**U.S. DEPARTMENT OF THE INTERIOR**
**U.S. GEOLOGICAL SURVEY**

# THE LAST INTERGLACIATION AT OWENS LAKE, CALIFORNIA: CORE OL-92

Edited by

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Open-File Report 98-132



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## THE LAST INTERGLACIATION AT OWENS LAKE, CALIFORNIA

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# INTRODUCTION AND RATIONALE OF STUDY

James L. Bischoff

Owens Lake, located at the eastern base of the central Sierra Nevada (Fig. 1), was the terminus of the Owens River prior to the lake's complete desiccation shortly after 1913 due to river diversion by the City of Los Angeles. During earlier wetter cycles, the lake overflowed to fill a series of downstream basins including China Lake Basin, Searles Valley, Panamint Valley, and ultimately, Death Valley (Smith and Street-Perrott, 1983). In 1992 the U.S. Geological Survey drilled a 323-m-deep core (OL-92) into Owens Lake sediments near the depocenter of the basin to obtain a continuous record of silty-clay sediment spanning the last 800,000 yrs. A multi-parameter reconnaissance study of the entire core (ca 7000-yr resolution), was reported in a 13-chapter summary volume (Smith and Bischoff, 1997). A document containing the numerical and other detailed forms of raw data collected by that volume's authors was prepared earlier (Smith and Bischoff, 1993). The reconnaissance study provided an approximate time-depth model for the entire core, based on radiocarbon dates from the top 31 m, the Bishop Ash (759,000 yrs) at 304 m, ten within-Brunhes paleomagnetic excursions, and a compaction-corrected mass-accumulation rate of 51.4 g/cm/1000yr (Bischoff *et al.*, 1997a). Application of this model to observed sediment parameters indicates that Owens Lake was saline, alkaline, and biologically productive at times of decreased water-flow, and was generally hydrologically flushed and relatively unproductive during times of increased water-flow. Grain size, abundance of $CaCO_3$, organic carbon, clay mineralogy, cation-exchange capacity of the clay fraction, fossil pollen, fish, ostracodes, and diatoms (see summary by Smith *et al.*, 1997) all show cyclic variation down the core. $CaCO_3$ abundance, in particular, strongly reflects an approximately 100 ka dominant cycle, characteristic of global ice-volume indicated by the MIS $\delta^{18}O$ record. Four of the last five marine isotope terminations are clearly shown in the OL-92 record.

An intermediate resolution (1500 yr) study was later undertaken and the results are reported by Menking *et al.* (1997) and Bischoff *et al.* (1997b). The results show that, to a first order, the records match well the marine $\delta^{18}O$ record (MIS), but that the last interglaciation appears to span the entire period from 120 to 53 ka (corresponding to 36-75 m depth in the core, see Fig. 2). The interglaciation appears to have been punctuated by three short periods of wetter, spilling-lake conditions during an otherwise dry climate. This study also revealed that the timing of Termination II, the end of the penultimate glaciation, is proxy-dependent. The onset of the last interglaciation is shown by abrupt increases in a number of parameters including authigenic $CaCO_3$ and an abrupt decrease in rock flour, at about 118 ka (at 75.0 m). according to our time scale. In contrast, the boundary appears to be gradual in the $\delta^{18}O$ record in which the change from light to heavy values begins at about 140 ka (85.5 m depth). Conditions of high carbonate and low rock-flour prevailed during the entire period from 118 ka until the glacial advance at 53 ka (36 m depth) signaled the end of this long interglaciation.

The present study was focused on the Last Interglaciation, referred to as MIS 5 in the marine record, or as Sangamon and Eemian in the North American and European continental records respectively. The objective was to obtain a high resolution record of this interval as a comparison to the Holocene, in order to observe fine-scale climatic departures not observable at the resolution of the earlier studies. The earlier studies identified the interval 36-75 m depth in the core as representing this interglaciation. Accordingly, in order to include the transitions of the beginning (MIS 5/6 boundary) and end (MIS 4/5 boundary) sampling spanned the interval from 32-83 m depth, representing the time span of ca 35 - 145 ka. Channel samples each of 10 cm length were taken continuously through this interval, with each sample representing about 250 years. These samples were dried and homogenized by light grinding, and aliquots were split for 1.) TIC, TOC and acid-leachable chemistry (Bischoff and others, part 3), 2.) $\delta^{18}O$ and $\delta^{13}C$ and mineralogy of the carbonate fraction, (Li and others, parts 4 and 5) 3.) pollen studies (Litwin, part 9), and 4.) magnetic studies including bulk chemical analyses (Reynolds and others, part 6). In a second suite, point samples were taken approximately every 10 to 20 cm for diatoms (Bradbury and Paquette, part 7) and every 20 cm for ostracodes (Forester and Carter, part 8). In addition, the sedimentary features of the interval were described and photographed in fine detail (Smoot, part 2). Also presented are the preliminary results of continuing efforts to improve the geochronology U-series results on 6 ostracode samples (Bischoff and others part 10) and the results of optical dating of 8 samples (Berger, part 11).

The purpose of the present volume is to present the data collected by the collaborating investigators in a single document . Data are reported in terms of depth rather than time because the chronology of the core is subject to refinement and further improvement. Because the data are correlative from study to study, the volume provides a basis for in-depth analysis and interpretation by each principle investigator of his own data in light of the data obtained by others, and a citable data base for the preparation of formal publication in the outside literature.

## ACKNOWLEDGMENTS

The chapters in this collection benefited from careful reviews by G.I. Smith, John Barron, Brian Edwards, and Robert Rosenbauer. I thank them warmly for their considerable efforts and for the many useful suggestions.

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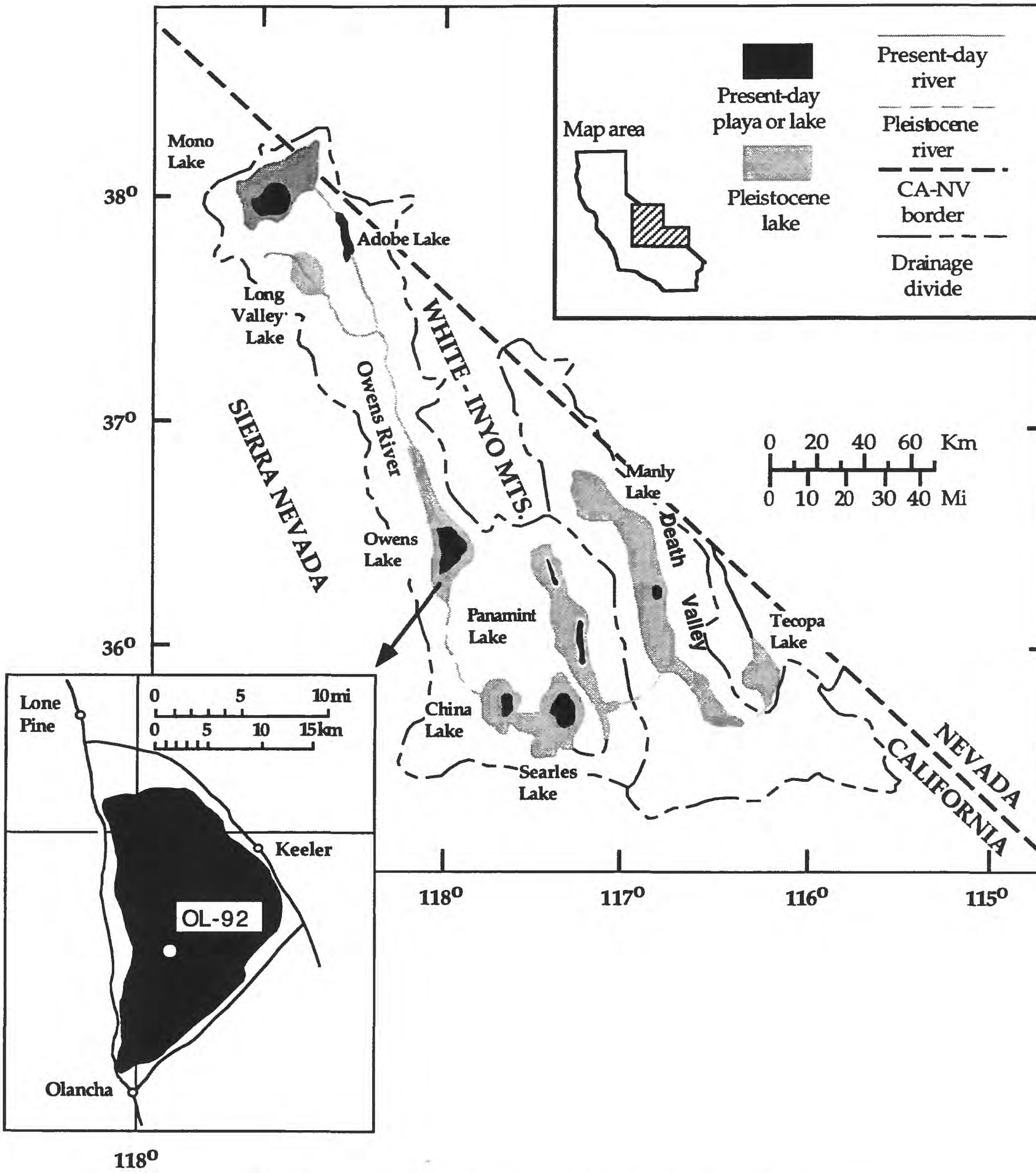


Fig. 1. Location of Owens Lake and core OL-92. Extent of modern lakes and playas indicated by black pattern, maximum pluvial lakes by grey pattern, and basin outline by dashed lines.

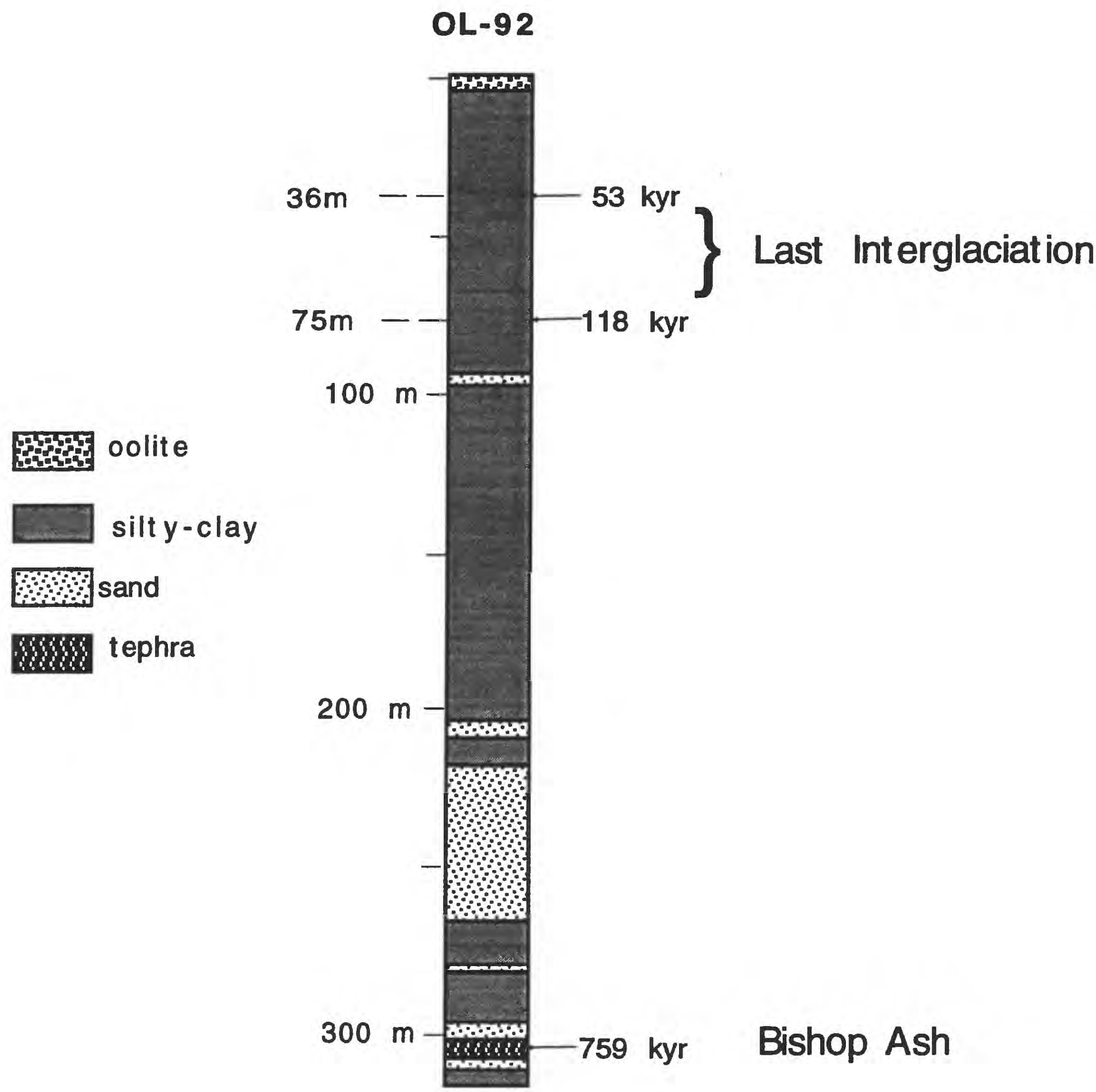


Fig. 2. Schematic drawing of Owens Lake core OL-92 showing position of last Interglaciation and Bishop Ash.

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# SEDIMENTARY FEATURES IN CORE OL-92, 0.9-82.5 M DEPTH, OWENS LAKE, CALIFORNIA

by
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Open-File Report 98-132 (part 2)



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1998

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## Introduction

The U.S. Geological Survey drilled a series of cores into Owens Lake sediments in 1992 (OL92-1, 2, 3) that collectively penetrated to a depth of 323 m. Core was recovered using a rotary drill rig with three-inch (7.6 cm), split-spoon core liner. Individual drive depths varied considerably with a maximum of fifteen feet (4.6 m). The core drives were cut lengthwise into an archive and working half. Long core drives were cut into 1.5 m lengths (slugs). Preliminary core logs by Smith (1993, 1997) emphasized grain size and color variations. Sedimentary structures in those descriptions noted the presence of layering, sand pods, clastic dikes, or color veins. This report provides a more detailed description of the sedimentary structures and features of the archive half of OL92 cores for the depths 0.9 m to 82.5 m to provide environmental and paleoclimatic information.

## Methods

The surface of each core slug was scraped smooth using a razor then photographed continuously in overlapping 15-cm intervals using 35-mm color slide film. Initial logs were made at the hand-lens scale on the prepared surfaces. Color and grain size reported in the sections were visually estimated in the initial descriptions. Each photographic slide was scanned at 1000 dpi resolution and 30-bit color on an Epson 1200-C scanner and imported into Adobe Photoshop 3.0 for Macintosh. The scanned images were reconfigured into a continuous image of each core segment and stored on 650 MB rewritable optical disks. Using the initial notes and the scanned images to check for uniformity of criteria, continuous sections were produced in Adobe Illustrator 5.5.

## Descriptive Criteria

The nature of the sedimentary deposits were emphasized by their relative variations that produce visible changes in the character of the core (Fig. 1). Grain sizes were estimated using shadow charts for silt and coarser sediment. Clay and silty clay have a slick waxy feel, whereas silty mud and muddy silt have a grainy feel and commonly have a knap when scraped. Grain types are only noted where they affect the sedimentary character, such as the occurrences of mica or ostracode shells. Grain size distributions are noted where they define the nature of layering.

Graded beds have a gradual decrease of grain size from the base and reverse graded beds have a gradual increase of grain size from the base. Fine laminae that are comprised of diatoms, carbonate crystals, or tephra are differentiated where possible, but most commonly are queried to emphasize the lack of confirming data. Colors are used only to differentiate between sediment types and are not intended for differentiating the abundance of carbonate minerals, organic content, or other mineralogical features.

The thickness of layering in OL92 is based on the classification of McKee and Weir (1953). Laminae are less than 1 cm thick and thin beds are greater than 1 cm thick. I have used the additional division of thin laminae which are less than 1.0 mm thick and microlaminae which are less than 0.1 mm thick. Clay or mud partings are thin laminae or microlaminae within silt or sand layers. Layers are continuous across the width of the core unless otherwise noted. Discontinuous layers have the same thickness over their extent of occurrence and patchy layers are discontinuous layers with irregular lateral distributions within unbedded material. Thickness variations of the layers are indicated by the terms lenticular or pinch-and-swell. Streaky laminae are thin laminae to microlaminae with irregular discontinuous distributions and wispy bedding refers to discontinuous layers with indefinite boundaries. Bedding is mostly flat and significant variations from horizontal are shown to scale on the diagram. Wavy bedding and deformed layering are depicted on the diagram to provide the sense of the feature rather than the precise angles or spacing. Bedding contacts are depicted by black lines if they are sharp and by dashed lines or pattern changes if they are indistinct or diffuse. Erosive or scour contacts appear to truncate underlying deposits. Fault offsets and shear planes are shown to scale on the vertical sections with the actual changes in bedding orientation.

Other sedimentary features within the cores are identified in the description and shown to scale on the figures. Discontinuous areas of different sediment types or colors are only roughly depicted and referred to as blobs if they are relatively large and blebs if they are relatively small. Pods are blebs that have circular cross-sections. Burrows in the core are recognized as circular or ovate cross-sections of cylinders and are mostly shown as one of four symbols with no attempt to depict the location or shape of each burrow. The vertical distribution and relative abundance of burrows are indicated by the density of symbols. Burrow symbols with vertical parallel lines depict burrowing styles with a significant vertical component and diameters greater than 2 mm. If these symbols include black dots, the burrows are recognized by the concentration of coarser material in the tubes. Burrow symbols with long, wavy, horizontal parallel lines represent burrows oriented parallel to bedding that are greater than 2 mm in diameter. Burrow symbols with horizontal straight lines represent burrows oriented parallel to bedding that are less than 2 mm in diameter. Burrow mottling refers to situations where changes in color, grain size, or grain orientation produces curved planes that resemble partial sections of cylinders.

Arrows along the margins of the vertical core sections are used to denote successions of sedimentary features that are gradual from an abrupt basal contact. Large arrow heads are used for successions that involve decreasing grain size. Small arrow heads are used for successions that are defined by changes in layering style, an increase of grain size, or other criteria. Where successions are too small to be marked in this manner, their thickness and number are noted in the caption.

Missing intervals in the core are shown as blank with a black "X". Blank areas with breaks in the vertical section outline indicate where significant portions of the archive half of the core were removed during splitting or by sampling before descriptions. Areas that were too broken up to be smoothed, mostly by problems during splitting of the core, are shown schematically by irregular-shaped patterns of the sediment type. In several slugs, the actual observed thickness of sediment was significantly greater than that reported by Smith (1993) and recorded on the archive half of the core. The excess thickness is shown with a dashed border and the core depth is kept constant for that thickness for those intervals.

## Discussion

The upper part of almost every drive in OL92-1 consists of clay with irregular blobs, blebs, and streaks of sediment. These intervals are characteristically soft and wet and exhibit a strong orientation of features parallel to the core wall. These intervals are identified as fluidized on the caption and are believed to represent coring artifacts. The soft gray clay is probably a mixture of drilling mud and fluidized sediment, whereas the blobs and blebs represent more coherent blocks of sediment that fell into the hole from the bottom of the previous drive as it was being removed. Most of the faulting observed in OL92 is also probably a coring artifact. High-angle normal faults formed as each drive was removed from the hole and a part of the core slipped through the core catcher. Low-angle shear planes, which are particularly abundant in the part of OL92-2 that was examined, formed from portions of the core spinning within the barrel during drilling. These shear planes have a diagnostic feature of flaring at the edges where they join material that lines the core barrel.

There is a strong correlation between changes in sedimentary style (Fig. 2) and changes in climatic proxies from these cores (Bischoff and others, 1997a, b; Bradbury, 1997; Litwin and others, 1997; Menking, 1997; Smith and others, 1997). Cold, glacial conditions are characterized by gray to green clay and silty clay with burrows and/or scattered sand and granules. Micaceous silty mud have mineralogy and diatom assemblages similar to the glacial conditions, but pollen assemblages indicative of warmer conditions. Burrowed silty mud that exhibit vague banding are coincident with moderate carbonate values, mixed diatom assemblages, and warmer pollen. The warmest driest conditions by all indicators are coincident with sandy laminites. The fine-scale variability of sedimentary features within any sedimentary package also coincide with fluctuations of climatic indicators in this volume suggesting a higher resolution of climate change.

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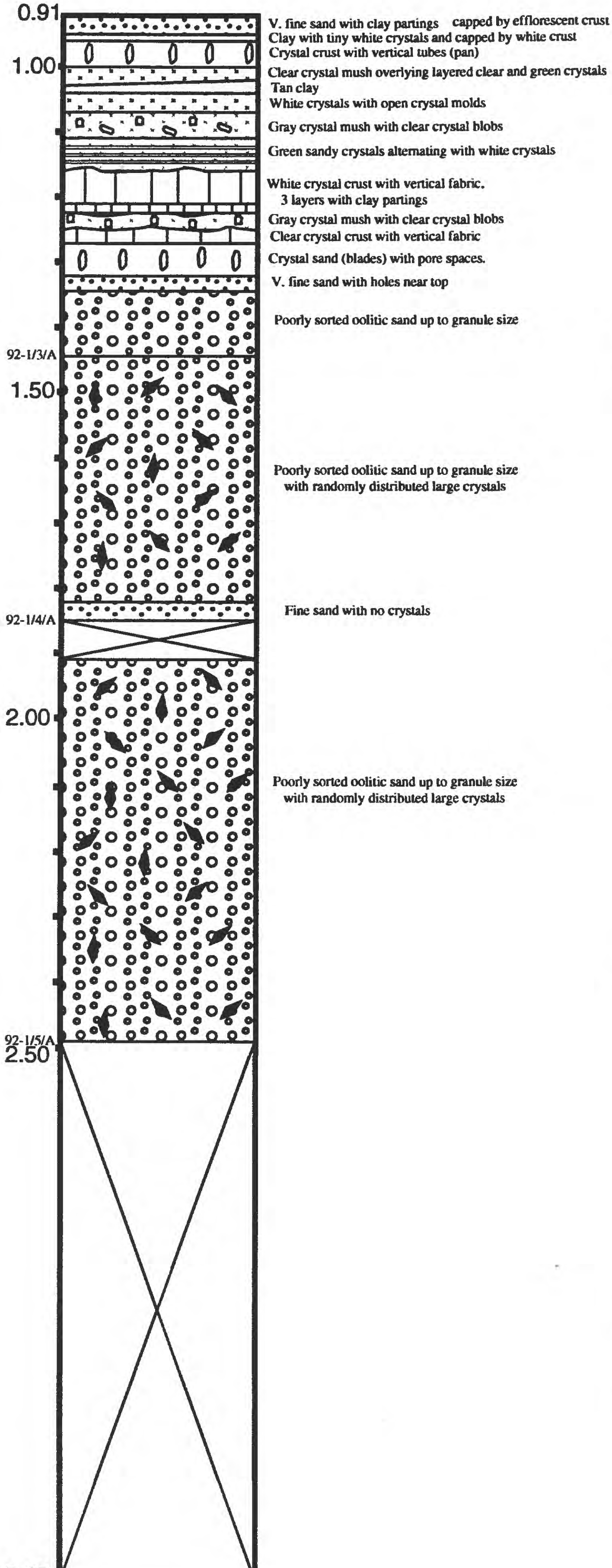
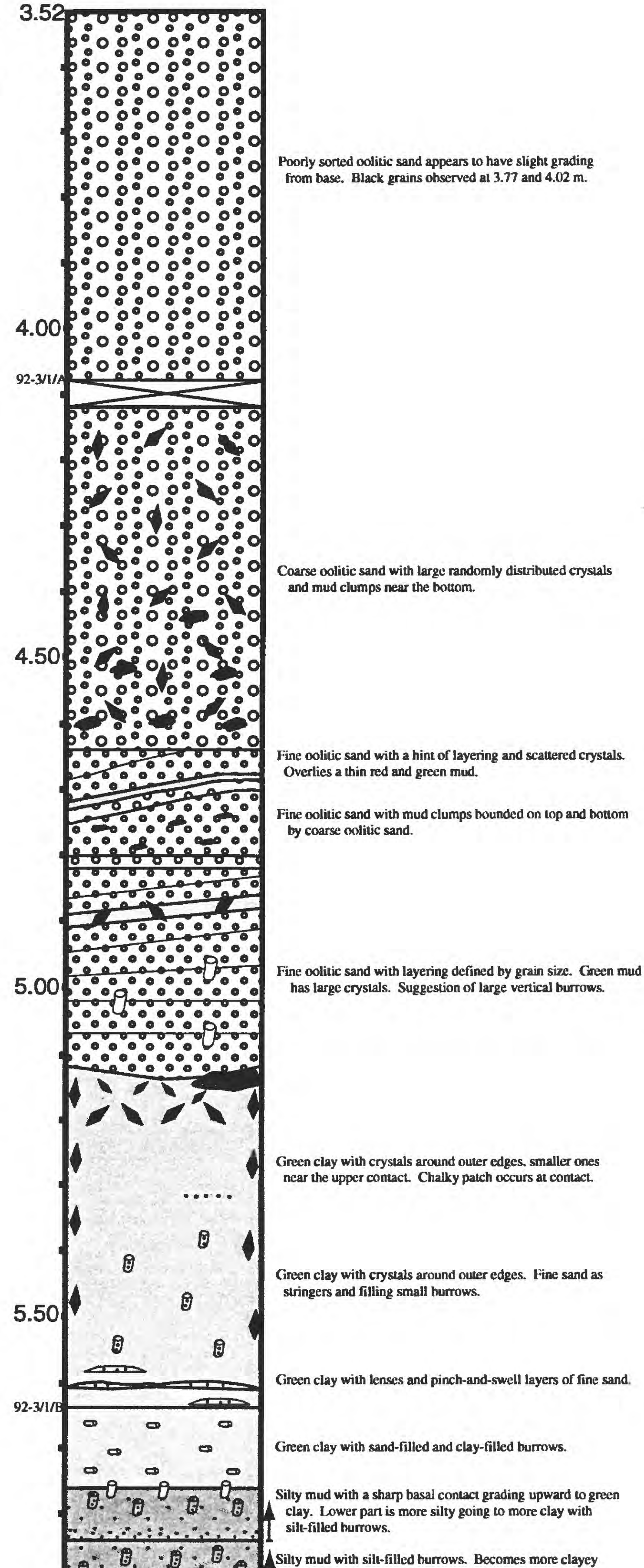
Figure 1

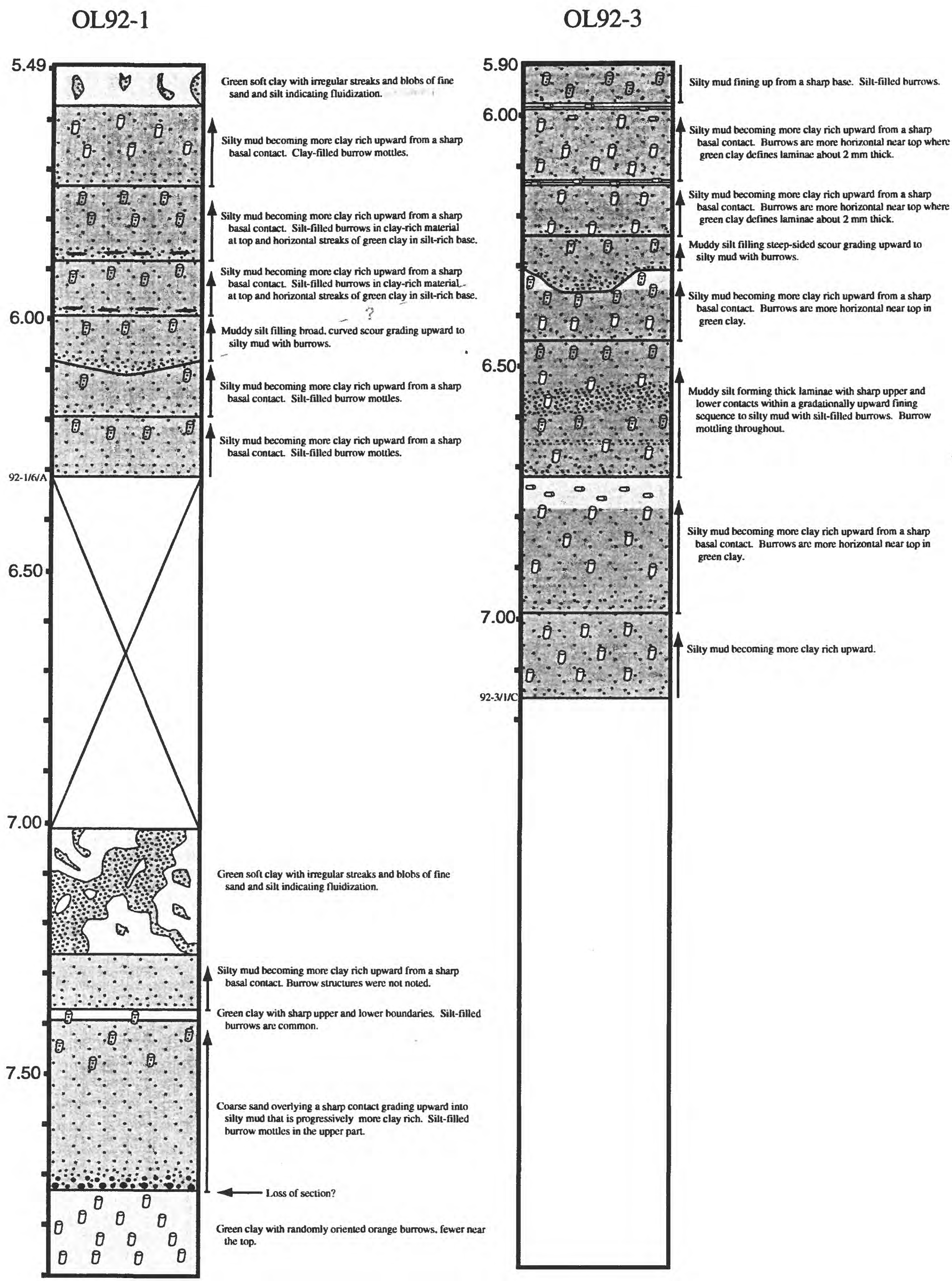
Detailed stratigraphic sections with brief caption for cores OL92-1, 2, and 3. Scale to left in each column is in meters and represents drilling depths as reported by Smith (1993). Small numbers on left side of each column denote the base of each slug with the core number/drive/slug shown for each. Correlative beds between cores are marked with pale gray dashed lines.

## OL92-1

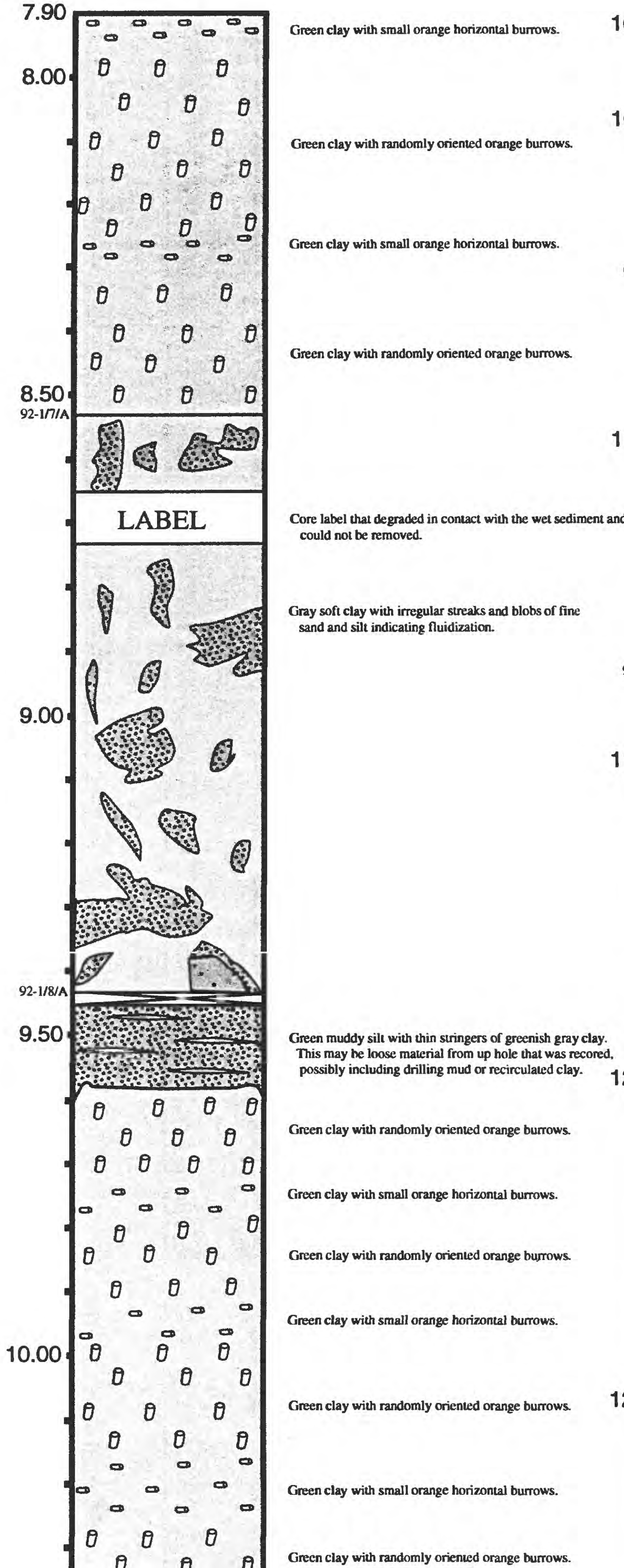

0.91
1.00
1.50
2.00
2.50
5.49
92-1/3/A
92-1/4/A
92-1/5/A
V. fine sand with clay partings capped by efflorescent crust
Clay with tiny white crystals and capped by white crust
Crystal crust with vertical tubes (pan)
Clear crystal mush overlying layered clear and green crystals
Tan clay
White crystals with open crystal molds
Gray crystal mush with clear crystal blobs
Green sandy crystals alternating with white crystals
White crystal crust with vertical fabric.
3 layers with clay partings
Gray crystal mush with clear crystal blobs
Clear crystal crust with vertical fabric
Crystal sand (blades) with pore spaces.
V. fine sand with holes near top
Poorly sorted oolitic sand up to granule size
Poorly sorted oolitic sand up to granule size
with randomly distributed large crystals
Fine sand with no crystals
Poorly sorted oolitic sand up to granule size
with randomly distributed large crystals

## OL92-3

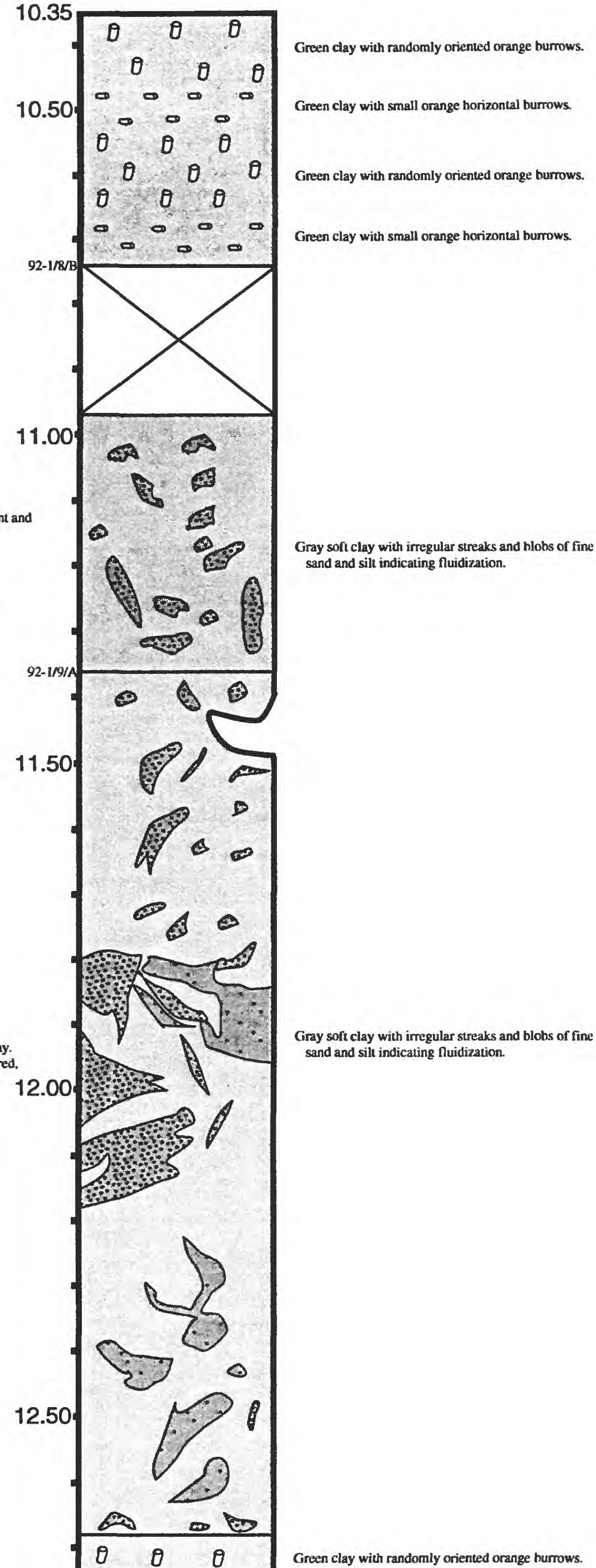

3.52
4.00
4.50
5.00
5.50
92-3/1/A
92-3/1/B
Poorly sorted oolitic sand appears to have slight grading
from base. Black grains observed at 3.77 and 4.02 m.
Coarse oolitic sand with large randomly distributed crystals
and mud clumps near the bottom.
Fine oolitic sand with a hint of layering and scattered crystals.
Overlies a thin red and green mud.
Fine oolitic sand with mud clumps bounded on top and bottom
by coarse oolitic sand.
Fine oolitic sand with layering defined by grain size. Green mud
has large crystals. Suggestion of large vertical burrows.
Green clay with crystals around outer edges, smaller ones
near the upper contact. Chalky patch occurs at contact.
Green clay with crystals around outer edges. Fine sand as
stringers and filling small burrows.
Green clay with lenses and pinch-and-swell layers of fine sand.
Green clay with sand-filled and clay-filled burrows.
Silty mud with a sharp basal contact grading upward to green
clay. Lower part is more silty going to more clay with
silt-filled burrows.
Silty mud with silt-filled burrows. Becomes more clayey
upwards.


OL92-1
5.49
Green soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Silty mud becoming more clay rich upward from a sharp basal contact. Clay-filled burrow mottles.
Silty mud becoming more clay rich upward from a sharp basal contact. Silt-filled burrows in clay-rich material at top and horizontal streaks of green clay in silt-rich base.
Silty mud becoming more clay rich upward from a sharp basal contact. Silt-filled burrows in clay-rich material at top and horizontal streaks of green clay in silt-rich base.
6.00
?
Muddy silt filling broad, curved scour grading upward to silty mud with burrows.
Silty mud becoming more clay rich upward from a sharp basal contact. Silt-filled burrow mottles.
Silty mud becoming more clay rich upward from a sharp basal contact. Silt-filled burrow mottles.
92-1/6/A
6.50
7.00
Green soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Silty mud becoming more clay rich upward from a sharp basal contact. Burrow structures were not noted.
Green clay with sharp upper and lower boundaries. Silt-filled burrows are common.
7.50
Coarse sand overlying a sharp contact grading upward into silty mud that is progressively more clay rich. Silt-filled burrow mottles in the upper part.
Loss of section?
Green clay with randomly oriented orange burrows, fewer near the top.
OL92-3
5.90
Silty mud fining up from a sharp base. Silt-filled burrows.
6.00
Silty mud becoming more clay rich upward from a sharp basal contact. Burrows are more horizontal near top where green clay defines laminae about 2 mm thick.
Silty mud becoming more clay rich upward from a sharp basal contact. Burrows are more horizontal near top where green clay defines laminae about 2 mm thick.
Muddy silt filling steep-sided scour grading upward to silty mud with burrows.
Silty mud becoming more clay rich upward from a sharp basal contact. Burrows are more horizontal near top in green clay.
6.50
Muddy silt forming thick laminae with sharp upper and lower contacts within a gradationally upward fining sequence to silty mud with silt-filled burrows. Burrow mottling throughout.
Silty mud becoming more clay rich upward from a sharp basal contact. Burrows are more horizontal near top in green clay.
7.00
Silty mud becoming more clay rich upward.
92-3/1/C

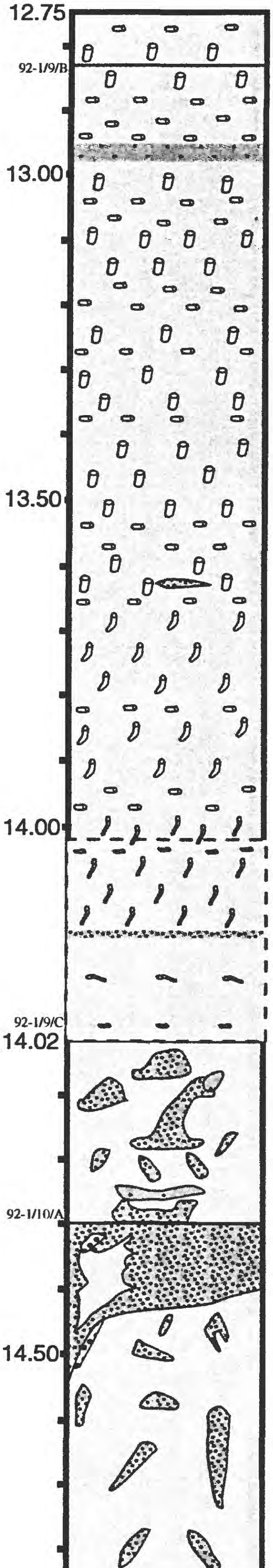
## OL92-1


7.90
8.00
8.50
92-1/7/A
LABEL
9.00
92-1/8/A
9.50
10.00
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Core label that degraded in contact with the wet sediment and could not be removed.
Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Green muddy silt with thin stringers of greenish gray clay. This may be loose material from up hole that was recored, possibly including drilling mud or recirculated clay.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.

## OL92-1

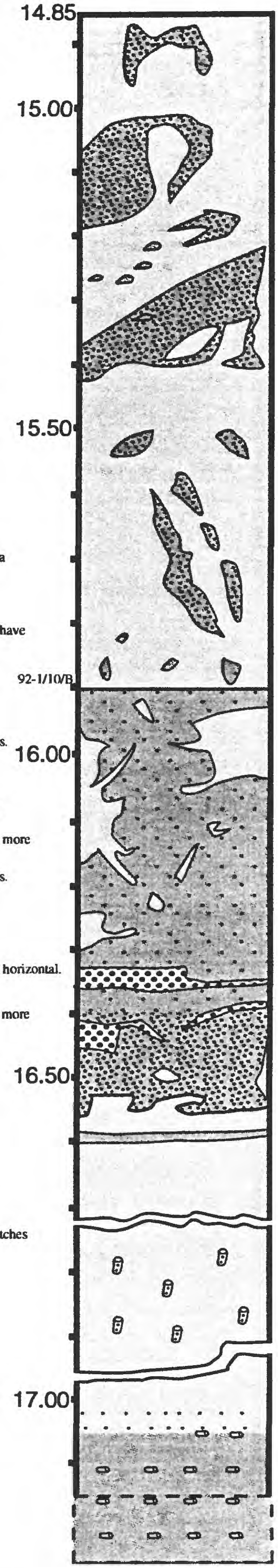

10.35
10.50
92-1/8/B
11.00
92-1/9/A
11.50
12.00
12.50
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Green clay with randomly oriented orange burrows.

