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# CHEMICAL DATA AND LEAD ISOTOPIC COMPOSITIONS OF GEOCHEMICAL BASELINE SAMPLES FROM STREAMBED SEDIMENTS AND SMELTER SLAG, LEAD ISOTOPIC COMPOSITIONS IN FLUVIAL TAILINGS, AND DENDROCHRONOLOGY RESULTS FROM THE BOULDER RIVER WATERSHED, JEFFERSON COUNTY, MONTANA

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## INTRODUCTION

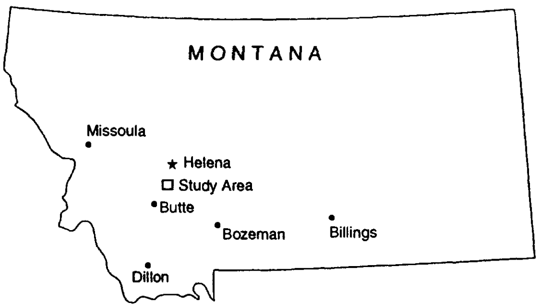
As a part of the U.S. Geological Survey Abandoned Mine Lands Initiative (Buxton and others, 1997), metal-mining related wastes in the Boulder River study area in northern Jefferson County, Montana, have been evaluated for their environmental effects. The study area includes a 24-km segment of the Boulder River in and around Basin, Montana and three principal tributaries to the Boulder River: Basin Creek, Cataract Creek, and High Ore Creek. Mine and prospect waste dumps and mill wastes are located throughout the drainage basins of these tributaries and in the Boulder River. Mine-waste material has been transported into and down streams, where it has mixed with and become incorporated into the streambed sediments. In some localities, mine waste material was placed directly in stream channels and was transported downstream forming fluvial tailings deposits along the stream banks. Water quality and aquatic habitat have been affected by trace-element-contaminated sediment that moves from mine wastes into and down streams during snowmelt and storm runoff events within the Boulder River watershed (Buxton and others, 1997; Farag and others, 1999; Nimick and others, 1999).

Present-day trace element concentrations in the streambed sediments and fluvial tailings have been extensively studied (Aamodt, 1978; Broxton, 1980; Campbell and others, 1982; Fey and Church, 1998; Fey and others, 1999a; 1999b, 2000). However, in order to accurately evaluate the impact of mining on the stream environments, it is also necessary to evaluate the pre-mining trace-element concentrations in the streambed sediments. Three types of samples have been collected for estimation of pre-mining concentrations: 1) streambed sediment samples from the Boulder River and its tributaries located upstream from historical mining activity, 2) stream terrace deposits located both upstream and downstream of the major tributaries along the Boulder River, and 3) cores through sediment in overbank deposits, in abandoned stream channels, or beneath fluvial tailings deposits. In this report, we present geochemical data for six stream-terrace samples and twelve sediment-core samples and lead isotopic data for six terrace and thirteen core samples. Sample localities are in table 1 and figures 1 and 2, and site and sample descriptions are in table 2.

Geochemical data have been presented for cores through fluvial tailings on High Ore Creek (Fey and Church, 1998), on upper Basin Creek (Fey and others, (1999a), and on Jack Creek and Uncle Sam Gulch (Fey and others, (2000). Geochemical and lead isotopic data for modern streambed-sediment samples have been presented by Fey and others (1999b)..

Lead isotopic determinations in bed sediments have been shown to be an effective tool for evaluating the contributions from various sources to the metals in bed sediments (Church and others, 1993, 1997). However, in order to make these calculations, the lead isotopic compositions of the contaminant sources must also be known. Consequently, we have determined the lead isotopic compositions of five streambed-sediment samples heavily contaminated with fluvial mine waste immediately downstream from large mines in the Boulder River watershed in order to determine the lead isotopic signatures of the contaminants. Summary geochemical data for the contaminants are presented here and geochemical data for the streambed-sediment samples are given by Fey and others (1999b).

Downstream from the Katie mill site and Jib tailings (fig. 1, 1T), fluvial deposits of mill tailings are present on a 10-m by 50-m bar in the Boulder River below the confluence with Basin Creek. The source of these tailings is not known, but fluvial tailings are also present immediately downstream from the Katie mill site, which is immediately upstream from the confluence with Basin Creek. Nine cores of fluvial tailings from this bar were analyzed.



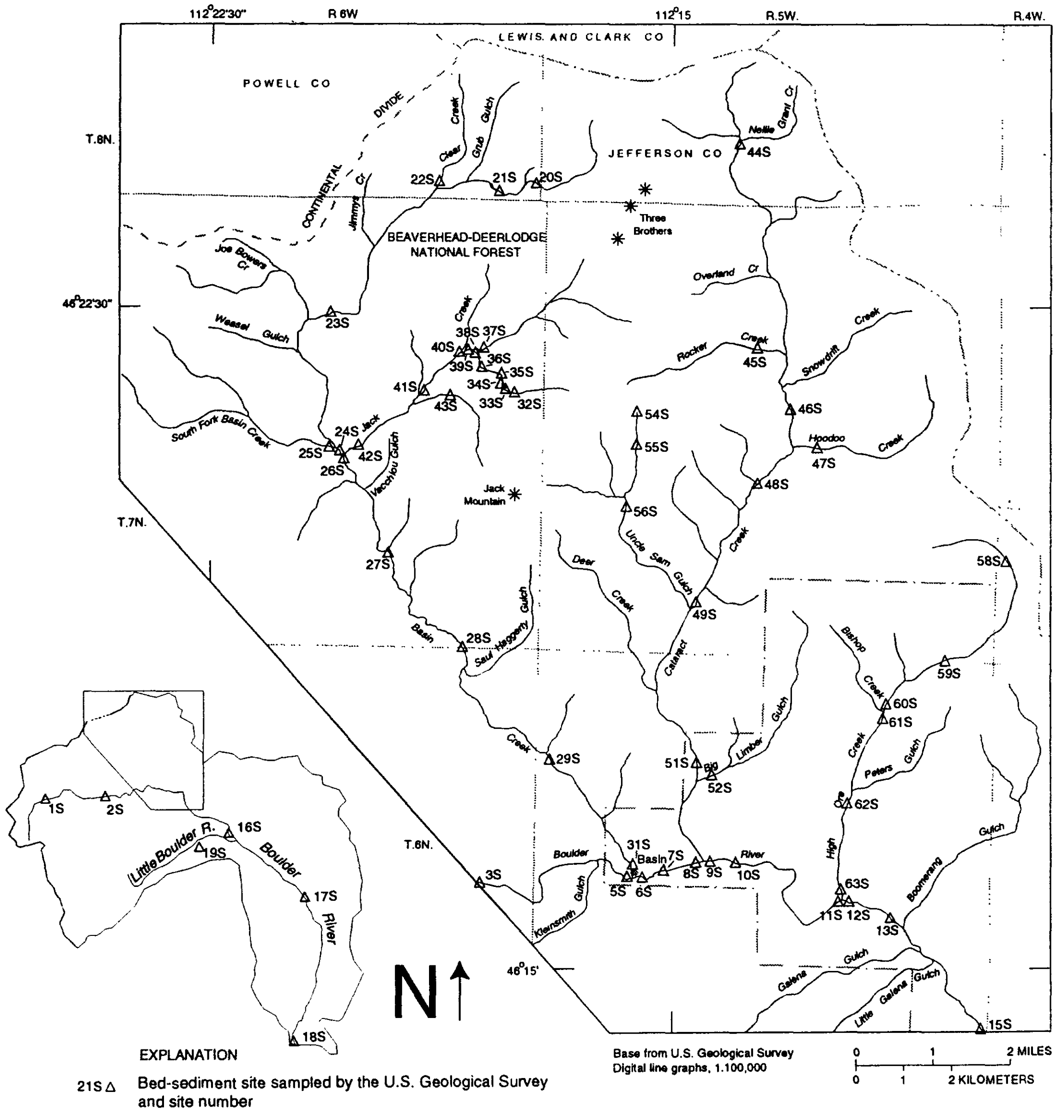
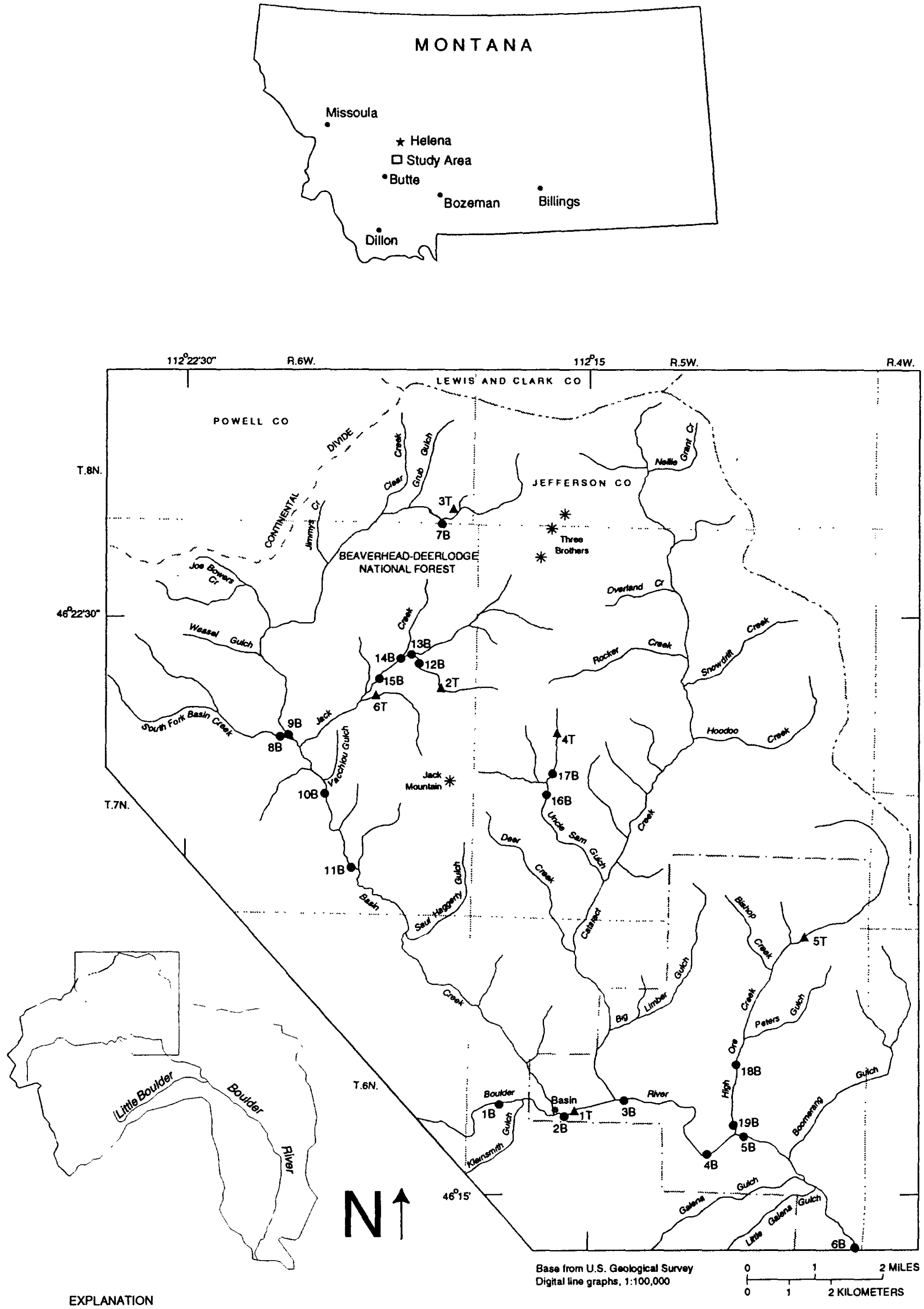




Figure 1. Index map of Montana showing Boulder River study area and sample locality map for bed-sediment sampling sites in the Boulder River Watershed.




EXPLANATION

16B ● Baseline core site sample by the U.S. Geogical Survey and site number

5T ▲ Mine waste or fluvial tailings site sampled by the U.S. Geological Survey and site number

Figure 2. Index map of Montana showing Boulder River study area and sample locality map for geochemical baseline cores and mine waste and tailings sites.

Dendrochronology samples were taken at several stream terrace localities to provide age control on the stream terrace deposits. Trees growing on the surfaces of stream terraces provide a minimum age for the terrace deposits, although floods subsequent to the trees' growth could have deposited post-mining overbank deposits around the trees. Historical data were also used to provide estimates of minimum ages of cultural features and to bracket the age of events (Rossillon and Haynes, 1999).

## METHODS OF STUDY

### Sample collection

Streambed sediments and fluvial tailings samples

Elemental and lead isotopic data for the baseline streambed-sediment samples that have little, if any, impact by historical mining have been reported by Fey and others (1999b). Their sample localities are indicated schematically in figure 1 (samples collected at nine sites; 2S, 3S, 4S, 20S, 22S, 32S, 44S, 54S, and 58S). Samples at sites 2S, 4S, and 22S were collected in October, 1996. Samples at sites 3S, 32S, 44S, and 54S were collected in July, 1997, and the remaining samples (20S, 58S) were collected in July, 1998. A second sample at site 3S was collected in July, 1998 in order to monitor yearly variations in trace-element concentrations. Sites were selected to be generally upstream from known historical mining activities. At each site, an integrated streambed-sediment sample was collected by compositing material from the active channel alluvium from 10 to 20 individual subsites within 15 m (50 ft) of the plotted sample locality. In the field, each composited sample was sieved through a 2-mm (10 mesh) stainless-steel screen, and the minus-2-mm fraction retained; the larger size fraction was discarded.

Samples of fluvial tailings collected at four sites (2T-5T, fig. 2) and the Bullion Smelter slag (6T, fig. 2) were selected for lead isotopic analyses. Three fluvial overbank-sediment samples from the Jack Creek drainage that were shown to contain tailings materials on the basis of their chemistry (35S, 37S, 40S) were also analyzed for lead isotopic compositions. These samples were collected in October 1996, in the same manner as the streambed-sediment samples, and were dry-sieved in the field to preserve the water-soluble salts contained in the samples.

Stream terraces

Samples of stream terraces were collected at six sites along the Boulder River during July 1999 (Sites 1B-6B in fig. 2). At each site, a pit was dug by hand or backhoe. Three to five subsamples were collected and given designations "a" through "e", with "a" being the highest sample stratigraphically (table 2). In general, no stratigraphy could be discerned in the gravel deposits, so each sample is really a subsample of the gravel deposit. Each subsample was sieved through a 2 mm (10 mesh) stainless-steel screen in the field. The minus-2-mm fraction for each subsample was retained separately and the larger size fraction was discarded. Each sample was treated separately, and the geochemical data evaluated to look for homogeneous distributions of ore-related trace elements throughout the terrace deposit. Samples from terrace sediment intervals having a uniform trace elemental distribution were used in this study to calculate the pre-mining geochemical baseline concentrations and determine the lead isotopic composition in pre-mining streambed sediments. This goal was achieved in streambed sediments for core 9B (table 3). Examination of the concentration data as a function of depth for arsenic, copper, and lead clearly indicate the impact of historical mining whereas concentrations of zinc show less of an impact on streambed sediments in upper Basin Creek.

Sediment cores

Twelve sediment cores were collected in acid-cleaned sections of 2 inch (5 cm) diameter PVC pipe to determine the metal concentrations and lead isotopic compositions in streambed sediments prior to historical mining. The objective of the sampling strategy was to sample sediments deposited through the time period before the onset of historical mining activity. Thus, the concentrations of metals in the cores should decrease with depth or reach a consistent concentration providing a clear indication of the pre-mining geochemical baseline in streambed sediments. One of these samples (site 18B, fig. 2) was collected in October 1996. Four additional cores (sites 11B, 13B, 17B, and 19B) were collected in July 1997, and seven more were collected in July 1998 (Sites 7B, 8B, 9B, 10B, 12B, 14B, 15B). Subsamples from ten of the sites were selected for lead isotopic analyses on the basis of their ore-related trace element concentrations and distributions within the cores.

In addition, segments of three one-inch diameter cores collected beneath the fluvial tailings were analyzed for their lead isotopic compositions: site (3T) near the Buckeye Mine, and sites 5Ta and 5Tb on High Ore Creek below the Comet Mine. A complete discussion of the geochemistry of the cores from the Comet Mine on High Ore Creek is in Fey and Church (1998) and of the cores from the Buckeye Mine on upper Basin Creek is in Fey and others (1999a).

Fluvial tailings from site T1

Nine cores were taken on the bar in the Boulder River at site T1 (fig. 2) just downstream from the confluence with Basin Creek. Nine cores were taken at 5-m intervals along the 50 m length beginning about 7 m from the downstream end of the bar. At sites 8 and 9, the tailings had been removed by erosion and no core samples were taken. Cores 10 and 11 were taken at the upstream end of the bar. The fluvial tailings deposit at site T1 is approximately 30-40 cm thick and the top of the bar is about 1 m above the low-flow water level in the Boulder River. Core descriptions and depths of penetration into fluvial tailings are in table 2. The cores were subdivided on the basis of discernable stratigraphy.

Dendrochronology

Cores of live trees were taken using a standard tree corer, the core was extracted and placed in a plastic sleeve, and most were sent to the Laboratory for Tree Ring Research, University of Arizona for analysis. Slabs of dead trees were also sent for analysis in hopes that the time of death could be determined to date the tree stump. The ages of the trees provides an estimate of the minimum age of the stream terrace.

## Sample Preparation

Streambed-sediment and stream-terrace samples were dried at ambient room temperature (25°C) and sieved to minus-80-mesh (<0.18mm) prior to laboratory analyses.

Core samples were subdivided in the laboratory on the basis of mineralogy, organic content, and apparent oxidation zones. The depth assigned to each subsample is defined as the mid point for that subsample after taking compaction into account (table 2). Individual cores were generally divided into two to ten subsamples, and ground in random order to minus-100-mesh in a vertical pulverizer.

## Sample Analyses

Total digestion

The streambed-sediment, stream-terrace, and core samples were digested with a mixed-acid solution consisting of HCl, $HNO_3$, $HClO_4$, and HF. This procedure is effective in dissolving most minerals, including silicates, oxides and sulfides; resistant or refractory minerals such as zircon, chromite, and some tin oxides are only partially dissolved. Previous investigations using a variety of materials support the completeness of the digestion (Church and others, 1987; Wilson and others, 1994).

Results are reported for 34 elements analyzed by ICP-AES (inductively coupled plasma-atomic emission spectroscopy; Crock and others, 1983; Briggs, 1996). Limits of determination for the total digestion method as well as a statistical summary of mean values, standard deviations, and median values for four National Institute of Standards and Technology (NIST) standard reference materials (SRM-2704, SRM-2709, SRM-2710, and SRM-2711) are given by Fey and others (1999b). Comparisons with certified values for these standards (NIST, 1993a; 1993b; 1993c; and 1993d) are also given by Fey and others (1999b). Both analytical precision and accuracy are well within acceptable ranges.

Warm 2M HCl-1 percent $H_2O_2$ leach extraction

The use of a partial-digestion extraction enables one to determine concentrations of trace elements bound within different mineral phases, whereas a total-digestion extraction releases all trace elements in a sample (Chao, 1984). All sample intervals analyzed for lead isotopic compositions were subjected to a partial-digestion extraction consisting of warm ($50^0$ C) 2M HCl-1 percent $H_2O_2$ for three hours with continuous agitation. The leachates were subsequently analyzed by ICP-AES for 32 elements. This partial extraction was designed to release trace elements associated with hydrous amorphous iron- and manganese-oxide mineral coatings and colloidal particles (Appendix III of Church and others, 1993; Church and others, 1997). Mineral coatings such as those observed in the study area can contain a significant percentage of the trace elements in a sample (Church and others, 1993, 1997).

Because we have shown that the vast majority of the contaminant lead exists within the amorphous iron- and manganese-oxide mineral coatings and colloidal particles (for example, Church and others, 1993, 1997), only the leachates were analyzed for lead isotopic compositions. This procedure presents a clearer picture of the distribution of contaminant lead and greatly reduces dilution effects from lead bound within the major mineral phases such as potassium-feldspar.

Ion exchange and mass spectrometry for lead isotope analyses

The lead separation procedure used on the 2M HCl-1 percent $H_2O_2$ extraction leachates to obtain the lead isotopic data is similar to those reported by Tatsumoto and others (1976) and by Unruh and others (1979). ICP-AES analyses of the selected samples provided an in-solution concentration for lead (Church and others, 1993). This concentration value is then used to calculate the volume of leachate needed to contain approximately 0.5 μg of lead; this aliquot is then evaporated to dryness in a teflon beaker. Then 0.5 to 1.0 mL of 1.0 N hydrobromic acid (HBr) is added to the sample and warmed gently for 5 to 10 minutes. The sample is allowed to cool, is centrifuged, and the supernatant loaded onto an anion-exchange column (0.8-1.0 mL resin volume) using Dowex AG1-X8 anion-exchange resin. The column is washed with 1.2 N HBr and water, and then the lead is eluted with either 8N hydrochloric acid (HCl) or 0.5-1.0 N nitric acid ($HNO_3$). The sample is again evaporated to dryness and then loaded onto a second anion-exchange column with a resin volume of 0.1-0.2 mL. The column is washed with 1.2 N HBr and water, and the lead is eluted with 0.5 N nitric acid. Two or three drops of dilute (0.25-0.5 percent) phosphoric acid ($H_3PO_4$) are added to the sample, and it is then evaporated again to dryness.

Approximately one-half of the sample is taken up in approximately 10 μL of dilute colloidal silica gel, loaded onto a rhenium-ribbon filament, and evaporated to dryness. The filament is then loaded into a solid-source thermal ionization mass spectrometer and heated to 1150-1350°C for data acquisition. Most analyses were made using a VG Sector 54, 7-collector mass spectrometer run in "static" mode. A few samples were run on a Micro Mass 54R, single-collector mass spectrometer. No systematic biases have been observed between the two mass spectrometers (Taylor and others, 1999). Analyses of NIST SRM 981 were used to monitor mass fractionation during mass spectrometry (Cantanzaro and others, 1968; Todt and others, 1993). Methods of calculation of the analytical uncertainty are presented in the Appendix. The lead isotopic data for replicate analyses of SRM-981 are in table A1.

As demonstrated by Fey and others (1999b), data from analyses of the leachates are inherently less reproducible than those from total digestion analyses. As a test of the leaching procedure for lead isotopic analyses, leachates of four NIST standards SRM 2704, 2709, 2710, and 2711 were analyzed for lead isotopic ratios. The lead isotopic analyses of replicate solutions of the four NIST standards are in Table A2.

## ANALYTICAL RESULTS

### Geochemical Baseline Samples

Geochemical data for total-digestion analyses of the baseline stream-terrace and core samples are given in table 3. Toxic ore-related trace element concentrations (for example, Pb, As, Cu) are generally similar to those found in streambed sediments upstream from known mineralization (Pb, near 60 ppm; As, about 45 ppm; Cu, about 50 ppm; Fey and others, 1999b). However, elevated concentrations of these three ore-related trace elements are found in pre-mining streambed sediments in Uncle Sam Gulch (site 17B), above the Bullion Mine (site 14B), and in High Ore Creek (site 19B). Elevated copper concentrations are found at several other sites (table 3). Zinc concentrations are quite variable throughout the study area as evidenced by the wide range in zinc concentrations among baseline streambed-sediment samples (Zn, ranges from 40 to 600 ppm; Fey and others, 1999b).

