In Cooperation with the U.S. Forest Service and the U.S. Bureau of Land Management

Stream-Sediment Geochemistry in Mining-Impacted Streams: Prichard, Eagle, and Beaver Creeks, Northern Coeur d'Alene Mining District, Northern Idaho

Scientific Investigations Report 2004–5284

U.S. Department of the Interior
U.S. Geological Survey

COVER (clockwise from left)
Drainage from the Carlisle Mine portal, lower Carbon Creek; collapsed Idora mill building, upper Beaver Creek; recontoured and seeded cobble dredge spoils, Prichard Creek valley above Murray, Idaho; sampling suspended sediment from lower Beaver Creek during peak flow on April 14, 2000.

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Stream-Sediment Geochemistry in Mining-Impacted Streams: Prichard, Eagle, and Beaver Creeks, Northern Coeur d'Alene Mining District, Northern Idaho

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Abstract

This report presents the results of one aspect of an integrated watershed-characterization study that was undertaken to assess the impacts of historical mining and milling of silver-lead-zinc ores on water and sediment composition and on aquatic biota in streams draining the northern part of the Coeur d'Alene Mining District in northern Idaho. We present the results of chemical analyses of 62 samples of streambed sediment, 19 samples of suspended sediment, 23 samples of streambank soil, and 29 samples of mine- and mill-related artificial-fill material collected from the drainages of Prichard, Eagle, and Beaver Creeks, all tributaries to the North Fork of the Coeur d'Alene River. All samples were sieved into three grain-size fractions (<0.063, 0.063–0.25, and 0.25–1.0 mm) and analyzed for 40 elements after four-acid digestion by inductively coupled plasma atomic-emission spectrometry and for mercury by continuous-flow cold-vapor atomic-absorption spectrometry in the U.S. Geological Survey laboratory in Denver, Colo.

Historical mining of silver-lead-zinc ores in the headwater reaches of the Prichard Creek, Eagle Creek, and Beaver Creek drainages has resulted in enrichments of lead, zinc, mercury, arsenic, cadmium, silver, copper, cobalt, and, to a lesser extent, iron and manganese in streambed sediment. Using samples collected from the relatively unimpacted West Fork of Eagle Creek as representative of background compositions, streambed sediment in the vicinity of the mines and millsites has Pb and Zn contents of 20 to 100 times background values, decreasing to 2 to 5 times background values at the mouth of the each stream, 15 to 20 km downstream. Lesser enrichments (<10 times background values) of mercury and arsenic also are generally associated with, and decrease downstream from, historical silver-lead-zinc mining in the drainages. However, enrichments of arsenic and, to a lesser extent, mercury also are areally associated with the lode gold deposits along Prichard Creek near Murray, which were not studied here. Metal contents in samples of unfractionated suspended sediment collected during a high-flow event in April 2000 are generally similar to, but slightly higher than, those in the fine (<0.063-mm grain size) fraction of streambed sediment from the same sampling site. Although metal enrichment in streambed sediment typically begins adjacent to the mine portals and their associated mine-waste rock dumps, volumetrically larger inputs of metal-enriched materials were contributed by the ore-concentration millsites and their associated, more finely ground, more metal rich mill-tailings impoundments.

Introduction

The drainages of Prichard, Eagle, and Beaver Creeks, all tributaries to the North Fork of the Coeur d'Alene River in northern Idaho (figs. 1, 2), include sites of historical mining activities in the northern part of the Coeur d'Alene Mining District, one of the world's largest producers of silver and one of the Nation's largest historical producers of lead and zinc. Because of historical activities associated with the mining and milling of silver-lead-zinc ores, these streams have been significantly impacted both physically and chemically. The U.S. Forest Service (USFS) and the U.S. Bureau of Land Management (BLM) have large land holdings in this drainage basin. At their request, the U.S. Geological Survey (USGS) undertook a basinwide sampling program of surface water, ground water, stream sediment, minesite and other fill materials, and instream aquatic biota in 2000, 2001, and 2002. The surface- and ground-water data have been reported elsewhere (Brennan and others, 2001, 2003; O'Dell and others, 2002; Ott and Clark, 2003). This report presents sampling and analytical data for basinwide streambed and suspended sediment, for selected vertical sections of streambank soil, and for artificial-fill materials around selected mines and millsites; a companion report (Harper and Farag, in press) presents sampling and analytical data for instream aquatic biota.

Regional Setting

The drainage basin of Prichard, Eagle, and Beaver Creeks incorporates four major drainages of approximately equal size: upper Prichard Creek (above its confluence with Eagle Creek), the West and East Forks of Eagle Creek, and Beaver Creek (fig. 2). European-American settlement of the basin began in the early 1880s with the discovery of placer gold in Prichard Creek (Magnuson, 1968). Significant early placer gold operations were located on Prichard Creek, lower Eagle Creek, and Trail Creek, a tributary to Beaver Creek (fig. 2). Older gravel deposits were hydraulically mined around 1900 in the hills north of Prichard Creek between the town of Murray and Eagle Creek (Ransome and Calkins, 1908). Between 1917 and 1926, a large floating dredge worked most of the valley gravel for an 8-km reach of upper Prichard Creek in the vicinity of Murray, leaving large, coarse-cobble dredge-spoil piles (Campbell, 1927). Underground gold-quartz lode mines are located in the same general area as the placer gold workings; the two largest lode mines were the Golden Chest and Mother Lode Mines, flanking Prichard Creek a few kilometers above Murray. Several intermittent placer gold/gravel-mining operations along tributaries to Prichard Creek are the only mining activity in the basin today.

Underground mines that historically produced zinc, lead, and silver ore are located in the headwaters of Prichard Creek (fig. 3), the East Fork of Eagle Creek (fig. 4), and Beaver Creek (fig. 5). Although the largest mine production (1.4 million tons of ore) was in the upper Beaver Creek drainage, only about 0.5 million tons of ore was processed at millsites in this drainage. About 0.2 million tons of ore was mined and milled in upper Prichard Creek, and about 0.67 million tons in the upper East Fork of Eagle Creek (Jack Waite Mine and mill; Bennett and Mitchell, 1999; Kauffman and others, 1999b; K.R. Long, unpub. data, 2002). Ore-concentration mills in the drainages of upper Prichard Creek (Paragon/Blackhorse, Bear Top, and Monarch mills, fig. 3) and upper Beaver Creek (Carlisle/Ray Jefferson and Idora mills, fig. 5) that operated before 1925 as gravity ("jig") mills produced small-volume piles of fine- to coarse-grained, metal-enriched jig tailings, as well as trains of downstream, jig-tailings-contaminated flood plains and stream channels. Large-scale flotation mills that operated in the upper East Fork of Eagle Creek (Jack Waite mill, fig. 4) and upper Beaver Creek (rebuilt Carlisle mill, fig. 5) between 1926 and 1960 produced large-volume, less metal rich flotation-tailings piles. A small-volume flotation-tailings pile was also produced between 1928 and 1930 at the Silver Strike millsite (fig. 3) in Granite Gulch, a tributary to upper Prichard Creek. No zinc-lead mining is active in the basin today.

Prichard Creek, which has the largest drainage in the study area (fig. 2), flows northwesterly to its confluence with the North Fork of the Coeur d'Alene River. Placer gold was

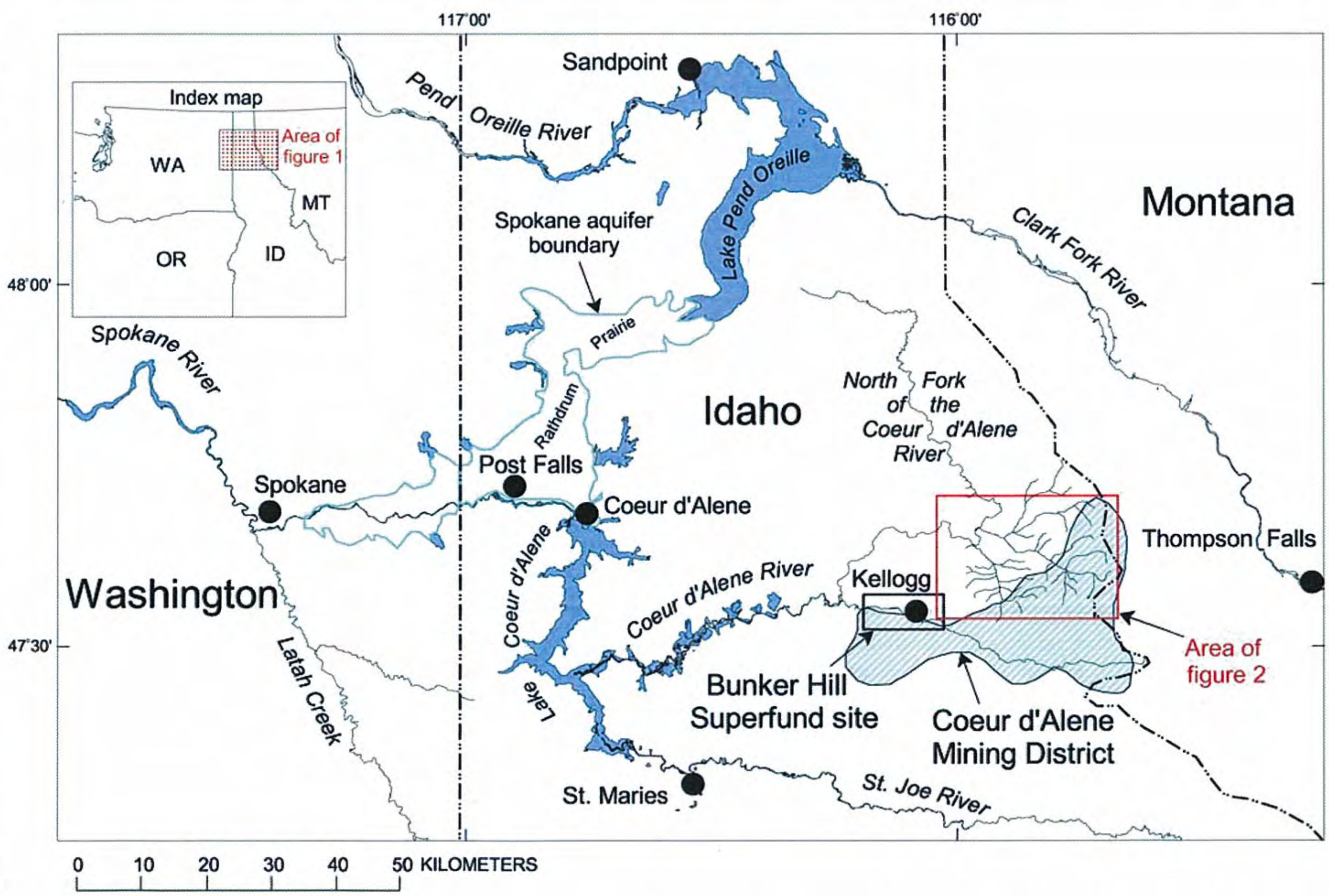


Figure 1. Coeur d'Alene-Spokane River drainage in eastern Washington, northern Idaho and western Montana, showing location of study area in the Coeur d'Alene Mining District (see fig. 2).

discovered near the junction of Prichard and Eagle Creeks in 1882, and a general gold rush of placer miners began in 1883, leading to the establishment of the town of Murray in the middle of the placered reach of Prichard Creek (Magnuson, 1968). By 1900, most of the major silver-lead-zinc deposits known in the drainage had been discovered (fig. 3). The history and total tailings production of ore-concentration mills in the drainage are shown in figure 6. Relatively coarse grained, metal-enriched jig tailings were produced by three mills between 1905 and 1921 (fig. 3): the Bear Top mill up Bear Gulch (Mitchell, 1997a), the Paragon/Blackhorse mill at the mouth of Paragon Gulch (Mitchell, 1998), and the Monarch mill along Prichard Creek below Paragon Gulch. Small-tonnage (<50,000 tons) streamside tailings impoundments were deposited at each site: below the Monarch and Paragon/Blackhorse millsites along Prichard Creek, and below the Bear Top millsite near the head of Bear Gulch. These impoundments have been somewhat eroded by the adjacent stream. For a few years in the late 1920s, two flotation mills operated in Granite Gulch: the Silver Strike and Giant Ledge mills. Tailings were impounded a short distance downstream from the Silver Strike millsite, but none are known from the Giant Ledge millsite.

Eagle Creek, a tributary to lower Prichard Creek, enters the larger stream from the north about 5.1 km above its mouth (fig. 2). The West and East Forks of Eagle Creek join about 2 km upstream of its confluence with Prichard Creek (fig. 4). The West Fork is relatively unaffected by mining; the only producing mine (Crystal Lead Mine) in the drainage operated intermittently from 1941 to 1952, producing 11,000 tons of ore that was trucked out of the drainage to be milled elsewhere (Long, 1998a). In contrast, the East Fork of Eagle Creek has been substantially impacted by mining and milling. The Jack Waite Mine and millsite is located near the headwaters of the drainage on Tributary Creek (figs. 2, 4); the mine produced about 670,000 tons of ore from 1928 to 1957, which was concentrated in the adjacent mill by a flotation process a few hundred meters downstream to produce about 570,000 tons of flotation tailings (fig. 6). The resulting fine-grained flotation tailings were released into Tributary Creek before December 1930 (Mitchell, 1997b), when, in response to complaints from downstream communi-

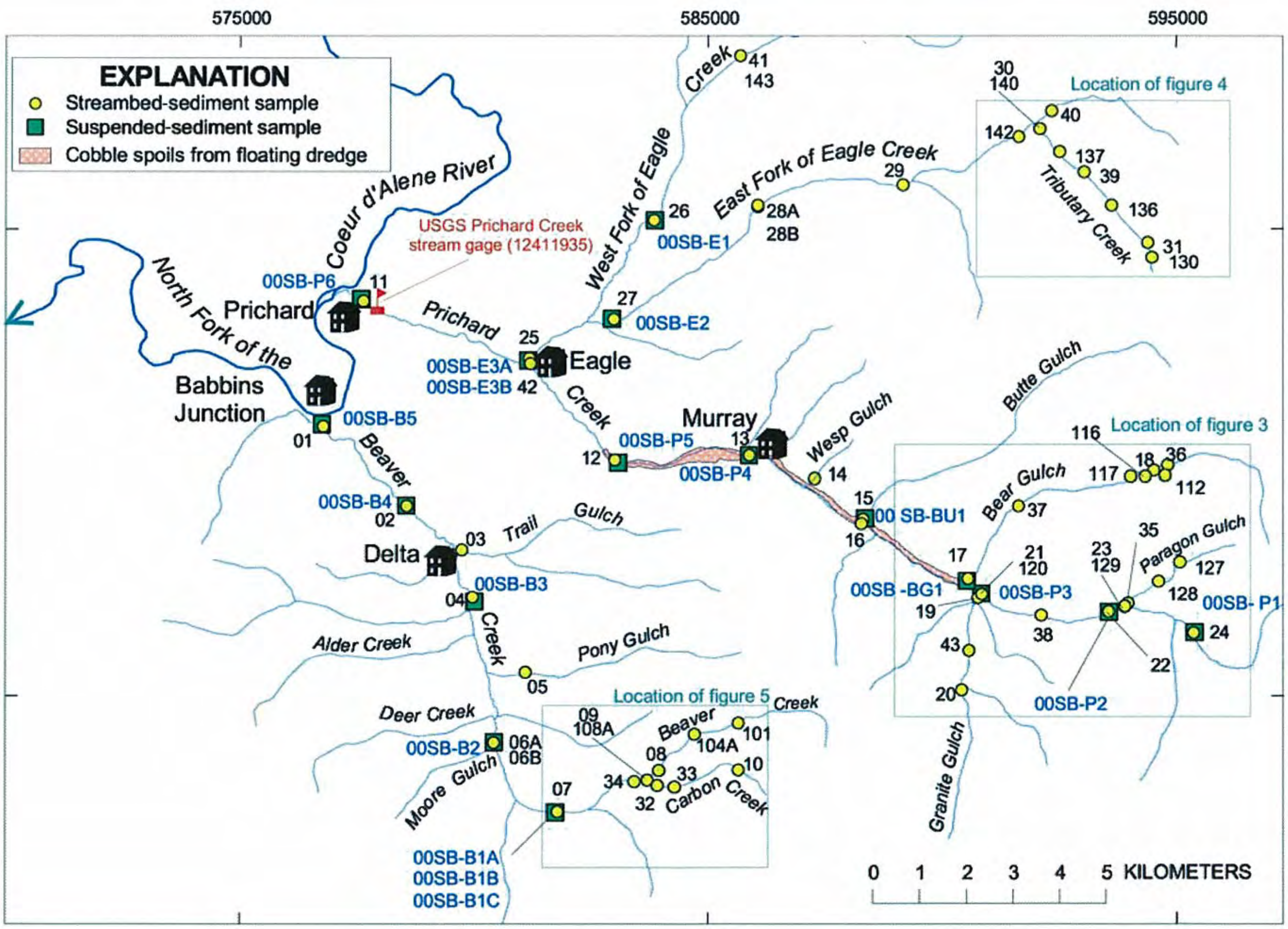
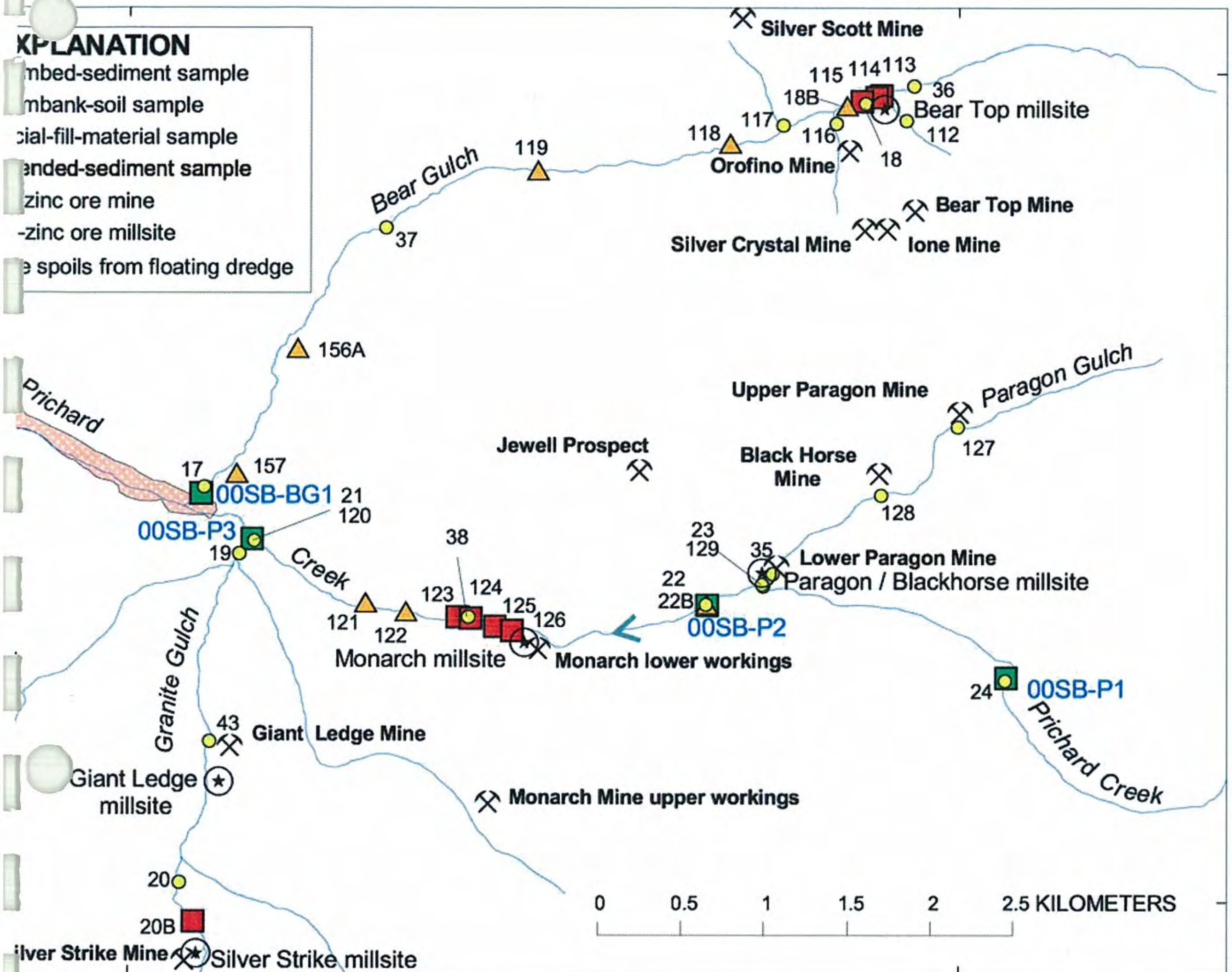
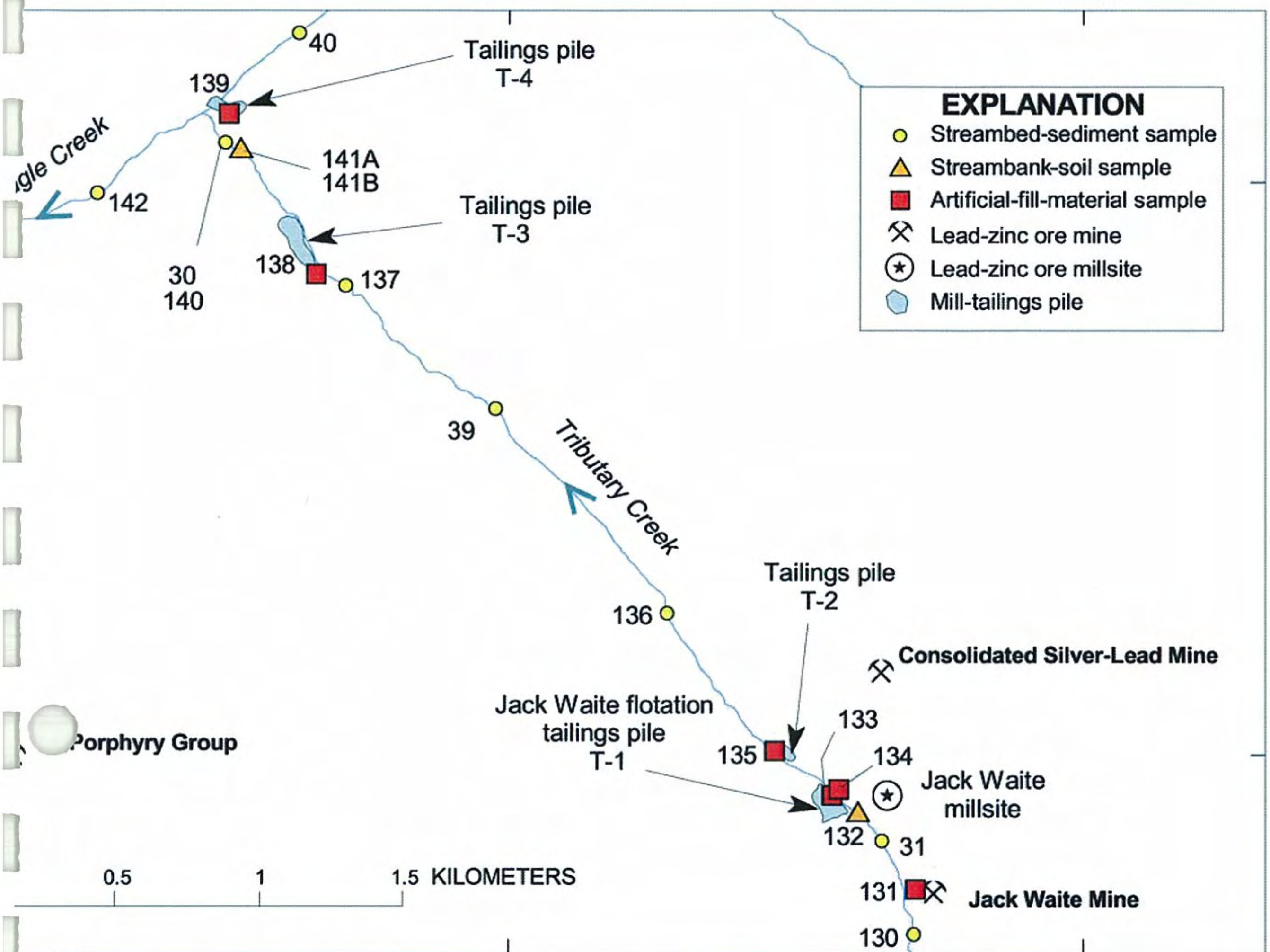


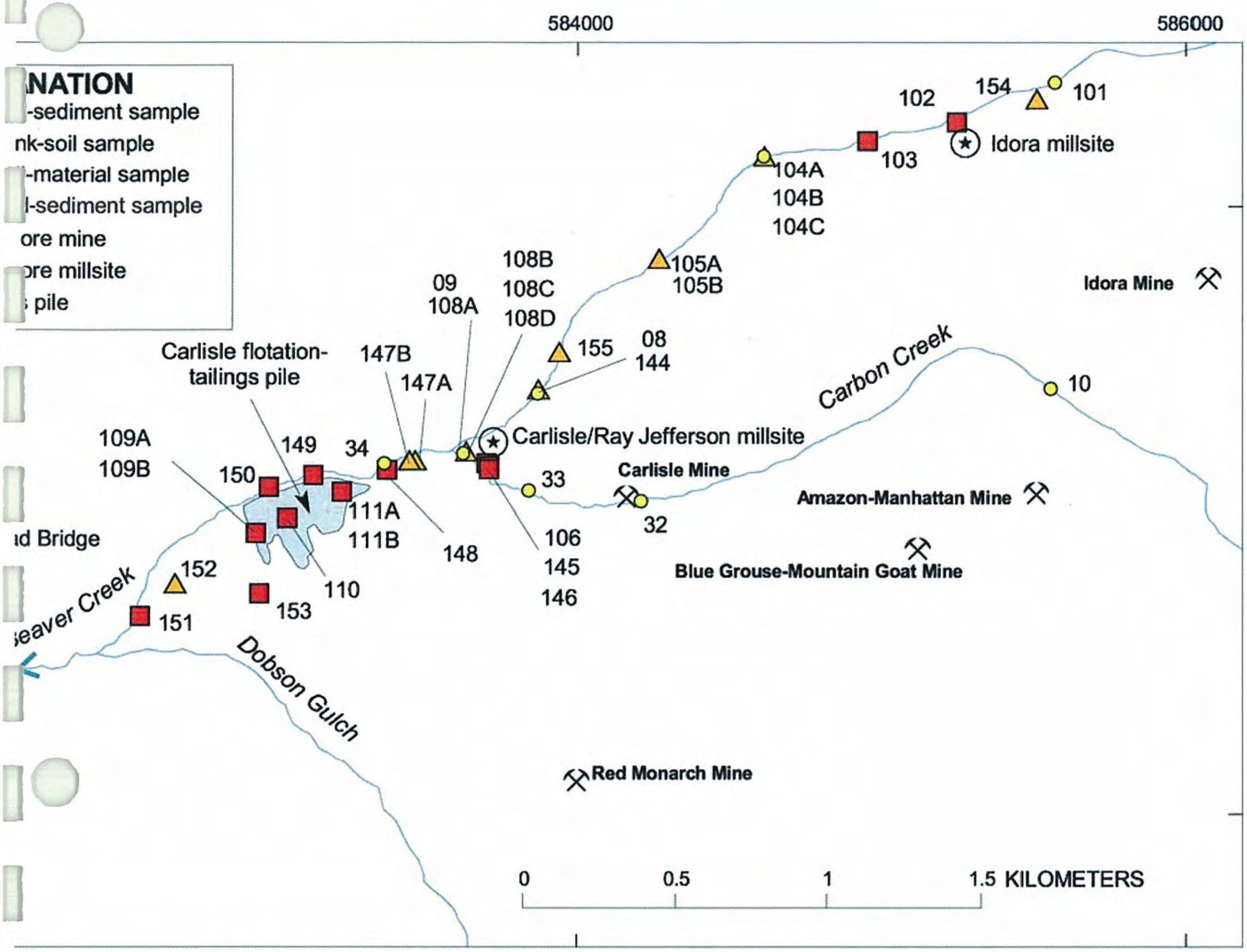
Figure 2. Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho, showing locations of sampling sites for streambed and suspended sediment. See figures 3 through 5 for locations of sampling sites for streambank soil and artificial-fill material.



reek drainage in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), showing locations of mines and mill-
or streambed sediment, suspended sediment, streambank soil, and artificial-fill material.



nd upper East Fork of Eagle Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), showing
and tailings piles and of sampling sites for streambed sediment, suspended sediment, streambank soil, and artificial-fill material.



drainage in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), showing locations of mines, millsites, and tail-
for streambed sediment, suspended sediment, streambank soil, and artificial-fill material.