## OL92-1



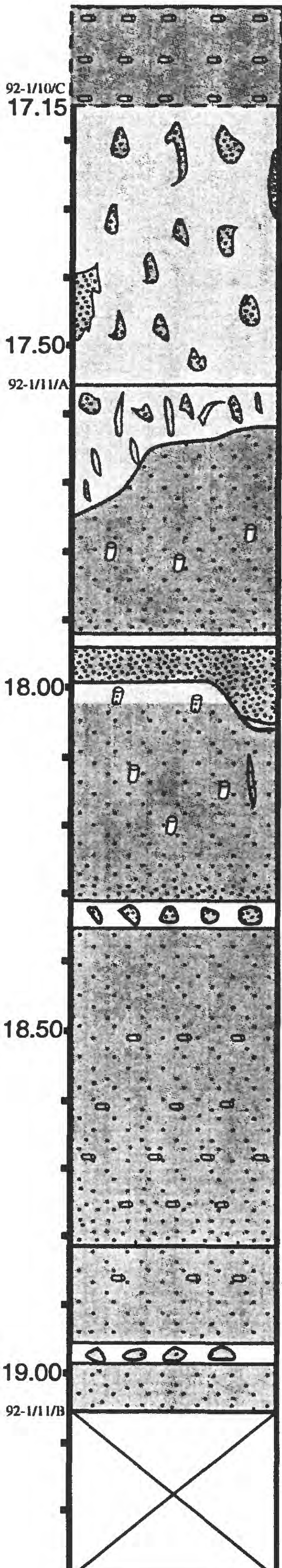

Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Silty mud layer with diffuse boundaries
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows and a lense of muddy silt.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows that have smaller diameters than those above.
Green clay with small orange horizontal burrows.
Green clay with small randomly oriented orange burrows.
Green clay with small orange horizontal burrows.
Green clay with randomly oriented orange burrows that have smaller diameters than those above.
Green clay with orange horizontal burrows that are little more dots and streaks of orange.
Green clay with small randomly oriented orange burrows.
Orange silt layer with sharp contacts
Green clay with no obvious burrows.
Green clay with small orange burrows that are not quite horizontal.
Green clay with no obvious burrows.
Green clay with orange horizontal burrows that are little more dots and streaks of orange.
Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Muddy silt and fine sand with swirls of gray clay and patches of medium sand. Looks fluidized.
Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.

## OL92-1




Gray soft clay with irregular streaks and blobs of fine sand and silt indicating fluidization.
Spots and blebs of orange silty mud within gray clay.
Gray soft clay with small clumps of green clay and irregular streaks and blobs of fine sand and silt indicating fluidization.
Spots and blebs of orange silty mud within gray clay.
Green silty mud with soft gray clay around outer edge. Looks fluidized.
Brown sand as lenses projecting in from sides. Probably injected into mud from movement along the core margin.
Muddy silt with blebs and streaks of green clay, very irregular contact. Contact suggests a coring artifact.
Green clay with dark band near top. The band may be a spin-out feature.
Green clay with orange silty blobs that may be burrows.
Green clay with two silty laminae that may be the edges of a bed.
Green clay siltier than above. Horizontal burrows define 0.5 cm bands separated by green clay.

## OL92-1




Green slightly silty clay with horizontal burrows that define 0.5 cm bands separated by green clay.

Gray-green clay with orange silty blobs that could be burrows, but edge-parallel streaks and irregular open cracks indicate fluidization.

Gray-green clay with orange silty blobs and gray clay streaks and blobs. May be burrow fabric, but looks more like fluidization.

Silty mud becoming more clay rich upwards from a sharp base possible burrow structures.

Green clay with sharp upper and lower boundaries.

Orange muddy silt filling scour and becoming slightly finer grained upward. Silty mud right at contact in lowest part.

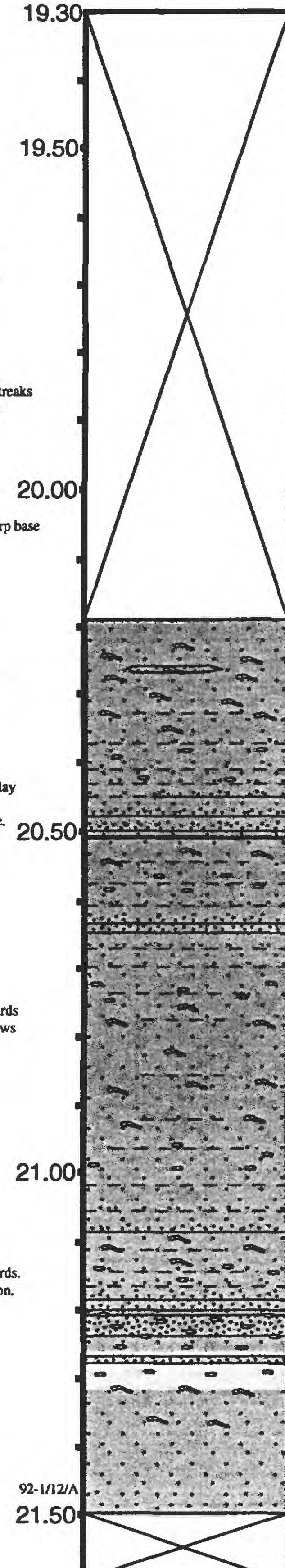
Silty mud becoming more clay rich upwards to a gray clay with silt-filled burrows. Silty mud is also burrow mottled and grades to an orange muddy silt at the base.

Core broken into blocks of orange muddy silt.

Orangish-gray silty mud becoming more clay rich upwards from a sharp base. Brown clay-filled horizontal burrows in distinct horizons.

Orangish-gray silty mud becoming more clay rich upwards. Brown clay-filled horizontal burrows in distinct horizon. Broken up zone near the base.

## OL92-1




Green slightly silty mud with small brown burrows

Orange silty layer that is penetrated by brown tubes

Green slightly silty mud with graded dark-to-light silty laminae at base becoming more diffuse and widely spaced upwards as brown burrows become more abundant and less horizontal.

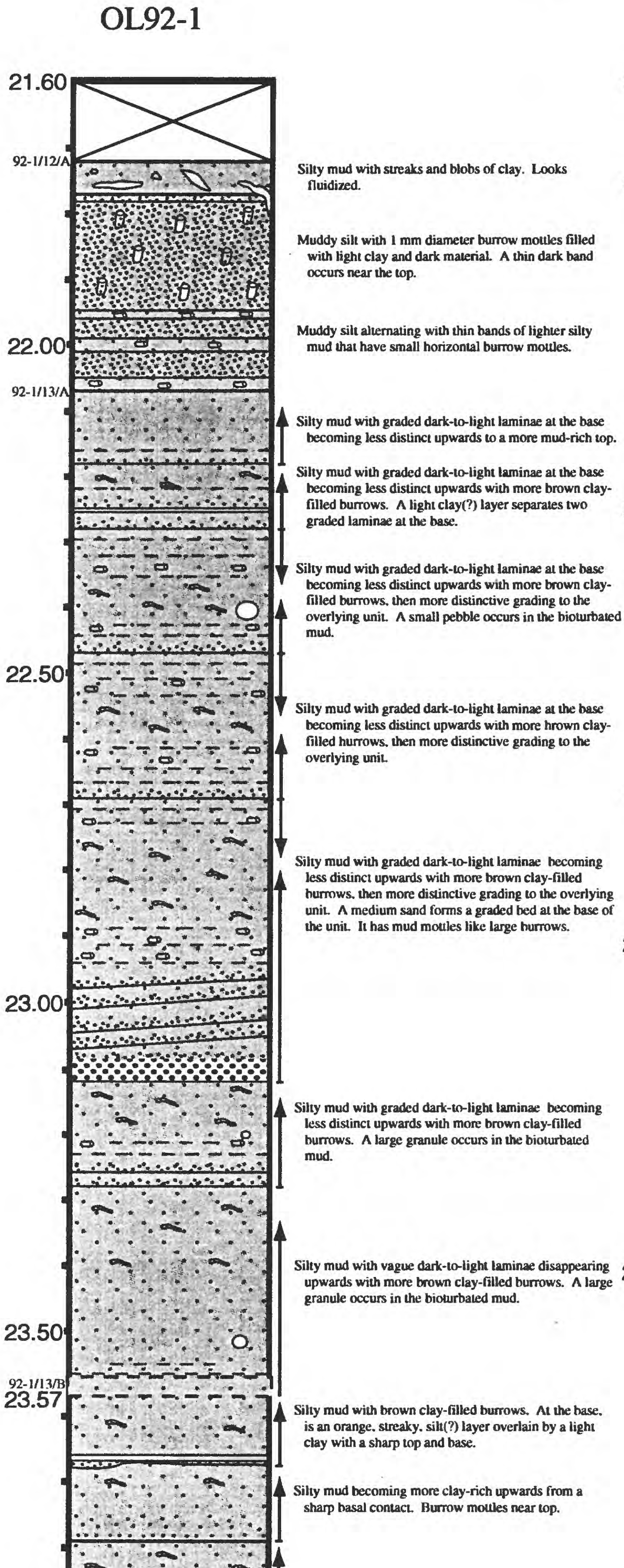
Green slightly silty mud with graded dark-to-light silty laminae at base becoming more diffuse and widely spaced upwards as brown burrows become more abundant and less horizontal. A 3 mm-thick light laminae near the top.

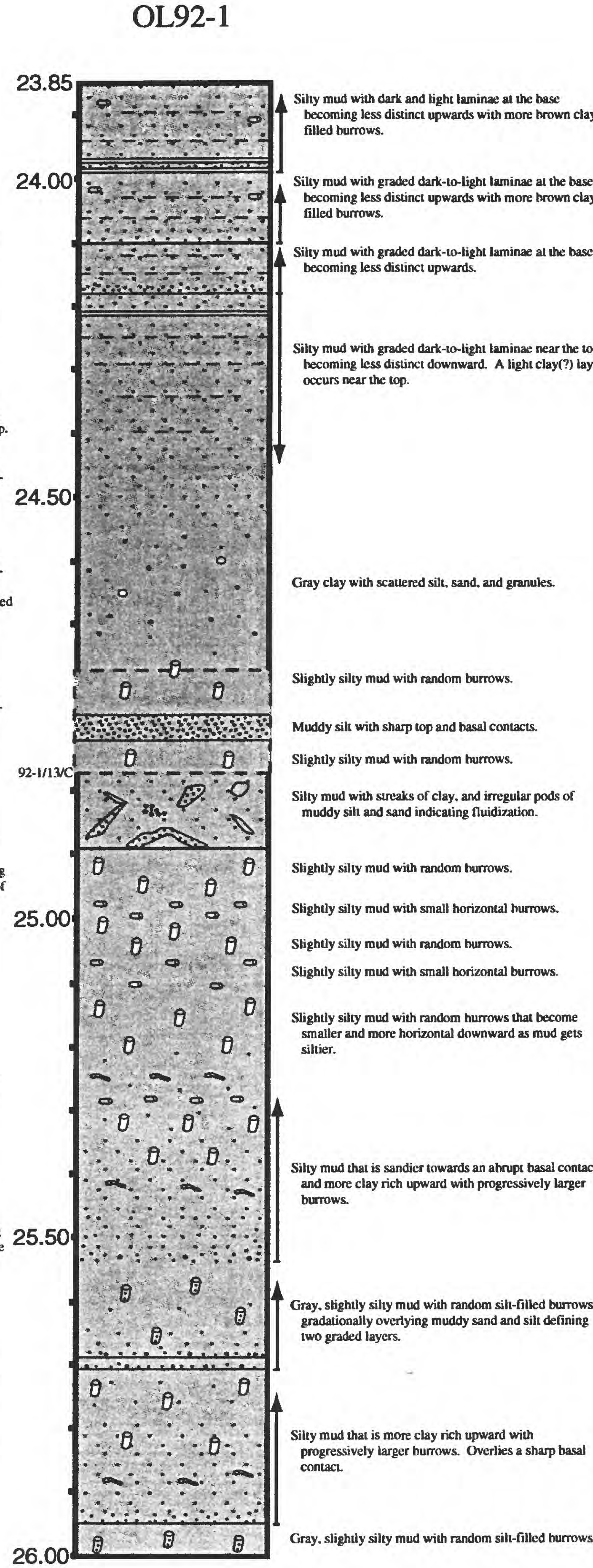
Green slightly silty mud with graded dark-to-light silty laminae at base becoming more diffuse and widely spaced upwards as brown burrows become more abundant and less horizontal, then becoming more distinct and less bioturbated in gradation to the overlying unit.

Green slightly silty mud with graded dark-to-light silty laminae at base becoming more diffuse and widely spaced upwards as brown burrows become more abundant and less horizontal.

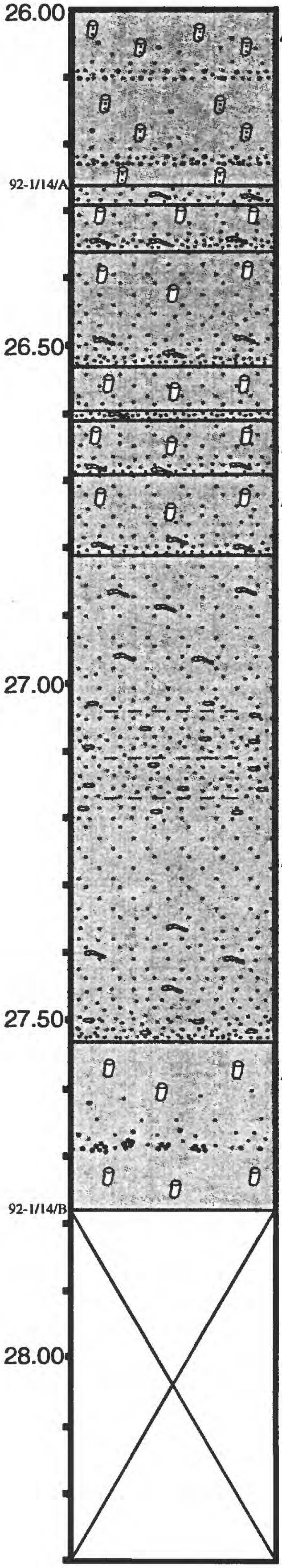
Silty mud with a 1 cm thick orange, silty thick lamina and a 3 cm thick orange silty thin bed disrupted by small horizontal burrows. Between the silt layers burrows are filled with white material (tephra?).

Silty mud becoming more clay rich upwards to a gray, slightly silty clay with brown, clay-filled burrows.


OL92-1
21.60
92-1/12/A
Silty mud with streaks and blobs of clay. Looks fluidized.
Muddy silt with 1 mm diameter burrow motles filled with light clay and dark material. A thin dark band occurs near the top.
22.00
Muddy silt alternating with thin bands of lighter silty mud that have small horizontal burrow mottles.
92-1/13/A
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards to a more mud-rich top.
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards with more brown clay-filled burrows. A light clay(?) layer separates two graded laminae at the base.
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards with more brown clay-filled burrows, then more distinctive grading to the overlying unit. A small pebble occurs in the bioturbated mud.
22.50
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards with more brown clay-filled burrows, then more distinctive grading to the overlying unit.
Silty mud with graded dark-to-light laminae becoming less distinct upwards with more brown clay-filled burrows, then more distinctive grading to the overlying unit. A medium sand forms a graded bed at the base of the unit. It has mud motiles like large burrows.
23.00
Silty mud with graded dark-to-light laminae becoming less distinct upwards with more brown clay-filled burrows. A large granule occurs in the bioturbated mud.
Silty mud with vague dark-to-light laminae disappearing upwards with more brown clay-filled burrows. A large granule occurs in the bioturbated mud.
23.50
92-1/13/B
23.57
Silty mud with brown clay-filled burrows. At the base, is an orange, streaky, silt(?) layer overlain by a light clay with a sharp top and base.
Silty mud becoming more clay-rich upwards from a sharp basal contact. Burrow motiles near top.


OL92-1
23.85
Silty mud with dark and light laminae at the base becoming less distinct upwards with more brown clay-filled burrows.
24.00
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards with more brown clay-filled burrows.
Silty mud with graded dark-to-light laminae at the base becoming less distinct upwards.
Silty mud with graded dark-to-light laminae near the top becoming less distinct downward. A light clay(?) layer occurs near the top.
24.50
Gray clay with scattered silt, sand, and granules.
Slightly silty mud with random burrows.
Muddy silt with sharp top and basal contacts.
Slightly silty mud with random burrows.
92-1/13/C
Silty mud with streaks of clay, and irregular pods of muddy silt and sand indicating fluidization.
Slightly silty mud with random burrows.
Slightly silty mud with small horizontal burrows.
25.00
Slightly silty mud with random burrows.
Slightly silty mud with small horizontal burrows.
Slightly silty mud with random burrows that become smaller and more horizontal downward as mud gets siltier.
Silty mud that is sandier towards an abrupt basal contact and more clay rich upward with progressively larger burrows.
25.50
Gray, slightly silty mud with random silt-filled burrows gradationally overlying muddy sand and silt defining two graded layers.
Silty mud that is more clay rich upward with progressively larger burrows. Overlies a sharp basal contact.
Gray, slightly silty mud with random silt-filled burrows.
26.00

## OL92-1




Slightly silty mud with silt-filled burrows gradationally overlying poorly sorted muddy sand with an abrupt basal contact.

Slightly silty mud with silt-filled burrows gradationally overlying poorly sorted muddy sand with an abrupt basal contact.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base.

Silty mud becoming more clay rich upward from a muddy silt with a sharp base. Burrow mottles are smaller and more horizontal toward base.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base.

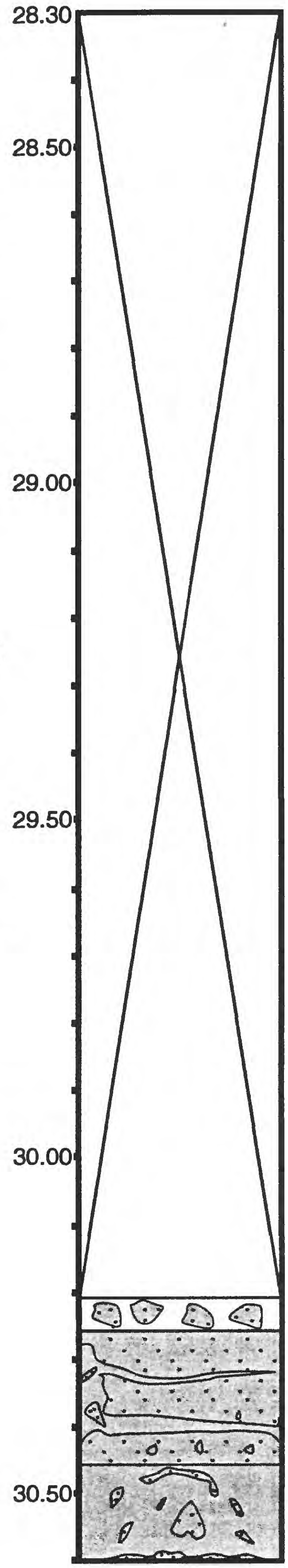
Silty mud becoming more clay rich upward with mostly horizontal clay-filled burrows. Faint layering near the base and burrows are smaller and more horizontal.

Silty mud becoming more clay rich upward from a sharp base. Burrow mottles are smaller and more horizontal toward base. Upper contact is gradational to the next unit.

Gray clay with brown random burrows gradationally overlying sandy mud with pods of sand (burrows?).

Gray clay with brown random burrows.

## OL92-1

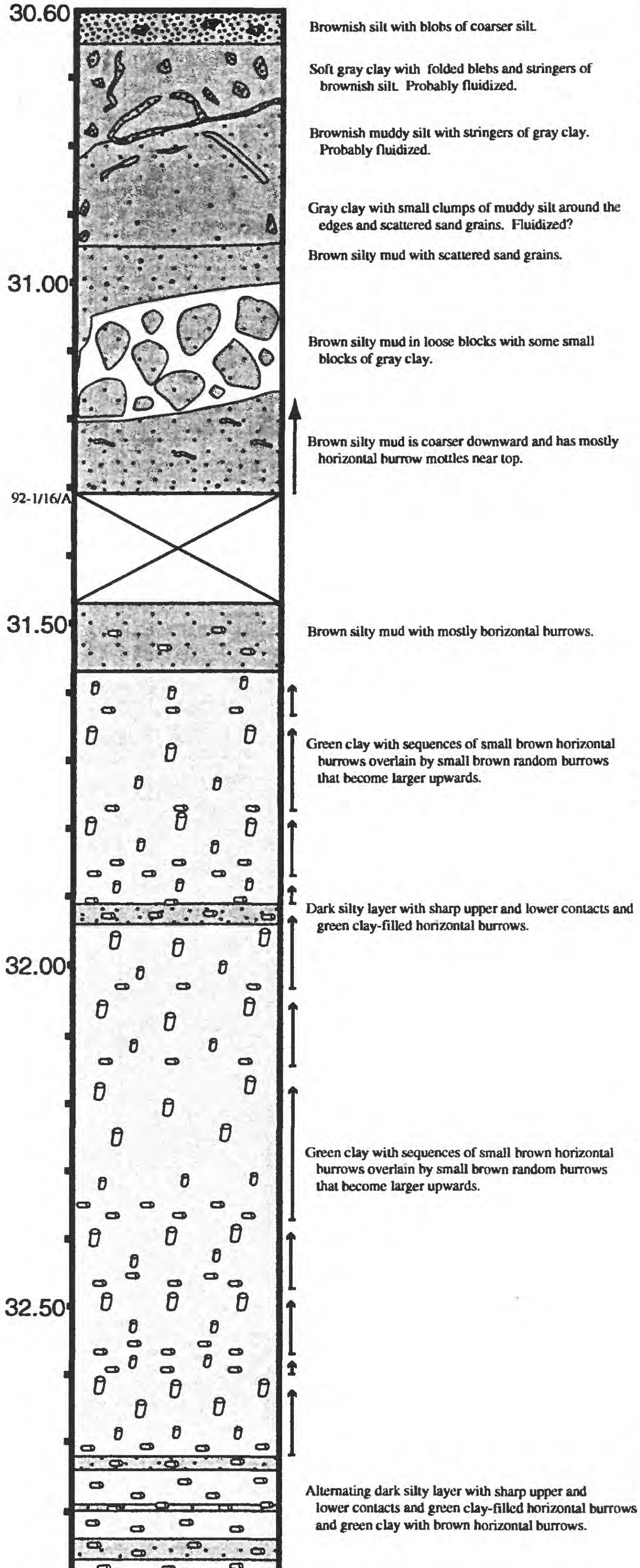



Loose clumps of gray silty mud.

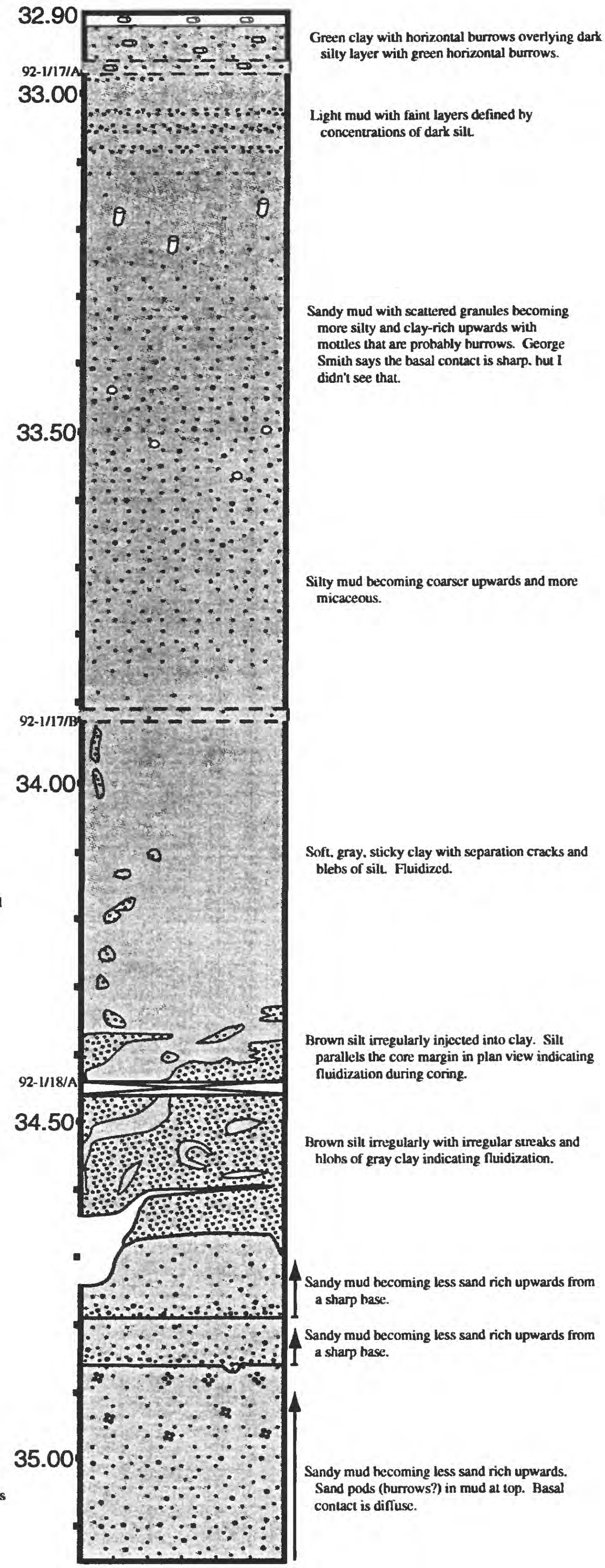
Brown silty mud with gray clay injected from the edges and small blebs of gray clay that look a little like burrows, but are probably fluidization features.

Soft gray clay with clumps and folded blebs of brown silty mud indicating fluidized sediment.

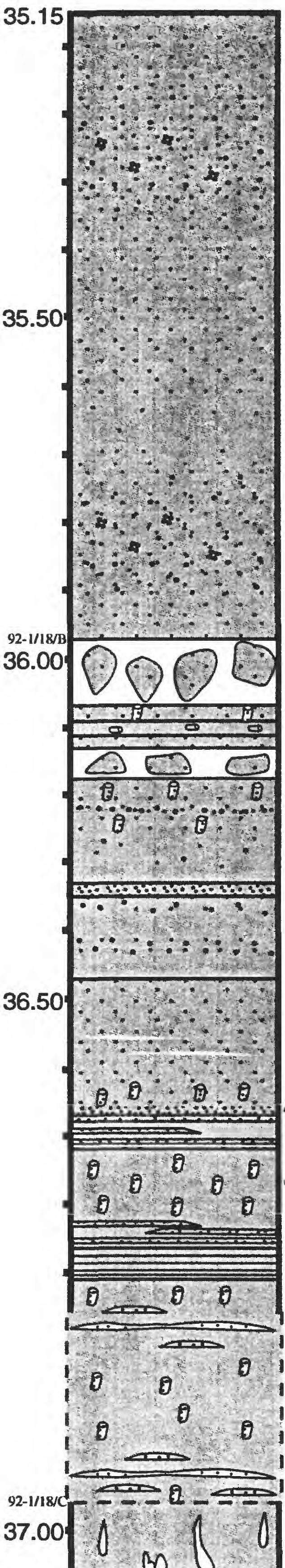
## OL92-1


30.60
31.00
92-1/16/A
31.50
32.00
32.50
Brownish silt with blobs of coarser silt.
Soft gray clay with folded blebs and stringers of brownish silt. Probably fluidized.
Brownish muddy silt with stringers of gray clay. Probably fluidized.
Gray clay with small clumps of muddy silt around the edges and scattered sand grains. Fluidized?
Brown silty mud with scattered sand grains.
Brown silty mud in loose blocks with some small blocks of gray clay.
Brown silty mud is coarser downward and has mostly horizontal burrow mottles near top.
Brown silty mud with mostly horizontal burrows.
Green clay with sequences of small brown horizontal burrows overlain by small brown random burrows that become larger upwards.
Dark silty layer with sharp upper and lower contacts and green clay-filled horizontal burrows.
Green clay with sequences of small brown horizontal burrows overlain by small brown random burrows that become larger upwards.
Alternating dark silty layer with sharp upper and lower contacts and green clay-filled horizontal burrows and green clay with brown horizontal burrows.

## OL92-1


32.90
92-1/17/A
33.00
33.50
92-1/17/B
34.00
92-1/18/A
34.50
35.00
Green clay with horizontal burrows overlying dark silty layer with green horizontal burrows.
Light mud with faint layers defined by concentrations of dark silt.
Sandy mud with scattered granules becoming more silty and clay-rich upwards with mottles that are probably burrows. George Smith says the basal contact is sharp, but I didn't see that.
Silty mud becoming coarser upwards and more micaceous.
Soft, gray, sticky clay with separation cracks and blebs of silt. Fluidized.
Brown silt irregularly injected into clay. Silt parallels the core margin in plan view indicating fluidization during coring.
Brown silt irregularly with irregular streaks and blobs of gray clay indicating fluidization.
Sandy mud becoming less sand rich upwards from a sharp base.
Sandy mud becoming less sand rich upwards from a sharp base.
Sandy mud becoming less sand rich upwards. Sand pods (burrows?) in mud at top. Basal contact is diffuse.

## OL92-1




Silty mud with more sand upward and downward. Diffuse contacts with adjoining units.

Sandy mud with scattered pods of sand (burrows?) Contacts are gradational.

Silty mud becoming sandier upward to the overlying unit. Basal contact is diffuse, but more abrupt.

Sandy mud with scattered pods of sand (burrows?). Becomes less sandy downwards.

Silty mud with silt-filled burrows and ostracods near the base.

Tan silty clay with horizontal burrows.

Silty mud with silt-filled burrows. A single grain layer of sand rests on an abrupt contact. Lower part is a gray clay with scattered sand and silt grains.

Buff, muddy silt with ostracodes(?).

Gray clay with bands of sandier material that includes black grains.

Greenish silty mud with thin streaks of gray clay. Silt may be diatoms.

Coarse silt filling burrows and forming layers may be small ostracodes.

Green silty clay with orange silt forming thick laminae.

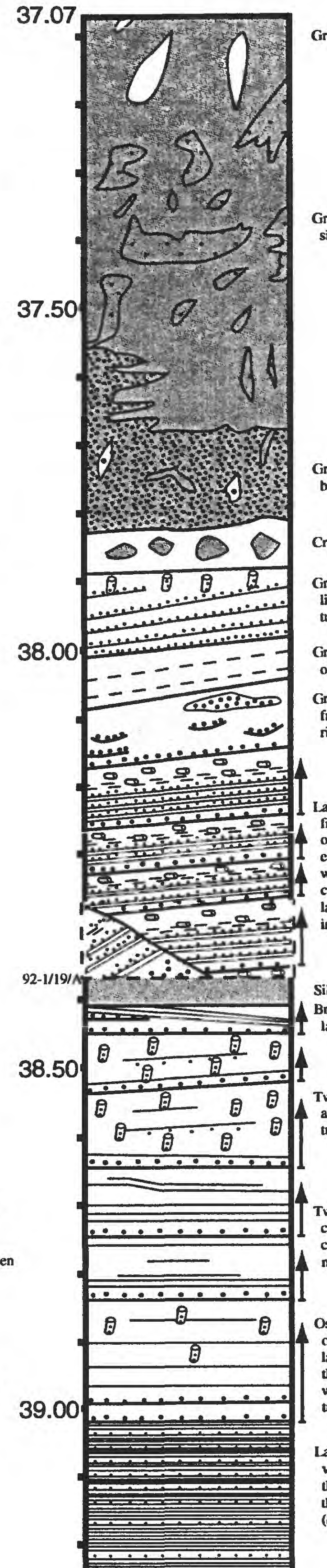
Green silty clay with orange-to-yellow silt forming thick laminae near the base and silt-filled tubes near the top.

Light laminae (1 mm thick) of diatoms(?) with dark green clay partings.

Silty clay with ostracodes filling burrows and forming lenticular layers.

Gray mud with green mottles.

## OL92-1




Gray mud with green mottles.

Gray mud with blobs and streaks of yellowish silty mud indicating fluidization.

Greenish silt with small blebs and streaks of brown silt and gray clay. Looks fluidized.

Crumbly green clay with ostracodes.

Graded laminae (0.5-1.0 cm) of dark silt and light clay. Ostracodes in light layers and filling tubes near top.

Green clay with vague color bands and scattered ostracodes.

Green clay with white lense of coarse ostracode fragments and concave-up lenses of ostracode-rich sand overlying sharp contacts.

Laminated silt and clay comprising four upward-fining units. The basal lamina of each unit is an ostracode-rich sand overlying a sharp, possibly erosive contact, and grading upward into a green silt with a thin, brown clay cap. Subsequent laminae are comprised of graded silt with a brown clay cap. These laminae are less distinct upward in each unit with an increase in abundance of small horizontal burrows.

Silty mud with ostracods(?).

Brown and green clay laminae overlying graded laminae of very fine sand to clay.

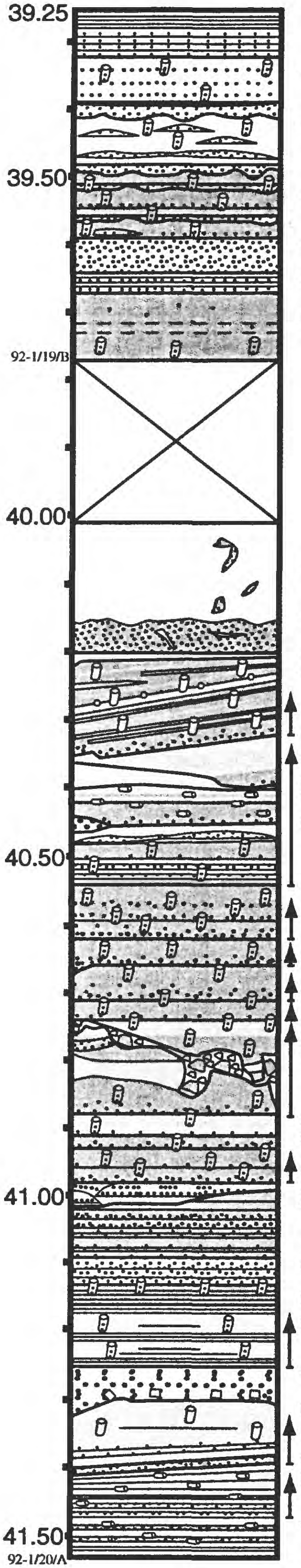
Two sequences of sand overlying a sharp contact with a green clay drape then clay with green bands and tubes filled with sand and silt.

Two sequences of sandy material overlying a sharp contact followed by graded laminae of dark sandy clay-to-light silty clay that become broader and more diffuse upwards.

Ostracode-rich sand laminae with clay drapes overlying sharp contacts followed by graded laminae of dark sandy clay-to-light silty clay that become broader and more diffuse upwards with increased disruption by ostracode-filled tubes.

Laminated clay in 2-5 cm thick sequences consisting of very fine sand-grading-to-clay laminae(about 0.5-2.0 mm thick) near the base overlain by laminae (0.5-0.25 mm thick) consisting of clay alternating with white material (diatoms?). Ostracodes in the clay near the top.

## OL92-1




Continuation of overlying pattern with more sand that may include oscillatory ripples.

Muddy sand alternating with clay that has sand-filled burrows.

Well-sorted fine sand lenses and pinch-and-swell layers alternating with clay that has sand-filled burrows.

Fine sand lenses and pinch-and-swell layers alternating with sandy clay that has sand-filled burrows.

Fine sand with mud clumps. Looks disturbed (coring artifact?).

Hard, chalky layer with alternations of fine sand or silt and mud.

Green clay with scattered sand at top, vague banding and silt-filled burrows toward base.

Sticky gray clay with blobs of brownish muddy silt indicating fluidization.

Brownish muddy silt with streaks of gray clay suggesting fluidization.

Gap.

Gray silty mud with layers of greenish clay disrupted by random burrows. Thicker layers have sharp upper and lower contacts. Thinner clays are streaky. All are disrupted by random burrows. Basal contact is siltier grading up to silty clay. White blebs along top of thickest clay layer.

Gray silty mud grading upward to greenish clay.

Gap.

Green clay with scattered ostracodes and dark silty vague laminae.

Gray silty mud with scattered ostracodes comprising graded layers interbedded with green clay and very fine, ostracode-rich sand layers that pinch-and-swell or are flat. Layers are disturbed by burrows.

Green silty mud grading up from coarse ostracode-rich sand overlying sharp base. Internal beds defined by concentrations of ostracode-rich sand, all disturbed by sand-filled burrows. Upper contact is brown.

Graded beds of sandy mud with ostracodes upward to silty mud with sand-filled burrows. Upper contact of each bed is orangish. Lowest bed is only slightly sandy at base and does not have orange at top.

Gray sandy clay with ostracodes grading up to greenish clay with a band of greenish clay near the middle. Sand-filled burrows are common. Core is broken up in the middle of this unit.

Gray clay has sandy base and patchy orange stains near contacts.

Graded beds of sandy mud with ostracodes upward to silty mud with sand-filled burrows. Upper contact of each bed is orangish. Light-colored layer is broken up near base of uppermost bed.

Pale green clay with sandy layers comprising a graded sequence.

Graded thick laminae of fine sand going to silty mud. Upper two layers appear reverse graded from clay to silty mud. Next two layers are thicker sand. Lower half consits of alternations of mm-thick graded laminae and cm-thick layers more clay rich.

Orange, med. sand with ostracodes and internal flat beds. Probably a wave-formed turbidite.

Dark-green silty mud in graded laminae that are sandy near top.

Dark silty graded laminae grade up to pale green laminae then burrow-mottled silty mud. Pale green laminae at top.

Coarse, orange sand appears graded. Tephra? Blocks of chalky clay at base appear graded.

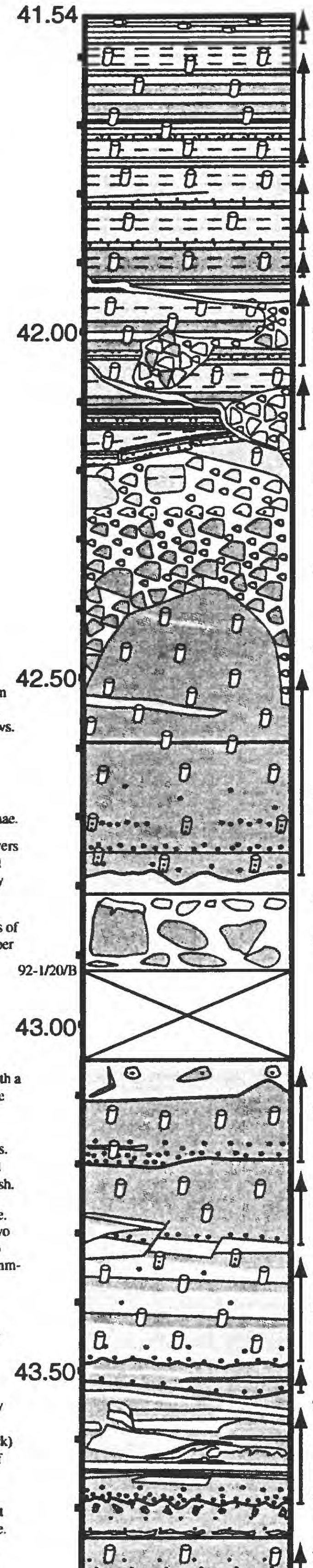
Pale green clay with graded sandy laminae at base (0.5 mm thick) becoming fainter and more disrupted by tubes upward. Top of layer is light, chalky, and fractured.

Orange silt with sharp base and slightly diffuse top. Tephra?

Pale green clay with sand laminae at base grading upward to silt laminae. Thicker laminae are not graded, but finer laminae are. All layers are disrupted by horizontal burrows.

Thick laminae of pale green clay alternating with silt layers of similar thickness. A thin dark sandy layer near the base may be a tephra. Some mottling by horizontal burrows.

## OL92-1




Graded laminae (5 mm) of dark silty mud to green clay. Minor disruption by horizontal burrows.

Graded laminae of fine sand to clay grading upward to silt-clay laminae, then to very thin beds of silty mud and clay, and finally clay with silty partings. Burrow mottling increases upward.

Graded laminae (5 mm) of dark silty mud to green clay grading up to clay with silty partings and bioturbation.

Two sequences with thin sand laminae at the base overlain by green clay with silty partings and burrows. Light laminae occur around the sandy laminae at the base.

Silty mud with vague banding becoming more clay rich upwards.

Light colored and brown clay beds alternating with silty mud.

Two sequences with graded sandy layers at the base and a thicker sand bed, overlain by clay with silty parting and bioturbation. Thin white lamina at base of lowest unit.

Thin sand bed and light colored laminae overlain by clay with silty partings and burrows.

Disrupted clay with hints of white laminae in large chunks.

Disrupted clumps of orange muddy sand.

Disrupted clumps of silty mud.

Green silty clay with ostracodes and clay layers. Burrows mottling disrupts layering. Basal contact is sharp.

Dark green silty to sandy mud with burrow mottling. Lower part is coarser with layers of medium sand and sand-filled burrows.

Pale green clay is also present in loose clumps including a sharp contact with underlying layer.

Loose clumps of green silty clay with ostracodes.

Gray clay with blebs of muddy silt. Fluidized.

Sandy mud overlying scour contact grading up into silty mud with burrows. Discontinuous green clay near the base.

Sandy mud overlying sharp contact grading up into silty mud with burrows.

Light green clay with sharp upper and lower boundaries is cut by faults.

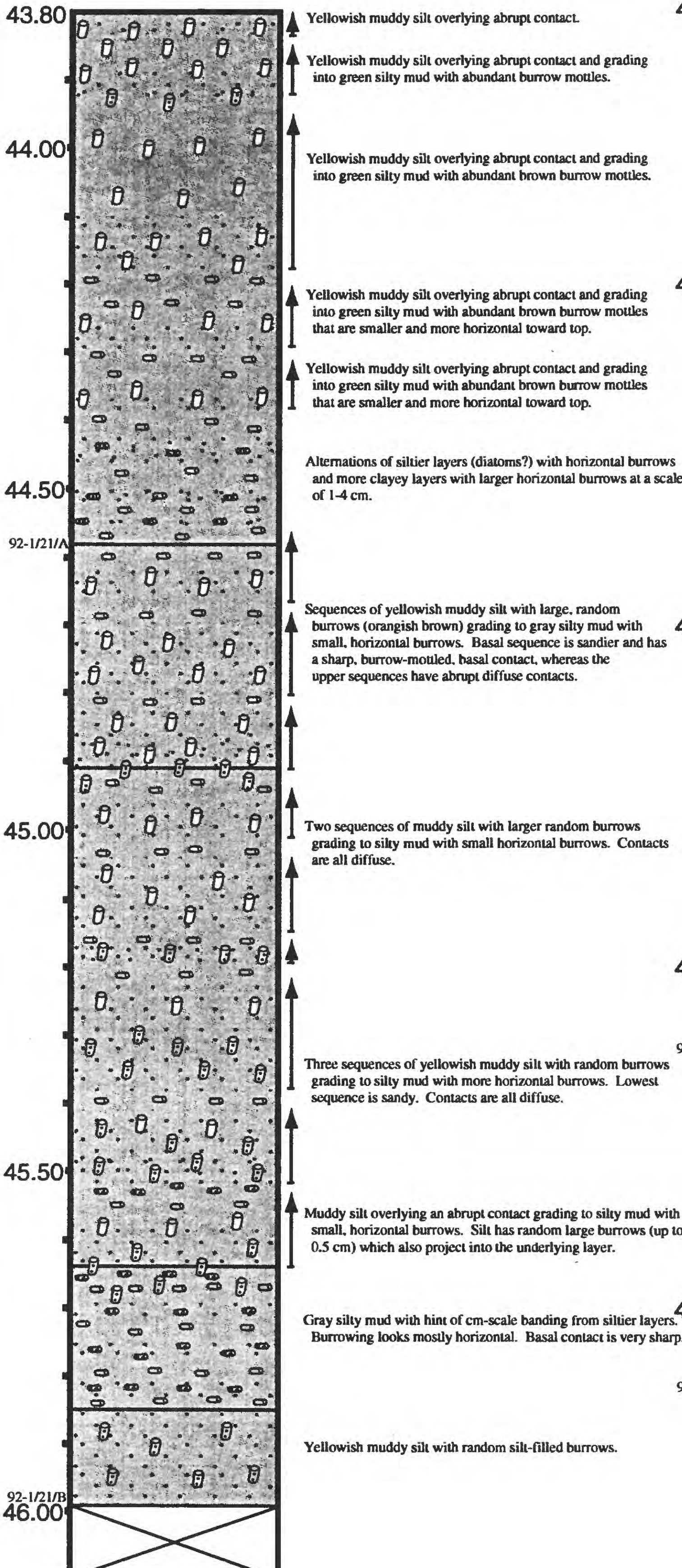
Light green sandy clay is sandier at the base. Internal dark layers are sharply capped by light.

Two graded layers of sandy mud grading upward to silty mud with interbeds of lighter clay. Clay layers have both sharp boundaries and gradational boundaries to underlying silty mud. Distortions of layers include faults and fluidization features.

Yellowish green mottled muddy silt with blobs of overlying sandy mud at top (burrows or load casts). A thin, ragged clay layer is near base.

