NATURAL RESOURCES

INACTIVE AND ABANDONED MINE LANDS— Deer Trail Mine, Cedar Canyon Mining District, Stevens County, Washington

by Fritz E. Wolff,
Donald T. McKay, Jr.,
and David K. Norman

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES
Information Circular 102
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Published in the United States of America

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INTRODUCTION

The Washington State Department of Natural Resources (DNR), Division of Geology and Earth Resources (DGER), is building a database and geographic information system (GIS) coverage of major mines in the state. Site characterization was initiated in 1999 (Norman, 2000). Work is funded through interagency grants from the U.S. Forest Service (USFS), Region 6. Other agencies sharing in the project are the U.S. Bureau of Land Management (BLM), the U.S. Environmental Protection Agency (EPA), and the Washington Department of Ecology (DOE).

More than 3800 mineral properties have been located in the state during the last 100 years (Huntting, 1956). Many are undeveloped prospects of little economic importance. Therefore, in considering the population to include in the Inactive and Abandoned Mine Lands (IAML) inventory, we have identified approximately 60 sites that meet one of the following criteria: (a) more than 2000 feet of underground development, (b) more than 10,000 tons of production, (c) location of a known mill site or smelter. This subset of sites includes only metal mines no longer in operation.

We have chosen to use the term *inactive* in the project's title in addition to the term *abandoned* because it more precisely describes the land-use situation regarding mining and avoids any political or legal implications of surrendering an interest to a property that may re-open with changes in economics, technology, or commodity importance.

The IAML database focuses on physical characteristics and hazards (openings, structures, materials, and waste) and water-related issues (acid mine drainage and/or metals transport). Accurate location, current ownership, and land status information are also included. Acquisition of this information is a critical first step in any systematic approach to determine if remedial or reclamation activities are warranted at a particular mine. Reports such as this one provide documentation on mines or groups of mines within specific mining districts or counties. The IAML database may be viewed by contacting Fritz Wolff (360-902-1468). IAML reports are posted online at http://www.dnr.wa.gov/geology/pubs/.

SUMMARY

The Deer Trail mine is located 6 miles east of Fruitland, Wash., in Stevens County. The original property consisted of 19 unpatented claims, one patented claim, and some deeded land occupying most of secs. 1 and 12, T29N R37E (Fig. 1). At present, the patented claim has reverted to the Bureau of Land Management (BLM). Two unpatented claims and 80 acres of deeded land are held privately by possessory title (BLM, written commun., 2005). DGER personnel performed field work at the site in September 2001 and May 2002. A partial overview of the property is shown in Figure 2. The property has produced some of the state's most concentrated silver mineralization. The total dollar value of all production to date, at historic metal prices, is approximately $5 million.

A series of small mines owned by individual operators characterized the site from its discovery in 1894 through 1923. The Cameron, Deer Trail, Elephant, Hoodoo,

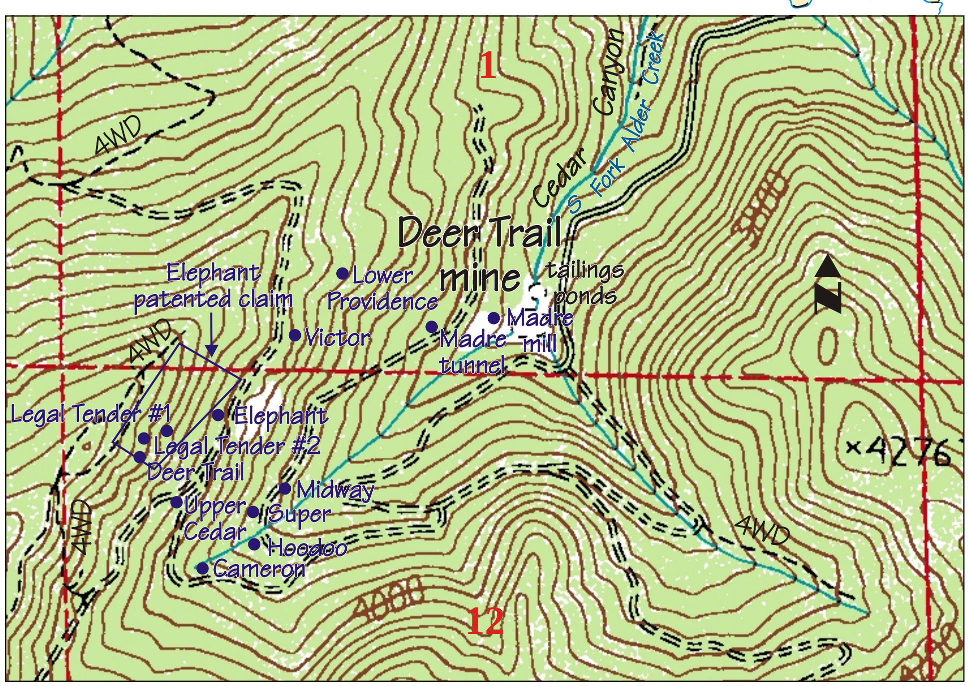

Figure 1. Map showing the location of the Deer Trail mine in Stevens County *(top)* and a more detailed map of the mine site *(bottom)*. Section lines (red) are 1 mile apart.

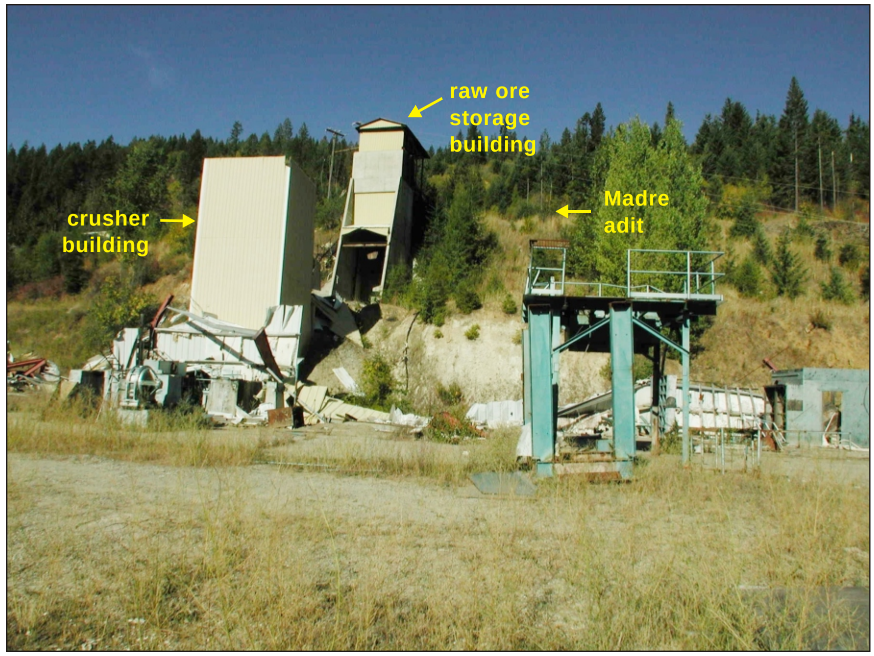

Figure 2. Partial overview of the mine site. The demolished mill with footings is in the center foreground. Legal Tender, Providence, Elephant, and Deer Trail openings are out of sight on the ridge line. View to the west.