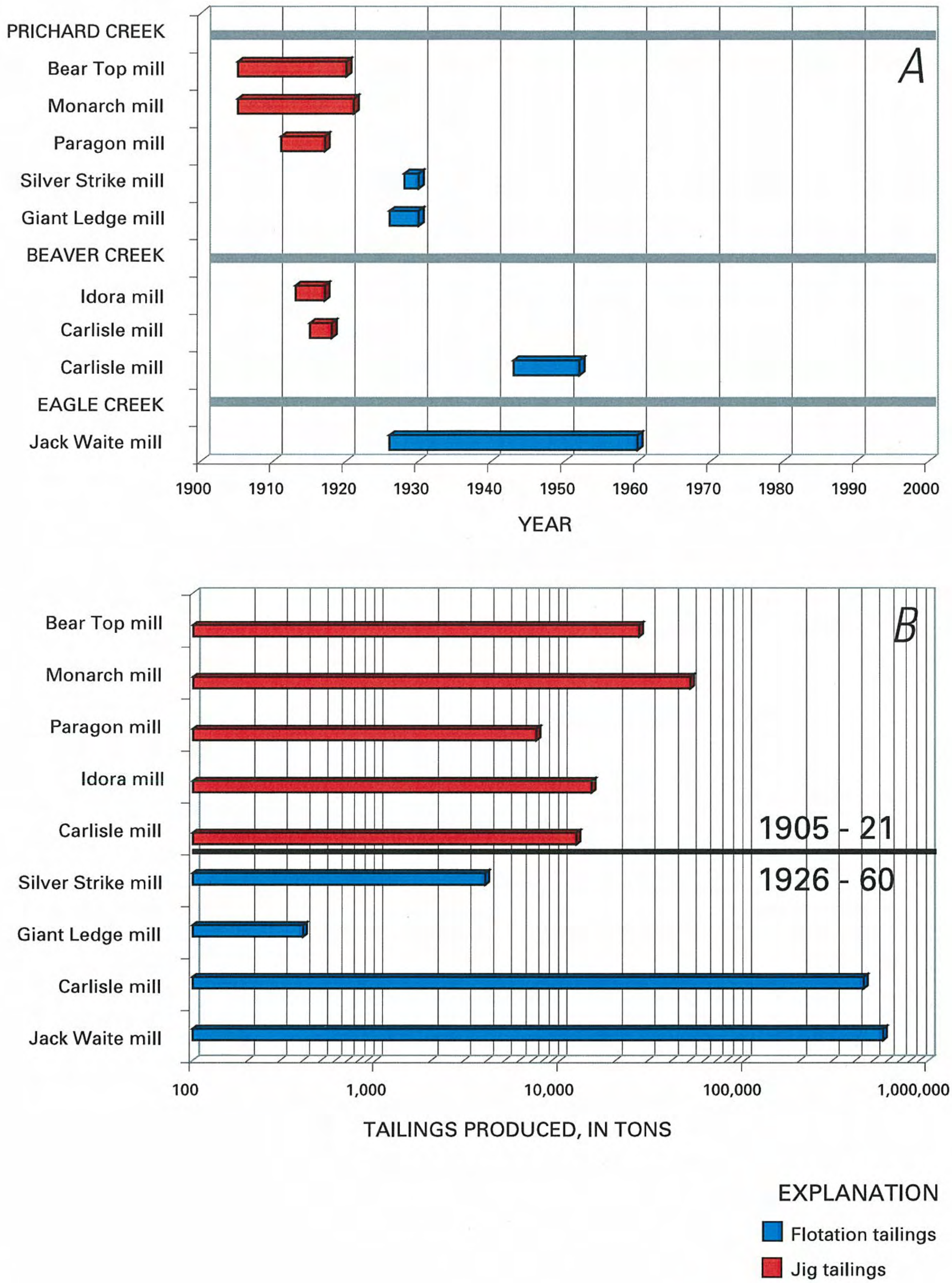


Figure 6. Years of operation of (*A*) and total output of tailings from (*B*) silver-lead-zinc ore-concentration mills in the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho (figs. 3-5). Data from K.R. Long (unpub. data, 2001).

ties, the operating mining company constructed streamside tailings impoundments or tailings piles (fig. 4) into which flotation tailings were transported by flume or pipe. These tailings piles have all been varyingly eroded by the adjacent stream.

Beaver Creek, the westernmost drainage in the study area (fig. 2), consists of one main branch that flows northwesterly to its confluence with the North Fork of the Coeur d'Alene River. Early placer gold mining began in the 1880s on Trail Creek and, to a lesser extent, on Beaver Creek below its confluence with Trail Creek (Ransome and Calkins, 1908). Significant production of silver-lead-zinc ores in the headwater reaches of the stream began after 1910, when small gravity mills operated on upper Beaver Creek (Idora) and Carbon Creek (Carlisle, then called Ray Jefferson, figs. 5, 6). Small, eroded jig-tailings impoundments remain adjacent to and downstream of the Idora millsite, but none has been identified below the Carlisle millsite. The portal to the Carlisle Mine is located in the valley bottom of Carbon Creek, about 0.5 km upstream from the Carlisle millsite (fig. 5); a significant waterflow emanates from the tunnel (Ott and Clark, 2003), passing over and along a large volume of angular non-ore or mine-waste rock (Kauffman and others, 1999a). Both the Idora and Carlisle gravity mills ceased operations before 1920. The Carlisle mill, which was rebuilt as a flotation mill in 1944, produced more than 440,000 tons of tailings before it ceased operation in 1952. Tailings were first piped to several small (30 by 30 by 1 m) impoundments downstream along Beaver Creek (sampling sites 148-151, fig. 5), all now varyingly eroded, followed by the establishment of a major, three-tiered tailings impoundment (gray area with sample sites 109-111, fig. 5) that incorporated the bulk of the tailings production. This large impoundment was placed across the existing stream channel, which was routed to the north around it. The north flank of the impoundment is armored with large boulders to protect it from erosion by Beaver Creek.

Sampling Methodology

Sample Collection

All samples were collected in 2000 and 2001 with a plastic trowel or shovel into plastic sample bags, using the chain-of-custody protocol of Murphy and others (1997). Sampling-site locations were marked directly onto 1:24,000-scale USGS topographic maps by inspection in the field, and the latitude and longitude (in coordinates of Universal Transverse Mercator [UTM], zone 11, NAD 1927 datum) were obtained by using a Garmin GPSMAP 76 global-positioning-satellite (GPS) receiver system, typically with an instrumental error of less than ±10 m in the horizontal plane. Where the GPS instrument would not give a location (too few satellites visible) or the instrumental error was greater than 10 m, the sampling-site location was transferred to the digital orthophoto quadrangle, using Arcview 3.2 software, and the digitized location was recorded in the table; those locations are inferred to have a larger error of about ±50 m. Sampling-site information was also recorded on sample-collection forms and on chain-of-custody forms in a looseleaf binder. Samples were transported to the laboratory at the end of each day.

Streambed Sediment

At each streambed-sediment-sampling site, a composite of three to five subsamples from within the high-water channel was collected from the upper 10 cm of sediment within a 10-m-diameter circle. One subsample was collected from beneath the water's edge at the time of sampling, and the other subsamples were collected above the low-water level on one side of the low-water stream and were mostly dry during sampling. Sampling was aimed at sand and finer material (<2-mm grain size), and subsampling was restricted to accumulations of that material in the typical sediment framework of cobble-size material. Digital photographs (available on request from the first author) were taken at each streambed-sediment-sampling site, looking upstream and downstream, as well as vertically downward from 1.5 m, to illustrate sediment characteristics. The locations of streambed-sediment-sampling sites are shown on figure 2 and listed in table 1.

Suspended Sediment

Samples of suspended sediment were collected within a 4-hour period during a single high-flow event on April 14, 2000 (table 2). Streamflow during this event at the USGS gage at the mouth of Prichard Creek (sta. 12411935, fig. 2) was the second highest recorded during the 4-year period of operation of the gage (10/01/98–09/30/02). All but two samples were collected from the stream center from bridges, using a 2-gal plastic bucket on the end of a rope. The sample was poured from the bucket into a prelabeled 1-gal plastic Ziplock bag, filled to capacity. Two samples (00SB–B4, 00SB–P5) were collected by wading into the stream and filling a 1-gal Plastic Ziplock bag directly. The sealed bag was placed in a second labeled plastic Ziplock bag, stored in a cardboard box in the vehicle, and transferred to the laboratory each night. The locations of suspended-sediment sampling sites are shown in figure 2.

Streambank Soil

Samples of streambank soil and surface material in the flood plain or in formerly active channels were collected at selected sites (table 3). At active-stream-cutbank sites ("channel" sampling method, table 3), the vertical cutbank was first cleaned of loose material with a trowel, and then a channel sample was collected over the indicated depth interval measured from the top of the cutbank. At flood-plain or formerly active channel sites ("composite" sampling method, table 3), only surficial material was sampled with a trowel from a few closely spaced holes; the depth of the holes is listed in table 3 (column labeled "Depth-interval bottom"). The locations of streambank-soil-sampling sites are shown in figures 3 through 5.

Artificial-Fill Materials

Samples of artificial-fill material of several types were collected at selected sites (table 4), mostly near mines or millsites, including impounded flotation tailings (14 sampling sites), impounded gravity ("jig") tailings (8 sampling sites), millsite-fill material (2 sampling sites), railroad-bed material (2 sampling sites) and mine-waste rock at a mine portal (1 sampling site). At all but two sampling sites, the material was collected by channel-sampling the side of an excavated trench or a cleaned surface cut ("channel" sampling method, table 4), with the sample interval measured downward from the horizontal surface of the feature. Because of collection difficulties, the two exceptions ("composite" sampling method, table 4) were composited from three subsamples grabbed over the indicated interval. The locations of artificial-fill-sampling sites are shown in figures 3 through 5.

Sample Preparation

All samples (except those of suspended sediment) were dried in open sample bags at room temperature over a 2-week period after collection, with care taken to separate probable metal-enriched and metal-poor samples in order to avoid cross-contamination. The dried samples were then sorted in the sample-preparation laboratory of Eastern Washington University, Cheney, into nine different grain-size fractions (<0.063, 0.063–0.125, 0.125–0.25, 0.25–0.5, 0.5–1, 1–2, 2–4, 4–8, and >8 mm) using the protocol of Peacock and others (2002). Each sample was screened by using standard wire-mesh sieves mounted on a "rotap" agitator for 3 minutes. Screens were hand-brushed and blown out with compressed air after each sorting. Each fraction was weighed to within 0.1 g, and its percentage of the total weight of the sample calculated (table 5). Three fractions were sent to the USGS laboratory in Denver, Colo., for chemical analysis: (1) fine—less than 0.063 mm (clay and silt), (2) intermediate—0.063 to 0.25 mm (very fine to fine sand), and (3) coarse—0.25 to 1.0 mm (medium to coarse sand). The intermediate and coarse fractions were pulverized in preparation for chemical analysis, using the procedures of Taylor and Theodorakos (2002); the fine fraction was already fine enough for analysis and did not require further preparation.

Samples of stream water with suspended sediment were transported to the sample-preparation laboratory after collection, where they were allowed to settle in the sample bags for several days, after which the supernatant was decanted from each sample and its volume measured. The remaining cloudy water was centrifuged for 4 minutes, and supernatant was decanted from the centrifuge tube and its volume measured. The solid residues were transferred to preweighed glass sample vials and oven-dried at 60°C for 1–3 days, during which some mercury may have been lost to vaporization. After drying, the sample vials were reweighed, and the weight of each sample calculated. The suspended sediment concentration was calculated by dividing the dry sample weight by the total supernatant volume (table 6).

Chemical Analyses

All samples were analyzed by inductively coupled plasma atomic-emission spectrometry (ICP–AES) in the USGS laboratory in Denver, Colo., for 40 elements (all except Hg), using the procedure of Briggs (2002), and for mercury by continuous-flow cold-vapor atomic-absorption spectrometry, using the procedure of Brown and others (2002).

Standards, Replicate Samples, and Field Duplicates

A total of 365 samples were analyzed, of which about 7 percent were standards or replicate samples. The samples were analyzed in jobs of about 40 samples each; two batches of five jobs were analyzed about 1 year apart. Two National Institute of Standards & Technology (NIST) Standard Reference Materials (SRM 2710, SRM 2711) were analyzed with each year's batch of five jobs (1 percent of total samples). Each year, six samples (3.1 percent of total) were split in the sample-preparation laboratory and submitted as replicates under different sample numbers. All standards and replicate samples were submitted "blind," that is, without identifying them as such to the analytical laboratory.

A few field duplicates were collected to test within-site and temporal variations in sediment chemical composition. Of 19 samples of suspended sediment samples, 3 (16 percent of total) were field duplicates, 2 at one sampling site and 1 at another. At two of the year 2000 streambed-sediment-sampling sites, two subareas within 20 m of each other were sampled; a total of six analyses (two sites times three size fractions) can be compared. In 2001, samples of streambed sediment were recollected at four of the year 2000 sampling sites to test the year-to-year variation in sediment chemical composition; with size fractionation, a total of 12 analyses can be compared.

Results

Analytical Data

Analytical data for the 19 samples of unfractionated (bulk) suspended sediment are listed in table 6, and for the 114 fractionated samples of streambed sediment, streambank soil, and artificial-fill materials in tables 7 (<0.063-mm grain-size fraction), 8 (0.063- to 0.25-mm grain-size fraction), and 9 (0.25- to1.0-mm grain-size fraction), respectively.

Although analytical data were reported for 41 elements, the data for only 31 elements are reported here. Of the 41 elements, 6 were at or below instrumental detection limit for all the analyses (Au, <8 ppm; Bi, <10 ppm; Eu, <4 ppm; Ho, <4 ppm; Ta, <40 ppm; U, <100 ppm), and 4 were at or below 3 times the instrumental detection limit (Be, <1 ppm;

Mo, <2 ppm; Sn, <5 ppm; Yb, <1 ppm) in more than 94 percent of the analyses, resulting in such poor precision that we do not report those results here.

Analytical Accuracy and Precision

The accuracy of the analytical data was gauged by blind analyses of two NIST SRM samples each year. Analytical data for the NIST SRM samples are listed in table 10, along with the NIST-certified values for certain elements and their reported ranges and the uncertified values for 11 elements (Ce, Co, Ga, La, Mo, Nd, Sc, Sr, Th, Y Yb). For elements for which certified values are listed, all of our analyses are within 4 percent of the range of certified values, except for Ag, Hg, and P (which are within 8 percent) and Ti (which is within 50 percent).

The precision of the analytical data was gauged by blind analyses of six replicate samples each year, for which the precision for each element is gauged by its coefficient of variation (CV, standard deviation divided by the mean value of each element in each replicate pair):

Element	*Mean and standard deviation of CV (percent)*
Al	2±2
Ca	2±2
Fe	3±2
K	2±1
Mg	1±1
Na	1±1
P	4±6
Ti	4±3
Ag	1±1
As	5±5
Ba	2±2
Cd	6±4
Ce	3±3
Co	4±4
Cr	3±3
Cu	4±4
Ga	3±3
Hg	3±2
La	4±3
Mn	3±4
Nb	6±4
Nd	3±3
Ni	2±2
Pb	5±4
Sc	2±2
Sr	2±2
Th	4±4
V	1±1
Y	4±3
Zn	3±5

The mean of the CVs for each element ranges from 1 to 6 percent.

Within-Site and Temporal Geochemical Variations

The mean and standard deviation (SD) of the CV for each element in the field duplicates of the streambed and suspended sediment and in the annual replicate samples collected at four streambed-sediment-sampling sites are listed in table 11. For the samples of suspended sediment, the field duplicates test the variation in sediment chemical composition over 5–10-minute intervals. The means of the CVs for each element are all less than 11 percent, with a median of 3 percent (5 percent for mining-related elements). For the samples of streambed sediment, the field duplicates test the variation in sediment chemical composition for pairs of composite samples within 20 m along the high-water channel. The means of the CVs for each element are all less than 30 percent, with a median of 8 percent (14 percent for mining-related elements). For the annual replicate samples of streambed sediment, the comparisons test the variation in sediment chemical composition at the same streambed-sediment-sampling site 1 year apart. The means of the CVs for each element are all less than 33 percent, with a median value of 12 percent (26 percent for mining-related elements).

Grain-Size Analysis

The grain-size distributions for each sample of streambed sediment, streambank soil, and artificial-fill material are listed in table 5, and the average results for streambed sediment, streambank soil, gravity tailings, and flotation tailings are plotted in figure 7. Note that streambed sediment is relatively poor in fine material (8 weight percent fine sand, silt, and clay <0.25 mm), whereas flotation tailings are mostly composed of fine sediment (80 weight percent fine sand, silt, and clay), and gravity tailings and streambank soil have intermediate proportions of fine sediment. (The fine sand, silt, and clay fractions of the two media are 28 and 32 weight percent, respectively.) These data provide important information on the relative contribution of fine material from potential metal-enriched sources to streambed or suspended sediment by different media. For example, if equivalent masses of flotation and gravity tailings are eroded into the stream, the flotation tailings would contribute 3 times the mass of fine material contributed by the gravity tailings.

Discussion

Geochemistry of Premining Streambed Sediment

The streambed sediment that resided in drainages in the study area (fig. 2) before mining began has been eroded and mixed with sediment derived from mining activities, and so its premining geochemical characteristics are unknown. Although natural premining ore exposures may have resulted in higher metal contents in premining streambed sediment in the mined drainages (relative to unmined drainages), we suspect that the streambed sediment in other streams draining the regionally mineralized district but without historical mines provides an approximation to the streambed sediment that occupied the impacted drainages before mining began. These surrogate samples from other nearby drainages are either from the main drainages upstream from mining impacts, from unimpacted small tributaries, or from a similar-size unimpacted drainage. Because the West Fork of Eagle Creek is a relatively unimpacted drainage similar in size to Prichard Creek above the Eagle Creek confluence, to the East Fork of Eagle Creek, and to Beaver Creek, we consider its sediment to approximate the geochemical composition of premining streambed sediment in the other drainages. Although the West Fork of Eagle Creek is relatively unaffected by mining, one mine in the headwaters of the drainage that produced a small amount of ore might have slightly affected downstream sediment chemistry. The mean composition of the fine (<0.063-mm grain size) fractions of three samples of streambed sediment collected from the West Fork of Eagle Creek is compared with that of five samples either upstream of mining impacts (Tributary Creek, Prichard Creek) or from unimpacted tributaries (Butte Gulch, Trail Creek, East Fork of Eagle Creek above its confluence with Tributary Creek) in table 12. The two approaches yield nearly identical elemental "background" values for streambed sediment.

Geochemistry of Mining-Material Sources

Ore-concentration technology changed considerably during the history of mining and milling in the Coeur d'Alene Mining District (Long, 1998b). As a result, mill-waste materials ("tailings") also changed considerably over time in terms of their grain-size and element-enrichment characteristics. Early (before 1925) mills used a relatively inefficient gravity-concentration technique ("jigging"), and their gravity ("jig") tailings range in coarseness from clay and silt to fine gravel (fig. 7) and are highly enriched in ore-related elements. Later (after 1925) mills used a more efficient technique of flotation separation to concentrate ore minerals from more finely ground ore, and their tailings generally consist of fine sand, silt, and clay (fig. 7) and are much less enriched in ore-related elements.

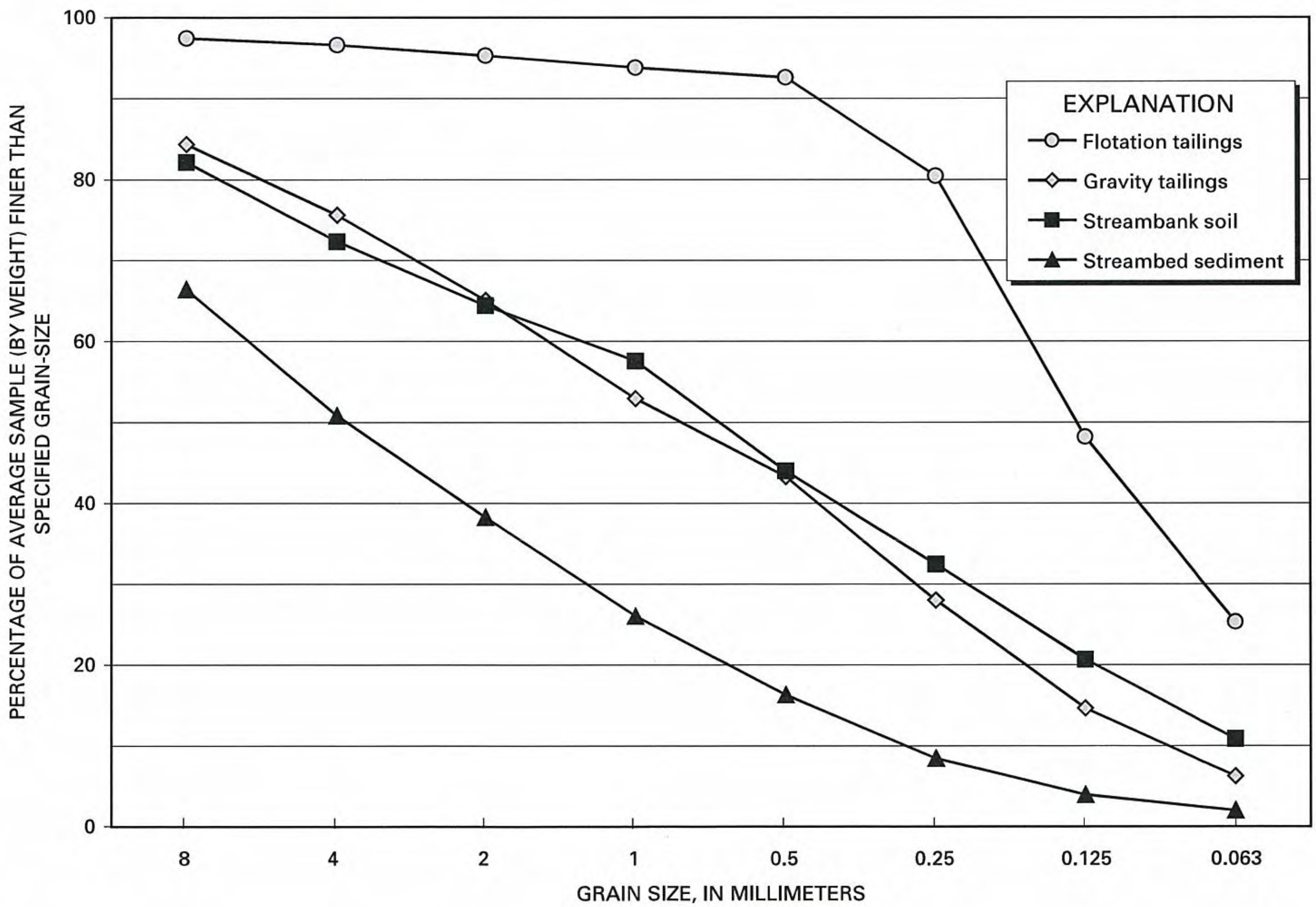


Figure 7. Average grain-size distributions in samples of streambed sediment (62 samples), streambank soil (23 samples), gravity tailings (8 samples) and flotation tailings (16 samples) collected from the northern Coeur d'Alene Mining District, northern Idaho (figs. 2–5).

To evaluate which elements have been enriched in sediment in the streams draining the mining district, we compare the chemical compositions of streambed sediment unaffected by mining with those of the tailings of ore-concentration mills in the mining district. In figure 8, we illustrate the relative element enrichments in mill tailings over the average chemical composition of three samples of streambed sediment collected from the unimpacted West Fork of Eagle Creek. The element enrichments (tailings composition divided by unimpacted-sediment composition) can be broadly considered as the number of times that the background values are exceeded. Data for samples of tailings collected from impoundments below the five gravity millsites in the mining district are plotted in figure 8*A*. A total of 10 elements are significantly enriched (3 or more times background values) in the gravity tailings (average enrichment factors in parentheses): Pb (650), Zn (400), Hg (140), Cd (80), Ag (30), Cu (11), As (7), Co (4), Fe (4), and Mn (3). For the flotation tailings (fig. 8*B*), enrichments in some elements (Pb, Ag, Hg) are consistently and significantly less than those in the gravity tailings; for the other mining-associated elements, enrichment factors overlap considerably between the samples of gravity and flotation tailings. However, if we compare elemental averages for samples of the two tailings types, all the mining-related elements are considerably less enriched in the flotation tailings relative to the gravity tailings.

Enrichments of Mining-Related Elements in Stream Sediment

Given the element enrichments that would be expected in stream sediment from release of the mining and milling source materials discussed above, we focus on four mining-related elements in our discussion: lead, zinc, mercury (the elements most enriched in tailings), and arsenic (an element with potential human-health impact). Several factors result in variation of mining-related elemental concentrations in sediment in and along each of the major drainages in the study area (figs. 1, 2). As discussed above, the composition of tailings varies between each mill because of differences in the original ore concentrations and in the efficiency of each mill in separating economic commodities from the mill waste. Each mill generated different amounts of tailings over different time periods and had varying success at keeping those tailings from entering the streambed. Also, the topographic variation in each stream valley influence the dispersion, dilution, and residence time of mining-related elements to the stream sediment. In the following section, the distributions of the above-mentioned four elements in the fine (<0.063-mm grain size) fraction of streambed sediment are summarized by element, followed by a more detailed presentation of the geochemical analyses of samples of streambed sediment, suspended sediment, streambank soil, and mining-related artificial-fill materials collected from each drainage basin.

Enrichments of Mining-Related Elements in the Fine Fraction of Streambed Sediment

Along-stream variations in Pb, Zn, As, and Hg contents in the fine (<0.063-mm grain size) fraction of streambed sediment throughout the study area (figs. 1, 2) are mapped in figure 9. Pb contents (fig. 9*A*) are as much as 128 times background value (max 10,500 ppm) and, in more than 80 percent of the samples, greater than 3 times background value (>250 ppm). Peak enrichments of lead (>4,000 ppm Pb) occur in a headwater branch (Bear Gulch) of Prichard Creek in the vicinity of the Bear Top millsite, on a short reach of a tributary to Prichard Creek (Paragon Creek) just below the Paragon/Blackhorse millsite, in the headwaters of the East Fork of Eagle Creek (Tributary Creek) downstream from the Jack Waite Mine/millsite area, and in upper Beaver Creek below the Idora millsite (fig. 9*A*). Below the severely impacted mine/millsite areas, Pb contents remain above 3 times background value in Prichard Creek to its mouth, in Tributary Creek and the East Fork of Eagle Creek to the mouth of Eagle Creek, and in Beaver Creek to about 5 km upstream of its mouth.

Zn contents in the fine (<0.063-mm grain size) fraction of streambed sediment (fig. 9*B*) are as much as 77 times background value (max 8,700 ppm), and greater than 2 times background value (>250 ppm) in more than 80 percent of the samples. Peak enrichments of zinc (>4,000 ppm Zn) occur on slightly different stream reaches than those of lead: on a shorter reach of Tributary Creek downstream from the Jack Waite Mine/millsite area, a different short tributary to Bear Gulch above the Bear Top millsite, and near the Carlisle Mine/millsite on Carbon Creek, a tributary to upper Beaver Creek (figs. 2–5). Below the severely impacted mine/millsite areas, Zn contents are greater than 2 times background value to the mouth of Prichard Creek, and greater than 4 times background value (>500 ppm Zn) to the mouths of both Eagle Creek and of Beaver Creek.

As contents in the fine (<0.063-mm grain size) fraction of streambed sediment (fig. 9*C*) are as much as 13 times background value (max 140 ppm), and greater than 2 times background value (>22 ppm) in about 50 percent of the samples. Peak enrichments of arsenic (>60 ppm As) occur in two areas: below the Silver Strike mill in Granite Gulch (a tributary to upper Prichard Creek), and along the middle and lower main stem of Prichard Creek, on a reach that is apparently associated with the area of lode gold deposits and with the valley floor that has been overturned by dredging (fig. 2). Weaker enrichments of arsenic are associated with the Jack Waite, Bear Top, Paragon, Idora, and Carlisle millsites.

