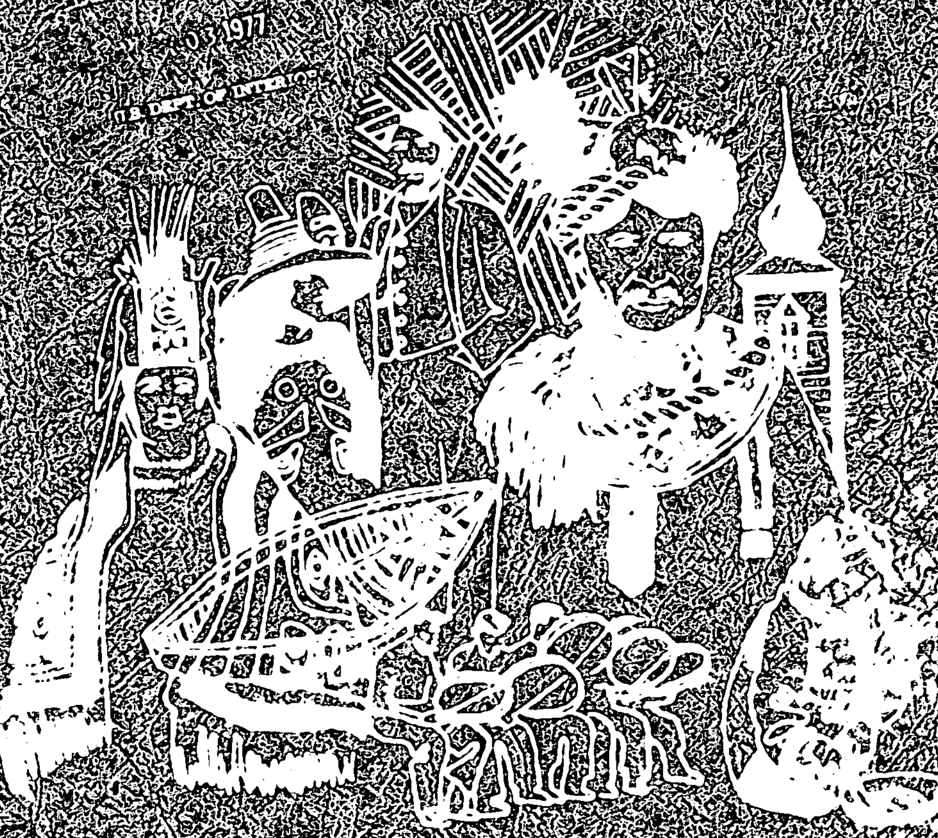
Big Business in Alaska: The Kennecott Mines, 1898-1938

Melody Webb Grauman



Anthropology and Historical Preservation
Cooperative Park Studies Unit
University of Alaska
Fairbanks

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PREFACE

The following study concentrates on the history and significance of the Kennecott area. I have emphasized the development of the town rather than include detailed discussions of the mines themselves. The appendices include a very brief history of McCarthy gleamed from the documents. A thorough oral history project should commence immediately to document that town's history while people are still alive to tell it. Since Lone Janson's The Copper Spike and the Alaska Division of Park's historic resource study of The Lower Copper and Chitina Rivers have compiled a history of the Copper River and Northwestern Railroad, I have only superficially touched that subject.

I would like to extend my appreciation to all those whom I have interviewed. Their insights added another dimension to this work. I especially want to thank William C. Douglass for his help, advice, and documents. Special thanks also go to Ralph MacKay for his photographs and to Jean Mattson for her librarian skills.

I. THE SETTING

Porched on a mountain side overlooking the merging of two glaciers lies the abandoned and nearly forgotten town of Kennecott, Alaska.[1] The unyielding summer wind and winter snow of southcentral Alaska whip through paneless windows, and thick underbrush thrusts up through rotting floors. The forest and creek, once contained by man, have returned to reclaim the land. This lonely, isolated town spawned the world's greatest copper conglomerate, Kennecott Copper Corporation. Boasting one of the richest copper ore deposits, Kennecott also evolved the ammonia leaching plant for mining technology and indirectly contributed to the downfall of a president. Yet even history has forgotten these contributions as time slowly consumes the fragile fabric man erected only seventy years ago.

Approximately two hundred million years ago a succession of basaltic lava flowed out under the sea forming what later became known as Nickolai greenstone. Within the beds native copper and copper sulphides of less than one-tenth of one percent settled out. Upon the greenstone formed the Chitistone limestone composed of shale and dolomitic limestone. Other materials completed the remaining formations. As time passed, mountain building resulted in uplift, tilting, folds, fractures, and faults. Thus, instead of being neatly and horizontally layered, the formations had a northeasterly slant of twenty-three to thirty degrees.

About seventy-five million years ago great volcanic activity burst forth. This activity produced Porphyry Mountain to the south of the Kennecott area but, more important, intruded hot molten porphyry into the previously laid formations. The resultant magma heated the circulating waters that searched the copper out of the greenstone. The heated waters then took advantage of the faults and

[1] Although the United States Geological Survey terminology gives the spelling as Kennicott, the post office and company name are spelled as Kennecott. As Kennecott is more commonly used, even by the U.S.G.S., it is used in this paper.

Occasionally the Ahtna Indians from the Copper River Valley made hunting excursions into the mountains. Aside from a few stone implements, the Indians left little imprint on the massive mountain range. They occasionally fashioned the native copper, eroded by nature, into tools and ornaments, but the rich Kennecott deposits awaited the white man's technology.

prospecting as they journeyed. Only a few succeeded. As a result of this great deluge and sacrifice of lives, the Army and the United States Geological Survey tried to explore, map and describe the trails and mineral resources of Alaska. In 1899 Captain William R. Abercrombie put U.S.G.S. geologist, Oscar Rohn, in charge of exploring and mapping the Chitina Valley.

Rohn became the first man to record in detail the area known as Kennecott. He named the Kennicott and Root Glaciers and described basic geologic structures that he believed held copper ore--Chitistone limestone and Nikolai greenstone.[3] He analyzed the volcanic contact zones and favorably compared the Nikolai greenstone to the Lake Superior greenstone that had produced the richest copper in the United States. He summarized that further exploration was needed and encouraged a more detailed economic survey.[4] That same year in the same vicinity, the Nikolai mine at the head of Nikolai Creek was staked out.[5]

Confusing and contradictory stories have clouded the truth of the discovery of the Bonanza ore deposits adjacent to the Nicolai mine.[6] Apparently in August of 1900 Jack Smith and Clarence Warner discovered the green cliffs of outcropping malachite that legend has them mistaking as grass for their horses. Recogniz-

[3] Rohn, Reconnaissance of the Chitina River, pp. 400-01.

[4] Ibid, p. 438-39.

[5] F. C. Schrader and A.C. Spencer, The Geology and Mineral Resources of a portion of the Copper River District, Alaska, Special publication of U.S.G.S. (Washington, 1901), pp. 86-7; F.C. Schrader and W.C. Mendenhall, The Mineral Resources of the Wrangell District, Alaska, U.S.G.S. Professional Paper No. 15 (Washington, 1903), p. 9; and Robert Stearns, "Alaska's Kennecott Copper and the Kennecott Copper Corporation," The Alaska Journal 5 (1975): 130-39.

[6] Stearns, "Alaska's Kennecott Copper," p. 130-135 has five different versions, William C. Douglass, A History of the Kennecott Mines, Kennecott, Alaska (Alaska Division of Parks Reprint, Anchorage, 1974), p. 3; L.A. Levensaler, Interview with Lewis A. Levensaler as told to Henry C. Carlisle, November, 1959, in University of Alaska Archives; Archie Shields, "The Kennecott Story," Mimeographed (University of Alaska Library, April, 1967) pp. 1-2; W.E. Dunkle, "Economic Geology," pp. 20-22, and Woodrow Johansen, "The Copper River and Northwestern Railroad," The Northern Engineer 7 (1975): 19.

and fourteen ounces of silver per ton tempted their appetite for greater expansion.[11]

Finally in November of 1906 Stephen Birch finally succeeded in merging the financial interests of the J. P. Morgans with the mining interests of the Guggenheims. This partnership, known as the Alaska Syndicate, purchased forty per cent of the Bonanza. By 1909 the Syndicate had acquired the whole Company, three thousand acres of lode and placer claims, for $2,987,500.[12] Coupling the delayed acquisition with his aggressive and hard-driving business acumen, Birch assured himself a prominent role as managing director in the new business.

[11]Schrader and Spencer, <u>The Geology and Mineral Resources of Copper River</u>, 1901, pp. 85-86; Walter C. Mendenhall and F. C. Schrader, "Copper Deposits of the Mount Wrangell Region, Alaska," <u>Contributions to Economic Geology</u>, U.S.G.S. Bulletin 213 (Washington, 1903), p. 145.

[12]Stearns, "Alaska's Kennecott Copper," p. 135.

ture in Alaska.

Recognizing the diversity of their holdings, copper and its transportation claimed the Syndicate's first priority. The Guggenheims assumed control over development of the Kennecott Mines Company while the Morgans tackled the tranportation problem. The Syndicate's Copper River and Northwestern Railway was started first in Valdez, geographically the closest port to Kennecott. After expending $85,000 in rock work in Keystone Canyon, the Bering coal fields attracted the Syndicate to the new town of Katalla.

A short railroad spur would allow the railroad to exploit the adjacent coal for use as fuel for the engines and smelters. Before leaving Valdez, the Syndicate assigned Deputy Marshall Edward Hasey to protect its interest in the Keystone Canyon in the eventuality that the Katalla route failed.

Katalla, too, presented serious problems. It lacked a port and required the investment of a million dollar breakwater. When a violent storm crushed and destroyed six months work, the Syndicate moved its railroad a third time, to still another new town, Cordova. Here the Syndicate brought, for $500,000, the short track laid by Michael J. Heney.[5]

Although several railroads competed with the wealthy Syndicate, only the Alaska Home Railroad presented any problems. When the Copper River and Northwestern Railroad left Valdez for Katalla, Valdez townspeople became angry and disappointed. They played into the hands of con artist, H.D. Reynolds. He capitalized on their indignation and challenged them to build their own railroad. Enthusiastically the townspeople responded with all their savings and even their credit. Former governor John Green Brady served as treasurer. The Alaska Home Railroad actually laid grade up to the Keystone Canyon that was still held and guarded by

[5] The whole story of the Copper River and Northwestern Railway can be found in Lone E. Janson, The Copper Spike (Anchorage: Northwest Publishing Co., 1975).

Syndicate men. Driven on by Reynolds' "trust-busting" rhetoric proclaiming that the Railroad Act of 1898 disallowed exclusively held right of ways, the Alaska Home Railroad men attacked the canyon. Deputy Marshall Edward Hasey found himself facing an unarmed mob that refused to retreat. He fired several rounds. Unfortunately one man was killed.

As a result of this "battle" a wave of anti-Syndicate feeling swept Alaska. Sides were drawn, and the word Syndicate became a political football. James Wickersham made charges of perjury, bribery, and jury-tampering against the Syndicate for entertaining Hasey's jurors.[6] Branded as a Guggenheim tool, Governor Wilford B. Hoggatt lost his credibility as he supported the Syndicate against the admitted trespassing of the Reynoldnites.[7]

Meanwhile Reynolds found himself and his railroad facing bankruptcy. Reynolds deftly disappeared and former governor, Brady tried to bring order into the financial chaos. As a result Brady along with seventeen hundred other hopeful investors, lost his life's savings. Brady's political and financial life collapsed with Reynolds fraudulent railroad. He left on a mission to China, a destroyed man.

Other lives were changed by the Syndicate's existence. Cordova became a "Syndicate or Guggenheim" town. The Cordova Daily Alaskan served as the media for the Syndicate's cause. Town leaders admitted that the Syndicate's plans took priority over the city.[8] By 1908, however, opposition developed primarily as a result of the "Keystone Massacre".

James Wickersham fanned this opposition into greater antagonism. Wickersham had offered his services as legal counsel to the Syndicate. Upon their rejection

[6] Ibid., p. 64; Arends, "The Guggenheims In Alaska," pp. 24-26; Ernest Gruening, The State of Alaska (New York: Random House, 1968), p. 337.

[7] Gruening, The State of Alaska, p. 337.

[8] Stearns, "The Morgan- Guggenheim Syndicate," pp. 302-13.

he ran for Alaska Delegate to Congress as a vehement anti-Syndicate and anti-monoply politician.[9] On election day in 1908 the Syndicate loaded the flat cars with railroaders, transported them to Cordova, and carefully coached them to vote against the outspoken Wickersham.[10] Appalled by such tactics, Cordova voters turned to Wickersham assuring his election.

One other great Alaskan hero found his life irrepairably changed by the Syndicate. Proclaimed a hero by dramatically rescuing ice-bound and starving whalers in 1898, David H. Jarvis reached the pinnacle of his popularity and respect in 1904 when Teddy Roosevelt offered him the governorship of Alaska. Jarvis decided, instead, to take a more financially attractive position as the Syndicate's lobbyist. Championing the Syndicate's causes, he successfully blocked a government subsidized railroad and opposed self-government for Alaska. At the same time his popularity collapsed and his integrity was challenged. Gripped by depression and charged with graft, in 1911, Jarvis committed suicide.[11]

Yet the greatest impact was felt nationally as the Syndicate inadvertantly became involved in the Ballinger-Pinchot Affair. The Syndicate was confronted not only with railroad problems but also with fuel problems--fuel for locomotives and fuel for smelters. Coal seemed the answer. Despite the enormous coal fields found in southcentral Alaska, the United States' coal laws had not been extended to Alaska. In 1903, however, Clarence Cunningham, a mining engineer, organized an association to acquire coal land and form a company to market the coal. They proceeded to do exploratory work on several claims of 160 acres each. All work was null and void, however, because no law existed. Finally in 1904

[9] Ibid., pp. 313-28. Stearns portrays Wickersham as "Flickering Wick" because of his shifting politics. He describes an actual fist fight between Wickersham and Frank Mondell, Chairman of the House Committee on Public Lands; Janson, The Copper Spike, p. 61

[10] Janson, The Copper Spike, p. 61; Stearns, "The Morgan-Guggenheim Syndicate," p. 346.

[11] Janson, p. 64; Stearns, "The Morgan-Guggenheim Syndicate," p. 403.

Congress extended the coal laws to Alaska. The 1904 law even allowed the formation of associations providing they formed _after_ patents had been received and consisted of not more than 640 acres per association. Regardless of the law, Cunningham and associates proceeded to pay for the surveys, filed notices of location, paid ten dollars per acre, and signed an oath that the coal was for the individual's benefit only. Despite the law and oath, Cunningham and associates still planned to pool their patented claims.[12]

Following closely on the 1904 law, President Theodore Roosevelt in 1906 withdrew all coal fields in Alaska that had not been legally filed upon. He justified the withdrawal as means to conserve natural resources and to prevent monopolies. Unfortunately, this withdrawal limited coal development to those claims filed upon in the preceeding two years. Thus to the Syndicate, the Cunningham claims appeared not only attractive but one of very few opportunities to obtain coal for the planned railroad and smelters. On July 20, 1907 the illegally formed Cunningham association offered on option to the Syndicate. In December the Syndicate accepted the option to buy one-half interest of the Cunningham coal fields after patents had been received, for $250,000.[13]

Meanwhile the Commissioner of the Central Land Office, Richard A. Ballinger, had two investigations into the Alaskan coal claims. Neither showed discrepancies. Under some political pressure from the former governor of Washington, who was one

[12]Harold L. Ickes, _Not Guilty: Official Inquiry Into the Charges Made by Glaves and Pinchot Against Richard A. Ballinger, Secretary of the Interior, 1909-11_, Department of the Interior (Washington, 1940), pp. 4-6.

[13]The following discuss the Syndicate's option in the Cunningham claims: Gifford Pinchot, _Breaking New Ground_ (New York: Harcourt, Brace & Co., 1947), p. 398; Nelson M. McGeary, _Gifford Pinchot: Forester, Politician_ (Princeton: Princeton University Press, 1960), p. 135; Stearns, "The Morgan-Guggenheim Syndicate," p. 295; Arends, "The Guggenheims in Alaska," pp. 36-39; while Ickes mentions the proposals but "ultimately nothing came of these proposals"/ true, because the claims were invalidated/ _Not Guilty_, p. 6.

of Cunningham's associates, Ballinger, also from Washington, approved the patents. A young idealistic investigator, Louis R. Glavis, telegramed that the claims should not be approved. As a result, Ballinger suspended the order until the conclusion of Glavis' investigation. Glavis, shortly after Ballinger resigned and returned to private practice, found Cunningham's 1903 journal entry of the verbal agreement to form a company. Cunningham meanwhile sought private attorney Ballinger's legal advice. Cunningham felt that no agreement existed as a result of the 1904 relocation of claims. Ballinger believed the mining engineer and prepared an affidavit to that effect.

When Ballinger once again returned to public office in 1909, as Secretary of the Interior, he told his subordinates of his role with Cunningham and told them he wanted nothing to do with the claims. Meanwhile a new act allowed extensive consolidation of coal claims made in good faith under the 1904 act. Glavis expressed concern to Gifford Pinchot, Chief Forester and tireless conservationist, that the Interior Department was trying to distort the 1908 law and allow the illegal Cunningham claims legitimacy. Both Glavis and Pinchot feared a Morgan-Guggenheim monopoly.[14] Pinchot additionally welcomed another opportunity to confront Secretary Ballinger who seemed to be destroying the conservation work of his mentor, Teddy Roosevelt. Pinchot encouraged young Glavis to appeal directly to President William Howard Taft. Unfortunately for Glavis, Taft exonerated Ballinger and recommended the dismissal of Glavis for "filing a disingeneous statement unjustly impeaching the official integrity of his superior officers."[15]

Without resigning his office, Pinchot appealed to the people over the head of his president. Collier's Weekly supported him even to the point of contriving a hoax implying that Taft was in collusion with the Morgan-Guggenheim Syn-

[14] Ickes, Not Guilty, p. 16; Pinchot, Breaking New Ground, p. 398.

[15] Ickes, Not Guilty, p. 31.

dicate.[16] Having no choice but to make Pinchot a martyr, Taft fired Pinchot. Eventually a Congressional investigation cleared Ballinger of charges of misconduct, and the Land Commissioner invalidated the Cunningham claims. But the public remained unconvinced. Furthermore, Pinchot had not completed his destruction of the "anti-conservation" forces of Taft and Ballinger. He wrote Teddy Roosevelt in Khartum, Africa and expressed sixteen ways that Taft had abandoned the Roosevelt policies.[17] Roosevelt returned to the United States, split from the Republican Party, formed his own Bull Moose Party, and inadvertently allowed the Democratic nominee, Woodrow Wilson, to win the presidential election of 1912.[18]

As a postscript to the Ballinger-Pinchot affair, in 1917 Daniel Guggenheim met Pinchot and urged him to correct his unjust statements that the Alaska Syndicate had attempted to obtain a monopoly in Alaska. Pinchot admitted that he could not dispute Guggenheim's facts, but "[The] natural and inevitable result of what was actually done in your name was to produce the impression that an effort was under way to monopolize the resources of Alaska. Hence I find it impossible to agree with you that the fault lay with myself."[19]

The coal problem, however, remained unresolved and a thorn in the side of Alaskans for years. As a result of the coal land withdrawal, the Copper River and Northwestern Railway shifted to locomotives run by oil. Without coal the Syndicate could not afford to develop the promised railroad to the Yukon or the coastal smelters. Alaskans opposed Pinchot and all of his conservation policies and blamed conservationists for Alaska's lack of development.[20]

[16] McGeary, Gifford Pinchot, p. 210; Janson, The Copper Spike, p. 120.

[17] Pinchot, Breaking New Ground, pp. 498-500.

[18] Ickes, Not Guilty, p. 48; Janson, The Copper Spike, p. 130; Carpel L. Berger, "Story of Kennecott Copper. Part I, Empire Building and Builders: Struggles," The Financial World 23 May 1921, p. 395.

[19] McGeary, Gifford Pinchot, p. 210.

[20] This is the basic theme of several books: Stearns, "The Morgan-Guggenheim Syndicate;" Janson, The Copper Spike; Gruening, The State of Alaska; and all of the U.S.G.S. Bulletins for this period.

IV. THE EARLY KENNECOTT MINES

While the Syndicate wrestled with the inherent logistical and political problems, exploration and development of the mines, which everyone hoped would make the gamble worthwhile, plodded along. The relatively high prices of copper in 1907 and the accompanying "copper famine" had kindled the Syndicate's interest in Kennecott. Stephen Birch, as manager of the Kennecott Mines Company, continued to guide mine development.

After extending the first two tunnels crosscutting the ore body at Bonanza, Birch began development on the Jumbo claim, located nearly one mile northwest of the Bonanza. These two mines lay at the base of lofty cliffs over six thousand feet above sea level. Three miles and nearly four thousand feet lower, at the mouth of National Creek, the main camp and office were constructed. To facilitate communication and the transportation of supplies, a temporary wagon road connected the lower camp with the Bonanza.

Until the railroad joined the mines with the coast, the task of getting food, mining equipment, building materials, and other supplies to the mines presented a major problem. Because Alaska lacked good wagon roads or even well maintained trails, winter travel proved the most expedient. Once the swamps, muskeg, streams, and rivers had iced over and snow had fallen, dog teams, pack horses, and horse drawn sleds could carry freight more easily than during the summer months. The evolution of the reversible one horse sled relieved the problem of having a horse or sled get stuck. If that happened, the horse was hooked to the other end and continued up the mountain or through the woods repeating the task as necessary.[1]

[1] C.D.N. Taylor, "A Prospector of the Dawson Range," Western Miner 44 (1971): 43; Jack Meloy to C.D.N. Taylor, 3 February, 1970, C.D.N. Collection, private, Victoria, British Columbia.

Only over Tasnuna trail, which had a snow plow, were heavy bobs used in place of the double ended sleds.[2]

Freighting of supplies during the short summer months was costly, difficult, and used only in an emergency. Nevertheless, one summer freighter preferred the longer but easier route through Canada to the Yukon. The Valdez trail wound through the coastal range, across glaciers, and forded glacier-fed steams. Grass for horses could not be counted on except during the early summer. On the other hand, the Donjek trail claimed better feed, no bad water crossings, plenty of wood, and proved to be twenty-five miles shorter.[3] Altogether freighting costs varied from an average of $200 a ton during the winter to $2000 a ton during the summer.[4]

To help alleviate the supply problem, the summer of 1907 saw the assemblage of the steamboat, Chittyna (later called the Chitina), that during the previous winter had been carried piece by piece above Abercrombie's Rapids. The steamer served mainly to supply the railroad but occasionally, during high water, was able to maneuver the Chitina River to bring supplies to the mines.[5]

A series of unforeseen circumstances in 1908 compounded the already severe supply problem. The early opening of the Chitina River hampered the shipment of supplies that had started along the frozen river the previous winter. The lower price of copper, from twenty cents to thirteen cents per pound, discouraged prospectors. This meant fewer supplies were shipped in over the snow and resulted

2 Moffit and Maddren, Mineral Resources of Kotsina - Chitina, p. 14.

3 Meloy to Taylor 3 February 1970, C.D.N. Taylor Collection; Fred H. Moffit and A.G. Maddren, "The Mineral Resources of the Kotsina and Chitina Valleys, Copper River Region," Mineral Resources of Alaska, U.S.G.S. Bulletin 345 (Washington, 1908), p. 132.

4 Alfred H. Brooks, "The Mining Industry in 1909," Mineral Resources of Alaska, U.S.G.S. Bulletin 442 (Washington, 1910), p. 25.

5 Moffit and Maddren, Mineral Resources of the Kotsina - Chitina, p. 15; Janson, The Copper Spike, p. 74.

in poorer maintained trails. In hopes of countering these problems, contruction began on a short piece of railroad from the camp to the Chitina River. Once completed, the Syndicate anticipated that supplies and ore could be shipped on the steamer Chitina and two other steamboats thereby relieving the dependency on winter freighting.[6]

Meanwhile at the camp, horses packed in those supplies that could not wait until freeze-up. Unfortunately, because of the tramway's weight, much of its equipment had to be cached at the mouth of the Chitina River until winter. Thus, since only half of the tramway's towers were erected before winter, the wagon road to the mine was widened and graded to expedite the sledding of food and supplies. Additionally, a sawmill, bunkhouse, and blacksmith shop added necessary shelter and tools to the embryonic mining town.

At long last, in 1909, the railroad conquered the crossing of the Copper River. Now the railroad could ship more freight in one day to Abercrombie Canyon than could be taken over the Valdez Trail in six months. Four steamboats met the railroad above Abercrombie Rapids and conveyed the freight to other spots along the railroad and to the Kennecott camp.[7] Although the steamers helped bring in the supplies during the summer, horse sleds during the winter still transported most of the supplies. Once completed the one hundred ton tramway opened a new route to get the supplies from the camp to the mine. Large weights of freight could be readily raised to the mines, counterbalanced by equally massive quantities of ore lowered to the camp below.

