helen S. claim, with the exception of a floor five feet in thickness under the main tunnel, all of the ore between the creek level and main tunnels has been stopped for a distance of 400 feet from the portal, and between the main tunnel and the surface of the hill for a distance of 800 feet. On the Hiyu claim all of the ore between the tunnel and the surface has been removed for a distance of 1,100 feet from the portal with the exception of a block 150 feet wide near the middle of the tunnel. A block 75 feet in width and extending to the surface was also taken from above the tunnel along the branch vein. The raise on the Helen S. and the shaft on the Hiyu claim are not protected by pillars but are cribbed carefully and the adjoining stopes have been filled with waste. No pillars are left in the stopes and it is expected to remove ultimately all the ore both in the Helen S. and the Hiyu claims. On the Nars claim approximately 200 tons of ore were removed by the former owners during prospecting. The present owners have not continued this work as they expect to mine the Nars claim from the tunnel on the adjoining Hiyu claim.

The property is equipped with a five-stamp amalgamating mill having a capacity of 15 tons in 24 hours. Ore is hauled with teams from the 50-ton bin at the portal of the Hiyu claim and dumped into an underground chute above the main tunnel of the Helen S. claim. From here it is trammed in mine cars to the mill. After passing through a 7 by 9-inch Blake crusher, it falls into a 40-ton bin from which it is fed by a Challenge type feeder to the stamps. There are five of these in the battery, each weighing 1,000 pounds and dropping 95 to 100 times per minute. The battery has a 50-mesh screen, through which the ground pulp passes to the amalgamating plate, which is 4 feet wide and 20 feet long and is provided with a mercury trap at the lower end. The tailings are being collected in a settling pond for possible future treatment, as they carry on the average approximately $4 in gold. The mill is ordinarily operated for one 8-hour shift daily except during the winter months, when it is idle.

Power for the mill is supplied by a 40 horsepower Oil City boiler, burning wood fuel, consisting, for the past three or four years, of stumps collected from the neighboring claims, the available supply of standing timber having been exhausted. The price of such fuel is variable, but on the average it is not far from $12 for the equivalent of a cord. The boiler also supplies power for an Ingersoll-Rand air compressor which furnishes air for a Leyner drill sharpener, four Ingersoll-Rand stopers and five jack-hammer drills.

Work on this property has been continuous, except for temporary seasonal interruptions, since 1912. During that year prospecting, which was conducted by means of surface pits and trenches, revealed several veins ranging from 1 to 3 feet in thickness and carrying values of $50 to $75 at the surface. During 1913 the main tunnel on the Helen S. claim was driven 450 feet and the raise at the 250-foot station was driven to the surface. The creek level tunnel was also started. The following year the main tunnel was extended to 550 feet and the lower tunnel to 450 feet, both in ore throughout the entire distance. The stamp mill was moved to the property from Chatham Creek and began crushing ore on September 1st. In 1915 the main tunnel was extended to 700 feet and a considerable body of ore between it and the lower level was mined and milled. In 1916 the Hiyu tunnel was started and the balance of the ore that has been taken from the Helen S. claim was mined and milled. Since 1916 work has been confined almost entirely to the Hiyu claim; and with one exception this is the only property in the Fairbanks district that has operated steadily throughout this entire period. As opportunity afforded, during that time the various interests in the Nars, Anderson and Gibbs claims were purchased, and it is the intention to extend the workings from the adjoining Hiyu claim into the Nars claim as soon as possible.
Ohio Group.

The Ohio group, which is owned by Thomas Gilmore and Gilbert B. Stevens, includes the Ohio, Mayflower, Early Bird and Grey Eagle claims, which are situated on the north side of Fairbanks Creek, a short distance west of Too Much Gold Creek. The property is three miles from Meehan, the nearest postoffice, and 24 miles northeast of Fairbanks. The distance to Gilmore is 12 miles.

The principal development work on the Ohio Group consists of a crosscut tunnel which starts just below the wagon road near the lower end of the property and runs N. 30° E. for a distance of 1,000 feet and thence in an easterly direction for 150 feet to the foot of the “upper” shaft on the Ohio claim. At the 790-foot station a branch tunnel follows a small stringer for 56 feet in a northerly direction; near the 800-foot station there are two branches, one in a northerly direction 100 feet in length and one in an easterly direction 75 feet long; and at the 1,000-foot station a fourth branch turns sharply to the west and connects with the 200-foot level of the main shaft on the adjoining Mizpah claim. The total length of the tunnel from this shaft to the portal is 1,350 feet. Besides this tunnel several prospect shafts varying in depth from 30 to 80 feet have been sunk on the claims of the Ohio group and have encountered a variety of stringers and veins.

At the bottom of one of these shafts, which is 25 feet deep, there are two veins 15 feet apart, having a strike of approximately N. 70° W., with a dip of 45° S., but which at the surface are only 4 feet apart. The upper hanging wall of these veins shows strong slickensides and pronounced vertical streaks, indicating a fault plane along which the southern block has been relatively down-thrown. The ore along the foot wall merges into the schist country rock. A second shaft which is 57 feet deep has exposed an eight-inch vein having an east-west strike with a dip of 45° N. The ore in this vein, which is also free-milling, is of low grade, perhaps $4 or $5 per ton. At the bottom of a third shaft, which is 70 feet deep, a drift was started in an easterly direction and then turned to the north. In this drift, which is 70 feet long, a quartz vein 4 to 6 inches thick was discovered carrying free-milling gold with some pyrite and stibnite. The vein strikes east and west and dips 45° N. The “upper” shaft on the Ohio claim exposed a body of low grade ore containing a large amount of sulphides, particularly galena and stibnite. And on the Early Bird claim a 25-foot shaft has uncovered a kidney shaped body of stibnite 12 to 15 inches thick.

The property is equipped with a five-stamp mill, which was installed in 1915. The ore is dumped from the mine cars as they come out of the tunnel over a 1½-inch grizzly. The oversize is crushed in a 7 by 9-inch Blake crusher and falls with the undersize from the grizzly to a small bin from which it is delivered to the stamps by a Challenge feeder. The stamp battery contains five 1,000-pound stamps which drop 55 times per minute and crush the ore through a 40-mesh slotted screen. The ground pulp passes over two 4½ by 8-foot amalgamating plates arranged in series with a 1-inch step between them and having a slope of 2 inches per foot. The lower plate is equipped with a mercury trap from which tailings are discharged as waste with no attempt to save them. Power for the mill is derived from a 30-horsepower, locomotive type, Erie boiler, which supplies steam for an 8 by 10-inch single cylinder engine, running at 180 r. p. m. The mill is housed in a neat, well constructed building.

Mizpah Mine.

The Mizpah mine, which is owned by Chas. L. Thompson of Fairbanks and associates, is situated on the north side of Fairbanks Creek just west of the Ohio group.

Two parallel veins 150 feet apart, having an east and west strike and a dip of 75° S., have been discovered on the claim. The first or Mizpah vein ranges from 1 to 2½ feet in thickness. The ore is chiefly free-milling gold-bearing quartz, but shoots of galena and lead carbonates carrying high values in silver occur at irregular intervals. An inclined shaft has been sunk on this vein to a depth of 220 feet at a point 250 feet from the east end of the claim and drifts along the vein in both directions have been driven at the 50, 150 and 220-foot levels. At the 50-foot level the drifts are each 100 feet in length; at the 150 and 220-foot levels the east drifts are 100 feet and the west drifts 175 feet in length. The cast drift on the 220-foot level connects with the Ohio tunnel. Approximately 1,500 tons of ore, the average value of which is reported to have been $32 per ton, have been stope from these drifts and milled at the Ohio and other neighboring mills. The second vein is 5 to 16 inches wide and carries approximately 20 per cent stibnite with some free gold in a quartz gangue. A shaft has been sunk to a depth of 120 feet on this vein.

War Eagle Group.

The War Eagle group is situated on the divide between the headwaters of Fairbanks and Wolf Creeks, and includes the War Eagle, Leroy, Pioneer, Iron Mask and Black Warrior claims, extending from west to east in the order named. They are four miles west of Meehan.

The bulk of the work for this group has been done on the Pioneer claim, where several shafts and a number of prospect pits have exposed an antimony bearing vein 18 inches in thickness, having a strike of N. 55° E. and dipping 80° N., together with three free-milling gold quartz veins ranging in thickness from 6 inches to 14 inches. A small tonnage of ore has been shipped to various custom mills in the district from a pert of which exceptionally high returns are reported.

CLEARY CREEK

Rexall Mine.

The Rexall mine is situated near the head of Wolf Creek, the easternmost branch of Cleary Creek. It is 2½ miles southeast of Cleary post-
The mine was opened by a tunnel running N. 25° E. along the strike of a 3-foot quartz vein which dips 25° NW. At a point 140 feet from the portal a smaller east-west vein dipping 60° N. was intersected and since this carried higher values in gold, subsequent work was confined to its exploitation. It varied from 12 to 15 inches in width, the vein material being chiefly quartz and containing but a small amount of sulphides. A well defined and slickensided gouge seam occurred on the hanging wall.

A shipment consisting of 25 tons of this ore was milled at Fairbanks, from which an average recovery of $112 per ton is reported. The development work on the vein consisted of 500 feet of drift, several raises and a winze. A mill was erected on the property, consisting of a Blake crusher, a Joshua Hendy 2-stamp mill and an amalgamating plate. The stamps weighed 1,006 pounds each and were set for an 8-inch drop. The mill was run by an Otto gasoline engine, which also pumped water for the mill from a well beneath the engine room. The mill was later sold to the owners of the David mine and moved to Snoopy Gulch.

Homestake Mine.

The Homestake mine is situated on Wolf Creek, a short distance above the Rexall. Early prospecting revealed several promising veins on the surface and a tunnel was driven 750 feet in a southerly direction to intersect them. The first one of importance was encountered at a point 320 feet from the portal. It has an east-west strike and dips 45° S. It varies from 3 to 12 inches in width and in places carries high values in gold. The vein material is chiefly quartz containing small amounts of antimony, copper and iron sulphides. Drifts were turned off to the east and west along its strike.

In the west drift a small pocket of high grade ore was found at a distance of 50 feet from the tunnel. In the east drift the first 90 feet from the tunnel were low in gold content but the next 160 feet were driven through a good ore shoot about 12 feet high. The drift extended 50 feet beyond this through barren material to a point 200 feet from the tunnel, where the vein was split up into several stringers. At a point in the east drift 135 feet from the tunnel an inclined raise driven 150 feet up the 45° slope showed the vein to be continuous to the surface, although much of it was barren. A second rich shoot was found, however, 30 feet above the drift. It was 10 feet high and extended for more than 100 feet along a horizontal pitch. The thickness of the vein averaged 8 inches in this shoot. A second raise in the east drift at a point 225 feet from the tunnel disclosed another shoot of high grade ore at a point 100 feet above the drift. The vein in this shoot averaged 5 inches in thickness and had a strike of N. 68° E. and a dip of 40° S.

The second vein was encountered 600 feet from the portal of the tunnel. It strikes N. 60° W. and dips 45° N. The vein material is chiefly iron stained quartz in which visible particles of gold are occasionally found. Sulphides are not abundant, although stibnite, pyrite and chalcopyrite were observed. A drift was turned off for 100 feet along this vein, in which it averaged one foot in thickness. At the face of the drift it pinched to a seam of gouge.

Pennsylvania Mine.

The Pennsylvania mine is situated about a quarter of a mile south-east of the Rexall near the top of the divide between Wolf and Fairbanks Creeks. It lies but a short distance north of the War Eagle group.

The principal work at this mine consists of an inclined shaft 150 feet deep which was sunk on a vein about a foot thick, having a strike of N. 76° W., and a dip of 58° S. Short drifts 25 to 30 feet long were run to the east and west at the 50-foot level, from which a small tonnage of selected ore was mined.

The property was equipped with a Little Giant mill, having a capacity of 8 to 15 tons per day. From the mill the ground ore passed over amalgamated plates and hence through a launder to a Monarch table. The mill was situated on Fairbanks Creek about a half mile from the property.

Chatham Mine.

The Chatham mine is located at the head of Chatham Creek, which joins Cleary Creek about a mile above the mouth of Wolf Creek. The mine is three miles from Cleary post office and a half a mile southwest of the Homestake mine.

The main vein, which ranges in width from 6 to 18 inches, has a strike of N. 60° W. and dips 65° to 80° SW. After it had been traced for more than 500 feet by surface excavations, a crosscut tunnel was started in the side of the hill 180 feet below the outcrop. The tunnel intersected the vein at a distance of 209 feet from the portal where drifts were turned off along the vein to the northwest and southeast for distances of 400 and 500 feet respectively. Rises were driven at 50-foot intervals from the drifts, several of them extending to the surface, and nearly all of the ore was stoped out for a distance of 175 feet from the tunnel to the northwest and 225 feet to the southeast.

The vein material is chiefly quartz containing a small amount of arsenic, antimony and iron sulphides. Faults of small displacement are a common occurrence and some movement has also taken place along the strike of the vein. Although the value of the ore, which is reported to be $25 to $40 per ton, varies from place to place, the vein contains but few barren spots on the one hand or grade pockets on the other.

The main tunnel was extended to a distance of 1,300 feet from the portal. At the 850-foot station a second vein carrying a large percentage of stibnite was encountered. It strikes N. 70° E. and is practically vertical. A raise was driven 100 feet to the surface, and during 1916 a considerable tonnage of antimony ore was mined from it. What is probably a con-
tinuation of this stibnite vein cuts the main gold-bearing vein in the east drift at a point 150 feet from the tunnel.

The property is equipped with a 4-stamp mill consisting of two batteries of two 1,000-pound stamps each, crushing the ore to 40-mesh. The ground pulp passes over amalgamating plates equipped with mercury traps, the tailings going to waste. The mill is situated on Chatham Creek about a mile below the mine.

Pioneer Mine.

The Pioneer mine is located on the east side of Chatham Creek, about three-quarters of a mile above the mouth.

The underground workings at this property, which was one of the first lode mining operations in the district, have long been inaccessible. They are reported to consist of an adit 125 feet long and a shaft about 100 feet deep with drifts to the east and west at the bottom, from which 290 tons of ore were treated at the mill erected in 1912.

It contained five 1,000-pound stamps of the Joshua Hendy pattern, dropping 100 tons per minute. The ground pulp passed over two amalgamation plates, placed in series, and fitted with a mercury trap and auxiliary riffles. It was sold to Crites and Feldman and moved to the Hyu group on Fairbanks Creek in 1914.

Free Gold Mine.

The Free Gold mine, also known as the Rhoads-Hall property, is situated on the east side and near the mouth of Bedrock Creek, which flows into Clear Creek a half mile west of Chatham Creek. The mine is two miles southwest of Clear Creek postoffice and 25 miles northeast of Fairbanks. The distance to Chatanika, the nearest railroad station, is six miles over a fairly good wagon road.

The ore deposit occurs in a series of fissure veins, consisting of a main vein which ranges from 1 to 3 feet in thickness with a small parallel stringer about 25 feet distant on each side. The gold is irregularly distributed through the vein material and in most cases uncombined with other minerals. In places it is more abundant near the walls of the vein and at others the vein is richest near the center. The sulphides of arsenic and antimony are often found associated with the gold in small amounts. The sulphides of zinc, lead, copper and iron are also occasionally present. The gold values appear to be higher wherever the quantity of sulphides is greater than usual. The vein material is grayish white opaque quartz, which is usually compact in texture.

The hanging and foot walls are Birch Creek schist and the vein cuts the laminations of the schist on a strike of N. 65° W. to N. 75° W. and at dips varying from 55° S. to 63° S. A number of instances of caving have been observed and near the portal of the main tunnel the rock has been so thoroughly shattered and broken that the vein is almost unrecognizable for a distance of 200 feet. Two sets of faulting have been recog-
The total production of gold from this property is reported to have been approximately $600,000.

**Wyoming Group.**

The Wyoming group consists of nine claims, including the Alabama, California, Pauper’s Dream, Texas and Wyoming, situated on the ridge between Bedrock and Chatham Creeks above the Free Gold Mine.

On the Wyoming claim an east-west vein 1 to 2 feet thick, consisting chiefly of quartz carrying free gold, has been opened by a tunnel 150 feet long and a winze 50 feet deep. The tunnel starts on the east side of Bedrock Creek about 1,000 feet south of the Free Gold Mine. The winze starts near the middle of the tunnel and follows a 60° dip which flattens to 50° near the bottom. The vein has been traced into the neighboring Alabama claim by a series of open cuts on the surface.

An east-west vein, having a dip of 60° S., has been exposed on the California claim. It contains from 1 to 3 feet of free-milling gold quartz. A shaft has been sunk on it for 60 feet, and near the bottom the dip of this vein also flattens.

A third vein which has a north-south strike and a steep dip to the west is exposed on the Texas claim north of the California. It has been traced across the latter claim into the Pauper’s Dream on the south. The vein is from 2 to 4 feet wide and has a steep dip to the north. It differs from the other two veins on the property by carrying a rather large amount of sulphides consisting mainly of arsenopyrite.

**Tolovana Mine.**

The Tolovana Mine is situated near the mouth of Willow Creek, a tributary of Cleary Creek, lying about a half a mile west of Bedrock Creek. The property is 2½ miles southwest of Cleary postoffice and 6 miles from Chatainika.

The main development consists of a tunnel that runs N. 75° E. for 130 feet along a vein or shear zone composed of a number of small quartz stringers ranging from less than 1 inch up to 3 inches in thickness. From this point the tunnel follows a fault, which has offset the vein for 30 feet to the north, and then along the vein for 200 feet. An inclined shaft 100 feet deep has been sunk on the vein near the mouth of the tunnel, and a winze in the tunnel at a point 100 feet from the portal is also 100 feet deep. A drift connects the bottom of the shaft and the winze, and most of the ore between them has been mined and milled. A drift also extends east from the 50-foot level of the winze until it encounters the fault discovered in the main tunnel.

The ore in this lode is white, milky quartz interbanded with schist. The gold in it is free milling but appears to have some association with the small quantity of sulphides, chiefly stibnite, scattered through the quartz. The stringers are usually “frozen” to the schist, which on that account forms a considerable proportion of the ore going to the mill.

About 100 feet south of the main tunnel a 50-foot shaft has exposed a vein of quartz ranging from 1½ to 2 feet in width and having two well defined walls. Drifts were run 15 and 20 feet to the west and east, respectively, along the strike of the vein, which dips 50° S. It carries a considerable amount of stibnite and free gold is visible both in the stibnite and in the quartz.

A shaft has also been sunk on an adjoining claim lying northeast of the Tolovana claim to a depth of 100 feet, from the 50-foot level of which drifts were turned off to the east and west along the vein for 50 and 30 feet, respectively. From the end of the west drift a raise was driven to the surface and the block of ore between the raise and the shaft was mined and milled. The vein contains quartz and stibnite, with smaller quantities of other sulphides.

The ore was originally treated in a Huntington mill, but this was replaced in 1912 by a 2-stamp Nissen mill. The stamps weigh 1,300 pounds each and crush the ore through a 40-mesh screen. The pulp then passes over the amalgamating plate, after which the sulphides are removed from the tailings by an endless conveyor belt operated something after the principle of a Frue vanner. The capacity of the mill is 6 to 8 tons per 24 hours

**Eldorado Mine.**

The Eldorado mine is situated on the headwaters of Cleary Creek about half a mile southwest of the Tolovana mine.

The development consists of 2 shafts and 3 drifts on a vein from 3 to 5 feet wide, striking N. 35° E. and dipping 85° N. The southwestern shaft is 45 feet deep, 4 by 8 feet in size, and is timbered and cribbed. From the bottom drifts have been driven along the vein in both directions, the one to the southwest being 30 feet and the one to the northeast 45 feet in length. They are timbered only where necessary and are 4 by 6 feet in size. Starting at a point 15 feet from the shaft along the south side of the northeast drift, a stop is located which is 25 feet long, 20 feet wide and 12 feet high. A body of silver-bearing galena 2 to 3 feet in thickness was mined from this stop, and shipped to the smelter at Tacoma without concentration, but around the edges of the stope pyrite and zinc blende became predominant and further mining was discontinued.

