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STATE OF IDAHO
Robert E. Smylie, *Governor*

Idaho Bureau of Mines and Geology
E. F. Cook, *Acting Director*

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Mineral Resources of Latah County

by
Charles R. Hubbard

Moscow, Idaho

FOREWORD

This report on the mineral resources of Latah County is part of a continuing program of the Idaho Bureau of Mines and Geology to make available to the public comprehensive reports on the mineral resources of each county in the state.

It is the aim of these reports to emphasize the economic aspects of mineral resources: their accessibility, present and potential economic value, and utilization. By bringing the mineral resources of each county to the attention of its citizens and to the attention of the nation's minerals industry, it is hoped that these reports will contribute to the development of the great mineral wealth of Idaho.

The author of the present report, Mr. Charles R. Hubbard, is well qualified by long experience as a mining engineer in the Philippines, New Caledonia, Mexico, and many parts of the United States to assemble information on various types of mineral deposits and to assess their economic importance. Mr. Hubbard, formerly of the Idaho Bureau of Mines and Geology staff, is now with the U. S. Bureau of Mines.

E. F. Cook
Acting Director
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LOCATION AND HISTORICAL BACKGROUND

Latah County is on the western border of the Panhandle of north Idaho. Adjoining counties are Benewah on the north, Shoshone on the east, Nez Perce on the south, and Clearwater on both east and south. The state of Washington forms the western boundary.

Latah County, with an area of 1,090 square miles, is thirtieth in size among the counties of Idaho. It ranks ninth in population with 20,971 inhabitants according to the 1950 census.

Established in 1888, Latah is the only county in the United States created by an act of Congress. The early settlers made three attempts to set up a county, but each time the opposition of Lewiston prevented its establishment. Finally, Idaho's delegate introduced a bill in Congress in 1887 to create the county of Latah and succeeded in getting it passed; it was signed by the President in 1888. Moscow, the principal trade center, was made the county seat. Later it was chosen as the site of the University of Idaho. The population of Moscow is about 10,000 or approximately half of the total for the county.

Early settlers were attracted to the county by reported mineral wealth in the mountains, large tracts of virgin timber, and lush grazing lands; consequently prospectors, lumbermen, and cattlemen were among the first arrivals.

The early prospectors found some fairly rich gold placers in the mountainous areas and worked them with some success for a short time. Gold and copper lodes were prospected before 1900, mica deposits were discovered about 1888 on Mica Mountain north of Avon, and high-grade clays of refractory quality were being produced by about 1910.

Lumbering was a major source of income in Latah County in the early days, and the mill of Potlatch Forests, Inc., at Potlatch is still the largest industrial operation in the county; however, today its timber, for the most part, comes from forests outside of Latah County. Early homesteaders preferred, in some instances, to locate on timber land rather than on open grazing land, believing the timber to be of greater value than the soil.

The "Palouse hills" were originally used mostly for grazing; however, settlers soon discovered the value of the soil for agriculture, which today is by far the greatest source of income for the people of

Latah County.

DRAINAGE AND PHYSIOGRAPHY

The county contains portions of two river systems (see Plate 1). The Potlatch River flows south through the eastern part, and the Palouse River flows west through the northern part of Latah County.

The source of the Potlatch River is in the Hoodoo Mountains, north of Bovill, at an elevation of about 5,500 feet, and it empties into the Clearwater River, near Spaulding, at an elevation of 799 feet. The upper part of the Potlatch flows over basalt. Its channel is typical of low-gradient, meandering streams. Numerous tributaries enter the main channel along this section. Above Kendrick, the character of the stream changes: aided by a steeper gradient, the river has cut a deep canyon in the basalt and from this point to its mouth becomes entrenched with steep almost vertical walls of basalt and intercalated sediments. The river is not navigable except for very short sections and is only used occasionally to transport lots to the saw mills. The narrow, steep-walled canyon offers excellent damsites and future power development seems likely.

The two towns, Kendrick and Juliaetta, in Latah County, are built in the bottom of this canyon where the walls are not more than a few hundred feet apart. Because they are served by a railroad, they are trading centers for the surrounding area.

The Palouse River also rises in the Hoodoo Mountains, northeast of Harvard, at an elevation of about 5,000 feet. In its upper reaches numerous tributaries enter the main stream, which is confined to a narrow valley, bordered by steep, timbered slopes. Near Harvard, the river enters a broad, flat valley, meandering through cultivated fields and pastures.

Latah County belongs partly in the Columbia River Plateau physiographic province and partly in the Northern Rocky Mountain physiographic province. The line of demarcation is very irregular but approximately coincides with the margin of the Columbia River basalt (see Plate 2).

The Hoodoo, Gold Hill, and Mineral Mountain areas, as well as the Thatuna Hills, are spurs and outliers of the Coeur d'Alene Mountains of the Northern Rocky Mountain province. The topography is fairly rugged with many heavily timbered, steep-sided ridges and rounded peaks.

South of the Thatuna Hills is a portion of the Palouse country which has a gently rolling topography, with a few ridges standing a little above the general level of the plateau, including Paradise Ridge, south of Moscow, and Tamarack and Alderman's Ridges in the southeast corner of the county.

The elevation of the Palouse country ranges from 2,550 feet to 3,000 feet, but the relief seldom exceeds 250 feet. In the mountainous parts of the county, elevations range from 3,000 feet to a little above 5,000 feet.

CLIMATE AND AGRICULTURE

With adequate rainfall or ground moisture during the growing season, the rich Palouse soil of the rolling hill country in the western and southern parts of Latah County produces large crops of wheat, barley, and peas. On the basis of yield per acre, this is probably one of the most productive areas in the nation.

Situated in the western part of the Panhandle and protected on the east by the rugged Coeur d'Alene and Clearwater Mountains, Latah County has a relatively mild climate, experiencing little of the severe cold and heavy snows which plague adjoining Shoshone and Clearwater Counties to the east. The mean temperature ranges from 27 degrees in January to 66 degrees in July.

Rainfall, from 25 to 30 inches a year, is sufficient for crop needs, and this county is one of the few in Idaho with no reported irrigated farm land. Some local shortage of water has been experienced for municipal supply largely because complete use of available water has not been developed.

TRANSPORTATION

Most of the towns in Latah County are served by at least one railroad. Moscow is served by three railroads. The following five railroads have lines within the county:

(1) A Great Northern branch which formerly was the Spokane, Coeur d'Alene, and Palouse Railroad, enters the county north of Moscow and terminates at Moscow.

(2) The Union Pacific has a branch line into Moscow from the west, which also terminates at Moscow.

(3) The Northern Pacific enters Moscow from Washington and continues east through Troy, thence southward through Kendrick and Juliaetta, down the Potlatch River Canyon to the Clearwater River. A branch line of the Northern Pacific from Uniontown, Washington, serves Genesee in the southern end of the county.

(4) The Chicago, Milwaukee, St. Paul, and Pacific has a branch line from St. Maries which enters Latah County a few miles south of Clarkia, continues southward through Bovill, and thence eastward toward Elk River.

(5) The Washington, Idaho, and Montana Railway, built originally as a logging railroad by Potlatch Forests, Inc., enters Latah County from Washington a few miles west of the town of Potlatch and continues eastward through Potlatch, Princeton, Harvard, and Deary, to Bovill.

Two federal highways, U. S. 95 and U. S. 95 Alternate, traverse the county. U. S. 95, from the south, enters the county about one mile

west of Genesee and continues northward through Moscow, thence to Potlatch Junction, and northward out of the county. U. S. 95 Alternate starts at Potlatch Junction, continues eastward through the towns of Potlatch, Princeton, and Harvard, thence northward, crossing the northern boundary of the county about six miles south of Emida. State highways include State 8 east-west across the center of the county through Moscow, Troy, and Deary, to Bovill; State 7, north from Kendrick to Deary, thence northwestward through Vassar and Stanford to Harvard; State 42 up the Potlatch River, through Juliaetta to Kendrick; and State 43 from Elk River through Bovill to Clarkia (see Plate 1). These are gravel or "black-top" roads which make most sections of the county easily accessible. A network of county roads is generally well maintained except under very severe winter conditions.

INDUSTRY

The lumber mill of Potlatch Forests, Inc., at Potlatch at one time was the largest white pine mill in the world and is still the largest industrial enterprise in Latah County. Several other towns in the county are supported largely by lumbering, including Kendrick, Juliaetta, Harvard, Bovill, and Troy. Grain storage and seed and pea processing are also important industries.