[6] Fred H. Moffit, "Mining in the Kotsina, Chitina, Chistochina, and Valdez Creek Regions," Mineral Resources of Alaska, U.S.G.S. Bulletin 379 (Washington, 1909), pp. 153-4; Levensaler to MacKay, 9 December 1955, MacKay Collection, private, Seattle, Washington.

[7] Fred H. Moffit, "Mining in the Chitina District," Mineral Resources of Alaska, U.S.G.S. Bulletin 442 (Washington, 1910), p. 159; Janson, The Copper Spike, p. 86.

The nearly completed railroad coupled with the summer steamboats had lowered the freighting costs for 1910. At the same time the Bonanza mine and the lower camp were fully equipped to ship ore. The Bonanza mine consisted of three different mines all mining the same ore deposit. The initial outcropping was called a "glory hole" and was the only ore body where open pit methods were used. Given the irregularity of the remaining ore bodies, subterranean tunnels were found more expedient. By 1910 these workings lay 150 feet below the surface. The ore from the underground mine proved to be at least fifty percent copper and could be bagged and shipped as it came from the mine.

Yet before man had discovered the Bonanza, nature had already begun to erode the chalcocite from the limestone. Thus ore could be found in the talus slide that assayed at thirteen percent copper. In addition, some ore had gone over the steep cliff to the west of the outcropping and had become buried in a glacier. These latter two "mines" consisted of low grade ore and its shipment would mean paying high freight rates for a great deal of waste material. The hundred ton concentrator fulfilled the purpose of separating the ore from the waste rock. The separation involved mechanical crushers, oscillating or rocking tables, and jets of water to wash away the waste.[8] The heavier ore that remained was dried and sacked.

Although the tramway could carry the ore from the mines to the newly constructed ore bins at camp,[9] L.A. Levensaler, the superintendent, preferred not to attempt much mining until the railroad was completed.[10] Since the railroad had problems

[8]Horace J. Stevens, The Copper Handbook, Vol. 7 (Houghton, Michigan: Horace J. Stevens, 1907), p. 143.

[9]Alfred H. Brooks, "The Mining Industry in 1910," Mineral Resources of Alaska, U.S.G.S. Bulletin 480 (Washington, 1911), p. 28; R. L. Button, "Kennecott," Alaska Sportsman 3 (April, 1965): 40.

[10]Levensaler to Dickey, 9 May, 1910, Folder 22, Box 2, W.S. Dickey Collection, University of Washington, Seattle, Washington.

with heavy snowfall, snow slides, frozen overflow, floods, winds, and moving glaciers, their deadline might not be met. Levensaler had the men constructing buildings to make the camp more habitable. Six men worked at the mine, but thirty men, at the lower camp, built the concentrator, steam plant, and other buildings. A dam on National Creek furnished water for the concentrator and hydroelectric power for the power plant.[11] Once again three hundred tons of fifty percent ore had been brought down on the gravity run tram simultaneously lifting the season's supplies to the mines.

Outside the Kennecott camp and the railroad construction camps, a wave of anti-Syndicate feeling, caused by the Keystone Massacre, the Hasey trial, and other unrelated dealings, swept Alaska and the eastern business world. Simon Guggenheim tried to present the Syndicate's perspective. He expounded on the virtues of large capitalist undertakings, primarily lode mining. "Alaska gets its first important railroad because of a lode mine.. [but] the point is that the mine had to come first. No individual, corporation, or government in the world would or could afford to build a railroad to prospect unknown territory. It would be the limit of absurdity."[12] He appealed to the government to release the Bering coal fields or warned that Alaska would be the loser. Alfred H. Brooks, Director of the United States Geological Survey in Alaska, and the highly respected Copper Handbook echoed his concerns.[13]

The 1911 Bonanza ore reserve report estimated 80,000 tons of fifty percent ore in the outcrop, 50,000 tons of twelve percent in the slide, and at least 80,000 tons of three to twenty percent mill ore around the high grade masses. As

[11] Janson, The Copper Spike, p. 146.

[12] Simon Guggenheim, "How to Develop Alaska," Independent 11 August 1910, p. 297.

[13] Brooks, "The Mining Industry in 1910," p. 21; Horace J. Stevens, The Copper Handbook, Vol. 10 (Houghton, Michigan: M.A Donohue & Co., 1911), p. 1024.

a result of these estimates, the reasonably objective and reputable Copper Handbook attempted to weigh the significance of the Kennecott mine. "The Bonanza mine probably is the highest grade copper mine in the world, and, with equal probability, may be called the most overrated copper mine in the world. Unless additional ore bodies are found, which is possible, but not entirely probable, the total amount of copper in the Bonanza mine is insufficient to render it more than a producer of the third rank."[14] Fortunately for the Syndicate, other mines had been discovered--The Jumbo, the Erie, and the Mother Lode.

Finally on March 29, 1911, at long last, the Copper River and Northwestern Railway joined the copper mines with the coast. At the enormous cost of nearly $20 million, the railroad's basic purpose had been met--it carried the Kennecott ore to the waiting steamships at Cordova.[15] Yet because of the locked up coal reserves, the railroad failed to develop the valley as the earlier boasts had proclaimed it would. There was no spur to the coal fields, no smelters or industrial development along the coast, no track to the Yukon, and no reciprocal agricultural development. Nevertheless, the Syndicate had poured more money into Alaska than any agency other than the federal government.[16] Moreover when compared to the rates for winter freighting, the railroad rates appeared reasonably low.[17] With the final completion of the railroad, the Syndicate phased out their Copper River steamboats.

Alaskans celebrated the first shipment of copper into Cordova on April 8, 1911. On April 14, the steamer, Northwestern, carried into Seattle 1200 tons of

[14] Stevens, The Copper Handbook, Vol. 10, p. 1024.

[15] Walter Harvey Weed, The Copper Handbook, Vol. 11 (Monadnock Block Chicago: Mining World Press, 1914), p. 500; Arends, "The Guggenheims in Alaska,"; Stearns, "The Morgan-Guggenheim Syndicate," p. 13; Janson, The Copper Spike.

[16] Stearns, "The Morgan-Guggenheim Syndicate," p. 245.

[17] Isabel McKenzie, "Great Bonanza Copper Mine Is Working," Alaska-Yukon Magazine 11 (May, 1911): 34.

sixty to seventy percent high grade copper ore worth $250,000.[18] Following this initial shipment, the railroad carried hand sorted high grade chalcocite twice a week. As a result of the first real shipment of copper ore, the owners received their first dividend in 1911. At the same time the development of the Jumbo and Erie excited great dreams of even greater production potential.[19] Unfortunately, the Jumbo tramway shipped by rail in 1911, took several years to construct.

Kennecott's shipments doubled Alaska's copper production figures while the value of the copper jumped from $538,685 in 1910 to $3,366,584 in 1911.[20] Copper production in 1912 climbed still twenty percent higher despite unusual obstacles.[21] A landslide on the railroad tracks prevented ore shipment for six weeks. The mill, erected on unstable glacier moraine, suspended operations until structural stability was assured. Still, 1912 saw the first ore concentrated from the talus slide below the Bonanza.[22]

As a result of two years of production and 40,000,000 pounds of copper (or 29,000 tons of ore) at an average tenor of seventy percent copper, Kennecott Mines Company reported over four million dollars of operating profits. Thus in 1912 the company paid its owners $3 million in dividends.[23] On the other hand,

[18] Ibid., p. 33; Cordova Daily Alaskan, 14 April 1911, p. 1; Janson, The Copper Spike, p. 137.

[19] Button, "Kennecott," p. 40; Fred H. Moffit, "The Chitina Copper District," Mineral Resources of Alaska, U.S.G.S. Bulletin 520 (Washington, 1912), p. 105.

[20] Alfred H. Brooks, "The Mining Industry in 1911," Mineral Resources of Alaska, U.S.G.S. Bulletin 520 (Washington, 1912), p. 24.

[21] Alfred H. Brooks, "The Mining Industry in 1912," Mineral Resources of Alaska, U.S.G.S. Bulletin 542 (Washington, 1913), p. 18.

[22] Fred H. Moffit, "Mining in the Chitina Valley," Mineral Resources of Alaska, U.S.G.S. Bulletin 542 (Washington, 1913), pp. 82-4; Charles Of, ed., The Mineral Industry, Vol. 21 (New York: Mc Graw-Hill Co. 1913), p. 174.

[23] Charles Of, ed., The Mineral Industry, p. 174; Carpel L. Berger, "Story of Kennecott Copper, Part 2: Rise of Big World-Wide Copper Empire," The Financial World, 30 May 1921, p. 934.

ore reserves shrank to 30,000 tons of fifty percent copper, 54,000 tons of thirty percent ore, and 30,000 tons of thirteen percent talus ore.[24]

Misfortune struck the Bonanza in 1913. A snowslide destroyed part of the tramway, and fire razed the compressor plant. Labor shortages arose as a result of an exodus to the Chisana placer district. Despite these problems the Bonanza made shipments for eight months, and the Jumbo went into limited production.[25]

Activity continued as the concentrator was expanded to handle 500 tons per day. As development work in the Bonanza reached the 700 foot level, further large quantities of high grade chalcocite of sixty to seventy-two percent copper were discovered. The Jumbo had reached the 400 foot level and its ore paid for all development despite having to be hauled to the mill by wagon.[26]

By May of 1915 the Kennecott mines had produced over 86,000,000 pounds of copper with operating profits of over $8 million. The payment of $7 million in dividends offset, in part, the lack of dividends from the Copper River and Northwestern Railway. Despite these seemingly high profits, the amount did not even equal the simple interest on the cash outlay.[27] The Alaska Syndicate evaluated its position and decided to invite public participation. The Syndicate valued their investment at $28 million in stocks and bonds. Weighing their original investment of over $50 million plus interest, the Syndicate seemed willing to pull out even at a sacrifice.[28] High copper prices and the correct prediction of

[24] Weed, The Copper Handbook, Vol. 11, p. 499.

[25] Alfred H. Brooks, "The Alaskan Mining Industry in 1913," Mineral Resources of Alaska, U.S.G.S. Bulletin 592 (Washington, 1914), p. 60.

[26] Emil E. Hurja, "Cordova, Alaska: Changes at the Bonanza; Jumbo Developing Favorably," Mining and Scientific Press, 109 (26 September 1914): 499.

[27] Berger, "Story of Kennecott Copper," p. 934; Walter Harvey Weed, The Mines Handbook, Vol. 12 (New York City: The Stevens Copper Handbook Co., 1916), p. 661.

[28] Berger, "Story of Kennecott Copper," p. 934; Stearns, "The Morgan-Guggenheim Syndicate," p. 13.

the 1915 to 1916 boom made the time right for a public flotation of Kennecott stocks at twenty-five dollars per share. On May 27, 1917, the new corporation, Kennecott Copper Corporation, assumed all the Syndicate's holdings plus large holdings in Utah Copper and Braden Copper mines in Chile.

The evaluation of the significance of the Alaska Syndicate has been brandished about by historians for the last sixty years.[29] It has been viewed by some as an exploitive octopus and by others as an a positive economic force. Without any doubt, it played an enormous, almost overwhelming role, in Alaska's history from 1905 to 1915. The Syndicate appeared to touch every facet of life from the political to the economic, from the national to the local level. In part, Alaska's small population necessitated the impact. Its steamships carried nearly all supplies and passengers between Alaska and Seattle; its railroad was the longest and best constructed in the territory with equitable rates operating at a loss each year; its fisheries, canneries, and merchandise outlets supplied needs to a developing territory; its copper production stimulated other mineral development; and its large capital investment infused economic opportunity into an isolated area. On the other hand, the Syndicate did involve itself in politics at the local and national level that, in the aftermath given the historical perspective of the era, could best be judged as "misconduct." Overall, however, their contributions seem to outweigh their liabilities.

[29] Jeanette Paddock Nichols' History of Alaska Under Rule of the United States (Cleveland: Arthur H. Clark, 1924) and her disciples, Dorothea Arends, felt strongly that the Syndicate had exploited and even corrupted Alaska. Robert Stearns and Lone Janson gave a revisionist view and felt that the Syndicate helped Alaska to develop but that the federal government inhibited all Alaskan development.

V. THE BEGINNINGS OF KENNECOTT COPPER CORPORATION

The business world stood agape. A brazen newcomer had absorbed two older, larger, and better established companies. Some viewed it a triumph of high finance over technology; others resented the implication of becoming subordinates to a tiny mine in Alaska.[1] Former Syndicate officials dominated the Board of Directors, and Stephen Birch continued as president.[2] In fact, Stephen Birch had pushed the merger with the Utah Copper Company and Braden Copper Mine in Chile. He wanted the Corporation to have the long term, stable investments of low grade porphyry mines as well as the high grade but low ore reserve profits of the Kennecott Mines.[3]

To capitalize on the high price of copper, the Corporation demanded greater capacity and efficiency from the Kennecott mines. Mining, being underground, went into year around schedules. Additions and improvements increased the concentrator's capacity to 800 tons a day. Nevertheless, only 84.6 percent copper was recovered from the ore mined in 1915. The Corporation felt a better average could be obtained.

Kennecott's uniquely high grade ore granted certain allowances that other ores could not afford, but its long and costly transportation set limits to those allowances. For instance, the high grade ore, thirty to seventy percent copper, could be bagged and shipped directly, but due to the distance and cost of transportation, the mill grade ore of seven to nine percent copper had to be reduced to a greater percentage of copper. The concentrator freed the basic sulphides,

[1]Leonard J. Arrington and Gary B. Hansen, <u>The Richest Hole on Earth: A History of the Bingham Copper Mine</u>, Monograph Series, Vol. 11, No. 1 (Logan, Utah: Utah State University Press, 1963), p. 69

[2]Cf. Stearns, "The Morgan-Guggenheim Syndicate," p. 11; Kennecott Copper Corporation, <u>Annual Report</u>, 1915, p. 1. Five of the nine Board of Directors came from the Syndicate, Stephen Birch (president), William Pierson Hamilton (vice-president), H.O. Havemeyer, S. W. Eccles, and John N. Steele.

[3]Kennecott Copper Corporation, <u>Annual Report</u>, 1915, p. 6; Henry Carlisle, "Alan M. Bateman: An Interview," <u>Mining Engineering</u>, November, 1964, p. 75.

chalocite and covellite, from the waste rock. The big problem lay in obtaining the carbonates, malachite and azurite, also in the rock. These ores had been oxidized before the Glacier Age and did not respond to mechanical concentration. Prior to 1915, because of the ore's high return in profits and the corporation's needs for dividends to offset high development costs, these carbonates had been discarded with the mill tailings. Yet the Corporation recognized this waste and sent E. Tappan Stannard, a brilliant young metallurgist, to design a new method of leaching copper carbonates from the tailings. The common acid leaching plants, used throughout the industry, dissolved the carbonates leaving the host rock behind. Unfortunately, acid also dissolved Kennecott's host rock, limestone. Stannard began leaching experiments using ammonia that would dissolve the copper carbonates but not the limestone.[4]

By the end of 1915, Kennecott had pushed its production to 63,000,000 pounds of copper at a cost of 4.5 cents per pound. Since the price of copper averaged 19.5 cents, the full profit averaged nearly 15 cents per pound.[5] Kennecott climbed from the eighth rank copper producer to the fifth.[6]

Prices and profits continued upward in 1916. The copper industry reaped the profits of World War. Prices reached the highest point known, and production could not supply the insistent war demands. Smeltering plants, overwhelmed with ore, became selective choosing the larger producers over the smaller miner.

[4]Lawrence Eddy, "Ammonia Leaching of Copper Ores," Engineering and Mining Journal, 107 (28 June 1919): pp. 1162-67; E.J. Duggan, "Flotation and Leaching at Kennecott," Engineering and Mining Journal, 126 (29 December 1928): 1008-15; E.J. Duggan, "Ammonia Leaching at Kennecott," Transactions of the American Institute of Mining and Metallurgical Engineers, Vol. 106, 1933, pp. 547-558; Summer S. Smith, The Mining Industry in the Territory of Alaska During the Calendar Year, 1915, Bureau of Mines Bulletin 142 (Washington, 1917), p. 38; and F.F. Hintze, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 24 (New York: McGraw-Hill Book, 1916), p. 137.

[5]Kennecott Copper Corporation, Annual Report, 1915, pp. 6-9.

[6]Watson Davis, The Story of Copper (New York: The Century Co., 1924), p. 66; Weed, The Mines Handbook, Vol. 12, p. 1310.

ill feeling against Kennecott, who owned not only the transportation systems but also the smelters, swept through Alaska. Still, as the price of copper climbed to thirty-five cents a pound, along with it climbed the wage scale.[7]

At Kennecott F.T. Stannard took over as general manager. Output from the mines outshadowed all other Alaskan copper production. While mining engineers discovered enormous new bodies of ore, production from the Jumbo jumped ahead of the Bonanza. One Jumbo ore body, of almost pure chalcocite, measured 350 feet by 40 feet wide by 40 feet high and produced over 70,000 tons of seventy percent copper and 20 ounces of silver per ton.[8] Alan M. Bateman, respected geologist and later editor of the Journal of Economic Geology, called the mines "one of the most unique deposits in the entire world."[9] On the other hand, the company's ore reserves were never more than four years ahead of production.[10]

Also in 1916 the world's first ammonia leaching plant began treatment of the mill tailings. A filtering system solved an early problem of carbonate slime clogging up the system, and plans were made to double its capacity. From 62,450 tons of mill tailings averaging only 1.48 percent copper came 703 tons of 70 percent copper. The total cost of production remained about five cents a pound, but selling price soared above thirty cents. The Corporation shared its profits as dividends of $5.50 per share.[11] The year 1916 proved to be Kennecott's greatest

[7] Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 25 (New York: McGraw-Hill Book Co., 1917), p. 150.

[8] Douglas, A History of Kennecott, p. 7; Carlisle, "Alan M. Bateman," p. 75.

[9] Carlisle, "Alan M. Bateman," p. 76.

[10] Douglas, A History of Kennecott, p. 7; Braden Copper Company had known ore reserves to last thirty-two years, Kennecott Copper Corporation, Annual Report, 1915, p. 10.

[11] Kennecott Copper Corporation, Second Annual Report, 1916, pp. 5-7, pp. 5-7; Fred H. Moffitt, "Mining in the Lower Copper River Basin," Mineral Resources of Alaska, U.S.G.S. Bulletin 662 (Washington, 1918), p. 174.

year in ore production and profits obtained.

As the capacity for the mine expanded, construction kept pace. The newly developed Erie mine was equipped with a tram. A hospital, recreation hall, apartment building, and guest house added to the town's dimensions. Additions to the power plant, including a steam heating system to provide heat to the staff's cottages, were built. Unfortunately, with the increased production and increased tension, accidents happened--during the year two men were killed and six men badly injured.[12]

Life at Kennecott seldom seemed dull. The mines' bunkhouses had been built on glaciers that moved occasionally each summer. Thus, the front ends had to be jacked back upstream to keep the buildings in tact. In 1916 the Bonanza bunkhouse burned down causing unpleasant living conditions. Mine water, always scarce, was obtained by shovelling snow into a tank and thawing it. The underground mines never rose above thirty-two degrees so "efficiency was high because it was too cold to sit down."[13] On the lighter side, the men staged badger fights, and the adjacent town of McCarthy exchanged dances with Kennecott. Since women were a premium, all women, dance hall girls and barmaids, were invited. In late October the Company began to show motion pictures in the new recreation hall.

Extraordinary activity and accelerated mine production marked the beginning of 1917. Improvements and enlargements of the mill, trams and mines led to high levels of production that literally swamped the railroad. Unfortunately the World War, which had created such great demand for copper, also resulted in the descent of profits. As the United States entered the World War, men left the labor force to join the military effort. Foreign miners and mill workers had

[12] Sumner S. Smith, The Mining Industry in the Territory of Alaska During the Calendar Year 1916, Bureau of Mines Bulletin 153 (Washington, 1917), pp. 62-71.

[13] Henry Carlisle, "David D. Irwin: An Interview," Mining Engineering, June, 1964, p. 89; Moffit, "Mining in the Lower Copper River Basin," p. 164.

already returned to fight for their home country. Despite a liberal wage scale, labor became scarce and inefficient. Supplies and transportation rates increased as everything became more expensive; the cost of living rose proportionally. Finally by fixing a stable price of 23.5 cents per pound, the government deprived the Corporation of its expected profits. Thus copper production costs had increased, whereas the profit margin had been arbitrarily lowered. Doomsayers predicted a copper famine.[14]

Production at Kennecott, meanwhile, rolled along. The mill, for the first time during the winter, had operated at full capacity. Changes in the water supply relieved the chronic water shortages that had previously required the mill's shutdown during the winter. The recovery had improved to 89.4 percent efficiency.[15] The ammonia leaching plant, the technological pride of Kennecott, had proved itself effective. A new store and warehouse plus still more living quarters for fifty men had been erected. With the profits from 1916 and the first half of 1917, Kennecott Copper Corporation essentially bought out Braden Copper Company in Chile and continued to buy Utah Copper Company's shares.

Amidst the bustle, Kennecott suffered its only strike. On June 12, 1917, the miners, unorganized by labor unions, demanded, instead of the sliding scale wage, a flat rate of $5.75 per day. The Corporation advised them that their demands could not be met. Thus on June 16, two hundred miners walked out practically closing the mill. This move forced a total of four hundred employees in other departments to curtail their work.[16]

[14] Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 26 (New York: McGraw-Hill Book Co., 1918), p. 137.

[15] Kennecott Copper Corporation, Third Annual Report, 1917, p. 7.

[16] Most of the facts regarding this strike came from a letter of Commissioner of Conciliation, Carles T. Connell to Secretary of Labor, W. B. Wilson, 15 August 1917, in Federal Mediation and Conciliation Service, file No. 33/515. Dispute Case File Box 25, Record Group 280, Federal Record Center, National Archives.

The controversy stemmed back to December, 1916, when a dispute over wages had been resolved by General Manager Stannard and the Miners Committee. Since the labor turnover was high, over sixty percent of the miners were new and did not feel bound by the agreement. The remaining forty percent claimed the Miners Committee had exceeded their authority and, thus, did not represent them.

During the strike both the Miners Committee and Kennecott Copper Corporation agreed to a joint request that McCarthy's saloons be closed. The United States Marshall arrived from Valdez to ensure order. Stannard also requested a thirty man detachment from the 14th Infantry to guard the bridges along the Copper River and Northwestern Railroad.

On July 1, Stannard expressed the Corporation's stand. He considered the men bound by the December, 1916 agreement and felt the differences could have been adjusted without a crippling strike. Since the sliding wage scale based on the price of copper had been adopted in principal by all large producers, he could <u>not</u> agree to its abolishment, but he could offer to readjust the sliding scale to increase the daily wage. He accused the Miners Committee of being Industrial Workers of the World agitators and would, under no circumstances, be re-employed. The whole controversy he blamed on a pro-German agitator, who had since left the area.

On July 3, 1917, Stannard met with the Miners Committee to work out a compromise. The miners demanded that they be able to return to work collectively and complained about the poor working conditions at the Bonanza--no bunkhouse or bathing facility. Stannard told them in no uncertain terms that he would not take them back collectively but would entertain individual applications. Unfortunately, Stannard's aloof, even cold and domineering, personality presented a great liability when dealing with his men.[17] The miners refused his terms.

[17] Interview by author with William C. Douglass, former superintendent of Kennecott, at his home in Seattle on 15 February 1976; interview by author with Julian Feiss, former staff geologist for Kennecott Copper Corporation, at Washington, D. C., 4 February 1976.

Consequently the Corporation brought in two hundred men of all nationalities to serve as strikebreakers. Upon their arrival fifty millmen walked out in sympathy.[18] Despite the tension, the Labor Department's arbitrator complimented the men on their peaceful behavior. The Corporation, although at ninety percent work force, operated at less than fifty percent efficiency. The Corporation continued to lose money.

Finally on August, with the help of an impartial arbitrator, a compromise was reached. The sliding wage scale increased the wage to $5.50 when copper was priced above 27.5 cents a pound. Thus, the miners received an increase of fifty cents a day. Stannard also agreed to build a new bunkhouse and messhouse plus a recreation hall at the Bonanza mine. In exchange for these concessions, Stannard demanded the right to decide which men could return to work. Only one member of the Miners Committee would be rehired. The miners accepted the terms but wrote to the Department of Labor, "The strikers wish to apologize to the Government for any inconvenience their actions may have caused. . . Fifty-eight of our members have already registered for the war and should the Government take over the Kennecott mines, they would have little trouble securing men at their own terms; for when Alaskans deal with the Government, they are patriots, but when they deal with the Guggenheims, they are hard fisted, cold-blooded flinty-hearted business men."[19]

The arbitrator expressed his belief that compared to other mines in Butte, Montana and Ely, Nevada the adjustment had been to the advantage of the miners. After forty-five days, the strike had ended.