Legal Tender, Madre, Midway, Super, Upper Cedar, Upper Providence, Venus, and Victor mines are located within a 280-acre area on the upper reaches of the Cedar Canyon/South Fork Alder Creek watershed (Fig. 3). Several attempts were made to consolidate the holdings under one owner. Venus Silver Mines, Inc., brought some or all of the disparate holdings under their umbrella between 1923 and 1930 (DGER mine file). McLennon C. Slate, doing business as Slate Construction Co., purchased the property in 1937 from a trusteeship and operated the mine until 1941 when it was closed by the mandate of government order L-208 affecting gold and silver producers. Slate remained the principal holder of the claims by possessory title until 1992, although the record indicates that some claims were sold or put in trust from 1957 through 1968. With the rapid increase in silver prices in 1980, Madre Mining Ltd., a Canadian corporation, leased the mineral rights from Slate to initiate the first full-scale mining operation since 1941. Madre drove a 9 by 12 foot haulage tunnel under the historic Providence and Hoodoo orebodies, constructed a modern flotation mill, mined approximately 7000 tons, and processed some pre-existing waste rock dumps that contained approximately 15 ounces silver per ton. Madre ceased operations in 1984 due to low silver prices and defaulted on the lease agreement.

Mining has taken place in at least two and possibly three narrow quartz fissure veins containing major silver mineralization. The earliest mining was confined to the supergene-enriched Elephant vein, which cropped out near the crest of Cedar Canyon's west ridge. It contained native silver and silver sulfides, oxides, and chlorides, with lesser amounts of copper oxides and minor amounts of residual lead and zinc minerals. Mining after 1930 focused on what appears to be a different vein or network of veins containing greater lead and zinc concentrations, in addition to a major assemblage of primary silver-sulfide and silver-antimony-sulfide minerals. The Edna Dolomite host rock is faulted parallel to and at right angles to bedding planes, offsetting the fissure veins into discrete fault blocks.

All the openings found by DGER personnel in 2001 and 2003 were caved. No hazardous materials or containers were found at the site. The mill erected by Madre was salvaged during a foreclosure action to satisfy liens in 1988. DGER sampled South Fork Alder Creek ¼-mile above and below the mine-affected area (see Table 6). Both samples exceeded the hardness-based standard for chronic effects of lead in surface waters set out in WAC 173-201A (Appendix B). The lead analyses do meet the standards for domestic consumption set out for ground water in WAC 246-290 (see Table 6). Analysis of these two samples for arsenic, cadmium, copper, zinc, silver, and mercury met the requirements for water quality within the limits of the quantitative method used. A sample taken from the one adit found to be discharging water met both WAC standards for the metals analyzed above. No acid mine drainage was encountered. The pH of South Alder Creek above and below the mine-affected area measured neutral to slightly basic. Although both tributaries of South Fork Alder Creek have been diverted around the tailings impoundments, erosion over the years has washed metal-laden sediments downstream. Stream sediment samples collected by Department of Ecology (DOE) in 2001 downstream from the tailings/mine area exceeded National Consensus-Based Guidelines for cadmium, copper, aluminum, silver, zinc, arsenic, and lead (Raforth and others, 2002).

Two mills were eventually built to concentrate Deer Trail ores. The circa-1923 Venus Silver mill utilized flotation and cyanide technology. It operated during Slate's mining operations from 1937 to 1941 and again in 1955 to concentrate copper ore from the nearby Turk mine. Madre dismantled this structure and erected a modern 150-tpd mill on the same site in 1981. Tailings from the first mill discharged onto the floor of Cedar Canyon. Madre excavated material from the early tailings with a dragline to construct berms around two impoundments on the same land as used previously.

Physical hazards include collapsing sheet metal and concrete block buildings constructed by Madre, and all the former tunnel portals, some of which are partly accessible.

OWNERSHIP

M. Inman of Hunters, Wash., owns E½SE¼SW¼ and W½SW¼SE¼ sec. 1, T29N R37E, in fee simple, which includes the former mill sites, tailings ponds, Madre tunnel site, and most of the Providence mine area (Stevens Co. Assessor, written commun., 2006). Mr. Inman also holds possessory title to two unpatented lode claims, Elephant 1 and 2, which include portions of the Legal Tender, Deer Trail, and Hoodoo mine adits and waste dumps in sec. 12 (BLM, land records database, 2006). The Elephant patented claim shown in Figure 1 has reverted to BLM ownership, as has most of the property surrounding the mine area.

HISTORY

Four distinct periods of active exploration or mine production can be documented: 1894 through 1920, 1923 through 1941, 1945 through 1956, and 1980 through 1984.

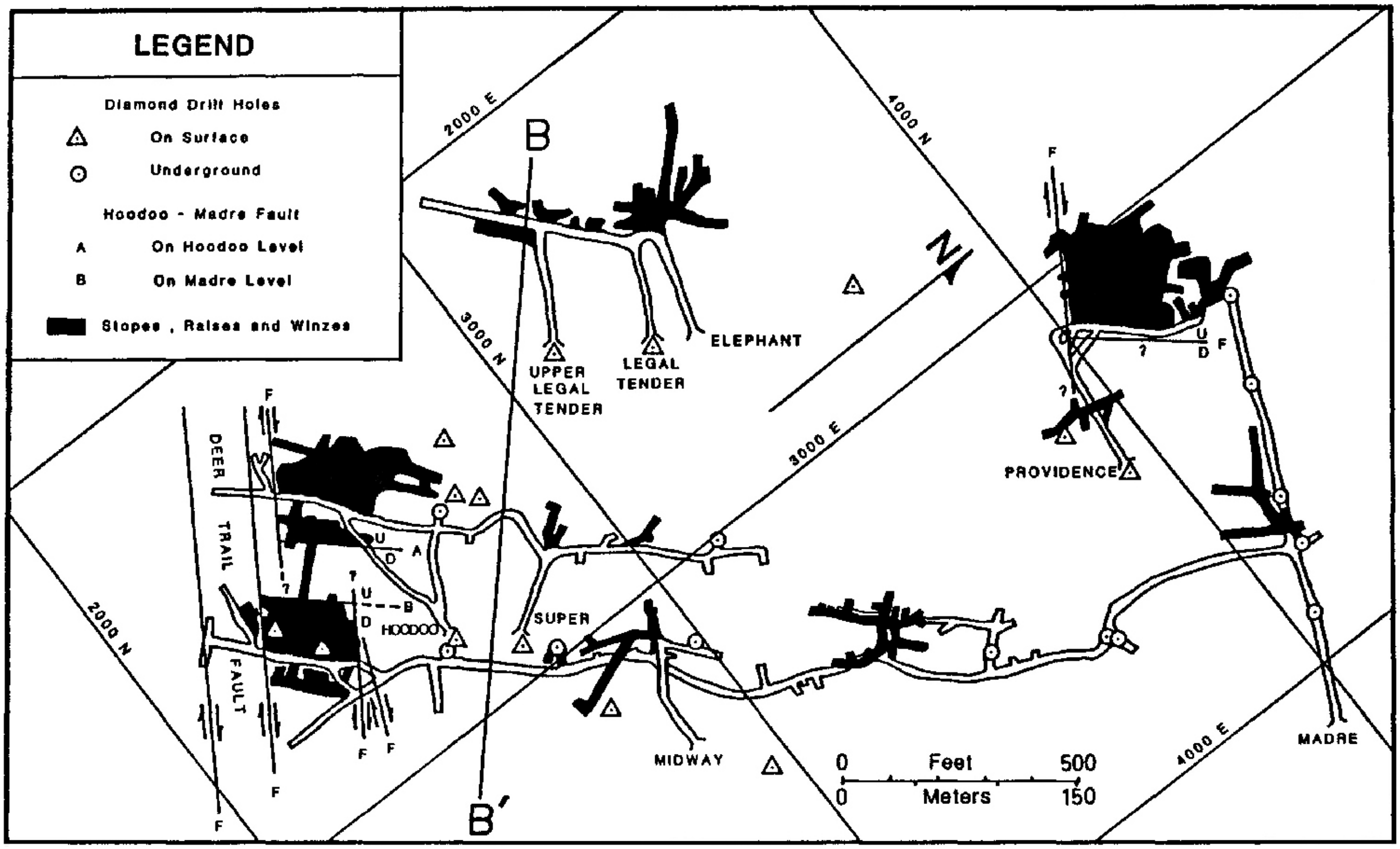

Figure 3. Plan view of principal mines in the Deer Trail group, showing connecting haulage way from the Madre tunnel to Hoodoo workings (after Fluet, 1986).