Lead isotopic data ($^{206}Pb/^{204}Pb$; table 4) show an inverse relationship with lead concentrations as is observed throughout the study area (Fey and others, 1999b). The highest $^{206}Pb/^{204}Pb$ values (approximately 18.1) found among the baseline samples are similar to those found in the streambed sediments from sites upstream from known historical mining activities. A major exception to the overall trend is the stream terrace sample collected at the confluence of

Basin Creek with the Boulder River (site 2B). The $^{206}Pb/^{204}Pb$ of this sample is the lowest in the entire study area, and although it shows low lead and arsenic concentrations (26 ppm and 35 ppm, respectively; table 3), its copper value is the highest of any of the baseline samples.

### Fluvial tailings deposits from site T1

Geochemical data for core-samples of the fluvial tailings collected from site T1, the bar in the Boulder River below Basin Creek, are in table 5. Ore-related trace element concentrations are generally more uniform in this fluvial tailings deposit than in those from the other mine-waste sites within the study area.

### Contaminant Source samples

Lead isotopic compositions in samples of fluvial tailings and in streambed sediments collected from just below major mines are shown in table 6. The overall inverse correlation between $^{206}Pb/^{204}Pb$ and lead concentrations observed among other samples from the district (table 4; Fey and others, 1999b) is also observed among the samples in table 6. The most contaminated samples from the Basin Creek and Cataract Creek drainages (Pb concentrations greater than 1,000 ppm) show a very narrow range of $^{206}Pb/^{204}Pb$, ranging from 17.90 to 17.93. The sample collected below the Comet Mine on High Ore Creek (site 59S, fig. 1) has $^{206}Pb/^{204}Pb$ of 18.07, a value found consistently in the High Ore Creek drainage below the Comet Mine (Fey and others, 1999b). The lead isotopic results indicate that the mineralization at the Comet Mine is from a different source and/or of a different age than the other mines in the area.

Geochemical data from the smelter slag sample from the Bullion Smelter are in table 7. Geochemical data from the mine wastes collected at sites 1T-5T are summarized for the ore-related trace elements arsenic, cadmium, copper, lead, silver, and zinc in table 8. Statistical summaries and ranges of compositions are given for all mine waste samples above the concentration ranges given in table 8. Since the geochemical data for these elements from these sites are highly skewed distributions, the best estimate of the composition of the deposit would be represented by the median or the geometric mean concentrations. Complete published geochemical data are in the references given for each data set in table 8.

### Dendrochronology

The age data from tree samples collected at selected stream terrace sites are reported in table 9. Unfortunately, no local dendrochronological record could be constructed from the ring structure of living trees that would allow dating of the older dead trees. The tree ring structure in living trees is complacent, that is the variation in the width of the tree rings was consistent from year to year and provided no markers in the tree ring structure that would allow ages to be assigned (written commun., Dec., 1999, Jeff Dean, Laboratory of Tree-Ring Research, Univ. of Arizona, Tucson, Ariz.). Ages from living trees therefore provide minimum ages of the terraces. These data, along with relevant historical data (Rossillon and Haynes, 1999), provide minimum ages for some of the stream terrace and core samples collected for determination of the pre-mining geochemical baseline.

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## Appendix

The largest contributor to the analytical uncertainty of the lead isotopic analyses of common lead is the mass fractionation induced during mass spectrometry (Ludwig, 1980). The effects of the mass fractionation are monitored by lead isotopic analyses of NIST standard SRM-981 (Cantanzaro and others, 1968; Todt and others, 1993). Results of replicate analyses of the SRM lead standards are shown in Table A1. A mass-fractionation factor, $\delta$, is calculated from the standard runs from each of the three isotopic ratios $^{206}Pb/^{204}Pb$, $^{207}Pb/^{206}Pb$, and $^{208}Pb/^{206}Pb$ in the following manner (Ludwig, 1980):

$$\delta = \{(^{206}Pb/^{204}Pb_t\ /^{206}Pb/^{204}Pb_m)-1\}/2$$
$$\delta = (^{207}Pb/^{206}Pb_t\ /^{207}Pb/^{206}Pb_m)-1$$
$$\delta = \{(^{208}Pb/^{206}Pb_t\ /^{208}Pb/^{206}Pb_m)-1\}/2$$

where the subscripts "t" and "m" refer to the true (certified) and measured values, respectively. The average of the three values is used to correct sample data for mass fractionation. Corrections to the raw sample data are applied using a linear fractionation correction in the following manner (Ludwig, 1980):

$$^{206}Pb/^{204}Pb_c = {}^{206}Pb/^{204}Pb_m * (1+2 * \delta)$$
$$^{207}Pb/^{206}Pb_c = {}^{207}Pb/^{206}Pb_m * (1+\delta)$$
$$^{208}Pb/^{206}Pb_c = {}^{208}Pb/^{206}Pb_m * (1+2 * \delta)$$

where the subscripts "c" and "m" denote corrected and raw measured data, respectively. Many of the standards were run at different temperatures to assess the effects of running temperature on mass fractionation. Standards run at higher temperatures (>1250°C) show a mean $\delta$-value of 0.12 percent/amu (atomic mass unit) whereas standards run at lower temperatures indicate a larger correction of 0.14 percent/amu is required.

An uncertainty in the mass fractionation correction of ± 0.03 percent/amu is applied to the corrected sample data and represents the 2-sigma external variation of the entire data set. Overall uncertainties in the lead isotopic data reported in table 4 and 6 are calculated in the manner given by Ludwig (1980) and represent the uncertainties at the 95% confidence interval (approximately $2\sigma_m$). Because the analytical blank does not significantly affect the measured isotopic compositions, the analytical uncertainty in an individual corrected ratio, $R_c$, is calculated in the following manner (Ludwig, 1980):

$$\Sigma R_c^{\,2} = \Sigma R_m^{\,2} + (\Delta m * \sigma\delta)^2$$

where 100 * $\Sigma$ is the percent uncertainty, $\Sigma R_m$ is the uncertainty in the measured ratio from mass spectrometry, $\Delta m$ is the nominal mass difference between the isotopes in the numerator and denominator (i.e. for $^{206}Pb/^{204}Pb$, $\Delta m = 2$) and $\sigma\delta = 0.0003$ (0.03 percent/100 from above).

As a test of the reproducibility of the leaching procedure, separate leachates of 4 NIST standards have been analyzed. Results are shown in table A2. Uncertainties have been calculated based on the procedure outlined above. The data are reproducible to within a total range of 0.2 percent in $^{206}Pb/^{204}Pb$ for each standard. Also shown are the lead isotopic data for leachates of three of the samples reported by Church and others (1997).

Table A1. Lead isotopic compositions in replicate analyses of NIST Standard SRM-981

[Uncertainties are in percent and represent 2 sigma-mean for the individual runs and 2 sigma for the mean values of each group]

| Run No. | T (°C) | $^{206}Pb/^{204}Pb$ | Uncertainty 2σ mean (percent) | $^{207}Pb/^{206}Pb$ | Uncertainty 2σ mean (percent) | $^{208}Pb/^{206}Pb$ | Uncertainty 2σ mean (percent) |
|---|---|---|---|---|---|---|---|
| Certified value[1] | | 16.9322 | 0.0047 | 0.914561 | 0.0044 | 2.16662 | 0.0060 |
| **VG Sector 54 Mass Spectrometer** | | | | | | | |
| 981-1 | 1196 | 16.8811 | 0.0117 | 0.913193 | 0.0030 | 2.16088 | 0.0030 |
| 981-2 | 1160 | 16.8871 | 0.0099 | 0.913319 | 0.0036 | 2.16088 | 0.0030 |
| 981-2 | 1236 | 16.8918 | 0.0087 | 0.913358 | 0.0027 | 2.16129 | 0.0039 |
| 981-4 | 1203 | 16.8950 | 0.0540 | 0.913293 | 0.0087 | 2.16105 | 0.0075 |
| 981-5 | 1185 | 16.8806 | 0.0184 | 0.913163 | 0.0054 | 2.15990 | 0.0036 |
| 981-6 | 1191 | 16.8837 | 0.0099 | 0.913184 | 0.0030 | 2.16029 | 0.0030 |
| 981-7 | 1194 | 16.8852 | 0.0093 | 0.913227 | 0.0033 | 2.16036 | 0.0033 |
| 981-7 | 1237 | 16.8883 | 0.0123 | 0.913303 | 0.0033 | 2.16094 | 0.0033 |
| 981-9 | 1191 | 16.8852 | 0.0150 | 0.913168 | 0.0045 | 2.16020 | 0.0039 |
| 981-9 | 1235 | 16.8850 | 0.0120 | 0.913200 | 0.0030 | 2.16040 | 0.0036 |
| 981-10 | 1195 | 16.8854 | 0.0100 | 0.913262 | 0.0036 | 2.16041 | 0.0048 |
| 981-11 | 1203 | 16.8836 | 0.0150 | 0.913190 | 0.0039 | 2.15991 | 0.0036 |
| 981-14 | 1189 | 16.8899 | 0.0054 | 0.913313 | 0.0018 | 2.16110 | 0.0039 |
| 981-14 | 1230 | 16.9070 | 0.0060 | 0.913615 | 0.0027 | 2.16334 | 0.0027 |
| 981-15 | 1186 | 16.8844 | 0.0120 | 0.913168 | 0.0045 | 2.16012 | 0.0039 |
| 981-16 | 1200 | 16.8840 | 0.0190 | 0.913079 | 0.0036 | 2.16006 | 0.0036 |
| 981-17 | 1201 | 16.8943 | 0.0230 | 0.913288 | 0.0045 | 2.16109 | 0.0048 |
| 981-17 | 1196 | 16.8870 | 0.0210 | 0.913331 | 0.0066 | 2.16076 | 0.0114 |
| 981-18 | 1203 | 16.8821 | 0.0132 | 0.913175 | 0.0036 | 2.16031 | 0.0030 |
| 981-19 | 1176 | 16.8905 | 0.0072 | 0.913243 | 0.0021 | 2.16082 | 0.0033 |
| 981-19 | 1219 | 16.8956 | 0.0084 | 0.913376 | 0.0024 | 2.16159 | 0.0039 |
| 981-20 | 1196 | 16.8886 | 0.0150 | 0.913188 | 0.0027 | 2.16074 | 0.0054 |
| 981-22 | 1204 | 16.8950 | 0.0130 | 0.913284 | 0.0039 | 2.16141 | 0.0063 |
| 981-23 | 1203 | 16.8847 | 0.0090 | 0.913188 | 0.0039 | 2.16034 | 0.0048 |
| 981-24 | 1193 | 16.8823 | 0.0120 | 0.913137 | 0.0027 | 2.16013 | 0.0033 |
| 981-25 | 1188 | 16.8870 | 0.0220 | 0.913291 | 0.0060 | 2.16082 | 0.0042 |
| 981-26 | 1188 | 16.8943 | 0.0240 | 0.913271 | 0.0051 | 2.16110 | 0.0033 |
| 981-28 | 1193 | 16.8957 | 0.0150 | 0.913357 | 0.0036 | 2.16166 | 0.0036 |
| 981 99-1 | 1201 | 16.8885 | 0.0150 | 0.913261 | 0.0042 | 2.16082 | 0.0048 |
| 981 99-2 | 1193 | 16.8903 | 0.0096 | 0.913280 | 0.0027 | 2.16091 | 0.0027 |
| 981 99-3 | 1197 | 16.8910 | 0.0150 | 0.913323 | 0.0039 | 2.16118 | 0.0036 |
| 981 99-4 | 1199 | 16.8846 | 0.0150 | 0.913221 | 0.0027 | 2.16056 | 0.0033 |
| 981 99-5 | 1194 | 16.8889 | 0.0300 | 0.913156 | 0.0051 | 2.16031 | 0.0045 |
| 981 99-6 | 1189 | 16.8848 | 0.0168 | 0.913175 | 0.0036 | 2.16036 | 0.0039 |
| 981 99-7 | 1223 | 16.8878 | 0.0190 | 0.913237 | 0.0036 | 2.16071 | 0.0033 |
| 981 99-9 | 1189 | 16.8848 | 0.0168 | 0.913175 | 0.0036 | 2.16036 | 0.0039 |
| 981 99-10 | 1175 | 16.8860 | 0.0240 | 0.913218 | 0.0060 | 2.16023 | 0.0051 |
| 981 99-11 | 1200 | 16.8855 | 0.0190 | 0.913141 | 0.0039 | 2.16048 | 0.0042 |
| 981 99-12 | 1194 | 16.8856 | 0.0110 | 0.913192 | 0.0039 | 2.16031 | 0.0030 |
| 981 99-13 | 1189 | 16.8818 | 0.0120 | 0.913137 | 0.0039 | 2.16015 | 0.0042 |
| 981 99-14 | 1195 | 16.8808 | 0.0330 | 0.913092 | 0.0630 | 2.16017 | 0.0057 |
| 981 99-15 | 1192 | 16.8872 | 0.0150 | 0.913205 | 0.0039 | 2.16063 | 0.0039 |
| 981 99-16 | 1188 | 16.8881 | 0.0102 | 0.913236 | 0.0033 | 2.16092 | 0.0048 |
| 981 99-17 | 1197 | 16.8901 | 0.0246 | 0.913382 | 0.0045 | 2.16122 | 0.0048 |
| 981 99-18 | 1200 | 16.8926 | 0.0220 | 0.913290 | 0.0039 | 2.16109 | 0.0045 |
| Mean[2] | | 16.8873 | 0.0460 | 0.913236 | 0.0160 | 2.16066 | 0.0410 |

Table A1. Lead isotopic compositions in replicate analyses of NIST Standard SRM-981—continued

| Run No. | T (°C) | $\frac{^{206}Pb}{^{204}Pb}$ | Uncertainty 2σ mean (percent) | $\frac{^{207}Pb}{^{206}Pb}$ | Uncertainty 2σ mean (percent) | $\frac{^{208}Pb}{^{206}Pb}$ | Uncertainty 2σ mean (percent) |
|---|---|---|---|---|---|---|---|
| 981-1 | 1272 | 16.8876 | 0.0093 | 0.913253 | 0.0033 | 2.16092 | 0.0063 |
| 981-3 | 1252 | 16.8835 | 0.0087 | 0.913136 | 0.0030 | 2.16014 | 0.0042 |
| 981-3 | 1288 | 16.8900 | 0.0084 | 0.913271 | 0.0021 | 2.16102 | 0.0054 |
| 981-4 | 1316 | 16.8960 | 0.0175 | 0.913488 | 0.0057 | 2.16225 | 0.0036 |
| 981-5 | 1319 | 16.8838 | 0.0075 | 0.913174 | 0.0027 | 2.16032 | 0.0057 |
| 981-8 | 1260 | 16.8900 | 0.0084 | 0.913296 | 0.0030 | 2.16096 | 0.0057 |
| 981-10 | 1271 | 16.8988 | 0.0069 | 0.913495 | 0.0024 | 2.16210 | 0.0063 |
| 981-11 | 1271 | 16.8934 | 0.0150 | 0.913343 | 0.0048 | 2.16117 | 0.0120 |
| 981-15 | 1290 | 16.8903 | 0.0100 | 0.913265 | 0.0039 | 2.16075 | 0.0054 |
| 981-16 | 1250 | 16.9000 | 0.0078 | 0.913453 | 0.0027 | 2.16219 | 0.0051 |
| 981-17 | 1299 | 16.8936 | 0.0130 | 0.913376 | 0.0036 | 2.16136 | 0.0069 |
| 981-18 | 1288 | 16.8887 | 0.0081 | 0.913323 | 0.0030 | 2.16124 | 0.0054 |
| 981-20 | 1310 | 16.9045 | 0.0084 | 0.913578 | 0.0039 | 2.16309 | 0.0045 |
| 981-21 | 1292 | 16.8868 | 0.0300 | 0.913372 | 0.0078 | 2.16148 | 0.0118 |
| 981-22 | 1301 | 16.9021 | 0.0099 | 0.913365 | 0.0033 | 2.16210 | 0.0066 |
| 981-24 | 1288 | 16.8933 | 0.0120 | 0.913320 | 0.0036 | 2.16141 | 0.0090 |
| 981-26 | 1301 | 16.8910 | 0.0081 | 0.913213 | 0.0036 | 2.16098 | 0.0036 |
| 981-27 | 1279 | 16.8824 | 0.0190 | 0.913069 | 0.0036 | 2.16018 | 0.0036 |
| 981 99-1 | 1318 | 16.9031 | 0.0180 | 0.913515 | 0.0057 | 2.16269 | 0.0150 |
| 981 99-2 | 1299 | 16.8995 | 0.0057 | 0.913485 | 0.0024 | 2.16222 | 0.0039 |
| 981 99-3 | 1286 | 16.8986 | 0.0072 | 0.913463 | 0.0021 | 2.16214 | 0.0042 |
| 981 99-5 | 1288 | 16.8829 | 0.0150 | 0.913153 | 0.0033 | 2.16017 | 0.0039 |
| 981 99-6 | 1289 | 16.8950 | 0.0090 | 0.913382 | 0.0027 | 2.16158 | 0.0042 |
| 981 99-7 | 1302 | 16.8913 | 0.0110 | 0.913325 | 0.0024 | 2.16134 | 0.0045 |
| 981 99-8 | 1292 | 16.9085 | 0.0420 | 0.913741 | 0.0075 | 2.16411 | 0.0052 |
| 981 99-9 | 1289 | 16.8950 | 0.0090 | 0.913382 | 0.0027 | 2.16158 | 0.0042 |
| 981 99-10 | 1313 | 16.8860 | 0.0075 | 0.913244 | 0.0033 | 2.16049 | 0.0048 |
| 981 99-11 | 1302 | 16.9011 | 0.0420 | 0.913406 | 0.0072 | 2.16236 | 0.0069 |
| 981 99-13 | 1292 | 16.8938 | 0.0090 | 0.913345 | 0.0033 | 2.16160 | 0.0066 |
| 981 99-17 | 1301 | 16.9020 | 0.0051 | 0.913574 | 0.0021 | 2.16277 | 0.0021 |
| 981 99-18 | 1301 | 16.8989 | 0.0099 | 0.913442 | 0.0030 | 2.16208 | 0.0036 |
| Mean[3] | | 16.8938 | 0.0690 | 0.913360 | 0.0230 | 2.16149 | 0.0590 |
| **Micro Mass 54R Mass spectrometer** | | | | | | | |
| 981-54R-1 | 1245 | 16.8991 | 0.0190 | 0.913400 | 0.0120 | 2.16084 | 0.0160 |
| 981-54R-1 | 1310 | 16.9038 | 0.0420 | 0.913643 | 0.0120 | 2.16249 | 0.0370 |
| 981-54R-2 | 1235 | 16.8834 | 0.0240 | 0.913313 | 0.0090 | 2.16071 | 0.0060 |
| 981-54R-2 | 1335 | 16.8927 | 0.0130 | 0.913408 | 0.0060 | 2.16113 | 0.0910 |
| Mean ± 2σ | | 16.8950 | 0.0980 | 0.913440 | 0.0260 | 2.16116 | 0.0410 |

[1]Certified value from Todt and others (1993)
[2]Mean value for mass spectrometer runs at low temperature ± 2σ (percent); average temperature was 1198 ± 15°C
[3]Mean value for mass spectrometer runs at high temperature ± 2σ (percent); average temperature 1291 ± 18°C

Table A2. Lead isotopic compositions in NIST standards SRM 2704, SRM 2709, SRM 2710, and SRM 2711

[Data are corrected for mass fractionation; uncertainties are absolute and are calculated in the manner of Ludwig, (1980)]

| Sample[1] | $^{206}Pb/^{204}Pb$ | $^{207}Pb/^{204}Pb$ | $^{208}Pb/^{204}Pb$ | $^{207}Pb/^{206}Pb$ | $^{208}Pb/^{206}Pb$ |
|---|---|---|---|---|---|
| SRM-2704-1 | 18.777 ± 0.011 | 15.634 ± 0.014 | 38.433 ± 0.046 | 0.83172 ± 0.00025 | 2.0469 ± 0.0012 |
| SRM-2704-2 | 18.819 ± 0.011 | 15.665 ± 0.014 | 38.544 ± 0.046 | 0.83148 ± 0.00025 | 2.0482 ± 0.0012 |
| SRM-2704-3 | 18.799 ± 0.012 | 15.641 ± 0.014 | 38.466 ± 0.046 | 0.83112 ± 0.00025 | 2.0462 ± 0.0012 |
| SRM-2704-4 | 18.788 ± 0.012 | 15.631 ± 0.016 | 38.438 ± 0.047 | 0.83103 ± 0.00041 | 2.0458 ± 0.0012 |
| | | | | | |
| SRM-2709-1 | 19.087 ± 0.013 | 15.674 ± 0.015 | 38.964 ± 0.048 | 0.82028 ± 0.00026 | 2.0413 ± 0.0012 |
| SRM-2709-2 | 19.077 ± 0.012 | 15.668 ± 0.014 | 38.939 ± 0.047 | 0.82042 ± 0.00025 | 2.0412 ± 0.0012 |
| SRM-2709-3 | 19.060 ± 0.012 | 15.652 ± 0.014 | 38.862 ± 0.047 | 0.82029 ± 0.00025 | 2.0390 ± 0.0012 |
| SRM-2709-4a | 19.059 ± 0.012 | 15.652 ± 0.015 | 38.879 ± 0.048 | 0.82049 ± 0.00026 | 2.0399 ± 0.0013 |
| SRM-2709-4b | 19.050 ± 0.013 | 15.646 ± 0.016 | 38.864 ± 0.049 | 0.82057 ± 0.00029 | 2.0401 ± 0.0012 |
| Church and others (1997) | 19.065 | 15.646 | 38.864 | | |
| | | | | | |
| SRM-2710-1 | 17.818 ± 0.011 | 15.533 ± 0.014 | 38.126 ± 0.046 | 0.87095 ± 0.00026 | 2.1397 ± 0.0013 |
| SRM-2710-2 | 17.806 ± 0.011 | 15.518 ± 0.014 | 38.078 ± 0.046 | 0.87056 ± 0.00026 | 2.1385 ± 0.0013 |
| SRM-2710-3 | 17.800 ± 0.011 | 15.509 ± 0.014 | 38.047 ± 0.046 | 0.87053 ± 0.00026 | 2.1375 ± 0.0013 |
| Church and others (1997) | 17.819 | 15.537 | 38.141 | | |
| | | | | | |
| SRM-2711-1 | 17.102 ± 0.010 | 15.437 ± 0.014 | 36.947 ± 0.044 | 0.90165 ± 0.00027 | 2.1604 ± 0.0013 |
| SRM-2711-2 | 17.105 ± 0.010 | 15.438 ± 0.014 | 36.956 ± 0.045 | 0.90176 ± 0.00027 | 2.1606 ± 0.0013 |
| SRM-2711-3 | 17.118 ± 0.010 | 15.460 ± 0.014 | 37.021 ± 0.045 | 0.90233 ± 0.00027 | 2.1628 ± 0.0013 |
| Church and others (1997) | 17.086 | 15.419 | 36.888 | | |
| Church and others (1997) | 17.097 | 15.430 | 36.936 | | |

[1]Subsample numbers 1-4 denote separate leaches. Samples SRM-2709- 4a and -4b are separate chemical separations of the same leach.