Even after the strike, Kennecott felt the pinch caused by the war. Labor shortages prevented the mill from operating at full capacity and delayed the

[18] Cordova Daily Times, 20 July 1917; Connell to Wilson, 15 August 1917.

[19] Connell to Wilson, 15 August 1917, contained letter from Miners Committee to Department of Labor, 1 August 1917.

completion of the leaching plant's addition. Labor turnover averaged two hundred percent making efficiency only seventy-five percent. Finally by August the Erie mine was shutdown for lack of labor. The war also resulted in an inability to obtain ammonia during the summer months. Furthermore, severe snowslides in the spring wrecked the tramways and curtailed production.

In spite of all these problems, Kennecott continued to explore and find new ore bodies. Tramway construction increased the Bonanza's capacity to 600 tons and connected the Glacier mine to the Jumbo tramway. More new cottages and additional dormitory accommodations were built. Suddenly, on November 11, 1918, the war ended.

VI. THE COPPER SLUMP, 1919-1922

Despite the armistice, the War Industries Board, in anticipation of postwar needs, encouraged all mines and smelters to maintain the existing high rate of production. The decision proved not only misfortunate but almost tragic---copper companies wound up with enormous stockpiles of unsold copper compounded by the sudden release, into the open market, of government scrap copper and brass.[1]

The high production and the consequent stockpiling had to stop. Kennecott began in early 1919 to curtail production. By April the mines and mills operated approximately one-third of normal.[2] The Copper River and Northwestern Railway, in an effort to offset the reduction in ore shipments, increased freight rates. In addition, labor remained a problem. High turnover rates caused inefficiency. Altogether, the fall in copper prices, the uncertainty of the market, the shortage of labor, and the high cost of supplies meant an increase in production costs, an unstable business climate, and the lowest production since 1914. Yet development continued. The completion of the Bonanza-Jumbo crosscut joined the two mines. But most important, Kennecott Copper Corporation acquired fifty-one percent interest in the adjacent and very profitable Mother Lode mine.

Founded in 1899 by the same two prospectors that had discovered Kennecott, the Mother Lode, on the other side of the mountain from Kennecott, developed

[1]Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 27 (New York: McGraw-Hill, 1919), p. 142; Ira B. Joralemon, Copper: The Encompassing Story of Mankind's First Metal (Berkeley, California: Howell-North Books, 1973), p. 271; N. E. Crump, Copper: A Survey of the Sources from Whence the Metal is Obtained, the Methods of its Manufacture, the Nature of its Uses, and the Conditions of the Trade (London: William Rides & Son, 1925), p. 172.

[2]Kennecott Copper Corporation, Fourth Annual Report, 1918, p. 11; G. C. Martin, The Alaska Mining Industry in 1918, U.S.G.S. Bulletin 712-A (Washington, 1919), p. 31; unsigned report, 4 February 1919, in Folder 12, Box 3, Eugene McCracken Papers, University of Alaska Archives.

independently. The ore deposits resembled the Bonanza ore, but lack of big capital kept production low. Without a railroad or a concentrator, wagons and sleds hauled only high grade ore to the Copper River and Northwestern Railroad. In 1915 a tramway connected the mine with bunkers on McCarthy Creek. Severe snowslides in 1919 wiped out the tramway and power lines. To repair the damage and to explore more extensively, the Mother Lode Copper Mines Company liquidated its stocks. Although separate books and accounts were kept, the Mother Lode Coalition Mines Company became a subsidiary of Kennecott Copper Corporation. Eventually a crosscut connected the Mother Lode and the Bonanza allowing the Bonanza tram to carry the Mother Lode ore to the Kennecott concentrator.[3]

As the price of copper remained low and stockpiles of copper and scrap stayed high, the copper slump became a world-wide depression. Coincidentally the continued low prices stimulated the consumer to make and find greater and greater uses for copper. This domestic use would eventually pull the copper industry out of the doldrums. In the meanwhile, many mines found themselves facing not only curtailment but actual shutdown. Each mine had to weigh the value of the ore, the ease in mining, and the transportation and smelting costs. Kennecott evaluated the situation and felt the mines could continue in production. Kennecott's costs were 10.84 cents per pound and copper, at the beginning of the year, sold at 17.5 cents.[4] This even allowed dividends of two dollars per share. In fact, production

[3]Douglass, A History of the Kennecott Mines, pp. 8-9; Stearns, "The Morgan-Guggenheim Syndicate," p. 264; Mendenhall and Schrader, The Mineral Resources of the Mount Wrangell, p. 28; Moffit, "Mining in the Kotsina, Chitina Valley," p. 84; H.A. Keller to the Mother Lode Copper Mines Company, "Report on the Mother Lode Property in the Chitina Mining District, Alaska," 16 September 1912, filed in Bureau of Mines, Juneau; Brooks, "The Alaskan Mining Industry in 1913," p. 61; Hurja, "Cordova, Alaska: Changes at the Bonanza," p. 449; W. Bertram Hancock, superintendent, Mother Lode mine to James J. Godfrey, president, Mother Lode Mines Company, 11 January 1916, Bureau of Mines, Juneau; Smith, The Mining Industry in the Territory of Alaska During the Calendar Year 1915, p. 38; Martin, The Alaska Mining Industry in 1918, p. 31.

[4]Kennecott Copper Corporation, Sixth Annual Report, 1920, p. 7.

increased subtantially above 1919 and Alaska regained her fifth rank among copper producers.[5]

Still, the business climate, for Kennecott and Alaska at large, became increasingly discouraging.[6] Although new ore bodies had been discovered and mining at Glacier mine began, the Erie mine remained closed. Labor shortages were a chronic concern. Additionally, since installation, leaching plant costs had increased thirty percent. Finally by the end of the year when copper prices dropped to thirteen cents per pound, Kennecott stopped selling copper.

Meanwhile administrative control at Kennecott shifted from E.T. Stannard, who moved on to become vice president and eventually president of the Corporation, to William C. Douglass. Stannard had carefully groomed Douglass to take his place, training him in management and fiscal responsibility. Thus, Kennecott continued to run like clockwork during the ten years of his stewardship.[7]

Across the nation, 1921 became known as the worst year in copper history: mines were shutdown; employees dismissed; and warehouses were full of unsold metal. When the price of copper dropped below the cost of production, curtailment proved insufficient. Only shutdown seemed feasible, and then maintenance expenses entailed heavy losses. One small benefit that copper producers could perceive from this business nightmare was an opportunity to eliminate the radical element from the miners and reduce the inflated wage scale.[8]

[5] Davis, The Story of Copper, p. 66; Walter Harvey Weed, The Mines Handbook, Vol. 15 (Tuckahoe, New York: The Mines Handbook Company, 1922), p. 39.

[6] Alfred H. Brooks, The Alaskan Mining Industry in 1920, U.S.G.S. Bulletin 722-A (Washington, 1921), p.7.

[7] E.T. Stannard called him "the best underground man we have ever had. . . . Practically and professionally, he is highly regarded by, and is a good handler of men, who consider him fair in his decisions, though by no means favoring them." Jack Meloy called him "One of the finest ever." The author found him remarkably informative. His Kennecott material was invaluable to this study.

[8] Kennecott Copper Corporation, Seventh Annual Report, 1921, pp. 8-9; Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 30 (New York: McGraw-Hill Book Co., 1922), p. 151.

Because of the general curtailment and shutdown, Alaska, despite Kennecott's own reduction, climbed into third place among the copper producing states.[9] Kennecott not only produced less ore in 1921, but the grade of ore proved lower than any mined since 1911. The 2.8 percent ore of the Glacier mine resulted in the low average, but the Bonanza and Jumbo also averaged lower than usual.[10] Except for remodeling the leaching plant's piping system, no improvements were made. For once, labor was plentiful and efficiency improved. Wages, however, had to be reduced by $1.35 a day. Thus, the cost of producing copper at Kennecott decreased slightly, whereas, at Utah Copper Company, Kennecott's sister Company, costs were nearly three cents a pound more. This difference forced the closure of Utah Copper for a year, but allowed Kennecott to continue at reduced status.[11]

By the last quarter of 1921, the demand for copper grew: the stockpiles disminished; European markets returned; and domestic consumption resumed. A steady growth of improving conditions prevailed.[12] During 1922 conditions also improved at Kennecott. Diesel engines replaced the steam turbines improving efficiency and decreasing the cost of power. Yet with the resumption of mining operations, a serious shortage of labor developed. Only by wage increases was the problem relieved. Nevertheless, the cost of producing copper shrank to 8.67 cents a pound while the selling price remained fairly stable at 13.6 cents.[13]

Not only did business conditions revive at Kennecott, but the overall quality of life improved. Since it was often too cold to go to the messhall for lunch, Manager Douglass built lunchrooms in the underground mines. He added strip heaters,

[9] Davis, The Story of Copper, p. 66.

[10] "Total Ore Production of Kennecott Copper Corporation's Kennecott Mines: 1911-1938," William C. Douglass Collection, Private, Seattle, Washington.

[11] Kennecott Copper Corporation, Seventh Annual Report, 1921, p. 7.

[12] Crump, Copper, p. 116; Walter Harvey Weed, "Copper," G. A. Roush, ed., The Mineral Industry, Vol. 31 (New York: McGraw-Hill Book Co., 1923), p. 157.

[13] Kennecott Copper Corporations, Eighth Annual Report, 1922, p. 7.

benches, and lights. The cooks and waiters brought the food to the miners. If necessary, hot plates kept the food hot. Pipes, enclosed in boxes of sawdust, carried steam to heat the staff's houses. Douglass also installed a lighted skating rink where carnivals, hockey games, and skating contests occurred. During the summer the company sponsored a baseball team that played on the mill tailings. Douglass, himself, played on the team that played teams in McCarthy and Cordova. Each mine and the town had a recreation hall where movies were changed once a week on a rotational basis. Since women were still not allowed at the mines, the women of McCarthy often provided solace to lonely miners.[14]

[14] An unpublished manuscript by Ralph MacKay provides insight to the individual men and their life at Kennecott.

VII. DECLINING YEARS, 1923-29

The year 1923 marked a pivotal year for Kennecott. During that year Kennecott reached its greatest production, yet that year also signaled the beginning of a slow decline.[1] Prior to 1923 Kennecott generally reflected the overall conditions within the copper industry. With the early rise in copper prices in 1907, the Syndicate bought out Stephen Birch. Fortuitous timing had the mines and mill sufficiently developed to capitalize on the World War's demands for copper. Postwar overproduction and surplus copper hurt Kennecott as well as the rest of the nation. Finally by 1923, as the nation's copper producers rose out of their slump, Kennecott rose with them. Yet high production, demanded by the consuming public, could not be maintained. From 1924 to 1929, Kennecott's production and percentage of high grade ore declined.

The generally improved conditions of 1922 recovered further in 1923. Mines reopened, prices stayed high, and consumers demanded copper. All mines responded with a production equaled only by that during the World War. Conforming to pattern, the supply exceeded the demand, and a brief period of overproduction followed.[2]

Kennecott began production at seventy percent capacity yet completed the year with the greatest volume of ore mined in its history.[3] Because of the lower grade ore and the lower prices, the overall value proved less than during 1916 and 1917. Nevertheless, the production figures demonstrated to a reluctant Utah Copper Company that the brazen upstart could produce. Kennecott Copper Corporation ab-

1 "Total Ore Production of Kennecott Mines," Douglass Collection.

2 Walter Harvey Weed, "Copper," G.A.Roush, ed. The Mineral Industry, vol.32 (New York: McGraw-Hill Book Co., 1924), p. 162.

3 "Total Ore Production of Kennecott Mines," Douglass Collection.

sorbed seventy-seven percent of Utah Copper Company and extended the Board of Directors to include Utah's Daniel C. Jackling.

A new change in values occurred in 1923. The highly praised Bonanza and Jumbo mines, steadily declining since 1918, suddenly found that the Mother Lode had outstripped them. The Mother Lode, alone, produced what the Bonanza and the Jumbo produced together.[4] Although the Erie remained closed most of the year, development began on the Jumbo-Erie crosscut that resulted in the discovery of a fair sized ore body.

With the mines' declining production and value, Douglass, in an effort to maximize the recovery of all copper, mined the Glacier mine, expanded and modified the concentrator and leaching plant, and finally, in 1923, built the flotation plant. The ammonia leaching plant had been specifically designed for Kennecott's unique deposits of copper carbonates, but it malfunctioned if either too fine a carbonate or slime found its way into the system. The newly constructed flotation plant received the slime directly from the concentrator, added more water and a minute amount of oil, and then blew air through the whole solution. The oil would stick to the surface of the metal (copper carbonates and sulphides and, if present, silver), and then the air would pick up the oil and metals. Thus, a froth of air, oil, and minerals floated to the top of the tank to be skimmed off as a rich concentrate while the worthless rock sank to the bottom. Flotation, thus, captured all forms of copper and silver as well. The main disadvantage to Kennecott resulted from the lack of water during the winter months. Overall recovery, with the addition of the flotation plant, increased to ninety-six percent.[5]

[4] Ibid.

[5] Duggan, "Flotation and Leaching at Kennecott," pp. 1008-15; Duggan, "Ammonia Leaching at Kennecott," pp. 547-48; Joralemon, Copper, p. 243; Douglass, A History of the Kennecott Mines, p. 10.

By controlling labor disturbances, Douglass further maximized efficiency. Although labor was in short supply, all workers had to sign a pledge that he was not a member of any organized union and that he would not join a union while working with Kennecott. If the worker wanted to join a union, he agreed to withdraw from Kennecott's employment. He also had to pledge not to try to unionize the camp.[6]

While the world copper industry greeted the high consumption and low copper surplus with enthusiasm and high production, Kennecott's mines could not respond. A definite decline began in 1924. Stephen Birch, possibly concerned about the mines' future, made his only visit to Kennecott since 1915. The Guest House had been specifically built in 1916 for him.[7] Later, with the dearth of important personages, the general manager assumed possession.

In anticipation of Birch's visit, Douglass compiled a summary of the present state of the Kennecott mines and plants.[8] He recorded that Kennecott had claim to 5226.4 acres in lode and placer claims. Employment, at the mines alone totaled 321, at the lower camp 249, and altogether 550 people. Payroll for these employees equaled $86,337. Electricians and machinists earned the highest wages. In addition to their salary, the Company charged the employees $1.45 a day for room and board.

Douglass detailed the exact costs for producing each pound of copper including exploration, development, mining, tramway, milling, leaching, sacking, freight, and smelter costs. After deducting the silver by-product, 1924's net cost proved

6 Statement of Non-Union Membership Pledge, June, 1923, Folder 11, Box 3, Eugene McCracken Papers, University of Alaska Archives.

7 Author's interview with William C. Douglass, 15 February 1976.

8 All the subsequent facts come from William C. Douglass, "General Points of interest on the Kennecott and Mother Lode Mines, Kennecott, Alaska," 15 July 1924, William C. Douglass Collection, private, Seattle, Washington.

to be 8.23 cents a pound. Available ore reserves, an important value in determining the mines' longevity, totaled 374,173 tons of 9.33 per cent ore with an additional 173,425 tons of unavailable ore. The total of the two reserves equalled only two years of production. The high grade ore, once assaying at seventy-five percent, now assayed at only fifty-two percent. Only the Mother Lode still assayed above sixty percent. Moreover, Douglass reported the discovery of only one new ore body.

Although two streams and a well supplied water, a chronic shortage appeared in all reports. Only 112 gallons per minute supplied the boilers, Diesels, condensers, concentrator, and flotation plant. Furthermore, a serious fire in August, 1924, destroyed part of the power plant, one dwelling, and a storehouse. Immediate construction began on a new power house resulting in only a slight interruption in power.

Between the years 1924 and 1928 copper prices averaged a stable fourteen cents a pound. This price encouraged consumers to use copper rather than other metals, and at the same time it gave the great copper companies a margin of profit. Consumption even surpassed the war years. In an effort to control world production and marketing, a cartel, with the Federal Trade Commission's approval, was formed--the Copper Exporters, Inc. By the end of 1928 most copper companies were taxing every productive facility to turn out sufficient copper to meet the demand. In 1929 when copper prices rose to twenty-four cents, the highest in ten years, the copper boom had reached its peak.[9]

9 Walter Harvey Weed "Copper," G.A. Roush, ed., The Mineral Industry, vol. 34 (New York: McGraw-Hill Book Co.,1926), p. 181; Walter Harvey Weed,"Copper," G.A. Roush, ed. _The Mineral Industry_, vol. 35 (New York: McGraw-Hill Book Co.,1927), p. 154; A.B. Parsons, "Copper," G.A. Roush, ed., _The Mineral Industry_, vol. 36 (New York: McGraw-Hill Book Co., 1928), p. 117; Homar L. Johnson, "Copper," G.A. Roush, ed., _The Mineral Industry_, vol. 37 (New York: McGraw-Hill Book Co., 1929), p. 123; Percy E. Barbour, "Copper," G.A. Roush, ed., The _Mineral Industry_, vol. 38 (New York: McGraw-Hill Book Co., 1930), p. 116; Joralemon, _Copper_, p. 272.

Kennecott, unfortunately, was unable to capitalize on the boom. Nevertheless, the mines' production in 1925 kept Alaska as the seventh major copper producing state. On the other hand, Alaska's mineral production no longer represented the principal productive business. Its decline to second place was a direct result of Kennecott's own declining mines.[10] More distrubing, no new ore bodies had been found, and the ore reserves were becoming increasingly smaller.[11] Kennecott Copper Corporation, meanwhile, bought out Braden Copper Company entirely and owned over ninety-five percent of Utah Copper. The Corporation had successfully used the rich and quick profits of Kennecott to invest in the longer living and, therefore in the long term, more profitable porphry mines. In 1929 Kennecott Corporation moved to ensure a stable and secure market--they acquired Chase Brass and Copper Company.

Although production declined, life at Kennecott continued as usual. Twenty families, primarily staff members, lived in Kennecott. Four of the children growing up were the Douglass children. Two teachers taught all eight grades in a two room schoolhouse. If the teachers or nurses arrived single, they generally found themselves married by the end of the year. The children were not allowed around the bunkhouse where the single men lived "for fear of exposure to the hardened life."[12] Tourists came during the summer to see the camp, but fear of contagious diseases kept a healthy distance between them and the townspeople.

10 Philip S. Smith, "Mineral Industry of Alaska in 1926," Mineral Resources of Alaska, U.S.G.S. Bulletin 797 (Washington, 1929), p. 4; Crump, Copper, p. 168; Weed, "Copper" The Mineral Industry, vol. 34, p. 183.

11 Smith, "Mineral Industry of Alaska in 1926," p. 35; Philip S. Smith, "Mineral Industry of Alaska in 1927," Mineral Resources of Alaska, U.S.G.S. Bulletin 810 (Washington, 1930), p. 5; Philip S. Smith, "Mineral Industry of Alaska in 1928," Mineral Resources of Alaska, U.S.G.S. Bulletin 813 (Washington, 1930), p. 52.

12 Most of the following reminiscences are of William D. Douglass, scn of Kennecott superintendent. He lived the first thirteen years of his life at Kennecott. Douglass to Grauman, 25 March 1976.

Amusements centered around skating or sledding during the winter and baseball during the summer. Occasional dances, bi-weekly movies, and Fourth of July celebrations in McCarthy marked special events. Hunting and fishing absorbed what little free time existed. Special drives occurred if one could obtain one of the few automobiles or get access to the "speeder" (a gasoline car driven on the railroad tracks). Kennecott maintained a library and subscribed to many magazines. Occasionally the radio could pick up a few night stations with a great deal of static.

Supplies and mail arrived by train several times a week. Some employees grew fresh vegetables while others raised chickens for eggs and meat. The Company owned a dairy that supplied butter and milk. The Company also ran the general store and meat market. Generally clothing was purchased through mail order catalogs. Overall, life in town passed pleasantly.

At the mines, arrival in itself was an adventure. The miners generally rode up the tram in the ore buckets. The bullcook assigned rooms according to the miner's nationality. The double decker bunk practically filled the small room. Although pool and billiard tables were available, card games proved the major diversion. On payday the games ran continuously until one or two men had most of the money. The lucky ones would then blow it all in the "wild" town of McCarthy.[13]

[13] Charles F. Herbert to C.D.N. Taylor, 16 November 1970, C.D.N. Taylor Collection, private, Victoria, British Columbia.

VIII. DEPRESSION: 1930-34

The high prices of early 1929 encouraged high production just as a serious business recession decreased the world's consumption of copper. These circumstances led to enormous stockpiles of unsold copper. Too late the copper producers realized what had happened. Immediately curtailment of all mining and smelting activities commenced.

Alaska happily reported being less affected by the world-wide business stagnation.[1] Kennecott, in an effort to expand their financial hold on the area, thoroughly explored nearby copper claims but failed to discover any ore bodies of mining size. The Mother Lode, too, expressed discouragement with exploration.[2] The Corporation's accumulation of copper stockpiles forced Kennecott to cut back on production. Meanwhile, William C. Douglass had left Kennecott and had turned over the managerial chores to Bevan Presley and later to E.J. Duggan, who had helped design the leaching plant.

Even with the still lower copper prices, Alaska's branch of the Geological Survey expressed reluctance to report the devastation of the 1931 mineral market. With false enthusiasm they tried to stimulate an apprenhensive industry.[3] Copper prices finally hit bottom--five cents a pound. Although most of Utah's mines closed down, Kennecott, foregoing the expensive leaching process, continued minimal production.

[1] Philip Smith, "Mineral Industry of Alaska in 1930," _Mineral Resources of Alaska_, U.S.G.S. Bulletin 836 (Washington, 1933), p.5.

[2] Mother Lode Coalition Mines Company, _Twelfth Annual Report_, 1930, p. 3.

[3] Philip S. Smith, "Mineral Industry of Alaska in 1931," _Mineral Industry of Alaska in 1931 and Administrative Report_, U.S.G.S. Bulletin 844-A (Washington, 1933), p. 5; Philip S. Smith, "Mineral Industry of Alaska in 1932," _Mineral Resources of Alaska_, U.S.G.S. Bulletin 857 (Washington, 1934), p. 5.

Despite curtailment Kennecott Copper Corporation reported a net loss of almost two million dollars. Consequently when the Copper River and Northwestern Railway's bridge washed out in October of 1932, the Corporation decided to close all the mines until the price of copper rose above the cost of production. A small crew maintained the underground workings, plants, and equipment, and the essential staff needed to resume operations stayed at Kennecott.

For 1933 and 1934 the mines remained closed. Throughout the United States business came almost to a halt. The National Industrial Recovery Act finally approved a Code for the copper industry. The Code enabled certain regulation of the industry, provided a sales and marketing plan, and allocated sales quotas for the copper companies.[4] The cartel, Copper Exporters, Inc., had failed the industry in 1929 and by 1933 had ceased to function.

Stephen Birch retired to Chairman of the Board of Directors, allowing E.T. Stannard to take over command as president. For over twenty-five years Birch had served as president. Almost all of Kennecott's development and subsequent decline occurred under his administration. A Kennecott man, however, still directed the Corporation. As the market improved slightly, the Corporation cautiously expanded and bought out Nevada Consolidated Copper Company.

At Kennecott, Alaska, a clean-up of the concentrating plant resulted in the recovery of 520 tons of copper, the sole production of 1933. With the full impact of depression, the U.S.G.S., for the first time in the literature realistically evaluated Kennecott's role and warned, "It must be remembered that the mines near Kennecott, which have contributed perhaps ninety percent of the Alaska copper, have been mining a unique deposit, not comparable with any other known deposit in the world, so that inevitably their mineral wealth is being depleted and there is no justification for expecting that their loss will be

[4] Kennecott Copper Corporation, Twentieth Annual Report, 1934, p. 5.

offset by new discoveries of equally marvelous lodes."[5]

Although the 1930's represented economic decline and depression, to the people who lived those years they were simply life. Arthur N. Wilson, M.D. and Fred J. Hoff, mining engineer, perceived life from the rather comfortable status as staff members.[6] Emil Oliver Goulet, as a miner, discerned life differently.[7] Goulet arrived at Kennecott in 1930, Wilson in 1931, and Hoff in 1935. These three men and their wives observed portions of Kennecott's years of decline, depression, and temporary recovery.

In the winter of 1930-31, Emil Goulet, a poor, young student, hiked from Cordova to Kennecott to seek employment. Employees usually rode the train and had the fare deducted from their salaries, but heavy snows had blocked the railroad for most of the winter. Assigned to the Jumbo mine, he had the choice of a four mile walk with a four thousand foot elevation gain or of riding the tramway. He chose the tramway. Before he could ride, he had to sign a form releasing the Corporation from responsibility for accidents, injuries, or deaths. After forty-five minutes, he arrived, quite shaken, at the Jumbo bunkhouse.

