MINERALOGY AND GRAIN SIZE OF SURFICIAL SEDIMENT FROM THE LITTLE LOST RIVER AND BIRCH CREEK DRAINAGES, IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO

by

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FACTORS FOR CONVERTING INCH-POUND UNITS TO METRIC (SI) UNITS

For readers who prefer to use International System (SI) units, rather than inch-pound units, the following conversion factors may be used.

Multiply inch-pound units	By	To obtain SI units
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
inch (in.)	25.4	millimeter
square mile (mi^2)	2.590	square kilometer
acre-foot (acre-ft)	1,233	cubic meter

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

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ABSTRACT

The U.S. Geological Survey's project office at the Idaho National Engineering Laboratory, in cooperation with the U.S. Department of Energy, collected 13 samples of surficial sediment from the Little Lost River and Birch Creek drainages during August 1988 for analysis of grain-size distribution, bulk mineralogy, and clay mineralogy. Samples were collected from five sites in the channel of the Little Lost River, two sites from overbank deposits of the Little Lost River, five sites in the channel of Birch Creek, and one site from an overbank deposit of Birch Creek.

Six samples from the Birch Creek channel and overbank deposits had a mean of 7.8 and median of 2.5 weight percent in the less than 0.062 millimeter fraction. The seven samples from the Little Lost River channel and overbank deposits had a mean of 34.5 and median of 23.8 weight percent for the same size fraction. Mineralogy data indicated that Birch Creek had larger mean percentages of quartz and calcite, and smaller mean percentages of total feldspar and dolomite than the Little Lost River deposits. Illite was the dominant clay mineral present in both drainages, but the Little Lost River deposits contained more smectite, mixed-layer clays, and kaolinite than the Birch Creek deposits.

INTRODUCTION

The INEL (Idaho National Engineering Laboratory) covers about 890 mi^2 of the eastern Snake River Plain in southeastern Idaho (fig. 1). The INEL was established in 1949 and is used by the U.S. Department of Energy to test different types of nuclear reactors. The INEL is one of the main centers in the United States for developing the peacetime use of atomic energy, nuclear

