

Open File Report No. 80-1  
PLACER MINING IN ALASKA II

by

E.N. Wolff, M.S. Robinson  
D.J. Cook, B. Thomas  
1980

State of Alaska / DNR  
Division of Geological &  
Geophysical Surveys  
3354 College Road  
Fairbanks, AK 99709-3707  
ADGGS Library

Final Report

PLACER MINING IN ALASKA II

Submitted to

Mining and Mineral Resources Research Institute  
Office of Surface Mining  
U.S. Department of Interior  
Washington, D.C. 20740

Grant No. G5184001

March 1980

By

Ernest N. Wolff  
Mark S. Robinson  
Donald J. Cook  
Bruce Thomas

Mineral Industry Research Laboratory  
School of Mineral Industry  
University of Alaska  
Fairbanks, Alaska 99701

State of Alaska / DNR  
Division of Geological &  
Geophysical Surveys  
3354 College Road  
Fairbanks, AK 99709-3707  
ADGGS Library

# TABLE OF CONTENTS

	Page
PLACER MINING IN ALASKA II . . . . .	3
SELECTED REFERENCES . . . . .	16

## LIST OF FIGURES

Figure 1.	Distribution of gold mining districts in Alaska, their discovery dates and production in ounces . . . . .	4
Figure 2.	Location of Mining Districts visited . . . . .	6
Figure 3.	Washing Plant at Mine No. 1 . . . . .	7
Figure 4.	General Layout for Mine No. 1 . . . . .	7
Figure 5.	Washing Gravel at Mine No. 1 . . . . .	8
Figure 6.	Return Water Reservoir at Mine No. 1 . . . . .	8
Figure 7.	Washing Plant at Mine No. 2 . . . . .	9
Figure 8.	General Layout at Mine No. 2 . . . . .	9
Figure 9.	General View at Mine No. 2 . . . . .	10
Figure 10.	Washing Plant at Mine No. 2 . . . . .	10
Figure 11.	General Layout at Mine No. 3 . . . . .	11
Figure 12.	Washing Plant at Mine No. 3 . . . . .	11
Figure 13.	Grizzly-shaking Screen Plant at Mine No. 3 . . . . .	12
Figure 14.	Sluice Box at Mine No. 3 . . . . .	12
Figure 15.	General Layout at Mine No. 4 . . . . .	13
Figure 16.	Washing Plant at Mine No. 4 . . . . .	14
Figure 17.	Scraper Moving Gravel to Hopper, Mine No. 4 . . . . .	14
Figure 18.	Oscillating Sluice at Mine No. 4 . . . . .	15

## PLACER MINING IN ALASKA II

Placer mining has played a key role in the economic development of Alaska, and hence in the settlement and spread of population. Figure 1 shows the distribution of gold districts, their discovery dates and production in ounces. Although a few of these districts, or camps, are noted chiefly for the production of lode gold, all lode districts have produced at least some placer gold. The widespread distribution indicates the importance of gold mining to Alaska's development.

The government agencies and institutions, and private individuals and organizations that are concerned with mineral production have recognized this and have from time to time published descriptions of placer mining, all of which are applicable to Alaska (see Selected References).

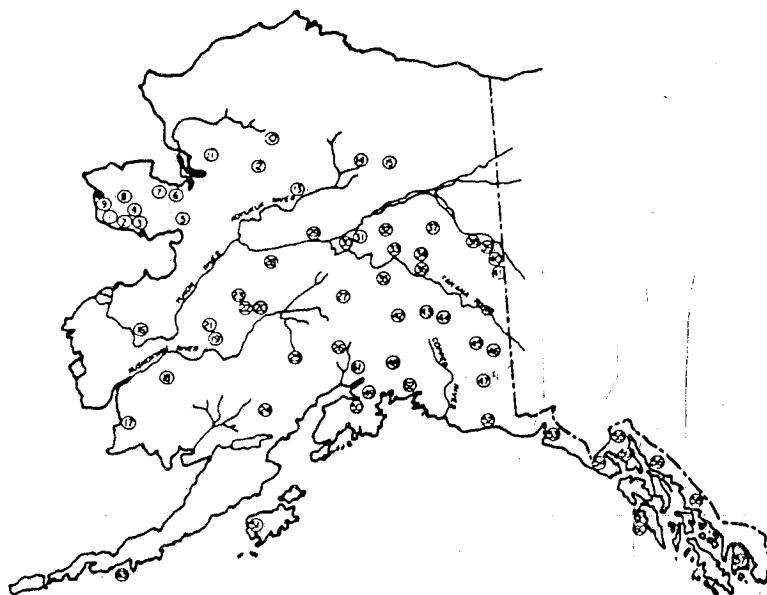
Two early works on Alaska placer mining stand out. U.S. Geological Survey Bulletin 263 by C.W. Purington, Methods and Costs of Placer and Gravel Mining in Alaska, was published in 1905 and contains comprehensive and detailed descriptions of placer mining as practiced during the early gold rushes. U.S. Bureau of Mines Bull. 259, by Norman L. Wimmeler, Placer Mining Methods and Costs in Alaska, was published in 1927. This too, brought up to date the state of the art of placer mining in Alaska.

In the mid 1950's, the then School of Mines of the University of Alaska, conducted another survey of post WWII Alaska placer mining. The results were published in U.S. Bureau of Mines Information Circular 7926 by Thomas, Cook, Wolff and Kerns. This work, entitled; Methods and Costs of Operations using Hydraulic and Mechanical Excavation Equipment with Non-Floating Washing Plants, was published in 1959.

Gold mining even at that time was in a long period of economic stagnation, and there was little interest in placer mining research for another fifteen years.

With the end of government control of the gold price, the price began to move up until in real terms it is very favorable. It is obvious that gold is desired very highly and that it should be produced. Interest in placer mining has revived, and the time has again come when the state of the art should be described, perhaps as a prelude to active research and development.

During July, August and September, 1979, a team from the Mineral Industry Research Laboratory visited a number of placer mining districts that could be reached by automobile, hence at a reasonable cost for transportation. These districts yielded varying amounts of information that will be of value to the industry. The districts visited were: 1. Fairbanks, 2. Circle (Birch Creek), 3. Livengood (Tolovana), 4. Manley Hot Springs, 5.



