Report on the May-June 2002 Englebright Lake deep coring campaign

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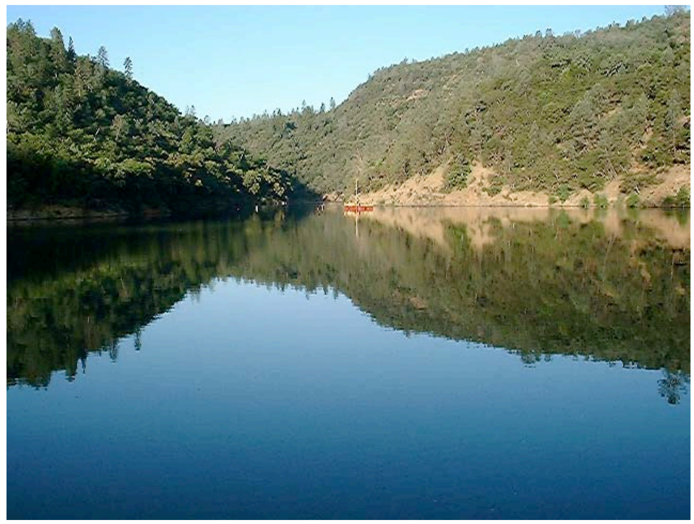

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ABSTRACT

This report describes the May-June 2002 Englebright Lake coring project. Englebright Lake is a 14-km-long reservoir on the Yuba River of northern California, impounded by Englebright Dam, which was completed in 1940. The sediments were cored to assess the current conditions in the reservoir as part of the California Bay-Delta Authority's Upper Yuba River Studies Program. Sediment was collected using both hydraulic-piston and rotational coring equipment mounted on a floating drilling platform. Thirty boreholes were attempted at 7 sites spaced along the longitudinal axis of the reservoir. Complete sedimentary sections were recovered from 20 boreholes at 6 sites. In total, 335 m of sediment was cored, with 86% average recovery. The core sections (each up to 1.5 m long) were processed using a standard set of laboratory techniques, including geophysical logging of physical properties, splitting, visual descriptions, digital photography, and initial subsampling. This report presents the results of these analyses in a series of stratigraphic columns. Using the observed stratigraphy as a guide, several series of subsamples were collected for various sedimentologic, geochemical, and geochronological analyses. The results of laboratory analyses of most of these subsamples will be presented in future reports and articles.

INTRODUCTION

Beginning in 2001, the California Bay-Delta Authority (CBDA), formerly the California-Federal Bay-Delta Program (CALFED), has sponsored the Upper Yuba River Studies Program (UYRSP, http://www.nasites.com/pam/yuba/), an investigation of the feasibility of introducing anadromous fish species to the Yuba River system upstream of Englebright Dam (Figure 1). The UYRSP has six scopes of work: sediment, water quality, habitat, flood risk, water supply and hydropower, and economics. To achieve the UYRSP objective of fish passage, some of the future management scenarios under consideration include lowering or removing the dam. Any reduction in size of the dam would result in some change in the sediment regime of the lower Yuba River, and could cause the release of material presently stored in the reservoir. This increased sediment load could exacerbate existing hazards in the lower Yuba River area. Deposition could raise riverbed elevations and therefore increase flood risk in the valley around Marysville (Figure 1). Also, because much of the stored material is likely derived from historical gold mining areas in the Yuba River watershed (James, 2003), it may contain high concentrations of mercury (Hg) that was lost during gold mining and recovery operations (Alpers and Hunerlach, 2000). The release of Hg-rich sediment from the reservoir could increase the amount of Hg available for bioaccumulation in downstream areas. The ability to make accurate predictions of the fate and transport of the material stored in Englebright Lake is critical to assessing the feasibility of various future dam-management scenarios. This report presents descriptions, methodologies, and data from a major sediment coring campaign undertaken to sample and characterize the three-dimensional distribution, properties, and chemistry of sediment stored behind Englebright Dam.

Harry L. Englebright Lake (hereafter Englebright Lake; Figure 1) is a 14-km-long reservoir located on the Yuba River in the Sierra Nevada foothills of northern California. The reservoir is impounded by Englebright Dam, which is 80 m tall, and was completed in December 1940 by the California Debris Commission. Its primary purpose was to help mitigate flood risk in the Central Valley around Marysville by impounding sediment from anticipated future hydraulic-mining activity in the watershed upstream. At present, the reservoir is a popular destination for recreational boaters and campers, as well as a site for hydroelectric power generation. The reservoir also serves as an afterbay for peak power generation at the Colgate Powerhouse, which receives water from New Bullards Bar reservoir on the North Yuba River (Figure 1). As part of this study, a previous report (Childs and others, 2003) describing lake bathymetry and pre-dam Yuba River topography found that in 2001 the reservoir contained 21,890,000 m^3 of material deposited since the dam was completed, reducing the original storage capacity (85,970,000 m^3) by 25.5%.

This report contains four sections. First, the coring campaign done on Englebright Lake in May and June 2002 are described. Second, the processing steps used on the recovered reservoir material are listed. Third, the various sets of subsamples taken from the cores are detailed, and some results from these analyses are presented. In the fourth section, a graphical series of stratigraphic columns and logs from each of the boreholes is presented.

DESCRIPTION OF THE CORING CAMPAIGN

The purpose of the coring project was to sample the entire post-dam sediment thickness in a variety of locations in Englebright Lake. This work was done by the U.S. Geological Survey and the DOSECC (Drilling, Observation, and Sampling of the Earth's Continental Crust, http://www.dosecc.org/) research drilling company, using the GLAD200 rig (Global LAke Drilling, 200 m maximum depth of water plus sediment; Figure 2) (Nielson, 1999; Dean and others, 2002). Descriptions of the drilling equipment can be found in Nielson (2003). The campaign was officially called GLAD3-ENG02, or informally as the “deep coring project”, to differentiate it from other shallow coring and sampling work described elsewhere (Snyder and others, 2004). More information about the campaign is available at the USGS Coastal and Marine Geology (CMG) website for the campaign (CMG activity G-1-02-NC), http://walrus.wr.usgs.gov/infobank/g/g102nc/html/g-1-02-nc.meta.html.

Coring locations

Boreholes were drilled at 7 locations along the longitudinal axis of the reservoir (Figure 3; Table 1). At each location, 2 to 5 boreholes were drilled, spaced approximately 5-10 m apart, with the primary objective of achieving complete recovery of the entire sedimentary section in each location by collection of redundant material (Figure 4). Secondarily, multiple boreholes allowed for some comparison of lateral variability in sediment properties, although this purpose is limited by the close proximity of the holes.

Coring methods and equipment

Cored sediment was recovered in clear, plastic liners approximately 70 mm in diameter. Each borehole consisted of one or more core runs or pushes up to 3 m in length (Table 1). Each 3-m core was brought onto the deck of the rig and placed in horizontal orientation. The liner and its contents were then cut into sections of up to 1.5 m, and each section was capped and sealed with plastic tape. The material recovered in or below the core catcher or extruded out of the core liners was stored in plastic sample bags or occasionally in small pieces of core liner if stratigraphy could be preserved intact. Each individual section of each core (in liners or bags) was given a section number, starting with section 1 at the top of the cored interval. Material recovered at the bottom of each cored interval, from the upper and lower parts of the core shoe, was given section numbers 6 and 7 respectively. The longest and deepest continuous borehole (7C, Table 1) involved the collection of 14 cores. All sampled material was refrigerated after initial collection and processing.

Most of the time, hydraulic piston coring equipment with 3-m runs was used. This method produced the best preservation of the sedimentary layering because of the rapid downward motion of the core barrel (piston released at ~4 MPa). Sometimes the piston would not extend completely when coring through coarse sediment or large organic material (such as buried woody debris). This resulted in occasional uncertainty in the depth penetrated with each push, a disadvantage of piston coring. Some coring was also done by rotation using an extended shoe tool. This method had several advantages. First, it has the ability to precisely control the length of each run (up to 3 m) based on recovery and material penetrated, which was particularly important when approaching the cobbles, boulders and bedrock of the pre-dam river bed. Second, it could be deployed more rapidly than piston cores. Third, it could penetrate and recover coarser material in some cases. The main disadvantage of the extended shoe relative to piston coring was increased disturbance of the sedimentary layering. The decision to use a given tool for each core collected was made based on prior recovery and depth within the sediment section; the default was to use the piston corer. For all coring equipment used, in most cases, a recovery gap of 5-20 cm existed between each core run because of incomplete preservation of material in the core catcher and water-depth changes.

Borehole logging

At each of the 7 coring locations at least one geophysical borehole log was produced (Table 1). To keep the borehole from filling or collapsing, in most cases logging was done through a liner– either the steel drill rods (sites 1, 2, 4, and 6), or PVC piping inserted into the hole after coring was complete (sites 7, 8 and 9). In the downstream locations (sites1 and 6), where the most cohesive, fine-grained sediment was located, logging was also done in the open borehole. At every site, at least one natural-gamma-radiation log was produced. Depending on the casing method and tool used, electrical resistivity and single-point resistance logs were also made at some locations (Table 1). Logging tools used were Century Geophysical Corporation models 9042, 9060, and 9511A.

Coring results and problems

Table 1 summarizes the results of the GLAD3-ENG02 campaign. In total, 30 boreholes were attempted, 335 m of sediment was cored, and 288 m of sediment was recovered, or 86% of the cored material. Complete sedimentary sections were recovered at 20 boreholes (or borehole pairs, Table 1) at 6 of the 7 coring sites. Early in the campaign, coring efforts were hampered by some technical problems relating to coring through and recovery of relatively young (<61 yr), poorly consolidated, thick (up to 35 m), and widely variable (silt, sand, cobbles, large woody debris) sedimentary material. However, during the campaign, coring techniques evolved and improved, through the ingenuity and expertise of the DOSECC personnel. Sites 2, 3 and 5 (Figures 3 and 4), located in the coarse, upstream part of the reservoir were abandoned after early attempts yielded poor recovery. Two of these sites were reoccupied later in the campaign (sites 7 and 8; Figures 3 and 4), using improved coring techniques and strategy, with greater success. Unfortunately, the coarse sand and gravel of site 2, at the junction of the South Yuba River with Englebright Lake, proved nearly impossible to recover in core liners. Other boreholes had to be aborted for various reasons. In two cases, boreholes were cored directly adjacent (<2 m away) to aborted holes to continue the borehole while skipping the already-cored upper part (boreholes 7A-7B and 8B-8C form such pairs, Table 1).

PROCESSING OF CORED SEDIMENTS

This section focuses on the techniques used for processing the cores. In general, the procedures outlined below are derived from those developed by the Integrated Ocean Drilling Program (http://www.oceandrilling.org/) and the University of Minnesota Limnological Research Center (http://lrc.geo.umn.edu/), with modifications for the relatively coarse-grained material and high-sedimentation-rate of the reservoir in this study.

Calculation of core depths

During the coring campaign, the depth interval sampled for each 3-m core was recorded relative to a datum on the coring rig. After the field component of the campaign was completed, the core depth information was converted to a more useful reference datum. The water level in Englebright Lake typically fluctuates a meter or more per day because of releases for power generation from New Bullards Bar reservoir upstream (Figure 1). Therefore, while coring an individual site, the lake level (and coring rig with it) could rise or fall ~1 m. Lake level is measured hourly and these data are available online (http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=ENG).

The elevation of the Englebright Dam spillway (160.60 m above mean sea level) was chosen as the stable reference datum. This was deemed to be superior to the lake floor because of the imprecision introduced by locating the actual sediment-water interface due to the presence of an unconsolidated fine-grained sediment and water slurry at the lake bottom. The imprecision of field measurements of the water depth (using a weighted line and other methods) are discussed by Childs and others (2003). The first step in post-processing the core-depth data was to interpolate the lake-surface elevation at the time when each core was taken using the lake-level time series. This elevation was then used to convert all of the core depth information into depth relative to the dam spillway, assuming that the lake surface was approximately flat. Table 1 presents data for the top and bottom of the cored sediments for each borehole in terms of absolute elevation above mean sea level.

Core database

All of the core data (locations, depth intervals, descriptions, logs, photographs, subsamples) were entered directly into a FileMaker Pro software database developed by Daniel Ponti (2001) for the USGS FOQUS-LA project (http://foqus.wr.usgs.gov/). The database offered two excellent benefits to the project: (1) it organized the vast and disparate types of data in one sortable location; and (2) it ensured that each core section would be described and analyzed with the same sequence of steps.

Multisensor core logging

The first step in processing the cores was to measure geotechnical properties of the sediment using a multisensor logger (MSL, Figure 5). This was done at the U.S. Geological Survey facility in Menlo Park, California (http://walrus.wr.usgs.gov/infobank/programs/html/facilities/mp/15.1/m1080.html) with a Geotek, Ltd. instrument that measures three sediment properties: (1) compressional wave (p-wave) velocity; (2) wet bulk density; and (3) magnetic susceptibility (Kayen and others, 1999). Each core section that was in a liner at least ~30-cm long was logged at 1-cm increments. We had limited success in acquiring p-wave velocity data because of incomplete water saturation and the presence of biogenic gas (most likely methane) in the cored material. The results of the p-wave analysis were so sparse that they are not included in Plates 1-10. For the purposes of the project, the most important property measured was wet bulk density. This was measured by passing the core section in front of a radioactive ^{137}Cs source, and counting the number of emitted gamma rays that passed through the liner and sediment. The attenuation of gamma rays can be related to bulk density by Lambert's Law (Kayen and others, 1999). Calibrations were done at regular intervals by logging the attenuation characteristics of distilled water (density of 1000 kg/m^3) and aluminum (density of 2700 kg/m^3) contained in the same type of plastic core liner as used for the sediment. Each calibration was tested, with correct measurement of water density within 1% as the criteria for acceptance. Therefore, analytical errors of bulk density should be <1%. The reader is referred to Kayen and others (1999) for more information about the MSL equipment and techniques used. The MSL data for each section was entered into the database. Data points known to be spurious were pruned from the dataset by the logger operator, including those logged through the core-section end caps, and solitary values of bulk density that were less than 1000 kg/m^3 (caused by a crack or void in the sediment, or a counter error).