Two local farmers Mr. Van Horn and Mr. Detillion discovered the original outcrop on the west ridge of Cedar Canyon while deer hunting in the winter of 1894. The following spring, an exploratory tunnel driven beneath the outcrop encountered a fissure called the Elephant vein, which contained native silver nodules the size of buckshot in addition to silver chloride and various silver sulfide minerals. Slate (1972) reported seeing a smelter return from a shipment of this material that assayed 5985 ounces per ton silver. Nineteen claims were soon staked adjacent to and below the original strike. The early mining and sorting was done by hand, resulting in small shipments of sacked high grade ore hauled by horse team to the Spokane Falls and Northern Railroad at Springdale, 45 miles away, and finally to the Trail, B.C., smelter. The principal named mines in this early period are the Deer Trail, Providence, and Legal Tender, insofar as they registered as corporations with the Secretary of State (Appendix C). The Victor, Cameron, and Hoodoo were also prominent operations, but no companies or corporations bearing those titles have been found in state archives. Approximately 17 different waste rock dumps are located to the north, south, and east of the original discovery (DGER mine file). General practice in this early period was to only ship ore running greater than 80 ounces silver per ton, due to the high cost of hand mining, sacking, and hauling. Lower grade ore was left in the stopes for ground support (Thurmond, 1929). Smelter returns prior to 1910 averaged 300 ounces silver per ton and 8 percent lead (Moen, 1976). Weaver (1920) reported the majority of this early mining development was caved and inaccessible at the time of his examination in 1917.

The years 1920 through 1941 saw two periods of active mining and a consolidation of the property. Jenkins (1924) reported that Venus Silver Mines Co., Inc., combined and took control of the disparate claims in 1923. The property was known thereafter as the Deer Trail mine. Venus Silver constructed a mill at the 3550-foot elevation in sec. 1 near the floor of Cedar Canyon, and a 1680-foot gravity tramline with headworks in the approximate center of sec. 12. Venus Silver was delisted from the Secretary of State in 1929 for nonpayment of fees. The record is confused regarding ownership of the Deer Trail immediately following 1929. A report written by consulting engineer F. Leroi Thurmond (1929) indicates that the Mining Corporation of America, Inc. (MCA) purchased all the Venus Silver holdings, probably around 1928, and placed the mine on the real estate market. Ownership of the property in the following 7 years is unclear. In 1937, A. W. Tyler and George Vervaeke of Bossburg, Wash., acting as trustees, held possessory title to the property and leased it to the Metals Development Co. of Spokane (DGER mine file). Mr. Vervaeke cancelled the lease and litigation followed. The trusteeship dissolved after a creditor to Metals Development, McLennon C. Slate (doing business as Slate Construction Co. of Albany, Ore.), bought the owner's interests and recovered his investment through mine production (Slate, 1972). Slate operated the mine and the Venus Silver mill until 1941, at which time federal government order L-208 shut down all industries viewed as nonessential to the World War II war effort. Gold and silver mining were, with a few exceptions, affected by this order.

In the years immediately following 1945, Slate appears to have maintained possessory title through assessment work on most of the property. Some claims may have been sold, leased, or placed in trust agreements. Alpine Uranium Corporation of Salt Lake City leased the Deer Trail mill to process copper-bearing waste rock from the Togo mine located 2 miles to the north (*Wallace Miner,* Sept. 9, 1954). The article stated that Alpine "... acquired a 25% interest in the two properties under an assignment from Triumph Uranium and Oil Co., Inc. which is purchasing title to the Deer Trail and Turk mines from Three Peaks Corporation." Alpine shipped copper concentrates from the Deer Trail mill to the Tacoma smelter in 1955. A year later, Intermountain Petro-Mining Ltd. of Calgary, Alberta, is reported to have purchased the "Turk and Deer Trail mines" (*Wallace Miner*, July 5, 1956). Slate (1972) reported that the mill had been "leased in the past to a Canadian firm to mill copper [but] the mill itself was used up and wrecked, so that now we have purchased another mill of about 300 tons capacity that is stored in our shops near Tangent, Oregon . . . preparing for an early start [in] spring 1973."

Slate obtained a quitclaim deed from Lead Trust Mines, Inc., in October 1968 for specific lands in secs. 1 and 12, and from Three Peaks Corporation in 1969 for land in sec. 1. An Order of Default for Quiet Title to all claims was entered in favor of Slate in Stevens County Superior Court in May 1970, and a similar decree was entered in 1978 for the same purpose in *Slate vs. Intermountain Petro-Mining Ltd.* (Mack M. Slate, written commun., 2006).

Madre Mining Ltd. of Calgary, Alberta, leased the mineral rights from Slate in November 1980 and launched a full-scale mining, milling, and exploration operation until silver prices fell in 1984. In the fall of 1981, Madre constructed an office/dry house, shop, and 150-tpd flotation mill and drove a 9 by 12 foot westerly beneath the former Providence orebody and then south 2000 feet to stopes in the Hoodoo mine (*Wallace Miner,* March 18, 1982). This mill was adjacent to the tunnel portal on the same site as the Venus Silver mill, which was demolished. The Madre mill came on line in February 1982 and processed some waste rock averaging 15 ounces per ton silver left by former operations. Estimates placed the combined waste rock dumps at 51,000 tons (DGER mine file), but it is unclear how much of this material was actually milled. Figure 3 shows the relationship between the Madre tunnel, mill, and Hoodoo and Providence mines. Four-hundred feet from the portal, the Madre tunnel intersected a silver-bearing fissure vein bearing S40°W. Output from this structure began in October 1983 at the rate of 150 tons per day, grading 20 ounces silver per ton (*Western Mining Letter,* October 1983). Madre encountered a complex structural condition due to faulting that necessitated an on-going diamond drilling program underground to support development work and keep ore reserves ahead of the mining plan.