The ore body in the stopes, before its removal, was found in practically a horizontal position, in contrast to the vertical position of the vein.

The northeasterly shaft, which is 4 feet by 6 feet in dimensions, has been sunk to a depth of 35 feet at a point 200 feet from the first shaft. It is also timbered to the full depth. From the bottom a drift extends for a distance of 45 feet southwest along the vein.

The ore contains a complex mixture of pyrite, galena, zinc blende and stibnite in a gangue composed largely of quartz. The country rock in the vicinity is highly metamorphosed limestone. The different minerals composing the ore are intimately intermixed and, generally speaking, the size of the individual crystals is small. The ore carries silver in the
proportion of 2 to 2½ ounces of silver per ton for every percent of lead. The
most of the silver is contained in the galena but there is, in addition,
no doubt a small amount of silver mineral present—possibly a sulphide
or antimonide. In the oxidized portion of the vein, which extends to a
depth of about 30 feet from the surface, the pyrite is changed to limonite
and a part of the galena to carbonate; the zinc content is extremely low,
and the presence of silver chloride is suspected.

Approximately four tons of this ore was tested at the Alaska Station
of the Bureau of Mines in 1918, and a mill was designed for the treat-
ment of the ore, the construction of which, however, was not recommended
until a much larger tonnage of ore had been blocked out. The lessees were
unable to do this at the time for financial reasons and the property
has remained idle.

LITTLE ELDORADO CREEK

Newsboy Mine.
The Newsboy mine is situated at the head of Little Eldorado Creek,
just over the divide from Cleary Creek. It is ¾ miles from Gilmore sta-
ton on the Chatanika branch of the Alaska Railroad.

The vein trends N. 40° E. with a dip of 73° NW., and averages 2 or
3 feet in thickness. In places, however, the vein splits and encloses a
horse of highly mineralized schist, permitting the mining of 12 to 14
feet of ore. Fine grained quartz is the most abundant mineral but the
vein carries a larger proportion of sulphides than most of the other mines
in the district. The sulphides are chiefly pyrite and stibnite.

The mine has been developed by an inclined shaft 350 feet deep.
Drifts aggregating more than 1,500 feet in length have been turned off
at the 60, 115, 150, 215 and 315-foot levels and most of the ore between
the upper levels has been stope! out for a distance of 75 to 100 feet froin
the south, has been named the Soo vein. At the west end line of the
Soo claim the vein is 35 feet north of the Wild Rose, while at the
west end line of the Soo claim the distance between the veins is only 60
feet. It has been prospected by a shaft 100 feet deep at the east end
of the Soo claim and by a crosscut tunnel near the center of the claim.

The mine is equipped with a 2-stamp Joshua Hendy mill, situated
half a mile from the mine. The ore was crushed at the mine before being hauled to the mill. The stamps weigh 1,000 pounds each
and crushed the ore through a 40-mesh screen. The tailings from the
plates were discharged into a Pierce amalgamator which caught any quick-
silver or rusty gold that passed over the plates. The capacity of the
mill is reported to have been 10 tons in 24 hours.

VAULT CREEK

Fredericks Mine.
The Fredericks mine is situated on the ridge between Vault and
Dome Creeks. The Chatanika branch of the Alaska Railroad crosses the
property, although Ridgetop station lies about a mile to the north.

The property is developed by two shafts and a series of open cuts.
The western shaft is 300 feet deep and from it levels have been turned
off along the vein in both directions at the 100, 200 and 300-foot levels.
These workings have exposed a fissure vein about three feet in width
which strikes N. 70° W. and dips 70° N. at the surface but flattens to 45°
at the bottom of the shaft. The chief vein material is quartz containing
some free gold and, in places, considerable masses of stibnite. The east-
ern shaft is 100 feet deep and in it the 80° dip of the vein does not change
in depth. The mineralization at this point has taken place in a fissured
zone which has no well defined walls.
PEDRO CREEK

Rainbow Mine.

The Rainbow mine is situated a short distance north of the junction of Skoogy Gulch with Twin Creek, which is one of the principal tributaries of Pedro Creek. The distance to Gilmore, the nearest point on the Chultanika branch of the Alaska Railroad, is five miles.

The ore occurs in a fissure vein having an east-west trend and a vertical dip. The vein averages from 10 to 12 inches in thickness and the vein material is glassy quartz containing rarely more than three per cent of sulphides. The chief sulphides are pyrite, arsenopyrite and stibnite, but galena and sphalerite have been identified. Visible gold is rare, although the ore is free milling. At the west end of the property the vein intersects a granite dike, which dips N. 45° E., but in the remainder of the property the walls of the vein are schist. The ore occurs in shoots which dip 45° E., three of which were encountered in the 600 feet of the vein exposed on this and the adjoining property, the David.

The ore from the Rainbow mine has been taken out through a shaft 130 feet deep, which was sunk at a point 250 feet east of the end line of the claim. From the 100-foot level of the shaft drifts were run along the vein for 125 feet to the east and 250 feet to the west. Chutes were spaced at 35-foot intervals in the drifts. Approximately 1,500 tons of ore, which is reported to have averaged $25 per ton, were mined before the property became involved in litigation which lasted from 1914 to 1920, during which the mine was idle.

David Mine.

The David mine is located on Skoogy Gulch, adjoining the Rainbow mine.

The vein, which is the western extension of the Rainbow vein, ranges from 8 to 10 inches in thickness and has an east-west trend with a vertical dip. The character of the ore is similar to that found in the Rainbow mine.

The property was developed by an adit starting on the east side of Skoogy Gulch about 20 feet above the creek level and running 300 feet east to the end line of the Rainbow claim. All of the ore between the tunnel and the surface has been mined and milled.

The mill contains a 7 by 9-inch Blake crusher, two 1,000-pound Joshua Hendy stamps, dropping 52 times per minute and crushing the ore through a 40-mesh screen, a silver plated amalgamating plate 4 by 16 feet, a Pierce amalgamator and a 6-foot Johnson vanner. Power for the mill is derived from a 40-horsepower Erie boiler, burning wood fuel. It also supplies the power for the Ingersoll-Rand air compressor which furnishes air for the drills used in mining.

Anderson and Burch Mine.

The Anderson and Burch property is situated three-quarters of a mile above the mouth of Granite Creek, which flows into Pedro Creek just below the mouth of Twin Creek. It is 4½ miles from Gilmore.

The principal feature at this property is a lode, ranging from 35 to 45 feet in thickness, composed chiefly of quartz with a small amount of pyrite, arsenopyrite and stibnite. The lode was first discovered in a shaft 35 feet deep on the east side of the creek, and a cross-cut tunnel nearly 400 feet long was driven from a point just above the creek level to intersect the vein. An 80-foot crosscut, starting at a point 250 feet from the mouth of the tunnel, also cuts the lode which crosses the main tunnel at an angle of about 45°. A shipment of several tons of ore taken out when driving this crosscut was tested at the Citizens Test Mill in Fairbanks and an average of $3 per ton in gold is reported to have been recovered.

The tunnel intersects two other lodes, one about 18 feet thick at a distance of 60 feet from the portal, the other 57 feet thick at a distance of 183 feet. The first lode is a brecciated zone in the schist containing a number of small quartz stringers carrying pyrite and arsenopyrite. Although occasional rich specimens have been found, the ore as a whole is low grade. The second lode contains horses of schist between quartz vein matter interspersed with seams of blue-gray gouge. Arsenopyrite and pyrite are prominent constituents of the vein matter, which is low in gold content but contains some silver.

SAINT PATRICK CREEK

Billy Sunday Mine.

The Billy Sunday mine, formerly known as the Leah or the Smith and McGlone property, is situated on the eastern flank of Ester Dome, near the head of St. Patrick Creek. It is 1½ miles from Berry, the nearest postoffice, and 11 miles from Fairbanks. The distance to Happy, which is the nearest railroad station and the junction point between the Chultanika branch and the main line of the Alaska Railroad, is 2½ miles.

The underground work includes two inclined shafts, one of them 155 feet and the other 190 feet deep, together with about 500 feet of drifts and levels. At the 60-foot level of the main or deeper shaft one drift runs 100 feet northeast, where it connects with the other shaft, and another drift runs southwest for 120 feet. At the 120-foot level drifts run to the northeast and southwest for 60 and 125 feet, respectively. At the bottom of the shaft a drift runs 60 feet northeast and another 50 feet southwest. A 50-foot crosscut was driven in a southeasterly direction from the north drift on the 120-foot level, and a winze sunk to a depth of 70 feet from the end of the crosscut. Most of the ore has been mined for a distance of 60 feet on both sides of the shaft between the 120-foot level and the surface.

The ore occurs in a fissure vein from 2 to 5 feet thick, having a strike of N. 85° E., and a dip ranging from 70° SE. to vertical. The vein material is mostly quartz containing a small amount (rarely more than three percent) of sulphides, including pyrite, stibnite, some sphalerite and smaller amounts of galena. The ore is free milling and visible gold can
often be detected. The walls of the vein are schist. At a point about
50 feet below the collar of the main shaft the vein splits and encloses a
horse of schist which is much shattered and filled with quartz stringers
carrying some gold. At the 120-foot level a nearly horizontal fault has
offset the vein about 50 feet to the southeast. The values in the vein
appear to be original constituents and no indications of secondary enrich-
ment have been observed in the 200 feet of depth thus far penetrated.

The ore is mined by the overhead stope method, and falls into
chutes spaced at 30-foot intervals along the drifts. It is skidded to
the shaft and dumped into a 500-pound bucket which is hoisted along skids in
the shaft by a 5-horsepower gasoline engine. At the collar of the shaft
an automatic trip dump the contents of the bucket into a mine car in
which the ore is trammed on a short trestle and dumped into wagons for
hauling to a nearby mill. An Ingersoll-Rand jackhammer and a Sullivan
stoper are used in drilling, for which air is supplied by an Ingersoll-Rand
compressor driven by a 12-horsepower gasoline engine. The cost of gasoline
at the mine is 72½ cents per gallon.

The shafts are timbered and cribbed where necessary and tunnel
sets are used in the drifts. A few stalls are also used in the stopes to
hold the roof until the stopes can be filled with waste. The timber is
local spruce logs ranging from

The ore in the Ryan lode occurs in a fractured or fissure zone rang-
ing from 20 to 85 feet in width, and consists of a mixture of quartz and
country rock containing a rather large amount (possibly as much as ten
percent) of sulphides which are chiefly arsenopyrite and stibnite. The
lode trends N. 30° E. and has a steep dip to the east.

A second and nearly parallel lode, lying 400 feet to the northwest,
have been traced for several hundred feet by a series of shallow shafts and
pits. It averages six feet in thickness.

During 1916 and 1917 this property was examined by a nationally
known exploration company who spent some $25,000 in prospecting the
ore deposits in this vicinity. It is reported that their estimate of the
available ore in the Ryan Lode group is 800,000 tons, having an average
value of $1 per ton.

Bondholder Group.

The Bondholder group includes the Bondholder, Bondholder Exten-
sion, Oakland, Oakland Extension and Yellow Jacket claims, situated at
the head of the north fork of St. Patrick Creek, about half a mile north
of the Billy Sunday mine. This group is often referred to as the Tyndall
and Finn property.

A ledge ranging in width from 6 to 12 feet, with a strike of N. 20°
E., and a dip of 40° NW., has been traced across the first four claims
mentioned above, which are located along the trend of the vein in the order
named. The vein matter is chiefly quartz and is frequently stained to a
greenish color due to the oxidation of arsenopyrite. Other sulphides are
of rare occurrence. The richest gold values are found near the hanging
wall and particularly in the stained quartz.
The principal development work consists of a crosscut tunnel nearly 700 feet long, starting on the Yellow Jacket claim (which adjoins the Bondholder on the northeast) at a point 250 feet vertically below the outcrop of the Bondholder ledge and driven to intersect that ledge. In addition, three shafts, two of which are nearly 150 feet deep, have been sunk on the ledge. At the 55-foot level of one of these a drift was driven for 50 feet to the southwest along the vein, which at this point has a mineable thickness of twelve feet.

Mohawk Group.

The Mohawk group includes the Mohawk and Mohawk No. 2 claims, situated just north of the Billy Sunday mine.

Two shafts on this property, each about 50 feet deep, have exposed a well defined ledge ranging from 2 to 8 feet in thickness. It is believed to be the extension of the Billy Sunday lode. The vein matter is quartz containing a small amount of stibnite and sphalerite. During the summer of 1922 approximately 300 tons of ore were mined from the Mohawk claim and treated at the neighboring St. Patrick mill, from which a recovery of more than $12,000 is reported.

Last Chance Prospect.

The Last Chance prospect is situated on the ridge at the head of St. Patrick Creek between the Mohawk and Bondholder properties.

A 60-foot shaft which was sunk during 1922 exposed a quartz vein about 2 feet thick, striking approximately N. 45° E. and dipping steeply to the north. The vein material is chiefly quartz containing a small amount of arsenic and antimony sulphides. Visible gold can often be detected. Short drifts were turned off at the bottom of the shaft along the vein from which about 125 tons of ore were mined. The ore was treated in the St. Paul mill, near by, and is reported to have yielded an average of $30 per ton.

ESTER CREEK

Saint Paul Mine.

The Saint Paul mine is located at the head of Eva Creek, the easternmost tributary of Ester Creek. The property is 1½ miles from Berry, the nearest postoffice, and 3½ miles from Happy Junction on the Alaska Railroad.

The principal development work consists of a tunnel nearly 400 feet long, which has been driven on a 3-foot vein of massive white vitreous quartz having a strike of N. 40° E. and a dip of 33° NW. The quartz is shattered and iron stained and often contains irregular bodies of stibnite. It is believed that the gold found in this vein was deposited with the quartz vein, which was probably barren of gold when first formed. Several hundred tons of ore have been mined and treated in the 7-foot Lafle mill on the property, the details of which are included in the description of the Billy Sunday mine.

Hudson Mine.

The Hudson mine is situated on the west side of Ready Bullion Creek, a tributary of Ester Creek lying about a mile west of Eva Creek. The property is a mile from Berry postoffice and six miles from Ester station on the main line of the Alaska Railroad.

The main opening of the Hudson mine is a 200-foot shaft from which a large amount of drifting has been done, chiefly at the 100-foot level. At this depth a 20-foot crosscut to the west intersected a fissured zone, 15 feet wide, filled with stringers and lenses of quartz between mineralized schist. It strikes N. 20° E., and dips 45° NW. It has been followed by a drift for 160 feet northeast along the strike until it was abruptly terminated by a transverse fault dipping 60° SW. Some very rich ore has been mined and milled from shoots in the stringers of this lead.

At the end of the west crosscut a drift was also run for 200 feet to the south along the strike of a 4-inch quartz stringer. Several short crosscuts have been driven to the east and west from this drift, disclosing other small stringers more or less parallel to the drift.

A crosscut was also driven for a distance of 100 feet east from the shaft.

The property is equipped with a mill containing two Nisson stamps. It is situated on Ester Creek a little more than half a mile from the mine.

ANTIMONY MINES

During the years 1915 and 1916 a number of antimony mines in the Fairbanks district were opened to take advantage of the high price of that metal caused by the exceptional demand for it in connection with the manufacture of war munitions, and nearly 4,000 tons of the ore were shipped to the various purchasers throughout the United States. The most important of these mines were situated on Vault and Little Eldorado Creeks, which are tributaries of Chatanika River; on Chatham Creek, a tributary of Clear Creek; and on Eva Creek, a tributary of Ester Creek. In 1917, however, the price of antimony declined to a point which no longer furnished a profit after paying mining costs and transportation charges, and hence the antimony mines in this district have since been idle.

VAULT CREEK

Black Eagle Mine.

The Black Eagle mine was the largest producer of antimony ore. It was situated on a small branch of Treasure Creek, which is the west fork of Vault Creek. The property is 4⅔ miles from the Vault Creek summit on the Chatanika branch of the Alaska Railroad.
The ore occurred in a shear zone ranging from 2 to 10 feet in thickness and having an east-west strike and a dip of 50° to 70° S. The enclosing country rock is schist. The richer portions of the ore were found in shoots or lenses varying from a few feet to 40 or 50 feet in length. A small amount of free gold and some silver accompanied the antimony.

The deposit was mined from an adit following along the strike of the lode. Hand drilling was used and the ore was sorted at the mine before shipment. It was hoisted from the mouth of the adit to the top of the ridge on the south side of Treasure Creek by an inclined tram 3,000 feet long. From this point a wagon road follows the tip of the divide to the railroad. The mine produced approximately 2,500 tons of ore during the two years of its operation.

Gilmer Mine.

The Gilmer mine is situated on the east side of Vault Creek, about a quarter of a mile south of the Fredericks mine, which has already been described on page 103 of this report.

The antimony ore at the Gilmer mine occurred as lenses or shoots in a fractured zone ranging from 1 to 5 feet in thickness and striking N. 70° E. with a dip of 60° NW. The property was developed by an inclined shaft about 100 feet deep with drifts and stopes on either side from which several hundred tons of high grade antimony ore were mined.

Hindenburg Mine.

The Hindenburg mine is situated on the west side of Little Eldorado Creek, about two miles above the Chatanika branch of the Alaska Railroad.

The workings consisted of a shaft about 25 feet deep from which drifts extended along an ore body trending northeast and southwest and dipping 60° SB. Approximately 200 tons of antimony ore were shipped from this property in 1916.

CHATHAM CREEK

Chatham Mine.

The Chatham mine is essentially a gold mine and has already been described as such, but in 1916 several tons of antimony ore were mined from a stope 60 feet above the main tunnel at a point 850 feet from the portal. The stibnite occurred in a small vertical vein about 18 inches thick which strikes N. 70° E. It cuts the main vein in the east drift at a point about 150 feet from the tunnel.

EVA CREEK

Stibnite Lode.

The Stibnite lode is situated at the head of Eva Creek about two miles north of Berry postoffice and seven miles from Ester station on the Alaska Railroad.

TUNGSTEN MINES

There was also considerable prospecting and mining of tungsten ores during 1915 and 1916 and 1917, likewise engendered by the high price of that metal due to abnormal war conditions. The work centered in two districts, one near the head of Gilmore Creek and the other near the head of First Chance Creek, both of which are tributaries of Goldstream from the south.

GILMORE CREEK

Alaska Tungsten Mines Company.

The property of the Alaska Tungsten Mines Company includes the Scheelite and Tungsten claims which are situated on the divide at the head of Gilmore Creek about six miles from Gilmore.

The ore occurs as a disseminated deposit in a mineralized zone following the cleavage of the country rock which is highly metamorphosed and silicated crystalline limestone. On the Scheelite claim the lode is from 2 to 12 feet thick and strikes N. 70° E. with a dip of 20° to 40° NW. It has been developed by an inclined shaft 150 feet deep, which starts on an angle of 40° but flattens appreciably in depth. Near the bottom the shaft has been widened to a stope which follows the irregular outlines of the ore body which in places attains a breadth of 40 feet. Approximately 400 tons of ore were mined from this claim.

The lode on the Tungsten claim, which adjoins the Scheelite on the east, has a strike of N. 70° E. and a dip of 38° N. It ranges from 4 to 6 feet in thickness and attains a breadth of 10 feet. It was developed by an inclined shaft 75 feet deep, from which approximately 250 tons of ore were mined.

During the first two years of operation the ore was hauled to one of the mills on Fairbanks Creek for treatment, but during 1917 a Faust jig and concentrating table were installed on Yellow Pup, a tributary of Fish Creek, about a mile from the property and at 1,000 feet lower elevation. The mill was operated but a few months, however, before mining ceased because of the drop in the price of tungsten ore.

FIRST CHANCE CREEK

Tanana Group.

The Tanana group consists of five claims situated at the head of First Chance Creek about two miles from Gilmore.
The principal work on this group consists of a shaft 40 feet deep, which follows a 3-foot mineralized zone having a strike of N. 30° E. and a dip of 35° NW. The scheelite occurs in stringers of soft, decomposed, iron-stained schist 2 to 6 inches thick.

Columbia Group.

