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A study of porewater in water saturated sediments of levee banks and marshes in the lower Coeur d'Alene River valley, Idaho: Sampling, Analytical Methods, and Results

by

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ABSTRACT

This report contains information about the composition of interstitial porewater and solids from water saturated, metal contaminated levee banks at the river's edge and marshes in the lower Coeur d'Alene River valley. Data include pH, alkalinity, and concentrations of sulfate and metals (arsenic [As], cadmium [Cd], copper [Cu], iron [Fe], mercury [Hg], manganese [Mn], lead [Pb], antimony [Sb], and zinc [Zn]) in porewater and sulfur (S), carbon (C), and metal contents of associated solids. The results indicate that the pH of the porewater in all of the sediments is less than the pH of the Coeur d'Alene River. Dissolved concentrations of Mn and Fe are elevated in all of the porewater and levels of sulfate in porewater are below detection limits in almost all marsh sediments and in levee banks at the 2 sites furthest downstream. These observations suggest that levee bank and marsh sediments are suboxic or anoxic below the surface. Concentrations of dissolved Cd are greater in the Coeur d'Alene River than in porewater, while concentrations of As are greater in the porewater relative to the Coeur d'Alene River. Some concentrations of Cu, Pb, Sb, and Zn in porewater are lower, while others are higher, than dissolved concentrations in the Coeur d'Alene River. In addition, leaching experiments (i.e., Standard Elutriate Tests [SET]) were done in the laboratory to evaluate potential water quality impacts resulting from the addition of oxygen and water to these sediments. The intent of the experiments was to simulate how metal concentrations in water may be affected during dredging of contaminated sediments in the lower Coeur d'Alene River valley. The results indicate that there are releases of protons, sulfate, As, Mn, Pb, Sb, and Zn from the majority of levee bank and marsh sediments during leaching by Coeur d'Alene River water. At a water to sediment ratio of 4 to 1, most values of pH and dissolved concentrations of Cd, Fe, Pb, and Zn in the leaching solutions exceed the freshwater aquatic life standards for water of a hardness of 100 mg $CaCO_3$/L. This work was funded by the U.S. EPA and was done to support their Remedial Investigation/Feasibility Study of the Coeur d'Alene and Spokane River basins.

INTRODUCTION

The Coeur d'Alene mining district is located in the north central Bitterroot Range in northern Idaho and western Montana. This district has produced 34,300 metric tons of silver, 7,288,300 metric tons of lead, and 2,870,000 metric tons of zinc since mining began in the region during the 1880s (Long, 1998). It is considered to be the largest silver-producing district in the world.

The commercial mining companies used jigging and flotation methods to concentrate the economically valuable minerals. These methods produced large amounts of tailings. Much of these tailings were enriched in metals, primarily zinc, because of the inefficiency of mineral separation during processing. Prior to the installation of tailings ponds in 1968, the principal method of disposal of the tailings was into the South Fork of the Coeur d'Alene River valley and its tributaries. A preliminary accounting by Long (1998) has estimated that 56 million metric tons of tailings containing 2,200 metric tons of silver, 800,000 metric tons of lead, and, at least, 650,000 metric tons of zinc were dumped into the river systems. A portion of this material, estimated at greater than 15 million metric tons, was subsequently dredged and either re-processed or placed in impoundments within the valley. Flooding within the Coeur d'Alene River system has re-distributed and continues to re-distribute metal enriched material between the river channel, the floodplain, and the sediments of Lake Coeur d'Alene (Horowitz and others, 1993a,b).

Development of effective remediation plans for the Coeur d'Alene and Spokane River basins requires an understanding of the distribution and composition of aqueous and solid phase materials throughout the system and, ultimately, the processes that result in the mobilization, transport, and fate of metals associated with these materials. Towards that end, this report provides information on the composition of porewaters and associated solid phases at a dozen sites within the lower Coeur d'Alene River valley. Sites were chosen to represent two types of environments – water saturated levee banks near the edge of the Coeur d'Alene River and back-levee marshes. In addition, results from a set of leaching experiments on the solid phases and associated porewater are presented. These experiments were done to provide information on potential metal release or uptake by sediments during dredging operations.

STUDY AREA

A total of 12 sites in the lake-backflooded reach of the lower Coeur d'Alene River valley between Cataldo and Harrison were selected for sampling of porewaters from saturated soils during drawdown of Lake Coeur d'Alene in the fall. Sampling was undertaken during the week of November 2-9, 1998. During this time, the water level in Lake Coeur d'Alene fell about 0.1 m and was about 1 m below its summer pool level. Porewaters were sampled from levee bank sediments at the edge of the Coeur d'Alene River and from back-levee marsh environments. Porewater was sampled at 2-4 shallow (< 50 cm) depth horizons within the historic, metal-enriched sediments that have been deposited since mining began. The locations of the sites are shown in Figure 1 and summarized in Table 1.

The stratigraphy of the two environments is distinctly different and results from variations in their depositional settings. The stratigraphy of the levee banks at the river's edge is characterized by alternating thin (1-3 cm) layers of sand and silt, with rare, thin plant-debris-rich horizons. Typically, sands coarser than very fine grained (grains coarser than 0.125 mm) in the upper 20-40 cm of the section have irregular red-brown iron oxide stains, whereas interbedded silts and very fine sands or more deeply buried fine sands and coarser are gray or green-gray in color. Where the sample site is situated on the inside of a gently curving river segment (sites 98R1, 98K1 and 98M1), the thickness of the historic, metal-enriched sediments greatly exceeds 50 cm. Where the sample site is situated on a straight section or on the outside of a gently curving river segment (sites 98C1, 98T1), the historic, metal-enriched sediments are a relatively thin veneer (14-34 cm) over lithologically similar, metal-poor pre-mining sediments.

The stratigraphy of the marsh environment is much more dominated by plant materials. The upper horizon of historic, metal-enriched sediment ranges from 40 to >70 cm thick and is typically subdivided into an upper horizon rich in black composting plant material (+/- 20 cm), and a lower horizon of banded gray silt with pervasive fibrous root material and occasional organic-rich seams. The pre-mining section immediately below the historic sediments is characterized by silt-poor peat. The stratigraphy of the cores collected from the individual sites is given in Table 2.

Site 98C1— Cataldo-levee bank (Cataldo quadrangle)

This sample site is located on the north side of the river on the river's edge bench about 5 m toward the river from the 2.5 m cutbank and about 12 m downstream from the pier at the Cataldo boat landing. Immediately shoreward of the bank is an extensive area of historic sandy dredge spoils dredged from the channel from 1932 to the 1960's, overlain by and partly incorporated into the I-90 highway embankment. The river's edge bench is characterized by abundant seeps of water and orange brown precipitates, probably Fe oxide phases. The stratigraphy of the 46 cm core collected at this site shows a 14 cm metal-enriched layer of medium to coarse-grained sand with an orange brown Fe stain, overlying a gray section of very fine sand/silt with a few 2-5 cm medium grained sand layers. The upper two porewater samples (5 & 10 cm) were derived from the upper metal-enriched section, while the lower two (20 & 35 cm) were extracted from the gray pre-mining section. Scattered debris along the adjacent bench of large metal pipes and other metal debris left from the dredging operation suggest little historic sediment deposition on this bench. The metal-enriched layer is oxidized, probably as a result of subaerial exposure during winter lake drawdown.

Site 98C2— Cataldo-marsh (Cataldo quadrangle)

This sample site is located within the historic slough used for the steamboat landing at the Cataldo Mission. The downstream end of the slough joins the river at the Cataldo boat landing. Much of the slough is filled by historic deposits, leaving a series of discontinuous ponds separated by exposed marshy grounds. The sample site is located in the marshy ground between the first two remnant ponds downstream of the Cataldo Mission hill. The sample site is mostly bare of vegetation. The stratigraphy of the 71 cm core collected here shows a layered sequence of tan to dark green-gray fine to very fine sand, all of which is historic metal-enriched sediment. The upper 25 cm of very fine sand (upper porewater sample at 20 cm) contains abundant, partially composted organic debris, while the 25-37 cm interval (lower porewater sample at 30 cm) consists of mottled to massive fine sand with no layering and little visible organic detritus. The section below 37 cm is finely laminated fine and very fine sand with a couple of 1 cm silt layers at 50 and 68 cm. It is inferred that the historic channel fill material was deposited after 1937, when airphotos show a continuous water-filled channel.

Site 98R1— Rose Lake-levee bank (Rose Lake quadrangle)

This site is located on the north side of the river on the river's edge bench about 3 m riverward from the water level at summer pool. A sloping, depositional bank rises about 2.5 m above summer pool level to a 200 m wide sandy flat on the riverward side of the Highway 3 roadbed. The stratigraphy of the 45 cm core collected here shows orange-brown medium sand with three 2-4 cm interbeds of gray very fine-grained sand with fibrous organic matter at 15, 27, and 32 cm depths. The entire section consists of metal-enriched sediments. The three porewater samples (5, 20, and 35 cm depths) are all in the Fe-stained medium-grained sand intervals.

Site 98R2 — Rose Lake-Porter Slough-marsh (Rose Lake quadrangle)

This site is located in Porter Slough just north of the river and the road. The sample site is on the edge of standing water in the slough in between clumps of grassy vegetation on a bare mud surface and is situated about 20 m west of the eastern shallow inflow channel from the river into the slough. At one time a bridge crossed over the inflow channel, but it was replaced by road fill with a 46 cm culvert in the 1960's(?) when the inflow channel was straightened and deepened. The culvert bottom sits at about 648 m, about 0.5 m above river elevation on the sampling date, resulting in a higher water level in the slough than in the river. Jess White, whose land abuts the sample site, remembers the Slough essentially draining in the 1940's, with the sample site occupied by woody brush. The stratigraphy of the 65 cm core consists of a 25 cm thick rooty composting vegetation mat with silt overlying medium-fine-grained sand to 38 cm depth. This metal-enriched sediment overlies a pre-mining section of silty black peat. Porewater was sampled at 10 and 20 cm depth within the silty organic debris mat; attempts to recover water from 40 cm (within the pre-mining peat) were unsuccessful. The sandy basal part of the metal-enriched section was probably deposited prior to modification of the inflow channel and its connection to the river.

Site 98K1— Killarney-levee bank (Lane quadrangle)

This site is located on the west side of the river near Killarney Lake on the river's edge bench about 2.5 m riverward from the water level at summer pool. The site is on the inside of a gradual bend in the river, located on a 3-4 m thick historic metal-enriched point bar deposit. The 44 cm core that was collected is entirely historically deposited metal-enriched sediment. The stratigraphy of the section consists of an upper 22 cm of medium and fine-grained sand with orange-brown mottling overlying a well-laminated gray section of very fine to medium-grained sands separated by 1-2 cm pale gray silts at 28, 32, 35, and 43 cm. Porewater sample depths of 10 and 20 cm were both within a massive medium-grained, Fe stained sand layer. Several attempts to extract water from gray silts and sands at 40 cm were unsuccessful. The prominent color break at 22 cm may reflect the depth of oxidation during winter lake drawdown or deposition after some date (1968) when more oxidized materials were deposited. The layering preserved in that upper oxidized horizon indicates that horizon was deposited in several (6-8) high flow events, rather than representing sediments re-mobilized in the most recent events.

Site 98K2— Killarney-marsh (Lane quadrangle)

This site is located in a horsetail marsh just east of Killarney Lake nearly a kilometer from the river's edge. The area is located downgradient of a low-levee flood spillover area noted during the floods of 1995 and 1996. The horsetail-laden marsh soil was difficult to core, and the upper 8 cm were removed prior to coring. Uncertainties in core recovery led to direct sampling of solid material from the sides of the core hole. The stratigraphy (interpreted from the 51 cm core penetration) consists of 40 cm of metal-enriched silt overlying about 10 cm of pre-mining peat. The metal-enriched horizon consists of 20 cm of black composting plant material with interstitial silt overlying a 20 cm thick gray banded silt with occasional plant debris-rich seams. Porewater was extracted from 15 and 30 cm depths within the metal enriched section. Attempts to extract porewater from 50 cm depth within the pre-mining peat were unsuccessful.

Site 98K3— Killarney-lake shore marsh (Lane quadrangle)

This site is located on a bare mud apron that borders the east side of Killarney Lake at this water level (647.6 m), lakeward of the horsetail marsh. An angular block dike embankment with culverts that was in place prior to 1933 separates the area from the site of 98K2. The stratigraphy of the 56 cm core consists of 53 cm of peaty metal-enriched silt overlying 3 cm of brown pre-mining peat. Porewater samples at 10, 25 and 40 cm were extracted from metal-enriched silt layers with internal fibrous plant root material.

Site 98M1— Medimont-levee bank (Medimont quadrangle)

This site is located on the east (south) side of the river at the river's edge of the riveredge bench, about 200 m upstream of the inlet to Medicine Lake. The site is on the inside of a gentle curve, presumably overlying a 3-4 m thick metal-enriched point bar deposit, and is situated about 8 m from the foot of a 5-foot cutbank of Fe-stained metal-enriched sediment. The 36 cm core consists of an upper 20 cm of tan medium-fine grained sand with irregular red-brown seams overlying a 16 cm section of well-laminated gray very fine sand with thin silt horizons. An additional core penetrated to 73 cm, still in metal-enriched fine sands and silts. Two of the porewater samples were recovered from the oxidized upper section (5 and 20 cm), while one was extracted from the unoxidized gray fine sand at 35 cm.

Site 98M2— Medimont-railway marsh (Medimont quadrangle)

The site is located south of the railroad embankment and the river just downstream of a sharp river bend, where the 1996 flood eroded through the railroad embankment in several places. The site is in a bare ground area within the horsetail marsh with standing water and occurs within a 10 m wide wet area paralleling the railroad embankment for over a mile, presumably a remnant of excavations associated with the 1889 construction of the railroad embankment. The stratigraphy of the 65 cm core consists of 21 cm of black composting plant matter with interstitial metal-enriched silt, overlying a 32 cm thick layered, metal-enriched silt sequence with abundant fibrous plant material, overlying a 12 cm of pre-mining silt with fibrous plant material. Two porewater samples (21 and 25 cm depths) were recovered from the metal-enriched sediment. Attempts to extract porewater at 40 cm failed.

Site 98M3— Medimont-marsh (Medimont quadrangle)

This site is located in a marsh south of the river but north of the railroad embankment, about 400 m east of the mouth of the inlet to Medicine Lake. The site is situated along the boundary between the horsetail marsh and standing water with sedge-like emergent vegetation. The stratigraphy of the 63 cm core consists of an upper 16 cm of organic material with silt (removed prior to coring), above 12 cm of black composting plant material with silt, above 31 cm of banded light to medium dark gray silt with fibrous plant matter, and underlain by 4 cm of dark silt. The upper 59 cm of the section is inferred to be historic metal-enriched sediment. Porewater samples were recovered from depths of 15 and 30 cm; attempts to extract porewater from 45 cm were unsuccessful.

Site 98T1— Thompson Lake-levee bank (Black Lake quadrangle)

The site is located on the north side of the river on the river's edge bench about 200 m upstream from Anderson Lake bridge and about 50 m downstream from 90 degree turn in the river. The site is on the inside of the turn and about 5 m from the summer pool river's edge. The stratigraphy of the 70 cm core consists of 34 cm of metal-enriched fine sand to silt, overlying 36 cm of dark gray pre-mining mostly very fine sand and silt. Porewater was extracted at 5 cm (fine sand), 20 cm (very fine sand) and 35 cm (contact of metal-enriched very fine sand and pre-mining silt to very fine sand). Unlike all the other river's edge sections, no obvious oxidation is visible in the upper part of the core.

Site 98T2— Thompson Lake-marsh (Black Lake quadrangle)

The site is located in Thompson Lake marsh 400 m west of the sharp 150 degree bend in the river at the lake inlet. The sample site lies on the east shore of the southwest lobe of Thompson Lake, in a bare ground area lakeward of the horsetail marsh. The stratigraphy of the core consists of 69 cm of metal-enriched silt with pervasive fibrous plant material overlying 4 cm of pre-mining peat. The upper 11 cm of the metal-enriched section consists predominantly of black composting plant material with interstitial silt. Porewater samples were extracted at 10 cm (within composting layer) and at 25 cm (within banded silt with 1-2 cm peat-rich seams); attempts to recover porewater at 40 and 45 cm were unsuccessful.

FIELD METHODS

Collection of sediment

We collected solid material at each site as a function of depth by pushing a plastic core liner into the sediments. Measurements were made during the coring process to account for compaction during coring. Either measurements at specific intervals or an overall compaction measurement were used to adjust the depths to in-situ conditions (Table 2). After retrieval, the core was split in half length-wise. The lithology was described and the depth of contaminated sediment was estimated using a Pb test kit (Tables 1 and 2). Depth intervals were chosen in one half of the split core and subsampled for total metal determinations. These depth intervals eventually corresponded to depths of porewater sampling. The entire contaminated layer in the second half of the core was homogenized in a stainless steel bowl and divided into four sections. One section was subsampled for the determination of total metal concentrations, another section was sub-sampled for doing standard elutriate tests (SET) and measuring water content, and the other two sections were archived. The archived samples and the one for total metal determinations were placed in plastic screw top jars. A cutoff 50 mL plastic syringe was used to collect 40 cc of the remaining composite sediment for the SET. This subsample was placed in a 500 mL plastic Erlenmeyer flask and sealed with a rubber stopper. The samples for the determination of water content were placed in pre-weighed glass scintillation vials and tightly capped.

Collection of porewater

Depth horizons for in-situ porewater sampling were chosen based on the depth of the contaminated layer and the depths subsampled for total metal determinations of solid phases. Interstitial porewater was collected in plastic syringes using a sipper array (Jackson and others, 1995) that was inserted into the sediment about 1 m from where the core was collected at each site. The array consisted of a plastic base through which plastic sipper tubes of varying lengths were placed in the sediment. Each sipper consisted of an inner tube with ports that were covered with mesh polyethylene screen at the lower end and had a three-way valve at the upper end. During insertion of the sipper into the sediment, the inner tube was sealed inside an outer tube and was not exposed to surface water or porewater. At the appropriate depth, the inner tube was evacuated using a hand pump. It then was exposed to the sediment and porewater was drawn into a syringe under partial vacuum. The sipper equipment was rinsed with distilled, deionized water between sites and stored in plastic tubes. New mesh screens and three-way valves were used at each site.

Because the porosity of the sediments was highly variable and, generally, not very porous, we were only able to collect limited volumes of porewater. We typically collected 20 mL or less from 2 or 3 depths in the contaminated zone of the sediment at each site.
Upon return to the field-based laboratory, we standardized an Orion pH meter and electrode with pH buffers and measured the pH of the porewater samples. Subsamples for sulfate, alkalinity, metals, and mercury were filtered through 0.45-micron nylon filters into unused bottles for sulfate and alkalinity or acid rinsed bottles for metals and mercury (Table 3). Sulfate concentrations were immediately determined by turbidity using LaMotte test kits, a Smart Colorimeter, and standard sulfate solutions. A standard curve for sulfate was run with each

batch of samples from a given site. Alkalinity was determined by Gran titration using 0.01M hydrochloric acid (Stumm and Morgan, 1996). Known carbonate solutions were used to standardize the acid. The metal and mercury samples are preserved with redistilled, concentrated acid.

River water

River water was collected in plastic syringes at the sampling sites near the river's edge (Table 1). After collection, this water was processed in the same manner as the porewater samples. In addition, about 20 liters of Coeur d'Alene River water were collected into a plastic cubitainer at the Cataldo boat landing. This water was used in the laboratory leaching experiments.

LABORATORY METHODS

Standard Elutriate Tests (SET)

The leaching experiments (i.e., SET) were done on subsamples of the sediment and associated porewater in 500 mL Erlenmeyer flasks in the laboratory at Eastern Washington University. These experiments were done immediately after all the work in the field was completed. The tests are described in Ludwig and others (1989) and DiGiano and others (1995) and were developed by the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. Briefly, the sediment sample was mixed with Coeur d'Alene River water in a sediment-to-water ratio of 1 to 4, stirred and aerated for 30 minutes, and allowed to settle for 1 hour. The overlying water was sampled and processed in the same manner as the porewater. A triplicate SET analyses was done on levee bank sediments collected near the river's edge at the Rose Lake site (98R1).

Analyses of metals in water

Dr. Mohammed Ikramuddin at Eastern Washington University determined concentrations of metals in the porewater and in water from the Coeur d'Alene River and SET experiments. Table 4 summarizes the analyzed elements, analytical technique, the EPA method number, and the method detection limits (MDL).

Internal standards (scandium [Sc], indium [In], and holmium [Ho]) that provided a range of atomic masses were used in all of the analyses done by inductively coupled plasma-mass spectrometry (ICP-MS). The solutions for Sc and In were obtained by serial dilution from 1000 ppm standard solutions obtained from Alfa Aesar Chemicals. The 1000 ppm standard for Ho was prepared by Dr. Ikramuddin from a Ho salt. The final concentrations used in the analyses were 100 ppb Sc, 50 ppb In, and 50 ppb Ho.

Calibration of the ICP-MS was done using a 5 ppb solution of Hg, 50 ppb solutions of Mn and Pb, 100 ppb solutions of Sb and Cu, and 200 ppb solutions of As, Cd, and Zn. These solutions were prepared by serial dilution of 1000 ppm solutions obtained from Alfa Aesar Chemicals for each element. Calibration of the FAA was done using 2 ppm solutions of Fe. Calibrations (or sensitivity determinations) were done every 10 samples.

Method detection limits (MDL) were determined using a 5 ppb solution of Hg, 50 ppb solutions of Mn and Pb, 100 ppb solutions of Sb and Cu, 200 ppb solutions of As, Cd, and Zn, and a 50 ppb solution for Fe. Samples were analyzed 10 times, the standard deviation was determined from the analyses, and the MDL calculated as 3 times the standard deviation.

The linear range for As, Cd, Cu, Hg, Mn, Pb, Sb, and Zn was determined by running 2 standard curves – one with 4 points and one with 5 points. The 4 point standard curve consisted of 0.5x, 1x, 2x, and 3x the calibration standards. The 5 point curve included a point that was 4x the calibration standards. For many elements, the latter standard was outside of the linear range. The linear range for Fe determinations consisted of 0.5x, 1x, and 2x the calibration standard.

The difficulties in analyzing the porewater solutions were the low sample volumes (8 mL) for the metal analyses and the wide ranging concentrations of certain elements (Zn, Pb, and Mn). The variations in metal concentrations required variable dilutions for most samples. Dr. Ikramuddin started out by doing a 1 to 10 dilution on all samples and doing a qualitative run to estimate concentrations. He followed this work with quantitative measurements and dilutions specific to each sample and, sometimes, each element. As a result, there was not enough sample volume left to measure the major cations (Ca, Mg, Na, and K).

Analyses of metals in solids

The concentrations of metals in solid phase samples were determined in the Sediment-Trace Element Partitioning Laboratory of Dr. Art Horowitz (USGS-WRD-Georgia District Office). A known weight (about 500 mg) of sediment was digested using a variety of acids (nitric [HNO_3], perchloric [$HClO_4$], and hydrofluoric [HF]) in Teflon beakers on a hot plate at 200^0C. All analyses were performed on the resulting solution, except Hg. Sediment samples for Hg analyses were digested using Aqua Regia in Teflon beakers on a hotplate at 150^0C.

