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Division of Geology and Earth Resources
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THE AVAILABILITY OF LEAD AND ZINC IN WASHINGTON

Annual/Final report completing the requirements set forth under U. S. Bureau of Mines
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by

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INTRODUCTION

Washington State has been a small but consistent producer of both lead and zinc for most of this century. The first recorded lead production in the state was in 1898, and since then, lead in varying quantities has been recovered annually from a number of different localities. The argentiferous nature of much of the local lead has no doubt contributed significantly to the attention it has received as an exploration or prospecting target.

Zinc, on the other hand, though usually closely associated with lead in several of the state's mining districts, did not enjoy the same early popularity. In fact, until 1928, there were no smelters in the state capable of handling the various zinc-bearing ores recovered during lead-mining operations. Consequently, most of the zinc ore produced here prior to 1928 was shipped together with the more valuable lead ore to smelters in Idaho, Montana, and elsewhere, or it was simply hand separated as much as possible from the lead ores at the mine site, then used for backfilling, road metal, etc.

Despite this long period of production, Washington State does not rank as one of the nations's prominent lead-zinc producers. This is reflected in the comparatively small amount of exploration work that has been carried on for lead and zinc combined, especially within the most promising areas of Stevens and Pend Oreille Counties.

All of the properties within the state that are included in this report are known or suspected to contain minable reserves of lead and(or) zinc. The data utilized to prepare each summary report was also used to construct the computer input schedules or records through which the selected mineral commodity data will be inserted for storage in the U.S. Bureau of Mines' Minerals Availability System. The Minerals Availability

System (MAS) is a process through which information regarding unmined reserves of selected mineral commodities may be rapidly recalled and utilized to establish or assess the nation's domestic mineral supply position at any given time in the future.

When at all possible, a Probabilistic Grade-Quantity Matrix has been prepared for each of those properties that have measured, estimated, or inferred reserves of ore. The matrix, which constitutes the heart of the Minerals Availability System, is an orderly accounting of the various commodities known or estimated to be available within various levels of probability. Copies of the matrices some of which contain confidential information have been prepared for the various deposits of lead and zinc in Washington and are included here in the appendix.

In this report each property selected for MAS input is described in detail as to location and access. Emphasis has been placed upon providing access descriptions that are sufficiently detailed in order to avoid or reduce the problems associated with actually trying to find the property on the ground. Each report or property summary gives a generalized or detailed description of the history and mineral production of the property, plus a description of the geology and the mining methods employed. Recommendations and conclusions regarding exploration, utilization, and disposition of the property have also been prepared.

OKANOGAN COUNTY, WASHINGTON

ALDER MINE

Property location and access: 48° 19' 17" N., 120° 09' 30" W., sec. 36, T. 33 ..., R. 21 E.

Commencing at the town of Twisp on Washington State Route 20, the North Cascades Highway, proceed west along the south bank of the Twisp River on U.S. Forest Service Route 349 toward the Poplar Flat and South Creek campgrounds. About 1/2 mile (0.8 km) west of the center of town and the intersection of routes 20 and 349, turn left, or south, on to U.S. Forest Service Route 3300 and continue along this gravel route, paralleling Alder Creek, for about 6 miles (9.7 km) to the Alder mine. The road climbs from an elevation of about 1,700 feet (518 m) at the river to over 3,400 feet (1036 m) at the mine site.

History, production, and ownership

Gold and copper mineralization was first discovered in the Alder Creek area in 1896. By the late 1920's the Alder mine had been opened on four levels; however, metallurgical and transportation problems, aggravated by the 1929 stock market collapse, combined to postpone further development of the mine until 1939. Between 1939 and 1941, ore and concentrates valued in excess of $400,000 were produced and shipped to the ASARCO smelter in Tacoma. Operation of the mine was curtailed during the Second World War under government directive L208 restricting mining operations to strategic minerals only.

The present owners, the Alder Gold-Copper Company, Inc. of Spokane, purchased the property in 1947, and by 1950 ore was being produced and then milled in their newly completed 300 TPD (272 MTPD) selected flotation mill. Mining at the Alder continued on a full-time basis until May of 1953 when

the mine was closed. There has been no significant production since that date.

The total recorded production of ore from this property is 86,634 tons (78,594 MT). From this tonnage, the following quantities of metal were produced: 15,148 ounces (471,148 gms) of gold, 19,054 ounces (592,636 gms) of silver, 1,296,953 pounds (587,519 kg) of copper, 38,489 pounds (17,435 kg) of lead and 648,130 pounds (293,602 kg) of zinc.

The present owners of the Alder mine are as follows:

Alder Gold-Copper Company, Inc.
1306 Washington Mutual Bank Bldg.
Spokane, WA 99201
Agent: Wm. E. Cullen

The property is currently (1976) under option to:

J. Edington & Associates
Washington Mutual Bank Bldg.
Spokane, WA 99201
Phone: (509) 624-3197

and

Continential Mining Company
c/o Dan Griffin
3101 Oakes Avenue
Everett, WA 98201
Phone: (206) 259-0107

The mine site is included within a total area of 470 acres held as patented claims, 18 unpatented claims, plus 3 homestead tracts. All of the claims are within or surrounded by lands belonging to the Okanogan National Forest.

Geology and description of the ore body

According to studies done in the Methow Valley by Barksdale (1975), the mineralization developed in the Alder mine has been emplaced at or near the junction of two locally significant faults, designated by Barksdale as the Smith Canyon Fault and the Moccasin Lake Fault. The Moccasin Lake Fault, which is exposed in the vicinity of the mine, is a

well-developed N. 20-25° W. trending shear or thrust zone, which separates low-grade metasediments and metavolcanics of the Jurassic(?) Twisp Formation on the east or hanging wall side from Cretaceous volcanics and sediments of the Newby Group on the western or footwall side. The north-trending Smith Canyon Fault intersects and cuts off the southern end of the Moccasin Lake Fault at the mine site. The Alder Creek stock, a Tertiary biotite-hornblende quartz diorite, intrudes Cretaceous volcanics and sediments of the Buck Mountain Formation (a part of the Newby Group) immediately east of the mine and junction of the nearby Moccasin Lake and Smith Canyon Fault. The Alder mineralization is believed by many observers to be directly related to the adjacent Alder Creek stock.

Sulfide mineralization is, for the most part, restricted to the Moccasin Lake Fault zone and consists primarily of pyrite, chalcopyrite, and sphalerite. Secondary derivitives of these minerals are ubiquitous throughout the upper portion of the mineralized zone. Much of the early mining was carried out in the upper zone where enriched values in gold and copper were encountered. Sampling and development performed on four mine levels indicate that both the gold and copper values gradually decrease with depth, whereas the silver, lead, and zinc values increase. A number of quartz porphyry dikes cut the mine area; however, they are not thought to be in any way related to the sulfide mineralization.

Description of the Probabilistic Grade-Quantity-Matrix

Aside from data established by underground mapping during the course of mining, there is little or no concrete information with which to otherwise expand the size and grade of the ore exposed in the workings of the mine. The resource quantities reported for the various levels of probability represent calculations based on dimensions established by the last ore producers and later confirmed or enlarged upon by Grant (1973) during

the course of reevaluating the worth and viability of this property. Dr. Grant's Report of Investigation, a copy of which is included in the MAS backup file, explains and outlines the procedures followed in establishing the ore reserves and potential of the mine property.

Conclusions and recommendations

Although a rather large tonnage of ore may be present on this property, the quality of desirable base metals, especially zinc, is considerably below contemporary commercial minimums for vein-type deposits. In spite of its minimal value, the deposit deserves futher study and attention for a number of reasons.

First and foremost is the strong possibility that a well-planned and well-executed program of exploration and diamond drilling will prove-up a tonnage equal to or greater than that inferred by Grant in his 1973 report. Hopefully, such a program will show that the precious metal values have remained high enough to justify mining and thereby sustain recovery of the associated base metals.

The additional subsurface information received from an adequate drilling program will be valuable not only from the standpoint of proving the worth and extent of the present deposit, but also by shedding some light on the origin of the deposit. Grant (1973) reasonably suggests that the Alder may be a volcanogenic massive sulfide deposit rather than a fissure vein deposit.

If a volcanogenic origin is indicated, then the extent and value of the deposit may be considerably larger than expected and the grade of the zinc may rise dramatically with depth. If, on the other hand, the deposit proves to be simply a fissure vein, the deposit may or may not continue with depth--but it may very well extend laterally along the fissure for a greater distance than anticipated. Additionally, if a fissure deposit

is indicated, further testing to the northwest, along the strike of the Moccasin Lake Fault, may be justified or dictated by the results of the drilling.

The steep attitude of this deposit and its localization along a plane of shearing may or may not be favorable from the standpoint of applying new, yet-to-be-perfected techniques of in-situ leaching (solution mining).

PEND OREILLE COUNTY, WASHINGTON

METALINE DISTRICT

Property location and access: 48° 53' 00" N., 117° 21' 19" W., sec. 15, T. 39 N., R. 43 E.

The point location above is for the Pend Oreille mine at Metaline Falls. This mine is the only property currently (1976) operating within the region described herein. But, exploratory and developemental work is being performed at the nearby Yellowhead mine.

The Metaline lead-zinc district is a triangular or wedge-shaped area of approximately 75 square miles, which expands from an apex 5 miles (8 km) south of Metaline Falls northward for about 18 miles (29 km) to the border of British Columbia, Canada. The chord or altitude portion of the triangular area extends east-west for over 10 miles (16 km) along the Canadian border.

The district lies about 100 miles (160 km) north of the city of Spokane via State Routes 2, 311, and 31. A branch line of the Chicago, Milwaukee and St. Paul and Pacific Railroad provides freight service between Metaline Falls and cities to the south. The northward-flowing Pend Oreille River bisects the area from the apex north through Metaline Falls to the Canadian border.

History, Production, and ownership

According to Park and Cannon (1943) exploration began in 1811 and lead deposits were known in the district as early as 1869. Limited at-

tempts to mine lead were made about 1886; however, the first serious mining developments followed the construction of the railroad branch to Metaline Falls in 1906. By 1915 the Pend Oreille mine began to produce substantial quantities of lead concentrates, which were shipped to smelters outside of the district. Between 1915 and 1931 other lead deposits came onstream, but as exploration and development expanded, it became evident that zinc was the predominant metal of the region, so the emphasis was gradually placed upon exploiting the zinc deposits and recovering lead as a subordinate product. By 1940 the Pend Oreille, Bella May, Grandview, and a number of smaller properties were producing lead and zinc ore. As a result of rising labor and mechanization costs, fluctuating metal prices, etc., all of these mines, with the exception of the Pend Oreille, have since been shut down.

Between 1906 and 1974, the approximate total production from the district amounted to over 18,000,000 tons (16,392,600 MT) of lead-zinc ore. From this tonnage approximately 413,263,033 pounds (187,451,979 kg) of lead and 920,024,311 pounds (417,313,827 kg) of zinc were extracted. Small amounts of copper, silver, cadmium, and gold were also won from these ores. Weissenborn (1966) noted that the average grade of ore mined prior to mechanization of the mines in 1950 was 1.38 percent lead and 3.60 percent zinc. Following the introduction of rapid high-volume mechanized mining methods, the combined average lead-zinc grade in the district dropped to 3.15 percent. The 1975 annual stockholder's report issued by the present owners of the Pend Oreille mine shows that the combined grade of the ore now being produced is 4.7 percent lead and zinc.

Land and mineral ownership within this large area is vested in nearly every conceivable type of proprietorship, ranging from federal and state to private and industrial interests; the bulk of the favorable

ground is controlled by private parties and various mining companies too numerous to be included here at this time. The only mine presently operating in the area is the Pend Oreille mine, which is owned and operated by:

The Bunker Hill Company
P. O. Box 29
Kellogg, ID 83837
Phone: (509) 784-1261

The Bunker Hill Company is a subsidiary of Gulf Resources and Chemical Corporation of Houston, Texas.

Geology and description of the ore bodies

Ore has been developed in the Metaline district in two horizons within the Middle Cambrian Metaline Limestone. The upper ore horizon from which nearly all of the past production has been mined is designated locally as the "Josephine horizon." The Josephine ore bodies, consisting primarily of irregular to lens-shaped masses of sphalerite and galena, are scattered throughout a zone or horizon located 35 to 200 feet (11 to 61 m) below the contact of the Metaline Limestone with the overlying Ordovician Ledbetter Slate. The ore minerals are usually carried in a gangue of jasperoid, dolomite, and coarse calcite. Pyrite is locally abundant but generally rare. Most of the known ore deposits are concentrated along zones of shearing or brecciation, and dolomitization of the limestone is considered to be a favorable feature when encountered during exploration.