Splitting and initial subsampling

After logging, the core sections were split down the long axis. A dual-blade cutting tool was used to slice the liner, and then a thin wire was drawn through the core section to separate the unconsolidated sediment into two haves. The two halves were then assigned for working and archive purposes. The working half was then immediately subsampled for factors that may change with exposure to the air (including moisture content and methylmercury concentration). The subsamples collected in this initial phase are discussed in detail in the next section of this report.

Core photography

The archive half of each core section was photographed in 30-cm lengths using a digital camera. These photographs were then mosaiced into one composite image per core section and entered into the core database.

Visual descriptions

The stratigraphy of the working half was described by visually analyzing a standard set of properties, including color, core disturbance, lithology, grain size, layering, contacts, sedimentary structures, sorting, roundness, and accessories (including organic material; Figure 6). All of this information was entered into the core database. The color of each stratigraphic layer was measured by comparison to the standard Munsell soil-color system. Grain size, lithology, sorting and roundness were assessed using a standard grain-size card and hand lens. The distinction between silt and clayey silt was generally made by color (silt was darker and clay lighter) and textural properties in hand sample. After the visual descriptions were completed, pH and redox measurements were made by placing probes in the cores, in the same area where material was subsampled for methylmercury analysis. Finally, both the working and archive halves were sealed into plastic bags and D-tubes, and returned to a refrigerated facility for storage.

Calculation of section depths

During the core descriptions phase, the depths of the top and bottom of each section were estimated based on the cored interval and the material recovered. The actual amount of sediment recovered in a given core could be more or less than the length of the cored interval due to sediment loss or gas expansion. Both of these issues were common. Sediment loss was most likely to occur out the bottom of the liner as the core was pulled out of the borehole. In practice, this was common for coarse-grained, uncohesive sediments (sand and gravel), which could flow through the core shoe. Therefore, the assumption was made that lost material was always from the bottom of the cored interval. The only exception to this case was when there was reason to believe that some material might have been absent from the top of the core. In particular, recovery of the sediment-water interface in the top core of most of the boreholes was difficult to ascertain with confidence due to the uncertainty in the position of the lake floor and the fluid nature of the uppermost material. As a result, depending on the nature and length of the recovered sediment, and the estimate of the position of the core relative to the lake floor, material in the uppermost (first) core in some boreholes was assumed to be absent from the top, not the bottom. Gas expansion (typically <5% to 10%) was common in fine-grained sediments. Estimates of the amount of expansion in each section were made based on the visual inspection of the material (including the presence of cracks or gas bubbles), notes of material expanding out of the liner during core processing on the rig, and the amount of sediment recovered relative to the distance cored.

SUBSAMPLING

A major objective of the Englebright Lake deep coring campaign was to quantify the sedimentological and chemical properties of the material deposited in the reservoir. Therefore, subsampling the cores, for various analyses and at various intervals was a critical aspect of the project. Table 2 lists all of the different types of subsamples collected for this project. An important goal of the project is to define the locations and concentrations of any pollutants that are contained in the reservoir sediments, and predict fate and transport of this material under future dam-management scenarios. Because grain-size distribution has an important influence on transport, all of the subsamples collected for geochemical analyses were divided in two so that grain-size distributions could be measured in concert with geochemistry. Results of the grain-size analyses are reported by Snyder and others (2004). Results of geochemical analyses (including trace metals, methylmercury and total mercury, mercury methylation and demethylation potential, pH, redox, gold assay) will be presented in forthcoming reports and articles.

Composite subsampling series

At each coring location, 2 to 5 boreholes were cored for the purpose of retrieving a continuous section of the stratigraphy, in spite of material lost between core pushes. After the initial logging and description phase was completed for most of the core sections, the core depth estimates were refined, and then resulting stratigraphy for each hole was graphed and plotted. This working stratigraphy provided a structure for a composite subsampling scheme that sought to retrieve as continuous a set of material as possible. This material was termed the "Y" series of subsamples (for example the series collected at site 1, from boreholes 1A, 1B, 1C, and 1D, was 1Y). Each subsample included about 10-100 cm of material. The subsamples were collected with a U-shaped channel sampler, either 1 cm^2 or 4 cm^2 in cross-sectional area. The length of each individual subsample was determined by the stratigraphic layering. Each subsample was split into several parts, for grain-size distribution, loss-on-ignition, trace metals, and total mercury concentration analyses (Snyder and others, 2004). As a quality-control check, we took occasional replicate subsamples by taking twice as much material from a given interval and making 2 sets of subsamples for each of the analyses (labeled 1 of 2 and 2 of 2, Table 3). During laboratory analysis, technicians produced additional replicate subsamples by splitting individual subsamples (Snyder and others, 2004).

The first step in the subsampling for each coring location was generally to identify a "master" borehole that included the most complete recovery. This borehole was used for subsampling as much as possible to minimize the uncertainty created by correlations. The first subsample collected from each coring location was the uppermost material recovered, as estimated by the properties of the material (usually fine grained, poorly consolidated, and high water content) and the core depths. The subsampling then continued in the same core whenever possible, shifting to adjacent boreholes at the gaps between core sections as necessary. These shifts were based upon direct, visual correlations of the stratigraphy whenever possible (Figure 7), and the estimated core depths in some cases where the visual correlations could not be made with confidence. Rarely, short gaps in the series of subsamples were unavoidable due to incomplete recovery of a stratigraphic unit from all of the parallel holes. At the base of each coring location, an effort was made to include the lowermost material recovered, generally based on the core-depth estimates. After subsampling was completed for each coring location, the depth interval for each subsample was computed based on the "master" hole that contained the majority of the material.

Methylmercury and total mercury concentration

Mercury, particularly in its bioavailable form, methylmercury, is a potentially harmful pollutant likely to be found in the Englebright Lake sediments because of the use of mercury in historical mining activities in the Yuba River watershed (Alpers and Hunerlach, 2000), and the known levels of methylmercury in fish within Englebright Lake (May and others, 2000). Therefore, the evaluation of mercury and methylmercury in reservoir sediments was a critical aspect of the project. Because methylmercury is created predominantly by microbial activity, immediately after the cores were split, subsamples for this analysis were taken, divided in half, and preserved by freezing. In each core section, 1 or 2 subsamples were taken by removing a series of sediment plugs from the cores using a ~1-cm diameter syringe over a ~10-cm interval. Care was taken to subsample material at least ~0.5 cm from the core liner to avoid the effects of post-coring chemical reactions (such as iron oxidation) that occurred in the sediment in contact with the liner. Because of the high cost of the mercury and methylmercury analyses, these subsamples were not taken from all of the boreholes.

Mercury methylation and demethylation potential

To evaluate potential rates of mercury methylation and demethylation (Marvin-DiPasquale and others, 2003) in the reservoir sediments, subsamples were taken from the bottom and middle of the stratigraphy at three coring sites spaced in the downstream (site 1), middle (site 4), and upstream (site 9) parts of the reservoir. The uppermost sediments were sampled in detail during a separate shallow coring campaign in October 2002 (Snyder and others, 2004). The subsamples were collected over ~50-

100-cm intervals using a 4 cm^2 channel sampler. After subsampling, the material was divided into three parts, for mercury methylation-demethylation analysis, methylmercury and total mercury concentration, and grain-size distribution (Snyder and others, 2004).

Moisture content

Sediment moisture content data were needed to quantify the mass of sediment in the reservoir using the multisensor logs of wet bulk density. Subsamples for this analysis were taken immediately after core splitting to avoid loss of moisture by evaporation. The procedure consisted of extracting a ~5 cm^3 plug of sediment from one or two locations in each core section using a syringe, and placing it on a pre-weighed aluminum dish. This was then weighed, and placed in a ~100°C drying oven overnight. The next morning, the dried subsamples were removed from the oven, allowed to cool briefly (~5 minutes), and weighed again. The results of the moisture content analyses are shown in Table 4. The ratio of the mass of dry sediment (m_d) to mass of wet sediment (m_w) is the percent dry weight (m_d/m_w), which can be used to estimate dry bulk density (ρ_d) from the multisensor-logger-derived wet bulk density values (ρ_w), via the relation $\rho_d = (m_d/m_w)\rho_w$.

Gold assay analysis

To gain a preliminary estimate of the economic potential of the reservoir sediments, a series of composite samples were prepared for gold-assay analysis. The sampling focused on the upstream part of the reservoir (sites 7, 9, 8, and 2), where sediments are coarser and thicker. Relatively large volumes of sediment were necessary because of expected inhomogeneity (the “nugget effect”), so the entire working halves of a set of split core sections were combined. The strategy was to integrate representative parts of the reservoir stratigraphy, so for each site, two or three composite samples were collected from the top, middle, and bottom of the deposit. Because of the destructive nature of this sampling scheme, this work was done after all other core evaluations were completed. Furthermore, when available, we used material from aborted boreholes (5A and 3D) for this analysis, because this material was not emphasized in the other subsampling schemes.

^{137}Cs and ^{210}Pb geochronology

Short-lived radioisotopes are commonly used to calculate chronology and rates of sedimentation in lakes, reservoirs, and marine environments (for example Holmes, 2001). We collected subsamples for ^{137}Cs and ^{210}Pb analysis from the three of the continuous stratigraphic series. We emphasized downstream areas for this analysis (sites 1, 4 and 7) because these atmospheric-derived isotopes generally attach to fine-grained sediment, (silt and clay) which is more abundant in the distal part of the reservoir (Snyder and Hampton, 2003; Snyder and others, 2004). The resolution of the ^{210}Pb geochronometer is about 1 year, so we subsampled the same intervals used for the continuous Y series, but with higher frequency (for sites 1 and 4) to gain ~60 subsamples at each location. These subsamples were called the “X” series. We used a U-shaped 1 cm^2 channel sampler, with a sampling interval of 5-100 cm, depending on the stratigraphic layering (shorter for thin layers, longer for massive units). The results of the geochronologic analyses will be presented and discussed in a future article.

pH and redox

After the core descriptions were completed, we used pH and redox probes to measure these properties over approximately the same intervals that were subsampled for methylmercury and total mercury analysis. At each interval, we took three pH measurements, and one redox measurement. Redox measurements were allowed to equilibrate for ~20 minutes. The results of the pH and redox analyses will be presented and discussed in the context of the methylmercury data, to be published elsewhere.

CORE STRATRAPHIC COLUMNS AND WELL LOGS

Plates 1-10 present the stratigraphic data for each of the 27 boreholes where sediment was recovered (Table 1). Details regarding production and presentation of these plates are discussed below.

Creation of stratigraphic columns

With the exception of the geophysical well logs, all of the data presented in Plates 1-10 are entirely contained in the FileMaker Pro core database. The plots were generated using AppleCORE, a software package designed specifically for the purpose of generating high-quality plots of borehole data (Ranger, 1999). The core database has algorithms to export core data into a text format that is compatible with AppleCORE.

Detailed description of Plates 1-10

A large amount of data is plotted on Plates 1-10, so each column is explained here in some detail. All of the stratigraphic columns for each site are plotted together on the same plate. The vertical and horizontal scales are the same for all of the borehole logs. Each borehole has a key explaining all of the symbols and colors used.

Header. The top part of each stratigraphic column includes some general information. The full name of each borehole includes the project name (GLAD3-ENG02) and the borehole number (for example 1C). The date logged refers to the date that the borehole was cored. The core curator (or curators) responsible on the rig (all of whom are authors of this report) is noted. The remarks section includes the depth reference used, and the date when the data were exported from the core database.

Depths and core numbers. The first two columns of data on the plates mark the core depths in meters below lake surface (mbls, defined as the dam spillway elevation, 160.60 m), the core number, and box (or section) number within each core.

Logs. The next 2-4 columns include core and borehole log data. Wet bulk density and magnetic susceptibility logs were measured in the laboratory with the multisensor logger for all of the core sections in liners, as explained above. These data are included for all of the boreholes. P-wave velocity data were so sparse these logs are not included. The gaps in the logs exist for several reasons, including: breaks between sections in liners; data gaps within cores (due to gaps or incomplete recovery); and material either lost or contained in liners too short to log or in bags. Where available (Table 1), borehole well-log data were imported directly into AppleCORE and plotted with the multisensor core logs. For consistency and clarity, density and resistivity are always plotted using the same scale, whereas magnetic susceptibility and natural gamma are plotted using variable scales.

Grain size. The centerpieces of the plates are the colorful grain-size stratigraphic columns produced based on the visual core descriptions described above. Intervals that were cored without recovery (usually from the base of the core, section 7, as explained above) are denoted with an “X”. Intervals that were not cored (due to lake-level fluctuations or drilling errors) are blank on the stratigraphic columns.

Accessories. This column shows any sedimentary structures, lithologic or organic accessories, or fossils found in the cores. Arrows mark accessories that occurred over an interval, and the sizes of the arrows correspond to relative abundance. In practice, most of the accessories or fossils were organic matter—usually recognizable as terrestrial material (woody debris, leaves). Organic matter too small to classify was called “disseminated organics.” The legend located at the bottom of each borehole column defines the symbols used.