All elements, except As, Sb, and Hg, were determined by flame atomic absorption spectrophotometry (FAAS) or inductively coupled plasma-atomic emission spectroscopy (ICP-AES). As and Sb were determined by hydride generation atomic absorption spectrophotometry (AAS), while Hg was determined by a cold vapor technique using AAS as the detector. The analytical instruments were calibrated using laboratory derived mixed salt standards.

Solid phase samples also were analyzed for total S, total C, and organic C using high temperature combustion and measurement of evolved CO_2 or SO_2 by infra-red detection. Samples for organic C were pre-treated with dilute acid before combustion. Bondar Clegg Intertek Testing Services did these analyses (http:\\www.bondarclegg.com).

QUALITY ASSURANCE/QUALITY CONTROL

Blank solutions that accounted for contamination during sampling were collected in the field for the porewater work and in the laboratory for the SET. The field blanks involved passing distilled, deionized water through the sipper apparatus, filtering the solution, and then acidifying it. The laboratory blanks were distilled, deionized water that was placed in a plastic Erlenmeyer flask, aerated for 30 minutes, allowed to sit for 1 hour, then filtered and acidified. The metal data for these blanks are summarized in Table 5.

Both aqueous and solid phase standard reference materials were run during the analyses of metals in the porewater and sediment samples and during analyses of carbon and sulfur in the sediment samples. A comparison of the measured values and the certified or reported values are given in Tables 6, 7, and 8.

Because the volume of the porewater samples was so small, replicates on a given sample were not possible. Instead, two separate volumes of porewater were removed from 20 cm in the levee bank deposits at the river's edge at Cataldo (site 98C1) for analyses and replicates of a standard reference solution (NIST-1643d) were run to determination precision. These data are summarized in Table 9. Duplicates of selected samples and replicates of standard reference materials were run during the analyses of solid phases. These data are summarized in Table 10.

RESULTS

The results are presented in a series of tables and figures that contain the analytical data. The compositions of porewater and Coeur d'Alene River water are summarized in Tables 11 and 12. The metal data for the solids associated with the porewater in the lower Coeur d'Alene River valley are given in Table 13. Tables 14 and 15 summarize the water and solids data from the SET experiments. Table 16 contains data on the water content of the solid samples used in the SET experiments.

The figures are arranged so that data from the levee bank deposits at the edge of the Coeur d'Alene River and marsh sediments are shown for each site as they occur downstream of the mining district. The amount of organic and inorganic carbon in the sediments at the various sites is shown in Figure 2. Variations in the pH and concentrations of alkalinity of the porewater with depth for all of the sample sites are presented in Figure 3. Figures 4 through 12 compare concentrations of sulfate and metals in the porewater with their corresponding concentrations in solid phases as a function of depth for all sample sites. Data for mercury are not graphically presented as the concentrations in all water samples were below the detection limit of 0.05 ppb.

Values of pH and concentrations of alkalinity in water from the SET experiments are shown in Figure 13. Figures 14 through 22 present concentrations of sulfate and metals in the water and sediments of the SET experiments. These figures compare concentrations of constituents in Coeur d'Alene River water before and after it has reacted with the solid phase material. Bars to the left of the dotted line indicate a decrease in concentrations or uptake of elements during the leaching experiment, while those to the right indicate an increase in concentration or release during the experiments. The concentrations in the SET solutions are compared to freshwater aquatic life standards (EPA, 1986), if available. The concentrations of elements in the solid phase before the experiment are given for comparison.

DISCUSSION AND CONCLUSIONS

pH in porewater

The pH of the Coeur d'Alene River (pH 7.19-7.32) was always higher than the pH of the porewater (pH 6.23-7.09) in sediments in the lower valley (Figure 3). The pH of porewater from the levee banks at the edge of the river (pH 6.54-7.09) generally was greater than the pH of porewater from the marshes (pH 6.23-6.53).

Fe, Mn, and SO_4 concentrations in porewater

Early diagenesis of organic matter in sediments typically produces distinct chemical changes as a function of in porewater in those sediments depth (Froelich and others, 1979; Berner, 1980; Luther and others, 1998). Because oxidants are used in a thermodynamically predictable sequence (i.e., oxygen, nitrate, manganese oxides, iron oxides, and sulfate), porewater in sediments has decreasing oxygen and then nitrate concentrations with depth followed by increasing dissolved Mn and Fe concentrations with depth, and then decreasing dissolved sulfate concentrations with depth. Suboxic conditions are usually indicated by decreases in nitrate and increases in dissolved Mn and Fe concentrations, while anoxic conditions occur during sulfate reduction and the production of sulfide. All of the porewater profiles had dissolved Mn and Fe concentrations greater than those observed in oxic Coeur d'Alene River water (Figures 8 and 9). Porewater from almost all of the marsh sediments and from levee banks at the river's edge at Medimont and Thompson Lake had sulfate concentrations at the detection level (<4 mg/L), much lower than concentrations of sulfate in Coeur d'Alene River water (19-28 mg/L). These observations suggest that the levee bank and marsh sediments are at least suboxic and probably anoxic below the surface.

Metal concentrations in porewater

As: The Coeur d'Alene River generally had lower concentrations of dissolved As than porewater in the lower Coeur d'Alene River valley (0.6-2 μg/L versus 3.1-910 μg/L) (Figure 5). The highest concentrations of As in porewater occurred in levee bank (466-700 μg/L) and marsh sediments (910 μg/L) at Thompson Lake. The levee bank deposits deeper than 15 cm at Cataldo and the lake shore marsh at Killarney had the next highest concentrations of As in their porewater (i.e., 334-416 μg/L and 142-307 μg/L, respectively). Porewater at all of the other sites contained < 102 μg/L of As.

Cd: Concentrations of dissolved Cd in the Coeur d'Alene River (2.2-3.8 μg/L) were greater than Cd concentrations in the porewater of levee banks and marshes (<0.04-1.6 μg/L) (Figure 6). Porewater in levee bank deposits at the river's edge generally had higher concentrations of Cd than porewater in marshes (0.1-1.6 μg/L versus <0.04-0.09 μg/L).

Cu: Concentrations of dissolved Cu in porewater in sediments of the lower Coeur d'Alene River valley ranged from 0.08 to 2.3 μg/L (Figure 7). Cu concentrations in the porewater in marshes at the upstream sites (Cataldo, Rose Lake, and Killarney) were larger than in the corresponding levee bank deposits. Concentrations of dissolved Cu were about equal in the levee bank deposits and marshes at Medimont and Thompson Lake.

Fe: Concentrations of dissolved Fe were much larger in the porewater of sediments in the lower Coeur d'Alene River valley than in the Coeur d'Alene River (16-224 mg/L versus 0.005-0.175 mg/L, respectively) (Figure 8).

Mn: Concentrations of dissolved Mn were greater in the porewater of the levee bank deposits at the river's edge and marshes in the lower valley (0.6-22 mg/L) when compared to concentrations in the Coeur d'Alene River (0.2-0.4 mg/L) (Figure 9).

Pb: Dissolved concentrations of Pb in porewater from levee bank deposits and marshes in the lower valley ranged from 0.2-46 μg/L (Figure 10). Levee bank deposits at Cataldo, Rose Lake, and Medimont had larger concentrations of Pb in their porewater compared to the marsh sediments at these sites (0.7-46 μg/L versus 0.1-0.4 μg/L, respectively).

Sb: Porewater concentrations of Sb ranged from 0.2-13 μg/L in the lower Coeur d'Alene River valley (Figure 11). Porewater in the levee banks at the river's edge at Medimont (> 10 cm) and Thompson Lake had higher concentrations of Sb than in the corresponding marsh sediments (5-12 μg/L versus 0.8-5 μg/L, respectively).

Zn: Dissolved Zn concentrations in the Coeur d'Alene River ranged from 0.5-1 mg/L (Figure 12). Dissolved concentrations of Zn in the porewater of levee bank deposits were greater than those in marsh sediments, except at Thompson Lake. The largest concentrations of dissolved Zn occurred in levee bank deposits at Cataldo and Rose Lake (36-70 mg/L).

pH in SET solutions

The pH of the Coeur d'Alene River water (pH 7.15-7.28) was always greater than the pH of the river water after reaction with the levee bank deposits and marsh sediments from the lower

Coeur d'Alene River valley (pH 4.88-7.08) (Figure 13). The majority of the SET solutions (10 of 14) had pH values less than the freshwater aquatic life standard (pH 6.5-9) (EPA, 1986).

SO_4 concentrations in SET solutions

Sulfate concentrations in Coeur d'Alene River water were 21 mg/L (Figure 14). The majority of SET solutions (9 of 14) indicated that sulfate is released from sediments in the lower valley during leaching by Coeur d'Alene River water. Levee bank deposits from Cataldo, Rose Lake, Killarney, and Medimont tended to release more sulfate than marsh sediments.

Metal concentrations in SET solutions

As: Leaching of all sediments in the lower Coeur d'Alene River valley released As to solution (Figure 15). Concentrations of dissolved As in the SET solutions using marsh sediments were greater (31-180 µg/L) than in solutions using levee bank deposits (8-30 µg/L). All SET solutions had concentrations of As less than the freshwater aquatic life standard (190 µg/L) (EPA, 1986).

Cd: Concentrations of dissolved Cd in SET solutions generally were largest for the marsh sediments (4-26 µg/L) (Figure 16). The control (Coeur d'Alene River water) had 3.1 µg/L of Cd, while most solutions in contact with levee bank deposits had 0.09-1.4 µg/L. Most (8 of 14) SET solutions exceeded the freshwater aquatic life standard (1.1 µg/L at a hardness of 100 mg $CaCO_3$/L) (EPA, 1986). For comparison, the dissolved aquatic life criteria (chronic) for Cd for the State of Idaho are 0.37 µg/L at a hardness of 25 mg $CaCO_3$/L and 1.03 µg/L at a hardness of 100 mg $CaCO_3$/L (Code of Federal Regulations, 1999). Note that the hardness of the Coeur d'Alene River varies from about 15 to 65 mg $CaCO_3$/L depending on season and location.

Cu: The SET solutions in contact with levee bank sediments contained less than or equal to the concentrations of dissolved Cu in the control (0.3-1.5 µg/L versus 0.9-2.1 µg/L, respectively) (Figure 17). Most (5 of 7) of the solutions in contact with marsh sediments had less dissolved Cu than the control (0.1-0.9 µg/L versus 0.9-2.1 µg/L). All SET solutions had dissolved Cu concentrations less than the freshwater aquatic life standard (12 µg/L at a hardness of 100 mg $CaCO_3$/L) (EPA, 1986). For comparison, the dissolved aquatic life criteria (chronic) for Cu for the State of Idaho are 3.48 µg/L at a hardness of 25 mg $CaCO_3$/L and 11.3 µg/L at a hardness of 100 mg $CaCO_3$/L (Code of Federal Regulations, 1999).

Fe: The Coeur d'Alene River control had a dissolved Fe concentration of about 0.05 mg/L (Figure 18). All SET solutions in contact with levee bank deposits had dissolved concentrations of Fe (0.02-0.08 mg/L) less than or equal to the control. In general, SET solutions in contact with marsh sediments had dissolved Fe concentrations (0.05-1.3 mg/L) equal to or greater than the control. Almost all (13 of 14) SET solutions had Fe concentrations less than the freshwater aquatic life standard (1 mg/L) (EPA, 1986).

Mn: Almost all (13 of 14) SET solutions in contact with sediments from the lower Coeur d'Alene River valley had higher concentrations of dissolved Mn than the control (0.5-3.4 mg/L versus 0.15 mg/L) (Figure 19).

Pb: Concentrations of dissolved Pb in the Coeur d'Alene River control (0.4-0.5 µg/L) were less than in SET solutions in contact with levee bank deposits (21-130 µg/L) which, in turn, were less than in most SET solutions in contact with marsh sediments (299-1243 µg/L) (Figure 20). All SET solutions exceeded the freshwater aquatic life standard for Pb (3.2 µg/L at a hardness of 100 mg $CaCO_3$/L) (EPA, 1986). For comparison, the dissolved aquatic life criteria (chronic) for Pb for the State of Idaho are 0.54 µg/L at a hardness of 25 mg $CaCO_3$/L and 2.52 µg/L at a hardness of 100 mg $CaCO_3$/L (Code of Federal Regulations, 1999).

Sb: All levee bank and marsh sediments in the lower Coeur d'Alene River released Sb during the SET experiments (Figure 21). Concentrations of Sb in the SET solutions were much lower than the freshwater aquatic life standard (1600 µg/L) (EPA, 1986).

Zn: Almost all (11 of 14) sediments in the lower Coeur d'Alene River valley released Zn to solution during the leaching tests (Figure 22). Twelve of 14 SET solutions exceeded the freshwater aquatic life standard (0.32 mg/L at a hardness of 100 mg $CaCO_3$/L) (EPA, 1986). For comparison, the dissolved aquatic life criteria (chronic) for Zn for the State of Idaho are 0.032 mg/L at a hardness of 25 mg $CaCO_3$/L and 0.104 mg/L at a hardness of 100 mg $CaCO_3$/L (Code of Federal Regulations, 1999).

Table 17 summarizes the release or uptake of elements during the SET experiments. The values were calculated by determining the difference in concentration between the SET solutions in contact with sediments and the control, and then normalizing to the volumes of solution and sediments used in the experiments. Hence, the values in Table 17 are expressed as the amount of an element or constituent that is released (positive numbers) or taken up (negative numbers) per cubic meter of sediment during the leaching process.

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Table 1. Location of sample sites in the lower Coeur d'Alene River valley.

Sample Site	Date of sampling	Site description	NAD27 Latitude (N) degrees mins.	NAD27 Longitude (W) degrees mins.	Map River mile	Thickness of metal-enriched sediments cm
POREWATER & CORE SITES						
98C1	11/7/98	Cataldo-levee bank	47 33.165	116 21.972	159.1	14
98C2	11/7/98	Cataldo-marsh	47 33.122	116 21.638	159.2	>71
98R1	11/6/98	Rose Lake-levee bank	47 32.068	116 28.803	152.7	>45
98R2	11/7/98	Porter Slough-marsh	47 32.379	116 28.027	153.3	38
98K1	11/3/98	Killamey-levee bank	47 31.240	116 31.801	148.6	>43.5
98K2	11/4/98	Killarney-marsh	47 31.048	116 32.995	148.6	??40
98K3	11/4/98	Killarney-lake shore marsh	47 30.935	116 33.194	148.6	53
98M1	11/5/98	Medimont-levee bank	47 28.832	116 35.480	143.6	>80
98M2	11/5/98	Medimont-railway marsh	47 28.834	116 34.765	144.4	53
98M3	11/5/98	Medimont-marsh	47 28.696	116 35.409	143.5	59
98T1	11/8/98	Thompson Lake-levee bank	47 28.817	116 43.689	134.8	34
98T2	11/8/98	Thompson Lake-marsh	47 29.111	116 43.804	135.1	69
RIVER WATER SAMPLES						
98C1E	11/7/98	Cataldo-edge of river	47 33.165	116 21.972	159.1	
CdA River 1	11/9/98	Cataldo-at boat landing	47 33.165	116 21.972	159.1	
CdA River 2	11/9/98	Cataldo-at boat landing	47 33.165	116 21.972	159.1	
CdA River 3	11/9/98	Cataldo-at boat landing	47 33.165	116 21.972	159.1	
98R1E	11/6/98	Rose Lake-edge of river	47 32.068	116 28.803	152.7	
98M1E	11/5/98	Medimont-edge of river	47 28.832	116 35.480	143.6	
98T1E	11/8/98	Thompson Lake-edge of river	47 28.817	116 43.689	134.8	

Table 2. Adjusted core depths and core stratigraphy for sample sites in the lower Coeur d'Alene River valley (2 pages).

Core	Depth measured in core (cm)		Interval recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SC1	0	0.5	0	0.5	red-orange coarse grained sand
98SC1	1	1	0.5	1	black plant fragments
98SC1	1	4	1	4	gray silt
98SC1	4	7	4	7	red-brown medium-coarse sand with plant fragments
98SC1	7	10	7.0	10.5	green gray very fine sand with 0.5 cm medium-coarse grained sand lens
98SC1	10	13	10.5	13.9	medium-grained sand with irregular red-brown stain (positive Pb test @ 13.5)
98SC1	13	19.5	13.9	21.4	green gray very fine sand with 0.5 cm tan silt @ 17 (negative Pb test @ 14.2)
98SC1	19.5	21	21.4	23.1	tan medium grained sand
98SC1	21	24	23.1	26.5	dark green-gray fine sand with 1 cm dark silt at base
98SC1	24	28	26.5	31.1	medium-fine-grained sand
98SC1	28	31	31.1	34.5	dark green gray very fine sand/silt
98SC1	31	33	34.5	36.7	light green gray very fine sand/silt with visible mica flecks
98SC1	33	36	36.7	40.1	tan medium-grained sand
98SC1	36	41	40.1	45.6	tan fine-grained sand

Core	Depth measured in core (cm)		Interval recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SC2	0	1	0	3.8	very fine sand
98SC2	1	10	3.8	25.7	very fine sand with 30% black partially decomposed plant matter
98SC2	10	20	25.7	37.2	mottled, tan, fine sand
98SC2	20	24	37.2	41.8	laminated black and tan fine sand with plant frag-rich seam at top
98SC2	24	28	41.8	46.0	massive tan fine sand
98SC2	28	32	46.0	50.0	plant debris-rich fine sand with massive 1 cm fine sand at base
98SC2	32	33	50.0	51.0	dark gray silt
98SC2	33	35	51.0	54.6	dark gray fine sand
98SC2	35	39	54.6	61.9	tan fine and very fine sand
98SC2	39	42	61.9	67.4	dark green-gray very fine sand
98SC2	42	43	67.4	69.2	dark green-gray silt
98SC2	43	44	69.2	71.0	green gray medium fine grained sand (positive Pb test @ base)

Core	Depth measured in core (cm)		Interval recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SR1	0	13.5	0	14.4	medium-grained sand with red-brown 1 cm splotches & bands
98SR1	14	15	14.4	16	dark gray very fine-grained sand/silt with fibrous organics
98SR1	15	21	16.0	26.0	medium-grained sand with red-brown 1 cm splotches & bands
98SR1	21	22	26.0	27.7	dark gray very fine-grained sand/silt with fibrous organics
98SR1	22	23.5	27.7	30.2	medium-grained sand with red-brown 1 cm splotches & bands
98SR1	24	26	30.2	34.3	dark gray very fine-grained sand/silt with fibrous organics
98SR1	26	27.5	34.3	36.9	medium-grained sand with red-brown 1 cm splotches & bands
98SR1	28	33	36.9	45	tan, very fine sand/silt with (3) 0.3 cm med-fine sands, red-brown streaks

Core	Depth measured in core (cm)		Interval recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SR2	0	10	0	23.3	dark brown rooty organic matt with silt
98SR2	10	11	23.3	25.0	tan silt
98SR2	11	19	25.0	38.3	tan medium-fine grained sand (pos Pb test @ 32 cm)
98SR2	19	30	38.3	58.2	silty black peat (neg Pb test @ 40 cm)
98SR2	30	31	58.2	60	tan silt
98SR2	31	33	60	62	brown-black peat
98SR2	33	38	62	65	balck and tan silt with fibrous plant fragments

Core	Depth meesured in core (cm)		92% average recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SK1	0	2	0	2.2	medium-grained sand, med gray with red-brown mottling
98SK1	2	8	2.2	8.7	fine-grained sand, med gray with red-brown mottling in upper 2 cm
98SK1	8	20	8.7	21.8	medium-grained sand, red-brown mottling strong in upper 6 cm (sharp base)
98SK1	20	25	21.8	27.2	med gray very fine sand
98SK1	25	26	27.2	28.3	pale gray silt
98SK1	26	29	28.3	31.5	finely layered fine-grained sand, med and lt gray layers
98SK1	29	31	31.5	33.7	pale gray silt
98SK1	31	34	33.7	37.0	med gy fine-grained sand/pale silt/med gy fine gr sand, cm-thick layers
98SK1	34	39	37.0	42.4	dark gray medium-grained sand
98SK1	39	40	42.4	43.5	pale gray silt (presume all metal-enriched)

Core	Depth measured in core (cm)		70% average recovery		Lithology
	Interval top	Interval base	adjusted top	adjusted base	
98SK2	0	8	0	8	Silty organic matter; not recovered
98SK2	8	14	8	20	black silty composting plant (horsetail) material (pos Pb test @ base)
98SK2	14	28	20	40	layered lt gray silt layers with some peaty layers (pos Pb test @ base)
98SK2	28	36	40	51	dark gray-brown peat (neg Pb test @ base)

Table 2. Adjusted core depths and core stratigraphy for sample sites in the lower Coeur d'Alene River valley (2 pages).

Core	Depth measured in core (cm)		70% average recovery		Lithology
	interval top	interval base	adjusted top	adjusted base	
98SK3	0	5	0	7	Composting black plant matter with minor silt
98SK3	5	11	7	16	dark gray silt
98SK3	11	12	16	17	peaty horizon
98SK3	12	20	17	29	medium gray silt
98SK3	20	24	29	34	light gray silt
98SK3	24	31	34	44	medium gray silt
98SK3	31	37	44	53	black plant fiber rich silt
98SK3	37	39	53	56	brown black peat

Core	Depth measured in core (cm)		100% recovery		Lithology
	interval top	intarval base	adjusted top	adjusted base	
98SM1	0	20	0	20	med-fine gr sand and fine-gr sand as 3-4 cm layers, with irreg red-brown Fe stain
98SM1	20	20.5	20	20.5	black silt
98SM1	20.5	21	20.5	21	red-brown medium-fine grained sand
98SM1	21	27	21	27	laminated dark and light gray very fine sand/silt
98SM1	27	31	27	31	laminated light and med gray very fine sand/silt
98SM1	31	35	31	35	laminated dark and light gray very fine sand/silt
98SM1	35	36	35	36	pale gray silt (positive Pb test at base)

Core	Depth measured in core (cm)		62.6% average recovery		Lithology
	interval top	interval base	adjusted top	adjusted base	
98SM2	0	13	0	21	Black composting plant matter with silt (pos Pb test @ 3 cm)
98SM2	13	33	21	53	medium gray silt with abundant fibrous plant matter
98SM2	33	41	53	65	medium-light gray silt with some fibrous plant matter (neg Pb test @ 65 & 56 cm)

Core	Depth measured in core (cm)		69.8% average recovery		Lithology
	interval top	interval base	adjusted top	adjusted base	
98SM3	0	11	0	16	Black composting plant matter with silt
98SM3	11	41	16	59	banded tan and medium gray silt with fibrous organic matter
98SM3	41	44	59	63	dark gray silt (possibly pre-mining??)

Core	Depth measured in core (cm)		interval recovery		Lithology
	interval top	interval base	adjusted top	edjusted base	
98ST1	0	9	0	9.5	medium green-gray fine sand, massive
98ST1	9	20	9.5	21.3	medium green-gray very fine sand, massive (pos Pb test @ base)
98ST1	20	21	21.3	22.5	peaty plant debris seam with silt
98ST1	21	25	22.5	27.1	dark gray very fine sand/silt
98ST1	25	31	27.1	34.0	dark gy very fine sand/silt with 0.3 cm bands of lt gy fine sand (pos Pb test @ base)
98ST1	31	43	34.0	55.3	silt to very fine sand with sand incr. downward; peat @ base (neg Pb test @ top)
98ST1	43	45	55.3	70	fine to medium fine-grained sand (negative Pb test @ base)

Core	Depth measured in core (cm)		interval recovery		Lithology
	interval top	interval base	adjusted top	adjusted base	
98ST2	0	6	0	11.1	black composting plant debris with interstitial silt
98ST2	6	17	11.1	29.5	medium light gray silt with plant debris-rich seams every 2-3 cm
98ST2	17	18	29.5	30.7	peaty plant debris rich seam
98ST2	18	31	30.7	47.7	light gray silt with scattered fibrous plant debris (pos Pb test @ base)
98ST2	31	43	47.7	67.6	dark gray silt with scattered fibrous plant debris (pos Pb test @ top & base)
98ST2	43	43.5	67.6	68.5	dark brown black peat
98ST2	43.5	44	68.5	69.4	medium dark gray silt layer
98ST2	44	46	69.4	73.0	dark brown black peat (neg Pb test @ base)

Table 3. The constituents measured in the porewater, the types of bottles used, preservation techniques, and volume of porewater used in the analyses. All samples, except pH, were filtered through 0.45 μm filters.