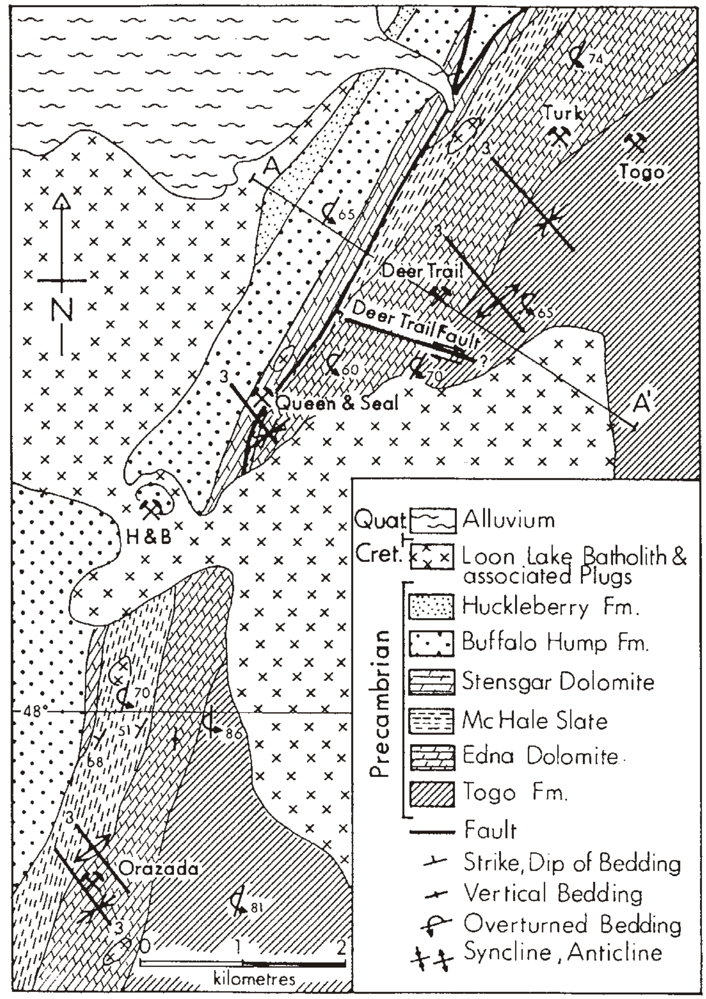

Figure 4. General geology of the Deer Trail mine area (after Fluet, 1987).

When Madre leased the mine in 1980, the average price of silver was $21 per ounce with a high of $40. The average price in 1981 was $10.52. By 1984, the price of silver hit a low of $6 per ounce and Madre suspended operations. Their corporate registration with the Secretary of State's office was revoked in September 1985 for nonpayment of fees. An article in the *Spokane Journal of Business* (Aug. 4, 1988) reported that Madre's auditors had ordered the sale of assets in a liquidation sale, local suppliers had placed liens on the company's bank account in Colville, and Madre "... had changed its name to Cortez International, Ltd. and acquired Ram Industries, Inc., an oil and gas company based in Dallas". Litigation followed in October 1988 with a Default Judgment entered against Cortez International, Ltd., in favor of McLennon C. Slate, Inc., a family-owned corporation registered in Oregon in 1982 (DGER mine file).

Moen (1976) estimated the gross income from all Deer Trail operations between 1894 and 1947 to be $3 million at prevailing silver prices ranging from $0.21 to $1.12 per ounce. Most of the production occurred prior to 1920. Madre recovered about $1 million from milling an unknown tonnage of waste rock dumps and reported making 30-ton concentrate shipments from newly mined ore every 4 days in November 1983. These shipments averaged 185 ounces per ton silver and 27 percent lead and 25 per-

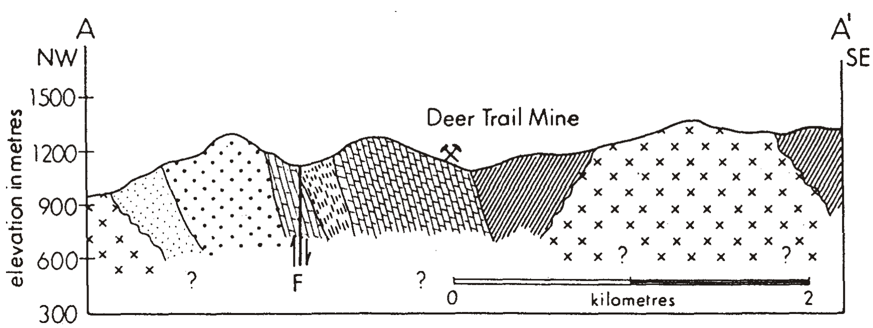

Figure 5. Geological cross section through the Deer Trail mine area (after Fluet, 1987).

cent zinc (DGER mine file). Fluet (1987) stated that the total value produced by Madre, including newly mined ore, was "almost two million dollars worth of Zn, Pb, and Ag concentrate . . . ."

GEOLOGIC SETTING

The host lithology of the Deer Trail mineralization is the Proterozoic Edna Dolomite. This unit is a member of the Belt series metasediments that include interbedded slate, argillite, limestone, dolomite, and quartzite. The Edna Dolomite within the mine is pervasive and generally a dark grey to black silty dolostone containing stringers of green-brown quartzite up to 12 feet thick. The entire Cedar Canyon mining district is underlain and surrounded by the Loon Lake batholith of Cretaceous age, which all investigators have concluded is the source material for the ore deposits. The metasediments have been overturned and folded but have a consistent strike of N40°E (Figs. 4 and 5). Scattered granitic plugs, dikes, and sills have locally metamorphosed the Edna Dolomite. These intrusions are often surrounded by an aureole of hornfels or marble. Dolomite adjacent to the veins has been hydrothermally altered to a calc-silicate-rich material varying in width from 3 to 9 feet (Fluet, 1987).

Fluet's interpretation of the mine's geology is probably the most comprehensive work available, since it was done when Madre's openings were intact and access to diamond-drill data was available. This work identified three quartz-sulfide fissure veins lying parallel to the bedding and to each other:

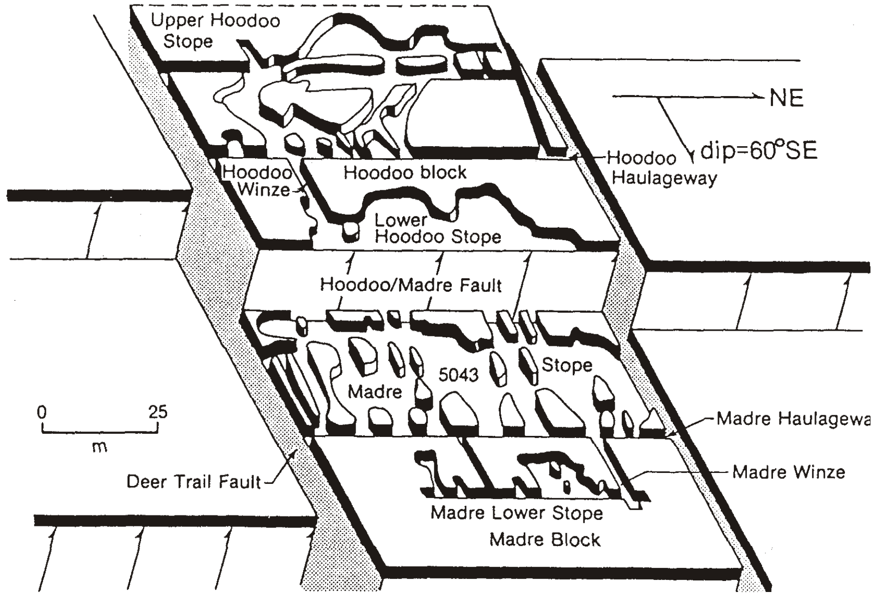

Figure 6. Fault displacement of the Madre-Hoodoo vein (after Fluet, 1987).

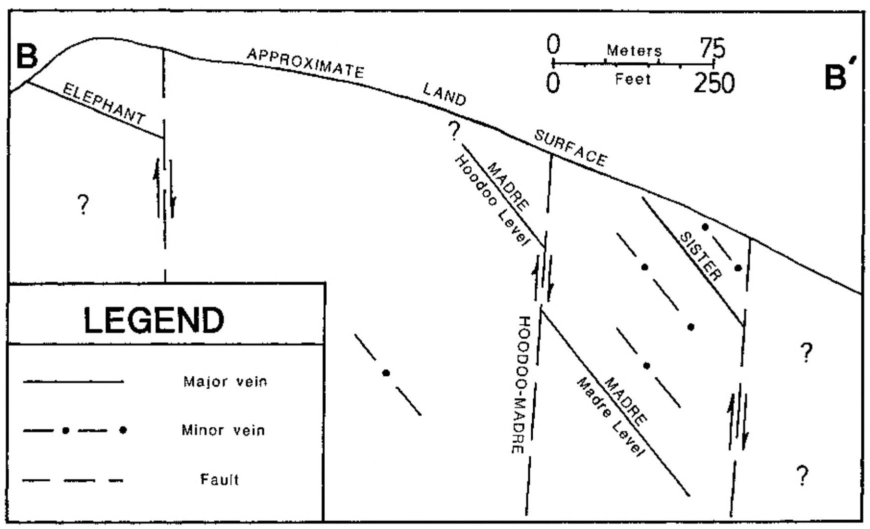

Figure 7. Cross section along line B–B′ in Figure 3 showing major faults and veins (after Fluet,1986).