Core disturbance. This column shows areas of the cores that were disturbed. Disturbance ranged from slight (stratigraphy intact but typically blurred along the liner) to extreme (stratigraphy not visible). In some cases, material was clearly resedimented—caused by mobility within the core liner—and these areas are marked, with arrow size corresponding to intensity of the resedimentation.

Sorting and roundness. These physical properties were logged based on visual analysis. Most fine-grained units were classified as well or very well sorted. Sorting in sand and gravel units was more variable. The relative scale ranges from very well sorted (far left) to poorly sorted and bimodal (far right). Roundness was evaluated only for layers containing medium sand or coarser sediment. Most sand was classified subrounded. The relative scale ranges from well rounded (far left) to very angular (far right).

Samples. The entries in this column mark the top of all subsampled intervals that were taken. The various types of subsamples are discussed above and in Table 2.

Color. The color column on Plates 1-10 shows the verbal version of the measured Munsell color (or colors) for the thicker layers.

Remarks. This column lists the remarks made during the core descriptions phase, marked at the center of the interval described. The remarks typically are related to overall descriptions of depositional sequences, interpretations of sedimentary structures, and verbal descriptions of core disturbance or post-coring weathering, often in a colloquial style. The sediment in contact with the core liner often exhibited a mottled oxidized color, which was classified “mottled rust color on sed exterior” or abbreviated “MRSCE.”

SUMMARY

- The May-June 2002 Englebright Lake deep coring campaign is described. Methodologies used during coring, processing, and subsampling of the cored material are discussed in detail.
- A series of tables present borehole location and depth information, subsampling series and composite core depth intervals, and the results of 277 moisture-content analyses.
- A series of plates present the results of the visual descriptions and logs of all of the ~335 m of material cored.
- Future reports will present the results of sedimentological, geochemical, and geochronological analyses of the various subsample series.
- Future articles will present an integrated portrait of the stratigraphy and depositional history of the reservoir.
- The deep coring campaign represents an important component of the data collection effort to quantify the current conditions in Englebright Lake. This information is vital to understanding the implications of various future scenarios for dam management under consideration as part of the Upper Yuba River Studies Program.

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Table 1. Borehole locations, depth intervals, sediment-recovery data, and well-log information. Coring sites in order from downstream to upstream. Bold lines are site means and totals. Site 3 was reoccupied as site 8, site 5 was reoccupied as site 7 (Figures 3-4). More information about this coring campaign is available at http://walrus.wr.usgs.gov/infobank/g/g102nc/html/g-1-02-nc.meta.html.

Bore-hole	Latitude (WGS84[a])	Longitude (WGS84[a])	USGS station number	Top (mbls[b])	Bottom (mbls[b])	Length cored (m)	Length recov. (m)	Recov. (%)	Num. of cores	Well logs[c]	Notes
1A	39.24540	-121.26865	391443121160701	60.78	67.59	6.81	3.66	53.7	5	g,r,s	logging done in unlined borehole
1B	39.24543	-121.26875	391443121160702	61.57	67.33	5.76	5.64	98.0	4	na	
1C	39.24545	-121.26879	391443121160703	61.92	67.36	5.44	4.48	82.4	4	na	
1D	39.24536	-121.26852	391443121160704	61.14	68.45	7.31	6.13	83.9	4	na	
1	**39.24541**	**-121.26868**		**61.35**	**67.68**	**25.32**	**19.92**	**78.7**	**17**	**na**	
6A	39.25782	-121.25972	391528121153501	51.54	59.61	8.07	5.25	65.1	5	g	logging done in borehole lined with metal casing
6B	39.25779	-121.25963	391528121153502	51.61	57.92	6.31	6.13	97.2	3	na	
6C	39.25770	-121.25961	391528121153503	na	na	na	na	na	0	na	borehole aborted without recovery
6D	39.25767	-121.25962	391528121153504	51.16	55.66	4.50	4.10	91.1	3	na	
6E	39.25795	-121.25999	391528121153505	51.41	58.88	7.47	6.49	86.9	3	g,r,s	logging done in unlined borehole
6F	39.25787	-121.25994	391528121153506	51.15	59.34	8.19	6.84	83.5	3	na	
6	**39.25781**	**-121.25974**		**51.37**	**58.28**	**34.54**	**28.82**	**83.4**	**17**	**na**	
4A	39.27585	-121.25922	391633121153301	34.70	49.49	14.81	14.06	95.0	7	g	logging done in borehole lined with metal casing
4B	39.27599	-121.25928	391633121153302	34.11	50.26	16.15	15.19	94.1	7	na	
4C	39.27597	-121.25933	391633121153303	34.20	49.87	15.67	14.55	92.9	6	na	
4D	39.27600	-121.25933	391633121153304	34.34	49.66	15.32	10.51	68.6	7	na	
4	**39.27595**	**-121.25928**		**34.34**	**49.82**	**61.95**	**54.31**	**87.7**	**27**	**na**	
5A	*39.27915*	*-121.24930*	391645121145704	*13.99*	*25.92*	*11.93*	*10.53*	*88.3*	*5*	na	did not core to the pre-dam surface
7A	39.27904	-121.24922	391645121145701	14.13	*26.00*	11.87	11.30	95.2	4	na	did not core to the pre-dam surface, hole paired w/ 7B
7B	39.27906	-121.24920	391645121145702	*24.25*	45.14	19.89	19.00	95.5	12	g,r	continuation of 7A; logging done in PVC-lined borehole
7C	39.27904	-121.24933	391645121145703	14.33	47.17	32.84	31.27	95.2	13	na	
7	**39.27905**	**-121.24925**		**14.23**	**46.16**	**64.60**	**61.57**	**95.3**	**29**	**na**	site 7 was a reoccupation of site 5
9A	39.28390	-121.23751	391702121141501	10.56	34.67	24.11	20.62	85.5	11	g,r	logging done in PVC-lined borehole
9B	39.28389	-121.23766	391702121141502	10.54	34.09	23.55	18.58	78.9	10	g,r	logging done in PVC-lined borehole
9C	39.28381	-121.23755	391702121141503	10.67	33.98	23.31	21.86	93.8	9	na	
9	**39.28387**	**-121.23757**		**10.59**	**34.25**	**70.97**	**61.06**	**86.0**	**30**	**na**	
3A	*39.28295*	*-121.22821*	391659121134201	*9.57*	*12.38*	*2.81*	*1.73*	*61.6*	*1*	na	did not core to the pre-dam surface
3B	*39.28300*	*-121.22827*	391659121134202	*9.60*	*12.60*	*3.00*	*2.85*	*95.0*	*1*	na	did not core to the pre-dam surface
3C	*39.28298*	*-121.22827*	391659121134203	na	na	na	na	na	*0*	na	borehole aborted without recovery
3D	*39.28296*	*-121.22826*	391659121134204	*11.40*	*17.27*	*5.87*	*4.26*	*72.6*	*5*	na	did not core to the pre-dam surface
8A	39.28268	-121.22710	391658121133801	10.16	34.17	24.01	20.65	85.7	13	g,r	logging done in PVC-lined borehole
8B	39.28277	-121.22717	391658121133802	11.22	*20.08*	8.86	7.21	81.4	3	na	did not core to the pre-dam surface, hole paired with 8C
8C	39.28277	-121.22717	391658121133803	*18.80*	33.75	14.95	13.51	90.3	8	g,r	continuation of 8B; logging done in PVC-lined borehole
8	**39.28274**	**-121.22715**		**10.69**	**33.96**	**47.82**	**41.37**	**86.5**	**24**	**na**	site 8 was a reoccupation of site 3
2A	39.29524	-121.21050	391743121123801	na	na	na	na	na	0	na	borehole aborted without recovery
2B	39.29522	-121.21050	391743121123802	3.82	10.14	6.32	1.54	24.4	3	g	logging done in borehole lined with metal casing
Total						335.13	287.97	85.9	159		

Explanation: na, not applicable. Numbers in italics are not included in individual site means. [a]WGS84, horizontal datum. [b]mbls, meters below lake surface, defined as the dam spillway elevation (160.60 m). [c]Well log codes: g, natural gamma-ray activity; r, electrical resistivity; s, single-point resistance.

Table 2. Subsampling series.

Analyses	Abbreviations (Plates 1-10)	Sites sampled	Number	Collection method	Length (cm)	Description
Trace metals, total mercury, grain-size distribution, loss on ignition (LOI)	TM GRS	1, 6, 4, 7, 9, 8, 2	237	channel	10-100	Composite (Y) subsample series (Table 3). Grain size and LOI data available in Snyder and others (2004).
Methyl-Hg and total Hg, grain-size distribution, LOI	MEM GRS	1, 6, 4, 7, 9, 8, 2	166	core plugs	~10	Sampled during initial descriptions phase and immediately frozen.
Hg methylation and demethylation potential, Methyl-Hg and total Hg, grain-size distribution	MDP MEM GRS	1, 4, 9	6	channel	50-100	Sampled from 6 locations in 3 boreholes early in the core splitting phase.
Moisture content	M	1, 6, 4, 5/7, 9, 3/8, 2	277	single core plug	2	Sampled during initial descriptions. Results in Table 4.
^{137}Cs and ^{210}Pb geochronology	CS1	1, 4, 7	186	channel	5-100	X series of subsamples. Sampled same intervals as Y series, but with higher frequency (~60 samples per profile).
Gold assay	TBD	5/7, 9, 3/8, 2	9	split core section	150-11500	Large-volume integrated samples.
pH, redox	PH	1, 6, 4, 7, 9, 8, 2	117	in-place	10-15 (pH); 1 (redox)	Measured in-place using a probe, generally coincides with methyl-Hg (MEM) subsamples.

Table 3. Locations of the composite subsamples (Y series) to be analyzed for total mercury and trace metals concentration, grain-size distribution, and loss on ignition (Snyder and others, 2004).

Lab ID	Core location ID	Date sampled	Top (mbls)	Bottom (mbls)	ρ_w (g/cm^3)
1Y-1	1A-1H-1, 4-93 cm	9/27/02	60.79	61.68	1.250
1Y-1A	1D-1H-1, 51-69 cm	9/27/02	61.50	61.68	1.318
1Y-2	1D-1H-1, 69-80 cm	9/27/02	61.68	61.79	1.349
1Y-3	1D-1H-1, 80-94 cm	9/27/02	61.79	61.93	1.404
1Y-4	1D-1H-1, 94-140 cm	9/27/02	61.93	62.39	1.416
1Y-5	1D-1H-2, 0-52 cm	9/27/02	62.39	62.91	1.455
1Y-6	1D-1H-2, 52-80 cm	9/27/02	62.91	63.19	1.477
1Y-7	1B-2E-1, 10-33 cm	9/30/02	63.19	63.26	1.329
1Y-8	1B-2E-2, 0-75 cm	9/30/02	63.26	63.94	1.344
1Y-9	1B-2E-2, 75-150 cm	9/30/02	63.94	64.61	1.308
1Y-10	1B-2E-3, 0-80 cm	9/30/02	64.61	65.35	1.293
1Y-11	1B-2E-3, 80-108 cm	9/30/02	65.35	65.61	1.412
1Y-12	1B-2E-3, 108-117 cm	9/30/02	65.61	65.69	1.443
1Y-13	1B-2E-3, 117-150 cm	9/30/02	65.69	66.00	1.467
1Y-14	1B-2E-6, 0-5 cm	9/30/02	66.00	66.05	nd
1Y-15	1B-2E-7, 0-1 cm	9/30/02	66.05	66.06	nd
1Y-16	1B-3E-1, 0-52 cm	9/30/02	66.11	66.63	1.492
1Y-17	1B-3E-1, 52-76 cm	9/30/02	66.63	66.87	1.447
1Y-18	1B-3E-1, 76-90 cm	9/30/02	66.87	67.01	1.458
1Y-19	1B-3E-1, 90-101 cm	9/30/02	67.01	67.12	1.445
1Y-20	1B-3E-1, 101-110 cm	9/30/02	67.12	67.21	1.413
1Y-21	1B-3E-6, 0-5 cm	9/30/02	67.21	67.26	nd
1Y-22	1B-3E-7, 0-4 cm	9/30/02	67.26	67.30	nd
1Y-23	1A-4E-1, 4-72 cm	9/30/02	67.30	67.51	1.487
6Y-1	6F-1H-1, 5-110 cm	5/7/03	51.23	52.11	1.426
6Y-2	6F-1H-2, 0-56.5 cm	5/7/03	52.11	52.58	1.220
6Y-3	6E-1H-2, 17-71.5 cm	5/7/03	52.58	53.13	1.338
6Y-4	6E-1H-2, 71.5-104.5 cm	5/7/03	53.13	53.46	1.394
6Y-5	6E-1H-2, 104.5-150 cm	5/7/03	53.46	53.91	1.440
6Y-6	6F-2H-1, 21-80 cm	5/7/03	53.91	54.47	1.455
6Y-7	6E-2H-2, 0-49.5 cm	5/7/03	54.47	54.96	1.382
6Y-8	6E-2H-2, 49.5-105.5 cm	5/7/03	54.96	55.53	1.365
6Y-9	6F-2H-2, 73-105.5 cm	5/7/03	55.53	55.84	1.445
6Y-10	6F-2H-2, 105.5-127.5 cm	5/7/03	55.84	56.05	1.545
6Y-11	6B-2H-2, 0-47 cm	5/7/03	56.05	57.26	1.373
6Y-11B	6F-2H-2, 127.5-150 cm	5/7/03	56.05	56.27	1.553
6Y-11C	6F-3E-1, 8-69.5 cm	5/7/03	56.67	57.26	1.422
6Y-12	6F-3E-1, 71-102.5 cm	5/7/03	57.26	57.56	1.497
6Y-13 (1/2)	6E-3E-1, 56.5-102 cm	5/7/03	57.56	58.02	1.399
6Y-13 (2/2)	6E-3E-1, 56.5-102 cm	5/7/03	57.56	58.02	1.399
6Y-14	6E-3E-2, 0-31 cm	5/7/03	58.02	58.33	1.369
6Y-15	6E-3E-2, 31-80 cm	5/7/03	58.33	58.82	1.486
4Y-1	4B-1H-1, 4-24 cm	11/11/02	34.37	34.57	1.650
4Y-2	4B-1H-1, 24-70 cm	11/11/02	34.57	35.03	1.825
4Y-3	4A-1H-1, 35-73 cm	11/11/02	35.03	35.41	1.197
4Y-4	4A-1H-1, 73-110 cm	11/11/02	35.41	35.77	1.343
4Y-5	4A-1H-2, 0-27 cm	11/11/02	35.77	36.05	1.331
4Y-6	4A-1H-2, 27-62 cm	11/11/02	36.05	36.40	1.066
4Y-7	4A-1H-2, 62-150 cm	11/11/02	36.40	37.27	1.402
4Y-8 (1/2)	4B-2H-1, 14-124 cm	11/11/02	37.27	38.38	1.425
4Y-8 (2/2)	4B-2H-1, 14-124 cm	11/11/02	37.27	38.38	1.425
4Y-9	4B-2H-2, 0-44 cm	11/11/02	38.38	38.86	1.414
4Y-10	4B-2H-2, 44-66 cm	11/11/02	38.86	39.08	1.576
4Y-11	4B-2H-2, 66-78 cm	11/11/02	39.08	39.20	1.540
4Y-12	4A-2H-3, 17-81 cm	11/11/02	39.20	39.84	1.589