Table 1. Sample localities of stream terrace and core samples, smelter slag, and sampled mine wastes, Boulder River watershed, Montana

[SIDG, sieved intervals, gravel deposits; FT, fluvial tailings deposits, usually along stream banks; TC, tree core or slab for dendrochronology]

| Site Number (fig. 2) | Sample Locality | Sample number | Sample type | Latitude (DMS) | Longitude (DMS) |
|---|---|---|---|---|---|
| **Boulder River** | | | | | |
| 1B | South side, Boulder River west of Basin | 99-BMB-102 | SIGD | 46 16' 12.8" | 112 16' 22.7" |
| 2B | South side, Boulder River below confluence with Basin Creek | 99-BMB-103 | SIGD | 46 16' 1.4" | 112 15' 30.4" |
| 3B | North side, Boulder River below Cataract Creek | 99-BMB-104 | SIGD | 46 16' 14.4" | 112 14' 16.3" |
| 4B | North side, Boulder River below Cataract Creek | 99-BMB-106 | SIGD | 46 15' 32.7" | 112 12' 40.7" |
| 5B | South side, Boulder River below confluence with High Ore Creek | 99-BMB-105 | SIGD | 46 15' 45.1" | 112 12' 2.2" |
| 6B | South side, Boulder River below Watson Gulch | 99-BMB-108 | SIGD | 46 14' 14.9" | 112 9' 23.1" |
| | | 99-BMT108 | TC | 46 14' 14.9" | 112 9' 23.1" |
| 1T | Boulder River below confluence with Basin Creek, deposited on gravel bar in river | 97-BMF-133 | Cores in FT | 46 16' 2.4" | 112 15' 26.1" |
| **Basin Creek** | | | | | |
| 7B | Basin Creek, meadow south of Buckeye complex | 98-BMB-406 | Core | 46 23' 37.2" | 112 17' 52.8" |
| 8B | South Fork Basin Creek | 98-BMB-401 | Core | 46 20' 51.9" | 112 20' 47.9" |
| 9B | Basin Creek above confluence with South Fork Basin Creek | 98-BMB-402 | Core | 46 20' 42.5" | 112 20' 25.7" |
| 10B | Basin Creek below Vacchiau Gulch | 98-BMB-403 | Core | 46 20' 10.7" | 112 19' 50.9" |
| 11B | Basin Creek above Saul Haggerty Gulch | 97-BMB-123 | SIGD | 46 19' 12.7" | 112 19' 25.0" |
| 3T | Buckeye mine waste dump | 98-BMF-105 | Core | 46 23' 39.8" | 112 17' 49.9" |

Table 1. Sample localities of stream terrace and core samples, smelter slag, and sampled mine wastes, Boulder River watershed, Montana—continued

| Site number (fig. 2) | Sample Locality | Sample number | Sample type | Latitude (DMS) | Longitude (DMS) |
|---|---|---|---|---|---|
| **Jack Creek** | | | | | |
| 12B | Jack Creek tributary below Bullion tailings | 98-BMB-407 | Core | 46 21' 51.5" | 112 18' 14.0" |
| 13B | Jack Creek below Bullion tailings, stream bank deposit | 97-BMB-122 | Core | 46 21' 52.3" | 112 18' 25.8" |
| 14B | Jack Creek below Bullion tailings | 98-BMB-405 | Core | 46 21' 52.8" | 112 18' 31.8" |
| | | 98-BMT-405 | TC | 46 21' 52.0" | 112 18' 31.0" |
| 15B | Jack Creek, sediment core from within smelter reservoir | 98-BMB-404 | Core | 46 21' 40.9" | 112 18' 48.2" |
| | | 98-BMT-404 | TC | 46 21' 41.2" | 112 18' 48.4" |
| | | 99-BMT-110 | TC | 46 21' 47.5" | 112 18' 54.4" |
| 35S | Jack Creek tributary below Bullion tailings | 97-BMS-104 | FT | 46 21' 38.6" | 112 17' 50.6" |
| 36S | Jack Creek tributary below Bullion tailings | 97-BMS-105 | FT | 46 21' 47.1" | 112 18' 11.7" |
| 37S | Jack Creek tributary below Bullion tailings | 97-BMS-106 | FT | 46 21' 52.5" | 112 18' 16.5" |
| 40S | Jack Creek below Bullion tailings | 97-BMS-107 | FT | 46 21' 52.4" | 112 18' 32.4" |
| 2T | Jack Creek tributary below Bullion tailings | 97-BMF-102 | Core | 46 21' 27.0" | 112 17' 44.9" |
| | Jack Creek tributary below Bullion tailings | 97-BMF-103 | Core | 46 21' 31.0" | 112 17' 49.9" |
| 6T | Smelter site near Jack Creek tributary | 96-BM-114 | Slag | 46 21' 23.0" | 112 18' 57.7" |
| **Uncle Sam Gulch** | | | | | |
| 16B | Uncle Sam Gulch below Crystal Mine | 97-BMB-134 | Core | 46 20' 2.8" | 112 15' 47.9" |
| 17B | Uncle Sam Gulch below Crystal Mine | 97-BMB-135 | Core | 46 20' 22.9" | 112 15' 41.8" |
| | | 97-BMT-135 | TC | 46 20' 23.0" | 112 15' 42.0" |
| 4T | Uncle Sam Gulch below Crystal Mine | 97-BMF-109 | Core | 46 20' 48.7" | 112 15' 36.1" |
| **High Ore Creek** | | | | | |
| 18B | High Ore Creek below Peters Gulch | 96-BMB-139 | Core | 46 16' 39.0" | 112 12' 8.2" |
| 19B | High Ore Creek above confluence with Boulder River | 97-BMB-125 | SIGD | 46 15' 53.1" | 112 12' 9.9" |
| 5T | High Ore Creek below Comet mine | 97-BMF-130 | Core | 46 18' 26.9" | 112 10' 48.5" |
| | High Ore Creek below Comet mine | 97-BMF-131 | Core | 46 18' 25.9" | 112 10' 51.2" |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana

[Elevations of samples from stream terraces are given relative to the low-flow water level in the stream at the site (in m); sample intervals in cores in stream terraces are also given relative to the elevation abover low-flow water level. Elevations given are at the mid point of the sample interval. Depths in cores where no other frame of reference is available are in cm below the surface to the mid point of the sampled interval; all depths have been corrected for uniform compression measured at the site.]

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| **Boulder River** | | | | |
| 1B | | 0.8 | | Samples are from a small bar on south side of Boulder River upstream from the town of Basin and before the first freeway bridge. Bar about 80 cm above low-flow water level; upper 10 cm of gravel from top of bar discarded before sampling began. Sample locality is on public property within freeway right-of-way. |
| | 99-BMB-102a | 0.6 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-102b | 0.5 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-102c | 0.3 | | medium and coarse pebble gravel, some medium sand |
| 2B | | 1.3 | | Samples are from stream terrace on the south bank of Boulder River east of confluence with Basin Creek. Stream terrace is about 1.3 m above low-flow water level; removed and discarded top 10 cm of gravel material. Site is downstream from the Jig mill site; it has a high probability of contamination from the milling activity. |
| | 99-BMB-103a | 1.1 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-103b | 1 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-103c | 0.8 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-103d | 0.5 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-103e1 | 0.3 | | medium and coarse pebble gravel, some medium sand |
| 3B | | | | Samples are from sand and gravel deposits on south side of Boulder River about 170 m downstream from the confluence with Cataract Creek. |
| | 99-BMB-104a | 130 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-104b | 100 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-104c1 | 50 | | medium and coarse pebble gravel, some medium sand |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| 4B | | 5 | | Samples are from stream terrace located on north side of Boulder River 100 m below abandoned bridge abutment upstream from High Ore Creek. Terrace is about 5 m above low-flow water level. Site accessed from public camping site on Boulder River. |
| | 99-BMB-106a | 3 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-106b | 2.8 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-106c | 2.5 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-106d | 2 | | medium and coarse pebble gravel, some medium sand |
| 5B | | 4 | | Samples are from a stream terrace on the south side of the Boulder River 200 m downstream from the confluence with High Ore Creek. |
| | 99-BMB-105a | 2.9 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-105b | 2.6 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-105c | 2.3 | | medium pebble gravel, some medium sand |
| | 99-BMB-105d | 2.1 | | medium and coarse pebble gravel, medium sand |
| 6B | | 2.5 | | Samples are from a stream terrace on the south side of the Boulder River downstream from the confluence with High Ore Creek. Samples taken from eroded bank under 60 year old cottonwood tree; thick soil horizon (60 cm). Site is on freeway right-of-way. |
| | 99-BMB-108a | 1.8 | | medium sand, few pebbles, probably an overbank deposit |
| | 99-BMB-108b | 1.5 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-108c | 1.2 | | medium and coarse pebble gravel, some medium sand |
| | 99-BMB-108d | 1 | | medium and coarse pebble gravel, some medium sand |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| **Basin Creek** | | | | |
| 7B | | | | Core sample taken in meadow south of Buckeye mine site 10 m south of existing creek; materials in core represent earlier sedimentation in valley from stream now present at the Buckeye mine site. Site is on U.S. Forest Service lands. |
| | 98-BMB-406-a | | 6 | white-tan tailings, with a dark band |
| | 98-BMB-406-b | | 16 | tan tailings, no organics. |
| | 98-BMB-406-c | | 22 | tan transition zone to dark layer |
| | 98-BMB-406-d | | 24 | dark brown clay |
| | 98-BMB-406-e | | 27 | tan silt and clay |
| | 98-BMB-406-f | | 31 | dark grey-brown silt, little mica, slight sulfur odor |
| | 98-BMB-406-g1 | | 36 | dark grey-brown silt, little mica, iron-oxidation, slight sulfur odor |
| | 98-BMB-406-h | | 42 | grey-brown silt and clay, coarse sand, mica, minor iron-oxidation |
| | 98-BMB-406-i | | 50 | grey-brown silt and clay, coarse to very fine sand, micas |
| | 98-BMB-406-j | | 59 | grey-brown coarse to fine sand, mica, abundant iron-oxidation |
| | 98-BMB-406-k | | 66 | grey-brown and black clay, mica, minor iron-oxidation |
| | 98-BMB-406-l | | 70 | brown clay, coarse to fine sand, mica, post-depositional iron-oxidation |
| | 98-BMB-406-m | | 72 | brown clay, mica, minor iron-oxidation |
| | 98-BMB-406-n | | 78 | brown silt and clay, coarse to very fine sand, mica, post-depositional iron-oxidation |
| | 98-BMB-406-o | | 91 | brown coarse to fine sand, find and medium pebble gravel, micas |
| | 98-BMB-406-p | | 104 | brown silt and clay, medium to fine sand, micas, rootlets |
| | 98-BMB-406-q | | 120 | brown silt and clay, medium to fine sand, micas, rootlets |
| | 98-BMB-406-r | | 127 | brown silt and clay, medium to fine sand, micas, rootlets |
| | 98-BMB-406-s | | 139 | brown silt and clay, medium to fine sand, micas, rootlets |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| 8B | | 2 (?) | | Core in stream terrace, probably from the South Fork of Basin Creek, about 2 m above low-flow water level. sampled on private property with permission. |
| | 98-BMB-401-a | | 7 | dark brown silt and clay, rootlets. |
| | 98-BMB-401-b | | 17 | dark brown silt and clay, medium to fine sand, sparse medium pebble gravel, rootlets |
| | 98-BMB-401-c | | 24 | dark brown silt and clay, medium to fine sand, roots |
| | 98-BMB-401-d | | 33 | dark brown silt and clay, coarse to fine sand, sparse medium pebbles, roots |
| | 98-BMB-401-e | | 40 | brown silt and medium sand, micas |
| | 98-BMB-401-f | | 47 | brown silt, medium to fine sand, moderate fine medium pebbles, micas |
| | 98-BMB-401-g | | 54 | brown silt, coarse to fine sand, sparse medium pebble gravel |
| | 98-BMB-401-h | | 65 | tan-brown silt, coarse to fine sand |
| | 98-BMB-401-i | | 74 | brown silt and clay, fine sand, post-depositional iron-oxidation |
| | 98-BMB-401-j | | 82 | brown silt and clay, fine sand, post-depositional iron-oxidation |
| 9B | | 1.2 | | Core in stream terrace from Basin Creek, terrace about 1.2 m above low-flow water level; sampled on private property with permission. |
| | 98-BMB-402-a | 1.11 | 9 | brown very fine sand and silt, post-depositional iron-oxidation |
| | 98-BMB-402-b | 0.99 | 21 | brown very fine sand, silt and clay, post-depositional iron-oxidation, rootlets. |
| | 98-BMB-402-c | 0.91 | 29 | brown silt, fine sand, heavily oxidized, grey clay layer with micas |
| | 98-BMB-402-d | 0.8 | 40 | brown silt, coarse to fine sand, micas, iron-oxidation, wood bits and roots |
| | 98-BMB-402-e | 0.68 | 52 | brown silt, fine to very fine sand, clay layer, post-depositional iron-oxidation |
| | 98-BMB-402-f | 0.63 | 57 | transition zone to clay layers below, contains grey clay with iron-oxidation, fine sand and silt |
| | 98-BMB-402-g | 0.59 | 61 | grey-brown silt and clay, micas, post-depositional iron-oxidation |
| | 98-BMB-402-h | 0.52 | 68 | brown and black clay, iron-oxidation, rootlets |
| | 98-BMB-402-i | 0.45 | 75 | black and grey clay, iron-oxidation, rootlets |
| | 98-BMB-402-j | 0.37 | 83 | black and grey clay, iron-oxidation, rootlets |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| | 98-BMB-402-k | 0.27 | 93 | dark grey-black clay, medium to fine sand, micas |
| | 98-BMB-402-l | 0.19 | 101 | black clay, medium to fine sand, micas, moderate coarse pebbles |
| | 98-BMB-402-m1 | 0.11 | 109 | dark brown clay, fine sand, some medium pebbles |
| 10B | | 1 | | Core in stream terrace on Basin Creek below confluence with Jack Creek, terrace about 1 m above low-flow water level. |
| | 98-BMB-403-a | 0.93 | 7 | brown silt and clay, very fine sand, rootlets |
| | 98-BMB-403-b | 0.81 | 19 | brown silt and clay, very fine sand, 2 cm thick clay layer, rootlets |
| | 98-BMB-403-c | 0.7 | 30 | brown silt, coarse to fine sand, rootlets |
| | 98-BMB-403-d | 0.56 | 44 | brown silt, coarse to fine sand, 3 cm thick layer of silt and clay, rootlets |
| | 98-BMB-403-e | 0.46 | 54 | brown silt and clay, fine sand, micas, rootlets |
| | 98-BMB-403-f | 0.4 | 60 | dark brown silt and clay, very fine sand, mica, rootlets |
| | 98-BMB-403-g | 0.33 | 67 | brown silt and clay, fine sand, micas, wood bits and rootlets |
| | 98-BMB-403-h | 0.27 | 73 | brown silt and clay, fine sand, micas, wood and rootlets, includes a 2 cm thick black clay layer |
| | 98-BMB-403-i | 0.21 | 79 | brown silt and clay, fine sand, micas, post-depositional iron-oxidation |
| | 98-BMB-403-j | 0.08 | 92 | brown silt, coarse to fine sand, medium to coarse pebble gravel, one 4 cm clast |
| 11B | | 1.5 | | Samples are from gravel bar stream terrace along Basin Creek. The bar is about 1.5 m above low-flow water level; site is on U.S. Forest Service lands. |
| | 97-BMB-123a | 1 | | poorly sorted coarse pebble gravel, coarse sand, some cobbles |
| | 97-BMB-123b | 0.7 | | moderately sorted coarse pebble gravel |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| 3T | | | | Samples are from pre-mining soils/sediments from beneath tailings sampled at the Buckeye Mine. Sample locality is on private property, sampled with permission. |
| | 98BMF 105B-k | | 64 | tan coarse, medium and fine sand |
| | 98BMF 105B-l | | 73 | tan coarse, medium and fine sand |
| | 98BMF 105B-m | | 82 | tan fine sand to silt, includes some coarse sand |
| | 98BMF 105B-n | | 87 | tan fine sand to silt |
| **Jack Creek** | | | | |
| 12B | | 0.7 | | Samples are from a stream terrace on tributary of Jack Creek that drains the Bullion Mine area. Sample locality is on U.S. Forest Service lands. |
| | 98-BMB-407-a | 0.64 | 6 | dark brown silt and clay, micas |
| | 98-BMB-407-b | 0.56 | 14 | dark brown silt and clay, micas, roots and wood bits |
| | 98-BMB-407-c | 0.54 | 16 | brown clay, fine sand, micas, rootlets |
| | 98-BMB-407-d | 0.5 | 20 | brown silt and clay, coarse to medium sand, micas, rootlets |
| | 98-BMB-407-e | 0.43 | 27 | brown clay, medium to fine sand, micas |
| | 98-BMB-407-f | 0.35 | 35 | brown clay, medium to fine sand, micas |
| 13B | | 1 | | Samples are from a 1 m high stream terrace on Jack Creek below confluence with tributary draining bullion Mine, but above flooded beaver pond. Sample locality is on U.S. Forest Service lands. |
| | 97-BMB-122a | 0.96 | 4 | coarse to medium sand, some silt, some medium pebble gravel |
| | 97-BMB-122b | 0.89 | 11 | brown fine sand and silt, abundant charcoal at bottom of interval |
| | 97-BMB-122c | 0.83 | 17 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| | 97-BMB-122d | 0.77 | 23 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| | 97-BMB-122e | 0.71 | 29 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| | 97-BMB-122f | 0.64 | 36 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| | 97-BMB-122g | 0.58 | 42 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| | 97-BMB-122h | 0.52 | 48 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| | 97-BMB-122i | 0.45 | 55 | medium to dark brown fine sand and silt, abundant oxidized micas, minor iron oxide staining |
| 14B | | | | Core in sediments in beaver dam flooded with tailings. Old dead tree in dam sampled. Sample locality is on U.S. Forest Service lands. |
| | 98-BMB-405-a1 | | 8 | brown fine sand and silt, micas, tan tailings |
| | 98-BMB-405-b | | 19 | black silt and clay, micas |
| | 98-BMB-405-c | | 25 | dark grey silt, micas, iron-oxidation |
| | 98-BMB-405-d | | 32 | dark grey silt and clay, micas, iron-oxidation |
| | 98-BMB-405-e | | 42 | dark grey and red-brown silt, medium to very fine sand, micas, slight sulfur odor |
| | 98-BMB-405-f | | 55 | dark grey and red-brown silt, medium to very fine sand, coarse pebbles, micas, slight sulfur odor |
| | 98-BMB-405-g | | 69 | dark grey and red-brown silt, medium to very fine sand, very coarse pebbles, micas, slight sulfur odor |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| 15B | | 1.3 (?) | | Core is in sediments trapped in impoundment built for water supply for Bullion Smelter (1903?); sample taken beneath tree stump of Douglas Fir that was probably cut for use in dam. |
| | 98-BMB-404-a | | 10 | brown silt, medium to very fine sand, micas |
| | 98-BMB-404-b | | 25 | brown silt, medium to very fine sand, micas |
| | 98-BMB-404-c | | 37 | brown silt, medium to very fine sand, micas, iron-oxidation |
| | 98-BMB-404-d | | 47 | black silt and clay, fine sand, micas |
| | 98-BMB-404-e | | 56 | red-brown coarse to fine sand, dark clay layer, medium pebbles, micas, roots |
| | 98-BMB-404-f | | 70 | brown coarse to fine sand, fine to coarse pebble gravel, micas |
| | 98-BMB-404-g | | 82 | red-brown coarse to fine sand, pebbles and gravel, micas |
| | 98-BMB-404-h | | 102 | red-brown coarse pebbles in clay, large wood fragments |
| **Uncle Sam Gulch** | | | | |
| 16B | | 0.3 | | Core is from 0.3 m stream terrace on lower Uncle Sam Gulch near abandoned miners cabin; material looks highly contaminated with fluvial deposits. |
| | 97-BMB-134a | | 2 | brown silt, oxidized micas, some rootlets |
| | 97-BMB-134b | | 6 | brown silt, minor charcoal, trace iron oxide staining |
| | 97-BMB-134c | | 11 | tan medium sand, minor silt, slight iron oxide staining, sparse rootlets |
| | 97-BMB-134d | | 18 | dark brown silt and clay, medium sand, some iron oxide staining, some roots and wood |
| | 97-BMB-134e | | 23 | dark brown silt and clay, minor medium sand, moderate iron oxide staining, some roots |
| | 97-BMB-134f | | 29 | dark brown clay, minor silt with moderate iron oxide staining |
| | 97-BMB-134g | | 37 | brown fine sand and silt, minor charcoal, iron oxide staining of sand |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| 17B | | 0.3 | | Core is from 1983 clear cut area in Uncle Sam Gulch. Core was taken between roots of 1-m diameter Ponderosa Pine stump. |
| | 97-BMB-135a | | 3 | dark brown fibrous silt |
| | 97-BMB-135b | | 9 | dark brown fibrous silt |
| | 97-BMB-135c | | 16 | dark brown fibrous silt |
| | 97-BMB-135d | | 23 | dark brown fibrous silt, minor iron oxide staining, minor charcoal |
| | 97-BMB-135e | | 60 | dark brown silt and clay, iron oxide staining, some micas, root fibers |
| | 97-BMB-135f | | 37 | dark gray silt and clay, some oxidized micas, abundant wood fibers |
| | 97-BMB-135g | | 43 | dark gray silt and clay, some oxidized micas, abundant wood fibers |
| | 97-BMB-135h | | 50 | dark gray silt and clay, some oxidized micas, abundant wood fibers, iron oxide banding |
| | 97-BMB-135i | | 57 | dark gray silt and clay, some fine sand, some oxidized micas, no root fibers, iron oxide banding |
| | 97-BMB-135j | | 63 | dark gray silt and clay, some fine sand, oxidized micas, no roots, iron oxide banding, minor charcoal |
| | 97-BMB-135k | | 69 | dark gray medium and fine sand, oxidized micas, some roots, minor iron oxide staining |
| | 97-BMB-135l | | 74 | dark gray medium and fine sand, some silt, moderately strong iron oxide staining, some rootlets |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| **High Ore Creek** | | | | |
| 18B | | 1 | | One m core was taken through fluvial tailings deposit on the side of High Ore Creek. |
| | 96-BM-139a1 | 0.95 | 5 | orange-brown silt-sized fluvial tailings with some root material |
| | 96-BM-139b | 0.85 | 15 | orange-brown silt-sized fluvial tailings with minor root material |
| | 96-BM-139c | 0.75 | 25 | brown medium and fine sand, some medium gravel, abundant roots and sticks |
| | 96-BM-139d | 0.66 | 34 | brown medium and fine sand, some medium gravel, minor iron oxide staining, roots and sticks |
| | 96-BM-139e | 0.57 | 43 | brown coarse to fine sand, some medium gravel, minor iron oxide staining, some roots |
| | 96-BM-139f | 0.48 | 52 | poorly sorted coarse sand and coarse gravel |
| | 96-BM-139g | 0.39 | 61 | poorly sorted coarse sand and coarse gravel |
| | 96-BM-139h | 0.28 | 72 | poorly sorted coarse sand and coarse gravel |
| 19B | | 1 | | Core taken through stream terrace deposit at lower end of High Ore Creek. |
| | 97-BMB-125a | 0.93 | 7 | light brown silt and clay, some wood fragments |
| | 97-BMB-125b | 0.91 | 9 | light brown silt and clay, some wood fragments and rootlets |
| | 97-BMB-125c | 0.87 | 13 | light brown fine sand and silt, sparse rootlets |
| | 97-BMB-125d | 0.81 | 19 | medium brown fine sand and silt, minor iron oxide staining, minor wood |
| | 97-BMB-125e | 0.75 | 25 | transition zone from silt to medium sand, fresh biotite in sand, minor pebble gravel |
| | 97-BMB-125f | 0.68 | 32 | coarse to medium sand, minor coarse pebble gravel, minor iron oxide staining |
| | 97-BMB-125g | 0.62 | 38 | coarse to medium sand, minor coarse pebble gravel, minor fresh biotite, minor iron oxide staining |
| | 97-BMB-125h | 0.55 | 45 | coarse and very coarse sand, minor medium pebble gravel, minor iron oxide staining, rootlets |
| | 97-BMB-125i | 0.49 | 51 | coarse and very coarse sand, minor medium pebble gravel, minor iron oxide staining, rootlets |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| | 97-BMB-125j | 0.43 | 57 | coarse and very coarse sand, minor medium pebble gravel, moderate iron oxide staining, rootlets |
| | 97-BMB-125k1 | 0.36 | 64 | coarse to fine sand, minor coarse pebble gravel, minor iron oxide staining, fresh biotite, rootlets |
| | 97-BMB-125l | 0.3 | 70 | blocky silt, abundant charcoal, minor pebble gravel, some wood and root fragments |
| | 97-BMB-125m | 0.24 | 76 | blocky silt, coarse sand, sparse charcoal, minor pebble gravel, some root fragments |
| **High Ore Creek below Comet Mine** | | | | |
| 5T | | 2 | | Samples from cores in sediments underlying fluvial tailings deposits in High Ore Creek on BLM lands. |
| | 97BMF-130-5-d | | 31 | medium brown fibrous silt and clay, fresh and oxidized micas |
| | 97BMF-130-5-f | | 50 | light brown coarse and medium sand, very fine pebble gravel, fresh biotite, minor iron oxide staining |
| | 97BMF-130-7-e | | 34 | dark gray and brown silt and clay with rootlet fibers |
| | 97BMF-130-7-g | | 56 | medium to dark gray silt and clay, moderate charcoal, minor very fine pebble gravel, minor wood fiber |
| | 97BMF-131-9-f | | 34 | medium gray and brown coarse to fine sand, oxidized micas, minor charcoal |
| | 97BMF-131-9-g | | 42 | coarse and medium sand, oxidized micas, minor charcoal, minor iron oxide staining |
| | 97BMF-131-13-e | | 106 | tan coarse sand, medium pebble fragments of monzonite, weathered feldspars, some fresh and oxidized micas |
| | 97BMF-131-13-f | | 120 | blocky silt and clay, abundant very coarse sand, moderate fresh biotite, weathered feldspars |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| **Boulder River** | | | | |
| 1T | | 1 | | Samples from cores of fluvial tailings deposit on bar in Boulder River below confluence with Basin Creek. Top of bar is about 1 m above low-flow water level; depths indicate thickness of fluvial tailings deposit on top of bar. |
| | 97BMF-133-1-a | | 12 | light yellow coarse sand |
| | 97BMF-133-1-b | | 28 | light yellow coarse sand and very coarse sand, some gray-black smelter slag |
| 36 | 97BMF-133-1-b | | 28 | light yellow coarse sand and very coarse sand, some gray-black smelter slag |
| | 97BMF-133-2-a | | 15 | light yellow coarse sand, minor medium pebbles, minor gray-black smelter slag fragments |
| 41 | 97BMF-133-2-b | | 32 | light yellow coarse sand, abundant gray-black smelter slag fragments |
| | 97BMF-133-3-a | | 24 | light yellow coarse sand, minor medium pebbles, minor gray-black smelter slag fragments |
| 41 | 97BMF-133-3-b | | 31 | light yellow coarse sand, minor medium pebbles, minor gray-black smelter slag, few oxidized micas |
| | 97BMF-133-4-a | | 3 | tan-sage coarse to fine sand |
| | 97BMF-133-4-b | | 18 | yellow coarse to fine sand, minor fragments of gray-black smelter slag |
| 41 | 97BMF-133-4-c | | 34 | yellow coarse to fine sand, moderate fragments of gray-black smelter slag |
| | 97BMF-133-5-a | | 4 | tan-sage coarse to fine sand |
| | 97BMF-133-5-b | | 14 | yellow coarse to fine sand, minor fragments of gray-black smelter slag |
| 30 | 97BMF-133-5-c | | 25 | yellow coarse to fine sand and silt, minor fragments of gray-black smelter slag |