No.	Camp*	Gold Production (ounces)	Discovery Date	No.	Camp*	Gold Production (ounces)	Discovery Date
1.	Nome	3,606,000	1898	29.	Gold Hill	1,200	1907
2.	Solomon	251,000	1899	30.	Hot Springs	447,900	1898
3.	Bluff	90,200	1899	31.	Rampart	86,800	1882
4.	Council	588,000	1898	32.	Tolovana	375,000	1914
5.	Koyuk	52,000	1915	33.	Fairbanks	7,464,200	1902
6.	Fairhaven (Candle)	179,000	1901	34.	Chena (included in Fairbanks Production)		
7.	Fairhaven (Innchuck)	277,000	1900	35.	Bonfield	45,000	1903
8.	Kougarok	150,400	1900	36.	Richardson	95,000	1905
9.	Port Clarence	28,000	1898	37.	Circle	730,000	1893
10.	Nome	9,000	1898	38.	Woodchopper—Coal Creek (included in Circle production)		
11.	Kobuk (Squirrel River)	7,000	1909	39.	Seventymile (included in Fortymile production)		
12.	Kobuk (Shungnak)	15,000	1898	40.	Eagle	40,200	1895
13.	Koyukuk (Hughes)	201,000	1910	41.	Fortymile	400,000	1886
14.	Noyukuk (No'an)	290,000	1893	42.	Valdez Creek	37,000	1903
15.	Chandalar	30,700	1905	43.	Delta	2,500	
16.	Marshall (Anvik)	120,000	1913	44.	Chisochina-Chisna	141,000	1898
17.	Goodnews Bay	29,700	1900	45.	Nabesna	63,300	1899
18.	Kuskokwim (Aniak)	230,600	1901	46.	Chisana	44,800	1910
19.	Kuskokwim (Georgetown)	14,500	1909	47.	Nizina	143,500	1901
20.	Kuskokwim (McKinley)	173,500	1910	48.	Nelchina	2,900	1912
21.	Iditarod	1,320,000	1908	49.	Girdwood	125,000	1895
22.	Innoko	350,000	1906	50.	Hope (included in Girdwood production)		1888
23.	Tolstoi	87,200		51.	Kodiak	4,800	1895
24.	Diamna (Lake Clark)	1,500	1902	52.	Yakutat	15,700	1898
25.	Skwentza (included in Yenena production)			53.	Yakutat	2,500	1880
26.	Yenena (Cache Creek)	115,200	1905	54.	Lutaya Bay	1,700	1894
27.	Kanishina	55,000	1903	55.	Porcupine	61,000	1898
28.	Ruby	389,100	1907	56.	Juneau (Gold Belt)	7,107,000	1880
				57.	Ketchikan Flyder	62,000	1898
				58.	Sumdum	15,000	1869
				59.	Glacier Bay	11,000	
				60.	Chichagof	770,000	1871
				61.	Willow Creek	652,000	1897
				62.	Prince William Sound	137,900	1894
				63.	Unga Island	108,900	1891

(Data compiled from U.S. Geological Survey publications, U.S. Bureau of Mines records, Alaska Division of Geological and Geophysical Surveys records and publications, Mineral Industry Research Laboratory research projects and other sources.)

\*Camp names are those that appear in official recording district records. Many are also known by other names, some of which are shown in brackets.

Figure 1. Distribution of gold mining districts in Alaska, their discovery dates and production in ounces

Fortymile, 6. Klondike, 7. Kantishna, 8. Yentna. The locations of these mining districts are shown in Figure 2. This field work was funded through the Mining and Mineral Resources Research Institute at the University of Alaska, and it is the purpose of this report to describe the first phase of this project.

Before beginning a visit to a district, an attempt was made to contact at least one miner, or road house keeper or anyone else who could tell miners that the team was coming. On the previous study of this kind, during the 1950's, a questionnaire was used, but during this one, no fixed format was followed. A mining student was attached to the party and it was his duty to make sketches and take notes while the other members were talking to the operator. The results of field work were thus embodied in notes, sketches, and photographs. A number of recent meetings and conferences have been devoted to placer mining, reflecting the renewed interest. It was apparent from these that the most important advances and the greatest interest deal with recovery systems. Hence field work concentrated on these.

The publication which will come out of the field work will describe operations categorized by the methods used to move the gravel and secondly by the type of washing plant. Hence there will be sections on bulldozer, dragline, loader, hydraulic, and ground-slucice mines, among others. Dredging, as was the case in the 1959 publication, will not be described. Complete and detailed descriptions will be made of the various kinds of washing plants, screens, riffles and other components.

In the various districts visited, it was evident that one operator would put into practice a new idea, and that idea would be quickly copied. For example, in the Circle district, sloping grizzlies to remove boulders are popular. In the Fortymile district, steep gradients are used, and shaking screens are evident.

With this report are included a number of typical photographs and sketches. Figures 3 and 4 show the washing plant and cut layout for a mine using a front end loader and small giant to feed the boxes (Mine No. 1). Tailing disposal is no problem at this mine. Figures 5 and 6 show two photographic views of this operation. Figures 7 and 8 show the plant and general layout for a mine using a bulldozer to feed the boxes and a dragline to stack tailings. Figures 9 and 10 show two photographic views of this mine. Figures 11 and 12 show a mine using a shaker screen to size the material going to the sluice, and Figures 13 and 14 again show two views. Figure 15 is a sketch of a mine where gravel is moved to a central hopper by scraper, then conveyed to shaker screen by belt feeder. The sized material is then fed to several oscillating sluice boxes. Figures 16, 17, and 18 show three views of this plant.