A mica-processing plant operated at Deary until recently, and a garnet sand plant operates just across the border in Benewah County, obtaining its raw material from within Latah County. The brick plant at Troy is one of the oldest industrial enterprises in the county.

POWER AVAILABILITY

The Washington Water Power Company provides the electrical energy used in Latah County. The routes of the principal lines are: along the Washington-Idaho state line from Palouse to Lewiston, passing through Moscow, with feeders to Potlatch, Viola, and Genesee; along State Highway 8 from Pullman to Elk River, through Moscow, Troy, Deary, and Bovill; and from Moscow to the Clearwater River, with feeders to Juliaetta and Kendrick. Power is available for future expansion.

GEOLOGIC SETTING

The formations exposed in Latah County coincide with some of the topographic features (Plate 2). A zone six to 12 miles wide across the north part of the county consists of Precambrian Belt sedimentary rocks which have been metamorphosed to quartzite, gneiss, and schist. A similar zone, four to eight miles wide, extending along the eastern border of the county, includes the Hoodoo Mountains, Mineral Mountain, and Tamarack and Alderman's Ridges. Other areas of Belt rocks, such as Tomer Butte and Viola Ridge, are isolated knobs and ridges surrounded by basalt.

The Precambrian metamorphics were invaded by Cretaceous granitic rocks related to the great Idaho batholith. Granodiorite is the most common granitic rock in this area and underlies the Thatuna Hills, Paradise Ridge, and a large area north of Bovill, in a belt four to eight miles

wide across the center of the county. Smaller areas of granodiorite are completely surrounded by basalt. The exposed granodiorite is badly fractured and weathered. Syenite occurs as a stock at Gold Hill, north of Potlatch (Tullis, 1944, pp. 150-152).

Potato Hill, north of Deary, consists of flow breccia and rhyolite of possible Tertiary age (Bitten, 1951, pp. 58-61).

The basalt flows which cover approximately one-third of the county were poured out on a terrain of considerable relief. The lava filled the ancient valleys and covered the lower hills, until only the crests of the higher hills remained above the flood. As a result, the basalt varies greatly in thickness and in some areas has been removed entirely by later erosion. Columbia River basalt covers most of this area; however, in the vicinity of Princeton and Harvard, there may be a younger lava flow (Tullis, 1944, pp. 155-156).

Between periods of lava extrusion, weathered surfaces developed, and debris from weathered slopes washed down into lakes and depressions along the margin of the lava plateau, thus forming lacustrine deposits of gravel, sand, and clay called the Latah formation. Later flows covered most of these Latah beds, so that they now occur intercalated with layers of basalt (Kirkham and Johnson, 1929, pp. 500-504).

MINERAL DEPOSITS

METALLIC MINERAL DEPOSITS

Production

Gold has probably accounted for 99 percent of the value of all metallic mineral production in Latah County. Furthermore, nearly all the gold has come from placer deposits. Several gold quartz lodes have been discovered, but exploration has not developed a profitable lode-mining operation.

Small amounts of silver are found with the gold in most of the placer deposits, and a small silver production has also been recorded. Copper mineralization occurs in at least two localities, and a few hundred tons of copper ore has come from one deposit. A magnetic iron ore deposit has been explored and is currently being considered for development by an iron-mining company. Occurrences of tungsten in the form of wolframite, cobalt as cobaltite, and titanium as rutile have been reported.

No records are available to show the total mineral production of Latah County; however, Table 1 lists the recorded production of gold, silver, and copper from 1904 to 1956. Several volumes of Mineral Resources (U. S. Geological Survey, 1885-1924; U. S. Bureau of Mines, 1924-1932) and Mineral Yearbooks (U. S. Bureau of Mines, 1932-1952) give brief reports which indicate the location and scope of activity.

Mineral Resources for 1905 states for Latah County:

"The output of this county, received entirely from placers, consisted of 225 ounces of gold valued at $4,651, and 21 ounces of associated silver, valued at $13. Seven producers contributed to the total, which was produced principally from the Gold Creek district. The Hoodoo and Moscow districts also recorded some production. The total value was less than in 1904."

In 1906, for Latah County, Mineral Resources reports:

"The output consisted of 36.65 ounces of gold and 4 ounces of silver with a total value of $761. Four placers contributed to the total which was produced principally in the Moscow district. Gold Creek and Hoodoo districts also reported some production."

The report for 1907 for Latah County states:

Gold Creek district--small amount of placer gold was produced. Hoodoo and Moscow districts--placer gold was produced valued at $1,848.68."

The Statistical Appendix of the Minerals Yearbook for 1932-33 reports for Latah County:

"Gold Creek district, 3 placer operations produced $223 in gold values; Hoodoo district, 2 placers produced $130 in gold; and Moscow Mountain, 2 placers produced $147 in gold.

The 1934 volume states:

"Gold was produced from placers in the following: Gold Creek district, three properties produced 13.69 ounces of gold valued at $283; Hoodoo district, six properties produced 25.59 ounces valued at $529; and Moscow Mountain district, five properties produced 40.68 ounces valued at $843 and 6 ounces of silver."

In Minerals Yearbook Review of 1940, Latah County is reported as follows:

"Gold Creek district--a little placer gold was recovered in 1940---. One lode mine produced 7 ounces, and 3 placers produced 3 ounces of gold. Hoodoo district--there was a notable increase in output of gold in this district in 1940, owing to a new operation by Northwest Goldfields as a 4 1/2 cubic foot bucket-line dredge on the North Fork of the Palouse River. Three placer operations (including the dredge) produced 2,672 ounces of gold and 166 ounces of silver for a total value of $93,638. Moscow Mountain district produced 14 ounces of gold valued at $490 from 2 operations."

TABLE 1 -

RECORDED PRODUCTION - GOLD, SILVER, COPPER - LATAH COUNTY, IDAHO

Date	Number of Mines	Gold (fine ounces) Lode	Gold (fine ounces) Placer	Silver (fine ounces) Lode	Silver (fine ounces) Placer	Copper (pounds)	Total Value
1904	7	68	225				5,860
1905	7		225		21		4,664
1906	4		37		4		761
1907	7		60				1,200
1908			65				1,300
1909			40				800
1910			79				1,580
1911			46				920
1912			58				1,160
1913			22				440
1914			34				680
1915			32				640
1916	4		37.2		2		744
1917	1		13			18,506	5.412
1918	1		-			79,044	19,524
1919	1		22			12,338	2,735
1920			14				280
1921	4		25		2		500
1922	4		54		2		1,080
1923	3		41				820
1924	2		29			8,431	1,592
1925	2	1	7			12,834	1,999
1926	2		15				300
1927			17				340
1928			--				
1929	2		6		35	8,270	1,639
1930			--				
1931	1		12				240
1932			24				480
1933	7		80				1,600
1934	14		86		6		1,720
1935			87				1,740
1936			47				940
1937			120				2,400
1938			55				1,100
1939			14				280
1940	9	7	2693		166		94,128
1941	1		5553		329		194,589
1942	1		6021		329		210,969
1947	1		722		42		26,000
1950	2		343		32		12,034
1955	3		105		8		3,682

No production was recorded in 1928, 1930, 1943-46, 1948-49, 1951-54, 1956.

Minerals Yearbook for 1941 states:

> "The output in the Hoodoo district in 1941 was virtually all recovered by the bucket-line dredge and was 5,553 ounces of gold and 329 ounces of silver with a total value of $194,589."

The Yearbook in 1942 reports:

> "The dredge accounted for virtually all gold produced in the Hoodoo district. The output for 1942 was 6,012 ounces of gold and 329 ounces of silver valued at $210,654. Moscow Mountain district produced 9 ounces valued at $315."

Finally, Minerals Yearbook for 1947 states:

> "The Northwest Goldfields bucket-line dredge operated in the Hoodoo district from April 12 to July 12, when operations ceased because of exhaustion of available placer ground; 722 ounces of gold and 42 ounces of silver valued at $26,000 was produced."

From the preceding reports, together with more ambiguous reports in Minerals Yearbook (U. S. Bureau of Mines, 1932-1952) for some of the intervening years, it is inferred that placer mining on a small scale has been conducted in some part of Latah almost continuously since 1900. We also know that placer mining dates back to the first gold discovery in the county in 1860.