The Columbia group consists of three claims situated at the head of Steele Creek just over the divide from First Chance Creek and half a mile south of the Tanana group. The principal development work consists of an adit driven for 90 feet along the granite hanging wall of a vein which strikes N. 20° W. and dips northeast. The vein, which is three feet thick, consists of decayed stringers of country rock impregnated with a small amount of scheelite. A Faust concentrating mill was erected at the property in 1917.

Other Properties.

Scheelite has been found at a number of other properties in the vicinity, including the Tungsten Hill Group of eight claims lying a quarter of a mile west of the Tanana Group, the Spider Hill Group of three claims a quarter of a mile east of the Tanana Group, and the Blossom Group west of the Tungsten Hill. Work on these properties has been confined to surface trenching and, although in several instances encouraging prospects were found, no appreciable development work was done prior to the drop in the price of tungsten ore, which effectively terminated tungsten mining in the Fairbanks district.

FUTURE OF GOLD LODE MINING

It is true that the inactivity from 1917 to 1921 has created in some quarters a feeling of skepticism as to the future of lode mining in the Fairbanks district, but even a brief survey of the three reasons for that inactivity, namely, lack of adequate transportation facilities, shortage of fuel, and the high cost of supplies, if made in the light of conditions as they now exist will show that such skepticism is without foundation in fact.

The lack of adequate transportation facilities was caused by the fact that shipments of supplies to Fairbanks could only be made on river steamers with a long haul up the Yukon River from St. Michael or a longer haul downstream from Whitehorse after a costly railroad portage from Skagway, and by the fact that such steamers could operate but four or possibly five months at best during the summer of each year. Hence, not only were freight charges high, but, what is more important, shipments had to be planned at least a year in advance and a much larger stock of supplies had to be carried. This condition has been entirely changed by the completion of the Alaska Railroad, which now operates bi-weekly trains from Fairbanks to open tidewater at Seward throughout all the twelve months of the year. The shortage of fuel was due to the exhaustion of the available standing timber on most of the important creeks in the district, necessitating longer hauls and a consequently higher price. This has been remedied by the building of a spur from the railroad at Healy to the coal mines at Suntrana, as a result of which fuel for mining operations, the cost of which is one of the big items of expense, is now available at any point on the main line or the Chatanika branch at a much lower cost per horsepower than it has ever prevailed during the last 10 or 15 years. And the cost of supplies, although it has not yet reached the pre-war level, is appreciably lower than it was five years ago and is steadily decreasing each year.

In the above descriptions of gold mines and prospects the attempt has been made to include none but those which have either made an appreciable production or show reasonable possibilities of such. There are no large and rich bonanzas in the list, however, and future mining at most of them must be done slowly, carefully and economically by, or at least under the direct personal supervision of, the owners or operators. The outstanding factors in the success of the two mines in the district that were able to operate during the lean years are direct personal supervision, the elimination of overhead expense, and the postponement of mill construction until fully warranted by the mine development. On the other hand the above list contains several instances where the showing was as good if not better than these two mines but where financial failure was caused by a disproportionately large organization with high overhead expense, or by the investment in a mill or an expensive cross-cut tunnel in advance of adequate delimitation of the ore body. If this past experience is used as a guide to avoid similar errors in the future there is no hesitancy in predicting a steady and sound increase in gold mining activity in the Fairbanks district.

THE KANTISHNA REGION, ALASKA

By JOHN A. DAVIS
Superintendent, Alaska Experiment Station, U. S. Bureau of Mines.

INTRODUCTION

LOCATION

The Kantishna Region, in the broader sense, includes that portion of Interior Alaska lying between the Tanana River on the north, the crest of the Alaska Range on the south, and the 149th and 152nd meridians on the east and west respectively, and embodies an area of approximately 10,000 square miles.
DRAINAGE

The main stream within this area is Kantishna River. It is one of the chief tributaries of the Tanana and empties into that stream about 80 miles above the junction with the Yukon. Two of its principal tributaries, Toklat and McKinley Fork, have their headwaters in the Alaska Range and are supplied from the melting ice fields and glaciers on the northern slopes of these mountains. A third tributary, the Bearpaw, does not reach the high mountains but has its headwaters in the Kantishna hills, which lie 15 or 20 miles north of the main range. The eastern portion of the region is drained by Nenana River and its principal tributary from the west, the Teklanika.

TOPOGRAPHY

The northern part of the region contains the broad, flat lowlands of the Tanana River, which is about 25 miles wide along the Nenana River and increases to 60 miles in width in the western part of the region. In this lowland the surface rises gently from the river to the base of the foothills. It is dotted with lakes and marshes and for the most part is so swampy that travel across it is impossible during the summer months. Flanking the lowlands from the Nenana to the Toklat is a range of foothills. Beyond the Toklat these widen and include the Kantishna hills. A second range of foothills lies south of the first and extends from the Nenana River at the mouth of Healy Fork to the east fork of the Toklat, where it merges with the main Alaska Range. Between the foothills ranges are broad, open valleys having little relation to the present drainage which crosses them at right angles and pierces the foothills in deep, rock-walled canons.

The Alaska Range between Nenana River and Muldrow Glacier is about 20 miles in width and many of the peaks rise to elevations of 7,000 or 8,000 feet. Beyond Muldrow Glacier to the west the range becomes higher, culminating in Mount McKinley, whose summit rises 20,300 feet above sea-level.

 GEOLOGY

The geology of the region has been covered at length by Capps(a) in Bulletin 687 of the U. S. Geological Survey, to which the reader is referred for a more detailed description.

MINING DISTRICTS

From the viewpoint of mining development the most important localities in this region are the Kantishna and Copper Mountain districts. The Kantishna district is situated in the southern part of the Kantishna hills and comprises the area drained by Eldorado, Friday,

THE KANTISHNA DISTRICT

PLACER MINING

Placer gold was first discovered in the Kantishna district in 1905. The diggings were shallow and rich and the news of their discovery caused a stampede of several thousand people, chiefly from the Fairbanks district. But by midwinter it was generally known that bonanza ground was restricted to a few short creeks and by the fall of the following year the population had dwindled to 50 or 60 of the more fortunate who had staked paying claims. The value of placer gold won from this district during the period from 1905 to 1921 is estimated by the U. S. Geological Survey (a) at $480,000.

With the exception of two large-scale hydraulic operations, the Kantishna Hydraulic Co. and the Mt. McKinley Gold Placers, Inc., placer mining in the Kantishna district is conducted at present by individuals, or by partnerships having not more than two or three members, usually without the employment of any additional labor. Mining is carried on in the narrow V-shaped bottoms of the present creeks, the paystreak being caused by "ground sluicing" from an automatic dam, and the lower 2 or 3 feet of gravel containing the concentrated gold from the entire deposit is shoveled by hand into sluice boxes mounted on low trestles and containing riffles for saving the gold. Where the bedrock is "loose" or shattered and broken one or two feet of the top portion is also shoveled in with the gravel.

Various types of riffles are used, depending upon individual preference of the miner, the pole and the Hungarian types being the favorites. The gold is usually coarse and the recovery is therefore relatively high. The automatic dams are provided with a spillway and a flexible gate. Attached to the gate is a lever having a counterweight and a wooden box which becomes filled with water when the level behind the dam reaches a predetermined height. The weight of this water opens the gate abruptly, loosing a flood through the spillway. When the pond above the dam is emptied, the gate closes and the operation is repeated.

automatically at intervals, depending upon the amount of water flowing down the creek.

During the season of 1922 there were 12 individuals or partnerships engaged in placer mining in the Kantishna district. They were: Peter Liesh on Friday Creek; Weisel and Ferraris at claim 19 above; and Peter Nelson at claim 13 above discovery on Eureka Creek; Faulkner and Appelle on Rainy Creek; Dan Badavinae at claim 6 above; and Dan Keeler at claim 13 above discovery on Glen Creek; Spinadel and Lithka on the right fork of Glen Creek; Chas. Trundy on the left fork of Glen Creek; Sutherland and Le Claire on Spruce Creek; John Lee at claim 14 above, and William Sorgia at claim 22 above discovery on Glacier Creek; and Andrew Ness on 22-pup of Glacier Creek.

The largest area of bedrock cleaned at any of these operations was 20,000 square feet, from which approximately $5,000 was recovered. The other operations were much smaller than this, ranging from 1,500 to 4,000 square feet with recoveries of $300 to $1,000.

Kantishna Hydraulic Mining Co.

The Kantishna Hydraulic Mining Co. owns approximately 890 acres of placer ground on Moose Creek, embraced in 45 claims, extending from a short distance above Eureka Creek to 1 1/2 miles below Friday Creek. The claims were located at various times from 1905 to 1920 and none are patented.

Moose Creek is one of the larger tributaries of Bearpaw River and has a gradient of 227 feet in three miles at the property. Its valley is 2,000 to 2,500 feet in width and the sides are abrupt. The creek flows through a narrow canon about two miles above Eureka Creek and there is a second canon at the lower end of the property. Water for hydraulic operations can be had from Moose Creek, which carries from 1,500 to 3,000 miners' inches, and from Wonder Lake, the outlet of which joins Moose Creek 1 1/2 miles above the property. This lake is about 3 1/2 square miles in area, and the water is impounded by a dam five feet high. It is believed that the lake derives its water chiefly from underground seepage. An additional 5,000 or 6,000 miners' inches could be brought to Wonder Lake from McKinley Fork at an estimated cost of $125,000. It would, however, have to be taken from within the boundaries of Mt. McKinley National Park.

The property is underlain by a false bedrock at a depth of eight feet below the bottom of the creek. The distance to true bedrock is not known, although a shaft was driven at a depth of 90 feet is thought to have been very close to it. The pay creek is from 400 to 600 feet in width, the value of which preliminary estimates placed at fifty cents per square foot. Gravels of lower value which, it is estimated, carry from eight cents to ten cents per square foot extend beyond this on either side. Some gold is found distributed all through the gravel, although the richer ground is found near the false bedrock. Large boulders are rare, the maximum being 400 or 500 pounds.

Preparatory work at this project included the construction of a dam at the outlet of Wonder Lake, a ditch 12,000 feet long, two to six feet deep, five and a half to six feet wide at the bottom and six to eight feet wide at the top, and an inverted siphon across Willow Creek 268 feet long, 41 feet high on the intake and 21 feet high on the discharge end.

The pipe line consists of 4,000 feet of riveted steel pipe tapering from 26 inches to 18 inches in diameter, together with 1,300 feet of side lines and feeders tapering from 14 inches to 9 inches in diameter. There are five giants, using 3, 3 1/2 and 4-inch nozzles interchangeably. The effective head is 235 feet.

The cost of the claims is reported at $33,000; the dam $300; the ditch, including the trestle for the siphon, $9,700; and the pipe lines, including the siphon, $19,500.

Approximately 50,000 square feet of bedrock were cleaned during 1922, which was the first season of operation at this property. The gravel was piped over the side of the sluice boxes, which were 20 inches wide, 20 inches deep and had a slope of 9 inches in 12 feet. The upper boxes of the string were fitted with riffles made of iron boiler tubes and the lower boxes had iron plates perforated with 3/4-inch holes. The gold recovery was disappointing as it fell considerably below the estimated value of the ground.

The mining method employed at this property is further described by Norman L. Wimmer, whose account is given herewith:

The creek deposit mined is practically all thawed and averages 10 feet in depth, there being about 2 feet of moss and soil and 8 feet of medium sized gravel. This gravel rests upon a "false bedrock" of clay. This clay has been found to be from 10 to 15 feet thick and to be underlain by about 25 feet of gravel, which will be prospected. Bedrock is very flat and a method of "piping in" over the side is used.

This method, as described to me by Mr. J. Howell, is in general as follows:

A giant is set up and a cut made across the channel sufficiently large and at a grade so that from 9 to 10 lengths of 40-inch boxes can be set at a grade of 9 inches to the box. As a rule the head of the boxes is about 30 inches below the surface of the ground, the lower end being a foot or so above bedrock. These boxes are heavily built out of 2x10 lumber with liners of similar size and the portion exposed to battering of the gravel and water is reinforced and protected. A heavy board apron extending 7 feet or more above the top of the boxes is constructed on the upstream side and set at a high angle so that gravel driven against it will fall into the boxes. An 8x8-inch timber is bolted lengthwise along the apron at a sufficient height to keep the gravel from falling behind the boxes and also to serve as a protection to the edge of the box.

Two giants are set from 200 to 300 feet downstream from this line of boxes so that each giant can cover its field to the best advantage. A third giant is placed so that it can pipe material into the field of the middle giant and also stack the tailing. The material is then piped
upstream or against the slight grade, but is piped into the boxes well toward the head so as to allow sufficient riffle area for good gold saving. As the gravel is driven towards the boxes, the bedrock is piped clean, the boulders being piled to one side, and giants are moved forward if necessary. When a cut is finished to the boxes, they are cleaned up and pulled to one side. The giants are then brought up and operations continued to the next set of boxes, already placed about 200 feet further upstream. The method is well adapted to the shallower gravel deposits where but little grade is available. A good supply of water under fairly high head is necessary to move sufficient gravel. There is no stream upstream. The method is well adapted to the shallower gravel and pushed to one side. All giants are then brought up and operated necessary. When a cut is finished to the boxes, they are cleaned up and pulled to one side. The giants are then brought up and operations continued to the next set of boxes, already placed about 200 feet further upstream. The method is well adapted to the shallower gravel deposits where but little grade is available. A good supply of water under fairly high head is necessary to move sufficient gravel. There is no stream upstream.

Mount McKinley Gold Placers, Inc.

The Mount McKinley Gold Placers, Inc., owns all the claims on Caribou Creek from the mouth to one mile above Crevice Creek; all the first tier, left limit, bench claims on Glacier Creek from discovery to 14 above; and approximately 400 acres on the divide between Glacier and Caribou Creeks. The claims were located at various times from 1905 to 1920 and none are patented.

Caribou Creek has its headwaters on the north and west slopes of Kankone Peak in the Kantishna hills and flows west for approximately ten miles, then north for seven or eight miles, emptying into the Bearpaw near the mouth of Glacier. On its westerly course it is joined at intervals of one to two miles by Crevice, Last Chance, Snowshoe and Rex Creeks in the order named, all of them flowing into the main creek from the south. After Caribou Creek turns to the north it has no important tributaries from either side.

Glacier Creek has its headwaters on the north and west slopes of Glacier Peak, which is situated about five miles southwest of Kankone Peak, flowing west for two or three miles and then north for ten miles, emptying into the Bearpaw near the mouth of Caribou Creek. The distance between Glacier and Caribou Creeks varies from two to three miles.

The gradient of Caribou Creek at the upper end of the property is approximately 150 feet per mile, but after it turns to the north the gradient is about 75 feet to the mile. The valley floor averages 7,500 feet in width and in the upper portion of the creek the valley walls are steep and abrupt, somewhat more so on the right limit than on the left, but where the stream flows on a northerly course the sides are low and equally gently sloping. There are three canons or constricutions in the valley of the creek, one near the center of the property, one at Rex Creek and one at Last Chance Creek.

LODE MINING

Lode mining development in the Kantishna district centers in Quigley Hill. (a) as the main ridge between Friday and Eureka Creeks has been named in honor of Joseph B. Quigley, the pioneer “quartz” prospector of the district. The mineralized zone found in this hill has been traced beyond Glacier Peak to the east, a distance of 8 or 10 miles, and for about 5 miles to the southwest across Moose Creek along the divide between Eldorado Creek and Bear Creek.

(b) Note: The positions of the claims on Quigley Hill are indicated on the accompanying sketch map—Plate I.
Red Top Claim.

One of the most important claims on Quigley Hill is the Red Top, which lies across a spur that slopes toward the mouth of Friday Creek from the western end of the hill. The claim trends N. 70° E., and its center lies along the crest of the spur; the western half extends down a steep slope toward Moose Creek and the eastern half extends along the more gentle slope of Friday Creek valley.

The vein on the Red Top claim occupies a fault fissure in a country rock of Birch Creek schist. It ranges from 4 to 10 feet in width, the vein matter being chiefly quartz with shoots containing galena, zinc blende, arsenopyrite and occasionally tetrahedrite, together with the oxidation products of these minerals. The hanging wall is quite distinct and both slickensides and gouge are present. The reverse is usually true in regard to the foot wall and shows replacement of the schist by vein matter. The sulphides, particularly those of lead and copper, carry a high silver content and some gold. They are usually segregated in a band or seam varying in width from 5 or 6 inches to as much as 3 feet, and at some places are found near the hanging wall and at others near the foot wall of the vein. Where weathered the quartz is stained with oxides of iron and often contains free gold which may be detected by panning.

At the time the claim was visited by the writer in September, 1922, the development work consisted of a series of open cuts and a tunnel 300 feet long. The open cuts extend southwesterly along the outcrop of the vein from the discovery stake, which is situated about half way up the steep slope mentioned above. The tunnel near the bottom of the slope starts at a point about 150 feet from the west end of the claim.

The discovery cut disclosed something over nine feet of vein matter, although the full width may not have been exposed. The vein consisted of two bands of mineralized quartz each about three feet in width, separated by a band of practically solid galena and oxidized products of galena also about three feet in thickness. A sample taken by the writer across the galena bearing portion assayed 0.28 ounce of gold, 57.6 ounces of silver, and 12.8 percent lead. The quartz portion also carries some gold and silver.

A second open cut, 50 feet southwesterly from discovery shows four feet of galena or its oxidation products. An interesting feature of this open cut is the occurrence of a considerable amount of what is apparently free sulphur, which will ignite with a match and burn with a characteristic blue flame and odor.

A third cut, 80 feet southwesterly from discovery, shows vein matter in place, but at the time of the visit it had caved in so that it was inaccessible.

A fourth cut, about 150 feet from discovery, was also inaccessible, but a fifth cut, at 220 feet, showed 15 inches of galena which is said to have
assayed $275 per ton in combined gold and silver. The full width of the
vein could not be determined at this point.

The Red Top tunnel starts at a point 255 feet S. 75° W. from
the discovery stake and follows a somewhat irregular course, the general
trend of which is north of east, for a distance of approximately 700 feet.

Thirty-seven samples were taken by the writer from the unlumbered
portion of the Red Top tunnel. Eight samples from the timbered portion,
which includes the first 67 feet of the tunnel, were taken by Mr. Quig-ley
at the time the timbering was placed. The assay returns of these
samples, which are lettered A to H, inclusive, to distinguish them from
the numbered samples taken by the writer, are given here because they
indicate the values in a portion of the tunnel which could not be sampled
at the time the mine was examined. All assays were made at the Alaska
station of the U. S. Bureau of Mines.

The following table shows the results of the assay of these samples:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Width of Portion</th>
<th>Gold (oz per ton)</th>
<th>Silver (oz per ton)</th>
<th>Total Value ($ per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.66</td>
<td>1717.10</td>
<td>$1155.50</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1.94</td>
<td>2255.60</td>
<td>$580.00</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1.72</td>
<td>232.36</td>
<td>625.90</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1.28</td>
<td>601.26</td>
<td>687.06</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.25</td>
<td>620.25</td>
<td>692.05</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1.56</td>
<td>735.78</td>
<td>768.21</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>0.50</td>
<td>2373.00</td>
<td>2592.00</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>0.14</td>
<td>1.19</td>
<td>2.99</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.06</td>
<td>0.39</td>
<td>1.44</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.30</td>
<td>0.80</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.30</td>
<td>0.80</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.08</td>
<td>0.20</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.06</td>
<td>0.04</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.10</td>
<td>0.30</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.04</td>
<td>0.16</td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.24</td>
<td>0.68</td>
<td>1.96</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.19</td>
<td>0.59</td>
<td>1.72</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.40</td>
<td>1.36</td>
<td>4.04</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.16</td>
<td>0.50</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.69</td>
<td>2.09</td>
<td>6.04</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.12</td>
<td>0.38</td>
<td>1.16</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.16</td>
<td>0.50</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.04</td>
<td>0.12</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.12</td>
<td>0.32</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>0.04</td>
<td>0.12</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>0.20</td>
<td>0.60</td>
<td>1.80</td>
<td></td>
</tr>
</tbody>
</table>

Note: Calculated on the basis of gold at $20.67 per ounce and silver at $1 per ounce.