At the Jumbo, Goulet found three two-story barracks accommodating eighty men each, a cook shack, and a boiler house, all built on a glacier with only one corner of each building firmly anchored to solid ground. The semi-individual rooms were "very cozy" and were kept in good order. Empty dynamite boxes nailed to the wall served as shelves. A well-equipped gymnasium, pool and billiards tables offered some recreation variation.

5 Philip S. Smith, "Mineral Industry of Alaska in 1933," Mineral Resources of Alaska, U.S.G.S. Bulletin 864 (Washington, 1936), p. 59.

6 Author's interview with Arthur N. Wilson, M.D. and Mrs. Gagmar Wilson in Ketchikan, Alaska, 16 February 1976, and with Fred and Eva "Mickey" Hoff in Mesa, Arizona, 29 March 1976.

7 Emil Oliver Goulet, Rugged Years on the Alaska Frontier (Philadelphia: Dorrance and Co., 1944)

The average day began with a seven o'clock breakfast. In the locker rooms the men dressed warmly in woolen clothing and filled their carbide lamps as only the main tunnels had light. By eight o'clock a skip lowered them to the foreman's office where duties and levels were assigned. The deeper levels were drier and were preferred, whereas, the upper levels had melted snow or ice covered walls and constant fog floated in to irritate the throat. The men worked the cold subterranean pits of sixty to eighty feet in depth. They blasted first the high grade ore from a deposit, removed it, then blasted out the mill grade ore.[8] Goulet drilled the powder holes preparatory to the blasting. In the course of this work, Goulet related a courageous and inspirational cave-in rescue, but he also told of less fortunate mine accidents.

The miners represented nearly all nationalities. Some were illiterate and requested help from Goulet with their correspondence. Altogether he enjoyed his companions, learned the rudiments of underground mining, saved some money, and experienced Alaska. When a notice of a ten percent reduction in wages appeared in the fall, however, he was ready to leave. He left to trap and travel.

During the depression years, Wilson and Hoff arrived by railroad happy to have work. The Wilsons lived on the second floor of the hospital in a steam heated apartment. They had been instructed "to bring nothing but their clothes". Everything from china and silver service to bedding and leather furniture was provided--even etchings and paintings for the walls. A woman came in weekly to do the laundry.

8 This method of mining is know as the Shrinkage Method, described in William C. Douglass, "Outline of Geology and Mining Methods of Kennecott Mines," Douglass Collection; cf. the nearly identical article by Stephen Birch, "Geology and Mining Methods of Kennecott Mines," <u>Transactions of American Institute of Mining and Metallurgical Engineers</u>, vol. 72, 1925, pp. 499-510; Robert Peel, ed., <u>Mining Engineers' Handbook</u> (New York: J. Wiley and Sons, 1941), vol. 2, pp. 10-296-7.

The eight-bed hospital never had more than five or six patients. Three nurses helped with surgery: an anethetist, a scrub nurse, and an assistant. An old X-ray machine served only to X-ray fractures and was very rarely used on the stomach. The surgery room, however, was adequate, and hospital supplies never ran short. Once a week Dr. Wilson rode up to the mines in the tram bucket. While the miners daringly stood, they forced him to sit cramped down inside.

The train arrived only once a week in the summer to bring supplies and fresh produce. In the winter when trains ceased because of snowslides, produce had to be specifically ordered and flown in. When the mines closed, Dr. Wilson stayed on to care for the staff and maintenance crew. For the rest of the men, the Company furnished transportation only as far as Cordova after that they were on their own.

Fred Hoff arrived in 1935 to work as assayer and then as assistant mining engineer. At Kennecott he met his wife working as a nurse. They moved out of the staff house and into the apartments above the store. Surprisingly enough the houses along the tracks were regarded more desirable than the larger ones on the hill because they were closer to work. Very few lived on Staff Row. The close proximity of the glacier bountifully supplied ice for the ice boxes. Shortage of other goods and supplies, however, reflected the continuing depression. One compromise included closing down the expensive winter railroad maintenance. Throughout the winter the Company stored the concentrates and high grade ore. By May of 1936 over 56,400 sacks weighing 4500 tons and valued at $860,000 lay awaiting the first spring train.

The social life of the thirties continued that of the twenties: poker games; bridge games; skating; skiing; basketball; pool; billiard; baseball; fishing; hunting; swimming; berry-picking; and walks. The thirties had the "speeder" but also a "snowsled", which was similar to an airboat on skis that carried four passengers at thirty miles per hour. A tennis court had been built on the hill behind the mill, but the mosquitoes were so bad that mosquito nets had to be used. Dances, held once every two weeks, did not regard social status. Miners, millworkers, and staff all danced with the few women, nurses, teachers, secretaries, and wives, that were available. The dentist came once a month as did the Episcopal missionaries, who had the contract for religious services. Although the depression years represented for many a time of hardship and unhappiness, to a lucky few Kennecott's patronage fostered a benevolent environment--a good life of few cares.[9]

[9]Author's interviews with the Wilsons, Hoffs, and also with William Humphries, 8 March 1976 in Fairbanks, Alaska.

IX. FINAL DAYS

Meanwhile, the National Recovery Administration in 1935 allowed copper to rise from 4.5 cents to 9 cents a pound. Unfortunately, later that year the Supreme Court declared the Act unconstitutional, and the price of copper declined by one cent per pound. Nonetheless, Kennecott Corporation reopened, on reduced scale, its Alaskan mines. The mines helped, in part, to relieve unemployment in the Copper River region--one hundred seventy-five men worked at the mine and additional men worked the railroad. Exploratory work resumed but without locating any new ore showings. The Corporation's annual report began to forecast the eventual closing unless new ore bodies were found.[1]

Foreign countries, Great Britain and Germany primarily, consumed greater and greater quantities of copper. World consumption with a forty-five percent increase over 1935 finally outstripped production, and copper stockpiles were visibly reduced.[2] International copper organizations tried to force the industry to continue rational production. At the same time that Kennecott Copper Corporation finally acquired all of Utah Copper Company, its Alaskan mines, unable to disclose new ore, appeared short lived.[3] Moreover, a maritime strike, during November and December, on the Pacific Coast interrupted the transportation of ore and concentrates.

[1] Kennecott Copper Corporation, Twenty-first Annual Report, 1935 p. 7; Philip S. Smith, Mineral Industry of Alaska in 1935, U.S.G.S. Bulletin 880-A (Washington, 1937)

[2] Percy E. Barbour, "Copper," G.A.Roush, ed. The Mineral Industry, vol. 45 (New York: McGraw-Hill Book Co., 1937), p. 112; Kennecott Copper Corporation, Twenty-second Annual Report, 1936, p. 5.

[3] Kennecott Copper Corporation, Twenty-second Annual Report, 1936, p. 6; Mother Lode Coalition Mines Company, Eighteenth Annual Report, 1936, p. 3.

The shipping strike continued into 1937. Even after resolution, unrest, inefficiency, and uncertainty impaired normal operations. An additional hindrance resulted when the territorial legislature placed a license tax on all mining enterprises. Despite these problems, Kennecott produced more copper in 1937 than anytime since 1928 to 1929.[4] Since development work failed to find new ore bodies, the Corporation reported, "It is now expected to discontinue all operations at Kennecott in the latter part of 1938 upon completion of the mining of the remaining tonnage of ore."[5] Throughout the world, rearmament and war alarms stimulated copper production. Kennecott, even at full capacity, could not capitalize on the boom.

Despite the threat of war, even as Hitler moved into Czechoslovakia the Kennecott mines were closed. Philip S. Smith, Alaskan Director of U.S.G.S., gave a fitting eulogy to the closure, "The records of these great mines mark a series of brilliant achievements in the history of Alaskan mining, and their closing forms a distinct loss not only to the mining industry but also to the development of the whole territory."[6]

When the mines closed in October, the Company gave two large farewell banquets and distributed bonuses. Equipment of salvagable value was removed and shipped out before the abandonment of railroad operations. Before closure, Dr. Ernest Gruening, Director of the Division of Territories and Island Possessions of the Interior Department, had visited the Kennecott-McCarthy area and had recommended that a National Park be established.[7]

[4] "Total Ore Production of Kennecott Mines," Douglass Collection.

[5] Kennecott Copper Corporation, Twenty-third Annual Report, 1937, p. 6.

[6] Philip S. Smith, Mineral Industry of Alaska in 1938, U.S.G.S. Bulletin 917-A (Washington, 1939), p. 87.

[7] Cordova Times 29 August 1938; Interview with William Humphries.

In November following the closure of the mines, the Corporation abandoned the Copper River and Northwestern Railroad.[8] The annual washout of the Chitina River bridge completed the isolation of the deserted town of Kennecott. Although the "speeders" had been left, landslides and the washout of the Kennecott River bridge in 1943 made Kennecott inaccessible. Copper ?

Despite all reports to the contrary, several authorities refused to believe that the mines were exhausted. Although the Corporation's annual reports explicitly stated the continual decline, the U.S.G.S. chronicled the loss of production, and the local newspapers recorded rumors of the eventual closure, some believed that as a result of labor problems, whether it was a push to organize labor on the railroad and in the mines or the maritime strike on the Pacific Coast, the Corporation closed the mines rather than concede to labor's demands.[9] Another authority, Lewis A. Levensaler, Kennecott's former superintendent and consultant mining engineer, wrote in 1972 when he was ninety-two years old, "Geologically I never thought Kennecott exhausted the possibility of another Bonanza. Kennecott was closed down during E.T. Stannard's administration--he hated Alaska and wanted to get out of it."[10] Yet in 1936 when the Mother Lode Coalition Mines Company hired Levensaler as a consultant, he advised that no commercial ore remained, that the development possibilities were too

[8] Janson, The Copper Spike, pp. 155-164; Don J. Miller, "Copper Deposits of the Nizina District, Alaska," Mineral Resources of Alaska, U.S.G.S. Bulletin 947 (Washington, 1947), pp. 93-120.

[9] Author's interviews with William Humphries, James Harrower and Tony Oney, members of Consolidated Wrangell Mining Company's Board of Directors, 24 February 1976 in Anchorage, Alaska; John M. Kinney, "Copper and the Settlement of South-central Alaska," Journal of the West 10 (1971): 316-17; Johnason, "The Copper River and the Northwestern Railroad," p. 31.

[10] Levensaler to Holdsworth, 16 March 1972, Kennecott File, Bureau of Mines, Juneau, Alaska.

weak to justify prospecting, and that the mines should be abandoned.[11] Thus, speculation of the mines' current value continues to the present day.

The picturesque setting coupled with people's fascination for abandoned technology prompted an Anchorage airlines to fly in tourists on two day excursions. A Model T converted to rail use transported the visitors from McCarthy.[12] Concern for the public's safety and an awareness that injury would mean expensive lawsuits, Kennecott Copper Corporation contracted with Ray Trotuchau to close the portals and raze the buildings. In exchange for these services he would obtain the right to the surface estate. He supposedly agreed to pay $6000. but placed only $1000 down. He never completed more than precursory demolition: the roof of the concentrator was removed; the two superintendents' houses and staff house were destroyed; fixtures, furniture, and equipment in all buildings were salvaged.[13]

Trotuchau sold his quit claim deed to the Copper River Corporation. Kennecott Copper Corporation reserved the subsurface underground rights, water and tailings as well. Eventually Consolidated Wrangell obtained the quit claim deed and attempted "surface mining." They ran into a Kennecott injuction that prevented their mining. A lease was negotiated and mining, on a limited scale, began.[14] The distance, isolation, and expense proved unprofitable. The mines and town were left, once again, to the slow deterioration of time and nature.

11 Mother Lode Coalition Mines Company, Eighteenth Annual Report, 1936, pp. 2-3.

12 Robert Moore, "Alaska The Big Land," National Geographic, 109 (June, 1956):790

13 Author's interview with James Harrower and Tony Oney, 24 February 1976.

14 Ibid.

X. CONCLUSIONS

When compared with the world's other great copper producers in 1938, Kennecott ranked eleventh (graph in Appendix G).[1] Whether the production valued $300 million or $200 million, the figure is insignificant.[2] Kennecott's significance lies not in its quantity but in its quality. Its high grade ore, fortuitously timed to reap the immediate profits of World War, allowed the acquisition of longer lasting copper mines. It was the aggressiveness and long range thinking of the Syndicate's leaders that promoted the merger with Braden and Utah not vice versa. The Kennecott mines provided the immediate capital to invest in these companies--Utah and Braden had enormously large capital outlay invested in the development of low grade mines. On the other hand, Kennecott's contribution to mining technology, the ammonia leaching plant, can hardly be equated with the remarkable technology developed by Utah Copper Company to mine porphyry ore. Again Kennecott's significance lies in the ore deposit. Articles have been written and are still being written describing the Kennecott deposits hoping to serve as a guide to similar properties.[3]

[1] E.O. Gardner and C.H. Johnson, Copper Mining in North America, Bureau of Mines Bulletin 405 (Washington, 1938), p. 5.

[2] C.D.N. Taylor arrived at the $300 million figure through analysis of state and federal mining records, Taylor to Grauman, 10 March 1976 and Taylor, "Copper Mining at Kennecott," p. 34. The $200 million figure, William C. Douglass arrived at by using Kennecott's production figures and the average price of copper each year, interview with William C. Douglass and Douglass, A History of the Kennecott Mines, p. 11.

[3] Alan M. Bateman, "Notes on a Kennecott Type of Copper Deposit, Glacier Creek, Alaska," Economic Geology, 27 (May, 1932): 297-306; Fred H. Moffit, "The Metalliferous Depostis of Chitina Valley," Mineral Resources of Alaska, U.S.G.S. Bulletin 755 (Washington, 1924), pp. 57-72; W.S. Wright and A.W. Tolnen, "Chitistone Copper Deposits," December, 1945, Bureau of Mines, Juneau, Alaska; Taylor, "Copper Mining at Kennecott," part 1, Western Miner (May, 1973): 29-34; Taylor, "Copper Mining at Kennecott," part 2, Western Miner (June, 1973): 33-9; R.P. Maloney and R.G. Bottge, Estimated costs to Produce Copper at Kennecott, Alaska, Bureau of Mines Information Circular 8602 (Washington, 1973); and all United States Geological Survey Bulletins for the period.

Kennecott can also be perceived as a mirror reflecting the history of world and United States copper between 1907 and 1938. The cause and the effect of each boom and slump affected Kennecott and the world alike. These booms and busts, however, cannot be isolated to the mining industry, they also changed the Territory of Alaska and the local communities of the Copper River Valley. Booms brought high employment, inflated wages, and better standards of living; slumps brought unemployment, depressed wages, and lower standards of living. Between gold in the 1890's and oil in the 1950's copper was Alaska's primary mineral. Thus, the rise and decline of Kennecott copper brought a parallel rise and decline in Alaska's mineral production.

On still another level, Kennecott represents not only the extension of western mining frontiers to Alaska but also provides a case study in the analysis of American business and economic history. In other words, the discovery of one of the world's richest copper deposits led to the development of one of the world's greatest copper conglomerates.

The Alaska Syndicate, comparable to the early Rockfeller and Carnegie enterprises, typified the nineteenth century business organization and tactics. Kennecott Copper Corporation, on the other hand, applied the methods and philosophy of twentieth century business management. This interesting contrast becomes fascinating when it is recognized that essentially the same people directed and controlled both organizations--Stephen Birch and the Guggenheims.

The basic goals of both organizations were to keep down production costs and raise copper prices. The Syndicate employed political means to achieve these business goals. As a result, threatened politicans lashed back crying "monopolism." Kennecott adroitly succeeded by controlling labor, acquiring competitive mines, and ensuring a ready market. Furthermore, rather than singlehandedly attacking local or national politics as the Syndicate attempted, Kennecott Corporation joined with rest of the copper industry in various organizations to lobby Congress, to stimulate national and international consumption, and to minimize cut-throat competion.

The broad diverse holdings of the Syndicate in a small geographic area opened the door to charges of trust and monopoly at a time when the words were anathema. The Corporation kept their holdings within the copper industry: mines, smelter, transportation services, and markets. Because of the large local investment in Alaska, the Syndicate became overly concerned with the economics and politics of the region. This concern resulted in the Ballinger-Pinchot involvement and smaller political fiascos. The Corporation, on the other hand, had expanded beyond Alaska to Utah and Chile. Their concerns became national and international, and events in Alaska could be viewed from a broader perspective.

The distinct difference in style and method of the two organizations directed by the same people reflects a change in national business philosophy and development. No longer were railroads, such as the Union Pacific and Southern Pacific, built as an end in themselves. The Copper River and Northwestern Railway served solely as the means to remove the profitable Kennecott copper. The fact it operated at a loss each year was expected and regarded as an operating expense. Furthermore, whereas the Syndicate provided only the basics of life, the Corporation added the amenities that made life in a company town pleasant, a prototype of an eventual movement known as "corporate socialism."

In the end the Syndicate failed because it had become an anachronism. Despite the expansion of the copper industry, its archaic tools and philosophy hampered its growth. Kennecott Copper Corporation, with a flexible business oriented philosophy, jockeyed with its competitors and became more than a partnership dependent on a few small Alaskan mines. Thus, Kennecott's broadest significance arises not from its achievements in the mining industry but from its role in the business and economic world.

APPENDICES

APPENDIX A - RECOMMENDATIONS

The preceeding history concludes that at least three buildings have significance: the ammonia leaching plant represents Kennecott's sole contribution to mining technology; the office is the oldest and most historic building that symbolizes the Kennecott enterprise, and William C. Douglass, superintendent from 1920 to 1929, recommended its preservation; finally, for overall interpretive value, the concentrator excells all others. The less significant aspects of social life, depending on the state of repair and the resources available for preservation, could be depicted in the hospital, school, store, recreation hall, or one of the bunkhouses or cottages.

APPENDIX B -- MCCARTHY

The history of the service town of McCarthy can only be briefly sketched from the documents. Only through oral histories of the few old-times can part of the history be saved. In 1916 two newspapers, The Copper Bee and The Avalanche, published for a couple of months each. These newspapers described the town as being dry--no liquor was legally sold. Peter Johnson was building a hotel on Second Street of logs, calked with burlap, and paneled with beaverboard on the inside. The newspaper regarded it as "one of the best and most substantial buildings in the country."

The following businesses advertised in the newspapers: McCarthy Steam Baths; McCarthy Meat and Grocery Co.; McCarthy Bar; W.W. Harvey and Co., Inc., a general store with lumber, hardware and hay; Merchants Cafe; Barber Shop; McCarthy Sheet Metal Works; A.E. Todd General Merchandise; Laurie Bros', a gentlemen's furnishing store; The Club, a pool hall and card room; J.R. Underwood, blacksmithing and repair; Otto Lubbe, dray and transfer; The Mecca, bar and pool room; Alaskan Bar; Charley's Place, Chinese resturant; and F.H. Foster, Attorney-at-Law. In 1916 supposedly thirty-three houses were started and the schoolhouse received new paint.

The newspaper briefly discussed a suggestion to incorporate the town--nothing came of the suggestion. James Wickersham spoke October 21, 1916, in the McCarthy auditorium on an inquiry into freight rates on the railroad and steamship lines.

Social life consisted of occasional pavillion dances shared with Kennecott, the Fourth of July celebration and rodeo, movies at Kennecott, and later a reading club. The town's wild reputation is illustrated in Emil Goulet's comment that beer was served in whiskey glasses for fifty cents, diluted whiskey for a dollar, and "if we got any change out of a ten-dollar bill, it was because they thought we were still sober." Other Kennecott people also viewed the town as mostly saloons and prostitute houses.

By the 1930's Sig Wold owned most of the businesses. He owned the only car, and during the winter on dogsled he carried supplies between McCarthy and Kennecott. Because only two students attended school in 1931, the Commissioner of Education closed McCarthy's Territorial school.

The closing of the mines essentially closed up McCarthy. A few people stayed on--some to serve the few tourists; other because they liked the area.

APPENDIX C - BUILDINGS AND THEIR APPROXIMATE CONSTRUCTION DATES

Camp established	1907	
Office	1907	
Bonanza tramway	1908	Completed 1909, destroyed by snowlides 1913, handled 400 tons 1914, additions to handle 600 tons 1918, destroyed by snowslides 1918 and 1919, additions to handle 1000 tons
Sawmill	1908	
Bunkhouse	1908	
Blacksmith Shop	1908	
Manager's House	1910	
Ore Bunkers	1910	
Concentrator	1910	(100 tons), 1914 (500 tons), 1915 additions (800 tons), 1922 additions (1200 tons), 1925 painted gray
Power Plant	1910	Addition in 1916, equipment added 1917, diesel engines 1922, burned and rebuilt 1924-25.
Staff House	1910	
Messhouse	1910	
Assay office addition	1910	
Post Office	1910	
Store(not big one)	1910	
Barn	1910	
Powder House	1910	
Snow Sheds	1911	
Jumbo Tramway	1911	Completed 1915, 1918 (600 tons), 1919 destroyed by by snowslides
Leaching Plant	1915	Operating 1916 (300 tons), enlarged 1917, completed 1918 (600 tons)
Oil Storage Tanks	1916	

Hospital	1916	
Manager's Cottage (Birch's House)	1916	
Apartment house	1916	
Recreation Hall	1916	
Erie Tram	1916	Destroyed by snowslides 1919, additions 1920 (600 tons).
Tailings Disposal System	1916	
Fuel Oil Storage Tanks	1917	
New Store and Warehouse	1917	
Living Quarters for 50 men	1917	
Glacier mine connected to Jumbo tram	1918	
Number of cottages built	1918	
Dormitory accommodations increased	1918	
Flotation Plant	1923	

BUILDINGS WITHOUT DATES

Laundry

Schoolhouse

Storage

Electric Shop and Transformer Station

Carpenter and Paint Shop

Steel and Sack Storage

Bonanza mine

Bunkhouse	1910	Burned 1916, rebuilt 1917

Messhouse 1910

Blacksmith 1910

Compressor by 1915

Recreation Hall 1917

<u>Jumbo Mine</u>

Bunkhouse by 1915

Messhouse by 1915

Blacksmith by 1915

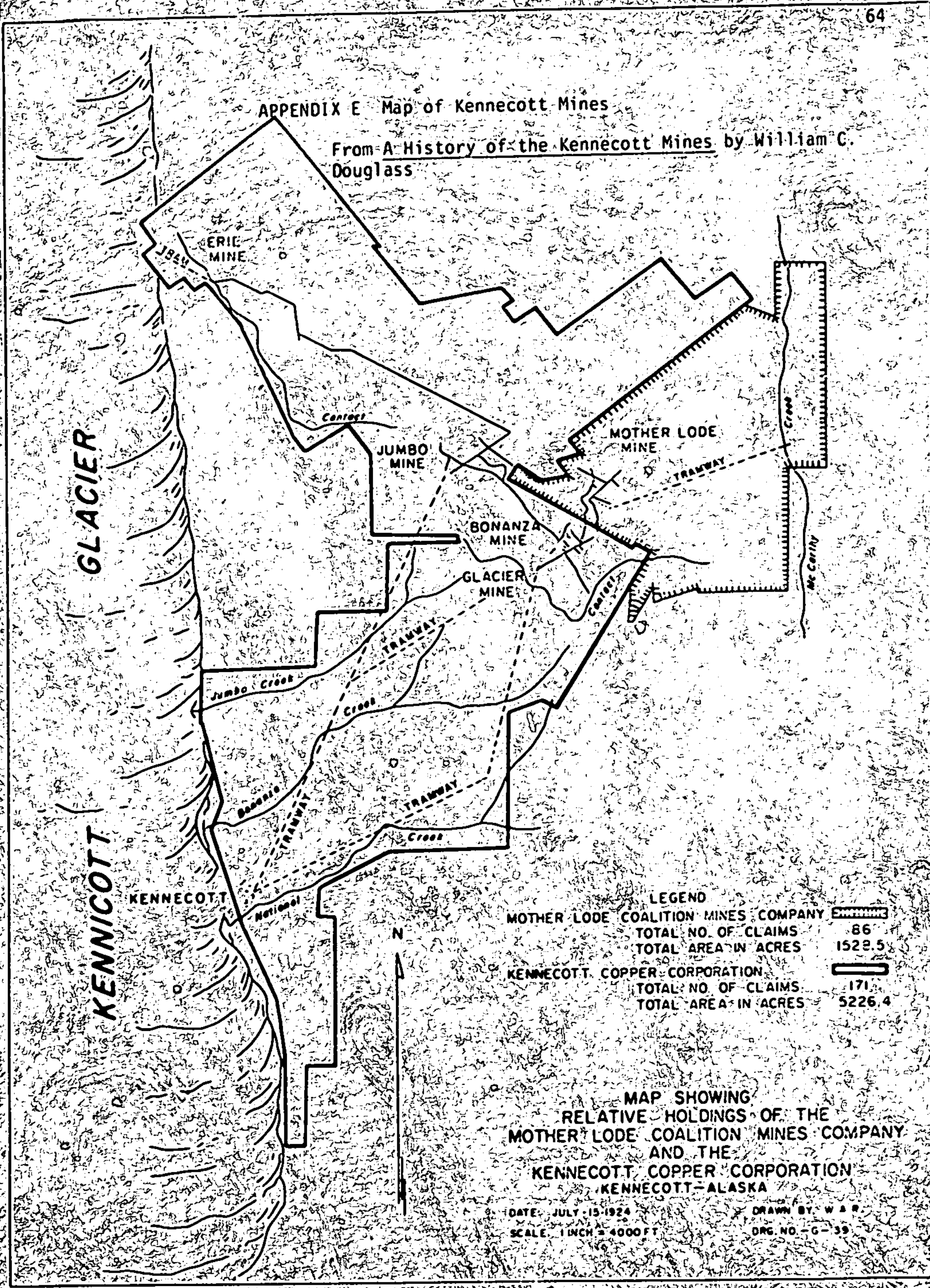
Loading station of tram moved underground 1919