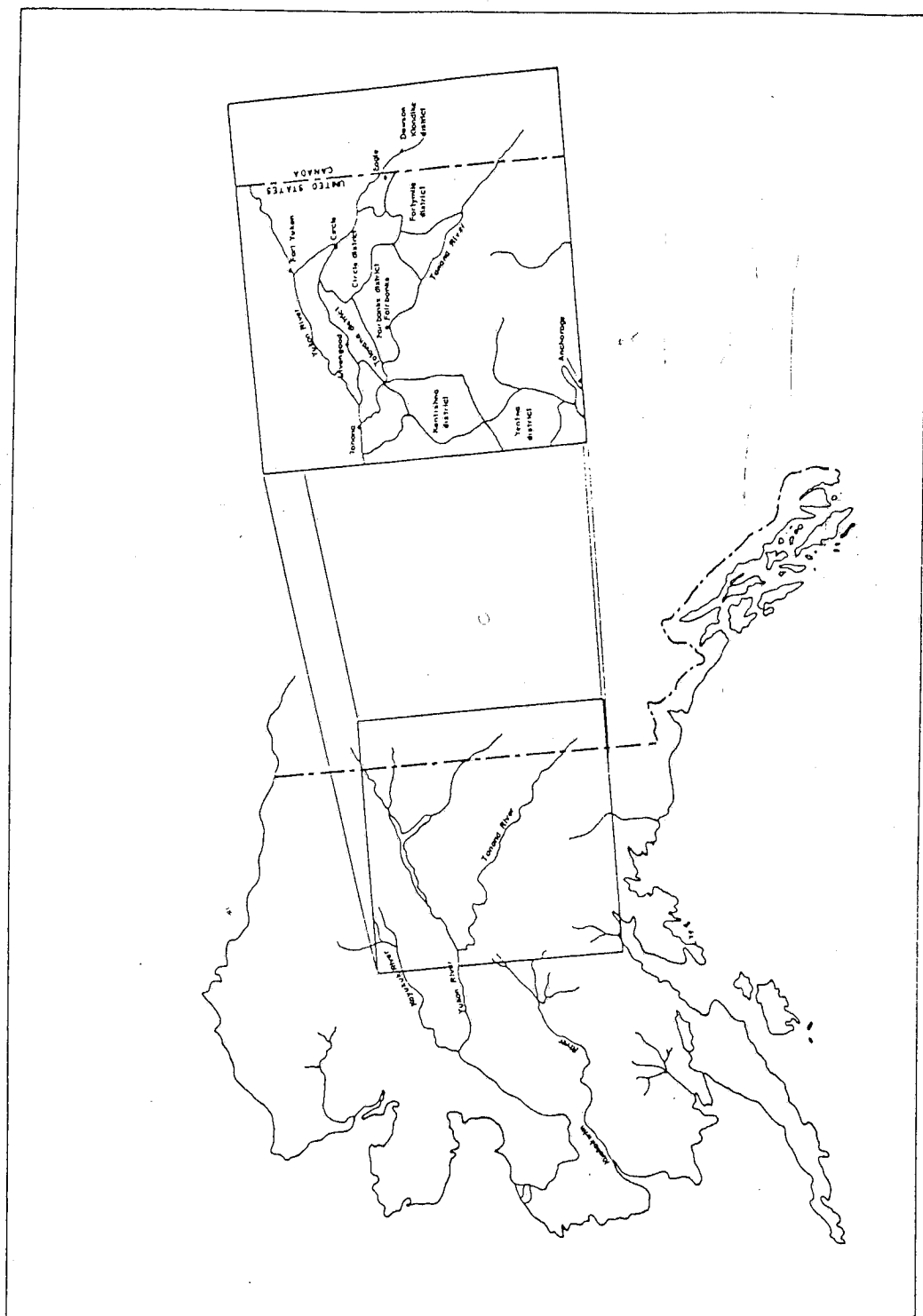


Figure 2. Location of Mining Districts visited

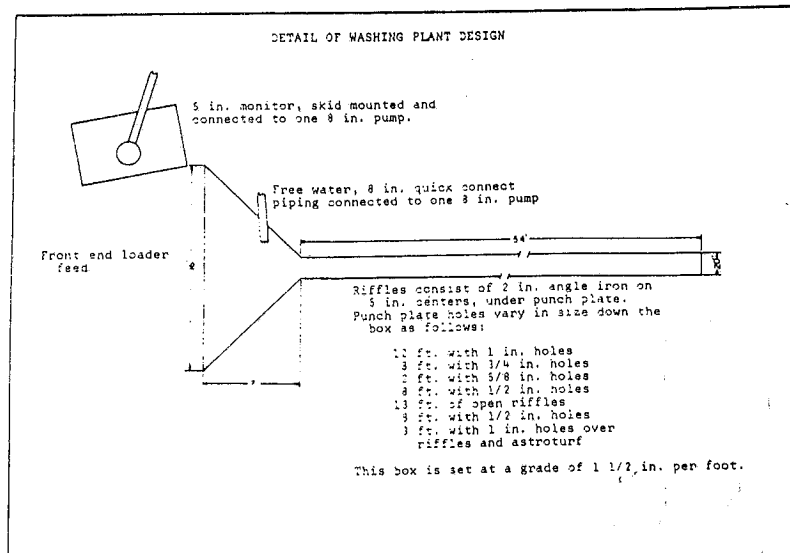


Figure 3. Washing Plant at Mine No. 1

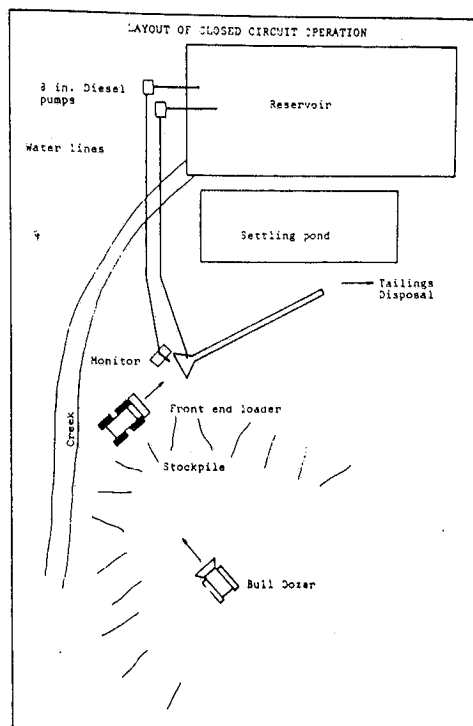


Figure 4. General Layout for Mine No. 1





Figure 5. Washing Gravel at Mine No. 1



Figure 6. Return Water Reservoir at Mine No. 1

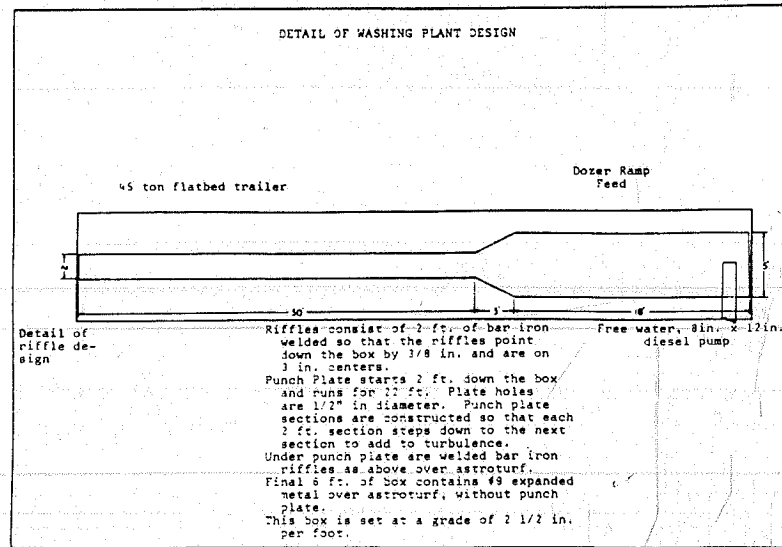


Figure 7. Washing Plant at Mine No. 2

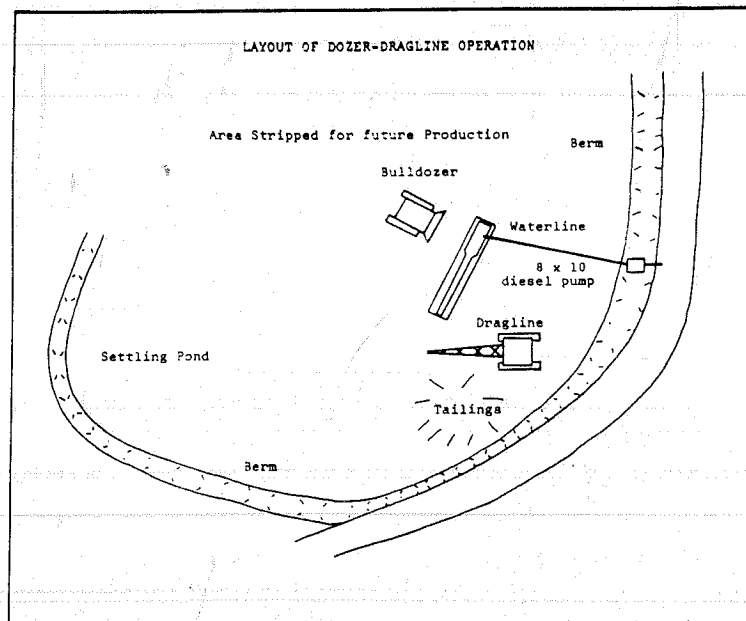


Figure 8. General Layout at Mine No. 2

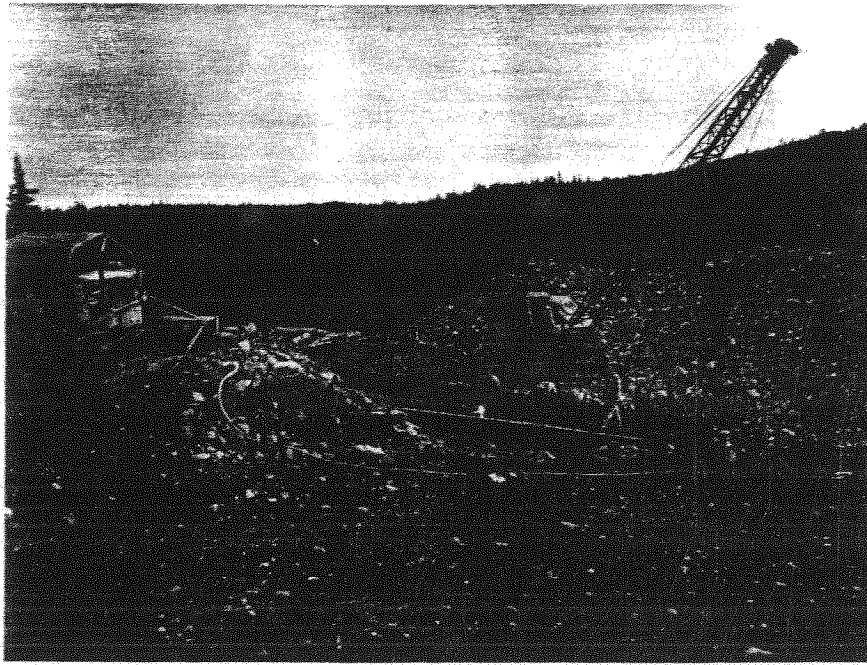


Figure 9. General View at Mine No. 2



Figure 10. Washing Plant at Mine No. 2

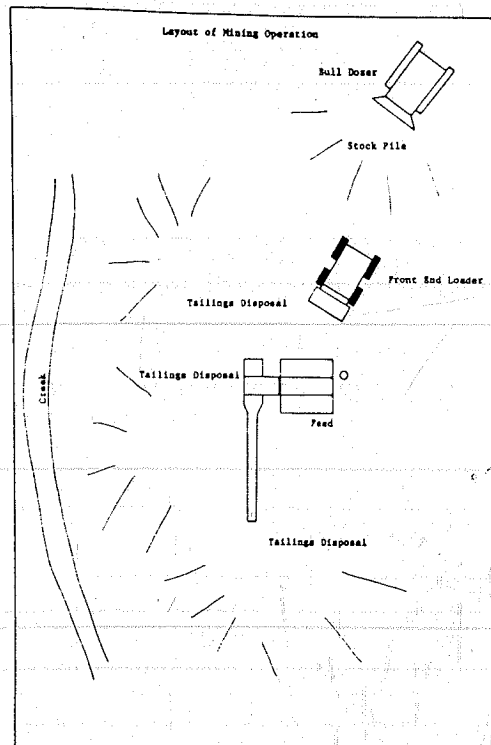


Figure 11. General Layout at Mine No. 3

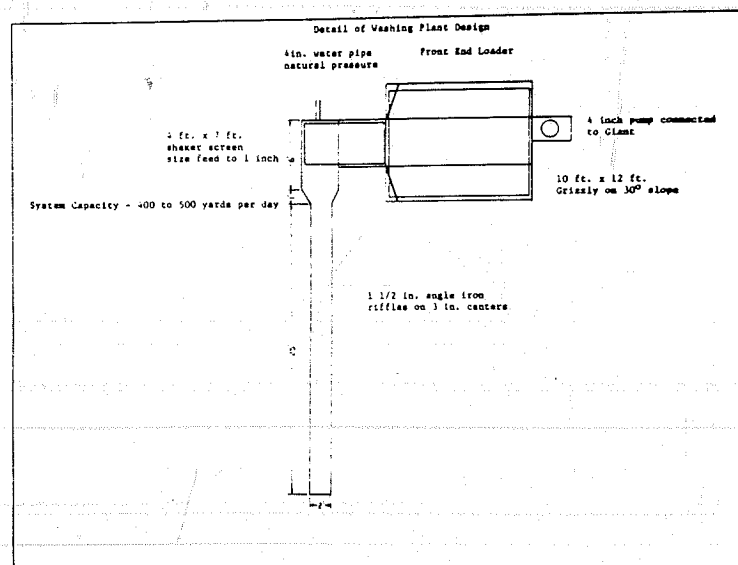


Figure 12. Washing Plant at Mine No. 3

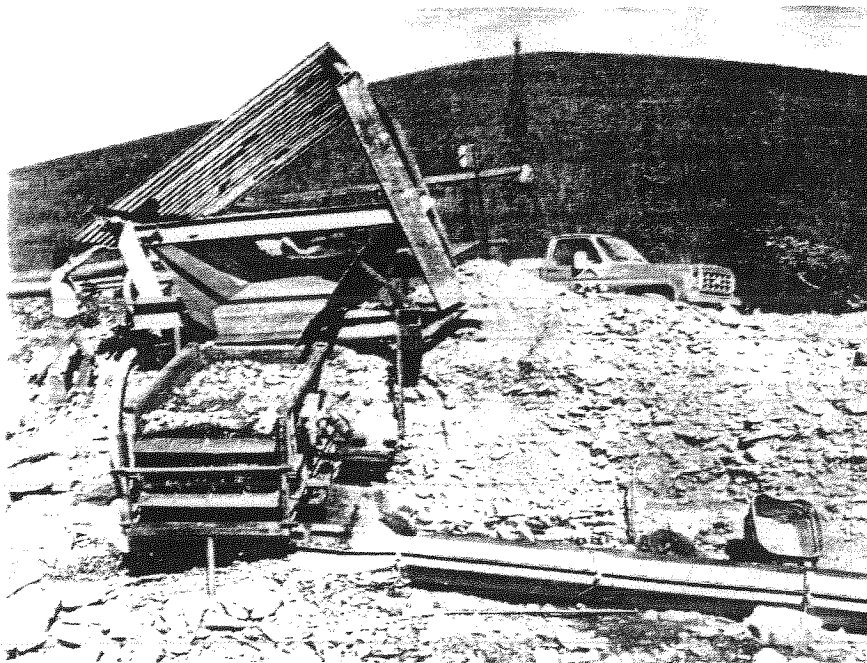


Figure 13. Grizzly-shaking Screen Plant at Mine No. 3



Figure 14. Sluice Box at Mine No. 3

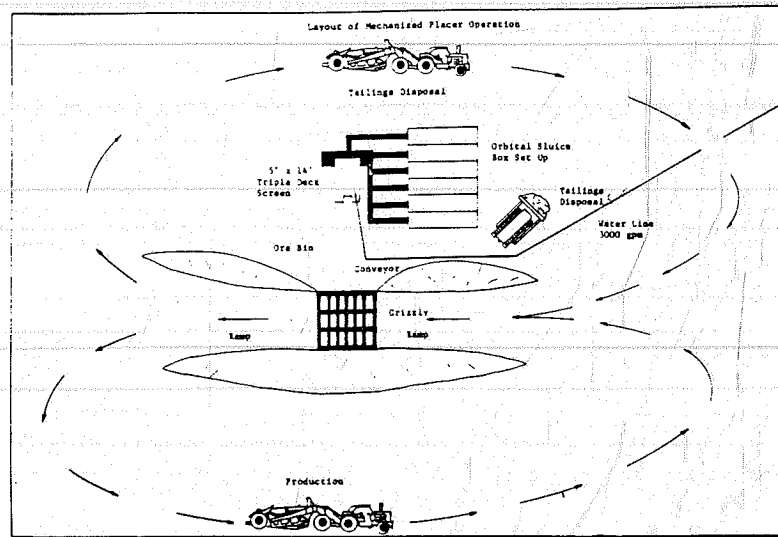


Figure 15. General Layout at Mine No. 4



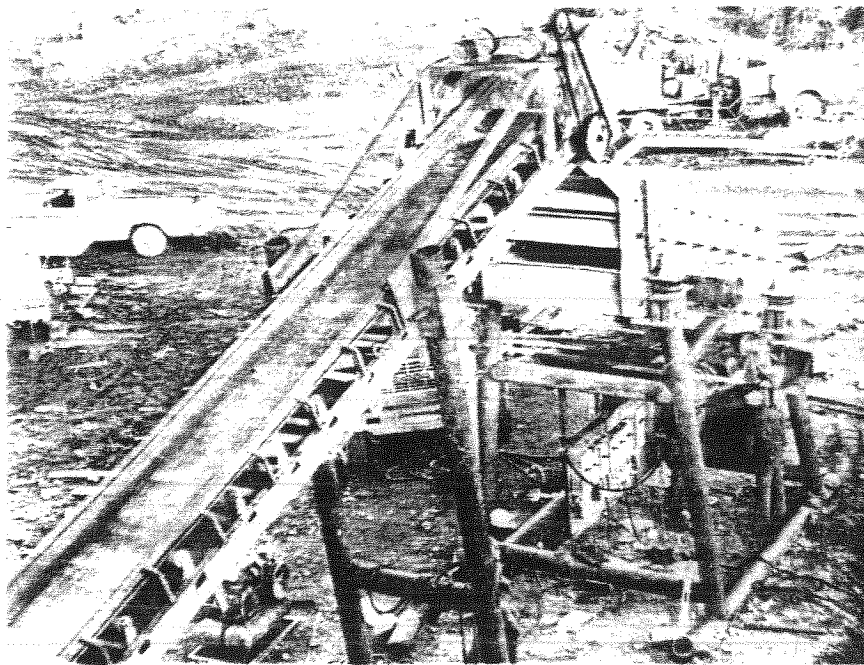


Figure 16. Washing Plant at Mine No. 4

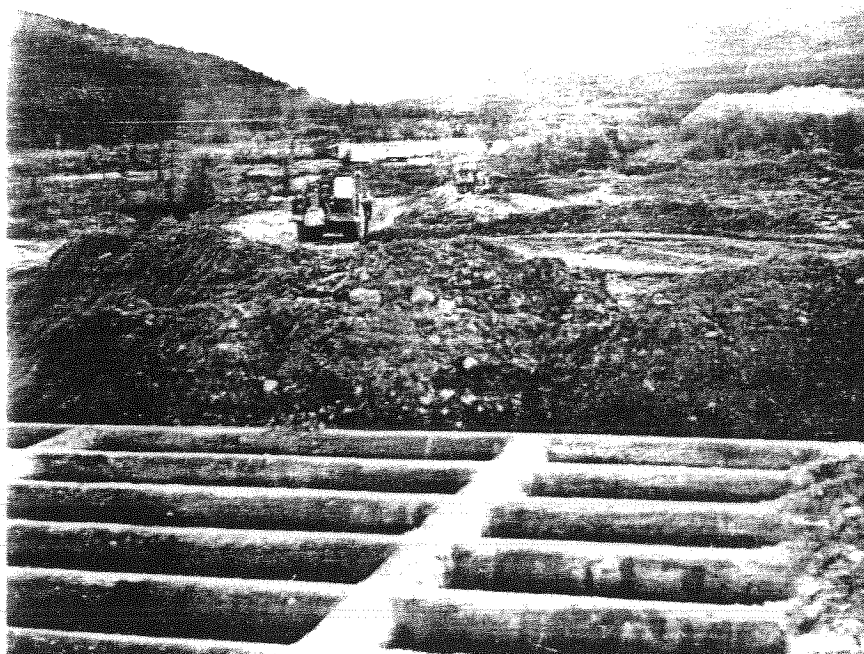


Figure 17. Scraper Moving Gravel to Hopper, Mine No. 4

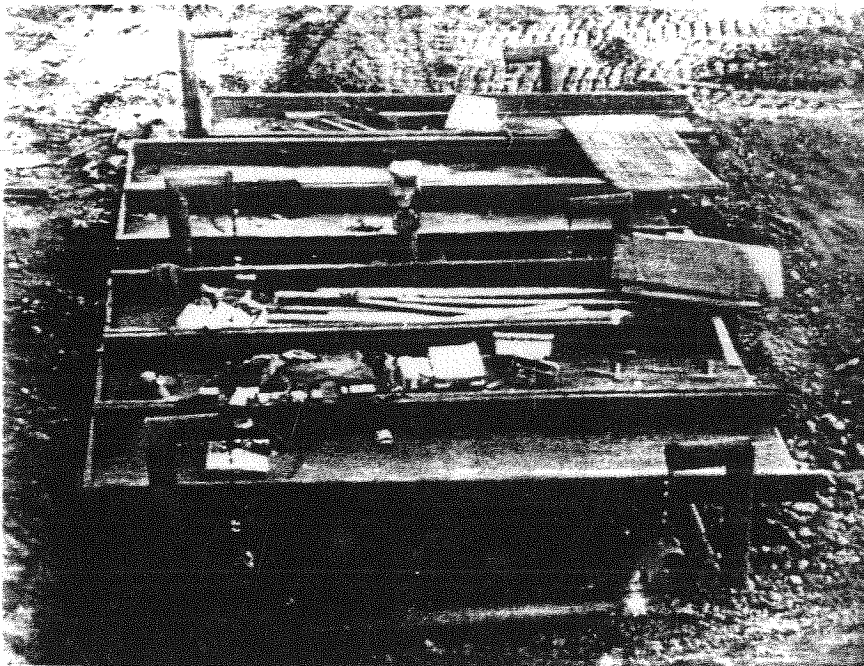


Figure 18. Oscillating Sluice at Mine No. 4



## SELECTED REFERENCES

- Adams, John, Zimpter, G.L., and McLane, C.F., 1978, Basin dynamics, channel processes and placer formation: A Model Study: Economic Geology, vol. 73, p. 418-426.
- Akhmenov, M.Z., Krasovskii, I.U.P., and Shabokhin, A.D., 1974, Placers of the far north: Bezopasnost' truda v promyshlennosti, April, 1975 - No. 4., p. 18-20.