Approximately five tons of high grade ore, secured while driving the
first 50 feet of the tunnel, had been sorted and sacked for shipment
and the dump contains approximately 600 tons, which it is estimated has
a value of $15 to $20 per ton. A grab sample of the sacked ore, taken
by Mr. Livingstone Wernecky, and assayed at Juneau, showed 1.24 oz.
of gold and 243.1 oz. of silver per ton.

In September, 1922, Mr. Hawley Sterling of Fairbanks obtained a
lease to mine the high grade ore shoot near the portal of the tunnel
and on January 1, 1923, had taken out approximately 50 tons of ore believed
to average over $200 per ton. The ore mined under the lease will be
hauled to the Alaska Railroad at Kobe (Mile 357) and shipped to the
smelter by way of Seward.

Hillside or Silver King Claim.

An extension of the Red Top claim has been located to the west
along the bench above Moose Creek. The Red Top vein was exposed in
the bottom of a 40-ft. shaft which was sunk just beyond the west
end line of the Red Top claim. The vein at this point was from 5 to 6
feet wide and carries sulphides of lead and copper in a quartz gangue.

The ownership of this ground is at present in litigation, one of the
claimants calling it the Hillside and the other calling it the Silver King.

What is thought to be a further extension of the Red Top ledge was
exposed in 1921 in an open cut made by ground sluicing on the steep
hillside above Moose Creek on the opposite side from the Red Top claim.
At the time the district was visited by the writer a slide of debris, loosened
by the water used in ground sluicing, had completely refilled the cut,
making it impossible to secure any detailed data as to this exposure.

Galena Claim.

The Galena claim lies along the western end of Quigley Hill, about
2,000 feet south of the Red Top, and is adjacent to the Frances claim on
the east. The principal developments on this claim are a tunnel near the
discovery stake and an open cut about 300 feet to the northeast.

The tunnel is driven through schist country rock for a distance of 30 feet until it intersects a vein which it follows for 30 feet. The
vein is 5 or 6 feet wide, consisting chiefly of highly iron-stained quartz,
which contains galena, arsenopyrite, zinc blende, and some tetrahedrite.
These sulphides occur in a band about 12 inches thick near the hanging
wall, which is well defined. The foot wall, however, gradually merges
into the schist country rock. The strike of the vein is approximately N. 45°
E., the dip 65° -70° S.E. A shallow winze a few feet from the breast was
inaccessible at the time this claim was visited.

The open cut lying northeast of the tunnel shows a quartz vein about
40 ft. long, 6 ft. wide, consisting chiefly of highly iron-stained quartz,
which contains galena, arsenopyrite, zinc blende, and some tetrahedrite.

Claim.

The extension of the Ered Top ledge has been located to the west
along the bench above Moose Creek. The Red Top vein was exposed in
the bottom of a 40-ft. shaft which was sunk just beyond the west
end line of the Red Top claim. The vein at this point was from 5 to 6
feet wide and carries sulphides of lead and copper in a quartz gangue.

The ownership of this ground is at present in litigation, one of the
claimants calling it the Hillside and the other calling it the Silver King.

What is thought to be a further extension of the Red Top ledge was
exposed in 1921 in an open cut made by ground sluicing on the steep
hillside above Moose Creek on the opposite side from the Red Top claim.
At the time the district was visited by the writer a slide of debris, loosened
by the water used in ground sluicing, had completely refilled the cut,
making it impossible to secure any detailed data as to this exposure.

Galena Claim.

The Galena claim lies along the western end of Quigley Hill, about
2,000 feet south of the Red Top, and is adjacent to the Frances claim on
the east. The principal developments on this claim are a tunnel near the
discovery stake and an open cut about 300 feet to the northeast.

The tunnel is driven through schist country rock for a distance of 30 feet until it intersects a vein which it follows for 30 feet. The
vein is 5 or 6 feet wide, consisting chiefly of highly iron-stained quartz,
which contains galena, arsenopyrite, zinc blende, and some tetrahedrite.

These sulphides occur in a band about 12 inches thick near the hanging
wall, which is well defined. The foot wall, however, gradually merges
into the schist country rock. The strike of the vein is approximately N. 45°
E., the dip 65° -70° S.E. A shallow winze a few feet from the breast was
inaccessible at the time this claim was visited.

The open cut lying northeast of the tunnel shows a quartz vein about
a foot in width containing tetrahedrite and chalcopyrite. The strike of this vein is N. 45° E. with a nearly vertical dip. Between 50 and 100
tons of ore derived partly from the tunnel and partly from the open cut
have been mined and shipped to the smelter at Selby, California.
Lucky Strike Claim.

Two veins have been discovered on the Lucky Strike claim in the bluff overlooking Moose Creek. A tunnel has been driven along the strike of one of these veins which is N. 55° E. The vein, which dips 74° S., is exposed for 30 feet above the tunnel and shows at least 3 feet of quartz between schist walls. The hanging wall is highly fissured. A sample of this vein next the foot wall, consisting of highly mineralized quartz, and thought to be the richest portion, shows 84 ounces of gold and 840 ounces of silver per ton. A sample of the next 3 feet of the vein shows 4.5 ounces of gold and 10.00 ounces of silver per ton. The vein is reported to carry valuable minerals beyond this width but a sample could not be obtained.

The second vein has been exposed in two open cuts about 40 feet apart and lying 125 feet north of the tunnel just mentioned. They show a strong quartz vein, well mineralized, and probably about 5 feet wide, although the cuts were so badly caved that the width could not be accurately determined, nor could a representative sample be secured. A sample of pieces of vein matter that were broken off at random assayed 63 ounces of gold and 1.00 ounces of silver per ton. The samples were taken by Mr. John Gross, metallurgist of the Bureau of Mines.

Silver Pick No. 2 Claim.

At discovery, on the Silver Pick No. 2 claim, which is 200 feet from the east end of the claim, a shaft 12 feet deep showed 6 or 7 feet of iron-stained quartz and calcite. The shaft was caved at the time of the visit and no samples were taken for assay.

An open cut near the northeast corner of the claim showed 2 feet of iron-stained quartz. A sample taken by Mr. Gross at this point assayed 14 oz. of gold and .10 oz. of silver per ton. The strike of the vein is N. 85° E. and the dip 53° N.

Frances Claim.

Development on the Frances claim consists of a tunnel 75 feet in length, the first 25 feet of which is timbered, and a series of open cuts on the surface extending along the strike of the vein which is N. 55° E. As exposed in the tunnel the vein varies from 12 to 10 inches in width. It dips to the south at an angle of 65°. The vein matter is composed chiefly of white quartz carrying gold and silver, but at discovery cut, near the east end line of the claim, some copper sulphide was observed. The open cuts were filled with material which had caved from the sides, hence no information could be obtained about the vein other than that indicated by the small dumps produced when the cuts were excavated. A series of samples taken by Mr. Gross across the total width of the vein at five-foot intervals in the tunnel gave the following assays:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Number</th>
<th>Gold</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>.02</td>
<td>.06</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>.03</td>
<td>.10</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>trace</td>
<td>.20</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>.04</td>
<td>.06</td>
</tr>
</tbody>
</table>

The value of the ore in the Frances tunnel appears to vary greatly from place to place, however, and samples taken by the lessee of this property in 1919 gave much better returns than this, some of them running as high as $35 per ton in gold and silver.

Martha Q. Claim.

A shallow shaft near the northwest corner of the Martha Q. claim has exposed a narrow vein, consisting chiefly of galena, having a strike of N. 15° W. and a dip of 56° E. A sample taken by Mr. Gross across 6 inches of this vein assayed .6 oz. in gold and 284.30 oz. in silver per ton. Several tons of ore were shipped from this claim in 1920-21, being added to the ore from the Gold Dollar claim, which is described below.

North Star Claim.

An open cut in the southwestern part of the North Star claim disclosed a 6-inch stringer containing galena and zinc blende from which a sample is reported to have assayed 60 ounces per ton in silver.

Friday Claim.

Development work on the Friday consists of a number of open cuts which were excavated in an effort to discover an extension of the Red Top vein. Although encouragement has been received from the finding of rich float in the debris of the hill, solid bed-rock was not reached in any of these cuts.

Polly Wonder Claim.

An open cut on the Polly Wonder claim 100 feet southwest of discovery exposed 8 feet of iron-stained quartz in which free gold can be detected by panning. The ore also contains a small amount of galena. The strike of the vein is approximately N. 65° W. with a dip to the south of 70°.

Little Maud Claim.

At discovery, on the Little Maud claim, which is near the west end line but a few feet from the discovery on the Frances, the open cut line intersects three veins, the first directly at the portal, the second at a distance of 55 feet and the third at a distance of 155 feet.

Silver Pick Claim.

The Silver Pick claim is developed by a number of open cuts and by a cross-cut tunnel 150 feet long which starts on the Little Maud claim. The first 25 feet of the tunnel is timbered and its course is S. 30° E. It intersects three veins, the first directly at the portal, the second at a distance of 55 feet and the third at a distance of 165 feet.

The first vein, which is composed chiefly of quartz carrying free gold and some galena, is also exposed in an open cut 100 feet southwest
of the tunnel. It is 3 feet in width. The strike is N. 50° E. and the dip 70° S. A sample taken in the tunnel by Mr. Gross showed .03 oz. of gold and 5.70 oz. of silver per ton.

The second vein shows 6 feet in thickness where it crossed the tunnel on a strike of N. 50° E. with a dip of 65° N.W. The vein matter consists of rusty quartz containing numerous bunches of galena, some pyrite and a considerable amount of zinc blende. According to Capps (a) a picked sample of the galena assayed 100 oz. of silver per ton. A sample taken by Mr. Gross across 6 feet of the vein along the north wall of the tunnel shows .06 oz. of gold and 10.00 oz. of silver per ton. This vein is also exposed in an open cut 72 feet south of the tunnel portal.

The third vein, as described by Capps (a) “consists of one foot of calcite on the footwall and 12 feet of quartz and schist, more or less sheeted, the quartz predominating in bulk over the country rock. Little galena is seen in the tunnel, but it is abundant along the surface crop of the vein. The whole zone is brecciated and leached, and large open cracks extend from the tunnel to the surface. Pyrite, arsenopyrite, and small amounts of galena and sphalerite were observed, and along some of the cracks deposits of a soluble salt, which on analysis proved to be the iron sulphate melaniterite, were found.” A sample taken by Mr. Gross across 12 feet of the vein along the south wall assayed .05 oz. of gold and .90 oz. of silver per ton. It is quite likely, however, that this sample is not representative, because there are unquestionable evidences of leaching at the point where the sample was taken. The strike of this vein as determined by survey between its exposure in the tunnel and in an open cut on the top of the hill 200 feet distant is N. 65° E. The dip, measured in the tunnel, is S. 67° E.

Darling Claim.

The discovery cut, near the center of the Darling claim, disclosed a ledge of iron-stained quartz one foot wide, in which a small amount of pyrite was observed. It is quite probable that the large vein exposed in the Silver Rock tunnel crosses the Darling claim but the work on this claim has as yet failed to expose it.

Little Annie Claim.

On the Little Annie claim an open cut on the crest of a spur jutting out from the main hill towards Friday Creek discloses a vein of quartz 10 feet wide, having a strike of N. 58° E. and a steep dip to the SE. The ore for the most part is free-milling and strongly oxidized, although some galena was noted near the hanging wall of the vein. Slickensides indicating a horizontal movement along the strike were observed. A sample taken by Mr. Gross across the full width of the vein assayed .08 oz. of gold and 4.90 oz. of silver per ton.

The same vein is also exposed in a second cut 60 feet southwest and a sample taken by the writer across 10 feet of ledge matter at this point assayed .02 oz. of gold and .30 oz. of silver per ton.

The principal development work on this claim centers around the Little Annie tunnel which was driven through schist country rock along a course of S. 40° W. to intersect this vein, starting from the west side of a small gulch in the northeast corner of the claim. It is timbered for the first 35 feet. In the tunnel the large vein just described is apparently split into two fairly well defined smaller ones which stand roughly parallel at a distance of 30 feet from center to center. The first of these, which was encountered at a point 60 feet from the portal of the tunnel, is 3 feet 2 inches thick and has a strike of N. 55° E. and a dip of 62° SE. The vein material is iron-stained quartz. A drift extends along the strike of this vein to the southwest for 19 feet and a sample taken by Mr. Gross across the vein at the end of this drift assayed .07 oz. of gold and .10 oz. of silver per ton. The second vein, which is cut by the tunnel at a point 90 feet from the portal, is 4 feet, 6 inches thick and has a strike of N. 55° E. and a dip of 65° SE. A sample taken on the left wall of the tunnel yielded .20 oz. of gold and .60 oz. of silver per ton. A drift has been driven along this vein for 75 feet to the southwest. The combined material from cuts taken in the roof of the drift at points 10, 20, 30 and 40 feet from the tunnel and across the full width of the vein in each case assayed .08 oz. of gold and .50 oz. of silver per ton. The material between these veins is highly silicified schist, intricately dissected by small quartz veinslets, carrying a small amount of gold.

From the point of its intersection with this second vein the main tunnel was extended for 170 feet in a southeasterly direction and it was used during 1919 in mining the high grade ore from a small vein which it intersected at this point.

This small vein consisted principally of silver bearing galena and was traced for nearly 100 feet along the surface by four open cuts. A series of samples taken by Mr. Gross across the full width of the vein in each instance gave the following assay returns:

<table>
<thead>
<tr>
<th>Location of Sample</th>
<th>Width of vein sampled</th>
<th>Ounces per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uppermost cut</td>
<td>24 in.</td>
<td>.26</td>
</tr>
<tr>
<td>Silver</td>
<td>286.20</td>
<td>48.70</td>
</tr>
<tr>
<td>Gold</td>
<td>.22</td>
<td>218.90</td>
</tr>
<tr>
<td>Third cut</td>
<td>12 in.</td>
<td>.64</td>
</tr>
<tr>
<td>Uppermost cut</td>
<td>24 in.</td>
<td>.14</td>
</tr>
<tr>
<td>Silver</td>
<td>242.80</td>
<td>46.70</td>
</tr>
<tr>
<td>Gold</td>
<td>218.90</td>
<td>52.40</td>
</tr>
</tbody>
</table>

During 1919 this claim was operated by a lessee and approximately 500 tons of high grade ore, which averaged over $200 per ton, were mined and shipped to the smelter at Selby, California. In this work it was discovered that the high grade values barely continued to a depth of more than 60 feet from the surface. All the ore in this particular shoot having a value greater than $150 per ton was removed, and the workings were then abandoned. By 1921, when they were first visited by the writer, they had become inaccessible.

---

The strike of this vein is approximately N. 26° E. with a dip of 65° or 70° SE. The ore is described as being almost solid galena, although some zinc blende and a little gray copper ore were associated with it. The gangue matter when present was either iron carbonate or calcite.

Several small faults in a practically vertical plane having a throw of perhaps 5 or 6 feet were encountered during the mining operations.

Little Annie No. 2 Claim.

The development on this claim consists of three open cuts. One of them, lying about 100 feet east of discovery, which is situated near the west end line of the claim, disclosed a vein of quartz about 9 feet wide which is highly iron-stained and contains some partly oxidized galena. Free gold can be detected by panning. The strike of this vein is approximately N. 65° E., with a dip of 70° S., and it is believed to be a continuation of the second branch of the Little Annie vein encountered in the Little Annie tunnel. A second open cut, 125 feet south of discovery, disclosed a 12-inch vein containing 5 or 6 inches of practically solid galena having a strike of N. 50° E. with a dip of 65° SE. The galena carries high values in silver and a sample taken by Mr. Gross across 12 inches of the vein assayed .98 oz. in gold and 136.50 oz. in silver per ton. The lessee mined approximately 10 tons of high grade ore from this vein in 1920 having a value of $200 per ton.

A third cut 300 feet northeast of discovery disclosed a vein of quartz 10 to 12 feet wide which is highly iron-stained and contains a considerable amount of oxidized galena. The cut was partly caved and the strike of the vein difficult to determine, but it is approximately N. 60° E., dipping steeply to the southeast. The vein might well be a continuation of the first branch of the Little Annie vein encountered in the Little Annie tunnel. A sample taken by the writer across 10 feet of vein matter assayed 0.10 oz. in gold and 1.00 oz. in silver.

Gold Dollar Claim.

A rich shoot of ore was discovered in an open cut near the east end line of the Gold Dollar claim. The vein averages 3 or 4 feet in width and contains galena, sphalerite, tetrahedrite and some stromerite. The strike of the vein is S. 65° E., dipping 75° to the south. It was developed by a shaft 38 feet deep and a short tunnel driven from the side of a small draw to intersect the foot wall of the shaft. During 1923 the lessee mined between 500 and 600 tons of ore from this shoot having a minimum value of $170 per ton. At the time it was visited by the writer, however, the workings were so badly caved that they were inaccessible.

Gold Eagle Claim.

At discovery cut, near the west end line of the Gold Eagle claim, a vein approximately 3 feet wide was disclosed containing galena, pyrite, sphalerite and the oxidation products of these minerals. The sulphides carry high values in silver. A tunnel was started on the east side of the small draw previously mentioned to intersect this vein and follows a crushed and slicken side zone for 60 feet along a course N. 70° E. It then swings to the north for an additional 50 feet where it intersects the vein and follows it for 30 or 40 feet along a course N. 65° E. The vein dips 75° SE. The vein in the tunnel, which is chiefly quartz, does not contain as many sulphides as are found in the surface cut. In the tunnel these are confined to a band 8 or 10 inches wide near the foot wall. Three or four tons of high grade ore, valued at $170 per ton, were mined from the surface cut by the lessee in 1920.

Gold King Claim.

The Gold King claim is developed by two tunnels which were inaccessible. As described by Capps (a) the vein has a width of from 4 to 6 feet and strikes No. 80° E. It consists chiefly of quartz containing arsenopyrite, sphalerite and galena.

Gold King East Claim.

The vein has been traced across the entire length of the Gold King East claim by a series of open cuts which, however, were so badly caved that no accurate determinations of the width of the vein could be made.

Pittsburgh Claim.

At discovery near the west end line of the Pittsburgh claim an open cut disclosed a vein consisting of 6 or 7 feet of quartz containing some sulphides and calcite. The hole was inaccessible, however, and no samples were secured.

Pennsylvania Claim.

There are two principal veins on the Pennsylvania claim which have been named Pennsylvania and Keystone by the owner.

The Pennsylvania vein crosses the west end line of the claim, which lies at the bottom of Iron Gulch) about 100 feet north of the center and extends up the east slope towards the Pittsburgh claim. The strike of the vein is N. 65° E. with a dip of 85° S. and it has been traced for over 500 feet by a series of open cuts spaced at approximately 100 feet intervals. Although there is a gap of about 1000 feet which has not been prospected as yet, hence the continuity is not absolutely established, it is quite likely that this vein is the same one that is exposed in the discovery cut on the Pittsburgh claim. The vein matter is quartz containing some pyrite and calcite, and free gold can be panned from samples taken along the outcrop.

The Keystone vein crosses the west end line of the claim at a point 100 feet south of the Pennsylvania vein. It has a strike of N. 50° E. with a dip of 60° S. and extends up the hill towards the NE. corner of the claim, intersecting the Pennsylvania vein about 400 feet from the west end line. It contains some pyrite and calcite, and free gold can be panned from samples taken along the outcrop.

end line. It has been traced along the surface for more than 1,200 feet by 20 open cuts on the outcrop. The vein matter is chiefly quartz containing a considerable quantity of pyrite and arsenopyrite and some sphalerite and galena. It varies from 4 to 6 feet in width. A tunnel starting near the western end line of the claim has been driven for 50 feet along the hanging wall of the vein, and a shaft was sunk to a depth of 30 feet at a point near the intersection with the Pennsylvania vein. A sample taken by Mr. Gross across 14 inches of vein matter in the face of the tunnel assayed 1.6 oz. of gold and 1.60 oz. of silver per ton. Several ounces of finely crystallized gold were obtained by panning in a small open cut 60 feet east of the portal of the tunnel. A sample taken in the shaft by the writer gave the following assay: Gold, 0.96 oz. per ton, and silver, 0.26 oz. per ton.

Keystone Claim.