<u>Erie Mine</u>

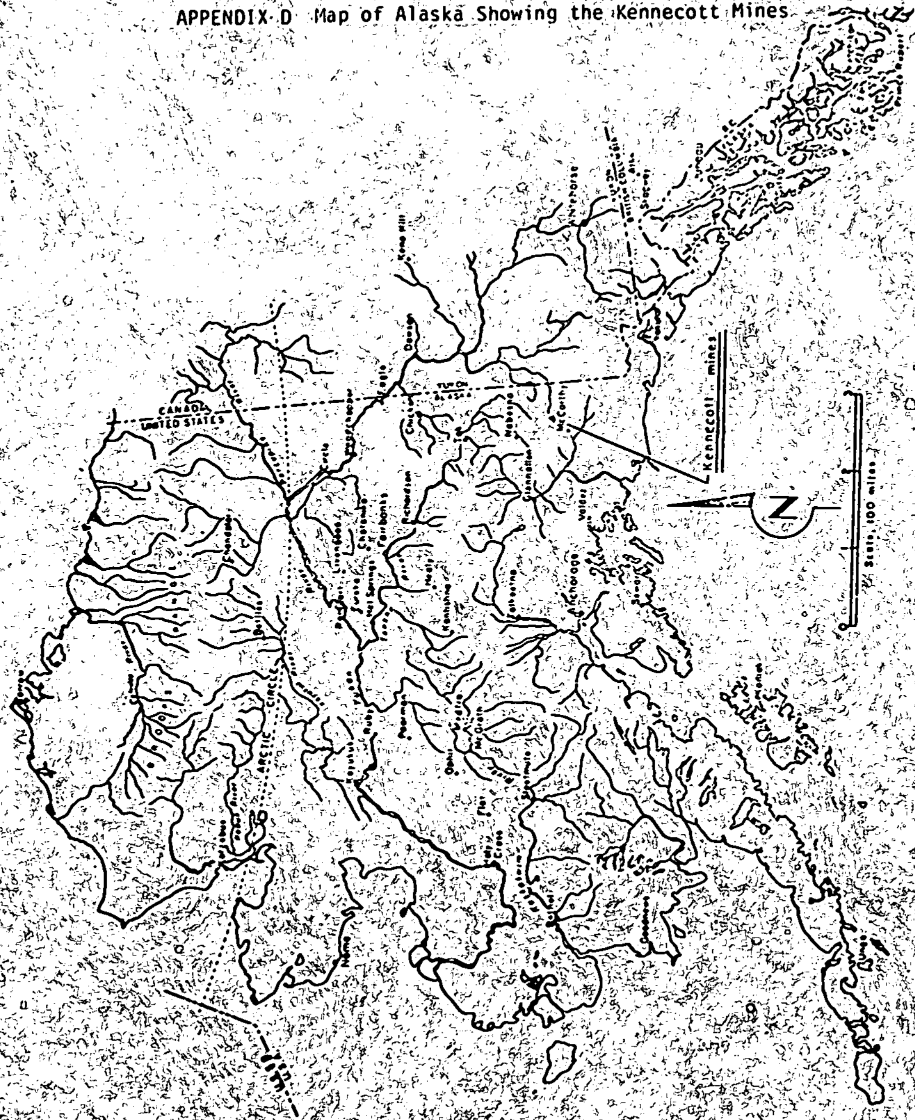
APPENDIX D Map of Alaska Showing the Kennecott Mines

APPENDIX E Map of Kennecott Mines

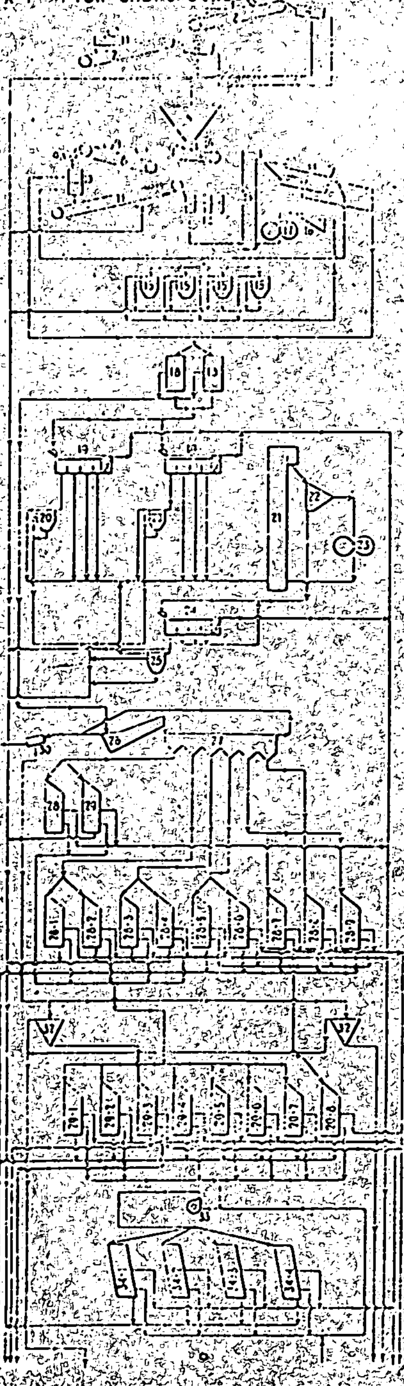
From A History of the Kennecott Mines by William C. Douglass



APPENDIX D Map of Alaska Showing the Kennecott Mines



APPENDIX F Flow chart of Concentrator, Flotation Plant, and Ammonia Leaching Plant



1 2 [illegible] jaw crushers—Size 13x24 in.; r.p.m., 250, opening 3½ in.
2 2 conveyors { Jumbo—length 205 ft., width 32 in., 5 ply; Bonanza—Length 196 ft., width 32 in., 5 ply
3 1 cobbing magnet
4 2 trommels (Jumbo and Bonanza), each 9 ft. long, [illegible] diam.; 7 mm. opening, 1½ in. slope per foot; of punched plate
5 [illegible] available capacity, 100 tons; max. width, [illegible] max. length, 32 ft.; max. depth, 20 ft.
6 1 Stevens Adamson apron feeder
7 1 conveyor—length, 10 ft., width, 32 in., 6 ply; 60 ft. per minute
8 1 conveyor—length, 52 ft., width, 32 in., 5 ply; 60 ft. per minute
9 1 cobbing magnet
9a 1 Vezin head sampler
10 1 trommel—diameter, 4 ft.; 27 in.; 11 mm.; 30 in., [illegible] mesh; r.p.m., 16
11 sorting conveyor—length, 40 ft.; width, 32 in.; 5 ply; [illegible] ft. per minute
12 Symons crusher—size 36 in.; oscillations, 335; r.p.m., 133 opening, 1 in.
13 2 elevators—length, 68 ft.; width, 18 in.; 10 ply; 380 ft. per minute; 54 cups
14 2 trommels—diameter, 4 ft.; length, 9 ft.; r.p.m., 18; punched plate with 11 mm. openings
15 4 Bull Jigs

	Stroke, Inch.	R.P.M.	Screen
No. 1	2½	189	9 mm.
No. 2	2	194	9 mm.
No. 3	not running		9 mm.
No. 4	not running		9 mm.

16 Drag dewaterer—length, 32 ft.; width, 32 ft.; chain No. 83; slope, 6½ in. in 12 in.; 45 ft. per minute
17 Traylor rolls—size, 54x20 in.; r.p.m., 83
18 2 trommels—diameter, 4 ft.; length, 9 ft.; r.p.m., 15; punched plate with 11 mm. openings
19 2 Hancock jigs each

R.P.M.	Lift, Inch	Throw, Inch	Depth of Pocket, Feet	Width of Pocket, Feet
195	¾	1½	3½	3½

Screens

Inches of screen	15½	35	10	25	20	15	25	15	40	20½
Total 221 in.										
Size in millimeters	4	6	9	13	6	13	6	13	6	[illegible]

20 2 single hutch Harz jigs; r.p.m., 265; stroke, ¾ in.; 4-mm screens
21 1 elevator—length, 50 ft.; width, 18 in.; 10 ply; 400 ft. per minute, 45 cups
22 1 Colorado impact screen—size, 3x3 ft.; No. of impacts, 324; size of opening, 2½ mm.; slope, 22 deg.
23 1 set Traylor rolls—size, 36x16 in.; r.p.m., 125
24 1 Hancock jig.

	R.P.M.	Lift, Inch	Throw, Inch	Depth of Pocket, Feet	Width of Pocket, Feet
No. 3	195	¾	1½	3½	3½

Screens

Inches of screen	63½	9	22½	9	27	18	13½	13	18	13½
Total 222 in.										
Size in millimeters	4	9	4	13	4	9	13	9	6	[illegible]

25 1 2-compartment Harz jig; r.p.m., 265; stroke, ¾ in.; 4 mm. screens
26 1 drag dewaterer—length, 32 ft.; width, 30 in.; chain No. 836; slope, 3½ in. in 12 in.
27 1 Richards hindered settling classifier; No. of spigots, 6; water head, 30 ft.
28 1 Wilfley table; stroke, 1½ in.; slope, ¾ in., 12; r.p.m., 255
29 1 Plat-O table; stroke, 1½ in.; slope, 1½ in. 12; r.p.m., 284
30 1 Chip Trommel—length 5 ft.; diameter, 3 ft.; r.p.m., 16; screen, 4-mm. opening
28 9 Wilfley tables—

	R.P.M.	Slope Per Foot, Inches	Stroke, Inches
28—1	256	[illegible]	[illegible]
28—2	270	[illegible]	[illegible]
28—3	248	[illegible]	[illegible]
28—4	276	[illegible]	[illegible]
28—5	258	[illegible]	[illegible]
28—6	257	[illegible]	[illegible]
28—7	259	[illegible]	[illegible]
28—8	256	[illegible]	[illegible]
28—9	260	[illegible]	[illegible]

29 8 Plat-O tables—

	R.P.M.	Slope Per Foot, Inches	Stroke, Inches
29—1	315	[illegible]	[illegible]
29—2	315	[illegible]	[illegible]
29—3	315	[illegible]	[illegible]
29—4	261	[illegible]	[illegible]
29—5	320	[illegible]	[illegible]
29—6	262	[illegible]	[illegible]
29—7	315	[illegible]	[illegible]
29—8	318	[illegible]	[illegible]

32 2 8-ft. Callow cones
33 1 2-in. Wilfley centrifugal pump
34 4 James table—

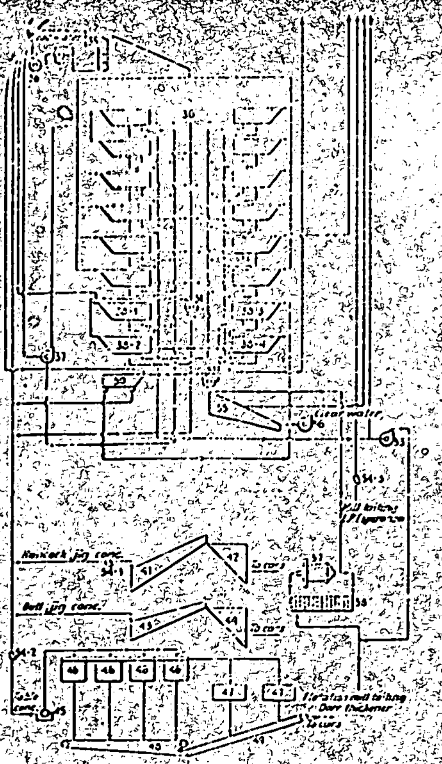
	R.P.M.	Slope Per Foot, Inches	Stroke, Inches
34—1	215	[illegible]	[illegible]
34—2	247	[illegible]	[illegible]
34—3	230	[illegible]	[illegible]
34—4	230	[illegible]	[illegible]

From "Flotation and Leaching at Kennecott" by E.J. Duggan, Engineering and Mining Journal 126 (1928): 1011-1114

35 1 2-tray Dorr thickener—diameter, 20 ft.; height, 16 ft.
36 12 Plat-O slime tables, each 305 r.p.m.; ½-in. slope per ft.; ⅝-in. stroke
37 1 4x6-in. Frenier pump
38 4 Plat-O slime tables

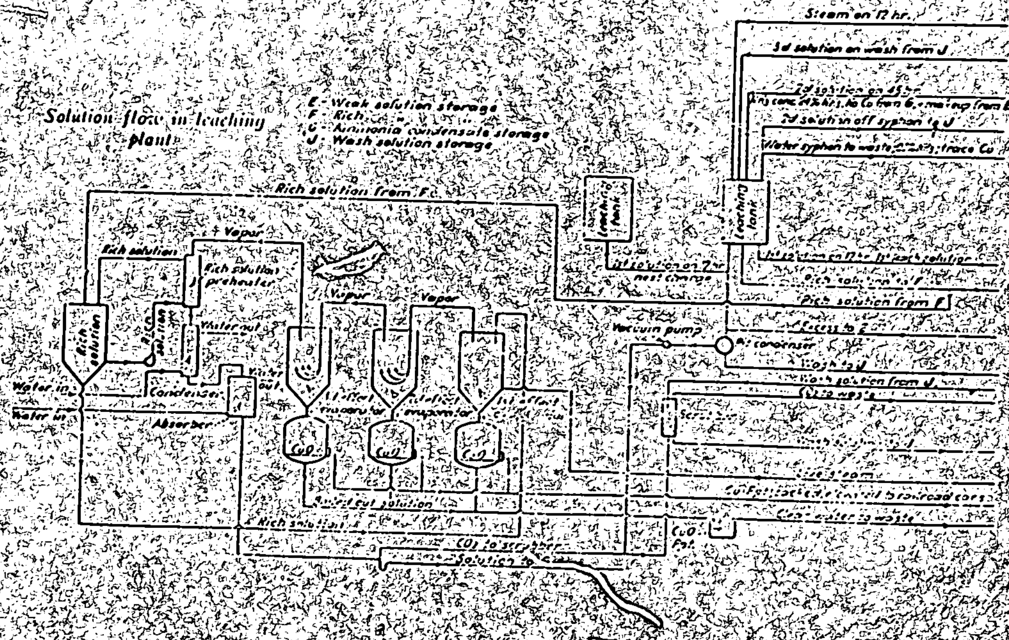
	R.P.M.	Stroke, Inches
38—1	305	½
38—2	305	½
38—3	280	¾
38—4	280	¾

39 1 conveyor—length of belt, 170 ft.; width, 16 in.; 5 ply; 100 ft. per minute
40 1 2-compartment bin; capacity, 350 tons
41 1 drag dewaterer—length, 26 ft.; width, 40 in.; slope, 3¾ in. 12; 12 ft. per minute
42 1 bin—capacity, 119 tons
43 1 drag dewaterer—length, 26 ft.; width, 24 in.; slope, 3¾ in. 12; speed, 12 ft. per minute
44 1 bin—capacity, 16 tons
45 1 Frenier pump, 4x6 in.
46 4 table concentrate tanks, diameter, 9 ft.; height, 5 ft.
47 2 table concentrate tanks—diameter, 11 ft. 6 in.; height, 5 ft.
48 1 conveyor—length, 27 ft.; width, 22 in.; 5 ply; 14 ft. per minute; slope, 3¾ in. in 12 in.
49 1 conveyor—length, 25 ft.; width, 22 in.; 5 ply; 14 ft. per minute; slope, 3¾ in. 12 in.
50 1 2-spigot classifier
51 1 Frenier pump, 4x6 in.
52 1 2x9-in. centrifugal Byron Jackson pump
53 1 4-in. centrifugal Wilfley pump
54 3 Galligher samplers
55 1 drag dewaterer
56 2 2-stage, 3-in. Moran centrifugal pumps
57 1 ball mill—4x4 ft.; r.p.m. 20
58 1 26-in. Esperanza classifier.



Flow sheet of the Kennecott concentrator

Solution flow in leaching plant



APPENDIX G Graph of Kennecott's Significance

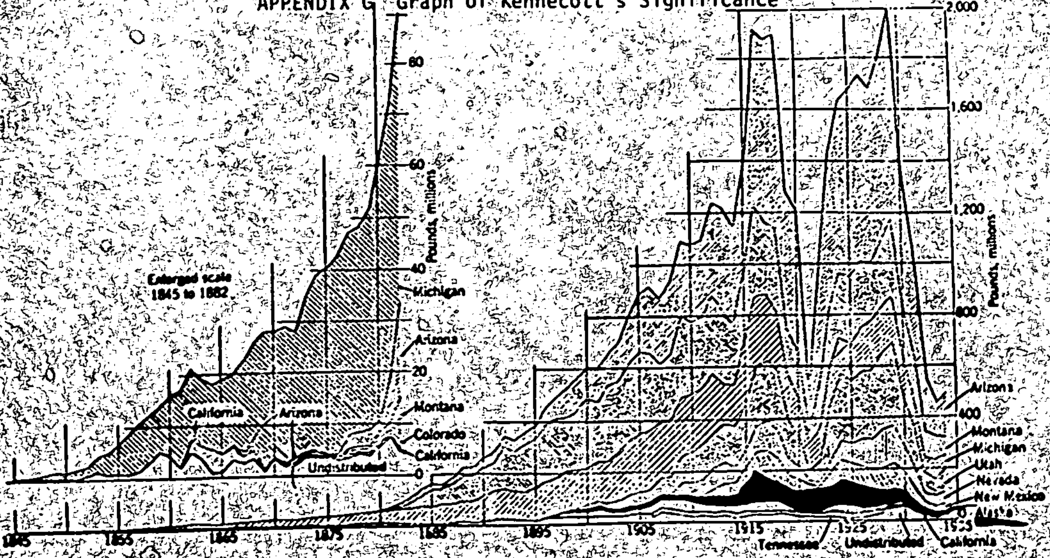


FIGURE 1.—Distribution of United States copper production (smelter) by States, 1845-1934.

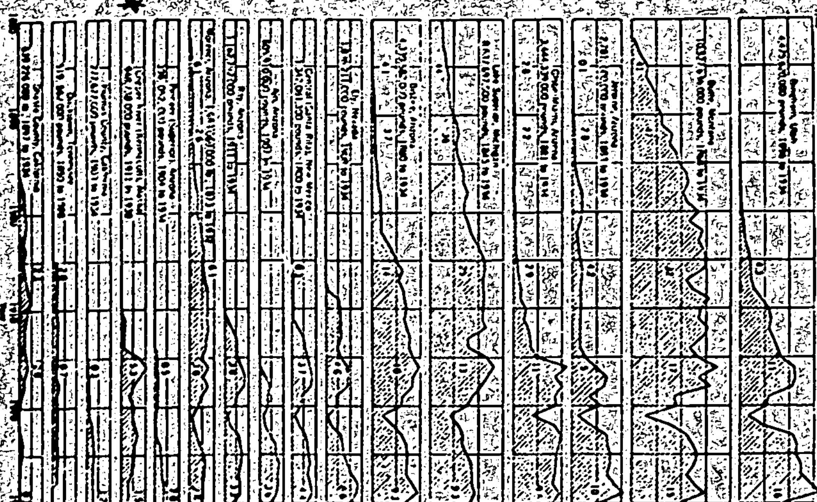


FIGURE 2.—Production of principal United States copper mining districts, 1870-1934. (Figures for 1880, 1890, 1900, 1910, and 1920 indicate percentages of United States total.)

From Copper Mining in North America by E.D. Gardner and C.H. Johnson, Bureau of Mines Bulletin 405 (Washington, 1938)

APPENDIX H - BIBLIOGRAPHY

I. BOOKS

All About Kennecott: A Story of Kennecott Copper Corporation. New York: Kennecott Copper Corporation, 1961.

Arrington, Leonard J. and Hansen, Gary B. The Richest Hole on Earth: A History of the Bingham Copper Mine. Monograph Series, vol. 11, no. 1. Logan, Utah: Utah State University Press, 1963.

The Copper Handbook: A Manual of the Copper Industry of the World. Edited by Horace J. Stevens. Houghton, Michigan: Horace J. Stevens, 1907-13.

Crump, N.E. Copper: A Survey of the Sources from whence the Metal is Obtained, the Methods of its Manufacture, the Nature of its Uses, and the Conditions of the Trade. London: William Rider & Son, 1925.

Davis, Watson The Story of Copper. New York: The Century Co., 1924.

Douglass, William C. A History of the Kennecott Mines, Kennecott, Alaska. Reprint. Anchorage, Alaska: Alaska Division of Parks, 1974.

Goulet, Emil Oliver. Rugged Years on the Alaska Frontier. Philadelphia: Dorrance & Co. 1949.

Gruening, Ernest. The State of Alaska. New York: Random House, 1968.

Hanable, William S. and Workman, Karen Wood. Lower Copper and Chitina Rivers: An Historic Resource Study. History and Archeology Series, no. 5. Anchorage: Alaska Division of Parks, 1974.

Janson, Lone E. The Copper Spike. Anchorage: Alaska Northwest Publishing Co., 1975.

Joralemon, Ira B. Copper: The Encompassing Story of Mankinds First Metal. Berkeley: Howell - North Books, 1973.

Lindgren, Waldemar. "The Kennecott Mine, Alaska." In Mineral Deposits, pp. 466-9. New York: McGraw-Hill Book Co., 1928.

McGeary, M. Nelson. Gifford Pinchot: Forester, Politican. Princeton: Princeton University Press, 1960.

The Mineral Industry, Its Statistics, Technology and Trade. New York: McGraw-Hill Book Co., annually, 1904-1938.

The Mines Handbook Succeeding the Copper Handbook. Edited by Walter Harvey Weed. New York: W.H.Weed, 1916-1931.

Nichols, Jeanette Paddock. History of Alaska Under Rule of the United States. Cleveland: Arthur H. Clark Co., 1924.

Peel, Robert, Ed. Mining Engineer's Handbook. 2 vols. New York: J. Wiley & Sons, 1941.

Pinchot, Gifford. Breaking New Ground. New York: Harcourt, Brace, & Co., 1947.

Smith, B. Webster. The World's Great Copper Mines. London: Hutchinson & Co., 1967.

II. ARTICLES

Bateman, Alan M. and McLaughlin, D.H. "Geology of the Ore Deposits of Kennecott, Alaska." Economic Geology 15 (1920): 1-80.

_____. "Notes on a Kennecott type of Copper Deposit, Glacier Creek, Alaska." Economic Geology 27(1932): 297-306.

Berger, Carpel L. "Story of Kennecott Copper: Part 1. Empire Building and Builders: Struggles." The Financial World,23 May 1921, pp. 893-895.

_____. "Story of Kennecott Copper. Part 2. Rise of Big World-Wide Copper Empire." The Financial World, 30 May 1921, pp. 933-935.

_____. "Story of Kennecott Copper. Part 3. Stock Market Career, Past and Prospective." The Financial World,6 June 1921, pp. 973-974.

Birch, Stephen. "Geology and Mining Methods of Kennecott Mines." Transactions of American Institute of Mining and Metallurgical Engineers 72 (1925): 499-510

Button, R.L. "Kennecott," Alaska Sportsman, April 1965, pp. 38-40.

Carisle, Henry. "Alan M. Bateman: An Interview." Mining Engineering, November 1964, pp. 74-77.

_____. "David D. Irwin: An Interview." Mining Engineering June 1964, pp. 88-91.

Duggan, E.J. "Ammonia Leaching at Kennecott." Transactions of the American Institute of Mining and Metallurgical Engineers 106 (1933): 547-558.

_____. "Flotation and Leaching at Kennecott" Engineering and Mining Journal 107 (1928): 1008-1015.

Eddy, Laurence. "Ammonia Leaching of Copper Ores." Engineering and Mining Journal 107 (1919): 1162-1167.

"The Great Bonanza Copper Mine." Alaska Yukon Magazine. December 1910, pp. 384-385.

Guggenheim Projects." The Alaska Monthly, June 1906.

