BRITISH COLUMBIA DEPARTMENT OF MINES
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NOTES ON PLACER-MINING IN BRITISH COLUMBIA

by

OFFICERS OF THE DEPARTMENT

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PREFACE

This bulletin contains general information about the geology, physiography, and climate of British Columbia, the nature and formation of placer deposits, the history of placer-mining, and the placer-gold production of British Columbia. It also contains brief notes dealing with placer-gold areas in the Province and information about prospecting for placer, and describes methods of placer-mining suitable for small-scale operations. It has not been found practicable to refer to all the numerous creek and bench deposits from which small quantities of gold have been won.

Previous publications of the Department of Mines dealing with this subject include: "Notes on Placer-mining," subtitled "For the Individual Miner," published in 1936, with subsequent editions in 1937, 1938, and 1943 in which minor changes were made; and Bulletin No. 2, 1930; Bulletin No. 1, 1931; and Bulletin No. 1, 1933, all entitled "Placer-mining in British Columbia." These publications were written at a time when depression conditions had caused many to give thought to small-scale placer-mining as a possible way of making a livelihood. Although the present bulletin follows "Notes on Placer-mining" rather closely, most of the material reproduced from that publication has been revised or rewritten.

Bulletin No. 21 was originally printed in 1946. It was reprinted in 1947 and 1953 with some additions and minor revisions; the present reprinting incorporates further minor changes.

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PLACER-MINING IN BRITISH COLUMBIA

INTRODUCTION

These notes are intended primarily for those who are not experienced placer-miners; however, the historical facts and other information contained may also be of interest and value to others. This bulletin presents some basic placer information and describes the simple hand methods of placer-mining.

Any man bent on placer-mining should have a clear idea of what he expects from it. He must realize that the older diggings were worked by fully experienced men, and many were worked during a long period of years. Prospecting has been extensive and the novice stands little chance of finding another Williams, Granite, or Cedar Creek. This does not mean that money cannot be made on the old creeks or that new creeks will not be found; but the one requires hard, intelligent work and the other needs hard work and also luck in good measure. If a search is made for virgin ground the prospector must expect to go into the backwoods, frequently under trying circumstances, and he must be prepared to work hard for the long chance of making a stake. On the older creeks for the most part he is working close to civilization and is pitting his skill against that of former operators, who may have lost or missed some gold, or he is endeavouring to work sections that others have given up as being too difficult or too low in value. He may also be reworking bars or sections of riverbottom which are only exposed at low water or taking up bedrock which has been made workable by recent weathering. He should have it clear in his own mind whether in the hope of making a quick fortune he is prepared to risk time and expense that will probably yield no return, or alternatively whether with lesser risk he is prepared to undertake work that can scarely be expected to yield more than a bare living.

As outlined in the section on History, the life-cycle of many placer streams is first the discovery of shallow gravels that are worked by individuals using hand methods; then deeper gravels may be drift-mined by individuals or small groups, and this stage may be followed by company operations equipped to handle and wash large volumes of gravel. The sniper then takes over, cleaning and scraping pockets and even rewashing old boulder-piles. Chinese miners were particularly adept at sniping and have worked in most camps and on most creeks. The first or hand-mining stage is short-lived, company operations may or may not make a complete recovery, and the sniper may have a chance over the years to earn a livelihood.

Sniping and bar-combing are continuously being carried out by individuals who would rather do this than work for wages, and the number so engaged increases in hard times. Successful snipers are usually men who have made an extensive study of placer gold and the methods of recovering it, and have learned all they can of the history of the creek they are on, particularly of the details of former operations.

Placer-mining in British Columbia is not always a straightforward matter of washing the bedrock gravels in a creek. The effects of glaciation have been such that many, if not most, streams have had a complex life history. Some streams flow over a deep fill of gravels above a previously excavated channel, others have been diverted and have completely abandoned old channels to carve new ones for themselves, and still others have re-excavated old valleys to leave remnants of former channels as rock benches and gutters on the walls. The gold concentration or paystreak may have been formed in pre-glacial, interglacial, or postglacial times, or paystreaks of all three periods may lie in different parts and at different levels in a single valley.

Any placer-miner soon becomes a student of stream action. In British Columbia *he must also be a student of glacial action and must endeavour to unravel stream* history and the part played in it by glacial depositition or erosion, a matter that is seldom easy. He should know the local history of placer activity and separate fact from fancy; many a man has spent weeks or months working on a worthless piece of ground owing to ignorance, misinformation, or the wrong sort of advice.

PHYSIOGRAPHY

Physiographic divisions and names are established by the Geographic Board of Canada. Recently H. S. Bostock, of the Geological Survey of Canada, studied the physiography of the northern Cordilleran region; his report and maps are published

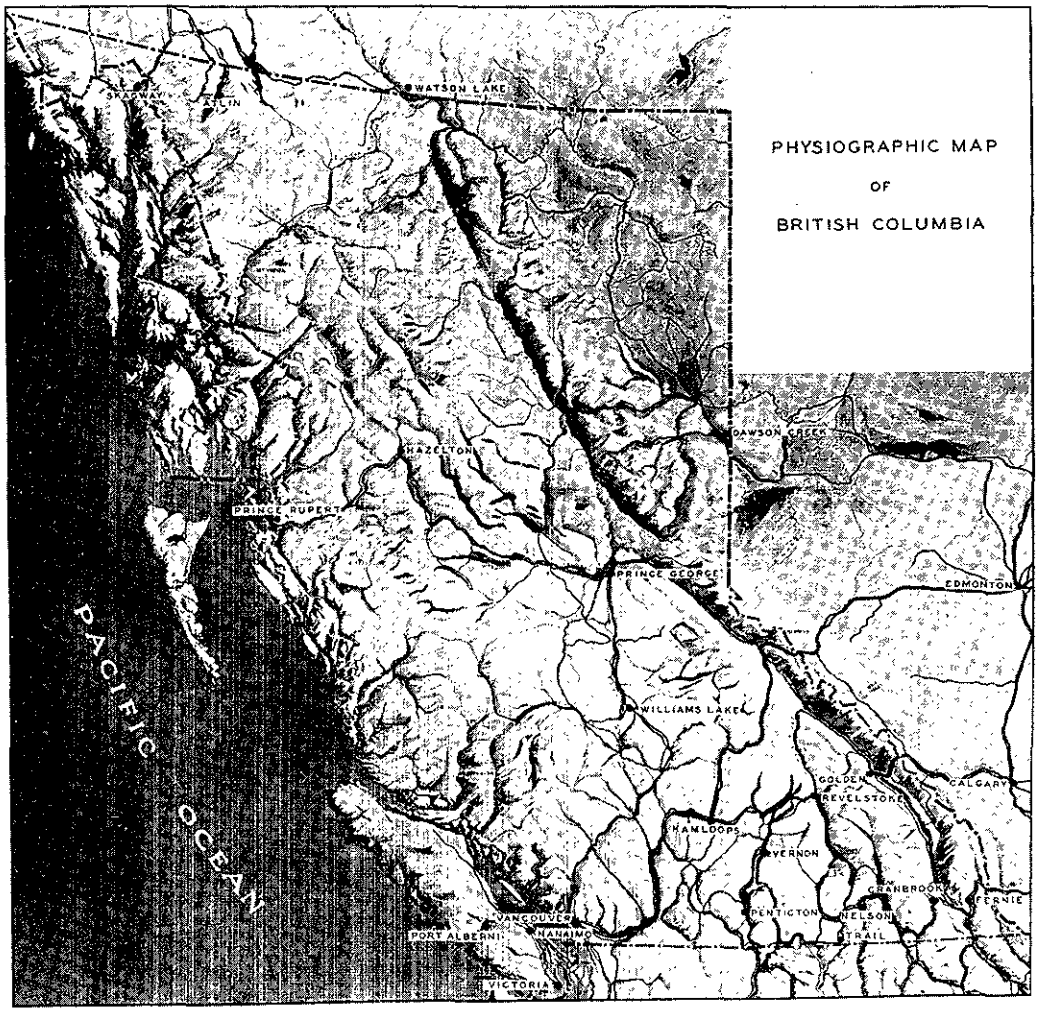


Fig. 1. Relief map of British Columbia.

in Memoir 247 of the Geological Survey, Department of Mines and Resources, Ottawa. The divisions shown on the accompanying sketch, Figure 2, and the nomenclature used in the text are those proposed by Bostock.

Most of the Province of British Columbia lies within the region of mountains and plateaus, the Cordillera of Western Canada, that forms the western border of the North

American Continent. The extreme northeastern corner of the Province, lying east of the Cordillera, is part of the Great Plains region.

The Rocky Mountain Area extends along the eastern boundary of the Province for a distance of 400 miles, and continues northwestward for an additional 500 miles entirely within the Province. The high, rugged Rocky Mountains, averaging about 50 miles in width, are flanked on the west by a remarkably long and straight valley, known as the Rocky Mountain Trench, and occupied from south to north by the Kootenay, Columbia, Canoe, Fraser, Parsnip, Finlay, Fox, and Kechika Rivers. Of these, the first four flow into the Pacific Ocean and the second four join the Mackenzie River to flow ultimately into the Arctic Ocean.

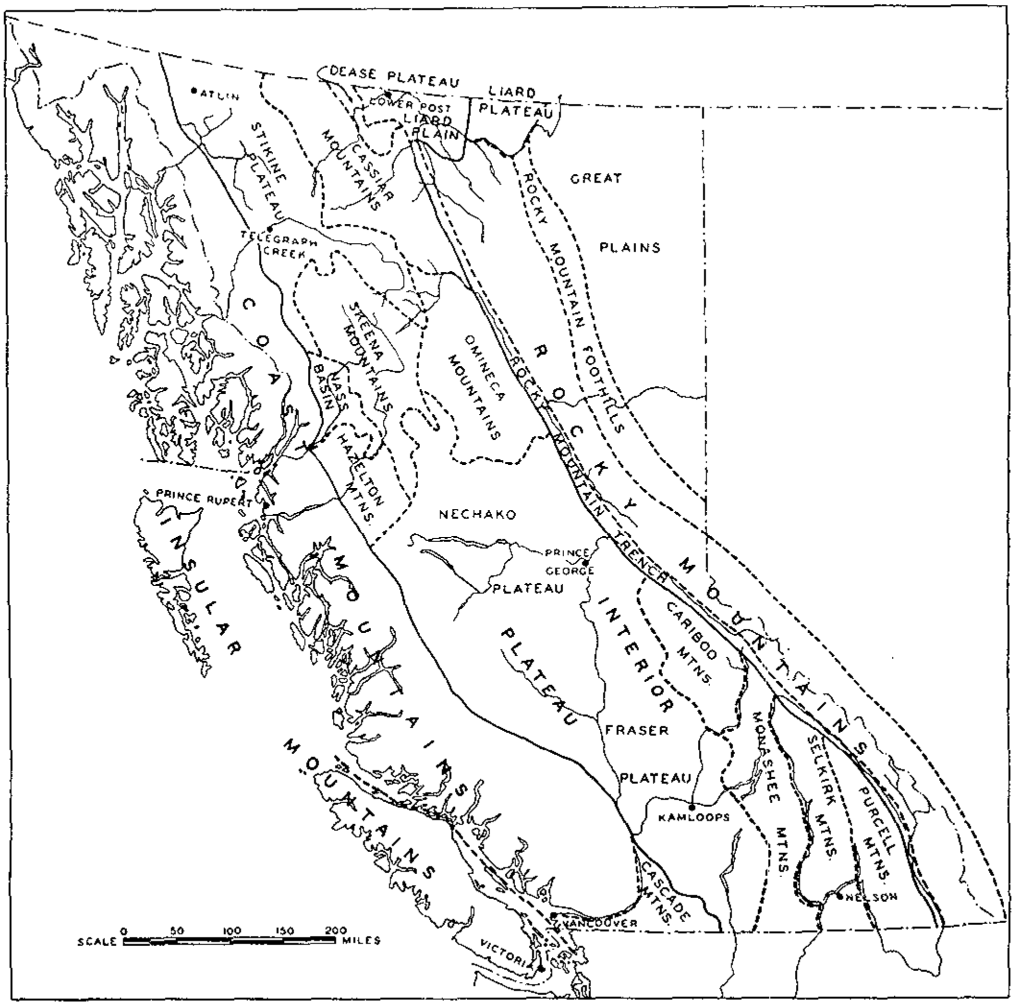


Fig. 2. Principal physiographic divisions of British Columbia.

In the southern part of the Province, lying immediately west of the Rocky Mountain Trench, are the Columbia Mountains, comprising the Purcell, Selkirk, and Monashee Mountains in the extreme south, and the Cariboo Mountains to the north yet within the big bend of the Fraser River. These four mountain groups are separated by prominent intermontane valleys.

In the northern part of the Province the Omineca and Cassiar Mountains lie to the west of the Rocky Mountain Trench.

The Coast Mountain Area, comprising the Cascade Mountains and Coast Mountains, extends northwestward along the Mainland coast, with a maximum width of about 150 miles. Long, narrow fiords of the deeply indented and submerged coast reach into the heart of the mountains.

The central part of the Province, between the Coast Mountain Area on the west and the Cassiar, Omineca, and Columbia Mountains on the east, is divided into the Interior Plateau in the south, the Hazelton and Skeena Mountains in the vicinity of the Skeena River, and the Stikine Plateau in the extreme north. East of the big bend of the Fraser River, the Nechako Plateau, part of the Interior Plateau, separates the Cariboo from the Omineca Mountains and bounds the Rocky Mountain Trench on the west.

To the west of the Coast Mountain Area, and west of the Coastal Trough, are the Insular Mountains, comprising the Vancouver Island and Queen Charlotte Ranges.

British Columbia lies within the belt of prevailing westerly winds, which, coming from the great area of the Pacific Ocean, are mild and laden with moisture. On encountering the colder areas of the mountains, they are chilled and precipitate a great part of their moisture, producing a luxuriant forest growth on the western slopes of the Coast Mountains. Passing eastward, the air currents, deprived of most of their moisture, take up moisture over the eastern slopes of the Coast Mountains and the Interior Plateau, causing arid to semi-arid conditions. Once again encountering high, colder land in the Selkirk and other mountain systems, precipitation is great on the western slopes, and once again the air currents collect moisture as they pass eastward toward the Rockies, producing the dry belts found in some of the larger intermontane valleys such as the Upper Columbia. In the northern part of the Province the changes are not as marked as in the southern part. The climate varies accordingly with moderate temperatures and heavy precipitation along the coastal region, and more extreme temperatures, with greater seasonal variations, in the interior and eastern parts of the Province.

Physiographic and climatic conditions exerted a great influence on the early exploration and development of the Province. The natural routes of travel cross the Interior Plateau and use the great intermontane valleys which trend from southeast to northwest and from south to north. Only a few passes suited to all-year transportation exist through the mountains from the interior of the Province, either westward to the coast or eastward to the Great Plains region.

GEOLOGY OF BRITISH COLUMBIA

The northeastern corner of the Province, east of the Rocky Mountains, lies within the Great Plains region and is underlain by sedimentary rocks chiefly of Mesozoic age. No igneous rocks are known. Deposits of coal are known, and field exploration and drilling for oil and natural gas are being undertaken. In the light of present knowledge it is not considered likely that many metalliferous deposits will be found in this region.

The Rocky Mountains are largely made up of sedimentary rocks of Palæozoic and Mesozoic age. A few small bodies of igneous rock are known at Ice River and elsewhere, but the proportion of igneous rock in the entire mountain chain is believed to be almost negligible. Some lead-zinc and some copper-bearing deposits have been found, but few gold-bearing deposits. The Rockies have long been considered relatively unfavourable for placer prospecting even though coarse placer gold in the south has come from Wild Horse River and Bull River, and placer gold is known to occur in small quantities in a few westerly flowing streams in the northern part of the mountains.

The Cassiar and Omineca Mountains contain granitic rocks throughout most of their length; concentrated in three areas—near the Yukon Boundary, in a batholith or belt of intrusives extending some 400 miles through the southern part of the Cassiar Mountains into the northern Omineca Mountains, and in the southeastern Omineca Mountains.

The granitic rocks intrude sedimentary rocks of diverse ages, and volcanic rocks chiefly of Mesozoic age; the structure is complex. Tertiary lavas cover the older rocks at a number of points. Although the region has not been fully explored, the main geological facts are known, and prospectors have covered a good deal of the ground during the past seventy years. Difficulties of transportation make prospecting of many parts difficult, but interest has reawakened during the last few years and some discoveries have been made. Although there has been no production from them, gold-bearing veins have been found at many points and there is a variety of metallic mineralization.

The Cariboo Mountains are largely made up of sedimentary rocks. A few small granitic stocks and a few dykes are known in the central and southern parts of the mountains. Sedimentary rocks of Precambrian age, which extend throughout the central part of the mountains, are overlain by Mesozoic rocks on the southwest and by Palæozoic rocks on the northeast. The central part of the Cariboo Mountains has been the most productive placer ground in the Province and, although quartz veins in abundance were known for years, it was only in the early 1930's that lode-mining was established. The Cariboo area is now one of the major producers of lode gold.

In the Monashee, Selkirk, and Purcell Mountains extensive areas are underlain by granite and allied rock, between which sedimentary and volcanic rocks of diverse ages are folded, faulted, and to a greater or lesser extent metamorphosed. The same general conditions extend from the coast across the southern part of the Province, almost to the Rocky Mountain Trench. There is no clear distinction between granitic rocks referred to the Nelson batholiths on the east and to the Coast Range batholiths on the west. This general region has been, and is, the most productive of metallic minerals in the Province. Within it lie the gold camps of Rossland, Sheep Creek, and Hedley, as well as important silver, silver-lead-zinc, and copper and copper-gold mines, and many smaller camps of diverse mineralization. Unlike the Cariboo, however, the gold camps were not accompanied by exceedingly rich placers.

The Interior Plateau region does not differ greatly geologically from the mountainous regions to the east. A great diversity of sedimentary and volcanic rocks is intruded by igneous rocks of many sorts. The structure as a whole is complex, but locally, as in parts of the Chilcotin plateau, the rocks are less deformed. Lavas of Tertiary age are widespread, more so than in any other part of the Province. The areas of lava, many of which are extensive, blanket the country and effectively hide from view the older rocks and any mineralization they contain. Although erosional effects of glaciation are not prominent in the plateau region as a whole, glacial deposits are widespread. Most of the major valley bottoms and much of the upland surfaces are blanketed by glacial drift. Metalliferous deposits are varied in the plateau region and placer deposits have been discovered at many points.