Constituent	Container	Preservation	Volume
pH	polystyrene test tube	none, measured in field	1 mL
Sulfate	8 mL HDPE	none, measured in field	5 mL
Alkalinity	8 mL HDPE	cooler, measured in field	1 mL
Metals	acid rinsed 8 mL HDPE	1 drop nitric acid	8 mL
Mercury (Hg)	acid rinsed 8 mL glass vial	1 drop nitric acid	5 mL

where HDPE = high density polyethylene bottles.

Table 4. Techniques, method numbers, and method detection limits (MDL) for metal analyses in porewater, Coeur d'Alene River water, and water from the SET experiments.

Parameter	Technique	Method Number	MDL (µg/L)
Antimony (Sb)	ICP-MS	200.8	0.02
Arsenic (As)	ICP-MS	200.8	0.1
Cadmium (Cd)	ICP-MS	200.8	0.04
Copper (Cu)	ICP-MS	200.8	0.02
Iron (Fe)	FAA	236.1	5*
Lead (Pb)	ICP-MS	200.8	0.01
Manganese (Mn)	ICP-MS	200.8	0.01
Mercury (Hg)	ICP-MS	200.8	0.1
Zinc (Zn)	ICP-MS	200.8	0.1

ICP-MS = inductively coupled plasma-mass spectrometry
FAA = flame atomic absorption spectrometry
* = Using high sensitivity nebulizer

Table 5. Summary of blank determinations for water samples.

Sample Number	As µg/L	Cd µg/L	Cu µg/L	Fe µg/L	Hg µg/L	Mn µg/L	Pb µg/L	Sb µg/L	Zn µg/L
98B1	0.31	<0.04	0.37	<5		0.05	0.14	<0.02	0.91
98B2	<0.1	<0.04	0.37	<5		0.06	0.12	<0.02	0.69
98B3					<0.05				
98B4					<0.05				
98SETB	<0.1	0.07	8.1	<5	<0.05	0.73	1.7	<0.02	5.9

98B1 through 98B4 = blanks for porewater sampling. Distilled water was drawn through sipper, then filtered and acidified.
98SETB = blank for SET experiments. Distilled water was put in an Erlenmeyer flask, aerated, filtered, and then acidified.

Table 6. Summary of results for aqueous standard reference materials.

SRM	As µg/L	Cd µg/L	Cu µg/L	Fe µg/L	Mn µg/L	Pb µg/L	Sb µg/L	Zn µg/L
98R1 (NIST 1643d)	54	6.1	20	90	37	18	55	70
98R5 (NIST 1643d)	55	6.1	20	94	36	18	54	69
98R8 (NIST 1643d)	54	6.1	20	92	37	18	56	69
NIST 1643d reported	**56.02**	**6.47**	**20.5**	**91.2**	**37.66**	**18.15**	**54.1**	**72.48**
+/- of reported	**0.73**	**0.37**	**3.8**	**3.9**	**0.83**	**0.64**	**1.1**	**0.65**
98R2 (USGS T-135)	11	52	61	224	413	104	77	52
USGS T-135 reported	**10**	**50.5**	**62**	**228**	**423**	**103**	**76.3**	**48.2**
+/- of reported	**1.1**	**3.2**	**4.2**	**11**	**20**	**7**	**8.7**	**4.7**
98R6 (USGS T-137)	0.5	7.2	2.5	68	94	6.5	16	56
USGS T-137 reported	**0.6**	**6.8**	**1.9**	**71**	**98**	**6.3**	**15.5**	**49.5**
+/- of reported	**1**	**0.52**	**1.2**	**9**	**5**	**1**	**2.7**	**4.2**

SRM = Standard Reference Material

Table 7. Summary of metal results for solid standard reference materials (2 pages).

SRM	Ag ppm	RR Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Cd ppm	RR Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	RR Hg ppm
98SB1D (NIST 2710)	26	*29*	5.1	480	700	1.9	18	*18*	8	26	2300	2.8	26	*25*
BALIS 2710	33		5.9	640	670	2	22		10	24	2500	3.4	31	
DUP BALIS 2710	33		6	630	680	2.1	22		10	23	2600	3.5	32	
HORO 2710	32	*35*	5.7	560	660	2.1	20	*21*	6	24	2500	3.4	35	*28*
DUP HORO 2710	33		5.7	570	670	2.2	22		9	30	2500	3.4	31	
NIST-2710 reported	**35.3**	***35.3***	**6.4**	**626**	**707**	**ND**	**21.8**	***21.8***	**10**	**39**	**2950**	**3.38**	**32.6**	***32.6***
+/- of reported	**1.5**	***1.5***	**0.08**	**38**	**51**		**0.2**	***0.2***			**130**	**0.1**	**1.8**	***1.8***
98SB1E (NIST 2711)	3.5	*4.2*	5.6	100	980	1.9	38	*36*	15	46	98	2.9	5.1	*4.4*
BALIS 2711	3.8		6	100	680	1.9	40		11	36	98	2.9	5.6	
DUP BALIS 2711	4.4		6	100	680	1.9	40		11	35	100	3	5.6	
HORO 2711	ND	*5.0/4.8*	6.3	100	700	2	43	*41*	10	41	100	2.9	6.5	*5.9*
DUP HORO 2711	4.1		6.2	110	690	1.8	41		11	39	110	2.9	6.1	
DUP HORO 2711	4.5		6.4	100	730	1.9	41		10	39	110	2.9	5.6	
NIST-2711 reported	**4.63**	***4.63***	**6.53**	**105**	**726**	**ND**	**41.7**	***41.7***	**10**	**47**	**114**	**2.89**	**6.25**	***6.25***
+/- of reported	**0.39**	***0.39***	**0.09**	**8**	**38**		**0.25**	***0.25***			**2**	**0.06**	**0.19**	***0.19***

SRM = Standard Reference Material

RR (italized values) = sample re-analyzed after drying at 110 °C overnight

ND = not determined

98SB1D = NIST 2710 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2710 = NIST 2710 (from bottle aquired by USGS-Spokane Field Office)

HORO 2710 = NIST 2710 (from bottle aquired by USGS-Georgia District)

98SB1E = NIST 2711 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2711 = NIST 2711 (from bottle aquired by USGS-Spokane Field Office)

HORO 2711 = NIST 2711 (from bottle aquired by USGS-Georgia District)

Table 7. Summary of metal results for solid standard reference materials (2 pages).

SRM	Li ppm	Mn ppm	Mo ppm	Ni ppm	P ppm	Pb ppm	RR Pb ppm	Sb ppm	Sr ppm	Ti %	V ppm	Zn ppm
98SB1D (NIST 2710)	32	8400	18	10	890	4800	*4900*	28	270	0.23	60	5100
BALIS 2710	40	10000	15	7	910	5800		32	300	0.25	73	6200
DUP BALIS 2710	40	11000	14	6	920	5700		32	300	0.26	74	6200
HORO 2710	37	10000	21	4	990	5500	*5700*	34	310	0.27	68	6900
DUP HORO 2710	32	11000	21	11	1000	5300		35	320	0.27	72	6300
NIST-2710 reported	**ND**	**10100**	**19**	**14**	**1060**	**5532**	***5532***	**38.4**	**330**	**0.283**	**76.6**	**6952**
+/- of reported		**400**		**1**	**150**	**80**	***80***	**3**		**0.01**	**2.3**	**91**
98SB1E (NIST 2711)	22	700 <5		27	820	1100	*1100*	16	200	0.27	76	300
BALIS 2711	27	640 <5		14	790	1200		20	220	0.28	81	360
DUP BALIS 2711	27	650 <5		15	780	1300		20	220	0.27	80	360
HORO 2711	24	650 <5		17	950	1200	*1200*	18	230	0.3	81	330
DUP HORO 2711	30	630 <5		14	750	1200		17	220	0.28	82	340
DUP HORO 2711	30	640 <5		18	830	1300		19	230	0.29	83	330
NIST-2711 reported	**ND**	**638**	**1.6**	**20.6**	**860**	**1162**	***1162***	**19.4**	**245.3**	**0.306**	**81.6**	**350.4**
+/- of reported		**28**		**1.1**	**70**	**31**	***31***	**1.8**	**0.7**	**0.023**	**2.9**	**4.8**

SRM = Standard Reference Material

RR (italized values) = sample re-analyzed after drying at 110 °C overnight

ND = not determined

98SB1D = NIST 2710 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2710 = NIST 2710 (from bottle aquired by USGS-Spokane Field Office)

HORO 2710 = NIST 2710 (from bottle aquired by USGS-Georgia District)

98SB1E = NIST 2711 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2711 = NIST 2711 (from bottle aquired by USGS-Spokane Field Office)

HORO 2711 = NIST 2711 (from bottle aquired by USGS-Georgia District)

Table 8. Summary of carbon (C) and sulfur (S) results for solid standard reference materials.

SRM	total C %	total S %
98SB1A (GXR-3)	1.31	0.23
GXR-3 reported	**1.31**	**0.232**
98SB1B (SDO-1)	9.78	5.24
SDO-1 reported	**9.95**	**5.35**
98SB1C (MAG-1)	2.13	0.3
MAG-1 reported	**2.15**	**0.39**
98SB1D (Montana 2710)	2.61	0.19
Montana 2710 reported	**3**	**0.24**
98SB1E (Montana 2711)	1.64	0.04
Montana 2711 reported	**2**	**0.042**

SRM = Standard Reference Material

Table 9. Summary of duplicates and replicates for aqueous samples.

Sample	pH	Sulfate mg/L	Alkalinity meq/L	As µg/L	Cd µg/L	Cu µg/L	Fe µg/L	Hg µg/L	Mn µg/L	Pb µg/L	Sb µg/L	Zn µg/L
98WC1C1 (Cataldo-levee bank, 20 cm)	6.57	486	1.21	334	1.3	0.17	90.2	<0.05	14.38	2.3	1	40.27
98WC1C2 (Cataldo-levee bank, 20 cm)	6.5	486	1.17	347	1.3	0.16	90.5	<0.05	14.77	1.4	1	41.26
98R1 (NIST 1643d)	ND	ND	ND	54	6.1	20	90	ND	37	18	55	70
98R5 (NIST 1643d)	ND	ND	ND	55	6.1	20	94	ND	36	18	54	69
98R8 (NIST 1643d)	ND	ND	ND	54	6.1	20	92	ND	37	18	56	69

ND = not determined

Table 10. Summary of metal analyses of duplicate solid samples and of replicate solid standard reference materials (2 pages).

		RR						RR					
Sample	Ag	Ag	Al	As	Ba	Be	Cd	Cd	Co	Cr	Cu	Fe	Li
	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
98SC1D	10	*10*	3.8	120	540	1.3	24	*24*	6	21	89	8	21
98SC1D-duplicate	11	*12*	3.8	120	550	1.4	26	*24*	11	25	90	8	21
98ST2D	23	*24*	4.2	120	620	1.5	44	*41*	15	26	180	11.3	22
98ST2D-duplicate	23	*25*	4.1	110	480	1.4	44	*42*	13	27	180	11.2	20
98SK3A	14	*15*	4.5	440	600	1.5	27	*25*	17	30	140	10.2	19
98SK3A-duplicate	14	*15*	4.5	440	610	1.6	26	*25*	21	32	140	10.2	19
98SM2D	3.9	*4.4*	5.7	21	740	1.7	8.7	*8.5*	7	35	44	2.7	27
98SM2D-duplicate	4.6	*4.8*	5.9	21	760	1.7	8.6	*8.6*	8	37	45	2.8	27
98SR1F	18	*19*	3.4	140	720	1.2	46	*51*	12	21	160	11.8	17
98SR1F-duplicate	17	*19*	3.4	130	640	1.2	45	*52*	11	21	160	11.5	17
98SB1D (NIST 2710)	26	*29*	5.1	480	700	1.9	18	*18*	8	26	2300	2.8	32
BALIS 2710	33	*ND*	5.9	640	670	2	22	*ND*	10	24	2500	3.4	40
DUP BALIS 2710	33	*ND*	6	630	680	2.1	22	*ND*	10	23	2600	3.5	40
HORO 2710	32	*35*	5.7	560	660	2.1	20	*21*	6	24	2500	3.4	37
DUP HORO 2710	33	*ND*	5.7	570	670	2.2	22	*ND*	9	30	2500	3.4	32
98SB1E (NIST 2711)	3.5	*4.2*	5.6	100	980	1.9	38	*36*	15	46	98	2.9	22
BALIS 2711	3.8	*ND*	6	100	680	1.9	40	*ND*	11	36	98	2.9	27
DUP BALIS 2711	4.4	*ND*	6	100	680	1.9	40	*ND*	11	35	100	3	27
HORO 2711	ND	*5.0/4.8*	6.3	100	700	2	43	*41*	10	41	100	2.9	24
DUP HORO 2711	4.1	*ND*	6.2	110	690	1.8	41	*ND*	11	39	110	2.9	30
DUP HORO 2711	4.5	*ND*	6.4	100	730	1.9	41	*ND*	10	39	110	2.9	30

RR (italized values) = sample re-analyzed after drying at 110 ° C overnight
ND = not determined
NIST 2710 and NIST 2711 are standard reference materials.
98SB1D = NIST 2710 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)
BALIS 2710 = NIST 2710 (from bottle aquired by USGS-Spokane Field Office)
HORO 2710 = NIST 2710 (from bottle aquired by USGS-Georgia District)
98SB1E = NIST 2711 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)
BALIS 2711 = NIST 2711 (from bottle aquired by USGS-Spokane Field Office)
HORO 2711 = NIST 2711 (from bottle aquired by USGS-Georgia District)

Table 10. Summary of metal analyses of duplicate solid samples and of replicate solid standard reference materials (2 pages).

Sample	Mn ppm	Mo ppm	Ni ppm	P ppm	Pb ppm	RR Pb ppm	Sb ppm	Sr ppm	Ti %	V ppm	Zn ppm
98SC1D	5500	<5	7	590	3500	*3200*	42	36	0.17	32	6600
98SC1D-duplicate	5500	<5	13	640	3400	*3200*	43	37	0.18	32	6600
98ST2D	11000	<5	15	350	9000	*10000*	74	39	0.14	35	6800
98ST2D-duplicate	11000	<5	14	350	8900	*10000*	75	38	0.14	35	6400
98SK3A	9400	<5	16	340	4400	*4100*	66	32	0.16	38	2900
98SK3A-duplicate	9400	<5	17	350	4300	*4100*	64	33	0.15	38	3000
98SM2D	660	<5	15	780	1600	*1700*	15	66	0.3	49	1100
98SM2D-duplicate	680	<5	17	890	1600	*1600*	15	68	0.31	51	1100
98SR1F	10000	<5	10	430	4800	*4600*	52	33	0.18	32	8500
98SR1F-duplicate	10000	<5	9	430	5100	*4600*	49	34	0.18	32	8600
98SB1D (NIST 2710)	8400	18	10	890	4800	*4900*	28	270	0.23	60	5100
BALIS 2710	10000	15	7	910	5800	*ND*	32	300	0.25	73	6200
DUP BALIS 2710	11000	14	6	920	5700	*ND*	32	300	0.26	74	6200
HORO 2710	10000	21	4	990	5500	*5700*	34	310	0.27	68	6900
DUP HORO 2710	11000	21	11	1000	5300	*ND*	35	320	0.27	72	6300
98SB1E (NIST 2711)	700	<5	27	820	1100	*1100*	16	200	0.27	76	300
BALIS 2711	640	<5	14	790	1200	*ND*	20	220	0.28	81	360
DUP BALIS 2711	650	<5	15	780	1300	*ND*	20	220	0.27	80	360
HORO 2711	650	<5	17	950	1200	*1200*	18	230	0.3	81	330
DUP HORO 2711	630	<5	14	750	1200	*ND*	17	220	0.28	82	340
DUP HORO 2711	640	<5	18	830	1300	*ND*	19	230	0.29	83	330

RR (italized values) = sample re-analyzed after drying at 110 °C overnight

ND = not determined

NIST 2710 and NIST 2711 are standard reference materials.

98SB1D = NIST 2710 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2710 = NIST 2710 (from bottle aquired by USGS-Spokane Field Office)

HORO 2710 = NIST 2710 (from bottle aquired by USGS-Georgia District)

98SB1E = NIST 2711 (from bottle aquired by USGS-Spokane Field Office and after return from Bondar Clegg, which analyzed sub-split for S and C)

BALIS 2711 = NIST 2711 (from bottle aquired by USGS-Spokane Field Office)

HORO 2711 = NIST 2711 (from bottle aquired by USGS-Georgia District)

Table 11. Analytical data for porewater collected in the lower Coeur d'Alene River valley (2 pages).

Site	Sample Number	Location description	Sample Depth (cm)	pH	Sulfate mg/L	Alkalinity meq/L	As µg/L	Cd µg/L	Cu µg/L
98C1	98WC1A	Cataldo-levee bank	5	6.54	384	ns	13	0.04	0.2
98C1	98WC1B	Cataldo-levee bank	10	6.62	419	1.45	25	0.04	0.08
98C1	98WC1C1	Cataldo-levee bank	20	6.57	486	1.21	334	1.3	0.17
98C1	98WC1C2	Cataldo-levee bank	20	6.5	486	1.17	347	1.3	0.16
98C1	98WC1D	Cataldo-levee bank	35	6.49	548	0.32	416	0.28	0.14
98C2	98WC2A	Cataldo-marsh	20	ns	4	2.51	7.3	0.04	0.5
98C2	98WC2B	Cataldo-marsh	30	6.63	4	5.22	18	0.04	0.66
98R1	98WR1A	Rose Lake-levee bank	5	6.54	652	0.12	22	0.57	0.21
98R1	98WR1B	Rose Lake-levee bank	20	6.61	621	1.27	96	2.6	0.2
98R1	98WR1C	Rose Lake-levee bank	35	6.56	579	1.13	47	1.2	0.21
98R2	98WR2A	Rose Lake-Porter Slough-marsh	10	6.27	4	0.55	4.9	0.04	0.29
98R2	98WR2B	Rose Lake-Porter Slough-marsh	20	6.33	4	ns	56	0.04	0.51
98K1	98WK1A	Killarney-levee bank	10	6.74	70	6.05	3.1	0.66	0.18
98K1	98WK1B	Killarney-levee bank	20	6.63	145	5.3	175	0.54	0.2
98K2	98WK2A	Killarney-marsh	15	6.5	4	1.15	8.7	0.04	0.75
98K2	98WK2B	Killarney-marsh	30	6.36	4	1.51	68	0.07	0.56
98K3	98WK3A	Killarney-lake shore marsh	10	6.29	4	1.07	161	0.04	0.26
98K3	98WK3B	Killarney-lake shore marsh	25	6.32	4	1.02	142	0.05	0.28
98K3	98WK3C	Killarney-lake shore marsh	40	6.23	4	1.47	307	1.1	0.22
98M1	98WM1A	Medimont-levee bank	5	6.76	4	2.04	11	0.86	0.54
98M1	98WM1B	Medimont-levee bank	20	6.72	4	2.66	199	1.6	0.08
98M1	98WM1C	Medimont-levee bank	35	6.72	4	2.21	102	0.04	0.3
98M2	98WM2A	Medimont-railway marsh	21	6.48	19	1.64	4.4	0.09	0.6
98M2	98WM2B	Medimont-railway marsh	25	6.53	4	2.82	12	0.07	0.25
98M3	98WM3A	Medimont-marsh	15	6.51	4	2.06	3.9	0.04	0.21
98M3	98WM3B	Medimont-marsh	30	6.45	4	2.42	6	0.04	0.26
98T1	98WT1A	Thompson Lake-levee bank	5	7.05	4	6.3	629	0.13	2.3
98T1	98WT1B	Thompson Lake-levee bank	20	7.09	4	9.13	466	0.1	0.38
98T1	98WT1C	Thompson Lake-levee bank	35	7	4	9.44	700	0.4	0.9
98T2	98WT2A	Thompson Lake-marsh	10	6.62	ns	ns	8.5	0.04	1
98T2	98WT2B	Thompson Lake-marsh	25	6.52	4	1.49	910	0.19	0.41

ns = no sample

Table 11. Analytical data for porewater collected in the lower Coeur d'Alene River valley (2 pages).

Site	Sample Number	Location description	Sample Depth (cm)	Fe mg/L	Hg µg/L	Mn mg/L	Pb µg/L	Sb µg/L	Zn mg/L
98C1	98WC1A	Cataldo-levee bank	5	104.05	<0.05	13.56	0.26	0.68	1.986
98C1	98WC1B	Cataldo-levee bank	10	137.6	<0.05	13.96	0.08	0.29	8.533
98C1	98WC1C1	Cataldo-levee bank	20	90.2	<0.05	14.38	2.3	1	40.27
98C1	98WC1C2	Cataldo-levee bank	20	90.5	<0.05	14.77	1.4	1	41.26
98C1	98WC1D	Cataldo-levee bank	35	119.2	<0.05	15.22	0.72	5.5	36.37
98C2	98WC2A	Cataldo-marsh	20	137.2	<0.05	12.35	0.13	1	0.013
98C2	98WC2B	Cataldo-marsh	30	138.7	<0.05	10.06	0.23	0.95	0.014
98R1	98WR1A	Rose Lake-levee bank	5	139.1	<0.05	17.07	11	0.42	41.75
98R1	98WR1B	Rose Lake-levee bank	20	107.5	<0.05	13.21	46	0.49	70.2
98R1	98WR1C	Rose Lake-levee bank	35	105.8	<0.05	14.54	24	0.39	60.31
98R2	98WR2A	Rose Lake-Porter Slough-marsh	10	16.71	<0.05	0.634	1.5	0.23	0.022
98R2	98WR2B	Rose Lake-Porter Slough-marsh	20	78.2	<0.05	2.634	0.22	1.1	0.062
98K1	98WK1A	Killarney-levee bank	10	29.25	<0.05	8.192	1.8	1.3	1.813
98K1	98WK1B	Killarney-levee bank	20	59.5	<0.05	5.82	3	2.1	1.739
98K2	98WK2A	Killarney-marsh	15	44.15	<0.05	3.268	0.42	0.8	0.017
98K2	98WK2B	Killarney-marsh	30	71.85	<0.05	3.883	8.7	8.4	0.21
98K3	98WK3A	Killarney-lake shore marsh	10	32.5	<0.05	6.266	0.45	5.8	0.017
98K3	98WK3B	Killarney-lake shore marsh	25	32.75	<0.05	5.351	1.5	4.4	0.095
98K3	98WK3C	Killarney-lake shore marsh	40	52.1	<0.05	3.184	10	13	1.203
98M1	98WM1A	Medimont-levee bank	5	43.55	<0.05	21.51	0.83	1	0.81
98M1	98WM1B	Medimont-levee bank	20	63.6	<0.05	14.58	7.8	5.1	1.663
98M1	98WM1C	Medimont-levee bank	35	33.15	<0.05	3.676	1.2	12	0.266
98M2	98WM2A	Medimont-railway marsh	21	196.05	<0.05	17.99	0.43	1.6	0.13
98M2	98WM2B	Medimont-railway marsh	25	224.1	<0.05	16.7	0.17	1.9	0.024
98M3	98WM3A	Medimont-marsh	15	83.8	<0.05	9.696	0.14	0.82	0.0092
98M3	98WM3B	Medimont-marsh	30	104.6	<0.05	11.55	0.16	0.76	0.0053
98T1	98WT1A	Thompson Lake-levee bank	5	71.4	<0.05	5.264	3.1	6.8	0.295
98T1	98WT1B	Thompson Lake-levee bank	20	57.04	<0.05	1.709	0.71	4.6	0.137
98T1	98WT1C	Thompson Lake-levee bank	35	90.4	<0.05	1.272	3.1	8.5	0.36
98T2	98WT2A	Thompson Lake-marsh	10	15.9	ns	5.131	0.31	1.3	0.017
98T2	98WT2B	Thompson Lake-marsh	25	81.2	<0.05	3.695	11	4.6	1.144

ns - no sample

Table 12. Analytical data for Coeur d'Alene River water collected at levee bank sample sites and used in SET experiments.