Harrison, E.S. "What is the Alaska Syndicate Doing? Facts about the Morgan-Guggenheim Interest in Alaska Taken From the Testimony of Stephen Birch, Managing Director." Alaska-Yukon Magazine, May 1910, pp. 374-375.

Hulberts, W.D. "In the Hunts of the Syndicate". (New) Outlook, 20 April 1912, pp. 866-872.

______. "What is Really Going on in Alaska: Bringing the Coal to the Sea." (New) Outlook, 20 January 1912, pp. 133-138.

Hurja, Emil E. "Cordova, Alaska: Changes at the Bonanza; Jumbo Developing Favorably; Mother Lode, Great Northern, and other Copper Mines; Nabesna, Nazina, and Chisana Placers." Mining and Scientific Press, 26 September 1914, pp. 499-500.

Jacobs, E. "Chitina Valley Copper Deposits." Mines and Minerals, December 1910, pp. 315-318.

Johnasen, Woodrow. "The Copper River and Northwestern Railroad." The Northern Engineer 7 (1975): 19-31.

Kinney, John M. "Copper and the Settlement of Southcentral Alaska." Journal of the West 10 (1971): 307-318.

Laskey, Samuel G. "A Colloidal Origin of Some of the Kennecott Ore Minerals." Economic Geology 25 (1930): 737-757.

McKenzie, Isabel. "Great Bonanza Copper Mine is Working." Alaska-Yukon Magazine, May 1911, pp. 33-34.

Moore, Robert. "Alaska, The Big Land." National Geographic, June 1956, p. 790.

Posnjak, K. Eugen, Allen, E.T., and Merwin, H.E. "The Sulphides of Copper." Economic Geology 10 (1915): 491-535.

Slotnick, Herman. "The Ballinger-Pinchot Affair in Alaska." Journal of the West 10 (1971): 337-347.

Stearns, Robert A. "Alaska's Kennecott Copper and the Kennecott Copper Corporation." The Alaska Journal 5 (1975): 130-139.

Taylor, C.D.N. "A Prospector of the Dawson Range." Western Miner, February 1971, pp. 42-52.

______. "Copper Mining at Kennecott: A Guide to Highgrade Copper Deposits." part 1, Western Miner, May 1973, pp. 29-34.

______. "Copper Mining at Kennecott: A Guide to Highgrade Copper Deposits." part 2, Western Miner, June 1973, pp. 33-39.

Wilhelm, U.H. "Bonanza Copper Mine, Alaska." Mines and Minerals, February 1911 p. 441.

III. REPORTS

Kennecott Copper Corporation. Annual Report. Annually, 1915-1938.

Mother Lode Coalition Mines Company. Annual Report. Annually, 1915-1939.

IV. NEWSPAPERS

The Avalanche. McCarthy, Alaska. August 5 to October 28, 1916.

The Copper Bee. McCarthy, Alaska. February 1916.

Cordova Daily Alaskan. Cordova, Alaska. 1906-1915.

Cordova Times. Cordova, Alaska. 1938.

The Seattle Times. Seattle, Washington. 13 October 1974.

V. PUBLIC DOCUMENTS

Allen, Henry T. Lieutenant. Report of an Expedition to the Copper, Tanana, and Koyukuk Rivers in the Territory of Alaska in the Year 1885. U.S. Army. Department of the Columbia. Washington, D.C.: Government Printing Office. 1887.

Brooks, Alfred H. "The Mining Industry in 1909." In Mineral Resources of Alaska: Report on Progress of Investigations in 1909. pp. 20-46. United States Geological Survey Bulletin 442. Washington, D.C.: Government Printing Office. 1910.

______. "The Mining Industry in 1910." In Mineral Resources of Alaska: Report on Progress of Investigations in 1910, pp. 21-42. U.S.G.S. Bulletin 480. Washington, 1911.

______. "The Mining Industry in 1911". In Mineral Resources of Alaska: Report on Progress of Investigations in 1911, pp. 17-44. U.S.G.S. Bulletin 520. Washington, 1912.

______. "The Mining Industry in 1912." In Mineral Resources of Alaska: Report on Progress of Investigations in 1912, pp. 18-51. U.S.G.S. Bulletin 542. Washington, 1913.

______. "The Alaskan Mining Industry in 1913." In Mineral Resources of Alaska: Report on Progress of Investigations in 1913, pp. 45-74. U.S.G.S. Bulletin 592. Washington, 1914.

______. The Alaskan Mining Industry in 1920. U.S.G.S. Bulletin 722-A. Washington, 1921.

Gardner, E.D. and Johnson, C.H. Copper Mining in North America. U.S. Bureau of Mines Bulletin 405. Washington, 1938.

Ickes, Harold L. Not Guilty: Official Inquiry Into the Charges Made by Glavis and Pinchot Against Richard A. Ballinger, Secretary of the Interior, 1909-11. U.S. Department of the Interior. Washington, 1940.

Maloney, R.P. and Bottge, R.G. Estimated Costs to Produce Copper at Kennecott, Alaska. U.S. Bureau of Mines Information Circular 8602. Washington, 1973.

Martin, G.E. The Alaska Mining Industry in 1918. U.S.G.S. Bulletin 712-A. Washington, 1919.

Mendenhall, Walter C. and Schrader, Frank C. "Copper Deposits of the Mount Wrangell Region, Alaska." In Contributions to Economic Geology, 1902, edited by S.F.Emmons and C.W.Hays, pp. 141-148. U.S.G.S. Bulletin 213. Washington, 1903.

______. The Mineral Resources of the Mount Wrangell District, Alaska. U.S.G.S. Professional Paper No. 15. Washington, 1903.

Mendenhall, Walter C. Geology of the Central Copper River Region, Alaska. U.S.G.S. Professional Paper No. 41. Washington, 1905.

Miller, Don J. "Copper Deposits of the Nizina District, Alaska." In Mineral Resources of Alaska: Report on Progress of Investigations in 1943 and 1944, pp. 93-120. U.S.G.S. Bulletin 947. Washington, 1947.

Moffitt, Fred H. and Maddren, A.G. "The Mineral Resources of the Kotsina and Chitina Valleys, Copper River Region." In Mineral Resources of Alaska: Report on Progress of Investigations in 1907, pp. 127-175. U.S.G.S. Bulletin 345. Washington, 1908.

✓Moffit, Fred H. "Mining in the Kotsina, Chitina, Chistochina, and Valdez Creek Region." In Mineral Resources of Alaska: Report on Progress of Invest-igations in 1908, pp. 153-160. U.S.G.S. Bulletin 379. Washington, 1909.

______. "Mining in the Chitina District." In Mineral Resources of Alaska: Report on Progress of Investigations in 1909, pp. 158-163. U.S.G.S. Bulletin 442. Washington, 1910.

✓______. Mineral Resources of the Kotsina - Chitina Region, Alaska. U.S.G.S. Bulletin 374. Washington, 1909.

______, and Capps, Stephen R. Geology and Mineral Resources of the Nizina District, Alaska. U.S.G.S. Bulletin 448. Washington 1911.

______. "The Chitina Copper District." In Mineral Resources of Alaska: Report on Progress of Investigations in 1911, pp. 105-107. U.S.G.S. Bulletin 520. Washington, 1912.

______. "Mining in Chitina Valley." In Mineral Resources of Alaska: Report on Progress of Investigations in 1912, pp. 81-85. U.S.G.S. Bulletin 542. Washington, 1913.

______. "Mining in the Lower Copper River Basin." In Mineral Resources of Alaska: Report on Progress of Investigations in 1916, pp. 155-182. U.S.G.S. Bulletin 662. Washington, 1918.

______. "Mining in Chitina Valley." In Mineral Resources of Alaska: Report on Progress of Investigations in 1919, pp. 189-196. U.S.G.S. Bulletin 714. Washington, 1921.

______. "The Metalliferous Deposits of Chitina Valley." In Mineral Resources of Alaska: Report on Progress of Investigations in 1922, pp. 57-72. U.S.G.S. Bulletin 755. Washington, 1924.

______. "Mineral Industry of Alaska in 1925." In Mineral Resources of Alaska: Report on Progress of Investigations in 1925, pp. 1-40. U.S.G.S. Bulletin 792. Washington, 1927.

______. Recent Mineral Developments in the Copper River Region, Alaska. U.S.G.S. Bulletin 880-B. Washington, 1937.

______. Geology of the Chitina Valley and Adjacent Area, Alaska. U.S.G.S. Bulletin 894. Washington, 1938.

Rohn, Oscar. "A Reconnaissance of the Chitina River and the Skolai Mountains, Alaska." In Twenty-first Annual Report of the United States Geological Survey to the Secretary of the Interior, 1899-1900, part 2, pp. 343-440. Washington, 1900.

Schrader, F.C. and Spencer, A.C. The Geology and Mineral Resources of a Portion of the Copper River District, Alaska. Special publication of U.S.G.S., Washington 1901.

Smith, Philip S. "Mineral Industry of Alaska in 1926. In Mineral Resources of Alaska: Report on Progress of Investigations in 1926, pp. 1-50. U.S.G.S. Bulletin 797. Washington, 1929.

______. "Mineral Industry of Alaska in 1927." In Mineral Resources of Alaska: Report on Progress of Investigations, pp. 1-64. U.S.G.S. Bulletin 810. Washington, 1930.

______. "Mineral Industry of Alaska in 1928." In Mineral Resources of Alaska: Report on Progress of Investigations in 1928, pp. 1-72. U.S.G.S. Bulletin 813. Washington, 1930.

______. "Mineral Industry of Alaska in 1930." In Mineral Resources of Alaska: Report on Progress of Investigations in 1930, pp. 1-84. U.S.G.S. Bulletin 836. Washington, 1933.

______. "Mineral Industry of Alaska in 1931." In Mineral Resources of Alaska: Report on Progress of Investigations in 1931, pp. 1-82. U.S.G.S. Bulletin 844-A. Washington, 1933.

______. "Mineral Industry of Alaska in 1932" In Mineral Resources of Alaska: Report on Progress of Investigations in 1932, pp. 1-76. U.S.G.S. Bulletin 857. Washington, 1934.

______. "Mineral Industry of Alaska in 1933" In Mineral Resources of Alaska: Report on Progress of Investigations in 1933, pp. 1-82. U.S.G.S. Bulletin 864. Washington, 1936.

______. Mineral Industry of Alaska in 1935. U.S.G.S. Bulletin 880-A. Washington, 1937.

———. *Mineral Industry of Alaska in 1938.* U.S.G.S. Bulletin 917-A. Washington, 1939.

Smith, Summer S. *The Mining Industry in the Territory of Alaska During the Calendar Year 1915.* U.S. Bureau of Mines Bulletin 142. Washington, 1917.

———. *The Mining Industry in the Territory of Alaska During the Calendar Year 1915.* U.S. Bureau of Mines Bulletin 153. Washington, 1917.

VI. MANUSCRIPTS

Arends, Dorothea. "The Guggenheims in Alaska: An Essay." Master's Thesis, Columbia University, 1936.

Douglass, William C. "General Points of Interest on the Kennecott and Mother Lode Mines, Kennecott, Alaska." Typescript. Douglass Collection, Seattle, Washington, 1924.

———. "Outline of Geology and Mining Methods of Kennecott Mines." Typescript. Douglass Collection, Seattle, Washington, n.d.

Dunkle, W.E. "Economic Geology and History of the Copper River District, Alaska." Paper read at Fifth Alaskan Science Conference, November 1954. Typescript. Bureau of Mines, Juneau, Alaska.

Keller, H.A. "Report on the Mother Lode Property in the Chitina Mining District, Alaska." 16 September 1912. Typescript. Bureau of Mines, Juneau, Alaska.

Shiels, Archie. "The Kennecott Story." Mimeographed. 11 April 1967.

Stearns, Robert Alden. "The Morgan-Guggenheim Syndicate and the Development of Alaska, 1906-1915." Ph.D. Dissertation, University of California at Santa Barbara, 1967.

Wright, W.S. and Tolonen, A.W. "Chitistone Copper Deposits, Chitistone River area, Alaska." December 1945. Typescript. Bureau of Mines, Juneau, Alaska.

VII. COLLECTIONS

Fairbanks. University of Alaska Archives. L.S. Levensaler Letters.

Fairbanks. University of Alaska Archives. Eugene McCracken Papers.

Juneau. U. S. Bureau of Mines. Kennecott File.

Seattle. University of Washington Manuscript Collections. W.A. Dickey Collection.

Seattle. William C. Douglass Collection.

Seattle. Ralph MacKay Collection. Autobiography, Alaskan Character Sketches, Photographs.

Victoria, British Columbia. C.D.N. Taylor Collection.

Washington, D.C. National Archives, Record Group 280. File 33/515. Federal Mediation and Conciliation Service, "Strike of Miners of Kennecott Copper Corporation" [by Charles T. Connell]

VIII. INTERVIEWS

William C. Douglass, former Superintendent of Kennecott, 15 February 1976, Seattle, Washington.

William D. Douglass, son of Kennecott Superintendent, written reminiscences, 25 March 1976.

Julian Feiss, former staff geologist for Kennecott Copper Corporation, 4 February 1976, Washington, D.C.

James Harrower and Tony Oney, members of Consolidated Wrangell Mining Company's Board of Directors, 24 February 1976, Anchorage, Alaska.

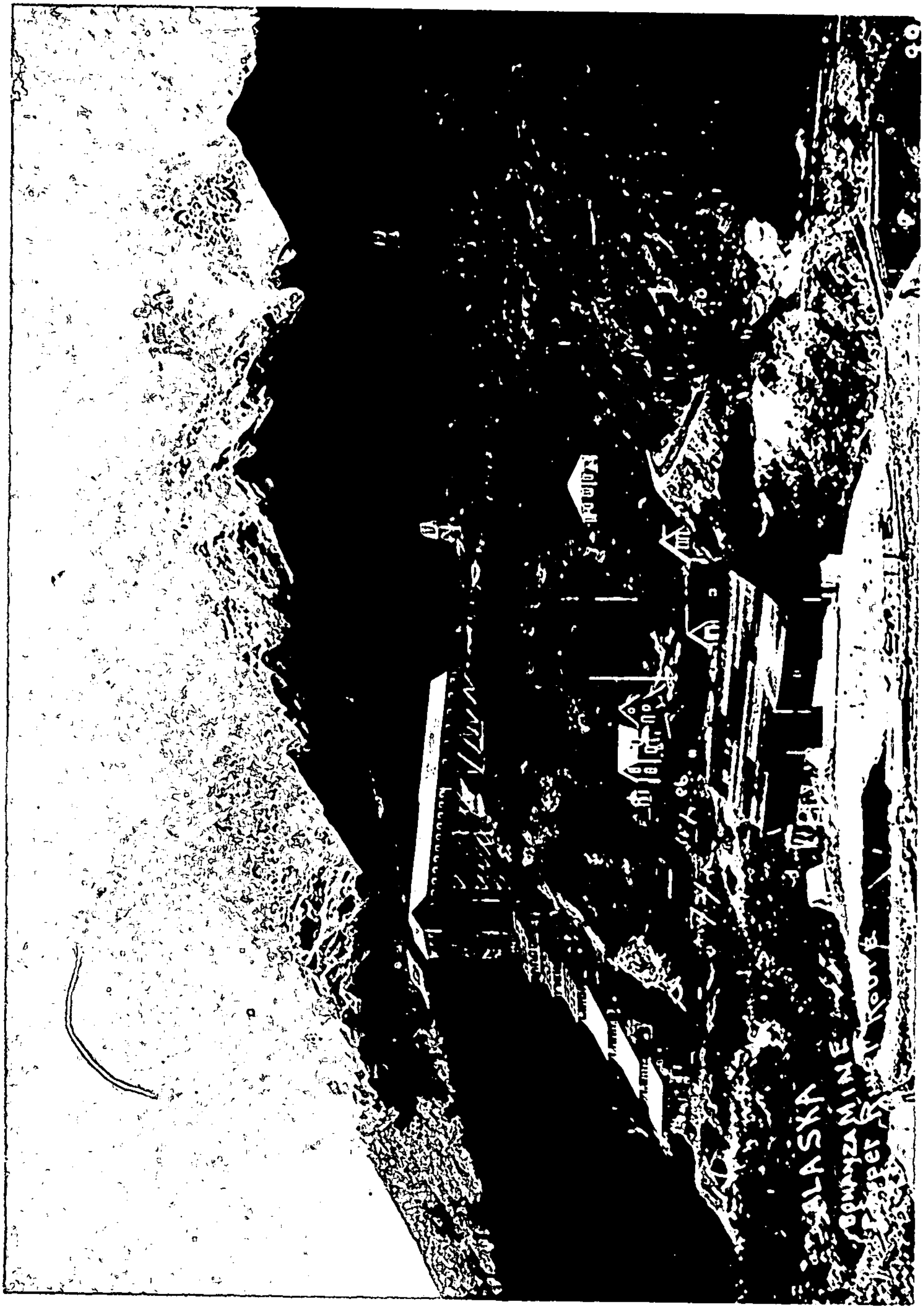
Fred and Eva "Mickey" Hoff, former Kennecott mining engineer and nurse, 29 March 1976, Mesa, Arizona.

William Humphries, child of a Kennecott purchasing agent, 8 March 1976, Fairbanks, Alaska.

Dr. Arthur N. and Dagmar Wilson, former Kennecott doctor and his wife, 16 February 1976, Ketchikan, Alaska.

APPENDIX I PHOTOGRAPHS

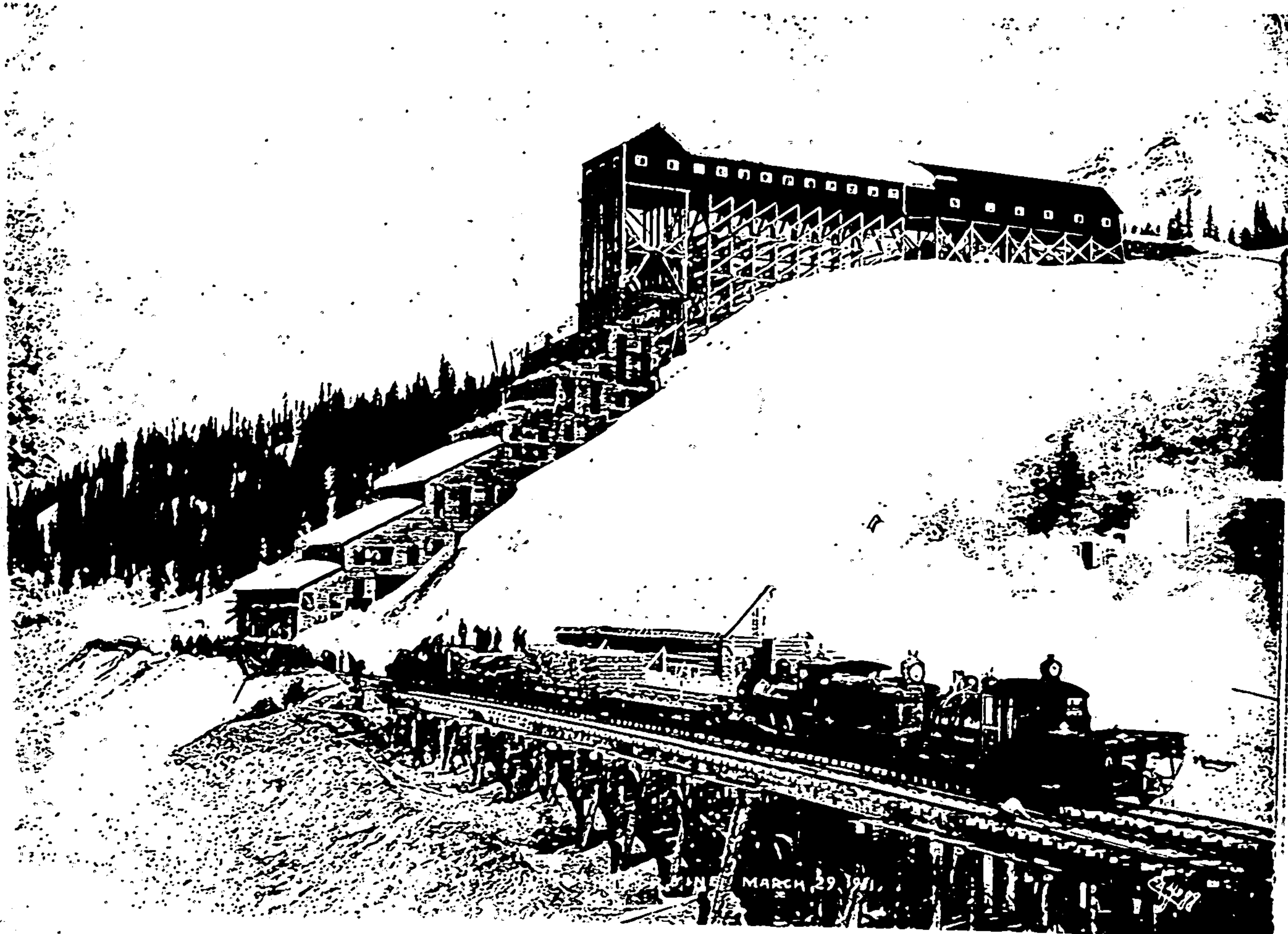
1. Kennecott in 1910 - Seattle Historical Society
2. Kennecott in 1910 - Eugene McCracken Collection, University of Alaska Archives
3. Kennecott in 1911 - Alaska Historical Library
4. Kennecott about 1912 - Ralph MacKay Collection
5. Kennecott Concentrator, 1913-1915 - Seattle Historical Society
6. Kennecott, 1912- 1915 - Seattle Historical Society
7. Kennecott in 1915 - R.N. DeArmond Collection
8. Kennecott, 1917-1924 - R.N. DeArmond Collection
9. Kennecott, 1920-1924 - LuLu Fairbanks Collection, University of Alaska Archives
10. Kennecott in 1925 - LuLu Fairbanks Collection, University of Alaska Archives
11. Kennecott in 1916 - Ralph MacKay Collection
12. Kennecott in the 1930's - Seattle Historical Society
13. Diesel Engine - Ralph MacKay Collection
14. Receiving End of Kennecott Tramway - Ralph Mackay Collection
15. Bonanza Tram - Ralph MacKay Collection
16. McCarthy - Seattle Historical Society
17. Chitina - Ralph MacKay Collection
18. Bonanza Mine - Seattle Historical Society
19. Bonanza Mine - Charless Bunnell Collection, University of Alaska Archives
20. Mother Lode Mine - Ralph MacKay Collection
21. Underground Messhall - William C. Douglass Collection
22. Winter Freighting OutFit - Ralph MacKay Collection
23. Kuskulana Bridge, C.R. & N.W.R.R. - Seattle Historical Society
24. Gilhina Trestle, C.R. & N.W.R.R. - Seattle Historical Society



KENNECOTT IN 1910

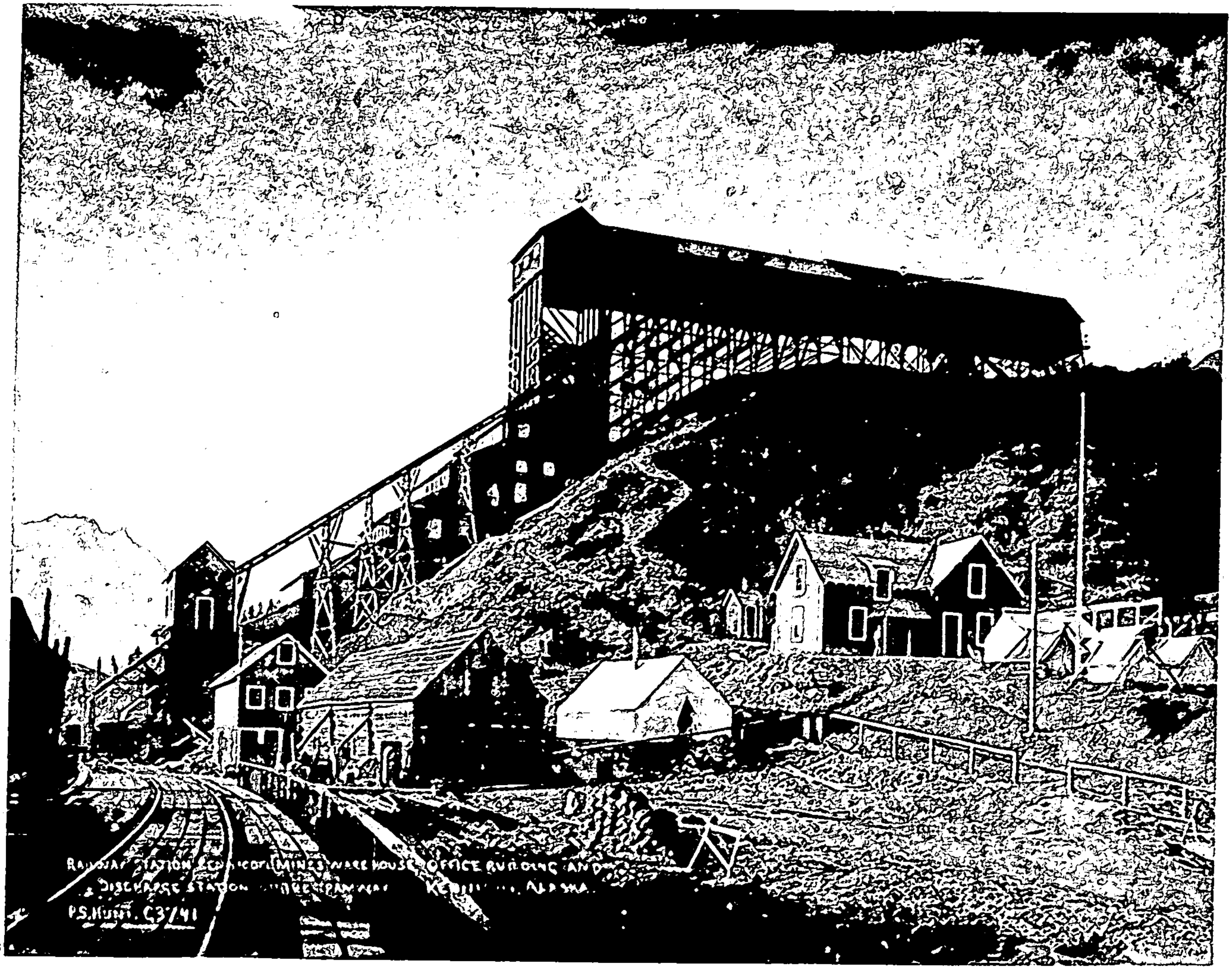
Concentrator, Office, Manager's House, Bunkhouse, and Saw Mill