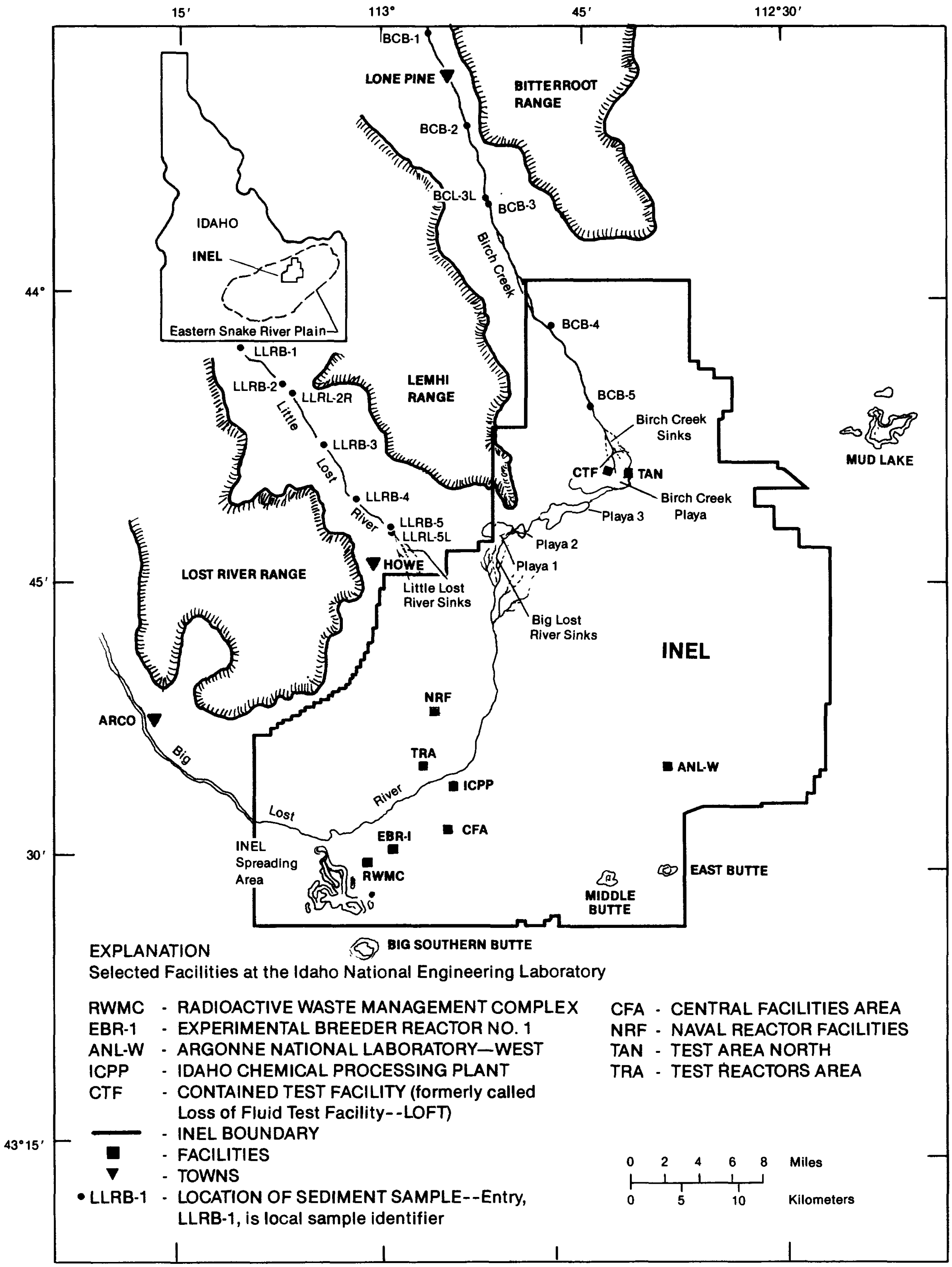

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Figure 1.--Locations of the Idaho National Engineering Laboratory, selected facilities, and sampling sites for surficial sediment.

safety research, defense programs, and advanced energy concepts.

Aqueous chemical and radioactive wastes generated at the INEL were discharged to ponds and wells from 1952 to 1983. Since 1983, most of the aqueous wastes have been discharged to unlined infiltration ponds. Many of the waste constituents enter the Snake River Plain aquifer indirectly following percolation through the unsaturated zone (Pittman and others, 1988, p. 2); however, the movement of some constituents--including some radionuclides--may be retarded by minerals in the unsaturated zone.

A sampling program was conducted to document the mineralogy and grain-size distribution of surficial sediment at selected sites from the Little Lost River and Birch Creek drainages during August 1988. Samples were collected from five sites in the channel of the Little Lost River, two sites from overbank deposits of the Little Lost River, five sites in the channel of Birch Creek, and one site from an overbank deposit of Birch Creek (fig. 1). This report describes the methods used to collect, prepare, and analyze surficial sediment samples and summarizes their mineralogy and grain-size distribution. The sampling program was conducted by the U.S. Geological Survey in cooperation with the U.S. Department of Energy.

Hydrologic Setting

The eastern Snake River Plain is a northeast-trending structural basin about 200 mi long and 50 to 70 mi wide. The plain is underlain by a layered sequence of basaltic lava flows and cinder beds intercalated with alluvium and lakebed sedimentary deposits. Individual flows range from 10 to 50 ft in thickness, although the average thickness may be from 20 to 25 ft (Mundorff and others, 1964, p. 143). The sedimentary deposits consist mainly of beds of sand, silt, and clay with lesser amounts of gravel. Locally, rhyolitic lava flows and tuffs are exposed at the land surface or occur at depth. The basaltic lava flows and intercalated sedimentary deposits combine to form the Snake River Plain aquifer, which is the main source of ground water on the plain. The altitude--relative to sea level--of the water table for the Snake River Plain aquifer in July 1985 and July 1978 ranged from about 4,580 ft in the northern part of the INEL, to about 4,430 ft in the southern part (Pittman and others, 1988, fig. 9; Barraclough and others, 1981, fig. 7). The corresponding depths to water below land surface ranged from about 200 ft in the northern end to as much as 1,000 ft in the southern end (Barraclough and others, 1981, fig. 8). The INEL obtains its entire water supply from the Snake River Plain aquifer.

Much of the northern part of the INEL is contained in a topographically closed depression that includes the Big Lost River Sinks, Little Lost River Sinks, Birch Creek Sinks, the Big Lost River playas--playas 1, 2, and 3--and the Birch Creek playa. The Big Lost River, Little Lost River, and Birch Creek terminate in the Birch Creek playa (Robertson and others, 1974, p. 8) (fig. 1). The INEL also contains several other small, isolated closed basins. Except for years with above normal runoff, flow from the Little Lost River and Birch Creek is diverted for irrigation and power generation and does not reach the INEL playas. The Big Lost River is the primary source of surface water to the INEL, most of which subsequently recharges the Snake River Plain aquifer. Data from May and November 1985 seepage runs on the Big Lost River near the ICPP (Idaho Chemical Processing Plant) (fig. 1) indicate that the river loses from 1.1 to 3.8 (acre-ft/day)/mi depending on the amount of flow in the channel (Mann and others, 1988, p. 17).

Previous Investigations

The U.S. Geological Survey has conducted geologic, hydrologic and water-quality investigations at the INEL since it was selected as a reactor testing area in 1949. Many of the reports generated by these investigations contained data on the physical and chemical characteristics of Snake River Plain aquifer materials. The information published in previous U.S. Geological Survey reports, along with the types of data and the number of analyses for each are summarized in a report by Bartholomay and others (1989). That report also contains information on surficial sediment from the Big Lost River drainage and vicinity.