The Coast Mountains contain much granitic rock. This is the Coast Range batholith, now known to consist of a complex of several intrusives and of small and large areas of older rocks. The intrusives range in age from Jurassic to early Tertiary. The older rocks, consisting of sediments and volcanics, are for the most part greatly altered and deformed, particularly where closest to the intrusive bodies. Most of the sedimentary-volcanic assemblages are of Jurassic age. The gold camp of the Bridge River and the gold-silver camp of the Portland Canal are among the most important in the Province. Other gold deposits occur at various points along both sides of the batholithic area. A great deal of the Provincial copper production has come from Britannia and Anyox, and metallic deposits are widespread throughout the region.

Vancouver Island, the Queen Charlotte Islands, and other islands of the coastal area are similar geologically to the Coast Mountains. Palæozoic and Mesozoic sediments and volcanics are intruded by igneous rocks of various sorts. Much gold has been produced from the Zeballos camp and older production came from Texada and Princess Royal Islands. Other metallic deposits are principally of copper and iron.

In Pleistocene times the entire Province was covered by ice which caused some erosion and which on melting left vast quantities of drift to blanket the land. Many peculiarities of drainage are traceable to the erosional and depositional effects of glaciation, evidences of which are to been seen in all parts of the Province.

References: *B.C. Dept. of Mines*, Bull. 20, 1944.

Geol. Surv., Canada, Ec. Geol. Series 1, 1957, "Geology and Economic Minerals of Canada," pp. 283-392.

HISTORY OF PLACER-MINING

Before the discovery of placer gold the white population of British Columbia consisted of a few hundred men who trapped or bartered with the Indians, chiefly along routes established by the earliest explorers. In 1855 placer gold was discovered at Fort Colville in Northern Washington, and the news quickly reached the attention of placer-miners spreading north from the rich but already waning goldfields of California. At about the same time flour gold was found on the gravel bars of the lower Fraser River but attracted relatively little attention. The news of the discovery in 1857 of coarse gold at the mouth of the Nicoamen River above Lytton quickly reached San Francisco, and by 1858 the rich bars at Yale were being worked and hundreds of miners were pushing their way up the river in search of what they belived must be even richer diggings.

In 1860 the first important discoveries in the Cariboo were made at Quesnel Forks, Keithley Creek, and Antler Creek, and in 1861 the celebrated Williams, Grouse, Lowhee, and Lightning Creeks were found.

The penetration of the Cariboo, first by hundreds and soon by thousands, was extremely rapid, considering the physical difficulties entailed. Men were active in many other districts as well. Placer gold was discovered in 1860 at Rock Creek on the Kettle River, and within the next five years in the Okanagan, at Fort Steele, on the Big Bend of the Columbia River, probably at Scotch Creek on Shuswap Lake, the Peace River, and at many other points in the southern section of the Province. The next important discovery was made at Dease Lake in 1873 and other discoveries have been made from time to time since then.

The army of miners that invaded the country in the early 1860's had to be fed, clothed, and supplied with tools. In order to carry on the greatly expanding trade it became necessary to construct trails and roads. The famous Cariboo Trail first followed a water route by way of Harrison, Anderson, and Seton Lakes to Lillooet, thence over Pavilion Mountain to Clinton, and northward to the goldfields around Quesnel Forks and Barkerville. Later the Royal Engineers built a road through the Fraser Canyon via Cache Creek to Clinton that enabled wagons to be hauled the entire distance from Yale. After the Canadian Pacific Railway was completed in 1886 a road from Ashcroft connected with the original road at Cache Creek.

In the early 1860's the Dewdney Trail was built across the mountains from Hope to Princeton and through to the Kootenays. It was the first trans-Provincial trail, and was constructed primarily to serve the placer-miners in the Southern Interior and enable them to travel to Victoria without crossing the boundary-line into Washington. Other trails were built, and a more or less regular boat service was provided on some of the waterways, such as Kootenay, Okanagan, and Arrow Lakes, and Columbia River.

During this period large tracts of country were rapidly opened up, but unfortunately the diggings rich enough to support hundreds of individual miners were soon worked out. The greatest recorded placer production was in 1863, which meant that the diggings reached their peak three years after discovery. The Cariboo continued to prosper, owing principally to the fact that hydraulic mining was introduced there in 1879, but by that year activity in most of the other camps had dwindled, and over half of the few men remaining in them were Chinese. The heyday of placer-mining for the individual miner was over by 1885, with the single exception of the important Atlin field, discovered in 1898.

On many creeks company operations followed those of the individual miners, chiefly by hydraulicking but also by underground mining, dredging, and in later years by mechanical methods, or dragline dredges. In the Cariboo, Lowhee Gulch has been worked continuously for eighty years, first by surface-washing, later by drift-mining on bedrock, and finally by hydraulicking. This sequence has been common, particularly in the Cariboo, the final stage being the sniping activity of individuals who comb the sites of former operations in search of gold which has been lost or overlooked.

Physical conditions determine the method by which a placer is worked. Factors such as the location and extent of the pay gravel, gold value per yard, amount and thickness of barren or low-grade overburden, availability and volume of water for sluicing, bedrock gradient, position of water-table, and space for tailings-disposal are important and determine and affect the cost of the mining method employed.

The earliest placer-mining was by hand methods on the bars and low benches of the Fraser and Quesnel Rivers and various other creeks. Later much gold was recovered from the Cariboo by drift-mining deep bedrock gravels from shafts sunk below creek-level. This method necessitated continuous pumping to keep the workings from flooding. In the Cassiar and Atlin camps much of the gold was mined by drifting the bedrock gravel on benches lying for the most part above creek-level. Many of the creeks in Atlin, Cassiar, Omineca, Cariboo, Similkameen, and other areas have been hydraulicked. From time to time dredges of a variety of sizes and types have been built and have been operated on the Fraser and Quesnel Rivers, on Antler, Pine, and Granite Creeks. In almost every instance the operation has been unsuccessful.

In 1941 two dragline dredges were built—one on the Similkameen River and another on the Fraser River at Alexandria; since then other dragline dredges have been operated on the Quesnel, Swift, Cottonwood, Similkameen, and other rivers and creeks. In 1948, the peak year, eight dragline dredges were in operation.

A variety of methods for mining placer ground presenting peculiar working conditions have been attempted, notably the shovel and mobile sluicing plant on Spruce Creek, the dragline operation on Slate Creek, the pump-hydraulic on Cedar Creek, the gravel-elevator on Williams Creek, and many others.

Chronology of British Columbia Placers

The following chronological table gives the discovery dates of the principal creeks and diggings:—

1852—Chief Trader McLean, of the Hudson's Bay Company, purchased gold dust from Indians at Kamloops.

1855—Gold discoveries on the Columbia at the mouth of the Pend d'Oreille River.

1857—Coarse gold discovered at the mouth of the Nicoamen River, tributary to the Thompson, above Lytton.

1858—Gold first discovered in quantity on the lower Fraser River, at Yale.

1860—Rock Creek in Boundary District discovered.

1860—First discoveries in Cariboo area, on Quesnel River and on Keithley and Antler Creeks.

1861—Williams Creek and Lightning Creek strikes made.

1861—Gold discovered on the Parsnip River.

1863—Placers found on Wild Horse River, East Kootenay.

1863—This was the year of greatest development and output of the Cariboo. Maximum official recorded production in the history of the Province.
1864—Leech River placers discovered on Vancouver Island.
1865—Gold discovered on French Creek in the Big Bend of the Columbia River.
1869—Vital Creek, tributary of Omineca, discovered.
1873—Gold discovered on Dease and Thibert Creeks.
1879—Hydraulic mining on a large scale commenced in Cariboo.
1885—Placer strike made at Granite Creek, Tulameen River.
1898—Atlin placer fields discovered.
1921—Rich strike made at Cedar Creek.
1924—Gold found on Goldpan Creek.
1927—Coarse gold found by Indians on Squaw Creek.
1932—Initial discovery of gold on Wheaton (Boulder) Creek.

References:—

"History of British Columbia," H. H. Bancroft, 1887, Vol. XXXII.
"History of British Columbia," Howay and Scholefield, 1914.
"Review of Dragline Dredging," Minister of Mines, B.C., Ann. Rept. 1949, pp. 227–237.

British Columbia Placer-Gold Production

Year	Crude Oz.	Value	Year	Crude Oz.	Value
1858-1862	580,680	$ 9,871,634	1928	8,424	$ 143,208
1863-1867	957,860	16,283,592	1929	6,983	118,711
1868-1872	582,080	9,895,318	1930	8,955	152,235
1873-1877	530,540	9,019,201	1931	17,176	291,992
1878-1882	328,230	5,579,911	1932	20,400	395,542
1883-1887	225,970	3,841,515	1933	23,928	562,787
1888-1892	148,550	2,525,426	1934	25,181	714,431
1893-1897	135,340	2,300,876	1935	30,929	895,058
1898-1903	374,740	6,370,630	1936	43,389	1,249,940
1904	65,610	1,115,300	1937	54,153	1,558,245
1905	57,020	969,300	1938	57,759	1,671,015
1906	55,790	948,400	1939	49,746	1,478,492
1907	48,710	828,000	1940	39,067	1,236,928
1908	38,060	647,000	1941	43,775	1,385,962
1909	28,060	477,000	1942	32,904	1,041,772
1910	31,760	540,000	1943	14,600	462,270
1911	25,060	426,000	1944	11,433	361,977
1912	32,680	555,500	1945	12,589	398,591
1913	30,000	510,000	1946	15,729	475,361
1914	33,240	565,000	1947	6,969	200,585
1915	45,290	770,000	1948	20,332	585,200
1916	34,150	580,500	1949	17,886	529,524
1917	29,180	496,000	1950	19,134	598,717
1918	18,820	320,000	1951	23,691	717,911
1919	16,850	286,500	1952	17,554	494,756
1920	13,040	221,600	1953	14,245	403,230
1921	13,720	233,200	1954	8,684	238,967
1922	21,690	368,800	1955	7,666	217,614
1923	24,710	420,000	1956	3,865	109,450
1924	24,750	420,750	1957	2,936	80,990
1925	16,476	280,092	1958	5,650	157,871
1926	20,912	355,503	Total	5,205,946	$96,113,030
1927	9,191	156,247			

The recorded placer-gold production of all creeks in British Columbia is tabulated in British Columbia Department of Mines Bulletin No. 28, 1950.

PLACER DEPOSITS

Unconsolidated material containing gold or other valuable minerals in sufficient quantity to be of economic interest is called a placer deposit. Any heavy mineral that resists mechanical destruction owing to its hardness or malleability, and responds slowly to chemical change, is apt to be concentrated in placers. Placer deposits may contain such minerals as gold, platinum, metallic copper, magnetite (black sand), ilmenite, garnet, pyrite, hematite, occasionally galena, zircon, scheelite, tourmaline, stream-tin (cassiterite), and gem stones. In British Columbia, placers have been worked for gold, and a few for gold and platinum or principally for platinum.

Placer-gold deposits are formed by the natural concentration of the weathered products of gold-bearing rocks. During the course of weathering, rocks are broken down by the combined processes of mechanical disintegration and chemical decomposition. The more resistant minerals are little changed other than to be broken into various small-sized fragments while the less resistant minerals are made over and partly dissolved. As a result, grains of quartz, magnetite, gold, etc., are set free from the rock-mass, while the grains of feldspar and of ferro-magnesian and other minerals may be transformed into clay-like minerals, iron oxides, and soluble salts. When this disintegrated and decomposed material is subjected to the sorting action of water, the resistant minerals of high specific gravity are deposited near their source while the lighter minerals are carried farther downstream. The gold contained in a paystreak is derived from the concentration of a very large volume of rock.

Residual Placers

Residual placers may be formed at the weathered outcrops of gold-bearing deposits. In the course of weathering, part of the deposit is dissolved and carried away in solution and part is disintegrated and carried away by run-off water. Gold, being heavy and inert, tends to remain at or close to its original position and is concentrated at the outcrop. Run-off water removes a relatively small amount of material; the richness of a residual placer, therefore, depends upon the richness of the original lode. In British Columbia, residual placers are of little importance because rapid erosion has dispersed the parts of most lodes that had been weathered in preglacial times, particularly those parts lying in exposed positions above valley bottoms. Nevertheless, in the early prospecting for outcrops of gold-bearing veins in the Bridge River and Wells mining camps some residual concentrations were found and were worked as placers.

Stream Placers

British Columbia placers have formed largely as a result of stream concentration. The disintegrated material from a gold-bearing lode gradually moves downhill under the influence of slope wash until it reaches a stream channel. The sorting action of running water results in small fragments and material of lower specific gravity being moved selectively downstream. In addition, the material in the stream bed is continually being agitated so that the minerals of high specific gravity tend to work down, eventually becoming concentrated in the creek bottom. Nuggets of gold sink rapidly through the gravel without travelling far downstream. Finer gold is gradually and continuously carried farther, and very fine flaky gold may be carried many miles downstream.

During its life history a stream may pass through a number of stages that affect the formation of placers. Where a stream is down-cutting, bedrock is being scoured and any gold lodged on it gradually moves downstream. In other sections of the stream flattening of the grade, overloading of the stream, or slackening of the current on the inside of a bend will cause gravel and gold to be deposited owing to the lessened carrying power of the water. In some sections the stream may swing from one side of the valley bottom to the other, eroding on the outside of a curve and depositing material on the inside. Bars form in large creeks during certain stages, and fine gold that is carried by the flood-waters is deposited on them.

All streams have a sorting action upon the gravel in their beds, but extremely rich placers are formed only by the concentration of gold released from lodes during long periods of weathering and stream erosion.

In British Columbia, active down-cutting by streams took place in late Tertiary or early Pleistocene time, with the result that stream valleys were deepened, leaving rock benches, on some of which the gravel is rich enough to be mined profitably.

The formation of British Columbia placers has been greatly affected by glaciation. Normal development of placers in many mountain streams has been greatly modified; in numerous places gravel has been dispersed, bedrock eroded, and a layer of boulder clay deposited by valley glaciers. Overloading of streams and disturbances of drainage brought about during interglacial and postglacial times have complicated both the formation of placer deposits and the search for them.

In the early stages of glaciation, before there was much accumulation of ice, there was undoubtedly an increased precipitation and a high run-off during the summer months. This run-off swept much of the weathered rock debris and residual gold deposits into the valleys. The valleys were filled in many instances to depths of several hundreds of feet with this material. Many streams were unable to transport the tremendous load supplied to them, with the result that previously formed placers were buried to considerable depths.

During interglacial periods the streams cut down through these deposits and in places cut through rock-spurs projecting into the old valleys. Since the final retreat of the ice, streams have again cut down their channels in the filled valleys and locally in bedrock. Most present-day streams follow old valleys, in part at least, but in some instances streams have completely abandoned their former valleys.

Stream activity during interglacial periods and in recent time caused the erosion of some earlier placers and their redeposition as placers of various ages, origin, and richness. Old gravel-filled channels, possibly cut through and partly destroyed by later streams in a valley, may still remain as bench deposits, deep leads, or buried channels, higher or lower than the present stream bed.

Postglacial streams have reworked older gravel and boulder-clay deposits to form surface enrichments extending only to shallow depths.

Beach Placers

Beach placers are formed by a combination of the concentrating action of longshore drift, currents, tides, and waves upon gold-bearing sands and gravels. Local concentrations of gold and black sand are formed only when the wind and the waves are from particular directions. Concentrations rich enough to be worked are usually small, and considerable difficulty is often experienced in separating the exceedingly small, rusty flake gold from the magnetite sand. There are beach placers at Wreck Bay, Vancouver Island, and on the east coast of Graham Island.

Characteristics of Placer Gold

Gold particles that are rough and hackly or have adhering quartz prove that the gold has not been much worn and indicate that the gold is close to its original source. Gold that is pounded and worn into smooth flat nuggets or flakes has travelled some considerable distance from its source. These characteristics apply regardless of the size of the individual pieces, although the finer sizes naturally travel farther, and fine flaky pieces will travel farther than rounded or shot-like pieces of equal weight.

An almost constant characteristic of placer gold from any one creek is its fineness —i.e., the gold-silver ratio. In British Columbia, placer gold ranges in fineness from about 700 parts per 1,000 for gold from Cherry and Monashee Creeks to about 970 parts for gold from Goat River. Most placer gold ranges from 800 to 900 fine. The numerical average of the average fineness of gold from 173 streams is 861.

Placer gold is an alloy, mainly of gold and silver, but may contain small amounts of platinum, copper, iron, and other elements. Its colour depends largely on the amount of silver present, and also on the presence or absence of surface films of iron oxide. The colour, size, and general shape of the gold pieces present so characteristic an appearance that experienced gold-buyers can tell from which creek any packet of gold has come.

Size of Placer Gold

Placer gold occurs in sizes ranging from large nuggets to minute particles requiring many thousands to yield a value of 1 cent. Pieces valued at more than 5 to 10 cents are spoken of as nuggets. Coarse gold will not pass through a 10-mesh screen, and fine gold will be retained on a 40-mesh screen. Flour gold includes all sizes that will pass through a 40-mesh screen. These figures refer to standard screens in which there are 10 and 40 openings per lineal inch. The Cariboo was remarkable for its coarse gold, whereas mostly fine and flour gold was recovered from the bars and benches of the Fraser River below Hope, and from the Peace River.

Nuggets are formed from plates and masses of gold which have been released from lode deposits by weathering, and pounded and rolled into solid lumps. The recovery of large pieces of gold from lode-mining at Cariboo and Bridge River demonstrates that gold-bearing veins contain gold of sufficient size to form large nuggets. There is no evidence to show that chemical deposition of gold in the gravel has played any part in the formation of placer-gold nuggets.