- The Elephant vein, mined prior to 1920, was comparatively flat with a dip of 15–30°SE. It varied in width from 1 foot to 7 feet, carrying pods or stringers enriched by near-surface oxidation and subsequent precipitation during water table fluctuations. It contained native silver, argentite *var*. acanthite, chlorargyrite, pyrargyrite, partially oxidized copper sulfides, cerrusite, and residual, partially oxidized galena and sphalerite. Moen (1976) calculated the average silver content of the Elephant vein–type ore from the Legal Tender and Providence mines as 216 and 143 ounces silver per ton, respectively.

- The Madre vein dipped 60°SE and varied in width from 6 inches to 6 feet, with an approximate overall average of 2 feet. It was mined along a total strike length of about 225 feet and down dip a distance of 150 feet between the northernmost Hoodoo stopes and the Madre tunnel (Fig. 6). Fluet reported, "Its average silver grade is 10 - 20 ounces per ton, and may reach 200/300 ounces per ton in rich pods and shoots." In the Madre vein, supergene-enriched silver, lead, and zinc mineralization are noticeably absent, having been replaced by primary sphalerite and galena. Sphalerite was the most prominent sulfide in the Madre vein's discontinuous ore shoots, constituting up to 60 percent of the vein material. Galena, at up to 30 percent of the vein fill in these areas, was the second most common sulfide. The silver minerals freibergite, polybasite, acanthite, and stephanite made up most of the remaining 10 percent. Fluet (1987) identified these minerals by electron microprobe. Flecks of native silver, copper, and gold were observed.

- The Sister vein was discovered by Madre in the last stages of mine exploration. It may be an altogether separate fissure, or it may be a segment of the Madre vein displaced upward by a near-vertical normal fault (Fig. 7). It was intersected by two diamond drill holes, where "grades of 36.7 ounces/ton and 4.2 ounces/ton over one foot were recorded by Madre Mining records" (Fluet, 1987).

Examination of the early excavations on the west side of Cedar Canyon indicates that mine development commonly stopped abruptly at faults in a transverse direction perpendicular to strike or vertically along strike. This suggests that the faulting is post-ore and raises the question of whether the historic operations mined discrete fault blocks carrying the same vein, a network of veins, or some combination thereof.

Two major faults are present within the mined area. The first is a steeply dipping normal fault striking roughly parallel to the

Figure 8. Exposed drift sets of the Madre tunnel. View to the east away from the adit.

bedding at N40°E identified by Fluet as the Hoodoo-Madre fault. It displaced the Madre vein 60 feet vertically (Fig. 6). This fault is offset at right angles in at least two places by vertical strike-slip faults with right lateral displacement, one of which was recognized early on and named the Deer Trail fault (Figs. 3 and 6). Fluet mapped it as a shear zone approximately 130 feet wide extending across Cedar Canyon to the east and into the Togo Formation. The displacement along strike was not determined, but it may be considerable as the Queen Seal mine 1 mile west of the Deer Trail contained identical mineralization and high-grade silver values up to 240 ounces silver per ton (Moen, 1976).

Anecdotal evidence points to the existence of a silver-bearing fissure vein on the east slope of Cedar Canyon opposite the developed west slope. Slate (1972) stated, “Three rich pieces of ore have been found near the bottom of the slope on the east side. One of these was found directly across the gulch from the Hoodoo tunnel portal and about 50 feet up slope. This [piece] assayed 1100 ounces of silver per ton. It had the appearance of Elephant [vein] type ore and we do not think it would have rolled uphill, so we deduct that the main stem of the Elephant vein is somewhere in the east slope of the canyon.” Thurmond (1929) reported, “On the east side of the canyon in which our plant is located, there is known to be a lead and silver vein running parallel with the Deer Trail vein. Our company has done no exploratory work whatever on this vein up to the present time.”

OPENINGS

All the openings found by DGER personnel in 2003 were caved at the portal, including the Madre tunnel located just above the mill site. Top lagging on the drift sets penetrating the surface alluvium have fallen through, leaving a hazardous condition (Fig. 8). Figure 9 is typical of the condition of pre-1980 adits. BLM installed steel culverts with bat gates in some of these openings in 2005 (M. Sweeney, BLM, oral commun., 2006).

MATERIALS AND STRUCTURES

No hazardous materials or containers were found at the site. The mill erected by Madre was dismantled during the 1988 foreclosure action (Fig. 10). The reinforced concrete crusher building is still intact, but the jaw and cone crushers have been removed. The dry house/office has been vandalized, resulting in structural collapse. It is unsafe (Fig. 11). There are two large-diameter recycled tanks on the property, one of which is a 15,000-gallon rail car that supplied water to the mill (Fig. 12).

Figure 9. Deer Trail #2 adit showing typical condition of pre-1920 openings.

WATER

At some undocumented time in the past, both tributaries of South Fork Alder Creek flowing through Cedar Canyon were diverted into a channel bypassing the tailings impoundments. Since the cessation of Madre’s activities in 1984, beavers have constructed a dam at a point where the diversion channel reenters the canyon floor (Fig. 13). Meltwater and rain collects temporarily on the surface of the tailings before evaporating or infiltrating (Fig. 14). DGER sampled South Fork Alder Creek ¼-mile above and below the mine-affected area. Both samples exceeded the hardness-based standard for chronic effects of lead in surface waters set out in WAC 173-201A (Appendix B). The lead analyses do meet the standards for domestic consumption set out for ground water in WAC 246-290 (see Table 6). Analysis of these samples for arsenic, cadmium, copper, zinc, silver, and mercury met the requirements for water quality within the limits of the quantitative method used. A sample taken from the one adit found to be discharging water met both WAC standards for the metals analyzed above. No evidence of acid mine drainage was found. Stream sediment samples were collected by DOE in 2001 at points downstream and upstream from the tailings/mine area. The downstream sample taken below the beaver dam shown in Figure 13 was from a bright orange seep that analyzed 3.1 percent iron. Analyses in this sample exceeded National Consensus-Based Guidelines for cadmium, copper, aluminum, silver, zinc, arsenic and lead (Raforth and others, 2002).

DGER personnel took a benthic macroinvertebrate sample in the stream immediately below the beaver dam. Two taxa were found: a cranefly and a segmented worm indicative of "lesser water quality" (M. Hayes, DNR, written commun., 2003).