Site	Sample Number	Location description	pH	Sulfate mg/L	Alkalinity meq/L	As µg/L	Cd µg/L	Cu µg/L
98C1	98WC1E	Cataldo-edge of river	7.24	28	0.51	2	3.3	1
98R1	98WR1E	Rose Lake-edge of river	7.19	28	0.54	0.59	3.8	0.27
98M1	98WM1E	Medimont-edge of river	7.28	22	0.53	0.64	2.9	0.41
98T1	98WT1E	Thompson Lake-edge of river	7.32	19	0.59	6.4	2.2	0.59
98C1	CdA RIVER1	Cataldo-at boat landing; used in SET	7.28	21	0.52	0.7	3.1	0.88
98C1	CdA RIVER2	Cataldo-at boat landing; used in SET	7.15	21	0.41	0.74	3.2	1.4
98C1	CdA RIVER3	Cataldo-at boat landing; used in SET	7.15	21	0.51	0.53	3.2	2.1

Site	Sample Number	Location description	Fe mg/L	Hg µg/L	Mn mg/L	Pb µg/L	Sb µg/L	Zn mg/L
98C1	98WC1E	Cataldo-edge of river	0.131	<0.05	0.165	0.51	2.3	0.81
98R1	98WR1E	Rose Lake-edge of river	0.071	<0.05	0.409	2.2	1.9	1.004
98M1	98WM1E	Medimont-edge of river	0.005	<0.05	0.227	0.92	2.2	0.616
98T1	98WT1E	Thompson Lake-edge of river	0.175	<0.05	0.212	1.7	2.4	0.513
98C1	CdA RIVER1	Cataldo-at boat landing; used in SET	0.054	<0.05	0.15	0.38	2.2	0.653
98C1	CdA RIVER2	Cataldo-at boat landing; used in SET	0.049	<0.05	0.154	0.41	2.3	0.668
98C1	CdA RIVER3	Cataldo-at boat landing; used in SET	0.052	<0.05	0.153	0.49	2.2	0.651

Table 13. Analytical data for solids collected in the lower Coeur d'Alene River valley (3 pages).

			Adjusted depth			rerun					total	organic	inorganic		rerun
Site	Sample	Location description	top	bottom	Ag	Ag	Al	As	Ba	Be	C	C	C	Cd	Cd
	Number		cm	cm	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm
98C1	98SC1A	Cataldo-levee bank	2.5	7.5	12	*12*	4.3	120	580	1.5	2.46	0.75	1.71	36	*33*
98C1	98SC1B	Cataldo-levee bank	7.5	12.7	14	*11*	3.7	120	560	1.3	1.88	0.27	1.61	16	*16*
98C1	98SC1C	Cataldo-levee bank	17.3	22	11	*11*	4.2	130	580	1.4	2.60	0.96	1.64	61	*59*
98C2	98SC2A	Cataldo-marsh	19	21.7	8.7	*8.5*	5.9	92	750	1.9	4.47	2.00	2.47	39	*38*
98C2	98SC2B	Cataldo-marsh	28	32.6	13	*14*	3.8	210	530	1.3	3.36	0.80	2.56	40	*39*
98R1	98SR1A	Rose Lake-levee bank	2.7	8	20	*22*	3.3	170	490	1.2	2.99	0.39	2.60	48	*57*
98R1	98SR1B	Rose Lake-levee bank	17	23.5	20	*22*	3.1	160	270	1.1	3.08	0.22	2.86	53	*62*
98R1	98SR1C	Rose Lake-levee bank	32.7	39.5	14	*16*	3.5	110	580	1.2	2.42	0.34	2.08	42	*38*
98R2	98SR2A	Rose Lake-Porter Slough-marsh	5	12	9.9	*11*	5.2	170	630	1.5	4.82	2.10	2.72	34	*32*
98R2	98SR2B	Rose Lake-Porter Slough-marsh	15	23	14	*15*	5.1	270	670	1.7	5.55	2.77	2.78	35	*32*
98K1	98SK1A	Killarney-levee bank	7.6	13	15	*16*	3.1	180	700	1.1	2.78	0.18	2.60	45	*44*
98K1	98SK1B	Killarney-levee bank	17.4	22.8	16	*17*	2.7	310	440	1.0	3.21	0.12	3.09	42	*40*
98K2	98SK2A	Killarney-marsh	13	17	12	*13*	5.0	370	590	1.7	8.80	5.06	3.74	68	*70*
98K2	98SK2B	Killarney-marsh	28	32	16	*17*	5.0	370	620	1.7	5.77	2.25	3.52	74	*80*
98K3	98SK3A	Killarney-lake shore marsh	10.7	18	14	*15*	4.5	440	600	1.5	3.02	0.63	2.39	27	*25*
98K3	98SK3B	Killarney-lake shore marsh	32	39.3	18	*19*	5.0	100	870	1.8	3.16	0.52	2.64	29	*27*
98K3	98SK3C	Killarney-lake shore marsh	53	56	44	*46*	5.2	74	620	1.7	6.53	3.03	3.50	63	*65*
98M1	98SM1A	Medimont-levee bank	2.5	7.5	15	*17*	3.2	120	660	1.1	2.72	0.40	2.32	46	*46*
98M1	98SM1B	Medimont-levee bank	17.5	22.5	15	*17*	3.4	78	600	1.3	2.52	0.24	2.28	32	*30*
98M1	98SM1C	Medimont-levee bank	31	36	14	*16*	3.6	130	520	1.4	2.71	0.27	2.44	43	*41*
98M2	98SM2A	Medimont-railway marsh	7.2	12.5	4.1	*4.2*	5.3	29	560	1.8	5.13	2.79	2.34	10	*9.8*
98M2	98SM2B	Medimont-railway marsh	22.5	27.5	4.3	*4.3*	5.9	24	680	1.9	3.10	1.73	1.37	11	*11*
98M3	98SM3A	Medimont-marsh	18	25	13	*14*	5.2	180	640	1.7	5.36	2.22	3.14	38	*36*
98M3	98SM3B	Medimont-marsh	29.4	34.4	13	*14*	4.8	280	700	1.6	3.66	1.00	2.66	44	*42*
98T1	98ST1A	Thompson Lake-levee bank	2.6	7.9	12	*11*	4.1	120	630	1.4	2.67	0.58	2.09	26	*33*
98T1	98ST1B	Thompson Lake-levee bank	16.3	21.9	12	*12*	4.2	120	600	1.3	2.77	0.84	1.93	37	*35*
98T1	98ST1C	Thompson Lake-levee bank	31	37.2	11	*10*	3.7	130	590	1.3	2.54	0.56	1.98	31	*28*
98T2	98ST2A	Thompson Lake-marsh	7.5	13	15	*15*	4.2	180	630	1.5	3.68	0.96	2.72	35	*32*
98T2	98ST2B	Thompson Lake-marsh	22.2	27.2	16	*17*	3.6	100	650	1.3	3.37	0.53	2.84	33	*31*

rerun (italized values) = sample re-analyzed after drying at 110° C overnight
inorganic C = total C - organic C

Table 13. Analytical data for solids collected in the lower Coeur d'Alene River valley (3 pages).

Site	Sample Number	Location description	Adjusted depth top cm	Adjusted depth bottom cm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	rerun Hg ppm	Li ppm	Mn ppm	Mo ppm	Ni ppm	P ppm
98C1	98SC1A	Cataldo-levee bank	2.5	7.5	13	28	110	8.2	3.6	*3.3*	21	5400	<5	13	780
98C1	98SC1B	Cataldo-levee bank	7.5	12.7	8	24	78	9.1	2.4	*2.2*	18	7100	<5	9	580
98C1	98SC1C	Cataldo-levee bank	17.3	22	11	23	122	7.3	5.1	*5.6*	26	5800	<5	5	110
98C2	98SC2A	Cataldo-marsh	19	21.7	16	37	99	7.8	3.8	*3.8*	34	2300	<5	20	900
98C2	98SC2B	Cataldo-marsh	28	32.6	12	23	120	10.1	4.9	*5.0*	21	8500	<5	2	560
98R1	98SR1A	Rose Lake-levee bank	2.7	8	11	19	190	12.9	6.8	*6.2*	17	11000	<5	7	370
98R1	98SR1B	Rose Lake-levee bank	17	23.5	10	15	200	14.1	7.1	*6.8*	16	13000	<5	5	310
98R1	98SR1C	Rose Lake-levee bank	32.7	39.5	11	20	130	9.6	5	*4.6*	18	8300	<5	10	450
98R2	98SR2A	Rose Lake-Porter Slough-marsh	5	12	11	29	95	6.6	2.6	*2.6*	23	5000	<5	14	590
98R2	98SR2B	Rose Lake-Porter Slough-marsh	15	23	19	35	130	6.6	4.4	*4.1*	23	4000	<5	19	700
98K1	98SK1A	Killarney-levee bank	7.6	13	10	18	140	12.3	4.7	*5.3*	17	11000	<5	4	300
98K1	98SK1B	Killarney-levee bank	17.4	22.8	13	16	130	14.3	4.9	*4.8*	15	13000	<5	7	490
98K2	98SK2A	Killarney-marsh	13	17	26	39	120	8.4	3.2	*3.3*	24	5100	<5	27	750
98K2	98SK2B	Killarney-marsh	28	32	43	36	160	11.4	3.9	*4.5*	21	9200	<5	29	580
98K3	98SK3A	Killarney-lake shore marsh	10.7	18	17	30	140	10.2	2.1	*2.1*	19	9400	<5	16	340
98K3	98SK3B	Killarney-lake shore marsh	32	39.3	15	27	140	10.7	2.8	*2.9*	22	9800	<5	12	380
98K3	98SK3C	Killarney-lake shore marsh	53	56	14	40	260	5.9	7.4	*6.9*	23	4800	<5	23	460
98M1	98SM1A	Medimont-levee bank	2.5	7.5	10	19	130	11.1	4.2	*4.4*	16	10000	<5	8	330
98M1	98SM1B	Medimont-levee bank	17.5	22.5	14	14	130	10.5	3.4	*3.4*	17	10000	<5	12	270
98M1	98SM1C	Medimont-levee bank	31	36	19	27	160	11.7	3.2	*3.4*	17	12000	<5	18	300
98M2	98SM2A	Medimont-railway marsh	7.2	12.5	11	28	46	3.1	0.79	*0.6*	28	800	<5	17	870
98M2	98SM2B	Medimont-railway marsh	22.5	27.5	10	38	42	2.5	0.68	*0.63*	31	530	<5	15	730
98M3	98SM3A	Medimont-marsh	18	25	14	32	120	7.5	3.1	*3.1*	23	5900	<5	14	610
98M3	98SM3B	Medimont-marsh	29.4	34.4	19	30	130	9.0	3.8	*3.3*	20	7900	<5	13	560
98T1	98ST1A	Thompson Lake-levee bank	2.6	7.9	11	23	110	8.8	3.8	*3.6*	22	7600	<5	8	490
98T1	98ST1B	Thompson Lake-levee bank	16.3	21.9	6	23	110	8.2	3.7	*3.6*	22	6800	<5	8	570
98T1	98ST1C	Thompson Lake-levee bank	31	37.2	9	20	98	9.1	3.3	*3.0*	20	7500	<5	7	500
98T2	98ST2A	Thompson Lake-marsh	7.5	13	14	28	140	9.5	3.3	*3.2*	22	8800	<5	15	320
98T2	98ST2B	Thompson Lake-marsh	22.2	27.2	14	25	130	11.7	3.2	*3.3*	18	11000	<5	14	300

rerun (italized values) = sample re-analyzed after drying at 110° C overnigr
inorganic C = total C - organic C

Table 13. Analytical data for solids collected in the lower Coeur d'Alene River valley (3 pages).

Site	Sample Number	Location description	Adjusted depth top cm	Adjusted depth bottom cm	Pb ppm	rerun Pb ppm	Sb ppm	Sr ppm	Ti %	V ppm	Zn ppm
98C1	98SC1A	Cataldo-levee bank	2.5	7.5	3900	*3700*	44	42	0.21	38	7800
98C1	98SC1B	Cataldo-levee bank	7.5	12.7	3200	*2900*	34	34	0.18	33	3900
98C1	98SC1C	Cataldo-levee bank	17.3	22	4400	*4400*	55	45	0.20	35	12000
98C2	98SC2A	Cataldo-marsh	19	21.7	2900	*2800*	38	59	0.27	53	3100
98C2	98SC2B	Cataldo-marsh	28	32.6	3800	*3700*	68	38	0.16	31	3300
98R1	98SR1A	Rose Lake-levee bank	2.7	8	5200	*6000*	55	31	0.18	31	8800
98R1	98SR1B	Rose Lake-levee bank	17	23.5	5300	*5200*	61	29	0.18	28	9900
98R1	98SR1C	Rose Lake-levee bank	32.7	39.5	4300	*4300*	45	35	0.20	31	8800
98R2	98SR2A	Rose Lake-Porter Slough-marsh	5	12	3100	*3100*	34	82	0.23	45	4100
98R2	98SR2B	Rose Lake-Porter Slough-marsh	15	23	3900	*3800*	79	43	0.21	46	4500
98K1	98SK1A	Killarney-levee bank	7.6	13	4400	*4300*	48	31	0.16	26	7100
98K1	98SK1B	Killarney-levee bank	17.4	22.8	3900	*3800*	58	29	0.16	25	5500
98K2	98SK2A	Killarney-marsh	13	17	5300	*5200*	65	42	0.18	51	4900
98K2	98SK2B	Killarney-marsh	28	32	3600	*3600*	97	33	0.15	46	5400
98K3	98SK3A	Killarney-lake shore marsh	10.7	18	4400	*4100*	66	32	0.16	38	2900
98K3	98SK3B	Killarney-lake shore marsh	32	39.3	6300	*7000*	64	31	0.15	42	4000
98K3	98SK3C	Killarney-lake shore marsh	53	56	14000	*16000*	119	46	0.19	47	8700
98M1	98SM1A	Medimont-levee bank	2.5	7.5	4900	*4900*	41	30	0.16	28	5800
98M1	98SM1B	Medimont-levee bank	17.5	22.5	6200	*7000*	46	32	0.14	30	4900
98M1	98SM1C	Medimont-levee bank	31	36	6600	*7000*	76	30	0.13	31	5600
98M2	98SM2A	Medimont-railway marsh	7.2	12.5	2100	*2100*	15	86	0.30	54	1200
98M2	98SM2B	Medimont-railway marsh	22.5	27.5	1500	*1400*	13	68	0.32	52	1100
98M3	98SM3A	Medimont-marsh	18	25	4200	*4000*	60	50	0.20	43	3500
98M3	98SM3B	Medimont-marsh	29.4	34.4	4100	*4000*	64	46	0.19	40	3700
98T1	98ST1A	Thompson Lake-levee bank	2.6	7.9	4500	*4400*	41	44	0.20	34	4300
98T1	98ST1B	Thompson Lake-levee bank	16.3	21.9	4800	*5000*	42	45	0.20	35	4200
98T1	98ST1C	Thompson Lake-levee bank	31	37.2	4200	*4300*	41	40	0.18	31	3900
98T2	98ST2A	Thompson Lake-marsh	7.5	13	6100	*6800*	64	39	0.18	37	4800
98T2	98ST2B	Thompson Lake-marsh	22.2	27.2	6900	*7300*	61	30	0.12	31	4500

rerun (italized values) = sample re-analyzed after drying at 110 ° C overnigt
Inorganic C = total C - organic C

Table 14. Analytical data for water from Standard Elutriate Tests (SET) for samples collected in the lower Coeur d'Alene River valley.

Site	Sample Number	Location description	pH	Sulfate mg/L	Alkalinity meq/L	As µg/L	Cd µg/L	Cu µg/L
98C1	98SC1DW	Cataldo-levee bank	6.26	82	0.13	15	0.09	0.33
98C2	98SC2DW	Cataldo-marsh	6.58	25	0.24	83	0.23	0.72
98R1	98SR1DW	Rose Lake-levee bank (1 of 3)	4.88	57	0.09	12	0.37	0.44
98R1	98SR1EW	Rose Lake-levee bank (2 of 3)	5.61	24	0.1	14	0.54	0.4
98R1	98SR1FW	Rose Lake-levee bank (3 of 3)	6.43	48	0.07	11	0.4	0.58
98R2	98SR2DW	Rose Lake-Porter Slough-marsh	6.75	37	0.16	81	15	2.6
98K1	98SK1DW	Killarney-levee bank	6.19	53	0.12	7.9	1.4	0.32
98K2	98SK2DW	Killarney-marsh	6.47	52	0.15	180	3.1	0.25
98K3	98SK3DW	Killarney-lake shore marsh	5.29	19	0.03	72	4.9	0.13
98M1	98SM1DW	Medimont-levee bank	6.66	94	0.12	13	4.5	0.33
98M2	98SM2DW	Medimont-railway marsh	5.94	21	0.1	35	9.3	0.87
98M3	98SM3DW	Medimont-marsh	6.04	19	0.08	118	26	0.46
98T1	98ST1DW	Thompson Lake-levee bank	7.08	19	0.36	30	0.58	1.5
98T2	98ST2DW	Thompson Lake-marsh	6.11	19	0.12	31	4.2	2

Site	Sample Number	Location description	Fe mg/L	Hg µg/L	Mn mg/L	Pb µg/L	Sb µg/L	Zn mg/L
98C1	98SC1DW	Cataldo-levee bank	0.079	<0.05	1.656	21	7.7	1.145
98C2	98SC2DW	Cataldo-marsh	0.112	<0.05	0.541	46	162	0.17
98R1	98SR1DW	Rose Lake-levee bank (1 of 3)	0.054	<0.05	1.014	73	12	1.92
98R1	98SR1EW	Rose Lake-levee bank (2 of 3)	0.047	<0.05	1.184	130	12	2.852
98R1	98SR1FW	Rose Lake-levee bank (3 of 3)	0.035	<0.05	1.155	66	11	1.879
98R2	98SR2DW	Rose Lake-Porter Slough-marsh	0.046	<0.05	0.526	907	20	1.506
98K1	98SK1DW	Killarney-levee bank	0.019	<0.05	2.185	93	42	2.312
98K2	98SK2DW	Killarney-marsh	1.278	<0.05	1.148	547	59	1.363
98K3	98SK3DW	Killarney-lake shore marsh	0.281	<0.05	1.152	502	29	1.358
98M1	98SM1DW	Medimont-levee bank	0.025	<0.05	3.362	96	14	1.592
98M2	98SM2DW	Medimont-railway marsh	0.34	<0.05	2.926	299	5	2.3
98M3	98SM3DW	Medimont-marsh	0.086	<0.05	1.045	1243	26	2.888
98T1	98ST1DW	Thompson Lake-levee bank	0.068	<0.05	0.129	36	63	0.065
98T2	98ST2DW	Thompson Lake-marsh	0.147	<0.05	0.871	569	18	0.611

Table 15. Analytical data for solids collected in the lower Coeur d'Alene River valley and used in SET experiments (3 pages).

Site	Sample Number	Location description	Adjusted depth top cm	bottom cm	Ag ppm	rerun Ag ppm	Al %	As ppm	Ba ppm	Be ppm	total C %	organic C %	inorganic C %	Cd ppm	rerun Cd ppm
98C1	98SC1D	Cataldo-levee bank	0	13.9	10	*11*	3.8	120	540	1.3	2.75	1.08	1.67	24	*24*
98C2	98SC2D	Cataldo-marsh	0	71	13	*12*	3.4	250	520	1.2	3.00	0.61	2.39	25	*24*
98R1	98SR1D	Rose Lake-levee bank (1 of 3)	0	45	16	*18*	3.2	130	433	1.1	2.76	0.30	2.46	52	*54*
98R1	98SR1E	Rose Lake-levee bank (2 of 3)	0	45	17	*19*	3.4	140	700	1.2	2.80	0.40	2.40	46	*53*
98R1	98SR1F	Rose Lake-levee bank (3 of 3)	0	45	18	*19*	3.4	140	720	1.2	2.76	0.38	2.38	46	*51*
98R2	98SR2D	Rose Lake-Porter Slough-marsh	0	38.3	14	*16*	4.0	85	660	1.4	3.82	1.51	2.31	13	*13*
98K1	98SK1D	Killarney-levee bank	0	43.5	16	*17*	3.1	380	580	1.1	3.05	0.19	2.86	39	*36*
98K2	98SK2D	Killarney-marsh	8	37	15	*16*	4.9	230	661	1.7	3.16	0.84	2.32	32	*29*
98K3	98SK3D	Killarney-lake shore marsh	0	53	16	*18*	4.7	220	760	1.7	3.34	0.79	2.55	47	*44*
98M1	98SM1D	Medimont-levee bank	0	36	15	*16*	3.4	130	680	1.3	2.68	0.24	2.44	41	*38*
98M2	98SM2D	Medimont-railway marsh	0	57.5	3.9	*4.6*	5.7	21	740	1.7	3.26	1.69	1.57	8.7	*8.5*
98M3	98SM3D	Medimont-marsh	0	63	22	*23*	5.5	110	920	1.8	3.34	1.19	2.15	27	*25*
98T1	98ST1D	Thompson Lake-levee bank	0	34	13	*13*	4.3	120	690	1.5	2.56	0.68	1.88	37	*33*
98T2	98ST2D	Thompson Lake-marsh	0	69.2	23	*24*	4.2	120	620	1.5	3.88	0.84	3.04	44	*41*

rerun (italized values) = sample re-analyzed after drying at 110° C overnight
inorganic C = total C - organic C

Table 15. Analytical data for solids collected in the lower Coeur d'Alene River valley and used in SET experiments (3 pages).