Table 2. Site and sample descriptions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Elevation above low-flow water level (m) | Core Depth (cm) | Site and sample descriptions |
|---|---|---|---|---|
| | 97BMF-133-6-a | | 3 | tan-sage coarse to fine sand, minor smelter slag |
| | 97BMF-133-6-b | | 16 | yellow coarse to fine sand, minor fragments of gray-black smelter slag |
| 36 | 97BMF-133-6-c | | 30 | yellow coarse to fine sand, minor fragments of gray-black smelter slag |
| | 97BMF-133-7-a | | 4 | tan-gray coarse to fine sand, minor fragments of gray-black smelter slag |
| | 97BMF-133-7-b | | 16 | yellow fine and coarse sand, minor gray-black smelter slag |
| 36 | 97BMF-133-7-c | | 30 | yellow fine and coarse sand and very fine pebbles, some gray-black smelter slag |
| | 97BMF-133-10-a | | 2 | light tan-brown medium and fine sand, some oxidized micas, minor fine pebbles |
| | 97BMF-133-10-b | | 5 | light tan-brown fine sand and silt, abundant oxidized micas |
| 9 | 97BMF-133-10-c | | 8 | light tan-brown fine sand and silt, abundant oxidized micas, minor charcoal and wood fibers |
| | 97BMF-133-11-a | | 2 | medium gray-brown fine sand and silt, some wood and charcoal, some oxidized micas |
| | 97BMF-133-11-b | | 7 | sage-brown medium well sorted sand, minor wood, some oxidized micas |
| | 97BMF-133-11-c | | 18 | sage-yellow fine sand, fresh and oxidized micas |
| | 97BMF-133-11-d | | 30 | medium brown-tan fine sand, moderate charcoal, abundant oxidized micas |
| 46 | 97BMF-133-11-e | | 40 | medium brown-tan fine sand, abundant oxidized micas |
| **Bullion Smelter Site** | | | | |
| 6T | | | | Bullion smelter site on an unnamed tributary to Jack Creek built in 1903. |
| | 96-BM-114 | | | black medium- to coarse-grained sand sized glass slag particles from smelter site |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana

[Major element data expressed in weight percent; trace element data expressed in ppm (parts per million) or μg/g, dry weight basis]