Hg contents in the fine (<0.063-mm grain size) fraction of streambed sediment (fig. 9*D*) are as much as 100 times background value (max 6.1 ppm), and greater than 2 times background value (>0.12 ppm Hg) in 75 percent of the samples. Peak enrichments of mercury (>0.77 ppm Hg) occur in two areas: below the Jack Waite Mine/millsite in the headwaters of the upper East Fork of Eagle Creek, and near the Carlisle Mine/millsite on Carbon Creek, a tributary to upper Beaver Creek

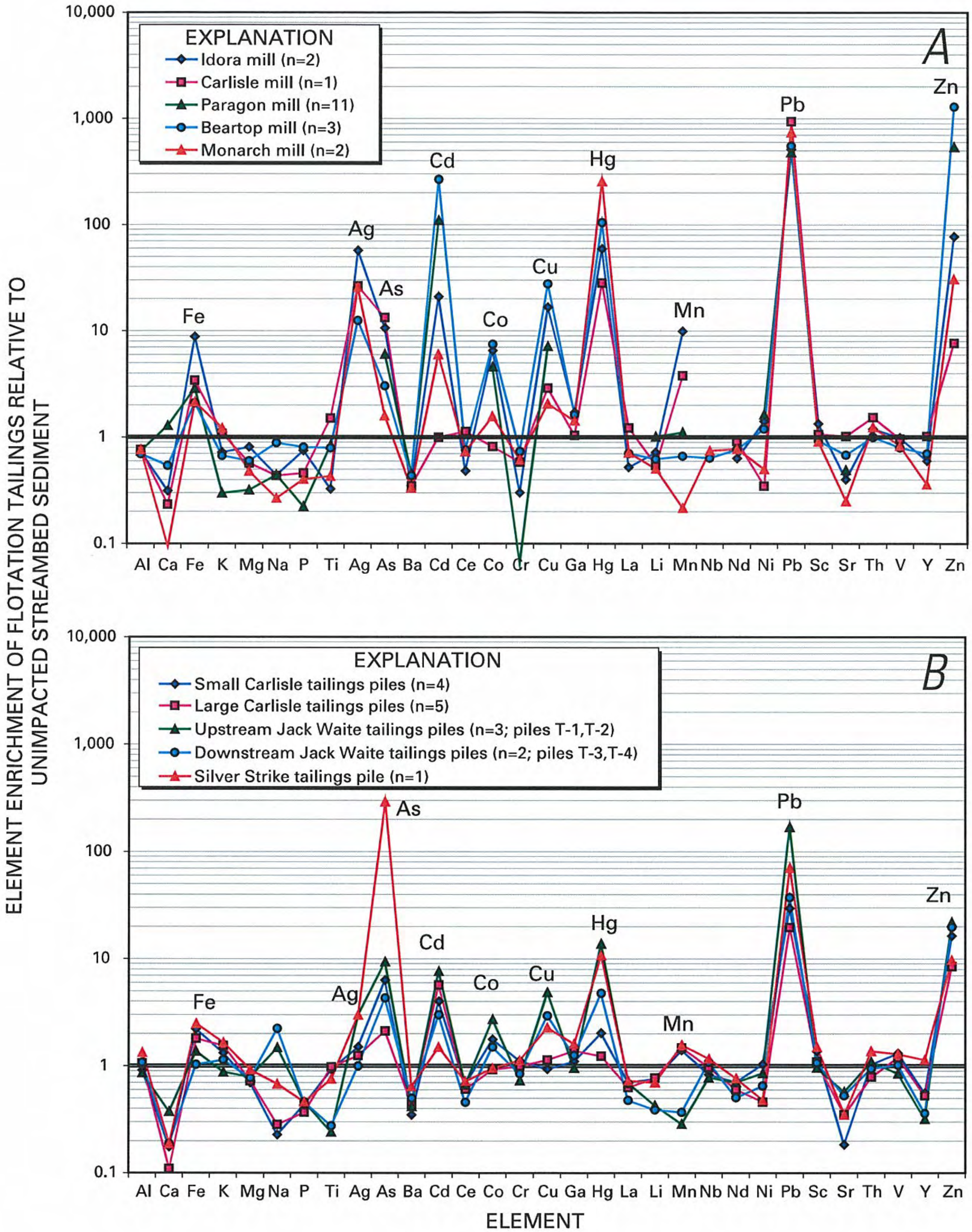
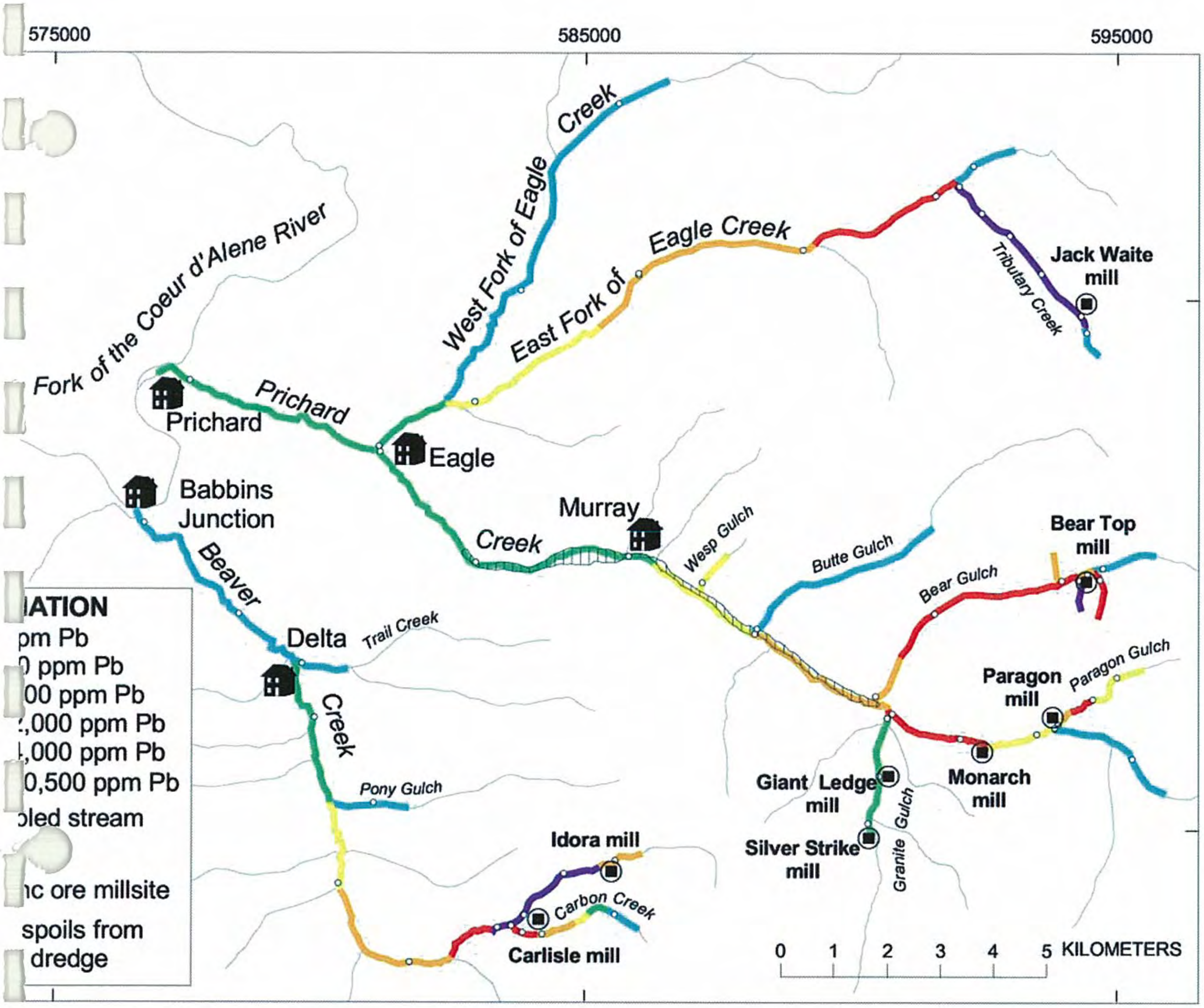
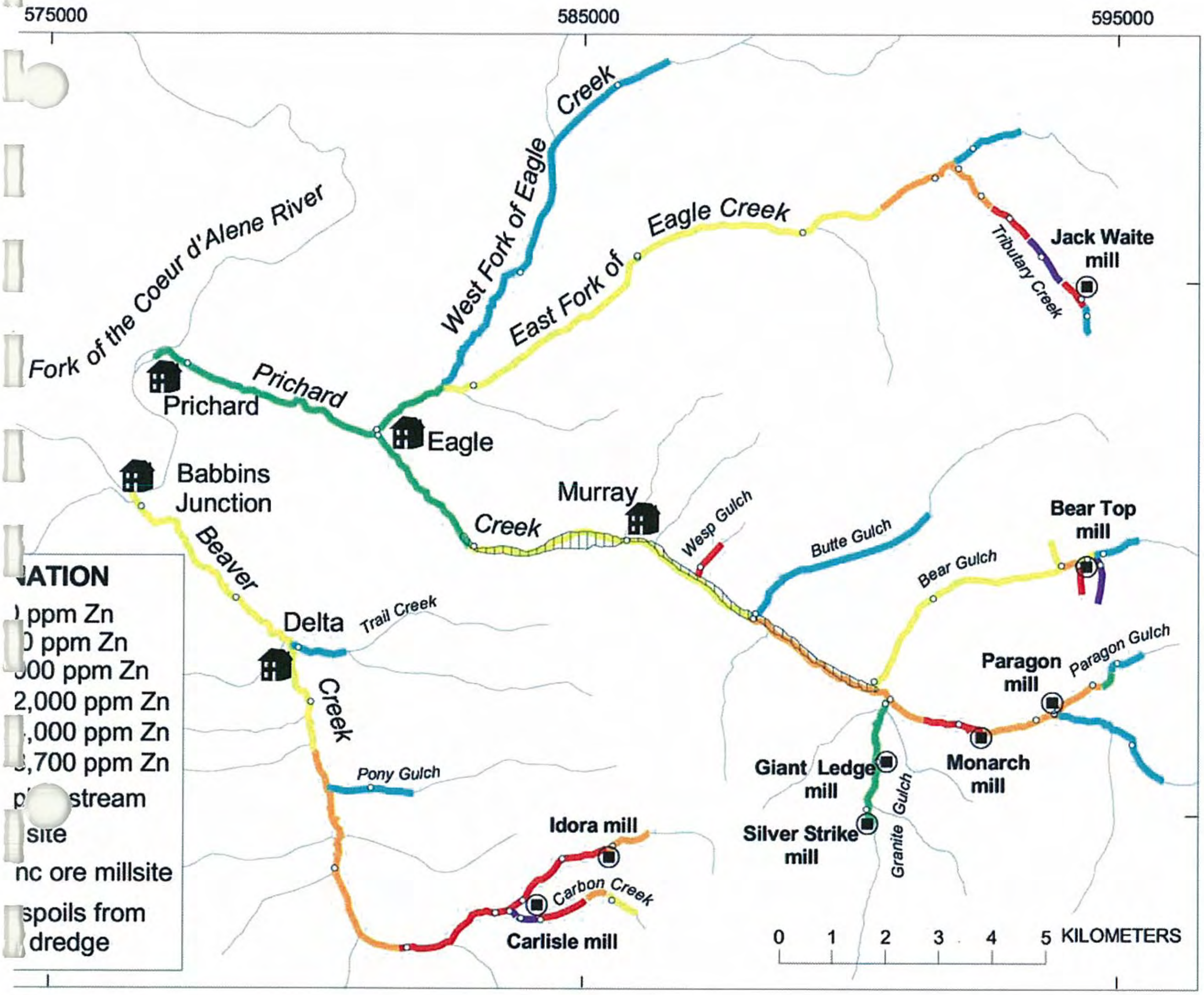


Figure 8. Element enrichments in samples of tailings piles (n, number of averaged samples) collected from the northern Coeur d'Alene Mining District, northern Idaho (figs. 3–5), relative to average composition of three samples of fine (<0.063-mm grain size) fraction of streambed sediment collected from the unimpacted West Fork of Eagle Creek; relatively enriched elements are noted above peaks. *A*, Gravity ("jig") tailings from five millsites. *B*, Flotation tailings associated with three different mills (data for Paragon mill gravity tailings from Johnson, 1999).



le Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), showing ranges of
) contents in fine (<0.063-mm grain size) fraction of streambed sediment along segments of streams, extrapolated from measured
s. Locations of stream-segment boundaries were interpolated from measured values at discrete sampling points or extrapolated
d relations to either metal-poor or metal-enriched inflowing tributaries. Locations of major lead-zinc ore millsites, the source of
-enriched sediment, are also shown. Background values, based on samples from the unimpacted West Fork of Eagle Creek:
As, 11±1 ppm; Hg, 0.06±0.01 ppm.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Delta
Trail Creek
Pony Gulch
Idora mill
Carbon Creek
Carlisle mill
Wesp Gulch
Butte Gulch
Bear Gulch
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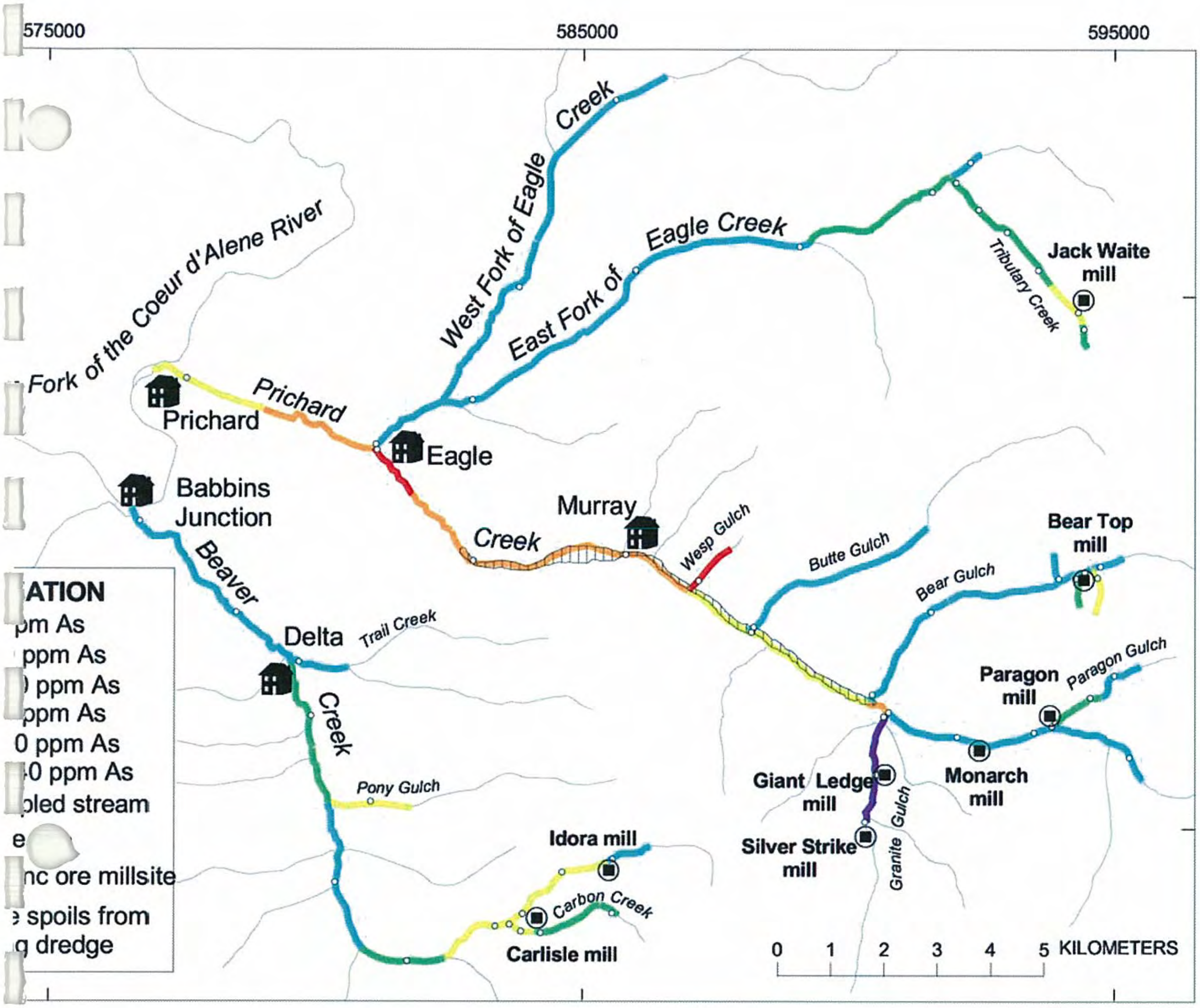
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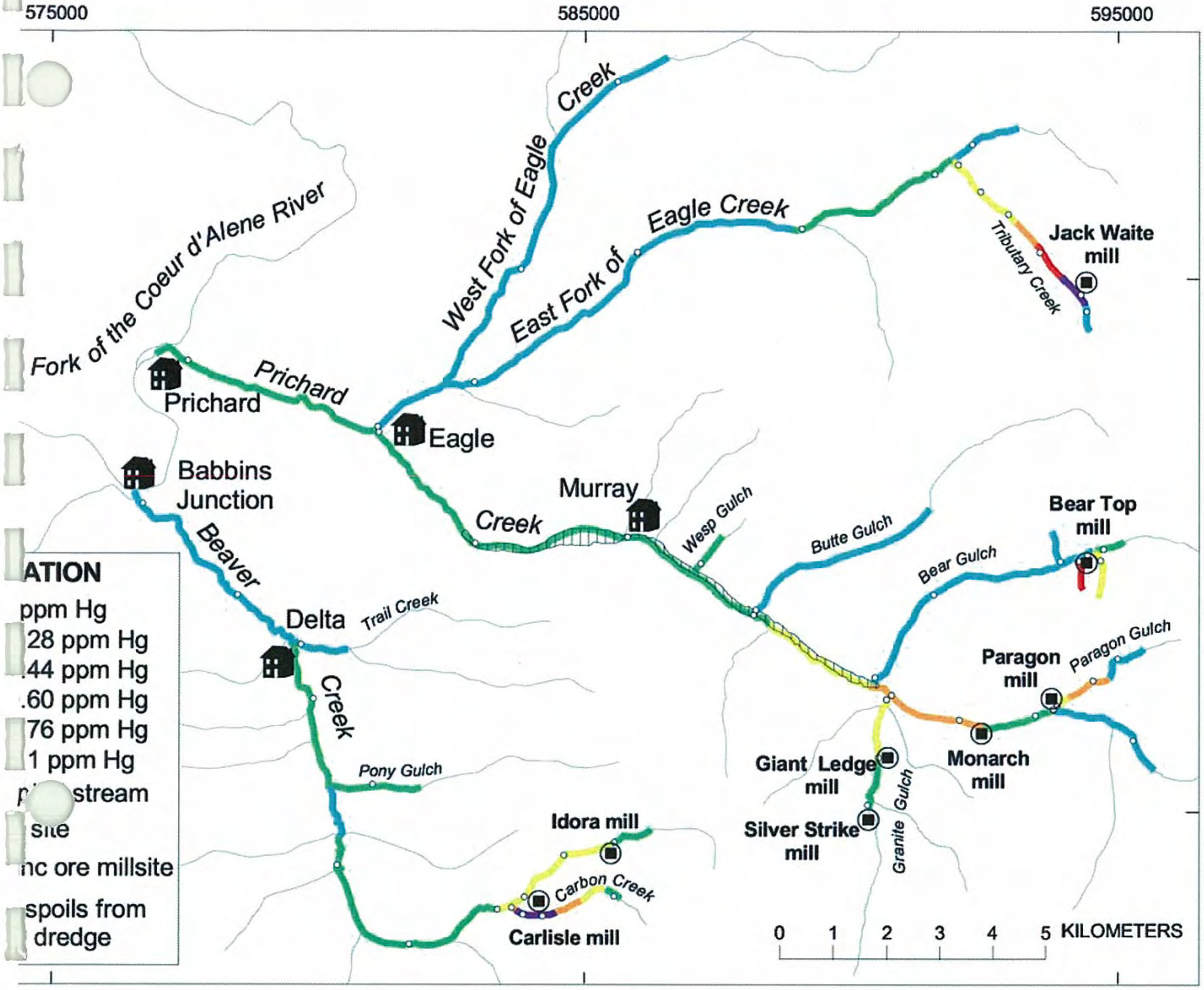
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(figs. 2-5). Weaker enrichments of mercury are also associated with the Bear Top, Paragon, Monarch, Giant Ledge, and Idora millsites. The downstream decrease in Hg content to less than 2 times background value occurs about 4 km below the confluence of Tributary Creek and the East Fork of Eagle Creek, and about 5 km below the confluence of Carbon and Beaver Creeks, although a minor enrichment of mercury due to input from Pony Gulch occurs in middle Beaver Creek. Hg contents are greater than 3 times background value to the mouth of Prichard Creek; the persistence of this enrichment of mercury may be due to a small but widespread contribution from discarded processing mercury associated with placer and lode gold mining in the Murray-Eagle area (fig. 2).

Prichard Creek

The locations of sampling sites for streambed and suspended sediment in Prichard Creek are shown in figure 2, and the locations of mines and millsites and of sampling sites for streambed sediment, streambank soil, and artificial-fill material along upper Prichard Creek and its tributaries are shown in figure 3. The Pb, Zn, As, and Hg contents in three grain-size fractions of streambed sediment and in suspended sediment from the main stem of Prichard Creek are plotted against distance upstream from its mouth in figure 10, along with data for the fine (<0.063-mm grain size) fraction from near the mouths of several tributaries (Eagle Creek and Bear, Paragon, Granite, and Wesp Gulches) at their confluences with Prichard Creek.

Maximum enrichments of mining-related elements in streambed sediment in Prichard Creek (fig. 10) generally occur upstream from Murray (figs. 2) except for arsenic, which peaks from Murray to Eagle. The farthest-upstream sample from Prichard Creek, upstream of mining impacts, has the lowest Pb and Zn contents in the entire sample set. Metal contents increase downstream past the Paragon millsite and again past the Monarch millsite. Pb, Zn, and Hg contents peak in Prichard Creek just below the Monarch millsite and decrease sharply to the vicinity of the town of Murray, then more gradually downstream. As content increases only slightly past the Paragon and Monarch millsites but increases sharply below the inflow of As-rich sediment from Granite Gulch, then again at Murray below the inflow of arsenic-rich sediment from Wesp Gulch (fig. 9*C*).

In the Prichard Creek drainage basin (figs. 2, 3), Hg contents consistently decrease with increasing grain size in all samples of streambed sediment (mean ratio in fine over coarse fractions, 3.5); Pb and Zn contents mostly decrease with increasing grain size (mean ratios in fine over coarse fractions, 1.5 and 1.3, respectively). As content is highest in the fine fractions of only three of eight samples and is highest in either the intermediate or coarse fraction of the other five samples.

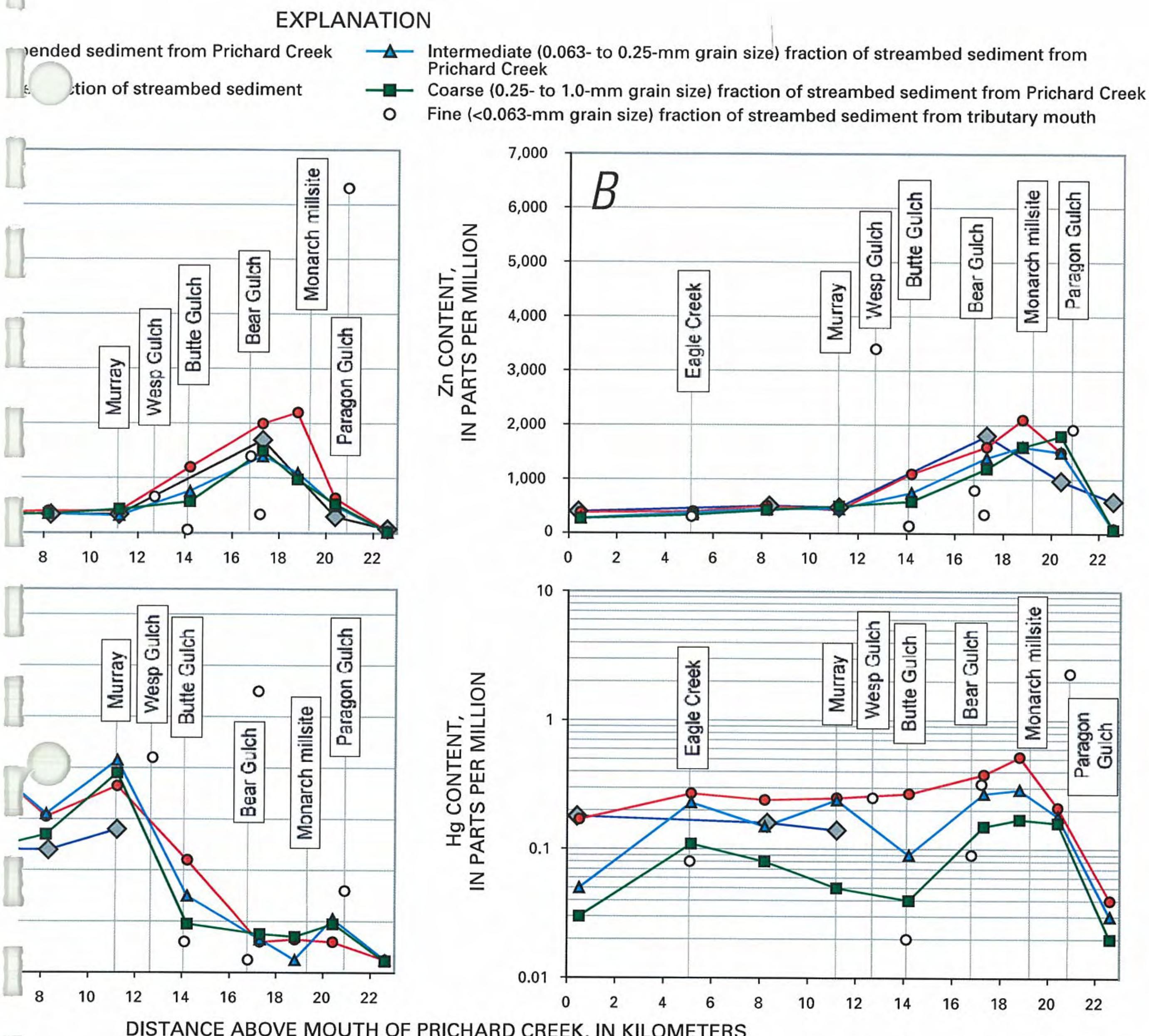
During sampling of suspended sediment from the high-runoff event of April 14, 2000, Prichard Creek above the confluence of Butte Gulch (figs. 2, 3) was relatively clear (suspended-sediment concentration, 13–30 mg/L, table 6), and snow blanketed the streambanks. Chocolate-brown suspended-sediment-laden water (suspended-sediment concentration, 683 mg/L, with background metal contents; sample 00SB–BU1, table 6) flowed out of Butte Gulch into Prichard Creek, which remained highly turbid to its mouth. Upstream from the inflow of Butte Gulch, Pb and Zn contents were high in the sparse suspended sediment of Prichard Creek but lower than those in the fine (<0.063-mm grain size) fraction of streambed sediment at each sampling site (As and Hg contents were below analytical detection limits in the small samples.) At Murray, 3 km downstream from the inflow of Butte Gulch, Pb and Zn contents in suspended sediment were similar to, and As and Hg somewhat less than, those in the fine fraction of streambed sediment at the same sampling sites. By the mouth of Prichard Creek, all four metal contents are the same in suspended sediment and in the fine fraction of streambed sediment at the same sampling sites. This downstream increase in compositional similarity between suspended sediment and the fine fraction of streambed sediment presumably reflects a gradual substitution of suspended material inflowing into Prichard Creek from Butte Gulch with resuspended material from the fine fraction of streambed sediment in Prichard Creek.

The spatial and compositional relations between streambed sediment, streambank soil, and impounded tailings along upper Prichard Creek and its mined tributaries are illustrated in figure 11. Significant element enrichments in streambed sediment occur in each stream below each streamside millsite, although the metal contents in streambed sediment are significantly lower than those in adjacent impounded tailings. If the metal-enriched sediment is interpreted as a mixture of native sediment and tailings, only about 1 to 3 percent tailings would be required to account for the Pb (a relatively insoluble element) content in the fine (<0.063-mm grain size) fraction of streambed sediment below each millsite.

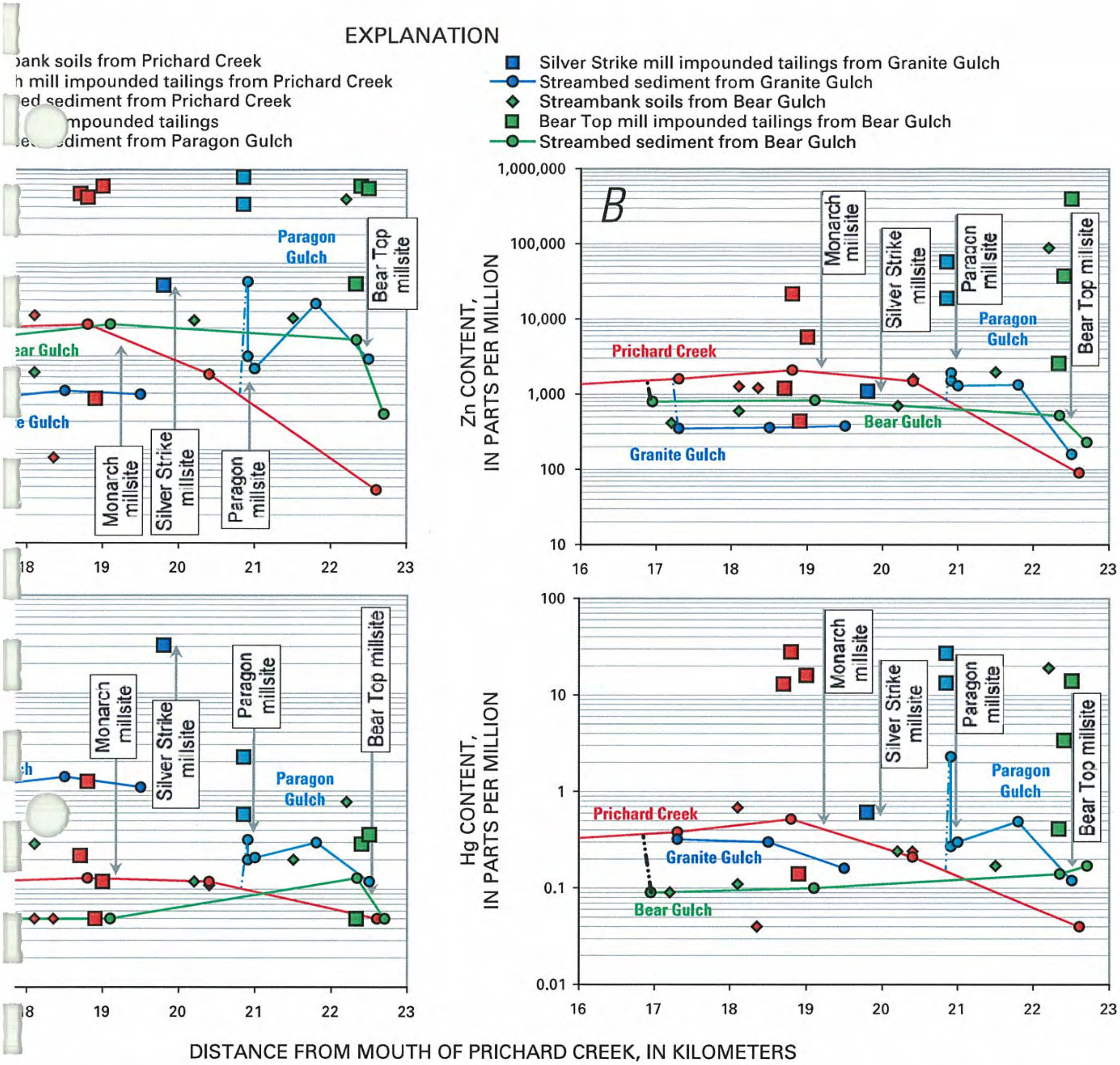
Streambank soil represents both a potential source (through erosion) of material to streambed sediment and a record of past overbank deposition during channel-overflow floods. Because overbank deposits are derived from mobilized streambed sediment, the compositions of historically deposited streambank-soil horizons can be compared with those of present streambed sediment to test for temporal changes in the composition of streambed sediment. For example, the high metal content in streambank soil just downstream from the Bear Top millsite (fig. 11) is similar to that of impounded tailings just upstream, suggesting that tailings were once the dominant component of stream sediment near the millsite. In contrast, the metal contents in samples of streambank soil collected along Prichard Creek below both the Paragon and Monarch millsites have that are the same as or less than those in samples of the adjacent streambed sediment; no evidence exists that tailings input to this reach of Prichard Creek was ever significantly more in the past than at present.