Site	Sample Number	Location description	Adjusted depth top cm	bottom cm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	rerun Hg ppm	Li ppm	Mn ppm	Mo ppm	Ni ppm	P ppm
98C1	98SC1D	Cataldo-levee bank	0	13.9	6	21	89	8.0	3.0	*2.9*	21	5500	<5	7	590
98C2	98SC2D	Cataldo-marsh	0	71	17	25	110	10.3	3.8	*3.7*	18	9000	<5	11	380
98R1	98SR1D	Rose Lake-levee bank (1 of 3)	0	45	9	19	150	10.9	6	*5.6*	16	9500	<5	6	430
98R1	98SR1E	Rose Lake-levee bank (2 of 3)	0	45	11	21	160	11.5	5.8	*5.6*	18	10000	<5	8	450
98R1	98SR1F	Rose Lake-levee bank (3 of 3)	0	45	12	21	160	11.8	6.1	*5.6*	17	10000	<5	10	430
98R2	98SR2D	Rose Lake-Porter Slough-marsh	0	38.3	7	28	120	8.1	3.9	*3.5*	19	5100	<5	9	580
98K1	98SK1D	Killarney-levee bank	0	43.5	16	21	140	12.9	4.4	*4.5*	16	12000	<5	12	390
98K2	98SK2D	Killarney-marsh	8	37	20	33	140	9.0	2.4	*2.6*	22	7900	<5	17	400
98K3	98SK3D	Killarney-lake shore marsh	0	53	23	33	160	10.4	3.0	*3.2*	22	9600	<5	18	380
98M1	98SM1D	Medimont-levee bank	0	36	16	23	130	11.9	3.8	*4.0*	17	11000	<5	12	330
98M2	98SM2D	Medimont-railway marsh	0	57.5	7	35	44	2.7	0.72	*0.75*	27	660	<5	15	780
98M3	98SM3D	Medimont-marsh	0	63	10	35	140	6.7	3.7	*3.5*	25	4900	<5	13	610
98T1	98ST1D	Thompson Lake-levee bank	0	34	12	27	110	8.2	3.3	*3.4*	25	6900	<5	14	550
98T2	98ST2D	Thompson Lake-marsh	0	69.2	15	26	180	11.3	4.2	*4.4*	22	11000	<5	15	350

rerun (italized values) = sample re-analyzed after drying at 110° C overnigh
inorganic C = total C - organic C

Table 15. Analytical data for solids collected in the lower Coeur d'Alene River valley and used in SET experiments (3 pages).

Site	Sample Number	Location description	Adjusted depth top cm	bottom cm	Pb ppm	rerun Pb ppm	S %	Sb ppm	Sr ppm	Ti %	V ppm	Zn ppm
98C1	98SC1D	Cataldo-levee bank	0	13.9	3500	*3200*	0.43	42	36	0.17	32	6000
98C2	98SC2D	Cataldo-marsh	0	71	3900	*3700*	0.46	67	32	0.15	29	3100
98R1	98SR1D	Rose Lake-levee bank (1 of 3)	0	45	4500	*4700*	0.89	48	34	0.18	29	8000
98R1	98SR1E	Rose Lake-levee bank (2 of 3)	0	45	5000	*5000*	0.87	51	34	0.19	31	8800
98R1	98SR1F	Rose Lake-levee bank (3 of 3)	0	45	4800	*4600*	0.84	52	33	0.18	32	8500
98R2	98SR2D	Rose Lake-Porter Slough-marsh	0	38.3	5400	*5900*	0.26	42	41	0.19	37	2000
98K1	98SK1D	Killarney-levee bank	0	43.5	4200	*3800*	0.75	78	27	0.13	28	5300
98K2	98SK2D	Killarney-marsh	8	37	5100	*4800*	0.6	60	36	0.17	42	3400
98K3	98SK3D	Killarney-lake shore marsh	0	53	5900	*6600*	0.68	77	34	0.15	40	4800
98M1	98SM1D	Medimont-levee bank	0	36	5600	*5700*	0.81	52	32	0.16	30	5500
98M2	98SM2D	Medimont-railway marsh	0	57.5	1600	*1700*	0.13	15	66	0.30	49	1100
98M3	98SM3D	Medimont-marsh	0	63	7400	*8200*	0.33	67	45	0.22	46	3200
98T1	98ST1D	Thompson Lake-levee bank	0	34	4900	*4900*	0.46	41	47	0.20	37	4200
98T2	98ST2D	Thompson Lake-marsh	0	69.2	9000	*10000*	0.92	74	39	0.14	35	6800

rerun (italized values) = sample re-analyzed after drying at 110° C overnigh
inorganic C = total C - organic C

Table 16. Water content of solid samples used in the SET experiments.

Site	Sample Number	Location description	wet weight g	dry weight g	water %
98C1	98SC1D	Cataldo-levee bank	21.25	14.99	29.5
98C2	98SC2D	Cataldo-marsh	22.21	15.77	29
98R1	98SR1D	Rose Lake-levee bank	24.28	17.41	28.3
98R2	98SR2D	Rose Lake-Porter Slough-marsh	12.79	6.77	47.1
98K1	98SK1D	Killarney-levee bank	33.14	25.45	23.2
98K2	98SK2D	Killarney-marsh	14.31	8.51	40.5
98K3	98SK3D	Killarney-lake shore marsh	16.53	10.2	38.3
98M1	98SM1D	Medimont-levee bank	18.83	14.15	24.9
98M2	98SM2D	Medimont-railway marsh	14.03	7.59	45.9
98M3	98SM3D	Medimont-marsh	29.04	16.91	41.8
98T1	98ST1D	Thompson Lake-levee bank	25.38	16.53	34.9
98T2	98ST2D	Thompson Lake-marsh	23.24	14.98	35.5

Table 17. Summary of the release (positive numbers) or uptake (negative numbers) of elements during the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley (2 pages).

Site	Sample Number	Location description	H mole/m^3	Alkalinity 10^3eq/m^3	Alkalinity g CaCO$_3$/m^3	Sulfate g/m^3	As g/m^3	Cd g/m^3	Cu g/m^3	Fe g/m^3
98C1	98SC1DW	Cataldo-levee bank	1.9	-1.4	-70063	244000	57	-12	-4.5	109
98C2	98SC2DW	Cataldo-marsh	0.8	-0.96	-48043	16000	329	-12	-3	241
98R1	98SR1DW	Rose Lake-levee bank (1 of 3)	52.5	-1.56	-78070	144000	45	-11	-4.1	9
98R1	98SR1EW	Rose Lake-levee bank (2 of 3)	9.6	-1.52	-76068	12000	53	-11	-4.2	-19
98R1	98SR1FW	Rose Lake-levee bank (3 of 3)	1.2	-1.64	-82074	108000	41	-11	-3.5	-67
98R2	98SR2DW	Rose Lake-Porter Slough-marsh	0.5	-1.28	-64058	64000	321	47	4.6	-23
98K1	98SK1DW	Killarney-levee bank	2.3	-1.44	-72065	128000	29	-7	-4.6	-131
98K2	98SK2DW	Killarney-marsh	1.1	-1.32	-66059	124000	717	0	-4.8	4905
98K3	98SK3DW	Killarney-lake shore marsh	20.3	-1.8	-90081	-8000	285	7	-5.3	917
98M1	98SM1DW	Medimont-levee bank	0.6	-1.44	-72065	292000	49	5	-4.5	-107
98M2	98SM2DW	Medimont-railway marsh	4.3	-1.52	-76068	0	137	25	-2.4	1153
98M3	98SM3DW	Medimont-marsh	3.4	-1.6	-80072	-8000	469	91	-4	137
98T1	98ST1DW	Thompson Lake-levee bank	0.1	-0.48	-24022	-8000	117	-10	0.2	65
98T2	98ST2DW	Thompson Lake-marsh	2.8	-1.44	-72065	-8000	121	4	2.2	381

Units are the amount of an element in moles, equivalents,
or grams per cubic meter of wet sediment.

Table 17. Summary of the release (positive numbers) or uptake (negative numbers) of elements during the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley (2 pages).

Site	Sample Number	Location description	Mn g/m^3	Pb g/m^3	Sb g/m^3	Zn g/m^3
98C1	98SC1DW	Cataldo-levee bank	6015	82	22	1951
98C2	98SC2DW	Cataldo-marsh	1555	182	639	-1949
98R1	98SR1DW	Rose Lake-levee bank (1 of 3)	3447	290	39	5051
98R1	98SR1EW	Rose Lake-levee bank (2 of 3)	4127	518	39	8779
98R1	98SR1FW	Rose Lake-levee bank (3 of 3)	4011	262	35	4887
98R2	98SR2DW	Rose Lake-Porter Slough-marsh	1495	3626	71	3395
98K1	98SK1DW	Killarney-levee bank	8131	370	159	6619
98K2	98SK2DW	Killarney-marsh	3983	2186	227	2823
98K3	98SK3DW	Killarney-lake shore marsh	3999	2006	107	2803
98M1	98SM1DW	Medimont-levee bank	12839	382	47	3739
98M2	98SM2DW	Medimont-railway marsh	11095	1194	11	6571
98M3	98SM3DW	Medimont-marsh	3571	4970	95	8923
98T1	98ST1DW	Thompson Lake-levee bank	-93	142	243	-2369
98T2	98ST2DW	Thompson Lake-marsh	2875	2274	63	-185

Units are the amount of an element in moles, equivalents, or grams per cubic meter of wet sediment.

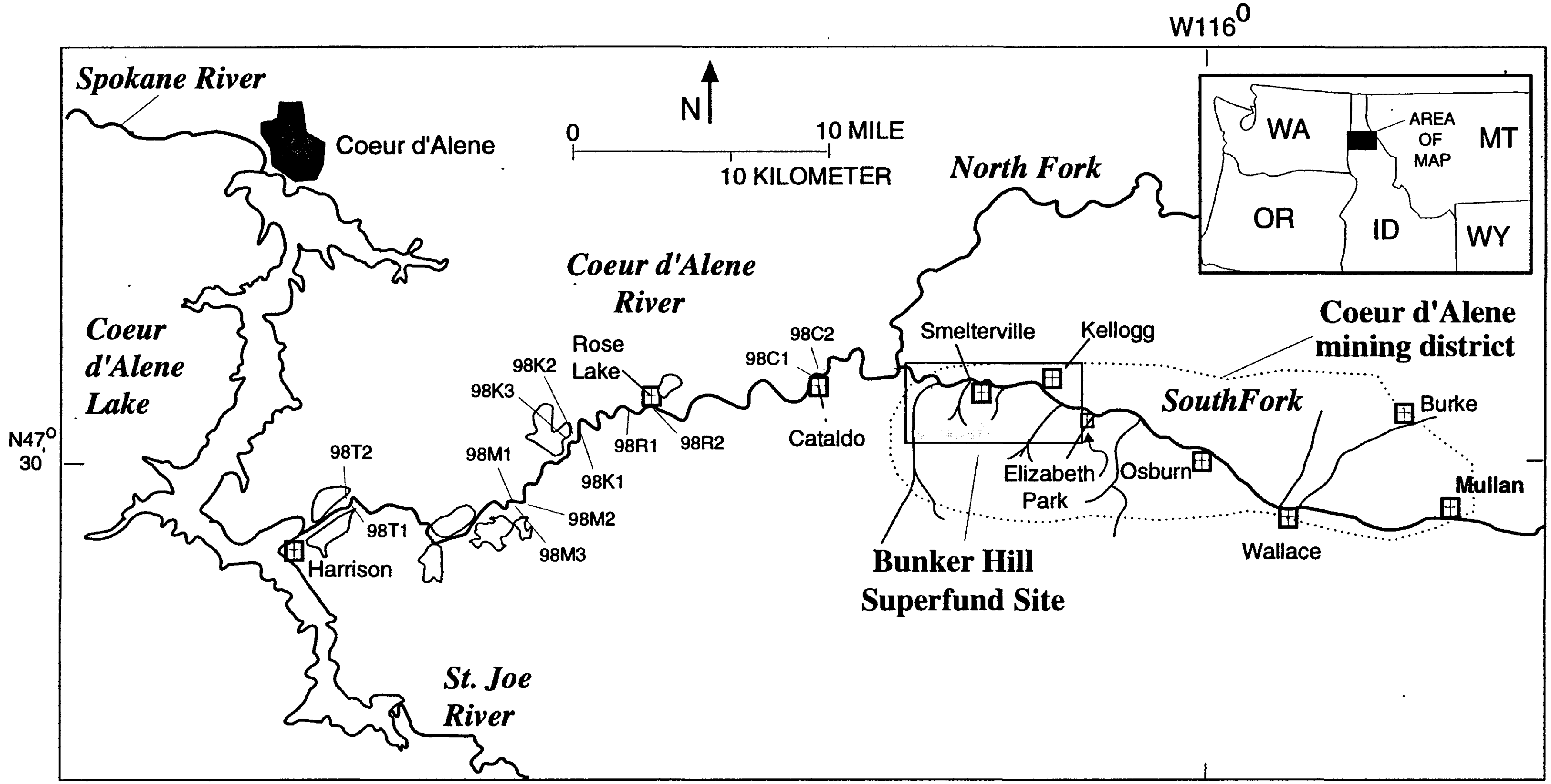

Figure 1. Map showing the locations of the porewater sample sites in the lower Coeur d'Alene River valley, Idaho.

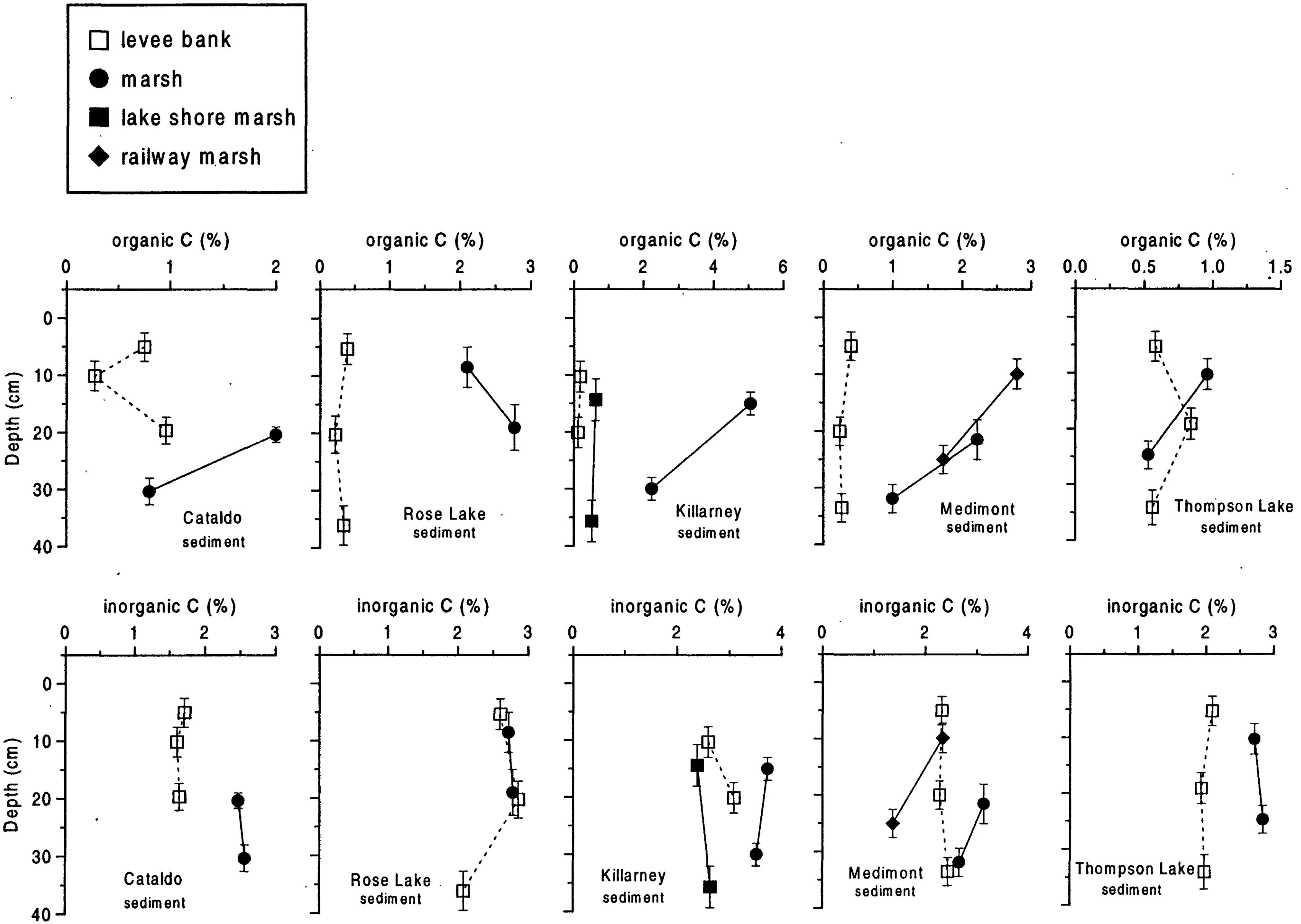

Figure 2. Concentrations of organic and inorganic carbon (C) in levee banks near the river's edge and in back levee marshes in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

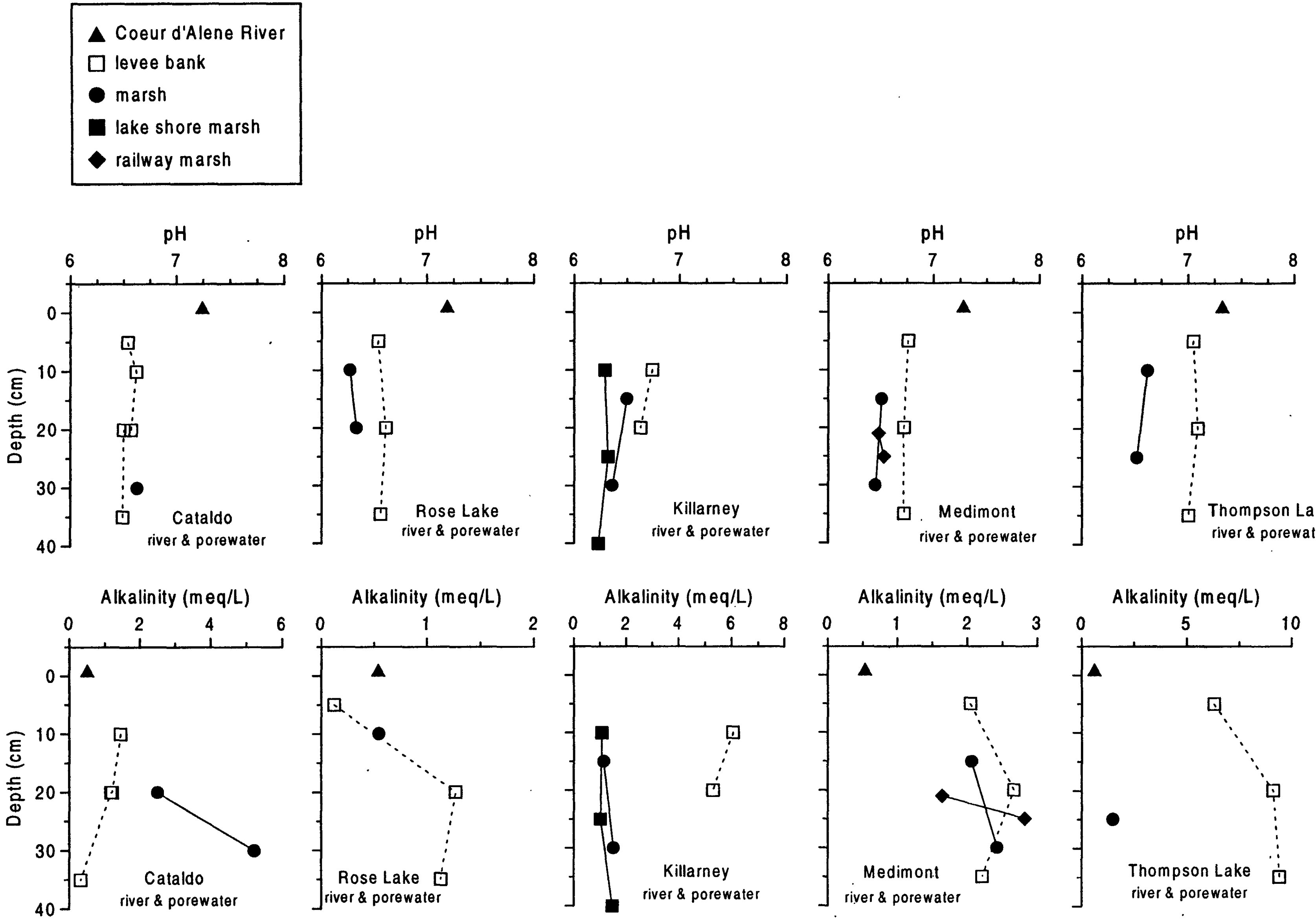

Figure 3. Values of pH and concentrations of alkalinity in porewater from sediments in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

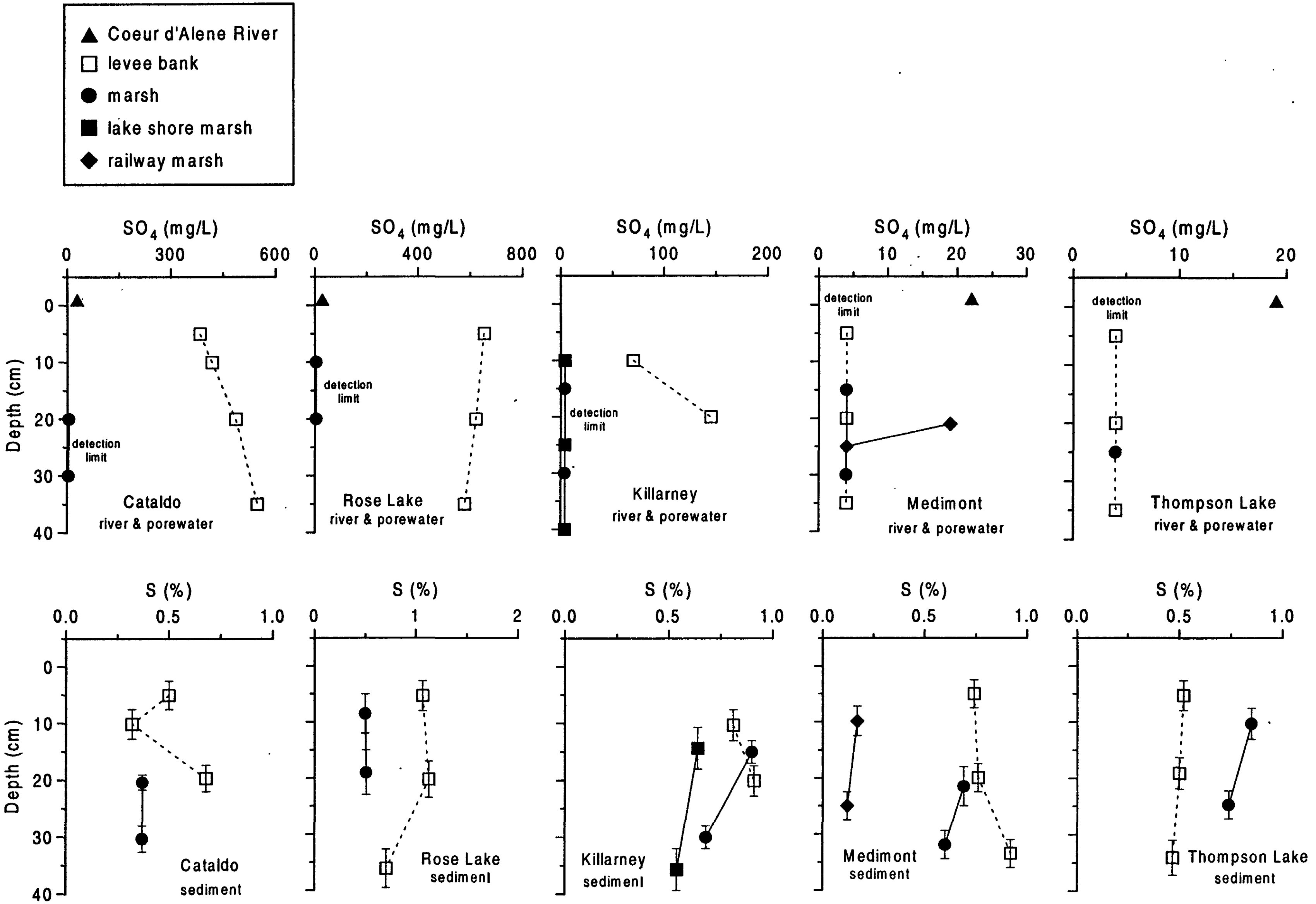

Figure 4. Concentrations of sulfate (SO_4) in porewater (top row) and total sulfur (S) in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