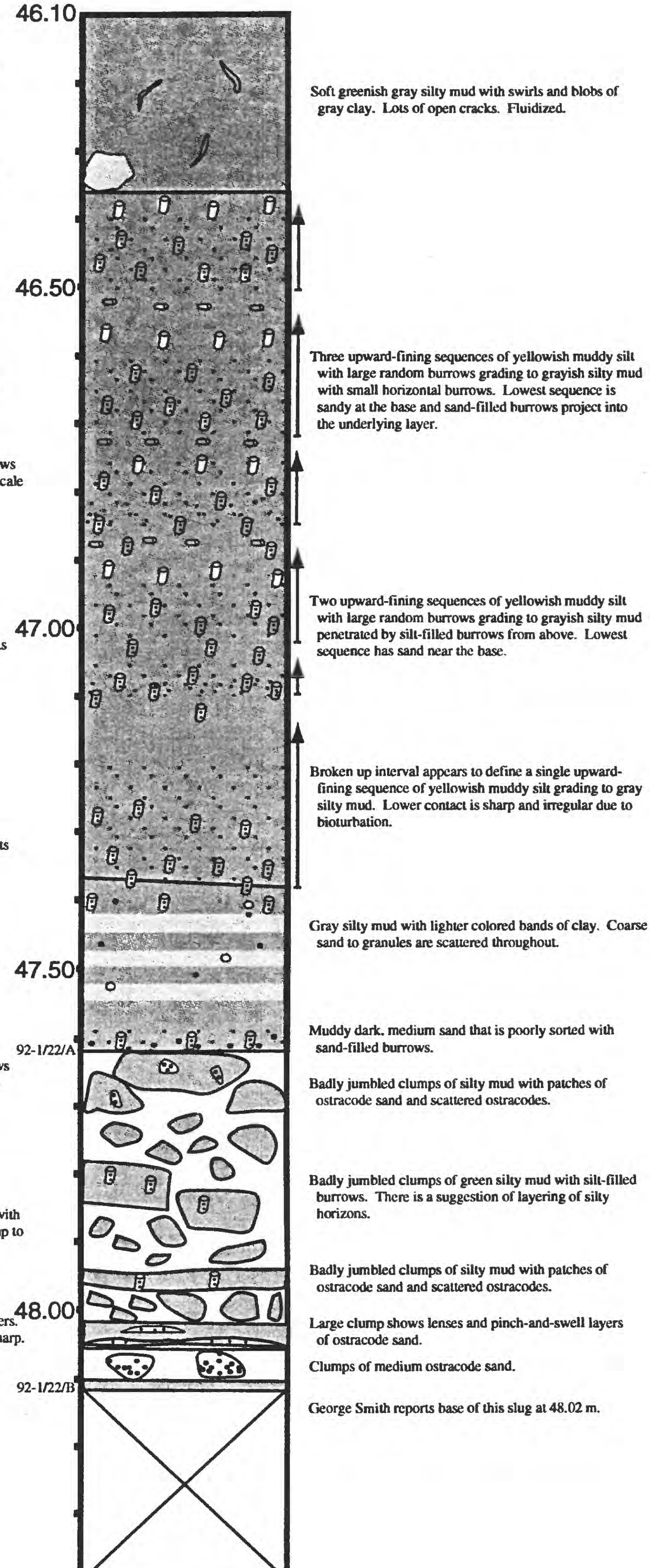
Yellowish green muddy silt grading up into silty mud, vague burrow(?) mottles.

## OL92-1



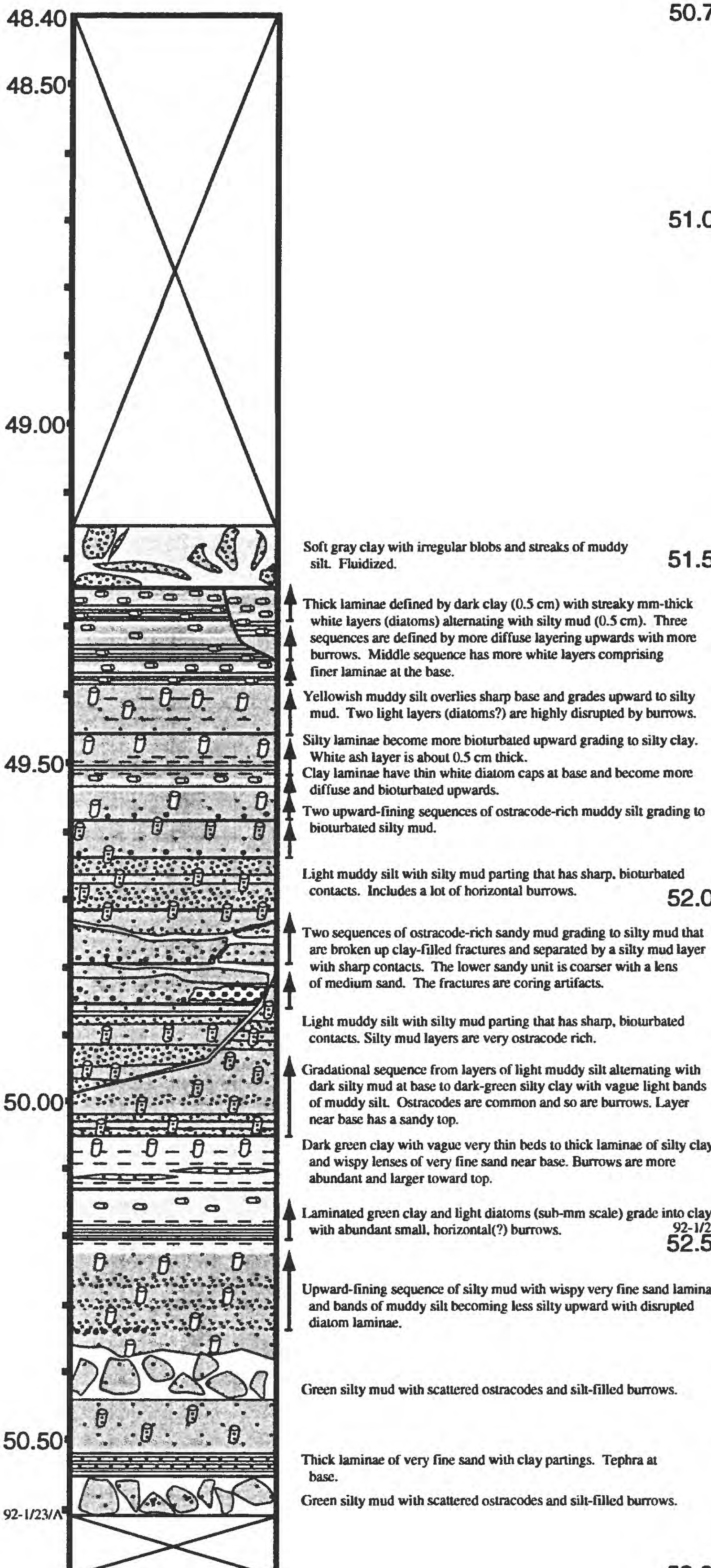
43.80
Yellowish muddy silt overlying abrupt contact.
Yellowish muddy silt overlying abrupt contact and grading into green silty mud with abundant burrow mottles.
44.00
Yellowish muddy silt overlying abrupt contact and grading into green silty mud with abundant brown burrow mottles.
Yellowish muddy silt overlying abrupt contact and grading into green silty mud with abundant brown burrow mottles that are smaller and more horizontal toward top.
Yellowish muddy silt overlying abrupt contact and grading into green silty mud with abundant brown burrow mottles that are smaller and more horizontal toward top.
Alternations of siltier layers (diatoms?) with horizontal burrows and more clayey layers with larger horizontal burrows at a scale of 1-4 cm.
44.50
92-1/21/A
Sequences of yellowish muddy silt with large, random burrows (orangish brown) grading to gray silty mud with small, horizontal burrows. Basal sequence is sandier and has a sharp, burrow-mottled, basal contact, whereas the upper sequences have abrupt diffuse contacts.
45.00
Two sequences of muddy silt with larger random burrows grading to silty mud with small horizontal burrows. Contacts are all diffuse.
Three sequences of yellowish muddy silt with random burrows grading to silty mud with more horizontal burrows. Lowest sequence is sandy. Contacts are all diffuse.
45.50
Muddy silt overlying an abrupt contact grading to silty mud with small, horizontal burrows. Silt has random large burrows (up to 0.5 cm) which also project into the underlying layer.
Gray silty mud with hint of cm-scale banding from siltier layers. Burrowing looks mostly horizontal. Basal contact is very sharp.
Yellowish muddy silt with random silt-filled burrows.
92-1/21/B
46.00


## OL92-1

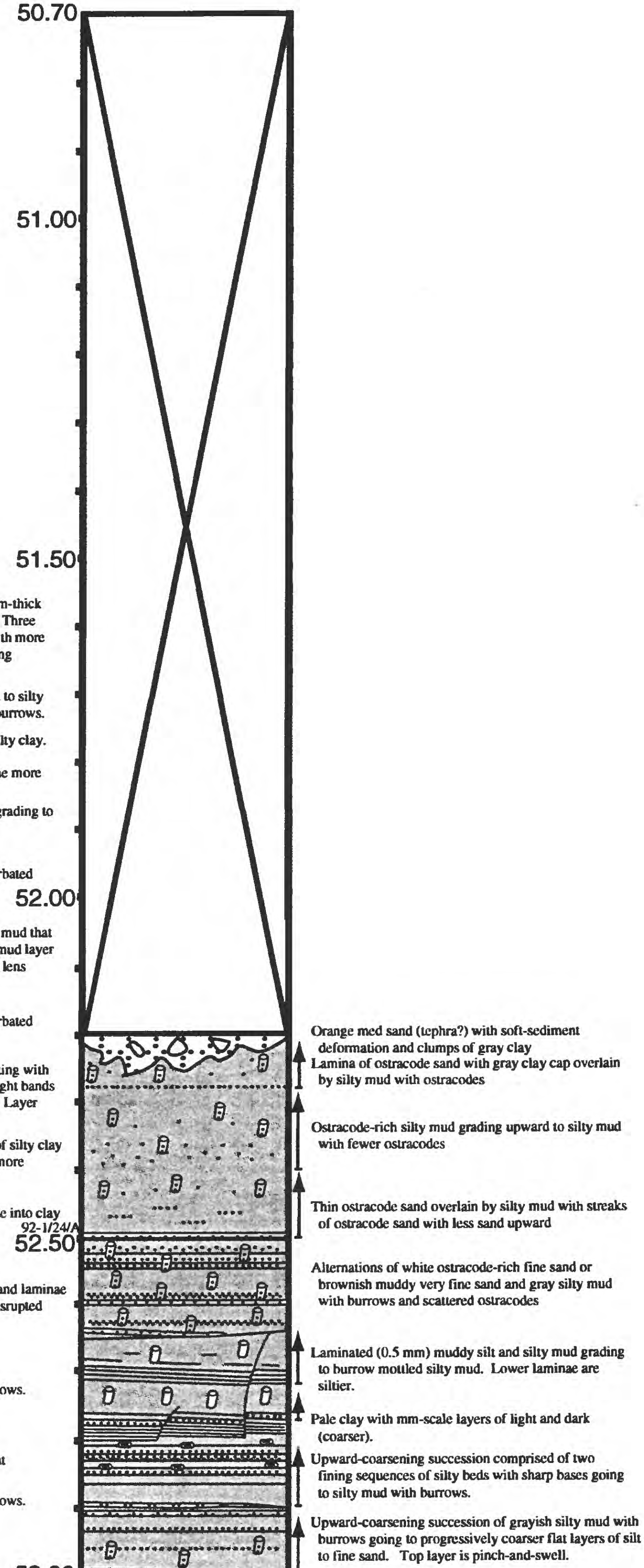


46.10
Soft greenish gray silty mud with swirls and blobs of gray clay. Lots of open cracks. Fluidized.
46.50
Three upward-fining sequences of yellowish muddy silt with large random burrows grading to grayish silty mud with small horizontal burrows. Lowest sequence is sandy at the base and sand-filled burrows project into the underlying layer.
47.00
Two upward-fining sequences of yellowish muddy silt with large random burrows grading to grayish silty mud penetrated by silt-filled burrows from above. Lowest sequence has sand near the base.
Broken up interval appears to define a single upward-fining sequence of yellowish muddy silt grading to gray silty mud. Lower contact is sharp and irregular due to bioturbation.
Gray silty mud with lighter colored bands of clay. Coarse sand to granules are scattered throughout.
47.50
Muddy dark, medium sand that is poorly sorted with sand-filled burrows.
92-1/22/A
Badly jumbled clumps of silty mud with patches of ostracode sand and scattered ostracodes.
Badly jumbled clumps of green silty mud with silt-filled burrows. There is a suggestion of layering of silty horizons.
Badly jumbled clumps of silty mud with patches of ostracode sand and scattered ostracodes.
48.00
Large clump shows lenses and pinch-and-swell layers of ostracode sand.
Clumps of medium ostracode sand.
92-1/22/B
George Smith reports base of this slug at 48.02 m.

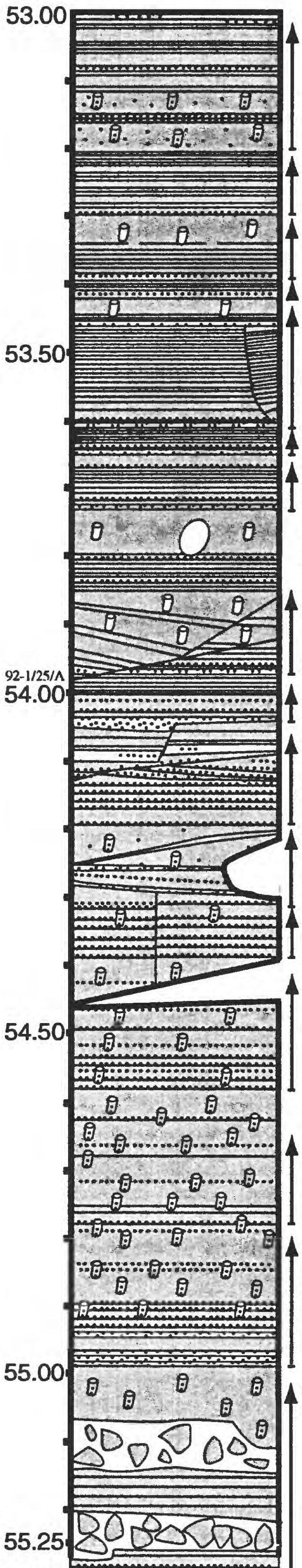
OL92-1


48.40
48.50
49.00
Soft gray clay with irregular blobs and streaks of muddy silt. Fluidized.
Thick laminae defined by dark clay (0.5 cm) with streaky mm-thick white layers (diatoms) alternating with silty mud (0.5 cm). Three sequences are defined by more diffuse layering upwards with more burrows. Middle sequence has more white layers comprising finer laminae at the base.
Yellowish muddy silt overlies sharp base and grades upward to silty mud. Two light layers (diatoms?) are highly disrupted by burrows.
Silty laminae become more bioturbated upward grading to silty clay. White ash layer is about 0.5 cm thick.
49.50
Clay laminae have thin white diatom caps at base and become more diffuse and bioturbated upwards.
Two upward-fining sequences of ostracode-rich muddy silt grading to bioturbated silty mud.
Light muddy silt with silty mud parting that has sharp, bioturbated contacts. Includes a lot of horizontal burrows.
Two sequences of ostracode-rich sandy mud grading to silty mud that are broken up clay-filled fractures and separated by a silty mud layer with sharp contacts. The lower sandy unit is coarser with a lens of medium sand. The fractures are coring artifacts.
Light muddy silt with silty mud parting that has sharp, bioturbated contacts. Silty mud layers are very ostracode rich.
Gradational sequence from layers of light muddy silt alternating with dark silty mud at base to dark-green silty clay with vague light bands of muddy silt. Ostracodes are common and so are burrows. Layer near base has a sandy top.
50.00
Dark green clay with vague very thin beds to thick laminae of silty clay and wispy lenses of very fine sand near base. Burrows are more abundant and larger toward top.
Laminated green clay and light diatoms (sub-mm scale) grade into clay with abundant small, horizontal(?) burrows.
Upward-fining sequence of silty mud with wispy very fine sand laminae and bands of muddy silt becoming less silty upward with disrupted diatom laminae.
Green silty mud with scattered ostracodes and silt-filled burrows.
50.50
Thick laminae of very fine sand with clay partings. Tephra at base.
Green silty mud with scattered ostracodes and silt-filled burrows.
92-1/23/A

OL92-1


50.70
51.00
51.50
52.00
Orange med sand (tephra?) with soft-sediment deformation and clumps of gray clay
Lamina of ostracode sand with gray clay cap overlain by silty mud with ostracodes
Ostracode-rich silty mud grading upward to silty mud with fewer ostracodes
Thin ostracode sand overlain by silty mud with streaks of ostracode sand with less sand upward
92-1/24/A
52.50
Alternations of white ostracode-rich fine sand or brownish muddy very fine sand and gray silty mud with burrows and scattered ostracodes
Laminated (0.5 mm) muddy silt and silty mud grading to burrow mottled silty mud. Lower laminae are siltier.
Pale clay with mm-scale layers of light and dark (coarser).
Upward-coarsening succession comprised of two fining sequences of silty beds with sharp bases going to silty mud with burrows.
Upward-coarsening succession of grayish silty mud with burrows going to progressively coarser flat layers of silt to fine sand. Top layer is pinch-and-swell.
53.00

## OL92-1




Alternation of brownish-gray, thick-laminated, silt and mud with layers and lenses of v. fine sand and grayish silty mud and muddy silt with scattered ostracodes and burrows. Laminated layers are thicker to top as burrowed layers are thinner and finer grained.

Thick laminae of silty mud with brownish clay partings alternating mottled layers. Toward base layers are thicker and coarser.

Light-dark silty mud laminae grading upward into burrow mottled silty mud. Lower part is pale green comprised of thicker silt layers with mud parting.

Thick silt lamina grading to progressively finer silty mud and brown clay laminae

Fine sand layers brownish mud partings grading to silt laminae with clay partings. Laminae become thinner upwards as silt thins. Four laminae of white fine sand near top may be tephra. Top of sequence is bioturbated.

Fine sand grading to gray silt layers with brownish mud partings. Laminae are thinner upwards.

Fine sand grading to gray silt layers with brownish mud partings. Laminae are thinner upwards except for burrow mottled sand and mud at top.

Silty mud with burrows including one about 2 cm in diameter.

Silt and fine sand with brownish mud partings. Coarser layers thicken and thin.

Silty mud with burrows alternating with laminae of silt with brownish mud partings. Layering is better toward base with fine sand layers.

Pale green silty mud with thick laminae of siltier and muddier layers

Ostracode sand at base overlain by silt layers alternating with silty mud and brownish clay laminae at top.

Pale green silty mud thick laminae separated by brownish mud.

Brown clay with wisps of silt

Silt to very fine sand forming layers and lenses with silty mud interbeds. Some coarse layers are inclined.

Silty mud with vague internal layering and burrows.

Thin beds to thick laminae of very fine sand to coarse silt grading upward into silty mud. Defines two sequences with overlying unit with sharp bedding grading to more bioturbated.

Thin beds to thick laminae of very fine sand to coarse silt grading upward into silty mud. Sequence from sharp bedding to mostly burrowing consists of three smaller less well defined sequences.

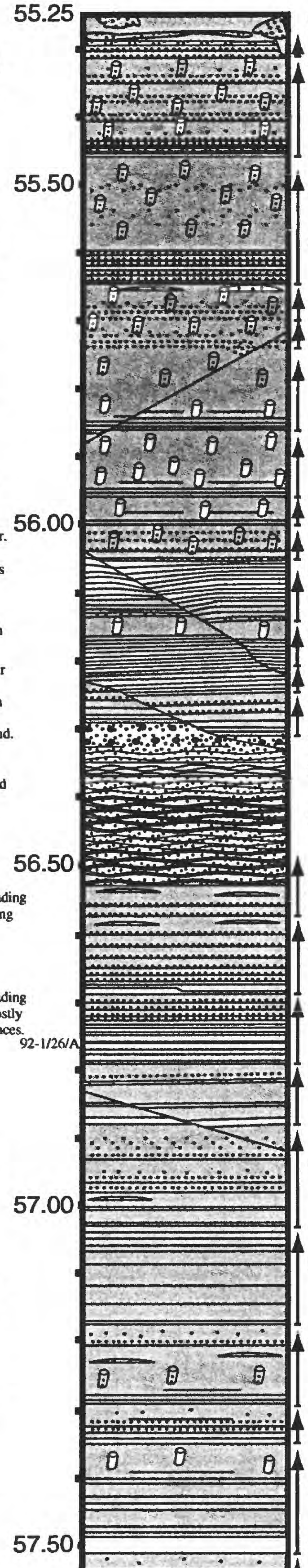
Burrowed silty mud with beds of silt to very fine sand that have sharp basal contacts and gradational upper contacts. Layers are sharp toward the base and more bioturbated to top.

Upward fining sequence with more bioturbation toward the top. Fine sand at base has thin mud partings internally. Subsequent silt and very fine sand beds have sharp bases and gradational tops.

Green-gray silty mud with abundant burrows and disrupted layers toward base

Silty mud with 0.5 cm thick layers of light (coarser) and dark. Fine sand with mud drape at base.

## OL92-1




Brown silty mud with blobs and stringers of muddy silt. Fluidized.

Thin beds of silt to very fine sand overlying sharp basal contacts grading up in burrowed silty mud. Fine sand layers at base have sharp tops and bottoms. Overall sequence fines upward with more burrowing toward top.

Brown silty mud with diffuse beds of silt and ostracode sand all heavily burrowed.

Coarse silt to very fine sand with internal layers of fine silt. Grades up into overlying mud. Light 2 mm thick layer at base may be carbonate.

Two upward-fining sequences of muddy coarse silt grading to brown silty mud all heavily burrowed. Lenses of very fine sand at top.

Brown silty mud with light laminae (0.5 mm) at base and more burrows toward the top with silt fillings forming three sequences.

Thin ostracode sand at base overlain by silt layers grading into burrowed silty mud. Contacts less distinct toward top.

Brown and green clay defining flat <0.5 mm laminae. 5 mm green lamina has horizontal burrow mottles.

Brown silty mud with light layers about 1 cm apart. Thin fine ostracode-rich sand at base.

Brown silty mud with burrows and sharp base.

Clay with <.5 mm laminae of brown, green, and white. Grainy layers at top and base made of orangish clumps.

Brown clay with white partings at .5 mm intervals grading to thicker layers of silty mud with white partings

Graded laminae of silt to clay <.5 mm thick grading to very fine sand to clay laminae about 3 mm thick.

Fine sand with wavy clay parting or trains of clay clumps defining layers 1-2 cm thick.

Green clay with pinch-and-swell to lenticular brown silty mud defining wavy lamination.

Fine sand with wavy clay parting or interbeds of laminated clay defining pinch-and-swell layers ranging from 0.5-2 cm thick.

Graded laminae of silt to silty mud to lenses of fine sand in silty mud.

Green clay with white layer at base overlain by graded laminae of silt and mud 5 mm thick going to 3 cm thick thin beds and lenses of fine sand.

Graded laminae of silt to silty mud 3 mm thick to 5 mm thick at top. Green clay at base has white blebs.

Brown silty mud with thin layers of green clay. Silty mud is sandier near top with a very fine sand bed.

Upward coarsening sequence of brown silty mud with green clay at base overlain by graded muddy sand to brown silt. In middle sand has silty partings.

Brown silty mud with thick graded silt laminae at top and thin beds defined by green clay layers at bottom. Base is a chalky indurated white layer.

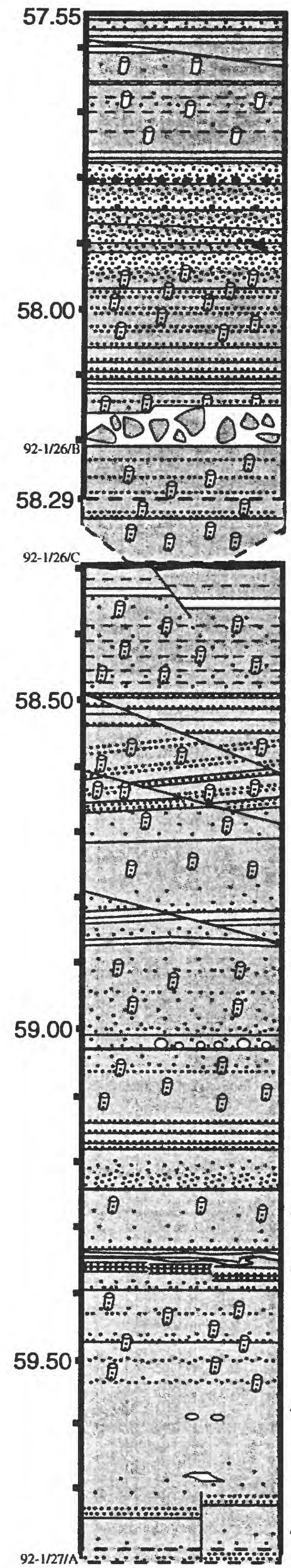
Brown silty mud with lenses and beds of fine sand all disrupted by burrows. At base green clay laminae (0.5 mm) alternate with brown laminae.

Thick laminae of pale green silty mud grading to brown silty mud or sand. Layering less distinct toward top.

Three sequences of thick laminae of green silty mud grading to unbedded brown silty mud.

Green silty clay that appears to be amalgamated laminae.

## OL92-1




Thick laminae of silty mud and sandy mud grading up from a pale green silty clay.

Thick laminae of brown silty mud and green silty clay becoming more diffuse upward and sandier with burrows. Thin white fine sand layer near top pinch and swells.

Graded beds of coarse sand to fine sand and sandy mud. Lower beds are mostly finer grained defining an upward coarsening sequence. Pebbles occur along some sand basal contacts.

Reverse graded bed of silty mud to fine sand.

Upward coarsening sequence with overlying bed. Base is silty mud with light layers overlain graded beds of coarse silt to silty mud. Top has fine sand layers with burrowed contacts into silty mud.

Silty mud with silt-filled burrows. Lower mud is less silty and disrupted.

Silty mud with discontinuous layers of silt and ostracode sand disturbed by burrows. Basal contact is sharp.

Dark green silty mud with silt-filled burrows.

Silty mud with vague light bands. Pale green clay layer at top and tan clay at base.

Dark green micaceous silty mud with thin bands of green clay disrupted by silt-filled burrows.

Silty mud with layers of silt. Top and bottom beds are tan coarse silt.

Thick laminae (3-5 mm) of light muddy silt with diffuse edges interbedded with gray silty mud. White layer in middle is very fine sand (tephra?) and basal layer has sharp upper and lower boundaries.

Yellowish silty mud with burrows from above.

Yellowish silty mud grading up into a finer-grained gray silty mud with silt-filled burrows.

Two pale green clays interbedded with silty mud. Upper clay is overlain by gray and lower clay is overlain by coarser yellow grading to gray silty mud.

Gray silty mud with diffuse concentrations of silt and very fine sand defining layers that are disrupted by brown burrows. Sharp contact at base is overlain by sandy mud with pebbles.

Gray silty mud with silt-filled burrows and a more silt-rich layer overlying an abrupt contact.

Gray silty mud with muddy silt layers overlying sharp bases. Two thin white lenses occur within the second layer from the base (possible tephra?).

Yellowish muddy silt overlying a sharp contact and grading up into gray silty mud.

Yellowish muddy silt overlying an abrupt contact and grading up into gray silty mud with silt-filled burrows.

Yellowish muddy silt alternating with gray silty mud forming 1-2 mm thick laminae that are finer-grained upward.

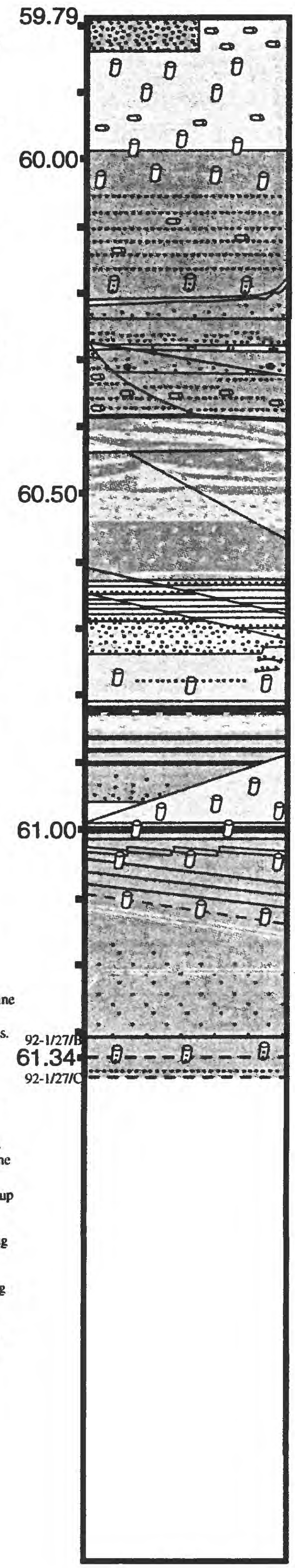
Three sequences of yellowish muddy silt grading up to gray silty mud. Contacts are abrupt and disturbed by burrows.

Gray silty mud with diffuse bands of siltier mud with burrows.

Gray silty mud grading up from dark sandy mud. Hard white blebs are scattered throughout.

Dark sandy mud grading up into light gray silty mud.

## OL92-1




Pale green muddy sand and sandy mud in fault block.

Gray green clay with alternations of small horizontal burrows and larger random burrows. Basal contact is sharp and burrows filled with clay extend into lower unit.

Dark green silty mud with wispy layers of higher silt content. Top is finer grained and base has silt-filled random burrows.

Gray muddy silt grading to brownish silty mud capped by a thin deformed brown clay.

Gray-green muddy silt with wisps of brown silty mud grading up to gray silty mud.

Gray silty mud with scattered granules grading up to thin green clay with blobs of fine sand.

Green silty mud with wispy brown silty laminae and horizontal burrows sharply overlying thin gray clay.

Green silty mud interbedded with wispy gray clay all disrupted by mostly horizontal burrows.

Gray clay with numerous wisps of green silty mud that resemble burrows.

Green silty mud with wisps of gray clay that resemble burrows.

Green and gray clay make mm-scale laminae in two sequences with brown very fine sand grading to clay.

Brown fine sand with wispy gray clay partings fines upward.

Gray clay with patchy layers of silt and green clay and with random burrows.

Yellowish silty mud with pale green clay partings. Basal layer is a muddy silt.

Pale green clay with burrows which extend into the underlying unit.

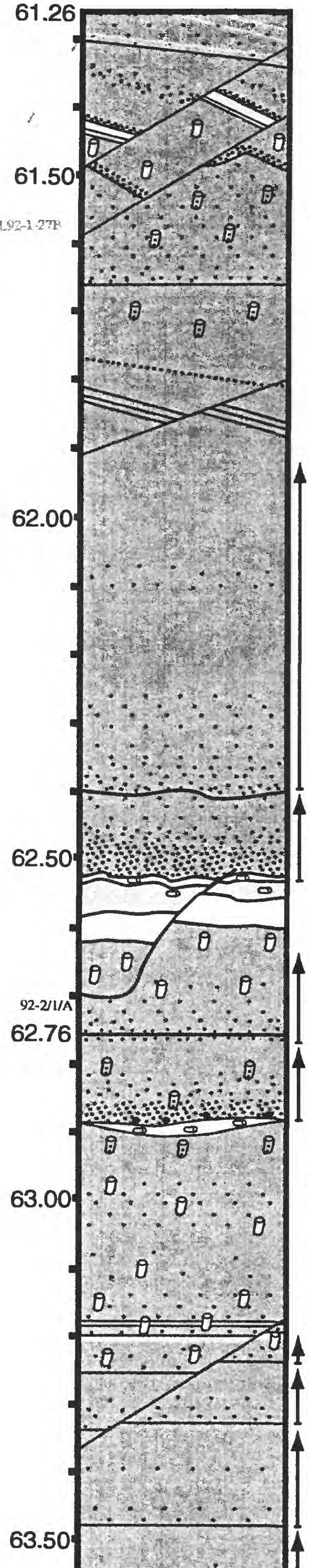
Green silty mud with sharp laminae of very fine sand. A pale green clay lamina fills burrows into mud.

Green silty mud with thin clay laminae that are abrupt at the top and base. lowest laminae is bioturbated.

Green muddy silt with two doublets of pale green clay laminae. Bottom silt looks deformed.

Yellowish silty mud with ostracode-filled burrows and a layer rich in ostracodes near the base.

## OL92-2




Green muddy silt with two doublets of pale green clay.

Green silty mud with a diffuse siltier layer. Base is an orange silt overlying burrow mottled gray clay underlain by a thin brown clay.

Silty mud with burrow mottles. Orange silt layer at base.

Yellowish silty mud with abundant ostracodes. Wispy layering near base of more silt.

Silty mud with burrows filled by ostracodes.

Silty mud with 2-5 mm thick layers of light and dark silty mud. A thin very fine sand layer is at top.

Gray silty mud with some zones of higher silt content. Green muddy silt at base is very micaceous overlying an irregular sharp contact. Abundant white silt grains may be diatoms.

Green micaceous muddy silt grading to silty mud.

White layer at top has horizontal mottles of dark clay and base is a chalky hard white layer. Between these is mix of white and gray mud with dark horizontal burrows.

Gray silty mud with burrows filled with white. Basal contact is abrupt.

Green muddy silt grading to silty mud with burrow mottles.

Micaceous sandy mud grading up to silty mud with burrow mottles.

Pale green clay with dark burrow mottles.

Silty mud with brown burrows. Zones of higher silt and lower silt content.

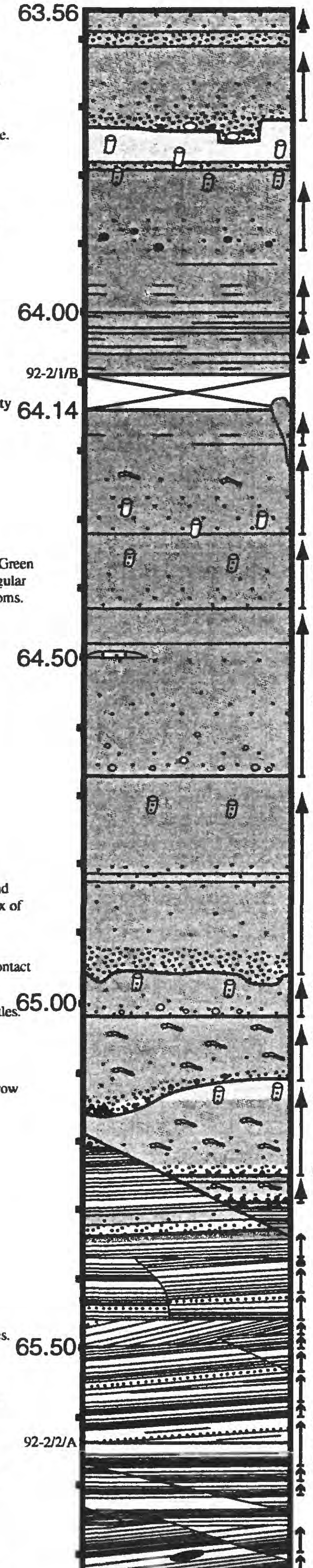
Silty mud grading to pale green clay with burrow mottles. Top clay has sharp base.

Light coarse silty mud grading up to dark finer-grained silty mud.

Light coarse silty mud grading up to dark finer-grained silty mud. Some siltier horizons within sequence.

Light coarse silty mud grading up to dark finer-grained silty mud.

## OL92-2




Light coarse silty mud grading up into dark silty mud.

Dark muddy silt layer with sharp upper and lower contacts.

Graded bed with muddy sand overlying a scoured base grading up into silty mud.

Pale green clay with burrows sharply overlying coarse silt layer also filling burrows.

Silty gray mud with floating silt and sand grains near base and finer at top.

Yellowish silty mud with thin white laminae (<0.5 mm) comprising 3-4 sequences of continuous laminae to highly fragmented laminae.

Yellowish silty mud with thin white laminae (<0.5 mm). A wedge of fluidized silty mud is at the top.

Coarse yellowish silty mud with large burrows grading to fine gray silty mud with small burrows.

Coarse yellowish silty mud grading to fine gray silty mud with silt-filled burrows.

Dark gray silty mud with suggestion of silty bands.

Green micaceous sandy mud with granules grading to yellowish silty mud alternating with gray silty mud. Lens of fine sand near top.

Yellowish coarse silty mud grading up into gray silty mud with sand-filled burrows.

Very fine muddy sand overlying a scour surface abruptly grading upward into yellowish silty mud.

Silty mud becoming sandy at the sharp basal contact with scattered granules.

Coarse sand grading to fine sand overlying a scour surface grading up into a yellowish silty mud with large, brown, horizontal burrows.

Two coarse sand layers overlying sharp contacts grading to silty mud with horizontal burrows. Each sand is underlain by an orange silty mud (stain?). Top of upper layer is pale green clay with sand-filled burrows.

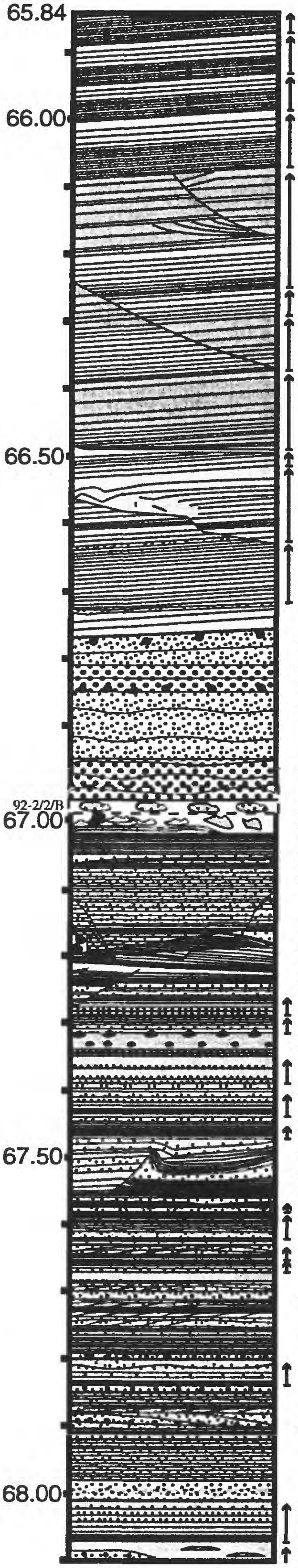
Coarse sand overlying a sharp contact sharpy overlain by silty mud with scattered sand grains. This is followed by laminated green and brown clay producing sequences 2-4 cm thick with finer-grained (more brown) and thinner laminae upwards which also fine upward.

Multiple sequences of fine laminae (about 0.5 mm) of brown and green clay grading up to thicker laminae (as much as 5 mm thick) of green slightly silty clay or fine silt. Lamina sequences are disrupted by growth faults.

Dark green clay with a mm-thick silt layer and streaks of silty mud.

Multiple sequences of fine laminae (about 0.5 mm) of green and brown clay grading up to thicker laminae which have white speckles in lower cycles and green slightly silty clay in the upper sequences. On left side of upper fault sequences start with thick laminae of silty clay and become progressively finer and thinner laminae unconformably overlying more steeply dipping lower sequences. Black nodule at top of lowest sequence.

## OL92-2




Multiple sequences of fine laminae (about 0.5 mm) of brown and green clay grading up to thicker laminae (up to 3 mm) with white specks.

Silty mud comprising graded laminae about 2-10 mm thick with some white or pale green layers. Two places have inclined bedding that truncates underlying layers.

Brown and green clay comprising laminae (0.5-2 mm) that become thicker and slightly siltier upward in two sequences. Some white laminae intermixed.

Yellowish silty mud comprising thick laminae (3-4 mm) that become thinner and finer toward base.

Two upward coarsening sequences of thin laminae of brown clay and tan silty mud grading to thicker laminae (3-5 mm) of pale green silty mud that looks disrupted and some white laminae.

Two sequences of fine laminae of brown clay alternating with green silty mud with white specks where laminae become thinner upward with more brown clay then thicker with more green silty mud.

Two fine sand laminae with irregular bulbous bases are separated by an upward fining sequence of silty green mud and brown clay laminae that are about 2-5 mm thick near the base and < 1mm thick near the top.

Thick laminae of silty green mud with white specks and thin brown clay partings.

Fine sand with pebble-size steinkerns (?) of gastropods near the top. Changes in grain size suggest flat beds.

Coarse to medium sand with gastropods at base and white clumps near top which may be steinkerns or ooids.

Fine sand with wavy bedding defined by thin layers of medium sand that pinch and swell.

Medium sand with wavy bedding defined by fine sand layers that pinch and swell.

Loose clumps of muddy fine sand.

Gray silty mud with brown partings forming <0.1 mm laminae. Upper part is disrupted and has a gray pebble.

Brown silty mud with graded silt laminae 0.5 mm thick.

Silt to fine sand laminae 2-4mm thick alternating with dark brown mud. Laminae at top are graded and include layers of ostracode (?) shells. Base is more muddy with graded laminae.

Light and dark clay laminae from < 0.1 mm to laminae 2-5 mm thick which are slightly silty or milky white.

Fine white sand with brown and orange clay interbeds.

Two upward thinning sequences of graded laminae. Sand layers with clay partings in the lower part and graded silt to clay in the upper part.

Gray silty mud with pebble-size cemented (?) clumps.

Brown silty clay with graded white sand laminae at top and an upward thickening sequence graded silt to clay.

Upward coarsening sequence of 0.5 mm silty clay and diatom laminae grading to 1-2 mm silt and silty clay laminae. Sand beds at top and base.

Clay with < 0.1 mm laminae of silty or diatom mud.

Muddy silt laminae (3-5 mm) overlying silty mud and clay laminae (0.5-1 mm) and an irregular sand layer.

Silty clay with brown clay partings forming < 0.1 mm laminae sharply caps a cm-thick sand layer.

Two upward fining and thinning sequence of gray silt laminae grading from about 2 mm thick to < 0.1 mm thick. Base is silty clay laminae overlying a thin basal sand.

Ripple cross-laminated fine sand upward coarsening sequence overlying flat laminated upward fining sequence.

Alternation of ripple cross-laminated fine sand and clay or silty mud with flat lamination. Base of unit is a medium brown sand.

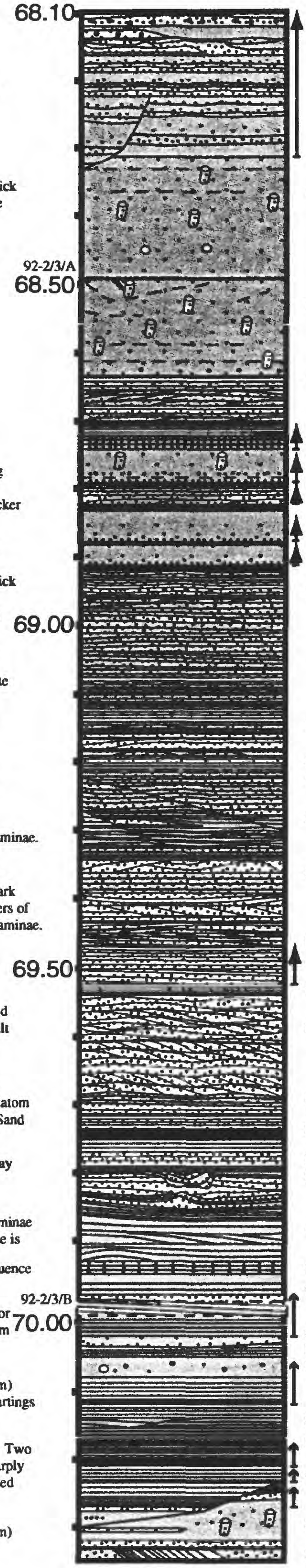
Upward-coarsening sequence of laminated clay (<0.1 mm) grading to wavy bedded silty and fine sand with clay partings overlying a coarse brown sand with gastropods (?).

Mostly graded flat laminae of silt or fine sand with clay. Two medium brown sands overlie sharp contacts and are sharply overlain by fine laminae. Middle area has more inclinded lamination with medium sand lenses.

Upward-coarsening sequence of laminated clay (<0.1 mm) grading to graded laminae (5 mm) of silt and clay.

Silty clay with lenses of medium to fine sand.

## OL92-2




Upward-coarsening sequence of silty clay with interbedded of silt and sand pinch-and-swell laminae to lenses. Coarse to medium sand at top has sharp upper and lower boundaries, but fine sand and silt toward base grades into silty mud above a sharp transition.

Silty mud with silt-filled burrows and blebs. Faint layering near top defined by less-silty mud and granules occur near the base.

Silty to sandy mud with silt-filled burrows and vague layering defined by more clay-rich areas. Pebble-sized clast(?) at top.

Fine sand to silt comprising two ripple cross-laminated layers capped by flat sand laminae and clay. Medium sand layer near base is sharply capped by clay.

Upward-fining sequence of flat graded laminae (2-5mm) of fine sand or silt to clay.

Graded sequence of silty mud with very fine sand layers at base and burrow-mottled silty clay at top.