Hoodoo district

The Hoodoo mining district is in parts of T. 42 N., R. 1 W., and T. 42 N., R. 2 W., Boise Meridian. It covers about 28 square miles in the Hoodoo Mountains in northeastern Latah County. The northern boundary of the district is the northern boundary of the county, and the southern limit is the South Fork of the Palouse River. The district extends from the divide between the Palouse River and Emerald Creek drainage on the east to Bluejacket Creek on the west.

This district has produced by far the largest amount of gold, silver, and copper in the county. Most of the gold and silver has come from placer deposits along the North Fork of the Palouse River, Poorman Creek, and along the ridge between these two streams. Some gold production has also come from dredging operations on the Palouse River, from its confluence with the North Fork to near the mouth of Bluejacket Creek. The copper production has come from deposits near the head of Mizpah Creek.

The Mizpah Creek deposits were located before 1900, but the original locator abandoned them to go to the Klondike. The claims were re-located about 1900 by J. C. Northrup and his associates of Palouse, Washington, who organized the Merger Mining Company, Ltd., and carried on development work and mining operations intermittently until about 1925. The Merger

Mining Company was then re-organized as the Copper Mountain Mining Company, which continued development work until about 1935. The Copper Mountain Mining Company then merged with the Spokane-Idaho Copper Company, and finally the latter company and its holdings were acquired by the Columbia Mines Corporation in February, 1935, and have been part of the Columbia Mines holdings since that time. The Columbia Mines Company did extensive exploratory drilling and continued improvements on the property until recently. In recent years, only assessment work has been done.

The principal mineralization at the Mizpah mine occurs in three roughly parallel zones, near a contact between mica schist containing garnets and a quartzite probably related to the Prichard and Burke formations of the Belt series (Livingston and Laney, 1920, pp. 92-97). Geologic investigation and prospecting are made difficult by the covering of soil and silt and by the dense underbrush. The underground work shows two types of deposition (1) sparsely disseminated mineralization along sills of hornblende diorite and (2) replacement, in which chalcopyrite and pyrrhotite replace the schist wall rock. Anderson (1941, pp. 641-657) on the other hand, concludes that mineralization affected intensely altered wall rock, which the earlier workers mistook for sills. The major ore bodies are localized along bedding plane fractures and fissures in partially granitized quartzite. Petrographic study revealed the occurrence of three distinct stages of mineral deposition: the silicate stage, the carbonate stage, and the sulfide stage. Minerals of the later stages partially replace those of the earlier ones.

The first work, according to Livingston and Laney (1920, pg. 94), was done on the Hecla ledge, which forms a prominent outcrop about 1,500 feet northwest of and about 400 feet above the main workings. A shaft was sunk 100 feet, and a cross-cut tunnel was driven about 200 feet to connect with the bottom of the shaft. This work opened up a 20-foot bed of white crystalline limestone containing some disseminated chalcopyrite and siderite. No material of ore grade was encountered.

The Mizpah zone of mineralization strikes northeast and crosses, at about the center, the line between sec. 7 and sec. 8, T. 42 N., R. 1 W. It is apparently close to the contact between quartzite on the southeast and mica schist on the northwest. Livingston and Laney (1920, pp. 94-95) state that two cross-cut adits, one about 100 feet vertically above the other, had been driven into the mineralized zone. The lower adit encountered the mineralized zone at 250 feet from the portal. The zone, 200 feet or more in width, consists of narrow hornblende diorite sills and quartzite which contain finely disseminated chalcopyrite and more massive pyrrhotite. The adit was driven to a total distance of 700 feet, and no material of ore grade was found. The upper adit had a showing of good oxidized copper ore at the portal but at 50 feet was in quartzite containing only sparsely disseminated chalcopyrite.

Livingston and Laney go on to report that in the spring of 1917 some interesting gossan was found on the hillside just above the portal of the lower adit. Further prospecting uncovered a body of high-grade copper carbonate ore, near the surface, for a width of five to 15 feet. This ore body, as mining progressed, was found to extend downward almost vertically,

cutting across the bedding planes of the metasedimentary rocks. The oxidized zone proved to be very shallow; primary sulfides, including chalcopyrite and pyrrhotite, were encountered at a depth of approximately 20 feet. In the next three years (1917-18-19), several carloads of copper ore were shipped; records show output of 18,506 pounds of copper for 1917, 79,044 pounds for 1918, and 12,338 pounds for 1919. No records are available of tons of ore shipped. Production from the Mizpah property was reported in only two later years, 8,431 pounds of copper in 1924 and 12,834 pounds in 1925.

A considerable amount of exploration work is mentioned occasionally in Annual Reports of the State Inspector of Mines (1898-1955). The 57th Annual Report (1955) states that the Columbia Mines Corporation of Spokane owns the Mizpah group which consists of four patented claims, developed by four tunnels.

Gold is reported to have been first discovered in Latah County at Hoodoo Gulch on the South Fork of the Palouse River in 1860. The discovery and subsequent mining activity gave the name Hoodoo to the surrounding mountainous area. The first discoveries were small but rich and were soon exhausted; however, placer gold was found along the North Fork of the Palouse and along Poorman Creek, a parallel stream to the west. Old dumps and workings, visible in the gulches and along the ridges between the North Fork and Poorman Creek, are attributed in part to the work of Chinese placer miners which date back to about 1870-1880. As noted previously, small production is reported at various times since 1900 from placers on the North Fork. A group was organized about 1935 as the Engineers Gold Mining Company to investigate and acquire placer ground on the North Fork for the purpose of starting a dredging operation. Subsequently, some 280 acres of patented ground and six placer claims were acquired. A churn-drilling program was conducted in the summer of 1939, and a lease was made with L. J. Burrows of Spokane for a dredging operation.

The Northwest Goldfields, Inc., of which Mr. Burrows was president, erected a four and one-half foot bucket dredge on the North Fork of the Palouse River in the early part of 1940. The dredge was set up near the mouth of White Pine Creek in the upper part of the North Fork. A considerable amount of placer mining at this location had left a depression which was easily converted into a pond for flotation. Dredging started June 1, 1940 and was continued almost without interruption until October 15, 1942, when Limitation Order L-208 issued by the War Production Board closed down the operation for the duration of the war. During this period of operation, the dredge excavated the North Fork river bed from White Pine Creek to the confluence of the North Fork and the Palouse, a distance of approximately two and one-quarter miles, and moved a total of 2,900,000 cubic yards of material. The gravel ranged from 10 feet to 25 feet in depth with an average depth of about 18 feet. Bedrock, except for local spots, was decomposed enough to allow digging of the upper two feet or so with the bucket line. An average of 18 inches of bedrock was removed in the dredging operation.

The gold content of the gravel varied greatly particularly in areas where the dredge re-worked old placer tailings; however, the average value

was about $0.18 a cubic yard. Operation costs averaged $0.07224 a cubic yard before depletion and depreciation; labor accounted for $0.03245 of this amount and material for $0.03979. Clearing cost about $0.01 a cubic yard. These averages would have to be revised upward in estimating present day costs.

Within recent years some efforts have been made to produce gold by hand methods and by dragline-washing plant. In 1950 the Behrens Brothers operated a dragline and dry-land washing plant on the upper part of the North Fork, probably above the mouth of White Pine Creek. During approximately 75 days of operation, they produced 328 ounces of gold and 18 ounces of silver from 64,000 cubic yards of gravel handled. A similar dragline and washing plant was tried out at the mouth of Poorman Creek in 1955 but apparently was not successful, as it operated for only about one month. At this location, two or three feet of gravel, lying on uneven bedrock, was reported to average $1.00 per cubic yard, but it is covered by 12 to 18 feet of barren gravel.

During 1956 George Hudson of Potlatch is reported to have obtained control of the Mary Lee claim in sec. 1, and the Taylor, Black Dust, and Hidden Treasure claims in sed. 12, T. 42 N., R. 2 W., on the upper North Fork, for the purpose of installing a dragline-washing plant.

Another group from Potlatch has filed several claims in secs. 22, 27, 28, and 34, T. 42 N., R. 2 W., an area almost entirely between the Palouse River and Big Creek. This group was active in exploration work during 1956.

Blackfoot (Gold Hill) district

The Blackfoot or Gold Hill district includes all of T. 42 N., R. 4 W. and parts of T. 42 N., R. 3 W. and T. 41 N., Rs. 3 and 4 W. It lies north of the Palouse River between the towns of Harvard and Potlatch. The northern boundary of the district is about one mile south of the northern boundary of Latah County. The district is centered around the Gold Hill stock which crops out over six and one-half square miles; the mining district covers about 60 square miles.