Both the Keystone and Pennsylvania veins have been traced by open cuts for 300 or 400 feet on this claim. There is a third vein which outcrops near the east end line of the claim between the other two veins and intersects both of them. The strike of this vein is N. 30° E. and it has a steep dip. It is developed by a tunnel which is 50 feet long and by several open cuts on the surface. The vein matter is quartz carrying galena and some pyrite. The vein is 3 feet wide at the portal of the tunnel but narrows to 12 inches at the face. Some of the assays of weathered quartz taken from the surface cuts show high values in gold while others show but a trace, indicating that the deposit is extremely "spotty."

Sulphide Claim.

The discovery cut, near the center of the Sulphide claim, disclosed an 8-ft. quartz vein carrying pyrite. It shows free gold on panning.

Water Level Claim.

A cut at the eastern end of the Water Level claim disclosed a vein 3 feet in width carrying galena. Samples from this cut are reported to have assayed from 30 to 40 oz. of silver per ton.

White Hawk Claim.

A 3-ft. vein carrying some tetrahedrite but no galena was exposed in the discovery cut on the White Hawk claim. This vein has been traced 500 feet to the southwest where a 12-ft. shaft disclosed a 3-ft. vein, which was followed by a drift 15 feet long. The ore is similar to that found at discovery. No assays have been made of samples from this claim.

Other Claims.

In addition to these claims there are a number of others, including the Jumbo, Caribou, Meadowbrook, Bluebell, Iron Gulch, etc., which have been staked on Quigley Hill. At the time this district was visited by the writer the excavations on these claims were so badly filled by caving that no data could be obtained regarding the veins exposed in them.

ELDORADO CREEK

A number of claims have been staked on the hill north of Eldorado Creek and west of Moose Creek, and in line with the trend of mineralization on Quigley Hill. On the majority of these claims the development work is limited to open cuts on the surface which were inaccessible through caving at the time the district was visited. On the Alpha claim, however, a considerable amount of development work has been done.

Alpha Claim.

The Alpha claim lies near the top of the hill on the Eldorado Creek side about a mile from Moose Creek. The development work consists of a tunnel 120 feet long, the first 106 feet of which is timbered, and a shaft 20 feet deep situated 60 feet S. 25° W. from the end of the timbering. The vein matter is highly iron-stained quartz and contains sulphides and oxides of lead and copper. The bottom of the shaft exposed a mineralized zone 8 or 9 feet wide containing three bands of highly mineralized iron-stained quartz, each about one foot in width. Something over a ton of ore was sorted and sacked from the material excavated in sinking this shaft. A grab sample of this ore assayed by the Bureau of Mines showed 266.30 oz. of silver per ton.

GLACIER CREEK

Mc Gonagall Claims.

The McGonagall claims are located near the head of Glacier Creek. The upper claim lies at an elevation of about 3,500 feet. The vein is exposed at the surface and is developed by a tunnel 30 feet long at the face of which 8 feet of mineralized quartz was exposed which carried some galena and a small amount of stibnite. Samples taken by the owners across the entire width of the face are reported to have yielded 0.9 oz. of gold and 63.00 oz. of silver per ton.

The lower claim is also situated on the right limit of the creek but approximately one-half mile to the west and several hundred feet lower in elevation. The vein is exposed at the surface and consists of 15 inches of quartz which is free milling. One ton of ore from this outcrop was sent to a testing plant in Seattle and milled, yielding $30 in gold. A crosscut tunnel was started from the bank of the creek and driven to intersect this vein. At a distance of 30 feet from the portal it encountered a 3-ft. shear zone impregnated with gray copper, stibnite and chalcopyrite, from which assays containing as high as 55 oz. of silver per ton were secured. The tunnel was extended 15 feet beyond this shear zone without encountering the free milling quartz vein which it was being driven to intersect. A crosscut was then driven 12 feet to the right of the tunnel along the shear zone at the end of which the quartz vein was encountered.
It was discovered that the vein had been faulted and displaced to the left and that the tunnel had been driven through the fault. The tunnel is 4 feet by 6 feet in the clear and is timbered for the first 25 feet.

GLEN CREEK

Two prospects were discovered during the summer of 1921 near the head of the west fork of Glen Creek.

Arkansas Claim.

The first of these is known as the Arkansas claim, and the open cut at discovery exposed a mineralized zone about 14 feet wide, consisting of three bands of quartz separated by two bands of schist from right to left as follows: Five feet of quartz, 2½ feet of schist, 1½ feet of quartz, 2½ feet of schist, 1½ feet of quartz. A grab sample taken by the writer across the 5-ft. quartz band showed 90 oz. of silver per ton. The ore is chiefly sulphides of lead and antimony with some sphalerite.

Pension Claim.

The Pension claim lies about 1,500 feet farther up the creek. The open cut at discovery exposed a vein 5 feet wide, of which 2½ feet was nearly solid galena, the remainder being quartz. A grab sample, taken by the writer, of the 2½ feet of galena assayed 150 oz. of silver per ton. The owner was starting a tunnel about 25 feet below the outcrop at the time the claim was visited.

SPRUCE CREEK

Five claims have been located at the head of Spruce Creek, as follows:

Lucky Jim Claim.

The discovery cut on the Lucky Jim claim exposed a ledge of rusty quartz one foot in width which pans free gold and carries some galena and chalcopyrite.

Lena Claim.

The vein on the Lena claim is two feet wide and also consists of rusty quartz. It carries galena, some copper oxides or carbonates and some native silver. In an open cut 75 feet below discovery the vein is 3 feet in width.

Silver Wire Claim.

The discovery cut on the Silver Wire claim showed a quartz vein two feet in width, carrying galena and some copper oxides.

Mystery Claim.

At the Mystery claim the quartz vein is 2½ feet wide as exposed in the discovery cut, carrying galena, stibnite and copper oxides. No free silver was observed on this claim.

TRANSPORTATION

The only route available in the past for the transportation of any quantity of supplies to the Kantishna district is the water route down the Tanana River and up the Kantishna River to Roosevelt, and thence overland to the mines. The distance from Fairbanks to the mouth of the Kantishna is 155 miles, from the mouth of the Kantishna to Roosevelt is 156 miles, and from Roosevelt to Kantishna Post Office is 53 miles, a total of 341 miles to cover an "air line" distance of 135 miles. The rivers are, of course, navigable only during the summer months, but during that season of the year the first six miles of the overland portion of the route from Roosevelt to Kantishna are almost impassable for teams because of swamps. The usual procedure therefore involves the storage of the supplies at Roosevelt until the swamps are frozen, when they can be crossed by horses and sleds. The cost of transportation over this route is $80 per ton—$40 by water to Roosevelt and $40 by sleds from Roosevelt to Kantishna. During the years 1919 and 1920 a special rate of $25.50 per ton was made by the Alaska-Yukon Navigation Company for ore shipments from Roosevelt down the Kantishna River to St. Michael and thence by sea to Tacoma. This company has abandoned transportation on the Tanana River, owing to the completion of the Alaska Railroad, and this rate will probably not be duplicated.

Another route starts at McKinley Park station on the Alaska Railroad, which is 348 miles from Seward, and follows up Morris Creek, thence along the northern slope of the second foothill range (described on page 2) across Savage, Sanctuary and Toklatka Rivers, thence up Igloo Creek and around the southern end of Sable Mountain, thence through Polychrome and Highway Passes, past the northern end of Muldrow Glacier, down McKinley Fork and along the shores of Wonder Lake to Moose Creek in the Kantishna district. This route is used chiefly during the summer months when it is easily passable for pack-horses but not for wagons, and saves several days' travel compared with the river route. It is, of course, impossible to transport any quantity of supplies economically by these means. During the winter months deep snow and the absence of standing timber to prevent its drifting divert travel to other more favorable routes.

The favorite winter route has always been up Moore and Myrtle Creeks and over a low divide into Clearwater Creek, thence down that stream and Toklat River to the mouth of the Susitna and across the Tanana lowland to the railroad. The cost of transportation by dog teams, which are used exclusively on this route, is $240 to $300 per ton. In the future, however, this trail will undoubtedly be abandoned.
in favor of a new one which the Alaska Road Commission is now building from Kobe, a station on the Alaska Railroad 387 miles from Seward, to the Kuskokwim mining region.

The Kuskokwim trail, which follows the southern edge of the Tana-tna lowlands across Teklanika and Toklat Rivers, has been completed as far as Diamond on the Bearpaw River. From here it will run by way of Lake Mountain to Metzirth and ifaired. It is being cut wide enough and the bridges are strong enough to accommodate heavy traffic. From Diamond a branch trail follows Bearpaw River, Gladder and Mouse Creeks to Kanshima. The distance from Kobe to Diamond is 55 miles; from Diamond to Kanshima the distance is 25 miles. The cost of transportation over this route has not been definitely established. With horse-drawn sleds, which will probably be used to haul ore from the Kanshima district during the present winter, although catarpillar tractors are being considered, it is estimated at $39 per ton from Kanshima to the railroad. Although this is no cheaper than the cost of water transportation, this route has a great advantage in the fact that the delay at Roosevelt is eliminated. Supplies will no longer have to be stored there until the swamps are frozen, and ore mined during the winter can be delivered at the smelter by way of the railroad several months earlier than when it is necessary to wait for river navigation to open in the summer. The sole disadvantage of this route is due to the fact that the swampy ground over which it passes is absolutely impassable in the summer, nor could a summer wagon road that would suffice even for light equipment be constructed except at a prohibitive expense.

**COPPER MOUNTAIN DISTRICT**

The Copper Mountain district is situated near the northern terminus of Matroow Glacier, which is the main source of water supply for the McKinley Fork of the Kanshima River. The district lies near Lat. 61° 20' N. and Long. 165° 20' W. about five miles south of the southern boundary of the map (a) accompanying U. S. Geological Survey bulletin 687.

![Image](Image)

---

**LODE MINING**

The Copper Mountain district was discovered early in the spring of 1921. It was visited by the writer in September, 1921, and September, 1922, on the return from trips to the Kanshima district, but owing to inclement weather in both cases time was available for only a brief reconnaissance of a portion of the district, and such examination as could be made was rendered extremely difficult by snow which masked much of the ground. The examinations were confined chiefly to the neighborhood of Grant Creek, a small stream rising in the heart of Copper Mountain and flowing north into McKinley Fork. The upper part of this stream flows through a steep, rock-walled canyon and descends across a terrace half to three-quarters of a mile wide before emptying into the gravel basin above the canyon at the end of Matroow Glacier.

**Owen Claim.**

The Owen claim is located across Grant Creek near the middle of this terrace. No well-defined vein was observed, the deposit occurring in a zone of quartzite about 100 feet wide lying between two areas of granite. Portions of the quartzite are impregnated with galena, copper sulphides and some native copper.

**Virginia Claim.**

The Virginia claim is situated at the mouth of the rocky canon of Grant Creek about one-quarter of a mile above the Owen claim. At the discovery stage on this claim a ledge 30 feet wide was observed, having a strike of N. 75° E. and a dip of 75° S. The hanging wall is limestone of the foot wall granite and the foot wall porphyry. The vein matter is chiefly quartz containing banded streaks highly impregnated with galena. The proportion of galena bearing ore to the more barren quartz is perhaps that of 1 to 5. A sample of the galena bearing material from this vein taken at random by the writer assayed a trace of gold, 0.10 oz. of silver per ton and 4.18 percent lead.

About 75 feet to the south is a second vein 12 feet thick having a limestone foot wall and a granite hanging wall. The strike is S. 85° W. with a dip of 40° S. and the vein carries galena and sphalerite interbedded with quartz. At a distance of 25 or 30 feet south of this is a third vein 8 feet in thickness having a strike due east and west and a dip of 60° S. The foot wall is granite and the hanging wall limestone. This vein also carries sulphides of lead and zinc. All three of these veins are exposed in the rocky walls of the canyon and required practically no excavation to discover them.

**Denver Claim.**

On the Denver claim, 150 feet south of the third vein on the Virginia, is a 15-ft. ledge having a strike of N. 60° E. and a dip of 70° S. The vein matter is quartz containing some galena. At a point 100 feet east of the creek and 100 feet higher up on the hill the ledge carries...
a considerable amount of copper stain, and the assay of a picked sample taken by the owners from this place showed 270 oz. of silver per ton.

A second ledge 50 feet to the south is 6 feet in width and has a strike of N. 70° E. and a dip of 70° S. The foot wall is granite but the hanging wall was concealed. A third vein on the Denver claim 75 feet further south is 7 feet in width and consists chiefly of quartz carrying lead sulphide. The strike and dip of this vein could not be determined.

A sample broken at random from the ledge by the writer assayed .40 oz. of silver per ton and 5.87 percent lead.

Caribou Claim.

The main vein of the Caribou claim lies 200 feet south of the third vein on the Denver. Its strike is N. 75° W. and it has a dip of 50° N. The foot wall is granite. The lode, which appears to be a zone of quartzite of more than 100 feet in thickness, contains a band of galena bearing material along the foot wall 12 to 18 inches thick. At a distance of 12 feet from the foot wall is a zone of copper stained rock about 1 foot in thickness, with bands containing galena, sphalerite and pyrite 2 feet wide on either side. At a distance of 25 feet from the foot wall a similar band of copper stained rock with galena, sphalerite and pyrite on either side was also observed. Except for the band along the foot wall the ore in this lode appears to be “pockety.”

Two other veins about 800 feet south of the Caribou are reported by the owners, one of which is 12 feet and the other 14 feet in width. The character of the ore is said to be similar to that on the Virginia.

Arizona Claim.

The Arizona claim is situated one-half mile west of the Virginia in a small gully which flows into Grant Creek. The deposit occurs in a band of quartzite 125 feet thick occurring between the masses of granite. Portions of this quartzite show considerable mineralization, galena and sphalerite being the chief constituents, with some pyrite and copper stain. A random sample of the mineralized quartzite taken by the writer showed .50 oz. of silver per ton and 3.98 percent lead. The strike of a porphyry dike 12 feet wide occurring in the quartzite 12 feet from the foot wall is a zone of copper stained rock about 15 feet from the lower contact with the quartzite is N. 70° E. The dip is 40° S.

Montana Claim.

The Montana claim lies just above the Arizona and contains two ledges about 50 feet apart, each of which is two feet in thickness. The vein matter of both ledges is quartz and both carry galena and sphalerite. In the upper ledge, however, galena is predominant, while the lower ledge is chiefly sphalerite. A selected sample from the lower ledge taken by the writer assayed .40 oz. of silver per ton and 57.36 percent zinc.

Giles Claim.

The Giles claim lies east of the Virginia and Denver claims, along the face of the bluff east of Grant Creek and south of the terrace of McKinley Fork.

At discovery an open cut 30 feet long and from 5 to 15 feet wide was excavated during the summer of 1922. An extensive body of ore, which appears to be an impregnation in the limestone, has been exposed across the entire face of this cut. Several tons of the ore were piled at the edge of the cut and more than 100 tons were mixed with the waste scattered down the slope of the hill below the cut. The ore consists chiefly of galena and sphalerite in a limestone gangue, but a small amount of chalcopyrite, which occurs as a filling in incipient cracks of the ore, was also observed. A sample of the ore was taken and assayed at the Alaska Station of the Bureau of Mines with the following results: Gold, trace; silver, 2.20 oz. per ton; lead, 6.25 percent; zinc, 5.05 percent, and copper, 0.33 percent.

The ore shows also on the point of the ridge 300 feet west of discovery in an open cut which was partly caved. This cut is on the east bank of a small gully and the ore is also exposed in an open cut on the west bank of the gully. This cut was filled by a deep snow drift. The course between the two cuts is N. 50° E. A big deposit of light colored porphyritic rock, belonging to the granite or the diorite group, occurs about 25 feet north of the west cut.

Other Claims.

Approximately fifty other claims have been located, for the examination of which time was not available. Those described above, however, are fairly typical of the district and serve to indicate the abundance of lead and zinc ores found there.

Fuel.

There is no standing timber within 20 miles of the property and hence the question of fuel, both for domestic needs and for possible future mining operations, is important. Fortunately an outcrop of subbituminous coal has been discovered on the west fork of Stony Creek, one of the tributaries of the Toklat River, at Lat. 53° 30' N. and Long. 154° 15' W., at a distance of 8 or 9 miles from the property. The exact thickness of this bed is unknown, but more than 20 feet are exposed at a point where several tons were mined and transported to the property by pack horses. The resulting pile of coal was sampled by the writer and analyzed by the Pittsburg station of the Bureau of Mines with the following results:

<table>
<thead>
<tr>
<th>Moisture</th>
<th>Ash</th>
<th>Volatile matter</th>
<th>Fixed carbon</th>
<th>B.t.u.</th>
</tr>
</thead>
<tbody>
<tr>
<td>As received</td>
<td>21.2</td>
<td>9.0</td>
<td>36.6</td>
<td>23.2</td>
</tr>
<tr>
<td>Moisture free</td>
<td>11.4</td>
<td>44.4</td>
<td>25.2</td>
<td>47.6</td>
</tr>
<tr>
<td>Moisture and ash free</td>
<td>52.4</td>
<td>47.6</td>
<td>12220</td>
<td></td>
</tr>
</tbody>
</table>
TRANSPORTATION

From the viewpoint of transportation the Copper Mountain district is in even more dire straits than the Kantishna district. The only method available at present for getting supplies to the district in any quantity is by dog team from Kantishna during the winter months. The distance from Kantishna Post Office to the Copper Mountain district by way of Wonder Lake and McKinley Fork is about 25 miles. It would be possible, although difficult, to haul supplies from there by horse sleighs in winter. The Polychrome-Highway Pass trail described on page 133 passes through the edge of the Copper Mountain district but as has been already stated this is passable during the summer months only for pack trains or men on foot, while during the winter months deep snows make travel very difficult. It would be possible, however, to make a fairly good wagon road for the 65 miles along this route which would also give access to the scenic beauties of Mt. McKinley National Park through which it passes.

LITTLE MOOSE CREEK

Little Moose Creek is one of the tributaries of Clearwater Fork, joining that stream about 5 miles above its confluence with Toklat River.

The principal activity in this district is placer mining, the methods employed being similar to those in the Kantishna District. The placers are distinguished by the occurrence of native silver, small nuggets of which are found in practically every clean-up.

During 1922 the principal operators were Federson and Christianson. Fred Haukenson, and Mike Lody. Approximately 30,000 square feet of bedrock, valued at twenty-two cents per square foot, were cleaned during the season.

REVIEW OF COAL MINES BY FIELDS

MATANUSKA COAL FIELD

During 1922 there were five operating coal properties in the Matanuska field, four of which were privately owned.

Private operators in this field produced 45,262 tons of coal during the year. The Alaskan Engineering Commission, operating on reserved units, mined 3,256 tons.

The most significant features of the 1922 development in the Matanuska field were the awards made to private operators of contracts to furnish the coal used on the Alaska Railway during the current fiscal year and the consequent active development of new coal properties in the Moose Creek section of the field. The yield from the Moose Creek beds would have been materially greater but for the severe handicap occasioned by lack of adequate transportation facilities between the mines and the railway.

The distances from the properties on Moose Creek capable of producing coal to the railway, are from 1 to 2 miles. Hauling can be done only in winter and even then is restricted to periods during which conditions favorable to sledding exist. Such periods were of very short duration during the past winter.

Evan Jones Coal Company.

The mine of the Evan Jones Coal Company at Jonesville made the largest output of coal produced in the Territory in 1922. The total tonnage mined at this property during the year amounted to 42,412 tons. The greatest monthly output was made in September, 1922, when 5,499 tons were shipped.

A disastrous fire occurred in this mine on November 13, 1922. In order to quench the fire, flooding of the mine with water became necessary and production was stopped during the remainder of the year. Prior to the occurrence of the fire, extensive underground development work was completed during the year. The main crosscut entry tunnel was extended until it now has a total length of 850 feet.

A barren slope was sunk from the main-level gangways on bed No. 3 to the second level, which is 265 feet lower on the slope than the main level. Gangways were driven on the second level on beds 2, 3 and 4, and most of the coal mined during the year was secured from rooms driven off these gangways.

The power equipment on the property was augmented during the year by the erection of the machinery formerly placed on the Netland property at Chickaloon.