Lab ID	Core location ID	Date sampled	Top (mbls)	Bottom (mbls)	ρ_w (g/cm^3)
4Y-13	4A-2H-3, 81-117 cm	11/11/02	39.84	40.20	1.514
4Y-14	4A-2H-4, 0-25 cm	11/11/02	40.20	40.45	nd
4Y-15	4B-3H-1, 0-47 cm	11/11/02	40.45	41.06	1.484
4Y-16	4B-3H-1, 47-86 cm	11/11/02	41.06	41.57	1.241
4Y-16x	4A-4H-1, 25-35 cm	11/11/02	41.27	41.37	1.997
4Y-17	4A-4H-1, 55-108 cm	11/11/02	41.57	42.10	1.464
4Y-18	4A-4H-1, 108-127 cm	11/11/02	42.10	42.38	1.521
4Y-19	4A-4H-2, 9-95 cm	11/11/02	42.38	43.24	1.301
4Y-20	4A-4H-2, 95-146 cm	11/11/02	43.24	43.75	1.542
4Y-21	4B-4H-1, 26-48 cm	11/12/02	43.75	43.89	nd
4Y-22	4B-4H-1, 48-73 cm	11/12/02	43.89	44.04	1.487
4Y-23	4B-4H-1, 73-125 cm	11/12/02	44.04	44.36	1.575
4Y-24	4B-4H-1, 125-140 cm	11/12/02	44.36	44.59	1.445
4Y-25	4B-4H-2, 20-89 cm	11/12/02	44.59	45.01	1.492
4Y-26	4B-4H-2, 89-150 cm	11/12/02	45.01	45.39	1.514
4Y-27	4A-5H-2, 51-101 cm	11/12/02	45.39	45.86	1.456
4Y-28	4B-5H-1, 0-56.5 cm	11/12/02	45.86	46.42	1.491
4Y-29	4B-5H-1, 56.5-142 cm	11/12/02	46.42	47.26	1.563
4Y-30	4B-5H-2, 0-71 cm	11/12/02	47.26	47.97	1.512
4Y-31	4B-5H-2, 71-135 cm	11/12/02	47.97	48.61	1.566
4Y-32	4B-5H-2, 135-250 cm	11/12/02	48.61	48.76	1.596
4Y-33	4B-5H-6, 0-5 cm	11/12/02	48.77	48.82	nd
4Y-34	4B-6H-1, 0-80 cm	11/12/02	48.93	49.70	1.569
7Y-1	7C-1H-1, 0-80 cm	1/22/03	14.33	15.13	1.934
7Y-2	7C-1H-1, 80-117 cm	1/22/03	15.13	15.50	1.393
7Y-3	7C-1H-2, 0-31 cm	1/22/03	15.50	15.81	1.408
7Y-4	7C-1H-2, 31-97 cm	1/22/03	15.81	16.47	1.646
7Y-5	7C-1H-2, 97-135 cm	1/22/03	16.47	16.85	1.805
7Y-6	7C-2H-1, 42-92 cm	1/22/03	17.13	17.63	1.908
7Y-7	7C-2H-1, 92-150 cm	1/22/03	17.63	18.21	1.853
7Y-8	7C-2H-2, 0-74 cm	1/22/03	18.21	18.95	1.806
7Y-9	7A-2H-2, 29.5-66.5 cm	1/22/03	19.28	19.65	1.750
7Y-10	7A-2H-2, 66.5-112 cm	1/22/03	19.65	20.10	1.493
7Y-11	7C-3H-1, 46-93.5 cm	1/22/03	20.10	20.58	1.498
7Y-12	7C-3H-1, 93.5-146 cm	1/22/03	20.58	21.10	1.492
7Y-13	7C-3H-2, 0-52 cm	1/22/03	21.10	21.60	1.572
7Y-14	7C-3H-2, 52-101.5 cm	1/22/03	21.60	22.08	1.475
7Y-15	7C-3H-2, 101.5-150 cm	1/22/03	22.08	22.55	1.689
7Y-16	7A-3H-2, 40-65 cm	1/22/03	22.55	22.75	1.943
7Y-17	7C-4H-1, 9-52 cm	1/22/03	22.75	23.18	1.625
7Y-18	7C-4H-2, 4-79 cm	1/22/03	23.18	23.93	1.892
7Y-19	7C-4H-3, 0-54 cm	1/23/03	23.93	24.47	1.740
7Y-20	7C-4H-3, 54-124.5 cm	1/23/03	24.47	25.18	1.710
7Y-21	7A-4H-2, 29.5-73 cm	1/23/03	25.18	25.60	1.627
7Y-22	7A-4H-2, 73-109.5 cm	1/23/03	25.60	25.96	0.935
7Y-23	7C-5H-1, 41.5-98.5 cm	1/23/03	25.96	26.52	1.437
7Y-24	7C-5H-1, 98.5-140 cm	1/23/03	26.52	26.92	1.071
7Y-25	7C-5H-2, 0-20 cm	1/23/03	26.92	27.11	nd
7Y-26	7C-6H-1, 0-87.5 cm	1/23/03	27.30	28.06	1.058
7Y-27	7C-6H-1, 87.5-151 cm	1/23/03	28.06	28.61	1.217
7Y-28	7C-6H-2, 0-78 cm	1/23/03	28.61	29.39	1.795
7Y-29	7C-6H-2, 78-131 cm	1/23/03	29.39	29.92	1.682
7Y-30	7C-6H-2, 131-150 cm	1/23/03	29.92	30.11	1.694
7Y-31	7C-7H-1, 10-71 cm	1/23/03	30.30	30.91	1.792
7Y-32	7C-7H-1, 71-144 cm	1/23/03	30.91	31.64	1.848
7Y-33	7C-7H-2, 0-68 cm	1/23/03	31.64	32.28	1.663
7Y-34	7C-7H-2, 68-120 cm	1/23/03	32.28	32.77	1.436

Lab ID	Core location ID	Date sampled	Top (mbls)	Bottom (mbls)	ρ_w (g/cm^3)
7Y-35	7C-7H-2, 120-150 cm	1/23/03	32.77	33.05	1.780
7Y-36	7C-8H-1, 23-90 cm	1/31/03	33.33	34.00	1.655
7Y-37	7C-8H-1, 90-126 cm	1/31/03	34.00	34.36	1.855
7Y-38	7B-4H-1, 88.5-120 cm	1/31/03	34.36	34.72	1.678
7Y-39	7C-9H-2, 7-108.5 cm	1/31/03	34.72	35.60	1.563
7Y-40	7C-9H-2, 108.5-142 cm	1/31/03	35.60	35.89	1.495
7Y-41	7C-9H-3, 0-93.5 cm	1/31/03	35.92	36.68	1.573
7Y-42	7B-6H-1, 50-113 cm	1/31/03	36.68	37.24	1.845
7Y-43	7C-10H-1, 10-98 cm	1/31/03	37.24	38.06	1.851
7Y-44	7C-10H-1, 98-150 cm	1/31/03	38.06	38.55	1.483
7Y-45	7C-10H-2, 5-67 cm	1/31/03	38.55	39.17	1.714
7Y-46	7C-10H-2, 67-137.5 cm	1/31/03	39.17	39.87	1.684
7Y-47	7B-9H-1, 57-113 cm	1/31/03	39.87	40.41	1.556
7Y-48	7C-11H-1, 21-70 cm	1/31/03	40.41	40.88	1.621
7Y-49	7C-11H-1, 70-92 cm	1/31/03	40.88	41.10	1.604
7Y-50	7C-11H-2, 0-44.5 cm	1/31/03	41.10	41.54	1.617
7Y-51	7C-11H-2, 44.5-104 cm	1/31/03	41.54	42.13	1.622
7Y-52	7C-11H-2, 104-130 cm	1/31/03	42.13	42.38	1.634
7Y-53	7B-10H-1, 102-136 cm	1/31/03	42.38	42.74	1.730
7Y-54	7C-12H-1, 0-47 cm	1/31/03	42.74	43.21	1.420
7Y-55	7C-12H-1, 47-99.5 cm	1/31/03	43.21	43.74	1.623
7Y-56	7C-12H-1, 99.5-133 cm	1/31/03	43.74	44.07	1.645
7Y-57	7C-12H-2, 0-40.5 cm	2/4/03	44.07	44.47	1.569
7Y-58	7C-12H-2, 40.5-69 cm	2/4/03	44.47	44.75	1.644
7Y-59	7C-12H-2, 69-104 cm	2/4/03	44.75	45.10	1.525
7Y-60	7B-11H-2, 4-47 cm	2/4/03	45.10	45.48	1.484
7Y-60B	7C-12H-2, 104-123.5 cm	2/4/03	45.10	45.29	1.526
7Y-60C	7C-12H-2, 123.5-150 cm	2/4/03	45.29	45.55	1.598
7Y-61	7B-11H-2, 47-82 cm	2/4/03	45.48	45.78	1.611
7Y-62	7B-11H-2, 82-113 cm	2/4/03	45.78	46.06	1.648
7Y-63	7B-11H-2, 113-140.5 cm	2/4/03	46.06	46.30	1.621
7Y-64	7C-13H-3, 23-55 cm	2/4/03	46.30	46.52	1.605
7Y-65	7C-13H-3, 55-61.5 cm	2/4/03	46.52	46.57	1.675
7Y-66	7C-13H-3, 61.5-99 cm	2/4/03	46.57	46.83	1.608
7Y-67	7C-13H-3, 99-125.5 cm	2/4/03	46.83	47.02	1.590
7Y-68	7C-13H-3, 125.5-142 cm	2/4/03	47.02	47.13	1.764
9Y-1	9A-1H-1, 1-127 cm	5/8/03	10.56	11.75	1.893
9Y-2	9A-1H-2, 25.5-119 cm	5/8/03	11.75	12.57	1.629
9Y-3	9A-1H-2, 119-134 cm	5/8/03	12.57	12.70	1.975
9Y-4	9A-2H-1, 0-24 cm	5/8/03	13.23	13.43	2.026
9Y-5	9A-2H-1, 24-89 cm	5/8/03	13.43	13.96	1.538
9Y-6	9C-2H-1, 74-114 cm	5/8/03	13.96	14.35	2.031
9Y-7 (1/2)	9C-2H-2, 0-82 cm	5/8/03	14.35	15.15	2.001
9Y-7 (2/2)	9C-2H-2, 0-82 cm	5/8/03	14.35	15.15	2.001
9Y-8	9A-2H-3, 56-108.5 cm	5/8/03	15.15	15.70	1.648
9Y-9	9A-2H-3, 108.5-150 cm	5/8/03	15.70	16.14	1.785
9Y-10	9C-3H-1, 18-91 cm	5/8/03	16.14	16.87	1.887
9Y-11	9A-3H-1, 95-114 cm	5/8/03	16.87	17.07	1.907
9Y-12	9A-3H-2, 0-44.5 cm	5/8/03	17.07	17.55	1.785
9Y-13	9A-3H-2, 44.5-82 cm	5/8/03	17.55	17.95	1.798
9Y-14	9A-3H-2, 82-150 cm	5/8/03	17.95	18.69	2.072
9Y-15	9C-4H-1, 0-97 cm	5/8/03	18.69	19.64	2.094
9Y-16	9C-4H-2, 9-48 cm	5/8/03	19.64	20.03	2.035
9Y-17 (1/2)	9C-4H-2, 48-131.5 cm	5/8/03	20.03	20.86	2.048
9Y-17 (2/2)	9C-4H-2, 48-131.5 cm	5/8/03	20.03	20.86	2.048
9Y-18 (1/2)	9A-5H-1, 24-118 cm	5/8/03	20.86	21.67	2.155
9Y-18 (2/2)	9A-5H-1, 24-118 cm	5/8/03	20.86	21.67	2.155