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | |
| 1B | 99-BMB-102a | 8.3 | 2.1 | 2.9 | 2.2 | 0.77 | 2.0 | 0.07 | 0.33 |
| | 99-BMB-102b | 8.0 | 2.2 | 3.3 | 2.2 | 0.67 | 2.1 | 0.08 | 0.31 |
| | 99-BMB-102c | 6.8 | 1.8 | 9.6 | 1.9 | 0.76 | 1.3 | 0.13 | 0.30 |
| 2B | 99-BMB-103a | 7.8 | 1.6 | 3.0 | 2.2 | 0.86 | 1.5 | 0.10 | 0.29 |
| | 99-BMB-103b | 8.3 | 2.1 | 3.2 | 2.3 | 0.71 | 2.1 | 0.07 | 0.44 |
| | 99-BMB-103c | 8.5 | 2.5 | 4.3 | 2.5 | 0.73 | 2.5 | 0.09 | 0.59 |
| | 99-BMB-103d | 7.9 | 2.3 | 4.3 | 2.3 | 0.70 | 2.2 | 0.09 | 0.51 |
| | 99-BMB-103e[1] | 8.1 | 2.4 | 4.0 | 2.4 | 0.88 | 2.1 | 0.10 | 0.53 |
| 3B | 99-BMB-104a | 7.3 | 1.7 | 3.7 | 2.5 | 0.74 | 1.5 | 0.10 | 0.37 |
| | 99-BMB-104b | 7.2 | 1.4 | 4.8 | 2.4 | 0.62 | 1.3 | 0.12 | 0.39 |
| | 99-BMB-104c[1] | 7.8 | 2.2 | 7.1 | 2.3 | 0.78 | 2.0 | 0.11 | 0.61 |
| 4B | 99-BMB-106a | 7.4 | 1.6 | 4.2 | 2.5 | 0.66 | 1.6 | 0.08 | 0.32 |
| | 99-BMB-106b | 7.8 | 1.7 | 4.2 | 2.6 | 0.65 | 1.6 | 0.08 | 0.32 |
| | 99-BMB-106c | 7.9 | 1.7 | 4.5 | 2.6 | 0.69 | 1.7 | 0.08 | 0.31 |
| | 99-BMB-106d | 9.1 | 1.9 | 4.6 | 3.3 | 0.79 | 2.0 | 0.10 | 0.30 |
| 5B | 99-BMB-105a | 7.4 | 1.8 | 4.1 | 2.3 | 0.99 | 1.6 | 0.1 | 0.42 |
| | 99-BMB-105b | 7.4 | 1.7 | 4.7 | 2.4 | 0.79 | 1.5 | 0.09 | 0.39 |
| | 99-BMB-105d | 7.6 | 1.7 | 4.9 | 2.4 | 0.75 | 1.4 | 0.10 | 0.38 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| 6B | 99-BMB-108a | 8.1 | 1.8 | 3.5 | 2.6 | 0.87 | 1.6 | 0.08 | 0.42 |
| | 99-BMB-108b | 8.5 | 2.0 | 5.2 | 2.6 | 0.94 | 1.6 | 0.12 | 0.45 |
| | 99-BMB-108c | 8.6 | 2.0 | 4.6 | 2.4 | 0.92 | 1.7 | 0.11 | 0.42 |
| | 99-BMB-108d | 8.4 | 2.1 | 4.8 | 2.4 | 1.0 | 1.6 | 0.13 | 0.40 |
| **Basin Creek** | | | | | | | | | |
| 7B | 98-BMB-406-a | 7.5 | 1.2 | 1.7 | 2.0 | 0.37 | 3.0 | 0.06 | 0.31 |
| | 98-BMB-406-b | 7.5 | 1.2 | 1.6 | 2.1 | 0.34 | 3.1 | 0.05 | 0.30 |
| | 98-BMB-406-c | 8.2 | 1.1 | 2.2 | 1.3 | 0.50 | 1.8 | 0.04 | 0.35 |
| | 98-BMB-406-d | 7.7 | 0.83 | 2.0 | 0.94 | 0.55 | 0.81 | 0.02 | 0.33 |
| | 98-BMB-406-e | 5.5 | 0.59 | 1.4 | 0.67 | 0.39 | 0.55 | 0.02 | 0.22 |
| | 98-BMB-406-f | 8.2 | 0.98 | 2.5 | 1.3 | 0.64 | 0.94 | 0.03 | 0.37 |
| | 98-BMB-406-g[1] | 8.8 | 1.4 | 6.0 | 1.6 | 0.86 | 1.2 | 0.07 | 0.49 |
| | 98-BMB-406-h | 9.0 | 1.9 | 5.4 | 1.8 | 1.2 | 1.3 | 0.07 | 0.54 |
| | 98-BMB-406-I | 9.6 | 1.7 | 3.1 | 1.8 | 1.1 | 1.3 | 0.04 | 0.53 |
| | 98-BMB-406-j | 9.4 | 2.2 | 6.3 | 2.0 | 1.4 | 1.5 | 0.13 | 0.51 |
| | 98-BMB-406-k | 9.1 | 1.3 | 3.2 | 1.6 | 1.0 | 1.2 | 0.05 | 0.49 |
| | 98-BMB-406-l | 7.5 | 1.6 | 2.5 | 3.2 | 0.49 | 1.6 | 0.06 | 0.20 |
| | 98-BMB-406-m | 9.2 | 1.6 | 3.4 | 2.0 | 1.1 | 1.2 | 0.07 | 0.49 |
| | 98-BMB-406-n | 9.2 | 2.4 | 4.9 | 2.2 | 1.5 | 1.6 | 0.12 | 0.61 |
| | 98-BMB-406-o | 9.2 | 3.0 | 8.4 | 2.2 | 1.4 | 1.9 | 0.16 | 0.81 |
| | 98-BMB-406-p | 9.5 | 2.2 | 3.9 | 2.1 | 1.4 | 1.6 | 0.15 | 0.58 |
| | 98-BMB-406-q | 9.4 | 2.2 | 4.0 | 2.0 | 1.4 | 1.6 | 0.15 | 0.57 |
| | 98-BMB-406-r | 8.9 | 1.7 | 3.6 | 1.8 | 1.3 | 1.3 | 0.18 | 0.55 |
| | 98-BMB-406-s | 8.5 | 1.8 | 3.4 | 1.8 | 1.1 | 1.4 | 0.20 | 0.51 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| 8B | 98-BMB-401-a | 7.8 | 1.0 | 2.7 | 1.9 | 0.53 | 0.78 | 0.11 | 0.24 |
| | 98-BMB-401-b | 8.0 | 0.97 | 2.6 | 2.1 | 0.59 | 0.88 | 0.09 | 0.29 |
| | 98-BMB-401-c | 8.1 | 1.0 | 2.5 | 2.2 | 0.58 | 0.96 | 0.09 | 0.29 |
| | 98-BMB-401-d | 8.1 | 1.0 | 2.4 | 2.4 | 0.58 | 1.1 | 0.05 | 0.36 |
| | 98-BMB-401-e | 8.3 | 1.0 | 2.8 | 2.4 | 0.63 | 1.0 | 0.05 | 0.35 |
| | 98-BMB-401-f | 8.4 | 0.96 | 2.6 | 2.4 | 0.60 | 1.1 | 0.04 | 0.36 |
| | 98-BMB-401-g | 8.3 | 1.1 | 2.9 | 2.6 | 0.64 | 1.2 | 0.08 | 0.39 |
| | 98-BMB-401-h | 8.1 | 1.2 | 2.7 | 2.6 | 0.64 | 1.2 | 0.10 | 0.36 |
| | 98-BMB-401-I | 8.6 | 1.1 | 3.6 | 2.3 | 0.67 | 1.0 | 0.08 | 0.34 |
| | 98-BMB-401-j | 8.5 | 1.2 | 4.2 | 2.3 | 0.67 | 1.1 | 0.10 | 0.38 |
| 9B | 98-BMB-402-a | 7.0 | 1.2 | 3.4 | 2.3 | 0.64 | 1.1 | 0.11 | 0.29 |
| | 98-BMB-402-b | 6.5 | 0.78 | 2.2 | 3.1 | 0.37 | 1.1 | 0.05 | 0.21 |
| | 98-BMB-402-c | 6.8 | 0.78 | 2.3 | 3.1 | 0.43 | 1.1 | 0.06 | 0.21 |
| | 98-BMB-402-d | 7.4 | 1.0 | 4.2 | 2.5 | 0.56 | 1.1 | 0.12 | 0.30 |
| | 98-BMB-402-e | 7.0 | 0.69 | 2.6 | 3.0 | 0.45 | 1.0 | 0.06 | 0.23 |
| | 98-BMB-402-f | 7.5 | 0.77 | 3.3 | 2.3 | 0.66 | 0.92 | 0.11 | 0.28 |
| | 98-BMB-402-g | 7.8 | 0.63 | 2.7 | 2.2 | 0.58 | 0.81 | 0.08 | 0.26 |
| | 98-BMB-402-h | 7.2 | 0.47 | 3.0 | 1.2 | 0.43 | 0.44 | 0.08 | 0.22 |
| | 98-BMB-402-I | 7.7 | 0.80 | 2.7 | 1.5 | 0.56 | 0.74 | 0.04 | 0.30 |
| | 98-BMB-402-j | 7.7 | 1.0 | 2.1 | 2.1 | 0.60 | 1.1 | 0.03 | 0.34 |
| | 98-BMB-402-k | 7.7 | 1.2 | 1.7 | 2.9 | 0.53 | 1.4 | 0.02 | 0.28 |
| | 98-BMB-402-l | 8.5 | 1.2 | 2.9 | 2.0 | 0.83 | 1.2 | 0.04 | 0.41 |
| | 98-BMB-402-m[1] | 8.3 | 1.0 | 2.6 | 2.7 | 0.74 | 1.2 | 0.04 | 0.42 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| 10B | 98-BMB-403-a | 7.5 | 1.2 | 3.8 | 2.0 | 0.66 | 0.88 | 0.12 | 0.30 |
| | 98-BMB-403-b | 7.9 | 1.3 | 3.4 | 2.4 | 0.72 | 1.2 | 0.11 | 0.34 |
| | 98-BMB-403-c | 7.9 | 1.3 | 3.2 | 2.5 | 0.67 | 1.2 | 0.11 | 0.32 |
| | 98-BMB-403-d | 7.6 | 1.4 | 2.9 | 2.4 | 0.67 | 1.1 | 0.10 | 0.31 |
| | 98-BMB-403-e | 7.3 | 1.1 | 2.1 | 3.0 | 0.57 | 1.2 | 0.06 | 0.28 |
| | 98-BMB-403-f | 8.0 | 1.2 | 2.7 | 2.4 | 0.75 | 1.0 | 0.07 | 0.33 |
| | 98-BMB-403-g | 7.1 | 1.1 | 2.2 | 2.8 | 0.59 | 1.2 | 0.05 | 0.28 |
| | 98-BMB-403-h | 7.8 | 1.2 | 2.6 | 2.6 | 0.68 | 1.2 | 0.06 | 0.33 |
| | 98-BMB-403-I | 7.5 | 1.1 | 2.1 | 2.8 | 0.60 | 1.2 | 0.05 | 0.30 |
| | 98-BMB-403-j | 8.5 | 1.7 | 3.0 | 2.5 | 0.87 | 1.6 | 0.09 | 0.45 |
| 11B | 97-BMB-123a | 6.9 | 1.2 | 4.7 | 2.3 | 0.67 | 1.1 | 0.09 | 0.35 |
| | 97-BMB-123b | 7.5 | 1.6 | 5.3 | 2.5 | 0.73 | 1.4 | 0.10 | 0.42 |
| 3T | 98BMF 105B-k | 7.5 | 1.2 | 1.2 | 3.2 | 0.43 | 1.5 | 0.04 | 0.20 |
| | 98BMF 105B-l | 6.7 | 1.1 | 0.91 | 3.4 | 0.37 | 1.4 | 0.03 | 0.16 |
| | 98BMF 105B-m | 8.1 | 1.0 | 1.6 | 2.1 | 0.58 | 1.3 | 0.04 | 0.32 |
| | 98BMF 105B-n | 8.4 | 1.2 | 1.9 | 1.8 | 0.71 | 1.4 | 0.04 | 0.39 |
| **Jack Creek** | | | | | | | | | |
| 12B | 98-BMB-407-a | 8.3 | 1.6 | 4.9 | 1.4 | 1.1 | 0.87 | 0.10 | 0.44 |
| | 98-BMB-407-b | 8.4 | 1.6 | 4.9 | 1.2 | 0.95 | 0.62 | 0.11 | 0.35 |
| | 98-BMB-407-c | 8.4 | 1.8 | 4.7 | 1.7 | 1.2 | 1.1 | 0.08 | 0.46 |
| | 98-BMB-407-d | 8.3 | 1.8 | 4.7 | 1.8 | 1.3 | 1.2 | 0.08 | 0.52 |
| | 98-BMB-407-e | 8.5 | 2.1 | 4.8 | 2.0 | 1.4 | 1.4 | 0.09 | 0.54 |
| | 98-BMB-407-f | 8.6 | 1.8 | 4.8 | 1.8 | 1.2 | 1.3 | 0.10 | 0.52 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| 13B | 97-BMB-122a | 7.5 | 2.1 | 7.9 | 2.2 | 1.2 | 1.5 | 0.13 | 0.57 |
| | 97-BMB-122b | 8.0 | 2.3 | 5.9 | 2.2 | 1.5 | 1.6 | 0.12 | 0.58 |
| | 97-BMB-122c | 8.0 | 2.1 | 5.2 | 2.1 | 1.5 | 1.5 | 0.10 | 0.62 |
| | 97-BMB-122d | 8.2 | 2.1 | 5.1 | 2.1 | 1.5 | 1.5 | 0.10 | 0.60 |
| | 97-BMB-122e | 8.3 | 2.1 | 5.3 | 2.2 | 1.4 | 1.6 | 0.09 | 0.60 |
| | 97-BMB-122f | 8.7 | 2.0 | 5.0 | 2.2 | 1.4 | 1.6 | 0.07 | 0.60 |
| | 97-BMB-122g | 8.1 | 1.8 | 4.9 | 2.0 | 1.4 | 1.6 | 0.08 | 0.63 |
| | 97-BMB-122h | 8.5 | 2.4 | 5.8 | 2.5 | 1.6 | 1.7 | 0.08 | 0.65 |
| | 97-BMB-122I | 7.9 | 2.0 | 5.5 | 2.2 | 1.5 | 1.6 | 0.09 | 0.66 |
| 14B | 98-BMB-405-a[1] | 5.1 | 0.62 | 3.6 | 1.8 | 0.46 | 0.47 | 0.09 | 0.20 |
| | 98-BMB-405-b | 8.2 | 1.8 | 4.4 | 1.9 | 1.3 | 1.3 | 0.14 | 0.46 |
| | 98-BMB-405-c | 8.6 | 2.3 | 5.1 | 2.0 | 1.6 | 1.6 | 0.13 | 0.58 |
| | 98-BMB-405-d | 8.5 | 2.3 | 5.4 | 1.9 | 1.6 | 1.6 | 0.11 | 0.65 |
| | 98-BMB-405-e | 8.0 | 3.6 | 11 | 1.8 | 2.3 | 1.8 | 0.18 | 1.1 |
| | 98-BMB-405-f | 8.4 | 3.7 | 9.9 | 1.7 | 2.3 | 2.0 | 0.19 | 0.78 |
| | 98-BMB-405-g | 8.3 | 3.2 | 7.0 | 1.8 | 2.0 | 1.8 | 0.15 | 0.67 |
| 15B | 98-BMB-404-a | 7.4 | 2.2 | 5.0 | 2.1 | 1.2 | 1.5 | 0.12 | 0.47 |
| | 98-BMB-404-b | 7.6 | 2.2 | 4.9 | 2.2 | 1.2 | 1.5 | 0.12 | 0.47 |
| | 98-BMB-404-c | 7.5 | 2.3 | 5.9 | 2.1 | 1.2 | 1.5 | 0.12 | 0.54 |
| | 98-BMB-404-d | 7.7 | 1.7 | 4.6 | 2.0 | 1.2 | 1.2 | 0.11 | 0.44 |
| | 98-BMB-404-e | 7.2 | 2.1 | 9.2 | 2.0 | 1.1 | 1.4 | 0.13 | 0.64 |
| | 98-BMB-404-f | 7.4 | 2.3 | 9.5 | 2.4 | 1.2 | 1.6 | 0.14 | 0.63 |
| | 98-BMB-404-g | 7.6 | 2.3 | 7.2 | 2.3 | 1.3 | 1.6 | 0.15 | 0.47 |
| | 98-BMB-404-h | 7.7 | 1.1 | 3.6 | 1.6 | 0.59 | 1.1 | 0.28 | 0.37 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **Uncle Sam Gulch** | | | | | | | | | |
| 16B | 97-BMB-134a | 7.7 | 1.6 | 4.8 | 2.3 | 0.77 | 1.6 | 0.09 | 0.23 |
| | 97-BMB-134b | 7.4 | 1.6 | 5.2 | 2.0 | 0.66 | 1.8 | 0.07 | 0.21 |
| | 97-BMB-134c | 7.0 | 1.6 | 6.8 | 1.8 | 0.66 | 1.7 | 0.06 | 0.22 |
| | 97-BMB-134d | 6.7 | 1.3 | 9.1 | 1.6 | 0.59 | 1.2 | 0.08 | 0.01 |
| | 97-BMB-134e | 6.2 | 1.2 | 8.5 | 1.4 | 0.55 | 1.2 | 0.08 | < 0.005 |
| | 97-BMB-134f | 6.8 | 1.2 | 4.7 | 1.5 | 0.62 | 1.3 | 0.09 | < 0.005 |
| | 97-BMB-134g | 6.6 | 1.3 | 7.0 | 1.6 | 0.58 | 1.4 | 0.07 | < 0.005 |
| 17B | 97-BMB-135a | 2.3 | 0.76 | 4.6 | 0.54 | 0.22 | 0.28 | 0.13 | < 0.005 |
| | 97-BMB-135b | 5.1 | 0.59 | 6.4 | 0.94 | 0.47 | 0.50 | 0.10 | 0.006 |
| | 97-BMB-135c | 6.0 | 0.63 | 7.0 | 1.1 | 0.54 | 0.65 | 0.10 | 0.07 |
| | 97-BMB-135d | 6.6 | 1.1 | 6.4 | 1.2 | 0.61 | 1.1 | 0.09 | 0.15 |
| | 97-BMB-135e | 8.5 | 1.5 | 5.0 | 1.5 | 0.80 | 1.6 | 0.11 | 0.27 |
| | 97-BMB-135f | 8.8 | 1.6 | 5.0 | 1.6 | 0.77 | 1.6 | 0.10 | 0.29 |
| | 97-BMB-135g | 8.4 | 1.6 | 4.4 | 1.5 | 0.81 | 1.7 | 0.09 | 0.36 |
| | 97-BMB-135h | 8.7 | 1.6 | 4.8 | 1.6 | 0.85 | 1.6 | 0.10 | 0.38 |
| | 97-BMB-135i | 9.1 | 1.7 | 4.8 | 1.6 | 0.86 | 1.9 | 0.09 | 0.40 |
| | 97-BMB-135j | 9.2 | 1.8 | 6.2 | 1.7 | 0.82 | 1.7 | 0.08 | 0.38 |
| | 97-BMB-135k | 8.6 | 1.7 | 3.7 | 1.8 | 0.80 | 1.8 | 0.08 | 0.39 |
| | 97-BMB-135l | 8.7 | 2.0 | 4.2 | 1.7 | 0.82 | 2.1 | 0.08 | 0.38 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek** | | | | | | | | | |
| 18B | 96-BM-139a[1] | 3.4 | 0.8 | 6.9 | 1.2 | 0.37 | 0.48 | 0.07 | 0.13 |
| | 96-BM-139b | 3.5 | 0.54 | 6.3 | 1.2 | 0.29 | 0.46 | 0.06 | 0.11 |
| | 96-BM-139c | 6.9 | 1.6 | 6.1 | 2.2 | 1.0 | 0.88 | 0.14 | 0.45 |
| | 96-BM-139d | 6.9 | 1.4 | 6.6 | 2.3 | 1.0 | 0.91 | 0.14 | 0.44 |
| | 96-BM-139e | 6.8 | 1.4 | 6.9 | 2.1 | 1.0 | 0.88 | 0.16 | 0.40 |
| | 96-BM-139f | 7.4 | 1.7 | 7.7 | 2.5 | 1.2 | 0.99 | 0.15 | 0.41 |
| | 96-BM-139g | 8.5 | 2.1 | 6.7 | 3.0 | 1.6 | 1.3 | 0.16 | 0.56 |
| | 96-BM-139h | 8.4 | 1.9 | 6.3 | 2.8 | 1.5 | 1.1 | 0.16 | 0.62 |
| 19B | 97-BMB-125a | 6.7 | 0.71 | 5.9 | 2.1 | 0.69 | 0.81 | 0.12 | 0.24 |
| | 97-BMB-125b | 7.4 | 1.6 | 7.3 | 2.5 | 1.1 | 1.0 | 0.15 | 0.36 |
| | 97-BMB-125c | 8.0 | 1.4 | 4.3 | 2.4 | 1.0 | 1.4 | 0.18 | 0.40 |
| | 97-BMB-125d | 8.9 | 1.4 | 4.0 | 2.5 | 0.88 | 1.7 | 0.17 | 0.41 |
| | 97-BMB-125e | 7.9 | 1.0 | 4.4 | 2.4 | 0.78 | 0.84 | 0.14 | 0.37 |
| | 97-BMB-125f | 10 | 1.2 | 5.8 | 3.5 | 0.91 | 0.82 | 0.16 | 0.44 |
| | 97-BMB-125g | 9.2 | 1.2 | 5.3 | 3.5 | 0.82 | 0.86 | 0.15 | 0.40 |
| | 97-BMB-125h | 10 | 1.3 | 5.8 | 3.5 | 0.91 | 0.75 | 0.16 | 0.39 |
| | 97-BMB-125i | 9.8 | 1.4 | 5.9 | 3.4 | 0.93 | 0.72 | 0.15 | 0.42 |
| | 97-BMB-125j | 11 | 1.4 | 6.5 | 3.7 | 0.89 | 0.77 | 0.16 | 0.39 |
| | 97-BMB-125k[1] | 10 | 1.5 | 5.7 | 3.5 | 0.88 | 0.73 | 0.14 | 0.37 |
| | 97-BMB-125l | 9.0 | 1.6 | 5.1 | 2.8 | 0.97 | 0.77 | 0.13 | 0.42 |
| | 97-BMB-125m | 9.0 | 1.5 | 5.4 | 2.9 | 1.0 | 0.91 | 0.14 | 0.45 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek below Comet Mine** | | | | | | | | | |
| 5T | 97BMF-130-5-d | 6.5 | 0.9 | 2.3 | 1.8 | 0.56 | 1.1 | 0.07 | 0.31 |
| | 97BMF-130-5-f | 6.4 | 0.78 | 1.0 | 3.4 | 0.24 | 1.4 | 0.03 | 0.17 |
| | 97BMF-130-7-e | 6.5 | 0.7 | 1.7 | 2.3 | 0.46 | 1.1 | 0.05 | 0.25 |
| | 97BMF-130-7-g | 7.7 | 0.94 | 1.9 | 2.7 | 0.55 | 1.4 | 0.05 | 0.29 |
| | 97BMF-131-9-f | 7.3 | 0.84 | 1.0 | 3.3 | 0.28 | 1.7 | 0.04 | 0.19 |
| | 97BMF-131-9-g | 7.0 | 0.76 | 1.1 | 3.3 | 0.27 | 1.5 | 0.03 | 0.20 |
| | 97BMF-131-13-e | 7.3 | 0.98 | 1.4 | 3.5 | 0.24 | 1.9 | 0.04 | 0.18 |
| | 97BMF-131-13-f | 8.1 | 0.98 | 2.2 | 3.0 | 0.41 | 1.7 | 0.05 | 0.31 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | | |
| 1B | 99-BMB-102a | 57 | 870 | 2 | < 2 | 82 | 34 | 11 | 100 | 17 |
| | 99-BMB-102b | 110 | 900 | 2 | < 2 | 72 | 34 | 10 | 150 | 17 |
| | 99-BMB-102c | 520 | 940 | 2 | 2 | 77 | 39 | 20 | 1100 | 18 |
| 2B | 99-BMB-103a | 26 | 840 | 2 | < 2 | 72 | 44 | 13 | 750 | 17 |
| | 99-BMB-103b | 37 | 920 | 2 | < 2 | 120 | 36 | 16 | 150 | 16 |
| | 99-BMB-103c | 24 | 940 | 2 | < 2 | 230 | 50 | 16 | 52 | 17 |
| | 99-BMB-103d | 40 | 900 | 2 | < 2 | 180 | 49 | 14 | 160 | 17 |
| | 99-BMB-103e[1] | 69 | 830 | 2 | 3 | 150 | 47 | 15 | 160 | 16 |
| 3B | 99-BMB-104a | 160 | 660 | 2 | 6 | 88 | 27 | 14 | 210 | 14 |
| | 99-BMB-104b | 430 | 710 | 2 | 2 | 110 | 43 | 12 | 560 | 17 |
| | 99-BMB-104c[1] | 61 | 695 | 2 | < 2 | 170 | 74 | 15 | 715 | 19 |
| 4B | 99-BMB-106a | 31 | 780 | 2 | < 2 | 76 | 38 | 13 | 63 | 16 |
| | 99-BMB-106b | 37 | 840 | 2 | < 2 | 85 | 38 | 12 | 68 | 16 |
| | 99-BMB-106c | 39 | 810 | 2 | < 2 | 87 | 42 | 12 | 69 | 17 |
| | 99-BMB-106d | 52 | 960 | 2 | 6 | 100 | 38 | 14 | 100 | 19 |
| 5B | 99-BMB-105a | 46 | 720 | 2 | < 2 | 79 | 41 | 15 | 43 | 17 |
| | 99-BMB-105b | 130 | 700 | 2 | 4 | 130 | 46 | 14 | 120 | 16 |
| | 99-BMB-105d | 290 | 720 | 2 | 5 | 84 | 40 | 16 | 310 | 16 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 6B | 99-BMB-108a | 28 | 780 | 2 | < 2 | 86 | 36 | 13 | 31 | 17 |
| | 99-BMB-108b | 88 | 810 | 2 | < 2 | 140 | 51 | 15 | 89 | 18 |
| | 99-BMB-108c | 61 | 840 | 2 | < 2 | 120 | 50 | 15 | 89 | 18 |
| | 99-BMB-108d | 140 | 780 | 2 | 3 | 91 | 47 | 16 | 180 | 17 |
| **Basin Creek** | | | | | | | | | | |
| 7B | 98-BMB-406-a | 15 | 740 | 2 | < 2 | 45 | 6 | 8 | 25 | 15 |
| | 98-BMB-406-b | 14 | 770 | 2 | < 2 | 46 | 3 | 7 | 21 | 15 |
| | 98-BMB-406-c | 23 | 770 | 2 | 2 | 65 | 27 | 9 | 54 | 17 |
| | 98-BMB-406-d | 19 | 560 | 2 | 2 | 71 | 41 | 8 | 61 | 16 |
| | 98-BMB-406-e | 14 | 380 | 1 | < 2 | 39 | 30 | 6 | 30 | 11 |
| | 98-BMB-406-f | 19 | 560 | 2 | 3 | 90 | 40 | 10 | 78 | 17 |
| | 98-BMB-406-g[1] | 44 | 615 | 2 | < 2 | 75 | 40 | 12 | 44 | 20 |
| | 98-BMB-406-h | 30 | 560 | 3 | 2 | 130 | 48 | 16 | 50 | 22 |
| | 98-BMB-406-i | 18 | 570 | 2 | 2 | 96 | 43 | 16 | 56 | 21 |
| | 98-BMB-406-j | 48 | 550 | 3 | 2 | 110 | 42 | 16 | 26 | 22 |
| | 98-BMB-406-k | 32 | 610 | 3 | 4 | 100 | 46 | 18 | 72 | 20 |
| | 98-BMB-406-l | 24 | 850 | 2 | < 2 | 62 | 15 | 8 | 12 | 13 |
| | 98-BMB-406-m | 30 | 600 | 2 | < 2 | 92 | 40 | 18 | 49 | 20 |
| | 98-BMB-406-n | 32 | 570 | 3 | < 2 | 120 | 46 | 17 | 48 | 24 |
| | 98-BMB-406-o | 26 | 550 | 2 | < 2 | 160 | 89 | 19 | 20 | 21 |
| | 98-BMB-406-p | 29 | 540 | 3 | < 2 | 120 | 42 | 17 | 42 | 22 |
| | 98-BMB-406-q | 25 | 520 | 3 | < 2 | 98 | 40 | 16 | 31 | 23 |
| | 98-BMB-406-r | 25 | 460 | 2 | 2 | 73 | 39 | 17 | 24 | 19 |
| | 98-BMB-406-s | 24 | 470 | 2 | < 2 | 79 | 38 | 15 | 28 | 18 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 8B | 98-BMB-401-a | 32 | 640 | 6 | 2 | 100 | 19 | 10 | 42 | 16 |
| | 98-BMB-401-b | 28 | 650 | 5 | < 2 | 94 | 22 | 11 | 28 | 18 |
| | 98-BMB-401-c | 17 | 640 | 5 | < 2 | 93 | 20 | 10 | 19 | 19 |
| | 98-BMB-401-d | 16 | 690 | 4 | < 2 | 99 | 21 | 11 | 16 | 18 |
| | 98-BMB-401-e | 21 | 680 | 5 | < 2 | 88 | 22 | 12 | 17 | 20 |
| | 98-BMB-401-f | 18 | 690 | 5 | < 2 | 96 | 22 | 11 | 19 | 19 |
| | 98-BMB-401-g | 21 | 690 | 5 | < 2 | 82 | 24 | 12 | 34 | 19 |
| | 98-BMB-401-h | 32 | 650 | 4 | < 2 | 74 | 20 | 11 | 16 | 20 |
| | 98-BMB-401-i | 29 | 700 | 4 | < 2 | 87 | 20 | 15 | 14 | 20 |
| | 98-BMB-401-j | 41 | 740 | 4 | < 2 | 85 | 19 | 14 | 11 | 20 |
| 9B | 98-BMB-402-a | 440 | 620 | 3 | 5 | 74 | 19 | 16 | 110 | 16 |
| | 98-BMB-402-b | 130 | 740 | 3 | < 2 | 59 | 13 | 8 | 36 | 14 |
| | 98-BMB-402-c | 160 | 730 | 3 | 2 | 60 | 13 | 12 | 110 | 14 |
| | 98-BMB-402-d | 740 | 620 | 4 | 4 | 93 | 20 | 25 | 180 | 16 |
| | 98-BMB-402-e | 360 | 730 | 3 | 3 | 68 | 11 | 11 | 160 | 16 |
| | 98-BMB-402-f | 620 | 650 | 4 | 4 | 84 | 24 | 11 | 530 | 18 |
| | 98-BMB-402-g | 720 | 580 | 4 | 3 | 78 | 21 | 11 | 240 | 20 |
| | 98-BMB-402-h | 280 | 640 | 3 | 5 | 76 | 27 | 14 | 170 | 16 |
| | 98-BMB-402-i | 68 | 660 | 3 | 4 | 79 | 32 | 16 | 71 | 16 |
| | 98-BMB-402-j | 28 | 760 | 2 | 2 | 72 | 29 | 13 | 38 | 16 |
| | 98-BMB-402-k | 17 | 800 | 2 | < 2 | 68 | 19 | 10 | 23 | 15 |
| | 98-BMB-402-l | 27 | 830 | 3 | 2 | 90 | 36 | 15 | 47 | 18 |
| | 98-BMB-402-m[1] | 41 | 835 | 3 | < 2 | 98 | 49 | 15 | 46 | 17 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 10B | 98-BMB-403-a | 58 | 700 | 4 | 3 | 90 | 23 | 21 | 38 | 14 |
| | 98-BMB-403-b | 35 | 730 | 4 | < 2 | 87 | 21 | 16 | 16 | 16 |
| | 98-BMB-403-c | 34 | 720 | 4 | < 2 | 87 | 26 | 16 | 18 | 16 |
| | 98-BMB-403-d | 35 | 700 | 4 | < 2 | 88 | 21 | 14 | 23 | 16 |
| | 98-BMB-403-e | 20 | 800 | 3 | < 2 | 68 | 16 | 12 | 13 | 15 |
| | 98-BMB-403-f | 29 | 690 | 4 | < 2 | 86 | 24 | 13 | 21 | 18 |
| | 98-BMB-403-g | 20 | 780 | 3 | < 2 | 72 | 16 | 11 | 15 | 15 |
| | 98-BMB-403-h | 24 | 760 | 4 | < 2 | 76 | 22 | 13 | 19 | 17 |
| | 98-BMB-403-i | 21 | 780 | 3 | < 2 | 64 | 15 | 11 | 12 | 16 |
| | 98-BMB-403-j | 35 | 730 | 3 | < 2 | 86 | 24 | 18 | 13 | 18 |
| 11B | 97-BMB-123a | 120 | 600 | 3 | < 2 | 96 | 56 | 12 | 90 | 13 |
| | 97-BMB-123b | 210 | 680 | 3 | < 2 | 100 | 57 | 11 | 150 | 12 |
| 3T | 98BMF 105B-k | 30 | 850 | 2 | 2 | 51 | 13 | 7 | 97 | 14 |
| | 98BMF 105B-l | 18 | 800 | 1 | 2 | 47 | 9 | 6 | 48 | 12 |
| | 98BMF 105B-m | 27 | 690 | 2 | 8 | 85 | 28 | 12 | 62 | 18 |
| | 98BMF 105B-n | 50 | 700 | 2 | < 2 | 63 | 28 | 13 | 48 | 18 |
| **Jack Creek** | | | | | | | | | | |
| 12B | 98-BMB-407-a | 93 | 620 | 2 | 4 | 76 | 50 | 16 | 200 | 18 |
| | 98-BMB-407-b | 80 | 630 | 2 | 3 | 80 | 48 | 15 | 140 | 14 |
| | 98-BMB-407-c | 50 | 620 | 2 | < 2 | 74 | 47 | 15 | 65 | 19 |
| | 98-BMB-407-d | 57 | 620 | 2 | 2 | 77 | 45 | 16 | 59 | 17 |
| | 98-BMB-407-e | 49 | 610 | 2 | < 2 | 78 | 43 | 17 | 49 | 17 |
| | 98-BMB-407-f | 54 | 650 | 2 | < 2 | 84 | 48 | 17 | 50 | 19 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 13B | 97-BMB-122a | 260 | 600 | 2 | 10 | 180 | 74 | 46 | 540 | 14 |
| | 97-BMB-122b | 98 | 550 | 2 | 7 | 120 | 47 | 21 | 660 | 20 |
| | 97-BMB-122c | 62 | 560 | 2 | 5 | 99 | 46 | 21 | 500 | 19 |
| | 97-BMB-122d | 46 | 560 | 2 | 5 | 120 | 46 | 18 | 470 | 18 |
| | 97-BMB-122e | 59 | 600 | 2 | 7 | 110 | 48 | 17 | 360 | 20 |
| | 97-BMB-122f | 41 | 680 | 2 | 17 | 130 | 45 | 15 | 110 | 23 |
| | 97-BMB-122g | 62 | 700 | 2 | 14 | 130 | 45 | 17 | 66 | 19 |
| | 97-BMB-122h | 54 | 670 | 2 | 2 | 130 | 51 | 21 | 68 | 18 |
| | 97-BMB-122i | 72 | 680 | 2 | 3 | 130 | 54 | 22 | 86 | 21 |
| 14B | 98-BMB-405-a[1] | 3050 | 280 | 1 | < 2 | 48 | 32 | 7 | 375 | 11 |
| | 98-BMB-405-b | 1100 | 540 | 2 | 6 | 97 | 44 | 16 | 1200 | 19 |
| | 98-BMB-405-c | 140 | 600 | 3 | 16 | 110 | 44 | 25 | 800 | 19 |
| | 98-BMB-405-d | 140 | 610 | 2 | < 2 | 110 | 46 | 26 | 69 | 19 |
| | 98-BMB-405-e | 110 | 570 | 3 | 3 | 200 | 130 | 26 | 26 | 20 |
| | 98-BMB-405-f | 170 | 590 | 3 | 2 | 160 | 100 | 25 | 35 | 20 |
| | 98-BMB-405-g | 120 | 560 | 3 | < 2 | 140 | 60 | 21 | 42 | 19 |
| 15B | 98-BMB-404-a | 930 | 510 | 2 | 9 | 100 | 40 | 19 | 330 | 15 |
| | 98-BMB-404-b | 830 | 530 | 2 | 9 | 100 | 38 | 20 | 320 | 14 |
| | 98-BMB-404-c | 1100 | 530 | 2 | 8 | 130 | 46 | 23 | 340 | 14 |
| | 98-BMB-404-d | 500 | 540 | 2 | 17 | 82 | 36 | 27 | 700 | 15 |
| | 98-BMB-404-e | 740 | 590 | 2 | 12 | 130 | 95 | 22 | 510 | 16 |
| | 98-BMB-404-f | 500 | 720 | 2 | 7 | 140 | 100 | 33 | 320 | 10 |
| | 98-BMB-404-g | 690 | 750 | 2 | 4 | 120 | 58 | 25 | 260 | 13 |
| | 98-BMB-404-h | 110 | 1100 | 2 | 3 | 52 | 41 | 17 | 72 | 17 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Uncle Sam Gulch** | | | | | | | | | | |
| 16B | 97-BMB-134a | 2400 | 580 | 2 | 16 | 100 | 14 | 19 | 1100 | 17 |
| | 97-BMB-134b | 2600 | 510 | 3 | 14 | 110 | 14 | 27 | 1900 | 15 |
| | 97-BMB-134c | 3000 | 520 | 3 | 20 | 110 | 16 | 59 | 2700 | 11 |
| | 97-BMB-134d | 6400 | 500 | 3 | 28 | 120 | 11 | 22 | 4400 | 13 |
| | 97-BMB-134e | 5400 | 480 | 3 | 54 | 100 | 11 | 20 | 4700 | 13 |
| | 97-BMB-134f | 3900 | 430 | 3 | 36 | 110 | 17 | 19 | 6400 | 14 |
| | 97-BMB-134g | 3900 | 460 | 3 | 22 | 120 | 14 | 22 | 6600 | 14 |
| 17B | 97-BMB-135a | 3600 | 350 | 1 | 34 | 38 | 4 | 19 | 4400 | < 4 |
| | 97-BMB-135b | 2200 | 350 | 2 | 21 | 110 | 10 | 23 | 2900 | 9 |
| | 97-BMB-135c | 1500 | 380 | 2 | 17 | 110 | 14 | 34 | 2400 | 8 |
| | 97-BMB-135d | 640 | 450 | 2 | 21 | 110 | 16 | 72 | 2000 | < 4 |
| | 97-BMB-135e | 270 | 490 | 3 | 10 | 120 | 22 | 26 | 1200 | 16 |
| | 97-BMB-135f | 260 | 550 | 4 | 88 | 110 | 23 | 29 | 1100 | 14 |
| | 97-BMB-135g | 220 | 530 | 4 | 26 | 110 | 25 | 30 | 150 | 14 |
| | 97-BMB-135h | 230 | 550 | 4 | 22 | 130 | 28 | 25 | 120 | 15 |
| | 97-BMB-135i | 220 | 560 | 4 | 22 | 140 | 28 | 23 | 90 | 18 |
| | 97-BMB-135j | 340 | 580 | 4 | 21 | 130 | 26 | 28 | 92 | 18 |
| | 97-BMB-135k | 230 | 540 | 4 | 16 | 130 | 27 | 26 | 110 | 18 |
| | 97-BMB-135l | 190 | 520 | 4 | 59 | 150 | 26 | 27 | 470 | 18 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek** | | | | | | | | | | |
| 18B | 96-BM-139a[1] | 6850 | 200 | < 1 | 15 | 60 | 8 | 22 | 460 | < 4 |
| | 96-BM-139b | 6000 | 360 | 1 | 29 | 52 | 7 | 24 | 650 | < 4 |
| | 96-BM-139c | 2100 | 670 | 2 | 22 | 100 | 32 | 22 | 320 | 10 |
| | 96-BM-139d | 3000 | 720 | 2 | 26 | 100 | 35 | 26 | 630 | 12 |
| | 96-BM-139e | 4300 | 670 | 2 | 38 | 110 | 36 | 36 | 1000 | 8 |
| | 96-BM-139f | 5300 | 730 | 2 | 39 | 110 | 36 | 39 | 1100 | 9 |
| | 96-BM-139g | 1000 | 700 | 2 | 22 | 140 | 40 | 36 | 390 | 13 |
| | 96-BM-139h | 120 | 700 | 2 | 24 | 130 | 53 | 29 | 130 | 12 |
| 19B | 97-BMB-125a | 8500 | 580 | 2 | 9 | 76 | 23 | 10 | 1600 | 16 |
| | 97-BMB-125b | 5300 | 690 | 2 | 37 | 100 | 34 | 35 | 1100 | 8 |
| | 97-BMB-125c | 1300 | 680 | 2 | 12 | 120 | 30 | 16 | 820 | 19 |
| | 97-BMB-125d | 540 | 690 | 3 | 21 | 130 | 29 | 20 | 520 | 19 |
| | 97-BMB-125e | 280 | 620 | 2 | 58 | 100 | 30 | 19 | 280 | 16 |
| | 97-BMB-125f | 120 | 650 | 3 | 31 | 120 | 33 | 20 | 100 | 20 |
| | 97-BMB-125g | 76 | 690 | 3 | 17 | 120 | 33 | 20 | 80 | 19 |
| | 97-BMB-125h | 46 | 710 | 3 | 12 | 120 | 32 | 22 | 93 | 20 |
| | 97-BMB-125i | 86 | 710 | 3 | 7 | 120 | 32 | 24 | 140 | 20 |