Eagle Creek

The locations of sampling sites for streambed and suspended sediment in Eagle Creek are shown in figure 2, and the locations of mines and millsites and of sampling sites for



›and Hg (*D*) contents in three grain-size fractions of samples of streambed sediment and in samples of unfractionated (bulk) ›m the Prichard Creek drainage basin in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), versus distance ›Creek, beginning (at right) at head of Prichard Creek and continuing down to mouth. Data points for samples of fine (<0.063-mm ›ediment from tributaries to Prichard Creek are plotted at location of confluence of tributary and Prichard Creek.



C), and Hg (*D*) contents in fine (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and
om Prichard Creek and Paragon, Granite, and Bear Gulches in the northern Coeur d'Alene Mining District, northern Idaho
am from mouth of Prichard Creek, with locations of four historical lead-zinc ore-concentration mills along stream labeled.
ailings from Johnson (1999).

streambed sediment, streambank soil, and artificial-fill material along Tributary Creek and the upper East Fork of Eagle Creek are shown in figure 4. The Pb, Zn, As, and Hg contents in three grain-size fractions of streambed sediment and in samples of suspended sediment collected from the main stem of Eagle Creek, the East Fork of Eagle Creek, and Tributary Creek versus distance upstream from the mouth of Eagle Creek are plotted in figure 12, along with data for the fine (<0.063-mm grain size) fraction of streambed sediment from near the mouths of two tributaries (upper East Fork of Eagle Creek above the Tributary Creek confluence, and the West Fork of Eagle Creek) at their confluence with the East Fork of Eagle Creek.

Maximum enrichments of mining-related elements (Pb, Zn, As, Hg) in streambed sediment of the Eagle Creek drainage basin (fig. 12) generally occur on Tributary Creek and on the East Fork of Eagle Creek for some distance below the Tributary Creek confluence (fig. 2). Streambed sediment from Tributary Creek 150 m upstream from the Jack Waite Mine portal (km 17.4, fig. 12) has background values of lead, zinc, and mercury but is relatively arsenic rich. Just below the mine portal (next sample downstream, fig. 12), Pb, As, and Hg contents peak in the Eagle Creek drainage basin (figs. 2, 4); Zn content peaks at the next sampling site downstream, below the Jack Waite millsite. Metal contents decrease sharply below the millsite and the first two tailings impoundments, and thence decrease irregularly to the confluence with the East Fork of Eagle Creek. Below the confluence of Tributary Creek and the East Fork of Eagle Creek, metal contents in streambed sediment decrease more gradually to the mouth of Eagle Creek.

In the Eagle Creek drainage basin (figs. 2, 4), the generalization that metal contents decrease with increasing grain size is consistently true only for mercury. The Hg content in the fine (<0.063-mm grain size) fraction of streambed sediment averages 4 times greater than that in the coarse (0.25- to 1.0-mm grain size) fraction. The difference in Pb and Zn contents between grain-size fractions is much less than that in Hg content; the average fine-fraction/coarse-fraction ratios for Pb and Zn contents are 1.7 and 1.3, respectively. Although the fine fraction of each sample generally has the highest Pb and Zn contents of the three grain-size fractions (with a few exceptions), the Pb and Zn contents in the coarse fraction can be either higher or lower than that in the intermediate (0.063- to 0.25-mm grain size) fraction. The coarse fraction has the highest As content in 7 of 11 samples, most commonly followed by the fine fraction. The metal contents in the two samples of suspended sediment collected from the main stem and East Fork of Eagle Creek are generally similar to, but slightly greater than, those in the fine fraction of streambed sediment at each sampling site.

The metal contents in the fine (<0.063-mm grain size) fraction of streambed sediment, streambank soil, and artificial-fill material at sampling sites of potential sources of metals along Tributary Creek above its confluence with the East Fork of Eagle Creek (figs. 2, 4) are plotted in figure 13. The metal contents in samples of streambed sediment are similar to, but slightly less than, those in samples collected from the Jack Waite mill tailings impoundments, suggesting that the fine fraction of streambed sediment is derived dominantly from tailings mixed with a much smaller component of the native premining sediment of Tributary Creek, represented by the sample upstream from the Jack Waite Mine portal. Samples of streambank soil near the confluence of Tributary Creek and the East Fork of Eagle Creek (figs. 4, 13), which have metal contents higher than those in the present stream sediment, are inferred to represent deposits either from tailings released to the stream before construction of the first tailings impoundment in December 1930, or from erosion of an early tailings impoundment by a major early flood, such as that of December 1933, the second- or third-largest flood since European-American settlement of the mining district.

Beaver Creek

The locations of sampling sites for streambed and suspended sediment in Beaver Creek are shown in figure 2, and the locations of mines and millsites and of sampling sites for streambed sediment, streambank soil, and artificial-fill material in the drainage of upper Beaver Creek are shown in figure 5. The Pb, Zn, As, and Hg contents in three grain-size fractions of streambed sediment and in unfractionated suspended sediment from the main stem of Beaver Creek versus distance upstream from its mouth are plotted in figure 14, along with data for the fine (<0.063-mm grain size) fraction of stream sediment from several tributaries (Pony Gulch and Carbon and Trail Creeks) at their confluences.

Maximum enrichments of mining-related elements (Pb, Zn, As, Hg) in streambed sediment of the Beaver Creek drainage basin (fig. 2) occur upstream from the Dobson Pass Road Bridge (fig. 5). Metal contents in the farthest-upstream samples from both Beaver and Carbon Creeks appear to be significantly higher than background values; presumably, the mine workings in each drainage above those points have contributed small amounts of metal-enriched sediment to the streams. Peak contents of various metals in the streambed sediment occur at different places along the stream. Pb content peaks just below the Idora millsite and decreases sharply to the Dobson Pass Road Bridge, then more gradually to the mouth of Beaver Creek. Zn and As contents also increase below the Idora millsite but peak just below the confluence of Carbon Creek, apparently owing to the addition of metal-enriched material from that drainage. Hg content also increases below the Idora millsite but peaks just above the confluence of Carbon Creek. Although Hg and As contents decrease from the Carbon Creek confluence to the mouth of Beaver Creek, both Hg and As contents increase slightly in the fine fraction of streambed sediment below Pony Gulch, apparently owing to the contribution of metal-enriched material from that drainage. Kauffman and others (1999a) reported the existence of a lode gold mine in upper Pony Gulch that may be the source of that material.

In the Beaver Creek drainage basin (figs. 2, 5), metal contents decrease with increasing grain size in all samples of streambed sediment for mercury (mean ratio in fine over

EXPLANATION

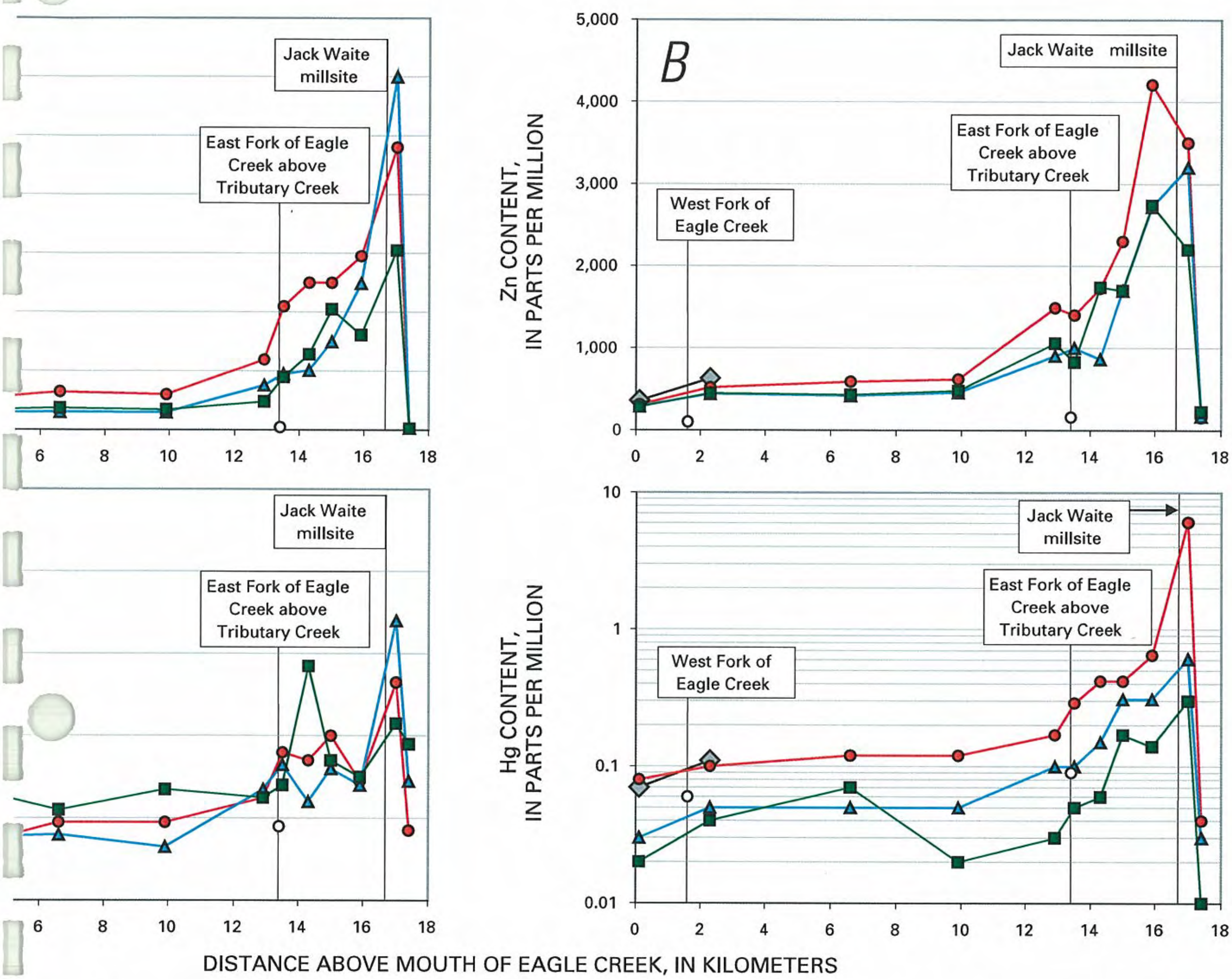
ded sediment from Eagle Creek

raction of streambed sediment

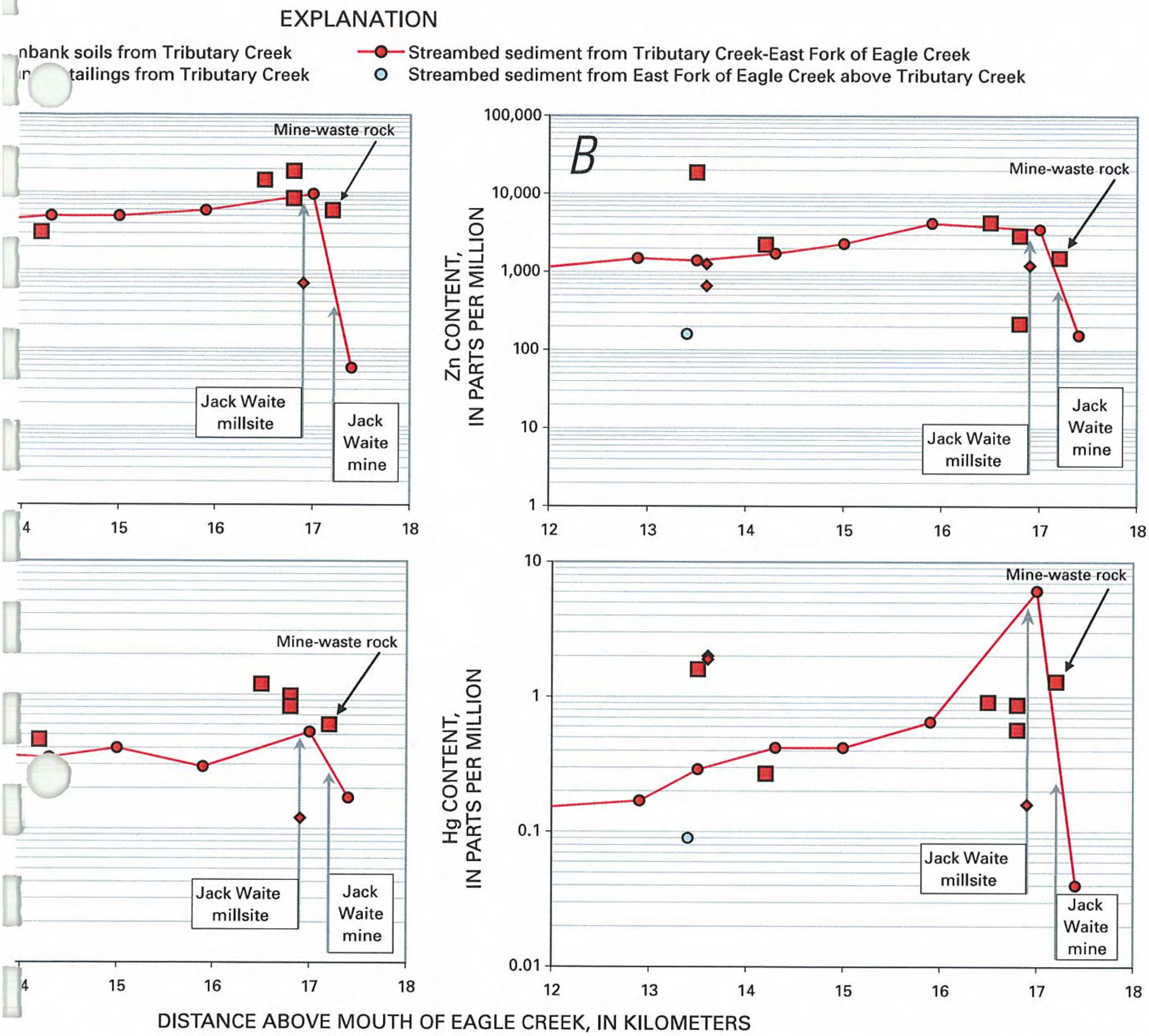
Intermediate (0.063- to 0.25-mm grain size) fraction of streambed sediment from Eagle Creek

Coarse (0.25- to 1.0-mm grain size) fraction of streambed sediment from Eagle Creek

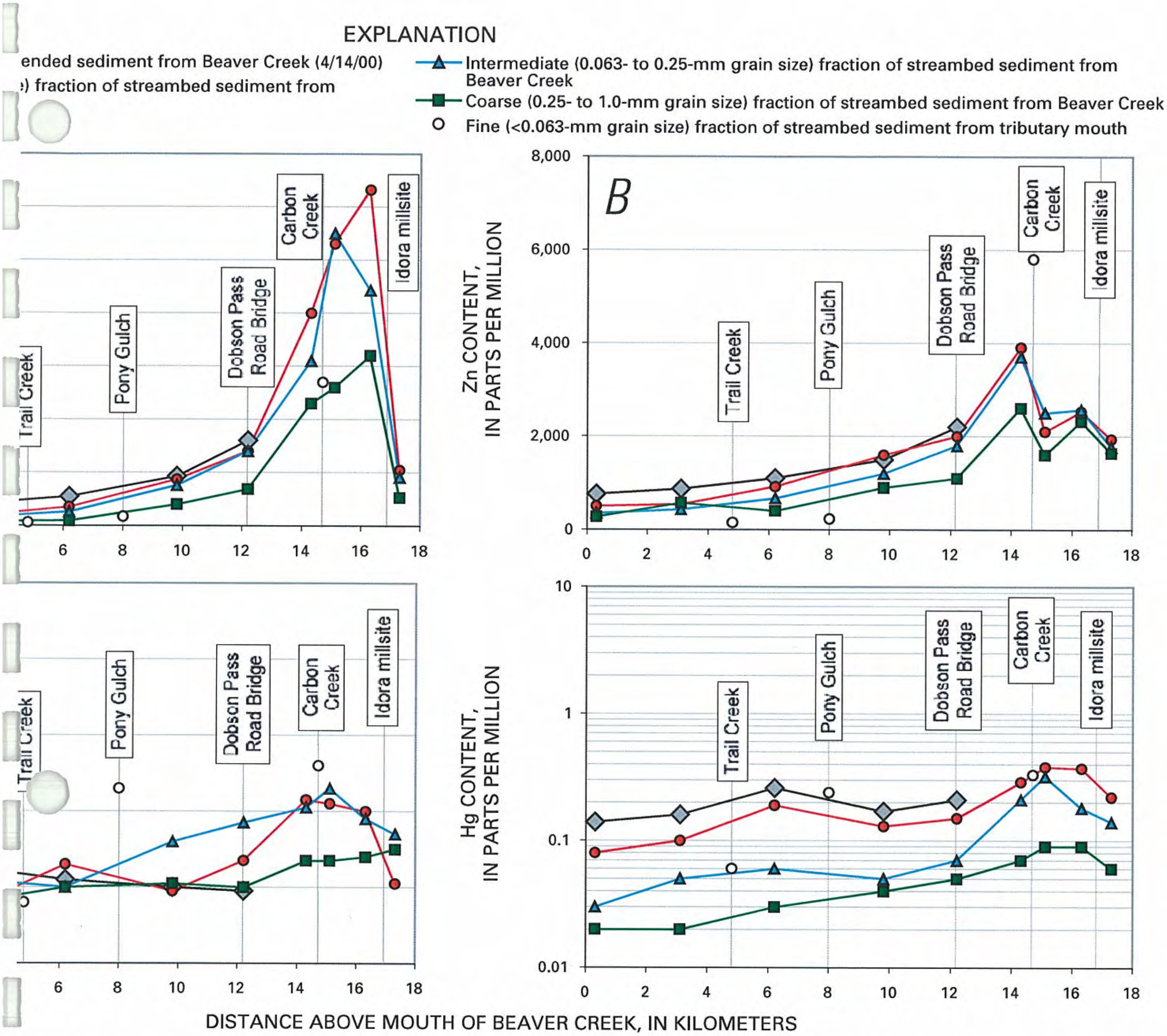
Fine (<0.063-mm grain size) fraction of streambed sediment from tributary mouth



and Hg (*D*) contents in three grain-size fractions of samples of streambed sediment and in samples of unfractionated (bulk) sus-
e Eagle Creek drainage basin in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), versus distance upstream
ning (at right) at head of Tributary Creek and continuing down the East Fork of Eagle Creek to mouth of main stem of Eagle Creek.
ain size) fraction of streambed sediment from tributaries to Eagle Creek are plotted at confluence of tributary and Eagle Creek.



and Hg (*D*) contents in fine (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill ot where noted) collected from Tributary Creek and immediately downstream segment of the East Fork of Eagle Creek in the strict, northern Idaho (fig. 4), versus distance upstream from mouth of Eagle Creek, with locations of the Jack Waite (Pb-Zn) ill along stream labeled.



·), and Hg (*D*) contents in three grain-size fractions of samples of streambed sediment and in samples of unfractionated (bulk) sus- ·Creek drainage basin in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), versus distance upstream from mouth of ·it) at head of creek and continuing down to mouth. Data points for samples of fine (<0.063-mm grain size) fraction of streambed sedi- Creek are plotted at confluence of tributary and Beaver Creek.

coarse fractions, 4.2) and, less consistently, in most samples for lead and zinc (mean ratios in fine over coarse fraction, 2.3 and 1.5, respectively). As content is highest in the fine fraction of only a third of the samples and most typically (in five of nine samples) is highest in the intermediate (0.063- to 0.25-mm grain size) fraction. The Pb, Zn, and Hg contents in unfractionated samples of suspended sediment collected from Beaver Creek during the high-flow event of April 14, 2000, generally are slightly higher than those in the fine fraction of streambed sediment at each sampling site. However, the As content in suspended sediment, though generally similar to that in streambed sediment, shows no consistent relation to that in any of the grain-size fractions.

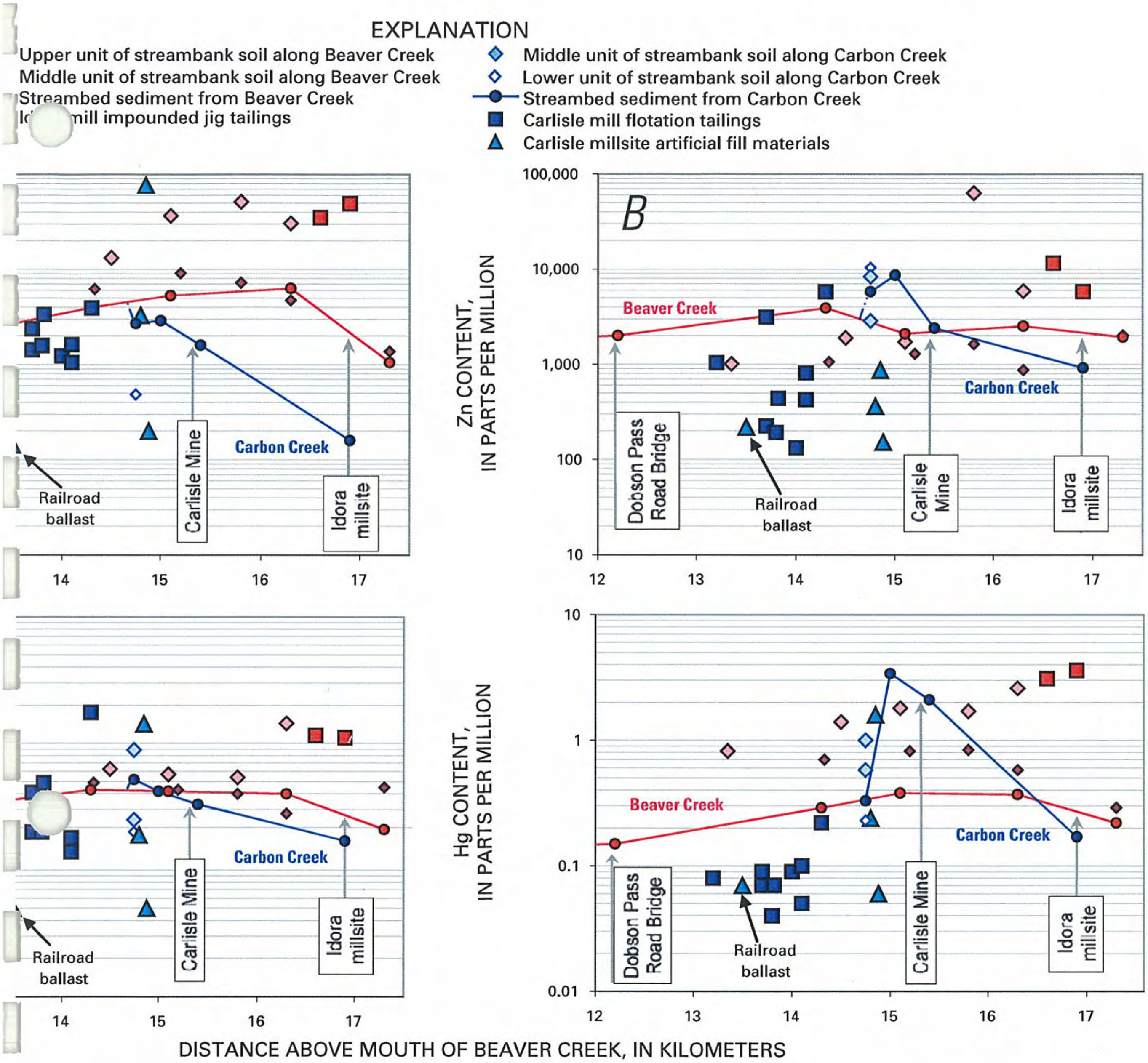
The metal contents in the fine (<0.063-mm grain size) fraction of streambed sediment, streambank soil, and artificial-fill material at sampling sites of potential sources of metals along upper Beaver Creek and its tributaries (figs. 2, 5) are plotted in figure 15. In upper Beaver Creek (above the Carbon Creek confluence), gravity tailings from the Idora mill, which show strong element enrichments over present streambed sediment, are clearly the source of the middle unit of streambank soil downstream (see next paragraph), on the basis of Pb and Hg contents. The metal contents in Carlisle mill flotation tailings are much lower, overlapping with, but mostly less than, those in adjacent streambed sediment. The high metal contents of the present streambed sediment of upper Beaver Creek cannot result from erosion of Carlisle mill flotation tailings but most likely are due to erosion of Idora mill tailings impoundments and of streambank soil rich in Idora mill tailings.

In the upper Beaver Creek drainage, unconsolidated streambank deposits (ranging in grain size from silt to coarse angular cobbles, here called simply "soil") are here divided into lower, middle, and upper units, depending on their relative stratigraphic position. The lower unit consists of pebble to cobble conglomerate with a dark-brown, organic-rich fine matrix; the middle unit consists of red-brown sandy material; and the upper unit consists of light-colored, sand-poor, pebble-cobble gravel. As mentioned above, the high metal content in the middle unit of streambank soil and its downstream decrease suggests that this material represents overbank sediment deposited from the stream channel when aggraded with gravity tailings from the Idora mill. We suspect that aggradation of the streambed and deposition of the middle unit of streambank soil occurred during or soon after operation of the Idora mill (1913–17). The very high Zn content in sample 105A at km 14.7 (figs. 5, 15) may approximate that in the original unweathered tailings; this sample is the only unoxidized material collected from the middle unit of streambank soil or from the Idora mill gravity tailings (deposited behind a 1.5-m-high plank dam across the stream that was subsequently breached). The upper unit of streambank soil records overbank deposition of coarse, subangular streambed materials when the stream bed was aggraded by an influx of coarse colluvial material. Vertical black-and-white USFS aerial photographs taken in 1937 show large deforested areas on the slopes above upper Beaver Creek and several major avalanche chutes that had built visible debris cones of colluvial material in the valley bottom. We suspect that the heavy influx of this colluvial material would clog the stream channel and would result in more common overbank-flood events, depositing the coarse upper unit of streambank soil during that period. Subsequent to this aggradational episode, the previously aggraded deposits were eroded from the streambed, lowering its elevation and leaving an aggraded alluvial bench along the stream that is rarely inundated. Metal contents of the upper unit of streambank soil are intermediate between those of the jig-tailings-rich middle unit of streambank soil and the present streambed sediment (fig. 15).

Enrichments of mining-related elements in the streambed sediment of Carbon Creek show a pattern distinct from those in the streambed sediment of Beaver Creek (fig. 15). Metal contents in the farthest-upstream sample (10, fig. 5) collected from Carbon Creek are above background values, presumably owing to contributions from mine drainage and mine-waste-rock dumps still farther up the drainage. Metal contents increase downgradient, even upstream of the significant disturbances at the Carlisle Mine portal, most likely owing to contributions from mine drainage and mine-waste-rock dumps associated with the Amazon-Manhattan Mine/Blue Grouse-Mountain Goat Mine trend of workings (fig. 5). The Pb, Zn, and Hg contents in the streambed sediment of Carbon Creek peak below the Carlisle Mine portal and decrease farther downstream below the Carlisle millsite. Enrichments of mining-related elements in the streambed sediment of Carbon Creek above the Carlisle millsite cannot be the result of mill-tailings release but must be due primarily to erosion of mine-waste-rock dumps and to precipitation of dissolved elements from mine drainage (such as from the Carlisle Mine portal; see Ott and Clark, 2003) and, possibly, from ground water draining through the mine-waste-rock dumps.