Ripple cross-laminated fine sand overlying laminated silty clay and overlain by upward-fining laminae of silt and mud.

Two graded silty mud layers separated by a green clay lamina. Upper layer is muddier than lower.

Upward-coarsening sequence of silty mud to very fine sand all with thin clay interbeds. Coarse layers are wavy to lenticular and appear to define ripple-scale cross-lamination. Silty mud beds near the base are graded. Basal clay bed is tan.

Very fine sand forming graded laminae with silty mud and fine sand forming lenses or thin beds with wavy layering.

Silty mud with graded laminae and lenticular fine sand.

Very fine sand to fine sand forming wavy beds that may be cross-lamination perpendicular to flow.

Silty clay with lenses of fine sand and laminae of silt to very fine sand that are inclined around the lenses. A laminated green clay is at the base.

Cross laminated fine sand with an interval of flat laminated very fine sand with silty clay partings.

Fine sand comprising a sequence with progressively smaller scale cross-lamination and thicker more common clay drapes.

Green clay with light and dark fine laminae (<0.5 mm).

Fine sand with wavy thin beds and ripple-scale cross-lamination. Thin clay drapes occur between layers near the middle.

Flat laminae of fine to medium sand with clay partings separated into thicker units of mostly clay or mostly sand.

Gray silty clay with 2 mm graded laminae overlain by brown clay with < 1mm laminae. Orange carbonate layer at top.

Medium sand with flat laminae.

Graded sand-to-clay laminae overlying and underlying sand alternating with clay. Coarser interval is more lenticular and deformed.

Thick graded silt to silty mud laminae are wavy to lenticular.

Graded sand-to-clay laminae.

Thick graded silt to silty mud laminae. Fine sand lense in middle has muddy partings. Laminae toward base are finer.

Graded silt to silty mud overlying scour surface.

Finely laminated silt mud grading to clay.

Clay laminae (<0.1 mm) becoming coarser and thicker to graded silty-clay laminae capped by unbedded silty mud with scattered sand and granules.

Silty mud laminae (0.5 mm) with thin green clay partings.

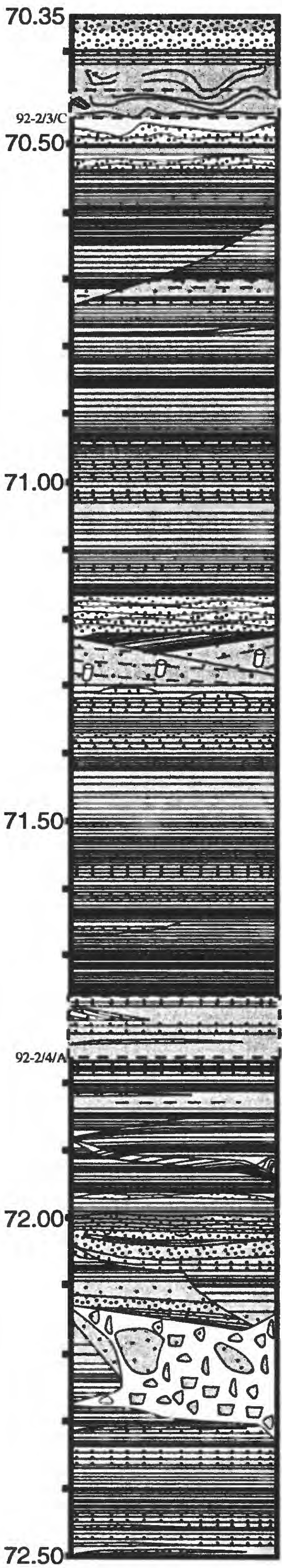
Paper thin clay-white (carbonate?) laminae becoming thicker and siltier upward.

Two sequences of thin gray laminae grading upward to thick graded silt to silty mud laminae.

Silty clay with sand lenses and burrows(?)

Sandy mud with deformed clump of laminated clay.

## OL92-2




Graded fine sand to sandy mud overlying a sharp scour contact.

Silty mud with deformed layers of muddy silt and loose clay clumps. Upper two cm has silt laminae that are slightly deformed.

Fine sand in wavy to lenticular layers with thin clay partings. Thick silty mud and clay layers near middle.

Finely laminated clay with white and brown laminae grading to siltier, thicker laminae.

Finely laminated clay with diatoms becoming thicker and siltier upwards. There are several smaller -scale sequences internally within the larger one.

Thin laminae (0.5 mm) with clay or diatom partings grading up into thicker silty mud laminae.

Upward coarsening succesion of three sequences each grading from fine laminae to thicker laminae. Base is clay with diatom laminae and top is muddy silt with faint internal lamination and a laminated gray clay layer.

Brown microlaminae grading up to graded silty mud laminae about 3-5 mm thick.

Upward fining sequence of laminated fine sand grading to laminated silty mud. There are 3 internal fining sequences each becoming more muddy silt.

Three sequences of clay with fine lamination grading to silty mud with thick graded laminae. There is progressively less clay and thicker layers upwards.

Fine sand with wavy thin beds becoming thinner with clay lenses then clay laminae.

Sandy mud with vague more clay-rich bands and scattered burrows. Laminated sequence at top is mostly silty clay with clay and fine sand laminae.

Two upward-coarsening sequences with thin laminae of graded silty mud to clay becoming thick laminae of very fine sand alternating with clay.

Two sequences of clay with fine lamination including diatoms grading up to thicker laminae of graded muddy silt to clay.

Two upward-coarsening sequences with thin laminae of graded silty mud to clay becoming thick laminae of very fine sand alternating with clay.

Two sequences of clay with fine lamination including diatoms grading up to thicker laminae of graded muddy silt to clay.

Silty clay with flat to wavy laminae of very fine sand and lenses of fine sand.

Green clay with fine laminae grading upward to alternations of graded silty mud laminae and thin, finely laminated green clay partings.

Two sequences of silty mud with very fine lamination grading to thicker lamination. Top sequence has a fine sand lense.

Two sequences of brown microlaminated clay grading to silty clay with thicker lamina

Silty mud with very fine lamination grading to thicker laminae including an organish brown layer at top.

Thick laminae of silt or fine sand grading to clay. Some layers are wavy or lenticular with internal cross lamination.

Thin laminae of green clay grading upward to thick graded laminae of silt and clay.

Silt with fine sand lenses grading upward into silty mud with clay layers.

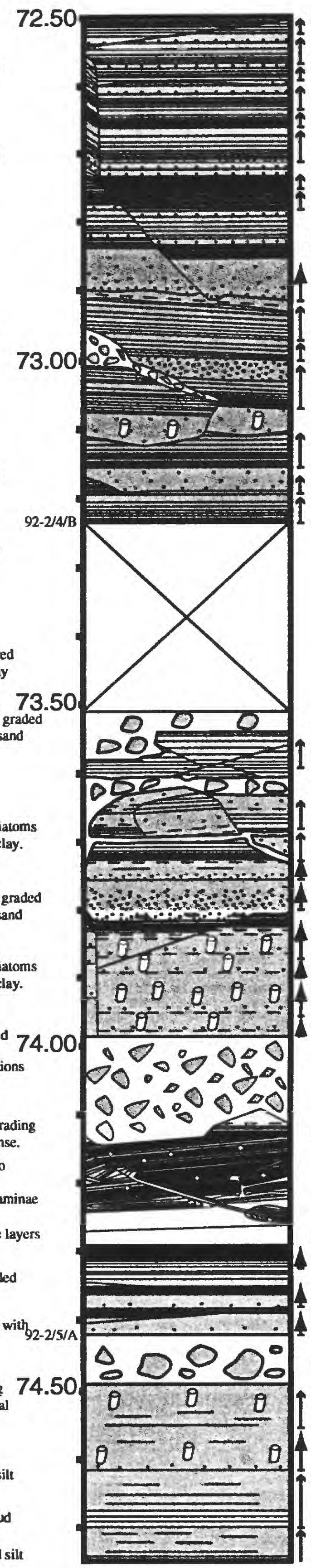
Three sequences of green clay with fine laminae grading upward to silty mud with thick graded laminae. Interval disrupted by splitting.

Two sequences of laminated clay grading up to graded silt and clay thick laminae then sand layers.

Green clay with fine laminae grading upward to silty mud laminae in two upward thickening successions.

Fine sand lenses with clay partings grading up to graded silt thick laminae with clay partings.

## OL92-2




Green clay with thick laminae grading to silty mud with thick graded laminae.

Two sequences of laminated clay grading upward to thick laminae of silt or very fine sand grading to clay.

Two sequences of laminated clay grading upward to thick laminae of silt and clay or fine sand lenses with clay drapes.

Clay with fine laminae grading upward to silty mud with graded thick laminae.

Graded thick laminae of very fine sand and silt to silty mud.

Brown clay finely laminated clay grading to green clay with slightly thicker laminae. Upper sequence is two successions of dark brown microlaminae grading to green clay.

Graded thick laminae of very fine sand and silt with clay layers.

Green clay with fine laminae thickens on one side of fault.

Sandy mud overlying sharp base grading upward to silty mud.

Three upward coarsening sequences of graded silty mud to clay in thin laminae grading to thick laminae of silt or fine sand. The sequences are disrupted by a fault and intruded by muddy silt.

Silty mud with burrows that may overlie a scour.

Upward coarsening sequences of graded silty mud to clay in thin laminae grading to thick laminae of silt or fine sand.

Silty mud truncates underlying laminae and may be intruded.

Two upward coarsening sequences of graded silty mud to clay in thin laminae grading to thick laminae of silt or fine sand.

Clay with graded thin laminae grading upward to silty mud with thick graded laminae

Silty mud with clay laminae grading to muddy silt with burrows. Numerous faults are probably coring artifacts.

Clay with graded thin laminae grading upward to silty mud with thick graded laminae

Two upward fining sequences. Basal sequence is fine sand with clay intraclasts grading to silty mud. Upper sequences is muddy silt grading to silty mud with thin carbonate streaks.

Four upward-fining sequences of burrowed silty mud grading to less silty mud with vague laminae. Uppermost sequence has better defined laminae at top grading to next unit. Lowest sequence is yellowish.

Interval broken up during splitting. Mud clumps include silty mud and clay with laminae near the base.

Clay with brown partings defining fine laminae to very fine in 2-3 cm thick packets. Layering is disrupted by faults and green clay filled injection features. Euhedral crystals 1-2 mm long are scattered throughout.

Blebbly green clay filling injection(?) around clumps of laminated brown clay.

Gap in core.

Fine silty laminae grading to very fine clay laminae.

Silty mud sharply capped by pale tan clay layers of equivalent thickness.

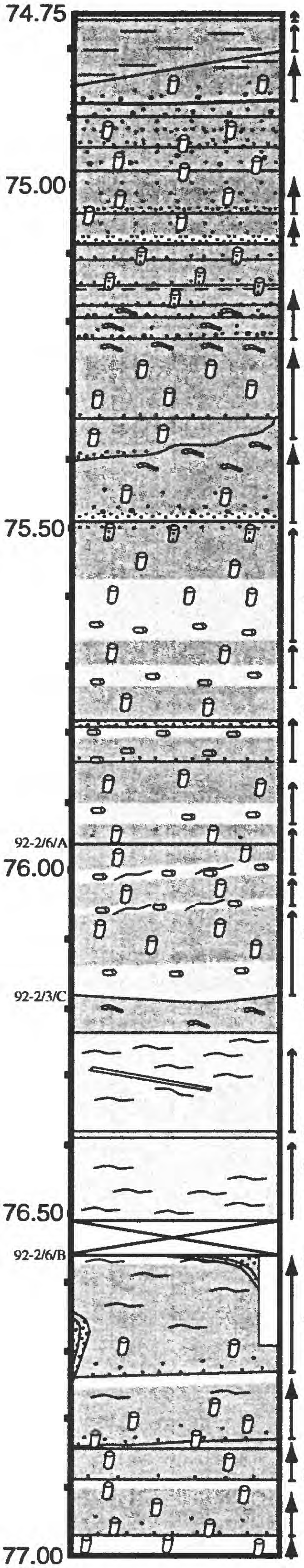
Two sequences of silty mud with scattered sand grading upward to finely laminated clay.

Loose clumps of yellowish silty mud.

Yellowish silty mud with burrows overlying streaky carbonate laminae and grading up from a silty basal contact to streaky laminae.

Two sequences of clay with irregular carbonate and silt laminae grading up to silty mud with streaky diatom hairline laminae that are more discontinuous upwards.

## OL92-2




Silty mud with streaky carbonate laminae near base and and diatom(?) laminae near the top.

Purplish micaceous silty mud grading up to greenish silty mud with carbonate streaks. Coarse sand-sized clumps (snail steinkerns?) near sharp basal contact overlying greenish silty mud with coarse grains.

Purplish micaceous silty mud with burrows and diffuse bands of sandy mud. Middle zone of greenish silty mud with granules and pebbles. Base is a muddy fine sand.

Medium sand overlying erosive base grading up to sandy micaceous mud with burrows.

Green silty mud with orange silt-filled burrows and silty layers. Gray layers near base.

Two graded layers of sandy mud grading to silty mud with large horizontal burrows.

Graded sequence with muddy silt at base with random burrows grading upward to silty mud with horizontal burrows at top.

Medium sand overlying sharp contact grading upward to sandy mud with random burrows and silty mud with horizontal burrows.

Gray silty mud with random burrows and a silt-rich layer near the top.

Gray clay with small horizontal burrows grading upward to large random burrows.

Gray clay with small horizontal burrows grading upward to silty mud with large random burrows.

Gray clay with small horizontal burrows interbedded with silty mud and muddy silt with horizontal burrows then grading upward to silty mud with large random burrows.

Gray clay with small horizontal burrows grading upward to silty mud with large random burrows.

Gray silty mud with random burrows.

Two sequences of gray clay with horizontal burrows and light wisps grading upward to silty mud with large random burrows.

Gray clay with no visible burrows overlain by horizontal burrows (some filled with light material of wisps) and then silty mud with large random burrows.

Gray silty mud with large horizontal burrows and some light burrow fillings.

Gray clay with no visible structure with increasing abundance of light streaks upward. Orange stained inclined feature demarks a break in the character of streaks (fault?).

Gray silty mud with sharp contacts.

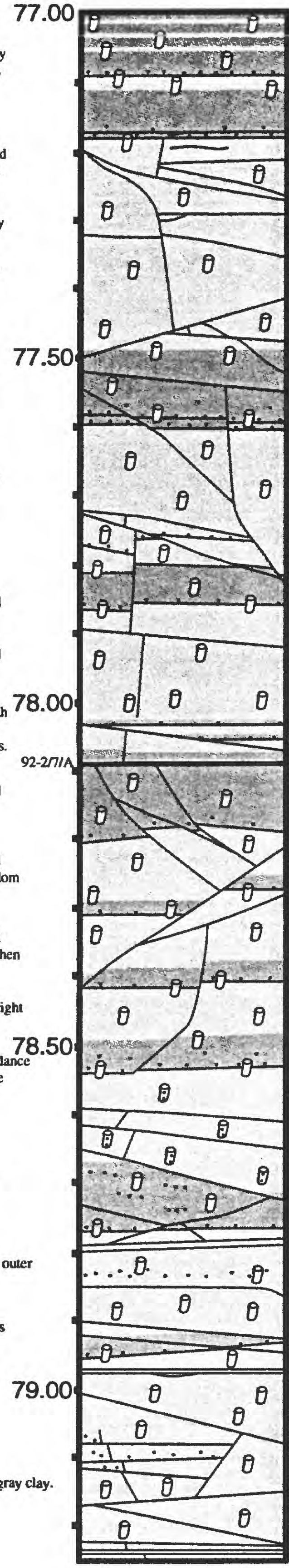
Gray clay with light streaks that decrease in abundance upward.

Orange muddy silt with mud streaks intruded around the outer edge of the core.

Two graded sequences of silty mud with random burrows and light wisps near tops overlain by gray clay. Basal contacts are sharp with more silt.

Graded sequences of silty mud with random burrows to gray clay. Basal contacts are sharp with more silt.

## OL92-2




Interbedded silty gray mud and gray clay all disrupted by random burrows. Silty layers are thicker and coarser near base.

Gray clay with vague burrow mottles and orange stained streaks and blobs. Disrupted by dark cross-cutting shear planes.

Gray silty mud with scattered sand and burrowsgrading up to gray clay. Disrupted by dark cross-cutting shear planes.

Gray clay with vague burrow mottles and dark silty layers near base. Disrupted by dark cross-cutting shear planes.

Gray silty mud with hints of dark layers and burrows. Disrupted by dark cross-cutting shear planes.

Gray clay with vague burrow mottles and dark silty layers near base. Disrupted by dark cross-cutting shear planes.

Four upward-fining sequences of gray silty mud grading to gray clay. Basal contacts are sharp and slightly coarser and burrows occur throughout. Dark cross-cutting shear planes disrupt bedding.

Gray silty mud with streaks of silt grading upward into gray clay with silty patches and silt-filled burrows. Dark cross-cutting shear planes disrupt bedding.

Thick, dark shear plane indicating spin-out of core.

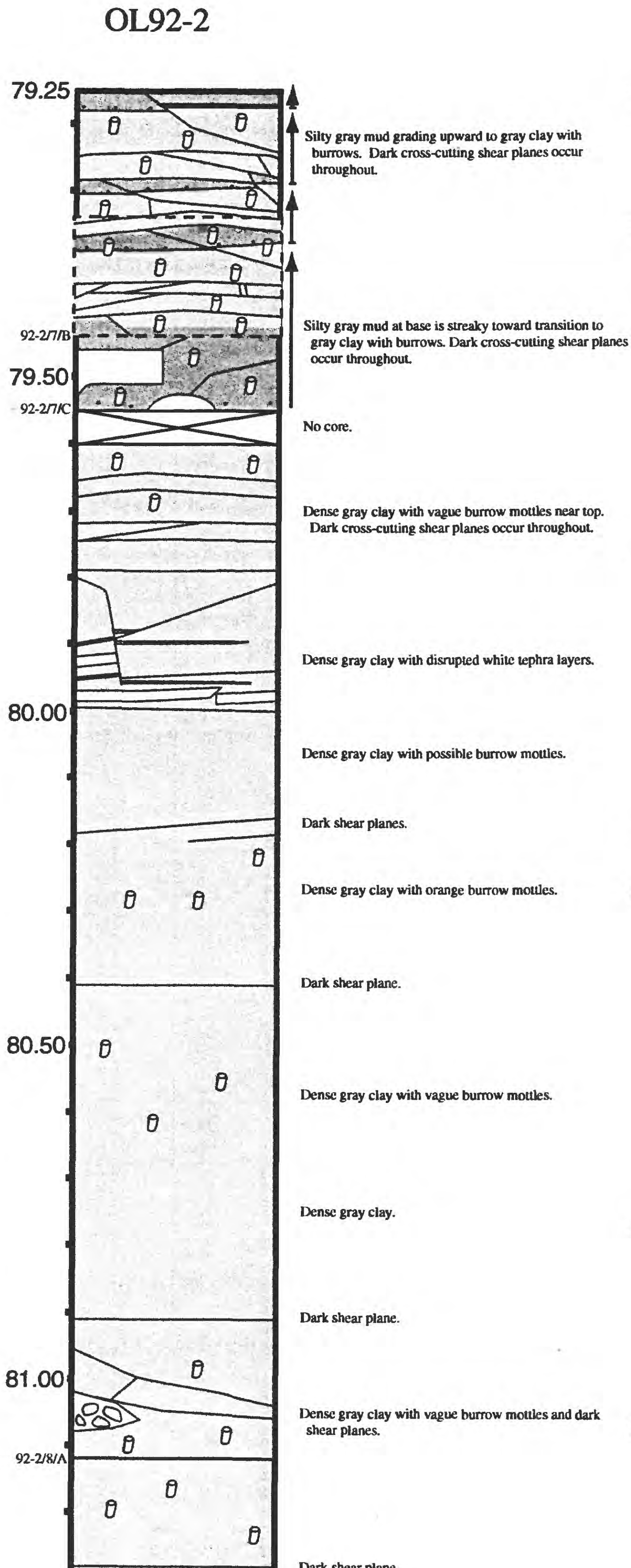
Gray clay with burrows has concentration of silt at base.

Silty mud with sharp basal contact grades upward to gray clay with burrows.

Thick, dark shear plane indicating spin-out of core. Orange streak is truncated.

Gray clay with burrow mottles, orange stains and zones of more silt. Dark cross-cutting shear planes throughout.

Thick, dark shear plane indicating spin-out of core.


OL92-2
79.25
Silty gray mud grading upward to gray clay with burrows. Dark cross-cutting shear planes occur throughout.
92-2/7/B
Silty gray mud at base is streaky toward transition to gray clay with burrows. Dark cross-cutting shear planes occur throughout.
79.50
92-2/7/C
No core.
Dense gray clay with vague burrow mottles near top. Dark cross-cutting shear planes occur throughout.
Dense gray clay with disrupted white tephra layers.
80.00
Dense gray clay with possible burrow mottles.
Dark shear planes.
Dense gray clay with orange burrow mottles.
Dark shear plane.
80.50
Dense gray clay with vague burrow mottles.
Dense gray clay.
Dark shear plane.
81.00
Dense gray clay with vague burrow mottles and dark shear planes.
92-2/8/A
Dark shear plane.

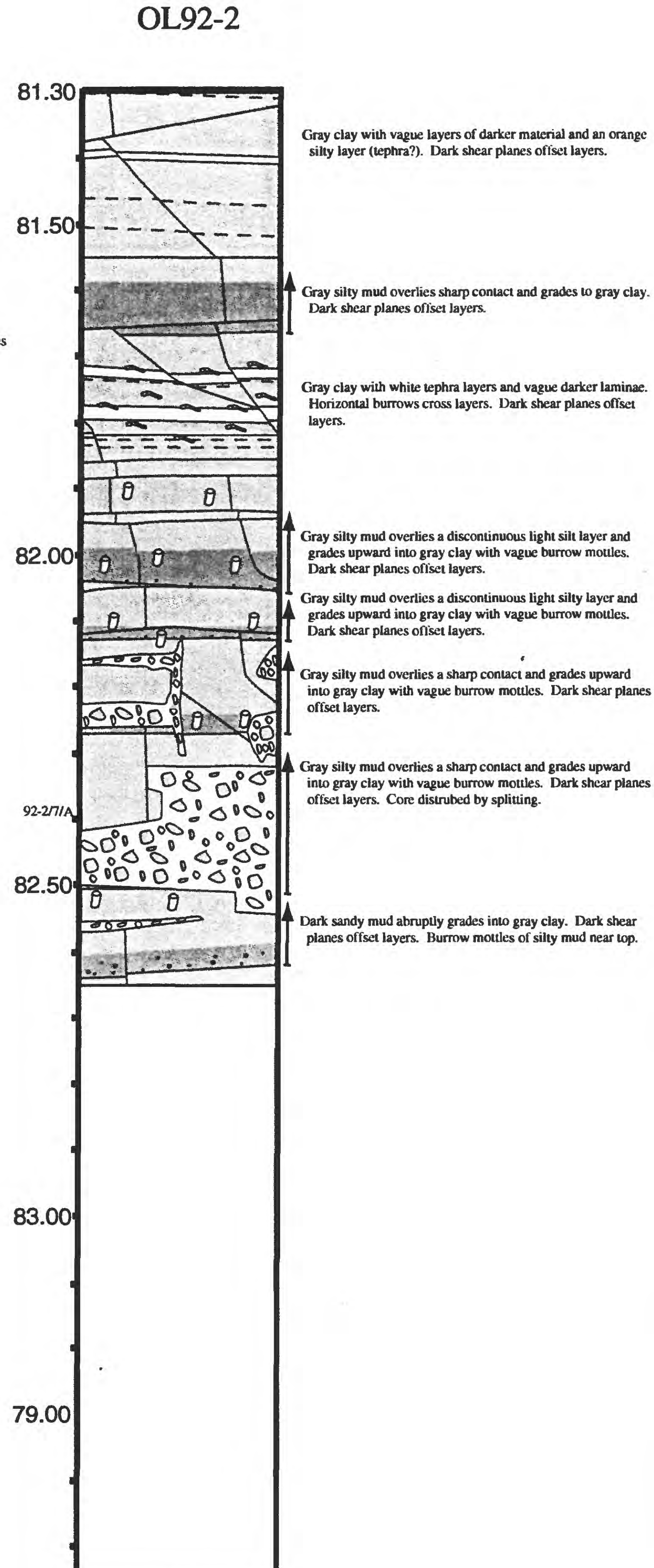
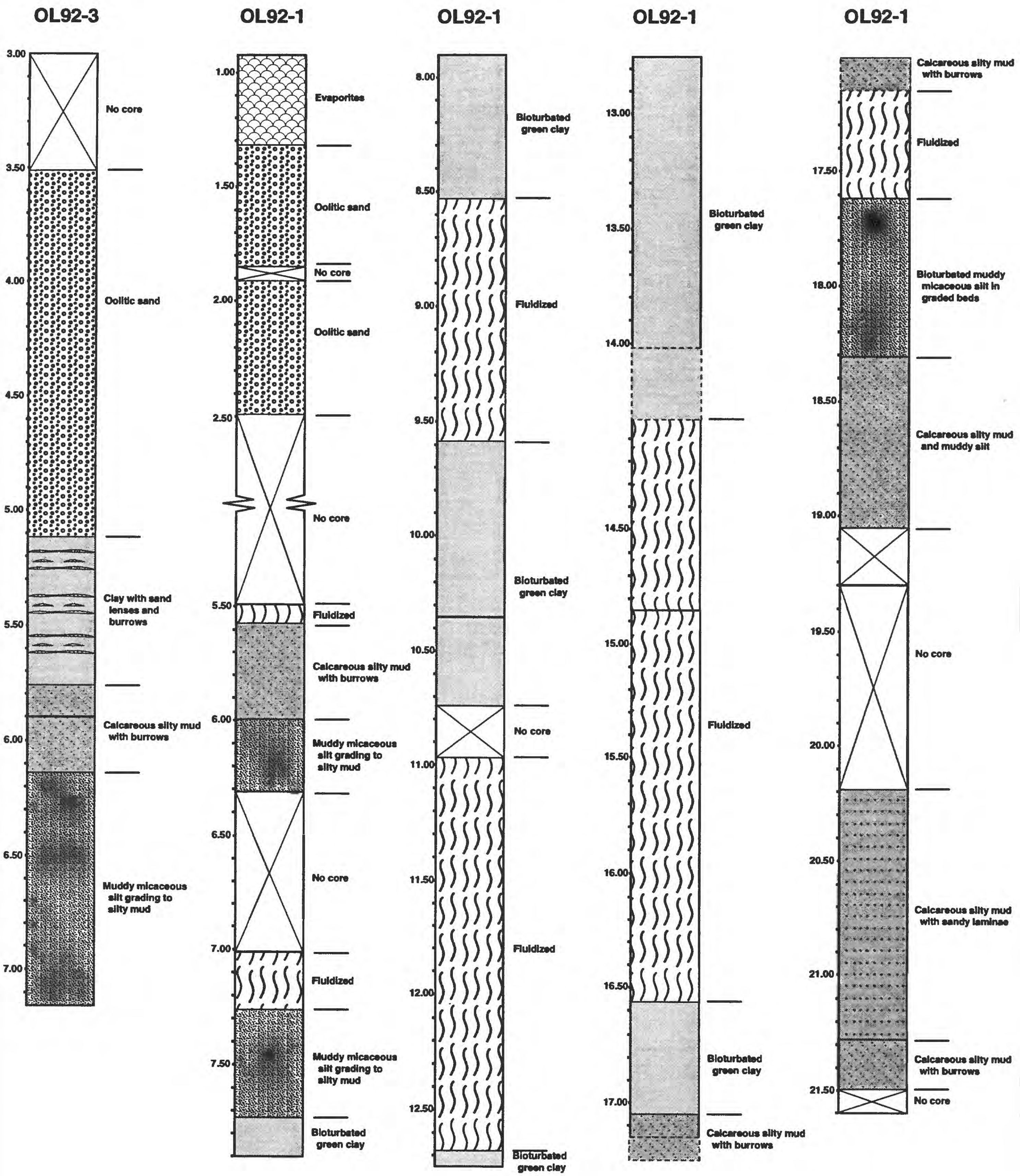
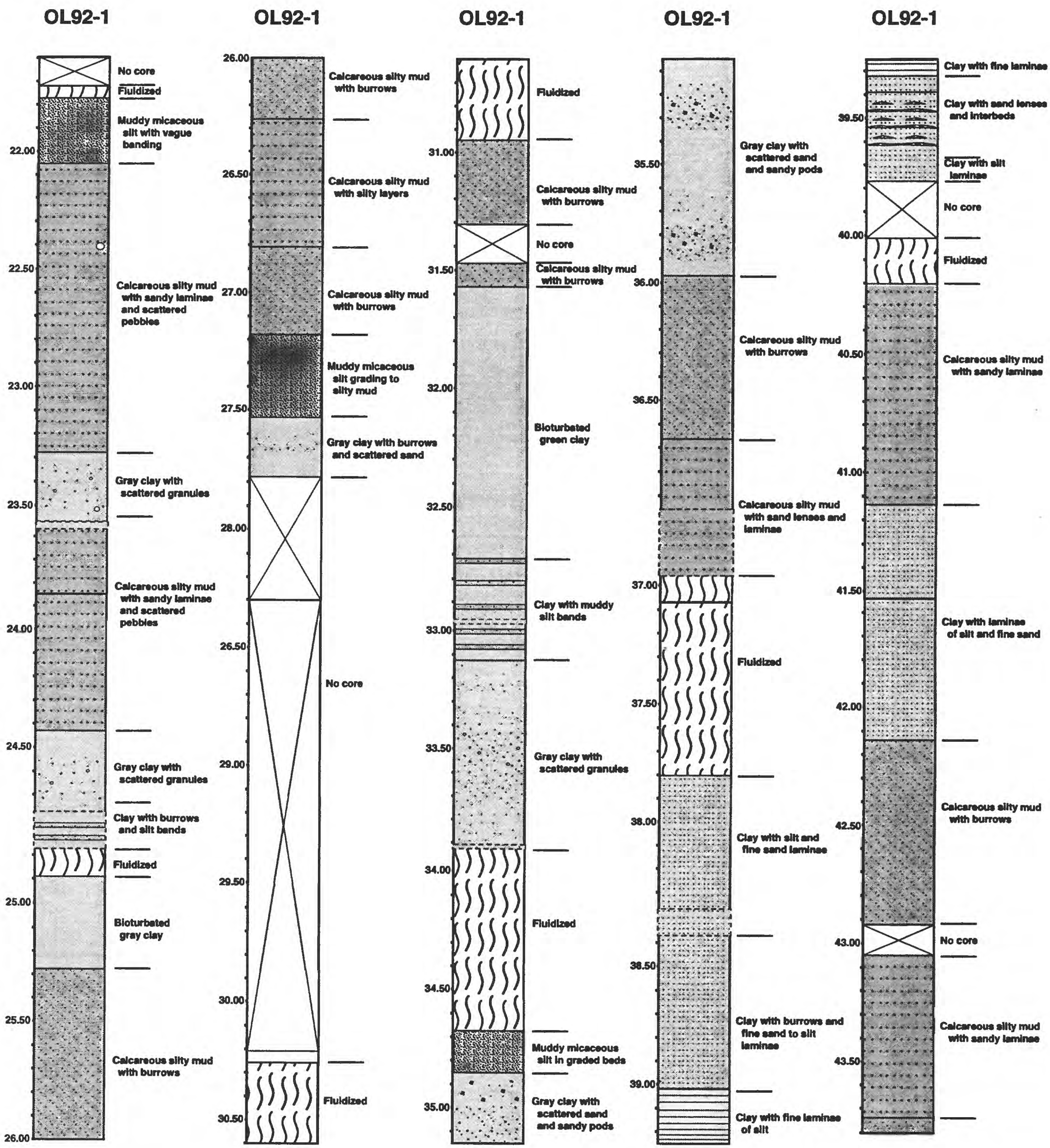
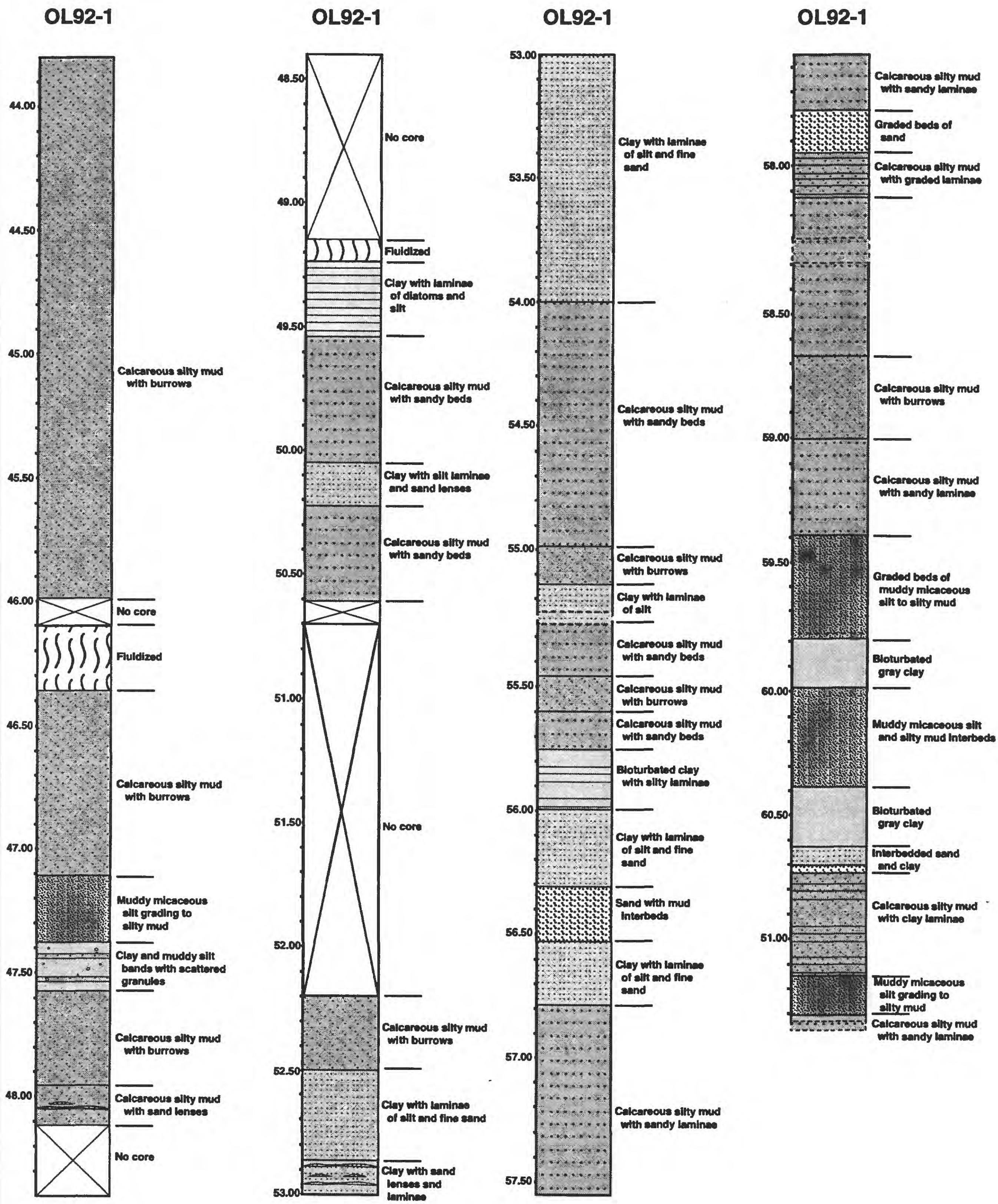

OL92-2
81.30
Gray clay with vague layers of darker material and an orange silty layer (tephra?). Dark shear planes offset layers.
81.50
Gray silty mud overlies sharp contact and grades to gray clay. Dark shear planes offset layers.
Gray clay with white tephra layers and vague darker laminae. Horizontal burrows cross layers. Dark shear planes offset layers.
Gray silty mud overlies a discontinuous light silt layer and grades upward into gray clay with vague burrow mottles. Dark shear planes offset layers.
82.00
Gray silty mud overlies a discontinuous light silty layer and grades upward into gray clay with vague burrow mottles. Dark shear planes offset layers.
Gray silty mud overlies a sharp contact and grades upward into gray clay with vague burrow mottles. Dark shear planes offset layers.
92-2/7/A
Gray silty mud overlies a sharp contact and grades upward into gray clay with vague burrow mottles. Dark shear planes offset layers. Core distrubed by splitting.
82.50
Dark sandy mud abruptly grades into gray clay. Dark shear planes offset layers. Burrow mottles of silty mud near top.
83.00
79.00

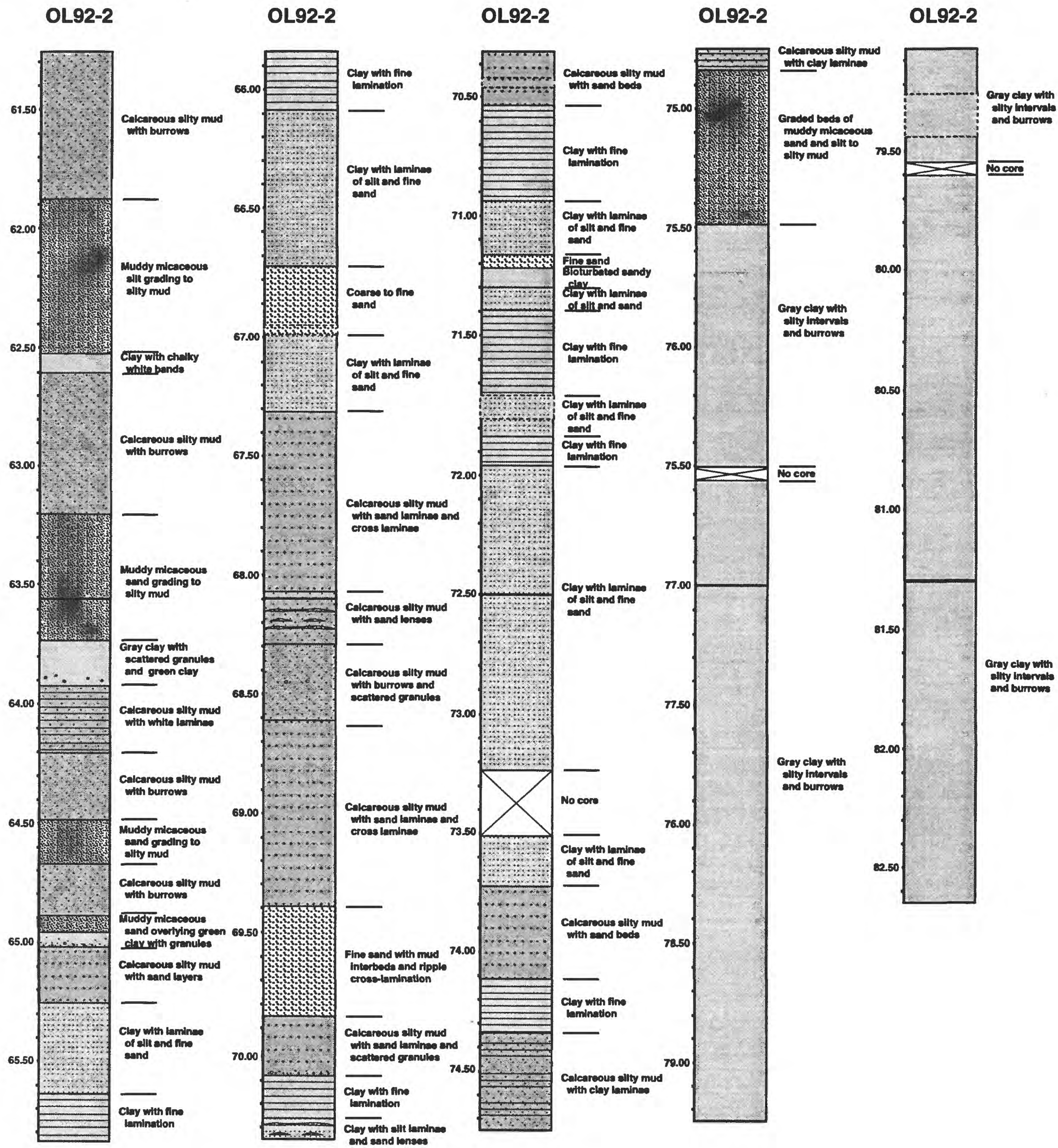
Figure 2

Generalized log of sediment types in OL92-1, 2, and 3. Scale on left of each column is in meters and represents drilling depths as reported by Smith (1993).


OL92-3
OL92-1
OL92-1
OL92-1
OL92-1
No core
Oolitic sand
Clay with sand lenses and burrows
Calcareous silty mud with burrows
Muddy micaceous silt grading to silty mud
Evaporites
Oolitic sand
No core
Oolitic sand
No core
Fluidized
Calcareous silty mud with burrows
Muddy micaceous silt grading to silty mud
No core
Fluidized
Muddy micaceous silt grading to silty mud
Bioturbated green clay
Bioturbated green clay
Fluidized
Bioturbated green clay
No core
Fluidized
Bioturbated green clay
Bioturbated green clay
Fluidized
Bioturbated green clay
Calcareous silty mud with burrows
Calcareous silty mud with burrows
Fluidized
Bioturbated muddy micaceous silt in graded beds
Calcareous silty mud and muddy silt
No core
Calcareous silty mud with sandy laminae
Calcareous silty mud with burrows
No core


OL92-1
No core
Fluidized
Muddy micaceous silt with vague banding
Calcareous silty mud with sandy laminae and scattered pebbles
Gray clay with scattered granules
Calcareous silty mud with sandy laminae and scattered pebbles
Gray clay with scattered granules
Clay with burrows and silt bands
Fluidized
Bioturbated gray clay
Calcareous silty mud with burrows
22.00
22.50
23.00
23.50
24.00
24.50
25.00
25.50
26.00
OL92-1
Calcareous silty mud with burrows
Calcareous silty mud with silty layers
Calcareous silty mud with burrows
Muddy micaceous silt grading to silty mud
Gray clay with burrows and scattered sand
No core
Fluidized
26.00
26.50
27.00
27.50
28.00
26.50
29.00
29.50
30.00
30.50
OL92-1
Fluidized
Calcareous silty mud with burrows
No core
Calcareous silty mud with burrows
Bioturbated green clay
Clay with muddy silt bands
Gray clay with scattered granules
Fluidized
Muddy micaceous silt in graded beds
Gray clay with scattered sand and sandy pods
31.00
31.50
32.00
32.50
33.00
33.50
34.00
34.50
35.00
OL92-1
Gray clay with scattered sand and sandy pods
Calcareous silty mud with burrows
Calcareous silty mud with sand lenses and laminae
Fluidized
Clay with silt and fine sand laminae
Clay with burrows and fine sand to silt laminae
Clay with fine laminae of silt
35.50
36.00
36.50
37.00
37.50
38.00
38.50
39.00
OL92-1
Clay with fine laminae
Clay with sand lenses and interbeds
Clay with silt laminae
No core
Fluidized
Calcareous silty mud with sandy laminae
Clay with laminae of silt and fine sand
Calcareous silty mud with burrows
No core
Calcareous silty mud with sandy laminae
39.50
40.00
40.50
41.00
41.50
42.00
42.50
43.00
43.50


OL92-1
44.00
44.50
45.00
45.50
46.00
46.50
47.00
47.50
48.00
Calcareous silty mud with burrows
No core
Fluidized
Calcareous silty mud with burrows
Muddy micaceous silt grading to silty mud
Clay and muddy silt bands with scattered granules
Calcareous silty mud with burrows
Calcareous silty mud with sand lenses
No core
OL92-1
48.50
49.00
49.50
50.00
50.50
51.00
51.50
52.00
52.50
53.00
No core
Fluidized
Clay with laminae of diatoms and silt
Calcareous silty mud with sandy beds
Clay with silt laminae and sand lenses
Calcareous silty mud with sandy beds
No core
Calcareous silty mud with burrows
Clay with laminae of silt and fine sand
Clay with sand lenses and laminae
OL92-1
53.00
53.50
54.00
54.50
55.00
55.50
56.00
56.50
57.00
57.50
Clay with laminae of silt and fine sand
Calcareous silty mud with sandy beds
Calcareous silty mud with burrows
Clay with laminae of silt
Calcareous silty mud with sandy beds
Calcareous silty mud with burrows
Calcareous silty mud with sandy beds
Bioturbated clay with silty laminae
Clay with laminae of silt and fine sand
Sand with mud interbeds
Clay with laminae of silt and fine sand
Calcareous silty mud with sandy laminae
OL92-1
58.00
58.50
59.00
59.50
60.00
60.50
51.00
Calcareous silty mud with sandy laminae
Graded beds of sand
Calcareous silty mud with graded laminae
Calcareous silty mud with burrows
Calcareous silty mud with sandy laminae
Graded beds of muddy micaceous silt to silty mud
Bioturbated gray clay
Muddy micaceous silt and silty mud interbeds
Bioturbated gray clay
Interbedded sand and clay
Calcareous silty mud with clay laminae
Muddy micaceous silt grading to silty mud
Calcareous silty mud with sandy laminae


OL92-2
61.50
62.00
62.50
63.00
63.50
64.00
64.50
65.00
65.50
Calcareous silty mud with burrows
Muddy micaceous silt grading to silty mud
Clay with chalky white bands
Calcareous silty mud with burrows
Muddy micaceous sand grading to silty mud
Gray clay with scattered granules and green clay
Calcareous silty mud with white laminae
Calcareous silty mud with burrows
Muddy micaceous sand grading to silty mud
Calcareous silty mud with burrows
Muddy micaceous sand overlying green clay with granules
Calcareous silty mud with sand layers
Clay with laminae of silt and fine sand
Clay with fine lamination
OL92-2
66.00
66.50
67.00
67.50
68.00
68.50
69.00
69.50
70.00
Clay with fine lamination
Clay with laminae of silt and fine sand
Coarse to fine sand
Clay with laminae of silt and fine sand
Calcareous silty mud with sand laminae and cross laminae
Calcareous silty mud with sand lenses
Calcareous silty mud with burrows and scattered granules
Calcareous silty mud with sand laminae and cross laminae
Fine sand with mud interbeds and ripple cross-lamination
Calcareous silty mud with sand laminae and scattered granules
Clay with fine lamination
Clay with silt laminae and sand lenses
OL92-2
70.50
71.00
71.50
72.00
72.50
73.00
73.50
74.00
74.50
Calcareous silty mud with sand beds
Clay with fine lamination
Clay with laminae of silt and fine sand
Fine sand
Bioturbated sandy clay
Clay with laminae of silt and sand
Clay with fine lamination
Clay with laminae of silt and fine sand
Clay with fine lamination
Clay with laminae of silt and fine sand
No core
Clay with laminae of silt and fine sand
Calcareous silty mud with sand beds
Clay with fine lamination
Calcareous silty mud with clay laminae
OL92-2
75.00
75.50
76.00
75.50
77.00
77.50
76.00
78.50
79.00
Calcareous silty mud with clay laminae
Graded beds of muddy micaceous sand and silt to silty mud
Gray clay with silty intervals and burrows
No core
Gray clay with silty intervals and burrows
OL92-2
79.50
80.00
80.50
81.00
81.50
82.00
82.50
Gray clay with silty intervals and burrows
No core
Gray clay with silty intervals and burrows

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## A HIGH-RESOLUTION STUDY OF SEDIMENTS FROM THE LAST INTERGLACIATION AT OWENS LAKE, CALIFORNIA: GEOCHEMISTRY OF SEDIMENTS IN CORE OL-92, 83-32 M DEPTH

by

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1998

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## Introduction

In 1992 the U.S. Geological Survey drilled a 323-m-deep core (OL-92) into Owens Lake sediments near the depocenter of the basin to obtain a continuous record of silty-clay sediment spanning the last 800,000 yrs. A multi-parameter reconnaissance study of the entire core (ca 7000-yr resolution), reported in a 13-chapter summary volume (Smith and Bischoff, 1997), revealed cycles characterized by closed and overflowing lake conditions.