| | 97-BMB-125j | 82 | 770 | 3 | 6 | 130 | 31 | 25 | 140 | 21 |
| | 97-BMB-125k[1] | 120 | 685 | 3 | 7 | 125 | 30 | 24 | 125 | 20 |
| | 97-BMB-125l | 250 | 680 | 3 | 14 | 120 | 32 | 21 | 190 | 19 |
| | 97-BMB-125m | 96 | 710 | 3 | 7 | 130 | 38 | 19 | 120 | 18 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek below Comet Mine** | | | | | | | | | | |
| 5T | 97BMF-130-5-d | 136 | 836 | 2 | 30 | 59 | 5 | 5 | 47 | 12 |
| | 97BMF-130-5-f | 50 | 1010 | 1 | 0 | 40 | < 2 | 2 | 20 | 11 |
| | 97BMF-130-7-e | 788 | 839 | 2 | 32 | 51 | 3 | 4 | 365 | 12 |
| | 97BMF-130-7-g | 73 | 928 | 2 | 55 | 74 | 8 | 10 | 29 | 16 |
| | | | | | | | | | | |
| | 97BMF-131-9-f | 40 | 1040 | 1 | 0.01 | 48 | 5 | < 2 | 85 | 10 |
| | 97BMF-131-9-g | 31 | 1010 | 1 | 0.01 | 45 | < 2 | < 2 | 48 | 9 |
| | 97BMF-131-13-e | 13 | 1120 | 2 | 0.01 | 49 | 5 | 3 | 6 | 7 |
| | 97BMF-131-13-f | 25 | 1040 | 2 | 5 | 71 | 3 | 14 | 16 | 17 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | | |
| 1B | 99-BMB-102a | 51 | 40 | 22 | 690 | < 2 | 37 | 14 | 21 | 9 |
| | 99-BMB-102b | 46 | 72 | 21 | 470 | < 2 | 32 | 14 | 22 | 8 |
| | 99-BMB-102c | 48 | 440 | 25 | 790 | 2 | 39 | 28 | 10 | 11 |
| 2B | 99-BMB-103a | 44 | 35 | 28 | 710 | < 2 | 33 | 17 | 21 | 10 |
| | 99-BMB-103b | 72 | 42 | 21 | 1200 | < 2 | 49 | 15 | 24 | 9 |
| | 99-BMB-103c | 150 | 34 | 22 | 1300 | < 2 | 89 | 18 | 28 | 11 |
| | 99-BMB-103d | 110 | 49 | 22 | 960 | < 2 | 68 | 17 | 24 | 11 |
| | 99-BMB-103e[1] | 91 | 87 | 23 | 1200 | < 2 | 60 | 19 | 26 | 12 |
| 3B | 99-BMB-104a | 53 | 230 | 25 | 1400 | < 2 | 35 | 15 | 21 | 11 |
| | 99-BMB-104b | 63 | 410 | 23 | 770 | < 2 | 43 | 15 | 22 | 11 |
| | 99-BMB-104c[1] | 108 | 105 | 20 | 780 | < 2 | 68 | 18 | 30 | 13 |
| 4B | 99-BMB-106a | 44 | 55 | 22 | 490 | < 2 | 36 | 15 | 19 | 10 |
| | 99-BMB-106b | 54 | 73 | 21 | 510 | < 2 | 38 | 14 | 20 | 9 |
| | 99-BMB-106c | 56 | 78 | 23 | 520 | < 2 | 42 | 14 | 23 | 10 |
| | 99-BMB-106d | 62 | 130 | 29 | 630 | < 2 | 50 | 18 | 20 | 12 |
| 5B | 99-BMB-105a | 48 | 74 | 24 | 670 | < 2 | 37 | 19 | 21 | 11 |
| | 99-BMB-105b | 81 | 200 | 27 | 800 | < 2 | 54 | 18 | 20 | 11 |
| | 99-BMB-105d | 50 | 290 | 27 | 1300 | < 2 | 37 | 16 | 23 | 11 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 6B | 99-BMB-108a | 54 | 48 | 32 | 580 | < 2 | 37 | 16 | 25 | 11 |
| | 99-BMB-108b | 82 | 91 | 34 | 960 | < 2 | 61 | 20 | 23 | 13 |
| | 99-BMB-108c | 68 | 72 | 31 | 1300 | < 2 | 49 | 20 | 24 | 13 |
| | 99-BMB-108d | 50 | 110 | 32 | 1600 | < 2 | 40 | 19 | 22 | 14 |
| **Basin Creek** | | | | | | | | | | |
| 7B | 98-BMB-406-a | 24 | 22 | 38 | 370 | < 2 | 26 | 6 | 17 | 8 |
| | 98-BMB-406-b | 24 | 21 | 38 | 370 | < 2 | 26 | 6 | 17 | 8 |
| | 98-BMB-406-c | 42 | 48 | 66 | 270 | < 2 | 41 | 14 | 19 | 13 |
| | 98-BMB-406-d | 49 | 64 | 65 | 190 | < 2 | 44 | 14 | 19 | 16 |
| | 98-BMB-406-e | 26 | 50 | 43 | 140 | < 2 | 23 | 9 | 13 | 12 |
| | 98-BMB-406-f | 60 | 100 | 60 | 230 | < 2 | 58 | 18 | 20 | 18 |
| | 98-BMB-406-g[1] | 47 | 100 | 51 | 345 | < 2 | 45 | 18 | 21 | 19 |
| | 98-BMB-406-h | 89 | 110 | 44 | 680 | < 2 | 82 | 21 | 23 | 23 |
| | 98-BMB-406-i | 64 | 140 | 60 | 470 | < 2 | 55 | 18 | 27 | 22 |
| | 98-BMB-406-j | 57 | 120 | 43 | 600 | < 2 | 57 | 20 | 23 | 24 |
| | 98-BMB-406-k | 75 | 110 | 66 | 430 | < 2 | 66 | 26 | 24 | 21 |
| | 98-BMB-406-l | 38 | 64 | 21 | 240 | < 2 | 29 | 9 | 17 | 9 |
| | 98-BMB-406-m | 62 | 86 | 52 | 490 | < 2 | 54 | 19 | 23 | 20 |
| | 98-BMB-406-n | 76 | 76 | 47 | 650 | < 2 | 64 | 21 | 26 | 23 |
| | 98-BMB-406-o | 94 | 58 | 32 | 1000 | < 2 | 69 | 21 | 26 | 26 |
| | 98-BMB-406-p | 72 | 87 | 52 | 680 | < 2 | 59 | 20 | 27 | 24 |
| | 98-BMB-406-q | 58 | 89 | 52 | 720 | < 2 | 49 | 20 | 25 | 21 |
| | 98-BMB-406-r | 43 | 83 | 57 | 1000 | < 2 | 33 | 19 | 24 | 18 |
| | 98-BMB-406-s | 47 | 78 | 46 | 760 | < 2 | 36 | 17 | 24 | 18 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 8B | 98-BMB-401-a | 69 | 58 | 38 | 1400 | < 2 | 72 | 13 | 23 | 12 |
| | 98-BMB-401-b | 71 | 64 | 40 | 960 | < 2 | 71 | 13 | 27 | 12 |
| | 98-BMB-401-c | 63 | 56 | 40 | 570 | < 2 | 64 | 12 | 28 | 12 |
| | 98-BMB-401-d | 65 | 54 | 37 | 390 | < 2 | 60 | 10 | 31 | 12 |
| | 98-BMB-401-e | 60 | 73 | 40 | 460 | < 2 | 55 | 11 | 33 | 12 |
| | 98-BMB-401-f | 69 | 55 | 37 | 340 | < 2 | 61 | 11 | 29 | 13 |
| | 98-BMB-401-g | 84 | 66 | 38 | 400 | < 2 | 75 | 13 | 33 | 13 |
| | 98-BMB-401-h | 53 | 56 | 40 | 360 | < 2 | 46 | 11 | 38 | 12 |
| | 98-BMB-401-i | 48 | 94 | 40 | 920 | < 2 | 45 | 12 | 35 | 13 |
| | 98-BMB-401-j | 52 | 87 | 38 | 910 | < 2 | 47 | 12 | 33 | 12 |
| 9B | 98-BMB-402-a | 44 | 420 | 33 | 800 | < 2 | 37 | 12 | 28 | 11 |
| | 98-BMB-402-b | 35 | 280 | 25 | 250 | < 2 | 28 | 8 | 28 | 7 |
| | 98-BMB-402-c | 36 | 420 | 28 | 360 | < 2 | 29 | 9 | 28 | 7 |
| | 98-BMB-402-d | 53 | 660 | 34 | 840 | < 2 | 44 | 12 | 32 | 11 |
| | 98-BMB-402-e | 40 | 480 | 33 | 310 | < 2 | 35 | 10 | 30 | 8 |
| | 98-BMB-402-f | 52 | 910 | 39 | 310 | 2 | 46 | 14 | 30 | 12 |
| | 98-BMB-402-g | 47 | 860 | 40 | 220 | < 2 | 41 | 13 | 38 | 11 |
| | 98-BMB-402-h | 48 | 360 | 48 | 170 | 5 | 48 | 21 | 24 | 11 |
| | 98-BMB-402-i | 53 | 70 | 47 | 220 | < 2 | 48 | 23 | 21 | 13 |
| | 98-BMB-402-j | 49 | 49 | 41 | 260 | < 2 | 42 | 18 | 22 | 12 |
| | 98-BMB-402-k | 46 | 40 | 33 | 230 | < 2 | 34 | 15 | 21 | 9 |
| | 98-BMB-402-l | 58 | 51 | 53 | 350 | 2 | 50 | 26 | 25 | 15 |
| | 98-BMB-402-m[1] | 59 | 69 | 44 | 385 | < 2 | 45 | 24 | 25 | 14 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 10B | 98-BMB-403-a | 54 | 65 | 40 | 2200 | < 2 | 52 | 18 | 26 | 12 |
| | 98-BMB-403-b | 54 | 56 | 40 | 1500 | < 2 | 49 | 15 | 30 | 12 |
| | 98-BMB-403-c | 50 | 58 | 40 | 1400 | < 2 | 46 | 16 | 30 | 12 |
| | 98-BMB-403-d | 56 | 63 | 38 | 1000 | < 2 | 50 | 14 | 28 | 12 |
| | 98-BMB-403-e | 44 | 47 | 34 | 600 | < 2 | 36 | 10 | 27 | 9 |
| | 98-BMB-403-f | 54 | 63 | 44 | 560 | < 2 | 49 | 15 | 29 | 12 |
| | 98-BMB-403-g | 46 | 48 | 32 | 420 | < 2 | 40 | 11 | 25 | 9 |
| | 98-BMB-403-h | 47 | 58 | 41 | 460 | < 2 | 41 | 14 | 27 | 11 |
| | 98-BMB-403-i | 40 | 48 | 36 | 380 | < 2 | 32 | 10 | 28 | 9 |
| | 98-BMB-403-j | 50 | 64 | 37 | 800 | 2 | 40 | 12 | 30 | 14 |
| 11B | 97-BMB-123a | 54 | 99 | 31 | 700 | 2 | 52 | 16 | 28 | 12 |
| | 97-BMB-123b | 56 | 86 | 28 | 770 | 2 | 54 | 14 | 30 | 13 |
| 3T | 98BMF 105B-k | 36 | 41 | 30 | 160 | < 2 | 26 | 8 | 20 | 7 |
| | 98BMF 105B-l | 33 | 31 | 21 | 130 | < 2 | 21 | 6 | 19 | 6 |
| | 98BMF 105B-m | 63 | 67 | 50 | 220 | < 2 | 42 | 16 | 24 | 12 |
| | 98BMF 105B-n | 44 | 66 | 55 | 290 | < 2 | 37 | 17 | 26 | 14 |
| **Jack Creek** | | | | | | | | | | |
| 12B | 98-BMB-407-a | 64 | 50 | 74 | 1200 | 3 | 52 | 26 | 17 | 18 |
| | 98-BMB-407-b | 79 | 39 | 78 | 2000 | 3 | 65 | 27 | 14 | 17 |
| | 98-BMB-407-c | 56 | 35 | 71 | 1500 | < 2 | 46 | 23 | 20 | 19 |
| | 98-BMB-407-d | 55 | 35 | 72 | 1800 | 2 | 43 | 23 | 20 | 18 |
| | 98-BMB-407-e | 52 | 33 | 70 | 1300 | < 2 | 42 | 22 | 24 | 20 |
| | 98-BMB-407-f | 55 | 36 | 80 | 1300 | < 2 | 44 | 23 | 23 | 18 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 13B | 97-BMB-122a | 96 | 180 | 39 | 2100 | 6 | 69 | 21 | 20 | 19 |
| | 97-BMB-122b | 63 | 86 | 43 | 1200 | 5 | 50 | 21 | 25 | 19 |
| | 97-BMB-122c | 50 | 78 | 55 | 900 | 4 | 38 | 22 | 26 | 18 |
| | 97-BMB-122d | 61 | 90 | 56 | 840 | 4 | 44 | 22 | 26 | 18 |
| | 97-BMB-122e | 58 | 72 | 56 | 680 | 4 | 42 | 23 | 24 | 17 |
| | 97-BMB-122f | 65 | 69 | 54 | 620 | 2 | 44 | 25 | 27 | 17 |
| | 97-BMB-122g | 69 | 72 | 51 | 620 | 3 | 55 | 26 | 27 | 18 |
| | 97-BMB-122h | 82 | 70 | 48 | 730 | 3 | 62 | 25 | 28 | 20 |
| | 97-BMB-122i | 85 | 85 | 48 | 700 | 4 | 68 | 26 | 27 | 20 |
| 14B | 98-BMB-405-a[1] | 31 | 2750 | 33 | 265 | 7 | 24 | 9 | 11 | 10 |
| | 98-BMB-405-b | 64 | 570 | 54 | 670 | 4 | 52 | 21 | 23 | 19 |
| | 98-BMB-405-c | 76 | 90 | 54 | 910 | < 2 | 64 | 27 | 25 | 22 |
| | 98-BMB-405-d | 77 | 69 | 54 | 1000 | < 2 | 64 | 25 | 27 | 23 |
| | 98-BMB-405-e | 120 | 43 | 37 | 1700 | < 2 | 89 | 29 | 34 | 37 |
| | 98-BMB-405-f | 92 | 66 | 38 | 1500 | 5 | 77 | 28 | 25 | 36 |
| | 98-BMB-405-g | 87 | 65 | 42 | 1300 | < 2 | 72 | 25 | 26 | 30 |
| 15B | 98-BMB-404-a | 64 | 400 | 34 | 1500 | 3 | 49 | 18 | 21 | 18 |
| | 98-BMB-404-b | 62 | 380 | 34 | 1500 | < 2 | 48 | 18 | 23 | 18 |
| | 98-BMB-404-c | 79 | 430 | 32 | 1600 | 2 | 55 | 19 | 22 | 19 |
| | 98-BMB-404-d | 53 | 450 | 49 | 1100 | < 2 | 44 | 23 | 20 | 17 |
| | 98-BMB-404-e | 82 | 360 | 35 | 1100 | < 2 | 59 | 25 | 21 | 19 |
| | 98-BMB-404-f | 85 | 230 | 29 | 4300 | < 2 | 58 | 25 | 17 | 19 |
| | 98-BMB-404-g | 71 | 350 | 33 | 2100 | 4 | 53 | 21 | 19 | 20 |
| | 98-BMB-404-h | 31 | 60 | 48 | 540 | 3 | 25 | 18 | 17 | 11 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Uncle Sam Gulch** | | | | | | | | | | |
| 16B | 97-BMB-134a | 54 | 1600 | 39 | 1000 | 9 | 39 | 13 | 25 | 11 |
| | 97-BMB-134b | 62 | 1000 | 36 | 1400 | 10 | 43 | 12 | 26 | 10 |
| | 97-BMB-134c | 61 | 700 | 36 | 2800 | 12 | 44 | 13 | 26 | 11 |
| | 97-BMB-134d | 67 | 1000 | 38 | 920 | 15 | 52 | 14 | 20 | 11 |
| | 97-BMB-134e | 59 | 890 | 34 | 620 | 13 | 48 | 14 | 20 | 10 |
| | 97-BMB-134f | 66 | 1000 | 40 | 400 | 12 | 50 | 13 | 29 | 11 |
| | 97-BMB-134g | 68 | 990 | 32 | 710 | 16 | 49 | 13 | 29 | 11 |
| 17B | 97-BMB-135a | 21 | 820 | 13 | 670 | 6 | 18 | 9 | 7 | 4 |
| | 97-BMB-135b | 64 | 870 | 38 | 1300 | 11 | 57 | 12 | 14 | 9 |
| | 97-BMB-135c | 59 | 750 | 44 | 2400 | 10 | 58 | 13 | 14 | 11 |
| | 97-BMB-135d | 57 | 440 | 47 | 6600 | 12 | 48 | 14 | 18 | 11 |
| | 97-BMB-135e | 71 | 260 | 58 | 2700 | 15 | 56 | 14 | 31 | 12 |
| | 97-BMB-135f | 71 | 190 | 65 | 3300 | 22 | 55 | 18 | 30 | 12 |
| | 97-BMB-135g | 75 | 180 | 62 | 3200 | 21 | 60 | 18 | 29 | 12 |
| | 97-BMB-135h | 80 | 200 | 67 | 3000 | 18 | 60 | 17 | 30 | 13 |
| | 97-BMB-135i | 80 | 210 | 68 | 2400 | 21 | 63 | 16 | 33 | 13 |
| | 97-BMB-135j | 72 | 220 | 73 | 2400 | 30 | 58 | 16 | 30 | 14 |
| | 97-BMB-135k | 79 | 180 | 61 | 1500 | 20 | 57 | 16 | 33 | 12 |
| | 97-BMB-135l | 93 | 210 | 58 | 2100 | 14 | 68 | 16 | 33 | 13 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek** | | | | | | | | | | |
| 18B | 96-BM-139a[1] | 29 | 3100 | 27 | 5300 | 20 | 21 | 11 | < 4 | 6 |
| | 96-BM-139b | 25 | 3300 | 27 | 7900 | 22 | 17 | 12 | < 4 | 6 |
| | 96-BM-139c | 48 | 1400 | 60 | 3500 | 10 | 38 | 22 | 18 | 15 |
| | 96-BM-139d | 52 | 2800 | 57 | 2600 | 7 | 41 | 23 | 19 | 16 |
| | 96-BM-139e | 56 | 6000 | 54 | 4300 | 11 | 43 | 24 | 17 | 17 |
| | 96-BM-139f | 56 | 7400 | 57 | 4400 | 12 | 44 | 24 | 20 | 19 |
| | 96-BM-139g | 70 | 1900 | 72 | 3700 | 6 | 51 | 29 | 23 | 24 |
| | 96-BM-139h | 62 | 220 | 77 | 4600 | 6 | 48 | 33 | 20 | 22 |
| 19B | 97-BMB-125a | 40 | 19000 | 34 | 460 | 12 | 32 | 16 | 17 | 13 |
| | 97-BMB-125b | 51 | 7000 | 53 | 4200 | 11 | 41 | 23 | 17 | 19 |
| | 97-BMB-125c | 60 | 4200 | 42 | 900 | 5 | 47 | 18 | 25 | 16 |
| | 97-BMB-125d | 67 | 1900 | 39 | 1500 | 5 | 48 | 16 | 29 | 14 |
| | 97-BMB-125e | 56 | 1200 | 55 | 2000 | 6 | 40 | 19 | 20 | 15 |
| | 97-BMB-125f | 62 | 440 | 91 | 1400 | 8 | 49 | 22 | 25 | 21 |
| | 97-BMB-125g | 63 | 300 | 76 | 1500 | 7 | 50 | 20 | 25 | 21 |
| | 97-BMB-125h | 68 | 360 | 84 | 1700 | 10 | 56 | 25 | 22 | 25 |
| | 97-BMB-125i | 68 | 400 | 83 | 1800 | 12 | 55 | 28 | 23 | 25 |
| | 97-BMB-125j | 72 | 370 | 98 | 2100 | 11 | 56 | 30 | 24 | 27 |
| | 97-BMB-125k[1] | 68 | 740 | 88 | 1850 | 10 | 53 | 27 | 24 | 24 |
| | 97-BMB-125l | 71 | 1000 | 70 | 1600 | 9 | 55 | 29 | 25 | 21 |
| | 97-BMB-125m | 72 | 460 | 70 | 1600 | 7 | 55 | 27 | 26 | 22 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek below Comet Mine** | | | | | | | | | | |
| 5T | 97BMF-130-5-d | 34 | 134 | 28 | 1365 | 5 | 29 | 11 | 8 | 8 |
| | 97BMF-130-5-f | 21 | 136 | 16 | 341 | < 2 | 14 | < 3 | 11 | 4 |
| | 97BMF-130-7-e | 30 | 131 | 25 | 392 | 2 | 23 | 7 | 10 | 7 |
| | 97BMF-130-7-g | 38 | 128 | 28 | 823 | < 2 | 28 | 10 | 16 | 8 |
| | 97BMF-131-9-f | 26 | 64 | 18 | 109 | < 2 | 20 | 4 | 10 | 4 |
| | 97BMF-131-9-g | 26 | 51 | 17 | 114 | < 2 | 18 | 3 | 10 | 5 |
| | 97BMF-131-13-e | 25 | 30 | 16 | 360 | < 2 | 15 | 4 | 12 | 4 |
| | 97BMF-131-13-f | 37 | 45 | 24 | 1310 | < 2 | 27 | 9 | 18 | 8 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | |
| 1B | 99-BMB-102a | < 2 | 630 | 14 | < 5 | 80 | 2 | 20 | 110 |
| | 99-BMB-102b | < 2 | 680 | 17 | 10 | 73 | 2 | 17 | 150 |
| | 99-BMB-102c | 14 | 480 | 22 | 13 | 120 | 2 | 23 | 670 |
| 2B | 99-BMB-103a | < 2 | 500 | 16 | < 5 | 81 | 2 | 25 | 380 |
| | 99-BMB-103b | < 2 | 630 | 18 | < 5 | 94 | 2 | 21 | 300 |
| | 99-BMB-103c | < 2 | 730 | 31 | < 5 | 140 | 2 | 26 | 150 |
| | 99-BMB-103d | < 2 | 660 | 68 | < 5 | 140 | 2 | 26 | 210 |
| | 99-BMB-103e[1] | < 2 | 595 | 40 | < 5 | 125 | 3 | 27 | 365 |
| 3B | 99-BMB-104a | 4 | 350 | 24 | < 5 | 110 | 2 | 23 | 560 |
| | 99-BMB-104b | 11 | 380 | 42 | 9 | 160 | 2 | 21 | 510 |
| | 99-BMB-104c[1] | < 2 | 460 | 51 | < 5 | 245 | 3 | 33 | 340 |
| 4B | 99-BMB-106a | < 2 | 450 | 15 | < 5 | 120 | 2 | 23 | 97 |
| | 99-BMB-106b | < 2 | 490 | 26 | < 5 | 120 | 2 | 24 | 96 |
| | 99-BMB-106c | < 2 | 480 | 33 | < 5 | 140 | 2 | 28 | 110 |
| | 99-BMB-106d | < 2 | 550 | 67 | < 5 | 120 | 3 | 33 | 160 |
| 5B | 99-BMB-105a | < 2 | 430 | 42 | < 5 | 120 | 2 | 23 | 140 |
| | 99-BMB-105b | < 2 | 400 | 33 | < 5 | 140 | 2 | 27 | 360 |
| | 99-BMB-105d | 3 | 380 | 31 | < 5 | 140 | 2 | 25 | 670 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| 6B | 99-BMB-108a | < 2 | 440 | 59 | < 5 | 110 | 2 | 25 | 130 |
| | 99-BMB-108b | < 2 | 470 | 29 | < 5 | 160 | 3 | 32 | 270 |
| | 99-BMB-108c | < 2 | 530 | 65 | < 5 | 150 | 3 | 34 | 240 |
| | 99-BMB-108d | < 2 | 490 | 25 | < 5 | 150 | 3 | 34 | 550 |
| **Basin Creek** | | | | | | | | | |
| 7B | 98-BMB-406-a | < 2 | 290 | 6 | < 5 | 46 | 3 | 26 | 93 |
| | 98-BMB-406-b | < 2 | 280 | 6 | < 5 | 35 | 3 | 26 | 65 |
| | 98-BMB-406-c | < 2 | 220 | 19 | < 5 | 92 | 4 | 42 | 160 |
| | 98-BMB-406-d | < 2 | 150 | 27 | < 5 | 120 | 4 | 44 | 140 |
| | 98-BMB-406-e | < 2 | 110 | 20 | < 5 | 92 | 2 | 21 | 120 |
| | 98-BMB-406-f | < 2 | 180 | 32 | < 5 | 140 | 5 | 54 | 150 |
| | 98-BMB-406-g[1] | < 2 | 235 | 31 | < 5 | 190 | 3 | 36 | 150 |
| | 98-BMB-406-h | < 2 | 290 | 36 | < 5 | 190 | 6 | 71 | 200 |
| | 98-BMB-406-i | < 2 | 280 | 37 | < 5 | 140 | 4 | 44 | 200 |
| | 98-BMB-406-j | < 2 | 340 | 34 | < 5 | 230 | 5 | 39 | 210 |
| | 98-BMB-406-k | < 2 | 220 | 34 | < 5 | 130 | 6 | 68 | 240 |
| | 98-BMB-406-l | < 2 | 370 | 17 | < 5 | 98 | 2 | 19 | 70 |
| | 98-BMB-406-m | < 2 | 270 | 36 | < 5 | 130 | 4 | 46 | 220 |
| | 98-BMB-406-n | < 2 | 340 | 39 | < 5 | 180 | 5 | 50 | 200 |
| | 98-BMB-406-o | < 2 | 390 | 36 | < 5 | 360 | 4 | 43 | 140 |
| | 98-BMB-406-p | < 2 | 330 | 40 | < 5 | 150 | 4 | 47 | 210 |
| | 98-BMB-406-q | < 2 | 320 | 35 | < 5 | 140 | 4 | 38 | 210 |
| | 98-BMB-406-r | < 2 | 260 | 31 | < 5 | 140 | 2 | 24 | 220 |
| | 98-BMB-406-s | < 2 | 270 | 29 | < 5 | 130 | 3 | 26 | 190 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| 8B | 98-BMB-401-a | < 2 | 200 | 9 | < 5 | 65 | 6 | 71 | 140 |
| | 98-BMB-401-b | < 2 | 210 | 14 | < 5 | 70 | 6 | 71 | 130 |
| | 98-BMB-401-c | < 2 | 210 | 16 | < 5 | 69 | 6 | 64 | 110 |
| | 98-BMB-401-d | < 2 | 240 | 18 | < 5 | 72 | 5 | 60 | 96 |
| | 98-BMB-401-e | < 2 | 240 | 18 | < 5 | 84 | 5 | 57 | 110 |
| | 98-BMB-401-f | < 2 | 230 | 18 | < 5 | 78 | 5 | 61 | 98 |
| | 98-BMB-401-g | < 2 | 260 | 22 | < 5 | 82 | 6 | 82 | 110 |
| | 98-BMB-401-h | < 2 | 260 | 21 | < 5 | 75 | 5 | 52 | 110 |
| | 98-BMB-401-i | < 2 | 250 | 17 | < 5 | 88 | 4 | 44 | 110 |
| | 98-BMB-401-j | < 2 | 260 | 16 | < 5 | 92 | 4 | 46 | 120 |
| 9B | 98-BMB-402-a | 2 | 240 | 17 | < 5 | 78 | 3 | 35 | 490 |
| | 98-BMB-402-b | < 2 | 240 | 16 | < 5 | 56 | 3 | 27 | 210 |
| | 98-BMB-402-c | < 2 | 230 | 17 | < 5 | 58 | 3 | 32 | 280 |
| | 98-BMB-402-d | < 2 | 230 | 21 | < 5 | 90 | 4 | 41 | 420 |
| | 98-BMB-402-e | < 2 | 220 | 18 | < 5 | 59 | 4 | 39 | 320 |
| | 98-BMB-402-f | 6 | 190 | 23 | < 5 | 84 | 4 | 47 | 340 |
| | 98-BMB-402-g | 6 | 160 | 24 | < 5 | 78 | 4 | 43 | 330 |
| | 98-BMB-402-h | 2 | 120 | 22 | < 5 | 87 | 4 | 50 | 380 |
| | 98-BMB-402-i | < 2 | 170 | 24 | < 5 | 91 | 4 | 45 | 320 |
| | 98-BMB-402-j | < 2 | 240 | 24 | < 5 | 84 | 3 | 37 | 220 |
| | 98-BMB-402-k | < 2 | 290 | 20 | < 5 | 68 | 2 | 28 | 130 |
| | 98-BMB-402-l | < 2 | 250 | 28 | < 5 | 120 | 4 | 46 | 240 |
| | 98-BMB-402-m[1] | < 2 | 240 | 37 | < 5 | 140 | 4 | 35 | 230 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| 10B | 98-BMB-403-a | < 2 | 210 | 13 | < 5 | 83 | 5 | 53 | 260 |
| | 98-BMB-403-b | < 2 | 260 | 15 | < 5 | 82 | 5 | 50 | 180 |
| | 98-BMB-403-c | < 2 | 250 | 15 | < 5 | 78 | 5 | 48 | 160 |
| | 98-BMB-403-d | < 2 | 260 | 20 | < 5 | 78 | 5 | 49 | 160 |
| | 98-BMB-403-e | < 2 | 260 | 15 | < 5 | 60 | 3 | 35 | 120 |
| | 98-BMB-403-f | < 2 | 230 | 22 | < 5 | 82 | 4 | 47 | 160 |
| | 98-BMB-403-g | < 2 | 260 | 14 | < 5 | 62 | 4 | 39 | 120 |
| | 98-BMB-403-h | < 2 | 250 | 19 | < 5 | 74 | 4 | 39 | 140 |
| | 98-BMB-403-i | < 2 | 260 | 18 | < 5 | 61 | 3 | 30 | 110 |
| | 98-BMB-403-j | < 2 | 340 | 18 | < 5 | 100 | 4 | 35 | 120 |
| 11B | 97-BMB-123a | < 2 | 240 | 19 | < 5 | 160 | 4 | 43 | 220 |
| | 97-BMB-123b | < 2 | 270 | 37 | < 5 | 170 | 5 | 43 | 270 |
| 3T | 98BMF 105B-k | < 2 | 320 | 17 | < 5 | 47 | 2 | 24 | 180 |
| | 98BMF 105B-l | < 2 | 320 | 14 | < 5 | 35 | 2 | 16 | 180 |
| | 98BMF 105B-m | < 2 | 230 | 24 | < 5 | 82 | 3 | 38 | 760 |
| | 98BMF 105B-n | < 2 | 240 | 26 | < 5 | 90 | 3 | 38 | 700 |
| **Jack Creek** | | | | | | | | | |
| 12B | 98-BMB-407-a | < 2 | 210 | 35 | < 5 | 140 | 4 | 46 | 520 |
| | 98-BMB-407-b | < 2 | 190 | 35 | < 5 | 130 | 5 | 58 | 510 |
| | 98-BMB-407-c | < 2 | 260 | 37 | < 5 | 140 | 4 | 40 | 280 |
| | 98-BMB-407-d | < 2 | 260 | 38 | < 5 | 140 | 4 | 36 | 280 |
| | 98-BMB-407-e | < 2 | 280 | 37 | < 5 | 140 | 3 | 35 | 220 |
| | 98-BMB-407-f | < 2 | 280 | 37 | < 5 | 140 | 3 | 36 | 210 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| 13B | 97-BMB-122a | < 2 | 280 | 31 | < 5 | 260 | 5 | 44 | 720 |
| | 97-BMB-122b | < 2 | 290 | 31 | < 5 | 180 | 4 | 36 | 620 |
| | 97-BMB-122c | < 2 | 280 | 25 | < 5 | 160 | 3 | 25 | 560 |
| | 97-BMB-122d | < 2 | 280 | 36 | < 5 | 160 | 3 | 28 | 640 |
| | 97-BMB-122e | < 2 | 290 | 30 | < 5 | 170 | 3 | 27 | 810 |
| | 97-BMB-122f | < 2 | 320 | 31 | < 5 | 160 | 3 | 26 | 1400 |
| | 97-BMB-122g | < 2 | 280 | 38 | < 5 | 160 | 3 | 35 | 1700 |
| | 97-BMB-122h | < 2 | 300 | 36 | < 5 | 180 | 4 | 42 | 1400 |
| | 97-BMB-122i | < 2 | 280 | 41 | < 5 | 170 | 4 | 46 | 1700 |
| 14B | 98-BMB-405-a[1] | 22 | 98 | 23 | < 5 | 105 | 2 | 17 | 195 |
| | 98-BMB-405-b | 5 | 230 | 37 | < 5 | 150 | 5 | 53 | 680 |
| | 98-BMB-405-c | < 2 | 310 | 40 | < 5 | 150 | 5 | 60 | 1800 |
| | 98-BMB-405-d | < 2 | 310 | 38 | < 5 | 160 | 5 | 56 | 570 |
| | 98-BMB-405-e | < 2 | 310 | 50 | < 5 | 450 | 7 | 66 | 210 |
| | 98-BMB-405-f | < 2 | 340 | 45 | < 5 | 390 | 7 | 63 | 250 |
| | 98-BMB-405-g | < 2 | 340 | 44 | < 5 | 230 | 6 | 61 | 180 |
| 15B | 98-BMB-404-a | 3 | 280 | 30 | < 5 | 140 | 4 | 39 | 780 |
| | 98-BMB-404-b | 3 | 290 | 30 | < 5 | 140 | 4 | 39 | 780 |
| | 98-BMB-404-c | 4 | 290 | 32 | < 5 | 170 | 4 | 41 | 810 |
| | 98-BMB-404-d | 4 | 250 | 34 | < 5 | 120 | 4 | 40 | 1700 |
| | 98-BMB-404-e | 2 | 270 | 36 | < 5 | 330 | 4 | 42 | 1400 |
| | 98-BMB-404-f | < 2 | 290 | 23 | < 5 | 350 | 4 | 41 | 620 |
| | 98-BMB-404-g | 2 | 300 | 30 | < 5 | 210 | 4 | 40 | 510 |
| | 98-BMB-404-h | < 2 | 290 | 10 | < 5 | 100 | 2 | 18 | 400 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **Uncle Sam Gulch** | | | | | | | | | |
| 16B | 97-BMB-134a | 14 | 350 | 26 | < 5 | 68 | 2 | 21 | 1100 |
| | 97-BMB-134b | 6 | 330 | 28 | < 5 | 61 | 3 | 25 | 940 |
| | 97-BMB-134c | 5 | 310 | 22 | < 5 | 79 | 3 | 30 | 1100 |
| | 97-BMB-134d | 5 | 250 | 33 | < 5 | 65 | 4 | 39 | 1500 |
| | 97-BMB-134e | 4 | 250 | 33 | < 5 | 62 | 4 | 40 | 1700 |
| | 97-BMB-134f | 5 | 240 | 37 | < 5 | 63 | 5 | 52 | 1400 |
| | 97-BMB-134g | 6 | 290 | 29 | < 5 | 73 | 4 | 40 | 1300 |
| 17B | 97-BMB-135a | 4 | 100 | 11 | < 5 | 25 | 2 | 19 | 1600 |
| | 97-BMB-135b | 3 | 120 | 29 | < 5 | 52 | 6 | 52 | 1600 |
| | 97-BMB-135c | 3 | 140 | 26 | < 5 | 61 | 6 | 45 | 1400 |
| | 97-BMB-135d | 2 | 240 | < 4 | < 5 | 66 | 5 | 37 | 1100 |
| | 97-BMB-135e | < 2 | 340 | 32 | < 5 | 86 | 5 | 47 | 1200 |
| | 97-BMB-135f | < 2 | 370 | 30 | < 5 | 84 | 5 | 48 | 3800 |
| | 97-BMB-135g | < 2 | 350 | 27 | < 5 | 88 | 6 | 49 | 2900 |
| | 97-BMB-135h | < 2 | 360 | 34 | < 5 | 96 | 6 | 52 | 940 |
| | 97-BMB-135i | < 2 | 390 | 47 | < 5 | 99 | 5 | 44 | 1200 |
| | 97-BMB-135j | < 2 | 400 | 43 | < 5 | 100 | 5 | 47 | 1200 |
| | 97-BMB-135k | < 2 | 380 | 45 | < 5 | 92 | 5 | 47 | 2100 |
| | 97-BMB-135l | < 2 | 420 | 39 | < 5 | 93 | 5 | 53 | 2700 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek** | | | | | | | | | |
| 18B | 96-BM-139a[1] | 38 | 105 | < 4 | < 5 | 49 | 1 | 10 | 2150 |
| | 96-BM-139b | 38 | 100 | < 4 | < 5 | 46 | 1 | 13 | 4100 |
| | 96-BM-139c | 14 | 210 | 14 | < 5 | 130 | 2 | 24 | 3800 |
| | 96-BM-139d | 28 | 220 | 19 | < 5 | 140 | 3 | 25 | 2800 |
| | 96-BM-139e | 47 | 210 | 13 | < 5 | 140 | 3 | 28 | 4000 |
| | 96-BM-139f | 51 | 240 | 17 | < 5 | 150 | 3 | 28 | 4300 |
| | 96-BM-139g | 10 | 280 | 29 | < 5 | 180 | 3 | 31 | 3300 |
| | 96-BM-139h | < 2 | 280 | 20 | < 5 | 180 | 3 | 31 | 3900 |
| 19B | 97-BMB-125a | 120 | 170 | 23 | < 5 | 81 | 2 | 19 | 1300 |
| | 97-BMB-125b | 53 | 240 | 19 | < 5 | 140 | 3 | 28 | 4300 |
| | 97-BMB-125c | 28 | 300 | 31 | < 5 | 100 | 4 | 34 | 1100 |
| | 97-BMB-125d | 12 | 330 | 36 | < 5 | 95 | 3 | 31 | 1600 |
| | 97-BMB-125e | 7 | 200 | 27 | < 5 | 110 | 3 | 27 | 3300 |
| | 97-BMB-125f | 4 | 220 | 41 | < 5 | 150 | 3 | 28 | 2500 |
| | 97-BMB-125g | 3 | 240 | 38 | < 5 | 140 | 3 | 31 | 2300 |
| | 97-BMB-125h | 2 | 220 | 37 | < 5 | 160 | 4 | 41 | 3800 |
| | 97-BMB-125i | 3 | 220 | 45 | < 5 | 160 | 4 | 40 | 3700 |
| | 97-BMB-125j | 2 | 210 | 40 | 6 | 160 | 4 | 40 | 3300 |
| | 97-BMB-125k1 | 5 | 215 | 37 | < 5 | 145 | 4 | 35 | 2950 |
| | 97-BMB-125l | 9 | 250 | 35 | < 5 | 140 | 4 | 38 | 4500 |
| | 97-BMB-125m | 3 | 260 | 41 | < 5 | 150 | 4 | 36 | 3100 |