Acknowledgments

The authors gratefully acknowledge the ISU (Idaho State University) Department of Geology--Dr. Paul K. Link, Chairman--for providing X-ray diffraction equipment, laboratory space, and computer support. Several professors from the Department of Geology deserve special thanks for providing assistance as follows: Dr. H. Thomas Ore provided helpful discussions on grain-size analysis and selection of sampling locations; Dr. Charles W. Blount demonstrated the proper use of the X-ray equipment and helped with computer software; and Dr. William R. Hackett helped to modify the sample preparation techniques for the semiquantitative X-ray method used to identify bulk mineralogy and provided useful discussions on applying the theory of X-ray diffraction to unknown mineral identification.

METHODS

Sample Collection

Sediment samples were collected from 13 sites for mineralogical and grain-size analysis during August 1988. Sampling sites (fig. 1) were selected on the basis of accessibility and topographic setting. Five samples from the Little Lost River channel were collected from point bars (LLRB-1 to LLRB-5), which may contain finer grained material than the rest of the channel deposits (Davis, 1983, p. 254). The five samples were collected at intervals of about 3 to 6 river mi between a location about 25 mi northwest of Howe and a location 1 mi north of Howe (fig. 1). Overbank deposits of the Little Lost River (LLRL-2R and LLRL-5L) were collected from two locations adjacent to two channel deposits (LLRB-2 and LLRB-5) (fig. 1). Five samples from the Birch Creek channel were collected from point bars and transverse braid bars (BCB-1 to BCB-5), which may contain finer grained material than the rest of the channel deposits (Davis, 1983, p. 254; Smith, 1970, p. 2995). The five samples were collected at intervals of about 5 to 8 river mi between a location about 3 mi north of Lone Pine to a location 3 mi north of the Birch Creek Sinks (fig. 1). One overbank deposit from Birch Creek (BCL-3L) was collected adjacent to channel deposit BCB-3 (fig. 1).

The samples were collected by digging a hole approximately 1 to 2 ft deep and filling each of four plastic vials with about 150 g (grams) of sediment from the bottom of the hole. The samples were then labeled and transported to the analyzing laboratory.

Sample Preparation and Analysis

Three of the four vials of sample from each of the 13 sites were used for grain-size analysis. The fourth was used for X-ray diffraction analysis.

Grain-size samples.--The 450 g of sample from the three vials for grain-size analysis was uniformly mixed and passed through standard sieves to determine the distribution of sand-sized and larger material--greater than 0.062 mm (millimeter). Finer-grained samples were split one or two times prior to sieving. The size fractions (0.062-0.125 mm, 0.125-0.25mm, 0.25-0.50mm, 0.50-1.00 mm, 1.00-2.00 mm, 2.00-4.00 mm, and greater than 4.00 mm) were collected and weighed. The distribution of the clay- and silt-sized fractions--less than 0.062 mm--was determined using pipette analysis.

The pipette method of analysis (Folk, 1974, p. 37-39) is based on settling velocity of spherical particles in a fluid; an aliquot of sample was collected from the settling cylinder at predetermined times--derived from Wadell's modification of Stoke's law (Krumbein and Pettijohn, 1938, p. 105-107)--dried, and weighed. Correction factors were applied to the raw data to account for weight changes resulting from adding the dispersing agent--sodium hexametaphosphate--and to adjust the weights to account for the larger volume of the settling cylinder.

The size fractions (less than 0.002 mm, 0.002-0.004 mm, 0.004-0.008 mm, 0.008-0.016 mm, 0.016-0.031 mm, and 0.031-0.062 mm) were collected and weighed. The weights of the various fractions were converted to weight percents of the bulk samples.

X-ray diffraction samples.--X-ray diffraction analysis was used to determine bulk mineralogy of all particles in a sample less than 0.5 mm in diameter and clay mineralogy of particles less than 0.004 mm in diameter. Clay mineralogy was only determined on samples that had clay present in the bulk analysis. For bulk mineralogy, the 150 g of sample from the vial for X-ray diffraction analysis was passed through a 0.5 mm sieve. A representative sample--approximately 2 g of sediment that passed through the 0.5 mm sieve--was ground for 8 minutes in a ball and mill device to reduce grain size and to homogenize the sample. The sample was subsequently ground with a mortar and pestle until all of the sample passed through a 0.062 mm sieve. The powdered sample was packed into an aluminum holder and scanned with a diffractometer using copper Kα (wavelength of the characteristic line) radiation at a rotation rate of 1 degree 2 theta per minute. The generator was operated at 35 kilovolts and 15 milliamps. Diffractograms were prepared at a scale factor of 4, a multiplier of 1, and a time constant of 4.

Semiquantitative analysis was used to determine the relative abundances of minerals in the samples. A modification of the method described by Diebold and others (1963) and Schultz (1964) was used to obtain the relative mineral percentages. The raw percentage of each mineral was calculated by dividing the intensity of each mineral peak height by the intensity of its pure standard. The raw percentages were normalized to 100 percent. The intensities of the pure standards were calculated from standard minerals provided by the ISU Department of Geology. Because peaks of the detrital micas, such as muscovite and biotite, overlap with the clay mineral illite, detrital mica and total clays were reported together when both types of minerals were present in a sample. Schultz (1964, p. C1) reported uncertainties of ±10 percent for minerals that make up at least 15 percent of the sample. Diebold and others (1963, table 5, p. 130) calculated weight percents within ±8 percent of the true concentrations using a 95-percent confidence interval.