We report here the geochemical results of a high-resolution study of sediments from the last interglaciation (presumably Marine Isotope Stage 5), and extending slightly into the glaciations of stages 4 and 6 to observe the 6/5 boundary and 5/4 transitions. We present analyses for total inorganic carbon (TIC), organic carbon (TOC), and for acid soluble elements (in order of abundance): Ca, Mg, Fe, Na, Al, K, Si, Ti , P, Mn , Sr, Li, B, Ba, V, Cu, Co, and Mo

## Sampling

A total of 444 channel samples, each 10-cm in length, were taken from core OL-92 continuously from 83 to 32 m depth. This depth span represents deposition from approximately 134 up to 46 kyrs before present according to the time-depth scale estimated by Bischoff et al (1997b). Thus, each sample represents an integration of approximately 170 yrs. The samples were dried, lightly ground and homogenized, and separated into aliquots for distribution to cooperating laboratories.

## Analytical Techniques

TIC was determined by standard coulometry, which measures carbonate as $CO_2$ released by acid dissolution. Total carbon was measured as $CO_2$ released by induction-furnace combustion. TOC is taken as the difference between total carbon and TIC. Sample splits of 0.5 grams were leached in 10 mls of 3N HCl overnight, and the supernate was analyzed by inductively coupled plasma spectrometry (ICP) for Ca, Mg, Fe, Na, Al, K, Si, Ti , P, Mn , Sr, Li, B, Ba, V, Cu, Co, and Mo.

## Results

Results are shown in Tables 1 and 2, and averages in Table 3. Time plots and inter-element correlations indicate the analyzed components reflect four different sediment-fractions, each of which has climatic implications. These fractions are, 1) authigenic carbonate (TIC, Ca, Mg, Sr), 2) organic matter (TOC, Mo, and Ba), 3) authigenic silicates and exchangeable ions (Mg, Si, Li, Na, B), and, 4) a detrital biotite component (Fe, K, Al, Ti, Mn, V, Cu, and Co).

TIC and leachable Ca (Fig. 1) represent the authigenic $CaCO_3$ fraction. XRD analyses of high-carbonate samples in the reconnaissance study (Bischoff *et al.*, 1997a) indicated that calcite is the dominant carbonate mineral, with minor dolomite and aragonite found in a few samples.

Low carbonate contents reflect overflowing, fresh-lake conditions, whereas high carbonate contents reflect saline-lake, closed-basin conditions, in which Owens Lake was below its sill level much of the time (Bischoff *et al.*, 1997a). Low $CaCO_3$ values from 30-35 m and 75-82 m suggest overflowing conditions whereas fluctuating high values between 35 and 76 m indicate generally closed lake conditions. A unique occurrence at 62.4 to 62.5 m (seen as a spike in Fig. 1) is a 10-cm bed of almost pure dolomite, unconsolidated, finely-crystalline, and ordered

TOC (Fig. 1) reflects biological productivity, and generally follows TIC, indicating that nutrient abundance generally increases with water residence-time. Some of the maxima in TOC, however, occur in regions where TIC is only intermediate. These regions may reflect periods of extreme salinity during which nutrients and productivity are maximized, but in which riverborne Ca is precipitated near where it enters the lake, 60 km north of the coring site, because of high carbonate alkalinity. Thus, maxima in TIC may reflect intermediate or moderate salinities, in which the water chemistry accommodates roughly equal amounts of Ca and carbonate

Fig. 2 shows the carbonate and authigenic silicate components derived from TIC, leachable Ca, and Mg. All Ca is attributed to $CaCO_3$. $CO_3$ in excess of Ca is attributed to a $MgCO_3$ component. Mg, however, exceeds this excess $CO_3$, and this "excess" Mg is attributed to an authigenic Mg-silicate phase (Fig. 2). Such acid-soluble authigenic phases form in saline lakes by reaction of dissolved Mg and silica in alkaline solution (Bischoff et al, 1997a and 1997c). For semiquantitative estimates, we use the stoichiometry of dehydrated sepiolite for this phase (i.e. $Mg_4Si_6O_{15}(OH)_2$).

Chemical mass balance calculations based on the lake area at the spill elevation and the pre-diversion Ca flux from the Owens River suggested that sediments should contain an average of about 11 dry wt % $CaCO_3$ at the limit of a steady-state full, but not spilling, lake (Bischoff *et al.*, 1997a). This conclusion assumes that $CaCO_3$ is homogeneously distributed throughout the sediment surface. $CaCO_3$ falls below this limit for at least five short-lived events from 35-76 m (Fig. 2), indicating brief spilling events during the generally dry intergalciation.

Li seems to correlate closely to the Mg-silicate component, particularly for the pronounced minimum from 43 to 48 m (Figs. 2 and 3). Na and B correlate closely to each other, and less strongly to Li and Mg-silicate. Na is likely the dominant exchangeable ion on the Mg-silicate phase, and B is well know to have an adsorption affinity for smectitic clays (You et al., 1995), but how the negative borate ion is actually incorporated is not clear. Al, Fe, K, and Ti correlate strongly with each other (Fig. 4). Mn, V, Cu, and Co (not shown) also correlate strongly with this group. The triangular diagram of Al, K, and Fe (Fig. 5) indicates that this entire group of elements plots within the field of biotite compositions. Fig. 5 suggests that a portion of the biotite dissolves congruently during the acid leach.

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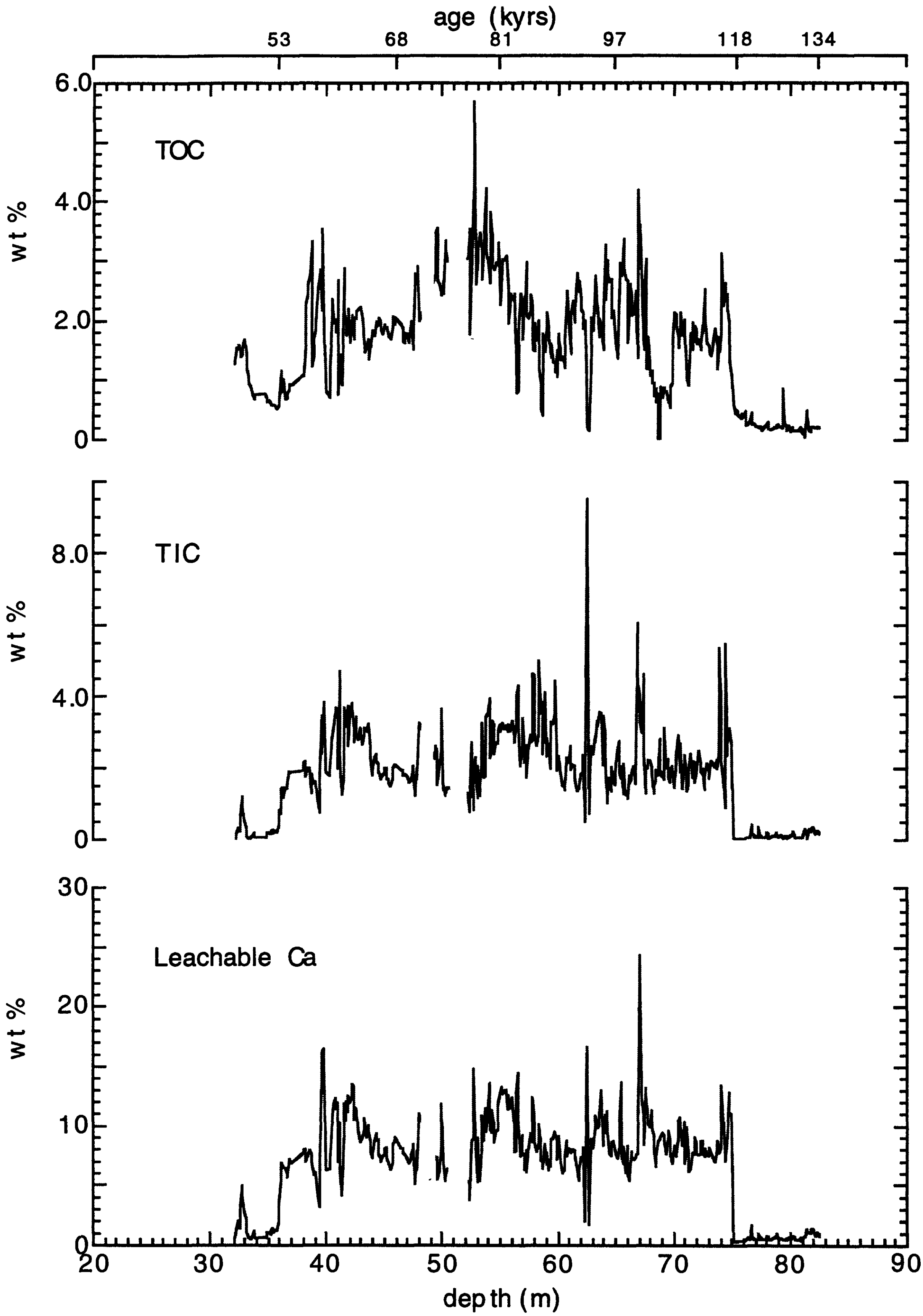


Fig. 1

Depth plots of organic carbon (TOC), inorganic carbon (TIC) and acid-leachable Ca in core OL-92; 83-32 m depth interval. Ages shown at top of diagram from Bischoff et al (1997b).

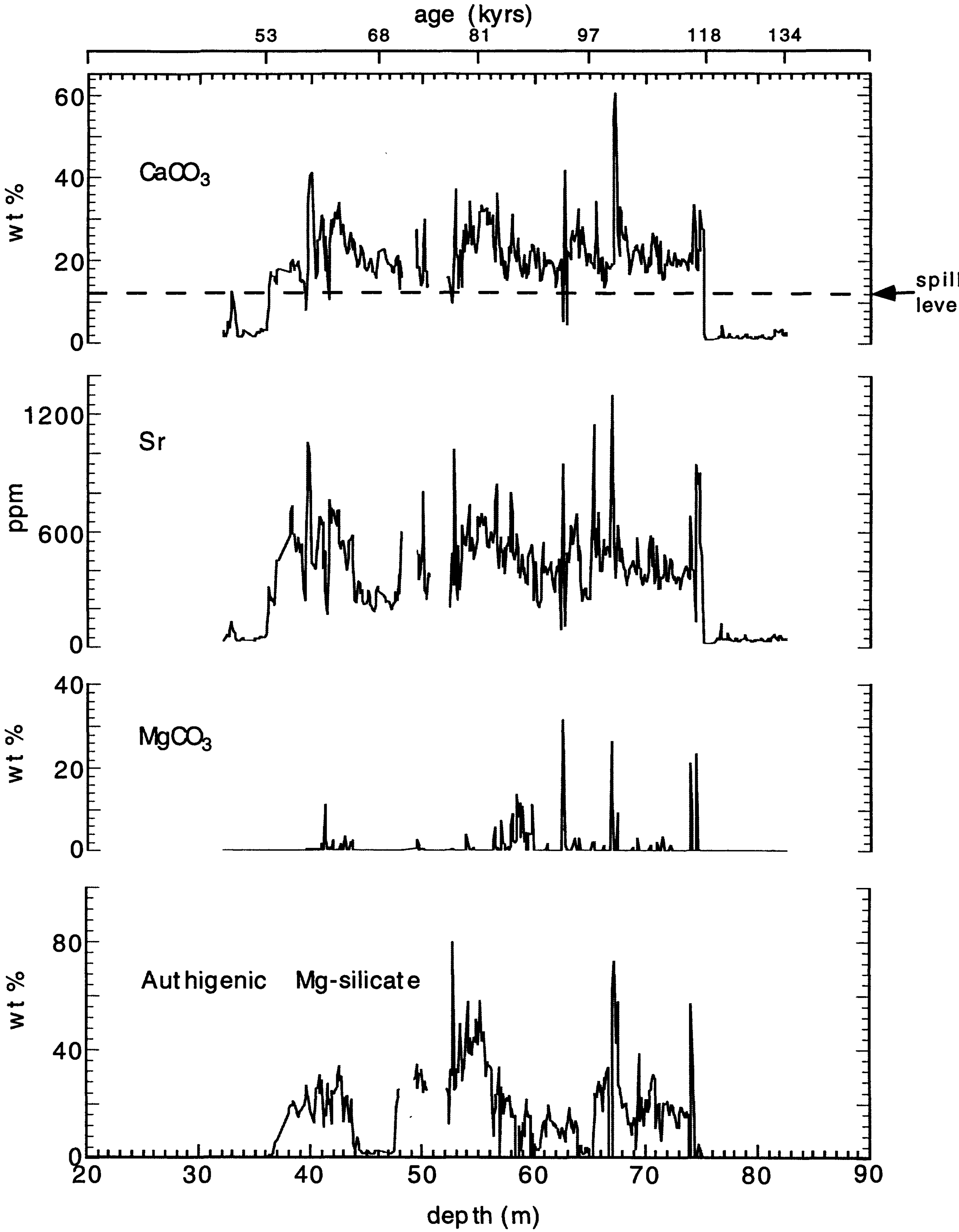


Fig. 2
Depth plots of $CaCO_3$, Sr, $MgCO_3$ and authigenic Mg-silicate in core OL-92; 82-32 m depth. Ages shown at top of diagram from Bischoff et al (1997b).

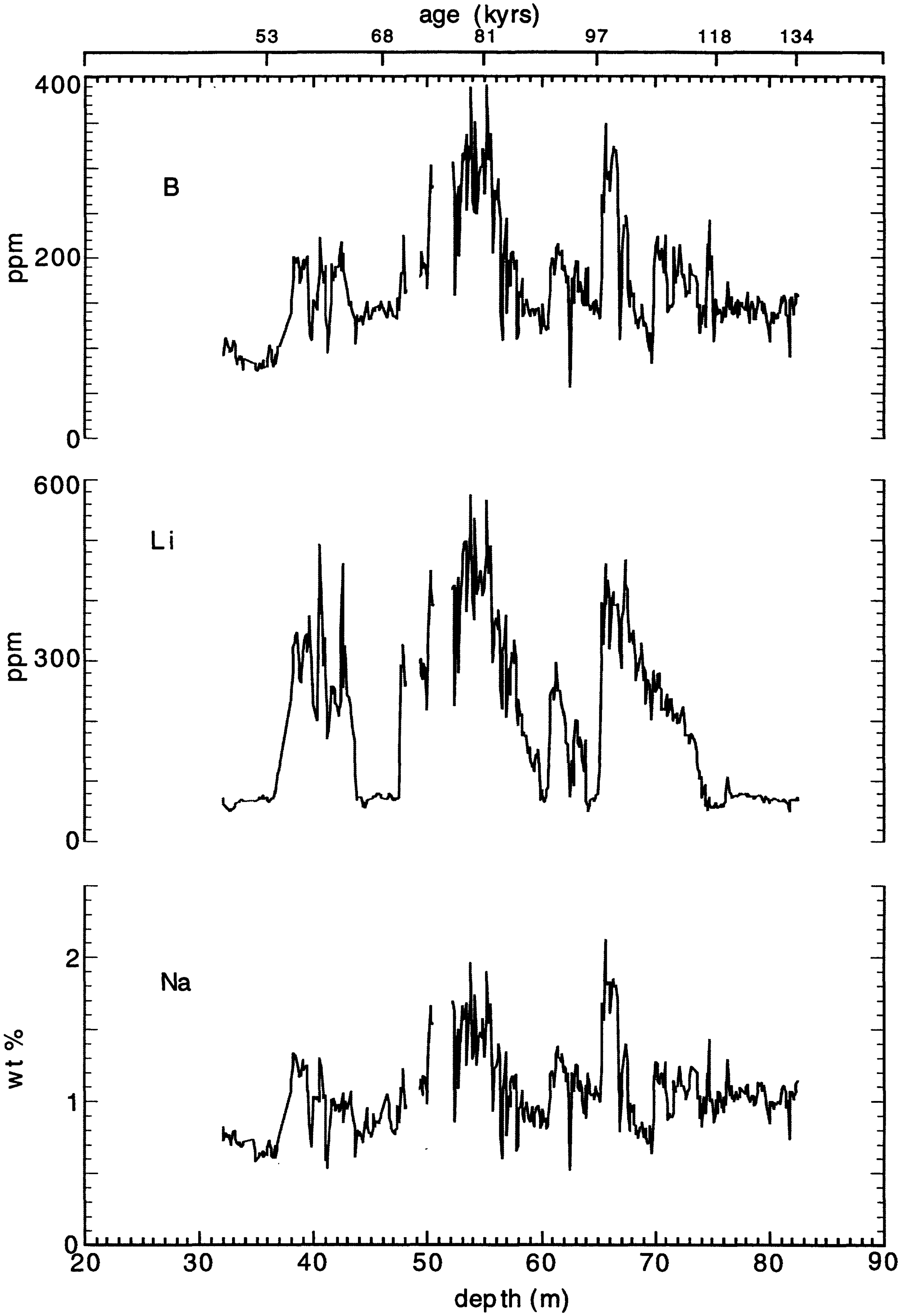


Fig. 3

Depth plots of acid-leachable B, Li and Na in core OL-92; 83-32 m depthinterval. Ages shown at top of diagram from Bischoff et al (1997b).

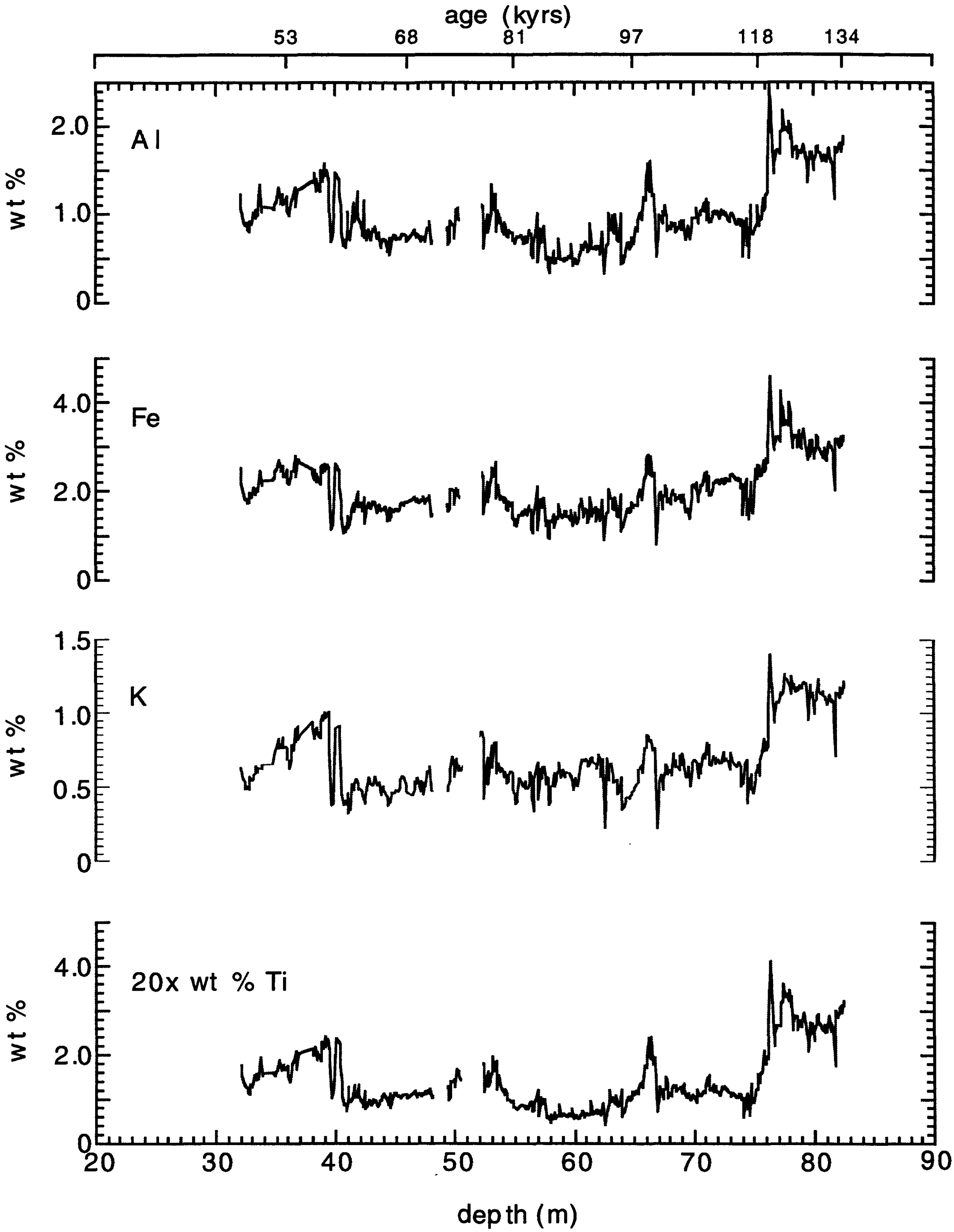


Fig. 4

Depth plot of acid-leachable Al, Fe, K and Ti in core OL-92; 83-32 m depth interval. Ages shown at top of diagram from Bischoff et al (1997b).

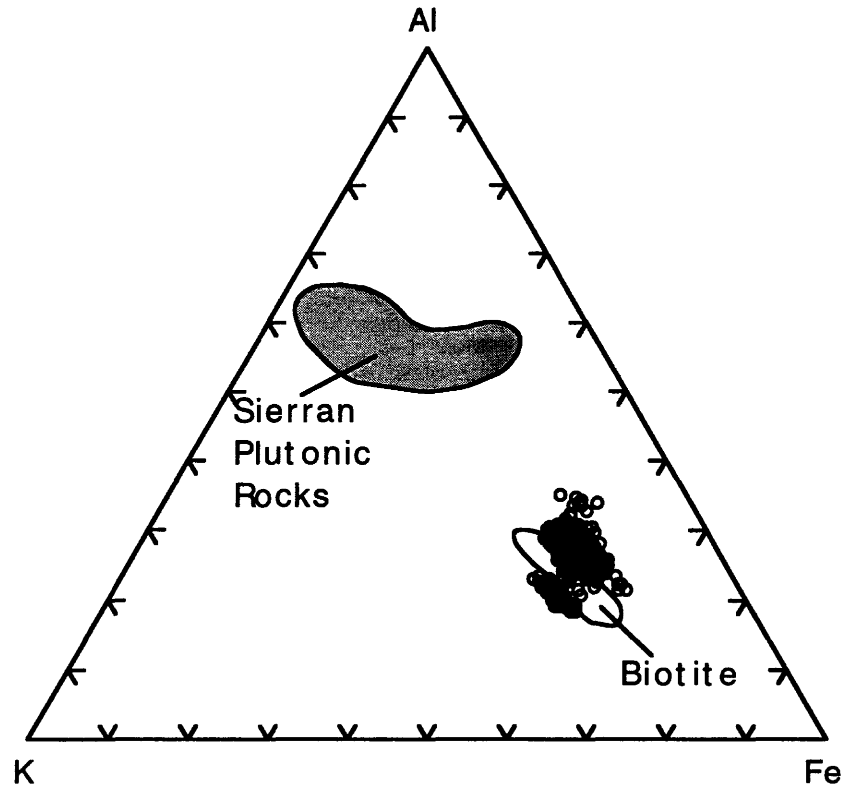


Fig. 5

Diagram showing Al-K-Fe relations for acid-leachable components from core OL-92; 83-32 m depth interval. Field for Sierra plutonic rocks from Bateman (1961), for biotites from Deer, Howie and Zussman (1962).