The second mineralized horizon known locally as the "Yellowhead horizon" occurs about 1,000 feet (304 m) below the Josephine and consists for the most part of zones and stringers of disseminated sphalerite and pyrite and little or no galena. A small block of Metaline, faulted to expose the Yellowhead, was mined years earlier, and it has only been in recent years that exploratory drilling in adjacent blocks has disclosed deep-lying Yellowhead of possible economic quality.

The Metaline Limestone within the district has been structurally depressed and preserved within a graben formed between the Flume Creek Fault along the west side and the Slate Creek Fault to the east. The mineralized Josephine horizon is generally present in those areas where the Metaline-Ledbetter contact remains intact; however, the greatest concentrations of economic deposits tend to be aligned along zones of brecciated and dolomitized limestone, and the frequency of occurrence tends to increase toward the apex or southern tip of the wedge-shaped graben.

Description of the Probabilistic Grade-Quantity-Matrix

A separate MAS report and matrix has been submitted describing the potential of the Pend Oreille mine. However, inclusion in the system of the district as a whole unit is unavoidable for a variety of reasons, with the foremost reason being that it represents a large, only partially explored, domestic reserve of valuable if not strategic metals. Also of great importance at this time is the fact that the mineral potential of the district was estimated by highly qualified investigators having a thorough knowledge of the district's "working" geology, which was gained from experience during a period when most of the known ore deposits were being exploited. Consequently, most of the data utilized to prepare the published (Weissenborn, 1959, 1966) estimates represented first-hand observations collected from "fresh" underground workings, reports prepared by mine, mill, and exploration personnel, and esoteric data assembled by federal investigators. All of the available data were gathered together and used to establish the basis of testimony presented during a court hearing aimed at determining the extent to which the Pend Oreille River valley could be flooded by the proposed Boundary Dam hydroelectric scheme. Pertinent excerpts from the testimony given by Mr. A. E. Weissenborn of

the U.S. Geological Survey in April of 1959 are included in the backup file.

During the hearings, Mr. Welssenborn testified that, if only 25 percent of an estimated 13,000 acres (5,261 hectares) of projected Josephine horizon contained minable ore, a tonnage of 36 million tons (32,659,000 MT) of ore should exist. The combined lead-zinc grade of this ore was estimated to be about 3.5 percent. Judging from the quality and reliability of the data used to compute the tonnage above, it seems reasonable to speculate that the figures stand a 50/50 chance of being correct, hence the resource estimate of 36 million tons (33 MMT) was placed in the matrix at the 50 percent level of probability.

If as much as 40 percent of the Josephine contains ore, then a 25-percent level of probability may reasonably be applied. Mr. Weissenborn's estimated tonnage for this 40 percent of the volume is 146 million tons (132,451,000 MT); and, being very optimistic, Mr. Weissenborn testified that, if 100 percent of the Josephine is found to be minable, then an ultimate tonnage of 234 million tons (212,284,000 MT) should be available. This final estimate was deemed to be barely possible and was therefore inserted at the 10 percent or P_5 level of probability.

The estimated grade of the Josephine ore is admittedly sub-economic at this particular point in time; however, as in the past, the flux of world economics may sooner than later dictate otherwise.

There is no adquate or reliable information available at this time regarding the grade or extent of the Yellowhead horizon; consequently, no attempt has been made to include an estimated value for this possibly extensive mineralized zone.

Completion of the MAS mining, beneficiation, and transportation records would at this juncture be both superfluous and premature.

THE PEND OREILLE MINE

Property location and access: 48° 53' 00" N., 117° 21' 19" W., sec. 15, T. 39 N., R. 43 E.

The main workings and headquarters of the Pend Oreille mine are situated 1½ miles (2.4 km) north of the town of Metaline Falls in Pend Oreille County, Washington. Both the mine and the town are developed along the east bank of the Pend Oreille River. Metaline Falls is about 100 miles (160 km) due north of Spokane via State Routes 2, 311, and 31. A railroad branch line connects Metaline Falls with Newport and other cities to the south.

History, production, and ownership

Development of the Pend Oreille property commenced in 1906; however, it was not until 1915 that various technologic and economic difficulties were overcome and the first significant production of ore was realized. At this time, lead was the principal metal produced; but beginning about 1931 and to the present, zinc production has exceeded that of lead.

Recorded mineral production between 1906 and 1974 amounted to 348,402,246 pounds (158,031,774 kg) of lead and 681,595,271 pounds (309,164,799 kg) of zinc. The approximate total tonnage of ore mined during this period was 14,090,057 tons (12,782,500 MT). Small quantities of silver, cadmium, and copper were also recovered from these ores. The overall grade of the lead-zinc ores in the district is low, ranging around 3 percent zinc and generally about 1 percent lead.

In 1974, the Pend Oreille Mines and Metals Company was acquired by:

The Bunker Hill Company
P. O. Box 29
Kellogg, ID 83837
(208) 784-1261

The Bunker Hill Company is a subsidiary of Gulf Resources and

Chemical Corporation of Houston, Texas.

Geology and description of the ore bodies

Nearly all of the lead and zinc produced by the various mines in the Metaline district has been won from the "Josephine horizon," a zone of brecciated and silicified limestone and dolomite, which occurs in the Metaline district, near the top of the Middle Cambrian Metaline Limestone. Mills (1976) has designated this unit as the Josephine Breccia. The limestone, up to 3,000 feet (914 m) thick, is overlain by the Ordovician Ledbetter Slate. The Ledbetter is about 2,500 feet (762 m) thick.

The ore bodies, consisting of irregular to lens-shaped bodies, are scattered throughout the limestone; however, the most productive bodies occur within the Josephine horizon, which lies 35 to 200 feet (11 to 61 m) below the Metaline-Ledbetter contact. Galena and sphalerite occur as masses, stringers, and veinlets, or as disseminated grains in a gangue of gray jasperoid, crystalline dolomite, and coarse calcite. Pyrite occurs within the ore but only locally and in small quantities. The ratio of lead to zinc is about 1:2 in terms of recovered metal, though large masses of high-grade galena were occasionally encountered during the course of mining; in fact, according to Fulkerson and Kingston (1958), in 1954 the production of lead exceeded that of zinc. The ore zone, as outlined by the old mine workings, forms an elongate sinuous pattern striking roughly N. 25° E. and dipping up to about 20° toward the northeast. The ore bodies range in length from tens of feet to several hundred feet and to over 100 feet (30 m) in width and thickness. Many of the stopes left by the mining operations are over 100 feet high (30 m).

Another mineralized zone designated as the "Yellowhead horizon" occurs about 1,000 feet (304 m) below the Josephine. Though a small

faulted block exposing this horizon was mined many years ago, its relation to the Josephine was uncertain until about 1970, when exploratory drilling intersected it at depth within an adjacent faulted block that contained a full section of Metaline Limestone. The character of the Yellowhead ore is quite unlike the ore exploited in the overlying Josephine; mineralization in this zone is predominately pyrite, with subordinate amounts of sphalerite and very little galena. Sphalerite is apparently sufficiently, though erratically, concentrated in the Yellowhead to warrant current exploration development and studies relating to the feasibility of bring the Yellowhead into full production.

According to Dings and Whitebread (1965), the most prominent structural features in the Pend Oreille mine are broad, open folds cut by numerous predominantly north- or northeasterly-trending faults. Displacement along the faults. Displacement along the faults ranges from a few inches to several hundreds of feet. Both pre-ore and post-ore faults are present and most of the brecciated pre-ore fault zones have become loci for the development of ore bodies and(or) silicification and alteration.

Caves, varying in size from large vugs to caverns several tens of feet high, are widely distributed throughout the mine workings. They occur from a short distance beneath the surface to a depth of well over 600 feet (183 m). Most are developed along faults or fractures, and they may or may not be mineralized or serve as passageways for groundwater.

In the Metaline area Pleistocene lacustrine silt deposits form prominent terraces on both sides of the Pend Oreille River. These extensive Quaternary deposits and the nearly inpenetrable, secondary vegetation mask a large portion of the geology and considerably hamper the explo-

ration and detailed mapping required to find new ore deposits.

Description of the Probabilistic-Grade-Quantity Matrix

The present owners of the Pend Oreille mine were understandably reluctant to elaborate upon the potential of their property beyond the reserve figures published in their 1975 annual stockholder's report. The published figures are reported to include tonnage estimates from the Yellowhead horizon. However, it is believed that the Yellowhead contribution constitutes a relatively small percentage of the total.

The matrix was compiled utilizing the limited data published in the annual report. No up-to-date or reliable information is otherwise available at this time. The first inferred tonnage shown at the P_3 or 50-percent level of probability is simply twice the published figure recorded at the P_2 level; it is reasoned here that the block of mineralized ground presently being mined appears to be continuous upstrike, at least far enough to assure that, if there is not a drastic change in the character or occurrence of ore, there is at least a fifty-fifty chance that the large tonnage exists. Again, due to a lack of factual data, speculation beyond the 50-percent level has not been attempted at this time.

Mining and beneficiation

After 60 or more years of nearly continuous production from a number of different levels, the Josephine Breccia or horizon at the Pend Oreille resembles a well-developed rabbit warren. Sublevel stoping used in conjunction with a trackless haulage system has proven to yield optimum results with a minimum of subsurface expenditure per ton of ore. Headings on the various development levels are apparently controlled or directed by a combination of both surface and subsurface longhole exploration drilling enhanced by close control at both the working face and the mill head.

The rock mass being excavated is extremely strong and required no support even in stopes over 100 feet high. Broken ore is transported from the face to the nearest ore pass by 5-yard LHD's and(or) small 10- to 12-yard dump trucks. Two underground crushers connected by ore passes to the various working levels are utilized to prepare the ore for removal to the surface. The crusher at the 900-foot (274 m) level crushes the ore to minus 2 inches (5 cm), while the crusher at the 1400-foot (427 m) level reduces the ore it receives to minus 3 inches (7.6 cm). Crushed and sized ore is thence transported by conveyor belt to a surface crusher where it is further reduced to minus 5/8 of an inch (1 cm).

From the surface crusher, the ore is fed via several storage bins directly to the mill where the ore is further reduced and a selective flotation process is employed to produce concentrates averaging 60 to 62 percent zinc and 70 to 80 percent lead. Twenty-six to thirty-ton (24 to 27 MT) capacity trucks are utilized to transport the mill concentrates 145 miles (235 km) to the Bunker Hill smelter in Kellogg, Idaho for smelting and final processing.

STEVENS COUNTY, WASHINGTON

BECHTOL MINE

Property location, access, and generalized descriptions: 47° 51' 58" N., 117° 35' 40" W., sec. 23, T. 39 N., R. 41 E.

From Northport, in Stevens County, take county road number 700, the Northport-Colville highway to the settlement of Spirit and the Deep Lake turn-off, a distance of about 10 miles (16 km) southeast of Northport. Turn north on the Deep Lake highway and go about 3.6 miles (5.8 km) to the second gravel pit along the east side of the highway.

An old wagon road, now a trail, leading northward to the mine cuts

through the woods above and just east of the gravel pit. The mine site is about 2,000 feet (609 m) north of the pit, just across a small stream valley, and at an elevation of 2,600 feet (792 m) or nearly 600 feet (182 m) in elevation above the highway.

The ore body around which the Bechtol mine has been developed is of the same sort as those developed 3 miles (4.8 km) to the northeast on Gladstone Mountain. That is, mineralization consisting primarily of coarse galena scattered throughout a matrix of siderite is developed along fault zones and is best developed as concentrations or in breccia pipes at fault intersections. Intense weathering along the faults and at the various intersections has largely reduced the siderite gangue to limonite and segregated the galena into lumps as large as 1 foot (0.3 m) in diameter. Also, as on Gladstone Mountain, lead constitutes the principal metal value with silver, zinc, and iron making up only a small fraction of the total value recovered. The total production recorded from the mine since its discovery in 1896 is 249,230 pounds (113,048 kg) of lead and 198 ounces (6,158 gms) of silver.

Unlike the ore bodies on Gladstone Mountain, those of the Bechtol mine have been developed along faults in the intraformational breccia formed above the middle unit of the Metaline Limestone (Yates, 1964). This unusual occurrence of Gladstone-type mineralization outside of Gladstone Mountain and within a different and slightly more widespread horizon is valuable in that it ties the Bechtol area to Gladstone Mountain. Therefore, any exploration efforts around the mountain should be expanded to include an investigation of all of that large area of carbonates known to occur between the Gladstone Mountain and Deep Lake. Special emphasis should be placed upon investigating those carbonate areas underlying glaciofluvial and alluvial deposits along all of the major valleys.

Drilling with geochemical sampling along the bedrock-alluvium interface may be of particular value in tracking down new areas of potentially economic lead mineralization

CALHOUN (ANDERSON) MINE

Property location and access: 49° 55' 10" N., 117° 35' 29" W., sec. 2, T. 39 N., R. 41 E.