Of the large nuggets found in British Columbia, there is record of one weighing about 72 ounces, valued at $1,300, found on McDame Creek in 1877; it is probably the largest all-gold nugget found in the Province. Dease Creek yielded one of about 60 ounces, valued at $800, in 1875. A quartz and gold nugget, found on Spruce Creek in 1899, weighed 85 ounces, and in 1901 one weighing 36 ounces 12 pennyweight was found. In 1931 one weighing 73 ounces and valued at $1,200 was found on Birch Creek. Germansen Creek in 1935 yielded a nugget of about 24 ounces. In 1937 a nugget weighing 52 ounces 15 pennyweight was found on a tributary of Wheaton (Boulder) Creek and also one weighing 46 ounces 5 pennyweight on Squaw Creek. A nugget valued at $900 was found on Lockie (Boulder) Creek in 1887 and one weighing 32 ounces found about 5 miles up the Bridge River.

The largest nugget, of which there is record, from the Cariboo was found in 1864 on Butcher Bench, Lightning Creek, and weighed 30$\frac{1}{16}$ ounces. Wild Horse River yielded a nugget weighing 37 ounces.

Minerals Associated with Gold in Placers

Placer concentrates are frequently composed largely of black sand. The black sand is chiefly magnetite but may include small amounts of ilmenite and chromite. In the Cariboo, sluice-box concentrates contain very little black sand, being composed mostly of cube iron (pyrite) and, on some creeks, abundant galena. Brown and red garnets are found in placer concentrates from Quesnel and Tulameen Rivers.

Platinum is associated with gold in some British Columbia placers, and in some localities has been equal to or greater than the amount of gold. Platinum has been recovered in some quantity from the Tulameen River. It also occurs with placer gold on Pine, Thibert, McConnell, Rainbow, Tranquille, Rock, and Government Creeks. Small amounts of platinum are recovered with the gold from placers along the Quesnel, Fraser, Cottonwood, Peace, and Coquihalla Rivers; it occurs also on the North Thompson River at the mouth of the Clearwater River. Small amounts of platinum have been recovered from the beach placers on Graham Island. No platinum is known from the placer creeks in the vicinity of Barkerville.

Zircon and scheelite are found in placer concentrates. Scheelite is not uncommon in grains up to bean size in placer creeks around Barkerville. Prospectors have discovered in panning that an occurrence of scheelite will throw a train of small particles for considerable distances.

Wolframite and cassiterite have been recovered from placers on Boulder Creek, Atlin.

Arquerite (a natural silver amalgam) occurs in the gold placers on Vital, Tom, Harrison, Silver, and other creeks in the Omineca; it is also reported from the mouth on Tahltan River.

Cinnabar in appreciable amounts has been recovered by placer-miners on the Quesnel River near Quesnel Forks. The greatest amount appears to have been obtained near the mouth of Four Mile Creek.

A somewhat uncommon mineral, awaruite (a nickel-iron alloy), has been recovered from Bridge River, Fraser River near Lillooet, and Wheaton (Boulder) Creek.

Nuggets of native copper are recovered in some placer concentrates. Pieces weighing as much as 15 pounds have been found on Squaw and Thibert Creeks.

A nugget of native silver was recovered from a creek tributary to Kehlechoa River in 1945. Other heavy minerals, such as barite, hematite, or epidote, form part of the placer concentrates from various creeks.

No native mercury is known from British Columbia placers, although gold in part covered with quicksilver has been recovered from old workings where the mercury was evidently spilled by miners.

Shot, coins, nails, solder, and a variety of other metal objects are recovered when reworking old ground or sniping around old diggings. No recovery of gem stones from British Columbia placers has been recorded officially.

Distribution of Gold in Placers

Gold in gravel or sand will migrate downward as long as the material is loose and is agitated by flowing water. As a general rule the gold settles until it reaches bedrock, consequently the paystreak in many instances rests on bedrock.* If the downward movement of the gold is stopped at a clay layer or a bed of tightly packed gravel some distance above the actual bedrock, a paystreak may be formed on what is termed false bedrock.

Gold is seldom uniformly distributed through the gravel, and as a consequence the prospector is usually searching for a workable paystreak. In most bars and in some bench deposits it is the upper gravel that is enriched while the lower material is low in grade or barren. The boulder clay of glacial deposits is commonly almost devoid of gold, but in some rare instances masses of gold-bearing gravel have become incorporated in it.

The outline and position of a paystreak depends on a number of factors, of which the most important is the stream history. Many possibilities for concentration are provided by complex drainage histories, the various factors involved in placer formation, and the complicating effects of glaciation. There is no absolutely certain way of predicting the occurrence of a paystreak. A study of the stream history is helpful in formulating a working hypothesis, but test work must ultimately be done in order to prove the existence and define the position of a paystreak.

The richest section of a placer deposit is most apt to be close to the source of the gold or in some place where there has been a greater than ordinary amount of concentration. Stream placers in general are found to become lower in grade and contain smaller particles of gold when followed downstream. Points of greater concentration will occur where a stream crosses and erodes a higher gold-bearing deposit. Paystreaks may form on the inner sides of river bends or on bars, or in any slack water where the gold particles are dropped. A paystreak may branch, reflecting a change in course of the stream, a second run of gold, or the entrance of a tributary into the main channel. Paystreaks may terminate abruptly because of steepening in grade of the stream or change in character of bedrock, or by having been eroded either by stream

* However, gold will penetrate into any crack or crevice, and this fact should be kept in mind when cleaning up bedrock.

or ice action. It is only after considerable mining experience on a single placer deposit or on a single creek that the vagaries of a paystreak may be predicted in advance.

PLACER-MINING POSSIBILITIES

Placer-gold production has generally declined since the peak production in 1863. There are, however, local peaks which indicate increased production due to new discoveries, new methods of working, and to the increase in the price of gold from 1932 to 1940. Known placer deposits are progressively being worked out and important new discoveries are infrequent, consequently it is probable that placer-gold production will continue slowly to decline. Nevertheless, possiblities do exist for the discovery of virgin creeks or of ancient and hitherto unknown channels in old camps. Important new finds, such as those on Cedar Creek in 1921, Squaw Creek in 1927, and of coarse gold on Wheaton (Boulder) Creek in 1937, suggest that the possiblity is not too remote. Ancient channels, either buried or elevated, are apt to be suspected around an old placer area, but the proof of their existence and their testing for workable values may constitute an undertaking of considerable difficulty and expense.

Other possiblities exist in the adaption of new methods of working to deposits already known. Mechanical methods of mining using the latest and cheapest dirt-moving equipment and techniques might be applied to deposits that in the past could not have been worked profitably. An example of a new technique is the dragline dredge that is so successful in working certain types of deposit. Opportunities also exist for the development of a technique for the successful mining of deep leads, such as those on Lightning Creek, as well as for the working of small yardages of bench deposits remote from water and too small to warrant a dragline-dredge operation.

In established camps, as old operations cease and water rights are relinquished or transferred, water in volume may become available for the hydraulicking of other deposits that hitherto have been handicapped by a shortage of water.

Finally, for the individual there is always sniping. Just so long as there are men with ideas as to where gold my be found, and just so long as there is bedrock to be cleaned and there are men who would rather work for themselves than for someone else, sniping will continue. The number of men at work sniping varies considerably with economic conditions. When work is plentiful or wages are high the number diminishes, but when work is scarce and unemployment is general the number increases many times. In the Cariboo and on the Fraser and Quesnel Rivers, even ninety years after the discovery of gold, places still remain on the bars and benches and on bedrock where a man may work and recover some gold.

Sniping is an art in itself. It may mean cleaning bedrock that was not thoroughly cleaned in the original operation, or reworking old tailings that contain recoverable gold. For example, when water is scarce boulders from a drift operation may not be thoroughly washed, or when the gravel is clayey sufficient water may not be available to break up the balls of clay that will roll through the sluice-boxes and rob them of gold. In other instances it may mean doing a lot of dead work to reach a piece of virgin ground that because of low values or some other reason was left unworked by the old-timers. It may mean waiting for extreme low water in order to get out on to river bars to skim the upper few inches of sand and gravel. Sniping means hard work, but at the same time it offers a livelihood and promises independence for the individual.

PLACER-MINING AREAS

ATLIN AREA

Gold was discovered on Pine Creek in the Atlin camp in 1898. Since then about $12,000,000 worth of placer gold has been recovered from the camp. The two most important creeks are Spruce and Pine Creeks; other creeks, in order of their production, are Boulder, Ruby, McKee, Otter, Wright, and Birch Creeks. Some production has come from O'Donnel River and tributaries.

Since the first discovery of shallow diggings, the operations at Atlin included hydraulicking and drift-mining. Pine, Birch, Boulder, and other creeks were hydraulicked. Spruce Creek was worked largely by drifting, although on the lower part several power-shovels have been used.

There was much coarse gold and exceedingly rich ground in the Atlin camp. The pay gravel was notably sticky and clayey. Small operators have reworked tailings from many of the drift mines and have recovered a substantial amount of gold.

References:—

Geol. Surv., Canada, Rept. No. 743, 1901.
B.C. Dept. of Mines, Bull. 2, 1930, pp. 17-21.
Minister of Mines, B.C., Ann. Rept., 1936, pp. B 39–B 56.

Squaw Creek

Gold on Squaw Creek was found by an Indian in 1927. The creek is notable for its coarse gravel and large boulders. The gold is exceedingly coarse, 1- to 4-ounce pieces are common. The largest, found in 1937, weighed 46 ounces 5 pennyweight. The total placer-gold production is estimated to be about 5,000 ounces. The gravel is comparatively shallow and was worked by hand-shovelling into boxes.

References:—

Minister of Mines, B.C., Ann. Rept., 1932, pp. 74–79.
B.C. Dept. of Mines, Bull. 1, 1933, pp. 30–33.
B.C. Dept. of Mines, Bull. 25, 1948, pp. 36–40.

Cassiar District

The three most important creeks on the Cassiar were Thibert, Dease, and McDame Creeks, and their tributaries. Gold was found on Thibert Creek in 1873. Since then the three creeks have produced about $4,500,000 worth of gold, almost equally divided between them. The largest nugget ever found in the Province, valued at $1,300, was taken from McDame Creek in 1877. The shallow ground and bedrock benches were first worked, and hydraulic operations followed in certain sections. Most of the gold was recovered before 1890.

Gold was found on the Stikine River in 1861 and the bars between Chutine (Clearwater) River and Telegraph Creek were extensively worked. Gold has been recovered from Barrington River, the junction of Tahltan and Stikine Rivers, Goldpan Creek, Walker Creek, Wheaton (Boulder) Creek, and bars on the Liard and Kechika Rivers.

References:—

Geol. Surv., Canada, Ann. Rept. 1887–88, Vol. III, Pt. I, Report B.
Geol. Surv., Canada, Sum. Rept. 1925, Pt. A, pp. 33–74.
B.C. Dept. of Mines, Bull. 2, 1930, pp. 21–27.
Geol. Surv., Canada, Mem. 194, 1936.

Graham Island

Fine placer gold occurs in black-sand beach deposits on the east coast of Graham Island. The black sand and gold are concentrated in lenses during "gold storms" when the combination of wind, tide, waves, and current is just right. Other less favourable storms disperse the concentration so that a continuous mining operation is not possible. It is possible although difficult even for an experienced man to separate the gold from the black sand. The weather makes working conditions along the beach exceedingly difficult.

References:—
B.C. Dept. of Mines, Bull. 2, 1930, pp. 28–31.
Minister of Mines, B.C., Ann. Rept., 1932, pp. 38–39.

Douglas Creek (Skeena Mining Division)

Gold was recovered from this creek as early as 1886 but the production recorded has a total value of only a few thousand dollars. There was a revival of activity on the creek between 1930 and 1933, at which time further hand-work was done. In 1933 a nugget weighing 6.27 ounces was found, this being the largest from the creek.

References:—
Minister of Mines, B.C., Ann. Rept., 1914, pp. 107–108.
B.C. Dept. of Mines, Bull. 1, 1931, pp. 47–48.
Minister of Mines, B.C., Ann. Rept., 1932, p. 51.

Lorne Creek (Omineca Mining Division)

Gold was first found on Lorne Creek in 1884 by Harry McDame, after whom McDame Creek was named. The total production of the creek is estimated at more than $70,000, of which about $50,000 was recovered in the four years following discovery. Subsequent hydraulic operations yielded about $20,000 but were unprofitable. Part of the old channel was left unworked. A 1½-ounce nugget was found in 1931.

Small amounts of placer gold have been produced from Fiddler, Chimdemash, Kleanza, Phillips, Porcupine, Buck, and Bob Creeks.

References:—
Minister of Mines, B.C., Ann. Rept., 1930, pp. 154–159.
Geol. Surv., Canada, Mem. 212, 1937, pp. 52–53.

Peace River

Gold was first discovered on the Parsnip River, about 20 miles above its mouth, by Bill Cust in 1861. In 1862 rich diggings were found on Pete Toy's Bar on the Finlay River, 3 miles above its junction with the Parsnip at Finlay Forks. Subsequently, fine and flour gold has been found on many bars and low benches of the Finlay, Parsnip, and Peace Rivers. Bar-miners have worked along these rivers for many years. In the early 1920's a dragline operated at Branham Flat, 26 miles above Peace River Canyon. In 1922 a dredge proved unsuccessful at Fort St. John. A small amount of platinum occurs with the gold on the Peace River and at Pete Toy's Bar.

References:—
Geol. Surv., Canada, Ann. Rept., 1894, Vol. III, pp. 38c--40c.
Minister of Mines, B.C., Ann. Rept., 1906, p. 103.
Minister of Mines, B.C., Ann. Rept., 1923, pp. 141–143.

Liard River

Placer gold was found on McCullough's Bar, near old Fort Halkett, on the Liard River in 1872. Fine bar gold was found and worked at the mouth of Rabbit and Fort Nelson Rivers and on bars along the upper Liard River. It is reported that there is no bar gold found below Devil's Portage on the Liard River.

Reference: *Geol. Surv., Canada,* Ann. Rept., 1887–88, Vol. III, Pt. I, Report B.

Northern Omineca Area

Placer creeks north of the Omineca River include Jimmay, McClair (McLaren), and McConnell Creeks. A 1-once 7-pennyweight nugget was found on Jimmay Creek in 1939. Several thousand dollars worth of gold has been taken from McClair (McLaren) Creek.

Gold was found at the junction of McConnell Creek and Ingenika River in 1899. In 1908 and again in 1932 there were small " rushes " into the creek. The recorded production from the creek has been about 1,100 ounces. Some platinum occurs with the gold.

References:—

Minister of Mines, B.C., Ann. Rept., 1908, pp. 80–83.
B.C. Dept. of Mines, Bull. 2, 1932.
Minister of Mines, B.C., Ann. Rept., 1934, pp. C 16–C 18.
B.C. Dept. of Mines, Bull. 1, 1940, pp. 29–32.

Omineca Area

Gold was found on Vital Creek in 1869, on Germansen Creek in 1870, and on Manson River in 1871. Since that time it is estimated that the value of placer gold produced from the area has exceeded $1,500,000.

The placer streams of importance include Germansen Creek, the Manson River and its tributaries, Slate and Lost Creeks, and Black Jack and Kildare Gulches. Other important streams include Silver, Vital, Tom, Harrison, Rainbow, Philip, Dog, and Sauchi Creeks.

Much of the gold is coarse; in 1934 a nugget weighing about 24 ounces was recovered from the hydraulic workings on Germansen Creek. Arquerite occurs with the gold on Vital, Silver, and Tom Creeks, and platinum occurs on Rainbow Creek. Stream-tin has been reported from Philip Creek but its actual presence has not been confirmed.

The deposits are of a variety of origins. Consequently, the operations have included shallow diggings, wing-damming of the streams, drift-mining on Vital Creek and Manson River, a dragline-shovel operation on Slate Creek, a steam-shovel operation on Tom Creek, and hydraulic operations on Harrison, Vital, and Germansen Creeks and Manson River. Snipers are almost constantly at work at various places on Slate Creek and Manson River.

References:—

B.C. Dept. of Mines, Bull. 1, 1931, pp. 82–88.
Minister of Mines, B.C., Ann. Rept., 1933, pp. 104–113.
Geol. Surv., Canada, Sum. Rept., 1933, Pt. A, pp. 9–29.
Minister of Mines, B.C., Ann. Rept., 1936, pp. C 3–C 16 and C 34–C 36.
Geol. Surv., Canada, Paper 38-14, 1938.
Geol. Surv., Canada, Paper 45-9, 1945.

McLeod River Area

Gold was found on the Little McLeod River in 1932. The gravel is shallow and lies on low-lying rock benches flanking the river. Gold is medium in size, nuggets up to $1 in value being recovered. Platinum occurs with the placer gold. After considerable test work some hydraulicking was done in 1935 and 1936 before operations were suspended. The recorded production is about 300 ounces.

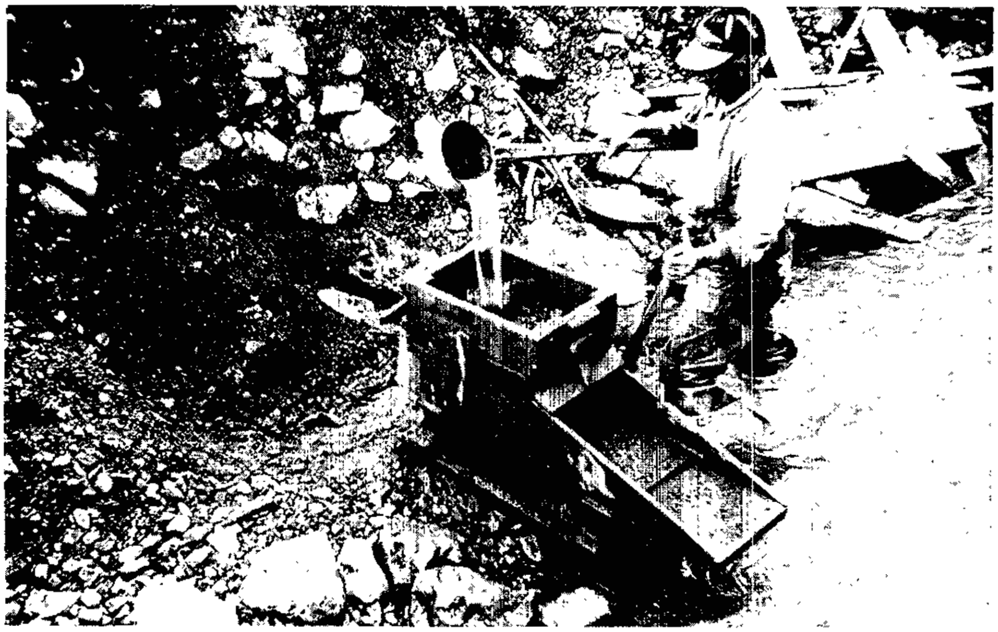
References:—

Minister of Mines, B.C., Ann. Rept., 1932, pp. A 88–A 90.
Minister of Mines, B.C., Ann. Rept., 1933, pp. A 100–A 104.
Minister of Mines, B.C., Ann. Rept., 1936, pp. C 31–C 32.