Table 1

Analyses of high-resolution (10 cm) samples from core OL-92 (83 to 32 m depth) for TIC, TOC and acid-leachable major elements. Depth refers to midpoint of sample from the surface in meters. Concentrations in weight %.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.1 | <0.01 | 1.29 | 0.56 | 0.93 | 2.52 | 0.83 | 1.23 | 0.63 | 0.17 |
| 2 | 32.2 | <0.01 | 1.27 | 0.56 | 0.80 | 2.17 | 0.73 | 1.07 | 0.61 | 0.19 |
| 3 | 32.3 | 0.15 | 1.55 | 1.17 | 0.74 | 1.96 | 0.78 | 0.93 | 0.55 | 0.23 |
| 4 | 32.4 | 0.33 | 1.54 | 2.05 | 0.67 | 1.80 | 0.76 | 0.87 | 0.53 | 0.25 |
| 5 | 32.5 | 0.24 | 1.60 | 1.62 | 0.66 | 1.81 | 0.75 | 0.88 | 0.48 | 0.23 |
| 6 | 32.6 | 0.21 | 1.47 | 1.45 | 0.67 | 1.82 | 0.77 | 0.90 | 0.49 | 0.21 |
| 7 | 32.7 | 0.66 | 1.40 | 3.13 | 0.66 | 1.73 | 0.75 | 0.84 | 0.51 | 0.21 |
| 8 | 32.8 | 1.19 | 1.45 | 4.95 | 0.67 | 1.74 | 0.69 | 0.80 | 0.48 | 0.27 |
| 9 | 32.9 | 0.88 | 1.58 | 4.00 | 0.72 | 1.95 | 0.72 | 0.92 | 0.57 | 0.27 |
| 10 | 33.0 | 0.53 | 1.68 | 2.70 | 0.67 | 1.85 | 0.79 | 0.88 | 0.54 | 0.27 |
| 11 | 33.1 | 0.31 | 1.41 | 2.21 | 0.75 | 2.07 | 0.80 | 1.01 | 0.55 | 0.32 |
| 12 | 33.2 | 0.09 | 1.18 | 1.12 | 0.78 | 2.05 | 0.74 | 1.02 | 0.58 | 0.31 |
| 13 | 33.3 | 0.01 | 1.05 | 0.59 | 0.76 | 1.93 | 0.71 | 0.96 | 0.59 | 0.21 |
| 14 | 33.4 | 0.04 | 0.94 | 0.67 | 0.81 | 2.07 | 0.71 | 1.04 | 0.64 | 0.29 |
| 15 | 33.5 | 0.03 | 0.89 | 0.52 | 0.83 | 2.07 | 0.69 | 1.06 | 0.59 | 0.29 |
| 16 | 33.6 | 0.04 | 0.89 | 0.54 | 0.79 | 1.99 | 0.72 | 0.98 | 0.63 | 0.26 |
| 17 | 33.7 | 0.11 | 0.75 | 0.83 | 0.92 | 2.45 | 0.68 | 1.33 | 0.62 | 0.28 |
| 18 | 33.8 | 0.21 | 0.67 | 1.24 | 0.81 | 2.13 | 0.70 | 1.03 | 0.62 | 0.34 |
| 19 | 33.9 | 0.06 | 0.74 | 0.62 | 0.82 | 2.22 | 0.72 | 1.08 | 0.65 | 0.31 |
| 20 | 34.8 | 0.06 | 0.77 | 0.69 | 0.84 | 2.24 | 0.74 | 1.08 | 0.65 | 0.27 |
| 21 | 34.9 | 0.06 | 0.69 | 0.57 | 0.80 | 2.31 | 0.65 | 1.05 | 0.73 | 0.31 |
| 22 | 35.0 | 0.19 | 0.63 | 1.07 | 0.84 | 2.43 | 0.58 | 1.10 | 0.73 | 0.36 |
| 23 | 35.1 | 0.19 | 0.66 | 1.09 | 0.87 | 2.51 | 0.60 | 1.15 | 0.77 | 0.38 |
| 24 | 35.2 | 0.16 | 0.60 | 0.92 | 0.93 | 2.68 | 0.62 | 1.31 | 0.83 | 0.37 |
| 25 | 35.3 | 0.23 | 0.59 | 1.24 | 0.93 | 2.65 | 0.64 | 1.30 | 0.75 | 0.35 |
| 26 | 35.4 | 0.27 | 0.57 | 1.40 | 0.89 | 2.52 | 0.63 | 1.18 | 0.77 | 0.40 |
| 27 | 35.5 | 0.18 | 0.58 | 1.05 | 0.88 | 2.44 | 0.62 | 1.12 | 0.76 | 0.40 |
| 28 | 35.6 | 0.24 | 0.57 | 1.30 | 0.93 | 2.57 | 0.66 | 1.22 | 0.84 | 0.38 |
| 29 | 35.7 | 0.23 | 0.56 | 1.29 | 0.86 | 2.32 | 0.62 | 1.11 | 0.76 | 0.37 |
| 30 | 35.8 | 0.21 | 0.52 | 1.21 | 0.88 | 2.33 | 0.64 | 1.13 | 0.77 | 0.36 |
| 31 | 35.9 | 0.41 | 0.57 | 1.95 | 0.90 | 2.48 | 0.63 | 1.20 | 0.75 | 0.36 |
| 32 | 36.0 | 0.83 | 0.67 | 3.64 | 0.81 | 2.19 | 0.68 | 1.04 | 0.68 | 0.34 |
| 33 | 36.1 | 0.72 | 1.16 | 5.33 | 0.77 | 2.15 | 0.73 | 0.98 | 0.68 | 0.38 |
| 34 | 36.2 | 1.40 | 0.80 | 6.90 | 0.80 | 2.17 | 0.71 | 1.01 | 0.62 | 0.37 |
| 35 | 36.3 | 1.45 | 0.92 | 6.53 | 0.93 | 2.37 | 0.67 | 1.13 | 0.68 | 0.42 |
| 36 | 36.4 | 1.18 | 1.02 | 6.48 | 0.95 | 2.44 | 0.63 | 1.13 | 0.79 | 0.45 |
| 37 | 36.5 | 1.45 | 0.67 | 6.45 | 0.97 | 2.44 | 0.61 | 1.21 | 0.74 | 0.44 |
| 38 | 36.6 | 1.43 | 0.69 | 6.04 | 1.12 | 2.79 | 0.69 | 1.30 | 0.90 | 0.50 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 36.7 | 1.49 | 0.79 | 5.64 | 1.00 | 2.33 | 0.61 | 1.08 | 0.80 | 0.42 |
| 40 | 36.8 | 1.91 | 0.85 | 7.06 | 1.45 | 2.67 | 0.68 | 1.27 | 0.91 | 0.45 |
| 41 | 36.9 | 1.86 | 0.94 | 7.17 | 1.47 | 2.71 | 0.71 | 1.28 | 0.81 | 0.47 |
| 42 | 37.0 | 1.87 | 0.91 | 6.84 | 1.53 | 2.63 | 0.77 | 1.28 | 0.84 | 0.47 |
| 43 | 38.0 | 1.93 | 1.10 | 7.72 | 2.50 | 2.48 | 1.08 | 1.38 | 0.94 | 0.31 |
| 44 | 38.1 | 2.12 | 1.06 | 7.98 | 2.64 | 2.38 | 1.15 | 1.35 | 0.89 | 0.18 |
| 45 | 38.2 | 2.18 | 1.61 | 8.06 | 2.73 | 2.25 | 1.25 | 1.36 | 0.82 | 0.19 |
| 46 | 38.3 | 1.76 | 2.29 | 7.01 | 2.83 | 2.46 | 1.34 | 1.46 | 0.89 | 0.10 |
| 47 | 38.4 | 1.99 | 2.44 | 7.56 | 2.64 | 2.20 | 1.30 | 1.26 | 0.85 | 0.16 |
| 48 | 38.5 | 1.89 | 2.61 | 7.40 | 2.91 | 2.37 | 1.32 | 1.40 | 0.90 | 0.18 |
| 49 | 38.6 | 2.00 | 2.74 | 7.97 | 2.68 | 2.22 | 1.27 | 1.29 | 0.84 | 0.15 |
| 50 | 38.7 | 1.29 | 3.31 | 7.59 | 2.49 | 2.15 | 1.19 | 1.26 | 0.82 | 0.14 |
| 51 | 38.8 | 1.82 | 1.23 | 6.80 | 2.56 | 2.53 | 1.17 | 1.50 | 0.94 | 0.20 |
| 52 | 38.9 | 1.55 | 1.40 | 6.07 | 2.42 | 2.57 | 1.17 | 1.47 | 0.99 | 0.22 |
| 53 | 39.0 | 1.57 | 1.71 | 5.89 | 2.46 | 2.40 | 1.20 | 1.37 | 0.95 | 0.22 |
| 54 | 39.1 | 1.62 | 1.84 | 6.11 | 2.74 | 2.60 | 1.29 | 1.58 | 1.01 | 0.17 |
| 55 | 39.2 | 1.57 | 2.03 | 5.88 | 2.62 | 2.44 | 1.21 | 1.43 | 0.96 | 0.19 |
| 56 | 39.3 | 1.06 | 2.55 | 4.19 | 2.77 | 2.59 | 1.24 | 1.50 | 0.98 | 0.11 |
| 57 | 39.4 | 0.75 | 2.78 | 3.18 | 2.75 | 2.50 | 1.25 | 1.37 | 1.01 | 0.11 |
| 58 | 39.5 | 1.70 | 2.85 | 7.23 | 2.61 | 2.09 | 1.12 | 1.16 | 0.76 | 0.10 |
| 59 | 39.6 | 3.44 | 2.18 | 13.54 | 2.66 | 1.22 | 0.81 | 0.71 | 0.42 | 0.10 |
| 60 | 39.7 | 2.39 | 3.52 | 16.16 | 2.90 | 1.14 | 0.83 | 0.69 | 0.37 | 0.09 |
| 61 | 39.8 | 3.82 | 1.76 | 16.49 | 2.70 | 1.26 | 0.68 | 0.77 | 0.39 | 0.09 |
| 62 | 39.9 | 1.87 | 0.81 | 6.26 | 2.77 | 2.61 | 1.03 | 1.47 | 0.89 | 0.33 |
| 63 | 40.3 | 1.76 | 0.71 | 6.36 | 2.30 | 2.42 | 1.01 | 1.39 | 0.91 | 0.33 |
| 64 | 40.4 | 1.94 | 1.23 | 6.90 | 2.39 | 2.07 | 1.03 | 1.23 | 0.83 | 0.27 |
| 65 | 40.5 | 2.70 | 2.00 | 9.94 | 3.15 | 1.76 | 1.00 | 1.07 | 0.45 | 0.10 |
| 66 | 40.6 | 2.77 | 2.36 | 9.99 | 3.06 | 1.40 | 1.30 | 0.79 | 0.45 | 0.08 |
| 67 | 40.7 | 3.16 | 1.96 | 11.89 | 2.98 | 1.07 | 1.24 | 0.64 | 0.37 | 0.08 |
| 68 | 40.8 | 3.62 | 2.01 | 12.33 | 3.48 | 1.20 | 1.08 | 0.71 | 0.41 | 0.08 |
| 69 | 40.9 | 3.66 | 1.80 | 11.42 | 3.31 | 1.09 | 1.02 | 0.63 | 0.38 | 0.12 |
| 70 | 41.0 | 3.58 | 2.07 | 11.94 | 3.37 | 1.31 | 1.04 | 0.82 | 0.40 | 0.08 |
| 71 | 41.0 | 3.17 | 2.67 | 10.21 | 3.79 | 1.43 | 1.04 | 1.03 | 0.46 | 0.09 |
| 72 | 41.1 | 1.98 | 0.74 | 6.99 | 3.12 | 1.18 | 0.59 | 0.79 | 0.32 | 0.08 |
| 73 | 41.2 | 4.68 | 1.42 | 10.31 | 5.14 | 1.27 | 0.69 | 0.78 | 0.42 | 0.09 |
| 74 | 41.3 | 2.24 | 1.08 | 6.11 | 3.15 | 1.27 | 0.53 | 0.71 | 0.34 | 0.10 |
| 75 | 41.4 | 1.25 | 0.92 | 4.17 | 2.22 | 1.59 | 0.79 | 0.92 | 0.52 | 0.12 |
| 76 | 41.5 | 1.68 | 2.87 | 9.05 | 3.49 | 1.73 | 0.93 | 1.12 | 0.47 | 0.10 |
| 77 | 41.6 | 3.67 | 2.15 | 11.87 | 2.85 | 1.53 | 1.02 | 0.91 | 0.52 | 0.10 |
| 78 | 41.7 | 3.13 | 1.93 | 10.46 | 2.65 | 1.75 | 0.97 | 0.97 | 0.55 | 0.12 |
| 79 | 41.8 | 3.33 | 1.76 | 11.99 | 2.82 | 1.80 | 1.02 | 0.98 | 0.56 | 0.13 |
| 80 | 41.9 | 3.72 | 1.83 | 11.21 | 2.96 | 1.98 | 0.98 | 1.26 | 0.52 | 0.11 |
| 81 | 42.0 | 2.60 | 2.19 | 12.54 | 2.90 | 1.66 | 0.93 | 0.95 | 0.48 | 0.10 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 82 | 42.1 | 3.56 | 1.64 | 11.91 | 2.76 | 1.74 | 0.97 | 0.90 | 0.49 | 0.12 |
| 83 | 42.2 | 3.79 | 2.08 | 12.47 | 2.96 | 1.61 | 0.97 | 0.82 | 0.46 | 0.09 |
| 84 | 42.3 | 3.58 | 1.97 | 13.54 | 2.83 | 1.55 | 0.93 | 0.76 | 0.44 | 0.10 |
| 85 | 42.4 | 3.07 | 1.70 | 13.25 | 3.21 | 1.86 | 0.96 | 1.16 | 0.40 | 0.09 |
| 86 | 42.5 | 2.69 | 2.05 | 10.49 | 3.24 | 1.28 | 0.98 | 0.74 | 0.39 | 0.09 |
| 87 | 42.6 | 3.42 | 2.02 | 10.72 | 4.09 | 1.55 | 1.05 | 0.81 | 0.50 | 0.09 |
| 88 | 42.7 | 2.93 | 2.15 | 11.47 | 3.07 | 1.60 | 0.85 | 0.70 | 0.47 | 0.13 |
| 89 | 42.8 | 2.76 | 2.20 | 9.53 | 3.32 | 1.73 | 1.00 | 0.83 | 0.57 | 0.11 |
| 90 | 42.9 | 3.08 | 2.22 | 8.62 | 2.76 | 1.62 | 0.95 | 0.71 | 0.52 | 0.13 |
| 91 | 43.2 | 2.65 | 2.04 | 9.03 | 2.59 | 1.77 | 1.00 | 0.83 | 0.50 | 0.09 |
| 92 | 43.3 | 2.88 | 1.59 | 9.61 | 2.68 | 1.70 | 1.07 | 0.80 | 0.57 | 0.13 |
| 93 | 43.4 | 3.08 | 1.48 | 10.68 | 2.42 | 1.75 | 0.97 | 0.86 | 0.57 | 0.10 |
| 94 | 43.5 | 2.99 | 1.56 | 9.00 | 2.35 | 1.51 | 0.88 | 0.73 | 0.51 | 0.11 |
| 95 | 43.6 | 3.19 | 1.69 | 10.04 | 2.93 | 1.70 | 0.81 | 0.80 | 0.52 | 0.15 |
| 96 | 43.7 | 3.21 | 1.36 | 9.54 | 2.76 | 1.71 | 0.62 | 0.75 | 0.53 | 0.21 |
| 97 | 43.8 | 2.59 | 1.67 | 8.69 | 1.15 | 1.55 | 0.79 | 0.63 | 0.44 | 0.19 |
| 98 | 43.9 | 2.28 | 1.56 | 7.85 | 0.95 | 1.57 | 0.80 | 0.67 | 0.46 | 0.22 |
| 99 | 44.0 | 1.80 | 1.83 | 7.31 | 0.80 | 1.58 | 0.76 | 0.72 | 0.51 | 0.19 |
| 100 | 44.1 | 1.91 | 1.77 | 7.62 | 0.83 | 1.59 | 0.79 | 0.72 | 0.48 | 0.19 |
| 101 | 44.2 | 2.27 | 1.74 | 8.80 | 1.20 | 1.65 | 0.76 | 0.70 | 0.45 | 0.22 |
| 102 | 44.3 | 2.36 | 1.98 | 9.40 | 0.91 | 1.45 | 0.71 | 0.63 | 0.43 | 0.18 |
| 103 | 44.4 | 2.17 | 1.90 | 8.78 | 0.68 | 1.33 | 0.74 | 0.57 | 0.37 | 0.17 |
| 104 | 44.5 | 2.08 | 1.92 | 8.88 | 0.77 | 1.63 | 0.86 | 0.73 | 0.42 | 0.18 |
| 105 | 44.6 | 1.89 | 2.04 | 7.55 | 0.59 | 1.35 | 0.82 | 0.54 | 0.39 | 0.15 |
| 106 | 44.7 | 1.74 | 1.96 | 7.33 | 0.66 | 1.47 | 0.96 | 0.68 | 0.45 | 0.17 |
| 107 | 44.8 | 1.65 | 1.86 | 7.00 | 0.68 | 1.60 | 0.84 | 0.69 | 0.46 | 0.19 |
| 108 | 44.9 | 1.80 | 1.78 | 7.43 | 0.72 | 1.54 | 0.78 | 0.77 | 0.45 | 0.17 |
| 109 | 45.0 | 1.83 | 1.93 | 7.59 | 0.76 | 1.60 | 0.78 | 0.75 | 0.47 | 0.20 |
| 110 | 45.1 | 2.00 | 1.90 | 8.00 | 0.78 | 1.59 | 0.75 | 0.72 | 0.48 | 0.19 |
| 111 | 45.2 | 1.98 | 1.90 | 8.15 | 0.73 | 1.60 | 0.80 | 0.73 | 0.47 | 0.23 |
| 112 | 45.3 | 1.69 | 1.88 | 7.27 | 0.70 | 1.56 | 0.91 | 0.72 | 0.47 | 0.20 |
| 113 | 45.4 | 1.66 | 1.73 | 6.85 | 0.68 | 1.61 | 0.82 | 0.72 | 0.49 | 0.20 |
| 114 | 45.5 | 1.56 | 1.77 | 6.85 | 0.69 | 1.69 | 0.84 | 0.72 | 0.54 | 0.24 |
| 115 | 45.6 | 1.49 | 1.69 | 6.28 | 0.71 | 1.74 | 0.86 | 0.78 | 0.57 | 0.22 |
| 116 | 45.7 | 1.68 | 1.91 | 6.90 | 0.73 | 1.69 | 0.84 | 0.77 | 0.56 | 0.22 |
| 117 | 45.8 | 1.95 | 2.07 | 8.40 | 0.79 | 1.72 | 0.86 | 0.76 | 0.55 | 0.22 |
| 118 | 45.9 | 2.07 | 1.94 | 8.79 | 0.81 | 1.76 | 0.89 | 0.76 | 0.51 | 0.19 |
| 119 | 46.0 | 2.09 | 2.06 | 9.09 | 0.75 | 1.73 | 0.91 | 0.70 | 0.46 | 0.21 |
| 120 | 46.4 | 1.93 | 1.94 | 8.08 | 0.80 | 1.81 | 1.05 | 0.78 | 0.44 | 0.22 |
| 121 | 46.6 | 1.92 | 1.87 | 8.08 | 0.79 | 1.88 | 0.98 | 0.82 | 0.48 | 0.20 |
| 122 | 46.7 | 1.79 | 1.66 | 7.71 | 0.77 | 1.85 | 0.89 | 0.80 | 0.54 | 0.25 |
| 123 | 46.8 | 1.79 | 1.63 | 7.59 | 0.74 | 1.77 | 0.84 | 0.74 | 0.52 | 0.25 |
| 124 | 46.9 | 1.82 | 1.79 | 7.62 | 0.77 | 1.82 | 0.81 | 0.78 | 0.56 | 0.29 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 125 | 47.0 | 1.76 | 1.77 | 7.32 | 0.72 | 1.73 | 0.79 | 0.75 | 0.52 | 0.25 |
| 126 | 47.1 | 1.65 | 1.64 | 6.88 | 0.67 | 1.76 | 0.77 | 0.70 | 0.47 | 0.27 |
| 127 | 47.2 | 1.60 | 1.73 | 6.80 | 0.71 | 1.81 | 0.80 | 0.75 | 0.54 | 0.28 |
| 128 | 47.3 | 1.65 | 1.94 | 7.29 | 0.71 | 1.80 | 0.81 | 0.72 | 0.53 | 0.29 |
| 129 | 47.4 | 1.65 | 1.98 | 7.59 | 0.71 | 1.88 | 0.97 | 0.71 | 0.44 | 0.32 |
| 130 | 47.5 | 1.90 | 1.52 | 8.05 | 0.77 | 1.71 | 0.88 | 0.74 | 0.52 | 0.25 |
| 131 | 47.6 | 2.04 | 1.67 | 8.47 | 0.79 | 1.73 | 0.85 | 0.69 | 0.50 | 0.26 |
| 132 | 47.7 | 1.21 | 2.77 | 5.12 | 2.34 | 1.84 | 1.09 | 0.85 | 0.61 | 0.10 |
| 133 | 47.8 | 1.99 | 2.70 | 7.96 | 2.65 | 1.80 | 1.06 | 0.82 | 0.61 | 0.11 |
| 134 | 47.9 | 1.67 | 2.90 | 6.30 | 2.94 | 1.91 | 1.23 | 0.91 | 0.64 | 0.11 |
| 135 | 48.0 | 3.25 | 2.00 | 11.03 | 2.77 | 1.44 | 0.95 | 0.66 | 0.47 | 0.10 |
| 136 | 49.3 | 2.25 | 2.76 | 7.23 | 3.46 | 1.70 | 1.11 | 0.85 | 0.47 | 0.11 |
| 137 | 49.5 | 2.60 | 3.45 | 7.35 | 3.91 | 1.54 | 1.15 | 0.65 | 0.50 | 0.14 |
| 138 | 49.6 | 2.42 | 3.54 | 7.39 | 4.07 | 1.62 | 1.04 | 0.70 | 0.54 | 0.16 |
| 139 | 49.7 | 1.53 | 2.67 | 5.50 | 2.98 | 2.04 | 1.17 | 0.92 | 0.62 | 0.13 |
| 140 | 49.8 | 1.94 | 2.59 | 6.15 | 3.64 | 2.02 | 1.16 | 0.88 | 0.70 | 0.19 |
| 141 | 49.9 | 2.50 | 2.42 | 8.21 | 3.53 | 1.98 | 1.07 | 0.87 | 0.64 | 0.24 |
| 142 | 50.0 | 3.64 | 2.41 | 11.89 | 3.65 | 1.70 | 0.98 | 0.73 | 0.56 | 0.20 |
| 143 | 50.1 | 1.38 | 2.69 | 7.05 | 3.11 | 2.05 | 1.48 | 1.05 | 0.69 | 0.10 |
| 144 | 50.2 | 1.58 | 2.44 | 6.82 | 2.86 | 1.96 | 1.41 | 0.95 | 0.67 | 0.10 |
| 145 | 50.3 | 1.22 | 3.33 | 5.34 | 3.35 | 2.02 | 1.67 | 1.07 | 0.60 | 0.09 |
| 146 | 50.4 | 1.27 | 3.16 | 5.62 | 3.12 | 1.90 | 1.55 | 0.95 | 0.65 | 0.09 |
| 147 | 50.5 | 1.45 | 2.99 | 6.41 | 2.91 | 1.84 | 1.53 | 0.93 | 0.60 | 0.09 |
| 148 | 52.3 | 1.29 | 3.03 | 5.22 | 3.12 | 2.41 | 1.69 | 1.10 | 0.87 | 0.10 |
| 149 | 52.4 | 0.77 | 3.52 | 5.18 | 2.92 | 2.29 | 1.63 | 1.07 | 0.82 | 0.10 |
| 150 | 52.5 | 0.80 | 1.77 | 3.79 | 1.56 | 1.49 | 0.85 | 0.61 | 0.42 | 0.10 |
| 151 | 52.6 | 2.70 | 3.04 | 8.77 | 3.72 | 1.83 | 1.38 | 0.85 | 0.61 | 0.14 |
| 152 | 52.7 | 0.82 | 4.25 | 8.90 | 3.46 | 2.20 | 1.50 | 0.99 | 0.70 | 0.14 |
| 153 | 52.8 | 1.86 | 5.69 | 14.82 | 7.78 | 1.75 | 1.09 | 0.79 | 0.51 | 0.13 |
| 154 | 52.9 | 2.30 | 2.63 | 8.61 | 4.10 | 1.99 | 1.47 | 0.90 | 0.64 | 0.15 |
| 155 | 53.0 | 1.77 | 2.61 | 8.00 | 2.92 | 2.11 | 1.42 | 0.93 | 0.67 | 0.11 |
| 156 | 53.1 | 1.16 | 3.04 | 5.23 | 3.14 | 2.33 | 1.67 | 1.03 | 0.78 | 0.10 |
| 157 | 53.2 | 2.06 | 3.23 | 9.02 | 3.92 | 2.52 | 1.57 | 1.33 | 0.62 | 0.11 |
| 158 | 53.3 | 1.22 | 3.47 | 5.34 | 3.61 | 2.33 | 1.58 | 1.05 | 0.79 | 0.11 |
| 159 | 53.4 | 2.12 | 3.12 | 7.83 | 5.37 | 2.64 | 1.68 | 1.22 | 0.80 | 0.14 |
| 160 | 53.5 | 3.25 | 2.69 | 10.85 | 4.70 | 1.83 | 1.25 | 0.80 | 0.58 | 0.12 |
| 161 | 53.6 | 2.14 | 3.35 | 8.82 | 3.86 | 2.14 | 1.58 | 1.02 | 0.65 | 0.12 |
| 162 | 53.7 | 1.72 | 3.42 | 9.97 | 3.33 | 2.11 | 1.53 | 1.04 | 0.66 | 0.11 |
| 163 | 53.8 | 1.78 | 4.22 | 11.49 | 3.92 | 1.82 | 1.71 | 0.89 | 0.59 | 0.12 |
| 164 | 53.9 | 3.43 | 3.13 | 9.53 | 4.84 | 1.90 | 1.96 | 0.96 | 0.63 | 0.12 |
| 165 | 54.0 | 3.53 | 2.97 | 10.88 | 5.31 | 1.86 | 1.29 | 0.82 | 0.61 | 0.12 |
| 166 | 54.1 | 3.92 | 2.63 | 13.69 | 5.79 | 1.74 | 1.37 | 0.77 | 0.56 | 0.13 |
| 167 | 54.2 | 2.28 | 3.80 | 9.72 | 4.21 | 1.87 | 1.74 | 0.90 | 0.61 | 0.11 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 168 | 54.3 | 2.51 | 3.42 | 9.46 | 4.06 | 1.78 | 1.49 | 0.83 | 0.57 | 0.11 |
| 169 | 54.4 | 3.31 | 2.92 | 11.32 | 4.55 | 1.61 | 1.25 | 0.75 | 0.52 | 0.11 |
| 170 | 54.5 | 3.17 | 2.87 | 10.23 | 4.21 | 1.57 | 1.42 | 0.74 | 0.54 | 0.11 |
| 171 | 54.6 | 2.37 | 2.85 | 8.64 | 4.18 | 1.77 | 1.44 | 0.82 | 0.58 | 0.11 |
| 172 | 54.7 | 2.70 | 2.97 | 9.63 | 4.61 | 1.67 | 1.48 | 0.78 | 0.61 | 0.11 |
| 173 | 54.8 | 2.66 | 2.93 | 9.66 | 4.43 | 1.74 | 1.44 | 0.79 | 0.59 | 0.12 |
| 174 | 54.9 | 3.03 | 3.30 | 11.86 | 5.14 | 1.41 | 1.57 | 0.70 | 0.48 | 0.11 |
| 175 | 55.0 | 3.20 | 2.36 | 12.62 | 4.51 | 1.34 | 1.33 | 0.71 | 0.44 | 0.11 |
| 176 | 55.1 | 2.99 | 2.26 | 12.69 | 4.23 | 1.26 | 1.31 | 0.66 | 0.38 | 0.11 |
| 177 | 55.2 | 3.22 | 3.00 | 13.30 | 5.39 | 1.37 | 1.58 | 0.74 | 0.40 | 0.13 |
| 178 | 55.3 | 3.24 | 3.02 | 12.68 | 5.79 | 1.23 | 1.90 | 0.74 | 0.44 | 0.12 |
| 179 | 55.4 | 3.07 | 3.00 | 12.91 | 4.42 | 1.47 | 1.55 | 0.74 | 0.56 | 0.12 |
| 180 | 55.6 | 3.18 | 3.07 | 13.05 | 4.76 | 1.46 | 1.68 | 0.76 | 0.53 | 0.11 |
| 181 | 55.7 | 2.99 | 2.52 | 11.43 | 3.60 | 1.54 | 1.16 | 0.71 | 0.50 | 0.13 |
| 182 | 55.8 | 3.18 | 1.96 | 12.60 | 3.17 | 1.47 | 0.93 | 0.66 | 0.50 | 0.11 |
| 183 | 55.9 | 3.13 | 2.31 | 11.47 | 3.70 | 1.56 | 1.19 | 0.68 | 0.54 | 0.16 |
| 184 | 56.0 | 3.02 | 2.44 | 11.53 | 3.64 | 1.59 | 1.23 | 0.75 | 0.48 | 0.12 |
| 185 | 56.1 | 3.29 | 2.37 | 12.36 | 3.59 | 1.46 | 1.24 | 0.68 | 0.49 | 0.13 |
| 186 | 56.2 | 2.92 | 2.32 | 10.24 | 3.54 | 1.68 | 1.31 | 0.82 | 0.52 | 0.11 |
| 187 | 56.3 | 2.70 | 2.44 | 7.83 | 3.31 | 1.59 | 1.40 | 0.77 | 0.60 | 0.14 |
| 188 | 56.4 | 3.20 | 0.97 | 7.96 | 2.98 | 1.58 | 1.28 | 0.78 | 0.57 | 0.10 |
| 189 | 56.5 | 4.00 | 0.78 | 12.73 | 2.21 | 1.18 | 0.76 | 0.54 | 0.42 | 0.11 |
| 190 | 56.6 | 4.29 | 0.82 | 14.48 | 2.05 | 1.06 | 0.60 | 0.51 | 0.33 | 0.09 |
| 191 | 56.7 | 3.15 | 1.84 | 10.16 | 2.85 | 1.47 | 1.04 | 0.68 | 0.55 | 0.11 |
| 192 | 56.8 | 2.04 | 2.44 | 7.47 | 2.67 | 1.68 | 1.16 | 0.78 | 0.61 | 0.14 |
| 193 | 56.9 | 2.61 | 2.24 | 9.20 | 3.76 | 2.09 | 1.34 | 1.00 | 0.66 | 0.19 |
| 194 | 57.0 | 3.36 | 1.68 | 7.69 | 2.78 | 1.13 | 0.77 | 0.46 | 0.41 | 0.10 |
| 195 | 57.1 | 2.51 | 2.38 | 7.58 | 3.35 | 1.61 | 1.00 | 0.68 | 0.55 | 0.16 |
| 196 | 57.2 | 2.13 | 2.12 | 6.27 | 3.13 | 1.80 | 1.04 | 0.83 | 0.62 | 0.14 |
| 197 | 57.3 | 2.61 | 2.98 | 7.97 | 3.11 | 1.63 | 0.96 | 0.68 | 0.55 | 0.16 |
| 198 | 57.4 | 1.71 | 2.09 | 6.08 | 2.04 | 1.80 | 1.13 | 0.79 | 0.63 | 0.13 |
| 199 | 57.5 | 2.51 | 2.03 | 8.09 | 2.77 | 1.84 | 1.17 | 0.86 | 0.63 | 0.18 |
| 200 | 57.6 | 2.90 | 2.18 | 9.20 | 2.71 | 1.30 | 1.09 | 0.49 | 0.51 | 0.16 |
| 201 | 57.7 | 2.69 | 2.43 | 9.35 | 2.27 | 1.23 | 1.17 | 0.51 | 0.56 | 0.12 |
| 202 | 57.8 | 2.74 | 2.23 | 8.65 | 2.57 | 1.34 | 1.19 | 0.51 | 0.56 | 0.19 |
| 203 | 57.9 | 4.62 | 1.51 | 12.42 | 4.24 | 0.99 | 0.66 | 0.40 | 0.37 | 0.11 |
| 204 | 58.0 | 4.56 | 1.48 | 10.97 | 4.23 | 0.94 | 0.70 | 0.33 | 0.41 | 0.14 |
| 205 | 58.1 | 2.91 | 1.95 | 8.54 | 2.75 | 1.33 | 0.95 | 0.51 | 0.50 | 0.14 |
| 206 | 58.2 | 2.61 | 1.67 | 7.84 | 2.23 | 1.31 | 0.97 | 0.45 | 0.50 | 0.22 |
| 207 | 58.3 | 2.88 | 2.00 | 8.38 | 2.62 | 1.47 | 1.07 | 0.58 | 0.59 | 0.22 |
| 208 | 58.4 | 5.00 | 1.19 | 10.15 | 4.43 | 1.19 | 0.92 | 0.44 | 0.50 | 0.19 |
| 209 | 58.5 | 3.75 | 0.94 | 8.63 | 2.73 | 1.36 | 0.85 | 0.45 | 0.54 | 0.19 |
| 210 | 58.6 | 3.49 | 0.54 | 7.09 | 2.33 | 1.42 | 0.94 | 0.50 | 0.58 | 0.21 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 211 | 58.7 | 3.82 | 0.41 | 7.22 | 2.58 | 1.39 | 0.97 | 0.50 | 0.61 | 0.20 |
| 212 | 58.8 | 2.37 | 1.77 | 6.40 | 2.55 | 1.70 | 0.99 | 0.72 | 0.66 | 0.19 |
| 213 | 58.9 | 4.09 | 1.47 | 8.51 | 3.75 | 1.49 | 0.89 | 0.49 | 0.56 | 0.20 |
| 214 | 59.0 | 2.32 | 1.90 | 6.75 | 2.04 | 1.40 | 0.86 | 0.48 | 0.60 | 0.19 |
| 215 | 59.1 | 2.83 | 2.13 | 7.70 | 2.62 | 1.46 | 0.87 | 0.49 | 0.61 | 0.21 |
| 216 | 59.2 | 2.51 | 1.88 | 6.23 | 2.39 | 1.44 | 0.96 | 0.46 | 0.56 | 0.25 |
| 217 | 59.3 | 2.54 | 1.70 | 7.17 | 2.46 | 1.54 | 0.89 | 0.50 | 0.60 | 0.25 |
| 218 | 59.4 | 2.33 | 1.38 | 6.63 | 2.34 | 1.54 | 0.82 | 0.49 | 0.60 | 0.30 |
| 219 | 59.5 | 3.27 | 1.61 | 8.84 | 3.22 | 1.43 | 0.91 | 0.48 | 0.59 | 0.21 |
| 220 | 59.6 | 3.23 | 1.29 | 8.90 | 2.89 | 1.44 | 0.95 | 0.52 | 0.59 | 0.19 |
| 221 | 59.7 | 3.46 | 1.30 | 9.52 | 3.04 | 1.36 | 0.97 | 0.50 | 0.55 | 0.18 |
| 222 | 59.8 | 4.43 | 1.12 | 9.41 | 3.14 | 1.56 | 0.96 | 0.66 | 0.58 | 0.17 |
| 223 | 59.9 | 2.50 | 1.50 | 8.84 | 1.15 | 1.22 | 0.88 | 0.45 | 0.49 | 0.20 |
| 224 | 60.0 | 1.94 | 1.05 | 7.23 | 0.69 | 1.22 | 0.82 | 0.41 | 0.47 | 0.22 |
| 225 | 60.1 | 2.06 | 1.78 | 7.80 | 0.86 | 1.44 | 0.84 | 0.49 | 0.56 | 0.24 |
| 226 | 60.2 | 2.32 | 1.68 | 9.17 | 0.83 | 1.51 | 0.94 | 0.49 | 0.55 | 0.27 |
| 227 | 60.3 | 1.85 | 1.33 | 6.89 | 0.59 | 1.27 | 0.85 | 0.43 | 0.50 | 0.22 |
| 228 | 60.4 | 1.50 | 1.40 | 6.00 | 0.62 | 1.41 | 0.88 | 0.48 | 0.60 | 0.25 |
| 229 | 60.5 | 1.55 | 1.39 | 6.11 | 0.71 | 1.65 | 0.81 | 0.51 | 0.60 | 0.30 |
| 230 | 60.6 | 1.61 | 1.20 | 6.33 | 0.77 | 1.71 | 0.84 | 0.58 | 0.68 | 0.30 |
| 231 | 60.7 | 1.38 | 1.73 | 7.41 | 0.98 | 1.81 | 0.91 | 0.65 | 0.68 | 0.31 |
| 232 | 60.8 | 2.22 | 2.37 | 8.76 | 1.42 | 1.52 | 1.03 | 0.60 | 0.68 | 0.17 |
| 233 | 60.9 | 2.27 | 2.49 | 7.45 | 1.61 | 1.41 | 1.18 | 0.61 | 0.67 | 0.16 |
| 234 | 61.0 | 2.15 | 1.91 | 8.09 | 1.75 | 1.60 | 1.21 | 0.68 | 0.69 | 0.15 |
| 235 | 61.1 | 2.60 | 1.45 | 7.86 | 1.69 | 1.52 | 1.14 | 0.62 | 0.66 | 0.14 |
| 236 | 61.2 | 1.95 | 2.12 | 7.70 | 1.65 | 1.28 | 1.09 | 0.57 | 0.63 | 0.11 |
| 237 | 61.3 | 2.11 | 2.33 | 8.07 | 1.96 | 1.44 | 1.25 | 0.61 | 0.66 | 0.14 |
| 238 | 61.4 | 2.07 | 2.24 | 7.80 | 2.43 | 1.85 | 1.32 | 0.89 | 0.68 | 0.15 |
| 239 | 61.5 | 2.05 | 1.97 | 7.95 | 1.84 | 1.63 | 1.38 | 0.67 | 0.70 | 0.18 |
| 240 | 61.6 | 1.72 | 2.22 | 7.44 | 1.71 | 1.43 | 1.31 | 0.62 | 0.67 | 0.12 |
| 241 | 61.7 | 1.34 | 2.79 | 6.46 | 1.68 | 1.57 | 1.30 | 0.60 | 0.66 | 0.14 |
| 242 | 61.8 | 1.45 | 2.48 | 5.43 | 1.54 | 1.64 | 1.27 | 0.63 | 0.65 | 0.19 |
| 243 | 61.9 | 1.42 | 2.66 | 6.32 | 1.63 | 1.33 | 1.33 | 0.60 | 0.61 | 0.11 |
| 244 | 62.0 | 1.83 | 2.37 | 7.32 | 1.55 | 1.50 | 1.20 | 0.62 | 0.69 | 0.12 |
| 245 | 62.1 | 1.80 | 2.17 | 7.11 | 1.49 | 1.59 | 1.25 | 0.63 | 0.72 | 0.14 |
| 246 | 62.2 | 1.88 | 2.13 | 7.53 | 1.43 | 1.46 | 1.22 | 0.60 | 0.67 | 0.12 |
| 247 | 62.3 | 2.34 | 1.87 | 8.17 | 1.32 | 1.34 | 1.14 | 0.54 | 0.56 | 0.15 |
| 248 | 62.4 | 0.49 | 1.99 | 2.07 | 1.25 | 1.79 | 1.19 | 0.79 | 0.69 | 0.15 |
| 249 | 62.5 | 9.68 | 0.22 | 16.63 | 10.43 | 0.92 | 0.52 | 0.32 | 0.22 | 0.12 |
| 250 | 62.6 | 2.36 | 0.16 | 1.75 | 1.66 | 1.49 | 1.20 | 0.64 | 0.69 | 0.13 |
| 251 | 62.8 | 2.60 | 1.49 | 8.90 | 1.05 | 1.54 | 1.07 | 0.67 | 0.54 | 0.19 |
| 252 | 63.0 | 2.48 | 2.04 | 8.53 | 1.62 | 2.04 | 1.10 | 1.01 | 0.65 | 0.19 |
| 253 | 63.1 | 2.60 | 1.84 | 8.08 | 1.84 | 1.84 | 1.25 | 0.82 | 0.66 | 0.17 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 254 | 63.2 | 2.48 | 2.74 | 9.88 | 2.40 | 1.82 | 1.24 | 0.97 | 0.57 | 0.12 |
| 255 | 63.3 | 2.36 | 2.68 | 10.89 | 2.10 | 1.62 | 1.10 | 0.83 | 0.53 | 0.17 |
| 256 | 63.4 | 2.87 | 2.12 | 10.31 | 1.99 | 1.58 | 1.07 | 0.77 | 0.54 | 0.15 |
| 257 | 63.5 | 2.69 | 2.26 | 9.86 | 2.39 | 1.85 | 1.15 | 0.99 | 0.54 | 0.13 |
| 258 | 63.6 | 3.29 | 1.72 | 10.13 | 2.30 | 1.64 | 1.09 | 0.82 | 0.55 | 0.14 |
| 259 | 63.7 | 3.13 | 2.02 | 10.67 | 2.05 | 1.46 | 1.01 | 0.72 | 0.45 | 0.14 |
| 260 | 63.8 | 3.46 | 1.90 | 12.96 | 1.74 | 1.42 | 0.91 | 0.69 | 0.47 | 0.17 |
| 261 | 63.9 | 3.53 | 1.52 | 8.30 | 1.74 | 1.93 | 1.11 | 1.00 | 0.57 | 0.18 |
| 262 | 64.0 | 3.50 | 2.23 | 10.05 | 0.95 | 1.10 | 0.88 | 0.43 | 0.34 | 0.12 |
| 263 | 64.1 | 2.08 | 3.25 | 10.16 | 0.80 | 1.28 | 1.20 | 0.53 | 0.38 | 0.16 |
| 264 | 64.2 | 2.31 | 2.35 | 9.48 | 0.63 | 1.20 | 1.17 | 0.44 | 0.36 | 0.17 |
| 265 | 64.3 | 1.01 | 3.01 | 7.91 | 0.63 | 1.39 | 1.11 | 0.53 | 0.40 | 0.16 |
| 266 | 64.4 | 1.26 | 2.74 | 7.42 | 0.67 | 1.39 | 1.05 | 0.55 | 0.42 | 0.15 |
| 267 | 64.5 | 1.71 | 2.64 | 8.55 | 0.82 | 1.57 | 1.04 | 0.66 | 0.43 | 0.18 |
| 268 | 64.6 | 1.34 | 2.69 | 8.76 | 0.84 | 1.62 | 1.05 | 0.68 | 0.42 | 0.19 |
| 269 | 64.7 | 2.02 | 2.04 | 8.43 | 0.73 | 1.52 | 1.02 | 0.60 | 0.43 | 0.17 |
| 270 | 64.8 | 1.68 | 2.17 | 7.84 | 0.77 | 1.56 | 1.11 | 0.64 | 0.45 | 0.18 |
| 271 | 64.9 | 1.63 | 2.13 | 7.82 | 0.83 | 1.73 | 1.09 | 0.73 | 0.47 | 0.20 |
| 272 | 65.0 | 1.51 | 1.65 | 7.32 | 0.82 | 1.63 | 1.04 | 0.71 | 0.47 | 0.19 |
| 273 | 65.1 | 1.93 | 1.61 | 8.29 | 0.83 | 1.69 | 1.06 | 0.66 | 0.48 | 0.22 |
| 274 | 65.2 | 2.47 | 1.37 | 10.03 | 1.22 | 1.69 | 0.99 | 0.85 | 0.51 | 0.22 |
| 275 | 65.3 | 2.76 | 2.79 | 13.50 | 2.25 | 1.67 | 1.22 | 0.81 | 0.53 | 0.11 |
| 276 | 65.4 | 1.86 | 2.95 | 7.75 | 2.95 | 1.85 | 1.68 | 0.92 | 0.61 | 0.11 |
| 277 | 65.5 | 1.69 | 2.81 | 6.84 | 2.77 | 2.02 | 1.56 | 1.00 | 0.62 | 0.12 |
| 278 | 65.6 | 2.03 | 2.74 | 8.08 | 2.67 | 1.88 | 1.57 | 0.95 | 0.63 | 0.11 |
| 279 | 65.7 | 1.26 | 3.36 | 6.15 | 3.46 | 1.93 | 2.13 | 1.02 | 0.65 | 0.10 |
| 280 | 65.8 | 2.12 | 2.85 | 8.31 | 3.00 | 1.81 | 1.84 | 0.93 | 0.59 | 0.10 |
| 281 | 65.9 | 1.25 | 2.69 | 5.44 | 3.30 | 2.25 | 1.81 | 1.19 | 0.76 | 0.10 |
| 282 | 66.0 | 1.31 | 2.66 | 5.27 | 3.13 | 2.36 | 1.83 | 1.15 | 0.76 | 0.11 |
| 283 | 66.1 | 1.14 | 1.63 | 6.03 | 2.79 | 2.72 | 1.61 | 1.32 | 0.85 | 0.12 |
| 284 | 66.2 | 1.80 | 2.31 | 7.90 | 3.60 | 2.82 | 1.76 | 1.57 | 0.83 | 0.11 |
| 285 | 66.3 | 1.56 | 2.61 | 7.54 | 3.53 | 2.46 | 1.80 | 1.30 | 0.81 | 0.11 |
| 286 | 66.4 | 1.68 | 2.38 | 7.15 | 3.68 | 2.37 | 1.85 | 1.25 | 0.80 | 0.10 |
| 287 | 66.5 | 1.85 | 2.09 | 7.26 | 3.83 | 2.78 | 1.79 | 1.60 | 0.82 | 0.11 |
| 288 | 66.6 | 2.03 | 2.11 | 7.54 | 3.45 | 2.33 | 1.81 | 1.19 | 0.74 | 0.10 |
| 289 | 66.7 | 1.55 | 2.49 | 7.62 | 3.36 | 2.39 | 1.70 | 1.21 | 0.76 | 0.10 |
| 290 | 66.8 | 1.93 | 2.15 | 7.75 | 3.36 | 2.23 | 1.63 | 1.12 | 0.74 | 0.10 |
| 291 | 66.9 | 6.05 | 1.38 | 21.72 | 6.02 | 0.85 | 0.80 | 0.56 | 0.22 | 0.10 |
| 292 | 67.0 | 4.36 | 4.19 | 23.76 | 6.29 | 0.80 | 0.87 | 0.52 | 0.23 | 0.10 |
| 293 | 67.1 | 4.00 | 3.08 | 12.14 | 7.20 | 1.65 | 1.04 | 0.80 | 0.47 | 0.10 |
| 294 | 67.2 | 3.26 | 3.60 | 11.35 | 7.33 | 1.90 | 1.18 | 0.98 | 0.53 | 0.10 |
| 295 | 67.3 | 2.98 | 2.37 | 8.42 | 5.09 | 1.96 | 1.29 | 0.96 | 0.58 | 0.10 |
| 296 | 67.4 | 4.62 | 1.51 | 12.98 | 5.81 | 1.59 | 1.39 | 0.89 | 0.47 | 0.09 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 297 | 67.5 | 2.41 | 2.55 | 13.08 | 3.34 | 1.87 | 1.40 | 1.03 | 0.55 | 0.10 |
| 298 | 67.6 | 1.29 | 3.01 | 11.24 | 3.06 | 1.92 | 1.28 | 0.98 | 0.60 | 0.09 |
| 299 | 67.7 | 2.05 | 1.20 | 10.08 | 2.79 | 2.11 | 0.96 | 1.09 | 0.65 | 0.09 |
| 300 | 67.8 | 2.01 | 1.19 | 9.95 | 2.29 | 1.99 | 0.79 | 0.96 | 0.63 | 0.09 |
| 301 | 67.9 | 2.22 | 1.73 | 11.18 | 2.36 | 1.74 | 0.99 | 0.81 | 0.58 | 0.11 |
| 302 | 68.0 | 2.18 | 1.08 | 9.63 | 2.39 | 1.82 | 0.92 | 0.86 | 0.61 | 0.10 |
| 303 | 68.1 | 2.03 | 1.15 | 8.87 | 2.39 | 1.70 | 0.97 | 0.83 | 0.59 | 0.10 |
| 304 | 68.2 | 1.83 | 0.96 | 8.08 | 2.36 | 1.89 | 0.84 | 0.89 | 0.57 | 0.10 |
| 305 | 68.3 | 1.30 | 0.95 | 6.82 | 1.85 | 2.01 | 0.83 | 0.88 | 0.73 | 0.11 |
| 306 | 68.4 | 1.50 | 0.74 | 7.51 | 1.68 | 1.93 | 0.77 | 0.86 | 0.65 | 0.12 |
| 307 | 68.5 | 1.66 | 0.85 | 8.48 | 1.74 | 1.93 | 0.80 | 0.89 | 0.68 | 0.11 |
| 308 | 68.6 | 1.94 | 0.63 | 8.78 | 1.66 | 1.78 | 0.74 | 0.79 | 0.63 | 0.11 |
| 309 | 68.7 | 1.79 | 0.76 | 9.07 | 1.73 | 1.85 | 0.82 | 0.83 | 0.64 | 0.12 |
| 310 | 68.8 | 2.80 | <0.01 | 9.47 | 1.92 | 1.82 | 0.82 | 0.86 | 0.61 | 0.11 |
| 311 | 68.9 | 1.85 | 0.89 | 9.43 | 2.01 | 1.90 | 0.86 | 0.90 | 0.71 | 0.13 |
| 312 | 69.0 | 1.75 | 0.81 | 9.03 | 1.68 | 1.74 | 0.75 | 0.82 | 0.64 | 0.12 |
| 313 | 69.1 | 1.89 | 0.70 | 8.80 | 1.82 | 1.90 | 0.81 | 0.92 | 0.73 | 0.13 |
| 314 | 69.2 | 1.68 | 0.87 | 7.61 | 2.31 | 1.91 | 0.81 | 0.92 | 0.66 | 0.13 |
| 315 | 69.3 | 3.08 | 0.81 | 9.05 | 4.12 | 1.84 | 0.75 | 0.85 | 0.63 | 0.18 |
| 316 | 69.4 | 2.00 | 0.81 | 9.50 | 1.83 | 1.52 | 0.71 | 0.71 | 0.56 | 0.11 |
| 317 | 69.5 | 2.24 | 0.63 | 8.61 | 2.53 | 1.61 | 0.73 | 0.86 | 0.56 | 0.11 |
| 318 | 69.6 | 1.74 | 0.73 | 7.74 | 2.31 | 1.60 | 0.83 | 0.85 | 0.64 | 0.12 |
| 319 | 69.7 | 1.60 | 0.55 | 6.98 | 1.76 | 1.39 | 0.64 | 0.71 | 0.53 | 0.10 |
| 320 | 69.8 | 1.93 | 0.90 | 6.85 | 1.76 | 1.40 | 0.64 | 0.72 | 0.50 | 0.10 |
| 321 | 69.9 | 2.04 | 0.95 | 8.19 | 2.60 | 1.86 | 0.88 | 0.88 | 0.61 | 0.10 |
| 322 | 70.0 | 1.97 | 1.54 | 7.68 | 2.74 | 2.11 | 1.10 | 0.95 | 0.67 | 0.14 |
| 323 | 70.1 | 1.44 | 2.13 | 7.99 | 2.51 | 2.13 | 1.28 | 0.95 | 0.68 | 0.17 |
| 324 | 70.2 | 2.12 | 2.08 | 8.76 | 2.77 | 2.02 | 1.27 | 0.95 | 0.67 | 0.16 |
| 325 | 70.3 | 2.38 | 1.91 | 10.09 | 2.89 | 2.17 | 1.14 | 1.07 | 0.66 | 0.13 |
| 326 | 70.4 | 2.87 | 1.75 | 10.95 | 3.07 | 1.76 | 1.12 | 0.89 | 0.55 | 0.11 |
| 327 | 70.5 | 2.89 | 1.55 | 9.88 | 3.31 | 1.91 | 1.16 | 0.98 | 0.66 | 0.11 |
| 328 | 70.6 | 1.88 | 1.93 | 8.12 | 3.50 | 2.02 | 1.20 | 0.99 | 0.59 | 0.11 |
| 329 | 70.7 | 2.66 | 2.13 | 10.29 | 3.41 | 2.11 | 1.20 | 1.03 | 0.61 | 0.16 |
| 330 | 70.8 | 1.42 | 1.75 | 6.96 | 2.42 | 2.14 | 1.09 | 1.04 | 0.71 | 0.12 |
| 331 | 70.9 | 2.11 | 2.01 | 8.32 | 2.71 | 2.39 | 1.27 | 1.12 | 0.73 | 0.18 |
| 332 | 71.0 | 2.33 | 1.76 | 9.88 | 2.45 | 2.23 | 1.07 | 1.03 | 0.69 | 0.20 |
| 333 | 71.1 | 1.86 | 1.13 | 7.40 | 2.57 | 2.41 | 0.98 | 1.17 | 0.80 | 0.19 |
| 334 | 71.2 | 1.33 | 1.03 | 5.99 | 2.03 | 2.00 | 0.87 | 0.93 | 0.71 | 0.13 |
| 335 | 71.3 | 1.53 | 0.91 | 6.35 | 2.24 | 2.32 | 0.92 | 1.12 | 0.78 | 0.15 |
| 336 | 71.4 | 1.92 | 1.07 | 7.75 | 2.59 | 1.91 | 0.90 | 0.90 | 0.65 | 0.17 |
| 337 | 71.5 | 2.41 | 1.79 | 7.65 | 2.55 | 1.91 | 0.89 | 0.91 | 0.64 | 0.13 |
| 338 | 71.6 | 1.71 | 1.51 | 7.63 | 2.56 | 2.06 | 0.92 | 1.00 | 0.71 | 0.16 |
| 339 | 71.7 | 2.18 | 1.96 | 9.09 | 2.54 | 2.16 | 1.15 | 1.01 | 0.69 | 0.19 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 340 | 71.8 | 2.14 | 1.65 | 8.43 | 2.53 | 2.18 | 1.07 | 1.03 | 0.70 | 0.15 |
| 341 | 71.9 | 1.59 | 1.90 | 7.58 | 2.62 | 2.21 | 1.10 | 1.02 | 0.65 | 0.17 |
| 342 | 72.0 | 1.90 | 1.81 | 7.57 | 2.55 | 2.24 | 1.10 | 0.99 | 0.69 | 0.21 |
| 343 | 72.1 | 1.91 | 1.60 | 7.80 | 2.57 | 2.24 | 1.10 | 1.03 | 0.69 | 0.15 |
| 344 | 72.2 | 2.47 | 1.68 | 9.04 | 2.59 | 2.15 | 1.25 | 0.94 | 0.66 | 0.25 |
| 345 | 72.3 | 2.14 | 1.52 | 8.63 | 2.39 | 2.26 | 1.10 | 1.05 | 0.67 | 0.22 |
| 346 | 72.4 | 1.92 | 1.62 | 7.81 | 2.26 | 2.18 | 1.11 | 0.99 | 0.68 | 0.22 |
| 347 | 72.5 | 1.81 | 1.92 | 7.51 | 2.12 | 2.25 | 1.11 | 1.00 | 0.74 | 0.27 |
| 348 | 72.6 | 1.98 | 1.80 | 8.09 | 2.15 | 2.15 | 1.11 | 1.03 | 0.67 | 0.15 |
| 349 | 72.7 | 1.40 | 2.53 | 7.79 | 1.74 | 2.19 | 1.05 | 0.97 | 0.69 | 0.23 |
| 350 | 72.8 | 1.80 | 2.06 | 7.49 | 1.68 | 2.27 | 1.02 | 1.01 | 0.68 | 0.19 |
| 351 | 72.9 | 2.13 | 1.62 | 8.10 | 2.15 | 2.23 | 1.07 | 0.93 | 0.67 | 0.26 |
| 352 | 73.0 | 1.93 | 1.58 | 7.73 | 2.45 | 2.22 | 1.09 | 0.91 | 0.61 | 0.21 |
| 353 | 73.1 | 1.71 | 1.49 | 6.86 | 1.97 | 2.36 | 1.17 | 0.98 | 0.73 | 0.26 |
| 354 | 73.2 | 2.19 | 1.41 | 7.99 | 2.23 | 2.37 | 1.24 | 1.01 | 0.67 | 0.26 |
| 355 | 73.6 | 2.03 | 1.87 | 8.77 | 2.05 | 2.24 | 1.21 | 0.87 | 0.63 | 0.27 |
| 356 | 73.7 | 2.22 | 1.60 | 8.25 | 2.16 | 2.29 | 1.19 | 0.90 | 0.67 | 0.31 |
| 357 | 73.8 | 1.98 | 1.18 | 7.81 | 1.54 | 2.23 | 1.02 | 0.94 | 0.67 | 0.24 |
| 358 | 73.9 | 2.37 | 1.73 | 8.19 | 2.82 | 2.25 | 1.04 | 0.93 | 0.64 | 0.36 |
| 359 | 74.0 | 5.33 | 1.47 | 13.59 | 5.61 | 2.06 | 0.88 | 0.86 | 0.50 | 0.25 |
| 360 | 74.1 | 3.58 | 1.79 | 10.73 | 4.08 | 2.16 | 0.99 | 0.93 | 0.58 | 0.26 |
| 361 | 74.2 | 2.16 | 3.12 | 7.27 | 0.91 | 1.48 | 0.83 | 0.52 | 0.52 | 0.18 |
| 362 | 74.3 | 1.72 | 2.25 | 7.34 | 1.06 | 2.11 | 1.03 | 0.87 | 0.66 | 0.32 |
| 363 | 74.4 | 0.90 | 2.62 | 4.23 | 1.78 | 2.27 | 1.00 | 0.95 | 0.68 | 0.19 |
| 364 | 74.5 | 5.47 | 2.33 | 15.79 | 5.34 | 1.48 | 0.92 | 0.64 | 0.39 | 0.24 |
| 365 | 74.6 | 2.33 | 2.45 | 9.10 | 0.75 | 1.81 | 1.20 | 0.85 | 0.56 | 0.32 |
| 366 | 74.7 | 2.72 | 2.19 | 8.90 | 0.55 | 1.37 | 1.04 | 0.51 | 0.48 | 0.27 |
| 367 | 74.8 | 2.92 | 1.95 | 12.80 | 1.28 | 2.18 | 1.43 | 1.09 | 0.59 | 0.32 |
| 368 | 74.9 | 3.09 | 1.30 | 11.12 | 1.03 | 1.62 | 1.00 | 0.79 | 0.50 | 0.14 |
| 369 | 75.0 | 2.70 | 1.08 | 11.00 | 0.80 | 1.50 | 1.02 | 0.77 | 0.46 | 0.28 |
| 370 | 75.1 | 0.04 | 0.65 | 0.93 | 0.65 | 2.40 | 0.90 | 0.84 | 0.55 | 0.12 |
| 371 | 75.2 | <0.01 | 0.60 | 0.35 | 0.64 | 2.49 | 0.85 | 0.85 | 0.59 | 0.11 |
| 372 | 75.3 | <0.01 | 0.44 | 0.30 | 0.65 | 2.26 | 0.91 | 0.88 | 0.62 | 0.13 |
| 373 | 75.4 | <0.01 | 0.51 | 0.34 | 0.74 | 2.57 | 1.02 | 1.09 | 0.65 | 0.18 |
| 374 | 75.5 | <0.01 | 0.49 | 0.34 | 0.65 | 2.56 | 0.92 | 0.86 | 0.57 | 0.16 |
| 375 | 75.6 | 0.01 | 0.43 | 0.38 | 0.72 | 2.34 | 1.07 | 0.93 | 0.68 | 0.39 |
| 376 | 75.7 | <0.01 | 0.39 | 0.36 | 0.72 | 2.36 | 1.06 | 0.94 | 0.73 | 0.44 |
| 377 | 75.8 | 0.02 | 0.37 | 0.40 | 0.89 | 2.67 | 0.96 | 1.18 | 0.83 | 0.35 |
| 378 | 75.9 | 0.01 | 0.44 | 0.41 | 0.80 | 2.43 | 0.99 | 1.03 | 0.74 | 0.42 |
| 379 | 76.0 | 0.01 | 0.38 | 0.38 | 0.79 | 2.49 | 0.92 | 1.08 | 0.81 | 0.56 |
| 380 | 76.1 | 0.01 | 0.41 | 0.42 | 0.84 | 2.73 | 1.03 | 1.20 | 0.74 | 0.51 |
| 381 | 76.2 | 0.02 | 0.48 | 0.47 | 0.87 | 2.63 | 0.97 | 1.23 | 0.78 | 0.38 |
| 382 | 76.3 | 0.05 | 0.25 | 0.47 | 1.20 | 3.05 | 1.02 | 1.62 | 1.05 | 0.60 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 383 | 76.4 | 0.05 | 0.26 | 0.69 | 1.72 | 4.58 | 1.29 | 2.47 | 1.40 | 0.75 |
| 384 | 76.5 | 0.05 | 0.31 | 0.56 | 1.34 | 3.49 | 1.04 | 1.89 | 1.12 | 0.59 |
| 385 | 76.7 | 0.44 | 0.44 | 1.69 | 1.14 | 2.92 | 1.11 | 1.46 | 0.93 | 0.56 |
| 386 | 76.8 | 0.17 | 0.26 | 0.66 | 1.10 | 3.02 | 1.02 | 1.57 | 0.99 | 0.57 |
| 387 | 76.9 | 0.11 | 0.25 | 0.56 | 1.19 | 3.15 | 1.04 | 1.68 | 1.08 | 0.55 |
| 388 | 77.0 | 0.08 | 0.27 | 0.54 | 1.19 | 3.22 | 1.00 | 1.71 | 1.07 | 0.56 |
| 389 | 77.1 | 0.11 | 0.23 | 0.56 | 1.20 | 3.23 | 1.07 | 1.73 | 1.07 | 0.61 |
| 390 | 77.2 | 0.06 | 0.21 | 0.50 | 1.20 | 3.10 | 1.01 | 1.68 | 1.14 | 0.48 |
| 391 | 77.3 | 0.34 | 0.22 | 1.00 | 1.38 | 4.25 | 1.04 | 1.93 | 1.11 | 0.65 |
| 392 | 77.4 | 0.08 | 0.19 | 0.57 | 1.37 | 3.48 | 1.02 | 1.95 | 1.14 | 0.60 |
| 393 | 77.5 | 0.12 | 0.23 | 0.69 | 1.48 | 3.90 | 1.09 | 2.18 | 1.13 | 0.52 |
| 394 | 77.6 | 0.06 | 0.15 | 0.55 | 1.43 | 3.53 | 1.08 | 1.97 | 1.27 | 0.64 |
| 395 | 77.7 | 0.07 | 0.16 | 0.53 | 1.40 | 3.49 | 1.08 | 1.95 | 1.24 | 0.61 |
| 396 | 77.8 | 0.05 | 0.21 | 0.52 | 1.44 | 3.57 | 1.07 | 1.99 | 1.23 | 0.55 |
| 397 | 77.9 | 0.07 | 0.25 | 0.54 | 1.39 | 3.47 | 1.05 | 1.92 | 1.19 | 0.60 |
| 398 | 78.0 | 0.20 | 0.24 | 0.79 | 1.46 | 3.99 | 1.10 | 2.05 | 1.20 | 0.58 |
| 399 | 78.1 | 0.16 | 0.30 | 0.73 | 1.32 | 3.74 | 1.12 | 1.86 | 1.12 | 0.70 |
| 400 | 78.2 | 0.04 | 0.19 | 0.48 | 1.43 | 3.49 | 1.03 | 2.01 | 1.25 | 0.60 |
| 401 | 78.3 | 0.04 | 0.18 | 0.43 | 1.22 | 2.96 | 1.00 | 1.64 | 1.16 | 0.53 |
| 402 | 78.4 | 0.05 | 0.17 | 0.47 | 1.27 | 3.14 | 1.00 | 1.71 | 1.20 | 0.66 |
| 403 | 78.5 | 0.11 | 0.18 | 0.63 | 1.30 | 3.25 | 1.05 | 1.76 | 1.14 | 0.60 |
| 404 | 78.6 | 0.09 | 0.19 | 0.65 | 1.31 | 3.21 | 1.03 | 1.76 | 1.17 | 0.63 |
| 405 | 78.7 | 0.11 | 0.21 | 0.66 | 1.23 | 2.98 | 0.97 | 1.62 | 1.15 | 0.48 |
| 406 | 78.8 | 0.19 | 0.19 | 0.86 | 1.28 | 3.35 | 0.99 | 1.72 | 1.19 | 0.66 |
| 407 | 78.9 | 0.12 | 0.24 | 0.95 | 1.25 | 3.05 | 1.00 | 1.70 | 1.16 | 0.61 |
| 408 | 79.0 | 0.07 | 0.25 | 0.54 | 1.24 | 2.96 | 1.08 | 1.71 | 1.16 | 0.67 |
| 409 | 79.1 | 0.10 | 0.22 | 0.57 | 1.26 | 3.16 | 1.13 | 1.69 | 1.18 | 0.72 |
| 410 | 79.2 | 0.13 | 0.22 | 0.63 | 1.33 | 3.38 | 1.11 | 1.79 | 1.21 | 0.75 |
| 411 | 79.3 | 0.08 | 0.20 | 0.55 | 1.25 | 3.01 | 1.13 | 1.64 | 1.19 | 0.57 |
| 412 | 79.4 | 0.04 | 0.86 | 0.47 | 1.24 | 3.00 | 1.07 | 1.69 | 1.21 | 0.69 |
| 413 | 79.5 | 0.06 | 0.24 | 0.45 | 1.06 | 2.71 | 1.09 | 1.49 | 1.00 | 0.55 |
| 414 | 79.6 | 0.09 | 0.29 | 0.47 | 1.00 | 2.69 | 1.12 | 1.36 | 0.95 | 0.44 |
| 415 | 79.7 | 0.10 | 0.22 | 0.64 | 1.30 | 3.13 | 1.00 | 1.70 | 1.19 | 0.55 |
| 416 | 79.8 | 0.03 | 0.15 | 0.44 | 1.17 | 2.77 | 0.99 | 1.63 | 1.10 | 0.69 |
| 417 | 79.9 | 0.08 | 0.24 | 0.66 | 1.25 | 3.14 | 0.91 | 1.70 | 1.14 | 0.65 |
| 418 | 80.0 | 0.12 | 0.14 | 0.72 | 1.10 | 2.73 | 0.84 | 1.49 | 0.99 | 0.67 |
| 419 | 80.1 | 0.10 | 0.14 | 0.60 | 1.18 | 2.84 | 1.00 | 1.61 | 1.08 | 0.67 |
| 420 | 80.2 | 0.15 | 0.21 | 0.66 | 1.22 | 2.98 | 1.00 | 1.67 | 1.09 | 0.61 |
| 421 | 80.3 | 0.24 | 0.15 | 0.85 | 1.29 | 3.26 | 0.99 | 1.76 | 1.14 | 0.69 |
| 422 | 80.4 | 0.11 | 0.15 | 0.65 | 1.32 | 3.18 | 0.95 | 1.77 | 1.23 | 0.68 |
| 423 | 80.5 | 0.05 | 0.15 | 0.50 | 1.28 | 2.98 | 0.99 | 1.71 | 1.14 | 0.66 |
| 424 | 80.6 | 0.04 | 0.15 | 0.45 | 1.24 | 2.88 | 0.97 | 1.69 | 1.13 | 0.64 |
| 425 | 80.7 | 0.05 | 0.15 | 0.43 | 1.21 | 2.79 | 1.00 | 1.60 | 1.15 | 0.50 |