The Calhoun mine is situated about 1 mile northwest of Leadpoint, a small settlement 9 miles (14 km) due east of Northport and about 36 miles (58 km) north of Colville. Access from Northport to the property is via the Northport-Colville highway to the small community of Spirit, thence north about 8 miles (13 km) on the Deep Lake road, county road No. 705, to Leadpoint. Continue north from the Leadpoint school for about 1 mile (1.6 km) to the main entrance of the property. The mine building, tailings dumps, etc. are visible on the left or west side of the road.

History, production, and ownership

Lead-zinc mineralization was first detected on the Anderson Ranch property about 1910; because of low demand for these metals and a lack of local smelting facilities, little more than cursory trenching was performed. Fulkerson and Kingston (1958) record 12 tons (11 MT) of production in 1919; however, this record conflicts with the U.S. Bureau of Mines' report by Lorain and Gammell (1947), which states that the property remained idle between its discovery and 1940.

In response to world conditions, N. P. Anderson, the property owner, performed intermittent exploration, mostly shallow pick and shovel work, between 1940 and 1943. The U.S. Bureau of Mines did some dozer trenching and diamond drilling between 1944 and 1945. The results of this work were published in 1947 as Report of Investigation No. 4043 (Lorain and Gammell, 1947).

Around 1948, the property was acquired under option by the Goldfield

Consolidated Mines Co. of San Francisco. Between 1948 and 1952 (according to Huntting, 1956), approximately 100,000 tons (90,770 MT) of ore averaging 2.4 percent zinc and 0.5 percent lead was produced from an open-pit operation. Mining was terminated in 1952 because of low metal prices. The Goldfield Company exercised its option and purchased the property in 1962 and in 1963 American Zinc, Lead and Smelting Co., of St. Louis, Missouri, took a new option on the property and began exploration. By 1964 sufficient ore had been found to justify underground development and the erection of a mill. The first ore was mined and milled in October of 1966 and the company continued its operation until the mine's closure on Christmas Eve, 1968. During the productive period, 875,147 tons (793,933 MT) of ore was mined and milled. The grade of this material averaged 3.18 percent zinc and 0.10 percent lead. An additional 33,468 tons (30,362 MT) of ore averaging 2.05 percent zinc and 1.62 percent lead was recovered from the stockpile left behind by the previous owners.

In 1971 the property was acquired under a sublease(?) by Cominco American Exploration of Spokane, Washington, from the new owners, Columbia (or Washington) Resources, also of Spokane. When Cominco acquired the property, the workings were (and still are) flooded and their plans for underground investigation were thwarted by the refusal of the Federal Environmental Protection Agency to allow the water to be removed. Exploration was consequently restricted to the surface and consisted primarily of shallow core drilling, which was apparently designed to confirm or enhance the unmined reserves established by American Zinc, Lead and Smelting prior to their withdrawal. As a result of the deterioration of the current business and metal's market, Cominco relinquished their lease on the property in July, 1975. The decision to cease exploration was apparently based entirely on contemporary economics rather than the results of their

exploratory efforts which are rumored to have been very favorable.

At the present time, 1976, the property, about 1200 acres of claims and deeded land, is part of a 6,000-acre package, consisting of various local past producers of lead and zinc, which has been assembled for sale or lease by the present owners:

Columbia Resources, Inc.
c/o Nandor Sombathy, president
N. 1115 Havana
Spokane, WA 99202
(509) 535-2039

The Calhoun mill and all of the support facilities are intact and under a maintenance guard.

Geology and description of the ore body

Most of the following data were summarized from a detailed report by James Browne, formerly the chief geologist at the Calhoun mine. A copy of the report is included in the backup file and will be included in Mills' report on the lead-zinc deposits of Stevens County (1976, in preparation).

The ore bodies in this mine are, like many of the principal lead and zinc occurrences in Stevens County, developed in carbonate rocks of the middle member of the Middle Cambrian Metaline Limestone.

The rocks in the vicinity of the mine are composed almost entirely of dolomite. That part of the Metaline Limestone from which most of the ore has been produced is a silicified dark-gray dolomite breccia. This breccia, the host rock for ore development, is confined to a long narrow zone, which strikes about N. 55° E. and dips 50° to 90° stoward the southeast. The zone is apparently conformable within the enclosing strata that make up the north limb of an anticline which is overturned toward the northwest.

In the brecciated host rock zone the dolomite fragments tend to be highly elongate, lenticular, or platy, and sufficiently parallel to give

the zone a banded or layered appearance. There is generally no sharp or definite contact between the layered host rock and the enclosing carbonates, though judging from one available cross section the zone appears to average about 50 feet (19 m) in thickness and extends for over 4,200 feet (1,280 m) downstrike. The mine workings, again as measured from the cross section, extend to a depth of over 800 feet (244 m). The matrix of the host breccia is composed of small fragments of sandy to silty clastic-like material which appears in places to have been replaced by coarse-grained white dolomite.

The only minerals of any commercial value in the mine are sphalerite and galena, though very small quantities of copper, silver, gold, and cadmium were recovered from the concentrates during the course of smelting and refining. Sphalerite accompanied by pyrite, quartz, and dolomite is the predominant ore mineral and it occurs replacing silicified dolomite in the ore zone and as fracture and breccia matrix fillings in the hanging wall near the ore zone. The best ore occurs in the breccia as irregular bodies elongated parallel to the regional strike and scattered throughout the breccia or host rock zone. The bodies average in size from 35 to 45 feet (11 to 14 m) wide, 20 to 30 feet (6 to 9 m) high and 300 to 350 feet (91 to 107 m) long.

Most of the ore is (was) restricted to within the main host rock breccia zone, however, one small body was mined entirely within the hanging wall block. Mineralization within the footwall is usually sparse and generally restricted to sphalerite filling interfragmental spaces or replacing breccia fragments. Purple fluorite is often found in the footwall adjacent to the breccia-footwall contact.

Faulting in the mine is generally post-ore and of limited displacement. Most of the faults strike in a northerly direction and dip

steeply east or west. Numerous lamprophyre dikes crisscross the host breccia and the enclosing unbrecciated carbonates. The dikes contributed significantly to the volume of waste rock handled during the course of mining. For the most part, the contact metamorphic effect produced by the dikes on their host and the ore has been of little or no significance.

Description of the Probabilistic Grade-Quantity-Matrix

The tonnage and grade figures shown on the matrix were taken directly from final ore reserve figures compiled and assembled by the Calhoun mine geologist immediately following the suspension of mining in 1968.

All of the data utilized in constructing the matrix were obtained in the mine prior to flooding. It covers a broad spectrum of reliability from educated guesswork on the part of personnel having an intimate knowledge of the ore occurrence in this mine to predevelopmental exploratory core drilling to which a 25-foot (7.6 m) area of influence was applied during the final calculations. Since the exact data or criteria upon which the measurement of each individual ore body was based are not available for use at this time, all of the prepared reserves were classified here as "indicated". The fairly consistent nature of the occurrence of ore within the brecciated host zone would seem to strengthen the possibility that deeper and more widespread exploration drilling will disclose considerably more ore within the mineralized zone. This expectation was estimated to yield roughly twice the tonnage classified as being "indicated" but at a much lower level of probability, 25 percent. The same explanation holds true for the 50 percent level of probability; however, the tonnage speculated to exist at this level represents simply the arithmetic difference between the figures shown at probability levels P_2

and P_4.

Mining, beneficiation, and transportation

The Calhoun mine, as it was successfully operated by American Zinc, Lead and Smelting, was essentially an open stope operation and rather than using the usual labor intensive procedures, mechanization was employed to full advantage to profitably mine these low-grade ores. According to various newspaper clippings in the files of the Washington Division of Geology and Earth Resources, the entire mining and milling operation functioned smoothly with a total work force of only 60 employees.

The underground workings consist of a series of ore passes connecting the various stopes with a 13 by 15 foot (4 by 4.6 m) access haulageway. This main haulageway, portaled in the old Goldfield Consolidated open-pit, followed the breccia zone toward the southwest at a grade of 15 percent for about 1,000 feet (305 m), thence horizontally just above the water table for about 2,000 feet (610 m), thence up at a 20 percent grade for 1,000 feet (305 m) to the surface. Jumbo drills and rubber-tired scrapers were used to break and move the ore, via the ore passes, to 20-ton trucks operating in the haulageway below. The ore was trucked to the 1200 TPD (1,089 MTPD) mill where differential flotation techniques were employed to produce a zinc-lead concentrate. The concentrate was then trucked to the railhead at Colville, thence to the Bunker Hill smelter at Kellogg, Idaho.

The system proposed in the MAS format is essentially the same as the now dormant operation outlined above, with the exception that concentrates should or could be trucked at possibly lower rates to the Consolidated Mining and Smelting Co. (Cominco) smelter at Trail, British Columbia, Canada, a distance of about 32 road miles (51 km).

The lead time estimated to reopen this mine is about 3 months. This should be ample time to dry out the workings, survey and repair damaged and deteriorated equipment and workings, repair electrical ventilation and telephone circuits, chutes, etc. At this writing, all of the surface facilities are being regularly maintained in a high state of readiness: mill equipment is clean and dry and all mechanized devices are turned-over on a regular basis to keep bearings and passageways oiled. The short lead time does not include the time that will be required to recruit labor, acquire spare parts, maps and exploration data, and the various permits and impact statements required to disturb the environment and the local economy. With the exception of the problems involved with gaining permission to dewater the mine into the local drainage, either directly or indirectly via temporary purification facilities, little or no environmental problems are envisioned over and above the minor ones, which are presently known. The picture regarding the readiness of the facilities to quickly resume operations may change drastically after 1976: the present owners volunteered that the escalating costs of maintenance, upkeep, annual assessment work, and above all, taxes, may prevent them from keeping the plant intact past 1976. If the plant is dismembered and sold and the other facilities are left to the elements and the vandals, the estimated lead time will be increased considerably.

According to the former mine geologist, there is a small outcrop of mineralized Metaline Limestone in a roadcut north of Leadpoint and to the northeast onstrike from the main workings. He suggested that future exploration should be concentrated in testing the intervening area, which is buried under glacial till and recent alluvial deposits. The Metaline Limestone outcropping north of the roadcut is terminated by

faulting. Exploration drilling should also be applied to the area southwest or onstrike from the mine, especially around the junctions of the two small drainage channels that meet in the extreme northwest corner of section 11, T. 39 N., R. 41 E. These two small streams may be developed along faults or zones of weakness or brecciation which elsewhere in Stevens County have been loci for lead-zinc mineralization.

DEEP CREEK MINE

Property location and access: 48° 51' 49" N., 117° 42' 54" W., sec. 26, T. 39 N., R. 40 E.

The Deep Creek mine is located 7 miles (11 km) south of Northport on the Northport-Colville highway.

From the Deep Creek community school located at the intersection of the Colville highway (county road 700) and the secondary Black Canyon road, continue south toward Colville for 1.7 miles (2.7 km); at this point, turn west on the mine road and proceed over the Deep Creek bridge and across the valley to the mine, which is located about 1,000 feet (305 m) west of the highway. The waste dump and a few old dilapidated buildings are the only gross indications of any previous mining activity.

History, production, and ownership

Lead and zinc mineralization was first discovered in the vicinity of the Deep Creek mine in 1914 by the Washington Quarry Company. By 1917 the property, consisting then of 280 acres (113 hectares), was owned by the Northport Mining Company, John Gorien, Treasurer. During 1917, the prospect was tested with three diamond drill holes; one hole encountered 23 feet (7 m) of commercial-grade ore while the other two were reported to be barren. Some underground work was performed in 1918 to 1919 to further test the deposit. The Northport Mining Company optioned the

property to the Anaconda Copper Company in 1916; however, the sale was not consummated and the property eventually reverted to the owners.

In 1941, the Western Knapp Engineering Company, of San Francisco, California, acquired the property and sank a 65° inclined shaft to a depth of 350 feet (107 m). The local Jameson-Higgenbotham Mining Company purchased the property around 1943 and began mining that year at the rate of 100 tons (90 MT) daily. Goldfield Consolidated Mines Company acquired the mine in 1948 and immediately extended the shaft to the 9th or 850-foot (259 m) level. The most significant period of production at the Deep Creek mine occurred between 1944 and 1956. According to tabulations by Fulkerson and Kingston, 1958, the following quantities of metals were obtained from a total production of 763,307 tons (692,472 MT) of ore: 65,621,962 pounds (29,765,465 kg) of zinc; 15,182,927 pounds (6,886,823 kg) of lead; 24,085 pounds (10,924 kg) of copper; 36,455 ounces (1,133,860 gm) of silver; and 69 ounces (2,146 gm) of gold. The mine was closed in 1956 due to a combination of a costly shaft fire, rising mining costs, and declining metal prices. Following closure, the headframe, hoisting, pumping, and other machinery were removed and the mine was allowed to flood. Flood waters now fill the mine to within several feet of the shaft collar.