Cariboo Area

The Cariboo has produced a far larger amount of gold than any other placer area in the Province. The richness of its placers early attracted men to the region from all parts of the world and caused the opening up and transformation of a little-known country.

A. Panning gravel along the side of Germansen Creek.



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B. Washing gravel with a rocker, beside Spruce Creek.

The migration of miners up the Fraser River led to the discovery of gold on the Quesnel River and at Quesnel Forks in 1860. Gold was found on Keithley Creek in the autumn of 1860. Overland to the north, gold was found on Antler Creek in 1859, on Grouse Creek in 1860, and on Williams and Lightning Creeks in 1861. Gold on the Horsefly River was discovered, and prospecting began in 1859 and 1860. Hixon Creek was found in 1866. Most of the important placer creeks of the Cariboo were discovered in the early 1860's. The one outstanding exception was the discovery (in the autumn of 1921) of rich placer ground on a flat about 500 feet above the old workings on Cedar Creek.

The total placer-gold production of the Cariboo has amounted to about $51,000,000. Some creeks have been worked almost continuously in various places since their first discovery. Most creeks have had a record of successes and disappointments, and much of the ground has been worked over several times. The first shallow diggings gave way to drifting on bedrock, then to hydraulicking, and finally to sniping operations along the rims or on weathered bedrock.

The Cariboo placer deposits have been worked by a variety of methods, such as the earliest hand-shovelling and drift-mining, and later hydraulicking (introduced in 1879). Attempts have been made to operate by deep lead mining on Slough and Lightning Creeks; a gravel-elevator operated on Williams Creek; hydraulic elevators were installed on upper Lightning Creek; a bucket dredge worked on Antler Creek; dragline dredges have been worked at Alexandria on the Fraser River, on the Quesnel, Cottonwood, and Swift Rivers, on Pine, Big Valley, Williams, and Lightning Creeks, and at Whisky Flat.

A list of all the placer creeks would be a long one. Some of the outstanding names are Hixon and Government Creeks; Lightning Creek and its tributaries, Mostique, Last Chance, Van Winkle, Perkins, Chisholm, Davis, and Anderson Creeks; Willow River and such tributaries as Rouchon, Dragon, Slough, Nelson, Burns, Big Valley, Sugar, Mosquito, Lowhee, and Williams; Cottonwood River, Grouse, Antler, and Cunningham Creeks. To the south, mention should be made of the Quesnel River, notably the large hydraulic operation at the Bullion mine, and to such tributaries as Keithley, Harvey, and Cedar Creeks, and Horsefly River.

References:—

Geol. Surv., Canada, Ann. Rept., 1887–88, Vol. III, Pt. I, Pt. C.
Geol. Surv., Canada, Maps 364 to 371, 1895.
Minister of Mines, B.C., Ann. Rept., 1902, pp. 59–126.
Geol. Surv., Canada, Sum. Rept., 1921, Pt. A, pp. 59–71.
Geol. Surv., Canada, Sum. Rept., 1922, Pt. A, pp. 68–81.
Geol. Surv., Canada, Mem. 149, 1926.
Geol. Surv., Canada, Sum. Rept., 1932, Pt. A I, pp. 76–145.
Geol. Surv., Canada, Sum. Rept., 1933, Pt. A, pp. 49–61.
Minister of Mines, B.C., Ann. Rept. 1938, pp. C 15–C 36.
B.C. Dept. of Mines, Bull. 26, 1948.
B.C. Dept. of Mines, Bull. 34, 1954.
Annual Reports of the *Minister of Mines, B.C.,* from 1874 to date give a commentary on the various operations in the Cariboo.

Fraser River

Although gold had first been found on a tributary of the Fraser River in 1857, it was the discovery of large amounts of gold on the bars of the lower river in 1858 that started the gold-rush to the country. By June of 1858 about 20,000 people had arrived in Victoria by boat from San Francisco. Prospectors kept pressing onward beyond the known diggings and soon placer discoveries were made along the entire length of the river and its tributaries. The impetus was given by the rich, rapidly worked, shallow bar diggings on the lower river. From there, in the first five months of work in 1858, gold valued at more than $500,000 was recovered.

Gold was found at the surface and to a depth of only a foot or more on bars, some exposed only at extreme low water, and on benches along the lower river.

"The lowest bar on the Fraser which was found to yield remunerative return, was Maria Bar, about 25 miles below Hope, and nearly opposite the mouth of the Chilliwack River. Thence to Hope, and in the neighbourhood of that place, all the gold found was flour gold of great fineness. In ascending from Hope to Yale, however, it was observed that the bars became richer and the gold was not so fine. It is highly probable that all this gold was transported by the river itself and not of local origin."* Hills Bar, just below Yale, probably yielded more gold than any other single locality on the Fraser. It is estimated to have produced at least $2,000,000 worth of gold.

"From a point on the river a few miles below Boston Bar (about 16 miles above Yale) to Sisco Flat, a short way below Lytton, a distance in all of about 25 miles, rich deposits of 'heavy' gold were worked. Farther up the river is a second run of 'heavy' gold . . . which appears to have extended from a point above half-way between Lytton and Foster's Bar (just below Lillooet) to some little distance above Fountain. Here nuggets of some size were occasionally unearthed, and there were some exceptionally rich diggings."* Nuggets up to 6 ounces in size are reported to have been recovered near Lillooet.

The bar and bench diggings extended upstream past Alexandria and the mouth of the Quesnel River to Cottonwood Canyon.

The total yield of placer gold from the Fraser River is unknown, but in the first three years, 1857–59, the aggregate is estimated at more than $1,700,000. Much of the placer was found and worked in the first few years after the initial discovery. By 1875 most of the miners were Chinese and Indians; in 1890, 400 Chinese miners were still working along the river. At that time it was reported that nine-tenths of the gold was being recovered by Chinese miners.

Dawson considered that the coarse gold such as was found around Lillooet was of local origin and was eroded from the belts of argillite and micaceous schists that cross the river. Also it is interesting to speculate on the possible effect that the great Fraser River fault zone may have had upon the localization of the original lode-gold sources of the placers. The fine gold on the other hand was partly concentrated from the glacial gravels and might have travelled considerable distances from its bedrock origin. The early miners who worked the bars below Yale, thinking that the gold had its origin in rich sources at the head of the river, kept pressing farther upstream. Despite the fact that their theory was only partly correct, the phenomenally rich placers of the Cariboo were discovered by them.

The existence of gold for several hundred miles along the Fraser River and the development of travel along its course led to placer discoveries on tributary streams. Placer was found and worked on Coquihalla, Thompson, and Lillooet Rivers, Siwash and Cayoosh Creeks, and Bridge River and its tributaries.

The early bar deposits were shallow and were worked with pans and rockers. Subsequently, some of the benches were hydraulicked and several dredges were built to work bars at Lillooet and Lytton. Even now some bars are worked every year by snipers at extreme low water.

References:—

Geol. Surv., Canada, Ann. Rept., 1887–88, Vol. III, Pt. II, pp. 17R–29R, 115R–119R.

Geol. Surv., Canada, Ann. Rept., 1896, Vol. VII, Pt. B, pp. 321B–333B.

Geol. Surv., Canada, Mem. 213, 1937, pp. 46–49.

B.C. Dept. of Mines, Bull. 3, 1940.

B.C. Dept. of Mines, Bull. 11, 1941.

* Dawson, G. M.: *Geol. Surv., Canada,* Ann. Rept., 1887-88, Vol. III, Pt. II, p. 28R.

Vancouver Island

Placer-miners have worked streams on Vancouver Island, including China and Loss Creeks, Leech, Gordon, Jordan, Sooke, Sombrio, San Juan, Bedwell, Nanaimo, Oyster, Gold, and Zeballos Rivers.

Gold was found on Leech River in 1864 and intermittent operations were carried on for many years; the last, a hydraulic operation, was closed down in 1941. The total production from the river is estimated to be between $100,000 and $200,000. One nugget valued at $70 is reported to have been found and snipers in recent years have recovered nuggets of about half an ounce and 1 ounce.

The first placer gold was found on China Creek about 1862. It is estimated that more than $40,000 in fine gold has been recovered, most of it by Chinese.

Bedwell River was worked for placer as early as 1862. In 1893 thirty Chinese were still working creek claims.

Placer gold has been known for many years along the Zeballos River and undoubtedly was derived from the gold-quartz veins of the area.

Beach placers containing very fine gold in black-sand concentration occur along a 3-mile stretch of beach at Wreck Bay, and at the mouth of Nahwitti River. The deposits at Wreck Bay were first worked in 1899, 1900, and 1901, at which time about 1,400 ounces of gold was recovered. Since then they have received attention by individual miners from time to time.

These beach placers present difficulties of working because only after certain storms are the sands sufficiently concentrated to be worked. Even then separation of the fine gold from abuntant magnetite sand is so difficult that an inexperienced man has little chance of accomplishing it profitably.

Both beaches are exposed to the full force of the storms so that working conditions are frequently unfavourable.

References:—

Geol. Surv., Canada, Report of Progress, 1876–77, pp. 95–102.
Geol. Surv., Canada, Ann. Rept., 1887–88, Vol. III, Pt. II, pp. 141R–143R.
Minister of Mines, B.C., Ann. Rept., 1893, p. 1080.
Minister of Mines, B.C., Ann. Rept., 1900, p. 921.
Minister of Mines, B.C., Ann. Rept., 1921, p. 214.
Minister of Mines, B.C., Ann. Rept., 1930, p. 287.
Minister of Mines, B.C., Ann. Rept., 1936, p. F 61 (lists Special Report on Wreck Bay available on application).

Similkameen and Tulameen Rivers

Gold is reported to have been found on the Similkameen River below Princeton as early as 1853. The bars attracted attention at various times, but the most active period began with the discovery of coarse gold on Granite Creek in 1885. Nuggets valued up to $150 were recovered from Granite Creek, though the largest nugget, valued at $900, came from Lockie (Boulder) Creek, a tributary of Otter Lake.

Platinum is recovered with the placer gold from Tulameen River and its productive tributaries, Granite, Cedar, Slate, and Lawless (Bear) Creeks. In some places there is more platinum than gold. The platinum found is in nuggets up to about half an ounce in weight. It is estimated* that from 10,000 to 20,000 ounces of placer platinum has been recovered since 1885.

The total placer-gold production from the area has had a value of approximately $750,000, of which about half came from Granite Creek, the richest creek in the area.

The earliest wing-damming and shallow hand operations were succeeded by hydraulic plants on Granite Creek and at various places along the benches of Tulameen River.

* *Geol. Surv., Canada,* Mem. 26, 1913, p. 129.

A dredge was built at the mouth of Granite Creek and operated for a short time in 1923; the buried channel at the mouth of Granite Creek was drifted on before 1900. A dragline dredge was operated on the Similkameen River below Princeton from 1948 to 1951.

References:—

Geol. Surv., Canada, Mem. 26, 1913, pp. 131–146.
Minister of Mines, B.C., Ann. Rept., 1926, pp. 228–234.

Okanagan Area

Several creeks in South Central British Columbia have produced varying amounts of placer gold. These include Scotch Creek, found before 1877 and mined for 8 miles above its mouth; Louis Creek, mined in 1861; Tranquille Creek, discovered in 1858 and worked for many years by Chinese; Mission Creek, discovered about 1875, was richest about 7 miles above its mouth; Cherry Creek, discovered about 1875, produced coarse gold, including a nugget valued at $130; and Harris Creek. Several small creeks flowing into the North Thompson River and a few into Okanagan Lake have produced some gold.

References:—

Geol. Surv., Canada, Ann. Rept., 1877–78, pp. 153B–160B.
Minister of Mines, B.C., Ann. Rept., 1925, pp. 184–186.
Minister of Mines, B.C., Ann. Rept., 1936, pp. D 43–D 53.

Rock Creek

Gold was found on Rock Creek in 1860. For a few years the creek produced well, but by 1900 work had almost entirely ceased. A small revival of interest took place between 1930 and 1935. The gold was largely recovered from the bed of the creek and from low benches; a little drifting has been done in search of abandoned channels. Some platinum was recovered during the early work.

Reference: *Minister of Mines, B.C.,* Ann. Rept., 1938, pp. D 26–D 33.

West Kootenay

Placer gold has been found, and varying amounts of work done, on the following streams: Boundary, May, and other creeks tributary to Kettle River, Forty-nine Creek, and Salmo, Pend d'Oreille, Lardeau, and Duncan Rivers.

Reference: *Geol. Surv., Canada,* Mem. 172, 1934, pp. 89–90.

Big Bend Area

The discovery of gold on French Creek in 1865 started a rush of prospectors into the Big Bend country. French Creek, McCulloch Creek, Camp Creek, the lower part of Goldstream River, and Carnes Creek were worked. Of these, the first two were the most important and possibly produced $2,000,000 worth of gold.

The gold for the most part was rough and coarse. A nugget valued at $253 was found on French Creek.

A hydraulic plant was operated on French Creek in 1929.

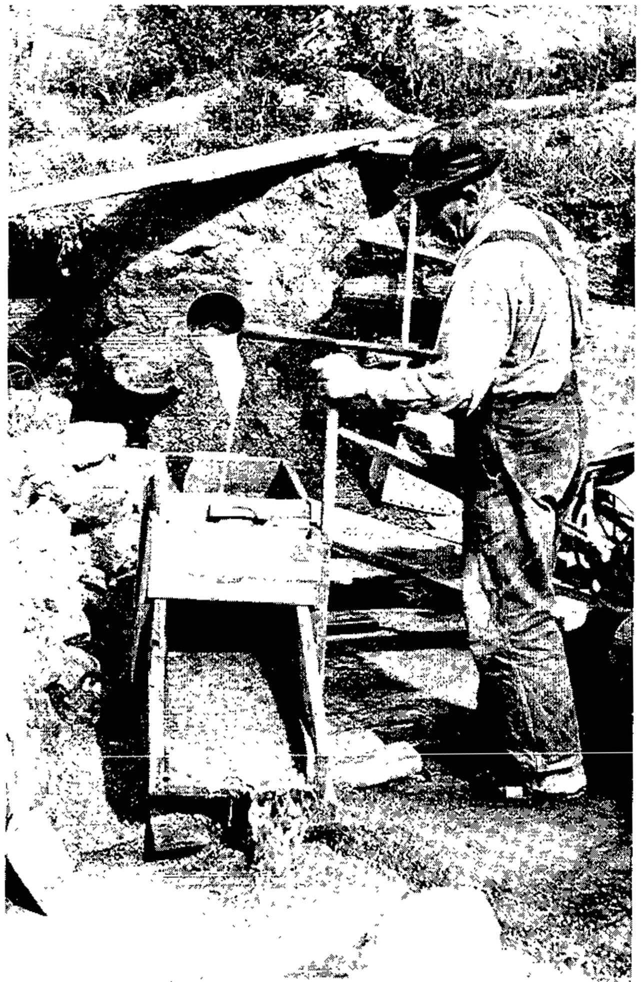
References:—

Geol. Surv., Canada, Ann. Rept., 1887–88, Vol. III, Pt. II, pp. 133R–134R.
Minister of Mines, B.C., Ann. Rept., 1922, pp. 213–214.
Geol. Surv., Canada, Sum. Rept., 1928, Pt. A, pp. 192–193.

East Kootenay

Placer gold has been recovered from Wild Horse River, Bull River, Perry Creek, Moyie River, Weaver Creek, Palmer Bar Creek, Findlay Creek, Boulder Creek, and Quartz Creek. The total production of placer gold may have exceeded $1,000,000, most of which came from Wild Horse River.

A. Detail of a rocker, showing tray with a punched metal screen, and coarse, expanded metal screen used in the bottom for riffles.



B. A rocker set up to rework old tailings at Cedar Creek.

Gold was found on Wild Horse River in 1863. The river has been extensively worked by hydraulicking; the latest operations were in 1935.

Wild Horse and Bull Rivers are two of the very few rivers draining westward from the Rocky Mountains that contain coarse placer gold.

Perry Creek was found in 1867 and has been the site of both drift and hydraulic operations.

References:—

Minister of Mines, B.C., Ann. Rept., 1903, pp. 76–79.
Minister of Mines, B.C., Ann. Rept., 1915, p. 114.
Geol. Surv., Canada, Sum. Rept., 1932, Pt. II, pp. 76–84.
Geol. Surv., Canada, Mem. 207, 1937, pp. 38–41.

INDIVIDUAL PLACER-MINING METHODS

Panning

Panning is a simple method of recovering placer gold, but it becomes laborious if any yardage is washed. The gold-pan commonly used is a circular basin with straight, flaring sides and a flat bottom. The diameter at the top is from 10 to 18 inches. The pan commonly used is 16 inches in diameter at the top, 2½ inches deep, the sides sloping towards the bottom at about 40 degrees. The Australian type has a rounded lip and the American, as shown in Fig. 3 (7), a straight lip. The inner surface of the pan must be kept free from grease, and before use a new pan should be heated to remove its oily protective covering. A pan must not be polished or it will become too slippery.

Most pans are made of sheet iron. Some are made of copper, or have copper bottoms, so that a coating of mercury may be applied to catch fine gold.

The gold-pan, filled heaping full with gravel, is submerged in quiet water, and the material is worked with the hands until it is thoroughly loosened and saturated. Rocks and large pebbles are washed clean at this stage and thrown out, and all clayey material is broken up and washed from the pan. The pan is shaken in a horizontal position to permit the gold to settle to the bottom, and then raised to the surface of the water with a tilt away from the panner to allow the fine and lighter material to be washed over the lip. The motion of slightly lowering the pan and then raising it with a forward tilt is repeated until all the lighter materials are washed away.