Table 1 cont.

| sample | depth | TIC | TOC | Ca | Mg | Fe | Na | Al | K | Si |
|---|---|---|---|---|---|---|---|---|---|---|
| 426 | 80.8 | 0.05 | 0.15 | 0.46 | 1.18 | 2.74 | 1.00 | 1.61 | 1.11 | 0.52 |
| 427 | 80.9 | 0.08 | 0.21 | 0.67 | 1.22 | 2.97 | 1.00 | 1.67 | 1.11 | 0.52 |
| 428 | 81.0 | 0.05 | 0.15 | 0.41 | 1.19 | 2.74 | 0.98 | 1.61 | 1.10 | 0.49 |
| 429 | 81.1 | 0.08 | 0.11 | 0.43 | 1.16 | 2.68 | 1.08 | 1.62 | 1.06 | 0.54 |
| 430 | 81.2 | 0.13 | 0.18 | 0.66 | 1.18 | 2.81 | 1.08 | 1.59 | 1.05 | 0.53 |
| 431 | 81.3 | 0.29 | 0.04 | 0.78 | 1.27 | 3.09 | 1.11 | 1.75 | 1.13 | 0.54 |
| 432 | 81.4 | 0.11 | 0.50 | 1.35 | 1.18 | 2.97 | 1.06 | 1.59 | 1.07 | 0.50 |
| 433 | 81.5 | 0.02 | 0.40 | 1.15 | 1.23 | 3.01 | 0.95 | 1.63 | 1.10 | 0.56 |
| 434 | 81.6 | 0.30 | 0.16 | 1.16 | 1.20 | 2.86 | 0.97 | 1.55 | 1.07 | 0.51 |
| 435 | 81.7 | 0.25 | 0.15 | 1.08 | 1.14 | 2.60 | 1.01 | 1.50 | 1.00 | 0.58 |
| 436 | 81.8 | 0.22 | 0.14 | 1.03 | 0.85 | 2.01 | 0.74 | 1.17 | 0.70 | 0.62 |
| 437 | 81.9 | 0.31 | 0.22 | 1.33 | 1.32 | 3.15 | 1.07 | 1.75 | 1.14 | 0.57 |
| 438 | 82.0 | 0.36 | 0.23 | 1.42 | 1.29 | 3.17 | 1.07 | 1.69 | 1.13 | 0.61 |
| 439 | 82.1 | 0.17 | 0.20 | 0.82 | 1.28 | 2.97 | 1.01 | 1.78 | 1.10 | 0.63 |
| 440 | 82.2 | 0.14 | 0.19 | 0.80 | 1.33 | 3.10 | 1.04 | 1.79 | 1.17 | 0.60 |
| 441 | 82.3 | 0.23 | 0.19 | 0.95 | 1.35 | 3.22 | 1.06 | 1.81 | 1.14 | 0.58 |
| 442 | 82.4 | 0.26 | 0.22 | 1.12 | 1.29 | 3.02 | 1.12 | 1.71 | 1.13 | 0.53 |
| 443 | 82.5 | 0.15 | 0.19 | 0.78 | 1.41 | 3.24 | 1.14 | 1.88 | 1.22 | 0.57 |
| 444 | 82.6 | 0.23 | 0.21 | 1.02 | 1.33 | 3.13 | 1.15 | 1.80 | 1.17 | 0.54 |

Table 2

Analyses of high resolution (10-cm) samples from core OL-92 (83 to 32 m depth) for acid-leachable minor elements. Depth refers to midpoint of sample from the surface in meters. Concentrations in ppm.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.05 | 881 | 879 | 488 | 37 | 72 | 97 | 70 | 58 | 26 | 9 | 9 |
| 2 | 32.15 | 762 | 723 | 461 | 33 | 62 | 91 | 59 | 52 | 27 | 11 | 9 |
| 3 | 32.25 | 688 | 720 | 563 | 50 | 58 | 111 | 57 | 50 | 23 | 8 | 10 |
| 4 | 32.35 | 640 | 768 | 524 | 66 | 54 | 105 | 57 | 47 | 21 | 14 | 7 |
| 5 | 32.45 | 631 | 653 | 494 | 56 | 54 | 103 | 56 | 47 | 19 | 17 | 9 |
| 6 | 32.55 | 635 | 629 | 504 | 51 | 52 | 99 | 66 | 50 | 22 | 21 | 10 |
| 7 | 32.65 | 583 | 723 | 670 | 84 | 50 | 95 | 71 | 47 | 20 | 20 | 9 |
| 8 | 32.75 | 556 | 1144 | 982 | 133 | 51 | 100 | 89 | 42 | 20 | 17 | 9 |
| 9 | 32.85 | 663 | 1058 | 972 | 116 | 54 | 96 | 86 | 47 | 22 | 19 | 11 |
| 10 | 32.95 | 640 | 1023 | 733 | 82 | 53 | 108 | 78 | 47 | 19 | 21 | 6 |
| 11 | 33.05 | 745 | 885 | 686 | 69 | 59 | 102 | 58 | 49 | 24 | 17 | 5 |
| 12 | 33.15 | 769 | 769 | 538 | 47 | 63 | 91 | 54 | 48 | 22 | 12 | 14 |
| 13 | 33.25 | 717 | 763 | 448 | 33 | 64 | 81 | 58 | 48 | 24 | 11 | 7 |
| 14 | 33.35 | 780 | 738 | 499 | 35 | 65 | 88 | 68 | 51 | 24 | 9 | 8 |
| 15 | 33.45 | 786 | 659 | 483 | 30 | 65 | 86 | 85 | 50 | 27 | 3 | 11 |
| 16 | 33.55 | 733 | 721 | 476 | 31 | 66 | 91 | 85 | 45 | 24 | 7 | 13 |
| 17 | 33.65 | 967 | 661 | 614 | 42 | 69 | 90 | 102 | 54 | 26 | 5 | 13 |
| 18 | 33.75 | 763 | 766 | 697 | 50 | 67 | 75 | 98 | 45 | 24 | <0.01 | 12 |
| 19 | 33.85 | 797 | 780 | 580 | 36 | 66 | 88 | 95 | 48 | 25 | 7 | 10 |
| 20 | 34.75 | 798 | 660 | 647 | 35 | 67 | 83 | 90 | 47 | 24 | 2 | 14 |
| 21 | 34.85 | 762 | 706 | 643 | 32 | 66 | 83 | 91 | 45 | 26 | 7 | 11 |
| 22 | 34.95 | 793 | 654 | 794 | 45 | 67 | 76 | 106 | 40 | 25 | 8 | 11 |
| 23 | 35.05 | 832 | 638 | 796 | 45 | 68 | 74 | 109 | 45 | 24 | 3 | 14 |
| 24 | 35.15 | 944 | 647 | 796 | 42 | 71 | 82 | 111 | 49 | 25 | 4 | 16 |
| 25 | 35.25 | 921 | 657 | 804 | 51 | 73 | 83 | 107 | 47 | 25 | 3 | 11 |
| 26 | 35.35 | 840 | 566 | 790 | 55 | 71 | 78 | 111 | 42 | 24 | 1 | 12 |
| 27 | 35.45 | 828 | 593 | 696 | 45 | 71 | 77 | 108 | 41 | 24 | 4 | 9 |
| 28 | 35.55 | 886 | 659 | 689 | 53 | 76 | 86 | 109 | 45 | 26 | 2 | 16 |
| 29 | 35.65 | 830 | 595 | 589 | 53 | 70 | 78 | 105 | 42 | 26 | 2 | 8 |
| 30 | 35.75 | 842 | 559 | 547 | 51 | 73 | 79 | 103 | 43 | 23 | 6 | 12 |
| 31 | 35.85 | 876 | 534 | 591 | 69 | 74 | 80 | 109 | 44 | 24 | 2 | 12 |
| 32 | 35.95 | 760 | 693 | 756 | 113 | 68 | 89 | 113 | 38 | 20 | 1 | 9 |
| 33 | 36.05 | 701 | 2968 | 1170 | 207 | 65 | 103 | 110 | 40 | 19 | 11 | 8 |
| 34 | 36.15 | 695 | 5859 | 1536 | 312 | 66 | 99 | 169 | 41 | 20 | 4 | 9 |
| 35 | 36.25 | 842 | 2000 | 1350 | 241 | 71 | 98 | 129 | 46 | 23 | <0.01 | 11 |
| 36 | 36.35 | 892 | 3334 | 1107 | 261 | 72 | 88 | 159 | 45 | 21 | 3 | 11 |
| 37 | 36.45 | 938 | 2776 | 1035 | 244 | 71 | 80 | 132 | 44 | 20 | 4 | 13 |
| 38 | 36.55 | 1044 | 1225 | 825 | 231 | 85 | 93 | 134 | 49 | 25 | 3 | 10 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 36.65 | 839 | 989 | 715 | 218 | 80 | 82 | 141 | 44 | 20 | 5 | 12 |
| 40 | 36.75 | 1001 | 823 | 762 | 443 | 107 | 96 | 230 | 64 | 26 | 19 | 12 |
| 41 | 36.85 | 1011 | 897 | 774 | 450 | 110 | 102 | 182 | 67 | 27 | 26 | 10 |
| 42 | 36.95 | 1028 | 715 | 743 | 448 | 120 | 102 | 173 | 64 | 27 | 38 | 14 |
| 43 | 37.95 | 1077 | 424 | 709 | 581 | 238 | 139 | 161 | 67 | 29 | 16 | 15 |
| 44 | 38.05 | 993 | 486 | 722 | 698 | 247 | 153 | 169 | 61 | 27 | 20 | 13 |
| 45 | 38.15 | 996 | 410 | 614 | 730 | 283 | 177 | 175 | 61 | 25 | 24 | 15 |
| 46 | 38.25 | 1088 | 371 | 648 | 589 | 323 | 201 | 152 | 63 | 28 | 29 | 9 |
| 47 | 38.35 | 944 | 381 | 582 | 586 | 330 | 194 | 155 | 60 | 24 | 24 | 12 |
| 48 | 38.45 | 1033 | 385 | 650 | 585 | 341 | 199 | 162 | 61 | 27 | 27 | 13 |
| 49 | 38.55 | 973 | 398 | 648 | 494 | 347 | 200 | 246 | 62 | 23 | 24 | 12 |
| 50 | 38.65 | 932 | 442 | 607 | 543 | 295 | 186 | 281 | 62 | 24 | 20 | 9 |
| 51 | 38.75 | 1145 | 421 | 701 | 570 | 271 | 171 | 297 | 65 | 30 | 18 | 11 |
| 52 | 38.85 | 1153 | 397 | 700 | 501 | 262 | 178 | 270 | 64 | 32 | 20 | 11 |
| 53 | 38.95 | 1074 | 350 | 661 | 490 | 276 | 187 | 241 | 62 | 27 | 16 | 13 |
| 54 | 39.05 | 1207 | 425 | 734 | 535 | 313 | 198 | 242 | 69 | 32 | 17 | 16 |
| 55 | 39.15 | 1089 | 356 | 682 | 478 | 313 | 186 | 209 | 68 | 28 | 23 | 14 |
| 56 | 39.25 | 1181 | 317 | 679 | 297 | 338 | 196 | 155 | 71 | 29 | 20 | 11 |
| 57 | 39.35 | 1052 | 320 | 666 | 241 | 344 | 203 | 116 | 69 | 27 | 14 | 9 |
| 58 | 39.45 | 892 | 346 | 539 | 516 | 314 | 186 | 157 | 56 | 19 | 18 | 10 |
| 59 | 39.55 | 523 | 346 | 362 | 867 | 350 | 122 | 199 | 40 | 5 | 15 | 9 |
| 60 | 39.65 | 511 | 310 | 354 | 1056 | 374 | 115 | 218 | 35 | 2 | 9 | 4 |
| 61 | 39.75 | 614 | 365 | 461 | 991 | 304 | 108 | 227 | 36 | 5 | 13 | 7 |
| 62 | 39.90 | 1189 | 411 | 752 | 437 | 227 | 153 | 146 | 63 | 30 | 16 | 9 |
| 63 | 40.25 | 1125 | 467 | 797 | 406 | 199 | 142 | 124 | 62 | 30 | 11 | 13 |
| 64 | 40.35 | 876 | 540 | 789 | 405 | 218 | 161 | 111 | 61 | 27 | 16 | 10 |
| 65 | 40.45 | 685 | 379 | 490 | 553 | 410 | 181 | 107 | 60 | 9 | 23 | 8 |
| 66 | 40.55 | 524 | 274 | 438 | 510 | 492 | 223 | 87 | 58 | 11 | 28 | 6 |
| 67 | 40.65 | 433 | 292 | 326 | 677 | 410 | 189 | 115 | 44 | 7 | 28 | 4 |
| 68 | 40.75 | 444 | 361 | 422 | 659 | 330 | 178 | 118 | 49 | 6 | 31 | 6 |
| 69 | 40.85 | 371 | 450 | 414 | 636 | 292 | 172 | 113 | 44 | 4 | 30 | 5 |
| 70 | 40.95 | 492 | 449 | 508 | 646 | 298 | 187 | 114 | 51 | 8 | 29 | 7 |
| 71 | 41.03 | 636 | 375 | 546 | 580 | 337 | 191 | 112 | 58 | 7 | 29 | 7 |
| 72 | 41.09 | 494 | 550 | 330 | 408 | 280 | 136 | 101 | 37 | <0.01 | 14 | 7 |
| 73 | 41.16 | 502 | 528 | 477 | 498 | 218 | 117 | 88 | 57 | 5 | 19 | 8 |
| 74 | 41.25 | 467 | 697 | 415 | 282 | 170 | 94 | 68 | 37 | <0.01 | 23 | 6 |
| 75 | 41.35 | 510 | 564 | 566 | 169 | 188 | 123 | 57 | 37 | 9 | 31 | 8 |
| 76 | 41.45 | 656 | 497 | 621 | 451 | 241 | 150 | 105 | 51 | 7 | 24 | 6 |
| 77 | 41.55 | 521 | 518 | 584 | 763 | 258 | 193 | 253 | 54 | 15 | 39 | 7 |
| 78 | 41.65 | 528 | 523 | 603 | 642 | 244 | 175 | 217 | 54 | 16 | 35 | 8 |
| 79 | 41.75 | 526 | 614 | 652 | 721 | 259 | 178 | 208 | 53 | 17 | 29 | 7 |
| 80 | 41.85 | 664 | 600 | 642 | 682 | 251 | 178 | 200 | 60 | 16 | 30 | 10 |
| 81 | 41.95 | 529 | 568 | 600 | 709 | 229 | 190 | 179 | 56 | 11 | 31 | 8 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 82 | 42.05 | 486 | 757 | 625 | 659 | 225 | 189 | 154 | 47 | 12 | 29 | 9 |
| 83 | 42.15 | 451 | 665 | 615 | 627 | 208 | 192 | 169 | 51 | 14 | 37 | 6 |
| 84 | 42.25 | 414 | 465 | 551 | 707 | 216 | 201 | 152 | 49 | 16 | 33 | 8 |
| 85 | 42.35 | 597 | 594 | 597 | 712 | 231 | 218 | 162 | 60 | 14 | 32 | 7 |
| 86 | 42.45 | 395 | 447 | 516 | 539 | 361 | 186 | 134 | 48 | 8 | 32 | 8 |
| 87 | 42.55 | 444 | 410 | 552 | 506 | 461 | 205 | 124 | 58 | 9 | 42 | 10 |
| 88 | 42.65 | 420 | 474 | 528 | 539 | 255 | 186 | 125 | 51 | 14 | 36 | 9 |
| 89 | 42.75 | 491 | 483 | 504 | 554 | 325 | 175 | 134 | 50 | 8 | 41 | 4 |
| 90 | 42.85 | 434 | 524 | 494 | 490 | 244 | 163 | 124 | 42 | 9 | 36 | 2 |
| 91 | 43.15 | 501 | 542 | 624 | 399 | 239 | 146 | 109 | 45 | 11 | 25 | 4 |
| 92 | 43.25 | 466 | 459 | 545 | 470 | 222 | 151 | 124 | 44 | 11 | 32 | 3 |
| 93 | 43.35 | 485 | 522 | 582 | 548 | 212 | 144 | 144 | 41 | 14 | 30 | 5 |
| 94 | 43.45 | 414 | 556 | 525 | 557 | 183 | 137 | 159 | 39 | 11 | 22 | 3 |
| 95 | 43.55 | 461 | 654 | 569 | 581 | 165 | 131 | 186 | 40 | 6 | 22 | 2 |
| 96 | 43.65 | 485 | 1034 | 698 | 449 | 111 | 104 | 136 | 48 | 12 | 25 | 6 |
| 97 | 43.75 | 491 | 402 | 542 | 287 | 68 | 137 | 78 | 38 | 10 | 26 | <0.01 |
| 98 | 43.85 | 527 | 568 | 498 | 246 | 72 | 130 | 79 | 42 | 9 | 13 | 4 |
| 99 | 43.95 | 561 | 461 | 441 | 229 | 74 | 130 | 76 | 40 | 10 | 9 | 2 |
| 100 | 44.05 | 549 | 412 | 473 | 250 | 73 | 130 | 77 | 42 | 12 | 8 | 5 |
| 101 | 44.15 | 514 | 641 | 818 | 344 | 74 | 135 | 104 | 41 | 8 | 4 | 1 |
| 102 | 44.25 | 469 | 678 | 741 | 326 | 60 | 125 | 102 | 38 | 4 | 3 | <0.01 |
| 103 | 44.35 | 440 | 564 | 554 | 278 | 57 | 129 | 92 | 34 | 4 | 4 | <0.01 |
| 104 | 44.45 | 564 | 645 | 608 | 296 | 65 | 141 | 100 | 43 | 4 | 6 | 1 |
| 105 | 44.55 | 401 | 516 | 471 | 239 | 56 | 140 | 72 | 31 | 3 | 6 | 1 |
| 106 | 44.65 | 499 | 534 | 454 | 221 | 66 | 152 | 83 | 40 | 9 | 2 | 4 |
| 107 | 44.75 | 509 | 736 | 461 | 225 | 68 | 147 | 86 | 41 | 8 | 2 | 2 |
| 108 | 44.85 | 576 | 420 | 473 | 226 | 69 | 131 | 90 | 47 | 6 | 6 | 3 |
| 109 | 44.95 | 567 | 560 | 549 | 253 | 70 | 132 | 95 | 48 | 10 | 4 | 4 |
| 110 | 45.05 | 537 | 555 | 639 | 295 | 69 | 134 | 104 | 43 | 6 | 1 | 1 |
| 111 | 45.15 | 544 | 474 | 542 | 259 | 72 | 145 | 96 | 40 | 7 | 2 | 3 |
| 112 | 45.25 | 530 | 450 | 495 | 220 | 75 | 143 | 88 | 39 | 6 | 1 | 3 |
| 113 | 45.35 | 524 | 426 | 461 | 203 | 75 | 140 | 86 | 39 | 9 | 4 | 4 |
| 114 | 45.45 | 513 | 514 | 463 | 198 | 74 | 145 | 77 | 38 | 8 | 6 | 5 |
| 115 | 45.55 | 548 | 451 | 447 | 181 | 80 | 145 | 83 | 43 | 9 | 4 | 5 |
| 116 | 45.65 | 550 | 454 | 490 | 218 | 79 | 147 | 91 | 39 | 9 | 2 | 1 |
| 117 | 45.75 | 557 | 509 | 575 | 291 | 77 | 141 | 103 | 41 | 9 | <0.01 | 3 |
| 118 | 45.85 | 553 | 532 | 608 | 314 | 78 | 153 | 106 | 42 | 9 | <0.01 | 7 |
| 119 | 45.95 | 512 | 543 | 605 | 292 | 72 | 149 | 93 | 36 | 8 | <0.01 | 3 |
| 120 | 46.43 | 572 | 524 | 597 | 270 | 70 | 134 | 103 | 42 | 11 | 12 | 4 |
| 121 | 46.55 | 603 | 427 | 600 | 250 | 75 | 150 | 97 | 39 | 14 | 5 | <0.01 |
| 122 | 46.65 | 572 | 419 | 555 | 232 | 79 | 151 | 100 | 41 | 16 | 2 | 2 |
| 123 | 46.75 | 528 | 476 | 538 | 241 | 76 | 140 | 96 | 36 | 10 | 2 | 1 |
| 124 | 46.85 | 571 | 424 | 575 | 243 | 77 | 144 | 100 | 42 | 11 | <0.01 | 3 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 125 | 46.95 | 559 | 402 | 544 | 230 | 67 | 136 | 95 | 37 | 13 | <0.01 | 5 |
| 126 | 47.05 | 530 | 509 | 519 | 192 | 67 | 135 | 85 | 38 | 10 | 2 | <0.01 |
| 127 | 47.15 | 566 | 496 | 534 | 193 | 72 | 136 | 86 | 42 | 10 | <0.01 | 8 |
| 128 | 47.25 | 559 | 550 | 546 | 228 | 72 | 132 | 87 | 39 | 8 | <0.01 | 6 |
| 129 | 47.35 | 549 | 491 | 520 | 222 | 70 | 155 | 79 | 42 | 6 | 7 | 2 |
| 130 | 47.45 | 590 | 495 | 539 | 240 | 73 | 141 | 97 | 45 | 12 | <0.01 | <0.01 |
| 131 | 47.55 | 555 | 560 | 577 | 288 | 72 | 146 | 103 | 43 | 8 | 2 | 4 |
| 132 | 47.65 | 598 | 596 | 543 | 243 | 292 | 183 | 85 | 56 | 13 | 24 | 3 |
| 133 | 47.75 | 562 | 766 | 593 | 383 | 289 | 185 | 105 | 54 | 11 | 26 | 3 |
| 134 | 47.85 | 619 | 564 | 554 | 276 | 328 | 225 | 97 | 63 | 12 | 34 | 4 |
| 135 | 47.95 | 511 | 436 | 465 | 598 | 258 | 161 | 146 | 44 | 4 | 22 | <0.01 |
| 136 | 49.33 | 644 | 559 | 421 | 497 | 303 | 181 | 116 | 58 | 9 | 25 | 3 |
| 137 | 49.45 | 495 | 542 | 436 | 480 | 278 | 206 | 103 | 60 | 8 | 22 | <0.01 |
| 138 | 49.55 | 526 | 692 | 461 | 483 | 269 | 188 | 111 | 60 | 10 | 22 | <0.01 |
| 139 | 49.65 | 698 | 605 | 513 | 350 | 295 | 194 | 83 | 66 | 17 | 17 | 6 |
| 140 | 49.75 | 694 | 719 | 518 | 406 | 289 | 191 | 92 | 64 | 14 | 21 | 10 |
| 141 | 49.85 | 725 | 676 | 570 | 544 | 233 | 178 | 117 | 61 | 11 | 26 | 5 |
| 142 | 49.95 | 635 | 659 | 536 | 807 | 218 | 165 | 150 | 55 | 9 | 27 | 4 |
| 143 | 50.05 | 843 | 433 | 530 | 323 | 379 | 249 | 86 | 64 | 13 | 30 | 5 |
| 144 | 50.15 | 788 | 418 | 495 | 296 | 359 | 243 | 81 | 62 | 14 | 31 | 5 |
| 145 | 50.25 | 821 | 306 | 514 | 277 | 449 | 303 | 71 | 67 | 10 | 32 | 7 |
| 146 | 50.35 | 751 | 352 | 496 | 251 | 420 | 277 | 72 | 62 | 9 | 24 | 4 |
| 147 | 50.45 | 718 | 419 | 485 | 385 | 391 | 278 | 96 | 56 | 10 | 27 | 1 |
| 148 | 52.25 | 908 | 447 | 539 | 243 | 420 | 306 | 64 | 71 | 17 | 25 | 9 |
| 149 | 52.35 | 902 | 381 | 506 | 250 | 424 | 270 | 69 | 74 | 17 | 21 | 9 |
| 150 | 52.45 | 590 | 345 | 327 | 207 | 225 | 158 | 81 | 35 | 3 | 18 | <0.01 |
| 151 | 52.55 | 712 | 412 | 497 | 486 | 401 | 258 | 105 | 60 | 7 | 30 | 1 |
| 152 | 52.65 | 811 | 456 | 528 | 320 | 439 | 279 | 84 | 68 | 14 | 32 | 11 |
| 153 | 52.75 | 645 | 662 | 516 | 1020 | 279 | 201 | 126 | 76 | 8 | 23 | 4 |
| 154 | 52.85 | 713 | 498 | 526 | 423 | 415 | 281 | 88 | 65 | 14 | 31 | 5 |
| 155 | 52.95 | 753 | 418 | 497 | 349 | 401 | 262 | 88 | 62 | 12 | 32 | 3 |
| 156 | 53.05 | 816 | 445 | 507 | 246 | 451 | 316 | 68 | 68 | 17 | 27 | 4 |
| 157 | 53.15 | 983 | 497 | 596 | 527 | 475 | 307 | 134 | 80 | 13 | 26 | 4 |
| 158 | 53.25 | 820 | 505 | 537 | 298 | 496 | 314 | 90 | 74 | 15 | 24 | 7 |
| 159 | 53.35 | 939 | 643 | 668 | 460 | 498 | 337 | 102 | 86 | 17 | 25 | 7 |
| 160 | 53.45 | 615 | 617 | 509 | 631 | 381 | 253 | 122 | 61 | 7 | 28 | 5 |
| 161 | 53.55 | 760 | 468 | 540 | 542 | 475 | 324 | 127 | 67 | 12 | 30 | 2 |
| 162 | 53.65 | 769 | 401 | 499 | 535 | 460 | 307 | 142 | 64 | 12 | 32 | 7 |
| 163 | 53.75 | 647 | 349 | 478 | 575 | 512 | 327 | 151 | 59 | 11 | 37 | <0.01 |
| 164 | 53.85 | 639 | 434 | 517 | 526 | 575 | 389 | 127 | 64 | 10 | 44 | 6 |
| 165 | 53.95 | 599 | 559 | 532 | 627 | 404 | 264 | 121 | 67 | 8 | 27 | 3 |
| 166 | 54.05 | 552 | 609 | 569 | 739 | 367 | 251 | 115 | 58 | 6 | 30 | 2 |
| 167 | 54.15 | 622 | 415 | 467 | 496 | 536 | 351 | 112 | 61 | 9 | 42 | 5 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 168 | 54.25 | 562 | 469 | 485 | 499 | 440 | 294 | 112 | 58 | 8 | 35 | 2 |
| 169 | 54.35 | 496 | 448 | 491 | 567 | 410 | 249 | 114 | 51 | 8 | 32 | 3 |
| 170 | 54.45 | 495 | 394 | 452 | 518 | 422 | 276 | 110 | 48 | 4 | 35 | 6 |
| 171 | 54.55 | 498 | 488 | 498 | 457 | 428 | 290 | 94 | 53 | 8 | 30 | 1 |
| 172 | 54.65 | 470 | 438 | 481 | 497 | 448 | 301 | 98 | 53 | 7 | 30 | 4 |
| 173 | 54.75 | 487 | 557 | 494 | 560 | 413 | 302 | 110 | 52 | 8 | 29 | 2 |
| 174 | 54.85 | 414 | 582 | 493 | 677 | 408 | 321 | 123 | 43 | 4 | 37 | 2 |
| 175 | 54.95 | 410 | 501 | 464 | 652 | 421 | 284 | 151 | 41 | <0.01 | 26 | <0.01 |
| 176 | 55.05 | 399 | 413 | 415 | 624 | 440 | 271 | 169 | 31 | <0.01 | 23 | <0.01 |
| 177 | 55.15 | 389 | 489 | 452 | 695 | 472 | 339 | 158 | 45 | 4 | 33 | <0.01 |
| 178 | 55.25 | 393 | 489 | 417 | 693 | 566 | 392 | 171 | 46 | 4 | 40 | 3 |
| 179 | 55.43 | 420 | 431 | 457 | 632 | 444 | 310 | 137 | 44 | 2 | 30 | 1 |
| 180 | 55.55 | 435 | 377 | 445 | 674 | 490 | 338 | 138 | 46 | 1 | 33 | <0.01 |
| 181 | 55.65 | 426 | 610 | 479 | 525 | 340 | 254 | 107 | 44 | 6 | 28 | <0.01 |
| 182 | 55.75 | 425 | 559 | 453 | 523 | 298 | 205 | 120 | 35 | 4 | 28 | 1 |
| 183 | 55.85 | 393 | 472 | 449 | 515 | 333 | 264 | 101 | 42 | 7 | 28 | 4 |
| 184 | 55.95 | 428 | 531 | 443 | 541 | 359 | 275 | 113 | 46 | 7 | 25 | 2 |
| 185 | 56.05 | 397 | 565 | 432 | 598 | 370 | 266 | 126 | 40 | 6 | 27 | 5 |
| 186 | 56.15 | 472 | 462 | 467 | 538 | 352 | 288 | 107 | 50 | 9 | 34 | <0.01 |
| 187 | 56.25 | 467 | 446 | 480 | 554 | 385 | 265 | 115 | 43 | 16 | 36 | 3 |
| 188 | 56.35 | 473 | 490 | 484 | 613 | 335 | 246 | 120 | 45 | 17 | 37 | 8 |
| 189 | 56.45 | 372 | 383 | 456 | 760 | 255 | 139 | 171 | 31 | 7 | 20 | 4 |
| 190 | 56.55 | 390 | 319 | 428 | 845 | 219 | 108 | 197 | 27 | <0.01 | 16 | 4 |
| 191 | 56.65 | 457 | 424 | 453 | 538 | 315 | 186 | 130 | 40 | 9 | 30 | 5 |
| 192 | 56.75 | 511 | 420 | 464 | 411 | 325 | 217 | 102 | 45 | 16 | 36 | 8 |
| 193 | 56.85 | 605 | 489 | 549 | 571 | 375 | 244 | 119 | 58 | 16 | 35 | 10 |
| 194 | 56.95 | 311 | 408 | 350 | 512 | 206 | 138 | 112 | 32 | 2 | 21 | 4 |
| 195 | 57.05 | 433 | 429 | 431 | 486 | 268 | 197 | 110 | 44 | 9 | 31 | 7 |
| 196 | 57.15 | 522 | 446 | 483 | 419 | 286 | 197 | 95 | 54 | 13 | 31 | 7 |
| 197 | 57.25 | 442 | 436 | 487 | 520 | 243 | 168 | 116 | 49 | 11 | 29 | 6 |
| 198 | 57.35 | 504 | 404 | 439 | 384 | 287 | 204 | 96 | 49 | 15 | 36 | 7 |
| 199 | 57.45 | 500 | 469 | 533 | 521 | 313 | 207 | 118 | 50 | 16 | 35 | 6 |
| 200 | 57.55 | 287 | 401 | 465 | 547 | 296 | 188 | 119 | 33 | 6 | 37 | 4 |
| 201 | 57.65 | 314 | 303 | 384 | 573 | 335 | 195 | 120 | 37 | 7 | 29 | 9 |
| 202 | 57.75 | 297 | 402 | 422 | 496 | 303 | 198 | 111 | 32 | 8 | 34 | 7 |
| 203 | 57.85 | 297 | 479 | 442 | 802 | 226 | 109 | 181 | 34 | <0.01 | 15 | 4 |
| 204 | 57.95 | 241 | 581 | 386 | 697 | 192 | 117 | 151 | 29 | <0.01 | 19 | 5 |
| 205 | 58.05 | 323 | 642 | 436 | 496 | 236 | 162 | 107 | 30 | 11 | 25 | 7 |
| 206 | 58.15 | 276 | 496 | 437 | 455 | 207 | 155 | 104 | 29 | 4 | 29 | 5 |
| 207 | 58.25 | 348 | 834 | 499 | 516 | 210 | 176 | 114 | 33 | 10 | 25 | 5 |
| 208 | 58.35 | 281 | 653 | 441 | 588 | 174 | 134 | 135 | 36 | 2 | 21 | 3 |
| 209 | 58.45 | 316 | 611 | 431 | 511 | 181 | 138 | 131 | 34 | 3 | 21 | 6 |
| 210 | 58.55 | 308 | 537 | 409 | 385 | 175 | 149 | 102 | 33 | 7 | 23 | 8 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 211 | 58.65 | 310 | 557 | 422 | 401 | 172 | 146 | 105 | 37 | 9 | 21 | 5 |
| 212 | 58.75 | 437 | 607 | 452 | 361 | 176 | 153 | 105 | 44 | 10 | 24 | 5 |
| 213 | 58.85 | 310 | 782 | 472 | 483 | 145 | 141 | 132 | 42 | 9 | 23 | 6 |
| 214 | 58.95 | 331 | 719 | 448 | 373 | 156 | 134 | 103 | 33 | 8 | 24 | 7 |
| 215 | 59.05 | 337 | 709 | 449 | 416 | 137 | 142 | 114 | 34 | 6 | 18 | 6 |
| 216 | 59.15 | 316 | 656 | 415 | 333 | 123 | 141 | 100 | 34 | 9 | 15 | 2 |
| 217 | 59.25 | 319 | 762 | 488 | 370 | 129 | 143 | 109 | 38 | 14 | 18 | 6 |
| 218 | 59.35 | 302 | 769 | 475 | 327 | 115 | 137 | 94 | 34 | 17 | 22 | 4 |
| 219 | 59.45 | 303 | 715 | 455 | 469 | 125 | 135 | 131 | 39 | 8 | 18 | 10 |
| 220 | 59.55 | 339 | 809 | 473 | 495 | 143 | 143 | 141 | 39 | 7 | 17 | 6 |
| 221 | 59.65 | 308 | 758 | 469 | 533 | 146 | 143 | 148 | 38 | 6 | 11 | 2 |
| 222 | 59.75 | 397 | 729 | 490 | 526 | 151 | 144 | 147 | 42 | 7 | 11 | 6 |
| 223 | 59.85 | 294 | 618 | 560 | 404 | 89 | 123 | 116 | 27 | 9 | 6 | 2 |
| 224 | 59.95 | 283 | 528 | 484 | 247 | 68 | 115 | 78 | 24 | 12 | 8 | 4 |
| 225 | 60.05 | 307 | 2448 | 887 | 385 | 86 | 132 | 114 | 27 | 8 | 8 | 5 |
| 226 | 60.15 | 320 | 1567 | 742 | 445 | 77 | 148 | 119 | 32 | 13 | 13 | 9 |
| 227 | 60.25 | 284 | 653 | 396 | 227 | 65 | 125 | 74 | 24 | 7 | 6 | 6 |
| 228 | 60.35 | 288 | 513 | 372 | 207 | 75 | 119 | 76 | 28 | 10 | 8 | 7 |
| 229 | 60.45 | 307 | 512 | 395 | 221 | 84 | 124 | 83 | 26 | 7 | 3 | 6 |
| 230 | 60.55 | 338 | 628 | 481 | 250 | 91 | 121 | 94 | 29 | 8 | 5 | 6 |
| 231 | 60.65 | 370 | 1792 | 678 | 407 | 108 | 137 | 123 | 28 | 11 | 17 | 8 |
| 232 | 60.75 | 331 | 1233 | 691 | 547 | 180 | 163 | 147 | 33 | 12 | 23 | 8 |
| 233 | 60.85 | 296 | 453 | 498 | 385 | 242 | 187 | 114 | 33 | 9 | 30 | 7 |
| 234 | 60.95 | 343 | 444 | 525 | 420 | 251 | 199 | 124 | 37 | 10 | 25 | 8 |
| 235 | 61.05 | 317 | 501 | 495 | 376 | 256 | 193 | 125 | 31 | 8 | 26 | 6 |
| 236 | 61.15 | 317 | 552 | 451 | 387 | 235 | 180 | 122 | 30 | 3 | 16 | 6 |
| 237 | 61.25 | 336 | 539 | 446 | 414 | 269 | 201 | 125 | 36 | 3 | 21 | 5 |
| 238 | 61.35 | 480 | 561 | 480 | 404 | 297 | 210 | 126 | 48 | 9 | 25 | 7 |
| 239 | 61.45 | 357 | 713 | 440 | 443 | 255 | 215 | 119 | 38 | 10 | 26 | 7 |
| 240 | 61.55 | 330 | 580 | 404 | 401 | 250 | 207 | 116 | 34 | 7 | 22 | 6 |
| 241 | 61.65 | 351 | 708 | 411 | 327 | 251 | 202 | 97 | 33 | 9 | 21 | 8 |
| 242 | 61.75 | 379 | 765 | 418 | 285 | 223 | 208 | 92 | 34 | 11 | 19 | 7 |
| 243 | 61.85 | 339 | 476 | 403 | 356 | 227 | 187 | 103 | 31 | 9 | 18 | 4 |
| 244 | 61.95 | 350 | 526 | 431 | 419 | 209 | 185 | 111 | 34 | 8 | 18 | 7 |
| 245 | 62.05 | 373 | 557 | 453 | 392 | 215 | 191 | 110 | 36 | 10 | 23 | 5 |
| 246 | 62.15 | 356 | 515 | 425 | 434 | 189 | 177 | 117 | 36 | 10 | 18 | 6 |
| 247 | 62.25 | 317 | 476 | 402 | 458 | 164 | 172 | 118 | 32 | 10 | 26 | 5 |
| 248 | 62.35 | 455 | 757 | 349 | 93 | 161 | 179 | 43 | 38 | 16 | 25 | 6 |
| 249 | 62.45 | 214 | 299 | 297 | 947 | 74 | 58 | 147 | 43 | <0.01 | 4 | <0.01 |
| 250 | 62.63 | 367 | 810 | 358 | 109 | 134 | 177 | 49 | 35 | 20 | 16 | 8 |
| 251 | 62.83 | 450 | 528 | 466 | 408 | 92 | 149 | 105 | 35 | 6 | 11 | 5 |
| 252 | 62.95 | 609 | 731 | 570 | 490 | 162 | 176 | 132 | 50 | 14 | 18 | 6 |
| 253 | 63.05 | 476 | 616 | 511 | 438 | 200 | 196 | 113 | 43 | 12 | 23 | 8 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 254 | 63.15 | 517 | 577 | 554 | 588 | 199 | 196 | 144 | 55 | 9 | 20 | 7 |
| 255 | 63.25 | 485 | 428 | 520 | 631 | 163 | 161 | 160 | 38 | 5 | 17 | 6 |
| 256 | 63.35 | 445 | 469 | 493 | 584 | 157 | 162 | 152 | 39 | 7 | 14 | 7 |
| 257 | 63.45 | 542 | 566 | 522 | 534 | 173 | 173 | 155 | 47 | 7 | 15 | 7 |
| 258 | 63.55 | 468 | 664 | 506 | 596 | 159 | 162 | 158 | 40 | 7 | 12 | 5 |
| 259 | 63.65 | 420 | 625 | 485 | 620 | 142 | 151 | 148 | 37 | 8 | 16 | 6 |
| 260 | 63.75 | 444 | 2580 | 589 | 693 | 116 | 146 | 171 | 35 | 4 | 12 | 10 |
| 261 | 63.85 | 612 | 1867 | 619 | 449 | 168 | 188 | 117 | 56 | 12 | 10 | 8 |
| 262 | 63.95 | 301 | 1328 | 592 | 530 | 66 | 146 | 121 | 29 | <0.01 | 17 | 2 |
| 263 | 64.05 | 385 | 702 | 659 | 475 | 58 | 190 | 118 | 35 | <0.01 | 12 | 3 |
| 264 | 64.15 | 349 | 572 | 563 | 344 | 50 | 149 | 88 | 32 | 15 | 1 | 8 |
| 265 | 64.25 | 426 | 597 | 440 | 253 | 62 | 145 | 75 | 36 | 15 | 5 | 6 |
| 266 | 64.35 | 456 | 541 | 406 | 237 | 68 | 141 | 77 | 37 | 16 | 1 | 7 |
| 267 | 64.45 | 518 | 561 | 484 | 301 | 71 | 145 | 87 | 41 | 19 | 2 | 9 |
| 268 | 64.55 | 529 | 548 | 496 | 308 | 72 | 151 | 88 | 44 | 19 | 2 | 7 |
| 269 | 64.65 | 488 | 486 | 460 | 265 | 67 | 137 | 86 | 38 | 17 | 6 | 6 |
| 270 | 64.75 | 519 | 443 | 446 | 248 | 74 | 151 | 85 | 43 | 20 | 1 | 8 |
| 271 | 64.85 | 590 | 415 | 455 | 252 | 77 | 153 | 89 | 46 | 17 | <0.01 | 7 |
| 272 | 64.95 | 574 | 497 | 472 | 248 | 78 | 139 | 88 | 43 | 17 | 3 | 5 |
| 273 | 65.05 | 551 | 1094 | 621 | 316 | 81 | 144 | 96 | 43 | 18 | 8 | 5 |
| 274 | 65.15 | 603 | 3342 | 686 | 637 | 128 | 133 | 145 | 45 | 18 | 6 | 10 |
| 275 | 65.25 | 561 | 313 | 458 | 1147 | 304 | 183 | 207 | 50 | 19 | 17 | 11 |
| 276 | 65.35 | 626 | 412 | 528 | 609 | 396 | 270 | 129 | 58 | 24 | 59 | 7 |
| 277 | 65.45 | 685 | 542 | 550 | 465 | 350 | 250 | 125 | 62 | 22 | 55 | 9 |
| 278 | 65.55 | 663 | 566 | 565 | 620 | 327 | 265 | 157 | 61 | 24 | 53 | 8 |
| 279 | 65.65 | 710 | 334 | 525 | 485 | 461 | 349 | 134 | 66 | 22 | 46 | 7 |
| 280 | 65.75 | 634 | 469 | 532 | 701 | 394 | 300 | 176 | 63 | 25 | 42 | 10 |
| 281 | 65.85 | 880 | 437 | 570 | 394 | 434 | 287 | 124 | 79 | 25 | 41 | 10 |
| 282 | 65.95 | 857 | 476 | 578 | 391 | 400 | 296 | 115 | 66 | 27 | 37 | 10 |
| 283 | 66.05 | 984 | 656 | 770 | 394 | 320 | 274 | 133 | 70 | 32 | 37 | 14 |
| 284 | 66.15 | 1194 | 526 | 757 | 560 | 382 | 312 | 166 | 75 | 27 | 36 | 19 |
| 285 | 66.25 | 1007 | 444 | 675 | 511 | 397 | 308 | 148 | 69 | 26 | 35 | 11 |
| 286 | 66.35 | 960 | 434 | 646 | 479 | 414 | 325 | 144 | 69 | 24 | 36 | 13 |
| 287 | 66.45 | 1209 | 529 | 776 | 511 | 391 | 319 | 156 | 78 | 26 | 35 | 12 |
| 288 | 66.55 | 893 | 478 | 647 | 526 | 392 | 321 | 151 | 65 | 25 | 36 | 12 |
| 289 | 66.65 | 971 | 461 | 606 | 482 | 394 | 294 | 153 | 67 | 22 | 26 | 15 |
| 290 | 66.75 | 900 | 383 | 608 | 471 | 395 | 284 | 143 | 64 | 20 | 19 | 12 |
| 291 | 66.85 | 379 | 380 | 384 | 1211 | 353 | 109 | 263 | 43 | 1 | <0.01 | 3 |
| 292 | 66.95 | 362 | 475 | 308 | 1300 | 323 | 114 | 294 | 42 | 1 | 1 | 7 |
| 293 | 67.05 | 541 | 501 | 475 | 641 | 289 | 168 | 143 | 57 | 14 | 39 | 10 |
| 294 | 67.15 | 642 | 426 | 522 | 582 | 368 | 204 | 143 | 65 | 16 | 34 | 9 |
| 295 | 67.25 | 591 | 622 | 559 | 361 | 385 | 237 | 124 | 65 | 17 | 19 | 7 |
| 296 | 67.35 | 509 | 531 | 533 | 598 | 466 | 237 | 174 | 65 | 12 | 18 | 7 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 297 | 67.45 | 617 | 504 | 485 | 632 | 425 | 247 | 203 | 58 | 18 | 22 | 9 |
| 298 | 67.55 | 616 | 530 | 558 | 521 | 417 | 224 | 146 | 52 | 18 | 15 | 10 |
| 299 | 67.65 | 751 | 663 | 649 | 451 | 388 | 165 | 121 | 51 | 17 | 11 | 12 |
| 300 | 67.75 | 680 | 537 | 634 | 444 | 336 | 145 | 114 | 38 | 15 | 14 | 12 |
| 301 | 67.85 | 516 | 498 | 571 | 515 | 330 | 174 | 123 | 42 | 19 | 14 | 10 |
| 302 | 67.95 | 575 | 502 | 569 | 418 | 345 | 156 | 109 | 44 | 15 | 12 | 12 |
| 303 | 68.05 | 534 | 568 | 578 | 398 | 328 | 160 | 91 | 39 | 16 | 12 | 9 |
| 304 | 68.15 | 624 | 612 | 592 | 375 | 350 | 144 | 111 | 43 | 14 | 13 | 9 |
| 305 | 68.25 | 656 | 566 | 604 | 318 | 300 | 134 | 97 | 39 | 17 | 13 | 6 |
| 306 | 68.35 | 629 | 592 | 622 | 348 | 267 | 126 | 92 | 39 | 16 | 14 | 10 |
| 307 | 68.45 | 654 | 659 | 643 | 385 | 295 | 131 | 90 | 37 | 15 | 10 | 11 |
| 308 | 68.55 | 594 | 610 | 604 | 408 | 283 | 121 | 97 | 34 | 16 | 8 | 8 |
| 309 | 68.65 | 627 | 599 | 633 | 420 | 302 | 133 | 99 | 38 | 14 | 8 | 12 |
| 310 | 68.75 | 626 | 583 | 626 | 448 | 313 | 135 | 104 | 34 | 13 | 13 | 9 |
| 311 | 68.85 | 638 | 618 | 657 | 452 | 328 | 148 | 118 | 41 | 17 | 15 | 12 |
| 312 | 68.95 | 572 | 603 | 650 | 411 | 268 | 124 | 102 | 37 | 14 | 11 | 12 |
| 313 | 69.05 | 632 | 627 | 698 | 403 | 290 | 129 | 107 | 37 | 17 | 6 | 9 |
| 314 | 69.15 | 674 | 714 | 661 | 380 | 280 | 127 | 99 | 39 | 14 | 10 | 11 |
| 315 | 69.25 | 593 | 615 | 635 | 571 | 229 | 126 | 132 | 43 | 13 | 9 | 9 |
| 316 | 69.35 | 522 | 644 | 538 | 418 | 269 | 107 | 110 | 31 | 10 | 8 | 9 |
| 317 | 69.45 | 570 | 688 | 545 | 412 | 258 | 96 | 118 | 36 | 10 | 13 | 11 |
| 318 | 69.55 | 544 | 724 | 533 | 371 | 261 | 117 | 99 | 30 | 10 | 11 | 7 |
| 319 | 69.65 | 493 | 871 | 457 | 324 | 202 | 83 | 93 | 28 | 8 | 8 | 7 |
| 320 | 69.75 | 496 | 795 | 458 | 321 | 203 | 84 | 103 | 27 | 7 | 8 | 7 |
| 321 | 69.85 | 551 | 650 | 602 | 383 | 284 | 150 | 106 | 39 | 15 | 18 | 9 |
| 322 | 69.95 | 539 | 514 | 679 | 356 | 275 | 187 | 106 | 45 | 18 | 23 | 9 |
| 323 | 70.05 | 513 | 523 | 694 | 339 | 248 | 215 | 108 | 46 | 22 | 22 | 12 |
| 324 | 70.15 | 461 | 534 | 661 | 391 | 257 | 224 | 130 | 47 | 21 | 23 | 12 |
| 325 | 70.25 | 611 | 643 | 711 | 505 | 278 | 210 | 171 | 56 | 20 | 11 | 13 |
| 326 | 70.35 | 537 | 549 | 566 | 582 | 280 | 197 | 193 | 46 | 14 | 10 | 9 |
| 327 | 70.45 | 550 | 602 | 656 | 513 | 255 | 208 | 167 | 52 | 19 | 15 | 15 |
| 328 | 70.55 | 555 | 663 | 636 | 419 | 253 | 207 | 129 | 51 | 18 | 23 | 11 |
| 329 | 70.65 | 541 | 598 | 731 | 567 | 218 | 210 | 158 | 54 | 23 | 24 | 8 |
| 330 | 70.75 | 597 | 670 | 699 | 332 | 221 | 183 | 125 | 52 | 25 | 14 | 12 |
| 331 | 70.85 | 574 | 608 | 789 | 401 | 218 | 225 | 136 | 59 | 31 | 27 | 13 |
| 332 | 70.95 | 637 | 654 | 734 | 528 | 228 | 185 | 162 | 53 | 22 | 19 | 10 |
| 333 | 71.05 | 744 | 685 | 800 | 381 | 245 | 168 | 139 | 52 | 25 | 14 | 13 |
| 334 | 71.15 | 662 | 665 | 651 | 302 | 207 | 139 | 132 | 43 | 16 | 10 | 11 |
| 335 | 71.25 | 778 | 759 | 760 | 303 | 219 | 144 | 136 | 52 | 22 | 11 | 11 |
| 336 | 71.35 | 607 | 714 | 664 | 367 | 236 | 147 | 135 | 47 | 15 | 8 | 12 |
| 337 | 71.45 | 608 | 677 | 669 | 358 | 237 | 145 | 125 | 45 | 14 | 13 | 10 |
| 338 | 71.55 | 667 | 660 | 704 | 385 | 200 | 150 | 134 | 44 | 19 | 18 | 12 |
| 339 | 71.65 | 590 | 710 | 707 | 484 | 211 | 212 | 142 | 49 | 24 | 23 | 11 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 340 | 71.75 | 652 | 667 | 722 | 434 | 211 | 172 | 139 | 53 | 23 | 28 | 10 |
| 341 | 71.85 | 595 | 686 | 743 | 345 | 204 | 178 | 114 | 57 | 23 | 23 | 11 |
| 342 | 71.95 | 584 | 669 | 743 | 342 | 212 | 180 | 115 | 52 | 22 | 32 | 13 |
| 343 | 72.05 | 589 | 731 | 742 | 362 | 195 | 182 | 127 | 54 | 22 | 22 | 12 |
| 344 | 72.15 | 541 | 694 | 715 | 464 | 197 | 214 | 142 | 53 | 23 | 22 | 11 |
| 345 | 72.25 | 645 | 738 | 746 | 443 | 211 | 190 | 150 | 56 | 24 | 16 | 9 |
| 346 | 72.35 | 618 | 696 | 713 | 381 | 212 | 183 | 130 | 50 | 22 | 20 | 13 |
| 347 | 72.45 | 629 | 705 | 757 | 349 | 223 | 177 | 133 | 54 | 25 | 19 | 12 |
| 348 | 72.55 | 648 | 712 | 700 | 373 | 220 | 181 | 149 | 54 | 23 | 16 | 12 |
| 349 | 72.65 | 611 | 683 | 721 | 337 | 189 | 164 | 142 | 53 | 28 | 20 | 13 |
| 350 | 72.75 | 623 | 680 | 702 | 334 | 175 | 156 | 140 | 51 | 27 | 24 | 11 |
| 351 | 72.85 | 583 | 610 | 748 | 367 | 177 | 163 | 138 | 55 | 28 | 21 | 13 |
| 352 | 72.95 | 584 | 672 | 711 | 355 | 176 | 160 | 127 | 50 | 22 | 21 | 12 |
| 353 | 73.05 | 531 | 695 | 719 | 302 | 161 | 194 | 114 | 52 | 28 | 32 | 13 |
| 354 | 73.15 | 575 | 634 | 785 | 363 | 179 | 182 | 129 | 59 | 29 | 29 | 10 |
| 355 | 73.55 | 521 | 524 | 606 | 425 | 165 | 179 | 132 | 48 | 26 | 33 | 11 |
| 356 | 73.65 | 523 | 627 | 699 | 397 | 147 | 170 | 133 | 55 | 28 | 26 | 14 |
| 357 | 73.75 | 562 | 709 | 679 | 372 | 122 | 145 | 139 | 53 | 30 | 30 | 14 |
| 358 | 73.85 | 557 | 696 | 830 | 355 | 116 | 148 | 146 | 54 | 30 | 15 | 15 |
| 359 | 73.95 | 498 | 515 | 713 | 683 | 103 | 116 | 220 | 58 | 23 | 11 | 11 |
| 360 | 74.05 | 516 | 595 | 804 | 490 | 108 | 139 | 150 | 57 | 26 | 19 | 12 |
| 361 | 74.15 | 304 | 536 | 455 | 407 | 73 | 126 | 110 | 30 | 22 | 30 | 9 |
| 362 | 74.25 | 490 | 754 | 562 | 401 | 86 | 148 | 132 | 45 | 30 | 48 | 15 |
| 363 | 74.35 | 568 | 717 | 654 | 134 | 95 | 148 | 58 | 50 | 35 | 32 | 12 |
| 364 | 74.45 | 392 | 1032 | 798 | 946 | 59 | 123 | 259 | 45 | 18 | 10 | 10 |
| 365 | 74.55 | 546 | 1055 | 609 | 843 | 68 | 215 | 212 | 42 | 30 | 26 | 9 |
| 366 | 74.65 | 319 | 945 | 577 | 849 | 51 | 179 | 265 | 27 | 24 | 22 | 6 |
| 367 | 74.75 | 673 | 2306 | 1955 | 903 | 74 | 243 | 175 | 56 | 30 | 23 | 6 |
| 368 | 74.85 | 482 | 3273 | 2059 | 543 | 60 | 186 | 110 | 43 | 26 | 10 | 8 |
| 369 | 74.95 | 466 | 4076 | 2542 | 480 | 55 | 202 | 160 | 41 | 27 | 5 | 9 |
| 370 | 75.05 | 594 | 743 | 404 | 40 | 59 | 116 | 32 | 41 | 30 | 2 | 10 |
| 371 | 75.15 | 614 | 687 | 378 | 23 | 55 | 107 | 26 | 43 | 26 | 7 | 12 |
| 372 | 75.25 | 621 | 666 | 434 | 20 | 62 | 142 | 48 | 43 | 29 | <0.01 | 10 |
| 373 | 75.35 | 789 | 657 | 567 | 22 | 65 | 154 | 62 | 55 | 31 | <0.01 | 10 |
| 374 | 75.45 | 695 | 704 | 697 | 22 | 56 | 139 | 50 | 41 | 31 | 5 | 10 |
| 375 | 75.55 | 791 | 589 | 662 | 22 | 57 | 137 | 60 | 46 | 30 | 6 | 8 |
| 376 | 75.65 | 815 | 601 | 657 | 20 | 57 | 143 | 61 | 47 | 34 | 3 | 14 |
| 377 | 75.75 | 1054 | 621 | 736 | 23 | 62 | 136 | 57 | 55 | 36 | 2 | 12 |
| 378 | 75.85 | 900 | 652 | 676 | 24 | 58 | 128 | 65 | 50 | 33 | <0.01 | 9 |
| 379 | 75.95 | 903 | 658 | 743 | 22 | 59 | 137 | 81 | 50 | 36 | 2 | 12 |
| 380 | 76.05 | 988 | 658 | 900 | 26 | 61 | 145 | 79 | 52 | 35 | <0.01 | 11 |
| 381 | 76.15 | 966 | 709 | 856 | 29 | 66 | 143 | 88 | 55 | 37 | <0.01 | 13 |
| 382 | 76.25 | 1382 | 776 | 839 | 31 | 80 | 134 | 191 | 65 | 42 | 1 | 12 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 383 | 76.35 | 2061 | 1060 | 1236 | 48 | 107 | 173 | 279 | 97 | 64 | <0.01 | 23 |
| 384 | 76.45 | 1578 | 715 | 890 | 38 | 83 | 143 | 222 | 72 | 48 | <0.01 | 16 |
| 385 | 76.65 | 1108 | 1435 | 935 | 125 | 76 | 157 | 192 | 59 | 41 | 4 | 14 |
| 386 | 76.75 | 1245 | 731 | 854 | 45 | 72 | 139 | 203 | 63 | 44 | 3 | 15 |
| 387 | 76.85 | 1319 | 735 | 879 | 39 | 75 | 145 | 225 | 66 | 46 | <0.01 | 17 |
| 388 | 76.95 | 1335 | 794 | 953 | 41 | 75 | 137 | 250 | 67 | 46 | <0.01 | 15 |
| 389 | 77.05 | 1337 | 919 | 945 | 45 | 76 | 150 | 263 | 67 | 48 | <0.01 | 13 |
| 390 | 77.15 | 1333 | 846 | 827 | 41 | 73 | 133 | 241 | 65 | 44 | 2 | 15 |
| 391 | 77.25 | 1588 | 1065 | 1457 | 75 | 76 | 153 | 366 | 76 | 47 | <0.01 | 15 |
| 392 | 77.35 | 1616 | 741 | 880 | 38 | 78 | 136 | 266 | 75 | 44 | <0.01 | 14 |
| 393 | 77.45 | 1809 | 837 | 1065 | 48 | 79 | 150 | 293 | 79 | 49 | <0.01 | 20 |
| 394 | 77.55 | 1671 | 818 | 847 | 35 | 80 | 150 | 276 | 74 | 49 | <0.01 | 19 |
| 395 | 77.65 | 1656 | 738 | 835 | 34 | 78 | 146 | 271 | 73 | 49 | <0.01 | 17 |
| 396 | 77.75 | 1692 | 730 | 857 | 34 | 78 | 144 | 269 | 76 | 49 | <0.01 | 14 |
| 397 | 77.85 | 1615 | 779 | 858 | 35 | 78 | 141 | 274 | 76 | 51 | <0.01 | 16 |
| 398 | 77.95 | 1739 | 861 | 1341 | 48 | 79 | 146 | 315 | 76 | 52 | <0.01 | 13 |
| 399 | 78.05 | 1546 | 789 | 1320 | 44 | 74 | 161 | 293 | 70 | 51 | 1 | 17 |
| 400 | 78.15 | 1665 | 739 | 815 | 33 | 79 | 143 | 283 | 74 | 54 | <0.01 | 19 |
| 401 | 78.25 | 1290 | 733 | 699 | 29 | 74 | 127 | 248 | 63 | 48 | <0.01 | 15 |
| 402 | 78.35 | 1391 | 742 | 812 | 30 | 73 | 141 | 268 | 63 | 50 | 3 | 19 |
| 403 | 78.45 | 1445 | 853 | 1004 | 41 | 74 | 152 | 278 | 66 | 48 | <0.01 | 15 |
| 404 | 78.55 | 1429 | 840 | 1008 | 43 | 75 | 142 | 281 | 64 | 47 | <0.01 | 16 |
| 405 | 78.65 | 1286 | 843 | 996 | 43 | 71 | 132 | 241 | 61 | 44 | 1 | 15 |
| 406 | 78.75 | 1393 | 926 | 1352 | 53 | 73 | 131 | 304 | 62 | 48 | <0.01 | 14 |
| 407 | 78.85 | 1329 | 835 | 976 | 69 | 75 | 136 | 280 | 63 | 46 | 2 | 15 |
| 408 | 78.95 | 1322 | 777 | 754 | 35 | 75 | 150 | 252 | 64 | 47 | <0.01 | 15 |
| 409 | 79.05 | 1355 | 764 | 973 | 35 | 75 | 157 | 270 | 63 | 51 | <0.01 | 15 |
| 410 | 79.15 | 1483 | 832 | 1086 | 38 | 77 | 150 | 288 | 64 | 51 | <0.01 | 13 |
| 411 | 79.25 | 1332 | 687 | 812 | 35 | 74 | 152 | 249 | 61 | 48 | 2 | 15 |
| 412 | 79.35 | 1341 | 773 | 731 | 30 | 73 | 143 | 257 | 63 | 48 | 1 | 14 |
| 413 | 79.45 | 1141 | 731 | 752 | 28 | 66 | 138 | 218 | 54 | 41 | 7 | 14 |
| 414 | 79.55 | 1043 | 725 | 885 | 27 | 64 | 149 | 185 | 53 | 40 | 4 | 14 |
| 415 | 79.65 | 1372 | 808 | 954 | 42 | 75 | 137 | 275 | 62 | 47 | <0.01 | 12 |
| 416 | 79.75 | 1236 | 817 | 704 | 31 | 70 | 137 | 255 | 58 | 47 | 1 | 15 |
| 417 | 79.85 | 1363 | 889 | 1063 | 43 | 72 | 123 | 290 | 62 | 48 | <0.01 | 16 |
| 418 | 79.95 | 1168 | 892 | 988 | 39 | 63 | 106 | 247 | 52 | 43 | 1 | 15 |
| 419 | 80.05 | 1289 | 856 | 914 | 36 | 68 | 125 | 255 | 55 | 44 | <0.01 | 13 |
| 420 | 80.15 | 1349 | 804 | 929 | 39 | 68 | 133 | 268 | 60 | 47 | <0.01 | 12 |
| 421 | 80.25 | 1437 | 838 | 1203 | 50 | 70 | 139 | 301 | 64 | 47 | <0.01 | 15 |
| 422 | 80.35 | 1462 | 827 | 1089 | 40 | 71 | 127 | 293 | 63 | 49 | 1 | 13 |
| 423 | 80.45 | 1372 | 818 | 792 | 35 | 73 | 139 | 273 | 63 | 51 | <0.01 | 13 |
| 424 | 80.55 | 1336 | 757 | 701 | 32 | 69 | 132 | 260 | 61 | 47 | <0.01 | 14 |
| 425 | 80.65 | 1290 | 742 | 677 | 33 | 69 | 134 | 257 | 63 | 46 | <0.01 | 15 |