In 1964, the property was obtained by the American Zinc Company and some claim staking and surface exploration was performed. American Zinc cored four shallow holes and encountered one 33-foot (10 m) zone of mineralization assaying 4.84 percent Zn and 0.96 percent Pb. No attempt was made to dewater and explore the underground workings.

Since 1971, the property, consisting now of 160 acres of surface and mineral rights, has been controlled by:

Columbia Resources, Incorporated
c/o Nandor Sombathy, president
N. 1115 Havana
Spokane, WA 99202
(509) 535-2039

Geology and description of the ore body

At the Deep Creek mine, as well as at most of the other past producers of lead and zinc in the Northport Mining district, the ore bodies have been developed in a collapse or intraformational carbonate breccia of the Middle Cambrian Metaline Limestone. According to Mills (1976), the Metaline Limestone in the vicinity of the mine has been complexly folded into a synformal anticline, plunging 80° to 90° east-southeast. The ore-bearing middle dolomite unit is surrounded to the northwest and southwest by younger limestones of the upper unit of the Metaline Limestone.

The block of Metaline Limestone, which hosts the Deep Creek ore bodies, is roughly triangular in plan outline. Its southern contact with the intrusive Late Cretaceous Spirit pluton forms an irregular line striking roughly east-west. Faults associated with the Nelson or Black Canyon Fault system form the northeast- and northwest-striking borders of the block. Some apparently pre-Spirit faulting is present along the intrusive contact in the vicinity of the mine. This faulting is thought by Waddell (1963) to have been the avenue along which mineralization was introduced from the Spirit pluton and into the intruded limestone.

Lead-zinc ore in the Deep Creek mine occurs along sheared or brecciated zones as nearly vertical chimneys or pipelike replacement bodies in dolomite or dolomite marble. The size of the ore bodies averages about 40 feet (12 m) by 160 feet (49 m) in plan diameters and extends to well over 700 feet (213 m) in depth from apex to the base. The depth of

the apices from the surface varies from zero (exposed) to several hundreds of feet.

Sphalerite, and to a lesser extent galena, occurs as small veinlets, lenses, and irregular masses scattered throughout the dolomite but more or less sufficiently concentrated in seven different localities to form commercial-grade deposits. Pyrite is abundant in the ore bodies and generally extends beyond them as veinlets and disseminations. Small amounts of tremolite, resulting from intrusion and metamorphism, have been encountered throughout the mine though the abundance and crystal size tend to increase toward the granodiorite-limestone contact.

Description of the Probabilistic Grade-Quantity-Matrix

According to a recent report on the Deep Creek mine prepared by Columbia Resources and included herewith in the MAS backup file, a total of seven ore bodies has been discovered at the mine. Of this number, two have been completely mined-out and three more have been partially exploited. The two remaining bodies were found as a result of exploration drilling performed since the mine closed in 1956.

The resource estimates shown on the matrix for the various levels of probability were computed by utilizing the approximate dimensions supplied in the Columbia Resources report. The shape of the bodies, as noted earlier, is generally cylindrical or pipelike with an eliptical cross-section. The various dimensions given in the report were applied to derive a volumetric estimate of the approximate size of each ore body, less the volume of material already mined. The tonnage volume factor used by the Goldfield Company, while mining the ore, is unknown so the tonnages were calculated with the factor used during mining at the Van Stone mine, the ores of which are quite similar in tenor and lithology to those of

the Deep Creek mine.

Since most of the dimensions shown on the report were established either from data collected during mining or from subsequent drilling, the tonnage established from these figures was classified in the matrix as "indicated" or P_2, available at the 75 percent level of reliability. For the "inferred" or P_3, 50 percent level, 100 feet was added to the depth of all of the bodies where such an extension seemed feasible.

Considering that there has been little or no exploration immediately west of the mine shaft, together with the fact that two new ore bodies have been discovered since the cessation of mining, it seems reasonable to speculate that there may be at least a 25 percent chance of discovering one more body of average dimensions in the unexplored western portion. The weight of this average speculative body was calculated and used to establish the value of P_4. More speculation that yet a second average-sized body would be discovered formed the basis for the value of probability level P_5.

Mining, beneficiation, and transportation

The sublevel open-stope system of mining used at the Deep Creek mine was found to be both low-cost and highly applicable to mining nearly vertical Deep Creek ore bodies; the great competence of both the limestone host and the ore bodies allowed mining to progress without any need of support, even in some of the larger stopes where the back stands unsupported over widths of 100 feet (30 m) or more.

The greatest problem to be overcome by any future mining operations here is controlling the influx of water. Grouting was used extensively during mining to keep back water, which during drilling was occasionally encountered at pressures in excess of 250 pounds per square inch

(17 kg/sq. cm). Waddell (1963) explains the grouting techniques employed to overcome the water problem.

It is proposed in the MAS format that should the Deep Creek mine be reopened, the ore should be concentrated at the mine site and the resulting concentrate trucked 7 miles (11 km) to the railhead at Northport. From Northport the concentrates would be moved by rail to the Consolidated Mining and Smelting Company (COMINCO) smelter at Trail, British Columbia, Canada. The distance from Northport to Trail is 23 miles (37 km).

An extensive well-planned and well-coordinated program of exploration in the Northport area may well lead to the discovery of many additional deposits of lead and zinc in the vicinity of Deep Creek. This would justify the establishment of a centrally located mill to serve not only the Deep Creek mine but other nearby sub-marginal or yet-to-be-discovered deposits. Tailings from an on-site or central mill could be returned via pipeline or conveyor to the now empty stopes of the Deep Creek mine.

The greatest environmental impact that reopening of the Deep Creek mine may have is that of disposing of mine water during the initial dewatering program. The possibility of pumping the flood water and water developed during mining into the local drainage depends to a large extent upon the quality of the water removed and the ability, both of the old grouting and any new grouting, to hold back or stop the flow of water within the mine.

The time estimated to reopen this mine is about 5 months. During this period the mine will have to be dewatered; the headframe, storage bin, hoisting, and surface mechanism and electrical gear will need to be installed, haulage roads must be repaired, and building and maintenance facilities provided. According to the Columbia Resources report,

the 1971 estimate for returning this mine to production is $170,000. This figure, however, is now out-of-date and must, of course, be revised upwards.

FARMER MINE

Property location, access, and generalized description: 47° 50' 57" N., 117° 37' 22" W., sec. 34, T. 39 N., R. 41 E.

To reach the Farmer mine, go east approximately 10 miles (16 km) from the town of Northport on Stevens County road number 700 to the settlement of Spirit and the Deep Lake turnoff. At this intersection turn north toward Deep Lake and the Canadian border and proceed for 2 miles (3.2 km) to the unimproved dirt road shown as intersection elevation 2051 on the 7.5-minute Deep Lake quadrangle. Turn left on the dirt road and follow it for a little over 2 tenths of a mile (320 m) to a second dirt road. Turn left again on the second road and follow it uphill toward the southwest for about 5 tenths of a mile (640 m) to the workings of the Farmer mine, which begin near the left side of the road and are scattered downhill toward the south and southwest for several hundred feet.

The Farmer mine, like the Maki mine 1 mile (1.6 km) or so toward the east, is developed in limestone-dolomite and dolomite marble of the upper unit of the Middle Cambrian Metaline Limestone. The intrusive Cretaceous Kaniksu batholith is in contact with the carbonate host a short distance to the south. Thermal metamorphism related to intrusion by this granite batholith has greatly altered and recrystallized most of the rocks in and around the mine property.

Mineralization on the property ranges from fine-grained mixtures of sphalerite and galena to coarsely crystalline masses of either one or the other, or both. The ore tends to be concentrated along irregular

fractures within a zone striking N. 60° W. and dipping 53° NE. Disseminated sulfides are often present within the carbonates of the wall rocks along some of the more intensely mineralized areas. These disseminated zones, however, do not persist for any more than a few feet away from the ore-host contact.

Fulkerson and Kingston (1958) have shown production from the Farmer for the years 1937, 1948, and 1950 as totalling 492 tons (446 MT) of ore. This total yielded 15,183 pounds (6887 kg) of lead, 23,624 pounds (10,715 kg) of zinc, and 71 ounces (2,208 gm) of silver.

The U.S. Bureau of Mines investigated this property in 1944. The results of this study, which included sampling and a small amount of diamond drilling, were assembled and published as Report of Investigations 4036.

The Farmer property has been inserted in the MAS as a second-level entry in order to establish or draw attention to the southwestern margin of that large faulted block of Cambrian carbonates surrounding Deep Lake. It is throughout this block that many formerly productive or prospective lead-zinc deposits are scattered and within which a renewed exploration effort may uncover significant new deposits of these metals.

GLADSTONE MOUNTAIN

Property location and access: 48° 52' 59" N., 117° 32' 26" W., sections 12, 13, T. 39 N., R. 41 E., sections 7, 17, 18, T. 39 N., R. 42 E. The eastern one-half of the mountain is within the Colville National Forest.

From the town of Northport on the Columbia River go southeast on Stevens County road number 700, the Northport-Colville highway, for a distance of about 10 miles (16 km), thence north to Leadpoint on county road number 705. At Leadpoint turn east on county road number 604, the Silver Creek road, and proceed approximately 2 miles (3.2 km) to U.S.

Forest Service Route 673. Follow the forest road up the north slope of Gladstone Mountain for a distance of about 5 miles (8 km). Vehicular access requires 4-wheel drive. The mines described herein are developed along the summit of the mountain.

History, production, and ownership

The principal mines developed on Gladstone Mountain, in descending order of importance, are the Electric Point, Gladstone, Lead Trust, and Lead King. There are several prospects known as the Red Iron, Wildcat (Boucher), Keystone, Elk, Blue Lime, and Lead Contact.

Over 46 percent of the lead produced in Stevens County between 1902 and 1956 was recovered from the deposits on Gladstone Mountain. A small quantity of lead ore was produced at the Lead Trust mine following its discovery in 1910; however, the first really significant discovery of lead mineralization on the mountain was made near the summit in 1915 by J. E. Yoder and Chris Johnson. This discovery resulted in the opening and development of the Electric Point mine followed by the Gladstone mine. During 1916, the Electric Point mine produced over 8,000 tons of high-grade ore, and by 1917 both mines were in production. The production from these mines hit a volume peak in 1926, and from 1926 to 1956 the volume of production declined steadily to a fraction of the peak output.

According to Fulkerson and Kingston (1958) the total recorded production of ore from Gladstone Mountain from 1910 to 1956 amounted to over 77,470 tons (70,281 MT). From this ore the following quantities of metal were recovered: silver 18,261 ounces (566,572 gms), copper 2,097 pounds (936 kg), lead 6,755,804 pounds (3,064,381 kg), zinc 279,735 pounds (126,885 kg), and 3 ounces (93 gm) of gold. Since 1956 there have been only intermittent small volumes of ore mined from the mountain. Ownership of the mineral rights on Gladstone Mountain is,

like most areas of high interest or potential, complicated, overlapping, or duplicated. Possibly ownership of a large percentage of the ground may ultimately be subject to challenge or litigation should any serious attempt be made to develop the entire area. The ownership data as assembled in 1975 from various Stevens County sources by the headquarters of the Colville National Forest are as follows:

Gladstone Resources, Inc.
J. F. Campbell, agent
1306 Washington Mutual Bank Bldg.
Spokane, WA 99201
phone (509) 546-8710

Atlas Mine & Mill Supply
W. 1115 Havanna Street
Spokane, WA 99202
phone (509) 535-2039

A. G. Lotze
Aladdin Route #1
Colville, WA 99114
phone (509) 732-4239

Gene Goodwin
E. 3225 24th Street
Spokane, WA 99202
phone (509) 534-7893

State Mining Company
509 N. Main Street
Colville, WA 99114

James E. Brousseau
132 Harwood Court
Vallejo, CA 94590

No attempt has been made at this juncture to calculate the exact percentage of individual ownership between the various groups of claims.

Geology and description of the ore body

All of the mines and properties developed on the mountain are in dolomite and dolomitic limestone of the Middle Cambrian Metaline Limestone. The Gladstone Mountain deposits are for the most part restricted to the

intersections of steeply dipping fault zones. These resulting highly brecciated intersections form nearly vertical "chimneys" or pipelike zones having a circular or oval cross section in plan view. The diameter of the chimneys ranges from 30 to 150 feet (9 to 46 m) and their depth ranges between 150 and 800 feet (46 to 244 m). According to Mills (1976) the pipes or chimneys may branch downward into separate roots or they may taper downward and eventually pinch out. Branches or roots may also extend laterally away from the pipes and along minor fractures.

Hydrothermal processes, either contemporaneous and(or) later than the preparatory faulting and brecciation, apparently introduced galena into some or all of the favorable zones. Together with the galena, siderite was introduced and constitutes a persistent gangue mineral throughout the Gladstone Mountain area.