For samples that had total clay present in the bulk mineralogy analyses, a qualitative identification of individual clay minerals was undertaken. Approximately 1 g of the sample material less than 0.5 mm in diameter was added to a 500 mL (milliliter) beaker of deionized water along with about 0.2 g of sodium hexametaphosphate--a dispersing agent--and stirred for 1 to 2 minutes. Equal volumes of the suspension were placed in two centrifuge tubes and centrifuged at 600 revolutions per minute for 2 minutes. After centrifugation, only particles less than 0.004 mm in diameter remained in suspension. The liquid containing the suspended particles was transferred to a glass thin-section slide and dried at room temperature.

The slides were scanned with a diffractometer using copper Kα radiation at a rotation rate of 1 degree 2 theta per minute. The generator was operated at 35 kilovolts and 15 milliamps. Diffractograms were prepared at a scale factor of 2, a multiplier of 1, and a time constant of 4. The samples were glycolated and rescanned to differentiate between smectite and chlorite clays. Smectite expands from 14 to 17 A (angstrom units) when ethylene glycol replaces water in the mineral lattice. The expansion was achieved by exposing the clay slides to an ethylene glycol atmosphere for 24 hours.

The results reported by the ISU X-ray diffraction laboratory for the 10 samples analyzed for clay mineralogy give qualitative estimates of the abundance of clay minerals in the samples. The estimates were based on the relative heights of the clay-mineral peaks on the X-ray diffractograms. Five categories were designated in order of decreasing abundance: dominant, major, minor, trace, and possibly present.

GRAIN-SIZE DISTRIBUTION OF SURFICIAL SEDIMENT

The distribution of grain size for 13 samples from the Little Lost River and Birch Creek drainages is given as weight percents in tables 1 and 2 (all tables are located at end of report). A statistical summary of the data for each drainage system is given in table 3. Overall, the Birch Creek channel and overbank deposits are coarser than the Little Lost River channel and overbank deposits. For example, six samples from Birch Creek had mean and median weight percents of 7.8 and 2.5, respectively, for the size fraction smaller than 0.062 mm (table 3). Conversely, seven samples from the Little Lost River had mean and median weight percents of 34.5 and 23.8, respectively, for the same size fraction (table 3). The minimum, maximum, median, and mean values for all size fractions for channel deposits and channel and overbank deposits for the two drainage systems are listed in table 3. Curves showing the cumulative percentages by weight for each of the 13 samples are shown in figures 2 and 3. For this report, size fractions of <0.002 mm (tables 1-3) were reported because clay minerals probably are the predominant constituent.

MINERALOGY OF SURFICIAL SEDIMENT

The mineralogy of seven bulk samples and six clay samples from the Little Lost River is listed in table 4. The mineralogy of six bulk samples and four clay samples from Birch Creek is listed in table 5. Three of the samples in tables 4 and 5 did not contain clay minerals and X-ray slides were not prepared. A statistical summary of the semiquantitative bulk mineralogy is given in table 6.

Statistical parameters for the semiquantitative bulk mineral analysis for Birch Creek and the Little Lost River (table 6) show that Birch Creek had larger mean percentages of quartz and calcite--44 and 28, respectively--than the Little Lost River--32 and 16, respectively. The Little Lost River had larger mean percentages of total feldspar and dolomite--29 and 10, respectively--than Birch Creek--15 and 4, respectively (table 6). Detrital mica was present in some of the Little Lost River samples, but was not present in the Birch Creek samples (tables 4 and 5).

Qualitative determination of clay mineralogy for the Little Lost River and Birch Creek drainages indicated that illite was the dominant clay mineral present (tables 4 and 5). Smectite and mixed layer clay minerals were in major abundance in four samples from the Little Lost River, but only