Table 3. Major and trace element data from total digestions of stream terrace and core samples of bed sediments, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **High Ore Creek below Comet Mine** | | | | | | | | | |
| 5T | 97BMF-130-5-d | < 2 | 253 | 11 | 10 | 66 | 2 | 16 | 4925 |
| | 97BMF-130-5-f | < 2 | 317 | 8 | < 5 | 32 | < 1 | 6 | 1360 |
| | 97BMF-130-7-e | < 2 | 247 | 10 | 0 | 49 | 2 | 18 | 2156 |
| | 97BMF-130-7-g | < 2 | 310 | 12 | < 5 | 57 | 2 | 18 | 4650 |
| | | | | | | | | | |
| | 97BMF-131-9-f | 0.01 | 372 | 9 | < 5 | 44 | 1 | 8 | 335 |
| | 97BMF-131-9-g | 0.01 | 333 | 11 | < 5 | 39 | 1 | 7 | 304 |
| | 97BMF-131-13-e | 0.01 | 433 | 11 | < 5 | 34 | < 1 | 7 | 166 |
| | 97BMF-131-13-f | 0.01 | 367 | 15 | 6 | 53 | 2 | 16 | 549 |

Table 4. Lead isotopic data from streambed sediments from stream terrace deposits and core samples, Boulder River watershed, Montana

[Data are corrected for mass fractionation; uncertainties are absolute at the 95 percent confidence level and are calculated in the manner of Ludwig (1980)]

| Site No. | Sample No. (core interval) | Sample Type | Leachable Pb in ppm | $^{206}Pb/^{204}Pb$ | $^{207}Pb/^{204}Pb$ | $^{208}Pb/^{204}Pb$ | $^{207}Pb/^{206}Pb$ | $^{208}Pb/^{206}Pb$ |
|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | |
| 1B | 99BMB-102a | Terrace | 48 | 18.190 ± 0.021 | 15.579 ± 0.022 | 38.250 ± 0.063 | 0.85644 ± 0.00048 | 2.1028 ± 0.0017 |
| 2B | 99BMB-103 (a-c) | Terrace | 29 | 17.726 ± 0.013 | 15.528 ± 0.016 | 37.726 ± 0.049 | 0.87598 ± 0.00029 | 2.1282 ± 0.0014 |
| 3B | 99BMB-104c | Terrace | 145 | 18.072 ± 0.024 | 15.568 ± 0.024 | 38.153 ± 0.084 | 0.86144 ± 0.00044 | 2.1111 ± 0.0032 |
| 4B | 99BMB-106 (a-c) | Terrace | 93 | 18.088 ± 0.011 | 15.575 ± 0.014 | 38.195 ± 0.046 | 0.86106 ± 0.00026 | 2.1116 ± 0.0013 |
| 5B | 99BMB-105a | Terrace | 94 | 18.104 ± 0.012 | 15.587 ± 0.015 | 38.234 ± 0.047 | 0.86097 ± 0.00031 | 2.1119 ± 0.0013 |
| 6B | 99BMB-108a | Terrace | 51 | 18.114 ± 0.011 | 15.572 ± 0.014 | 38.214 ± 0.046 | 0.85963 ± 0.00026 | 2.1096 ± 0.0013 |
| **Basin Creek** | | | | | | | | |
| 3T | 98BMF-105 | Core | 45 | 18.052 ± 0.012 | 15.568 ± 0.014 | 38.103 ± 0.047 | 0.86244 ± 0.00026 | 2.1108 ± 0.0013 |
| 7B | 98BMB-406 (a-e) | Core | 37 | 18.096 ± 0.011 | 15.562 ± 0.014 | 38.097 ± 0.046 | 0.86001 ± 0.00026 | 2.1053 ± 0.0013 |
| 8B | 98BMB-401(c,d,f,h) | Core | 42 | 18.126 ± 0.011 | 15.565 ± 0.014 | 38.124 ± 0.046 | 0.85868 ± 0.00026 | 2.1033 ± 0.0013 |
| 9B | 98BMB-402 (j-l) | Core | 35 | 18.099 ± 0.011 | 15.556 ± 0.014 | 38.161 ± 0.046 | 0.85952 ± 0.00026 | 2.1085 ± 0.0013 |
| 10B | 98BMB-403 (e,g-l) | Core | 38 | 18.122 ± 0.011 | 15.562 ± 0.014 | 38.118 ± 0.046 | 0.85873 ± 0.00026 | 2.1034 ± 0.0013 |
| **Jack Creek** | | | | | | | | |
| 12B | 98BMB-407 (b-f) | Core | 35 | 18.163 ± 0.011 | 15.577 ± 0.014 | 38.260 ± 0.046 | 0.85763 ± 0.00026 | 2.1065 ± 0.0013 |
| 13B | 97BMB-122 (e-h ) | Core | 44 | 18.094 ± 0.016 | 15.582 ± 0.018 | 38.236 ± 0.054 | 0.86113 ± 0.00033 | 2.1132 ± 0.0014 |
| 14B | 98BMB-405 (d-g) | Core | 55 | 18.031 ± 0.011 | 15.553 ± 0.014 | 38.129 ± 0.046 | 0.86256 ± 0.00026 | 2.1147 ± 0.0013 |
| 15B | 98BMB-404h | Core | 47 | 18.095 ± 0.011 | 15.582 ± 0.014 | 38.210 ± 0.046 | 0.86111 ± 0.00026 | 2.1117 ± 0.0013 |
| **Uncle Sam Gulch** | | | | | | | | |
| 17B | 97BMB-135 (f-l) | Core | 170 | 17.985 ± 0.013 | 15.580 ± 0.015 | 38.156 ± 0.048 | 0.86628 ± 0.00027 | 2.1215 ± 0.0013 |
| **High Ore Creek** | | | | | | | | |
| 5Ta | 97BMF-130 (5d,f;7e,g) | Core | 120 | 18.075 ± 0.011 | 15.561 ± 0.014 | 38.173 ± 0.046 | 0.86087 ± 0.00026 | 2.1119 ± 0.0013 |
| 5Tb | 97BMF-131(9f,g; 13e,f) | Core | 34 | 18.101 ± 0.011 | 15.567 ± 0.014 | 38.225 ± 0.046 | 0.86001 ± 0.00026 | 2.1117 ± 0.0013 |
| 18B | 96BMB-139 (g,h) | Core | 190 | 18.016 ± 0.011 | 15.559 ± 0.014 | 38.162 ± 0.046 | 0.86364 ± 0.00029 | 2.1182 ± 0.0013 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana

[Major element data expressed in weight percent; trace element data expressed in ppm (parts per million) or µg/g, dry weight basis]