Oxidation of both the siderite and galena has proceeded to great depths in most of the known deposits; consequently, most of the siderite has been altered to limonite and much of the galena has been converted to granular cerussite. The remaining galena now occurs as high-grade nodules and boulders weighing as much as 2,000 pounds (907 kg). As a result of the weathering or oxidation, a thin rind or skin of insoluble anglesite gradually formed on most of the galena masses and thus terminated further conversion of the sulfide mineral to cerussite.

In all of the chimneys, including those in which lead mineralization is sparse or apparently nonexistent, limonite is the most prominent constituent and it served in most cases as the most prominent prospecting target. Surface prospecting and exploration has consisted for the most part of simply bulldozer trenching and scraping away the soil cover to expose the limonitic traces of weathered fault zones. These faults are

then followed until intersections or chimneys are encountered. As a result of this sort of prospecting over a prolonged period of time, any chance of now using soil geochemistry as an exploration method is largely out of the question. The use of basic surface geophysical techniques was also proven to be of little value.

Exploration either by drilling or drifting away from the chimneys during the course of mining was successfully applied and resulted in the discovery of several blind mineralized chimneys--one of which began 80 feet below the surface. (Jenkins, 1924).

The process of exploiting the richer Gladstone chimneys was simple and straight-forward; the mining amounted to little more than removing the limonite, cerussite, and lump galena with steam shovels and buckets. The three fractions were then separated mechanically and shipped to an appropriate smelter, refinery, or waste dump.

For the most part, all of the known ore chimneys have been mined out; however, there is no evidence to suggest that all of the deposits have been found or that similar rich deposits will not be found elsewhere within the immediate vicinity of the mines or within the same unit but below the overlying "barren" sediments which cover the southern flanks of the mountain. All of the existing mine workings should therefore by thoroughly tested by drilling for both lateral and deeper deposits. Bedrock-soil interface geochemistry, vapor analysis, and newer more advanced geophysical techniques may be of value in locating new deposits. The most rapid and least expensive or environmentally restrictive method of penetrative exploration would probably be the use of high-speed percussion drills drilling holes 100 feet to 200 feet (30 to 60 m) deep on a close grid. Drill chip samples could be analyzed on the spot by cold extractable methods double-checked off-site

by AAS. Anomalies thus established could then be drilled by conventional diamond drilling methods.

The environmental impact of both exploration drilling and mining would not begin to approach the damage which has already been done by the indiscriminate use of the bulldozer. The nature of the deposits dictates that any future mining will probably be a low-profile underground operation.

IROQUOIS MINE

Property location and access: 48° 57' 06" N., 117° 32' 22" W., sec. 30, T. 40 N., R. 41 E.

The mine property is on private land surrounded by lands belonging to the Colville National Forest.

The Iroquois, which is located just to the east of Red Top Mountain, is about 9 miles (14.5 km) due east of the town of Northport on the Columbia River in northcentral Stevens County. From Northport, go about 10 miles (16 km) east on the Deep Creek or Northport-Colville highway to county road number 705 which intersects the main road at the settlement of Spirit. Turn onto 705 at Spirit and proceed north past Deep Lake, through Leadpoint to Hartbaur Orchard, which is just north of the bridge over Hartbaur Creek. At the orchard, turn right onto a gravel road and go about 1 mile (1.6 km) to the boundary line of the Colville National Forest. At the boundary the proper road should be designated as U. S. Forest Service route number 602. Continue uphill along this road for approximately 1.7 miles (2.8 km) to the Iroquois mine.

History, production, and ownership

The first discovery of mineralization that led to the development

of this property was made in 1893. Fulkerson and Kingston (1958), however, show 1917 as the first year of recorded production during which 22 tons (20 MT) of ore were mined. This was followed in 1918 by mining of 6 tons (5.14 MT) of ore. The same source reported that 3,000 tons (2,722 MT) were produced in 1949 and Huntting (1956) reported that 2,898 tons (2,629 MT) were produced in 1950, which averaged 3.3 percent zinc, 0.393 percent lead, 0.1 pound (0.045 kg) of cadmium per ton, and 0.025 ounce (0.78 gm) of silver per ton.

Since 1948 the property has been owned by:

Mines Management, Inc.
T. G. Patterson, agent
301 Old National Bank Bldg.
Spokane, WA 99201
phone (509) 838-4148

The property, which consists of 26 unpatented claims and roughly 65 acres of deeded land, was diamond drilled in 1952 by the U.S. Bureau of Mines under a Defense Minerals Exploration Administration contract. The results of this drilling program are not available. In 1964 the property was acquired under lease by the Bunker Hill Company and a number of holes were drilled to test targets established by geochemistry and geophysics. The same technique was again applied in 1974 by Cominco American Exploration of Spokane, Cominco dropped the property in 1975. Though the results of Cominco's investigation were reported to have been favorable, the decision to discontinue development of the property was primarily the result of an economic realignment policy established in response to decling metal prices, negative markets, etc.

Geology and description of the ore bodies

Yates, in his 1964 map of the Deep Creek area, and the discussion of the geology of the Northport and Metaline mining districts (Weissenborn,

1970) places the Iroquois mineralization in the Middle Cambrian Metaline Limestone. The host rocks as mapped by Yates in the Leadpoint area form an apparent transitional unit between the middle unit of the Metaline Limestone of the Northport district and the middle unit of the Metaline Limestone of Pend Oreille County to the east. For purposes of identification Yates has assigned the term "intraformational breccia" to distinguish this unit from other non-brecciated units of the same age. The intraformational breccia consists of layers of dolomite breccia alternating with layers of unbrecciated dolomite similar to that of the dolomite units of the same Metaline Limestone to the east and west of the Deep Creek area. The Metaline Limestone, which is the principal host for lead-zinc mineralization in northeast Washington, overlies the Cambrian Maitlen Phyllite and in turn is overlain by the Ordovician Ledbetter Slate, a black fine-grained clastic rock which is commonly referred to locally as the Ledbetter argillite.

The intraformational breccia unit, which hosts the mineralization of the Iroquois mine, is cut off in the mine by the Russian Creek Fault. This major fault dips steeply toward the south and strikes northeast and, according to several interpretations, near the British Columbia boundary it abruptly swings toward the south through Pend Oreille County, where it is designated as the Flume Creek Fault. Many of the major lead-zinc deposits of the Metaline area are located in rocks adjacent to and possibly influenced by the Flume Creek-Russian Creek Fault.

The Iroquois mine, formerly known as the Flannigan, consists of 2 short adits, a glory hole, and several prospect trenches. The main adit, at an elevation of 2,810 feet (856 m) bears S. 43° E. for 780 feet (238 m). The first 250 feet (76 m) is in Ledbetter Slate. The slate is separated from the Metaline Limestone to the east by a 10-foot zone of sheared

argillite and dolomite, which marks the position of the Russian Creek Fault.

The ore is developed or carried in a gangue of coarse white dolomite, which both crosscuts and parallels the bedded fractions and randomly cuts the matrix of the intraformational breccia.

The main ore body, which is confined to the brecciated portions of the intraformational breccia, is exposed discontinuously over a length of about 450 feet (137 m). The predominant ore minerals are fine-grained pyrite and sphalerite with lesser quantities of galena. Mills (1976) reported that in its richest part the main ore body assayed more than 8 percent zinc over a width of several feet.

A number of altered lamprophyre dikes are associated with the ore body; however, their influence, if any, on the development of the mineralization is unknown.

Description of the Probabilistic-Grade-Quantity-Matrix

According to a company prospectus published in 1950, a diamond drilling and underground rehabilitation project was commenced at the mine in 1948, and by 1950 over 640,000 tons (581,000 MT) of ore were indicated. The average grade of this indicated ore was stated to be 3.02 percent zinc and 0.88 percent lead. W. R. Green, president of the company, Mines Management, Inc., estimated (oral communication) that roughly 500,000 tons (454,000 MT) of ore may be classified as inferred reserves. These are the only figures available at this time for inclusion in the MAS. The results of subsequent exploration ventures by various lessees are not available for inclusion in this report; however, several knowledgeable sources indicated that the later work either substantiated or only slightly improved upon the earlier results obtained by Mines Management,

Inc. It seems that under improved market and(or) critical supply conditions, the Iroquois mine could well become a viable operation, producing both lead and zinc.

Mining, beneficiation, and transportation

Until a more complete study of this property becomes available for general use, the data supplied herein on the various development cards may well be open to question. Briefly, based upon present knowledge of the mine and assuming that the character and the quantity of the indicated ore remains unchanged, the following proposals are hereby submitted regarding the development of the mine: The mine should (1) be developed utilizing horizontal cut and fill methods, (2) the ore should be concentrated at an onsite mill and the resultant tailings returned to the workings, and (3) the concentrates should be trucked via county road 705 to the nearest smelter, which is presently at Trail, British Columbia.

Exploration of this property, in addition to searching for extensions of the known ore bodies, should be extended to include the intraformational breccia units mapped by Yates (1964) on either side of the Russian Creek Fault. Emphasis should be placed upon testing the areas adjacent to fault zones projected or proposed to project beneath the glacial and alluvial fills, both along Cedar Creek and the area due east of the mine site.

In the event that this mine is eventually developed, damage to the environment should be either temporary or minimal. Roads and scars resulting from an extensive drilling program will quickly heal or disappear and all of the necessary improvements at the mine site could and should be dismantled after mining either for salvage or for use else-

where. During the course of active mining and milling, most of the mine tailings should be returned to the workings for fill and support.

The lead-time required to reopen this property and commence mining operations should not exceed 9 months. This estimate should also adequately cover the time required to establish a surface drilling program and to also partially erect a beneficiation plant.

THE MAKI AND DOSSER PROSPECTS

Property location, access and generalized description: 45° 50' 00" N., 117° 36' 00" W., sec. 35, T. 39 N., R. 41 E.

From the town of Northport on the Columbia River, proceed about 10 miles (16 km) in a southeasterly direction on the Northport-Colville highway, Stevens County road number 700, to the Deep Lake turnoff. Go approximately 3 miles (4.8 km) north on the Deep Lake highway, then turn east on the first unimproved dirt road past or north of the gravel pit on the east side of the highway. Follow the dirt road uphill in a southeasterly direction for approximately 0.9 miles (1.5 km) to the Maki mine or prospect, which has been developed along the south-facing hillside 600 feet (183 m) north of Currant Creek.

The Dosser prospect is located about 2,000 feet (609 m) west of the Maki property.

Both of these properties have been developed within a thick band of slightly schistose dolomitic-limestone marble of the upper unit of the Middle Cambrian Metaline Limestone. The limestone extends east-west for more than a mile on the hillside above Currant Creek. This mineralized belt is sandwiched between biotite granite on the south and the Ordovician Ledbetter Slate on the north.

Though neither the Maki nor the Dosser appear to be significant from

the standpoint of possessing minable reserves of lead and zinc, the unit in which they have been developed is well situated geologically and should be explored in more detail for previously undetected deposits of lead and zinc.

NORTH CLUGSTON CREEK AREA

Property location and access: 48° 41' 32" N., 117° 50' 00" W., sec. 23, T. 37 N., R. 39 E.

The coordinates above are for the Chloride Queen which was the principal mine of the North Clugston Creek area. This report, however, encompasses a number of smaller mines and prospects beginning with the Tenderfoot mine (sec. 23, T. 37 N., R. 39 E.) and progressing in a north-northwesterly direction, through the Chloride Queen to the Leadville mine in sec. 3 of the same township.

To enter the North Clugston Creek area go about 2 miles (3.2 km) west of Colville on U. S. Highway 395 to the Williams Lake road. Turn north on the Williams Lake road and go approximately 4.5 miles (7.2 km) to Stevens County road number 730; the Onion Creek road, thence north on the Onion Creek road for about 4 miles (6.4 km) to U. S. Forest Route number 641. Turn east on the forest road and proceed for about 1 mile (1.6 km) to the Chloride Queen mine. The main adit and spoils dump of this mine are just north of the road. The remains of the mill and various ancillary and campsite buildings are located on both sides of the road.

The Tenderfoot mine is located about 1/2 mile (0.8 km) south-southeast from the Chloride Queen. A rough track leading to the mine intersects the main road at the Chloride Queen campsite.

A number of smaller lead-zinc-silver mines and prospects are located northwest of the Chloride Queen: the Echo and the Big Chief are barely accessible via a steep track which leaves the Onion Creek road just north of the road to the Chloride Queen. Several small but possibly significant prospects are located near the east side of the Onion Creek road about 2.5 miles (4.0 km) north of the Chloride Queen turn-off.

Geology and recommendations for future work

The lead-zinc-silver deposits in the North Clugston Creek area occur within a zone of brecciated dolomite developed along the unconformable contact separating the middle and upper units of the Middle Cambrian Metaline Limestone from the overlying Ordovician Ledbetter Slate. Various early investigators in the district concluded that the mineralized breccia was of tectonic or sedimentary origin; however, neither hypothesis was able to satisfactorily explain certain features encountered within the breccia which seemed to contradict the ideas being promoted. Schuster (1976) presents evidence to support his proposal that the brecciated zone, designated as the Josephine Breccia, may in fact represent a solution-collapse breccia related to the unconformity existing between the Ledbetter Slate and the Metaline Limestone.