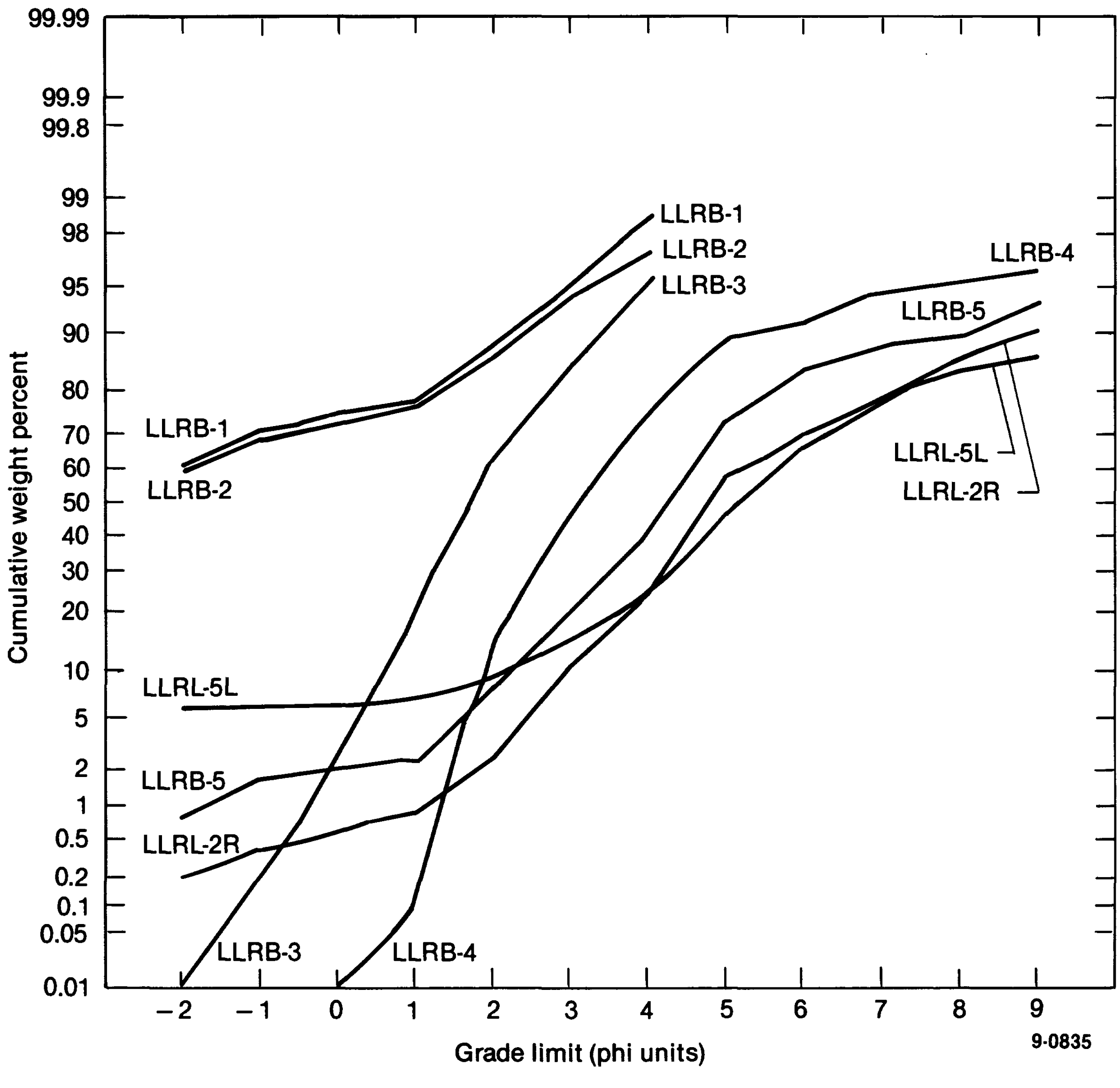

Figure 2.--Cumulative weight percent versus grade limits for grain-size analyses of surficial sediment from the Little Lost River (locations are shown in fig. 1).