Lab ID	Core location ID	Date sampled	Top (mbls)	Bottom (mbls)	ρ_w (g/cm^3)
9Y-19	9A-5H-2, 3-116 cm	5/28/03	21.67	22.80	2.039
9Y-20	9C-6H-1, 36-98 cm	5/28/03	23.14	23.76	2.111
9Y-21	9C-6H-2, 0-95 cm	5/28/03	23.76	24.63	1.969
9Y-22	9C-6H-2, 95-150 cm	5/28/03	24.63	25.14	2.113
9Y-23	9A-8H-2, 31-129 cm	5/28/03	25.14	25.99	1.828
9Y-24	9C-7H-1, 21-89 cm	5/28/03	25.99	26.66	1.741
9Y-25	9C-7H-1, 89-148 cm	5/28/03	26.66	27.25	1.526
9Y-26	9C-7H-2, 0-60.5 cm	5/28/03	27.25	27.85	1.648
9Y-27 (1/2)	9C-7H-2, 60.5-140 cm	5/28/03	27.85	28.64	1.691
9Y-27 (2/2)	9C-7H-2, 60.5-140 cm	5/28/03	27.85	28.64	1.691
9Y-28	9C-8H-1, 0-84 cm	5/28/03	28.74	29.52	1.659
9Y-29	9C-8H-1, 84-150 cm	5/28/03	29.52	30.14	1.468
9Y-30	9C-8H-4, 0-38 cm	5/28/03	30.16	30.53	1.624
9Y-31	9C-8H-4, 38-82.5 cm	5/28/03	30.53	30.97	1.684
9Y-32	9C-8H-4, 82.5-125.5 cm	5/28/03	30.97	31.40	1.626
9Y-33	9A-10H-3, 0-35 cm	5/28/03	31.40	31.71	1.584
9Y-34	9A-10H-3, 35-94.5 cm	5/28/03	31.71	32.26	1.700
9Y-35	9A-10H-3, 94.5-135.5 cm	5/28/03	32.26	32.63	1.672
9Y-36	9C-9H-3, 7-41 cm	5/28/03	32.63	32.95	1.582
9Y-37 (1/2)	9C-9H-3, 41-99 cm	5/28/03	32.95	33.50	1.514
9Y-37 (2/2)	9C-9H-3, 41-99 cm	5/28/03	32.95	33.50	1.514
9Y-38	9C-9H-3, 99-130 cm	5/28/03	33.50	33.79	1.335
9Y-39	9A-11H-2, 55-102 cm	5/28/03	33.79	34.26	2.045
8Y-1	8A-1H-1, 0-4 cm	11/15/02	10.16	10.20	nd
8Y-2	8A-1H-2, 0-17 cm	11/15/02	10.20	10.37	1.651
8Y-3	8A-1H-2, 17-45.5 cm	11/15/02	10.37	10.66	2.064
8Y-4	8A-1H-2, 45.5-89 cm	11/15/02	10.66	11.09	1.961
8Y-5	8A-1H-3, 0-127.5 cm	11/15/02	11.09	12.37	1.881
8Y-6	8A-1H-3, 127.5-150 cm	11/15/02	12.37	12.59	1.627
8Y-7	8A-1H-6, 0-5 cm	11/15/02	12.59	12.64	nd
8Y-43x	8B-1H-2, 43-101 cm	8/19/03	12.64	13.02	1.963
8Y-8	8A-2H-1, 72-114 cm	11/15/02	13.02	13.44	2.228
8Y-9	8A-2H-2, 4-22 cm	11/15/02	13.44	13.62	2.058
8Y-10	8A-2H-2, 22-66 cm	11/15/02	13.62	14.06	1.691
8Y-11	8A-2H-2, 66-129 cm	11/15/02	14.06	14.69	1.928
8Y-12	8B-2H-1, 48-62 cm	11/15/02	14.69	14.83	2.143
8Y-13	8B-2H-1, 62-127 cm	11/15/02	14.83	15.47	1.853
8Y-14	8B-2H-2, 5-133 cm	11/15/02	15.47	16.75	2.006
8Y-15	8A-4H-2, 3-82 cm	11/15/02	16.81	17.60	1.975
8Y-16	8B-3H-1, 16-83 cm	11/15/02	17.60	18.27	2.155
8Y-17	8B-3H-2, 0-136 cm	11/19/02	18.27	19.63	1.827
8Y-18	8C-2H-1, 17-81 cm	11/19/02	19.63	20.23	1.985
8Y-19	8C-2H-1, 81-133 cm	11/19/02	20.23	20.72	1.760
8Y-20	8C-2H-2, 0-31 cm	11/19/02	20.72	20.99	1.258
8Y-21	8C-2H-2, 31-102 cm	11/19/02	20.99	21.59	1.659
8Y-22	8A-8H-1, 29-129 cm	11/19/02	21.59	22.59	2.032
8Y-23	8C-3H-1, 33-66 cm	11/19/02	22.59	22.74	1.694
8Y-24	8C-3H-1, 66-102 cm	11/19/02	22.74	22.91	1.910
8Y-25	8C-3H-2, 0-73 cm	11/19/02	22.91	23.27	2.019
8Y-26	8C-3H-2, 73-135 cm	11/19/02	23.27	23.57	2.105
8Y-27	8A-10H-1, 42.5-76.5 cm	11/22/02	23.57	23.91	2.037
8Y-28	8A-10H-1, 76.5-110 cm	11/22/02	23.91	24.24	1.835
8Y-29	8C-4H-1, 22-141 cm	11/22/02	24.24	25.57	1.771
8Y-30	8C-4H-2, 0-26 cm	11/22/02	25.57	25.84	1.532
8Y-31	8C-4H-2, 26-151 cm	11/22/02	25.84	27.15	1.463
8Y-32	8A-12H-1, 113.5-142 cm	11/22/02	27.15	27.43	nd
8Y-33	8C-5H-1, 34.5-136 cm	11/22/02	27.43	28.18	1.561

Lab ID	Core location ID	Date sampled	Top (mbls)	Bottom (mbls)	ρ_w (g/cm^3)
8Y-34	8C-5H-2, 0-59.5 cm	11/22/02	28.18	28.63	1.532
8Y-35	8C-5H-2, 59.5-119 cm	11/22/02	28.63	29.07	1.735
8Y-36	8A-13H-1, 25-144 cm	11/22/02	29.07	30.26	1.802
8Y-37	8A-13H-2, 0-50.5 cm	11/22/02	30.26	30.76	1.692
8Y-38	8A-13H-2, 50.5-126 cm	11/22/02	30.76	31.50	1.605
8Y-39	8C-6H-3, 65.5-125 cm	11/22/02	31.50	32.02	1.726
8Y-40	8A-14H-1, 16-81 cm	11/22/02	32.02	32.67	1.671
8Y-41	8A-14H-2, 0-21.5 cm	11/22/02	32.67	32.89	1.925
8Y-42	8A-14H-2, 21.5-115 cm	11/22/02	32.89	33.82	2.007
2Y-1	2B-1H-1, 0-72 cm	5/6/03	3.82	4.54	2.047
2Y-2	2B-1H-1, 72-146 cm	5/6/03	4.54	5.28	2.089

Explanation: top and bottom of the sampled interval in meters below lake surface (mbls); ρ_w, mean wet bulk density (measured with the multisensor logger) over the sampled interval; nd, no density data available (section not logged).

Table 4. Moisture content subsamples and results.

Sample core ID	Date sampled	Depth (mbls)	ρ_w (g/cm^3)	m_w (g)	m_d (g)	m_d/m_w	ρ_d (g/cm^3)
1A-1H-1 / M, 48 cm	6/14/02	61.22	1.313	10.07	5.22	0.518	0.681
1A-1H-2 / M, 98 cm	6/14/02	62.52	1.405	8.25	4.90	0.594	0.834
1A-3H-1 / M, 55 cm	6/14/02	66.61	1.442	14.37	9.00	0.626	0.903
1A-4E-1 / M, 50 cm	6/14/02	67.36	1.564	8.63	5.17	0.599	0.937
1B-1H-1 / M, 10 cm	6/12/02	61.67	1.405	16.96	8.83	0.521	0.732
1B-2E-1 / M, 24.5 cm	6/11/02	63.23	1.343	9.41	5.20	0.553	0.742
1B-2E-2 / M, 75 cm	6/12/02	63.94	1.334	11.65	6.10	0.524	0.699
1B-2E-3 / M, 130 cm	6/13/02	65.81	1.469	8.12	4.78	0.589	0.865
1B-2E-3 / M, 40 cm	6/13/02	64.98	1.285	10.90	5.89	0.540	0.694
1B-3E-1 / M, 31 cm	6/13/02	66.42	1.469	8.23	4.99	0.606	0.890
1C-1E-1 / M, 36 cm	4/30/03	62.22	1.160	6.50	3.58	0.551	0.639
1C-1E-2 / M, 69 cm	4/30/03	62.96	1.463	11.35	7.16	0.631	0.923
1C-2E-1 / M, 75 cm	7/9/02	64.37	1.470	10.28	6.01	0.585	0.859
1C-2E-2 / M, 12 cm	4/30/03	65.24	1.428	9.63	6.14	0.638	0.911
1C-3E-1 / M, 46 cm	7/9/02	66.72	1.374	10.08	5.44	0.540	0.741
1D-1H-1 / M, 89 cm	6/14/02	61.97	1.377	9.35	5.69	0.609	0.838
1D-1H-2 / M, 40 cm	6/13/02	62.88	1.440	11.15	6.81	0.611	0.880
1D-2E-2 / M, 83 cm	6/13/02	64.16	1.179	8.08	4.20	0.520	0.613
1D-2E-3 / M, 140 cm	6/14/02	65.89	1.488	7.22	4.61	0.639	0.950
1D-2E-3 / M, 45 cm	6/14/02	65.09	1.267	12.54	6.96	0.555	0.703
1D-3E-1 / M, 30 cm	6/14/02	66.35	1.357	14.63	9.03	0.617	0.838
1D-3E-1 / M, 95 cm	6/14/02	66.96	1.487	13.44	8.12	0.604	0.899
6A-1H-1 / M, 23 cm	4/28/03	51.77	1.209	9.63	5.65	0.587	0.709
6A-1H-2 / M, 82 cm	4/28/03	52.81	1.274	5.69	2.79	0.490	0.624
6A-3E-1 / M, 60 cm	4/29/03	56.78	1.237	5.90	3.76	0.637	0.788
6A-3E-3 / M, 68 cm	4/28/03	57.76	1.446	10.41	6.42	0.617	0.892
6A-4E-1 / M, 78 cm	4/28/03	59.15	1.534	17.06	9.33	0.547	0.839
6B-1H-1 / M, 62 cm	4/28/03	52.13	1.290	6.78	3.52	0.519	0.670
6B-1H-2 / M, 95 cm	4/28/03	53.80	1.496	5.25	3.17	0.604	0.903
6B-2H-1 / M, 75 cm	4/28/03	55.28	1.470	7.38	4.35	0.589	0.866
6B-2H-2 / M, 111 cm	4/28/03	57.04	1.483	11.66	6.79	0.582	0.863
6B-3E-1 / M, 16 cm	4/29/03	57.77	1.746	15.47	11.28	0.729	1.273
6D-1H-1 / M, 108 cm	4/29/03	52.24	1.367	8.60	5.15	0.599	0.819
6D-1H-2 / M, 53 cm	4/29/03	53.03	1.495	22.17	13.42	0.605	0.905
6D-2E-1 / M, 53 cm	4/29/03	54.69	1.514	7.58	4.56	0.602	0.911
6E-1H-1 / M, 50 cm	7/24/02	51.91	1.364	11.36	6.22	0.548	0.747
6E-1H-2 / M, 65 cm	7/23/02	53.06	1.227	7.02	3.63	0.517	0.634
6E-2H-1 / M, 35 cm	7/24/02	54.37	1.429	15.12	8.72	0.577	0.824
6E-2H-2 / M, 85 cm	7/23/02	55.32	1.431	11.06	6.51	0.589	0.842
6E-3E-1 / M, 36 cm	7/23/02	57.36	1.515	13.21	7.93	0.600	0.910
6E-3E-2 / M, 24 cm	7/23/02	58.26	1.375	9.28	5.71	0.615	0.846
6F-1H-1 / M, 45 cm	7/22/02	51.55	1.439	12.11	6.93	0.572	0.823
6F-1H-2 / M, 45 cm	7/24/02	52.65	1.270	12.52	6.08	0.486	0.617
6F-2H-1 / M, 100 cm	7/22/02	54.96	1.435	16.25	9.14	0.562	0.807
6F-2H-2 / M, 55 cm	7/24/02	55.72	1.470	9.53	5.64	0.592	0.870
6F-3E-1 / M, 60 cm	7/22/02	57.59	1.438	11.54	6.76	0.586	0.843
4A-1H-1 / M, 15 cm	6/19/02	34.83	1.925	10.03	7.26	0.724	1.394
4A-1H-1 / M, 90 cm	6/19/02	35.58	1.456	7.82	3.51	0.449	0.653
4A-1H-2 / M, 80 cm	6/19/02	36.58	1.357	6.48	3.26	0.503	0.683
4A-2H-2 / M, 77 cm	6/19/02	38.41	1.349	10.12	5.15	0.509	0.687
4A-2H-3 / M, 48 cm	6/19/02	39.51	1.605	10.73	7.00	0.652	1.047
4A-4H-1 / M, 115 cm	7/8/02	42.17	1.579	13.10	7.77	0.593	0.937
4A-4H-1 / M, 20 cm	7/8/02	41.22	2.027	9.78	7.41	0.758	1.536
4A-4H-2 / M, 125 cm	7/8/02	43.54	1.576	7.49	4.67	0.623	0.983
4A-4H-2 / M, 15 cm	7/8/02	42.44	1.382	9.13	5.71	0.625	0.864
4A-5H-1 / M, 95 cm	7/8/02	44.56	1.594	7.74	5.11	0.660	1.052