- Anonymous, January, 1936, Gold Mines of Placer County, including Drag Line Dredges: Chapter, Jan., of Report XXXII, 1936 "California Journal of Mines and Geology".
- Anonymous, 1973, Manual for placer mining: Monograph, Moscow, Nedra, 1973, 590 p.
- Baldock, J.W., Hepworth, J.V., and Marengwa, B.S., 1976, Gold, base metals and diamonds in Botswana: Economic Geology, vol. 71, No. 1, p. 139-156.
- Bateman, A.M., 1942 and 1950, Economic mineral deposits: John Wiley and Sons, Inc., New York.
- Bilibin, Y.A., 1938, Principles of placer geology: GONTI-, Moscow-Leningrad, 505 p.
- Blatt, H., Middleton, G., and Murray, R., 1972, Origin of sedimentary rocks: Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
- Boericke, Wm.F., 1936, Prospecting and operating small gold placers, 2nd. ed., John Wiley and Sons' Inc., N.Y., 1936, 144 p.
- Bouery, P., 1913, Study of riffles for hydraulicking: Eng. and Min. Jour., May 24, 1913, p. 1055-1060.
- Bowie, A.J. Jr., 1885, A practical Treatise on hydraulic mining in California, 1885, p. 135.
- Bowie, A.J., 1889, A practical treatise on hydraulic mining in California, D. Van Nostrand Company, New York, p. 143.
- Bradley, Walter W., April 1932, Elementary placer mining methods and gold saving devices. The pan, rocker, and sluice box. Prospecting for vein deposits. Bibliography of Placer Mining; in Report XXVIII of the State Mineralogist, "Mining in California".

- Brady, L.L. and Jobson, H.E., 1973, An experimental study of heavy mineral segregation under alluvial flow conditions: U.S. Geol. Survey Prof. Paper 562-K, 30 p.