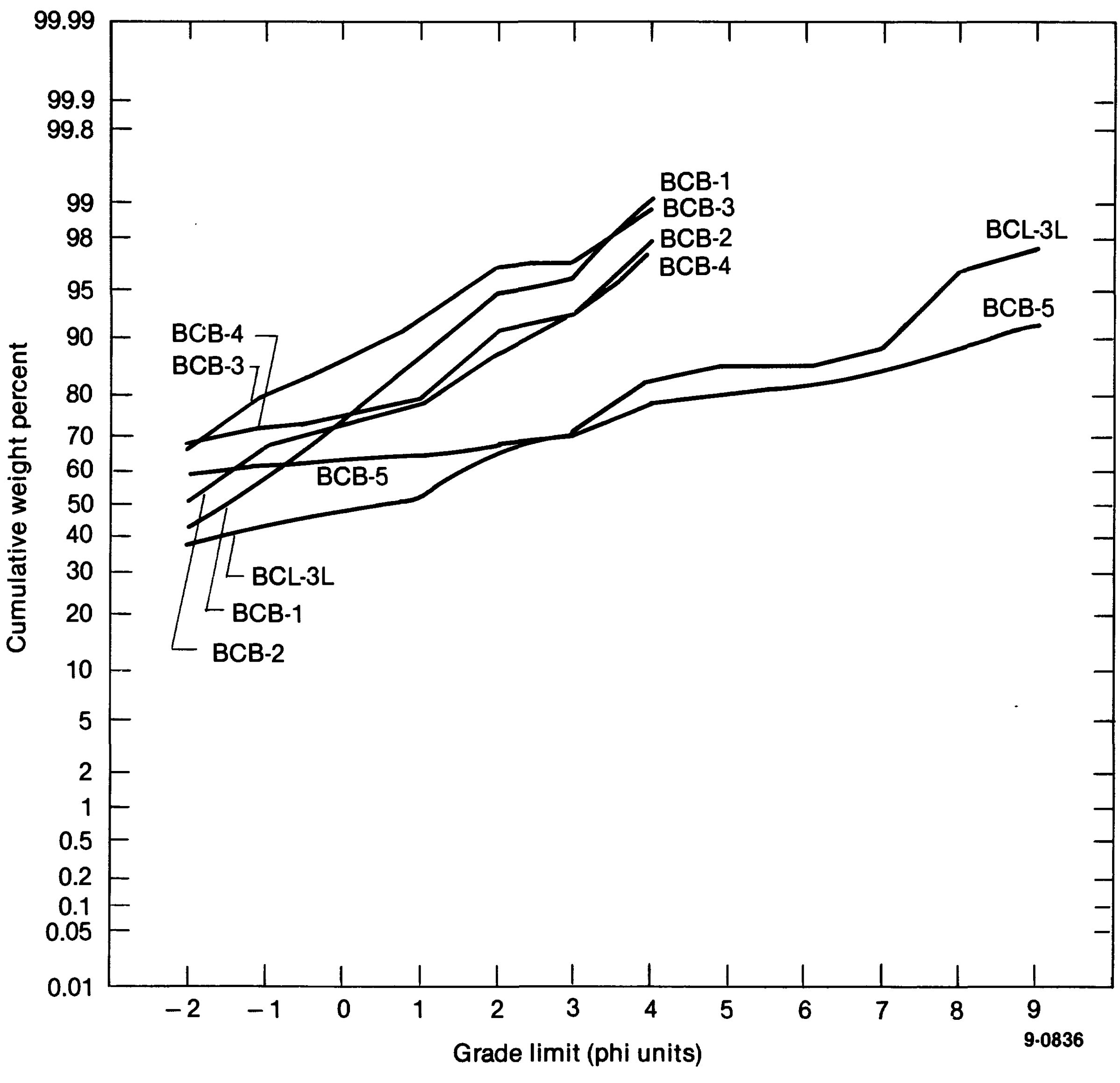

Figure 3.--Cumulative weight percent versus grade limits for grain-size analyses of surficial sediment from Birch Creek (locations are shown in fig. 1).

one sample from Birch Creek contained a trace of smectite and the possible presence of mixed-layer clays (tables 4 and 5). Kaolinite was present in variable amounts in four samples from the Little Lost River but only one sample from Birch Creek had possible kaolinite. Some of the samples had traces of quartz and calcite in the less than 0.004 mm fraction.

SUMMARY

The U.S. Geological Survey's project office at the INEL, in cooperation with the U.S. Department of Energy, collected 13 samples of surficial sediment from Little Lost River and Birch Creek drainages during August 1988 for analysis of grain-size distribution, bulk mineralogy, and clay mineralogy. Samples were collected from five sites in the channel of the Little Lost River, two sites from overbank deposits of the Little Lost River, five sites in the channel of Birch Creek, and one site from an overbank deposit of Birch Creek.

Semiquantitative X-ray diffraction analysis was used to determine bulk mineralogy. Individual clay minerals were identified in 10 samples. Sieve and pipette analyses were used to determine grain-size distribution.

The six Birch Creek channel and overbank deposits had a mean of 7.8 and median of 2.5 weight percent in the less than 0.062 mm fraction. The seven Little Lost River samples had a mean of 34.5 and median of 23.8 weight percent for the same size fraction. Mineralogy data indicated that Birch Creek had larger mean percentages of quartz and calcite, and smaller mean percentages of total feldspar and dolomite than the Little Lost River deposits. Illite was the dominant clay mineral present in both drainages, but the Little Lost River deposits contained more smectite, mixed-layer clays, and kaolinite than the Birch Creek deposits.

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Table 1.--Grain-size distribution for the Little Lost River channel and overbank deposits, in weight percent

[Symbols: < indicates value is less than indicated number; > indicates value is greater than indicated number. Grade name: Categories modified from the Wentworth scale (Dietrich and others, 1982, p.17.1).]

Sample identifier			LLRB-1	LLRB-2	LLRL-2R	LLRB-3	LLRB-4	LLRB-5	LLRL-5L
Date sampled			08/16/88	08/16/88	08/16/88	08/16/88	08/16/88	08/16/88	08/12/88
Grade limits									
Millimeters	Phi	Grade name	Weight percent						
>4.0	<-2	Other gravels	61.4	59.3	0.2	0	0	0.8	5.8
2.0-4.0	-1 to -2	Very fine gravel	9.7	8.8	0.2	0.2	0	0.9	0.2
1.0-2.0	0 to -1	Very coarse sand	4.2	4.7	0.2	2.7	0	0.4	0.1
0.5-1.0	1 to 0	Coarse sand	2.8	3.8	0.3	18.7	0.1	0.4	0.9
0.25-0.5	2 to 1	Medium sand	10.4	10.1	1.7	42.0	13.5	4.9	2.2
0.125-0.25	3 to 2	Fine sand	6.5	7.5	8.2	21.8	32.3	12.6	5.9
0.062-0.125	4 to 3	Very fine sand	3.5	3.0	13.3	10.3	30.1	21.5	9.8
0.031-0.062	5 to 4	Coarse silt	Pipette	Pipette	23.5	Pipette	13.8	31.6	33.4
0.016-0.031	6 to 5	Medium silt	analysis	analysis	19.2	analysis	1.6	11.2	11.9
0.008-0.016	7 to 6	Fine silt	not	not	10.7	not	3.2	3.7	9.5
0.004-0.008	8 to 7	Very fine silt	done,	done,	8.5	done,	0.8	1.9	4.8
0.002-0.004	9 to 8	Coarse clay	total	total	4.3	total	0.8	3.7	2.4
<0.002	>9	Clay	= 1.3	= 2.9	9.6	= 4.3	3.6	6.5	13.1