Gold and a little silver have been mined from placer deposits along the upper parts of Gold, Camas, Jerome, and Boulder Creeks, and their tributary gulches. Numerous gold quartz veins have been prospected; one lode is reported to have produced a little gold.

Faick (1937) reports that gold was discovered on Camas, Jerome, and Gold Creeks in the summer of 1870, and this discovery started a small rush into the area. Placer gold was found in every stream in the vicinity of Gold Hill; some of the deposits were worked intensely for short periods. Approximately 120 men are claimed to have worked the gravels along Gold Creek at one time, causing small settlements to spring up at the head of Gold Creek and on Jerome Creek near Jack Gulch. Extensive activity is indicated by abandoned arrastras, stamp mills, sluice boxes, and miles of old ditches and flumes along the hillsides. Estimates of the value of gold re-

covered from the stream placers range from one-quarter million to three or four million dollars. It is likely that the lower estimate is more nearly accurate.

In all the creek beds gold and black sands are nearly everywhere confined to the lower six to 12 inches of gravel above the bedrock. The gravel is composed of both sedimentary and igneous materials and ranges up to 15 feet in depth. Deposits are generally narrow because the stream beds are also narrow, and values are confined to the stream beds.

The Carrico family located on the upper part of Gold Creek in 1878, and, for many years thereafter, they operated placer diggings in Picnic Gulch and on the East Fork of Gold Creek in sec. 11, T. 42 N., R. 4 W. In some years these operations were quite profitable. When the Carricos finally died off or moved away, others took their places and continued to mine on a small scale. Mr. J. P. Shattock was perhaps the most persistent miner, and he managed to stay on at the old Carrico place for many years, working a small quantity of gravel each spring. Mr. Shattock died in 1955.

Frank Milbert, who operates a store and filling station on Highway 95 at the Palouse Junction, owns two placer claims near the head of Hoteling Creek in the S 1/2 of sec. 14, T. 42 N., R. 4 W. An attempt was made to work the placer with a power shovel and washing plant; the work apparently was abandoned after a short period because large boulders interfered with successful operation. The gravel is reported to average about $0.40 a cubic yard in gold. Mr. Milbert, in partnership with M. L. Darrow, has a lease on 60 acres of state land in the SW 1/4 of sec. 13, T. 42 N., R. 4 W., a few hundred feet west of the East Gold Hill fire tower and at the head of Hoteling Creek. A deposit of magnetite in an ultrabasic dike was exposed on this lease. A sample taken by the writer, in the fall of 1956, from three bulldozer cuts across the strike assayed 61.7 percent iron. This same deposit was located many years ago by Adam Carrico, and a tunnel was driven about 200 feet under one end of the outcrop. The present owners have exposed the dike in several cuts over a distance of about 1,000 feet along the strike. The property is presently under least to R. M. Adams of Ironton, Minnesota, and is being considered for development as an open-pit iron mine. Frank Milbert also owns four lode claims in sec. 11, T. 42 N., R. 4 W., in Picnic Gulch, tributary to Gold Creek. He reports having exposed a hematite vein four feet in width, containing some tungsten in the form of wolframite and scheelite. During 1956 an exploratory shaft was being sunk on the vein.

A quartz vein was exposed in the bed of the East Fork of Gold Creek during early placer operations. The Carricos explored the vein with open cuts and two prospect shafts and found it contained sparsely disseminated siderite and pyrite with a little gold. In 1937 the Carrico Gold Mining Company erected a 25-ton flotation mill and a power plant on the site and drove 110 feet of drift on the vein. The results of this work must have been disappointing because no further activity is recorded. At the present time, Lawrence Paul of Moscow and Arthur P. Gillian of Potlatch have the mining rights to this area and are considering some diamond drilling in 1957.

In the southeastern part of the district, a series of vein structures on the southeastern margin of the Gold Hill intrusive have been explored to a considerable extent. Several mines and prospects are grouped around the upper part of Jerome Creek, north of Harvard, in T. 42 N., R. 3 W.

The Gold Hill mine is at the head of Jack Gulch, tributary to Jerome Creek, in the NW ¼ sec. 29, T. 42 N., R. 3 W. An intense gangue zone and a lenticular quartz vein containing some gold-bearing pyrite and chalcopyrite developed along a shear zone in a dense grayish quartzite. The vein has been explored by three adits into the hillside at different elevations; they are 30 feet, 144 feet, and 300 feet below the outcrop. The property has no production record and is inactive.

The Gold Bug mine is at the head of Heath Gulch, tributary to Boulder Creek, in the SW ¼ sec. 20, T. 42 N., R. 3 W. It is approximately 1,200 feet north of the Gold Hill mine and appears to be on a parallel structure. Both properties are now holdings of the Gold Hill Mining and Milling Company. The vein is a fissure-filling type, consisting chiefly of quartz with some tetrahedrite, pyrite, specularite, and chalcopyrite which contains a little gold and silver. At one place the vein measures 15 inches in width and strikes N. 25° E. The vein has been explored by an adit from Heath Gulch and a vertical shaft 300 feet deep. This mine is also inactive at the present time and has no production record.

The Daisy Mine is east of Jerome Creek in the E 1/2 sec. 21, T. 42 N., R. 3 W.; it is nearly a mile northeast of the Gold Hill and Gold Bug mines and about the same distance from the Gold Hill stock. This mine was opened in 1898 by sinking an inclined shaft into the deposit. In 1903 ore was hauled to a five-stamp mill on Jerome Creek. It is reported that $80,000 in gold was recovered and that the mine operated at a profit for a short period. The vein, a fissure type, is composed of quartz containing gold-bearing pyrite and specularite. It strikes N. 63° E. The country rock is quartzite. Some exploration work was done in 1937, but the property has been inactive for several years.

Other prospects in the same locality which the future prospector may want to investigate are: the Blackfoot, located on the east side of Jerome Creek in sec. 28, T. 42 N., R. 3 W.; the Black Horse, in the SW 1/4 of sec. 19 about one-quarter mile west of the Gold Bug; the Last Chance, in the NE 1/4 SE 1/4 sec. 29, on the west side of Jerome Creek; the Copper Ridge, in the NE 1/4 and NW 1/4 secs. 19 and 20 respectively, on the ridge between Jerome and Boulder Creeks; and the Cassidy, in sec. 30, T. 42 N., R. 3 W., near the head of Camas Creek.

Moscow Mountain district

This district includes all of T. 40 N., R. 5 W.; secs. 31 to 36, T. 41 N., R. 5 W.; the southwest corner of T. 41 N., R. 4 W.; and the western row of sections in T. 40 N., R. 4 W. It includes part of the Thatuna Hills, west of Moscow Mountain. The district covers approximately 49 square miles.

In the district gold quartz veins occur in granodiorite. Several veins have been explored to some extent, but no economic deposits have been disclosed. The largest amount of exploration work was done in the White Cross mine located near the head of Gnat Creek in secs. 23 or 24, T. 40 N., R. 5 W. A stamp mill is reported to have been erected on this property, but there is no reported production.

Although the lodes have not been productive, placer gold has been recovered in small amounts for many years. Discovered probably as early as the 1870's, Mineral Resources (U. S. Geological Survey) for 1905, 1906, and 1907 report gold produced from as many as four placer deposits in the Moscow Mountain district. Minerals Yearbook (U. S. Bureau of Mines) for 1933 and 1934 also report gold produced from four placers in the same district.

Apparently most of the placer diggings were located on Crumarine, Gnat, and Howard Creeks, which head on the upper slopes of East and West Twins and empty into the South Fork of the Palouse River. Most of the gold quartz lodes are also located in this part of the district.

Troy District

The Troy mining district includes all of T. 39 N., R. 3 W., covering about 36 square miles. It is in the plateau region east of Troy. The elevated plateau has been deeply dissected by three streams: Little Bear Creek, Dry Creek, and Big Bear Creek. These streams have cut through the basalts which cap the plateau, exposing the underlying pre-Tertiary formations. Some Latah sediments, which are contemporaneous with the lava flows, are also exposed. The pre-lava rocks which crop out in limited areas are metamorphosed sediments of the Belt series and minor outcrops of granodiorite. Many pegmatites cut the metamorphics and granitic rocks.

Copper mineralization occured in the metamorphic rocks in close proximity to pegmatitic dikes, producing probable contact metamorphic deposits. The copper minerals are chiefly bornite and chalcopyrite with possibly a small amount of cobaltite in one deposit.