The pan should be shaken at intervals, either submerged or raised above the surface of the water, to allow all the gold to work its way to the bottom. The actual motion of the pan may be varied considerably, according to the preference of the panner and the character of the material treated. Some adopt a jerky, circular, tilting motion, whereas others prefer the foregoing method.

When the lighter material has been largely removed and the gold and heavier minerals remain in the pan it may be desirable to complete the operation in a tub of water, so that gold lost in the final stages may be recovered from the material accumulated in the tub. The process of panning gravel is necessarily a slow one and care must be taken or fine gold will slip over the edge of the pan and be lost.

When the water is very cold two pans may be used; one pan is punched with ¼-inch holes and fitted into and on top of another pan. After filling the top pan with gravel and thoroughly wetting and shaking the finer gravel into the lower one, all the coarse material in the top pan can be discarded and only the residue in the bottom pan worked for gold. Another plan is to punch two small holes on each side through the lip of the pan and thread two wire handles through them. In this way the panner's hands can be kept out of the water to some extent. Rubber gloves may also be worn.

The final residue in the pan is dried. Any magnetite may be removed with a magnet. The non-magnetic material, after first picking or screening out the larger pieces of gold, may be separated by amalgamating the fine gold or by blowing away the sand from the gold on a small flat tray.

As a general rule 150 to 170 pans of dirt (depending on how full the pan is heaped) are equivalent to a yard of material in place. An experienced panner can pan about one-half cubic yard of material a day. Consequently, only very rich gravel can be panned profitably. In the past much of the bar-mining was done by panning, but nowadays panning is used mostly for testing placer ground and for cleaning up.

Rocking

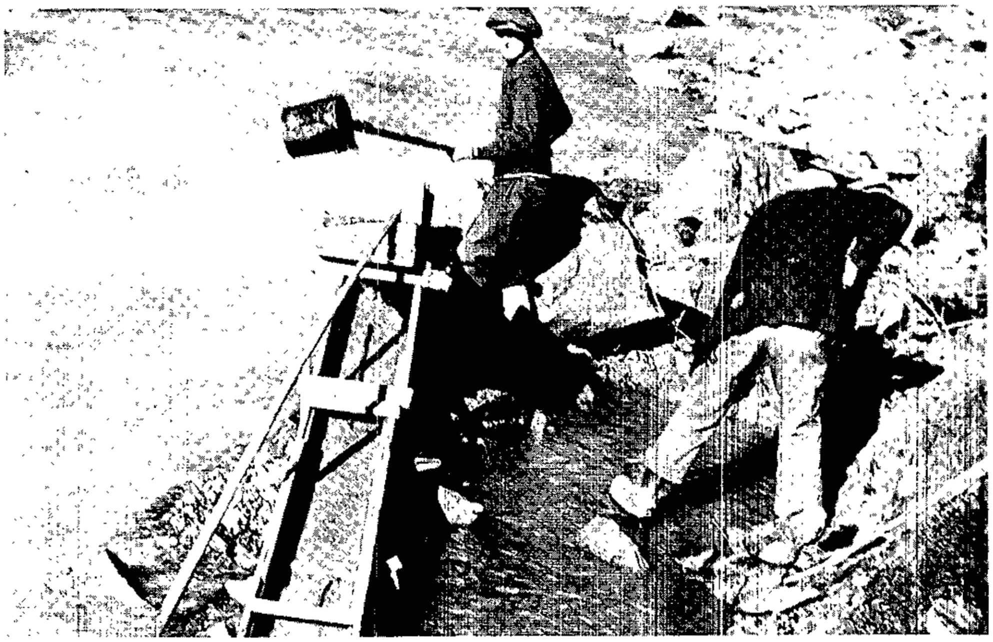
A rocker is a simple wooden contrivance for washing gravel. Operated by one or two men, much more gravel can be treated with less effort than by panning. One man can rock up to 3 cubic yards of gravel per day, depending on its character, the distance it has to be moved, and the availability of water.

A rocker is constructed from a few pieces of 1- by 12-inch lumber, a piece of metal screen, and some blanket or burlap. It may be made any size, within reason, to suit the occasion. A small type, shown in Fig. 3, is good for recovering coarse gold, and a larger size, built on the same principle, is more efficient for saving fine gold because of the greater length of the sluice. The smaller type has the advantage of being easily moved from place to place when prospecting. For convenience in moving, the larger rockers may be of " knock-down " construction, held together with bolts and nuts; but if made this way care must be taken that the joints are tight, otherwise fine gold will be lost. A piece of canvas, galvanized iron, or tin spread over the bottom and partly up the sides of the sluice will help prevent the loss of fine gold.

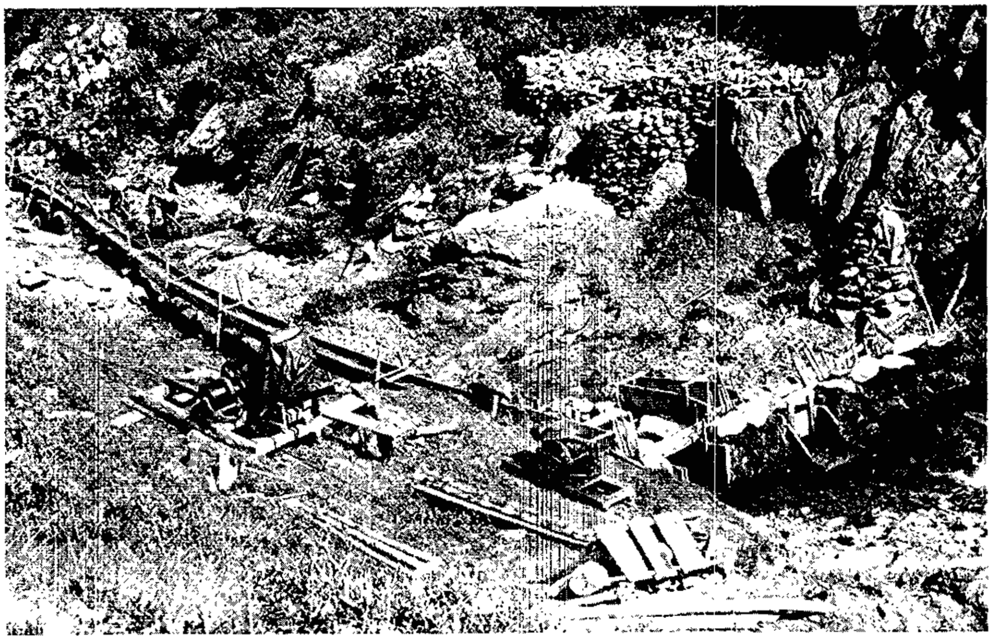
A rocker is set up either close to the bank of a stream or where water can be bailed or piped into the tray. The water should be poured in as steady a stream as possible; a sudden rush tends to wash the fine gold out of the sluice. If a high percentage of clay is mixed with the gravel a layer of mud will often form on the blanket covering the apron and making it difficult to catch the gold. Puddling the gravel in a separate box before rocking sometimes assists in avoiding this trouble, but more often than not the gold is mixed with the clay and the residue in the bottom of the puddling-box will require panning separately.

The operation of a rocker is more efficient when two men are working, one shovelling in and dumping the tray when the gravel is washed, and the other rocking and bailing water. When the tray is filled, water is poured over the gravel and at the same time the box is rocked from side to side. The movement of the rocker must not be violent, as too much motion will tend to wash the gold as well as the sands over the riffles. When the gravel is clean, search the bottom of the tray for any nuggets that may be too big to pass through the punched holes. The finer gold will pass through the holes and be caught either in the apron or sluice-riffles. The tailings should be panned occasionally to determine whether gold is being lost. If the ground is rich, the apron and sluice-riffles must be cleaned up frequently. The sand behind the riffles and on the blanket catch gold, and if much is in evidence, clean water should be run through and the box rocked gently to clear off the loose sands. The apron is then taken out and the residue washed into a pan or bucket full of water. The riffles from the sluice are now washed, the residue going into a pan placed across the mouth of the box. If canvas is used, it is also washed into a pan.

Fig. 3 (1) is the side view of a rocker showing the 2- by 4-inch side-braces nailed to the side-boards of the box. One of these is extended and tapered for a handle. Each side of the box and sluice can be cut out of one piece of 1- by 12-inch lumber, 42 inches or more in length. The bottom of the box, Fig. 3 (2), can be made of one piece of board 16 inches wide and 42 inches long. If not procurable, two pieces planed so that they fit tightly together can be used. It is safer to cover the bottom of the sluice with canvas, galvanized iron, or tin to prevent leakage, and, in the latter case, assist the flow



A. A long-tom with one man bailing water and the other shovelling gravel. Coarse cocoa-matting covers the bottom of the sluice-box.



B. Shovelling-in operation on Alice Shea Creek. The entire creek flows through the sluice-boxes. Notice the rock-piles in the background and the hoist and portable pump in the foreground.

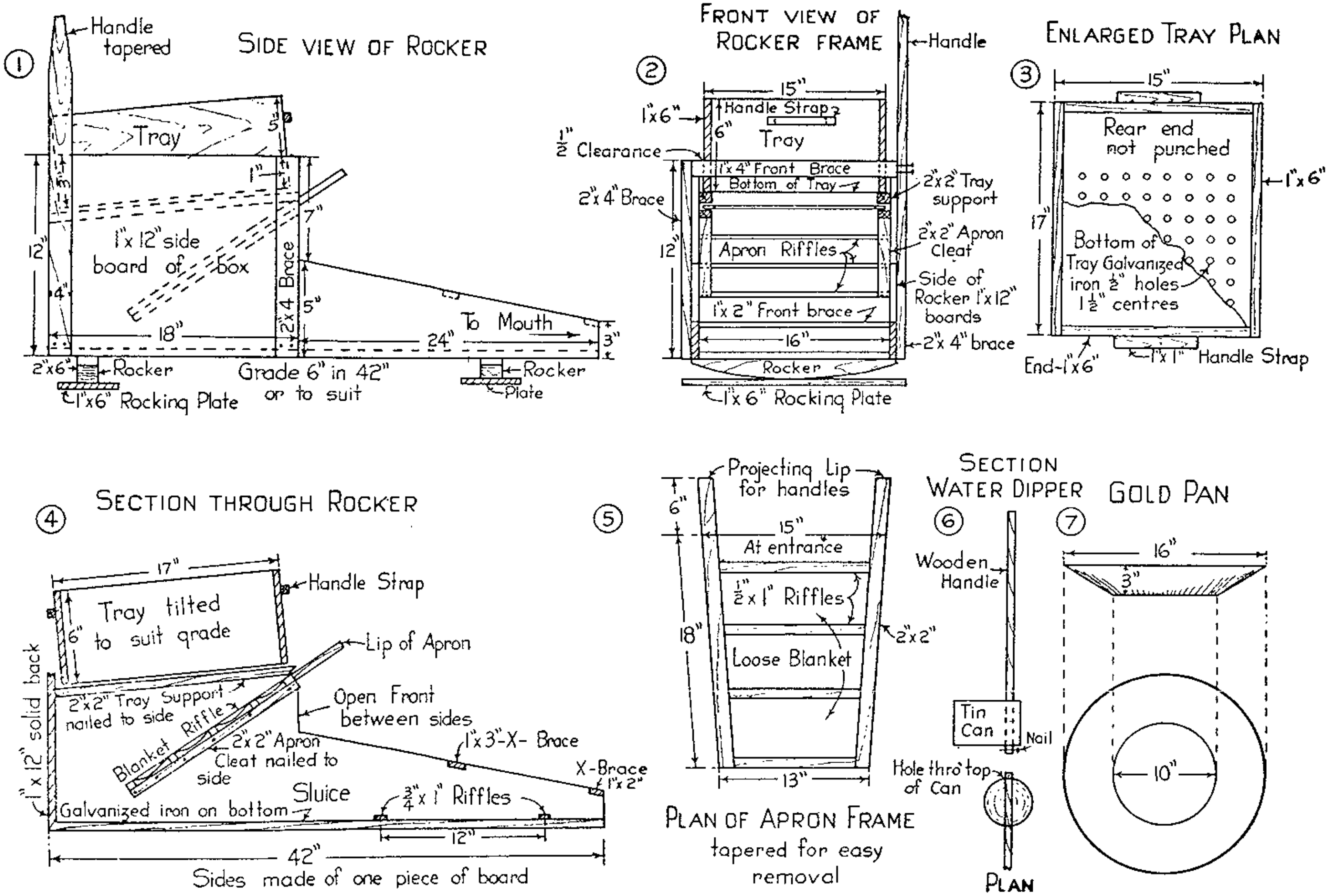


Fig. 3. Plan and sections of rocker, dipper, and gold-pan.

of sand and gravel. The tray, which is built of 1- by 6-inch lumber, 17 inches long, with screening or a punched galvanized plate nailed to the bottom or held in place with a 1- by ½-inch wooden strap, is set upon two 2- by 2-inch supports nailed to the side of the box at an angle sufficiently great so that when the entire rocker is set at the proper gradient it will tilt slightly forward. Make the outside measurements of the tray small enough so that it can be removed easily. Two pieces of wood nailed on the ends of the tray will be useful for handles. Be sure that the boards used for the rocker are free from knot-holes, otherwise gold will be lost.

At the bottom of Figs. 3 (1) and 3 (2), two "rockers," made of 2- by 6-inch or 2- by 4-inch lumber, the width of the sluice, and bevelled from the centre outwards, are nailed to the box sufficiently far apart so that it can be rocked to and fro easily. Underneath, two rocking-plates or flat stones are laid to keep the rocker in place. In some rockers a steel pin or large spike is inserted in the centre, which fits into a loose socket bored in the plate. In this way the box is kept from slipping down-grade.

In Fig. 3 (2) the front view of the rocker-frame is not drawn to scale, but to show the construction of the different supports, etc., clearly. For instance, the bottom of the tray is, in reality, hidden by the 1- by 4-inch brace.

In Fig. 3 (3) an enlarged drawing of a tray is shown. The rear end of the tray can be punched if the apron is built nearly the full length of the box. If not, it is better as planned so that the gold will fall upon the blanket riffles before being washed down the sluice. The slight down-gradient given to the tray will generally be sufficient to move the gold over the punched holes.

In Fig. 3 (4) the position of the tray before being tilted to obtain a suitable grade is shown. Also, the approximate position of the blanket riffle, which must be set on a steep enough gradient so that there will be as little packing of gravel on the riffles as possible. Two or three sluice-riffles are generally sufficient, but more can be added if the tailings are found to contain gold. Two cross-braces are necessary to keep the top of the sluice from warping.

In Fig. 3 (5) the plan of the apron shows the projecting lips of the frame which are useful for pulling out the apron before the clean-up. The tapered measurements can be regulated to suit the size of the box. If the frame is not tapered, it may stick owing to fine gravel packing along the sides. The loose blanket can either be tacked on or held in place with a narrow strip of wood; in some operations the blanket is used alone without wooden cross-pieces. The sand packed behind the riffles should be stirred occasionally so that the gold can sink.

Fig. 3 (6) shows a long-handled dipper which can be constructed by punching a hole through the top of a can and driving a nail as shown to keep the can from slipping.

Sluicing

Sluicing is the standard method of recovering gold in placer operations. Sluices vary in size according to the scale of operations. There are many types of riffles, most of which are successful in catching gold; not all types are shown on the accompanying sketch (*see* Fig. 4). Those described are simple and are easily constructed in out-of-the-way places.

The plan shows a sluice-box made from sawn lumber, but a sluice can be made from peeled poles, split poles, or whip-sawn lumber.

Small sluice-boxes (*see* Fig 4) are three-sided and are made of 1- by 12-inch lumber, 12 feet long, with the smoothest side placed on the inside of the box. The depth of the box is not so important as the width. Lumber used should be free from cracks and knots and be planed on the edge to permit a tight fit where the sides come against the bottom. If a close fit is not obtained, much gold will escape. Leaks may be caulked with moss or sacking. To prevent spreading of the sides of the box, a 2- by 4-inch cap and side-brace can be used where necessary (Fig. 4 (7)). In any case, a cap is advisable and is useful for lifting the sluice-box. If more than one box is used, they can be butt-jointed and held together by braces as shown in Fig. 4 (7), or the lower end of each box can be narrowed by cutting the sides of the bottom board so that it will telescope into the top end of the one following. The butt-joint is more satisfactory for a permanent operation and the telescope for working deposits where the boxes have to be constantly moved. The joints must be carefully packed with sacking or moss, which, when the operation is finished, is burnt, the ashes being panned for gold.

A sluice-box is used when there is sufficient water available to carry the gravel, and where there is sufficient headroom to introduce the water at the proper level, and a dump space to dispose of the tailings. The sluice-box should be set on a gradient of 6 inches in 12 feet. There should be sufficient water to cover and wash all the gravel shovelled into the box. Gold will be lost if there is too little water, and the riffles become packed. Likewise, some fine gold will be lost if there is too much water and its velocity is too high. Losses can be checked by constant panning of the tailings.

A " string " of three or four sluice-boxes has the advantage over a smaller number inasmuch as the gravel is washed more thoroughly and the fine gold is well wetted so that it will sink. If the gold is coarse, one sluice-box may be sufficient because the gold will lodge within a few feet of the head of the box.

Riffles

Riffles can be made in many ways and the simpler the better. In addition to those described below, there are the following: *Block riffles,* which can be made of squared poles or blocks of wood 3 inches or more square and set in a sluice box about 1 inch apart; *Hungarian riffles* are cross-riffles made of either angle-iron, steel rails, metal webbing, or iron straps fastened on top and projecting over a wooden cross-riffle with the open part of the angle downstream in the sluice-box. Very elaborate types of riffles, as a rule, will not catch any more gold than simple ones.

In Fig. 4 (1), (2), and (3) sections of peeled longitudinal poles, cross or ladder, and fine-gold riffles are shown through the side of the sluice-box. The pole riffles are generally made from poles 2 or 3 inches thick and between 3 and 4 feet long, laid lengthwise and about half an inch apart at the head of the sluice. The ends of the poles are nailed to two cross-pieces of lumber or split poles (Fig. 4 (4)), the diameter of the riffles and the width of the box. Wooden wedges are driven between the poles to keep them apart in the centre. The cross-pieces are nailed to the side of the box from the outside, leaving the head of the nail projecting so that it can be withdrawn easily. If the nails are driven inside the box, the gravel will pound them so that they cannot be pulled out when it is necessary to remove the riffles prior to cleaning up.