Table 2.--Grain-size distribution for Birch Creek channel and overbank deposits, in weight percent

[Symbols: < indicates value is less than indicated number; > indicates value is greater than indicated number. Grade name: Categories modified from the Wentworth scale (Dietrich and others, 1982, p.17.1).]

Sample identifier			BCB-1	BCB-2	BCB-3	BCL-3L	BCB-4	BCB-5
Date sampled			08/19/88	08/19/88	08/19/88	08/19/88	08/19/88	08/19/88
Grade limits								
Millimeters	Phi	Grade name	Weight percent					
>4.0	<-2	Other gravels	42.7	51.1	66.2	37.9	67.3	58.8
2.0-4.0	-1 to -2	Very fine gravel	15.8	15.5	13.8	5.8	4.7	2.9
1.0-2.0	0 to -1	Very coarse sand	14.4	5.8	6.4	4.1	2.3	1.1
0.5-1.0	1 to 0	Coarse sand	13.7	5.2	5.6	4.2	4.9	1.4
0.25-0.5	2 to 1	Medium sand	8.0	9.6	4.5	13.0	11.3	3.1
0.125-0.25	3 to 2	Fine sand	1.2	5.2	0.4	5.4	2.2	2.6
0.062-0.125	4 to 3	Very fine sand	3.2	5.3	1.9	12.5	4.6	7.6
0.031-0.062	5 to 4	Coarse silt	Pipette	Pipette	Pipette	2.4	Pipette	2.3
0.016-0.031	6 to 5	Medium silt	analysis	analysis	analysis	0.4	analysis	1.7
0.008-0.016	7 to 6	Fine silt	not	not	not	2.4	not	2.8
0.004-0.008	8 to 7	Very fine silt	done,	done,	done,	8.3	done,	4.0
0.002-0.004	9 to 8	Coarse clay	total	total	total	1.2	total	3.4
<0.002	>9	Clay	= 1.1	= 2.3	= 1.2	2.6	= 2.7	8.3

Table 3.--Summary of statistical parameters for grain-size data of surficial sediment for the Little Lost River and Birch Creek drainages

[Units are weight percents and are derived from tables 1 and 2. Grade limits: >4.0 indicates sum of all sizes larger than 4.0 millimeters; <0.062 indicates the sum of all sizes smaller than 0.062 millimeters; <0.002 indicates the sum of all sizes smaller than 0.002 millimeters.]

Grade limits (millimeters)	Statistical parameters				Sample size
	Minimum	Maximum	Median	Mean	
	[Little Lost River channel deposits]				
>4.0	0	61.4	0.8	24.3	5
2.0-4.0	0	9.7	0.9	3.9	5
1.0-2.0	0	4.7	2.7	2.4	5
0.5-1.0	0.1	18.7	2.8	5.2	5
0.25-0.5	4.9	42.0	10.4	16.2	5
0.125-0.25	6.5	32.3	12.6	16.1	5
0.062-0.125	3.0	30.1	10.3	13.7	5
<0.062	1.3	58.6	4.3	18.2	5
	[Birch Creek channel deposits]				
>4.0	42.7	67.3	58.8	57.2	5
2.0-4.0	2.9	15.8	13.8	10.5	5
1.0-2.0	1.1	14.4	5.8	6.0	5
0.5-1.0	1.4	13.7	5.2	6.2	5
0.25-0.5	3.1	11.3	8.0	7.3	5
0.125-0.25	0.4	5.2	2.2	2.3	5
0.062-0.125	1.9	7.6	4.6	4.5	5
<0.062	1.1	22.5	2.3	6.0	5
	[Birch Creek channel and overbank deposits]				
>4.0	37.9	67.3	54.95	54.0	6
2.0-4.0	2.9	15.8	9.8	9.8	6
1.0-2.0	1.1	14.4	4.95	5.7	6
0.5-1.0	1.4	13.7	5.05	5.8	6
0.25-0.5	3.1	13.0	8.8	8.2	6
0.125-0.25	0.4	5.2	2.4	2.8	6
0.062-0.125	1.9	12.5	4.95	5.8	6
<0.062	1.1	22.5	2.5	7.8	6
	[Little Lost River channel and overbank deposits]				
>4.0	0	61.4	0.8	18.2	7
2.0-4.0	0	9.7	0.2	2.9	7
1.0-2.0	0	4.7	0.4	1.8	7
0.5-1.0	0.1	18.7	0.9	3.9	7
0.25-0.5	1.7	42.0	10.1	12.1	7
0.125-0.25	5.9	32.3	8.2	13.5	7
0.062-0.125	3.0	30.1	10.3	13.1	7
0.031-0.062	13.8	33.4	27.55	25.6	4
0.016-0.031	1.6	19.2	11.55	11.0	4
0.008-0.016	3.2	10.7	6.6	6.8	4
0.004-0.008	0.8	8.5	3.35	4.0	4
0.002-0.004	0.8	4.3	3.05	2.8	4
<0.002	3.6	13.1	8.05	8.2	4
<0.062	1.3	75.8	23.8	34.5	7