The deposits in the breccia from which little of the past production has come consisted of thin stringers and irregular masses of sphalerite and galena with very little pyrite scattered at random throughout the breccia. Occasional pipelike bodies or chimneys containing lumps of argentiferous galena disseminated in a matrix of loose limonitic clay have also been mined in the area: specifically at the

Hi Cliff mine. The bulk of the earlier sulfide production came from mineralized quartz veins which cut the breccia and may be structurally controlled. None of the deposits in the Josephine Breccia of the North Clugston Creek area appear to be structurally or stratigraphically controlled. Future comparison of the Josephine Breccia with the mineralized tectonic breccias of Gladstone Mountain may reveal that both are to a certain extent genetically related and that the mineralization common to both is also common to the intervening ground.

The North Clugston Creek area has been submitted for inclusion in the Minerals Availability System in order to assure that it will ultimately be thorouthly studied and tested rather than discarded as an area of submarginal or insignificant mineralization. Diamond drilling directed by detailed surface and geophysical studies may be successful in locating lead-zinc ore bodies of significant proportions.

THE PHILLIPS RANCH PROSPECT

Property location, access and generalized description: 48° 53' 33" N., 117° 50' 14" W., sec. 10, T. 39 N., R. 39 E.

. Commencing at Northport, in Stevens County, take Washington State Highway 25 north toward Frontier and the Canadian border. After crossing the Columbia River bridge just outside of Northport, turn left at the first road intersection and proceed south past the airport and along the west bank of the river. At a point approximately 3.6 miles (5.8 km) south of the highway intersection, the small waste dumps and utility shed marking the prospect site should be visible roughly 500 feet (150 m) west of the road.

This prospect constitutes a new discovery, so consequently little or no information has been published or is otherwise available describing

the geology or the ultimate potential of this property. According to Professor J. W. Mills of Washington State University (oral communication) one of his graduate students is currently (1976) in the process of mapping and examining the property; however, the student's data is not available at this time for inclusion or use herein. Professor Mills did indicate that the prospect as it has been developed to date consists of a shallow incline perhaps 150 feet (46 m) long from which several short raises have been driven. At the bottom of the incline (roughly 40 feet (12 m) deep) there is presently a large chamber roughly 50 feet (15 m) in diameter. This room resulted from the removal, by mining, of a large zone of high-grade ore.

The mineralization encountered so far consists of slightly argentiferous galena with subordinate sphalerite and some associated pyrite. It occurs as massive or brecciated lenses and tabular bodies up to 2 feet (60 cm) thick. The sulfide mineralization forms matrix between the breccia fragments and ribbonlike veins of galena are common. These ore bodies are developed in dolomite mapped by Yates (1971) as belonging to the middle unit of the Middle Cambrian Metaline Limestone. The extent and configuration of the mineralized zone is uncertain; however, Professor Mills stated that it appears to have horizontal dimensions of roughly 100 x 100 feet (30 x 30 m) and may be cut off to the northeast by faulting. Deep overburden prevents any accurate projection of the zone toward the west and southwest.

The owners and developers of the property, the Boggs Brothers Construction Company of Spokane, Washington, disclosed that a recent shipment of ore to the Cominco smelter at Trail, British Columbia, produced very favorable returns. This shipment apparently consisted of hand-sorted material and therefore should not be regarded as representing

the true value or tenor of the average mine ore.

At the direction of the owners, a large mining company is presently conducting an IP survey over this property; it is therefore assumed that if the results of this investigation are favorable, further developmental work should soon be evident.

SHOEMAKER MINE

Property Location and Access: 48° 37' 59" N., 117° 47' 05" W., sec. 8, T. 36 N., R. 40 E.

The Shoemaker mine property is located within the Colville Mining District, 10 miles (16 km) from downtown Colville on County road number 700, which begins at the Colville airport and runs in a north-northeasterly direction toward Spirit and Deep Lake. The portal of the lowermost workings is only a few hundred feet (<100 m) west of the paved Spirit-Deep Lake road.

History, production and ownership

A small prospect tunnel was opened about 1910 on exposed lead and zinc mineralization, and according to Fulkerson and Kingston (1958) the American Concentration and Mining Company produced 36 tons (33 MT) of ore during the year 1926.

The Triton (or Tri-Nite) Mining Company of Colville, organized in 1959, acquired the property a short while later. By 1962 the old workings had been rehabilitated and over 3,100 tons (2,812 MT) of ore were produced during that year. In 1966 the mine was leased from Triton (or Tri-Nite) by Calix Mines Ltd. of Vancouver, British Columbia. Calix performed some diamond drilling and sampling; in 1968 the company reported a production totalling 1,768 tons (1,604 MT) of ore, which yielded 320 ounces (9,953 gms) of silver, 200 pounds (91 kg) of copper, 2,200

pounds (990 kg) of lead, and 136,000 pounds (61,688 kg) of zinc.

The Coronado Development Corporation leased the property in 1972 and a small tonnage of lower grade ore was later produced under a subordinate lease by the Consolidated Mining and Construction Company. The principal lessee produced an undisclosed tonnage from the property in 1974.

Ownership of the Shoemaker property is still retained by:

Triton (or Tri-Nite) Mining Company
Darrell A. Newland, president
Colville, Washington, 99114
phone (509) 684-4302

Geology and description of the ore body

The ore body at the Shoemaker mine is developed along the contact between what is believed by Professor J. W. Mills (1976) to be the lowermost unit of the Middle Cambrian Metaline Limestone and the Ordovician Ledbetter Slate.

The ore body and the enclosing sediments strike north-south and dip from 30° to 55° toward the west; the contact between the Metaline Limestone and the overlying Ledbetter is believed to represent a bedding plane fault rather than an unconformity. In either case, the middle and upper units of the Metaline Limestone, which are present elsewhere locally, are not represented here.

The rocks of the hanging wall block consist of black argillite and graphitic argillite, and though they resemble and correlate closely with the Ledbetter Slate, their exact stratigraphic position is uncertain. The footwall rocks consist for the most part of interbedded limestone and dolomite with intercalated beds or shaly partings of black argillite. Several schistose and highly graphitic zones are included within the limestone-dolomite unit.

Ore mineralization at the Shoemaker mine consists of from one to four veins of sphalerite and galena, with minor amounts of pyrite that for the most part closely follow the bedding planes of the enclosing limestone-dolomite. The veins are all generally contained within a zone comprising the uppermost 30 feet of the carbonate unit, with the principal vein occupying a position at or just below the faulted(?) contact.

Sphalerite, with small irregular patches of galena and occasional angular inclusions of black argillaceous dolomite, is the major constituent of the veins exposed in the mine workings. Microscopic examination of the ore material by Professor J. W. Mills (1976) showed that the bulk of the material is an exceedingly fine-grained sphalerite mylonite, which was apparently derived by the deformation of a preexisting, coarser grained sphalerite. Lesser amounts of deformed galena and intensely shattered pyrite were also observed in the samples.

The surface or horizontal dimension of the principal vein is about 600 feet (183 m) and the deepest, measured dimension is about 200 feet (61 m). The average thickness of the vein is about 4 feet (1.22 m). According to Mr. Scott Simonstad, president of Coronado Development (oral communication), diamond drilling in the mine revealed that the ore body apparently pinches out toward the south, while toward the north, the ore vein or sheet seems to warp or twist away from the area explored by recent diamond drilling.

A number of prospects including the Michigan Boy and the Joe Creek (Cherry) are located north of the Shoemaker mine but along the strike of what may be the same horizon or mineralized fault zone. Mills (1976) notes that one prospect several hundred feet north of the Shoemaker contained only sparsely disseminated pyrite in the limestone-dolomite rocks,

while Huntting (1956) wrote that both lead and zinc sulfides were reported in carbonate rocks from prospects up to 2 miles north onstrike from the mine. Further detailed examination and drilling along the Shoemaker horizon both to the north and to the south would seem to be warranted.

Description of the Probabilistic-Grade-Quantity Matrix

The grade values shown in column one of the matrix were based upon aggregated smelter returns from nearly 5,000 tons (4,636 MT) of ore produced in 1962 and 1968.

The tonnage figures shown represent confidential data supplied by Coronado Development Corporation. The president of Coronado estimated that there is roughly twice the measured amount of ore remaining in the mine. This estimated or inferred amount was assigned to the 50 percent probability level while the "indicated" quantity or 75 percent level is simply an arithmetic average between the measured and inferred tonnages.

The figures shown in column two of the Matrix represent cumulative tonnage and grade established by eight blocks of ore projected from within the workings and away from four diamond drill holes. Assay data and conjectural block dimensions were assembled and prepared for a Tri-Nite Mining Company prospectus. A copy of the pertinent data from the prospectus is included herein with the backup file. Lead values as shown on the assay sheets are essentially nil.

Due to the irregular configuration of the ore body and some confusion regarding the exact nature of the host rock, no attempt was made at this juncture to project the tonnage beyond the 50-percent level of probability.

Mining, beneficiation, and transportation

Resuing or stripping is the method which best describes the type of mining apparently practiced so far to develop the mine. It is reasonable to expect that a similar procedure may be followed to exploit the remainder of the deposit.

As a result of the high graphite content and extremely fine-grained nature of the Shoemaker ore, some difficulty may be encountered in dressing the ore from this mine. Consequently, it is proposed that a mill capable of handling this unusual ore be established at the mill site. The mill concentrate can then be trucked directly to the railhead at Colville for shipment to the Bunker Hill smelter at Kellogg, Idaho.

SIERRA ZINC MINE

Property location and access: 48° 46' 28" N., 117° 37' 32" W., sec. 20, T. 38 N., R. 41 E.

The Sierra Zinc or Blue Ridge mine is located about 20 miles (32 km) from Colville on the west side of the Colville-Spirit highway. This paved highway, Stevens County road number 700, begins at the Colville airport and goes northeast toward Deep Lake and Leadpoint. The mine portal, mill, and ancillary buildings are visible from the highway.

History, production, and ownership

According to Mills (1976), the first claim in the mine area was staked and worked in 1889. A small tonnage of ore was mined and shipped between the years 1906 and 1910 by the Aladdin Mining Company. The Blue Ridge Mining Company mined several car loads of ore during 1925 and 1926.

Fulkerson and Kingston reported in 1958 that the Sierra Zinc mine

produced over 56,000 tons (50,753 MT) of ore between 1941 and 1944. This tonnage yielded 754 ounces (23,451 gms) of gold, 29,058 ounces (909,544 gms) of silver, 57,143 pounds (25,920 kg) of lead and 5,648,594 pounds (2,562,202 kg) of zinc. In 1954 the 100-ton flotation mill at the mine site was expanded to handle 500 tons (453 MT) of ore per day; however, the only significant production recorded during and since the 1950's was 1,380 tons (1,252 MT) produced in 1956 by the Goldfield Consolidated Mining Company. All of the underground workings are in poor condition and many of the stopes above the main level collapsed in 1945.

Ownership of the mine and 1,200 contiguous acres of deeded land surrounding the property is vested in the following organization:

Triton Mining Company
Darrell A. Newland, president
Colville, Washington, 99114
phone (509) 684-4302

C. T. Higginbotham of Spirit, Washington, a mining engineer and former owner of the mine, reported (oral communication) that some exploratory bulldozing was done on the property around 1972 and that only a small amount of mineralized float was uncovered.

Geology and description of the ore body

The Sierra Zinc ore body, like many other lead-zinc deposits in Stevens County, is developed in metasediments surrounding the margin of the Spirit pluton. The pluton is an apparent satellite or offshoot of the Cretaceous Kaniksu batholith, which occupies a large area in east-central Stevens County.

The main workings of the mine are in intensely folded quartzite, schist, and calcitic marble which have been intruded by numerous sills, dikes, and irregular masses of granite and dacite. Extensive metamorphism and faulting have complicated all attempts to correlate the

mine rocks with the host rocks at other mines in the county; so in response to this problem, Yates (1964) referred to them as the Blue Ridge sequence.

The metasedimentary beds generally strike north to northeast and dip toward the west from 10° to 40° in the mine and up to 70° farther west on Blue Ridge Mountain.

The principal ore host is calcitic marble, which attains a maximum thickness of 44 feet (13 m) along the main level of the mine. There are two ore horizons separated by 10 to 20 feet (3 to 6 m) of barren calcitic or dolomitic marble or by wedgelike sills of granitic rocks. The highest grade zones appear to follow the contact of the marble with the underlying quartzite on the western contact of the marble with a dacite sill. Minor faulting commonly offsets the ore horizon. One prominent post-ore(?) and post-intrusive fault has a variable northeast strike and dips northwest fron 20° to 40° transecting the bedding of the metasediments irregularly at a low angle. This large fault is marked by an impervious zone of green gouge up to 10 feet (3 m) thick.