Enrichments of Mining-Related Elements over Background Values

The enrichment of each of four mining-related elements (Pb, Zn, As, Hg) in streambed sediment over background values and their interrelations differ for each drainage in the study area (figs. 1, 2, 16). For example, in Eagle Creek, the relative order of enrichment is Pb>Zn>Hg>As consistently along the length of the stream (except for a spike in Hg content below the Jack Waite Mine portal). In contrast, Beaver Creek shows a similar pattern above its junction with Carbon Creek, but farther downstream the relative enrichment of lead decreases more rapidly than those of the other three elements, such that the relative order of enrichment is Zn>Pb>Hg>As in lower Beaver Creek. In Prichard Creek, no enrichment of arsenic is associated with those of the other three elements above Granite Gulch. The As content in stream sediment increases below the confluence with Granite Gulch but continues to increase farther downstream, suggesting other sources of arsenic enrichment (for example, waste materials from lode gold mines) along lower Prichard Creek.



and Hg (*D*) contents in fine (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-
xcept where noted) collected from Beaver and Carbon Creeks in the northern Coeur d'Alene Mining District, northern Idaho
ı from mouth of Beaver Creek, with locations of two historical Pb-Zn ore-concentration mills and one major mine portal along

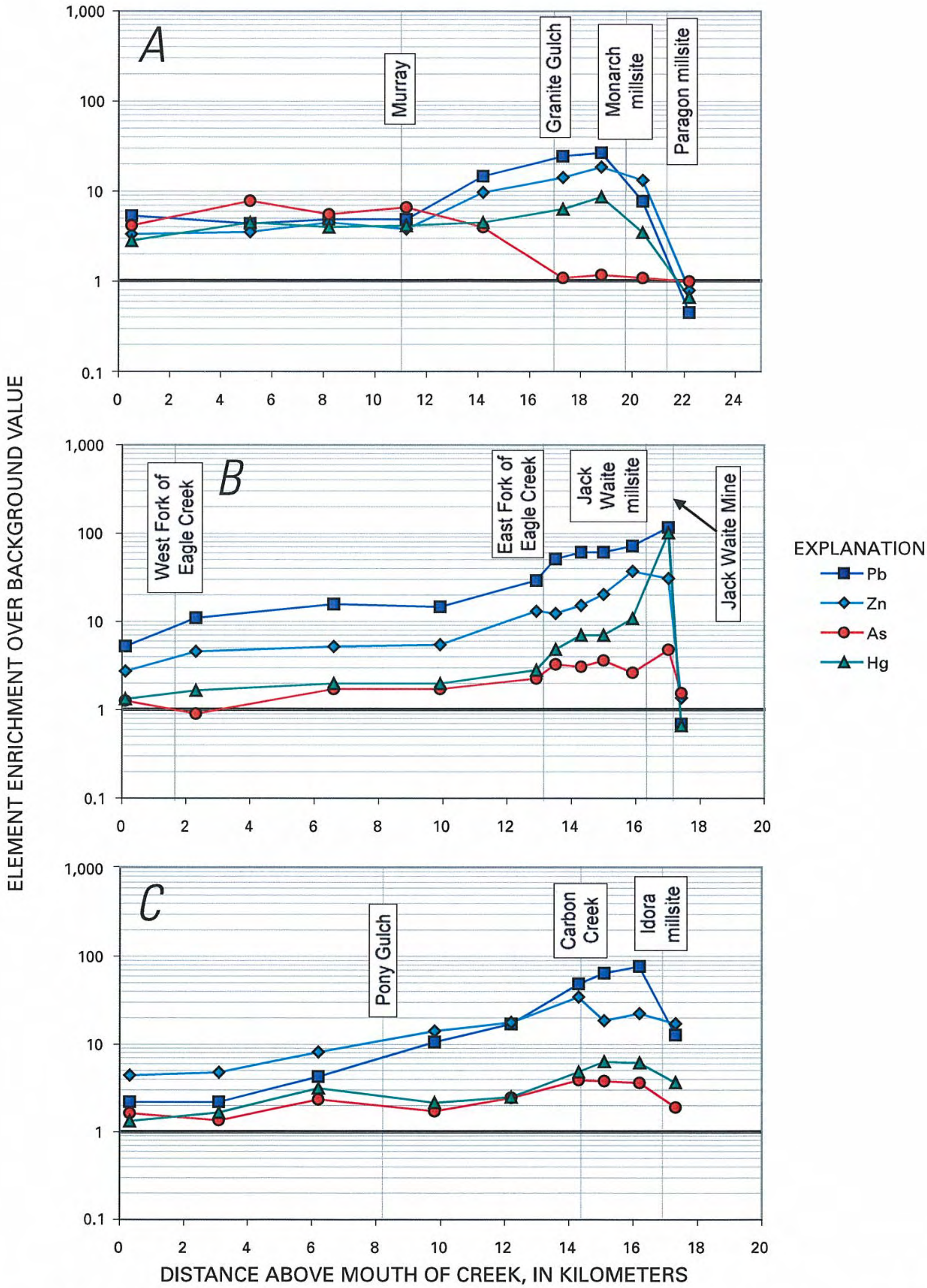


Figure 16. Enrichments of lead, zinc, arsenic and mercury over background values in fine (<0.063-mm grain size) fraction of samples of streambed sediment collected from Prichard Creek (*A*), Tributary Creek and East Fork and main stem of Eagle Creek (*B*), and Beaver Creek (*C*) in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2); background values based on mean Pb, Zn, As, and Hg contents in fine fraction of three samples of streambed sediment collected from the unimpacted West Fork of Eagle Creek.

Proportion of Metal Mass in the Fine Fraction of Streambed Sediment

In figures 10, 12, and 14, the metal contents in the fine (<0.063-mm grain size) fraction of streambed sediment are generally higher than those in either the intermediate (0.063- to 0.25-mm grain size) or the coarse (0.25- to 1.0-mm grain size) fraction. However, because the weight percentage of each grain-size fraction was measured (table 5), the proportion of the total mass of each metal in each analyzed sample that resides in each grain-size fraction can be calculated. A plot of the median percentages of the total mass of each metal in each grain-size fraction by drainage basin (fig. 17) shows that relatively little (~10 percent) is carried in the fine fraction (clay and silt) and that most (~65 percent) is carried in the coarse fraction (medium to coarse sand). This difference results from the much greater mass of the coarse fraction than of the other two fractions, even though the metal contents in the finer grain sizes actually are slightly higher. Although differences exist between drainages in the proportions of each metal carried in the fine fraction (fig. 18), in each drainage the percentage of metal mass in the fine fraction is highest for mercury, followed by lead, zinc, and arsenic. Plots of the percentage of the total mass of each metal in the fine fraction of each sample against downstream location (fig. 18) indicate relatively little systematic change downstream, although generally more of the metal load is carried in the fine fraction in the vicinity of the source mine/millsites.

Conclusions

Historical mining of silver-lead-zinc ores in the headwater reaches of the Prichard Creek, Eagle Creek, and Beaver Creek drainages (figs. 2–5) has resulted in enrichments of lead, zinc, mercury, arsenic, cadmium, silver, copper, cobalt, and, to a lesser extent, iron and manganese in streambed sediment. Using the metal contents in samples collected from the relatively unimpacted West Fork of Eagle Creek as representative of background values, the Pb and Zn contents in streambed sediment in the vicinity of the mines and millsites are 20 to 100 times background values, decreasing downstream to 2 to 5 times background values over 15 to 20 km to the mouth of the stream. Lesser enrichments (<10 times background values) of mercury and arsenic that are also generally associated with silver-lead-zinc mining decrease downstream, although enrichment of arsenic also is areally associated with the lode gold deposits near Murray, which were not studied here. Metal contents in suspended sediment collected during the high-flow event of April 14, 2000, are generally similar to, but slightly higher than,

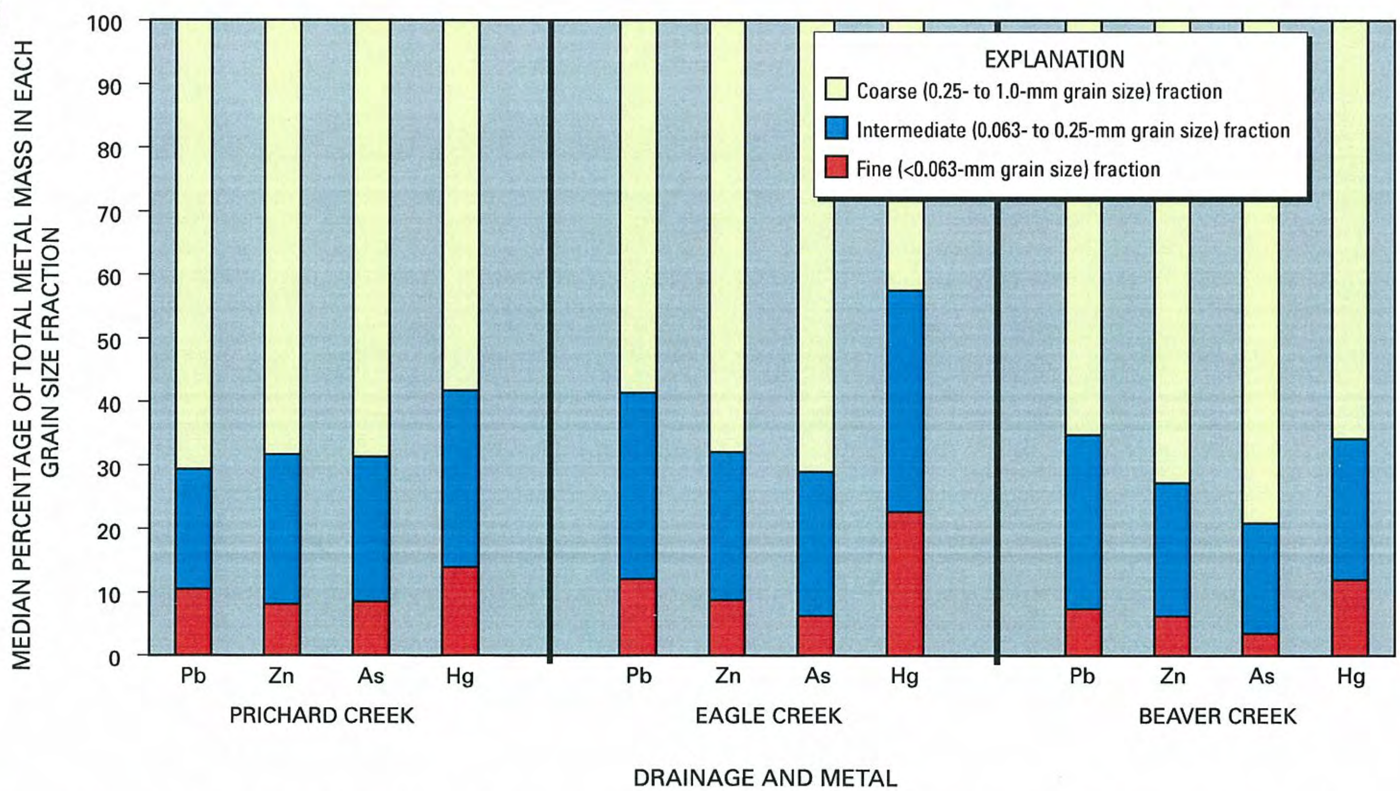


Figure 17. Partitioning of total mass of each of four metals (lead, zinc, arsenic, and mercury) in <1.0-mm-grain-size fraction of streambed sediment between coarse, intermediate, and fine fractions (using median percentages by drainage) in samples collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2).

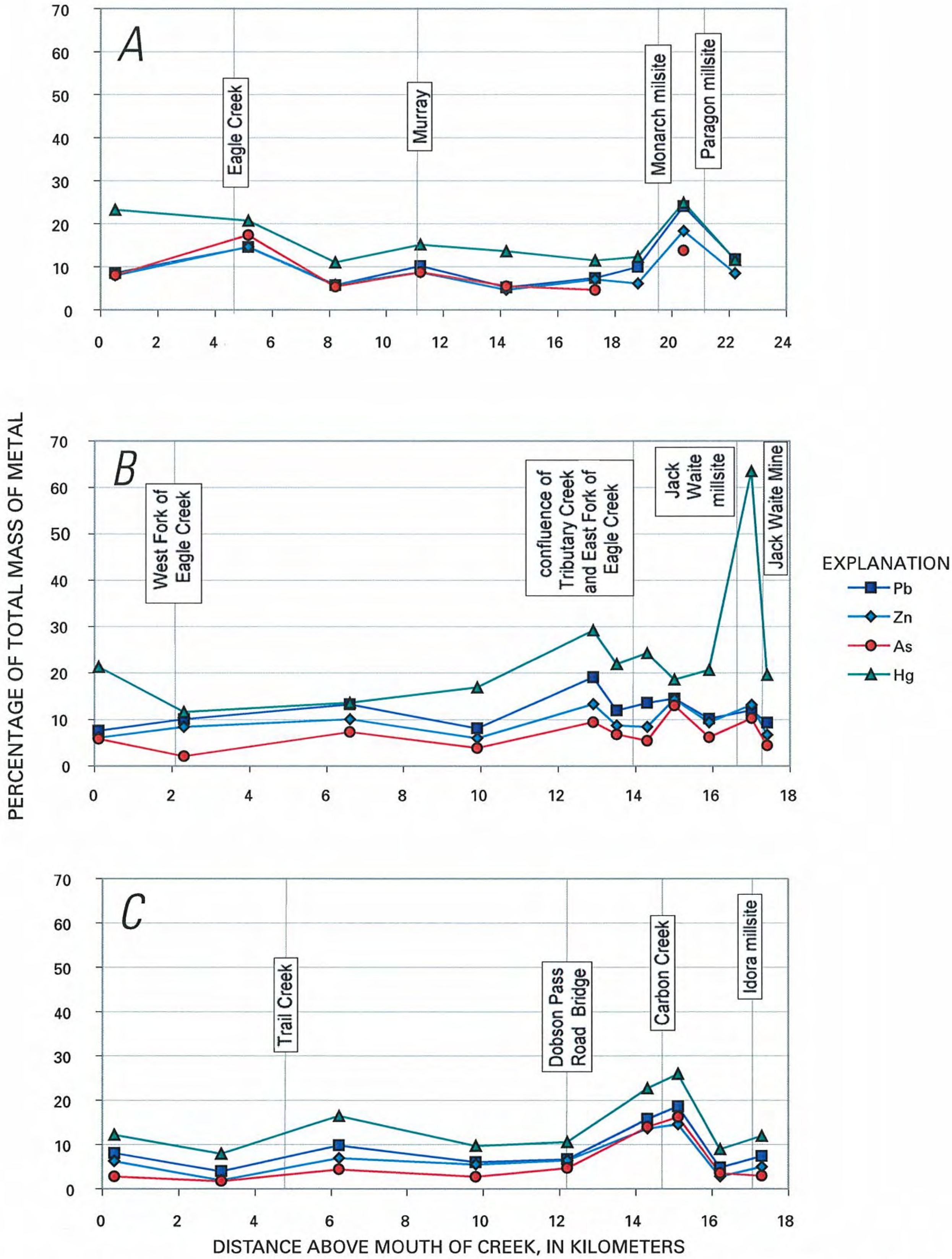


Figure 18. Percentages of total mass of lead, zinc, arsenic, and mercury that resides in the fine (<0.063-mm grain size) fraction of <1-mm grain-size fraction of samples of streambed sediment from Prichard Creek (*A*), Eagle Creek (*B*), and Beaver Creek (*C*) drainages in the northern Coeur d'Alene Mining District, northern Idaho (figs. 1, 2), versus distance upstream from mouth of creek.

those in the fine (<0.063-mm grain size) fraction of streambed sediment from the same sampling site. Although element enrichments in streambed sediment typically begin at the mine portals and their associated mine-waste-rock dumps, more volumetrically significant inputs of metal-enriched materials were contributed by the ore-concentration mills and their associated accumulations of more finely ground, more metal enriched tailings.

Metal enrichments in the streambed sediment of Eagle Creek originate at the inactive Jack Waite Mine/millsite in the headwater reaches of Tributary Creek, the largest ore producer in the study area (figs. 1, 2). The metal contents in samples of streambed sediment are similar to, but generally less than, those in samples of the Jack Waite flotation-tailings impoundments, suggesting that the fine fraction bears a significant component of eroded tailings mixed with a much smaller component of the native sediment of Tributary Creek. Historical records indicate that tailings were not initially impounded but were discarded directly into the stream. Streambank soil just above the confluence of Tributary Creek with the East Fork of Eagle Creek, which has metal contents higher than those of the present stream sediment, is inferred to represent overbank deposits from this early era of stream disposal of tailings.

Several abandoned Silver-Lead-Zinc mines and millsites are located along upper Prichard Creek and its tributaries (Paragon, Granite, and Bear Gulches, figs. 2–5). Streambed sediment of the Prichard Creek drainage basin is less enriched in lead and zinc than that of Tributary Creek, even though Pb and Zn contents in gravity tailings from mills in the Prichard Creek drainage are 5 to 10 times greater than in flotation tailings from the Jack Waite mill along Tributary Creek, suggesting that the release of tailings into Prichard Creek was much less than that into Eagle Creek. The absence of tailings-bearing streambank soils along Prichard Creek with much higher metal contents than those of the present streambed sediment suggests that tailings were always impounded and not directly released into Prichard Creek or its tributaries. High As contents were measured in samples of streambed sediment collected from Granite Gulch below the Silver Strike Mine/millsite and from Prichard Creek near Murray, where several lode gold mines apparently contributed arsenic-rich materials to the stream.

Although enrichments of mining-related elements in streambed sediment are associated with abandoned ore-concentration millsites in upper Beaver Creek (Idora millsite) and in its major tributary Carbon Creek (Carlisle millsite), lesser enrichments farther upstream are associated with mine portals and mine-waste-rock dumps (fig. 5). Early, highly metal-enriched gravity tailings were produced by each mill, although impounded gravity tailings are preserved only at the Idora millsite. Downstream from each millsite, the middle unit of streambank soil has high metal contents similar to those of the gravity tailings, indicating that both gravity mills sometimes discarded tailings directly into the streams, whereas the metal contents in the upper unit of streambank soil are intermediate between those in the gravity tailings and the present incised streambed. The progressive decrease of metal contents from the middle to upper units to those of the present streambed sediment apparently records reductions of the metal contents in streambed sediment over time since the end of operation of the early gravity mills. Major volumes of flotation tailings (second only to those from the Jack Waite mill) were generated at the Carlisle mill in the 1940s and 1950s; however, these tailings, which are generally less metal enriched than the adjacent streambed sediment, were more effectively impounded and so were never major contributors of metal to adjacent and downstream streambed sediment.

Acknowledgments

This research was supported by the USFS, BLM, and the USGS. We thank Ray Tesoro, Jeff Johnson, Jim Northrup, and Chris Dail of the USFS and Steve Moore and David Fortier of BLM for their support and encouragement. We appreciate the interaction with other USGS colleagues who undertook related studies of surface and ground waters (Dave Clark, Doug Ott, and Pat Lambert) and of aquatic biota (Aida Farag, Dave Harper, Jack Goldstein, and Terry Maret). We also thank Chris Murphy of the USGS analytical laboratory in Denver, Colo., for his careful oversight of sample handling, and Eastern Washington University, Cheney, for the use of their grain-size-fractionation facilities. Thanks also to George Havach for his careful editing of the manuscript.

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Tables 1–12

:tion zone 11, NAD27 datum; for samples from tributaries, distance above mouth of drainage basin is measured from mouth of tributary to mouth of the ...sured to mouth of tributary. Do, ditto]

Sampling date	Elevation (ft)	1:24,000-scale USGS topographic map	Drainage basin	Distance above mouth of drainage basin (km)	Tributary name	Distance above tributary mouth (km)
8/9/00	2,370	Prichard	Beaver Creek	.3	--	--
8/9/00	2,460	Osburn	do	3.1	--	--
8/9/00	2,520	do	do	4.8	Trail Creek	.1
8/9/00	2,560	do	do	6.2	--	--
8/9/00	2,700	do	do	8.0	Pony Gulch	.9
8/9/00	2,700	do	do	9.8	--	--
8/9/00	2,700	do	do	9.8	--	--
8/9/00	2,840	do	do	12.2	--	--
8/10/00	3,120	do	do	15.1	--	--
8/10/00	3,060	do	do	14.7	Carbon Creek	.05
8/9/00	3,990	Burke	do	14.7	do	2.2
8/10/00	2,410	Prichard	Prichard Creek	0.5	--	--
9/14/00	2,620	do	do	8.2	--	--
9/14/00	2,752	Murray	do	11.2	--	--
9/14/00	2,880	Burke	do	12.7	Wesp Gulch	.2
8/16/00	2,885	do	do	14.1	Butte Gulch	.1
8/16/00	2,885	do	do	14.2	--	--
8/16/00	3,060	do	do	16.8	Bear Gulch	.15
8/16/00	3,640	Thompson Pass	do	16.8	do	5.5
9/14/00	3,060	Burke	do	17.2	Granite Gulch	.1
9/14/00	3,320	do	do	17.2	do	2.3
8/16/00	3,050	do	do	17.3	--	--
8/16/00	3,990	do	do	20.4	--	--
8/16/00	3,450	do	do	20.9	Paragon Gulch	.01
8/16/00	3,860	Thompson Pass	do	22.6	--	--
9/14/00	2,535	Prichard	Eagle Creek	5.1	--	--
8/17/00	2,750	do	do	1.6	West Fork of Eagle Creek.	3.1
8/17/00	2,620	do	do	2.3	--	--
8/17/00	2,850	Murray	do	6.6	--	--
8/17/00	2,850	do	do	6.6	--	--
8/17/00	3,100	do	do	9.9	--	--
8/17/00	3,420	do	do	13.4	Tributary Creek	.1

es of streambed sediment collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene
tinued

ct... .one 11, NAD27 datum; for samples from tributaries, distance above mouth of drainage basin is measured from mouth of tributary to mouth of the
ı is measured to mouth of tributary. Do, ditto]

Sampling date	Elevation (ft)	1:24,000-scale USGS topographic map	Drainage basin	Distance above mouth of drainage basin (km)	Tributary name	Distance above tributary mouth (km)
8/17/00	4,230	Black Peak	do	13.4	Tributary Creek	3.6
8/10/00	3,280	Prichard	Beaver Creek	14.7	Carbon Creek	.7
8/10/00	3,150	Osburn	do	14.7	do	.3
8/10/00	3,030	do	do	14.3	--	--
8/16/00	3,540	Thompson Pass	Prichard Creek	20.9	Paragon Gulch	.1
8/16/00	3,670	do	do	16.8	Bear Gulch	5.9
8/16/00	3,250	Burke	do	16.8	do	2.3
8/16/00	3,200	do	do	18.8	--	--
8/17/00	3,660	Murray	Eagle Creek	13.4	Tributary Creek	1.6
8/17/00	3,440	do	do	13.9	--	--
8/17/00	3,040	do	do	1.6	West Fork of Eagle Creek.	7.4
9/14/00	2,535	Prichard	Prichard Creek	5.15	--	--
9/14/00	3,200	Burke	do	17.2	Granite Gulch	1.3
8/23/01	3,630	do	Beaver Creek	17.3	--	--
8/23/01	3,360	Osburn	do	15.2	--	--
8/23/01	3,060	do	do	14.7	Carbon Creek	.05
9/25/01	3,820	Thompson Pass	Prichard Creek	16.8	Southern tributary to Bear Gulch.	5.8*
9/25/01	3,700	do	do	16.8	do	5.3*
9/25/01	3,580	do	do	16.8	Northern tributary to Bear Gulch.	5.0*
9/25/01	3,050	Burke	do	17.3	--	--
9/28/01	4,040	Thompson Pass	do	20.9	Paragon Gulch	1.6
9/28/01	3,740	do	do	20.9	do	.9
9/28/01	3,480	Burke	do	20.9	do	.01
10/2/01	4,360	Black Peak	Eagle Creek	13.4	Tributary Creek	4.0
10/2/01	3,940	Murray	do	13.4	Tributary Creek	2.5
10/2/01	3,520	do	do	13.4	Tributary Creek	.9
10/2/01	3,420	do	do	13.4	Tributary Creek	.1
10/2/01	3,350	do	do	12.9	--	--
10/2/01	3,040	do	do	1.6	West Fork of Eagle Creek	7.4

ı mouth of tributary to Bear Creek.

Table 2. Data on locations of samples of suspended sediment collected on April 14, 2000, from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

[UTM, Universal Transverse Mercator projection, zone 11, NAD27 datum; for samples from tributaries, distance above mouth of drainage basin is measured from mouth of tributary to mouth of drainage, and distance above tributary mouth is measured to mouth of tributary; do, ditto]

Sample	UTM east	UTM north	Sampling time	Elevation (ft)	1:24,000-scale USGS topographic map	Drainage basin	Distance above mouth of drainage basin (km)	Tributary name	Distance above tributary mouth (km)
00SB–B1A	581664	5267487	09:25	2,840	Osburn	Beaver Creek	12.2	--	--
00SB–B1B	581664	5267487	09:30	2,840	do	do	12.2	--	--
00SB–B1C	581664	5267487	09:35	2,840	do	do	12.2	--	--
00SB–B2	580353	5268997	09:50	2,700	do	do	9.8	--	--
00SB–B3	579923	5272015	10:00	2,560	do	do	6.2	--	--
00SB–B4	578462	5274072	10:15	2,460	do	do	3.1	--	--
00SB–B5	576671	5275795	10:25	2,370	Prichard	do	.3	--	--
00SB–E1	583781	5280176	12:45	2,750	do	Eagle Creek	6.7	West Fork of Eagle Creek	3.0
00SB–E2	582882	5278062	12:55	2,620	do	do	2.3	--	--
00SB–E3A	581085	5277173	13:10	2,530	do	do	.1	--	--
00SB–E3B	581085	5277173	13:15	2,530	do	do	.1	--	--
00SB–P1	595288	5271349	11:00	3,860	Thompson Pass	Prichard Creek	22.6	--	--
00SB–P2	593484	5271789	11:10	3,380	Burke	do	20.4	--	--
00SB–P3	590741	5272186	11:20	3,050	do	do	17.3	--	--
00SB–BG1	590431	5272460	11:30	3,040	do	do	16.8	Bear Gulch	.1
00SB–BU1	588258	5273793	11:40	2,890	do	do	14.1	Butte Gulch	.1
00SB–P4	585782	5275129	12:00	2,750	Murray	do	11.2	--	--
00SB–P5	583002	5274978	12:10	2,620	Prichard	do	8.3	--	--
00SB–P6	577510	5278482	12:25	2,410	do	do	.4	--	--

s[illegible]treambank soil collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining

tion, zone 11, NAD27 datum; for samples from tributaries, distance above mouth of drainage basin is measured from mouth of tributary to mouth of drainage, and
o mouth of tributary. Do, ditto]

mpling date	Sample method	Elevation (ft)	1:24,000-scale USGS topographic map	Drainage basin	Distance above mouth of drainage basin (km)	Tributary name	Distance above tributary mouth (km)	Depth-interval top (m)	Depth-interval bottom (m)
/16/00	Channel	3,590	Thompson Pass	Prichard Creek	16.8	Bear Gulch	5.4	0.10	0.30
/16/00	do	3,990	Burke	do	20.4	--	--	.00	.10
/23/01	do	3,360	Osburn	Beaver Creek	16.3	--	--	.30	.60
1/8/01	Composite	3,360	do	do	16.3	--	--	.00	.30
/23/01	Channel	3,240	do	do	15.8	--	--	.00	.13
1/8/01	Composite	3,240	do	do	15.8	--	--	.00	.10
/23/01	Channel	3,070	do	do	14.7	Carbon Creek	.05	2.00	2.40
/23/01	do	3,070	do	do	14.7	do	.05	.80	1.60
/23/01	Composite	3,070	do	do	14.7	do	.05	.00	.80
/25/01	do	3,500	Burke	Prichard Creek	16.8	Bear Gulch	4.7	.00	.05
/25/01	Channel	3,360	do	do	16.8	do	3.4	.00	.12
/28/01	do	3,150	do	do	18.1	--	--	.00	.50
/2[illegible]/01	do	3,170	do	do	18.4	--	--	1.00	1.20
[illegible]	do	4,210	Black Peak	Eagle Creek	13.4	Tributary Creek	3.5	.75	1.00
0/2/01	do	3,430	Murray	do	13.4	do	.2	.00	.35
0/2/01	do	3,430	do	do	13.4	do	.2	.35	.50
0/9/01	do	3,120	Osburn	Beaver Creek	15.1	--	--	.00	.10
0/9/01	do	3,040	do	do	14.5	--	--	.10	.25
0/9/01	Composite	3,035	do	do	14.3	--	--	.00	.10
0/9/01	do	2,950	do	do	13.4	--	--	.00	.25
1/8/01	do	3,580	Burke	do	17.3	--	--	.00	.10
1/8/01	do	3,140	Osburn	do	15.2	--	--	.00	.30
1/8/01	do	3,150	Burke	Prichard Creek	16.8	Bear Gulch	1.3	.00	.15
1/8/01	do	3,070	do	do	16.8	do	.4	.00	.10

s of artificial-fill material collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining

;ion zone 11, NAD27 datum; for samples from tributaries, distance above mouth of drainage basin is measured from mouth of tributary to mouth of drainage, and of tributary. Sample types: F, impounded flotation tailings; J, impounded jig tailings; M, millsite fill material; R, railroad ballast material; W, mine-waste

ling e	Sample method	Elevation (ft)	1:24,000-scale USGS topographic map	Drainage basin	Distance above mouth of drainage basin (km)	Tributary name	Distance above tributary mouth (km)	Sample type	Depth-interval top (m)	Depth-interval bottom (m)
'00	Channel	3,380	Burke	Prichard Creek	17.2	Granite Gulch	2.6	F	0.00	0.50
/01	do	3,520	do	Beaver Creek	16.9	--	--	J	.00	1.00
'01	do	3,420	do	do	16.6	--	--	J	.00	1.00
01	do	3,090	Osburn	do	14.7	Carbon Creek	.1	M	.00	3.50
/01	do	2,990	do	do	13.7	--	--	F	.60	.75
/01	do	2,990	do	do	13.7	--	--	F	.00	.60
'01	do	3,010	do	do	13.8	--	--	F	.15	.92
'01	do	3,020	do	do	14.1	--	--	F	.63	.87
/01	do	3,020	do	do	14.1	--	--	F	.00	.63
/01	do	3,630	Thompson Pass	Prichard Creek	16.8	Bear Gulch	5.7	J	.25	.55
'01	Composite	3,620	do	do	16.8	do	5.6	J	.00	4.00
'01	Channel	3,610	do	do	16.8	do	5.53	J	.20	1.07
/01	do	3,210	Burke	do	18.7	--	--	J	.00	.37
'01	do	3,220	do	do	18.8	--	--	R	.00	.30
'01	do	3,230	do	do	18.9	--	--	J	.00	.47
01	do	3,250	do	do	19.0	--	--	J	.00	.55
/01	do	4,350	Black Peak	Eagle Creek	13.4	Tributary Creek	3.8	W	2.00	3.50
'0	do	4,180	do	do	13.4	do	3.4	F	(*)	(*)
0	do	4,190	do	do	13.4	do	3.4	F	.20	4.70
/01	do	4,130	do	do	13.4	do	3.1	F	.00	2.40
/01	do	3,540	Murray	do	13.4	do	0.8	F	.00	.15
'01	Composite	3,400	do	do	13.5	--	--	F	.00	1.00
'01	Channel	3,095	Osburn	Beaver Creek	14.7	Carbon Creek	.15	F	.00	1.70
/01	do	3,100	do	do	14.7	do	.18	M	.00	1.20
/01	do	3,025	do	do	14.3	--	--	F	.00	.40
'01	do	3,000	do	do	14.0	--	--	F	.00	.50
'01	do	2,980	do	do	13.8	--	--	F	.00	.60
/01	do	2,920	do	do	13.2	--	--	F	.00	.35
/01	do	2,980	do	do	13.5	--	--	R	.00	.25

ed surface.