The Copper Chief mine is on the Olson farm and belongs to the Troy Sillimanite Company; Albert and Robert Olson of Moscow and Troy are the owners. It is located in the SW $\frac{1}{4}$ sec. 7, T. 39 N., R. 2 W., near Big Bear Creek. The mineralization occurs in quartz veinlets in schist country rock. Bornite, chalcopyrite, and a little cobaltite have been found. Three adits, at different elevations in a small creek bed, have been driven into the hillside; a winze connects two of the levels, and there is more than 100 feet of workings. Some copper is reported to have been produced in a crude furnace on the property. During recent years the Olson brothers have drilled several holes in the property and report the discovery of cobaltite in the drill samples.

The O. K. Olson mine is located in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 39 N., R. 3 W., on Little Bear Creek, about three miles east of Troy. It is also a contact metamorphic deposit in which bornite and chalcopyrite occur in quartz stringers in schist. Johnson and Myrene (1929) describe

a shaft 100 feet deep, at the bottom of which a crosscut was driven 70 feet to the southeast and another 65 feet to the northwest. No ore bodies of economic value were disclosed.

The Gemmill property is located f rther down the canyon of Little Bear Creek in the SE ¼ NW ¼ sec. 15, T. 39 N., R. 3 W. There are prospect shafts, pits, and old caved adits for one-quarter mile or so along the creek. One shaft is reported to be a little more than 100 feet deep but is now caved at the collar. At least two core-drill holes were drilled by the Olson brothers during 1956 on the property, one of which showed some mineralization in five feet of core. No ore bodies of economic value have been discovered.

Ruby Creek District

The Ruby Creek mining district, sometimes called the Neva district, is located on the eastern border of Latah County but, for the most part, is in adjoining Clearwater County. It covers a belt about three miles wide in Latah County, extending from the southern boundary of T. 39 N. to the northern boundary of T. 41 N., R. 1 E., a distance of 18 miles. The area in Latah County is about 54 square miles.

Most of this area is underlain by mica schists and quartzites which are metamorphosed sediments of the Belt series. The ore veins were formed by replacement along fissures (Ross, 1941, p. 38). Early discoveries were prospected as gold veins. Several years later the veins were re-opened and developed for their lead-zinc content. The lead and zinc occur as galena and sphalerite in a siderite gangue.

Anderson (1930) locates the Ruby Creek mine a mile north of the Elk River-Bovill highway, which would probably put it in sec. 14, T. 40 N., R. 1 E., in Clearwater County. This was the most important discovery in the district; the ore occurs in lenses eight to 18 inches wide and swells and pinches along both the strike and dip. A 120-foot adit exposed a mineralized vein along its entire length. A 170-foot shaft was also sunk on the vein. A small mill was being erected at the time of Anderson's visit.

The Gold Hunter lode is located in the N ½ sec. 15, T. 40 N., R. 1 E., possibly in Latah County. The lode occurs in a fissure zone in shattered porphyry, which was extensively altered by hydrothermal solutions. A manganese-stained outcrop, which had been prospected by small cuts and a shaft 35 feet deep, was the only development noted. The Silver King and Gold Eagle properties adjoining the Gold Hunter are also probably in Latah County. These properties are reported to have been worked as gold mines. A stamp mill was erected on the Gold Eagle property, and underground workings appear to be extensive.

In the headwaters of Cedar Creek, in the southeast corner of the county, pebbles of almost pure rutile (titanium oxide) have been found. They are reported to have been picked up in the gravels and alluvium in the SE ¼ sec. 1 and the NE ¼ sec. 12, T. 38 N., R. 1 W., at the base of Mason Butte. The source of these pebbles has not been determined, and the quantity found in alluvium and gravels is not sufficient to be of economic importance.

INDUSTRIAL MINERAL DEPOSITS

By far the major potential mineral wealth of Latah County lies in deposits of so-called nonmetallic or industrial minerals. Deposits of high-grade fire clays and high-alumina clays are currently considered to be of greatest future importance.

Clay

Probably 95 per cent or more of the clay reserves of Latah County occur in a belt about 35 miles long and 12 miles wide across the center of the county. This region is on the south and east slopes of the Thatuna Hills, where the weathered granodiorite country rock is the principal source of the clay (Tullis and Laney, 1933, pp. 491-492).

A recent report of the Idaho Bureau of Mines and Geology (Hubbard, 1956) gives a detailed description of the known clay-bearing areas in Latah County; thus, they will be only briefly described in this report.

There is evidence that approximately 250,000,000 tons of clay may be a conservative estimate and that 500,000,000 tons of clay may exist in the county.

Canfield-Rogers clay deposit

The Canfield-Rogers clay-bearing area adjoins the town of Moscow on the east and north. Geologic criteria indicate that approximately 8,000 acres in T. 39 N., Rs. 5 and 6 W., and T. 40 N., Rs. 5 and 6 W., may be clay-bearing. The area is bounded on the south and east by the South Fork of the Palouse River and extends northward to the lower slopes of the Thatuna Hills. More than 80 percent of the clay present is estimated to be of transported granitic type. The transported clay was deposited mostly on flat-lying basalt which has weathered to a layer of basaltic clay at the contact. Basalt covers the clay beds over large areas, but in places deposits have formed directly beneath the Palouse soil or valley alluvium. Only clay beds directly beneath a shallow overburden of soil, sand, or gravel are considered workable at this time.

Clay has been mined from at least three pits along Paradise Creek, east of Moscow, and used to make brick by the Moscow Fire Brick and Clay Products Company. The company is no longer in existence; however, during the time it was active an estimated 5,000 to 7,000 tons of clay were mined. A clay pit was opened north of Moscow at the Rogers place in 1929. It is located near the center of sec. 31, T. 40, N., R. 5 W. Several carloads of clay were removed for testing, but no continuous production is recorded.

During 1943-44 the U. S. Bureau of Mines drilled 13 auger holes to test the clay in the vicinity of the Rogers pit. From the information derived from these holes, it was estimated that about 8,000,000 tons of clay underlie approximately 100 acres of land. On the basis of this work, the Anaconda Mining Company has acquired some 1,000 acres in the area and has test-drilled the ground with more holes spaced at closer intervals during the summer months of 1956. The clay is being tested primarily for its available alumina content.

Benson clay deposit

The Benson clay-bearing area includes some of the oldest clay pits in the county. It is about three miles north and two miles east of Troy, on the north side of the highway between Troy and Deary. The area covers about 1,800 acres in T. 40 N., R. 3 W. The clay in this area is chiefly of residual granitic type. Residual clay deposits in Latah County are relatively small in areal extent and are irregular in outline. Moreover, the deposits in the Benson clay-bearing area are covered in places by a layer of basalt from less than one foot to 20 feet in thickness. The Benson pit has produced the largest amount of clay, approximately 150,000 tons, of any pit in the county. The Troy Firebrick Company mined in the Benson pit, both open pit and underground, from 1930 to 1955 when fire destroyed the brick plant at Troy. Estimated clay reserves in the proximity of the pit are 6,000,000 tons. The clay has been used to make a high-grade fire brick.

Olson clay deposit

The Olson clay-bearing area is about three miles west of Deary; the larger part of it is north of the Troy-Deary highway. The area covers roughly 2,000 acres in T. 40 N., Rs. 2 and 3 W. The clay is mainly the transported granitic type. The U. S. Bureau of Mines drilling program indicated about 70,000,000 tons of clay underlying approximately 900 acres. Based on the results of this drilling, the Anaconda Company acquired more than 1000 acres of land in this area and has done test drilling and pit sampling during the summers of 1954 and 1955. The Troy Firebrick Company, which has now become the A. P. Green Firebrick Company of Idaho, has also acquired land to the north of this area and has proven reserves of good quality fire clay by intensive drilling during the 1955 season.

Stanford clay deposit

About two miles due north of the Olson deposit but on the opposite side of a granite knob, another clay-bearing area has been designated the Stanford area, after a station on the Washington, Idaho, and Montana Railroad located at about the center of the deposit. Clay is also exposed in a railroad cut near the Stanford station. Results of drilling indicate that transported granitic clay was deposited on flat-lying basalt. Some weathering of the basalt produced a layer of residual basaltic clay beneath the transported clays. Little if any further exploration work has been done in this area since the Bureau work during the last World War.