The cross or ladder riffle (Fig. 4 (5)) is generally placed next to the poles. The cross-pieces may be made of squared poles, 1 by 2 inches, or of lumber, and placed about 4 inches apart, and the ends fastened to two longitudinal 1- by 2-inch straps 4 feet long built similarly to a ladder so that the section of riffle can be easily removed.

A fine-gold riffle may be placed at the end of the sluice-box. First a blanket or doubled sack is laid on the bottom of the box. On top of this a small peeled-pole, framed riffle with wedges between is placed to protect the sacking from pounding by the gravel and from disturbing any gold that has settled in the bottom. The 2- by 4-inch cross-riffles on top of the poles and generally placed about 3 feet apart cause the necessary swirl in the water to thoroughly wet the fine gold so that it may sink.

Grizzly

A grizzly (*see* Fig. 4 (8) and (9)) is a set of parallel steel bars or rails, or even poles, set in a 2- by 4-inch rack and spaced according to the size of gravel which is to be kept out of the sluice-box. The grizzly is set over the head of the sluice at an angle of about 45 degrees so that the oversize material will roll off easily. The upper side is held in place at the required height by two pole props nailed to the frame of the grizzly and stuck in the ground. If a wheelbarrow is used, a wooden hopper can be built over the grizzly and the water-supply line raised to the height of the top of the hopper so that

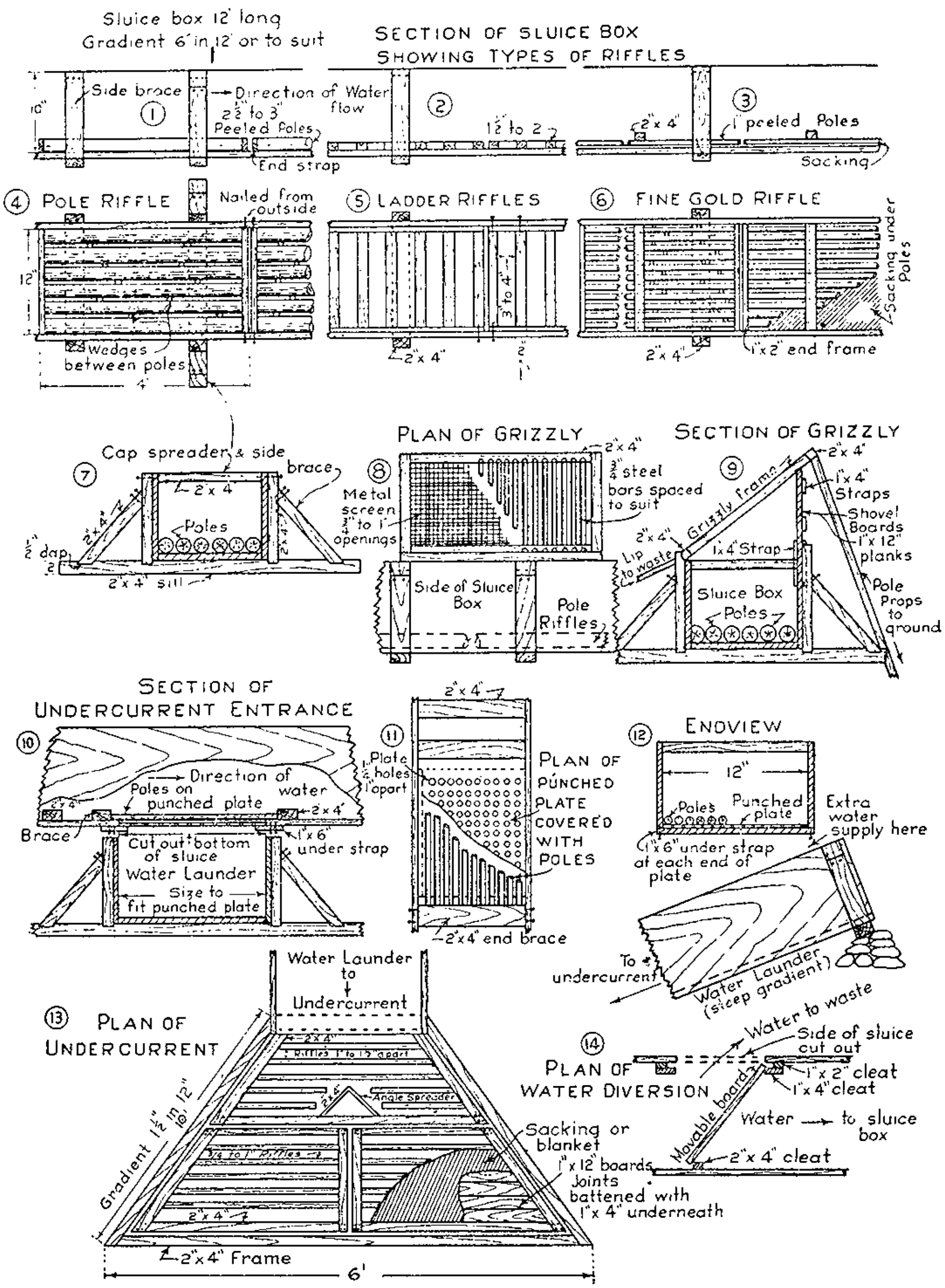


Fig. 4. Types of riffles, grizzly, undercurrent, and water diversion.

A. Sluice-box riffles, showing canvas covered by coarse expanded metal screen and a section of Hungarian riffles below.

B. Sluice-box set up for shovelling-in. A section of pole-riffles is shown.

the boulders will be washed before dumping. If the boulders are covered with mud, it is advisable to hand-wash or puddle the larger boulders and put the remainder through the sluice-box as the mud may contain gold.

Undercurrent

There are many types of undercurrent sluice-boxes which are successful. A box of this type is designed to save fine gold that otherwise would be washed away in the ordinary sluice by the disturbance caused by coarse rolling gravel. There are two important rules for the beginner to remember: (1) That fine gold must be wet before it will sink; (2) that when it has sunk it must be undisturbed, consequently coarse gravel must be kept out of the box in which the fine gold has fallen to the bottom.

In Fig. 4 (10) a section through the side of the sluice-box shows details of the position of the intake for an undercurrent. First of all, the bottom of the sluice-box is cut out the required length and width of the screen, consisting of a plate punched with ¼-inch holes 1 inch apart. Underneath the box and projecting far enough into the hole cut so that the plate will rest safely upon them are nailed two 1- by 6-inch pieces of lumber, the width of the sluice-box. After placing the plate in position, a riffle, made of framed, small, peeled poles spread about a quarter of an inch apart with wedges, is placed lengthwise over the plate and nailed in place from the outside of the sluice-box. Congestion often occurs in any type of undercurrent entrance, especially if the gravel contains much black sand, so care must be taken to keep the punched plate clear. The 2- by 4-inch riffle shown on the upper side of the plate opening can be set at the proper distance, according to the volume of water used, to give the final swirl.

In Fig. 4 (12) the undercurrent water-launder is shown in section. An extra amount of water is often necessary to drive the black sand on to the undecurrent. The gradient of the launder delivering to the undercurrent can be adjusted with rocks as shown.

In Fig. 4 (13) one of many types of undercurrents is shown. The idea, generally, is to spread the product received from the intake over as large an area as possible to give it a chance to settle more readily than it would in an ordinary sluice-box. The angle-spreader, made of two pieces of 2- by 4-inch, set on edge near the top of the undercurrent, assists in accomplishing this, as well as keeping the product away from the junction of the two separate frames below.

In the plan, Fig. 4 (13), the bottom of the undercurrent is made of 1- by 12-inch boards, planed, if possible, and fitted closely together. Underneath, 1- by 4-inch strips are nailed to the joints to prevent as much leakage as possible. On top of the boards a blanket or sacking is laid, and on top of this are set ¾- to 1-inch riffles about 1½ inches apart. Be sure that the hairs of the blanket or sacking do not project over the riffle. Instead of wooden riffles, metal webbing, if procurable, can be used to advantage. The dimensions given are arbitrary and any convenient size can be used. Plenty of water is necessary and a gradient of at least 1½ inches in 12 inches. All riffles must be constructed as separate trays and be easily removable.

Fig. 4 (14) shows one plan of water diversion used when cleaning up the sluices. The side of the sluice-box is cut out so that the piece removed will fit across the box and divert the flow of water through the opening.

If water is scarce and insufficient to roll the gravel quickly down the sluice-box, a space of a few feet is left between the riffles and is covered, if possible, with a metal plate or flattened tin can. This will accelerate the flow of water.

Cleaning Up

In cleaning up, only a small flow of water is allowed to run through the boxes. The riffles are removed successively from the top end and washed in the box itself. By working over the concentrates in the bottom of the box with long-handled wooden paddles it is possible to wash off additional light material. As the concentrates " stream down " the sluice, the gold begins to show at the head end. This should be picked up by means of a whisk-broom and small metal scoop. Finally, the concentrates should be shovelled from the box and the remaining finer gold panned or rocked from them.

If the gold is very fine, it may be separated from the concentrates by amalgamation. About five times as much mercury should be used as there is gold. If the gold is coated with oil or grease and will not amalgamate, it should be cleaned with soda or lye. Rusty, tarnished gold will not amalgamate unless it is cleaned by abrasion in a barrel amalgamator. An amalgam-barrel should be used if the operation yields fairly large amounts of sluice-box concentrates containing fine gold or gold that is difficult to amalgamate.

When using mercury, care should be taken to prevent loss as it is expensive and escapes readily.

The proper method for separating the gold from the mercury after amalgamation is by means of a metal retort. This can be obtained from any chemical supply company. The mercury, volatilized by gentle heat, will pass up through the tube in the sealed cap of the retort and down the tube into a bucket of water. Care must be taken to prevent the escape of the mercury fumes, which are poisonous, and for the same reason retorting should be done in the open or at least in a well-ventilated room. The early miners used a halved and partly hollowed potato into which the amalgam was placed. The halves were then bound tightly with wire, and the potato was put in a fire or oven, the mercury was absorbed by the potato and the gold was released. By rubbing and washing the residue, a little of the mercury was recoverable.

Long-tom

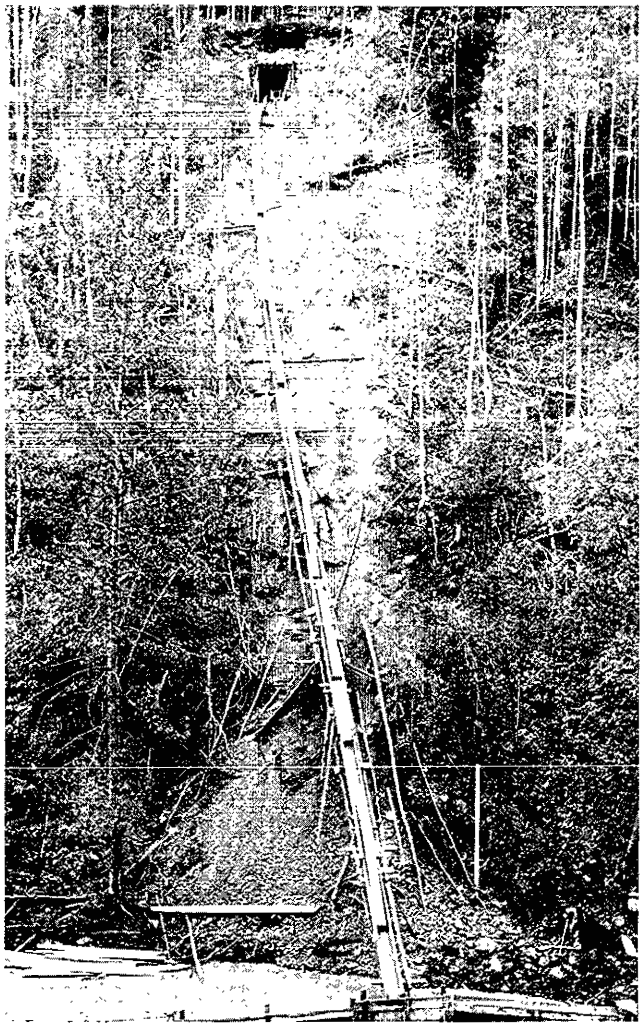
A long-tom is seldom used because a plentiful supply of water is necessary and a simple sluice is easier to build and is just as efficient. It is used by some prospectors when a greater amount of washing is needed than that provided by a rocker.

A long-tom consists of three boxes, the first being about 6 to 12 feet long, 12 inches wide, and 6 to 8 inches deep. It is set on a grade of about 1 inch per foot and rests on the closed upper end of the second or washing box, which is 6 to 12 feet long, 20 inches wide at the upper end, and 30 inches wide at the lower end. The lower end of the second or washing box is made from a perforated metal screen set at an angle of about 45 degrees outward from the bottom of the box. The washing-box rests on the closed upper end of the third or sluice-box, which is about 12 feet long and 36 inches wide. Cross-riffles are placed in the bottom of the sluice-box.

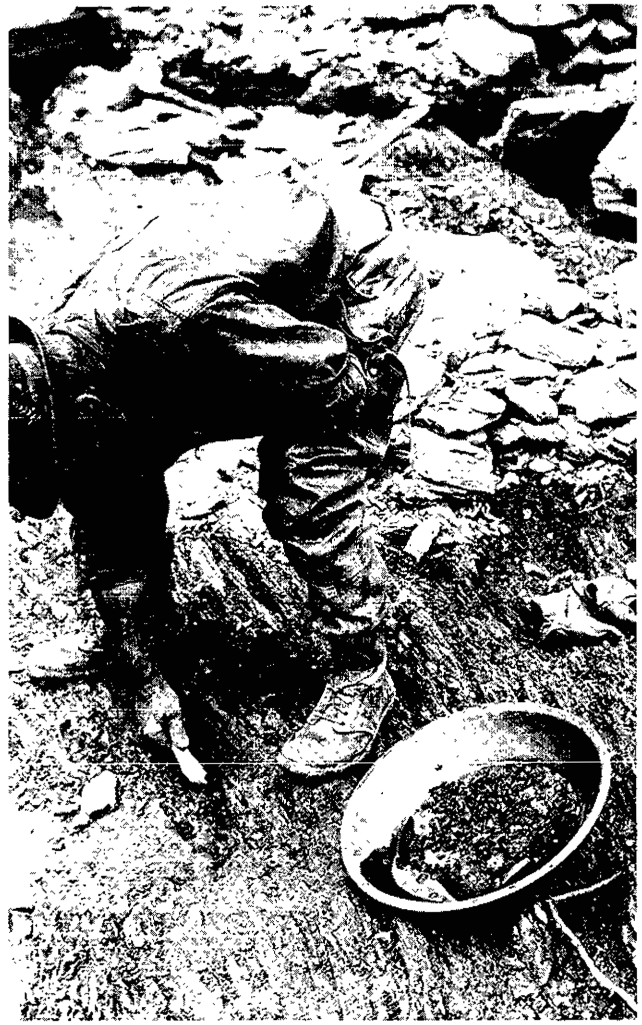
The water enters the receiving launder or first box, into which the dirt is shovelled. The drop into the second box helps to break up the clayey and sticky material. The finer material passes through the screen at the lower end of the washing-box into the sluice-box, and the larger material is allowed to remain in the washing-box until it is thoroughly cleaned, when it is forked out. Two men can handle about 6 yards of average gravel per day. One disadvantage of the long-tom is that the water must be raised to convey it to the first launder. This is ordinarily done by bringing the water in a flume from a point higher on the creek; where the grade of the creek is low, it follows that a considerable length of flume may be necessary.

Booming

Booming is a variation of ground-sluicing that makes use of the increased cutting and carrying power of water under flood conditions. Water is impounded in a reservoir and is released when the reservoir is full. Because of the large flow of water, larger amounts of material are moved than could otherwise be handled by the equivalent steady flow of the stream. The reservoir may be constructed by damming a creek, blocking a ditch, or even by building a tank. Larger sluice-boxes than are ordinarily used for sluicing are needed to handle the rush of water.



A. A bench mine with a gravel-slide from the portal of the drift to sluice-boxes set up in the creek.



B. Cleaning bed-rock with a pointed hand-scraper.

Either a log crib dam, an earth dam with boards on the inside, or a brush dam may be used. In every instance care must be taken to reinforce the structure according to its size and the depth of water to be accumulated in the reservoir behind it. If a dam should break unexpectedly, there would be danger to those working below.

The dam should be built in a good natural position so that water will accumulate in a reservoir behind it. The foot of the dam should be firmly fixed either by timber cross-bracing or hitches cut in the bedrock. Moss or other material may be used for tamping the cracks between the logs to prevent seepage. Some clay or earth should be thrown into the bottom of the reservoir against the dam to act as a seal.

Several different types of gates and dams can be constructed to suit the site chosen and the requirements of the operator.

The gate can be made any size, but generally from 3 to 8 feet wide, of stout timber or double planks. The pivot or hinge is placed horizontally about one-third the height of the gate from the bottom so that it will swing outward from the top when it empties.

Counterbalancing weights and floats can be attached by cables or ropes to assist the opening and shutting of the gate.

The gate can be counterbalanced so that it will close automatically when the reservoir is empty and will remain closed while the reservoir refills. When the reservoir fills to a certain level, water overflowing through a chute into a control-box can be made to over-balance the counterweight and open the gate. Escape of the water through holes drilled in the box permits the counterweight to close the gate again. Equipped in this way, the gate requires little attention from the operator.

Current-wheels

A current-wheel is a very old device for raising water from a stream. The device consists of a large paddle-wheel with buckets attached to one edge and is mounted on a raft. The raft is anchored and the current acting on the paddles turns the wheel, thus scooping up water and lifting it in the buckets which are emptied into a launder or trough.

A current-wheel can be built largely of material obtained locally at small cost and can be operated with little or no expenditure of money, but building a wheel requires time and ingenuity, and the total lift possible is a little less than the diameter of the wheel. If water must be lifted 15 feet or more, purchase of a portable placer pump would be advantageous; and even for lower lifts, a pump might well be justified unless the gasoline to run it can only be obtained at prohibitive cost in money or labour. In addition to making it possible to lift water higher, a pump has the advantage of being much easier to move and could probably be sold if no longer needed.