A new crosscut entry tunnel, designed to intercept the coal bed at the elevation of the lower or second level was commenced in the fall of 1922. Work on this tunnel was later stopped owing to difficulties arising from caving ground encountered.

At the close of the year work was proceeding on the driving of a second escapeway from the lower level to the surface.

The Evan Jones mine is provided with a railway spur which offers excellent shipping facilities.

Eska Mine.

The Eska mine of the Alaskan Engineering Commission was idle during most of the year 1922. The Commission relied upon the output of the Evan Jones mine for its supply of coal for the railway during the year. The fire at the Evan Jones mine made it imperative to reopen the Eska mine immediately, in order to forestall the threatened shortage of coal for railway use.

Owing to the excellent conditions existing at the Eska property, production was resumed within four days following the Jonesville fire. At the end of the year a crew of 8 men was employed at the mine and 2,062 tons of coal had been shipped.
Baxter Mine.

The Baxter mine, situated on Moose Creek, was idle from April until December, 1922, owing to the impossibility of hauling coal to the railway except by means of sleds.

During the year this property produced 2,729 tons of coal of excellent quality. The maximum monthly output was 1,104 tons, which was mined in February.

An attempt was made during the winter of 1922-1923 to utilize motor tractors in hauling the Baxter coal to the railway. This attempt was unsuccessful owing to the prevalence of "soft" weather.

Bruno Agostino Moose Creek Coal Co.

The mine of the Bruno Agostino Moose Creek Coal Company, situated about a mile below the Baxter mine on Moose Creek, was developed and put upon a producing basis during the year 1922.

The original and principal development was done on a 9 ft. coal seam outcropping on the east side of Moose Creek. Approximately 500 feet of underground work was completed. This work included the sinking of a haulage slope to a depth of 180 feet on the bed, and the driving of a parallel air course and two connecting crosscuts.

During the fall prospecting work revealed outcrops of a series of beds on the opposite or west side of Moose Creek and about 600 feet distant from the above described workings. These outcrops were of such promise that work was intensively centered upon their development and was discontinued in the other bed where ice and water conditions rendered progress difficult.

Exploration of the newly discovered beds by means of a crosscut tunnel revealed three seams, 2 3/4 feet, 5 feet and 6 1/2 feet, respectively, in width.

The coal produced at the Agostino property is of excellent quality. Samples of five thousand tons mined indicate an average heating value of 12,162 B. T. U. and an ash content of 12.55 percent.

A substantial permanent camp of log buildings was erected on the Agostino property and much work was done by the Company on the road leading from their mine to the railway.

Rawson Mine.

The Rawson mine is situated on Moose Creek about 2 1/2 miles above the Baxter mine. Development work has been done on the property during the past two years but no production has been made. A crosscut tunnel has revealed a series of five parallel beds of coal, ranging from 1 1/2 feet to 9 feet in thickness. One of these seams that has a thickness of 3 feet has been drifted for about 500 feet. This seam carries about 6 feet of clean coal of good grade. Another seam, 9 feet in thickness, has 8 feet of clean coal of similar or better grade.

Development work was also done on a sixth seam, parallel to the series above described. A gangway has opened this seam for a length of 56 feet. The bed has a thickness of 7 1/2 feet. Work on the gangway was still in progress at the close of the year. Many surface improvements were made on the Rawson property during the year. These included log camp buildings, storage bins, etc. A road was also constructed by Mr. Rawson from his camp down Moose Creek to the Baxter mine. The work on this road, which is 2 1/2 miles in length, included the building of a bridge across Moose Creek.

Leroy Prospect.

An extensive area extending approximately four miles along Moose Creek is held by Wm. T. Leroy, who spent much of the season of 1922 exploring the surface of his holdings. This work was successful and resulted in exposing a series of coal seams and establishing their continuity with a fair degree of certainty over a strike distance of approximately 1 1/2 miles.

This series is thought to be the easterly extension of the beds opened on the adjoining Rawson property above described.

The outcrops lie in such positions on the north flank of Wishbone Hill as to offer very favorable conditions for the conduct of mining operations.

The widths and mineability of the beds have not been determined.

Tunneling operations planned for the coming season will assist in establishing these features.

Reserved Units in the Chickaloon Section.

Mining operations conducted by the Navy Alaska Coal Commission on reserved units embracing the Chickaloon and Coal Creek mines and the King's River prospect were indefinitely suspended May 1, 1922, with the exception of a small amount of diamond drilling in the vicinity of the Chickaloon mine that was continued until the latter part of May.

The Chickaloon mine was temporarily reopened during July and August for the purpose of securing additional coal to form a part of a lot of 5,000 tons used in making a Naval test. The total tonnage mined at Chickaloon during the year amounted to 4,646 tons.

The output of the Coal Creek mine for the 4 months' period during which operations were conducted was 949 tons.

The beds at the Chickaloon and Coal Creek mines yield coking semi-bituminous coal of Naval grade.

Lindquist Prospect.

Prospecting work was commenced in November, 1922, on a coal seam found in the King's River section on a property held under permit by A. P. Lindquist of Anchorage. Prior to the end of the year a camp had been established, a road had been constructed connecting the camp with the Kings' River road, and a gangway 31 feet in length had been driven upon the coal bed. The work on this gangway resulted in the production of 74 tons of coal. Analysis of a mine sample of this coal showed it to be coking and of semi-bituminous grade, with a heat value,
as received, of 12,541 B. T. U.'s, an ash content of 12.43 percent. The moisture content, as received, was 6.31 percent, the volatile matter 26.14 percent, and the fixed carbon 57.92 percent.

Netland Prospect.

No work has been done on the Netland property during 1922. This prospect adjoins the Chickaloon reserved unit on the west.

COOK INLET COAL FIELD

Operations were conducted intermittently during 1922 at the McNally and Maitland lignite mine at Homer on Kachemak Bay, Cook Inlet. No mining was done after September 1st.

The total output for the year amounted to 2,729 tons.
River the field is crossed by Totathanika and Wood Rivers, which flow northward into the Tanana.

**TOPOGRAPHY**

The coal bearing rocks are found in broad open valleys having an east and west trend and crossing the main streams at right angles. The hills which border these valleys are high and rugged and, were it not for the dominance of the higher Alaska Range to the south, they would be timbered mountains.

Near the mouth of Healy River the Nenana debouches from a deep canyon in the schist which forms the backbone of the foothill range, and flows north in an open valley eroded across the coal bearing formation. On both sides of the valley the coal bearing rocks rise in bluffs or terraces varying in height from 100 to 500 feet. Opposite the mouth of Healy River the terrace is about 100 feet high and from 600 to 1,000 feet wide, the ground then rising to a second terrace. Along the east bank of the Nenana and also along the west bank a few miles below the mouth of Healy River the terraces are much higher.

**GEOLGY**

The coal bearing formation, which is of Tertiary age (probably Eocene) rests unconformably upon Pre-Dorovician Birch Creek schist. It is more than 2,300 feet in thickness and consists of soft light colored sandstones, light colored shales and beds of coal, the sandstones predominating. Approximately one-tenth of the total thickness of the formation is made up of coal beds, six of which are 20 feet or more in thickness. The following geologic sections were measured by the writer on the north bank of Healy River.

Stratigraphic Section of the Nenana Coal Bearing Formation Measured by John A. Davis on the Property of the Healy River Coal Corporation, Situated in Sections 23 and 24, T. 12 S., R. 7 W., P. B. M. at Suntran:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Feet</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Nenana&quot; gravel</td>
<td>75+</td>
<td></td>
</tr>
<tr>
<td>Unconformity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shale, with thin beds of sandstone</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Sandstone</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Shale</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Sandstone</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coal, fair quality</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bony coal</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td>Concealed</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Bony coal and bone</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Bony coal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Shale</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bony coal</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Light buff sandstone</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Brown shale</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**REPORT OF MINE INSPECTOR**

<table>
<thead>
<tr>
<th>Formation</th>
<th>Feet</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy shale</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Carbonaceous shale and bone</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Light buff sandstone</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Brown sandstone</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Gray sandy shale</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Carbonaceous shale</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Gray sandstone</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Buff sandstone</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Coal, good quality, &quot;Sharkey Bed&quot;</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Fine white sandstone</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Shale and bone</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Sandy shale</td>
<td>180</td>
<td>6</td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Not white sandstone</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Soft white sandstone</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Coal, very good quality</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Gray sandy shale</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>White and buff sandstone</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Coal, good quality, &quot;Morrison Bed&quot;</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Gray sandy shale</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Soft white sandstone</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>Coal, good quality, &quot;Lathrop Bed&quot;</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Gray sandy shale</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Soft light colored sandstone</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Coal, good quality, &quot;Bown Bed&quot;</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>While sandstone</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bony coal</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Shale</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Shale</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Sandy shale, suitable for brick clay</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Gray shale</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Gray shale</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Dark shale</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Coal, good quality</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>Gray shale, partly concealed</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fine white sandstone</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Coal</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Gray shale</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Coal</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Black carbonaceous shale</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Gray shale</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Gray shale</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Shale</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Sandy shale</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Coal, good quality</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Carbonaceous shale</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Coal, good quality</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>Concealed</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>Coal, good quality</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Bony coal</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Light gray sandy shale</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Course white sandstone</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Carbonaceous clay</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Feet | Inches
--- | ---
Fine white sandstone and sandy clay | 60 | 6
Dune and bony shale | 3 | 1
Sandy clay | 6 | 3
Fine white and yellow sandstone | 12 | 6
Carbonaceous clay | 4 | 2
Gray clay | 6 | 3
Coal, fair quality | 3 | 1.5
Sandy shale | 8 | 4
Fine white sandstone | 6 | 3
Coarse white sandstone and fine conglomerate | 16 | 8
Coal, good quality | 10 | 5
Gray shale | 5 | 2.5
B tone | 15 | 7.5
Coal, good quality | 5 | 2.5
Clay parting | 10 | 5
Coal, good quality | 5 | 2.5
B tone | 15 | 7.5
Coal, fair quality | 3 | 1.5
B tone | 6 | 3
Fine white sandstone, partly concealed | 50 | 25
Coal, partly concealed, estimated thickness | 15 | 7.5
Coarse sandstone, estimated thickness of bed | 18 | 9
Conglomerate | 18 | 9
Gravel and coal bleaching, estimated thickness of bed | 18 | 9
Coarse white sandstone and fine conglomerate | 20 | 10
Briar Creek Schist

Stratigraphic Section of Nenana Coal Bearing Formation Measured by John A. Davis on the North Bank of Healy River, in Section 22, T 12 S., R. 7 W., P. B. M., 152 miles west of Suntana.

EARLY COAL MINING OPERATIONS

LYNN MINE

The first mine opened in the Nenana Field was known locally as the Lynn mine. It was situated on the east side of the Nenana River near the right-of-way of the Alaska Railroad, at a point 385 miles from the Seward terminus of the road. The coal bed at this mine is a little over five feet in thickness and occurs near the top of the geologic section of the coal bearing formation, although its exact stratigraphic position has never been definitely determined. It was the first outcrop to become available as the railroad was being constructed south from the town of Nenana, which is situated on the Tanana River 111 miles from Seward. It was clearly recognized that this coal was inferior in quality to that obtainable further south, hence the mine was opened only for temporary use until the railroad could be built to the better coal.

The product of the mine was a poor grade of lignite, having a decided brown color and a woody texture. It contained some waste material due to the crude methods of mining necessarily adopted. It was used by the Alaskan Engineering Commission, the agency having in charge the building of the railroad, on locomotives and in the power plant at Nenana for about a year before the mine was abandoned in 1913.

Six samples were taken by the Commission at 20-ft. intervals in the 100-ft. tunnel at this mine and were analyzed at the Pittsburgh station of the Bureau of Mines. The average of these analyses shows: Moisture, 32.5 percent; volatile matter, 33.8 percent; fixed carbon, 20.5 percent; ash, 11.5 percent, and L. T. U. per lb., 5,220.


A steaming test made by the writer in 1920 at the Nenana power plant showed an equivalent evaporation of 3.65 pounds of water per pound of fuel as fired, in comparison with an evaporation of 3.65 pounds of water per pound of fuel as fired obtained during a similar test when using spruce wood.

**BURNS MINE**

Early in 1919, as soon as railroad construction had been extended 20 miles further to the south, the Burns mine was opened on the west bank of the Nenana River a few hundred yards from the right-of-way. The principal bed here was 8 to 10 feet thick. It contained a better grade of lignite which was brownish black in color and had a less pronounced woody texture than in the Lynn mine. Owing to complicated geologic structure the stratigraphic position of this bed has never been definitely determined. The mine furnished fuel for the Alaskan Engineering Commission's needs and to a small extent for domestic purposes in the town of Nenana and was operated for little more than a year, when it was abandoned in favor of a still better grade of fuel obtainable farther to the south.

A typical analysis of this fuel shows: Moisture, 28.6 percent; volatile matter, 34.2 percent; fixed carbon, 25.6 percent; ash, 7.4 percent, and B. T. U. per pound, 7,448. A steaming test made by the writer during the same week as that for the Lynn mine resulted in an equivalent evaporation of 3.99 pounds of water per pound of fuel as fired.

**CALDERHEAD MINE**

The Broad Pass Coal and Development Company obtained a permit early in 1920 to open a mine on the government reserve in Section 5, Township 12 S., Range 7 W., Fairbanks Meridian. This mine, which was known locally as the Calderhead mine, was situated on the south bank of Lignite Creek one and a half miles from its confluence with Nenana River. The coal bed is 13 feet thick, of which the upper 6 feet, being of somewhat inferior quality, was left to support the roof. The lower 12 feet consists of a good quality of lignite which is dull black in color and shows but few traces of woody texture. It was transported in sleds on the ice down Lignite Creek and across the Nenana River to the railroad.

The first season's work was terminated in April, 1920, by the "break-up" of the Nenana River after 7,000 tons had been mined. Approximately 200 tons were taken out during the winter of 1920-21, and 3,000 tons during the winter of 1921-22, after which the mine was definitely abandoned.

A typical analysis of this fuel made by the Pittsburgh station of the Bureau of Mines shows: Moisture, 26.4 percent; volatile matter, 35.8 percent; fixed carbon, 28.3 percent; ash, 9.5 percent, and B. T. U. per pound, 7,573. The sample was taken from fuel used during a steaming test made by the writer in 1920 at the Nenana power plant, which resulted in an equivalent evaporation of 3.33 pounds of water per pound of fuel as fired.

**PETERSON MINE**

The Peterson mine, which was the most extensive of the early attempts at coal mining, was owned by the Healy River Coal Corporation. It was situated on the west bank of the Nenana River opposite the mouth of Healy River, in Leasing Block 26, Nenana Coal Field. The mine was opened early in 1920 by a crosscut tunnel, starting at the edge of Nenana River just above high water mark and running in a southwesterly direction under the terrace on the west bank of the river. Workings extended from this crosscut developed two beds of coal, the upper one of which had a thickness of 5 feet and the lower one 6 feet.

The mineable portions of these two beds lying between the horizon of the entry tunnel and the surface have been practically all removed with the exception of pillars left to protect the tracks of the Alaska Railway, beneath which the beds extend. The gangways driven on the upper bed had an aggregate length of approximately 506 feet and those on the lower bed 300 feet.

The upper bed has a strike of N. 80° E. and dips north at angles varying from 35° to 52°. The lower bed strikes N. 75° E. and dips from 30° to 40° south.

At the portal of the main tunnel the coal was dumped from the mine cars into a 10-ton skip which was hoisted on an inclined tramway 336 feet long. The incline followed the natural slope of the bluff for 226 feet and was carried on a trestle for the remaining distance. At the top of the incline the coal was discharged over a 1-inch grizzly, the oversize going to a 350-ton bunker erected beside a spur track of the railroad, and discharging directly into railroad cars.

The following analyses of samples of coal from the Peterson mine have been made by the U. S. Bureau of Mines:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Moisture (lb. per ton)</th>
<th>Ash (lb. per ton)</th>
<th>Volatile Matter (lb. per ton)</th>
<th>Fixed Carbon (lb. per ton)</th>
<th>B. T. U. per pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample of coal as received</td>
<td>8.85</td>
<td>12.59</td>
<td>37.56</td>
<td>31.39</td>
<td>7,252</td>
</tr>
<tr>
<td>from coal as received</td>
<td>8.85</td>
<td>12.59</td>
<td>37.56</td>
<td>31.39</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
<tr>
<td>Sample of 35 lbs. delivered</td>
<td>9.49</td>
<td>13.74</td>
<td>36.72</td>
<td>30.95</td>
<td>7,252</td>
</tr>
</tbody>
</table>
Comparison with analyses published by the United States Bureau of Mines (a) of typical lignites, such as those found in North Dakota, and of typical subbituminous coals, such as those of Routt County, Colorado, for example, places the Nenana field midway between these two classifications as far as chemical composition is concerned. In appearance the coal is black and often shiny and although woody texture can be observed it is not so marked a feature as in the North Dakota lignite. The streak is a very dark brown—almost black—and the coal offers a great deal of resistance to weathering, particularly in certain portions of the bed. Since these physical characteristics are more typically those of subbituminous coal than of lignite, the product of this mine should properly be classed as subbituminous coal.

The Peterson mine produced approximately 12,500 tons of coal, of which 11,600 tons were furnished to the Alaskan Engineering Commission for use in locomotives, steam shovels and pumps, for the heating of buildings and for the power plant at Nenana. The town of Nenana consumed about 700 tons for domestic purposes and approximately 800 tons were shipped to Fairbanks, also for domestic use. The price of the coal at the mine in small lots was $5 per ton, but under contract in large lots a price of $4.50 per ton was made. Delivered at Nenana for domestic purposes the coal sold for $7 to $7.50 per ton, and at Fairbanks the price was $9.50 per ton delivered to the consumer in small lots but under contract involving 100 tons or more a price of $9 per ton was made. No coal was mined after January 1, 1922, and on October 6, 1922, the leases obtained a cancellation of the lease.

NEW MINE

During the summer of 1921 the Healy River Coal Corporation started a second mine in Leasing Block 26 on a coal bed about 1,000 feet north of the Peterson tunnel. It was known locally as the "new" mine and was opened by an inclined shaft extending to a depth of 157 feet on a 30° slope. From the bottom of the shaft a tunnel was driven along the strike of the vein, which is nearly vertical, for a distance of 110 feet to the face of the bluff along the river, and also in a westerly direction along the strike for a distance of 300 feet. The bed dips about 55° N.

Owing to the proximity of buildings and property of the Alaska Railroad only that portion of the coal in this mine east of the shaft was removed prior to August 25, 1922, when the application for the cancellation of the lease was made. The total production amounted to 1,500 tons.

The quality of the coal was practically identical with that of the Peterson mine, except for a slightly higher moisture content. The following analysis of a sample taken by the writer at the foot of the inclined shaft was made at the Alaska Station of the Bureau of Mines:

<table>
<thead>
<tr>
<th>Moisture Fixed Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample of bed at foot Ass. received</td>
</tr>
<tr>
<td>Inclined shaft</td>
</tr>
<tr>
<td>mine in Block 26, Oct. Moisture and ash free</td>
</tr>
<tr>
<td>Ash</td>
</tr>
<tr>
<td>Volatile Matter</td>
</tr>
</tbody>
</table>


(b)—See the stratigraphic section of the Nenana coal bearing formation, page 144.

PRESENT MINING OPERATIONS

The only coal mining operations in the Nenana field at present are those of the Healy River Coal Corporation at Suntrana on the north side of Healy River 2.5 miles from its confluence with Nenana River. Connection with the Alaska Railroad is afforded by a 4-mile spur which leaves the main line one mile north of Healy. The development of the Suntrana mine was started in November, 1921, under a prospecting permit, but the results of the first season's work were so satisfactory that application was made for the cancellation of the old lease on Block 25 and the issuance of a new one at Suntrana which is now pending.

About a quarter of a mile southwest of Suntrana, Healy River turns abruptly north from a deep gorge crossed by Birch Creek which is 20° to 45°, the generally well exposed on the north bank of the river in the nearly vertical cliffs that rise to a height of 700 to 800 feet except where cut by the steep canons of Coal Creek in the western part and by the canons of Cascade Creek near the center of the property. At the top of the cliffs the surface of the ground rises gently to the crest of the divide between Healy River and Lignite Creek.