MILLING OPERATIONS

Two mills were eventually built to concentrate Deer Trail ore. The first, constructed by Venus Silver in the 1920s, is described in Thurmond's 1929 report. "The mill buildings, power house and ore bins . . . have been built. The mill [is] designed to use [both] the flotation and cyanide processes because of the oxidized condition of the ores in the upper levels and on the dumps." Historic photos in the report indicate that tailings from this mill discharged directly to the floor of Cedar Canyon. The mill was located on the same site as Madre's mill (Figs. 1 and 2). It operated during Slate's mining operations from 1939 to 1941 and again in 1955 to concentrate copper ore from the nearby Turk mine. Madre tore down the old mill building, reclaimed some equipment and erected a modern flotation plant of 150-tpd capacity (Fig. 15). This mill processed some pre-1920 waste rock dumps and newly mined ore until 1984. Madre milled an unknown portion of the estimated 51,000 tons of historic waste rock dumps during start-up operations—70,000 ounces of silver were recovered (*Western Mining Letter*, Oct. 24, 1983). Concentrates averaging 185 ounces silver per ton, 27 percent zinc, and 21 percent lead (Fig. 16) were shipped to the Cominco, Ltd., smelter in Trail, B.C. The Madre mill was dismantled during a foreclosure sale to satisfy liens against the company in 1988.

Figure 10. Remains of Madre mill site after 1988 salvage operation.

Figure 11. Madre's circa-1981 dry house/office building. View to the north.

Figure 12. 15,000 gallon water storage tank. Rock tipple at far right. View to the east.

WASTE ROCK DUMPS AND TAILINGS

Metasediment waste rock, predominantly dolomite generated by Madre's development work, is located in an 80-foot-high embankment adjacent to and north of the Madre tunnel (Fig. 17). Its volume is in excess of 40,000 cubic yards. The tailings impoundments are shown in Figure 18. The combined volume is estimated to be in the range of 20,000 to 30,000 cubic yards, depending on pre-milling topography. A soil sample taken 6 inches beneath the surface of the upper impoundment was analyzed for arsenic, cadmium, copper, lead, and zinc and compared to the Model Toxics Control Act (MTCA) levels for priority contaminants of concern. The zinc analysis exceeded the standard for unrestricted land use, but did not exceed the standard for industrial or commercial use (see Tables 3 and 4). The impoundment berms contain rock aggregate in addition to tailing sand and appear stable (Figs. 13 and 14).

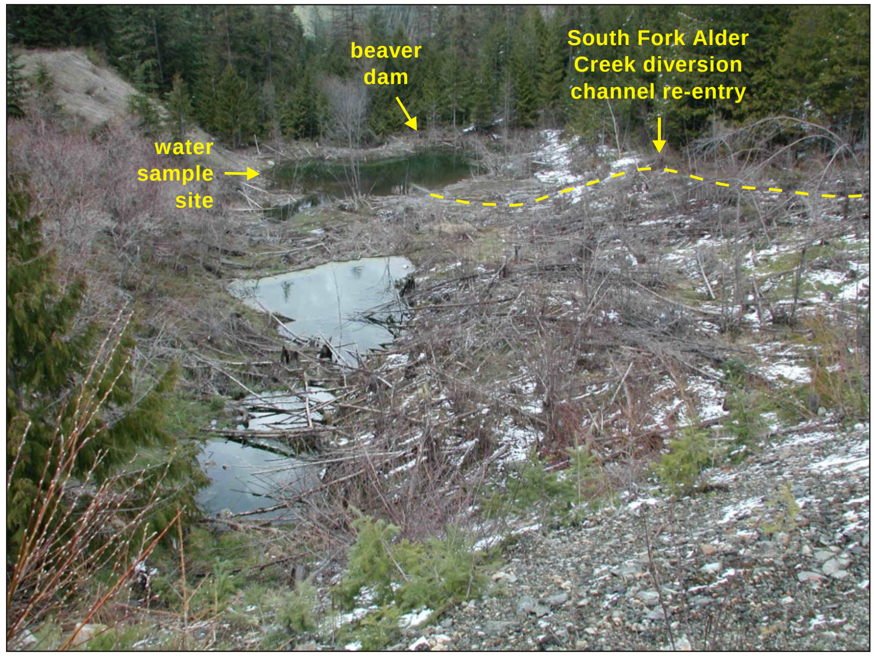

Figure 13. Downstream view of South Fork Alder Creek from crest of lower tailings impoundment. Diversion channel enters lower pond above beaver dam. Note rock aggregate on surface of berm, lower right corner. View to the north.

GENERAL INFORMATION

Names: Cameron, Deer Trail, Elephant, Hoodoo, Legal Tender, Madre, Midway, Super, Upper Cedar, Upper Providence, Venus, and Victor

MAS/MILS sequence number: 0530650341

Access: 4-wheel drive

Status of mining activity: none

Claim status: two unpatented claims—Elephant #1 and #2

Current ownership: M. Inman, A. Ross by possessory title

Surrounding land status: mixed BLM and private

Table 1. Location and map information.

Mine property	County	Location	Decimal latitude	Decimal longitude	1:24,000 quad.	1:100,000 quad.
Deer Trail	Stevens	secs. 1 and 12, T29N R37E	48.03551	118.09759	Adams Mt.	Nespelem

Table 2. Mine features. – – –, no data; *, name approximate from DGER map files.

Description	Condition	Fenced (yes/no)	Length along bearing (feet)	Width (feet)	Height/ depth (feet)	True bearing	Elev. (feet)	Decimal latitude	Decimal longitude
Madre mill and office	office/dry house collapsing steel building, mill dismantled	no	– – –	– – –	– – –	N/A	3600	48.03566	118.09547
Madre tunnel adit	caved/collapsing alluvium, exposed drift timbers	no	900	9	12	N55°W	3620	48.03552	118.0971
adit (Lower Providence)	caved	no	500	5	7	N85°W	3960	48.03637	118.09924
adit (Victor)	caved	no	– – –	5	7	N70°W	3980	48.03542	118.1006
adit (Elephant)	caved	no	400	5	7	N70°W	4100	48.03393	118.10372
adit (Legal Tender #1)	caved	no	300	5	7	N65°W	4100	48.03368	118.10376
adit (Deer Trail)*	caved	no	300	5	7	N65°W	4100	48.03321	118.10442
adit (Legal Tender #2)*	caved	no	– – –	5	7	N65°W	4100	48.03349	118.10431
adit (Upper Cedar)	caved	no	– – –	5	7	N65°W	4025	48.03246	118.10422
adit (Cameron)*	caved	no	100	5	7	N80°W	3940	48.03136	118.10381
adit (Midway)*	caved	no	250	5	7	N60°W	3760	48.03271	118.10079
adit (Hoodoo)	caved	no	500	5	7	S45°W	3840	48.0317	118.10153
adit (Super)	caved	no	250	5	7	N70°W	3825	48.0323	118.10127

Location and map information: Table 1

Directions: From Fruitland on SR25, take paved “Valley Road” east to the settlement of Turk, a distance of approximately 5 miles. From Turk, follow a dirt road about 3 miles east and then south along South Fork Alder Creek to the Deer Trail mine. The mine lies on the west side of Cedar Canyon at elevation 3600 to 4000 feet.

Table 3. Soil Analysis. Metal concentrations are mg/kg; analyses in bold indicate levels which exceed one or more standard shown in Table 4.

Sample Location	Arsenic	Cadmium	Copper	Lead	Zinc
Madre tailings	8.9	2.7	26.8	127	**323**

Table 4. Soil quality standards for unrestricted land use. WAC 173-340-900, Model Toxics Control Act, Table 749-2: Priority contaminants of ecological concern for sites that qualify for the simplified terrestrial ecological evaluation procedure (partial data). Concentrations are mg/kg. Levels for gold and iron are not specified.