Table 5. Grain-size distributions in samples of streambed sediment, streambank soil, and artificial-fill material collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

[All values in weight percent. Do, ditto]

Sample	Sample type	Fraction (mm)								
		>8	4–8	2–4	1–2	0.5–1.0	0.25–0.5	0.125–0.25	0.063–0.125	<0.063
01	Streambed	27	14	9.9	13	15	13	4.6	1.7	1.3
02	do	30	17	16	12	13	8.8	2.4	.8	.5
03	do	59	10	10	11	6.2	2.6	.8	.4	.4
04	do	51	12	8.9	13	8.5	4.0	1.4	.7	.5
05	do	59	12	10	10	4.7	1.5	.6	.6	1.0
06A	do	71	10	5.0	3.6	3.6	4.5	1.4	.4	.3
06B	do	0	0	.6	5.5	19	35	25	9.9	5.6
07	do	63	14	6.7	4.6	4.9	3.9	1.6	.5	.5
08	do	64	6.4	4.7	6.2	6.0	4.9	3.1	2.4	2.6
09	do	53	17	9.7	8.0	6.6	4.0	1.2	.4	.4
10	do	54	17	13	9.1	4.2	1.8	.6	.3	.3
11	do	54	9.0	5.7	6.3	8.2	9.7	4.5	1.5	1.5
12	do	26	13	6.7	6.3	6.6	24	12	3.2	2.5
13	do	19	8.5	3.5	7.0	8.7	18	21	7.9	6.0
14	do	44	21	15	12	5.5	1.9	.5	.2	.4
15	do	13	11	9.7	15	13	15	14	5.6	4.3
16	do	4.9	13	24	25	18	9.8	3.0	1.1	.9
17	do	37	14	9.6	14	12	8.7	2.5	.9	1.0
18	do	25	21	15	16	11	6.7	3.0	1.3	1.0
18B	Streambank	4.4	15	17	13	6.6	6.5	10	15	12
19	Streambed	26	18	20	17	11	5.8	1.6	.5	.6
20	do	43	6.5	3.4	23	12	5.2	2.9	1.7	1.7
20B	Artificial fill	2.5	0	2.1	0	1.4	15	24	32	23
21	Streambed	7.2	14	19	21	17	12	4.7	2.4	2.1
22	do	37	13	12	15	9.5	4.4	2.0	1.8	4.6
22B	Streambank	21	9.0	6.3	8.6	6.0	7.0	6.9	8.9	26
23	Streambed	25	25	20	12	7.3	4.7	2.7	1.6	1.7
24	do	27	13	14	15	13	9.3	4.4	2.3	2.1
25	do	31	12	8.8	9.2	7.4	11	13	4.4	3.0
26	do	36	6.5	6.7	20	20	9.0	1.5	.6	.7
27	do	16	1.8	1.8	6.9	20	32	12	5.3	3.9
28A	do	15	21	11	16	17	14	4.5	1.2	1.0
28B	do	7.0	1.5	1.5	4.4	14	31	25	8.7	6.4
29	do	27	12	8.4	9.7	11	18	9.2	2.6	2.0
30	do	17	17	15	17	15	9.9	5.4	1.8	1.9
31	do	33	18	15	14	8.7	5.4	2.6	1.4	1.9
32	do	24	22	19	16	9.1	5.4	2.3	1.2	1.5
33	do	45	19	12	11	7.9	3.4	.8	.3	.4
34	do	50	16	9.0	6.1	5.0	5.4	3.6	2.1	1.9
35	do	13	24	26	22	9.5	3.2	.9	.5	.7
36	do	37	26	14	9.4	6.0	4.4	2.1	1.0	.8
37	do	28	18	17	15	12	7.6	1.6	.5	.4
38	do	25	22	25	17	7.1	2.2	.9	.5	.5
39	do	25	16	14	14	8.9	7.0	7.4	3.7	3.4
40	do	39	19	15	14	7.1	3.4	1.2	.6	1.0
41	do	31	11	10	18	23	5.0	.7	.3	.4
42	do	26	13	14	14	9.2	7.6	7.4	4.0	4.3
43	do	48	11	11	14	7.2	3.3	1.7	1.1	2.0
101	do	36	22	1.9	17	13	6.2	2.4	1.3	1.0
102	Artificial fill	7.5	15	32	21	13	5.1	2.1	1.4	3.0
103	do	23	13	15	14	13	10	4.7	2.5	4.7
104A	Streambed	26	22	15	8.2	14	11	2.5	.6	.8
104B	Streambank	16	6.8	7.8	15	23	19	8.1	2.3	
104C	do	54	13	7.7	6.4	7.8	5.1	2.4	1.4	2.6
105A	do	30	8.4	8.6	6.1	10	12	12	9.9	3.7
105B	do	34	18	13	7.7	7.0	5.7	5.1	3.6	5.8
106	Artificial fill	30	16	10	9.7	7.5	4.9	3.3	3.9	14
108A	Streambed	29	31	19	8.9	7.8	3.5	.9	.3	.3

Table 5. Grain-size distributions in samples of streambed sediment, streambank soil, and artificial-fill material collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

[All values in weight percent. Do, ditto]

Sample	Sample type	Fraction (mm)								
		>8	4–8	2–4	1–2	0.5–1.0	0.25–0.5	0.125–0.25	0.063–0.125	<0.063
108B	Streambank	40	21	12	10	9.8	4.1	1.5	.9	.6
108C	do	0	.5	2.2	3.6	3.5	3.5	7.2	19	61
108D	do	21	26	18	6.3	9.8	9.3	4.8	2.1	2.7
109A	Artificial fill	0	0	0	0	0	21	18	30	31
109B	do	0	0	0	0	.3	.5	12	42	46
110	do	0	0	0	0	.3	3.9	14	41	41
111A	do	0	0	0	0	.4	15	13	12	60
111B	do	0	0	0	0	.8	6.8	9.5	23	60
112	Streambed	53	23	12	6.2	3.5	1.3	.4	.2	.4
113	Artificial fill	0	.4	2.3	8.4	4.8	8.0	19	33	24
114	do	35	25	14	8.2	6.0	3.9	2.5	1.9	4.2
115	do	0	5.8	11	15	21	22	18	6.2	.5
116	Streambed	49	20	13	6.7	4.8	3.1	1.6	.9	.9
117	do	51	21	12	6.0	3.7	2.5	1.4	.8	1.2
118	Streambank	26	11	12	12	11	6.8	5.0	4.5	12
119	do	43	5.5	2.5	3.0	9.4	16	11	4.9	5.0
120	Streambed	30	23	20	15	7.8	2.6	.8	.5	.4
121	Streambank	0	0	.7	1.5	15	26	28	20	9.3
122	do	1.3	2.3	1.3	1.8	27	20	16	20	10
123	Artificial fill	2.5	.3	1.4	22	7.7	45	21	.5	.4
124	do	51	21	10	6.8	4.8	3.8	1.2	.4	.7
125	do	58	10	5.4	6.3	5.9	5.7	6.2	2.2	.7
126	do	.1	.3	3.8	1.4	5.7	23	35	19	12
127	Streambed	40	22	16	10	6.4	3.2	1.3	.8	1.0
128	do	18	20	25	18	11	4.3	1.6	.9	1.4
129	do	45	4.5	5.2	4.3	7.2	12	15	5.4	1.3
130	do	20	28	22	13	7.2	3.5	2.3	2.1	1.5
131	Artificial fill	33	18	15	12	9.6	6.1	3.5	1.8	.8
132	Streambank	19	18	11	8.9	6.1	6.6	6.2	6.3	17
133	Artificial fill	0	0	0	0	.2	4.8	50	32	13
134	do	18	3.5	3.1	1.9	1.5	4.8	36	20	12
135	do	0	0	0	0	.2	10	56	21	13
136	Streambed	29	27	21	12	6.5	2.7	1.2	.7	.7
137	do	16	11	16	19	14	6.8	9.9	4.4	2.6
138	Artificial fill	15	6.9	8.8	16	1.3	11	30	7.6	2.8
139	do	5.4	1.9	1.4	1.2	.9	3.9	42	27	16
140	Streambed	35	16	19	16	9.3	2.4	1.0	.3	.3
141A	Streambank	24	11	6.9	5.1	6.1	7.3	14	13	12
141B	do	.7	6.1	9.5	13	20	19	14	9.7	9.3
142	Streambed	55	17	13	6.7	4.1	1.7	1.0	.5	.8
143	do	36	16	17	10	11	6.0	2.2	1.0	1.2
144	Streambank	0	.4	1.7	3.7	48	11	17	13	5.8
145	Artificial fill	0	1.0	4.9	3.4	7.4	48	29	5.1	.7
146	do	40	19	14	11	8.2	3.7	1.9	1.4	.6
147A	Streambank	1.5	5.5	4.4	2.7	8.7	22	24	14	17
147B	do	13	8.6	4.4	3.3	5.4	13	20	16	16
148	Artificial fill	0	0	0	0	.4	15	62	18	4.3
149	do	0	0	.3	1.1	1.3	4.8	37	32	23
150	do	0	0	.1	.1	3.2	14	69	10	3.5
151	do	0	0	0	0	.3	16	14	14	56
152	Streambank	0	0	0	0	0	20	40	30	9.4
153	Artificial fill	19	15	13	11	9.6	8.1	6.4	5.5	12
154	Streambank	36	24	19	12	6.3	1.8	.5	.2	.6
155	do	40	18	13	8.1	6.9	5.4	2.9	1.5	3.7
156A	do	0	1.3	1.3	3.9	63	8.3	6.6	5.6	9.8
157	do	0	.8	2.4	3.8	33	11	14	15	20

Table 6. Geochemical data for samples of unfractionated (bulk) suspended sediment collected on April 14, 2000, from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

[<, below listed analytical detection limit; dashes, insufficient material for analysis]

Sample	Suspended-sediment concentration (mg/L)	Al (wt pct)	Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)
00SB–B1A	554	7.7	0.39	4.7	2.7	0.70	0.70	0.07	0.33	2	19	580
00SB–B1B	478	7.8	.41	4.6	2.7	.72	.74	.07	.32	2	26	590
00SB–B1C	428	7.6	.42	4.4	2.6	.70	.71	.07	.31	3	19	580
00SB–B2	468	7.5	.34	4.2	2.8	.70	.72	.06	.29	<2	20	620
00SB–B3	451	7.7	.54	3.9	2.4	.71	.65	.09	.30	<2	22	700
00SB–B4	347	7.8	.50	3.9	2.5	.71	.66	.09	.27	<2	25	730
00SB–B5	382	7.6	.45	3.7	2.6	.68	.65	.08	.27	<2	23	720
00SB–E1	135	6.1	.54	2.6	2.2	.59	.76	.10	.26	<2	13	820
00SB–E2	119	7.3	.33	3.5	2.6	.69	.94	.06	.26	<2	18	630
00SB–E3A	248	7.6	.43	3.5	2.5	.76	.93	.07	.29	<2	15	740
00SB–E3B	437	7.9	.59	3.4	2.2	.70	1.0	.08	.33	<2	15	710
00SB–P1	30	6.5	.65	2.9	1.9	.61	.93	.10	.32	<7	<30	920
00SB–P2	20	6.3	1.00	3.0	1.8	.81	1.0	.10	.31	<5	<30	820
00SB–P3	13	6.5	.87	3.1	2.0	.80	1.0	.10	.29	<4	<20	760
00SB–BG1	33	7.0	.60	3.7	2.4	.76	.97	.09	.34	<3	<20	720
00SB–BU1	683	7.8	.35	4.9	2.7	.95	1.0	.06	.41	<2	18	690
00SB–P4	225	7.4	.36	4.5	2.8	.88	.99	.06	.35	<2	56	700
00SB–P5	276	7.7	.33	4.2	2.8	.80	.97	.06	.32	<2	48	710
00SB–P6	147	7.7	.32	3.6	2.7	.72	.84	.06	.28	<2	49	730

Sample	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Ga (ppm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)
00SB–B1A	11	110	26	60	100	20	0.21	53	36	1,500	13	48	35
00SB–B1B	10	110	27	59	92	20	.22	52	37	1,500	14	46	37
00SB–B1C	10	110	28	58	89	20	.25	51	36	1,500	12	45	37
00SB–B2	6	90	18	58	57	20	.17	44	38	1,000	14	40	30
00SB–B3	5	110	17	56	54	19	.26	52	51	1,300	12	49	34
00SB–B4	5	100	16	58	48	19	.16	50	53	1,200	12	48	32
00SB–B5	4	100	14	55	45	19	.14	50	50	1,000	13	47	29
00SB–E1	<2	97	9	45	48	15	.17	46	27	960	12	42	19
00SB–E2	3	95	15	57	110	19	.11	47	28	720	17	42	26
00SB–E3A	<2	94	14	51	72	19	.07	44	36	750	14	41	24
00SB–E3B	<2	91	9	42	63	20	.07	42	37	790	14	38	24
00SB–P1	<7	110	10	45	340	20	---	51	30	1,100	10	45	20
00SB–P2	<5	110	10	49	94	20	---	51	32	1,100	10	46	30
00SB–P3	7	110	10	45	98	20	---	53	30	1,100	10	47	27
00SB–BG1	4	110	21	49	94	20	---	53	33	930	10	47	36
00SB–BU1	<2	130	34	69	49	21	.03	58	36	1,600	14	54	60
00SB–P4	2	100	28	64	52	20	.14	46	34	1,300	14	44	45
00SB–P5	2	100	23	64	48	20	.16	48	35	1,100	14	45	40
00SB–P6	<2	97	14	62	60	19	.18	46	33	800	16	43	28

Sample	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
00SB–B1A	1,600	14	82	13	77	20	2,200
00SB–B1B	1,600	14	88	13	78	20	2,300
00SB–B1C	1,600	14	88	13	76	21	2,200
00SB–B2	930	14	77	12	74	17	1,500
00SB–B3	550	15	86	13	73	28	1,100
00SB–B4	410	15	80	13	75	26	870
00SB–B5	350	14	77	13	74	24	760
00SB–E1	160	10	77	11	56	17	130
00SB–E2	1,000	13	69	13	72	13	630
00SB–E3A	420	13	86	12	74	18	360
00SB–E3B	340	13	110	11	71	19	320
00SB–P1	72	10	100	10	57	20	590
00SB–P2	300	10	110	10	57	20	970
00SB–P3	1,700	10	100	10	59	20	1,800
00SB–BG1	1,500	10	89	10	69	20	840
00SB–BU1	62	17	88	13	110	22	170
00SB–P4	340	15	90	12	97	18	480
00SB–P5	340	14	96	12	90	16	510
00SB–P6	420	14	74	12	77	16	400

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the Prichard drainages in the northern Coeur d'Alene Mining District, northern Idaho.

nsufficient material for analysis]

Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)
.47	2.7	1.9	0.52	0.73	0.06	0.32	<2	18	570	2	110	8	40	52
.49	2.8	1.9	.52	.74	.06	.33	<2	15	580	2	110	10	40	54
.55	2.9	2.0	.51	.76	.06	.25	<2	16	610	<2	97	10	45	92
.59	3.0	2.0	.57	.78	.07	.32	<2	26	600	4	100	10	45	180
.70	2.7	1.9	.52	.92	.06	.30	<2	46	550	<2	95	10	42	61
.56	4.1	2.1	.68	.82	.06	.46	<2	19	560	6	96	14	50	140
.67	3.9	2.0	.67	.87	.07	.42	<2	13	560	7	100	13	43	79
.48	4.6	2.3	.66	.82	.07	.42	2	27	570	9	110	24	52	120
.57	6.1	2.1	.65	.94	.09	.38	11	42	500	12	90	35	46	230
.63	5.1	2.2	.67	.87	.08	.44	2	52	490	25	95	41	52	110
.80	4.2	1.9	.65	.84	.08	.40	<2	17	480	5	120	25	50	90
.32	3.2	2.3	.59	.92	.06	.31	<2	46	650	<2	100	9	44	60
.48	3.6	2.1	.64	1.1	.06	.38	<2	61	610	2	110	14	46	52
.44	4.2	2.1	.72	1.1	.06	.42	<2	73	590	<2	110	20	46	54
.68	3.5	2.0	.57	.96	.09	.29	<2	84	550	18	94	16	53	110
.45	4.4	2.1	.76	1.1	.06	.51	<2	12	560	<2	110	26	47	46
.61	3.5	2.1	.58	1.2	.08	.36	<2	44	660	5	92	14	40	74
.58	3.5	2.0	.64	1.2	.09	.34	<2	<10	710	4	110	17	46	100
.83	2.8	1.8	.55	1.3	.09	.35	<2	13	770	3	100	10	34	75
.05	6.9	2.1	.39	.65	.06	<0.005	46	78	320	190	95	50	38	4,700
.79	3.6	2.0	.58	1.3	.10	.35	<2	110	620	<2	94	12	41	81
.10	3.0	1.6	.51	1.2	.11	.32	<2	110	550	2	85	12	43	130
[illegible]	5.8	3.2	.50	.67	.04	.22	6	3,100	510	<2	66	7	56	240
.60	3.0	1.9	.53	1.1	.08	.33	<2	12	730	7	87	10	36	79
.93	3.2	1.7	.54	1.6	.14	.39	<2	12	730	7	83	4	30	88
.00	3.2	1.6	.53	1.7	.13	.42	<2	11	690	7	83	4	26	90
.75	4.2	2.0	.64	1.1	.10	.36	<2	20	660	7	110	22	42	74
.57	2.4	1.9	.54	1.1	.07	.34	<2	<10	840	<2	95	2	32	50
.49	3.2	2.0	.66	1.1	.06	.32	<2	14	640	<2	91	6	40	68
.68	2.4	1.8	.55	.96	.09	.28	<2	<10	770	<2	92	4	37	81
.34	3.3	2.0	.60	1.1	.06	.28	<2	10	550	2	95	8	44	100
.35	3.4	2.2	.59	1.0	.06	.29	<2	19	590	3	96	10	48	150
.29	3.6	2.2	.57	1.1	.05	.30	<2	19	580	2	100	15	45	150
.41	3.6	2.0	.60	1.1	.06	.32	<2	19	540	3	89	16	49	140
.30	3.8	2.2	.60	1.1	.05	.29	2	36	530	5	87	18	45	290
.55	5.2	2.3	.85	.96	.07	.29	4	53	610	18	100	35	59	270
.68	4.7	2.1	.66	.91	.08	.49	<2	33	500	11	110	25	53	64
.70	4.8	2.1	.65	.85	.08	.40	3	42	460	34	90	36	56	120

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the Prichard drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

is ent material for analysis]

Ca wt ct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)
.61	5.7	2.1	.65	.93	.08	.45	7	43	470	16	89	27	50	170
.79	4.1	2.0	.63	1.2	.10	.35	<2	21	670	6	110	22	44	79
.90	2.6	1.7	.53	1.3	.10	.33	<2	<10	900	<2	85	12	34	87
.57	3.2	2.0	.58	1.2	.08	.32	<2	<10	670	4	95	14	44	120
.63	3.0	1.9	.52	1.0	.08	.31	<2	13	730	9	82	14	39	98
.42	4.2	2.0	.62	.10	.06	.25	3	40	480	8	73	22	46	260
.53	3.4	2.1	.56	.96	.07	.31	<2	18	610	<2	98	16	52	70
.60	2.3	2.0	.52	1.0	.08	.29	<2	11	770	<2	88	7	40	89
.38	3.5	2.2	.58	.87	.06	.35	<2	86	590	<2	100	13	47	42
.82	3.7	2.1	.59	1.2	.11	.37	<2	140	660	2	93	14	47	67
.81	4.5	1.9	.63	.97	.11	.37	<2	21	487	17	111	24	46	100
.30	17.4	1.5	.47	.63	.09	.17	117	111	326	14	60	32	15	1,480
.10	23.6	1.3	.41	.24	.04	.02	111	116	232	70	29	64	<1	2,050
.60	5.6	2.0	.62	.92	.10	.35	10	40	464	15	110	26	52	321
.13	20.9	1.5	.41	.40	.05	.12	74	144	338	11	49	41	10	1,510
.97	6.2	2.0	.65	1.5	.12	.35	13	28	451	3	103	19	45	279
.09	13.6	1.4	.54	.39	.04	.06	105	54	159	328	36	45	7	2,660
.81	8.5	1.8	.63	1.3	.10	.34	29	40	422	6	92	19	35	411
.27	4.1	2.2	.44	.52	.05	.37	5	19	524	<2	78	13	54	77
.76	3.8	2.0	.66	1.2	.09	.36	<2	25	599	18	133	24	60	290
.54	4.5	1.7	.60	.84	.12	.39	<2	20	783	228	157	34	69	302
.11	4.9	2.2	.42	.39	.03	.22	14	25	336	10	38	9	50	139
[illegible]	7.2	2.1	.56	.59	.06	.27	18	89	370	28	66	33	57	339
.03	3.4	3.5	.44	.17	.03	.21	2	20	400	41	39	12	59	162
.04	5.9	2.2	.34	.21	.03	.33	3	41	271	<2	55	6	38	60
.11	4.5	2.7	.40	.51	.04	.37	3	20	331	<2	63	5	42	56
.06	3.7	3.4	.40	.16	.03	.25	2	18	384	13	57	6	58	223
.09	3.5	3.2	.39	.35	.03	.26	<2	14	366	<2	65	5	50	96
.58	4.9	2.1	.61	.82	.08	.39	4	47	423	27	100	25	64	259
.02	8.3	0.3	.7	.12	.06	<0.005	55	36	17	1,540	38	120	<1	6,880
.48	3.4	1.7	.39	1.2	.06	.11	18	29	360	48	64	32	37	1,710
.54	3.0	1.9	.52	1.3	.09	.35	2	<10	662	12	108	13	36	166
.95	4.0	1.6	.60	1.1	.13	.34	2	34	425	10	118	29	38	311
.85	4.2	1.8	.60	1.1	.10	.36	2	15	567	7	111	20	59	178
.97	3.3	1.8	.61	1.4	.14	.38	<2	20	720	15	107	15	38	94
.75	3.4	2.0	.60	1.4	.09	.38	<2	12	584	4	111	15	49	141
.51	2.9	2.0	.50	1.1	.08	.33	<2	14	675	9	99	16	36	143
.46	3.3	2.1	.56	1.2	.07	.36	2	<10	672	7	110	12	38	80
.48	3.2	2.5	.63	1.4	.05	.40	<2	<10	812	4	100	11	49	59

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the Prichard drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

ufficient material for analysis]

a (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)
06	5.0	2.6	.29	.20	.04	.14	43	22	390	2	76	9	37	110
52	10.3	1.3	.51	.49	.07	.17	74	126	350	101	43	30	86	620
.93	3.2	1.7	.59	1.4	.08	.48	<2	<10	786	<2	74	12	41	62
.06	5.0	2.1	.23	.33	.03	.11	60	12	142	22	58	14	24	326
96	3.1	1.7	.59	1.3	.09	.37	<2	12	822	<2	107	16	54	130
.72	4.1	2.0	.60	1.1	.11	.32	2	30	643	6	129	21	53	182
.42	5.0	2.1	.50	1.0	.11	.25	4	32	528	5	119	26	54	277
37	3.8	2.0	.66	.96	.07	.32	<2	17	633	<2	200	44	47	60
39	4.8	4.4	.10	.65	.04	.15	4	60	800	11	82	35	87	217
.75	4.2	1.4	.60	1.2	.15	.50	<2	12	682	6	54	12	36	478
.08	3.4	1.7	.30	1.1	.04	.13	6	98	376	<2	47	8	40	214
36	3.0	1.6	.50	1.7	.04	.03	6	82	300	21	62	27	36	850
28	3.2	1.8	.49	1.6	.04	.05	6	120	323	24	74	25	33	471
.37	3.8	2.1	.59	1.1	.06	.24	2	29	480	15	79	18	47	415
.23	4.2	2.2	.54	1.1	.06	.30	3	34	486	6	100	21	46	330
12	2.4	2.2	.42	2.2	.04	.08	2	46	395	6	42	11	42	310
.37	3.1	2.0	.54	1.9	.06	.14	4	34	435	33	37	22	35	214
.29	3.8	2.1	.57	1.1	.06	.22	<2	30	487	7	70	20	99	762
06	3.8	1.7	.25	1.8	.04	.09	7	78	518	4	61	6	37	213
10	4.0	2.0	.46	1.0	.04	.21	10	82	580	<2	67	11	40	302
.33	3.5	2.2	.58	.96	.07	.27	<2	25	552	7	104	15	85	424
.64	2.3	2.0	.56	1.0	.09	.30	<2	11	838	<2	96	11	72	146
[illegible]	13.4	1.7	.38	.56	.07	.20	81	57	339	<2	46	15	16	736
[illegible]	8.0	2.1	.31	.43	.04	.44	53	143	276	<2	104	6	29	306
.29	3.4	1.8	.41	.57	.04	.38	<2	<10	529	<2	76	12	47	59
14	9.8	2.0	.47	.39	.05	.25	22	63	320	<2	46	13	39	334
53	6.6	2.1	.66	1.0	.09	.38	12	49	446	2	104	15	48	255
.26	5.4	1.8	.37	.28	.04	.24	3	176	192	29	45	35	61	132
.07	5.8	2.3	.37	.21	.04	.36	4	30	252	<2	74	5	44	56
.06	5.9	2.4	.35	.22	.04	.26	2	49	267	<2	69	6	51	76
.06	3.5	3.7	.43	.19	.03	.21	<2	14	397	<2	59	6	66	128
.38	7.4	1.8	.56	.87	.08	.33	12	44	392	<2	95	14	38	282
.42	3.2	2.5	.98	.85	.05	.31	<2	<10	681	<2	96	14	54	63
.61	5.7	2.4	.68	1.0	.11	.31	2	45	536	13	100	37	86	320
.83	7.3	2.0	.65	1.4	.10	.33	21	43	444	6	88	25	40	473
.34	16.5	1.5	.47	.80	.16	.21	<2	29	514	6	77	28	15	155
.45	2.4	1.9	.56	1.1	.09	.31	<2	11	583	<2	89	7	39	90

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the r Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

is nt material for analysis]

g (pm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
.08	54	33	770	14	47	22	180	10	89	13	56	22	500
.10	54	35	760	14	48	24	180	11	92	13	56	23	540
.06	48	33	850	14	42	33	56	10	100	12	55	20	150
.19	50	39	840	15	44	27	350	11	94	12	58	23	920
.24	46	36	730	14	41	28	170	10	120	11	55	17	230
.13	46	34	1,300	17	40	33	870	12	100	12	67	23	1,600
.13	50	36	1,100	15	44	32	910	12	120	13	63	24	1,600
.15	52	35	1,400	16	46	38	1,400	13	100	14	70	26	2,000
.38	42	32	2,200	13	38	43	5,300	13	100	12	71	22	2,100
.33	44	38	1,700	16	38	50	2,700	13	150	12	73	25	5,800
.17	54	43	1,000	16	50	51	160	12	120	13	66	34	920
.17	50	25	710	15	44	24	440	12	76	13	62	20	380
.24	52	29	830	18	45	32	400	12	120	13	71	21	510
.25	51	27	1,100	16	44	39	400	14	110	13	82	22	430
.25	47	28	1,200	15	41	48	660	12	140	12	64	22	3,400
.02	54	26	1,100	15	46	44	54	14	100	12	90	23	140
.27	45	25	920	15	40	28	1,200	11	130	12	62	19	1,100
.09	48	30	920	17	44	35	1,400	12	120	13	65	21	800
.14	45	27	830	15	41	24	1,500	10	150	11	56	19	520
	45	18	310	10	45	25	48,000	12	29	18	49	13	88,000
.32	44	28	1,200	17	40	30	340	11	200	12	68	24	350
.16	43	21	1,300	13	39	30	390	9	270	9	59	23	380
	32	18	1,600	14	30	11	5,800	14	36	16	66	19	1,100
.38	42	25	840	14	38	22	2,000	10	120	11	53	18	1,600
.21	33	34	580	18	29	24	640	10	180	10	61	18	1,500
.24	38	36	530	20	34	24	640	11	200	9	62	25	1,600
.27	49	36	1,100	16	45	41	1,000	12	140	13	67	19	1,500
.04	45	28	680	15	40	17	37	9	110	11	48	16	90
.08	44	27	660	14	39	23	430	11	96	12	61	18	310
.06	44	26	960	13	39	20	64	10	110	12	51	20	100
.10	46	24	560	15	41	26	900	11	80	13	60	16	520
.08	48	26	670	15	43	27	890	12	80	13	65	17	620
.12	51	24	830	15	45	26	1,300	12	77	13	64	16	590
.12	43	26	870	14	38	32	1,200	12	89	13	69	17	620
.29	42	24	800	17	37	30	4,200	12	82	14	63	17	1,400
5.1	47	32	1,000	15	44	42	9,600	14	120	17	78	16	3,500
.1	47	39	1,100	14	42	42	1,600	12	120	14	73	24	2,400
.4	41	38	1,900	14	37	47	2,900	13	170	12	73	24	8,700