The first season's work at Suntrana, which was somewhat of the nature of prospecting, was terminated in June, 1922, because of the high water in Healy and Nenana Rivers. The mine had no railroad connection at that time, since the present spur was not completed until October 26, 1922. The coal was hauled by horses down Healy River during the winter months in 2-ton sleds and hauled up the incline at the Peterson mine from the ice, waggons and a 45-horsepower Holt caterpillar tractor were used and the coal was hoisted on a cable tramway extending from a landing station on the east bank of Nenana River to the top of the Peterson bunker. Approximately 12,000 tons were mined during the first season, the majority of which was used by the Alaskan Engineering Commission. Of this, 400 tons were shipped to Anchorage for trial in the power plant at that place. Several hundred tons were used at Nenana both in the power plant and for domestic purposes, and a smaller amount was shipped to Fairbanks, chiefly for domestic use. The first season's production was taken from three entries on the Bowen coal which were named Negri, Conley and Keyes tunnels and extended along the cliffs from east to west in the order given.

With the resumption of mining operations at Suntrana in the fall of 1922, work was started on a systematic plan for mining the coal in six of the beds on the property. This comprises a main crosscut tunnel start-
ing at a point on the Bowen bed 15 feet above the portal of the Conley tunnel and running nearly at right angles to the strike of the coal-bearing formation. It will be driven through the various coal beds until the Sharkey bed is reached, which it is estimated will be at a distance of 1,650 feet from the portal.

On January 1, 1923, the main tunnel had been driven along a course of N. 16½° E. for a distance of 159 feet. At a point 145 feet from the portal an entry had been turned off to the left and driven 220 feet along the strike of the Latrop bed. Another entry, which was 35 feet long, had also been started to the right on the Latrop bed; but in driving it a heavy seepage of water, which probably originated in Cascade Creek, was met with and upon encountering the cold air in the entry it promptly turned to ice, thus temporarily preventing further driving in that direction. Three raises had been driven up the slope of the Latrop bed from the left entry and connected by crosscuts with two air openings on the outcrop. The breasts in these raises had advanced to within 30, 40 and 60 feet of the outcrop, respectively, taken from east to west in the order given.

At the portal of the main tunnel the mine cars, which are of the side dumping type and have a capacity of 2,250 pounds, are trimmed by hand along a new trestle 35 feet high and 185 feet long at the end of which the coal is dumped over a grizzly 3 feet wide, 12 feet long and made of ½-inch flat steel bars spaced 4 inches apart. The oversize, or “lump” coal, passes down a steel lined chute set at an angle of 25° and is discharged directly into railroad cars on the main track of the Suntrana coal spur. The undersize falls to a second grizzly of the same dimensions but made of ½-inch flat steel bars spaced 2 inches apart. The oversize of this screen, or “nut” coal, passes down another steel lined chute set at an angle of 32° and falls into railroad cars on a short siding 18 feet north of the spur track. The undersize, or “screenings,” falls into a hopper from which it is discharged into railroad cars on a second short siding 18 feet north of the first one. The proportions of the various sizes are: 30 percent lump; 50 percent nut, and 20 percent screenings. The several tracks at the mine can provide storage space for 27 empty railroad cars.

In order to supply coal until such time as the development in the main tunnel should become adequate to supply the demand, work was resumed in the Negri tunnel and by January 1, 1923, it had been extended 225 feet beyond the former face. The original grizzly at this working was slightly remodelled so that it would discharge into railroad cars on a branch of the coal spur built under the lower end. The grizzly was removed and hence this tipple delivers only run-of-mine coal.

The mine has two Pennsylvania retort-flue boilers, one of which is rated at 50 horsepower and has already been set up in a boiler house near the end of the main tipple. The other is rated at 40 horsepower and is shortly to be installed beside the first. There is also an “American” hoist having a 16-inch drum driven by two 7 by 10-inch steam cylinders which is used for “spotting” railroad cars and for hoisting timbers up an inclined track at the end of the main tipple, and a “De Laval” steam turbine, direct-connected to a 40-amperes, 110 volt, “Western Electric” direct-current generator, which supplies lights for the tunnels and entries of the mine and for the living and office quarters. The Healy River Coal Corporation has also chartered a locomotive from the Alaska railroad which is used exclusively on the Suntrana spur to deliver cars to and from the main line.

The main tunnels and entries are electrically lighted, but carbide lamps are used in the rooms. No “gas” has yet been discovered in any of the workings.

During the month of December, 1922, the Suntrana mine employed an average of 35 men underground and 7 men on the surface. The production for this month was 5,243 short tons, an average of 175 tons per day, but during January, 1923, the average will probably be better than 250 tons per day and will probably continue to increase because of more advanced development work. The total production from October 26, 1922, to January 1, 1923, was 5,960 short tons.

The coal is based upon delivery in railroad cars at the main line of the Alaska Railroad. The following prices per long ton are charged for the various products: Screenings, $2; run-of-mine, $3; nut, $3.50; and lump, $4. The freight rate from Healy to Fairbanks is $2 per ton and includes a charge of fifty cents per ton to cover the cost of transferring from standard to narrow gauge cars at Nenana, which will be accordingly for the mine and for the living and office quarters. The Healy River Coal

**REPORT OF MINE INSPECTOR**

which is used for “spotting” railroad cars and for hoisting timbers up an inclined track at the end of the main tipple, and a “De Laval” steam turbine, direct-connected to a 40-amperes, 110 volt, “Western Electric” direct-current generator, which supplies lights for the tunnels and entries of the mine and for the living and office quarters. The Healy River Coal Corporation has also chartered a locomotive from the Alaska railroad which is used exclusively on the Suntrana spur to deliver cars to and from the main line.

**ANALYSES OF SUNTRANA COAL**

| Sample of 25 tons delivered to Alaska, Railroad at Fairbanks, Feb. 1922 | Moisture | Ash | Volatile Matter | Fixed Carbon |
| Cordwood | 20.72 | 9.46 | 61.12 | 39.29 | 56.50 | 43.50 |
| Railrodded to Alaska | Moisture free | 19.51 | 41.36 | 31.28 | 56.50 | 43.50 |
| Sample of 40 tons delivered to Alaska, Railroad at Nenana, Feb. 1922 | Moisture free | 8.28 | 50.19 | 22.56 | 48.39 |
| Sample of 400 tons used at Anchorage power plant, March 1922 | Moisture free | 10.35 | 49.77 | 48.39 | 54.53 | 45.47 |

The first six analyses represent coal from the Bowen bed; the last two from the Lathrop bed. All of the samples were taken by the writer with the exception of the second, which was taken by the master mechanic of the northern division of the Alaska Railroad. The sample in number 10. Negri tunnel, included nine feet of coal lying near the top of the Bowen bed. No partings occurred in this thickness and both roof and floor were coal. The sample at the breast of the Negri tunnel included eight feet six inches of coal without any partings. The roof and floor were also coal. The sample in number 3. Lathrop entry included seven feet six inches of coal without partings. One foot of coal was left as roof below the roof sandstone and the floor was very shale. The sample at the breast of the Lathrop entry included six feet four inches of clean coal above a horn floor. The roof was coal.

By comparison with those of the Peterson coal these analyses indicate a better grade of fuel; and this has been fully substantiated by actual use. There can be no question in this case as to its proper classification as sub-bituminous coal. An interesting comparison was made by the writer during April, 1922, with two coals from the Matsutaka field in a series of boiler tests conducted at the Anchorage power plant of the Alaskan Engineering Commission (a). The results of these tests showed the following equivalent evaporation from and at 212° F. expressed in pounds of water evaporated per pound of fuel: Suntrana mine coal, 4.52 pounds; Evans Jones mine coal, 5.14 pounds; and Henry mine coal, 5.89 pounds.

For domestic purposes its comparative value is more nearly equal. It is low in ash, ignites readily, burns freely, and a large portion of lump coal can be put on the market, all of which are important advantages from the viewpoint of the domestic consumer.

FREIGHT RATES VIA ALASKA (GOVERNMENT) RAILWAY

(Effective Oct. 1922.)

In less-than-carload lots—per 100 lbs.

<table>
<thead>
<tr>
<th>Service</th>
<th>Anchorage to Seattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carload</td>
<td>Fairbanks</td>
</tr>
<tr>
<td>1st class</td>
<td>10.50</td>
</tr>
<tr>
<td>2nd class</td>
<td>9.45</td>
</tr>
<tr>
<td>3rd class</td>
<td>8.80</td>
</tr>
<tr>
<td>4th class</td>
<td>7.80</td>
</tr>
</tbody>
</table>

- Add 10 per cent for grade in addition to above rate.

MINERAL PRODUCTION

The following tables of mineral production are taken from the publications of the U.S. Geological Survey, except as indicated by footnote:

GOLD AND SILVER PRODUCED IN ALASKA 1880-1922

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (tons)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>253,329</td>
<td>$496,725,913</td>
</tr>
<tr>
<td>1896</td>
<td>187,298</td>
<td>$314,708,284</td>
</tr>
<tr>
<td>1897</td>
<td>130,401</td>
<td>$179,612,679</td>
</tr>
<tr>
<td>1898</td>
<td>120,834</td>
<td>$150,388,642</td>
</tr>
<tr>
<td>1899</td>
<td>162,340</td>
<td>$208,653,352</td>
</tr>
<tr>
<td>1900</td>
<td>224,350</td>
<td>$314,708,284</td>
</tr>
<tr>
<td>1901</td>
<td>204,720</td>
<td>$307,200,000</td>
</tr>
<tr>
<td>1902</td>
<td>228,650</td>
<td>$369,812,000</td>
</tr>
<tr>
<td>1903</td>
<td>259,350</td>
<td>$412,412,000</td>
</tr>
<tr>
<td>1904</td>
<td>285,700</td>
<td>$467,214,000</td>
</tr>
<tr>
<td>1905</td>
<td>313,800</td>
<td>$522,012,000</td>
</tr>
<tr>
<td>1906</td>
<td>343,900</td>
<td>$577,812,000</td>
</tr>
<tr>
<td>1907</td>
<td>375,000</td>
<td>$632,612,000</td>
</tr>
<tr>
<td>1908</td>
<td>407,100</td>
<td>$687,412,000</td>
</tr>
<tr>
<td>1909</td>
<td>439,200</td>
<td>$742,212,000</td>
</tr>
<tr>
<td>1910</td>
<td>471,300</td>
<td>$797,012,000</td>
</tr>
<tr>
<td>1911</td>
<td>503,400</td>
<td>$851,812,000</td>
</tr>
<tr>
<td>1912</td>
<td>535,500</td>
<td>$906,612,000</td>
</tr>
<tr>
<td>1913</td>
<td>567,600</td>
<td>$961,412,000</td>
</tr>
<tr>
<td>1914</td>
<td>599,700</td>
<td>$1,016,212,000</td>
</tr>
<tr>
<td>1915</td>
<td>631,800</td>
<td>$1,071,012,000</td>
</tr>
<tr>
<td>1916</td>
<td>663,900</td>
<td>$1,125,812,000</td>
</tr>
<tr>
<td>1917</td>
<td>696,000</td>
<td>$1,180,612,000</td>
</tr>
<tr>
<td>1918</td>
<td>728,100</td>
<td>$1,235,412,000</td>
</tr>
<tr>
<td>1919</td>
<td>760,200</td>
<td>$1,290,212,000</td>
</tr>
<tr>
<td>1920</td>
<td>792,300</td>
<td>$1,345,012,000</td>
</tr>
<tr>
<td>1921</td>
<td>824,400</td>
<td>$1,399,812,000</td>
</tr>
<tr>
<td>1922</td>
<td>856,500</td>
<td>$1,454,612,000</td>
</tr>
</tbody>
</table>

### Copper Produced in Alaska 1880-1922

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Mined (tons)</th>
<th>Copper Produced Quantity (pounds)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1896</td>
<td>60,000</td>
<td>3,398</td>
<td>825</td>
</tr>
</tbody>
</table>

### Lead Produced in Alaska 1892-1922

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (Tons)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1892</td>
<td>2.40</td>
<td>$ 2,400</td>
</tr>
<tr>
<td>1893</td>
<td>2.16</td>
<td>2,160</td>
</tr>
<tr>
<td>1894</td>
<td>2.00</td>
<td>2,000</td>
</tr>
<tr>
<td>1895</td>
<td>1.76</td>
<td>1,766</td>
</tr>
<tr>
<td>1896</td>
<td>1.52</td>
<td>1,520</td>
</tr>
<tr>
<td>1897</td>
<td>1.29</td>
<td>1,290</td>
</tr>
<tr>
<td>1898</td>
<td>1.06</td>
<td>1,060</td>
</tr>
<tr>
<td>1899</td>
<td>0.83</td>
<td>830</td>
</tr>
<tr>
<td>1900</td>
<td>0.67</td>
<td>670</td>
</tr>
</tbody>
</table>

### Tin Produced in Alaska 1902-1922

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Metal (Tons)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1902</td>
<td>25</td>
<td>$ 8,600</td>
</tr>
<tr>
<td>1903</td>
<td>41</td>
<td>14,100</td>
</tr>
<tr>
<td>1904</td>
<td>28</td>
<td>8,096</td>
</tr>
<tr>
<td>1905</td>
<td>10</td>
<td>4,000</td>
</tr>
<tr>
<td>1906</td>
<td>12</td>
<td>4,000</td>
</tr>
<tr>
<td>1907</td>
<td>11</td>
<td>3,500</td>
</tr>
<tr>
<td>1908</td>
<td>9</td>
<td>2,750</td>
</tr>
<tr>
<td>1909</td>
<td>11</td>
<td>3,500</td>
</tr>
<tr>
<td>1910</td>
<td>16</td>
<td>5,000</td>
</tr>
<tr>
<td>1911</td>
<td>23</td>
<td>6,900</td>
</tr>
<tr>
<td>1912</td>
<td>15</td>
<td>4,500</td>
</tr>
<tr>
<td>1913</td>
<td>18</td>
<td>5,400</td>
</tr>
</tbody>
</table>

Total 16,067

Value $393,664
REPORT OF MINE INSPECTOR

COAL PRODUCED AND CONSUMED IN ALASKA, 1888-1922, IN SHORT TONS

<table>
<thead>
<tr>
<th>Year</th>
<th>Produced in Alaska, chiefly bituminous and lignite. Short tons</th>
<th>Value</th>
<th>Total foreign coal, chiefly bituminous from British Columbia (a)</th>
<th>Total coal consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880-1886</td>
<td>6,000</td>
<td>$84,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1887</td>
<td>2,000</td>
<td>28,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1888</td>
<td>1,000</td>
<td>14,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1889</td>
<td>1,200</td>
<td>16,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1890</td>
<td>2,500</td>
<td>36,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1891</td>
<td>3,000</td>
<td>42,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1892</td>
<td>2,500</td>
<td>36,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1893</td>
<td>2,500</td>
<td>36,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1894</td>
<td>1,437</td>
<td>19,722</td>
<td>46,656</td>
<td>50,992</td>
</tr>
<tr>
<td>1895</td>
<td>1,000</td>
<td>14,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896</td>
<td>754</td>
<td>10,663</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1897</td>
<td>814</td>
<td>11,747</td>
<td>69,493</td>
<td>71,729</td>
</tr>
<tr>
<td>1898</td>
<td>1,020</td>
<td>14,931</td>
<td>28,823</td>
<td>36,246</td>
</tr>
<tr>
<td>1899</td>
<td>2,600</td>
<td>36,300</td>
<td>30,112</td>
<td>60,084</td>
</tr>
<tr>
<td>1900</td>
<td>1,400</td>
<td>19,500</td>
<td>32,098</td>
<td>51,498</td>
</tr>
<tr>
<td>1901</td>
<td>2,900</td>
<td>42,976</td>
<td>27,767</td>
<td>66,157</td>
</tr>
<tr>
<td>1902</td>
<td>2,500</td>
<td>35,000</td>
<td>60,086</td>
<td>66,339</td>
</tr>
<tr>
<td>1903</td>
<td>1,400</td>
<td>19,441</td>
<td>46,339</td>
<td>65,780</td>
</tr>
<tr>
<td>1904</td>
<td>15,000</td>
<td>251,972</td>
<td>46,931</td>
<td>50,693</td>
</tr>
<tr>
<td>1905</td>
<td>53,926</td>
<td>265,321</td>
<td>38,116</td>
<td>68,056</td>
</tr>
<tr>
<td>1906</td>
<td>73,606</td>
<td>415,836</td>
<td>53,930</td>
<td>76,866</td>
</tr>
<tr>
<td>1907</td>
<td>69,674</td>
<td>342,547</td>
<td>57,166</td>
<td>67,728</td>
</tr>
<tr>
<td>1908</td>
<td>61,111</td>
<td>332,688</td>
<td>35,128</td>
<td>60,346</td>
</tr>
<tr>
<td>1909</td>
<td>76,837</td>
<td>496,294</td>
<td>42,755</td>
<td>57,776</td>
</tr>
<tr>
<td>1910</td>
<td>54,403</td>
<td>345,060</td>
<td>25,405</td>
<td>30,461</td>
</tr>
<tr>
<td>Totals</td>
<td>485,998</td>
<td>2,739,522</td>
<td>979,294</td>
<td>1,352,591</td>
</tr>
</tbody>
</table>

(a)—No figures on imports before 1889 are available.
(b)—From fiscal year ending June 30.
(c)—Estimated.

ACCIDENTS

CAUSES OF FATALITIES

During the year 1922 a total of five fatalities occurred in and about the mines and metallurgical plants of Alaska, as compared with twelve in 1921.

The causes that led to these fatalities are listed below:

1. Falls of rock or ore from roof
2. Fall of rock from stopes in bulldozing chamber
3. Falling down raise
4. Collapse of scaffolding

Total

The total number of men employed in the industry during 1922 was approximately 4,000.

REPORT OF MINE INSPECTOR

MINE FIRE AT EVAN JONES COAL MINE

A serious underground fire broke out on the second or lower level of the Evan Jones coal mine in the Matanuska field on the afternoon of November 19th, 1922.

While the origin of the fire is not definitely known, it was probably due to the use of coal dust as tamping in blasting operations or to the ignition of a small pocket of gas by the black powder in use at the time.

Without doubt the fire started when blasts were ignited, shortly after the day shift had left the mine, which was at 4:30 p.m. The existence of the fire was not discovered until about 6:20 p.m., by which time a portion of the crew comprising the night shift had gone to their working places in other portions of the lower workings.

The existence of fire in the mine was first recognized by the night fire-boss, Jack Jones, whose prompt action and intelligent procedure in removing the night shift from the mine resulted in the saving of the lives of at least ten men. All men were safely removed from the mine. Fire-boss Jones realized that the fire was in the east workings on the No. 3 bed, second level, but was unable to place its exact position with certainty owing to the volume of smoke that occupied all the No. 3 bed workings. Following the removal of the night crew from the mine, efforts were made to explore the workings in order to locate the exact position of the fire and to control the situation by manipulating the ventilation. During these operations seven men, including the Superintendent, were overcome by gas. Through the prompt efforts of Fire-boss Jack Jones with a crew of six men those overcome were removed to the surface and resuscitated. The fire gained rapid headway and further efforts to enter the lower workings, which were continued throughout the night and the following morning, met with progressively less success and were finally abandoned early in the afternoon of November 20th.

Reports received do not indicate that any effort was made to effectually seal the lower workings during the early stages of the fire.

An attempt was made to communicate by telephone with Capt. Hill, local representative of the U.S. Bureau of Mines at Anchorage. Owing the poor phone connections, information regarding the fire did not reach him until 9:15 a.m. November 20th, and he was unable to reach the mine until 2:30 p.m. of that date. At about that time a severe explosion occurred in the mine. This explosion was the ignition of a mixture of methane gas, generated by the fire, and air which entered the mine as a result of the lack of adequate stoppings.

Superintendent Jones reports that a 3-inch methane cap resulted when a safety lamp test of the return air was made at 11:00 a.m., at a point 15 feet inside the portal of the main haulage way, which constituted the return air course. Several minor explosions occurred later.