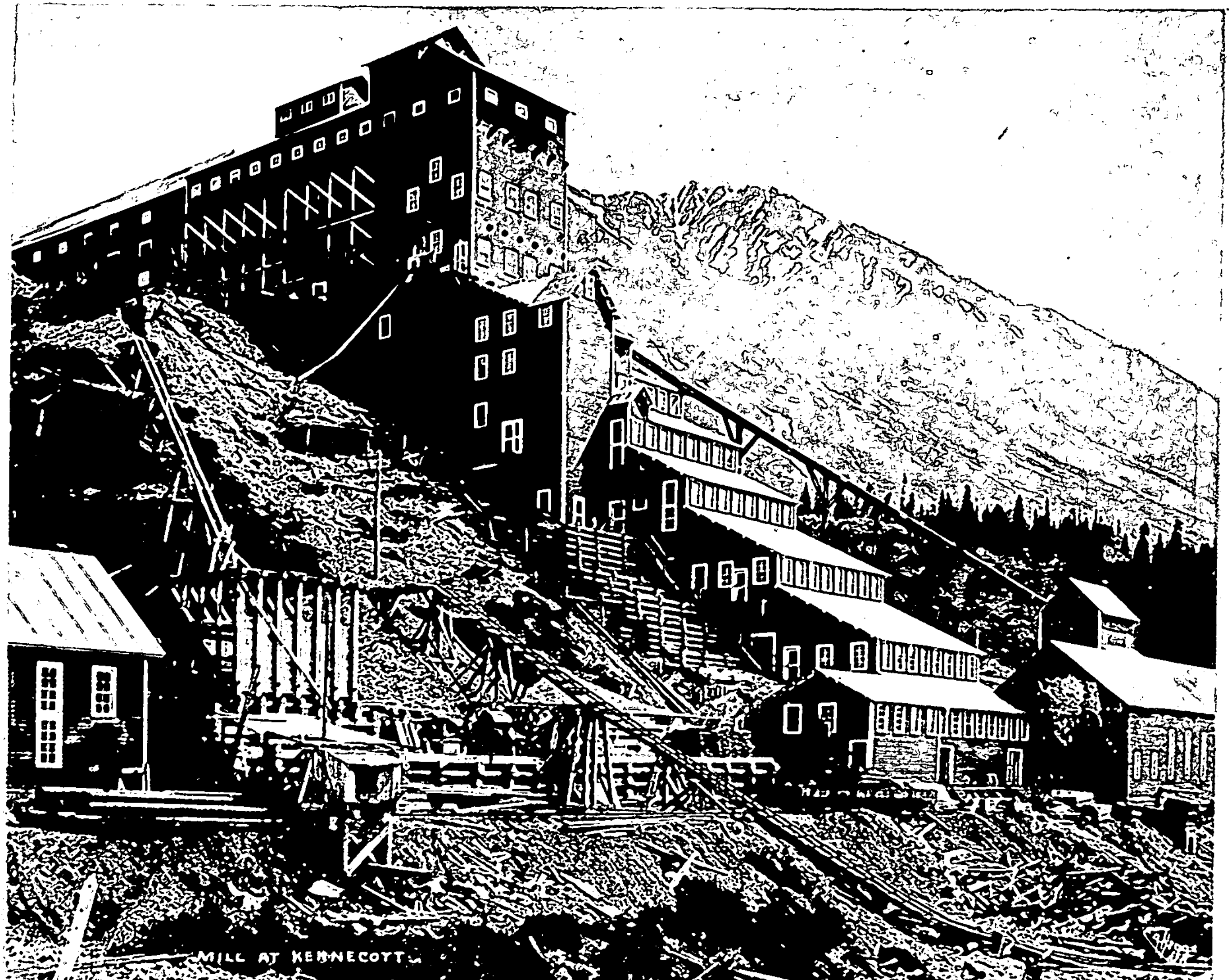
KENNECOTT IN 1910



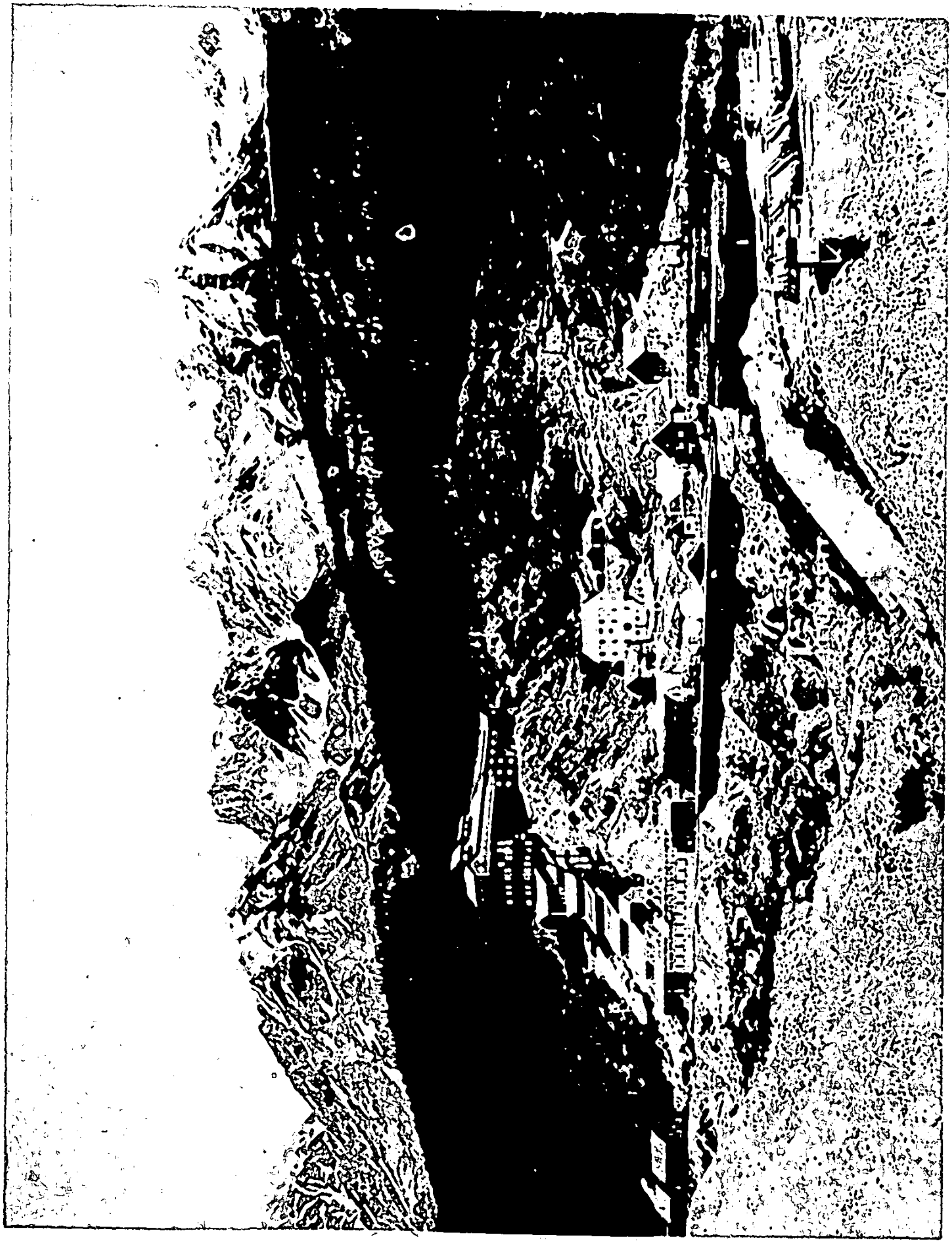
Concentrator of the Bonanza Mine, from Which is Obtained the Richest Copper Ore in Alaska. Photo by Hegg March 29, 1911

KENNECOTT ABOUT 1912





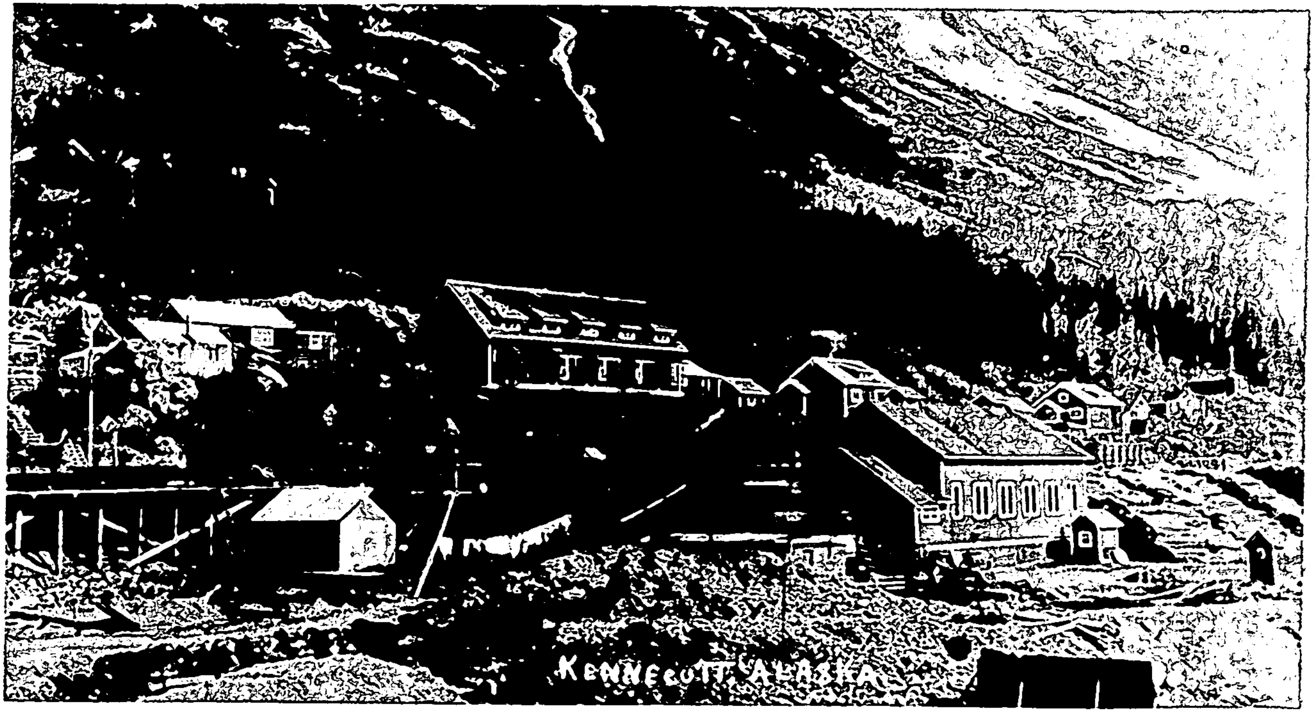
KENNECOTT CONCENTRATOR, 1913-1915

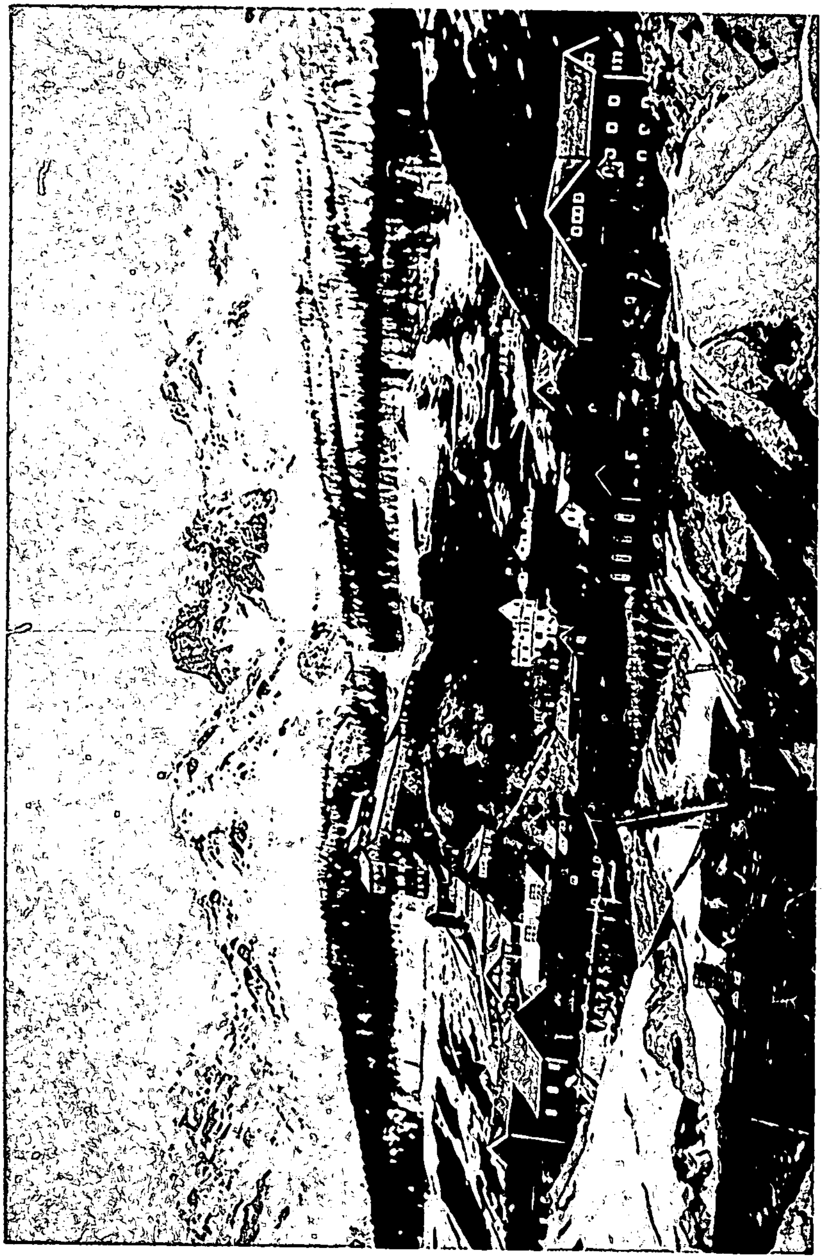


KENNECOTT, 1912-1915
Power Plant, Concentrator, Construction on Leaching Plant
Office, Staff House, Manager's House, Bunkhouse, Sawmill

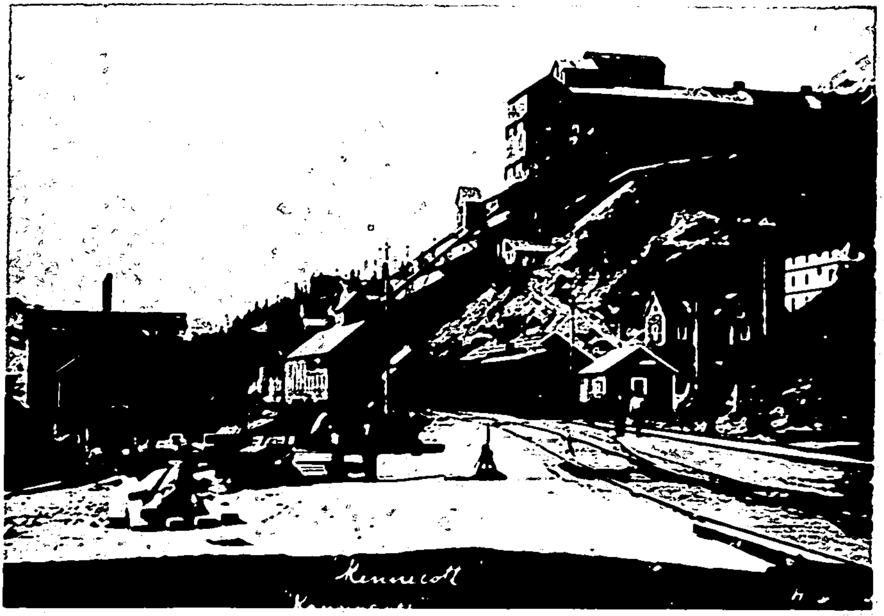
KENNECOTT IN 1915
Leaching Plant Completed

KENNECOTT IN 1916
Apartment House and Cottages





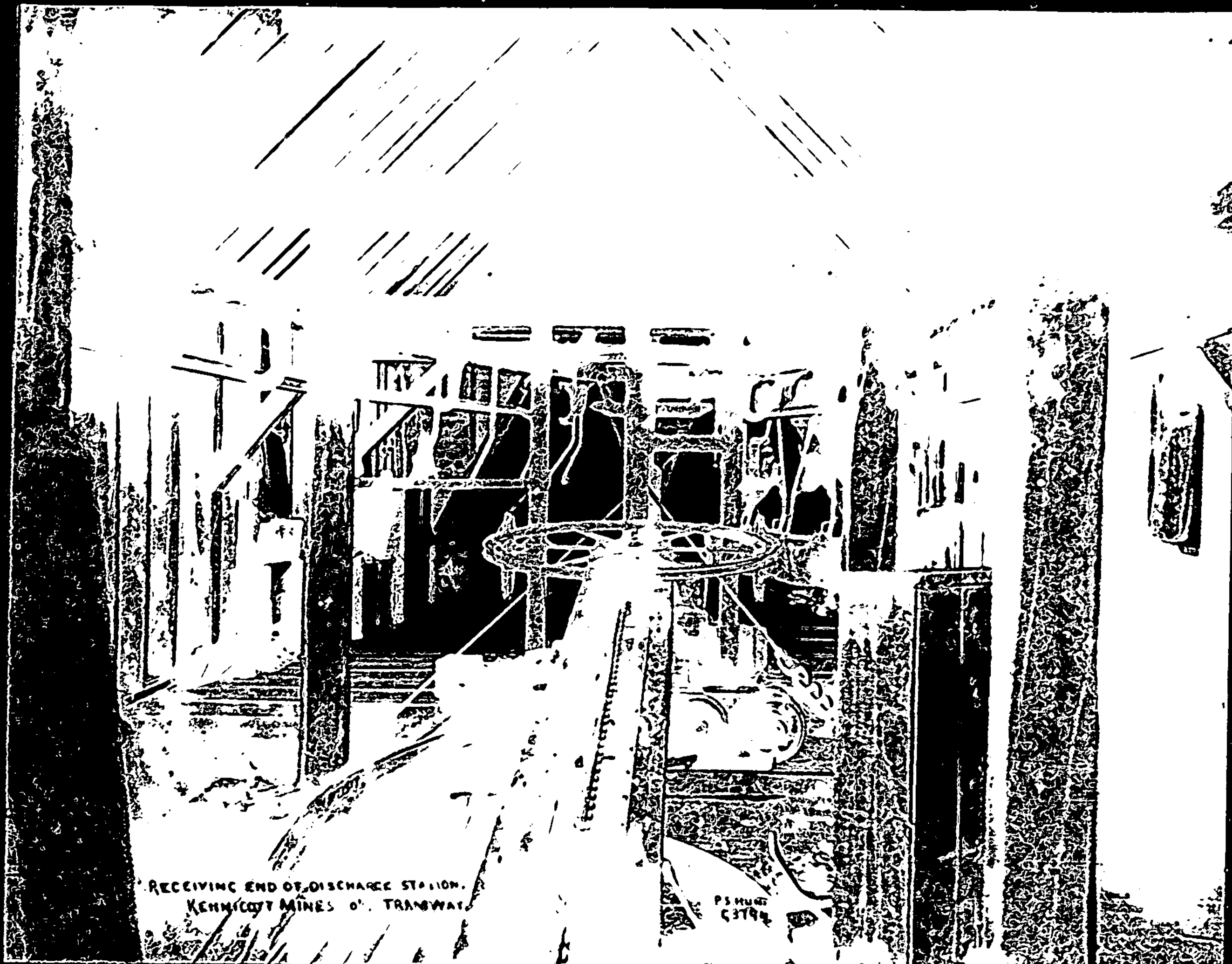
KENNECOTT, 1917-1924
Guest House or Manager's House, Hospital, Store, and Recreation Hall Added



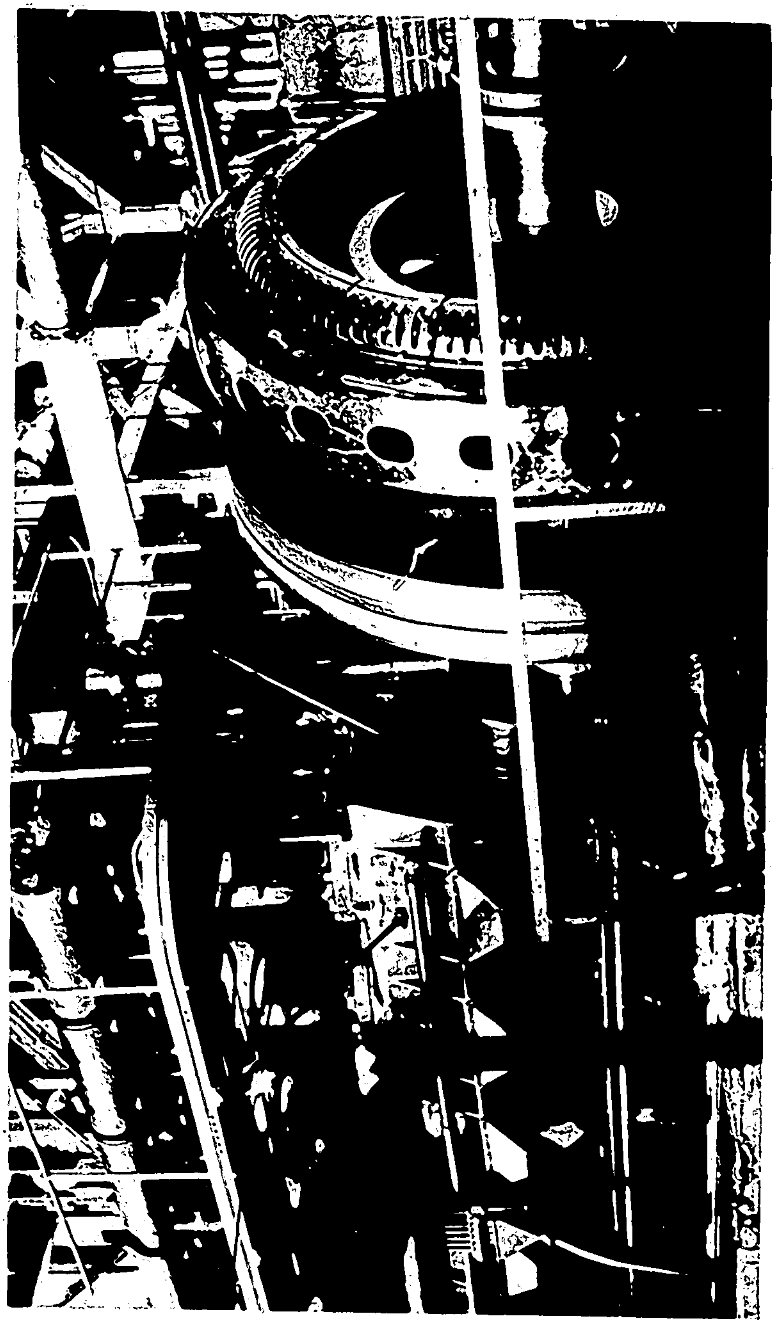
KENNECOTT, 1920-1924

KENNECOTT IN 1925

KENNECOTT IN THE 1930'S
Three of the Missing Buildings: Staff House, Assistant Superintendent's House or the Douglass House, and the Superintendent's House or the Guest House