Sample core ID	Date sampled	Depth (mbls)	ρ_w (g/cm^3)	m_w (g)	m_d (g)	m_d/m_w	ρ_d (g/cm^3)
4A-5H-2 / M, 77 cm	7/8/02	45.63	1.453	9.01	5.77	0.640	0.930
4A-6H-1 / M, 80 cm	7/8/02	47.14	1.427	10.78	6.44	0.597	0.852
4A-6H-2 / M, 72 cm	7/8/02	48.55	1.531	11.15	7.37	0.661	1.012
4B-1H-1 / M, 40 cm	7/9/02	34.47	1.894	8.78	6.33	0.721	1.365
4B-1H-2 / M, 134 cm	7/9/02	36.57	1.332	8.43	4.26	0.505	0.673
4B-1H-2 / M, 47 cm	7/9/02	35.70	1.433	13.44	6.79	0.505	0.724
4B-2H-1 / M, 46 cm	7/19/02	37.60	1.440	9.63	5.57	0.578	0.833
4B-2H-2 / M, 95 cm	7/19/02	39.37	1.495	12.53	7.73	0.617	0.922
4B-3H-1 / M, 50 cm	7/19/02	40.69	1.593	6.28	4.54	0.723	1.152
4B-3H-2 / M, 66 cm	7/9/02	42.10	1.564	15.13	9.38	0.620	0.969
4B-3H-3 / M, 6 cm	7/19/02	42.94	1.492	4.80	3.11	0.648	0.967
4B-4H-1 / M, 82 cm	7/22/02	44.02	1.560	8.56	5.36	0.626	0.977
4B-4H-2 / M, 75 cm	7/22/02	45.36	1.576	9.59	6.23	0.650	1.024
4B-5H-1 / M, 98 cm	7/22/02	47.32	1.580	14.90	9.22	0.619	0.978
4B-5H-2 / M, 64 cm	7/22/02	48.39	1.531	3.99	2.41	0.604	0.925
4B-6H-1 / M, 50 cm	7/9/02	49.90	1.640	11.96	7.61	0.636	1.044
4C-1H-1 / M, 31 cm	4/21/03	34.51	1.535	14.02	10.05	0.717	1.100
4C-1H-2 / M, 71 cm	4/21/03	35.63	1.218	8.78	3.69	0.420	0.512
4C-2H-1 / M, 70 cm	4/21/03	37.28	1.520	15.55	9.09	0.585	0.888
4C-2H-2 / M, 77 cm	4/21/03	38.78	1.505	10.86	6.43	0.592	0.891
4C-3H-1 / M, 68 cm	4/22/03	40.13	1.572	14.61	9.78	0.669	1.052
4C-3H-2 / M, 85 cm	4/22/03	41.52	1.439	14.65	9.13	0.623	0.897
4C-4H-2 / M, 76 cm	4/22/03	43.37	1.550	11.90	7.21	0.606	0.939
4C-4H-3 / M, 66 cm	4/22/03	44.59	1.579	13.31	8.84	0.664	1.049
4C-5H-2 / M, 58 cm	4/23/03	46.19	1.540	11.07	6.76	0.611	0.941
4C-5H-3 / M, 50 cm	4/23/03	47.07	1.575	14.69	9.74	0.663	1.044
4C-5H-4 / M, 49 cm	4/23/03	48.01	1.522	9.07	5.71	0.630	0.958
4C-6E-1 / M, 57 cm	4/23/03	49.23	1.640	9.86	6.38	0.647	1.061
4D-1H-1 / M, 39 cm	4/23/03	34.73	1.690	16.98	11.85	0.698	1.180
4D-1H-2 / M, 58 cm	4/23/03	35.80	1.381	8.35	4.28	0.513	0.708
4D-2E-1 / M, 50 cm	4/23/03	37.87	1.577	11.24	7.00	0.623	0.982
4D-3E-1 / M, 50 cm	4/24/03	40.45	1.399	10.85	6.06	0.559	0.781
4D-3E-2 / M, 62 cm	4/24/03	41.37	1.380	8.82	5.04	0.571	0.789
4D-3E-3 / M, 49 cm	4/24/03	42.13	1.431	7.59	4.28	0.564	0.807
4D-4E-1 / M, 110 cm	4/24/03	43.66	1.612	11.45	7.35	0.642	1.035
4D-5E-1 / M, 30 cm	4/24/03	45.68	1.410	6.81	4.31	0.633	0.892
4D-5E-2 / M, 70 cm	4/24/03	46.65	1.389	17.46	10.34	0.592	0.823
4D-6H-1 / M, 82 cm	4/24/03	49.25	1.567	12.34	7.60	0.616	0.965
5A-1H-1 / M, 10 cm	4/30/03	14.09	1.678	9.66	6.59	0.682	1.145
5A-1H-2 / M, 35 cm	5/1/03	15.32	1.853	15.02	11.74	0.782	1.448
5A-2H-1 / M, 100 cm	5/5/03	16.99	1.999	22.42	16.65	0.743	1.485
5A-2H-2 / M, 71 cm	5/5/03	17.99	1.771	14.81	11.14	0.752	1.332
5A-3H-1 / M, 98 cm	5/5/03	19.49	1.634	9.67	6.34	0.656	1.071
5A-3H-2 / M, 55 cm	5/6/03	20.44	1.578	15.39	10.06	0.654	1.032
5A-4H-2 / M, 53 cm	5/6/03	22.01	1.981	8.55	6.52	0.763	1.511
5A-5H-1 / M, 63 cm	5/6/03	23.49	1.593	11.54	8.83	0.765	1.219
5A-5H-2 / M, 72 cm	5/6/03	24.76	2.016	20.14	16.29	0.809	1.631
7A-1H-1 / M, 42 cm	7/23/02	14.53	1.980	15.45	11.66	0.755	1.495
7A-1H-2 / M, 72 cm	7/23/02	16.05	1.426	14.90	7.82	0.525	0.749
7A-2H-1 / M, 115 cm	7/24/02	18.21	1.947	13.90	10.38	0.747	1.454
7A-2H-2 / M, 122 cm	7/24/02	19.66	1.588	9.76	6.33	0.649	1.030
7A-2H-2 / M, 13 cm	7/24/02	18.57	1.948	11.15	8.30	0.744	1.450
7A-3H-1 / M, 31 cm	7/24/02	20.34	1.543	8.64	5.09	0.589	0.909
7A-3H-2 / M, 101 cm	7/24/02	22.35	1.563	13.70	8.53	0.623	0.973
7A-3H-2 / M, 61 cm	7/24/02	21.95	2.073	10.98	8.90	0.811	1.680
7A-4H-1 / M, 39 cm	7/24/02	23.43	1.926	14.52	11.26	0.775	1.493
7A-4H-2 / M, 43 cm	7/26/02	24.65	1.849	17.21	12.19	0.708	1.310

Sample core ID	Date sampled	Depth (mbls)	ρ_w (g/cm^3)	m_w (g)	m_d (g)	m_d/m_w	ρ_d (g/cm^3)
7B-10H-1 / M, 74 cm	7/31/02	40.61	1.631	8.12	5.38	0.663	1.080
7B-11H-1 / M, 72 cm	7/31/02	42.11	1.598	11.71	7.52	0.642	1.026
7B-11H-2 / M, 71 cm	7/31/02	43.54	1.612	13.89	9.33	0.672	1.083
7B-12H-1 / M, 21 cm	7/31/02	44.62	1.476	10.44	6.27	0.601	0.887
7B-12H-2 / M, 25 cm	7/31/02	44.91	1.587	5.86	3.66	0.625	0.991
7B-12H-3 / M, 47 cm	7/31/02	45.09	1.896	9.18	6.75	0.735	1.394
7B-1H-1 / M, 67 cm	7/26/02	24.69	1.307	6.42	3.75	0.584	0.763
7B-1H-2 / M, 34 cm	7/26/02	25.71	1.945	8.36	6.25	0.748	1.454
7B-2H-1 / M, 92 cm	7/26/02	28.13	1.867	19.98	14.73	0.737	1.377
7B-2H-2 / M, 57 cm	7/29/02	28.93	1.803	12.92	10.13	0.784	1.414
7B-3H-1 / M, 66 cm	7/29/02	30.56	1.937	13.17	9.54	0.724	1.403
7B-3H-2 / M, 35 cm	7/29/02	31.49	2.006	11.06	8.77	0.793	1.591
7B-4H-1 / M, 50 cm	7/29/02	32.96	1.912	9.58	7.55	0.788	1.507
7B-5H-1 / M, 92 cm	7/29/02	34.15	1.704	10.33	7.22	0.699	1.191
7B-6H-1 / M, 63 cm	7/29/02	34.79	1.817	13.84	10.13	0.732	1.330
7B-7H-1 / M, 81 cm	7/29/02	36.16	1.730	11.80	8.52	0.722	1.249
7B-8H-1 / M, 62 cm	7/29/02	37.45	1.661	8.94	6.30	0.705	1.170
7B-9H-1 / M, 70 cm	7/31/02	39.08	1.436	7.23	4.76	0.658	0.946
7C-10H-1 / M, 75 cm	8/15/02	37.85	1.898	8.15	5.91	0.725	1.376
7C-10H-2 / M, 71 cm	8/15/02	39.21	1.634	12.23	8.01	0.655	1.070
7C-11H-1 / M, 35 cm	8/15/02	40.54	1.662	12.24	8.06	0.658	1.095
7C-11H-2 / M, 77 cm	8/15/02	41.86	1.689	10.40	7.00	0.673	1.137
7C-12H-1 / M, 118 cm	8/15/02	43.92	1.694	14.32	9.47	0.661	1.121
7C-12H-1 / M, 37 cm	8/15/02	43.11	1.798	9.69	7.10	0.733	1.318
7C-12H-2 / M, 81 cm	8/15/02	44.87	1.670	11.14	7.59	0.681	1.138
7C-13H-1 / M, 22 cm	8/19/02	45.95	1.589	11.62	7.34	0.632	1.003
7C-13H-2 / M, 8 cm	8/19/02	46.13	nd	13.36	9.36	0.701	nd
7C-13H-3 / M, 130 cm	8/19/02	47.05	1.752	11.04	8.53	0.773	1.354
7C-13H-3 / M, 50 cm	8/19/02	46.49	1.587	10.97	7.45	0.679	1.078
7C-1H-1 / M, 57 cm	8/9/02	14.90	2.039	17.37	13.09	0.754	1.536
7C-1H-2 / M, 105 cm	8/9/02	16.55	1.923	17.98	13.55	0.754	1.449
7C-1H-2 / M, 25 cm	8/9/02	15.75	1.450	6.27	3.38	0.539	0.782
7C-2H-1 / M, 75 cm	8/9/02	17.46	1.925	11.19	8.36	0.747	1.438
7C-2H-2 / M, 66 cm	8/9/02	18.87	1.935	12.59	9.14	0.726	1.405
7C-3H-1 / M, 68 cm	8/9/02	20.32	1.526	10.00	6.14	0.614	0.937
7C-3H-2 / M, 62 cm	8/9/02	21.70	1.654	12.26	8.21	0.670	1.107
7C-4H-1 / M, 20 cm	8/13/02	22.86	1.667	9.83	6.64	0.675	1.126
7C-4H-2 / M, 46 cm	8/13/02	23.60	2.025	12.83	10.19	0.794	1.608
7C-4H-3 / M, 71 cm	8/13/02	24.64	1.914	14.44	11.15	0.772	1.478
7C-5H-1 / M, 60 cm	8/13/02	26.14	1.681	12.97	8.77	0.676	1.136
7C-5H-2 / M, 10 cm	8/13/02	27.02	nd	6.76	3.00	0.444	nd
7C-6H-1 / M, 22 cm	8/13/02	27.49	0.979	7.23	2.47	0.342	0.334
7C-6H-1 / M, 95 cm	8/13/02	28.12	1.702	11.39	7.71	0.677	1.152
7C-6H-2 / M, 71 cm	8/13/02	29.32	1.931	11.35	8.76	0.772	1.490
7C-7H-1 / M, 79 cm	8/14/02	30.99	1.899	13.10	9.76	0.745	1.415
7C-7H-2 / M, 104 cm	8/14/02	32.62	1.531	8.82	5.51	0.625	0.957
7C-7H-2 / M, 50 cm	8/14/02	32.11	1.795	11.27	8.24	0.731	1.313
7C-8H-1 / M, 84 cm	8/14/02	33.94	1.761	10.57	7.94	0.751	1.323
7C-9H-2 / M, 75 cm	8/14/02	35.31	1.839	15.48	11.25	0.727	1.336
7C-9H-3 / M, 72 cm	8/15/02	36.51	1.741	12.30	8.61	0.700	1.219
9A-10H-1 / M, 74 cm	8/7/02	29.57	1.687	11.34	7.41	0.653	1.103
9A-10H-3 / M, 66 cm	8/7/02	30.94	1.669	12.88	9.15	0.710	1.185
9A-11H-1 / M, 118 cm	8/7/02	32.28	1.657	11.04	6.85	0.620	1.028
9A-11H-2 / M, 27 cm	7/9/02	32.69	1.591	11.37	6.96	0.612	0.974
9A-11H-2 / M, 80 cm	7/9/02	33.22	2.041	11.45	9.31	0.813	1.659
9A-1H-1 / M, 64 cm	8/6/02	11.09	2.012	8.44	6.53	0.774	1.556
9A-1H-2 / M, 34 cm	8/6/02	11.95	1.799	14.36	9.81	0.683	1.229