- Brigham, H.A., 1908, Examining and fitting up a hydraulic mine: Eng. and Min. Jour., Dec. 26, 1908, p. 1257-1260; Jan 2, 1909, p. 23-29.
- Brooks, A.H., 1913, Placer Mining on Seward Peninsula, methods and costs: U.S. Geol. Survey Water Supply Paper 314, 1913, p. 269-303.
- Brooks, A.H., 1914, Formation and classification of placers: U.S. Geol. Survey Bull. 592, 1914, p. 27.
- Brown, C.J., 1876, Hydraulic gold mining: Min. and Sci. Press, vol. 31, 1875, p. 50, 114, 161, 178, 313, 316; vol. 32, 1876, p. 50, 89, 121.
- Bundtzen T.K. and Reger, R.D., 1977, The Richardson lineament - A structural control for gold deposits in the Richardson mining district, interior Alaska; in Short Notes on Alaskan Geology: AK. Div. of Geol. and Geophys. Surveys, Geologic Report 55, p. 29-35.
- Cheney, E.S. and Patton, T.C., 1967, Origin of the bedrock values of placer deposits: Economic Geol. vol. 62, p. 852-863.
- Cobb, E.H., 1973, Placer deposits of Alaska: U.S. Geol. Survey Bull. 1374, 200 p.
- Cockfield, W.E., 1932, The geology of placer deposits: Trans. Canadian Inst. Mining, Met., vol. 35, p. 53-64.
- Collins, G.A., 1936, Washing gravels underground at Lucky John: Engineering and Mining Journal, Oct., 1936.
- Collins, Glenville A., Dragline dredging; its application to the fine gold placers of the Caribou: Min. World, February, 1945, p. 25-37.
- Cooper, M., 1971, Selected annotated bibliography on the geochemistry of gold: U.S. Geol. Survey Bull. 1337, 63 p.
- Crampton, F.A., 1937, Occurrence of gold in stream placers: Mining Journal, vol. 20, p. 3-4, 33-34.

Cranston, R.E., Mechanical features of the California gold dredge: Min. and Sci. Press., vol. 104, 1912, p. 303-307, 338-342, 372-375.