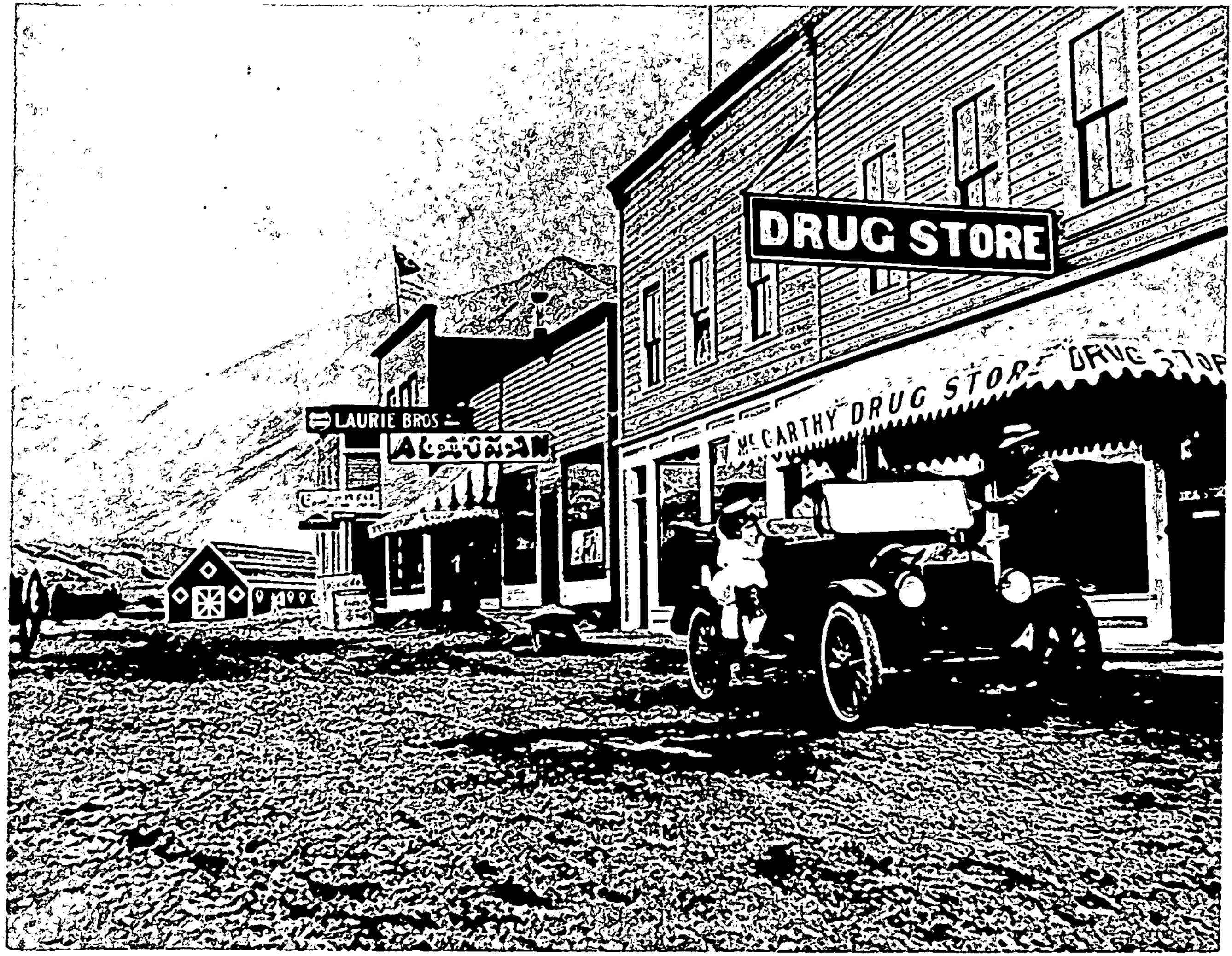


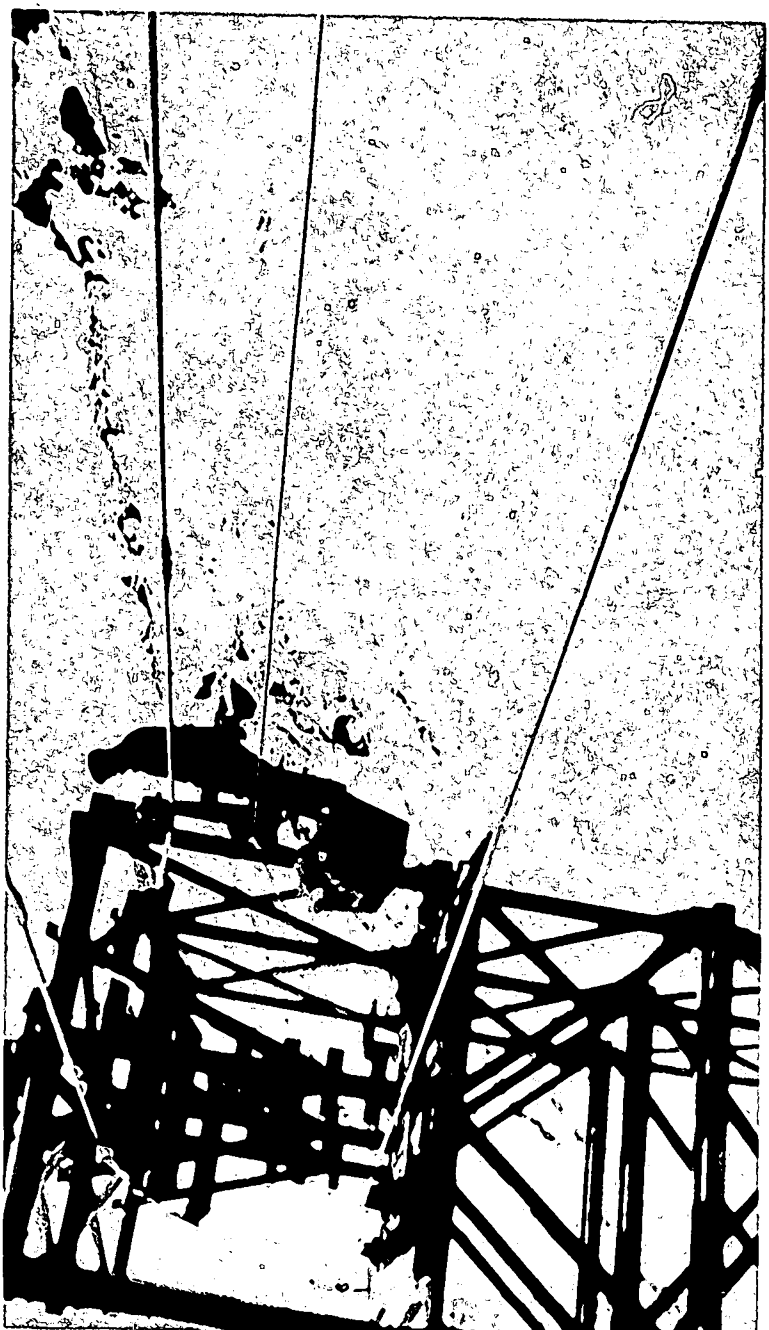
RECEIVING END OF KENNECOTT TRAMWAY



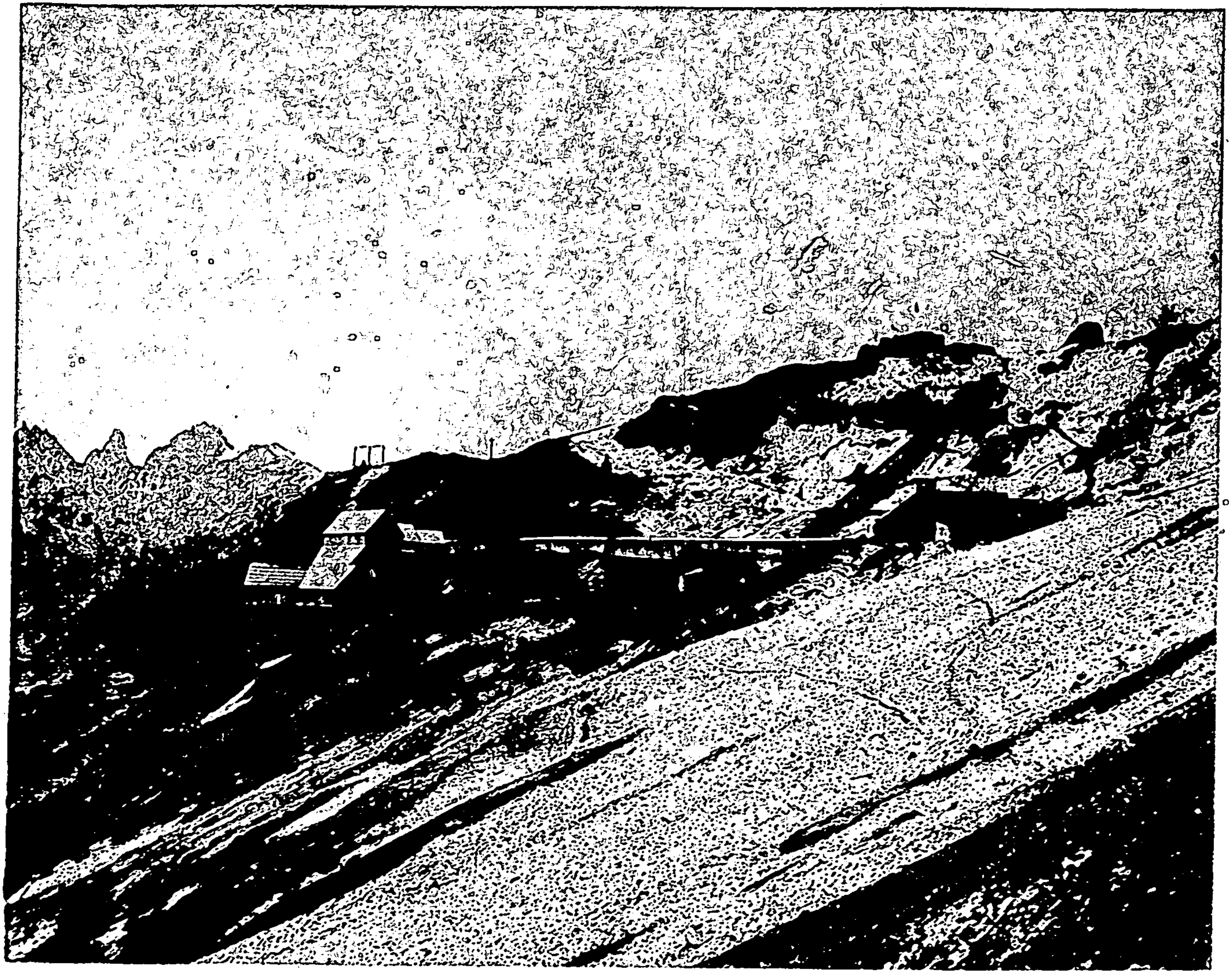
DIESEL ENGINE INSTALLED 1922, REMOVED UPON CLOSURE

MCCARTHY

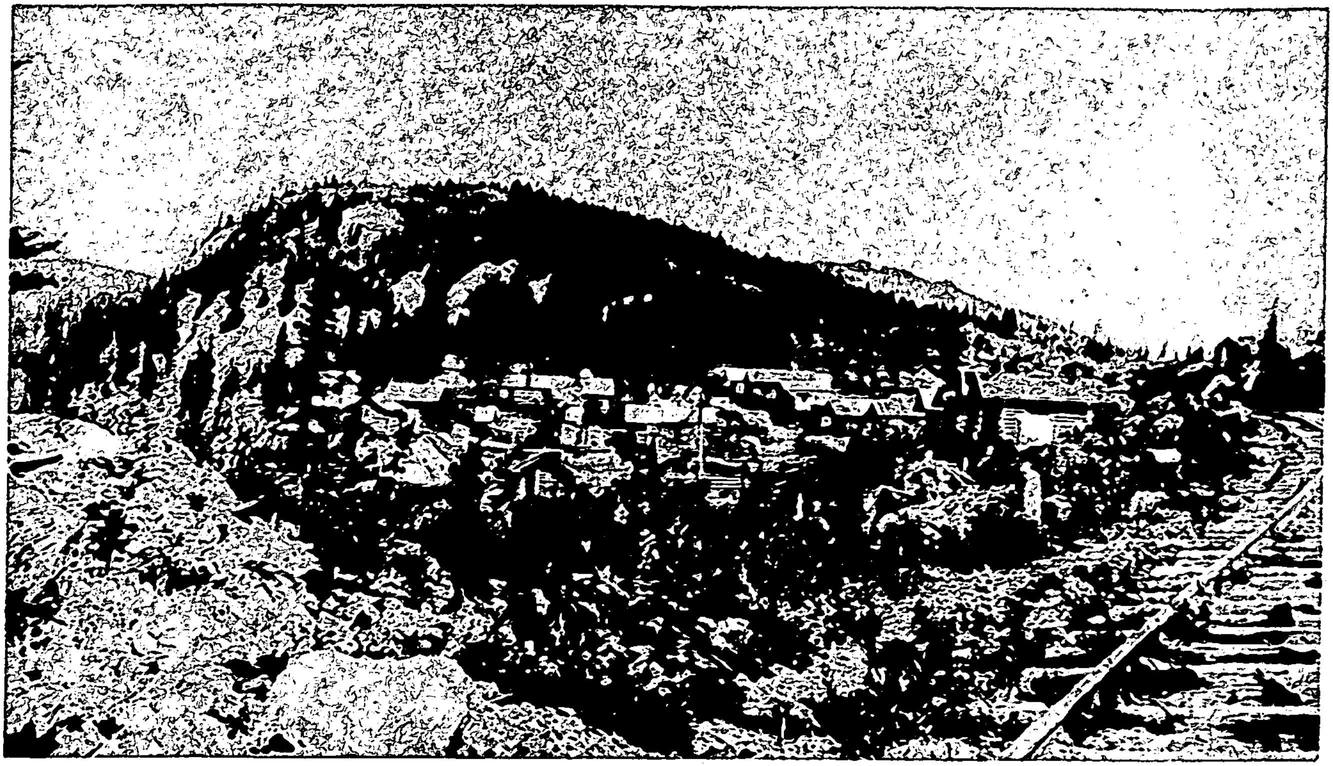




BONANZA TRAM



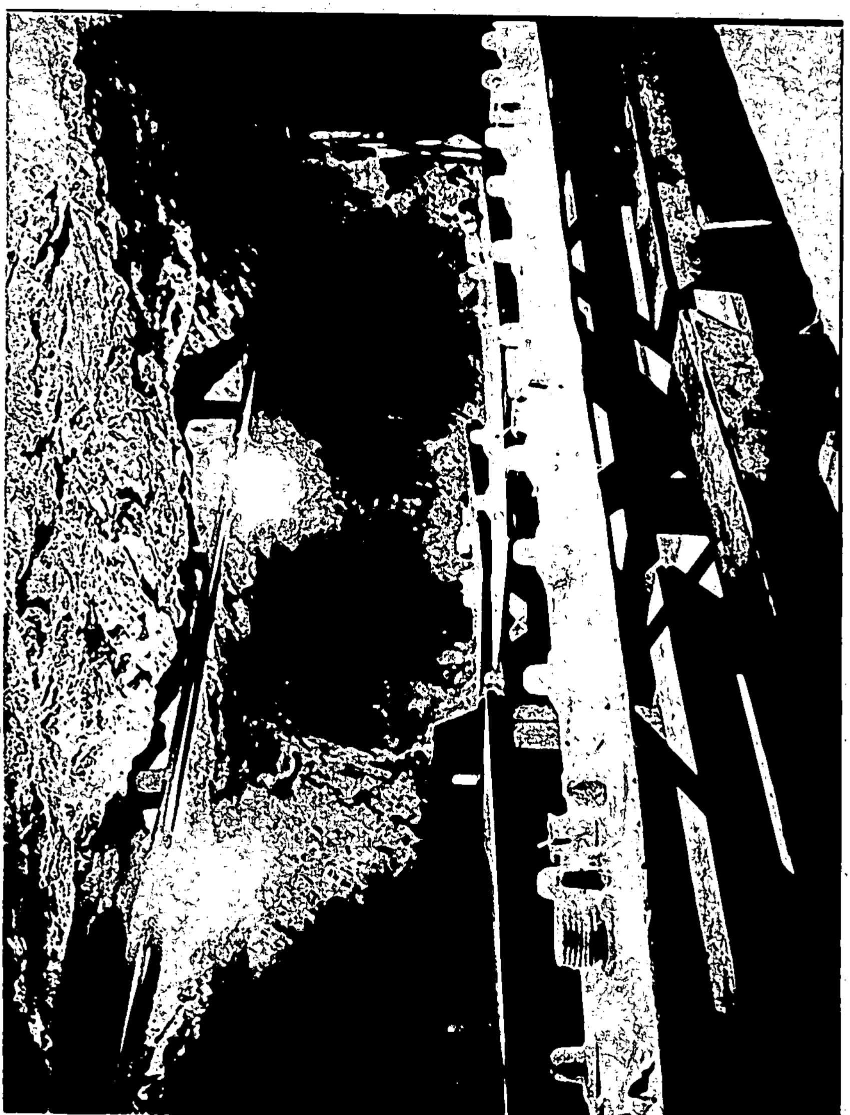
BONANZA MINE



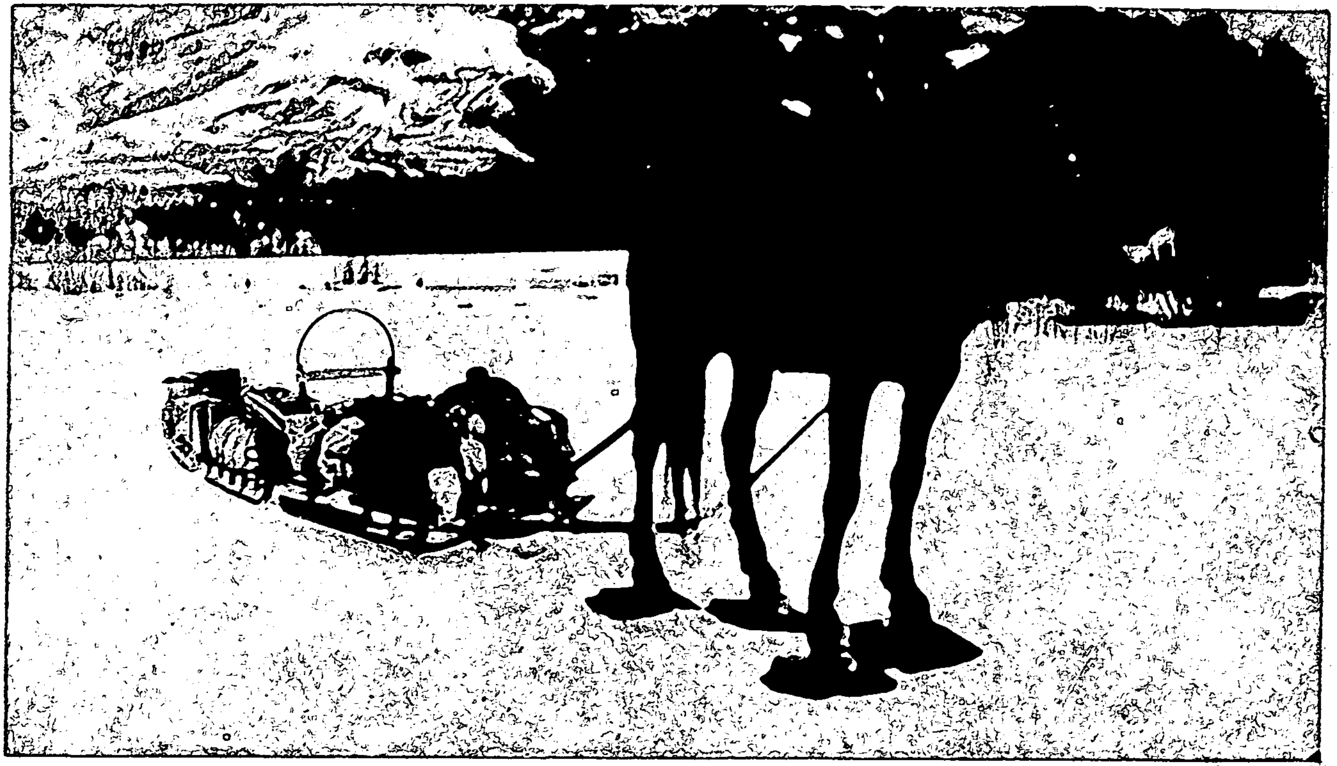
CHITTINA

MOTHER LODE MINE

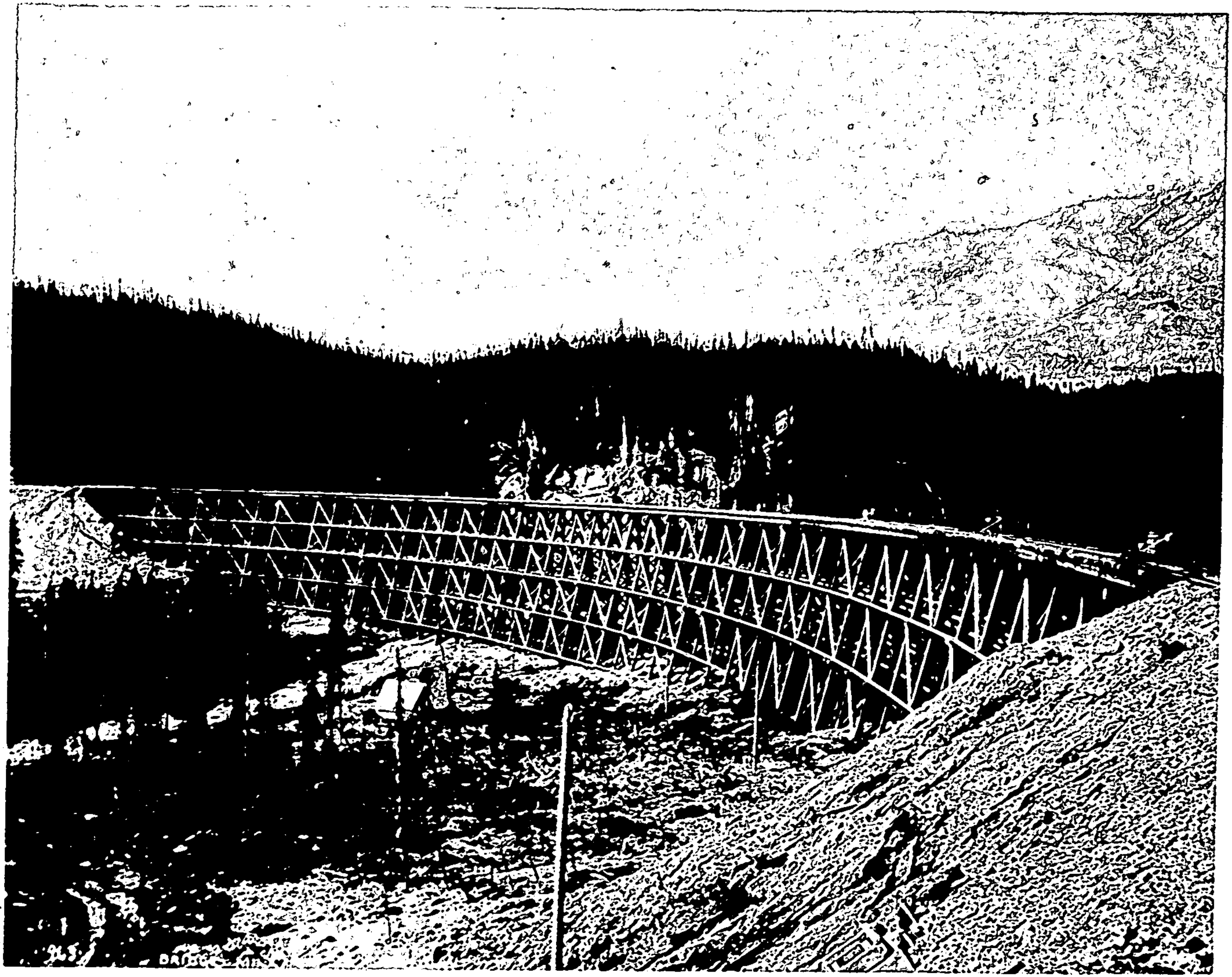
BONANZA MINE



UNDERGROUND MESSHALL



WINTER FREIGHTING OUTFIT



GILHINA TRESTLE, C.R. & N.W.R.R.

KUSKULANA BRIDGE, C.R.& N.W.R.R.