Deary clay deposit

The Deary clay-bearing area is about two miles south of Deary on the west side of the Deary-Kendrick highway. It is in the N 1/2 sec. 34 and the S 1/2 sec. 27, T. 40 N., R. 2 W. This area was also explored by a U.S. Bureau of Mines drilling program during the war. Results of the drilling indicate a transported clay deposit: granitic transported clay overlies basaltic residual clay, both of which overlie fresh basalt. Some of the clay is covered by a layer of younger basalt. The clay-bearing area, as delineated, is only 115 acres, but the clay beds are of unusual thickness,

averaging about 40 feet. On the basis of the drilling done by the Bureau, the Anaconda Company has acquired most of this clay-bearing area for their future use.

Helmer clay deposit

This clay-bearing area was discovered and explored during the summer months of 1956. It is located about one-half mile north of the settlement of Helmer, in the N 1/2 of sec. 16 and the W 1/2 sec. 9, T. 40 N., R. 1 W. The prospecting and exploration work was done by the A. P. Green Firebrick Company, who hold a mineral lease on the land from the State of Idaho.

Bovill clay deposit

The Bovill clay area lies southwest of the town of Bovill in Tps. 40 and 41 N., R. 1 W., in the eastern part of Latah County. Reconnaissance surveys and some drilling by the Bureau of Mines during the war indicated that a large area of 1,500 acres or more is possibly clay-bearing. Drill samples showed transported granitic clay, underlain by basaltic residual clay which in turn rests on basalt. During the summer months of 1956 the J. R. Simplot Company obtained leases on state land and explored this area with considerable drilling and several bulldozer cuts. It is reported that results disclosed high-quality clay.

Numerous other clay exposures are known in Latah County, and hidden clay beds surely exist; however, the potential economic value of such deposits depends on their accessibility.

Mica - Mica Mountain (Avon) district

General geology

Latah County has also, at one time or another, produced substantial quantities of mica and a little beryl from pegmatites in the Mica Mountain or Avon district, located in T. 41 N., R. 2 W., about five to six miles north of Deary. The district, about two and one-quarter miles long and one to two miles wide, includes about 18 mines and prospects (Stoll, 1950).

Most of this area is underlain by mica schist and gneiss, representing metamorphosed units of the Belt series of Algonkian age. A granodiorite contact lies along the west side of the East Fork of Big Bear Creek, and the southeast corner of the district is underlain by granodiorite.

Pegmatites contained in the metamorphics and, to a lesser extent in the margin of the granodiorite mass, were formed by hydrothermal replacement of an earlier dike-filling and some of the country rock (Anderson, 1933, pp. 55-58). Parts of these pegmatites contain muscovite mica in concentrations sufficient to be of economic value. Other minerals occurring in the pegmatite include schorl (black tourmaline), microcline, beryl, biotite, garnet, flake graphite, and small amounts of the uranium minerals, autunite and meta-torbernite. About 100 pegmatites, more than one foot wide

have been exposed in outcrops or workings in the district; however, they are not evenly distributed over the area. The productive pegmatites range in length from 30 to 275 feet and are all in the metamorphics; no minable mica deposits have been found in the granodiorite. Furthermore, the more productive pegmatites are distinctly zoned; a core zone composed of massive quartz; a wall zone containing sheet mica; and a border zone containing selvage.

The muscovite is classed as rum mica and green mica. Rum mica is distinguished by a deep-rum to pale-yellowish rum color, although some is nearly colorless. Almost all of the sheet mica produced is cut from rum mica. Green mica is light green or greenish brown; nearly all books are warped, soft, and broken, and are good only for scrap.

Muscovite mine

The largest and most productive property in the district is the Muscovite mine. It was also the largest mica producer in Idaho and one of the largest producers in the United States. It was first opened in 1888 by Woody and Lamb (Sterrett, 1911, p. 379), and later worked intermittently, first by the Muscovite Mica Company of Spokane, and then by Alexander Munro of Moscow, and later by the Producers Mica Company of Chicago. Anderson (1923) reports that 800 tons of crude book mica were produced before 1910. In 1918 120 tons of crude mica were shipped, so that by 1942, at least 920 tons were reported produced. Stoll (1950) states that the mine and adjacent ground was leased by Victory Mines, Inc. in 1942. Under the direction of Victor A. Christensen of Salt Lake City, exploration and development work was carried on during parts of 1942 and 1943. Production was started in October, 1943, and continued until the end of 1944. C. J. Montag and Sons of Portland obtained a lease in early 1945 and continued underground mining in conjunction with their open-pit operation. Pit mining was carried on from 1943 to 1945. Total production from the Muscovite mine from October, 1943, to May, 1945, was about 1,295,000 pounds of mine-cobbed mica.

During part of this period, 1943-45, the Colonial Mica Corporation maintained a buying office for the government at Moscow, and the cost of shipping was assumed by the government under the War Production Board's domestic mica program. In 1945 this program was concluded; and when government support was withdrawn, all the mica mines in Latah County were soon closed down.

The Idaho Beryllium and Mica Corporation reopened the Muscovite mine in 1951 and actively mined and shipped mica and a small quantity of beryl concentrates until 1955. In May, 1955, the Federal district court issued a foreclosure order, and mine and plant were closed pending sale to satisfy government liens. At the time of this writing, the property is in the hands of the U. S. Marshal. Information on purchase conditions may be obtained from the Reconstruction Finance Corporation, Portland, Oregon.

Three mica-bearing pegmatites comprise the major ore bodies: the East, Central, and West pegmatites. They are enclosed in mica schist, are roughly parallel, and closely spaced. The schist enclosing the pegmatites

is highly altered and in places contains beryl and books of mica. A detailed description of the mine workings is contained in Stoll's report (1950, p. 29).

Doerr mine

The Doerr property lies in the SE ¼ sec. 22, T. 41 N., R. 2 W., and is the easternmost property in the district. It is about 3,000 feet southeast of the Muscovite mine. The Doerr mine was located in 1914 as the Bentz claim and was operated for three years as the Washington Mica Company by A. W. Bentz of Spokane. During this period it is reported that several carloads of crude mica were shipped. In 1927 a small production is again reported, and several more attempts at operation were made over the years. The mine was later acquired by Mrs. Janett Doerr of Spokane, and in 1943 was leased to Frank Eichelberger of Spokane and C. J. Montag and Sons of Portland. In the fall of 1943, the Montag Company started open-pit mining. Cut No. 2, which was the major producer, was dug on the outcrop immediately above the upper tunnel of the earlier operation. The pit was excavated to a length of about 65 feet and to a depth of 25 to 55 feet. The total production from this pit amounted to 21,625 pounds of mine-cobbed mica during 1943 and 1944. During this same period, land adjoining the Doerr property was leased from the state by Don Gillis of Spokane and was called the Gillis lease. This land was explored by the Montag Company, and in 1944 Dan Carlson of Deary is said to have produced a few hundred pounds of sheet mica from the pegmatite exposed by the Montag workings.

The pegmatites in this area are exposed over a strike distance of more than 1,200 feet. They are mostly lenticular and strike almost due north. The pegmatite is enclosed in a country rock of mica schist with narrow bands of mica gneiss. The principal productive pegmatite, exposed in Cut No. 2 and mined earlier in the upper tunnel, is about 8 feet wide. It is composed of a four-foot wide quartz core, a two-foot thick wall zone, and a border zone. The sheet mica was recovered from the wall zone.

Steelsmith mine

The Steelsmith property is in sec. 22 and sec. 2" and is about 3,000 feet due south of the Muscovite mine. It was worked during 1910 as the Levi Anderson mine.

The early workings include an upper tunnel with stopes, a small open pit, and a lower tunnel. The production from these early workings is unknown, but some specimens of large sheets of mica were in the possession of Mr. Anderson of Spokane. The present owners, Robert Olson and Herman Krier of Troy, leased the property in 1943 and 1944 to O. H. Gleason of Moscow and R. Williams of Lewiston. The new workings excavated in 1943-44 include stopes, crosscuts, and drifts on the upper tunnel level and some open pits and exploratory cuts and trenches. Total production from these workings was about 32,900 pounds of crude book mica during 1943-44. More than 12 pegmatites were exposed; however, 75 per cent of the total production came from the upper tunnel workings in the main pegmatite. This pegmatite is a

pipe-like body about 58 feet long and 20 feet wide and is oval-shaped. It consists of a quartz core ten feet thick, a wall zone, containing sheet mica and beryl, one to ten feet thick, and a border zone, containing scrap mica, about one foot thick. The pegmatite is enclosed in mica schist and interbedded mica gneiss.

Last Chance mine

The Last Chance property is in sec. 22, T. 41 N., R. 2 W., and is about 2,200 feet northwest of the Steelsmith mine.