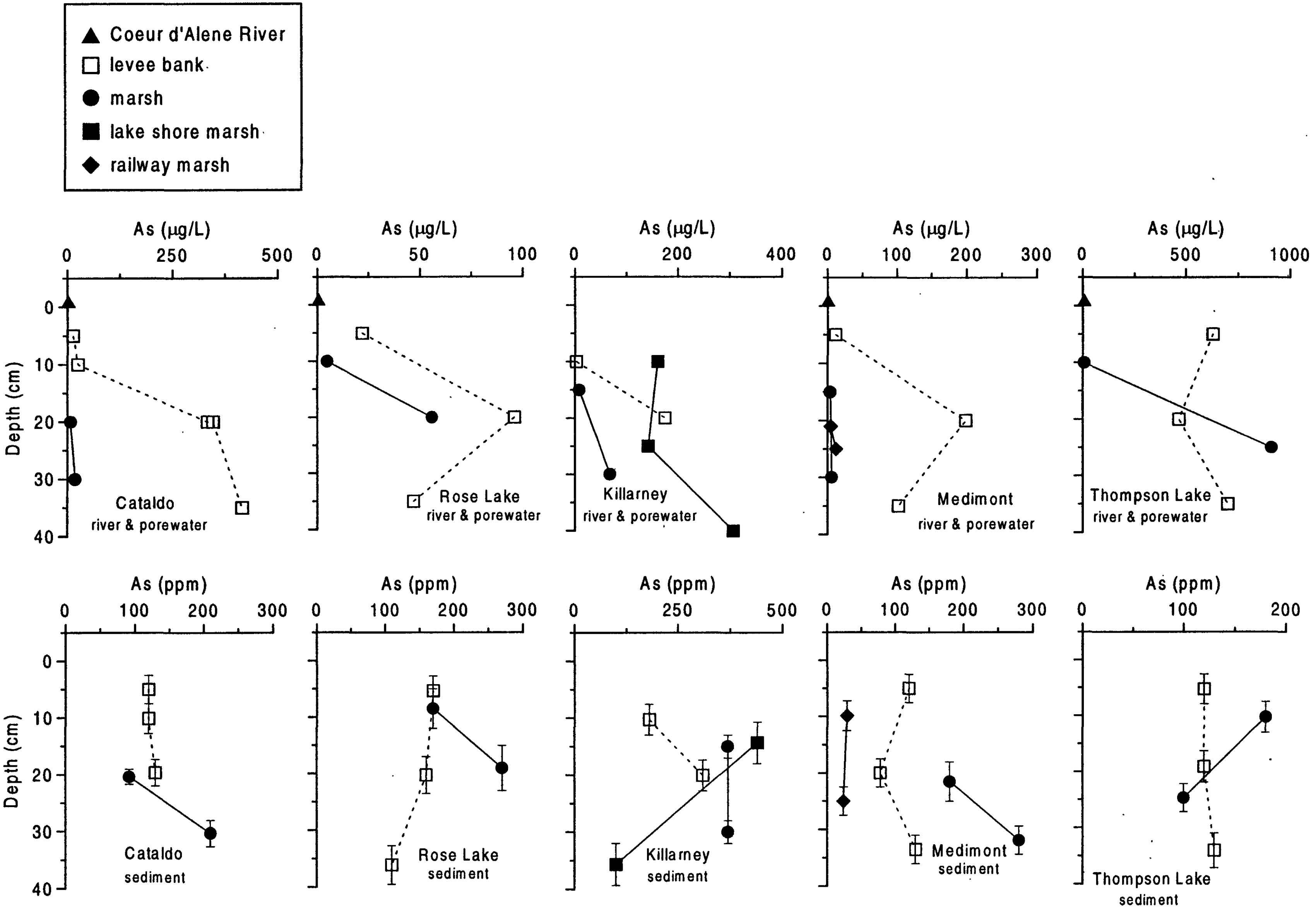

Figure 5. Concentrations of arsenic (As) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

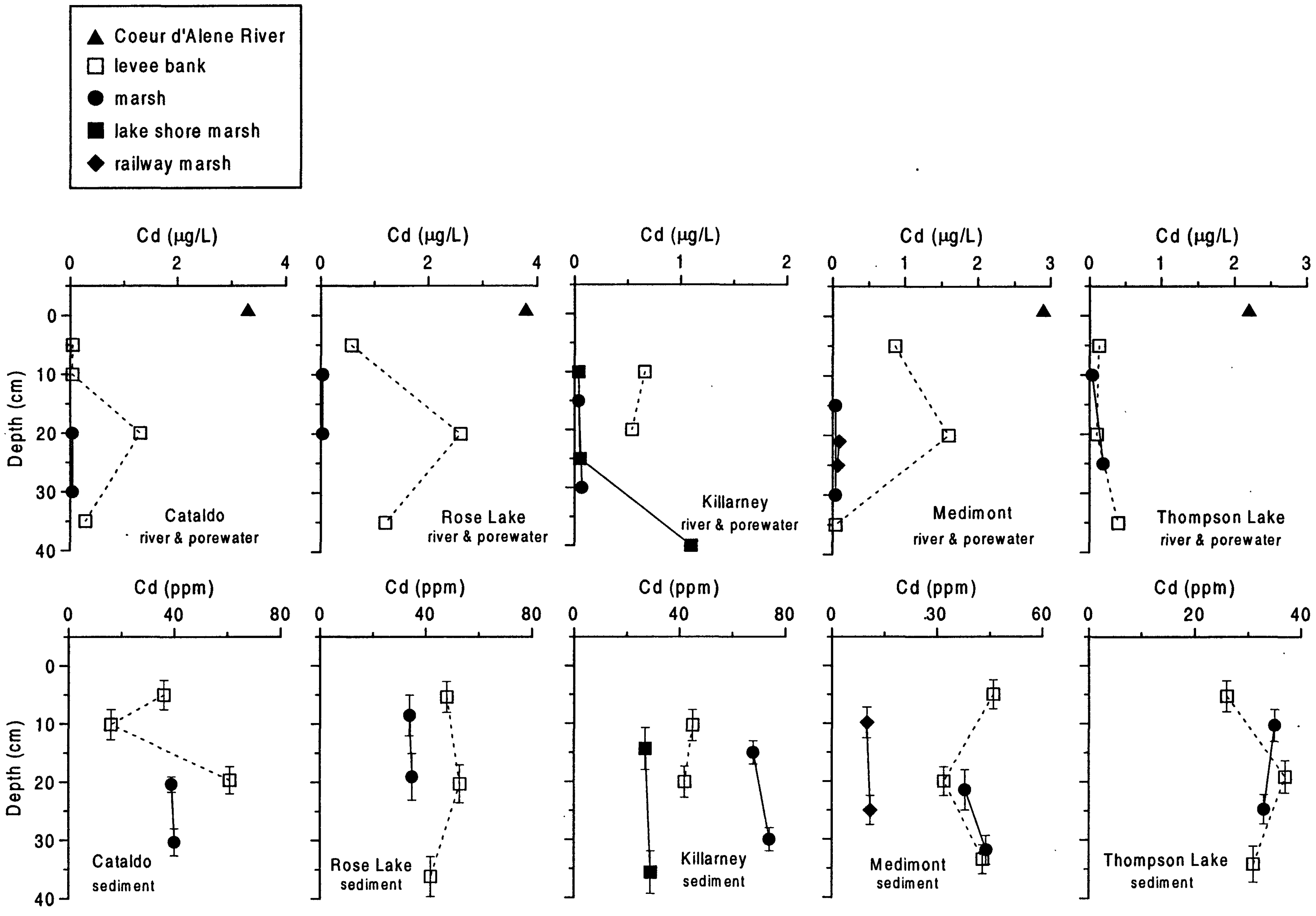

Figure 6. Concentrations of cadmium (Cd) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

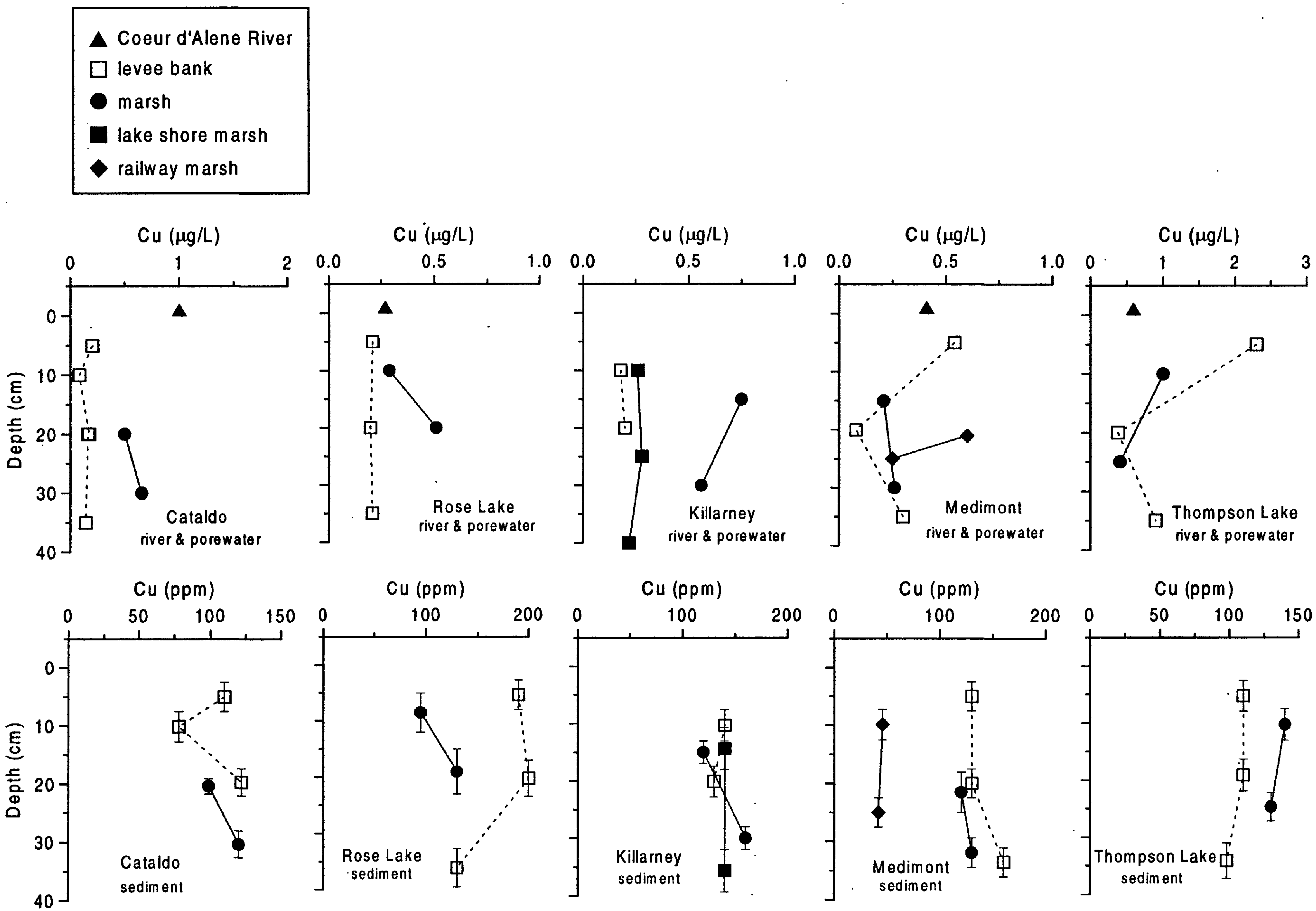

Figure 7. Concentrations of copper (Cu) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

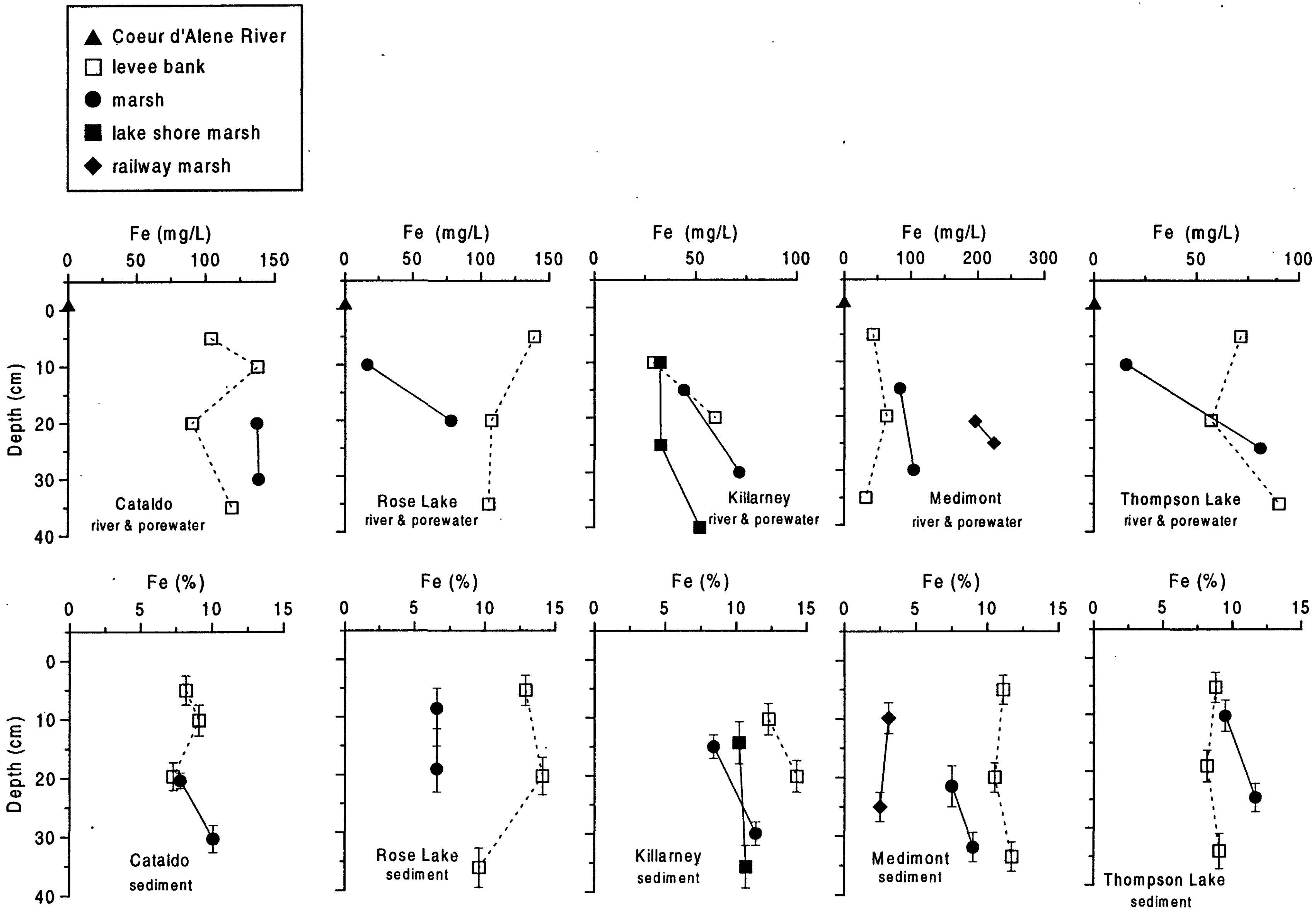

Figure 8. Concentrations of iron (Fe) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

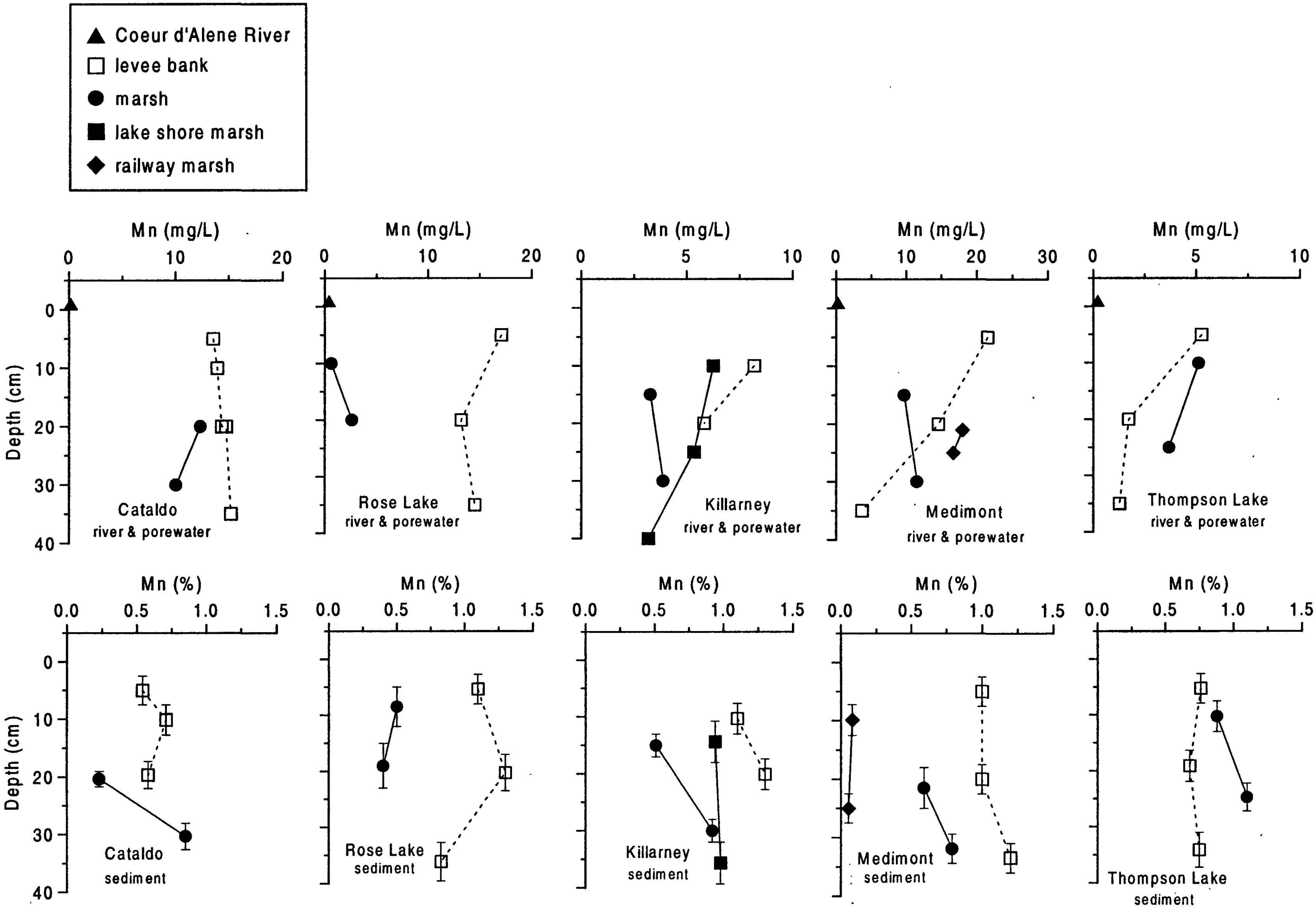

Figure 9. Concentrations of manganese (Mn) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

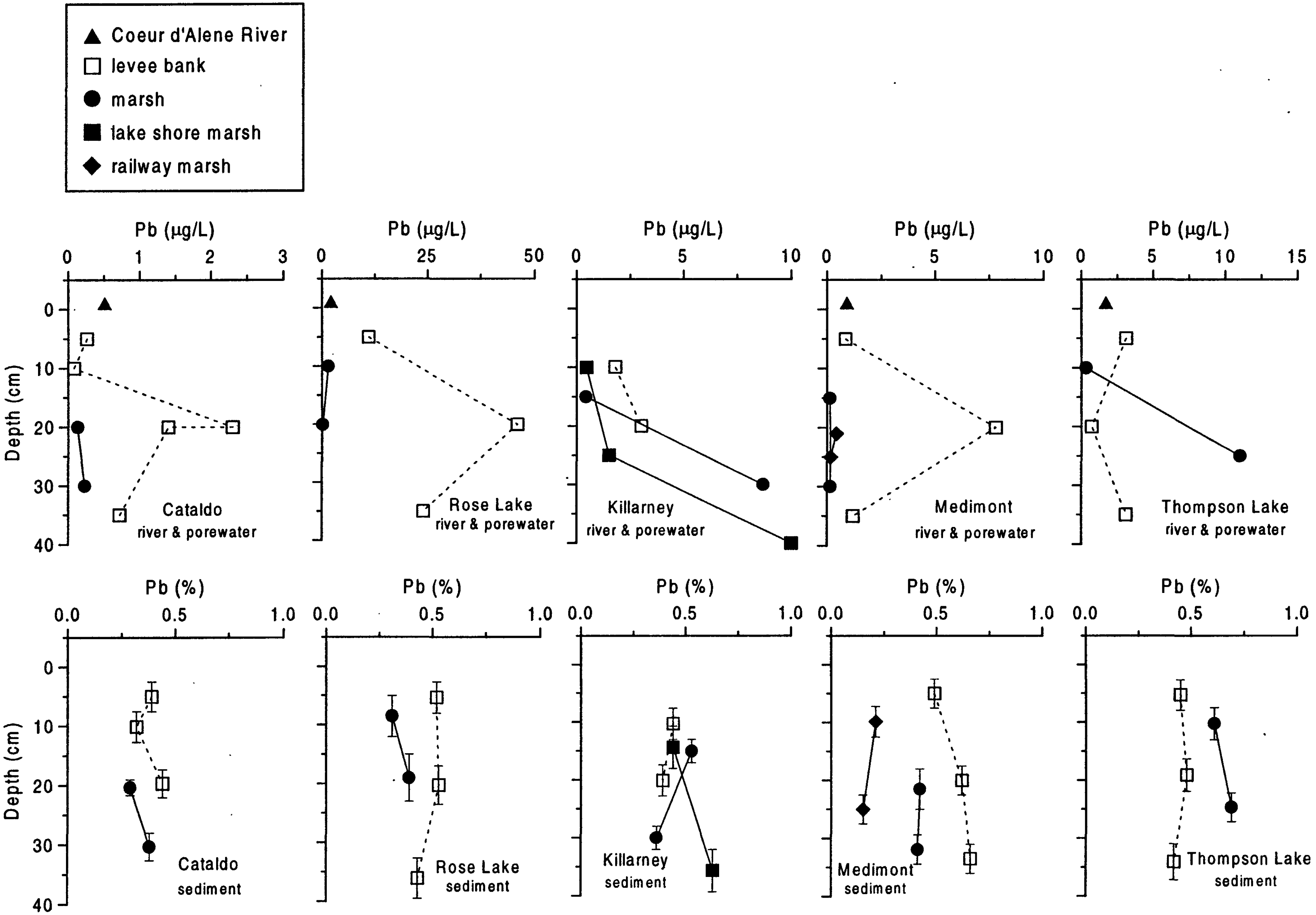

Figure 10. Concentrations of lead (Pb) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