Metals	Arsenic III	Cadmium	Copper	Lead	Zinc
unrestricted land use	20	25	100	220	270
industrial or commercial use	20	36	550	220	570

MINE OPERATIONS DATA

Type of mine: underground

Commodities mined: silver, minor values in copper, lead, and zinc

Geologic setting: quartz fissure veins in metasediments

Ore minerals: sphalerite, ZnS; galena, PbS; freibergite, $(Ag,Cu)_{12}(Sb,As)_4S_{13}$; polybasite, $(Ag,Cu)_{16}Sb_2S_{11}$; stephanite, Ag_5SbS_4; acanthite (argentite), Ag_2S; chalcopyrite, $CuFeS_2$; native Ag and Cu (Fluet, 1987); cerargyrite, AgCl; pyrargyrite, Ag_3SbS_3; cerussite, $PbCO_3$; tetrahedrite, $(Cu, Fe)_{12}Sb_4S_{13}$; malachite and azurite, $Cu_x(CO_3)_y(OH)_z$ (Moen, 1976)

Non-ore minerals: quartz, calcite, pyrite, adularia

Host rock: dolomite

Periods of production: 1894–1920, 1923–1941, 1945–1956, 1980–1984

Development: 10,000 feet of stopes, raises and drifts; 9000 feet of diamond drilling (DGER mine file)

Production: estimated $5 million (Moen, 1976)

Table 5. Surface water field data.

Description	Flow (gpm)	Conductivity (S/cm)	pH	Bed color	Temp. (°F)
South Fork Alder Creek above mine affected area	750	83	8	natural	45
South Fork Alder Creek at beaver dam below mine affected area	700	160	8	natural with algae	45
open adit, water infiltrates within 50 feet	5	325	7.5	natural	45

Mill data: Venus Silver mill, circa-1920s, flotation and cyanidation; Madre mill, 1980, 150-tpd flotation

PHYSICAL ATTRIBUTES

Features: Table 2

Materials: no hazardous materials

Machinery: scrap metal

Table 6. Surface water analysis. Metal concentrations are in micrograms/liter (g/L); hardness is in milligrams/liter (mg/L); USEPA, U.S. Environmental Protection Agency; – – –, no data; **, standards for these metals are hardness dependent; indicates metal was not detected—the number following is the practical quantitation limit above which results are accurate for the particular analysis method—the metal could be present in any concentration up to that limit and not be detected. Conversion formulae are shown in http://www.ecy.wa.gov/pubs/wac173201a.pdf. Standards calculated for hardness values specific to Part 1 below are shown in Appendix B.

PART 1: ANALYSIS BY USEPA METHOD 6010, INDUCTIVELY COUPLED PLASMA

Sample location	Arsenic	Cadmium**	Copper**	Iron	Lead**	Mercury	Zinc**	Hardness
South Fork Alder Creek above mine-affected area	≤10	5	≤10	2580	3.6	≤0.2	15.8	71
South Fork Alder Creek below mine-affected area	≤10	5	≤10	503	4.2	≤0.2	14.0	150
open adit	≤10	5	≤10	≤100	2.1	≤0.2	≤10	150

PART 2: APPLICABLE WASHINGTON STATE WATER QUALITY STANDARDS

Type of standards (applicable Washington Administrative Code)	Arsenic	Cadmium	Copper	Iron	Lead	Mercury	Zinc	Hardness
Surface water standards (WAC 173-201A, Standard for aquatic life in surface freshwater, chronic level maximums at 100 mg/L hardness)	190	**	**	none	**	0.012	**	100
Ground water standards (WAC 246-290, Washington State Department of Health, standards for ground water, domestic consumption)	50.0	none	1300	300 (cosmetic only)	15	2.0	5000	– – –

Structures: structural steel building, partly demolished, with sheet metal siding and roofing; steel crusher building, foundations.

Waste rock dumps, tailings impoundments, highwalls, or pit walls: tailings and ten-plus waste rock dumps

Analysis of waste rock dumps: none

Waste rock, tailings, or dumps in excess of 500 cubic yards: more than ten

Reclamation activity: none

Analysis of tailings and dumps: Tables 3 and 4

VEGETATION

Moderate to heavy forestation of fir, larch, inland cedar, red alder, shrubs; grass reestablishing on tailings.

WILDLIFE

Elk, deer, bear, beaver, pika (*Ochotona princeps*), and beaver (*Castor canadensis*). BLM reported bats present in many Deer Trail openings (M. Sweeney, BLM, oral commun., 2006).

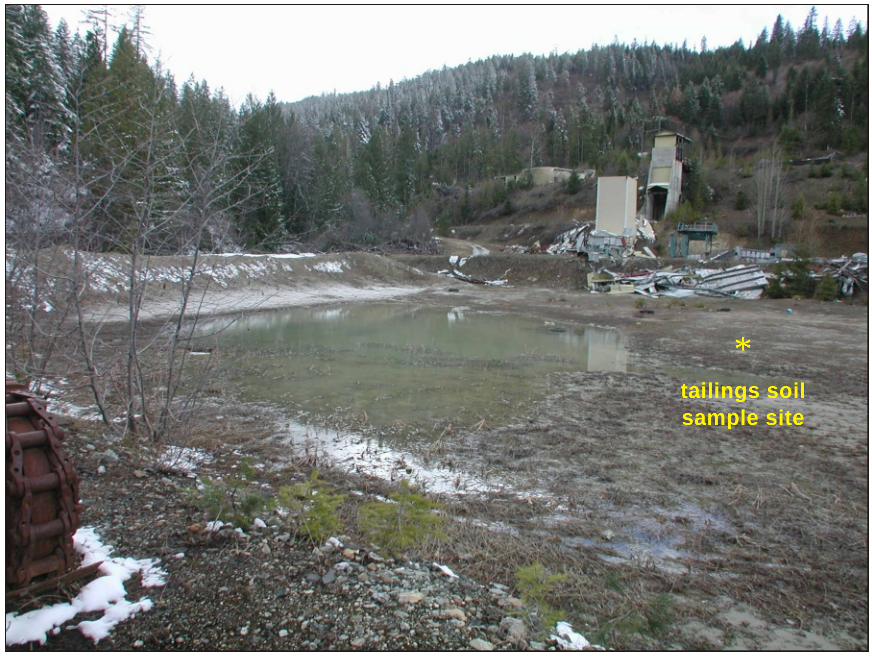

Figure 14. Upper tailings impoundment. Snowmelt water on surface. View to the southwest.

Figure 15. Madre mill site during construction circa-1981. Note dragline constructing berms for new tailings impoundment from surface alluvium and Venus Silver mill tailings. View to the southwest. (After Madre Mining Ltd., 1981.)

WATER QUALITY

Surface waters observed: South Fork Alder Creek

Proximity to surface waters: adjacent

Domestic use: none

Acid mine drainage or staining: none

Surface water field data: Tables 5 and 6

Surface water migration: none

ACKNOWLEDGMENTS

The authors thank our editors Jari Roloff and Karen Meyers for helpful suggestions on the layout and content of this report. We are indebted to Mack M. and Estalin Slate for providing invaluable information on the history of the Deer Trail mine from the estate of McLennon C. Slate.

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Figure 16. Madre silver-lead-zinc concentrate ready for shipment to the Cominco smelter at Trail, B.C., October 1983. Brownish cast of concentrate is due to high sphalerite content. (Photo courtesy of Mack M. Slate.)