The Last Chance and the nearby Silver White prospect were worked before 1910 as the Maybe mine. At the Last Chance, old workings include two tunnels and stopes above one of the tunnels, also some old open cuts. In 1944 Burton L. Meier of Deary obtained a least, and with two partners started open-pit mining. One of the old tunnels was also opened in 1944-45, and underground mining was carried on. The mine was closed in March, 1945. An estimated total of 87,200 pounds of mine-cobbed book mica was produced during 1944 and 1945. At least five pegmatites have been disclosed by the workings. The largest one was exposed over a strike length of 55 feet and is from three to 26 feet thick. Zoning also occurs in this pegmatite: the border zone, containing abundant mica flakes, is three to six inches thick; and adjoining wall zone, containing books of sheet-bearing mica of pale-rum color, is one to four feet thick; the intermediate zone contains pale-green mica, and the core zone is composed of massive white quartz.

About 600 feet east of the Last Chance is the Witherow lease, which was worked partly in conjunction with the Last Chance.

Luella mine

The Luella mine is in sec. 21, T. 41 N., R. 2 W., on the western edge of the district. It is one of the older mines with extensive early workings on three underground levels; stoping was done on all three. No records of early production are available; however, judging from the stoped areas, this must have been a major producer among the early mines. The Western Mica Company owned the mine in 1910, and it is reported that some mica was produced during the first World War.

In the fall of 1943, E. A. Campbell of Lewiston obtained a lease on the property. Small-scale mining, both open cut and underground, was done during 1943 and 1944. Campbell reportedly produced 17,880 pounds of mine-cobbed mica.

More than a dozen pegmatites, mostly pipe-like bodies, occur in the area. The pegmatites containing book mica show some zoning. The mica occurs as individual books and as flakes of scrap quality; sheet mica is scarce.

Other mines and prospects located in the district are reported by various writers. They include the McCormack property in sec. 28, the Silver White prospect in sec. 22, the Avon Mica Company mine in sec. 28, the Carlson lease in sec. 27, the Maxine No. 2 in sec. 27, the Olson mine

in sec. 27, the Fitzgerald property in sec. 27, the Campbell lease in sec. 27, and the Morning Star mine in sec. 15, all in T. 41 N., R. 2 W., B.M.

Sillimanite - Troy deposit

Adjoining the Copper Chief mine and located on the Olson farm in sec. 7, T. 39 N., R. 2 W., in the Troy mining district, there is a sillimanite deposit, covering an area of approximately one-half square mile. The sillimanite zones are on the north slope of Big Bear Creek canyon, where the overlying basalt flows have been removed by erosion. The sillimanite occurs in mica schists and gneisses of the Belt series. The enriched zones are closely related spatially to pegmatites.

Numerous test pits have been dug in the hillside; the workings of the Copper Chief mine also expose some of the sillimanite at shallow depths. Sampling and testing were done by the Idaho Bureau of Mines and Geology, and a report by J. D. Forrester was published in 1942.

Silica - Paradise Ridge deposit

About three miles south of Moscow, quartzite crops out for a width of 500 feet or more along the upper slope and top of a hog-back ridge which trends north-northeast for a mile or more. During June, 1956, the Pacific Silica Company, under the direction of Fred Williams of Pullman and Don Rolph of Lewiston, opened a quarry face on the west side of the ridge and built an access road from the main county road to the deposit. Some of the quartzite was shipped for test purposes. Several hundred thousand tons of quartzite are readily available if a market can be established for the material. The quartzite, of Beltian age, is massive, white, iron-stained, coarsely crystalline, and is reported to contain 99 per cent or more silica.

Precious opal

Opals were discovered about five miles northwest of Moscow in August, 1890, during the digging of a well on the O'Donnell farm. The first discovery was probably on the Washington side of the state line, but later diggings produced some good stones on the Idaho side in the W $\frac{1}{2}$ sec. 36, T. 40 N., R. 6 W. It is estimated that a little more than $5,000 worth of opals were sold during the two-year period 1891-1892.

According to Part II of Mineral Resources of the United States for 1910 (U. S. Geological Survey, 1911), mining was done at three places about 200 yards apart in a triangular area. At one of the mining sites, nearly an acre of ground was worked over.

The dumps are composed of vesicular basalt which breaks into blocks a few inches thick; the weathered portion is gray in color, and the fresh rock is grayish black. Precious opal fills some of the vesicles in the basalt. Some very fine gem opal was obtained. Some work was reportedly done on these deposits in 1904 (Shannon, 1926), but no more production is mentioned.

Garnet

Garnetiferous mica schists are plentiful in the upper part of the Emerald Creek drainage in the northeast corner of Latah County, in T. 42 N., R. 1 E., and R. 1 W. Large garnet crystals occur in a creek bank about one-quarter mile above its junction with Emerald Creek in sec. 7. In addition, placer deposits of garnet sand are currently being worked on Emerald Creek in the SW ¼ sec. 3, T. 42 N., R. 1 E. When it is operating, the Idaho Garnet and Abrasive Company is able to produce 100 tons of washed garnet sands a day from its dragline and dry-land washing plant. The garnet occurs in the two to four feet of sand resting on bedrock. Four to six feet of overlying barren sands must be stripped prior to the removal of the garnetiferous layer. Because the concentrator and the processing plant are in Benewah County, they will be described in detail in the Benewah County report. The concentrator is a jig-equipped plant which produces a garnet sand concentrate from the portable washing plant product. The processing plant is equipped to dry, crush, and screen the jig concentrate and thus produce the sized product required by the trade. It also provides facilities for sacking and storage.

Stone

Several kinds of stone have been quarried in Latah County, but the most widely distributed and most widely used is basalt. Basalt quarries are scattered throughout the county; they are generally located on private land, and when active, the owner is paid a royalty on the basis of yards of rock removed. All are operated only intermittently, mostly by contractors, to provide road metal for the county and state highways. Portable crushing and screening plants are now used almost exclusively. The plant is moved into a quarry during the summer working months; the stone is crushed and stockpiled at a convenient location for later use by highway crews; or it is distributed directly on the road bed.

Where conveniently located, some quartzite has been quarried for road material. It makes a good road surface but is more difficult to quarry and crush and thus more costly.

Granodiorite from the Thatuna Hills area has been quarried for road material; however, the outcrops are badly decomposed and break down to a clayey sand after a short period of use.

Sand and gravel

There are sand and gravel deposits in Latah County, but no commercial production is reported.

The dredge tailings on the North Fork of the Palouse and on the Palouse River above Laird Park are a readily accessible source of gravel. Many of the smaller creeks in the Hoodoo district and in the Gold Hill district have been worked by placer miners who left behind gravel piles sufficient for local use.

On the Coyote Grade in Nez Perce County, near the southern boundary of Latah County, a sand-gravel operation is exploiting a fluvial deposit exposed between layers of basalt. The same type of deposit is exposed in Latah County in the walls of the Potlatch River Canyon near Kendrick and in some road cuts.

POTENTIAL UTILIZATION OF MINERAL RESOURCES

A mineral deposit is a concentration of a certain mineral or combination of minerals in a particular place. Such deposits become mineral resources only if man is able to find some useful purpose for them. As man's technology advances, minerals not hitherto useful may become valuable, and minerals once valuable may no longer be of much use; therefore, the mineral resource picture is constantly changing.

The first miners in Idaho came seeking gold. Gold has a high value per unit weight and can be transported easily; placer gold requires no further treatment once it is separated from the gravel, and at that time it could be used by the miner to purchase all goods and commodities. The early miners were little interested in the base metals, such as lead, copper, and zinc, even though they found these metals in large deposits; furthermore, they had no use for such deposits as phosphate rock, limestone, gypsum, and clay. It was only many years later and after agriculture, railroads, industries, and larger populations arrived, that the latter deposits became useful and thus became mineral resources.

After the initial period of placer mining, attempts were made to find gold lodes, and during this exploration copper minerals were discovered and prospected. More recently, some interest has been shown in deposits of tungsten, cobalt, titanium, and iron. A small amount of gold placer mining persists, but the future of the mineral industry in Latah County depends on the development and utilization of the large reserves of industrial minerals. Clay probably ranks first in potential importance, followed by stone, mica, garnet, silica, sand and gravel, and sillimanite.