In the best exposures of ore, most of which are in marble, sphalerite with pyrite runs in conformable and parallel bands or beds from 1 mm to several centimeters in thickness. Minor quantities of galena are reported in the mine primarily in or near the major fault zone or together with sphalerite and pyrite in a thin conformable mineralized zone in calcitic marble, which is exposed in an area south of the main workings.

The origin of the mineralization is uncertain: Campbell (1946) concluded that the ores were formed by the selective replacement of the marble host by fault-controlled solutions originating from the granitic intrusions; Mills (1976), on the other hand, supports the theory that the mineralization is syngenetic in origin and that the galena veinlets

associated with post-ore faulting merely represent post-ore, stress-induced plastic mobilization of syngenetic galena from its original position to voids and fractures developed during later deformation.

In response to the increased demand for metals during the Second World War, the U.S. Bureau of Mines in cooperation with the U.S. Geological Survey initiated a program of mapping and diamond drilling on the Sierra Zinc property. During this program and between 1943 and 1944 six holes were drilled totalling 1,587 feet (484 m). The results of this mapping and drilling program were assembled and reported by C. D. Campbell in a USGS open-file report dated 1946. The drilling program did not reveal any additional ore; however, Dr. Campbell concluded that additional drilling should be done to adequately test the deposit. It would appear from the drilling results that there is a good possibility that the elusive extension of the ore has been faulted rather than excluded from the stratigraphic section.

Description of the Probabilistic-Grade-Quantity Matrix

The resource figures recorded on the matrix were taken from the open-file report by Campbell (1946); they represent the combined measured tonnages of both the older (now caved) and the younger (1944) workings of the mine. Both tonnage groups include pillars, free standing walls, and side blocks as observed and measured by Campbell during the course of his mapping.

As a result of the irregular and patchy nature of the ore, complicated faulting, and the fact that no significant mineralization was intersected during the drilling program, no attempt has been made at this stage of reporting to increase the tonnages beyond those established earlier by Campbell. Campbell concluded from his first-hand, on-site

account that "it is impossible to estimate the reserves of indicated and inferred ore until more drilling is done." With this conclusion in mind, completion of the mining, beneficiation, and transportation records would be premature.

VAN STONE MINE

Property location and access: 48° 45' 38" N., 117° 45' 23" W., sec. 33, T. 38 N., R. 40 E.

The Van Stone mine is located on the west slope of Gillette Mountain midway between the towns of Northport and Colville, Washington.

The simplest access to the mine is from Northport on the east bank of the Columbia River. Starting at Northport go 4 miles (6.4 km) south on State Highway 25 toward Kettle Falls to the Onion Creek road, county road 730. Proceed about 6 miles (9.6 km) south on the county road to the Onion Creek school and the intersection of the county road and the Van Stone mine road. Bear left or east on to the mine road and continue in a southeasterly direction for about 4 miles (6.4 km) to the mine site, which is located at the headwaters of Onion Creek and at an elevation of around 3,600 feet (1,097 m).

History, production, and ownership

The first indications of valuable mineralization that led to the eventual development of this property were discovered in 1920 by prospectors George Van Stone and Henry Maylor during the course of a hunting expedition. In 1926 the property was explored by the Hecla Mining Company, and in 1930 a small tonnage of ore was produced by the Van Stone Mining Company. Willow Creek Mines of Nevada, Incorporated owned and partially developed the property between the years 1939 and 1950.

The American Smelting and Refining Company acquired the property in 1950, and by 1952 ore production was begun from two open pits. The ore was concentrated on site at a newly constructed 1,000 TPD (907 MTPD) flotation unit. Reductions in metal prices and rising costs forced the mine to shut down between 1957 and 1964 and again between 1967 to 1969. Mining and milling operations by ASARCO ceased in 1970 and in June of 1971 the property was acquired by the following present owner:

Callahan Mining Corp.
CBT Plaza
1120 Post Road
Darien, CT 06820
phone (203) 655-7751

Since 1971, the Callahan Corporation has been developing the property under a joint venture with the U.S. Borax and Chemical Corporation of Los Angeles (25 percent ownership) and Brinco Ltd. of Canada (25 percent): both of these companies are subsidiaries of the Rio Tinto Corporation, Ltd. of England. At the present time (1976), Callahan still retains full ownership of the mill and reduction plant. The present owners refer to the property as the Washington Zinc unit rather than the Van Stone mine.

According to Keston (1970), during 8.5 years of operation by ASARCO about 7.5 million tons (6.8 MMT) of ore and waste were mined from two open pits. The average grade of the ore during this period was 4.1 percent combined lead and zinc. The metal recovered from over 2.5 million tons of processed ore amounted to 10,500 tons (9,526 MT) of lead and 86,000 tons (78,019 MT) of zinc. Small quantities of silver and copper were also recovered.

Geology and description of the ore body

The Van Stone mine is developed in dolomite belonging to the middle unit of the Middle Cambrian Metaline Limestone, which is exposed on the west limb of the northeasterly trending Gillette Mountain anticline.

The Late Cretaceous Spirit pluton cuts the Gillette Mountain anticline just to the north of the deposit and may or may not be directly related to the subsequent(?) formation of the Van Stone lead-zinc deposit.

According to Cox (1968), the ore bodies at the Van Stone mine were developed along a large east-west trending S-shaped fold, which was formed between the Rogers Mountain Fault and the Spirit pluton to the north. The deposits from which all of the past production came were developed as two individual elongate shoots of commercial-grade mineralization concentrated along the steeply southeast plunging axes of the fold. The two deposits were exploited by open-pit methods, though most of the ore produced was mined from the larger northern body. The north ore body, as exposed in the open pit, rolled over and pinched-out toward the northwest; however, post-mining diamond drilling by ASARCO northwest of the pinch-out disclosed that another ore body was present along the same horizon but at a greater depth. Subsequent investigation by ASARCO and later by the Callahan group showed that the new ore body, roughly N-shaped in section, had been developed along the northwest side of the folded limestone-dolomite unit.

Neitzel (1972), using company drilling data, constructed a three-dimensional model of the ore body as outlined by a 2.0 percent combined lead-zinc cut-off grade. The N-shaped ore body, as illustrated by the model, measures approximately 1,600 feet (488 m) long, by 600 feet (183 m) deep, by 200 feet (61 m) thick. The "exact" dimensions of the body and those used by Neitzel to construct the model are classified company data, so the figures shown above are only rough estimates based upon dimensions scaled directly from a photograph of Neitzel's model and various other published sources such as Cox and the text of Neitzel's thesis. The new ore body strikes N. 28° E. and dips at about 66° toward

the northwest.

In his thesis, Neitzel did an extensive study of the mineralogy, structure, and alteration features of the ore body exposed in the north pit. Most of the data compiled by Neitzel on the surface is also applicable to the new ore body. Sphalerite, and to a lesser extent galena, occur as pods, stringers, and irregular masses in more or less silicified dolomite which is characterized by the development of jasperoid and tremolite. Pyrite and pyrrhotite are erratically distributed throughout the ore body and the host carbonates. The combined grade and quality of the new ore body is comparable to the ore which was mined from the open pits: zinc values average 3.8 percent and lead averages 0.5 percent. Like many other lead-zinc deposits in northeastern Washington, ubiquitous graphite in the unaltered limestone may or may not be considered as an anomalous feature related to mineralization. A number of barren, irregular, and highly altered lamprophyre dikes have intruded the rocks in the vicinity of the ore bodies.

The granodiorite Spirit pluton immediately adjoining the mine area exhibits a thin alaskite border or rind, which has been chloritized, argillized, and sericitized, and according to Cox much of the altered area contains trace amounts of gold. This alteration is possibly directly related to the mineralization and(or) the alteration recorded in the host limestone-dolomite of the adjacent mineralized Metaline Limestone.

Deep glacial till obscures nearly all of the granodiorite-limestone contact. The contact shown on some of the geologic maps was established by using a magnetometer to differentiate between the pyrrhotitic limestone and the nonmagnetic granodiorite. A large portion of the original ore body is believed to have been removed by Pleistocene

continental-type glaciation, and according to Cox, a resultant present-day geochemical shadow is cast by the ore body toward the southwest.

Mills (1976) has compiled and summarized most of the recent published information concerning the geology of the Van Stone mine and the various events thought to have been responsible for the initial formation of its ore bodies. Professor Mills is, however, of the opinion that there is sufficient evidence to support a syngenetic or pre-tectonic origin for these deposits.

Description of the Probabilistic-Grade-Quantity Matrix

The average grade and indicated tonnage shown in the first column of the matrix represents confidential company data established during underground developmental drilling, tunnelling, and sampling of the new ore body. The inferred tonnage estimated for the 25 percent or P_2 level of probability was computed by applying the average dimensions described in the geology section above. As noted earlier, these dimensions were based on a 2.0 percent combined cutoff grade established by widely spaced preliminary drilling. In the matrix it is proposed that there may be not only a 25 percent chance that this larger tonnage exists but an equal possibility that an improvement of the overall grade to the value shown on the matrix will be forthcoming as the current more detailed examination of the deposit progresses. A tonnage volume factor of 11.5 cu. ft/ton was established and used during the years that the mine operated as an open pit.

The tonnage estimated to exist at the 50 percent or P_3 level of probability is simply the median difference between the quantity figures shown at levels P_2 and P_4.

Mining, beneficiation and transportation

The principals of the consortium presently responsible for developing the new ore body were reluctant to release very many details regarding the present extent of their underground exploration. The exploration adit is collared near the old south pit and strikes roughly N. 28° E. or parallel to the strike of the new ore body. The workings consist of an anticline of unknown length and slope joining a drift of unknown length and position relative to the ore body. The total length of the present workings is believed to be on the order of 1100 to 1200 feet (335 to 366 m). Ring drilling, which would seem to indicate that the tunnel drifts through the heart of the ore body, tests an area of 800 feet (224 m) around and perpendicular to the axis of the tunnel. Drill stations are at 100 foot (30 m) intervals along the length of the tunnel. According to the 1975 annual shareholder's report prepared by the Callahan Mining Corporation, 6400 feet (1951 m) of diamond drilling was completed, together with 800 feet (244 m) of drifting during that year. This exploratory or developemental drilling is estimated to be about one-third complete as of early 1976.

The plan for mining is reported to be blasthole or sublevel stoping. It is assumed that a rubber tire haulage system similar to that used at the Calhoun and Pend Oreille mines may be employed to greatest advantage. The mine is expected to produce on the order of 2,000 TPD (1814 MTPD).

The present 1,000 TPD (907 MTPD) milling facility used earlier by ASARCO will be modified and streamlined to handle 2,000 TPD (1914 MTPD). A decision on the disposition of the concentrates has not yet been reached; however, it is assumed, for the MAS records, that the concentrate will be trucked to or near Northport and thence by rail to the Cominco smelter at Trail, British Columbia, Canada, a distance of about 23 miles

(37 km). An alternate pathway would entail shipment of the concentrates from either a Northport or Colville railhead to the Bunker Hill smelter at Kellogg, Idaho, which is about 10 times the distance from Northport to Trail.

No new or unusual environmental problems are apparent at this juncture; in fact, the shift from an open pit to an underground operation will allow nature or the owners to reclaim the damaged surface. Doubling of the capacity of the mill is expected to be accomplished within the existing structures, however, tailings disposal, regardless of the size of the mill will continue to be a problem. Tailings from the previous open pit operation were piped to disposal areas several miles away from the mine.

By the time that the evaluation of the new ore body is completed, most of the intitial development required to begin mining should also be completed and assuming that the improved mill will be ready then to receive ore and that all of the necessary equipment and personnel have been acquired no more than 2 weeks to a month should be required to tie-up loose ends and commence mining and milling operations.

YOUNG AMERICA MINE

Property location and access: 48° 45' 29" N., 118° 02' 06" W., sec. 33, T. 38 N., R. 38 E.

The Young America mine is 1/4 mile (400 m) northeast of Bossburg, a small settlement on the east bank of Roosevelt Lake. Bossburg lies about 15 miles (24 km) north of Kettle Falls on all-weather State Route 25 and the Burlington Northern Railroad. A short unpaved road links the mine site with the main highway. The workings are established along a nearly vertical limestone cliff about 400 feet (122 m) in elevation

above Bossburg.

History, production, and ownership

Like the nearby Bonanza mine, the Young America mine was discovered by prospectors in 1885, thus making it one of the first mines to produce lead, zinc, and silver in the Colville-Northport area. According to a report by Hodges (1897), one of the first ore shipments from the mine yielded a smelter return in excess of $40,000.00. The mine was operated sporadically by a number of different companies from the year of discovery unti its ultimate closure in 1954. Production records assembled by Fulkerson and Kingston (1958) for the years 1908 through 1953 show that cumulative production from this mine amounted to 949,719 pounds (430,783 kg) of lead and 711,629 pounds (350,003 kg) of zinc. Also, 50 ounces (1,555 gms) of gold, 69,893 ounces (2,173,882 gms) of silver, and 5,138 pounds (2,330 kg) of copper were recovered.