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the er Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

sufficient material for analysis]

Hg (pm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
.29	42	34	1,800	12	37	39	4,000	13	130	13	74	20	3,900
.30	46	38	1,100	15	44	36	740	12	140	13	67	18	1,300
.17	36	26	900	12	34	19	240	9	150	10	54	15	230
.10	45	28	790	13	42	25	2,200	11	110	12	60	16	830
.52	39	27	940	13	37	22	2,200	10	120	12	54	17	2,100
.42	34	24	730	13	31	30	5,000	11	92	14	62	12	2,300
.09	47	30	890	15	43	38	95	12	100	13	65	16	160
.06	42	24	840	12	38	18	93	9	94	12	49	15	110
.27	47	28	810	15	43	27	360	12	93	14	69	18	400
.30	43	29	1,400	12	40	26	430	12	200	14	74	22	360
.22	53	29	1,530	12	48	48	1,050	12	136	11	67	26	1,940
3.6	28	22	3,080	<4	33	28	49,400	13	68	19	60	10	5,820
.1	18	15	17,100	<4	17	37	35,200	12	14	9	41	10	11,600
.37	52	33	2,260	10	46	45	6,320	14	109	13	69	26	2,530
2.6	26	18	7,040	<4	32	28	30,400	13	39	16	53	13	5,860
.58	48	30	1,520	12	45	37	4,730	13	161	12	70	22	873
.7	20	14	5,590	<4	19	28	51,200	9	16	13	36	10	63,400
.84	43	28	1,490	11	40	32	7,240	14	143	14	71	18	1,630
.24	36	31	696	16	30	25	3,300	11	85	10	85	12	364
.74	65	30	1,310	17	57	41	3,040	13	135	12	70	26	2,910
.23	57	46	5,320	8	51	69	485	15	123	14	68	41	10,400
.58	19	21	718	11	17	14	9,430	13	35	8	77	8	2,860
1.0	32	30	2,320	7	31	61	20,500	14	68	11	82	14	8,350
[illegible]	18	26	1,110	15	18	18	1,430	11	17	8	71	6	3,140
.07	28	15	1,520	10	23	8	2,380	10	16	9	52	10	224
.04	32	18	1,920	10	25	8	1,580	9	80	10	56	10	193
.10	28	21	1,440	10	24	11	1,630	10	17	9	66	8	812
.05	33	19	1,520	13	28	8	1,050	11	49	10	61	10	425
.34	51	35	1,810	13	43	47	3,460	14	147	12	69	28	6,520
4	17	4	174	<4	21	35	63,000	5	7	10	8	5	397,000
3.4	30	16	946	8	28	25	67,100	12	82	14	50	18	37,400
.41	46	28	916	13	42	23	5,950	9	120	11	64	12	2,590
.70	52	29	1,630	11	46	42	10,500	11	150	11	67	20	2,880
.12	50	27	1,280	14	45	43	1,150	12	137	11	66	21	723
.17	44	33	1,400	13	36	26	2,550	11	169	12	68	18	1,970
.24	51	29	958	17	45	28	2,420	12	140	12	66	20	702
.50	47	25	948	14	42	21	2,920	10	108	12	54	21	1,940
.68	50	26	696	16	44	23	2,740	12	124	13	66	22	1,270

e (<0.063-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from the
r Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

s nt material for analysis]

g (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
.04	44	24	368	18	39	33	82	12	142	11	84	18	1,210
	36	14	280	10	34	13	55,700	9	23	15	47	7	1,200
	22	18	12,200	<4	15	49	50,800	10	92	12	42	14	21,700
.14	31	34	883	16	26	27	354	11	196	8	79	15	440
	27	12	162	8	27	10	66,500	8	28	14	38	5	5,740
.12	46	34	936	13	42	30	935	11	161	10	64	19	159
.49	55	38	1,140	11	53	43	3,670	12	127	11	68	22	1,340
.3	52	30	1,420	9	52	36	6,300	11	87	12	66	17	1,920
.04	62	35	2,440	10	60	56	57	11	108	10	75	22	155
1.3	38	26	734	15	41	44	5,910	14	246	19	103	6	1,510
.16	29	33	628	18	20	20	691	10	153	8	91	15	1,210
.87	23	12	167	10	20	12	18,800	9	60	15	47	5	218
.57	31	10	367	9	29	23	8,400	9	59	11	41	5	2,910
.91	37	11	344	9	34	24	14,500	9	56	12	42	6	4,300
.65	40	22	594	13	35	29	5,910	11	83	12	61	12	4,210
.42	48	24	805	14	43	30	5,000	11	74	12	63	12	1,730
.27	21	10	376	13	20	15	3,070	10	54	11	52	6	2,230
1.6	18	17	517	12	17	18	5,730	11	90	12	54	9	18,800
.30	36	23	697	13	32	53	3,820	10	77	11	59	12	1,830
2.0	31	11	64	11	28	8	11,500	10	56	12	48	4	1,260
1.9	32	21	381	15	29	17	19,900	12	60	14	60	7	659
	51	28	779	15	47	46	2,390	11	82	11	65	14	1,490
	46	27	1,260	11	41	31	90	9	102	11	53	15	129
1.8	23	18	577	6	25	17	36,600	11	58	11	56	9	1,720
1.6	54	14	3,880	<4	36	8	77,200	10	104	18	49	17	866
.06	34	29	434	14	28	28	200	10	92	10	78	11	153
.4	22	22	1,850	5	22	17	13,200	14	36	11	74	9	1,890
.70	47	34	946	13	44	32	6,230	14	113	12	80	17	1,060
.22	23	19	1,050	6	22	66	3,930	14	23	7	79	9	5,780
.09	37	18	1,490	9	32	8	1,230	11	16	14	54	10	133
.07	35	16	2,120	8	29	10	3,360	12	16	18	58	9	440
.08	29	25	1,060	17	28	11	1,190	14	20	9	77	9	1,040
.82	44	29	1,120	10	40	29	7,880	12	92	11	69	15	1,010
.07	49	38	709	13	44	23	144	12	92	10	71	21	220
.29	46	34	2,240	10	44	70	1,370	13	112	11	78	18	2,020
.82	42	31	3,440	5	40	32	9,130	13	143	10	76	18	1,290
.11	35	20	713	<4	43	27	671	13	85	7	62	21	597
.09	41	27	227	15	38	24	783	10	106	9	63	16	413

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected
ınd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

ıfficient material for analysis]

Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)
.28	2.7	2.3	0.49	0.52	0.04	0.36	<2	18	580	<2	110	10	43
.27	2.9	2.4	.53	.52	.04	.33	<2	22	620	<2	160	12	46
.33	3.1	2.2	.49	.51	.04	.33	<2	30	580	<2	130	14	40
.33	3.0	2.4	.58	.56	.05	.44	<2	20	600	3	140	10	49
.56	2.9	2.0	.54	.64	.06	.34	<2	41	520	<2	100	14	43
.27	5.1	2.7	.67	.58	.05	.66	<2	32	590	4	170	21	55
.39	4.4	2.5	.67	.64	.06	.47	<2	13	570	6	100	19	49
.22	5.8	2.8	.68	.59	.06	.51	<2	37	570	7	110	30	59
.40	7.0	2.5	.71	.73	.08	.47	8	46	530	16	100	44	58
.37	6.3	2.6	.75	.65	.06	.68	<2	87	500	23	110	50	69
.50	5.8	2.3	.69	.61	.07	.56	<2	32	500	5	180	34	57
.15	4.4	2.4	.53	.65	.04	.62	<2	31	570	<2	150	13	46
.27	4.4	2.6	.67	.86	.05	.54	<2	62	620	<2	130	19	52
.30	5.1	2.5	.80	.96	.05	.59	<2	83	610	<2	140	27	51
.47	5.3	2.4	.62	.58	.08	.75	<2	210	650	17	110	35	49
.38	6.2	2.4	1.0	1.0	.05	.99	<2	14	600	<2	140	38	60
.31	5.0	2.6	.56	.97	.05	.57	<2	30	650	3	110	21	44
.29	4.1	2.6	.64	.83	.06	.45	<2	14	700	2	130	19	48
.42	3.2	2.0	.53	.76	.05	.39	<2	<10	680	2	130	14	38
.03	5.5	1.8	.35	.46	.06	<.005	38	54	66	160	66	34	38
.47	4.6	3.3	.43	1.5	.06	.44	<2	77	650	<2	130	13	38
.78	3.2	2.2	.48	1.2	.10	.38	<2	130	580	2	87	13	34
.10	4.5	3.0	.45	.81	.03	.27	5	2,000	510	<2	77	6	52
.32	3.2	2.4	.53	.81	.06	.41	<2	13	730	4	100	17	38
[illegible]	3.8	1.9	.54	1.0	.10	.48	<2	21	690	6	99	20	34
.8[illegible]	3.1	1.6	.50	1.4	.11	.38	<2	13	650	8	92	14	24
.51	4.8	2.5	.70	.87	.08	.62	<2	19	700	6	140	31	48
.31	2.3	2.1	.58	.70	.04	.35	<2	<10	810	<2	82	9	32
.21	3.3	2.5	.64	.85	.04	.36	<2	12	620	<2	120	13	44
.29	2.0	2.2	.51	.53	.05	.20	<2	<10	710	<2	100	6	31
.18	3.6	2.4	.59	.88	.05	.38	<2	15	560	<2	140	22	46
.15	4.6	2.5	.61	.90	.04	.71	<2	20	570	<2	160	21	44
.13	3.7	2.4	.55	.94	.04	.38	<2	16	520	<2	130	17	44
.20	4.3	2.3	.65	.97	.05	.54	<2	13	520	<2	150	20	45
.13	3.7	2.3	.54	1.1	.04	.35	<2	33	440	3	110	19	41
.24	5.8	3.1	.96	.9	.07	.28	5	68	600	13	120	42	59
.44	5.6	2.6	.73	.72	.07	.66	<2	40	530	8	110	36	58
.31	5.9	2.9	.70	.66	.06	.44	<2	40	550	25	100	44	64
.37	6.9	2.7	.74	.75	.07	.63	5	41	540	13	98	46	58
.55	5.0	2.4	.71	.87	.09	.62	<2	16	720	6	130	34	51

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected
nd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

s nt material for analysis]

Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)
.45	2.8	2.0	.50	.77	.06	.28	<2	<10	810	<2	96	14	32
.27	4.2	2.4	.61	.80	.05	.62	<2	<10	670	2	110	19	42
.38	3.3	2.1	.50	.78	.06	.41	<2	<10	700	6	110	19	33
.22	3.4	2.2	.58	1.1	.05	.25	2	32	420	5	110	17	41
.36	4.8	2.4	.59	.68	.06	.65	<2	42	670	<2	220	27	44
.27	1.9	2.1	.48	.48	.04	.24	<2	11	680	<2	100	4	29
.23	3.4	2.4	.57	.71	.05	.42	<2	86	610	<2	110	20	44
.58	7.7	2.5	.48	1.4	.07	.52	<2	140	620	2	110	27	47
.57	5.3	2.6	.73	.76	.09	.52	<2	34	577	14	127	25	60
.19	19.7	1.8	.38	.46	.09	.28	104	111	242	51	71	33	21
.10	25.7	1.0	.45	.19	.03	.01	72	60	168	113	21	50	<1
.27	6.1	2.7	.66	.70	.06	.43	6	38	536	11	111	26	54
.07	19.5	1.7	.38	.28	.04	.15	38	55	305	14	54	28	11
.43	7.1	2.4	.64	.86	.09	.45	12	40	463	3	116	23	45
.07	8.7	1.9	.40	.36	.03	.18	52	29	134	280	49	30	24
.33	9.3	2.2	.59	.71	.08	.43	22	54	440	8	98	26	41
.32	4.4	2.5	.42	.52	.07	.57	5	24	454	<2	99	12	65
.39	3.8	2.6	.63	.83	.07	.36	<2	14	664	12	173	22	50
.39	4.9	1.9	.62	.62	.11	.40	<2	22	492	208	150	32	52
.09	3.3	2.6	.38	.33	.04	.29	11	22	319	15	46	10	73
.13	5.0	2.7	.47	.40	.06	.37	14	57	354	45	54	23	81
.05	3.3	3.5	.46	.16	.02	.21	2	14	408	41	61	11	53
.03	3.8	2.4	.32	.21	.02	.28	2	22	280	<2	77	4	42
[illegible]	3.8	2.9	.38	.53	.02	.43	<2	24	370	<2	89	3	30
[illegible]	3.4	3.9	.45	.16	.02	.20	3	12	433	20	79	7	65
.07	3.5	3.3	.39	.27	.03	.29	<2	14	371	<2	87	6	52
.31	5.5	2.7	.69	.60	.06	.46	<2	82	484	21	125	31	62
.03	5.7	.7	.12	.21	.05	<.005	28	17	46	1,700	43	82	6
.21	2.8	2.1	.27	.90	.05	.09	18	23	161	180	65	27	40
.39	2.5	2.3	.46	.96	.08	.37	<2	<10	598	10	120	9	41
.60	4.6	2.0	.62	.81	.10	.38	3	58	449	9	141	34	41
.69	4.1	2.0	.56	.71	.09	.37	3	17	578	10	111	21	37
.76	3.4	1.8	.57	.94	.14	.39	<2	13	743	18	108	19	35
.26	3.4	2.4	.56	.83	.05	.39	<2	12	632	2	132	14	40
.32	3.2	2.3	.48	.78	.06	.42	<2	<10	679	7	105	13	36
.34	3.1	2.1	.49	.84	.06	.34	2	<10	676	6	123	13	36
.49	3.2	2.1	.56	1.2	.06	.39	<2	<10	754	5	110	12	42
.05	3.9	3.2	.28	.20	.05	.20	36	19	605	3	87	6	45
.32	21.4	.9	.60	.10	.04	.10	35	88	216	59	24	18	<1
1.00	3.0	1.9	.60	1.6	.10	.56	<2	<10	721	<2	74	9	47

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected nd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

sufficient material for analysis]

Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)
.04	4.0	2.9	.22	.24	.04	.14	47	11	279	53	47	11	38
.77	3.4	1.9	.61	.84	.08	.38	<2	<10	826	<2	118	15	38
.54	4.2	2.3	.63	.76	.09	.42	<2	19	667	4	152	19	46
.36	4.3	2.1	.46	.77	.09	.26	4	26	510	4	113	24	44
.34	5.0	2.3	.65	.71	.07	.51	<2	29	654	<2	290	57	48
.41	4.3	4.4	1.1	.65	.03	.16	2	42	857	7	111	23	76
.84	4.2	1.8	.64	1.3	.21	.66	<2	16	668	10	85	14	48
.03	2.2	1.7	.23	1.1	.02	.11	4	63	353	<2	73	4	32
.36	1.9	1.7	.44	1.5	.03	.05	4	43	275	14	66	12	30
.34	2.2	1.8	.47	1.4	.03	.06	6	72	297	20	82	15	29
.24	3.4	2.2	.55	1.1	.05	.23	2	28	418	9	91	14	40
.10	3.2	2.2	.48	1.1	.04	.31	<2	24	390	2	134	11	39
.13	2.1	2.0	.38	1.8	.04	.10	2	39	368	5	72	10	37
.15	2.0	2.0	.45	1.6	.03	.12	2	22	338	13	72	10	36
.12	3.5	2.2	.49	1.0	.04	.30	<2	26	426	3	114	14	39
.04	2.9	1.8	.25	1.4	.03	.14	5	73	506	6	61	5	33
.06	3.2	2.1	.38	.98	.03	.26	6	60	433	<2	98	12	37
.22	4.1	2.3	.53	.80	.05	.43	<2	27	514	4	140	14	42
.32	1.8	2.0	.46	.47	.04	.22	<2	<10	668	<2	98	6	29
.12	13.4	2.1	.34	.44	.06	.26	71	41	298	4	54	11	24
.12	6.2	2.7	.33	.47	.03	.44	30	117	355	<2	70	4	35
.32	4.0	2.2	.42	.53	.05	.58	<2	10	474	<2	100	12	65
.08	5.9	2.5	.38	.32	.04	.32	24	28	294	<2	51	9	57
.29	6.4	2.3	.65	.62	.07	.40	12	40	421	2	117	17	55
[illegible]	3.1	2.0	.38	.25	.03	.24	2	87	220	20	49	24	35
[illegible]	3.9	2.6	.36	.18	.02	.32	<2	19	286	<2	80	4	31
.05	4.4	2.4	.32	.22	.03	.30	2	37	270	<2	70	4	47
.07	3.5	3.8	.45	.19	.03	.21	3	19	433	<2	73	10	64
.29	6.5	2.0	.54	.64	.07	.37	23	35	370	<2	99	15	43
.43	3.6	2.6	1.0	.60	.06	.39	<2	<10	688	<2	110	15	52
.41	5.8	2.9	.71	.77	.08	.53	<2	48	582	10	115	32	59
.25	9.8	2.3	.58	.66	.06	.48	17	51	422	5	91	28	37
.30	18.4	1.3	.40	.61	.19	.20	<2	43	503	6	88	32	8
.40	2.5	2.1	.57	.84	.07	.38	<2	<10	599	<2	111	7	40

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected nd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

s nt material for analysis]

ia pm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
5	0.03	55	32	580	13	48	18	110	10	68	12	57	15	350
6	.05	73	36	650	13	70	20	150	11	65	12	62	15	430
15	.03	65	29	610	12	56	23	44	10	76	14	59	13	130
16	.06	67	37	710	15	58	22	260	11	76	12	64	16	670
5	.24	50	36	680	14	44	26	170	11	98	12	56	14	220
8	.05	78	32	1,600	17	65	27	760	13	72	14	74	19	1,200
18	.08	52	35	1,400	14	45	30	940	13	91	12	70	17	1,500
20	.07	53	33	2,000	15	46	32	1,400	14	68	13	78	13	1,800
20	.32	49	32	3,200	9	43	43	5,500	14	91	13	77	17	2,500
20	.19	50	41	1,700	18	41	44	2,000	15	96	14	95	16	5,800
19	.13	58	48	1,100	15	49	48	150	14	82	13	80	27	870
16	.05	75	21	700	16	65	20	300	11	55	14	70	12	280
18	.15	66	28	900	16	55	28	350	13	95	15	79	15	450
18	.24	67	30	1,200	16	56	36	320	15	94	14	94	21	450
18	.22	53	28	1,800	16	43	51	600	13	140	16	75	19	3,200
20	.02	70	31	1,400	19	56	45	51	18	95	15	120	24	170
18	.09	54	25	990	15	45	24	760	12	120	13	89	13	750
18	.04	63	30	800	16	54	28	940	13	72	13	69	14	610
14	.07	60	24	670	13	53	21	810	10	79	12	55	13	460
36	11	30	16	310	7	29	18	94,000	10	28	19	46	7	73,000
20	.16	63	21	810	18	56	20	340	10	250	13	120	20	240
18	.10	43	22	1,300	14	39	22	280	9	250	12	66	18	320
23	.46	39	19	1,300	18	34	8	3,000	12	36	16	65	14	870
18	.27	50	27	910	16	43	21	1,400	10	79	15	58	11	1,400
[illegible]	.18	45	29	730	20	40	22	500	9	110	12	60	12	1,500
20	.24	44	31	580	19	39	22	620	9	170	12	56	20	1,700
22	.20	64	40	1,000	20	57	39	670	13	98	18	76	14	1,700
15	.03	38	29	520	15	35	15	18	8	62	12	48	8	79
19	.03	55	25	600	19	52	22	310	10	53	14	65	10	290
14	.03	48	24	560	13	45	15	32	8	47	11	47	9	74
19	.05	72	24	580	21	62	23	570	12	51	19	67	13	440
20	.03	81	24	740	23	72	24	520	12	47	18	70	11	450
19	.05	66	22	640	19	60	21	610	11	46	17	66	10	420
20	.05	73	26	760	19	65	26	600	12	53	18	77	11	460
18	.10	52	20	640	16	47	21	1,900	11	47	17	63	8	1,000
24	.61	56	32	980	21	53	39	12,000	15	76	25	86	9	3,200
22	.11	50	46	1,300	24	43	44	970	13	90	17	82	16	2,100
24	.21	49	45	1,800	19	45	42	1,700	14	95	16	94	13	7,200
23	.21	46	37	2,500	16	42	41	3,100	14	100	16	90	14	3,700
22	.22	59	40	1,200	19	54	39	650	13	100	18	83	14	1,400
14	.04	45	24	700	13	41	19	47	9	76	12	51	10	91

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected
ınd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

sufficient material for analysis]

Ga (ppm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
18	.04	56	28	720	19	50	25	940	11	61	15	65	10	640
16	.29	50	25	800	18	46	21	1,100	9	80	14	56	10	1,600
18	.31	53	20	670	18	48	21	3,000	11	58	17	62	9	1,700
20	.04	110	31	1,000	22	97	38	61	12	68	21	72	14	160
14	.03	52	21	470	16	45	14	46	8	42	13	44	13	61
18	.23	54	26	880	19	50	26	310	11	80	15	69	12	380
22	.17	56	23	1,300	16	49	22	240	10	230	16	230	16	240
18	.14	64	31	1,580	16	54	48	912	14	127	14	73	24	1,770
30	2.9	35	22	3,950	<4	38	25	35,100	12	47	18	53	10	12,600
14	1.5	13	13	12,900	<4	16	32	19,600	10	7	6	31	7	18,600
19	.18	55	31	2,510	14	45	35	4,430	15	85	15	72	20	2,570
14	.91	28	19	4,550	<4	34	23	11,400	12	21	9	45	10	5,700
19	.39	57	29	2,040	12	50	32	4,540	14	96	14	69	19	941
18	1.1	25	18	3,020	<4	25	18	29,700	9	16	12	41	6	37,000
19	.51	48	26	2,740	10	42	31	6,960	14	82	13	66	17	1,930
22	.25	45	37	933	16	42	26	2,340	11	86	12	86	15	475
18	.29	87	31	1,050	17	77	31	2,550	15	72	16	69	18	2,300
19	.18	57	49	4,520	8	52	64	452	16	81	14	71	37	8,810
15	.36	22	26	1,170	10	21	14	9,430	13	33	10	86	7	3,310
17	.70	26	31	2,270	6	25	29	11,700	15	39	11	102	10	12,300
22	.11	32	28	997	17	26	17	1,520	15	19	12	71	18	3,210
15	.04	39	17	783	14	32	7	1,490	12	16	9	55	11	151
18	.05	47	19	1,520	15	35	7	1,250	12	84	8	57	15	134
23	.16	40	27	888	21	35	12	1,560	16	21	13	76	14	1,180
20	.05	45	20	1,420	16	36	8	1,330	13	38	12	63	17	378
[illegible]	.21	62	41	1,680	15	52	41	2,450	17	90	15	83	18	5,820
[illegible]	8.4	19	8	168	<4	22	20	52,300	6	6	12	15	5	298,000
23	3.7	28	14	864	7	29	17	57,400	10	36	15	44	13	42,900
16	.30	54	29	783	11	52	17	4,230	9	88	11	55	11	2,320
17	.72	67	32	1,870	12	59	40	10,400	13	92	14	68	17	2,880
15	.11	54	25	1,260	14	49	34	1,210	12	99	13	61	20	925
16	.21	46	30	1,920	11	38	26	3,490	11	126	12	65	16	2,250
16	.11	64	28	828	16	55	22	1,480	13	64	13	60	17	554
15	.80	52	24	959	14	45	19	2,340	11	79	12	54	15	1,760
15	.69	53	25	806	13	46	22	2,520	11	95	12	58	17	1,170
17	.05	51	22	389	18	44	33	101	13	136	13	77	20	1,290
21	10	41	17	234	11	40	11	41,900	9	22	16	50	7	1,340
10	18	14	14	16,000	<4	10	15	20,200	10	43	7	20	12	11,900
20	.11	31	41	956	15	27	25	346	10	214	8	78	16	524
21	11	22	15	182	10	23	10	52,200	8	19	12	43	4	12,400

ermediate (0.063- to 0.25-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected nd Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

s[illegible]nt material for analysis]

a (pm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
5	.10	54	33	846	12	49	23	869	12	127	12	62	18	132
8	.37	70	39	1,050	16	64	34	2,850	14	93	15	66	21	1,130
21	2.1	53	27	1,350	11	47	28	5,450	12	69	12	60	17	1,650
18	.03	110	37	2,810	13	98	59	60	15	86	16	74	24	168
6	.82	56	24	538	20	52	32	3,520	20	228	25	97	11	1,020
4	.14	44	43	1,010	14	35	22	725	10	169	10	98	18	1,590
14	.55	37	10	61	11	32	6	7,200	8	39	10	41	6	155
13	.37	34	10	286	10	29	12	7,320	9	52	11	41	7	2,000
4	.74	42	11	298	10	37	15	9,060	10	51	12	43	7	3,560
6	.31	47	18	524	13	40	20	4,980	12	56	16	55	10	2,720
16	.15	69	18	536	15	59	17	2,020	12	42	16	55	10	867
16	.18	37	9	331	12	32	13	2,770	11	51	12	48	8	1,770
7	.49	38	12	282	13	32	11	3,400	11	48	13	49	8	7,060
16	.13	58	18	667	14	50	20	2,140	12	42	15	55	11	973
16	1.2	31	11	94	12	27	6	5,520	10	40	11	47	7	1,520
17	.95	49	17	484	14	42	15	7,870	12	40	15	55	9	658
17	.10	71	24	754	16	61	26	1,520	13	54	16	60	16	906
12	.02	48	21	567	13	43	13	43	9	50	11	40	14	70
17	1.4	27	21	674	8	29	14	33,500	11	45	12	52	7	2,070
18	.89	38	17	2,980	10	26	6	28,200	12	93	12	54	18	610
20	.05	44	40	575	18	40	31	143	11	94	12	88	14	209
16	.64	24	24	1,680	7	23	12	9,010	12	28	9	74	7	1,500
18	.53	57	31	1,500	13	50	28	5,000	16	78	15	79	17	1,030
11	.19	24	19	1,460	7	21	37	3,710	14	22	8	84	9	5,740
[illegible]	.03	41	20	1,060	11	34	7	687	12	15	10	58	10	104
[illegible]	.05	36	16	1,500	11	29	8	2,010	12	17	12	58	14	303
23	.11	38	24	1,930	15	31	12	1,720	16	23	12	75	17	1,110
17	.64	48	30	2,050	11	42	26	8,250	14	74	13	69	16	893
16	.06	60	40	784	17	52	25	156	15	84	14	73	26	234
20	.13	58	33	2,020	16	50	48	1,030	16	98	16	75	16	1,840
22	.45	46	27	4,290	5	38	28	7,710	14	73	13	69	16	1,460
12	.11	40	18	766	<4	50	29	672	12	75	8	59	25	631
15	.12	55	28	251	18	49	25	813	12	91	12	61	18	425

ical data for the coarse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and l collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining aho.