Cranston, R.E., 1915, Gold dredging in 1914: Eng. and Min. Jour., vol. 99, January 9, 1915, p. 100.

Cruickshank, M.J., 1974, Mineral resources potential of continental margins; in Burk, C.A., and Drake, C.C., 1974, The Geology of Continental Margins: Springer Verlag, New York, p. 965-1000.

Daily, A., 1962, Valuation of large, gold-bearing placers: Eng. and Min. Jour., vol. 163, No. 7, p. 30-38.

Davis, E.G. and Sullivan, G.V., 1971, Recovery of heavy minerals from sand and gravel operations in the southeastern U.S.: U.S. Bureau of Mines Rept. Invest. 7517, 25 p.

De Groot, Henry, 1882, Hydraulic and drift mining: California State Mineralogists' Rept. II, 1882 p. 133-190.

Dennis, F.J., 1922, Modern methods of gravel excavation; steam shovel and dragline excavators: Min. and Sci. Press, August 3, 1922, p. 136-140.

Doheny, L.C., 1941 and 1942, Placer valuation in Alaska: Eng. and Min. Jour., December, 1941 and January, 1942.

Duling, John F., 1935, Geophysics as an aid in gold placer drift mining: Min. Jour. (Ariz), vol. 13, March 30, 1935, p. 5-6.

Dury, G.H., 1964, Principles of underfit streams: U.S. Geol. Survey Prof. Paper, 452-A, 67 p.

Eddy, L.H., Bagley scraper for gravel mining in Alaska: Eng. and Min. Jour., Aug. 14, 1915, p. 257.

Ellis, H.I., 1915, Hydraulic mining at Circle: Eng. and Min. Jour., December 19, 1914, p. 1104; December 11, 1915, p. 962.

Ellis, H.I., 1915, Sluicing methods at Fairbanks: Eng. and Min. Jour., December 18, 1915, p. 993.

Ellis, H.I., 1915, Prospecting methods at Fairbanks: Eng. and Min. Jour., June 12, 1915, p. 1023.