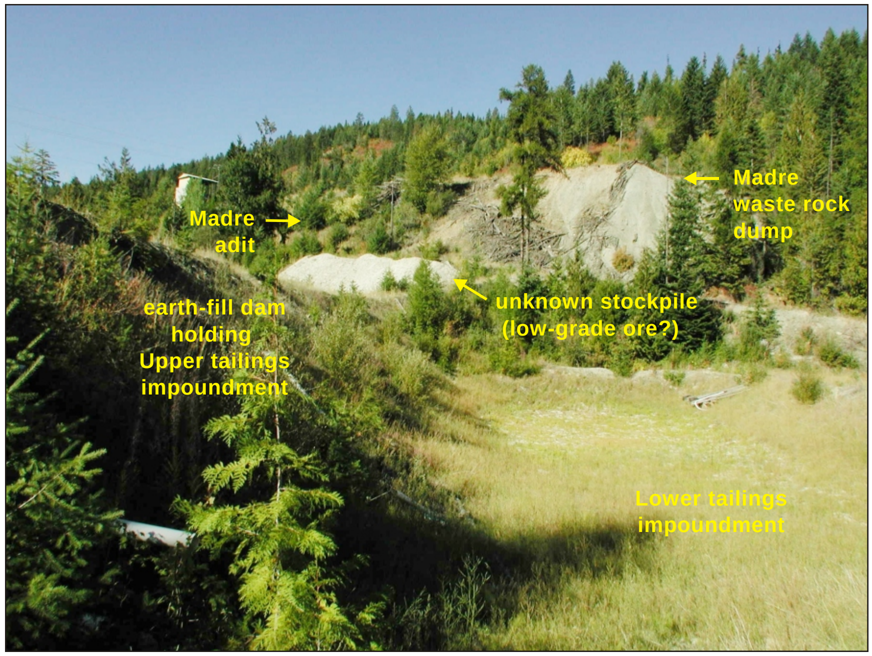

Figure 17. Overall view of Madre waste rock dump. View to the southwest.

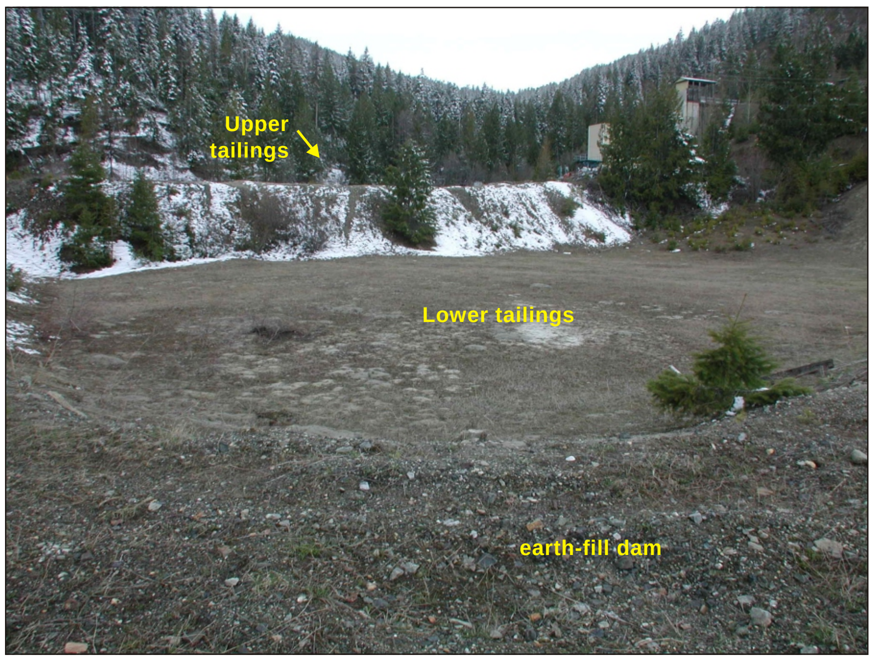

Figure 18. Upper and Lower tailings impoundments. View to the south.

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Appendix A. Methods and field equipment

METHODS

We recorded observations and measurements in the field. Longitude and latitude were recorded with a global positioning system (GPS) unit in NAD83 decimal degree format. Literature research provided data on underground development, which was verified in the field when possible.

Soil samples from dumps or tailings were taken from subsurface material and double bagged in polyethylene. Chain of custody was maintained.

Soil samples were analyzed for the metals listed in this report by inductively coupled plasma/mass spectrometry (ICP/MS) following USEPA (U.S. Environmental Protection Agency) Method 6010. Holding times for the metals of interest were observed.

Instrument calibration was performed before each analytical run and checked by standards and blanks. Matrix spike and matrix spike duplicates were performed with each set.

FIELD EQUIPMENT

barometric altimeter
binoculars
digital camera
flashlight
Garmin GPS III+, handheld GPS unit
Hanna Instruments DiST WP-3 digital conductivity meter
 and calibration solution
litmus paper, range 0–14, and 4–7
Oakton digital pH meter
Oakton digital electrical conductivity meter
Taylor model 9841 digital thermometer

Appendix B. Water quality standards for hardness dependent metals

Conversion formulae are given in WAC 173-201A at http://www.ecy.wa.gov/pubs/wac173201a.pdf.
Chronic standard in micrograms/liter (μg/L)

Sample location	**Hardness (mg/L)**	**Cd (μg/L)**	**Cu (μg/L)**	**Pb (μg/L)**	**Zn (μg/L)**
South Fork Alder Creek above mine-affected area	71	0.8	8.47	1.72	78
South Fork Alder Creek below mine-affected area	150	1.4	16.05	3.90	147
open adit	150	1.4	16.05	3.90	147

Appendix C. Mining companies associated with the Deer Trail mine

Company	Registered corporation in Washington?	Date registered with Sec. of State	Date stricken	Comment	Place of business
Deer Trail Mining Co.	yes	June, 1896	July, 1923	nonpayment of fees	Davenport, Wash.
Deer Trail No. 2 Mining Co.	yes	March, 1897	July, 1923	nonpayment of fees	Spokane, Wash.
Legal Tender Mining Co.	yes	January, 1899	August, 1907	nonpayment of fees	Wilbur, Wash.
Deer Trail Consolidated Mining Co., Ltd.	yes	March, 1900	July, 1923	nonpayment of fees	Ontario, Canada
Legal Tender Mining Co.	yes	March, 1902	August, 1909	nonpayment of fees	Spokane, Wash.
Providence Consolidated Gold Mining Co., Ltd.	yes	September, 1902	July, 1923	nonpayment of fees	Spokane, Wash.
Deer Trail Mining and Development Co.	yes	July, 1915	July, 1918	nonpayment of fees	Spokane, Wash.
Providence Gold Mining and Milling Co.	yes	January, 1917	July, 1923	fees paid 1917, 1918	Northport, Wash.
Venus Silver Mines Co.	yes	July, 1924	July, 1931	fees paid 1923–1929	Fruitland, Wash.
Mining Corporation of America	yes	– – –	– – –	– – –	– – –
Perdiver Mining Co.	yes	August, 1934	July, 1938	fee paid 1935	Fruitland, Wash.
Slate Construction Co. McLennon C. Slate, Inc.	no no	– – –	– – –	McLennon Slate, owner	Albany, Oregon
Intermountain Petro-Mining Ltd.	no	– – –	– – –	– – –	Calgary, Alberta
Alpine Uranium Co.	yes	September, 1954	July, 1958	nonpayment of fees	Salt Lake City, Utah
Lead Trust Mines, Inc.	yes	May, 1955	July, 1975	fees paid 1955–1969	Spokane, Wash.
Three Peaks Corporation	yes	November, 1956	July, 1960	nonpayment of fees	Salt Lake City, Utah
Madre Mining Ltd.	yes	May, 1981	September, 1985	fees paid 1981–1984	Calgary, Alberta; Sacramento, Calif.; Fruitland, Wash.; Vancouver, B.C.
Cortez International, Ltd. (successor to Madre Mining Ltd.)	no	– – –	– – –	– – –	– – –