ec imit; dashes, insufficient material for analysis]

ple e	Al (wt pct)	Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)
ıbed	6.6	0.12	2.9	2.7	0.45	0.54	0.03	0.21	<2	25	680	<2	120
)	5.9	.20	3.1	2.8	.48	.55	.04	.21	<2	16	720	<2	86
	6.5	.17	3.6	2.8	.48	.62	.04	.16	<2	33	700	<2	98
	7.4	.12	3.1	3.0	.52	.57	.03	.21	<2	20	690	<2	110
	7.4	.19	3.0	2.7	.49	.59	.04	.21	<2	27	620	<2	100
)	7.8	.13	3.8	3.1	.61	.62	.04	.25	<2	21	660	2	93
	7.5	.25	3.7	2.9	.64	.63	.05	.26	<2	15	640	4	91
	7.9	.08	4.3	3.0	.63	.61	.04	.24	<2	20	600	3	93
	7.8	.15	5.4	2.9	.66	.68	.05	.25	4	27	560	7	95
)	8.4	.12	4.5	3.2	.68	.62	.04	.29	<2	27	590	9	95
	8.7	.15	5.0	3.1	.63	.61	.05	.33	<2	26	620	2	97
	7.2	.09	4.0	3.0	.58	.71	.04	.24	<2	33	700	<2	92
	7.9	.15	3.8	3.2	.65	.86	.04	.25	<2	54	720	2	79
)	8.2	.16	4.3	3.2	.70	.91	.04	.28	<2	78	740	<2	97
)	8.5	.16	5.6	3.3	.67	.50	.07	.26	<2	120	780	12	100
	8.5	.19	5.0	3.2	.94	.77	.04	.39	<2	14	720	<2	100
	7.8	.12	3.8	3.2	.61	.96	.03	.26	<2	19	750	<2	88
)	8.3	.11	4.2	3.2	.68	.86	.04	.26	<2	19	760	2	95
)	7.2	.14	2.9	2.9	.53	.89	.04	.27	<2	<10	820	2	98
ıbank	6.6	.04	6.9	2.4	.42	.54	.07	<.005	49	74	250	89	84
nbed	8.3	.29	3.3	3.7	.46	1.5	.04	.24	<2	42	830	<2	75
)	6.7	.67	2.9	2.6	.42	1.2	.08	.24	<2	110	680	2	74
ial-fill	8.1	.10	5.3	3.5	.48	.64	.04	.24	7	2,800	530	<2	58
r	7.2	.13	3.2	3.0	.51	.86	.04	.26	<2	15	760	3	85
)	7.9	.34	4.1	2.9	.62	.91	.07	.29	<2	19	780	7	83
ıbank	7.3	.60	3.3	2.1	.50	1.1	.11	.32	<2	17	690	16	87
nbed	8.4	.22	4.2	3.1	.66	.78	.06	.28	<2	19	740	5	120
)	6.3	.12	2.1	2.7	.50	.77	.03	.25	<2	<10	880	<2	83
)	7.4	.13	4.8	3.0	.64	.62	.04	.25	<2	26	740	<2	110
)	6.1	.08	2.2	2.8	.51	.55	.03	.18	<2	<10	700	<2	81
)	8.2	.09	4.4	3.3	.66	.72	.04	.26	<2	30	680	<2	110
)	8.6	.07	4.6	3.4	.67	.72	.04	.24	<2	18	710	<2	92
)	8.1	.08	4.2	3.2	.64	.72	.04	.23	<2	22	680	<2	97
)	8.4	.10	5.2	3.2	.71	.70	.04	.26	<2	27	690	<2	120
)	8.2	.05	4.6	3.2	.63	.70	.04	.21	<2	28	640	2	92
)	8.6	.17	4.4	3.2	.81	.99	.04	.16	3	43	570	9	94
)	8.8	.12	4.8	3.4	.62	.59	.04	.32	<2	25	630	5	89
)	8.6	.10	4.5	3.4	.65	.57	.04	.32	<2	30	590	12	95

cal data for the coarse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining 1[illegible]—Continued

ction limit; dashes, insufficient material for analysis]

ple e	Al (wt pct)	Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)
)	8.3	.12	5.1	3.2	.67	.64	.04	.31	3	27	580	9	87
)	8.9	.15	4.3	3.3	.69	.78	.05	.28	<2	16	780	4	95
)	6.8	.27	2.7	2.6	.50	.95	.05	.27	<2	<10	900	<2	94
)	8.3	.07	4.0	3.3	.65	.86	.04	.29	<2	14	770	<2	97
)	7.6	.10	3.5	3.1	.56	.87	.04	.24	<2	14	770	5	80
)	8.2	.14	4.4	3.0	.62	.79	.05	.19	<2	34	600	6	92
)	8.8	.08	5.5	3.4	.62	.57	.04	.23	<2	25	800	<2	120
)	6.1	.05	1.9	2.8	.48	.53	.02	.15	<2	<10	720	<2	82
)	7.7	.16	3.9	3.1	.62	.79	.04	.24	<2	47	710	<2	90
)	7.9	.33	3.1	3.5	.43	1.5	.04	.22	<2	47	790	<2	70
)	9.3	.18	4.9	3.1	.67	.78	.06	.32	<2	30	597	8	117
al fill	6.3	.05	12.6	2.3	.35	.44	.04	.15	51	49	293	41	60
)	4.0	.09	20.1	1.4	.49	.27	.03	.05	35	33	221	87	37
nbed	8.9	.10	5.2	2.9	.61	.75	.05	.26	5	28	529	9	103
ibank	6.1	.05	9.1	2.2	.40	.36	.03	.15	16	30	355	13	51
)	8.6	.10	5.8	2.9	.59	.72	.06	.25	9	16	492	3	104
)	6.0	.06	8.7	2.4	.44	.47	.03	.14	32	33	252	137	62
)	7.6	.09	8.7	2.3	.45	.52	.05	.20	24	32	376	13	85
ial fill	8.3	.22	5.4	2.5	.48	.46	.07	.43	2	22	546	<2	108
nbed	9.2	.12	3.7	3.4	.59	1.0	.04	.26	<2	11	758	6	134
ibank	9.4	.12	4.9	3.0	.60	.68	.06	.33	<2	25	555	101	100
)	7.9	.19	5.0	2.7	.52	.52	.09	.24	12	33	484	68	89
)	6.7	.08	4.2	2.9	.49	.36	.04	.24	9	38	381	25	45
ial fill	9.1	.04	3.6	3.8	.47	.18	.03	.21	3	24	414	53	57
)	7.2	.14	8.0	2.4	.37	.39	.06	.26	11	65	356	<2	106
)	9.6	.05	4.8	3.9	.48	.40	.03	.24	2	36	454	<2	71
)	10.8	.04	3.7	4.6	.48	.18	.03	.22	4	16	460	28	74
)	9.8	.08	3.9	3.9	.45	.28	.03	.24	3	18	427	<2	74
nbed	9.2	.10	4.5	3.1	.66	.64	.05	.30	<2	27	531	13	92
ial fill	3.0	.04	4.9	1.3	.17	.46	.04	<.005	34	31	45	1,050	27
)	4.8	.17	2.5	2.1	.25	1.0	.03	.06	8	10	205	310	44
)	7.0	.20	3.0	2.9	.52	.94	.07	.29	<2	13	797	12	125
nbed	8.4	.25	4.6	2.6	.62	.87	.07	.28	<2	27	524	8	134
)	7.8	.42	3.9	2.6	.58	.71	.07	.28	<2	17	641	9	104
ibank	7.3	.41	3.2	2.1	.51	.75	.10	.27	<2	13	713	18	95
)	8.7	.09	3.4	2.9	.59	.89	.04	.25	<2	18	674	3	125
nbed	8.1	.08	3.2	3.0	.50	.87	.03	.24	<2	14	725	3	85
ibank	7.2	.28	3.2	2.2	.48	.85	.07	.29	3	<10	728	12	116
)	8.5	.44	3.6	2.5	.60	1.2	.06	.40	<2	<10	852	8	109

cal data for the coarse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining ho.—Continued

c mit; dashes, insufficient material for analysis]

ıle e	Al (wt pct)	Ca (wt pct)	Fe (wt pct)	K (wt pct)	Mg (wt pct)	Na (wt pct)	P (wt pct)	Ti (wt pct)	Ag (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Ce (ppm)
al fill	5.9	.06	4.3	3.0	.31	.21	.04	.15	36	13	426	4	78
)	3.2	.22	17.2	1.2	.54	.08	.02	.06	20	46	201	47	27
	8.0	.81	4.0	2.0	.64	1.3	.09	.50	<2	12	862	<2	88
	5.0	.05	4.4	2.7	.24	.23	.03	.12	38	10	159	23	75
ıbed	8.3	.26	3.6	2.9	.59	.82	.05	.32	<2	16	875	<2	124
)	9.6	.16	4.1	3.1	.63	.82	.05	.28	<2	21	723	3	109
	8.2	.18	4.7	2.6	.50	.86	.07	.22	3	24	556	8	107
	9.6	.08	5.9	3.2	.70	.65	.06	.26	<2	38	761	<2	157
al fill	10.1	.48	4.4	4.3	1.2	.83	.04	.15	2	30	1,000	7	106
bank	7.2	.60	4.9	1.8	.64	1.1	.15	.54	<2	10	739	8	82
al fill	7.2	.03	3.8	2.2	.32	.95	.04	.13	8	72	503	<2	90
)	5.9	.27	1.5	1.7	.38	1.6	.03	.05	3	32	230	13	45
	5.8	.25	1.6	1.7	.38	1.5	.03	.04	4	44	240	18	56
ıbed	8.9	.10	4.4	3.0	.62	.83	.04	.19	<2	30	530	7	116
)	8.9	.06	7.7	3.1	.61	.72	.06	.18	<2	57	656	7	156
al fill	8.1	.15	2.4	2.4	.42	1.7	.05	.14	3	48	418	8	106
)	7.0	.22	2.2	1.9	.41	1.6	.05	.12	4	20	363	23	93
nbed	9.4	.06	6.8	3.1	.64	.68	.05	.18	<2	48	624	6	145
bank	7.3	.03	3.6	2.2	.36	1.2	.03	.12	4	53	423	3	104
)	7.7	.03	3.1	2.3	.40	1.2	.03	.12	4	40	409	<2	96
ıbed	9.5	.06	5.6	3.2	.62	.65	.05	.22	<2	25	646	3	125
)	6.7	.09	2.0	2.7	.48	.54	.03	.15	<2	<10	692	<2	94
bank	5.9	.08	9.6	2.1	.33	.42	.05	.18	66	39	334	3	59
a	7.3	.10	5.9	2.9	.34	.47	.03	.34	32	98	357	2	56
)	8.4	.22	5.1	2.3	.49	.40	.05	.43	<2	13	540	<2	102
ıbank	6.6	.06	5.2	2.6	.40	.33	.04	.24	22	43	348	<2	64
)	7.8	.16	5.4	2.4	.55	.54	.07	.26	15	30	414	6	102
al fill	6.6	.15	3.2	2.5	.42	.28	.03	.20	3	57	290	27	47
)	7.0	.07	4.8	2.7	.34	.22	.04	.28	7	28	307	<2	86
)	6.9	.04	3.5	2.8	.34	.23	.03	.23	4	36	307	<2	65
)	9.8	.08	3.7	4.0	.46	.21	.03	.21	4	14	435	5	69
ıbank	7.3	.22	6.2	2.1	.54	.62	.10	.30	23	34	379	3	112
ial fill	7.6	.35	3.8	2.7	1.0	.57	.05	.34	<2	10	673	2	107
ıbank	8.3	.10	4.8	3.2	.63	.76	.04	.30	<2	24	555	6	99
)	8.1	.07	7.4	2.8	.57	.64	.04	.24	12	29	474	8	88
)	5.6	.32	17.8	1.2	.41	.64	.20	.20	<2	35	474	12	88
)	6.9	.31	2.6	2.1	.57	.83	.08	.31	<2	<10	583	3	112

oarse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

ent material for analysis]

r m)	Cu (ppm)	Ga (ppm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
2	16	18	0.02	61	34	520	17	58	16	70	10	49	14	61	14	270
5	26	19	.02	42	37	600	13	41	18	80	10	68	13	65	9	570
4	23	18	.02	49	30	550	13	46	21	29	11	60	14	64	10	120
9	24	20	.03	58	37	400	21	53	18	90	12	49	16	67	14	400
8	20	20	.08	51	37	410	20	45	22	69	12	44	16	65	14	150
2	33	21	.04	48	33	780	22	42	23	400	13	56	16	72	14	900
2	40	20	.09	46	36	960	15	42	27	620	12	67	15	72	15	1,200
6	49	22	.05	46	33	1,000	19	41	25	690	14	40	16	76	11	1,100
4	170	22	.09	50	30	2,200	16	44	27	2,600	14	42	16	76	14	1,600
9	35	23	.09	49	42	1,300	23	42	32	1,200	16	49	16	94	16	3,300
8	32	24	.04	50	51	730	25	43	38	80	14	40	18	81	23	620
8	31	19	.03	47	25	680	16	42	22	290	12	62	13	68	12	270
0	30	21	.08	41	30	820	19	36	24	350	14	110	12	75	15	430
8	38	22	.05	50	30	980	19	43	31	430	14	89	14	83	18	500
0	43	24	.06	54	32	1,800	17	48	49	360	16	78	15	82	17	2,700
4	34	23	<.02	55	30	920	20	47	38	44	18	65	14	110	19	150
0	28	21	.04	45	29	670	18	40	21	570	13	100	13	74	13	590
7	46	21	.02	50	34	840	18	43	28	720	15	48	14	78	17	560
5	28	18	.07	49	33	610	18	43	21	530	12	45	13	60	13	530
6	4,600	55	17	41	20	300	13	39	19	49,000	14	34	18	57	12	42,000
6	34	22	.07	39	24	580	22	33	19	150	11	280	12	68	14	190
5	32	18	.10	39	21	980	14	35	20	340	10	290	10	60	19	320
2	210	24	.56	29	19	1,200	17	27	8	4,600	14	48	14	71	16	800
5	39	19	.15	44	27	810	17	38	18	1,500	12	66	12	64	13	1,200
[illegible]	92	21	.16	42	35	700	18	37	22	530	14	63	12	73	14	1,800
3	110	19	.30	45	31	770	16	39	21	1,100	11	110	11	62	20	2,600
5	41	22	.11	60	42	790	22	53	30	580	15	59	15	75	16	1,400
8	18	16	.02	45	30	360	16	39	13	21	10	38	11	50	14	69
1	54	20	.02	56	26	700	14	50	30	340	13	38	14	71	18	280
8	15	16	.01	40	23	310	14	36	14	25	10	27	10	52	11	59
6	63	22	.04	56	28	620	22	49	25	630	15	40	14	78	16	450
1	59	23	<.02	48	29	610	20	43	24	550	16	41	15	82	13	440
8	82	22	.07	51	28	690	20	45	23	740	15	42	14	78	14	430
1	70	23	.02	63	32	830	18	56	31	690	16	40	15	88	16	480
0	130	23	.05	48	29	750	19	43	27	1,800	16	39	15	78	12	830
0	210	24	.30	48	28	720	19	42	25	6,100	16	60	17	79	11	2,200
8	29	24	.06	46	45	940	19	40	32	830	16	41	14	86	17	1,600
1	30	24	.09	50	42	1,100	19	42	28	1,200	17	46	14	93	16	4,000

arse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

sufficient material for analysis]

r n)	Cu (ppm)	Ga (ppm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
3	90	23	.07	45	37	1,800	15	39	27	2,300	16	47	13	83	15	2,600
0	31	24	.10	50	44	720	20	44	29	400	16	51	15	78	12	1,200
0	21	18	.03	46	29	730	15	40	20	47	11	60	12	56	12	97
5	39	22	.02	52	36	570	22	45	24	760	15	40	15	74	15	500
3	61	21	.17	42	31	690	17	37	20	980	13	52	13	66	11	1,600
3	190	22	.17	48	27	930	19	43	26	4,100	15	46	15	73	12	1,700
0	34	25	.02	61	36	940	19	55	36	79	16	42	16	81	12	160
5	11	16	<.02	41	22	330	13	37	13	28	9	20	10	47	8	55
3	28	20	.11	47	30	730	17	42	24	330	14	89	13	73	15	340
4	24	21	.06	37	24	600	20	33	16	180	10	290	12	69	13	170
3	39	24	.06	58	33	1,120	27	52	35	529	13	65	18	81	15	1,640
5	1,050	22	.78	30	21	2,540	<4	32	16	16,600	11	24	10	100	6	100
1	1,460	16	.76	21	14	15,600	<4	22	23	14,700	10	14	8	35	11	12,800
3	128	23	.09	50	31	2,260	21	46	28	3,200	13	49	18	75	12	2,320
9	586	17	.47	26	22	4,830	<4	23	16	9,000	10	25	9	51	7	4,060
3	207	23	.15	49	31	2,170	18	46	26	3,540	13	42	16	74	12	1,040
0	960	22	.52	31	20	2,690	<4	31	14	12,900	10	22	11	52	8	19,200
0	531	19	.31	46	24	2,160	15	42	21	6,350	13	34	16	60	17	3,630
3	53	26	.12	49	41	862	15	45	34	1,480	12	77	11	103	16	349
5	46	26	.10	63	35	614	30	63	24	1,160	13	46	18	79	9	1,690
3	42	26	.05	43	51	2,880	23	41	43	238	13	46	15	81	19	6,020
4	350	21	.75	38	33	5,240	<4	35	34	15,700	14	55	10	89	20	7,260
9	83	19	.40	22	28	1,960	7	20	22	9,750	15	30	9	110	8	7,050
4	213	29	.11	27	33	1,080	31	26	18	1,550	14	21	15	80	8	5,410
3	156	19	.10	51	22	681	19	46	14	8,050	12	44	72	66	14	389
2	95	28	.06	35	25	738	34	31	11	2,700	15	52	15	84	10	319
1	616	32	.19	35	32	959	38	34	14	1,690	16	23	17	90	16	2,160
0	160	28	.10	36	26	1,380	26	33	11	1,530	14	42	17	81	12	903
3	40	24	.08	44	43	1,360	23	42	32	1,540	15	50	16	91	12	4,820
7	3,790	30	3.1	11	8	133	<4	16	25	63,300	6	11	9	27	4	200,000
4	1,180	26	2.9	21	11	412	7	22	15	21,700	8	28	10	43	10	63,100
9	107	21	.22	58	34	1,040	13	55	21	6,100	10	66	11	68	12	2,240
0	160	24	.31	64	37	1,300	25	60	34	5,910	12	60	18	75	12	2,890
4	49	20	.06	52	28	954	23	48	30	829	12	72	18	68	14	1,010
7	58	18	.11	43	30	1,610	20	36	24	2,510	10	80	14	62	11	2,720
3	55	23	.05	61	33	760	24	57	23	1,290	12	46	16	72	10	729
2	34	21	.11	41	26	684	23	38	18	1,190	11	62	13	66	8	1,330
7	72	20	.46	53	27	1,290	20	50	24	3,730	10	95	15	63	20	2,080
5	44	23	.04	48	24	458	30	44	38	120	12	151	14	88	22	2,240

arse (0.25- to 1.0-mm grain size) fraction of samples of streambed sediment, streambank soil, and artificial-fill material collected from Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.—Continued

s... ent material for analysis]

r m)	Cu (ppm)	Ga (ppm)	Hg (ppm)	La (ppm)	Li (ppm)	Mn (ppm)	Nb (ppm)	Nd (ppm)	Ni (ppm)	Pb (ppm)	Sc (ppm)	Sr (ppm)	Th (ppm)	V (ppm)	Y (ppm)	Zn (ppm)
4	88	20	9.4	37	16	472	10	34	13	75,500	9	31	16	52	7	1,520
2	97	9	10	14	9	14,900	<4	12	13	14,500	8	20	5	19	12	11,100
5	45	23	.10	40	39	1,430	14	35	28	380	11	190	8	92	19	498
2	373	20	4.5	35	14	299	9	33	10	75,900	8	26	14	45	6	5,910
7	23	22	.05	58	40	626	25	54	23	555	11	66	17	70	12	161
3	32	25	.10	52	45	717	29	50	29	1,190	12	53	15	77	11	897
7	204	27	1.1	52	29	1,400	21	49	24	5,420	12	51	16	68	12	2,710
4	48	27	.01	62	42	1,960	22	66	53	51	15	51	16	90	13	225
0	64	29	.52	49	22	597	27	53	29	2,480	15	171	22	98	7	1,120
7	605	26	.12	42	36	1,800	12	32	23	913	9	140	9	106	16	1,350
0	164	20	.53	43	15	303	20	39	13	7,960	11	39	19	56	6	370
2	377	16	.14	22	10	224	16	20	9	3,760	8	48	13	42	4	2,360
0	412	17	.28	28	10	205	16	25	10	4,820	8	45	13	43	4	3,990
8	167	24	.14	57	28	656	22	56	24	3,230	13	46	18	76	9	2,740
0	184	25	.06	75	30	1,160	19	78	44	2,570	14	40	17	79	12	1,740
3	428	22	.20	53	14	449	22	46	16	3,160	11	62	18	61	9	3,220
2	198	18	.56	47	13	466	19	42	13	4,950	10	58	15	50	9	12,200
2	162	25	.06	71	30	988	28	72	37	2,120	15	38	19	80	11	1,710
9	132	21	.50	52	17	232	21	49	12	4,000	12	37	18	59	6	920
0	230	22	.32	47	18	505	21	44	15	5,740	12	34	17	62	6	657
4	69	25	.03	60	32	816	27	60	31	965	14	40	16	80	10	1,060
2	15	17	.01	45	24	319	21	42	14	37	8	27	13	49	8	87
7	649	19	1.2	30	18	797	7	28	11	44,000	10	41	11	51	8	1,730
8	157	21	.69	28	18	2,180	19	22	8	20,900	11	91	12	59	13	945
9	48	24	.05	46	39	751	15	41	36	213	12	75	10	101	16	592
6	269	18	.45	30	22	3,380	<4	26	10	12,300	12	28	9	77	8	1,220
9	240	21	.62	49	32	2,670	11	46	26	8,130	13	51	15	78	17	1,690
7	136	17	.12	23	23	1,740	12	21	43	4,150	16	23	10	106	7	17,200
9	47	20	.09	42	20	857	18	36	9	2,400	11	22	27	61	10	215
2	42	20	.06	32	19	776	19	28	8	1,920	12	19	24	70	8	413
2	237	29	.11	32	27	2,920	22	29	14	2,150	14	26	13	83	11	1,840
3	395	21	.93	52	32	5,020	<4	47	29	16,200	12	64	16	72	22	1,370
4	34	20	.07	56	41	765	21	51	25	141	12	78	16	80	26	332
8	40	24	.05	46	32	1,040	27	44	31	489	13	44	17	80	11	1,580
5	348	23	.18	43	30	4,080	8	38	24	5,380	12	36	15	70	11	2,190
0	62	13	.11	40	18	763	<4	50	30	631	12	83	12	60	27	898
0	51	18	.08	54	28	207	24	49	26	1,050	10	82	14	65	19	651

Table 10. Results of blind analyses of National Institute of Standards & Technology (NIST) Standard Reference Materials (SRM2710, SRM2711; Montana soils).

[Major-element contents in weight percent; minor- and trace-element contents in parts per million. NIST gives only "noncertified" values for listed trace elements, with no ± variation listed. Difference from certified value is calculated relative to range of certified values: positive value is percent above high end of range, negative value is percent below low end of range, and 0 value is within range. <, below analytical detection limit]

SRM------	2710					2711				
		2000 analysis		2001 analysis			2000 analysis		2001 analysis	
Element	NIST certified value (±variation, in percent)	Analytical value	Difference from certified value (percent)	Analytical value	Difference from certified value (percent)	NIST certified value (±variation, in percent)	Analytical value	Difference from certified value (percent)	Analytical value	Difference from certified value (percent)
					Major elements					
Al---------	6.44 (1.2)	6.1	-4	6.4	0	6.53 (1.4)	6.5	0	6.5	0
Ca---------	1.25 (2.4)	1.2	-2	1.2	-2	2.88 (2.8)	2.9	0	2.9	0
Fe---------	3.38 (3.0)	3.3	0	3.4	0	2.89 (2.1)	2.9	0	2.9	0
K----------	2.11 (5.2)	2	0	2.1	0	2.45 (3.3)	2.4	0	2.6	3
Mg--------	.853 (4.9)	.84	0	.84	0	1.05 (2.9)	1	-2	1	-2
Na--------	1.14 (5.3)	1.1	0	1.1	0	1.14 (2.6)	1.1	-1	1.2	3
P----------	.106 (14.2)	.11	0	.13	7	.086 (8.1)	.08	0	.08	0
Ti---------	.283 (3.5)	.14	-49	.14	-49	.306 (7.5)	.28	-1	.28	-1
					Minor elements					
Ag--------	35 (4.3)	35	0	31	-7	4.63 (8.4)	5	0	4	0
As---------	626 (6.1)	630	0	614	0	105 (7.6)	100	0	99	0
Ba---------	707 (7.2)	680	0	705	0	726 (5.2)	720	0	727	0
Cd--------	21.8 (0.9)	21	-3	21	-3	41.7 (0.6)	41	-1	42	.1
Cu--------	2,950 (4.4)	2,900	0	2,800	-1	114 (1.8)	110	-2	114	0
Hg--------	32.6 (5.5)	29	-6	31	0	6.25 (3.0)	5.8	-4	5.6	-8
Mn--------	10,100 (4.0)	9,800	0	9,910	0	638 (4.4)	650	0	653	0
Ni---------	14.3 (7.0)	15	0	15	0	20.6 (5.3)	22	1	21	0
Pb---------	5,532 (1.4)	5,400	-1	5,630	-.3	1,162 (2.7)	1,200	1	1,160	0
V----------	76.6 (3.0)	72	-3	73	-2	81.6 (3.6)	81	0	81	0
Zn---------	6,952 (1.3)	6,700	-2	6,980	0	350.4 (1.4)	350	0	350	0
					Trace elements					
Ce---------	57	56	---	60	---	69	71	---	78	---
Co---------	10	3	---	13	---	10	9	---	11	---
Cr---------	39	33	---	31	---	47	47	---	44	---
Ga---------	34	36	---	39	---	15	15	---	14	---
La---------	34	30	---	32	---	40	37	---	42	---
Mo---------	19	14	---	19	---	1.6	<2	---	2	---
Nd---------	23	17	---	17	---	31	30	---	32	---
Sc---------	8.7	10	---	10	---	9	10	---	10	---
Sr---------	330	320	---	318	---	245.3	240	---	245	---
Th---------	13	14	---	16	---	14	14	---	15	---
Y----------	23	21	---	23	---	25	26	---	29	---
Yb---------	1.3	2	---	2	---	2.7	3	---	3	---

Table 11. Mean and standard deviation (SD) of the coefficients of variation (CV) for field duplicates of samples of suspended and streambed sediment and for annual replicate samples of streambed sediment collected from the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

[All values in percent. Dashes, not calculable because most determinations were below analytical detection limit]

Element	Suspended sediment		Streambed sediment			
	Field duplicates 2000 (*n*=4)		Field duplicates 2000 (*n*=6)		Annual repeats 2000-1 (*n*=12)	
	Mean of CV	SD (pct)	Mean of CV	SD (pct)	Mean of CV	SD (pct)
Al -----	2	1	2	2	6	4
Ca -----	8	9	19	14	12	13
Fe -----	3	1	7	5	9	12
K ------	4	4	3	2	3	2
Mg ----	2	2	3	3	5	4
Na -----	3	2	4	3	7	11
P -------	2	5	9	7	9	9
Ti ------	4	3	14	17	10	12
Ag -----	---	---	---	---	---	---
As -----	11	13	23	20	33	33
Ba -----	1	1	3	2	7	6
Cd -----	---	---	---	---	---	---
Ce -----	1	1	10	14	13	12
Co -----	10	14	12	9	28	15
Cr------	5	6	4	4	14	17
Cu -----	6	3	17	14	28	19
Ga -----	1	2	2	2	8	4
Hg -----	6	6	30	20	25	20
La -----	2	1	10	10	14	11
Li ------	1	1	5	2	7	6
Mn ----	1	2	12	3	17	14
Nb -----	5	4	10	10	14	10
Nd -----	4	2	9	9	15	15
Ni ------	2	2	6	4	15	14
Pb -----	4	7	18	10	13	10
Sc -----	0	0	3	3	6	5
Sr ------	7	7	8	7	8	7
Th -----	2	3	5	3	10	6
V ------	2	1	3	2	6	6
Y ------	3	2	5	2	15	13
Zn -----	4	3	8	8	26	20
Median----	3	2	8	7	12	12
Mean ------	4	3	9	7	13	8
Calculated only for mining-related elements (Fe, As, Co, Cu, Hg, Mn, Pb, Zn)						
Median----	5	4	14	10	26	17
Mean------	6	5	16	6	22	7

Table 12. Mean and standard deviation (SD) of the "background" composition of the fine (<0.063-mm grain size) fraction of samples of streambed sediment collected from a large unimpacted drainage (West Fork of Eagle Creek) relative to those of several smaller unimpacted tributaries or the upstream unimpacted reaches of impacted streams in the Prichard Creek, Eagle Creek, and Beaver Creek drainages in the northern Coeur d'Alene Mining District, northern Idaho.

[Major-element contents in weight percent; minor-element contents in parts per million. See figures 1 and 2 for locations. Samples from the West Fork of Eagle Creek were collected at sampling sites 26, 41, and 143, and samples from small unimpacted tributaries were collected at sampling sites 03, 15, 24, 40, and 130 (fig. 2). Dashes, below analytical detection limit of 2 ppm, which is presumed to be background value]

Element	West Fork of Eagle Creek (*n*=3)		Unimpacted small tributaries (*n*=5)	
	Mean composition	SD	Mean composition	SD
	Major elements			
Al	5.8	0.3	6.6	0.2
Ca	.64	.04	.49	.08
Fe	2.3	.1	3.4	.8
K	1.9	.1	2.0	.1
Mg	.54	.02	.61	.10
Na	.99	.02	.98	.14
P	.09	.01	.07	.01
Ti	.3	.0	.3	.1
	Minor elements			
Ag	2	---	2	---
As	11	1	15	3
Ba	793	39	651	109
Cd	2	---	2	---
Ce	92	4	120	45
Co	7	4	20	16
Cr	50	19	45	8
Cu	105	35	64	18
Ga	14	1	16	1
Hg	.06	.01	.05	.03
La	44	2	51	7
Li	26	2	30	4
Mn	1,020	216	1,192	713
Nb	12	1	14	2
Nd	39	2	46	8
Ni	23	7	38	14
Pb	82	16	60	21
Sc	9	1	11	2
Sr	102	8	104	5
Th	12	1	12	1
V	51	2	67	17
Y	17	3	19	3
Zn	113	15	139	28