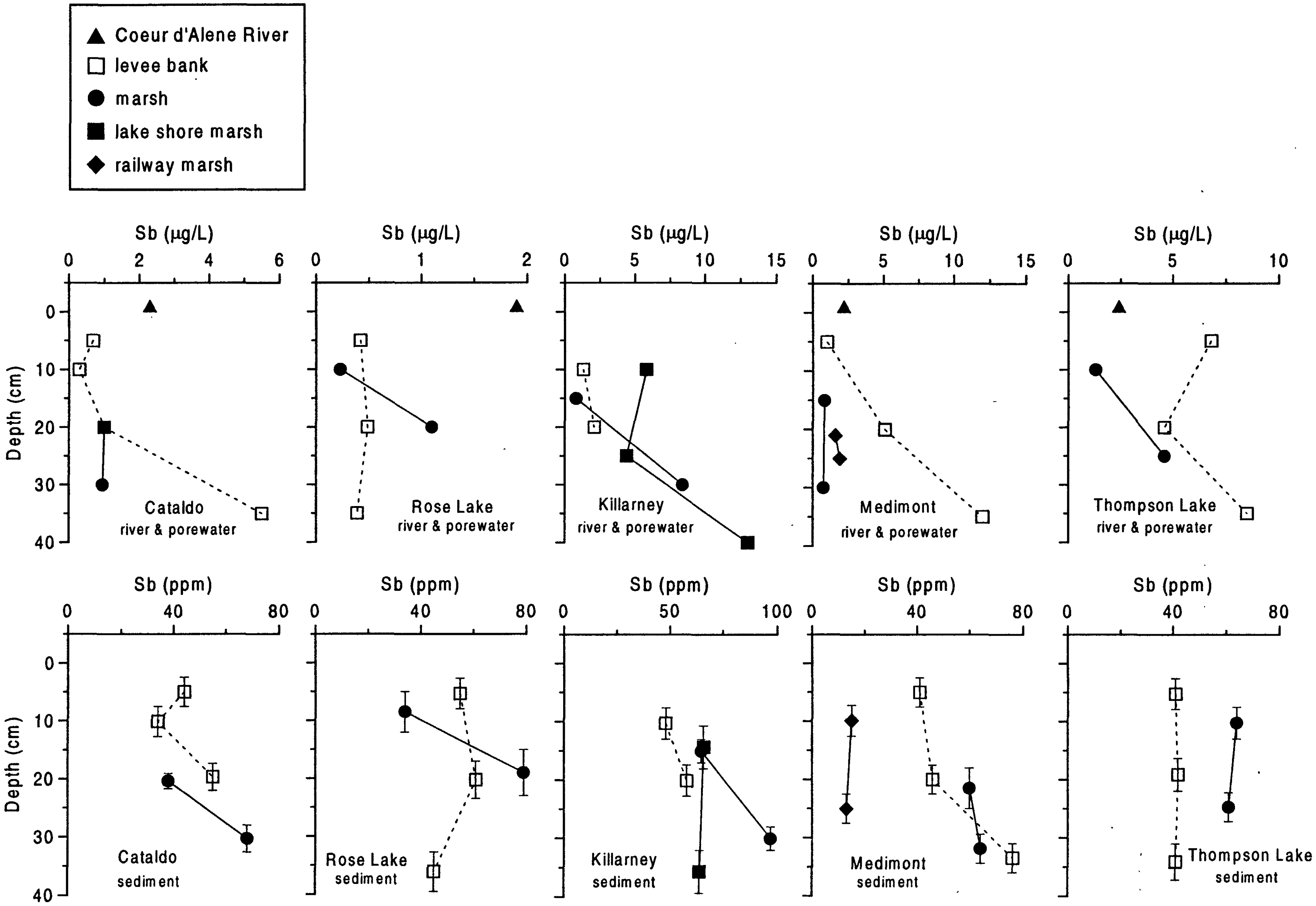

Figure 11. Concentrations of antimony (Sb) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

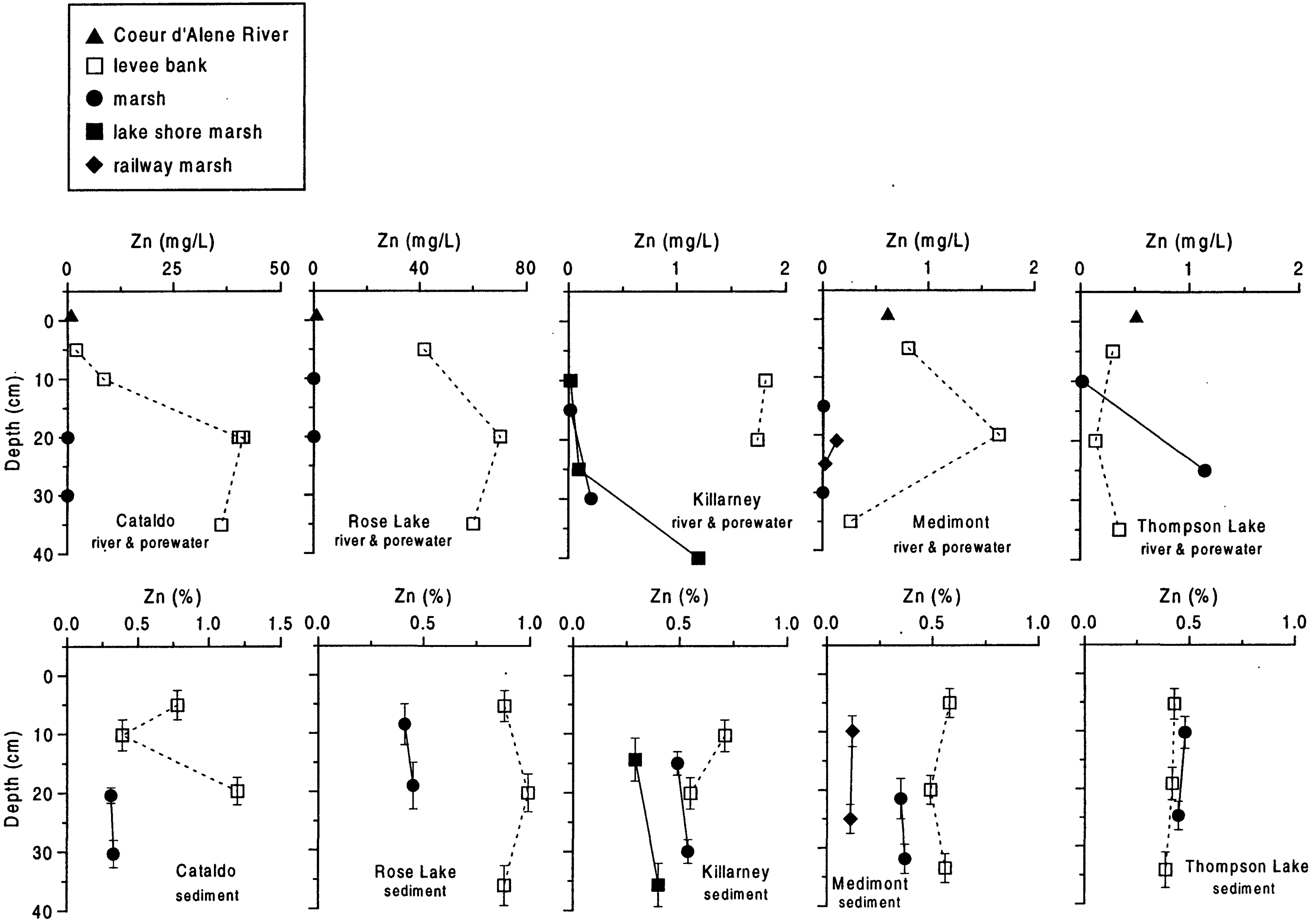

Figure 12. Concentrations of zinc (Zn) in porewater (top row) and in associated sediments (bottom row) in the lower Coeur d'Alene River valley. Data are plotted as a function of depth and distance downstream.

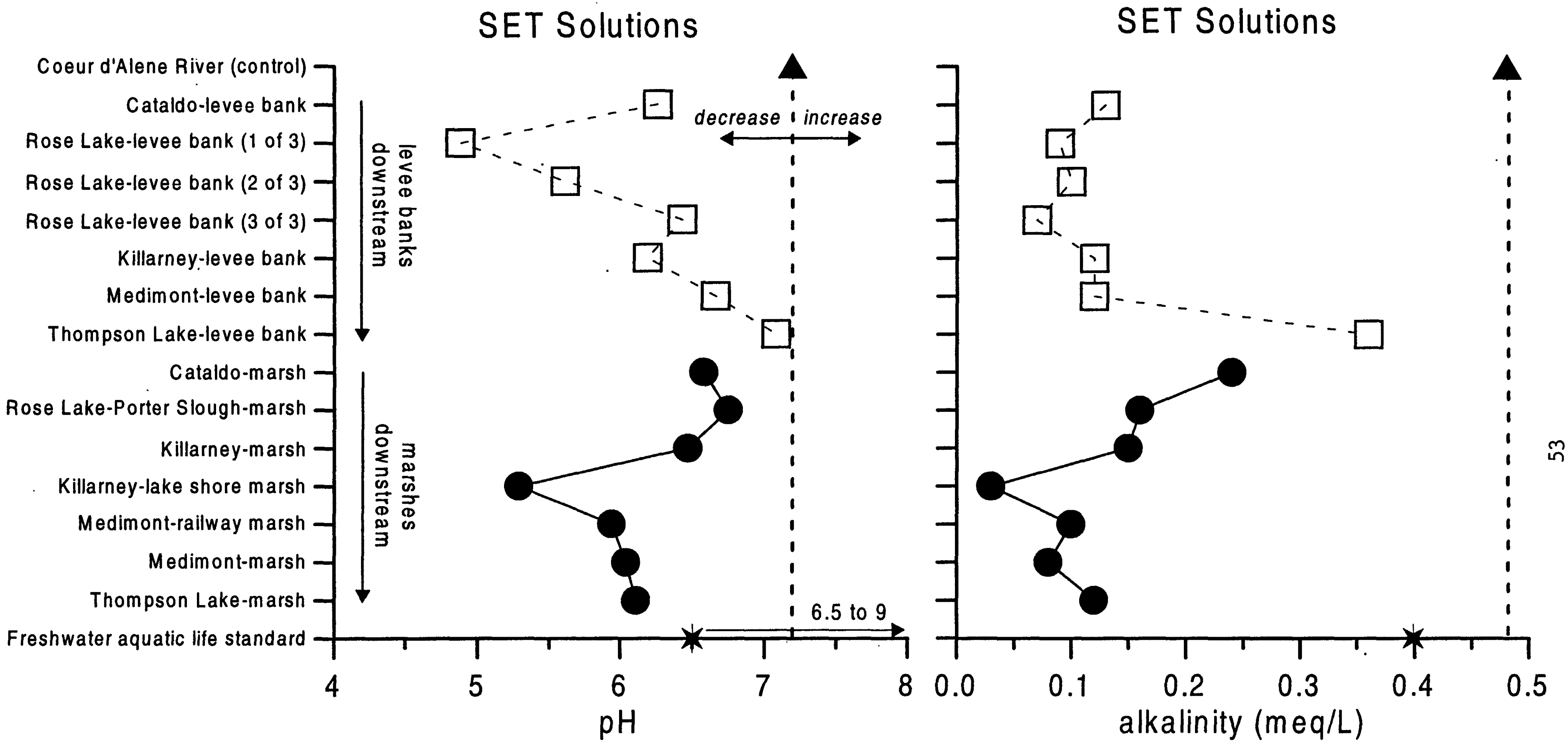

Figure 13. Values of pH and alkalinity in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley. Values of the freshwater aquatic life standards for pH and alkalinity (EPA, 1986) are also shown.

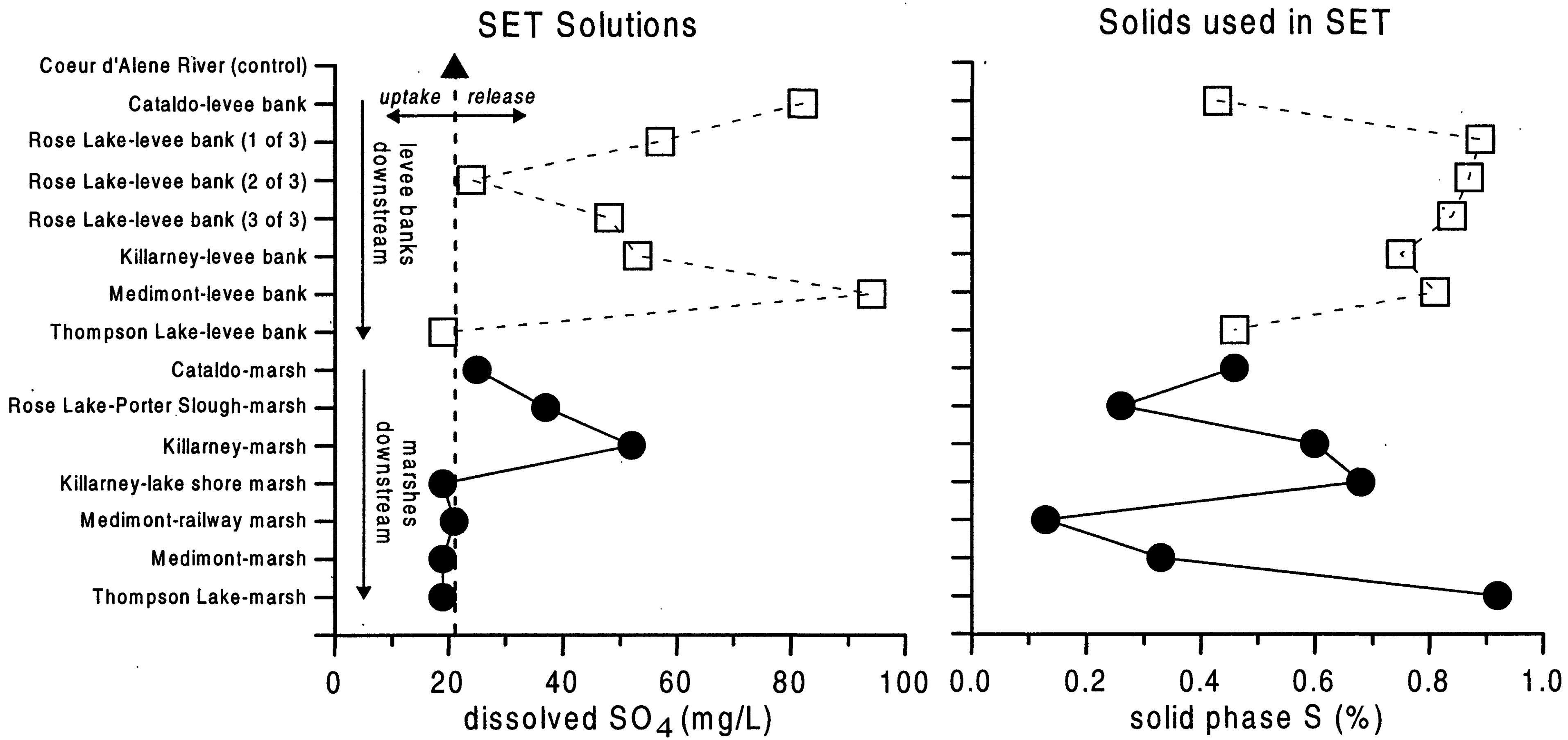

Figure 14. Concentrations of dissolved sulfate (SO_4) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total sulfur (S) in those sediments before the SET.

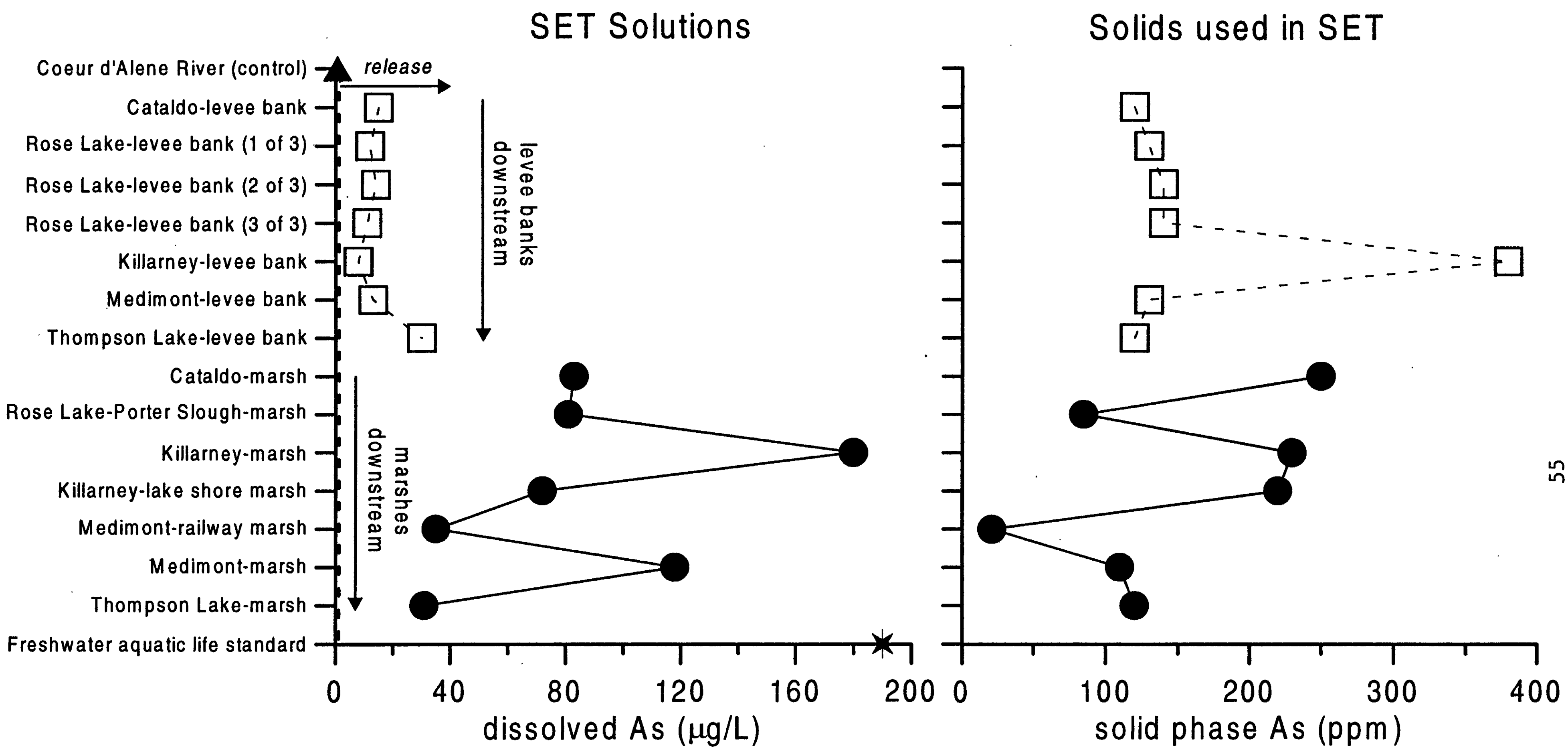

Figure 15. Concentrations of dissolved arsenic (As) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total As in those sediments before the SET. A value for the freshwater aquatic life standard for As in solution (EPA, 1986) is also shown.

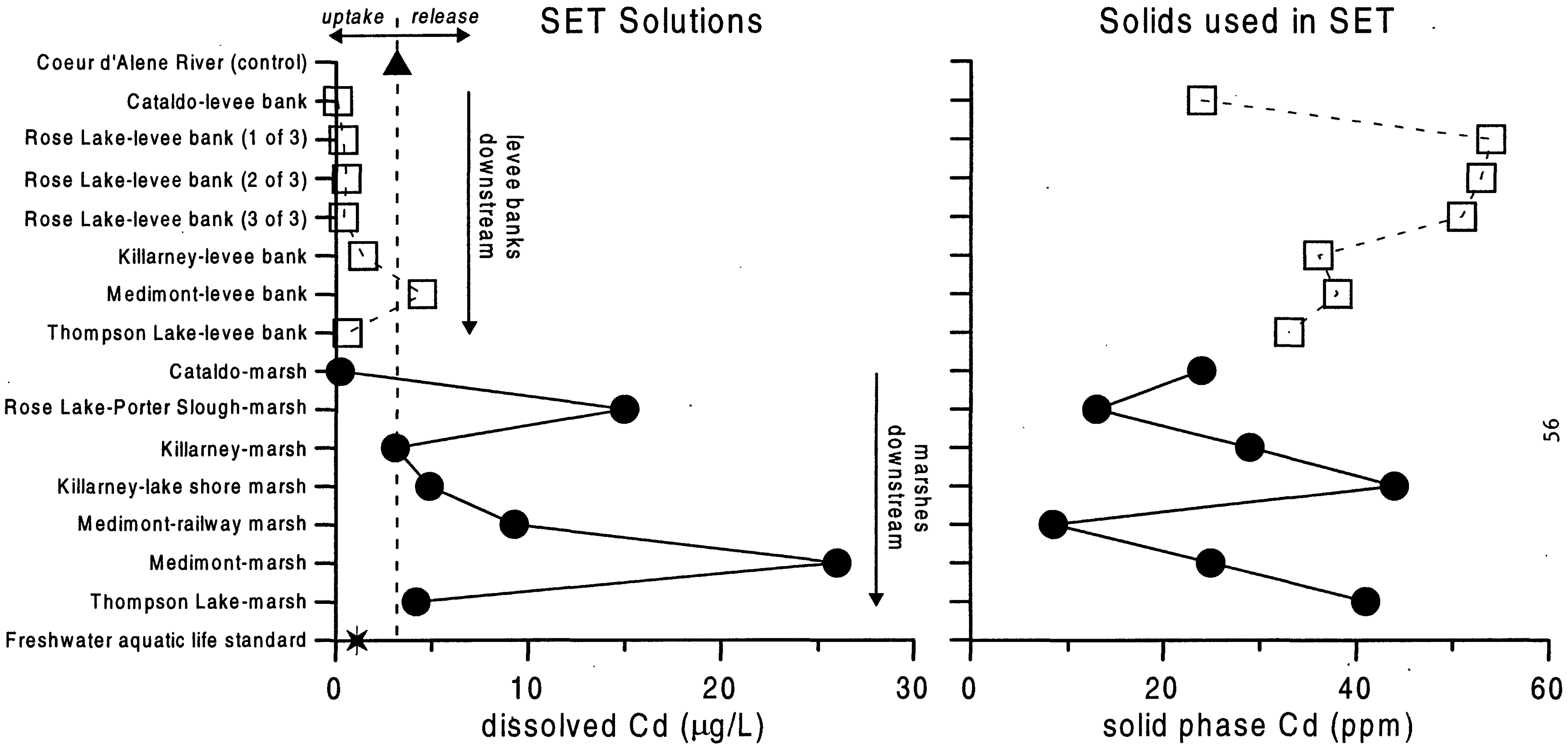

Figure 16. Concentrations of dissolved cadmium (Cd) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Cd in those sediments before the SET. A value for the freshwater aquatic life standard for Cd in solution at a hardness of 100 mg $CaCO_3$/L (EPA, 1986) is also shown.