Following the arrival of Captain Hill at the mine he held a conference with the superintendent and owners of the mine. It was decided that at that time it was impossible to effectually control the fire by at-
tempting to seal the mine. Breathing apparatus was not available until nearly a week after the inception of the fire, and entry into the workings was therefore impossible. The caved condition of the upper workings, which had been carried up on the coal beds to the surface overburden over a considerable distance, rendered it probable that air would reach the fire area despite any stoppages that might be built in sections of the mine that could at that time be reached without breathing apparatus. It was therefore decided to flood the mine.

Captain Hill took full charge of the situation and rendered effective service throughout the remainder of the fire-fighting operations and mine recovery work.

The only water available for use in flooding the mine was in a small lake, 5,300 feet distant from the portal of the haulage way and 150 feet lower in elevation. The property was not equipped with power or pumps suitable for meeting the situation. By telephoning to Anchorage, about 55 miles distant, Captain Hill was able to make arrangements with the Anchorage Fire Department whereby the La France fire track, owned by the City of Anchorage, was immediately despatched by train to the Jones mine. A plank roadway leading from the Jonesville railway spur to the shore of the lake was built, connecting with a plank-covered log float constructed on the lake.

A pipe line made up of iron pipe, ranging from 4 inches to 2½ inches in diameter, and standard 2½-inch fire hose was laid from the float to the mine. Pumping from the lake was started 9:15 a.m. November 22nd and filling of the mine was completed December 6th. During the above operations the outside temperature ranged from 20° above to 10° below zero. It was found necessary to replace the iron pipe with canvas hose in order to prevent freezing of the line.

Explorations were started on November 28th, with a view to determining the procedure to be followed in the recovery of the mine. This work was commenced as soon as oxygen-breathing apparatus was available and a crew trained in its use. John J. Delahide, First Aid Miner, U. S. Bureau of Mines, who was at Seward when the fire occurred, hastened to the mine upon call for assistance, and proceeded at once to assemble the breathing apparatus that had been stored at the Chickaloon Mine and to train a crew of local miners in its use.

The crew that wore breathing apparatus during the mine recovery operations consisted of John J. Delahide, Capt. W. P. T. Hill, Jack Jones, J. Smith, N. Leonard, J. Gustafson and J. Lucas. Mr. John G. Schoning, Foreman Miner in charge of the Mine Rescue Station of the U. S. Bureau of Mines at Seattle, who was called upon for assistance, left Seattle on November 22nd and reached Jonesville in time to render valuable assistance and advise in planning and conducting recovery operations.

Unwatering of the mine started on December 8th and was completed January 3rd.
### SUMMARY OF ALL LODE-MINE AND MILL ACCIDENTS OCCURRING IN ALASKA DURING 1922.

<table>
<thead>
<tr>
<th>Number of plants reporting</th>
<th>Number of men employed</th>
<th>Number of shifts worked</th>
<th>LODE MINES:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOTAL TIME LOST (Dys)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fatal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Gold</td>
<td>590</td>
<td>188,565</td>
<td>2</td>
</tr>
<tr>
<td>2 Copper</td>
<td>423</td>
<td>164,273</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>41 Sub-total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lode Mines:</td>
<td>372,037</td>
</tr>
<tr>
<td>21 Gold</td>
<td>204</td>
<td>69,911</td>
<td>None</td>
</tr>
<tr>
<td>2 Copper</td>
<td>259</td>
<td>55,228</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Sub-total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mills</td>
<td>165,143</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 Grand Totals</td>
<td>1,519</td>
<td>537,190</td>
<td>5</td>
</tr>
</tbody>
</table>

### LIST OF ALL ACCIDENTS REPORTED FROM COAL MINES OF ALASKA FOR THE YEAR 1922, CLASSIFIED AS TO CAUSES AND RESULTS OF ACCIDENTS.

<table>
<thead>
<tr>
<th>UNDERGROUND</th>
<th>CAUSES</th>
<th>Killed</th>
<th>Permanent partial Disability</th>
<th>Time lost from work in days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Falls of roof coal, rock, etc.</td>
<td>...............</td>
<td>...............</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. Falls of face or pillar coal</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3. Mine cars and locomotives</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. Gas explosions and burning gases</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5. Coal dust explosions</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6. Employees</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7. Suffocation from mine gases</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8. Electricity</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9. Animals</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10. Mining machinery</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11. Mine fires</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12. Other causes</td>
<td>................</td>
<td>................</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>................</td>
<td>................</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SHAFT</th>
<th>CAUSES</th>
<th>Killed</th>
<th>Permanent partial Disability</th>
<th>Time lost from work in days</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Falling down shafts or slopes</td>
<td>...............</td>
<td>...............</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14. Objects falling down shafts or slopes</td>
<td>...............</td>
<td>...............</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15. Cage, skip, or bucket</td>
<td>...............</td>
<td>...............</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16. Other causes</td>
<td>...............</td>
<td>...............</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>...............</td>
<td>...............</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>CAUSES</th>
<th>Killed</th>
<th>Permanent partial Disability</th>
<th>Time lost from work in days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AVERAGE NUMBER OF MEN EMPLOYED UNDERGROUND AND ON THE SURFACE.

<table>
<thead>
<tr>
<th>UNDERGROUND</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>SURFACE</td>
<td>92</td>
</tr>
</tbody>
</table>

Total number of shifts underground: 27,760
Total number of shifts on the surface: 27,560
Total time lost on accounts of all accidents: 250 days.

(A).—Permanent total disability.—Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralytic, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B).—Permanent partial disability.—Loss of one foot, leg, hand, eye, one or more toes, any disfigurement where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

(C).—Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.
REPORT OF MINE INSPECTOR

LIST OF ALL ACCIDENTS REPORTED FROM GOLD MINES OF ALASKA
FOR THE YEAR 1922, CLASSIFIED AS TO CAUSES
AND RESULTS OF ACCIDENTS.

| CAUSES | Killed | Permanent Disability-(A) | Temporary
Disability-(B) | Time Lost Last
10 days | Total Lost
30 days | Total Injured |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number killed or injured by:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Full of rock or ore from roof or wall</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2. Rock or ore while loading at working face or chute</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>3. Timber and hand tools</td>
<td></td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4. Explosives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Hauling system (mine cars, mine locomotives, breakings of rope, etc.)</td>
<td></td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>6. Falling down cattle, winzo, raise or stone</td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>7. Run of ore from chute or pocket</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Drilling accidents (by machine and hand drills)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9. Electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Machinery (other than locomotives or drills)</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>11. Mine fires</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Suffocation from natural gases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Inrush of water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Nails, splinters, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Other causes</td>
<td></td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Total number killed or injured underground</td>
<td>2</td>
<td>4</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>Shaft Accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number killed or injured by:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Falling down shafts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Objects falling down shafts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Breaking of cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Overwinding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Skin, cage or bucket</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>21. Other causes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number killed or injured by shaft accidents</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Surface Accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(At surface yards and shops)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number killed or injured by:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Mine cars and mine locomotives, gravity or aerial tram</td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>23. Railway cars and locomotives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Run or fall of ore in or from ore bins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Falls of persons</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>26. Nails, splinters, etc.</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>27. Hand tools, axes, bars, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Electricity</td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>29. Machinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Other causes</td>
<td></td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Total number killed or injured by surface accidents</td>
<td></td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>2</td>
<td>4</td>
<td>31</td>
<td>48</td>
</tr>
</tbody>
</table>

(A).—Permanent total disability.—Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B).—Permanent partial disability.—Loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where joints are severed, or any other injury known in surgery to be permanent partial disability.

(C).—Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.

Average number of men reported as employed at all Gold Mines during 1923 | 590 |
Total number of shifts underground | 15,283 |
Total number of shifts on surface | 69,264 |
Total time lost on account of all accidents at Gold Mines | 2,067 days.
### LIST OF ALL ACCIDENTS REPORTED FROM COPPER MINES OF ALASKA FOR THE YEAR 1922, CLASSIFIED AS TO CAUSES AND RESULTS OF ACCIDENTS.

#### UNDERGROUNDS

| Causes | Number killed or injured by: | Permanent Total Disability | Temporary Total Disability | Total | Total
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Fall of rock or ore from roof or walk</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2. Rock or ore while leading or working face or chute</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>3. Timbers or hand tools</td>
<td>7</td>
<td>16</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Explosives</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Hoisting system (mine cars, take-up locomotives, breakage rope, etc.)</td>
<td>4</td>
<td>13</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Falling down chute, winze, raise or slope</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Run of ore from chute or muck</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Diving accidents (by machine or hand drills)</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Electricity</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Machinery (other than locomotives or drills)</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Coke-fires</td>
<td>493</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12. Suffocation from natural gases</td>
<td>493</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13. Injuries from water</td>
<td>493</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14. Nails, splinters, etc.</td>
<td>493</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15. Other causes</td>
<td>10</td>
<td>13</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total number killed or injured underground</strong></td>
<td>2</td>
<td>1</td>
<td>25</td>
<td>51</td>
</tr>
</tbody>
</table>

#### SHAFT ACCIDENTS

<table>
<thead>
<tr>
<th>Causes</th>
<th>Number killed or injured by:</th>
<th>Permanent Total Disability</th>
<th>Temporary Total Disability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16. Falling down shafts</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>17. Objects falling down shafts</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>18. Breakage of cables</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>19. Overwinding</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>20. Skip, cage or bucket</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>21. Other causes</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total number killed or injured by shaft accidents</strong></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

#### SURFACE ACCIDENTS

(A) Surface yards and shops

<table>
<thead>
<tr>
<th>Causes</th>
<th>Number killed or injured by:</th>
<th>Permanent Total Disability</th>
<th>Temporary Total Disability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22. Mine cars and mine locomotives, gravity or aerial tram</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23. Railway cars and locomotives</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24. Run or fall of ore in or from ore bins</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25. Falls of persons</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26. Nails, splinters, etc.</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27. Hand tools, axes, bars, etc.</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28. Electricity</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29. Machinery</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30. Other causes</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total number killed or injured by surface accidents</strong></td>
<td>2</td>
<td>20</td>
<td>22</td>
</tr>
</tbody>
</table>

---

**Total number killed or injured by:***

- **Surface accidents:** 22
- **Shaft accidents:** 3
- **Underground accidents:** 82
- **Total number killed or injured by:** 117

**Total number lost on account of all accidents at Copper Mines during 1922:** 1,690 days
### List of All Accidents Reported from All Copper Milling Plants of Alaska for the Year 1922, Classified as to Causes and Results of Accidents

#### Causes and Results of Accidents

| CAUSES | Killed | Permanent Total Disability (A) | Permanent Partial Disability (B) | Temporary Disability (C) | Time lost more than 1 day | Time lost more than 14 days | Total Lost
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ore Dressing and Milling Accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Crushers, rolls or stamping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Other machinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Falls of persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sufocation in ore bins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Falling objects (rocks, timbers, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Cyanide or other poisoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Electricit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Other causes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total killed or injured at Gold Mills</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>17</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

(A) — Permanent total disability. — Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B) — Permanent partial disability. — Loss of one leg, one arm, one hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

(C) — Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.

Average number of men reported employed at all Gold Mills during 1922 | 204 |
Total number of shifts worked | 9,934 |
Total time lost on account of all accidents at Gold Mills | 158 days |

#### Ore Dressing and Milling Accidents

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>Killed</th>
<th>Permanent Total Disability (A)</th>
<th>Permanent Partial Disability (B)</th>
<th>Temporary Disability (C)</th>
<th>Time lost more than 1 day</th>
<th>Time lost more than 14 days</th>
<th>Total Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ore Dressing and Milling Accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Crushers, rolls or stamping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Other machinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Falls of persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sufocation in ore bins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Falling objects (rocks, timbers, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Cyanide or other poisoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Electricit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Other causes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total killed or injured by ore dressing and milling accidents</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(A) — Permanent total disability. — Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B) — Permanent partial disability. — Loss of one leg, one arm, one hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

(C) — Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.

Average number of men reported employed at all copper milling plants during 1922 | 259 |
Total number of shifts worked | 9,632 |
Total time lost on account of all accidents at copper mills during 1922 | 420 days |
A LIST OF THE FATAL ACCIDENTS WHICH OCCURRED AT THE MINES AND ORE DRESSING PLANTS OF ALASKA DURING THE YEAR 1922

April 2—VINCENT JURMAN. Austrian miner, age 50 years, employed by the Kennecott Copper Corporation at their Beaton Mine at Latouche, was killed by slipping on the ladder he was descending and falling down a raise and into a slope below.

The following statement is made by Mr. Jas. Pozard, Superintendent of the Beaton Mine:

"Beyond a doubt Jurman was walking down this raise with his back to the ladder, which, as I have since understood from the men, he was in the habit of doing; and further, a particular friend of his, by name of Max Saul, stated that he had cautioned Jurman about this in many instances.

"We had a serious accident happen, once before, to a man walking down the raise back to the ladder and this feature has been taken up and discussed at nearly every Safety-First meeting and warnings issued by the foreman against the practice."

The following descriptions of the accidents which caused Jurman's death are given in affidavits by Mr. Fred M. Radel, Mine Foreman, and Mr. John A. Richards, Mine Engineer, who were both present when the accident occurred:

Mr. Radel says: "Jurman was working in what is known as 205 No. Stope Raise at a point about 50 feet above the main level. This is a 45 degree raise, equipped with good ladders and extends below the main level for a distance of approximately 100 feet into what is known as 206 Stopes.

"On returning to work in the afternoon, Jurman went up this raise to blast four holes. Mr. J. A. Richards, the Mine Engineer, and myself were standing by the raise on the main level, awaiting for Jurman to light his holes and descend. I called to him, asking when he intended to blast, and he answered 'Right now,' so I told him I would wait until he came down. In about half a minute I looked up the raise and could see by his light that he was coming down the ladder. I stopped back from under the raise and in a few seconds something came past me, which I thought was Jurman and I also saw a box and two or three sticks of powder rolling by, which, no doubt, Jurman had left over when loading his round and which he was returning to the level.

"Richards and myself started to the 100-ft. level. Richards proceeding me. At the 100-ft. level Richards went into one part of the stope where he thought the rock would roll to, where there was found and I investigated another part and during this time the shots went off. None of the rock went to the part where Jurman was found. He was still breathing when we placed him on the stretcher

"My opinion is that Jurman slipped from the ladder as he was leaving the face after spilling the fuse."

August 28—TOM KATOFF. Russian miner, single, age 26 years, employed by the Kennecott Copper Corporation at their Beaton Mine at Latouche, was killed by being struck on the head and back by a piece of soft gouge, weighing about fifty pounds, which fell from the back of the slope in which he was working.

The following details concerning the accident are given in an affidavit by Nick Orfandis, Katoff's partner, who was present at the time of the occurrence:

Orfandis says: "On August 28, 1922, while in the employ of the Kennecott Copper Corporation at their Beaton Mine at Latouche, I was working in a part of the raise known as 206-A North Hanging Wall Stop, and that while he was tamping powder in the hole and Tom Katoff was cutting powder of soft gouge, weighing about fifty pounds, which fell from the back of the slope in which he was working.

The following statement appears in an affidavit by F. M. Radel, Mine Foreman: "On the morning of August 28, 1922, I was in the stope raise and told both Katoff and my partner, Orfandis, about spraying some holes. I did not go back any more during the day. At 3:30 P.M., Tom Lein, Mine Engineer, rang me up telling me that Tom P. M. Tom Lein, Mine Engineer, rang me up telling me that Tom Katoff was hurt. I immediately went up to mine. The men were carrying Katoff out of mine when I reached there. We took him to the hospital."

The following statement appears in an affidavit by F. M. Radel, Mine Foreman: "On the morning of August 28, 1922, I was in the stope raise and told both Katoff and my partner, Orfandis, about spraying some holes. I did not go back any more during the day. At 3:30 P.M., Tom Lein, Mine Engineer, rang me up telling me that Tom P. M. Tom Lein, Mine Engineer, rang me up telling me that Tom Katoff was hurt. I immediately went up to mine. The men were carrying Katoff out of mine when I reached there. We took him to the hospital."

"My opinion is that Jurman slipped from the ladder as he was leaving the face after spilling the fuse."

September 10—CALH STATTLE, naturalized American, pipe-fitter and plumber, age 23 years, employed by the Kennecott Copper Corporation at their National Creek camp at Kennecott, was instantly killed as a result of a double accident whereby the scaffolding upon which
he was standing collapsed under the impact of a falling pipe fitting, thus precipitating him to the floor thirty feet below and he was struck on the head by the pipe fitting after he had fallen to the floor.

The following account of the accident is given in an affidavit by Donald Oliver, fellow-workman with Statte. Robert Fitzgerald, Ole Peterson and myself was instructed to help Carl Statte to remove an old pipe header over the fume cones in boiler plant, which was about 25 feet from the boiler room floor. The pipe header consisted of 6' pipe and fittings, was about 4 feet long and weighed about 500 pounds. About six inches under the pipe header was a temporary staging on which Fitzgerald, Statte and myself was working on to remove the flange bolts. Statte was in the center, Fitzgerald on one end and myself on the other. Before the three of us removed the flange bolts, Statte wired the pipe header to the rollers above. Immediately after the flange bolts had been removed, Statte started pulling the wires by hammering the wires over the pipe and had cut two wires when I told to Carl to wait until I could assure the rope I was pulling around the pipe header. He paid no attention to me but gave the wires another blow. The pipe then fell onto the staging and the three of us were standing on, taking it out from under us. Carl fell to the boiler room floor, the pipe header following him down and striking him on the head. Fitzgerald fell only about 4 feet and caught himself on some insulated electric cable. As soon as the staging started under me I was lucky enough to grab hold of a ½” handrail with my left hand and save myself. I do not know what Carl was thinking or unless he intended to drop the header on the staging first, before putting on the ropes to lower it down. However, Fitzgerald and myself was hammering to secure it with a rope first before cutting the wires but Statte was in charge of the job."

September 25—OREN ODOLOVICH, Servant, contractor, single, age 38 years, employed by the Alaska-Juneau Gold Mining Company at their mine at Juneau, was fatally injured by being caught by a fall of rock that had been “hung up” in the throat of a ball-dozing chamber.

The following statement as to the details of the accident are contained in an affidavit by Alex Zibio, who was working under Oodovich’s direction at the time the latter was injured: “Affiant states that at about 2:10 o’clock A. M. on the 25th day of September 1922, he was ball-dozing at No. 45 ball-dozing chamber in the Alaska-Juneau Mine, Oren Odolovich, who had charge of the ball-dozing crew on that shift came where he was at No. 45 ball-dozing chamber and said ‘How is it coming,’ affiant answered ‘Pretty tough, the rocks are hanging up,’ then affiant went to the drift to get some powder and in about one minute he heard the rocks coming down and then heard Odolovich groaning and he called for help and went to No. 42 and No. 44 ball-dozing chambers to get the men who were working there; when he returned he found Oren Odolovich between the grizzly bars with his feet towards the wall and some huge rocks over his chest and side which was holding him against the grizzly bar. He was removed from underneath the rocks in about forty minutes and taken to the Hospital at Juneau, Alaska.”

November 9—ED BERG, Finlander, machine man, single, aged 36 years, employed by the Alaska-Juneau Gold Mining Company at their mine at Juneau, was fatally injured by being struck by rock loosened by a recent blast.

The accident is described as follows in an affidavit by Hugo Peterson, partner of Berg at the time he was injured: “Affiant states that on the 6th day of November, 1922, at or about 2:00 o’clock P. M., he and one Ed Berg were working at No. 430 Raise, Cruise Station, they set off a blast at the cruise station and waited about 40 minutes for the powder smoke to clear away, then they went to the cruise station where they blasted and affiant told Ed Berg to go to the drift and get a bar to bar down some loose rock that appeared to be hanging up; Ed Berg went for the bar, came back and as he was passing and alongside of affiant a large rock fell from the roof, striking Ed Berg on the left side of his head and arm and at the same time the rock struck on a plank that he was standing on, throwing him down and in the mean time the rock kind of rolled over his head and shoulders. Affiant immediately called for help and the injured was removed from under the rock and taken to St. Ann’s Hospital.”