The size and number of the buckets on a current-wheel will depend upon the size of the wheel and paddles, and on the speed of the current. The speed of a wheel may be controlled by decreasing or increasing the size and number of buckets. If there are too many or too large buckets for the speed of the current, the wheel either will not turn at all or will turn so slowly that very little water will be lifted. To obtain the best results, the speed of the wheel should be about half that of the stream current. The angle at which the paddles are set is also a controlling factor. The ordinary form of wheel, and the easiest to build, has paddles as shown in the sketch (Fig. 5). Greater efficiency can be obtained by setting the paddles at an angle of about 30 degrees from the vertical, but, as this entails more cross-bracing and consequently greater weight, it is advisable for ordinary purposes to construct a wheel according to the plan.

The size of the raft depends upon the diameter of the wheel. It is necessary to remember that clearance must be given for the paddles between the logs of the raft. The logs should be pointed at both ends, particularly upstream, to prevent baffling by the stream and to permit easy movement of the raft from place to place. Additional logs can be placed to widen the raft if required and provide a platform.

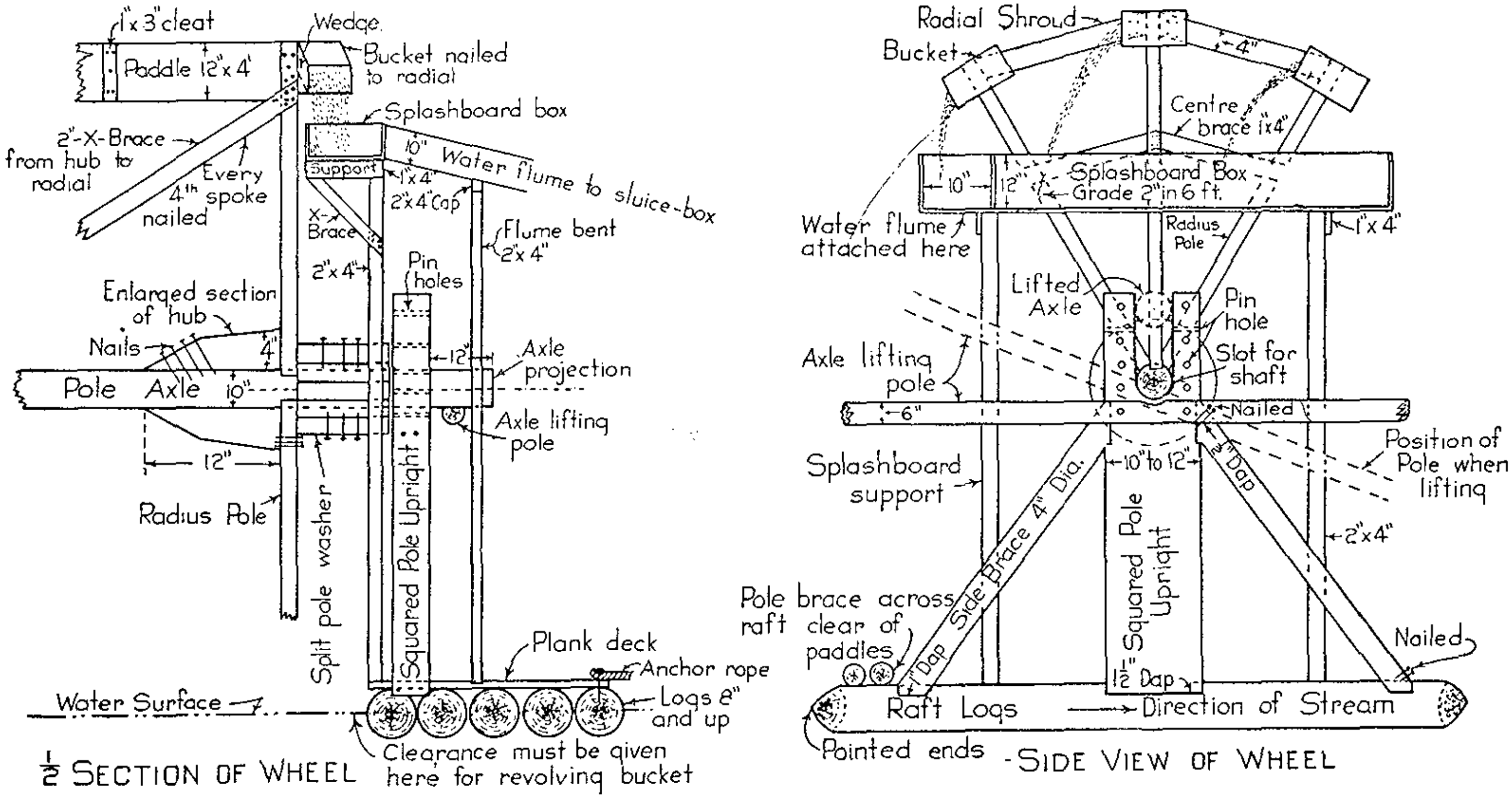
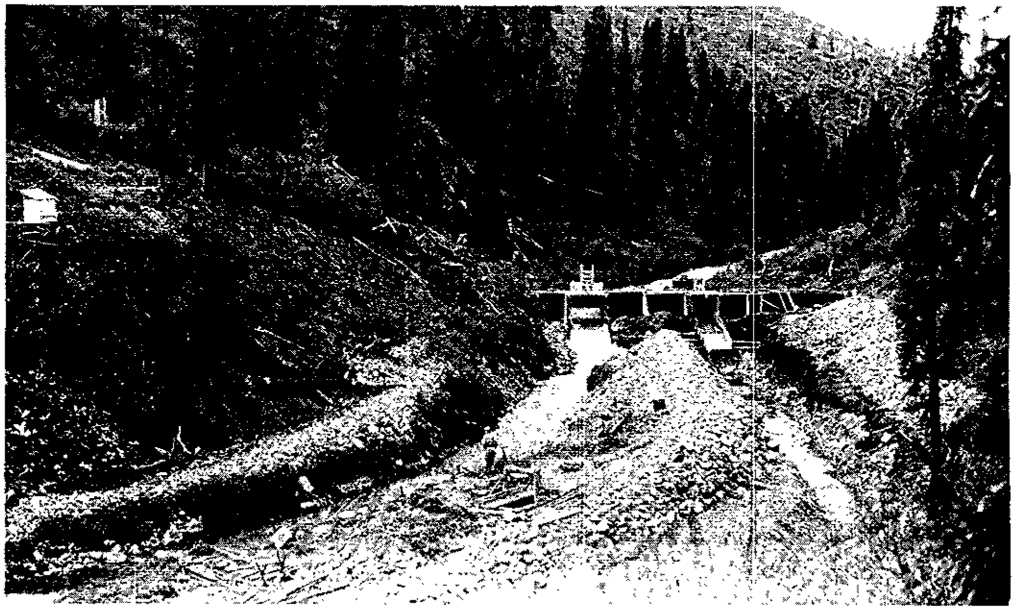


Fig. 5. Sections showing construction of parts of current wheel.

A. Cleaning bed-rock by hand after hydraulic operations on Germansen Creek. The man is picking up a small piece of gold with tweezers. Notice the whisk and spoon to the left.



B. Boom dam and ground-sluice cuts on Wheaton (Boulder) Creek. The cuts are worked alternately. Large boulders are thrown from the cuts and the smaller gravel is washed through.

The paddles, 4 feet long, can be made of 1- by 12-inch lumber, shakes, or whipsawn lumber. Cleats 1 by 3 inches can be nailed on the paddles to give them strength and prevent warping. Nail the paddle on to the radius-pole on both sides. Paddles should be placed about 2 feet apart, or about sixteen paddles on a 12-foot-diameter wheel. To provide the greatest efficiency, three paddles should be in the water at the same time and not more than half the width of the lowest paddle under the water. A 12-inch paddle-width is given in the sketch. Wider boards may be used.

If a sufficient number of jam tins, coaloil or gasoline cans are obtainable, they may be used for buckets; if not, board buckets may be made. The bucket fills through the downstream end, the lower fourth being closed to prevent too much spill as the bucket rises from the water.

It is important to remember that the bucket must be fastened to the main wheel in such a way that the water will empty into the splash-board box, which must be clear of the wheel; a wooden wedge, between the bucket and the wheel, with the thick end toward the open end of the bucket, will serve this purpose.

The buckets begin to empty before they reach the highest part of the wheel and continue emptying on the downward side, so that the splash-board box, which is a wooden launder, must be made long enough to take care of this condition, but not long enough to interfere with the paddles. The mouth of the splash-board box empties into the water-flume leading to the sluice-boxes. Too much gradient is inadvisable because less water splashes out of the box when it is half-filled with water. The water-flumes are set up on pole trestles with a cap nailed to the bottom of the flume.

It is necessary when moving the wheel from place to place to lift the paddles clear of the stream. This is done by means of the axle-lifting pole (*see* Fig. 5). If two or more men are working the wheel, it may be unnecessary to construct a lifting-pole, and by means of the projecting axle the wheel can be lifted and propped up with a board.

The axle-hub is made of split and bevelled poles and nailed on to both the axle and radius poles. This is very necessary to give sufficient strength to the radius-poles. Extra braces across the radial poles will also stiffen the structure.

An 8-inch washer, made of split poles nailed to the axle, but free from the squared pole upright, keeps the wheel in position. Cross-pole braces must be used at every fourth radius-pole, nailed to the radius-pole at the top and the hub opposite from it. These poles keep the wheel in a rigid position.

The raft must be anchored to the bank of the stream at both ends and the axle of the wheel set at right angles to the current.

If the wheel is not deep enough in the water, the raft must be weighted with rocks, correctly levelled. If no boat is available and the wheel has to be anchored some distance from the bank of the river, it can be reached by means of planks fastened on the bents beside the water-flume. The axle-socket requires proper greasing.

Portable Placer-pump

The portable placer-pump is a small piece of equipment that has found increasing favour with placer-miners. It consists of a ¾-horsepower air-cooled gasoline-engine direct-connected to a small centrifugal pump. The unit weighs about 150 pounds, the gasoline consumption is about half a gallon in eight hours, and the pump delivers about 75 gallons per minute to a height of 15 feet, or correspondingly less to greater heights. The unit is extremely portable and is cheap to operate. As a consequence, it may be used for bar-mining, or sniping on benches where the supply of water is small and must be reused. It allows one man to spend almost all his time shovelling and moving pay dirt, and consequently enables him to handle a greater yardage than with a rocker. It enables small patches of ground to be worked that would not justify the installation of a flume to bring water to them.

DRIFT-MINING

Sometimes rich ground, where the values are on bedrock covered by deep overburden, can be mined by an individual or a small group, by drifting. If the deposit is buried in the bottom of a valley, a shaft is sunk and drifts driven along bedrock following the pay streak. Water is the great problem in this kind of mining. If the deposit lies on a bench, a drift can sometimes be driven directly on it.

In starting to drive through unconsolidated material, a cut of sufficient size should be made so that the face will stand a few feet higher than the height of the working. If the ground holds up well, the cut may be completed before timbering. If the ground runs, timbering will have to proceed with the excavation. In running ground, a set may consist of two posts (uprights), cap, and sill (top and bottom cross-pieces). (*See* Fig. 6.) The posts rest on the sill and the cap rests on the posts. The cap and sill are notched so that the posts will not slip under pressure from the sides. When drifting on bedrock, the posts are usually set directly on the bedrock, and mud sills are not needed. Bridges or strips of plank are placed outside of and parallel to the posts and caps, from which they are separated by small blocks, leaving spaces between the posts and bridges through which lagging can be driven. Lagging is made of sawn or hewn planks; small poles are less satisfactory.

The lagging is placed outside the posts on the first set and outside of the bridges on the second set. The lagging from the second to third sets, and so on, is driven through the spaces between the posts and bridges of the second set slightly outward so that it will come outside of the bridges on the next set. A similar procedure is followed for the lagging driven over the caps. The lagging is driven forward as the ground is excavated. When the lagging has been driven forward about half of a set-length, a false set is placed to guide and support it. When the full set-length has been driven, the set is put in place, the lagging driven forward over the bridges, and the false set removed, allowing the lagging to press against the bridges of the completed set. The sets are usually placed 4 feet centre to centre and lagging 5 to 6 feet in length is used. Collar-braces should be put between sets.

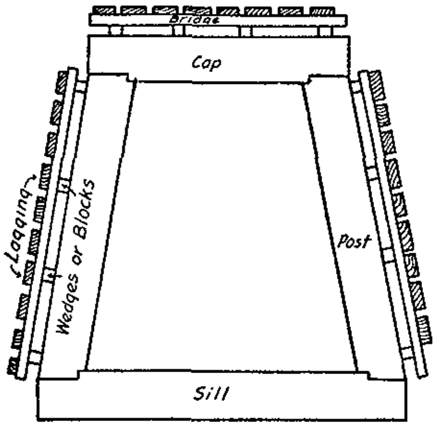
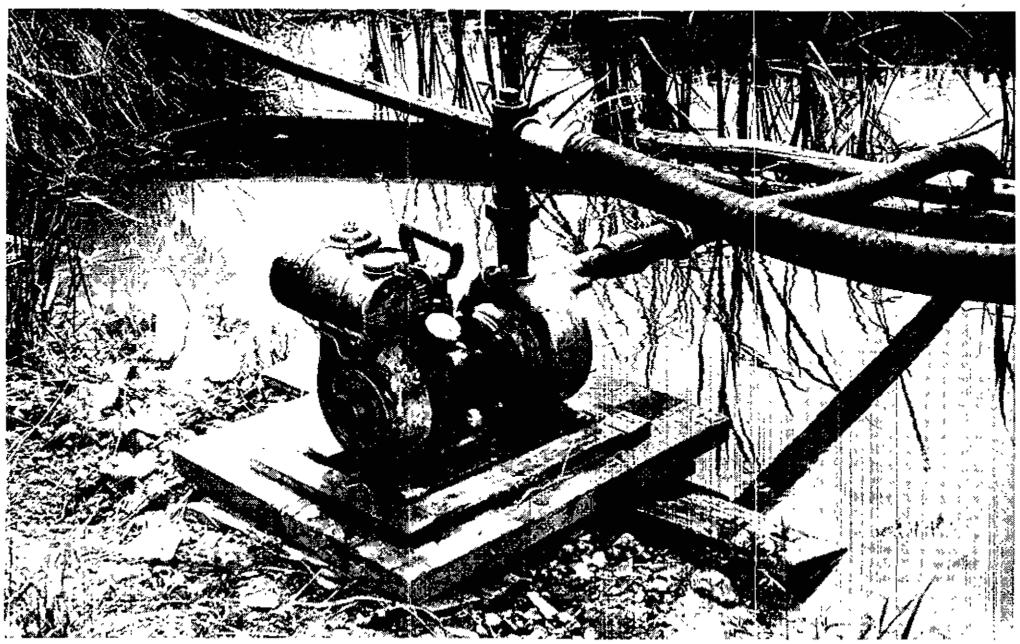


Fig. 6. A full set showing posts, cap, sill, wedges, bridges, and lagging. This is a breast set right up at the face of the working, with the lagging resting on the bridges. During the excavation of the next set-length the lagging is pushed through the spaces between the bridges and posts and cap and driven ahead.

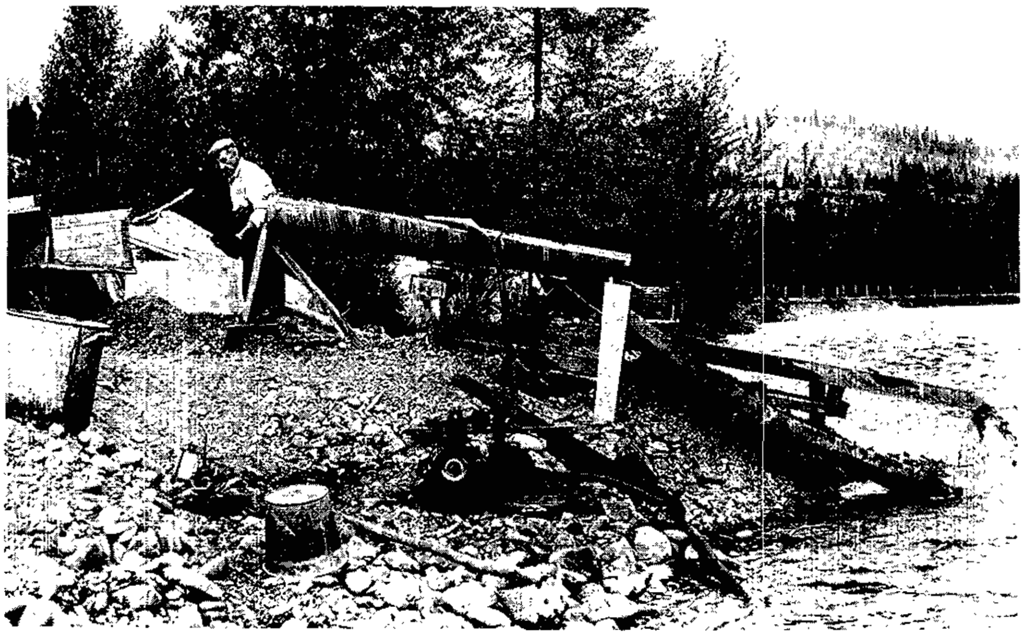
A drift should be driven with sufficient, but not more than enough, grade to provide good drainage. A ditch should be made along one side of the working, and its size will depend upon the flow of water. Where full sets are used (two posts, cap, and sill), the ditch will naturally pass under the sills. In soft ground the ditch should be replaced by a trough made of planks or split timber.

When a wheelbarrow is used for handling the muck, a split-timber or plank runway should be laid.

If an ore-car is to be used (they can be easily constructed if flanged wheels are available), simple wooden rails are satisfactory for preliminary work. They may be improved by being surfaced with strap-iron. Strap-iron can be rolled or bent into conveniently sized bundles for transport by pack-horse and is much cheaper than light steel rails.



A. Portable placer-pump set up beside a water sump at Cedar Creek.



B. A portable placer-pump delivers water to a metal trough which discharges the gravel onto a shed grizzly. The undersize is washed in the sluice-box at the extreme right. The gravel is brought by truck from a low bench beside the Tulameen River.