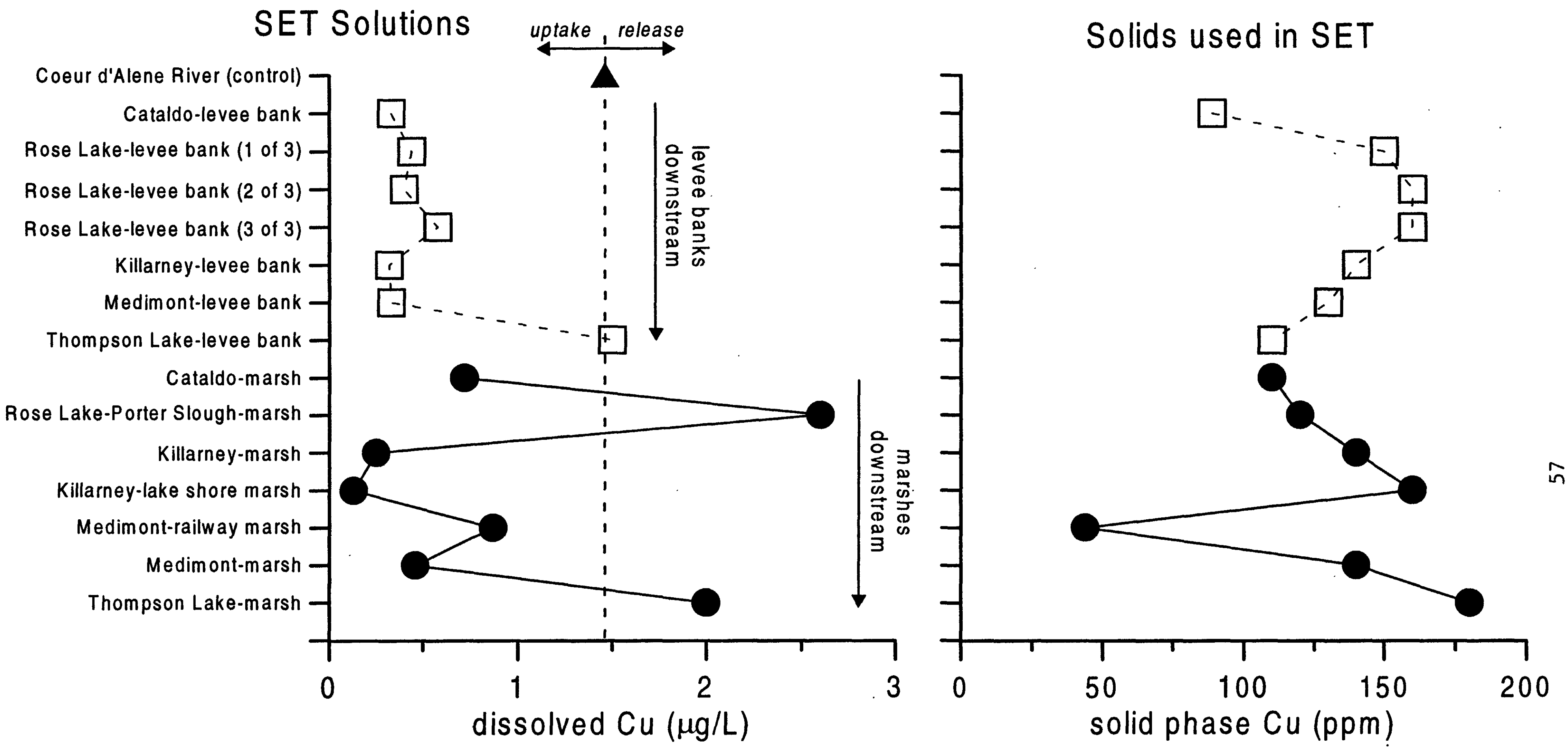

Figure 17. Concentrations of dissolved copper (Cu) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Cu in those sediments before the SET. The freshwater aquatic life standard for Cu in solution is 12 μg/L at a hardness of 100 mg $CaCO_3$/L (EPA, 1986); much higher than observed in the SET solutions.

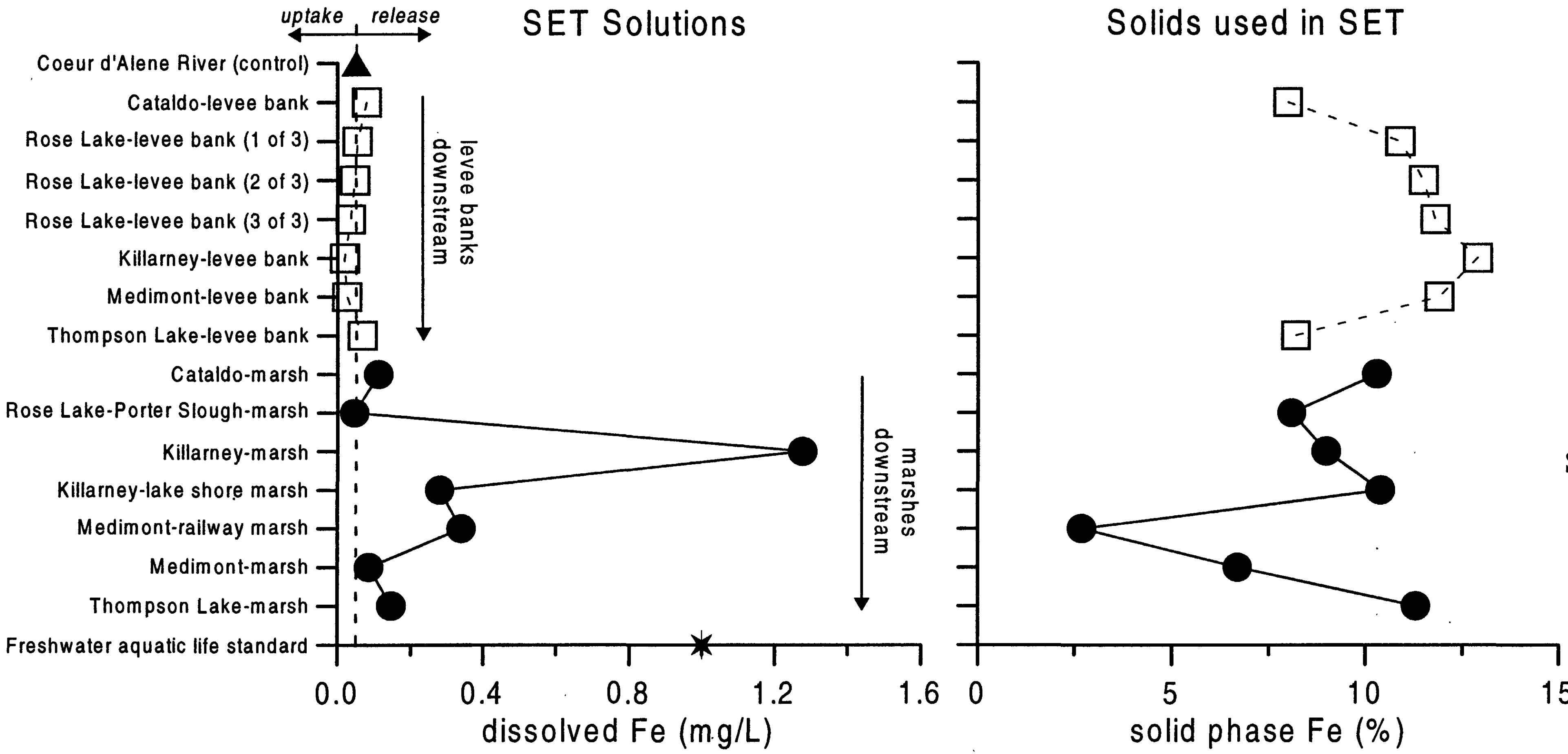

Figure 18. Concentrations of dissolved iron (Fe) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Fe in those sediments before the SET. A value for the freshwater aquatic life standard for Fe in solution (EPA, 1986) is also shown.

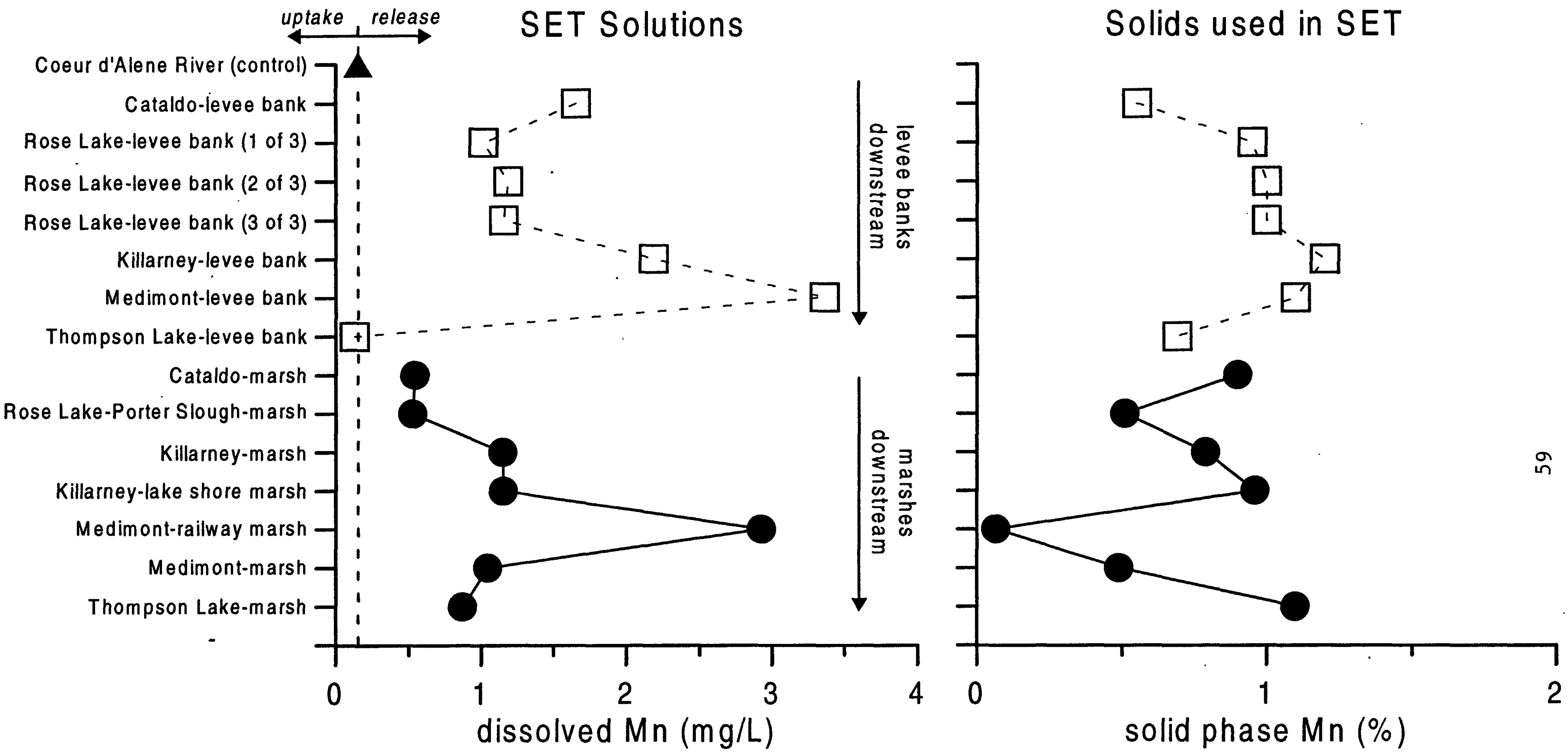

Figure 19. Concentrations of dissolved manganese (Mn) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Mn in those sediments before the SET.

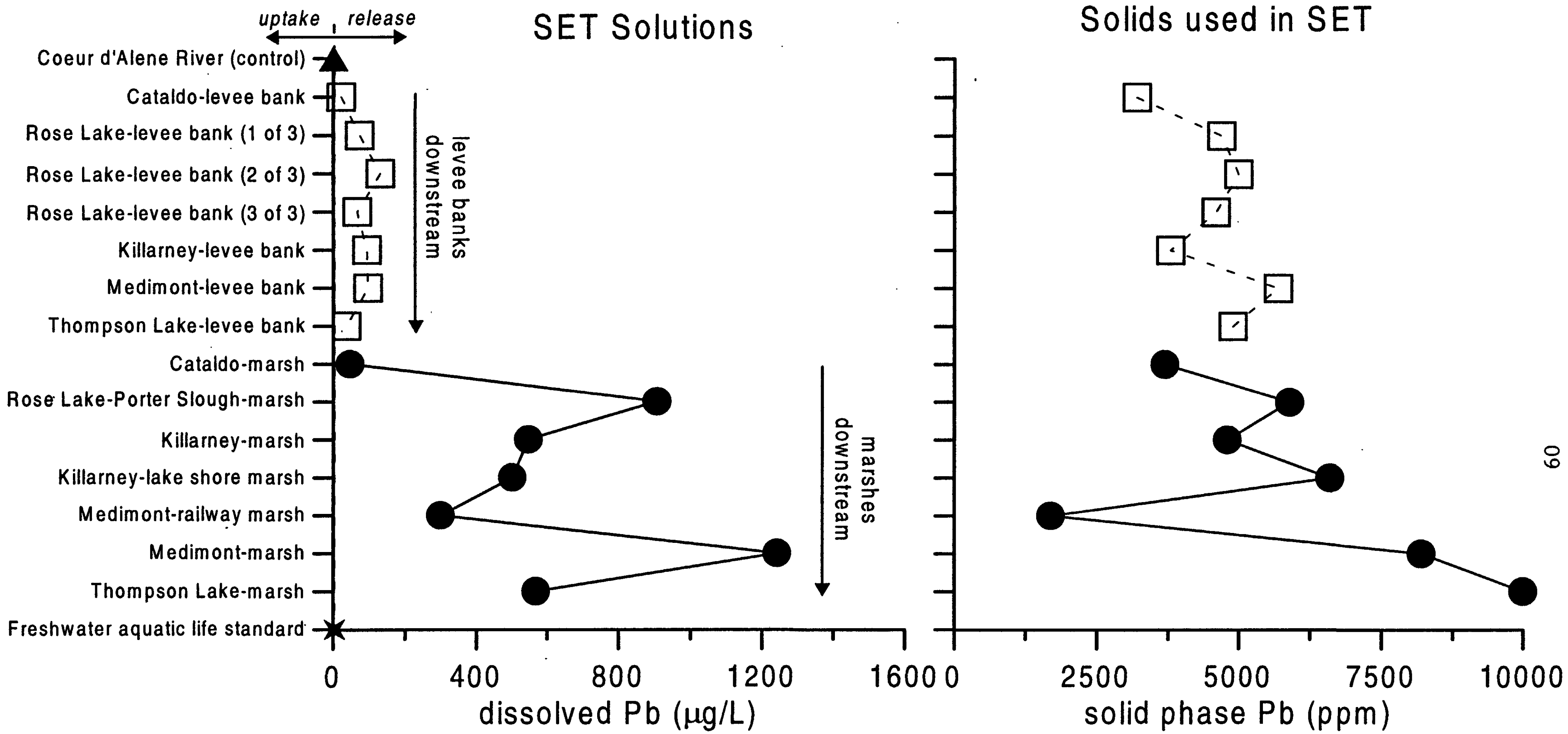

Figure 20. Concentrations of dissolved lead (Pb) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Pb in those sediments before the SET. The freshwater aquatic life standard for Pb in solution at a hardness of 100 mg $CaCO_3$/L (EPA, 1986) is also shown.

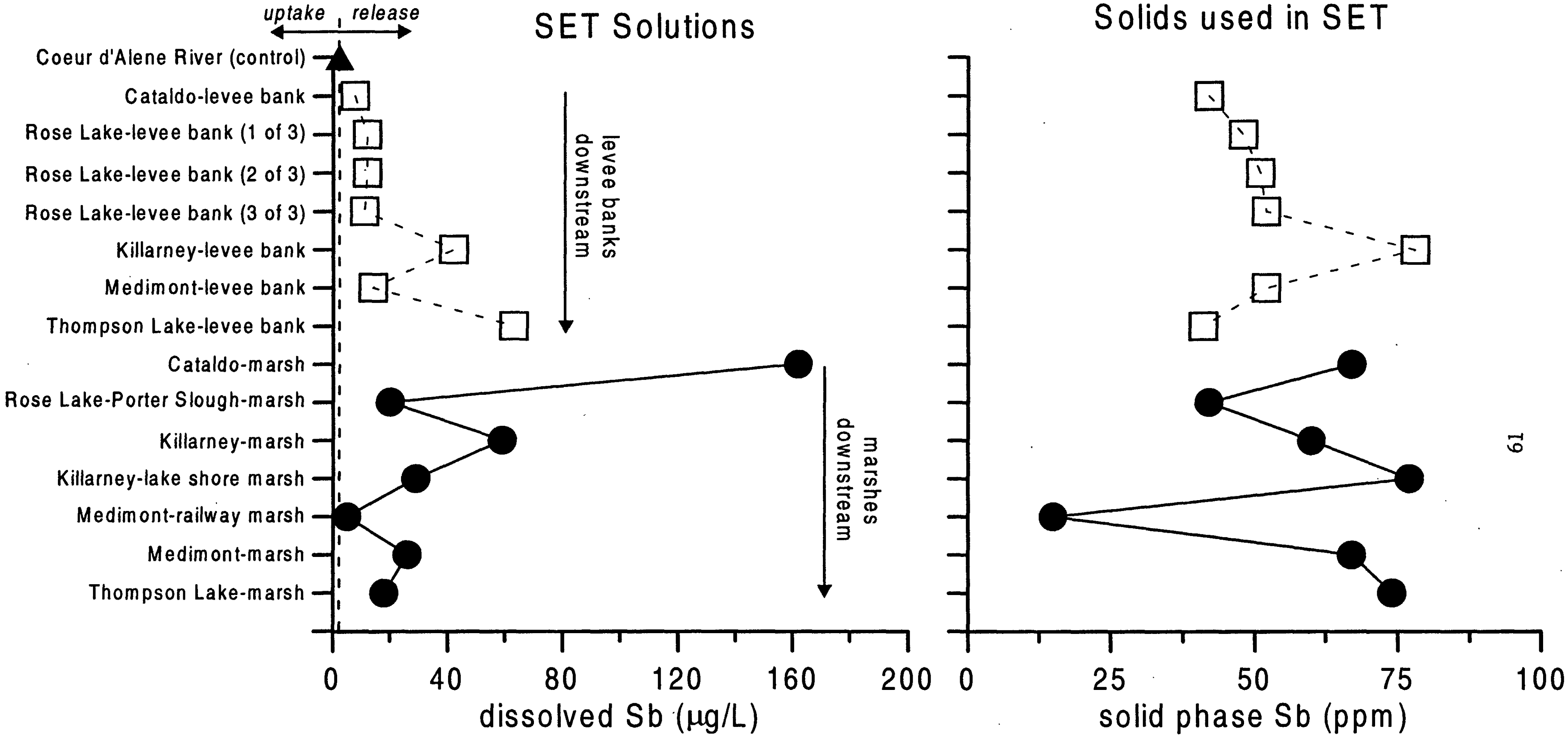

Figure 21. Concentrations of dissolved antimony (Sb) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Sb in those sediments before the SET. The freshwater aquatic life standard for Sb in solution is 1600 µg/L (EPA, 1986); much higher than observed in the SET solutions.

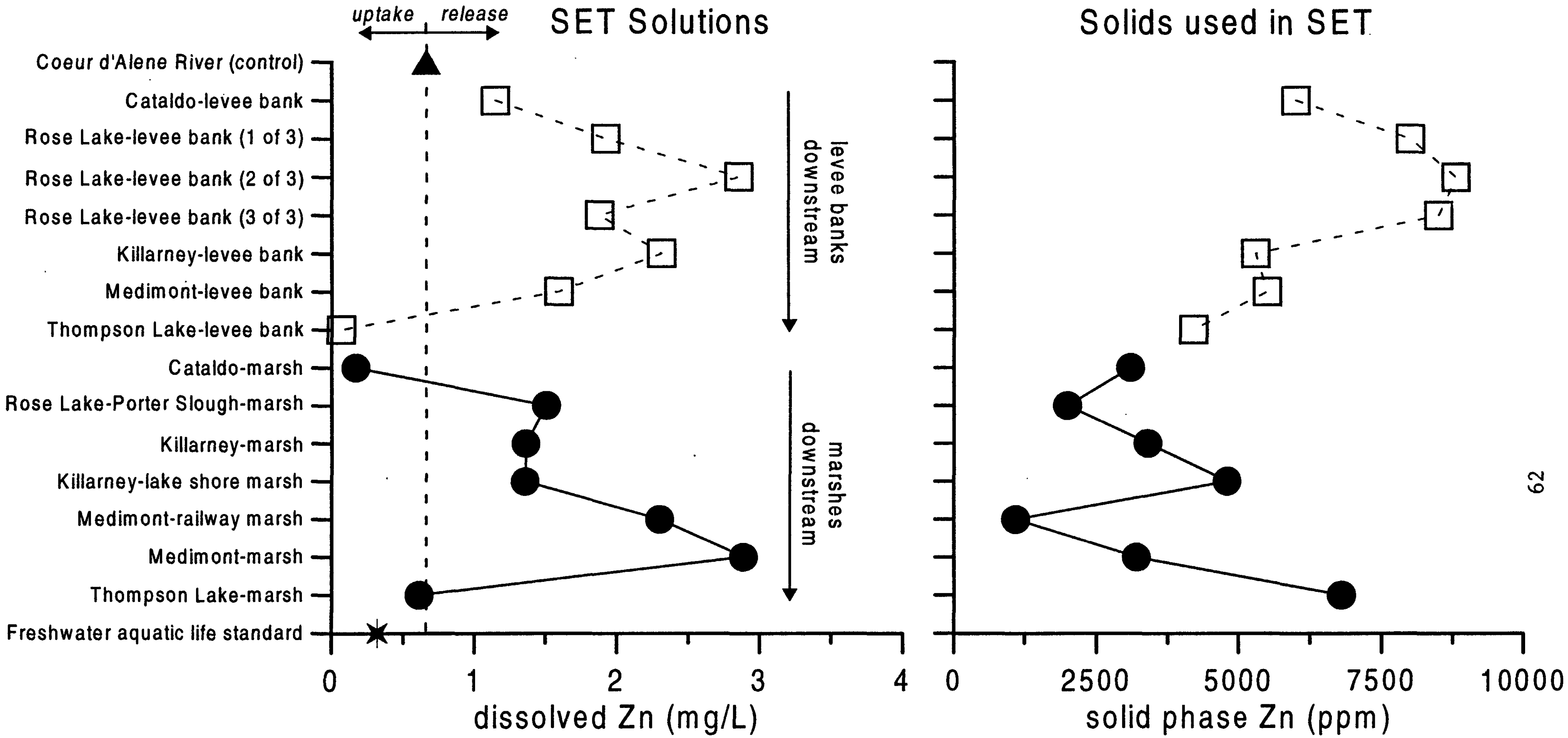

Figure 22. Concentrations of dissolved zinc (Zn) in solutions from the Standard Elutriate Tests (SET) on levee bank and marsh sediments in the lower Coeur d'Alene River valley and concentrations of total Zn in those sediments before the SET. The freshwater aquatic life standard for Zn in solution at a hardness of 100 mg $CaCO_3$/L (EPA, 1986) is also shown.