- Emelianov, V.I., 1976, Technology of bulldozer excavation of perennially frozen placer deposits: Monograph Moscow, Nedra, 287 p.
- Emmons,, W.H., 1917, Enrichment of ore deposits: U.S. Geol. Survey Bull. 625.
- Emmons, W.H., 1937, Gold Deposits of the world, with a section on prospecting: McGraw-Hill Book Co., Inc., New York.
- Evans, G.H., 1897, Practical notes on hydraulic mining, 48 p.
- Gardner, E.D., and Allsman, P.T., 1938, Power-shovel and dragline placer mining: U.S. Bureau of Mines Information Circular, No. 7063, 68 p.
- Gardner, E.D. and Johnson, C.H., 1934, Placer mining in the western United States, general, hand-mining and ground sluicing: U.S. Bureau of Mines Inf. Circ. 6786, pt. 1, 73 p.
- Gilbert, F.C., 1932, Design of sluices for gold placer mining: Eng. Journal, Arizona, vol. 16, No. 8, p. 4.
- Gilbert, G.K., 1914, The transportation of debris by running water: U.S. Geol. Survey Prof. Paper 86, p. 216.
- Gilbert, G.K., 1917, Hydraulic-mining debris in the Sierra Nevada: U.S. G.S. Prof. Paper 107, 1917, 85 p.
- Griffith, S.V., 1960, Alluvial prospecting and mining: Pergamon Press, New York, p. 245.
- Gunn, C.B., 1968, Origin of bedrock values of placer deposits (discussion): Economic Geology, vol. 63, p. 36.
- Hails, S.R., 1976, Placer deposits; in Handbook of Strata-Bound and Stratiform Ore Deposits: vol. 3, p. 213-239, Elsevier Scientific Publishing Co., New York.
- Haley, C.S., 1912, Elevating 10-cent gravel at a profit: Min. and Sci. Press, vol. 104, April 13, 1912, p. 530-532.
- Haley, C.S., 1923, Gold placers of California: Calif. Min. Bur. Bulletin 92, p. 5.
- Hanks, H.G., 1882, Placer, hydraulic and drift mining: California State Mineralogists' Report II, 1882, p. 28-192.

- Harrison, H.L.H., 1954, Valuation of alluvial deposits: Mining Publications Ltd., London, 303 p.
- Hazzard, F.H., 1911, The saving of fine placer gold: Eng. and Min. Jour., August 26, 1911, p. 394-396.
- Heiland, C.A. and Courtier, W.H., 1929, Magnetometric investigations of gold placer deposits near Golden, Colorado: Am. Inst. Min. Met. Eng., Geophysical Prospecting, 1929, p. 364-384.
- Holland, S.S., 1942a, Hydraulic mining methods: B.C. Dept. of Mines Bull. No. 15, 76 p.
- Holland, S.S., 1942b, Dragline dredging methods: B.C. Dept. of Mines Bull. No. 16, 36 p.
- Hutchins, J.P., 1907, The nomenclature of modern placer mining: Eng. and Min. Jour., vol. LXXXIV, No. 7, p. 293, August 17, 1907.
- Hutton, G.H., 1921, Valuation of placer deposits: Min. Sci. Press, San Francisco, vol. 123, p. 365-368.
- Inman, D.L., 1949, Sorting of sediments in light of fluid mechanics: Jour. Sedimentary Petrol., vol. 19, p. 51-70.
- Jackson, C.F., and Knaebel, J.B., 1932, Small-scale placer mining methods: U.S. Bureau of Mines Inf. Circ. 6611, 1932.
- Janin, Charles, 1911, Placer mining methods and operating costs: U.S. Bureau of Mines Bull. 121, 1916, p. 42-53.
- Janin, C., 1914, Recovery of gold in dredging: Min. and Sci. Press, Nov. 7, 1914, p. 717.
- Janin, Charles, 1918, Gold dredging in the United States: U.S. Bureau of Mines Bulletin 127, p. 143.
- Jenkins, Olaf P., 1933, Use of geology in seeking gold: Min. Jour. (Ariz), vol. 17, June 15, 1933, p. 3.
- Jenkins, Olaf P., and Wright, W. Quinby, 1934, California's goldbearing Tertiary channels: Eng. and Min. Jour., vol. 135, p. 497-502, Nov. 1934.
- Johnstone, W.A. and Uglow, W.L., 1926, Placer and vein deposits of Bankerville, Caribou District, British Columbia: Geo. Sur. Canada Mem. 149.

- Kartashov, I.P., 1971, Geological features of alluvial placers: Econ. Geol. vol. 66, p. 379-885.
- Katz, F.J., 1913, Methods of placer mining in the Fairbanks district: Fairbanks quadrangle, Alaska: U.S. Geol. Survey Bull. 525, 1913 p. 115-131.
- Knox, N.B., and Haley, Charles, Mining of alluvial deposits: Min. Mag.; 3 parts, February, March, April, 1915, 31 p.
- Krook, Leendert, 1968, Origin of bedrock values of placer deposits (discussion): Econ. Geology, vol. 63, p. 844-846.
- Laizure, C. McK., Elementary placer mining methods and gold saving devices: California State Mineralogists' Rept. XXVIII, 1932, p. 112-204.
- Laylander, K.C., 1926, Magnetometric surveying as an aid in exploring placer ground: Eng. and Min. Jour., vol. 121, 1926, p. 325-328.
- Lee, C.F., and Daultin, T.M., 1917, The solution of some hydraulic mining problems on Ruby Creek, British Columbia: Am. Inst. Min. Met. Eng. Trans. vol. 55, p. 90, 1917.
- Lee, H.A., 1963, Glacial fans in Till from the Kirkland Lake fault; a method of gold exploration: Geol. Survey of Canada Paper 63-45, 36 p.
- Leont'ev, O.K., Tarakanov, L.V., and Foteeva, N.I., 1976, Prospects and types of metal-bearing placers at the arctic coast of the northeastern USSR: Geomorfologiya, January-February, 1976, No. 1, p. 31-41.
- Leopold, L.B., Wolman, M.G., and Miller, J.P., 1964, Fluvial processes in geomorphology: W.H. Freeman and Co., San Francisco.
- Lindgren, W., 1911, The Tertiary gravels of the Sierra Nevada: U.S. Geol. Survey Prof. Paper 73.
- Lindgren, W., Mineral Deposits: McGraw-Hill Book Co., 1919, p. 213.
- Lindgren, Waldemar, 1933, Mineral Deposits: McGraw-Hill Book Co., Inc., New York.