Table 4.--Mineralogy of bulk and clay samples by X-ray diffraction analysis for the Little Lost River

[Symbols: -----5----- number is the sum of percents for detrital mica and total clays; ND indicates not detected. Bulk analyses: Semiquantitative analysis. Clay analyses: dom indicates mineral is dominant; maj indicates mineral is major in abundance; min indicates a minor amount; tr indicates mineral is present in a trace amount; poss indicates mineral is possibly present.]

		Bulk analyses (in percent mineral abundance)							
Sample identi-fier	Date sampled	Quartz	Plagio-clase feldspar	Potas-sium feldspar	Calcite	Pyroxene	Dolomite	Detrital mica	Total clays
LLRB-1	08/16/88	38	22	15	5	12	8	0	0
LLRB-2	08/16/88	40	12	11	26	0	7	------5-----	
LLRL-2R	08/16/88	24	11	8	25	0	14	-----18-----	
LLRB-3	08/16/88	31	24	11	10	10	10	------4-----	
LLRB-4	08/16/88	27	14	13	20	0	11	-----15-----	
LLRB-5	08/16/88	32	18	12	13	0	11	-----15-----	
LLRL-5L	08/12/88	30	17	12	15	0	12	-----14-----	

		Clay analyses (qualitative analysis)							
Sample identi-fier	Date sampled	Illite	Smectite	Kaolinite	Mixed layer	Chlorite	Quartz	Feldspar	Calcite
LLRB-2	08/16/88	poss	ND	ND	ND	ND	ND	ND	ND
LLRL-2R	08/16/88	dom	maj	tr	maj	ND	ND	ND	tr
LLRB-3	08/16/88	poss	ND	ND	ND	ND	ND	ND	ND
LLRB-4	08/16/88	dom	maj	min	maj	ND	ND	ND	tr
LLRB-5	08/16/88	maj	maj	poss	maj	ND	ND	ND	ND
LLRL-5L	08/12/88	dom	maj	poss	maj	poss	poss	ND	ND

Table 5.--Mineralogy of bulk and clay samples by X-ray diffraction analysis for Birch Creek

[Symbols: ND indicates not detected. Bulk analyses: Semiquantitative analysis. Clay analyses: dom indicates mineral is dominant; maj indicates mineral is major in abundance; min indicates mineral is present in a minor amount; tr indicates mineral is present in a trace amount; poss indicates mineral is possibly present.]

Sample identifier	Date sampled	Bulk analyses (in percent mineral abundance)							
		Quartz	Plagioclase feldspar	Potassium feldspar	Calcite	Pyroxene	Dolomite	Detrital mica	Total clays
BCB-1	08/19/88	54	8	10	26	0	2	0	0
BCB-2	08/19/88	34	6	9	37	0	4	0	10
BCB-3	08/19/88	52	6	9	25	6	2	0	0
BCL-3L	08/19/88	37	7	11	22	0	5	0	17
BCB-4	08/19/88	52	6	9	22	0	4	0	7
BCB-5	08/19/88	33	6	4	36	0	6	0	16

Sample identifier	Date sampled	Clay analyses (qualitative analysis)							
		Illite	Smectite	Kaolinite	Mixed layer	Chlorite	Quartz	Feldspar	Calcite
BCB-2	08/19/88	min	ND	ND	ND	ND	min	ND	ND
BCL-3L	08/19/88	dom	ND	poss	ND	ND	tr	ND	ND
BCB-4	08/19/88	maj	poss	ND	ND	ND	tr	ND	min
BCB-5	08/19/88	dom	tr	ND	poss	ND	tr	ND	ND

Table 6.--Summary of statistical parameters for bulk mineralogy of surficial sediment for the Little Lost River and Birch Creek drainages

[Units are percent mineral abundance and are derived from tables 4 and 5]

Mineral	Statistical parameter				
	Minimum	Maximum	Median	Mean	Sample size
[Little Lost River channel and overbank deposits]					
Quartz	24	40	31	32	7
Total feldspar	19	37	29	29	7
Calcite	5	26	15	16	7
Pyroxene[1]	0	12	0	3	7
Dolomite	7	14	11	10	7
Detrial mica and total clays	0	18	14	10	7
[Birch Creek channel and overbank deposits]					
Quartz	33	54	44.5	44	6
Total feldspar	10	18	15	15	6
Calcite	22	37	25.5	28	6
Pyroxene	0	6	0	1	6
Dolomite	2	6	4	4	6
Detrial mica	0	0	0	0	6
Total clays	0	17	8.5	8	6

[1]Only 2 samples contained a discernible amount of pyroxene.