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | |
| 1T | 97BMF-133-1-a | 5.0 | 0.41 | 0.99 | 2.0 | 0.15 | 0.61 | 0.03 | 0.12 |
| | 97BMF-133-1-b | 5.9 | 0.88 | 2.2 | 1.9 | 0.22 | 1.2 | 0.03 | 0.18 |
| | 97BMF-133-1-b | 5.9 | 0.88 | 2.2 | 1.9 | 0.22 | 1.2 | 0.03 | 0.18 |
| | 97BMF-133-2-a | 4.9 | 0.45 | 1.2 | 2.0 | 0.16 | 0.64 | 0.03 | 0.12 |
| | 97BMF-133-2-b | 5.8 | 0.46 | 1.7 | 1.7 | 0.17 | 0.67 | 0.02 | 0.22 |
| | 97BMF-133-3-a | 4.6 | 0.37 | 1.2 | 1.9 | 0.15 | 0.54 | 0.02 | 0.12 |
| | 97BMF-133-3-b | 4.9 | 0.40 | 1.2 | 2.0 | 0.16 | 0.58 | 0.02 | 0.13 |
| | 97BMF-133-4-a | 4.6 | 0.44 | 1.8 | 1.9 | 0.14 | 0.67 | 0.03 | 0.13 |
| | 97BMF-133-4-b | 4.9 | 0.41 | 1.3 | 2.0 | 0.16 | 0.61 | 0.03 | 0.14 |
| | 97BMF-133-4-c | 5.0 | 0.45 | 0.95 | 1.9 | 0.14 | 0.64 | 0.03 | 0.13 |
| | 97BMF-133-5-a | 4.6 | 0.41 | 2.2 | 1.9 | 0.14 | 0.60 | 0.03 | 0.15 |
| | 97BMF-133-5-b | 4.7 | 0.40 | 1.7 | 1.9 | 0.18 | 0.56 | 0.03 | 0.13 |
| | 97BMF-133-5-c | 5.2 | 0.47 | 1.2 | 2.0 | 0.17 | 0.68 | 0.03 | 0.14 |
| | 97BMF-133-6-a | 4.9 | 0.42 | 1.5 | 2.0 | 0.16 | 0.62 | 0.03 | 0.15 |
| | 97BMF-133-6-b | 4.7 | 0.44 | 1.2 | 1.9 | 0.18 | 0.57 | 0.03 | 0.13 |
| | 97BMF-133-6-c | 5.0 | 0.45 | 1.1 | 2.0 | 0.16 | 0.65 | 0.04 | 0.12 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| | 97BMF-133-7-a | 4.5 | 0.48 | 2.0 | 1.8 | 0.15 | 0.68 | 0.03 | 0.17 |
| | 97BMF-133-7-b | 4.7 | 0.35 | 1.2 | 1.9 | 0.15 | 0.47 | 0.03 | 0.13 |
| | 97BMF-133-7-c | 5.5 | 0.91 | 2.8 | 2.0 | 0.45 | 1.1 | 0.04 | 0.21 |
| | 97BMF-133-10-a | 7.3 | 1.5 | 3.6 | 2.6 | 0.44 | 2.1 | 0.03 | 0.22 |
| | 97BMF-133-10-b | 7.4 | 1.5 | 3.6 | 2.4 | 0.52 | 2.1 | 0.04 | 0.26 |
| | 97BMF-133-10-c | 7.3 | 1.4 | 3.7 | 2.3 | 0.57 | 1.9 | 0.05 | 0.26 |
| | 97BMF-133-11-a | 6.7 | 1.4 | 3.8 | 2.2 | 0.41 | 1.9 | 0.07 | 0.20 |
| | 97BMF-133-11-b | 7.3 | 1.5 | 2.1 | 2.5 | 0.30 | 2.3 | 0.03 | 0.17 |
| | 97BMF-133-11-c | 9.2 | 2.0 | 3.0 | 2.6 | 0.46 | 2.7 | 0.05 | 0.24 |
| | 97BMF-133-11-d | 7.6 | 1.7 | 2.4 | 2.3 | 0.45 | 2.3 | 0.05 | 0.27 |
| | 97BMF-133-11-e | 7.4 | 1.6 | 2.1 | 2.4 | 0.42 | 2.2 | 0.05 | 0.22 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | | |
| 1T | 97BMF-133-1-a | 340 | 590 | < 1 | < 2 | 32 | < 1 | < 1 | 380 | 19 |
| | 97BMF-133-1-b | 360 | 620 | 1 | < 2 | 42 | 6 | < 1 | 440 | 13 |
| | 97BMF-133-1-b | 360 | 620 | 1 | < 2 | 42 | 6 | < 1 | 440 | 13 |
| | 97BMF-133-2-a | 400 | 560 | < 1 | < 2 | 43 | < 1 | < 1 | 330 | 12 |
| | 97BMF-133-2-b | 400 | 560 | 2 | < 2 | 45 | 13 | 2 | 320 | 13 |
| | 97BMF-133-3-a | 450 | 560 | < 1 | < 2 | 31 | < 1 | < 1 | 420 | 13 |
| | 97BMF-133-3-b | 350 | 560 | < 1 | < 2 | 30 | 3 | < 1 | 260 | 15 |
| | 97BMF-133-4-a | 470 | 560 | < 1 | < 2 | 40 | < 1 | < 1 | 750 | 10 |
| | 97BMF-133-4-b | 450 | 610 | < 1 | < 2 | 47 | < 1 | < 1 | 400 | 15 |
| | 97BMF-133-4-c | 360 | 640 | < 1 | < 2 | 31 | < 1 | < 1 | 330 | 15 |
| | 97BMF-133-5-a | 460 | 570 | < 1 | < 2 | 40 | 3 | < 1 | 480 | 15 |
| | 97BMF-133-5-b | 370 | 550 | < 1 | < 2 | 37 | < 1 | < 1 | 310 | 15 |
| | 97BMF-133-5-c | 280 | 580 | < 1 | < 2 | 40 | < 1 | < 1 | 250 | 14 |
| | 97BMF-133-6-a | 370 | 510 | < 1 | < 2 | 39 | < 1 | < 1 | 520 | 12 |
| | 97BMF-133-6-b | 300 | 520 | < 1 | < 2 | 38 | < 1 | < 1 | 310 | 17 |
| | 97BMF-133-6-c | 400 | 570 | < 1 | < 2 | 33 | < 1 | < 1 | 340 | 14 |
| | 97BMF-133-7-a | 480 | 560 | < 1 | < 2 | 50 | 2 | < 1 | 790 | 8 |
| | 97BMF-133-7-b | 550 | 640 | < 1 | < 2 | 52 | < 1 | < 1 | 560 | 14 |
| | 97BMF-133-7-c | 540 | 640 | < 1 | < 2 | 43 | 3 | 2 | 260 | 20 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| | 97BMF-133-10-a | 430 | 990 | 1 | < 2 | 41 | 11 | < 1 | 530 | 21 |
| | 97BMF-133-10-b | 460 | 950 | 1 | < 2 | 54 | 5 | 3 | 500 | 18 |
| | 97BMF-133-10-c | 630 | 930 | 1 | < 2 | 43 | 10 | 3 | 570 | 11 |
| | 97BMF-133-11-a | 1600 | 900 | 1 | < 2 | 50 | 15 | 2 | 810 | 13 |
| | 97BMF-133-11-b | 330 | 910 | 1 | < 2 | 44 | < 1 | < 1 | 230 | 8 |
| | 97BMF-133-11-c | 440 | 1100 | 2 | < 2 | 65 | 6 | < 1 | 350 | 14 |
| | 97BMF-133-11-d | 330 | 940 | 1 | < 2 | 87 | 8 | 3 | 300 | 11 |
| | 97BMF-133-11-e | 350 | 910 | 1 | < 2 | 66 | 7 | 2 | 280 | 10 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | | |
| 1T | 97BMF-133-1-a | 17 | 310 | 11 | 120 | 2 | 12 | < 2 | < 4 | 5 |
| | 97BMF-133-1-b | 23 | 200 | 17 | 150 | 5 | 15 | 4 | < 4 | 6 |
| | 97BMF-133-1-b | 23 | 200 | 17 | 150 | 5 | 15 | 4 | < 4 | 6 |
| | 97BMF-133-2-a | 23 | 410 | 11 | 120 | 3 | 14 | < 2 | < 4 | 5 |
| | 97BMF-133-2-b | 24 | 200 | 18 | 91 | 6 | 16 | 6 | 6 | 7 |
| | 97BMF-133-3-a | 17 | 470 | 9 | 130 | 4 | 11 | < 2 | < 4 | 5 |
| | 97BMF-133-3-b | 16 | 300 | 10 | 120 | 4 | 11 | < 2 | < 4 | 5 |
| | 97BMF-133-4-a | 22 | 320 | 10 | 94 | 6 | 15 | < 2 | < 4 | 5 |
| | 97BMF-133-4-b | 26 | 390 | 11 | 120 | 3 | 18 | < 2 | < 4 | 5 |
| | 97BMF-133-4-c | 16 | 330 | 10 | 110 | 3 | 12 | < 2 | < 4 | 5 |
| | 97BMF-133-5-a | 23 | 360 | 10 | 110 | 4 | 15 | < 2 | < 4 | 5 |
| | 97BMF-133-5-b | 21 | 340 | 10 | 120 | 5 | 14 | < 2 | < 4 | 5 |
| | 97BMF-133-5-c | 23 | 320 | 12 | 110 | 3 | 16 | < 2 | < 4 | 5 |
| | 97BMF-133-6-a | 23 | 330 | 9 | 120 | 4 | 15 | < 2 | < 4 | 5 |
| | 97BMF-133-6-b | 20 | 340 | 10 | 110 | 3 | 13 | < 2 | < 4 | 5 |
| | 97BMF-133-6-c | 18 | 300 | 11 | 95 | 3 | 12 | < 2 | < 4 | 5 |
| | 97BMF-133-7-a | 29 | 320 | 9 | 160 | 4 | 19 | < 2 | < 4 | 5 |
| | 97BMF-133-7-b | 30 | 440 | 10 | 120 | 4 | 19 | < 2 | < 4 | 5 |
| | 97BMF-133-7-c | 26 | 250 | 13 | 240 | 4 | 16 | 4 | < 4 | 8 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| | 97BMF-133-10-a | 23 | 36 | 17 | 170 | < 2 | 15 | 7 | 7 | 5 |
| | 97BMF-133-10-b | 31 | 30 | 19 | 200 | < 2 | 19 | 8 | 11 | 6 |
| | 97BMF-133-10-c | 24 | 29 | 19 | 200 | < 2 | 16 | 9 | 10 | 6 |
| | 97BMF-133-11-a | 29 | 48 | 15 | 170 | < 2 | 18 | 7 | 10 | 5 |
| | 97BMF-133-11-b | 26 | 24 | 15 | 130 | < 2 | 16 | 4 | 7 | 4 |
| | 97BMF-133-11-c | 38 | 29 | 19 | 200 | < 2 | 23 | 6 | 13 | 6 |
| | 97BMF-133-11-d | 51 | 27 | 16 | 250 | < 2 | 32 | 6 | 14 | 6 |
| | 97BMF-133-11-e | 39 | 21 | 16 | 240 | < 2 | 24 | 6 | 9 | 5 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **Boulder River** | | | | | | | | | |
| 1T | 97BMF-133-1-a | 13 | 390 | 8 | < 5 | 47 | < 1 | 4 | 220 |
| | 97BMF-133-1-b | 7 | 440 | 7 | < 5 | 67 | < 1 | 7 | 110 |
| | 97BMF-133-1-b | 7 | 440 | 7 | < 5 | 67 | < 1 | 7 | 110 |
| | 97BMF-133-2-a | 15 | 410 | 8 | < 5 | 46 | < 1 | 4 | 340 |
| | 97BMF-133-2-b | 8 | 300 | 8 | 8 | 61 | 1 | 12 | 120 |
| | 97BMF-133-3-a | 22 | 340 | 7 | < 5 | 46 | < 1 | 3 | 340 |
| | 97BMF-133-3-b | 14 | 330 | 7 | < 5 | 51 | < 1 | 5 | 160 |
| | 97BMF-133-4-a | 13 | 360 | 9 | < 5 | 42 | < 1 | 4 | 390 |
| | 97BMF-133-4-b | 21 | 400 | 8 | 7 | 48 | < 1 | 4 | 330 |
| | 97BMF-133-4-c | 13 | 410 | 7 | < 5 | 43 | < 1 | 4 | 190 |
| | 97BMF-133-5-a | 18 | 370 | 10 | 7 | 52 | < 1 | 3 | 460 |
| | 97BMF-133-5-b | 19 | 360 | 8 | < 5 | 53 | < 1 | 4 | 190 |
| | 97BMF-133-5-c | 16 | 410 | 9 | 7 | 51 | < 1 | 5 | 240 |
| | 97BMF-133-6-a | 14 | 400 | 8 | < 5 | 51 | < 1 | 3 | 340 |
| | 97BMF-133-6-b | 15 | 400 | 7 | 8 | 49 | < 1 | 4 | 260 |
| | 97BMF-133-6-c | 14 | 420 | 8 | < 5 | 48 | < 1 | 4 | 230 |
| | 97BMF-133-7-a | 16 | 380 | 9 | 10 | 56 | < 1 | 4 | 350 |
| | 97BMF-133-7-b | 22 | 360 | 9 | 9 | 49 | < 1 | 3 | 520 |
| | 97BMF-133-7-c | 12 | 410 | 7 | 14 | 85 | < 1 | 8 | 240 |

Table 5. Major and trace element data from total digestions of fluvial tailings deposited on a bar in the Boulder River, Boulder River watershed, Montana—(continued)

| Site Number (fig. 2) | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| | 97BMF-133-10-a | < 2 | 610 | < 4 | < 5 | 78 | < 1 | 6 | 120 |
| | 97BMF-133-10-b | < 2 | 620 | 7 | < 5 | 82 | < 1 | 8 | 120 |
| | 97BMF-133-10-c | < 2 | 600 | 6 | < 5 | 86 | < 1 | 8 | 130 |
| | 97BMF-133-11-a | < 2 | 570 | 11 | < 5 | 97 | < 1 | 6 | 160 |
| | 97BMF-133-11-b | < 2 | 640 | 6 | < 5 | 49 | < 1 | 6 | 86 |
| | 97BMF-133-11-c | < 2 | 840 | 10 | < 5 | 69 | 1 | 9 | 100 |
| | 97BMF-133-11-d | < 2 | 690 | 13 | < 5 | 55 | 1 | 10 | 71 |
| | 97BMF-133-11-e | < 2 | 660 | 11 | < 5 | 45 | 1 | 9 | 64 |

Table 6. Lead isotopic data from fluvial tailings and contaminated streambed-sediment samples, Boulder River watershed, Montana

[Data are corrected for mass fractionation; uncertainties are absolute at the 95 percent confidence level and are calculated in the manner of Ludwig (1980)]

| Site No. | Sample No. | Leachable Pb in ppm | $^{206}Pb/^{204}Pb$ | $^{207}Pb/^{204}Pb$ | $^{208}Pb/^{204}Pb$ | $^{207}Pb/^{206}Pb$ | $^{208}Pb/^{206}Pb$ |
|---|---|---|---|---|---|---|---|
| **Contaminant signatures** | | | | | | | |
| 2T | 96-BM-115 (34S) | 1400 | 17.927 ± 0.011 | 15.556 ± 0.014 | 37.992 ± 0.046 | 0.86771 ± 0.00026 | 2.1193 ± 0.0013 |
| 3T | 96-BM-136 (21eS) | 1600 | 17.895 ± 0.011 | 15.552 ± 0.014 | 38.030 ± 0.046 | 0.86905 ± 0.00026 | 2.1252 ± 0.0013 |
| 4T | 96-BM-116 (55S) | 1500 | 17.921 ± 0.011 | 15.558 ± 0.014 | 38.022 ± 0.046 | 0.86816 ± 0.00026 | 2.1217 ± 0.0013 |
| 5T | 96-BM-101 (59S) | 1600 | 18.069 ± 0.012 | 15.548 ± 0.015 | 38.121 ± 0.047 | 0.86047 ± 0.00026 | 2.1098 ± 0.0013 |
| 6T | 96-BM-114 (43S) | 1100 | 17.897 ± 0.015 | 15.544 ± 0.017 | 37.984 ± 0.051 | 0.86851 ± 0.00027 | 2.1224 ± 0.0013 |
| **Overbank fluvial tailings deposits** | | | | | | | |
| 35S | 97-BMS-104G | 6500 | 17.925 ± 0.011 | 15.560 ± 0.014 | 37.997 ± 0.046 | 0.86805 ± 0.00026 | 2.1198 ± 0.0013 |
| 37S | 97-BMS-106G | 2000 | 17.923 ± 0.011 | 15.555 ± 0.014 | 38.000 ± 0.046 | 0.86786 ± 0.00026 | 2.1202 ± 0.0013 |
| 40S | 97-BMS-107GA | 210 | 17.986 ± 0.011 | 15.581 ± 0.014 | 38.129 ± 0.046 | 0.86634 ± 0.00026 | 2.1200 ± 0.0013 |

Table 7. Major and trace element data from the Bullion Smelter slag sample, Jack Creek drainage, Boulder River watershed, Montana

[Major element data from total digestion expressed in weight percent, trace element data and all leachate data expressed in ppm (parts per million) or µg/g, dry weight basis.]

A. Total Digestion Data

| Site Number (fig. 2) | Sample Number | Aluminum percent | Calcium percent | Iron percent | Potassium percent | Magnesium percent | Sodium percent | Phosphorous percent | Titanium percent |
|---|---|---|---|---|---|---|---|---|---|
| **Smelter slag sample** | | | | | | | | | |
| 6T | 96-BM-114 | 3.1 | 7.2 | 21 | 0.90 | 0.52 | 0.26 | 0.07 | 0.14 |

| Site Number | Sample Number | Arsenic ppm | Barium ppm | Beryllium ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Gallium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Smelter slag sample** | | | | | | | | | | |
| 6T | 96-BM-114 | 430 | 360 | 1 | 6 | 30 | 21 | 80 | 3500 | 9 |

| Site Number | Sample Number | Lanthanum ppm | Lead ppm | Lithium ppm | Manganese ppm | Molybdenum ppm | Neodymium ppm | Nickel ppm | Niobium ppm | Scandium ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| **Smelter slag sample** | | | | | | | | | | |
| 6T | 96-BM-114 | 16 | 1300 | 25 | 5000 | 10 | 12 | 9 | 7 | 8 |

| Site Number | Sample Number | Silver ppm | Strontium ppm | Thorium ppm | Tin ppm | Vanadium ppm | Ytterbium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|---|---|
| **Smelter slag sample** | | | | | | | | | |
| 6T | 96-BM-114 | 62 | 140 | 9 | < 5 | 57 | 1 | 14 | 9100 |

Table 7. Major and trace element data from the Bullion Smelter slag sample, Jack Creek drainage,Boulder River watershed, Montana—(continued)

B. Leachate data

| Site Number (fig. 2) | Sample Number | Aluminum ppm | Calcium ppm | Iron ppm | Potassium ppm | Magnesium ppm | Sodium ppm | Phosphorous ppm | Titanium ppm | Antimony ppm | Arsenic ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Smelter slag sample | | | | | | | | | | | |
| 6T | 96-BM-114 | 16000 | 60800 | 169000 | 4800 | 3000 | 300 | 450 | 83 | 18 | 120 |

| Site Number | Sample Number | Barium ppm | Bismuth ppm | Cadmium ppm | Cerium ppm | Chromium ppm | Cobalt ppm | Copper ppm | Lanthanum ppm | Lead ppm | Manganese ppm | Molybdenum ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Smelter slag sample | | | | | | | | | | | | |
| 6T | 96-BM-114 | 79 | 21 | 2.6 | 18 | 9.8 | 57 | 2700 | 11 | 1100 | 4500 | < 1 |

| Site Number | Sample Number | Nickel ppm | Silver ppm | Strontium ppm | Vanadium ppm | Yttrium ppm | Zinc ppm |
|---|---|---|---|---|---|---|---|
| Smelter slag sample | | | | | | | |
| 6T | 96-BM-114 | 4.1 | 53 | 78 | 43 | 10 | 7500 |

Table 8. Statistical summary of ore-related trace-element concentrations in sampled mine wastes, Boulder River watershed, Montana

[Geom. Mean is geometric mean; concentrations expressed in ppm (parts per million), or μg/g, dry weight basis]

| Site (fig. 2) | Arsenic Ppm | Cadmium ppm | Copper ppm | Lead ppm | Silver ppm | Zinc ppm |
|---|---|---|---|---|---|---|
| **Buckeye Mine (3T)[1]** | | | | | | |
| No. Samples | 121 | 120 | 19 | 113 | 66 | 37 |
| Mean | 10400 | 58 | 1100 | 8200 | 68 | 2000 |
| Median | 6000 | 32 | 520 | 1100 | 55 | 440 |
| Geom. Mean | -- | 34 | 750 | -- | 40 | 665 |
| Range | 210-63000 | 5-370 | 300-4800 | 100-93000 | 5-290 | 290-28000 |
| **Bullion Mine (2T)[2]** | | | | | | |
| No. Samples | 196 | 142 | 51 | 192 | 158 | 61 |
| Mean | 2800 | 29 | 1100 | 2750 | 37 | 1650 |
| Median | 2160 | 13 | 730 | 2300 | 27 | 650 |
| Geom. Mean | -- | 15 | 790 | -- | 30 | 860 |
| Range | 60-12600 | 5-1300 | 300-9000 | 100-16100 | 5-130 | 300-17700 |
| **Comet Mine (5T)[3]** | | | | | | |
| No. Samples | 119 | 74 | 34 | 115 | 84 | 48 |
| Mean | 2680 | 42 | 1160 | 2530 | 39 | 2000 |
| Median | 2120 | 14 | 690 | 1910 | 30 | 930 |
| Geom. Mean | -- | 18 | 790 | -- | 31 | 1050 |
| Range | 60-12600 | 5-1300 | 300-9000 | 100-16100 | 6-129 | 300-17700 |
| **Crystal mine (4T)[2]** | | | | | | |
| No. Samples | 13 | 4 | 7 | 12 | 9 | 12 |
| Mean | 2400 | 36 | 760 | 980 | 11 | 1240 |
| Median | 1500 | 14 | 490 | 890 | 9 | 640 |
| Geom. Mean | 1100 | 19 | 630 | 690 | 10 | 730 |
| Range | 140-1110 | 7-110 | 340-1600 | 100-2300 | 6-26 | 300-8000 |
| **Bar in Boulder River (1T)[4]** | | | | | | |
| No. Samples | 27 | -- | 22 | 19 | 19 | 8 |
| Mean | 450 | -- | 460 | 320 | 15 | 380 |
| Median | 400 | -- | 430 | 320 | 14 | 350 |
| Geom. Mean | 420 | -- | 440 | 310 | 14 | 380 |
| Range | 280-1600 | -- | 300-810 | 200-470 | 7-22 | 330-520 |

[1] Geochemical data published in Fey and others (1999a).
[2] Geochemical data published in Fey and others (2000).
[3] Geochemical data published in Fey and Church (1998).
[4] Geochemical data published in table 5, this report.

Table 9. Dendrochronology results from selected sites, Boulder River watershed, Montana

[Results based on the assumption that one growth ring represents one year of growth; sediments in terraces must be at least as old as the trees growing in them. Data provided by the Laboratory for Tree-Ring Research, University of Arizona. Species: CW, Cottonwood; DF, Douglas Fir; LP, Lodgepole Pine; PP, Ponderosa Pine]

| Site No. (fig. 2) | Sample Number | Species | Status | Miniumum Age of Tree | Comments |
|---|---|---|---|---|---|
| **Boulder River** | | | | | |
| 6B | 99 BMT·108 | CW | Live | 1939 A.D. | Complacent ring series; 60 rings (SEC data). |
| **Jack Creek** | | | | | |
| 15B | 98 BMT 404 | DF | Cut 1903(?) | 1642 A.D.(?) | Complacent ring series; 251 rings. Tree cut down to be used in dam for smelter which operated from 1904 - 1906 (Rossillon and Haynes, 1999) . |
| 15B | 99 BMT 110 | | | | |
| | A | LP | Live | 1941 A.D. | Complacent ring series; 58 rings (SEC data). |
| | B | DF | Live | 1637 - 1684 | Complacent ring series; 247 rings. |
| | C | | Live | A.D. | Complacent ring series; 362 rings. |
| | D | | Live | | Complacent ring series; 315 rings. |
| | E | | Live | | Complacent ring series; 316 rings. |
| | F | | Live | | Complacent ring series; 318 rings. |
| 14B | 99 BMT 111 | Pine | Live | 1900 A.D. | Complacent ring series; 99 rings. |
| 14B | 98 BMT 405 | PP | Dead tree | 1841 A.D. | Complacent ring series; 87 rings. Tree killed by flooding of beaver dam with mill tailings from the Bullion Mine, possibly prior to 1934 when forest fire damaged many trees in area. |
| **Uncle Sam Gulch** | | | | | |
| 16B | 97 BMT 116 | PP | Cut 1983 | 1731 A.D. | Complacent ring series; 252 rings. |