The property has been restaked several times since 1954; however, no ore has been produced. There are no valid claims covering the property in 1976.

Geology and description of the ore body

An excellent description of the Young America deposit was prepared by Hundhausen (1949) as part of a U.S. Bureau of Mines' investigation which was carried out between 1946 and 1948.

In the course of the Bureau's investigation, 15 diamond-drill holes totaling 4,590 feet (1,399 m) were completed along with some geologic mapping and laboratory testing of the ore.

The deposit consists of two types of ore designated by Hundhausen as "mine" ore and "dolomitic" ore. Mr. Hundhausen summarizes the deposit as follows:

Two ore types have been recognized; for convenience these types will be referred to as "mine" ore and "dolomitic" ore. All past production has been obtained from the "mine" ore; it occurs as stringers and lenses of sphalerite, galena, and geocronite (Pb-Sb-As-S) along an irregular, gently dipping zone of shearing. The "mine" ore has been developed along its strike for a distance of 300 feet (91 m) and up its dip for a distance of 200 feet (61 m). It ranges in width from a few inches up to 10 feet (3 m). The "mine" ore contains small amounts of tin.

Essentially all of the ore described above has been mined-out.

The "dolomitic" ore consists of sphalerite and galena disseminated along the footwall and hanging wall contacts of an irregular zone of silicified, brecciated, weakly mineralized, dolomitic limestone. This zone is 30 feet to 150 feet (9 to 46 m) thick; it dips gently to the southeast and trends N. 30° E. The "dolomitic" ore structure has been traced by outcrop indications and by Bureau of Mines' diamond drilling for 900 feet (274 m) along the strike.

Both of the ore bodies summarized above were developed in the lower unit of the Middle Cambrian Metaline Limestone, a dense, fine-grained, bluish-gray limestone or limestone-dolomite.

The limestone and other rock units in the Bossburg area strike N. 30° E. and dip eastward at about 30°. The major regional fault systems generally strike north-south. A secondary set of faults, some of which are parallel to the axial planes of the area's folded rocks, strike northeast. The secondary faults are complemented by a lesser series of northwest-trending cross faults. One large post-ore shear zone healed with calcite cuts both the "mine" and "dolomitic" ore zones. This fault trends N. 20° E. and dips 72° toward the southeast.

The limestone-dolomite in the vicinity of the mine has in places been highly altered and silicified and the quality and quantity of the ore mineralization tends to vary directly with the degree of alteration. The ore is therefore closely associated with a high-silica gangue.

A large mass of granite porphyry, possibly related to the nearby

Spirit pluton, outcrops west of and across Roosevelt Lake (Columbia River) from the mineralized carbonates. Both the alteration and the mineralization are possibly directly related to this nearby granite pluton. Several small basic pyritiferous dikes cross cut the deposit; they do not appear to be related to the lead-zinc mineralization.

Both shallow oxidized ore and deeper primary ore have been mined at the Young America mine. The best ore intersected in the Bureau of Mines' drill holes was strongly oxidized. Quoting again from Hundhausen:

> The primary ore is a fine-grained intimate mixture of sphalerite and galena with variable amounts of geocronite, a lead-antimony mineral. Pyrite, magnetite, chalcopyrite, and cassiterite are present in small quantities. The principal gangue mineral is quartz.
>
> Galena ranges in size from minus 48 to plus 560 mesh. Sphalerite is intergrown with galena; it has the same range in particle size. The galena apparently is argentiferous. In addition, a few sporadic inclusions of tetrahedrite or tennantite are in the galena. Pyrargyrite was identified in the ore.

As noted earlier there is little or no econimic ore remaining in the mine. The property was included in the Mineral Availability System (MAS) because it is or was a significant deposit found in an otherwise barren environment. A number of mines have been developed within the Metaline limestone-dolomite in the vicinity of Northport; however, little or no lead-zinc mineralization has been encountered within the carbonate rocks along the 18-mile (16 km) long area between Bossburg and Northport.

Despite the rugged terrain in this part of Stevens County, the land surface has been thoroughly prospected and the possibility of finding new economic depostis using contemporary surface techniques seems to be remote. It would appear however, that the Bossburg-Northport area warrants further investigation utilizing geophysical, geochemical,

and contemporary geological methods. In the meantime, in advance of newer, more sophisticated exploration techniques, the diamond drill should not be overlooked as the most valuable exploration tool for finding blind expressionless deposits.

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APPENDIX

Reference Number-E

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2 State: 53 | 3 5 County: 047 | 6 9 Sequence Number: | 10 Record Identification (1st digit): 6

ALDER MINE

Average Minable Grades (columns) 1 2 3 4 5

Record Identification (11 12)	Action Code (13)	Commodity (14)	1 (15 19)	2 (20 24)	3 (25 29)	4 (30 34)	5 (35 39)
01		ZINC	1.8				
02		COPPER	0.5				
03		GOLD	2.92				
04		SILVER	15.18				
05							
06							
07							
08							
09							
10							

Resource Quantity (thousands)

Record Identification (11 12)	Action Code (13)	Probability (14 15)	1 (16 24)	2 (25 33)	3 (34 42)	4 (43 51)	5 (52 60)
11		P 1 90					
12		P 2 75	388				
13		P 3 50	2268				
14		P 4 25	4082				
15		P 5 10	9072				

Year of this Evaulation - E 6162 76

CALHOUN (ANDERSON) MINE

Reference Number - E

PROBABILISTIC GRADE - QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2	3 5	6 9	10
53 State	065 County	Sequence Number	1 Record Identification (1st digit)

CONFIDENTIAL

Average Minable Grades (columns)

Record Identification (11 12)	Action Code (13)	Commodity	14	1 (15–19)	2 (20–24)	3 (25–29)	4 (30–34)	5 (35–39)
01		ZINC		3.15				
02		LEAD		0.11				
03								
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification (11 12)	Action Code (13)	Probability	14 15	16–24	25–33	34–42	43–51	52–60
11		P 1	90					
12		P 2	75	242				
13		P 3	50	363				
14		P 4	25	484				
15		P 5	10	484				

Year of this Evaulation - E 61 62

DEEP CREEK MINE

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

Reference Number-E

1 2	3 5	6 9	10
53 State	065 County	Sequence Number	1 Record Identification (1st digit)

CONFIDENTIAL

Average Minable Grades (columns) 1 2 3 4 5

Record Identification	Action Code	Commodity	14	15 19	20 24	25 29	30 34	35 39
01		ZINC		5.67				
02		LEAD		1.43				
03		SILVER		1.55				
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16 24	25 33	34 42	43 51	52 60
11		P 1	90					
12		P 2	75	707				
13		P 3	50	1138				
14		P 4	25	1422				
15		P 5	10	1706				

Year of this Evaulation - E 61 62 76

IROQUOIS MINE

Reference Number-E

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2	3 5	6 9	10
53 State	065 County	Sequence Number	6 Record Identification (1st digit)

Average Minable Grades (columns)

Record Identification	Action Code	Commodity	14	1 (15 19)	2 (20 24)	3 (25 29)	4 (30 34)	5 (35 39)
01		ZINC		3.02				
02		LEAD		0.88				
03								
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16 24	25 33	34 42	43 51	52 60
11		P 1	90					
12		P 2	75	581				
13		P 3	50	454				
14		P 4	25	454				
15		P 5	10	454				

Year of this Evaulation - E 61 62: 76

METALINE DISTRICT

Reference Number-E

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2 State: 53 | 3 5 County: 051 | 6 9 Sequence Number: | 10 Record Identification (1st digit): 6

Average Minable Grades (columns) 1 2 3 4 5

Record Identification	Action Code	Commodity	14	15 19	20 24	25 29	30 34	35 39
01		ZINC-LEAD		3.5				
02								
03								
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16 24	25 33	34 42	43 51	52 60
11		P 1	90					
12		P 2	75					
13		P 3	50	3265 9				
14		P 4	25	1324 51				
15		P 5	10	2122 84				

Year of this Evaulation - E 61 62: 76

PEND OREILLE MINE

Reference Number-E

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2 State: 53 | 3 5 County: 051 | 6 9 Sequence Number: | 10 Record Identification (1st digit): 6

Average Minable Grades (columns) 1 2 3 4 5

Record Identification	Action Code	Commodity	14	15 19	20 24	25 29	30 34	35 39
01		ZINC		4.2				
02		LEAD		0.5				
03								
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16 24	25 33	34 42	43 51	52 60
11		P 1	90	207				
12		P 2	75	325				
13		P 3	50	650				
14		P 4	25	650				
15		P 5	10	650				

61 62 Year of this Evaulation - E: 76

SHOEMAKER MINE

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

Reference Number-E

1 2 State: 53 | 3 5 County: 065 | 6 9 Sequence Number: | 10 Record Identification (1st digit): 1

CONFIDENTIAL

Average Minable Grades (columns)

Record Identification	Action Code	Commodity	1 (15 19)	2 (20 24)	3 (25 29)	4 (30 34)	5 (35 39)
01		ZINC	4.8	12.7			
02		LEAD	0.072	nil			
03		COPPER	0.002				
04		SILVER	1.01				
05							
06							
07							
08							
09							
10							

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16 24	25 33	34 42	43 51	52 60
11		P 1	90	163				
12		P 2	75	245	24			
13		P 3	50	327	48			
14		P 4	25	327	48			
15		P 5	10	327	48			

Year of this Evaulation - E 61 62: 76

SIERRA ZINC MINE

Reference Number-E

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

1 2	3 5	6 9	10
53 State	065 County	Sequence Number	6 Record Identification (1st digit)

Average Minable Grades (columns)

Record Identification	Action Code	Commodity	14	1 (15–19)	2 (20–24)	3 (25–29)	4 (30–34)	5 (35–39)
01		ZINC		7.77				
02		LEAD		0.79				
03								
04								
05								
06								
07								
08								
09								
10								

Resource Quantity (thousands)

Record Identification	Action Code	Probability	14 15	16–24	25–33	34–42	43–51	52–60
11		P 1	90	18				
12		P 2	75	18				
13		P 3	50	18				
14		P 4	25	18				
15		P 5	10	18				

61 62
Year of this Evaulation - E 76

VAN STONE MINE

PROBABILISTIC GRADE-QUANTITY MATRIX

U.S. BUREAU OF MINES
MINERALS AVAILABILITY SYSTEM

Reference Number-E

1 2 State [53] | 3 4 5 County [065] | 6 9 Sequence Number [ ] | 10 Record Identification (1st digit) [1]

CONFIDENTIAL

Average Minable Grades (columns)

Record Identification	Action Code	Commodity	1 (15–19)	2 (20–24)	3 (25–29)	4 (30–34)	5 (35–39)
01		ZINC	0.5				
02		LEAD	3.8				
03							
04							
05							
06							
07							
08							
09							
10							

Resource Quantity (thousands)

Record Identification	Action Code	Probability	1 (14–24)	2 (25–33)	3 (34–42)	4 (43–51)	5 (52–60)
11		P 1 90					
12		P 2 75	7258				
13		P 3 50	11202				
14		P 4 25	15146				
15		P 5 10	15146				

Year of this Evaulation - E 61 62 [76]

OPEN FILE REPORT 76-31
PLATE 1

LOCATION OF AVAILABLE OR POTENTIAL LEAD-ZINC RESOURCES IN WASHINGTON

BY

JOHN M. LUCAS

1976

6 0 6 12 18 MILES

MAP KEY TO PROPERTIES DESCRIBED IN REPORT

1. Okanogan County-Adler mine
2. Pend Oreille County-Metaline District
3. Pend Oreille County-Pend Oreille mine
4. Stevens County-Brechtol mine
5. Stevens County-Calhoun (Anderson) mine
6. Stevens County-Deep Creek mine
7. Stevens County-Farmer mine
8. Stevens County-Gladstone Mountain
9. Stevens County-Iroquois mine
10. Stevens County-The Maki and Dosser prospects
11. Stevens County-North Clugston Creek area
12. Stevens County-The Phillips Ranch prospect
13. Stevens County-Shoemaker mine
14. Stevens County-Sierra Zinc mine
15. Stevens County-Van Stone mine
16. Stevens County-Young America mine

DOMINION OF CANADA

UNSURVEYED

OKANOGAN

FERRY

STEVENS

PEND OREILLE

CHELAN

DOUGLAS

LINCOLN

SPOKANE

REPUBLIC

KETTLE FALLS

OKANOGAN

NEWPORT

DEER PARK

SPOKANE

COLUMBIA RIVER

SNAKE RIVER

LAKE CHELAN