In drift-mining it is frequently necessary to excavate as much as 18 inches of bedrock in order to recover all the gold that is lodged in cracks and irregularities in it. Soft bedrock may be broken by picking; if hard, it may be necessary to drill lifter holes, load them lightly, and blast. The charge should be just large enough to shatter the rock but not sufficient to scatter rock and gold all over the drift.

Shaft-timbering for preliminary work is carried out in much the same manner as timbering a drift in soft ground. The heavy timbers serve the same purpose as the posts, cap, and sill of a full set, but are called wall and end plates. The wall-plates of the collar set should be long enough to project beyond the ends of the shaft opening so that they can be placed on a solid foundation. The second set is ordinarily suspended from the first set by hanging-bolts, and so on for each succeeding set. The prospector, however, seldom uses this method and simply wedges his sets into place. When the ground stands up fairly well, he can complete a set before lagging it up, but in the case of soft ground he drives his lagging in the same manner as in driving a drift through ground that will not stand without support.

A simple headframe and windlass can be erected on the collar-plates and a bucket used to raise the muck. A ladder must be built in every shaft.

If the shaft is inclined, skids must be placed for the bucket to slide on. Small peeled poles nailed to the wall-plates on the lower side of the shaft will serve the purpose.

The gravel in drifting is ordinarily excavated by hand-pick. Exceedingly tight or cemented ground may be drilled. Large boulders should be drilled, lightly loaded, and blasted so that no timbers are broken and no gold splattered around.

Cleaning Bedrock

Cleaning bedrock is one of the most important parts of a placer operation. Unless bedrock is thoroughly and properly cleaned there is a possibility that a considerable amount of recoverable gold will be left behind. Snipers in many instances take advantage of the fact that former operators did not clean bedrock completely.

Gold very often occurs in cracks and crevices that may extend several feet down into bedrock. If the rock is soft or schistose, it may be possible to remove several feet of the top bedrock and recover the bulk of the gold. If, however, the bedrock is hard, it is necessary to clean out the individual crevices by the use of thin pointed picks, scrapers, wires, and stiff wire or bristle brushes.

Bedrock that has been exposed to the weather for a number of years in many cases becomes sufficiently loosened to enable a few more inches to be removed. In some of the rich creeks it is said that the bedrock has been cleaned as many as four or five times, with gold recovered at each operation. Snipers after many years continue to work over bedrock on Stouts Gulch, and Antler and Williams Creeks.

Saving Fine Gold

The gold in many placers is usually sufficiently large to be caught by ordinary methods of recovery. In some instances, however, when the gold is all fine, or a large proportion is fine, special precautions must be taken. Blanket-tables are generally used rather than sluice-boxes and, if certain principles are observed, fine bar gold can be saved by both small and large operations.

When a bar-miner using a single box takes these precautions, he should have little difficulty in saving fine gold:—

(1) Before passing over the blanket-tables, all material should be thoroughly washed and screened through at least ⅜-inch mesh.

(2) The slope of the blanket-table should be from 1½ to 3 inches per foot. The gradient should be determined experimentally and should be adjustable.

(3) The gravel should be shovelled at an even rate to maintain a uniform supply of feed. The flow of water and material should be closely controlled.
(4) The blanket-table should be surfaced with stair-carpet, blanket, corduroy cloth, or burlap. Some prefer to cover the burlap with expanded metal screen of various-sized apertures.
(5) It is important that the blankets be rinsed off in the clean-up tub whenever they become clogged. This may be every two hours or every day, depending on conditions.

The fine gold is recovered from the blanket concentrates by amalgamation.

In sluicing operations fine gold is frequently lost through carelessness in allowing a surge of water to run through the boxes, or allowing the riffles and boxes to become clogged with sand through overloading.

Amalgamating

Amalgamation may be used to separate fine gold from placer concentrates if it is difficult to make a clean separation of the two by panning.

Only clean gold will be picked up by mercury. Consequently, a method of cleaning the surface of gold must be used if it is greasy or dirty. A coating of oil or grease will be removed by treating the gold-bearing concentrates with a solution of soda or lye. The surface film of iron oxide on rusty, tarnished gold is best removed by abrasion in a mortar or an amalgamating-barrel.

Small amounts of concentrates containing clean gold can be amalgamated in a gold-pan. At least five times as much mercury as there is gold is added to the concentrates in the pan, and enough water is added to cover the sand. The mixture is stirred in order to bring the gold into contact with the mercury. When the bulk of the gold has been amalgamated, the amalgam and excess mercury are separated from the black sand by panning.

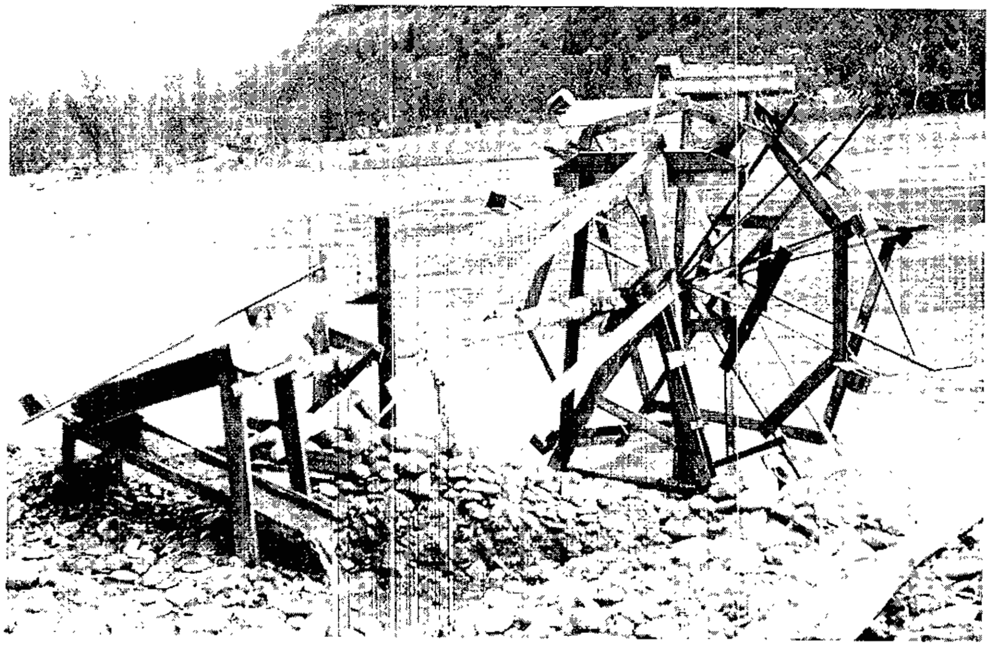
Small amounts of concentrates containing dirty, rusty gold may be amalgamated in a mortar. The gold-bearing sand is ground until the gold particles have had part of their film removed, then mercury is added and grinding is continued until all the gold is picked up.

A barrel amalgamator is used for treating large amounts of concentrates, regardless of whether the gold is clean or not. If the gold is rusty, a barrel amalgamator is needed to abrade the surface and to clean the gold before amalgamating. The sand and some pebbles or grinding-balls are charged into the barrel, which is rotated for several hours. Mercury is then added and the barrel rotated so that the gold has a chance to come in contact with the mercury. When all the gold has been taken up by the mercury, the amalgam and mercury are separated from the black sand by panning.

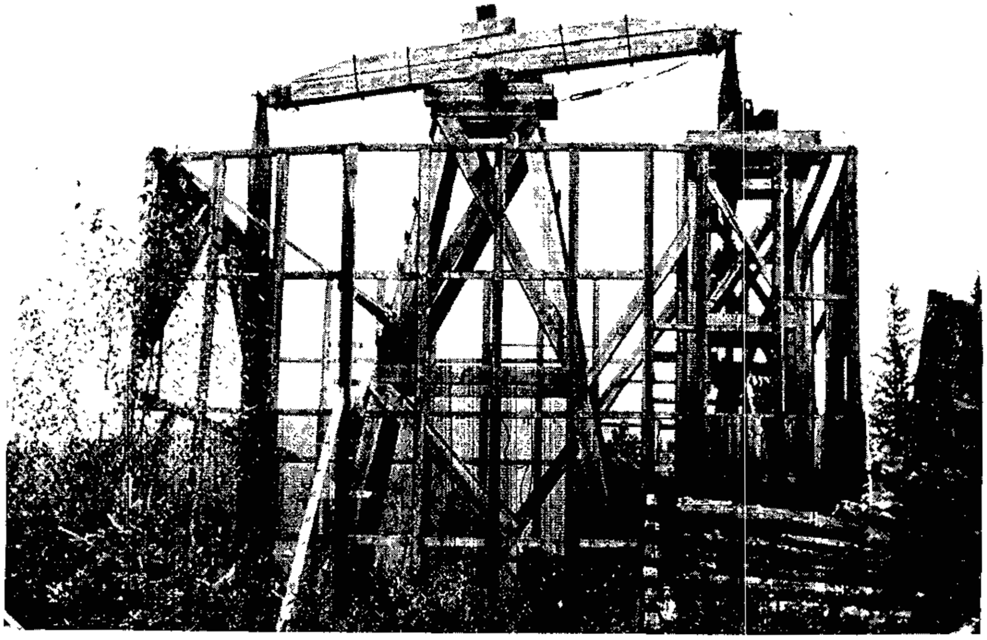
A barrel amalgamator capable of handling moderate amounts of black sand could be made from a piece of 6-inch pipe, 12 to 15 inches long, with a threaded cap on each end. It could be supported on rollers, and by using some ingenuity, a way of rotating it could be devised by using either a water-driven wheel or a pulley attached to a portable-pump engine.

Large amounts of black sand would require a large barrel. A satisfactory amalgamator can be made by welding ends on to a piece of 12- or 16-inch hydraulic pipe. A charging-hole is put on the side and a lid for it is made so that by using a rubber gasket a tight fit is obtained. An amalgamating-barrel of this size should be driven by power, either a ¾-horsepower gasoline-engine or a water-driven wheel.

Mercury is driven off by heating gold amalgam in a retort, leaving the gold as a spongy residue. The vaporized mercury can be condensed by passing it through a pipe cooled with water. The fumes of mercury are poisonous, and to avoid breathing them, retorting and condensing should be done in the open. Care must be taken that water from the condenser is not drawn into the retort when it is cooling.



A. A simple and easily constructed current wheel delivering water to a short sluice on the Fraser River below Quesnel.



B. Cornish pump head-frame built during the early operations in the Cariboo.

Black Sand

Fire assays of black sands sometimes show values of hundreds of dollars per ton in gold or platinum, and may lead to the erroneous idea that the values are contained within the grains of magnetite making up the sand. In any black sand the gold or platinum exists as small individual particles. Separation of fine gold from black sand may be difficult but is not impossible, just so long as the values warrant it. In many instances, the " hidden values " are tiny particles of gold, sometimes thinly coated with foreign substances so that amalgamation is prevented. Frequently, treatment in a barrel amalgamator will recover most of the gold. The recovery of platinum is more difficult.

A mistake is made if black sand sent in for fire assay does not represent the average concentrate. A sample from the head of the first sluice-box is bound to contain fine and frequently dirty gold in greater abundance than elsewhere in the boxes, and it is just this material that is so often referred to as being rich in so-called " hidden values." An assay of the average black sand, after it is carefully cleaned, rarely shows values of more than a few dollars in gold per ton.

References:—

U.S. Bureau of Mines, Inf. Circ. 6611, 1932.

U.S. Bureau of Mines, Inf. Circ. 6786, 1934.

" Hydraulic and Placer Mining," E. B. Wilson (Wiley & Sons), 1918.

" Operating Small Gold Placers," W. F. Boericke (Wiley & Sons), 1933.

TRANSPORTATION, EQUIPMENT, AND FOOD

Many of the older diggings can be reached by some sort of road, and nothing need be said regarding the cost of reaching them. Some old creeks are relatively inaccessible, but old trails lead to them and it is usually possible to pack in a season's supplies at no great cost. With few exceptions there is some habitation at or close to the old diggings. The following remarks are addressed to the prospector intent on exploring new placer-fields, but are equally applicable to any type of prospecting.

The prospector will travel as far as he can by train, bus, or boat, and will usually travel to the end of existing roads either in his own car or in one he hires. Thence he must, as a rule, either pack his outfit on his back or hire horses. In some sections access is by river and lake, and in most of these a boat can be contracted to take him in. If the prospector considers buying his own boat, he should remember that there is little canoe water in the Province, and that for river work the best craft is a flat-bottomed boat pointed at both ends and powered by an outboard motor. Whether boats or horses are considered, it is essential to make certain as to navigability of rivers in advance (they are without exception dangerous to the inexperienced), or whether the country is fit for horses. The importance of obtaining the best information on the feasibility of travel by boat or horses cannot be overemphasized; besides the obvious physical danger involved, there may be a serious loss of time.

All parts of the Province are accessible, but not with the same degree of ease or difficulty. Physical conditions vary greatly and some sections present particular problems. In all parts there are many men who spend much of their time in the bush, and a newcomer is well advised to consult local authority; short of this, some reliable person can usually be found who has travelled through a bit of country and who can advise regarding difficulties and problems. The following remarks are proffered as a rough guide only.

Horses can be used only when there is sufficient natural feed for them. A resourceful man can take horses through country that to others would seem impossible, but in some parts horse-travel is out of the question. If the owner of the horses is doing the packing, the prospector does not have to worry about details, but if he is to do his own packing he should get some prior experience. The hire of horses will range between 50 cents and $5 a day, depending upon availability and the length of time for which they are wanted.

Horses broken in to one type of country are amazingly sure-footed, but one accustomed, say, to the open ground of the Dry Belt is apt to get into trouble in the Coast woods or the northern muskegs. When the going is open and not steep a good horse can carry 250 pounds and even more for short spells, but for rough going where there are no trails 150 pounds is a good load.

Dogs are used for packing in some parts of Northern British Columbia. A good dog can carry 35 to 50 pounds in canvas panniers when the brush is not thick. The use of dogs is not to be recommended, however, as the necessity of providing food is a serious problem and much valuable time is taken up by it.

Back-packing must be resorted to on many trips, whether for a day or so or for an entire season. The amount a man can carry depends upon stamina and necessity, and obviously varies greatly with the individual, but it may be stated that 65 pounds is the heaviest load that should attempted for day-long cross-country travel. For short hauls and relays on trails a pack-sack with a tump-line may be used. but the universal choice is the pack-board. The pack-board is superior to the pack-sack; it keeps the back moderately cool and on it can be lashed almost any sort of load and, what is most important, the correct balance for the load is easily attained. A head-strap or modified tump-line may be attached to the board so as to ease the shoulders if desired.

In back-packing the thing to consider is the element of time as against load. Experience has shown that a man, in addition to his equipment, can rarely carry more than two weeks' food, even of the simplest and lightest variety. If, then, several days are needed to get his objective, say four days going in and three days coming out with a light load, he can only stay in a week. He can, of course, relay in almost any amount, but the time taken up and the food eaten during that time should be carefully figured. A man will eat between 3 and 3½ pounds of bush ration a day, and that is the fundamental basis of figuring.

A man's equipment for placer-mining depends on whether he will be prospecting and travelling about, or whether he will be more or less stationary, working on a deposit. His needs when he is in or near some settlement will be very different from when he is entirely dependent upon his own resources; the means of transportation on which he has to depend also makes a difference.

Placer-mining is restricted almost entirely to seasons when the ground is not frozen, when there is no snow covering the ground, and when there is water for washing. Drift-mining may be carried on during the winter.

If a man is prospecting away from settlements, he should be completely equipped for the duration of his proposed trip.

Clothing and personal outfit should be durable and water-repellant. It should include woollen socks and underwear, flannel shirts, durable trousers, warm sweater or mackinaw shirt, water-repellant jacket and hat, and well-fitting nailed boots. Hip rubber boots and rubber gloves are generally worn when placer-mining.

Camp equipment should be light and kept to a minimum of weight, consistent with the degree of comfort desired. It could include a silk or canvas wall or shed-type tent with sewn-in mosquito bar, medium-weight eiderdown, cooking utensils and cutlery, simple first-aid kit, a mosquito repellent, rifle and fishing gear; a stove is not essential. Tools should be kept to a minimum weight, in keeping with the work to be done. They should include an axe, whetstone, file, long-handled prospecting pick, shovel, gold-pan, saw, and such others as may be thought necessary.

Before anyone starts out on a prospecting trip he should examine his outfit carefully to see that it will stand up to hard treatment, and to see that no essentials are missing. The cost of making up an outfit depends on how much a person already has, what equipment is needed, and on local prices. Some equipment may be obtained second hand.

Food that is used when a man is in a settled community is very different from the light-weight rations that are carried for use in an unsettled country.

If a man is working on a showing, it may be possible to augment store food with wild fruit, fish—either fresh, smoked, or pickled—or with game shot and canned the previous autumn. These, together with fresh vegetables from a garden-patch, do much to lessen the amount of groceries bought.

Careful planning must be done in preparing for a trip on which all food must be taken along. The average light-weight rations must provide 3 to 3½ pounds for each man per day, and cost, depending on where they are bought, from $1.75 to $2.25 per man* per day.

The following provision list is suggested as a guide:—

	Pounds per Man per Month
Flour (white and whole wheat)	22
Baking-powder	1
Rolled oats (quick-cooking variety)	6
Beans	5
Rice	4
Dehydrated potatoes	4
Dehydrated vegetables (carrots, beets, cabbage, turnips, etc.)	4
Canned bacon, ham, and corned beef	20
Cheese	3
Egg powder	1
Sugar (white and brown)	10
Tea	1
Coffee	2
Chocolate, semi-sweet	2
Milk (powdered whole milk)	2
Salt	1
Dehydrated fruit (prunes, apples, peaches, apricots, raisins, figs)	6
Canned butter	5
Jam, honey	5
Dessert powders (puddings or jelly)	2
Yeast if desired	
Total	107

Additional supplies should include matches, soap, mosquito repellent, simple first-aid supplies, needles and thread.

A man going into an unknown region should not count on living off the country at all, but should be fully supplied with food and other necessities for the duration of his trip.

References: *Geol. Surv., Canada*, Ec. Geol. Series 7, 1956, "Prospecting in Canada."

*1959 estimate.

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