- Longridge, C.C., Hydraulic mining: Mining Journal (London), 1913, 335 p.
- Malozemoff, P., 1937, Jigging applied to gold dredging: Eng. and Min. Jour., vol. 138, No. 9.
- Malozemoff, P., 1939, Testing for tailing losses in placer mining: Engineering and Mining Journal, Sept., 1939.
- Mertie, J.B., 1922, The occurrence of metalliferous deposits in the Yukon and Kuskokwim regions, Alaska: U.S. Geol. Survey Bull., 739D.
- Mertie, J.B., Jr., 1954, The gold pan, a neglected geological tool: Economic Geol., vol. 49, No. 6, p. 639-651.
- Mosley, M.P., 1976, An experimental study of channel confluences: Jour. Geol., vol. 84, p. 535-562.
- Mosley, M.P., and Schumm, S.A., 1977, Stream junctions - A probable location for bedrock placers: Econ. Geol., vol. 72, p. 691-694.
- Neil, J.W., 1914, Application of jigs to gold dredging: Min. and Sci. Press, vol. 109, Nov. 28, 1914, p. 339.
- Nekrasov, A., IA and Tkachenka, A.M., 1974, Selecting impact loads for drilling frozen placers: Magadan, Vsesoiuznyi nauchno-issiedovatel skii institut zolota i redkikh metallov., 1974-35(2) p. 3-14.
- Newman, W.A., 1937, Sluice boxes must pay: Eng. and Min. Jour., May, 1937.
- Nordale, A., 1947, Valuation of dredging ground in the subarctic: Trans. Can. Inst. Mining and Met., vol. 50, p. 487-496.
- Parker, B.H., 1974, Gold placers of Colorado, Book 1: Quarterly of the Colorado School of Mines, vol. 69, No. 3, July, 1974, 268 p.
- Pavlov, A.V., and Clovin, B.A., 1974, Artificial thawing of permafrost by solar radiation in placer mining: Monograph, Novosibirsk, Nauka, 1974, 122 p.
- Peters, W.C., 1978, Exploration and mining geology: John Wiley and Sons, New York.

Poremkin, S.V., 1973, Improving the techniques of mining perennially frozen placers in northeastern USSR: Magadan. Knizhnoe izdatel' stov., 1973, 144 p.

Pretorius, D.A., 1976, Gold in the Proterozoic sediments of South Africa; systems, paradigms, and models. in Wolff, K.H., 1976, Handbook of Strata-Bound and Stratiform Ore Deposits; vol. 7, p. 1-27: Elsevier Scientific Pub. Co., New York.

Pretorius, D.A., 1976, The nature of the witwatersrand gold-uranium deposits; in Wolff, K.H., 1976, Handbook of Strata-Bound and Stratiform Ore Deposits; vol. 7, p. 29-87: Elsevier Scientific Publishing Co.

Prokhorenko, R.P., 1974, Development of waterlogged placers in polar regions: Povyshenie ettektivnosti gornoj promyshlennosti Iakutii, Novosibiesk, Nauka, 1974, p. 22-28.

Purington, C.W., Methods and costs of gravel and placer mining in Alaska: U.S. Geol. Survey Bull. 263, 1905, 273 p.

Purington, C.W., 1905, Hydraulic elevator work on Anvil Creek, Nome, AK.: Min. and Sci. Press, April 26, 1913, p. 615.

Radford, W.J., 1908, Rocker for washing gravel. Min. and Sci. Press, June 8, 1912, p. 801.

Radford, W.J., Methods of testing placer gravels: Min. and Sci. Press, July 4, 1914, p. 5.

Raeburn, C., and Milner, H.B., Alluvial prospecting - the technical investigation of economic alluvial minerals: D. Van Nostrand Co., 1927.

Rickard, T.A., 1908, Mining methods in the far north: Min. and Sci. Press, Dec. 12, 1908, p. 810.

Robinson, F.W., 1882, Notes on hydraulic mining: California State Mineralogists' Rept. II, 1882, p. 119-129.

Romanowitz, C.M., and Sawin, H.A., 1940, New developments in placer mining and recovery of gold: Mining Journal, December, 1940.

Sainsbury, C.L., 1970, Tin resources of the world: U.S. Geol. Survey Bull. 1301, 55 p.



- Schumm, S.A., 1976, Fluvial geomorphology; principles and applications; in Hails (editor) Applied Geomorphology; Elsevier, Amsterdam.
- Smyth, H.L., 1905, The origin and classification of placers: Eng. and Min. Journ., vol. 79., p. 1045-1046, 1179-1180, 1228-1230.
- Staley, W.W. and Storch, R.H., 1937, Choosing a mining method for gold-bearing gravels: Eng. and Min. Jour., July and September, 1937.
- Stewart, A.L., 1962, Pinched sluices classify sand deposits, lowgrade ores: Eng. and Min. Jour., vol. 163, No. 7, p. 89-91.
- Stupin, N.K., Valeev, Kh.S., and Topcheev, N.D., 1970, mining placer deposits in permafrost areas: Soviet Inventions Illustrated; Sect. 3, Mechanical and General, Dec, 1970, 37 p.
- Stupin, N.K., Valeev, Kh.S., and Topcheev, N.D., 1973: Soviet Inventions Illustrated; Sect. 3, Mechanical and General, p. 41.
- Sulin, G.A., 1974, Equipment and technology of placer open-casting: Moscow, Nedra, 1974, 232 p.
- Thoe bald, P.K. Jr., 1957, The gold pan as a quantitative geological tool; U.S. Geol. Survey Bull. 1071-A.
- Tooms, J.S., 1970, Some aspects of exploration for marine mineral deposits; in Jones, M.J. (editor); Mining and Petroleum Geology: Proceedings of the 9th Commonwealth Congr. Inst. Min. Met. London, p. 285-296.
- Tourtellor, H.A., 1968, Hydraulic equivalence of grains of quartz and heavier minerals and implications for the study of placers: U.S. Geol. Survey Prof. Paper 594 F, 13 p.
- Tsusue, A. and Ishihama, S., 1975, Residual iron sand deposits of southwest Japan: Economic Geology, vol. 70, p. 706-718.
- Vanderberg, William O., 1936, Placer mining in Nevada: Univ. of Nev. Bull., vol. 30., No. 4, May 15, 1936, p. 180.

- Van Wagenen, T.F., 1880, Manual of hydraulic mining; Van Nostrand Company, New York.
- Wells, J.H., 1969, Placer examination, principles and practice: U.S. Bureau of Land Management Publication.
- Wertz, J.B., 1949, Logarithmic pattern in river placer deposits: Economic geology - vol. 44, p. 193-209.
- Wilson, E.B., 1918, Hydraulic and placer mining, 3d. ed., p. 230, John Wiley and Sons, New York.
- Wilson, Eldred D. and Fansett, George, R., 1961, Gold placers and placering in Arizona: Arizona Bureau of Mines Bull. 168, p. 124.
- Wimmler, Norman L., 1927, Placer mining methods and costs in Alaska: U.S. Bureau of Mines Bull. 259, p. 11.
- Wolff, E.N., 1969, Handbook for the Alaskan prospector: Mineral Industry Research Laboratory, Univ. of Alaska, Fairbanks.
- Yeatman, J.A., 1904, The pump in Placer mining: Min. and Sci. Press, vol. 88, 1904, p. 226.
- Young, G.J., 1946, Alluvial mining; in Elements of Mining: McGraw-Hill Book Co., Inc., New York, p. 450-496.