Sample core ID	Date sampled	Depth (mbls)	ρ_w (g/cm^3)	m_w (g)	m_d (g)	m_d/m_w	ρ_d (g/cm^3)
9A-1H-2 / M, 95 cm	8/6/02	12.54	1.405	11.37	5.99	0.527	0.740
9A-2H-1 / M, 58 cm	8/6/02	14.02	1.526	19.12	10.54	0.551	0.841
9A-2H-3 / M, 20 cm	8/6/02	14.84	1.982	16.62	14.64	0.881	1.746
9A-2H-3 / M, 93 cm	8/6/02	15.57	1.682	15.00	9.50	0.633	1.065
9A-3H-1 / M, 82 cm	8/6/02	16.75	2.043	14.91	11.50	0.771	1.576
9A-3H-2 / M, 80 cm	8/6/02	17.87	2.043	12.94	9.82	0.759	1.551
9A-4H-1 / M, 68 cm	8/6/02	18.93	2.121	14.69	12.16	0.828	1.756
9A-4H-2 / M, 84 cm	8/6/02	19.91	2.193	13.64	12.47	0.914	2.005
9A-5H-1 / M, 64 cm	8/6/02	21.21	2.038	11.29	9.21	0.816	1.663
9A-5H-2 / M, 58 cm	7/9/02	22.22	2.055	7.84	6.55	0.835	1.717
9A-7H-1 / M, 66 cm	8/7/02	23.69	2.084	14.68	11.62	0.792	1.649
9A-8H-1 / M, 90 cm	8/7/02	24.50	2.173	16.77	14.35	0.856	1.859
9A-8H-2 / M, 66 cm	8/7/02	25.31	1.938	14.24	10.85	0.762	1.476
9A-9H-1 / M, 86 cm	8/7/02	26.86	1.678	13.55	8.89	0.656	1.101
9A-9H-2 / M, 72 cm	8/7/02	27.92	1.690	14.74	9.97	0.676	1.143
9B-10H-1 / M, 64 cm	5/5/03	33.37	1.643	11.01	7.11	0.646	1.061
9B-10H-2 / M, 27 cm	5/6/03	34.04	2.019	19.76	16.12	0.816	1.647
9B-1H-1 / M, 45 cm	4/30/03	10.99	1.874	13.11	10.29	0.785	1.471
9B-1H-2 / M, 80 cm	4/30/03	12.32	1.769	17.02	11.86	0.697	1.233
9B-2H-1 / M, 50 cm	5/1/03	14.03	1.552	6.56	3.71	0.566	0.877
9B-2H-2 / M, 85 cm	5/1/03	15.40	1.469	15.42	11.69	0.758	1.114
9B-3H-1 / M, 59 cm	5/1/03	17.09	1.762	15.54	11.22	0.722	1.272
9B-3H-2 / M, 70 cm	5/1/03	18.54	1.901	15.78	12.38	0.785	1.491
9B-4H-1 / M, 20 cm	5/1/03	19.68	1.986	19.34	15.66	0.810	1.608
9B-4H-2 / M, 52 cm	5/1/03	20.54	1.913	20.41	15.22	0.746	1.427
9B-6H-2 / M, 73 cm	5/1/03	24.40	1.811	7.80	5.85	0.750	1.359
9B-7H-1 / M, 70 cm	5/1/03	25.28	nd	18.80	16.51	0.878	nd
9B-7H-2 / M, 30 cm	5/5/03	25.66	2.132	18.03	14.93	0.828	1.765
9B-8H-1 / M, 70 cm	5/5/03	27.80	1.749	10.00	6.74	0.674	1.179
9B-8H-2 / M, 80 cm	5/5/03	29.31	1.695	11.50	7.50	0.652	1.105
9B-9H-1 / M, 88 cm	5/5/03	30.57	1.529	11.28	7.58	0.672	1.027
9B-9H-2 / M, 85 cm	5/5/03	32.00	1.726	11.70	8.09	0.691	1.194
9C-1H-1 / M, 47 cm	8/21/02	11.14	2.011	7.76	6.22	0.802	1.612
9C-1H-2 / M, 70 cm	8/21/02	12.22	1.940	16.48	12.80	0.777	1.507
9C-1H-2 / M, 94 cm	8/21/02	12.46	1.927	9.57	7.00	0.731	1.409
9C-2H-1 / M, 31 cm	8/21/02	13.55	1.532	13.58	7.36	0.542	0.830
9C-2H-1 / M, 82 cm	8/21/02	14.04	2.039	14.52	11.39	0.784	1.600
9C-2H-2 / M, 109 cm	8/21/02	15.42	1.622	15.30	9.39	0.614	0.996
9C-2H-2 / M, 29 cm	8/21/02	14.63	2.090	8.55	7.29	0.853	1.782
9C-3H-1 / M, 42 cm	8/22/02	16.38	2.045	11.10	9.28	0.836	1.709
9C-3H-2 / M, 138 cm	8/22/02	18.18	2.045	11.23	8.71	0.776	1.586
9C-3H-2 / M, 38 cm	8/22/02	17.43	1.871	13.80	9.64	0.699	1.307
9C-4H-1 / M, 56 cm	8/22/02	19.24	2.062	8.57	7.06	0.824	1.698
9C-4H-2 / M, 141 cm	8/22/02	20.96	2.313	11.67	9.80	0.840	1.942
9C-4H-2 / M, 67 cm	8/22/02	20.22	1.860	16.93	13.46	0.795	1.479
9C-5H-1 / M, 50 cm	8/22/02	21.40	2.234	16.53	14.41	0.872	1.947
9C-5H-2 / M, 125 cm	8/22/02	22.71	2.026	20.81	16.02	0.770	1.559
9C-5H-2 / M, 18 cm	8/22/02	21.80	2.261	15.11	12.91	0.854	1.932
9C-6H-1 / M, 55 cm	8/22/02	23.33	2.093	19.61	15.69	0.800	1.675
9C-6H-2 / M, 81 cm	8/22/02	24.86	1.965	22.82	17.53	0.768	1.509
9C-7H-1 / M, 67 cm	8/23/02	26.45	1.714	8.25	6.01	0.728	1.249
9C-7H-2 / M, 62 cm	8/23/02	27.86	1.710	12.86	8.64	0.672	1.149
9C-8H-1 / M, 69 cm	8/23/02	29.38	1.700	8.97	5.89	0.657	1.116
9C-8H-4 / M, 81 cm	8/23/02	30.96	1.697	8.93	6.10	0.683	1.160
9C-9H-2 / M, 30 cm	8/23/02	32.06	1.699	12.68	8.41	0.663	1.127
9C-9H-3 / M, 76 cm	8/23/02	33.28	1.667	19.96	11.96	0.599	0.999
3A-1H-1 / M, 15 cm	4/29/03	9.68	1.972	17.18	14.01	0.815	1.608

Sample core ID	Date sampled	Depth (mbls)	ρ_w (g/cm^3)	m_w (g)	m_d (g)	m_d/m_w	ρ_d (g/cm^3)
3A-1H-2 / M, 76 cm	4/29/03	10.56	2.013	16.74	12.77	0.763	1.536
3B-1H-1 / M, 55 cm	4/29/03	10.15	2.011	19.07	15.04	0.789	1.586
3B-1H-2 / M, 41 cm	4/29/03	11.24	2.031	16.70	12.71	0.761	1.545
3D-1H-1 / M, 44 cm	4/30/03	11.81	1.897	15.67	12.12	0.773	1.467
3D-2E-1 / M, 80 cm	4/30/03	13.51	1.943	18.02	13.97	0.775	1.506
3D-3H-2 / M, 95 cm	4/30/03	15.10	1.816	16.81	13.24	0.788	1.430
3D-4E-1 / M, 41 cm	4/30/03	16.15	2.086	16.86	13.75	0.816	1.702
8A-10H-1 / M, 86 cm	8/5/02	24.00	1.843	10.08	7.26	0.720	1.328
8A-11H-1 / M, 75 cm	8/5/02	25.27	1.500	6.91	4.00	0.579	0.868
8A-12H-1 / M, 37 cm	8/5/02	26.40	1.455	8.61	5.14	0.597	0.869
8A-12H-2 / M, 108 cm	8/5/02	28.46	1.686	14.25	9.25	0.649	1.094
8A-13H-1 / M, 80 cm	8/5/02	29.62	1.828	12.80	9.23	0.721	1.318
8A-13H-2 / M, 70 cm	8/5/02	30.95	1.665	12.12	8.00	0.660	1.099
8A-14H-1 / M, 26 cm	8/5/02	32.12	1.684	10.73	6.73	0.627	1.056
8A-14H-2 / M, 57 cm	8/6/02	33.24	2.028	20.89	15.76	0.754	1.530
8A-1H-2 / M, 28 cm	8/1/02	10.48	2.057	5.53	4.82	0.872	1.793
8A-1H-3 / M, 38 cm	8/1/02	11.47	1.936	12.92	9.97	0.772	1.494
8A-2H-1 / M, 101 cm	8/1/02	13.31	2.145	9.71	8.07	0.831	1.783
8A-2H-2 / M, 120 cm	8/1/02	14.60	2.024	13.31	10.36	0.778	1.575
8A-2H-2 / M, 33 cm	8/1/02	13.73	1.769	7.51	5.19	0.691	1.223
8A-3H-2 / M, 67 cm	8/1/02	15.50	2.086	10.50	8.19	0.780	1.627
8A-4H-1 / M, 43 cm	8/2/02	16.66	2.019	12.87	10.07	0.782	1.580
8A-4H-2 / M, 80 cm	8/2/02	17.58	1.906	9.65	8.06	0.835	1.592
8A-7H-1 / M, 70 cm	8/2/02	18.82	2.091	13.21	10.89	0.824	1.724
8A-7H-2 / M, 64 cm	8/2/02	20.01	2.019	10.04	7.76	0.773	1.560
8A-8H-1 / M, 48 cm	8/2/02	21.78	2.061	12.45	9.63	0.773	1.595
8A-8H-2 / M, 113 cm	8/2/02	22.88	2.066	13.25	10.58	0.798	1.650
8B-1H-1 / M, 45 cm	8/19/02	11.63	2.030	11.45	9.45	0.825	1.676
8B-1H-2 / M, 127 cm	8/19/02	13.24	1.662	12.47	8.03	0.644	1.070
8B-1H-2 / M, 55 cm	8/19/02	12.53	1.979	12.87	10.30	0.800	1.584
8B-2H-1 / M, 35 cm	8/19/02	14.56	2.196	14.24	13.04	0.916	2.011
8B-2H-1 / M, 95 cm	8/19/02	15.16	1.838	14.88	10.84	0.728	1.339
8B-2H-2 / M, 59 cm	8/19/02	16.01	2.046	11.54	9.55	0.828	1.693
8B-3H-1 / M, 48 cm	8/19/02	17.65	2.081	17.93	15.75	0.878	1.828
8B-3H-2 / M, 82 cm	8/19/02	18.82	2.037	10.93	9.18	0.840	1.711
8C-2H-1 / M, 58 cm	8/20/02	19.71	1.994	15.28	12.16	0.796	1.587
8C-2H-2 / M, 127 cm	8/20/02	21.60	1.738	7.85	6.86	0.874	1.519
8C-2H-2 / M, 40 cm	8/20/02	20.82	1.640	14.95	9.53	0.637	1.045
8C-3H-1 / M, 15 cm	8/20/02	22.19	1.966	10.49	8.35	0.796	1.565
8C-3H-1 / M, 48 cm	8/20/02	22.50	1.614	17.10	10.85	0.635	1.024
8C-3H-2 / M, 59 cm	8/20/02	23.60	2.023	11.36	9.29	0.818	1.654
8C-4H-1 / M, 70 cm	8/20/02	25.13	1.818	11.06	7.75	0.701	1.274
8C-4H-2 / M, 74 cm	8/20/02	26.53	1.606	9.64	6.25	0.648	1.041
8C-5H-1 / M, 53 cm	8/20/02	27.84	1.724	12.02	8.08	0.672	1.159
8C-5H-2 / M, 57 cm	8/20/02	29.24	1.609	12.68	8.54	0.674	1.084
8C-6H-1 / M, 81 cm	8/21/02	31.08	1.720	13.05	8.62	0.661	1.136
8C-6H-3 / M, 72 cm	8/21/02	32.43	1.763	16.20	10.69	0.660	1.164
8C-7H-1 / M, 16 cm	8/21/02	33.39	1.641	13.63	8.18	0.600	0.985
2B-1H-1 / M, 129 cm	4/30/03	5.11	2.110	13.36	10.73	0.803	1.694
2B-1H-1 / M, 50 cm	4/30/03	4.32	2.042	17.92	14.08	0.786	1.604

Explanation: ρ_w, wet bulk density (measured with the multisensor logger; m_w, mass of wet material; m_d, mass of dry material; ρ_d, dry bulk density (calculated from $\rho_d = (m_d/m_w)\rho_w$); nd, no density data available (section not logged).