CLAY

Clay deposits in Latah County have been noted since around the turn of the century; however, production during the past 55 years probably does not exceed 250,000 tons. A few thousand tons of clay were mined near Onaway about 1902-03 and hauled by wagon to a pottery plant at Palouse, Washington. Beginning about 1910, fire brick and other refractory products were made in a brick plant at Troy from clay mined northeast of the town, and starting about 1913, the Moscow Firebrick Company produced firebricks and other clay products from clay mined at Joel and from the outskirts of Moscow. Part of the Moscow plant burned around 1941, and it was closed down about that time. The Troy plant burned in 1955 and has been out of production since that time.

Clay investigations in Latah County have been conducted by several private companies in the past and intensive drilling, sampling, and estimation of clay reserves were done by the U. S. Bureau of Mines and the U. S. Geological Survey during the years 1942-45.

The greatest amount of activity in the history of the Latah County clay deposits has occurred within the last three years. The present activity has been directed toward determining the amount of clay available and its value for various uses. At least three well established companies, leaders in their field of mining, have bought, optioned, or leased large tracts of clay-bearing land in Latah County and have conducted large-scale investigations of clay deposits during 1954-1956.

The Anaconda Company, which has tested clays in north Idaho from time to time over a considerable period, has become interested in Latah County clay deposits as a source of alumina for their new aluminum reduction plant recently put into production at Columbia Falls, Montana. The company has acquired large areas of clay-bearing land, has drilled several hundred holes, and has tested pit samples. A pilot plant, which will extract the alumina from the raw clay, is presently under construction near Anaconda, Montana, at a cost of about one million dollars.

The A. P. Green Firebrick Company of Mexico, Missouri, having acquired the total ownership of the Troy Firebrick Company, has purchased or leased large tracts of clay land and has conducted intensive drilling to determine the size and quality of the clay bodies. A subsidiary of the parent company, the A. P. Green Firebrick Company of Idaho, is erecting a new and modern plant on the site of the old plant at Troy and is opening a new clay pit in the NW ¼ NW¼ sec. 16, T. 40 N., R. 1 W., on state land just north of Helmer.

The J. R. Simplot Company, which conducts large mining operations in phosphate rock and in other industrial minerals in Idaho, has done a large amount of drilling of clay deposits on state land near Bovill. Samples have been tested at the U. S. Bureau of Mines ceramic laboratories in Seattle and the results are reported to be encouraging; a high grade kaolin may be produced for use in porcelain ware and possibly as paper clay. The company has filed a mill site claim in the NW ¼ sec. 1, T. 40 N., R. 1 W., on the West Fork of the Potlatch River. This claim is on the Washington, Idaho, and Montana Railroad about one mile south of Bovill.

Clay production and utilization will probably become a major industry within the next five years in Latah County and will contribute substantially to the wealth and revenue of the county and the state.

MICA

Mica, from time to time, has been the principal industrial mineral product of Latah County. Currently, there is no production and no activity of any kind in the mica district. The last producer, the Idaho Beryllium and Mica Corporation, was closed in May, 1955 by a federal court order.

The mica district in Latah County has always been a marginal producer. When prices for mica are high or when government subsidies are sufficient, some profit can be made from mica mining. Each period of production, however, reduces the total available reserves and also makes recovery of the remaining reserves more difficult and thus more costly. Future successful

operations may depend on improved mining and processing methods and on the sale of more of the constituents of the pegmatites as by-products (Forrester, 1942, p. 14).

SILLIMANITE

In the past no market has existed for sillimanite within shipping range of the deposits in Latah County. However, if a refractory industry is developed in the Northwest to produce porcelain ware, such as electric insulators, a use for limited quantities of sillimanite may develop, and the deposit near Troy is readily accessible.

SILICA

Silica is an impurity in most of the clays of Latah County, which are mixtures of various proportions of clay minerals (chiefly kaolinite), quartz (silica), mica, unaltered feldspar, and lesser amounts of iron oxide, ilmenite, and carbonaceous material. The impure clay, as it comes from the pit, is used successfully in making fire brick and refractories. But for other uses part of the silica must be removed. In the beneficiating process, large quantities of high-grade silica sand are produced as a by-product. In addition, the large quartzite deposits previously mentioned are a potential source of silica. The availability of large supplies of silica may encourage glass or silicon manufacturers to locate plants in this area.

GARNET

Garnet sand has been produced on a limited scale from the placer deposits on Emerald Creek since about 1940, by the Idaho Garnet and Abrasive Company of Spokane. The washing and jig plants are capable of producing 100 tons of garnet concentrates a day; however, they are operated only on a part-time basis because the present available market is not sufficient for capacity operation. The garnet sand is used for sandblasting, and the market is limited to the western states. Shipping costs do not permit western garnet to compete in eastern markets, (McDivitt, 1952).

STONE

Stone is currently the chief mineral product of Latah County. Crushed and screened basalt is produced at two localities near Moscow, and several contractors have been producing crushed basalt on contract for county and state highway departments during summer months. Numerous basalt quarries and a few quarries in granodiorite and quartzite are scattered throughout the county. They are worked periodically during the open season. An accelerated road building program contemplated for the next ten years across the nation, will doubtless increase the amount of stone quarried in Latah County.

SAND AND GRAVEL

All sand and gravel is shipped into Latah County at the present time. This situation is largely due to a limited and seasonal demand which makes it unprofitable to set up a commercial operation in areas where either material is available. A growing market for these essential but low priced commodities will eventually warrant the establishment of sand-gravel operations.

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Idaho Bureau of Mines and Geology

E.F. Cook, Acting Director

PLATE I

MINING DISTRICTS & MINERAL RESOURCES OF LATAH COUNTY, IDAHO

1957

BENEWAH CO.

WASHINGTON

CLEARWATER COUNTY

NEZ PERCE COUNTY

Stratton Butte

Mineral Mtn.

Blackfoot or Gold Hill District

Gold Hill

Hoodoo District

Little Baldy

Baldy Mtn.

Baby Grand Mtn.

Snow Cap Mtn.

Emerald Butte

Emerald Cr

W Fk Emerald Cr

Beals Mtn.

Sand Mtn.

Boundary Mtn

Mica Mtn.

Mica Mountain District

Ruby

Bovill

Bovill Clay Deposit

Stanford Clay Deposit

Basalt Hill

Vassar

Avon

Potato Hill

Deary

Helmer

Ruby Creek District

Moscow Mountain District

Moscow Mtn.

E. Moscow Mtn.

Benson Clay Deposit

Olson Clay Deposit

Deary Clay Deposit

Canfield–Rogers Clay Deposit

MOSCOW

Troy

Troy District

Park

Linden

Joel

Cornwall

Tomer Butte

Juliaetta

Kendrick

Genesee

Ohawa

Potlatch

Princeton

Hampton

Harvard

Palouse

Deep Cr

Flat Cr

Paradise Cr

S Fk Palouse R

Middle Potlatch

Little Potlatch R

Little Bear River

Big Bear

Pine Cr

Potlatch River

Boulder Cr

So Fork Potlatch Cr

N.P. R.R.

U.P.R.R.

W.I. & M. Ry.

S.P. & P. R.R.

EXPLANATION

- Mining Districts
- Clay Deposit
- Basalt quarry
- Beryllium
- Clay, basaltic
- Clay, residual
- Clay, transported
- Cobalt
- Copper
- Garnet
- Gem Stone
- Gold
- Granite
- Iron Ore
- Mica
- Quartzite
- Sand and Gravel
- Sillimanite
- Titanium
- Tungsten

3 2 1 0 1 3 6 9 Miles

Scale

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E. F. Cook, Acting Director

PLATE II

GEOLOGIC MAP

OF

LATAH COUNTY, IDAHO

1957

Geology by Edward L. Tullis assisted by Walter Northby,
Idaho Bureau of Mines and Geology, 1931–1932.

EXPLANATION

SEDIMENTARY ROCKS

- Qal — Alluvium — Pleistocene — Quaternary
- Qt — Terrace Deposits — Pleistocene — Quaternary
- Ml — Latah Formation — Upper Miocene — Tertiary
- Ab — Belt Series — Algonkian — Precambrian

IGNEOUS ROCKS

- yl — Younger lava — Pliocene — Tertiary
- Mcr — Columbia River lava — Upper Miocene — Tertiary
- grd — Granodiorite — Upper Cretaceous — Cretaceous
- Sy — Syenite — Upper Cretaceous — Cretaceous
- Cv — Volcanics — Permian — Cretaceous

60° Strike and dip of beds

Fault

SCALE

0 1 2 4 6

Miles

STRUCTURE SECTIONS

A–A'

B–B'

C–C'

D–D'