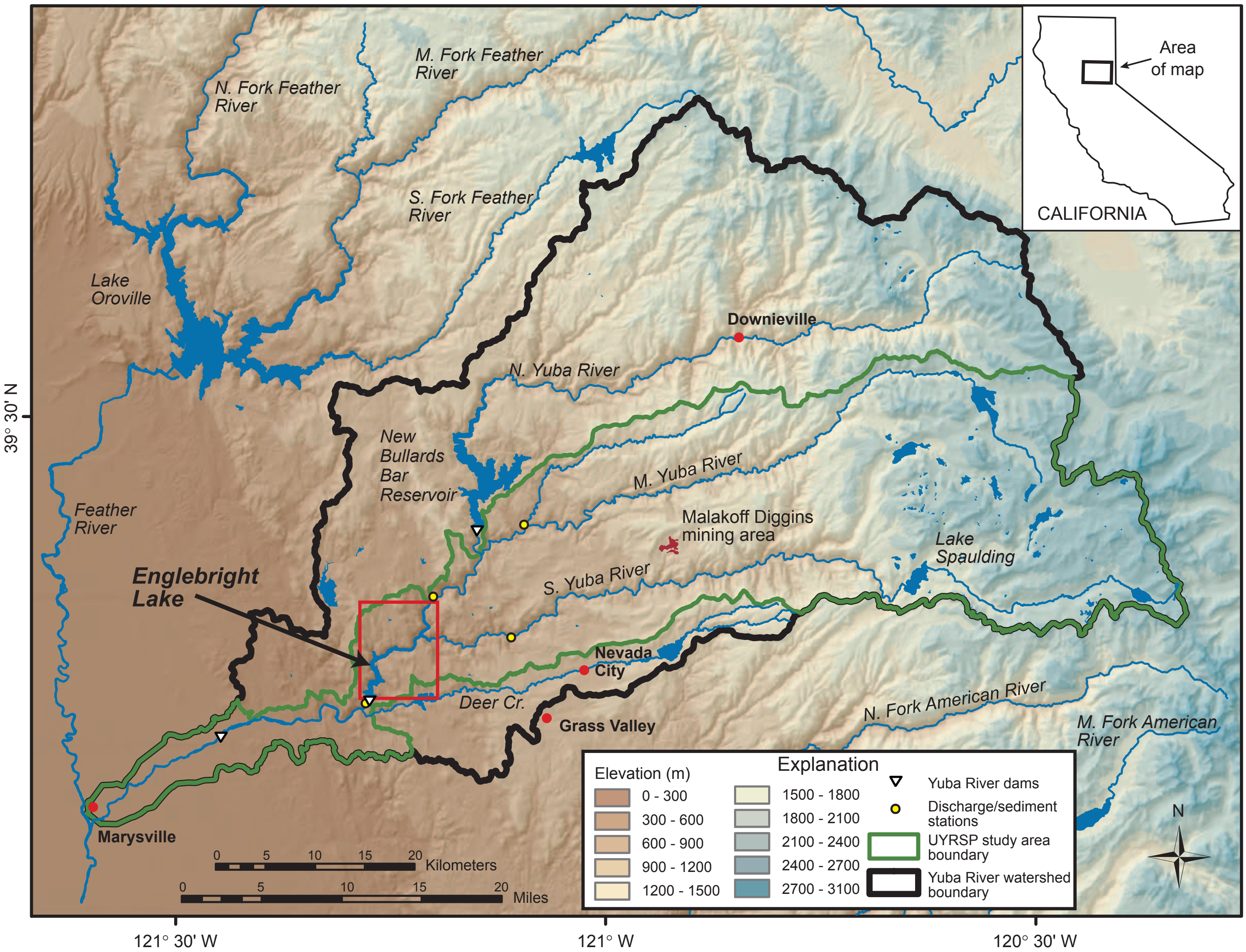


Figure 1. Map of the Yuba River watershed. Red box indicates the region around Englebright Lake shown in Figure 3.

Figure 2. Photograph of the GLAD200 coring rig on Englebright Lake.

Figure 3. Englebright Lake May-June 2002 coring locations. All labels are ordered from west to east, or north to south when applicable. See Figure 4 for detailed maps of boxed areas.

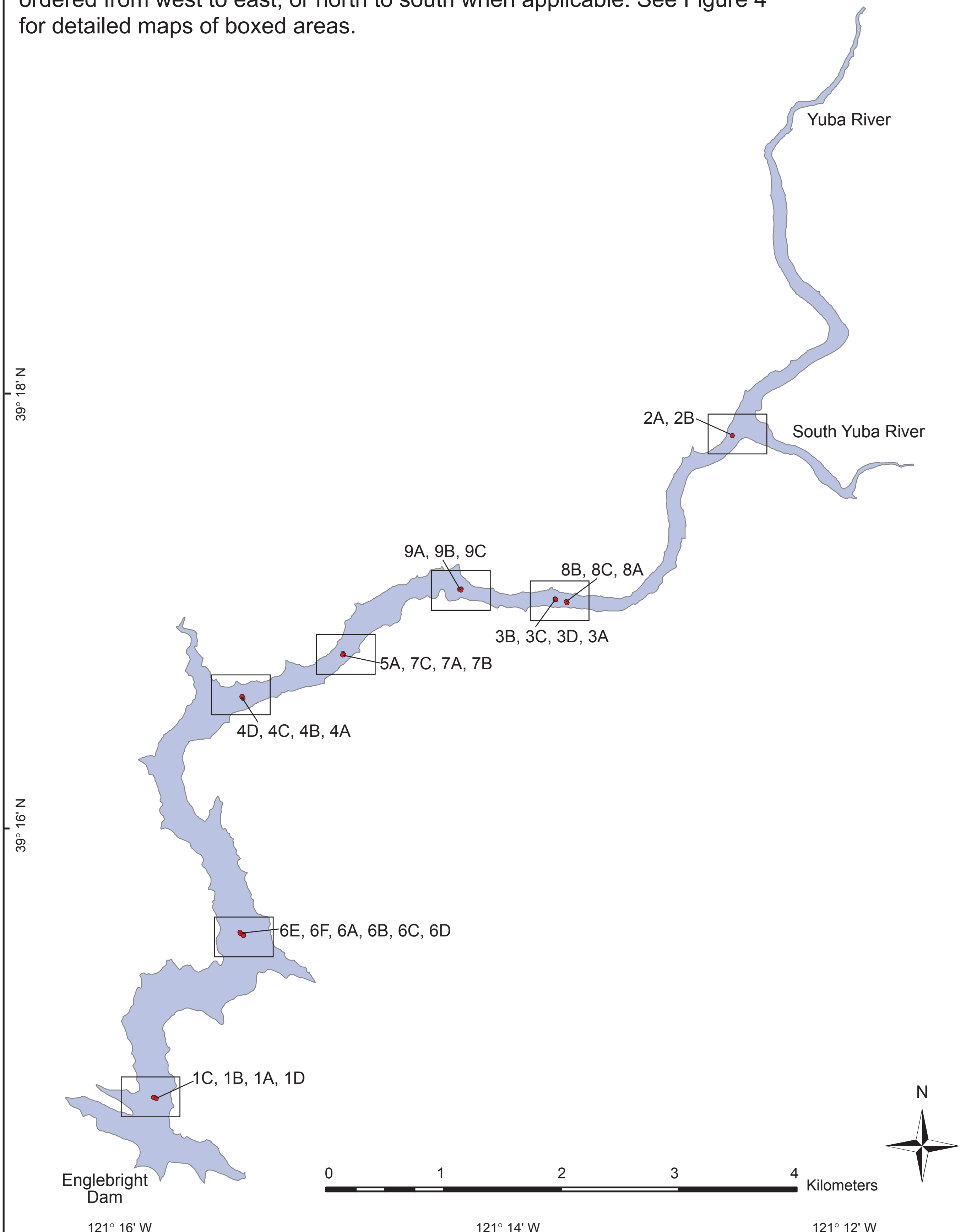
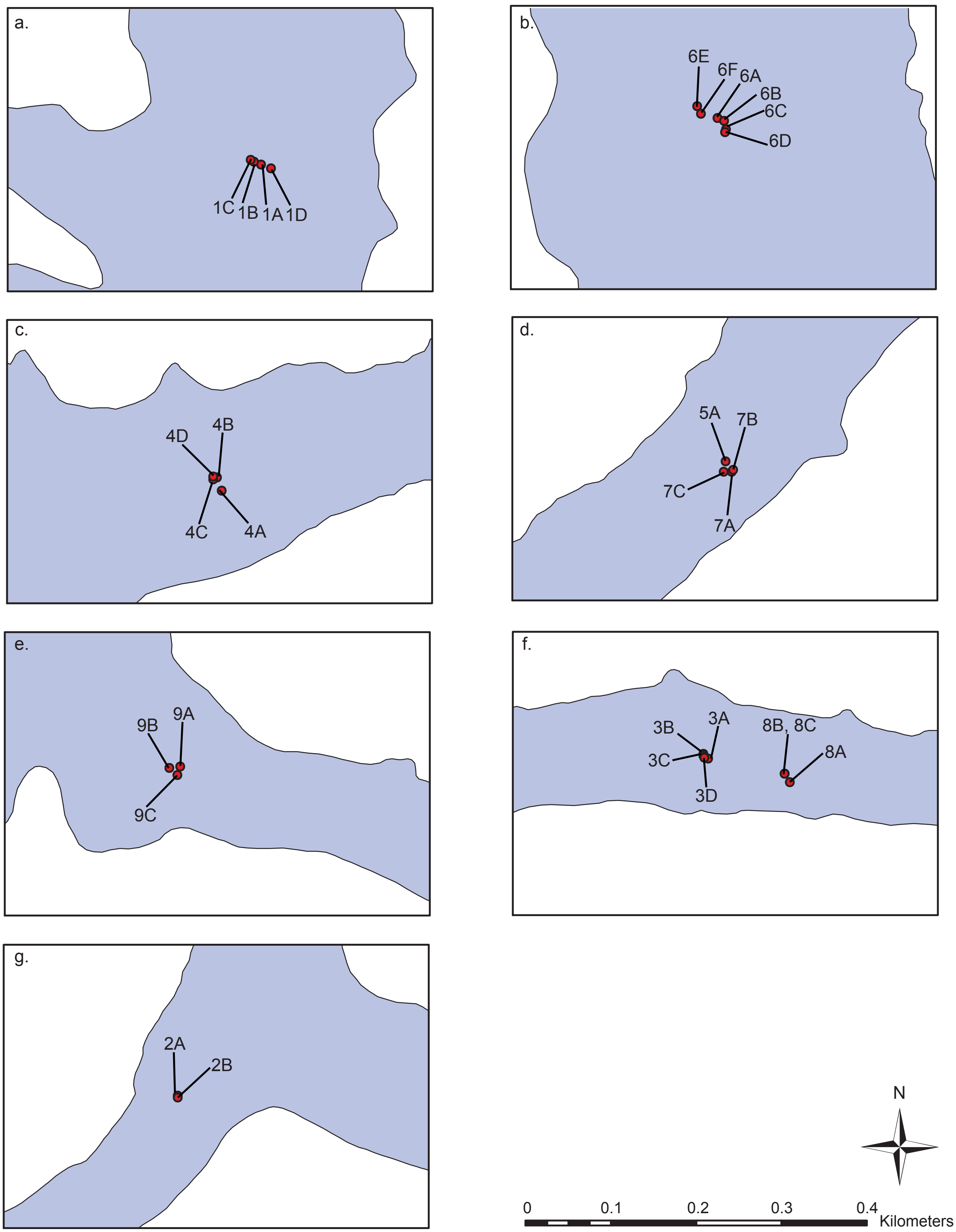


Figure 4. Detailed maps of coring locations. See Figure 3 for position of each box within the reservoir.



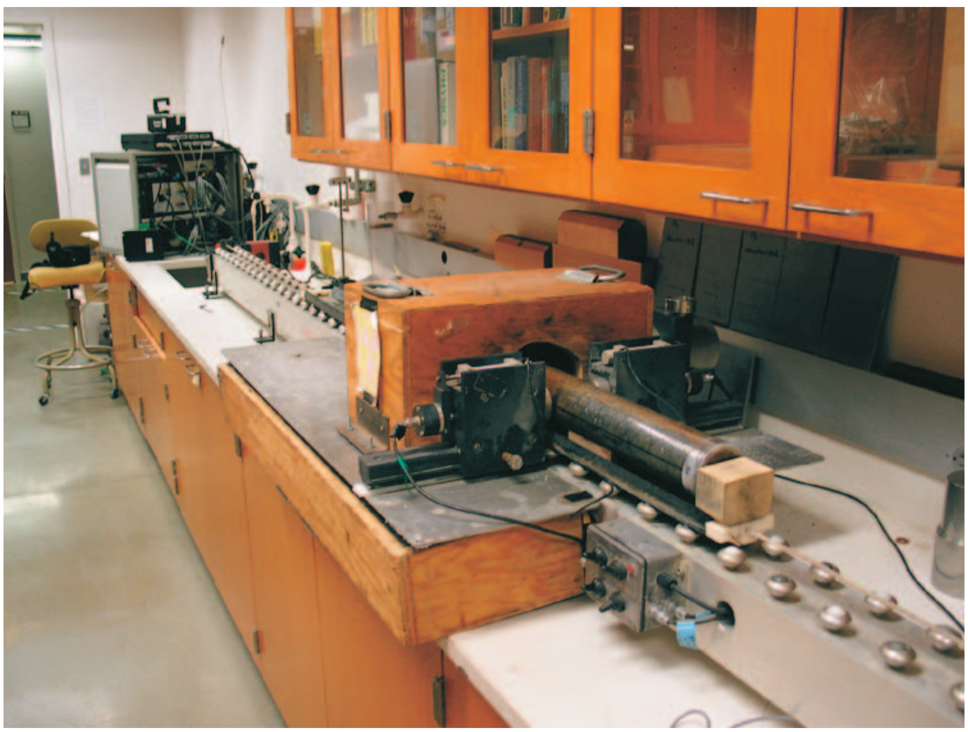


Figure 5. Photograph of the multisensor core logger used in this study.

Figure 6. Photograph of core visual descriptions.

Figure 7. Photograph of core sections sampling the same stratigraphy from three parallel holes aligned for subsampling.