Table 2 cont.

| sample | depth | Ti | P | Mn | Sr | Li | B | Ba | V | Cu | Mo | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 426 | 80.75 | 1282 | 807 | 723 | 37 | 67 | 138 | 261 | 55 | 44 | <0.01 | 13 |
| 427 | 80.85 | 1342 | 916 | 945 | 51 | 66 | 139 | 286 | 57 | 43 | <0.01 | 16 |
| 428 | 80.95 | 1258 | 731 | 655 | 31 | 67 | 142 | 250 | 57 | 45 | 5 | 10 |
| 429 | 81.05 | 1268 | 740 | 664 | 32 | 66 | 156 | 250 | 55 | 46 | 1 | 11 |
| 430 | 81.15 | 1293 | 764 | 869 | 46 | 66 | 149 | 268 | 57 | 44 | <0.01 | 15 |
| 431 | 81.25 | 1442 | 919 | 1032 | 56 | 70 | 158 | 303 | 60 | 46 | <0.01 | 15 |
| 432 | 81.35 | 1267 | 855 | 982 | 70 | 65 | 150 | 308 | 58 | 44 | 1 | 13 |
| 433 | 81.45 | 1360 | 822 | 1020 | 58 | 67 | 137 | 295 | 61 | 47 | <0.01 | 15 |
| 434 | 81.55 | 1287 | 727 | 928 | 48 | 63 | 135 | 259 | 58 | 43 | <0.01 | 16 |
| 435 | 81.65 | 1194 | 747 | 757 | 47 | 64 | 135 | 245 | 53 | 45 | <0.01 | 13 |
| 436 | 81.75 | 879 | 854 | 632 | 37 | 49 | 90 | 179 | 39 | 33 | 2 | 8 |
| 437 | 81.85 | 1507 | 792 | 931 | 55 | 68 | 153 | 298 | 67 | 46 | <0.01 | 18 |
| 438 | 81.95 | 1424 | 747 | 1011 | 62 | 68 | 156 | 311 | 62 | 48 | <0.01 | 14 |
| 439 | 82.05 | 1494 | 754 | 810 | 39 | 67 | 136 | 269 | 62 | 45 | <0.01 | 17 |
| 440 | 82.15 | 1532 | 743 | 841 | 40 | 69 | 147 | 288 | 66 | 49 | 1 | 19 |
| 441 | 82.25 | 1565 | 750 | 916 | 46 | 69 | 149 | 297 | 69 | 50 | <0.01 | 18 |
| 442 | 82.35 | 1479 | 728 | 849 | 45 | 67 | 160 | 282 | 65 | 49 | 1 | 17 |
| 443 | 82.45 | 1615 | 660 | 876 | 40 | 74 | 157 | 296 | 67 | 51 | <0.01 | 17 |
| 444 | 82.55 | 1551 | 769 | 886 | 46 | 68 | 159 | 285 | 67 | 50 | 2 | 17 |

Table 3

Averaged analyses (n=444) from Tables 1 and 2 for TIC, TOC and acid-leachable components of sediments from OL-92 (83 to 32 m depth).

| | wt % |
|---|---|
| Ca | 6.8 |
| Mg | 2.2 |
| Fe | 2.0 |
| Na | 1.0 |
| Al | 1.0 |
| K | 0.7 |
| Si | 0.2 |
| TIC | 1.8 |
| TOC | 1.6 |
| | ppm |
| Ti | 711 |
| P | 681 |
| Mn | 633 |
| Sr | 357 |
| Li | 197 |
| B | 169 |
| Ba | 142 |
| V | 50 |
| Cu | 20 |
| Mo | 16 |
| Co | 8 |

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## Climatic and Hydrologic Conditions in Owens Basin, California, Between 145 and 45 ka as Reconstructed from the High-resolution Stable Isotope Records

by
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## Introduction

That glacial/interglacial climatic variations on Earth are paced by Milankovitch cycles has been well documented by the oxygen isotopic record of marine sediments which reflects changes in seawater temperature and continental ice volume (Emiliani and Shackleton, 1974; Imbrie et al., 1993). Whereas terrestrial temperature variations can be linked to those in the sea, thus to the orbital forcing, any linkage between precipitation on land and the orbital elements would be subtle at best. Being strongly affected by changes in atmosphere-ocean circulation patterns, precipitation exhibits substantial spatial and temporal variability. For example, studies of lake sediments show that the Great Basin of the southwestern U.S. was a region dotted with large pluvial lakes during glacial periods (Bischoff et al., 1985, 1997a; Li et al., 1997; Menking et al., 1997; Morrison, 1975; Phillips et al., 1992, 1994; Smith and Street-Perrott, 1983; Street-Perrott and Harrison, 1984, 1985). On the other hand, studies of the loess-paleosol sequence in northern China indicate alternations of cold-dry glacial climate (loess) and warm-wet interglacial climate similar to the current one (paleosol) (An et al., 1991; Kukla et al., 1990; Ding et al., 1995). The following questions may be posed: (1) If the periodicity of the glacial and interglacial fluctuations in both regions matches that of the marine $\delta^{18}O$ record, what causes the regional climatic differences? 2) To what extent do the high-latitude climatic variations shown by the marine isotopic record correlate with the paleoclimate of the mid- to low-latitudes on continents? While the mechanism that causes regional differences in continental climates on glacial-interglacial time scales remains unclear, a reorganization of the marine and atmospheric circulation systems could well be involved. In order to address these questions, more regional climatic reconstructions from long-term, high-resolution records are of value, especially for information on the variability of paleoprecipitation. Closed-basin lakes serve as an excellent deposition system for such reconstructions.

Located in eastern central California within the rainshadow of the Sierra Nevada, Owens Lake is one in a chain of quasi-closed basin lakes in the Owens River system. A 323 m long core, OL-92, retrieved from the depocenter of the lake bed in 1992 represents continuous lacustrine sedimentation spanning the last 800,000 years. A multi-parameter reconnaissance study of the entire core, having a resolution of 7000 years, was carried out by Smith and Bischoff (1997). It was followed by a more detailed study of the core with a resolution of ~1500 years by Menking et al. (1997) for the last 155,000 years. Using data on stable isotopes, wt.% $CaCO_3$, and grain size of the lake sediments, they concluded that climate during the last interglacial period in Owens Valley was dry, punctuated with several short periods of wet conditions. We report here a study of core OL-92 over the period of 45 and 145 ka with even finer time resolutions. The study attempts to develop a stable isotope mass balance model to reconstruct lake volume variations. Using the $\delta^{18}O$ and $\delta^{13}C$ records, we will also determine closed and overflowing lake conditions, lake productivity, and general climatic variations during the study period.

## Sample Analysis and Data

We subsampled core OL-92 at 10 cm intervals from core depths 32 to 83 m, corresponding to an average resolution of ~170 years. The samples were washed with deionized water to remove interstitial salts and then oven-dried at 60°C. About 100 µg of sample material were reacted with 100% phosphoric acid at 90°C and the $CO_2$ produced was analyzed for $\delta^{18}O$ and $\delta^{13}C$ using a VG Prism triple-collecting mass spectrometer equipped with an Isocarb II automatic device for sample loading. Analytical precisions were about ±0.25‰ for $\delta^{18}O$ and ±0.15‰ for $\delta^{13}C$ based on replicate analyses of a calcite standard performed during sample runs. The isotope ratios are reported as the per mil deviation from the PDB standard. A total of 443 samples were analyzed and the results are presented in Table 1. Many sediment samples from depths between 75.15 and 82.45 m did not contain enough carbonate for analysis. Samples from 32 to 75.15 m contained mainly calcite with moderate amounts of aragonite; only a few samples formed during low lake level periods contained mainly dolomite. Two samples, at 62.45 and 62.55 m, were pure dolomite (which gave very heavy $\delta^{18}O$ and $\delta^{13}C$ values). In view of the difficulty in dissolving dolomite with phosphoric acid and dolomite-containing samples were relatively rare, most of the isotopic values given in Table 1 represent those of calcite and aragonite. Their variations are due to changes in lake hydrologic conditions rather than by changes in the relative proportion of calcite and aragonite, because isotopic fractionation between calcite and aragonite is small (e.g., 0.6‰ at 25°C for $\delta^{18}O$).

Figure 1 shows the $\delta^{18}O$ and $\delta^{13}C$ profiles of core OL-92 from 32 to 83 m depth. The $\delta^{18}O$ values range from −11.47‰ to 0.51‰ (PDB) and the $\delta^{13}C$ values vary from −1.38‰ to 13.59‰, excluding the questionable data from the 75.15–82.45 m interval (Table 1). The profiles generally match the coarser-resolution profiles of Menking et al. (1997) except for the interval between 75.15 and 82.45 m. While the 7 $\delta^{18}O$ values of Menking et al. profile in this interval range from −8‰ to −3‰, the 48 $\delta^{18}O$ values of our profile from the same interval vary from −8.4‰ to 7.45‰ (Table 1). Eight of these 48 values are greater than 1‰ which are abnormally heavy for lacustrine sediments. Analyses of the calcite standard accompanying the sample runs (one standard for every 5 sample runs) indicate signs of contamination of heavy $\delta^{18}O$ signals from these anomalous samples, an experience shared by James C. Zachos (personal communication) of University of California, Santa Cruz, when he analyzed several samples from the 75.15 - 82.45 m interval of the Menking et al. profile. It appears that the abnormally high $\delta^{18}O$ values were not caused by analytical error, though further investigations are in order. If so, as will be discussed below, they should not be taken to reflect the hydrological balance of the lake.

## Comments on the Data

*$\delta^{13}C$-$\delta^{18}O$ covariance*

Authigenic carbonates formed away from the sediment-water interface are generally in isotopic equilibrium with lake water (Fritz and Poplawski, 1974; Gasse et al., 1987; Johnson et al., 1991; Lister et al., 1991; Li et al., 1997), hence their downcore variations in $\delta^{18}O$ and $\delta^{13}C$ reflect past changes in the isotopic composition of lake water. Changes in $\delta^{18}O$ and $\delta^{13}C$ of a closed-basin lake record changes in lake volume (Li and Ku, 1997).

Li et al. (1997) showed that fresh water input reduces the lake $^{13}C$ and $^{18}O$ during rapid transgression (Precipitation > Evaporation under wet climates). Under such a circumstance, both $\delta^{18}O$ and $\delta^{13}C$ values move toward lighter values as the lake volume increases, giving rise to a good $\delta^{18}O$-$\delta^{13}C$ covariance. A rapid decline of the lake volume due to intense net evaporation (P < E under dry climates) will increase the lake $\delta^{18}O$. Curtailment of freshwater input to the lake will also result in an increase of $\delta^{13}C$ in the lake DIC because of increased productivity and decreased input of light-$\delta^{13}C$ source water. Consequently, a rapidly declining lake will lead to an increase of both its $\delta^{13}C$ and $\delta^{18}O$. In summary, in a closed-basin lake, $\delta^{13}C$ and $\delta^{18}O$ tend to covary.

When the lake level of a closed-basin lake rises high enough to spill over its sill, the lake becomes open with a stable level. For an open lake, the lake $\delta^{18}O$ is close to the input water $\delta^{18}O$ which is related to the moisture source and air temperature (Stuiver, 1970). Lake productivity for an over-flowing lake is generally lower than that of a closed lake because the nutrient concentrations in an open lake are usually diluted by fresh water. As both $\delta^{18}O$ and $\delta^{13}C$ in open lakes are relatively invariant, with the $\delta^{18}O$ being close to the input $\delta^{18}O$ and the $\delta^{13}C$ being around 1–3‰ (equilibrium with the atmospheric $CO_2$, covariance between $\delta^{13}C$ and $\delta^{18}O$ tends to be poor (Li and Ku, 1997).

Figure 2 shows the $\delta^{13}C$-$\delta^{18}O$ covariance in core OL-92 for the 32 to 83 m interval. Excluding the data from 75.15 to 82.45 m, they can be separated into two groups: those with $\delta^{18}O$ values heavier than −5‰ when the lake was closed and those with $\delta^{18}O$ lighter than –5‰ when the lake was open. The overflowing Owens Lake had a weak $\delta^{13}C$-$\delta^{18}O$ covariance, with a correlation coefficient R = 0.2. Its $\delta^{13}C$ values, mostly within the range of 1–3‰, indicate low lake productivity. In contrast, during the closed period the lake had a better $\delta^{13}C$–$\delta^{18}O$ covariance (R = 0.56), and its $\delta^{13}C$ values (excluding those of the two pure dolomite samples) were mostly between 3 and 12‰, reflecting very high productivity of the lake. The high lake productivity is also indicated by a parallelism between the total organic carbon (TOC) and $\delta^{13}C$ distributions in the sediments (Fig. 3a).

*$\delta^{18}O$-TIC and $\delta^{18}O$-Li Correlations*

Lake-level drop is generally conducive to enhanced carbonate precipitation. Thus the $\delta^{18}O$ of lake sediments is expected to have a positive correlation with the total inorganic carbon concentration (TIC), which is shown in Fig. 3b. Bischoff et al. (this volume) suggest that the acid leachable Li concentration in lake sediments is of diagnostic value for lake-level information. This is seen from the observed strong correlation between $\delta^{18}O$ and the Li concentration for the depth interval 32–75 m (Fig. 3c).

*Heavy $\delta^{18}O$ values of 75.15-82.45 m*

Data on TIC, TOC, trace metal, acid-leachable metal and XRD indicate that intervals 75.15-82.45 m and 32-36 m in core OL-92 were deposited under a similar climatic condition of being cold and wet (see Fig. 3). Under this condition, the lake probably overflowed and would have $\delta^{18}O$ values lighter than –4‰ (PDB) (Menking et al., 1997). However, Figure 1 shows that the $\delta^{18}O$ of sediments from 75.15 to 82.45 m (an interval with very low carbonate content) is mostly heavier than –4‰. The heavy values may be ascribed to the presence of detrital carbonates brought in by wind and/or glacial meltwater They may also be due to the presence of carbonate minerals formed in very cold lake water or in icy water that feeds the lake. If either of these two hypothetical scenarios is correct, then caution should be exercised for interpreting the $\delta^{18}O$ record in terms of hydrological balance of the lake in low-carbonate sediments deposited during glacial periods, particularly if the record is derived from measurements of very small samples (e.g., ~100 µg), as we have done.

*An alternative chronology for the interval of 32-82.5 m depth in core OL-92*

Bischoff et al. (1997c) and Menking et al. (1997) have interpreted the sediments from 75.15 to 82.45 m depth to have deposited under a major ice advance during the penultimate glacial cycle of marine isotope stage 6. Data on TIC, TOC, acid-soluble Li, Ca, Sr, and Mg, and glacial rock flour abundance all show a sharp change from 75.15 m upward, indicating a transition from glacial to interglacial. If we take this transition as corresponding to Termination II of the marine record, then the age at 75.15 m would be close to 128 ka, about 11 ka older than the 117 ka age-assignment based on extrapolating the radiocarbon dates from upper part of the core (Table 1). In order to relate the chronology of OL-92 with that of the marine isotope stages, we have added 11 ka to the original age assignments between 32 and 82.5 m (Table 2) as a possible alternative chronology for OL-92. This chronology would put the ages of studied interval of the core (32.05-82.45 m) at 58-145 ka.

*Changing climatic and hydrological conditions in the Owens Basin*

The $\delta^{18}O$ and $\delta^{13}C$ variations can be grouped into seven periods. Table 2 lists the averages and ranges of $\delta^{18}O$ and $\delta^{13}C$ for each of the periods. During Periods I, III, V and VII the climate in the Owens Basin was cold and wet, and Owens Lake overflowed with fresh and low productivity water. The lake was closed and had high productivity during Periods II, IV and VI, under dry and warm climatic conditions. During much of the last interglaciation, climate in the Owens Basin was dry and warm. The intervening wet and cold periods were comparatively short. Glacial periods corresponding to marine stages 4 and 6 were cold and wet in the Owens Basin. Transitions between the cold/wet and warm/dry climates appeared to have occurred rather abruptly to within a few hundred years.

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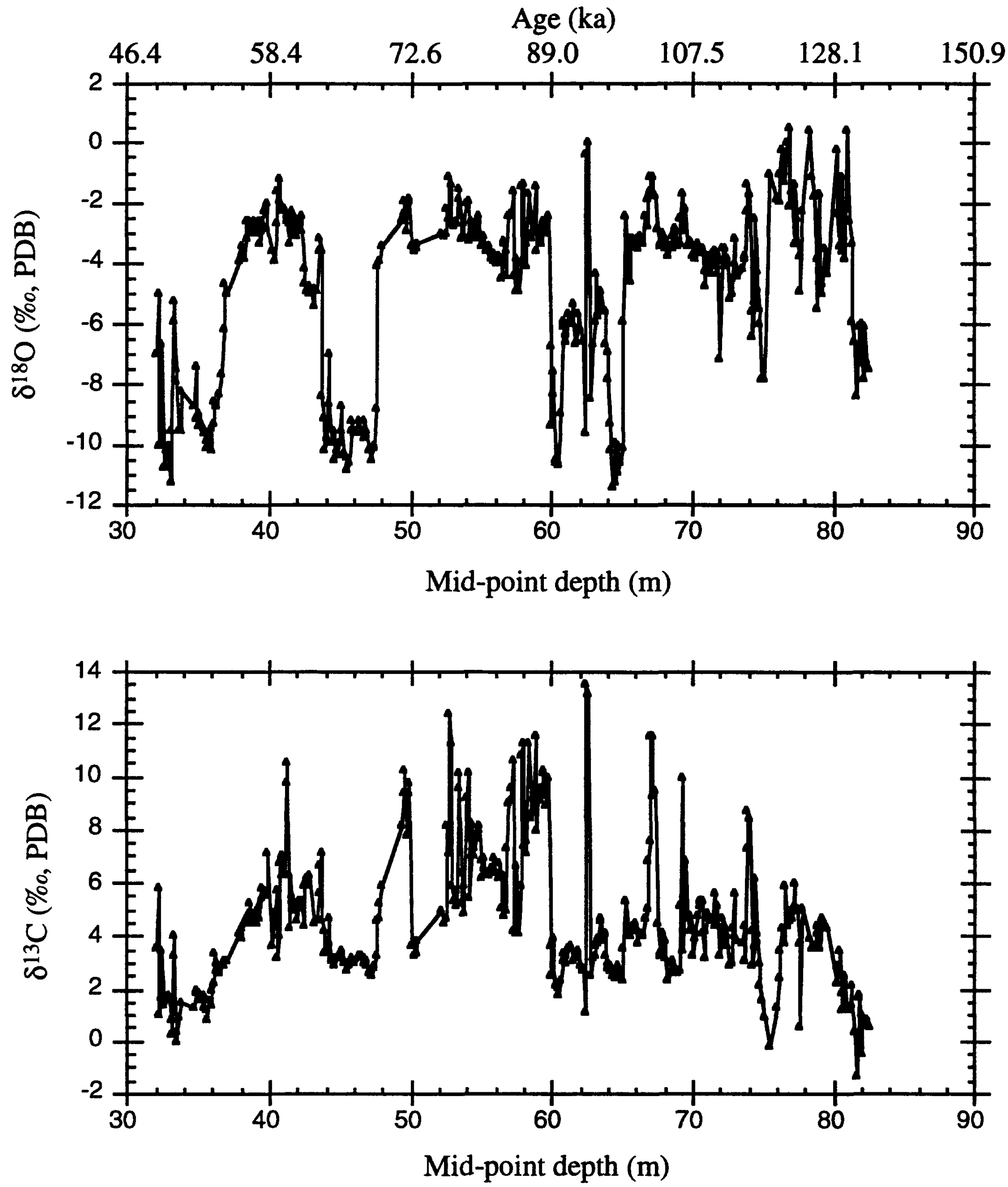


Fig. 1 Oxygen and carbon isotopic compositions of total carbonates in the sediments of OL-92 core. The age assignment is based on: Age (ka) = 23.254+0.448x+0.018x$^2$ where x = depth (m), according to Bischoff et al. (1997b).

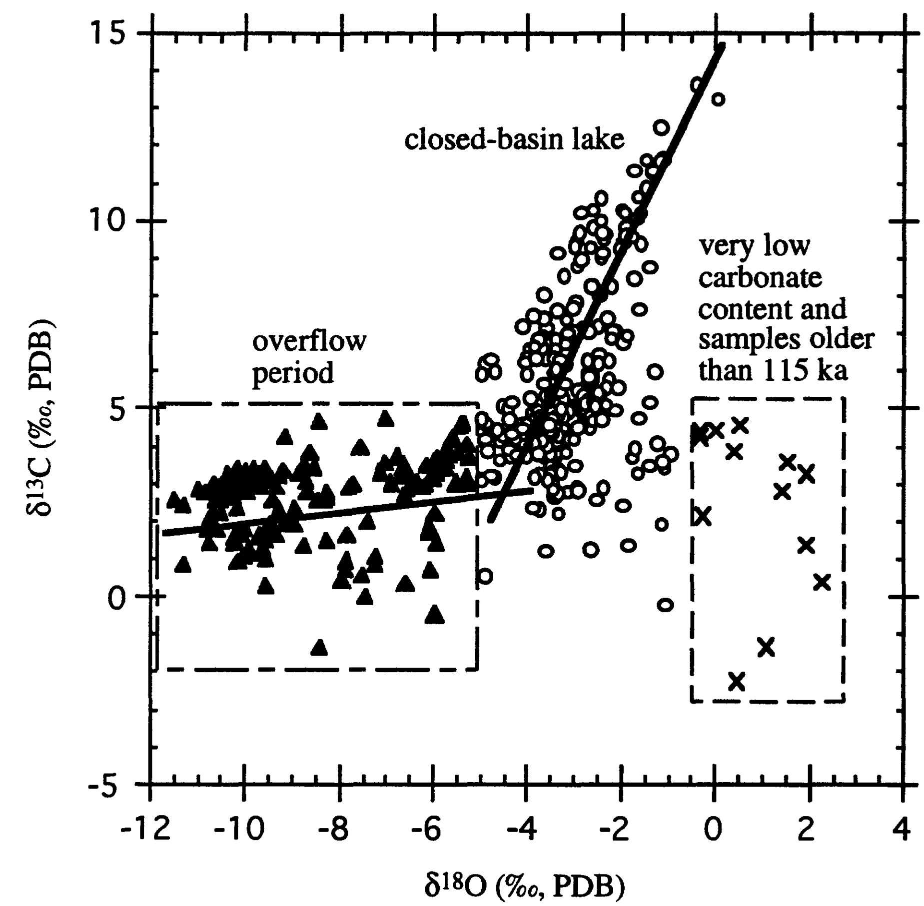


Fig. 2 $\delta^{13}C - \delta^{18}O$ covariance in sediments of core OL-92. Triangles denote data points with poor $\delta^{13}C - \delta^{18}O$ correlation (R = 0.2), showing that the lake overflowed and had low productivity. Open circles denote data points of a closed-basin lake with better $\delta^{13}C - \delta^{18}O$ covariance (R = 0.56) than that during lake overflowing periods, showing that lake productivity increases with decreasing lake volume. The cross symbols represent samples of older than 115 ka. These samples have $\delta^{18}O$ values less than –0.5‰ and contain very low carbonate concentrations. The source of the carbonate remains unclear.

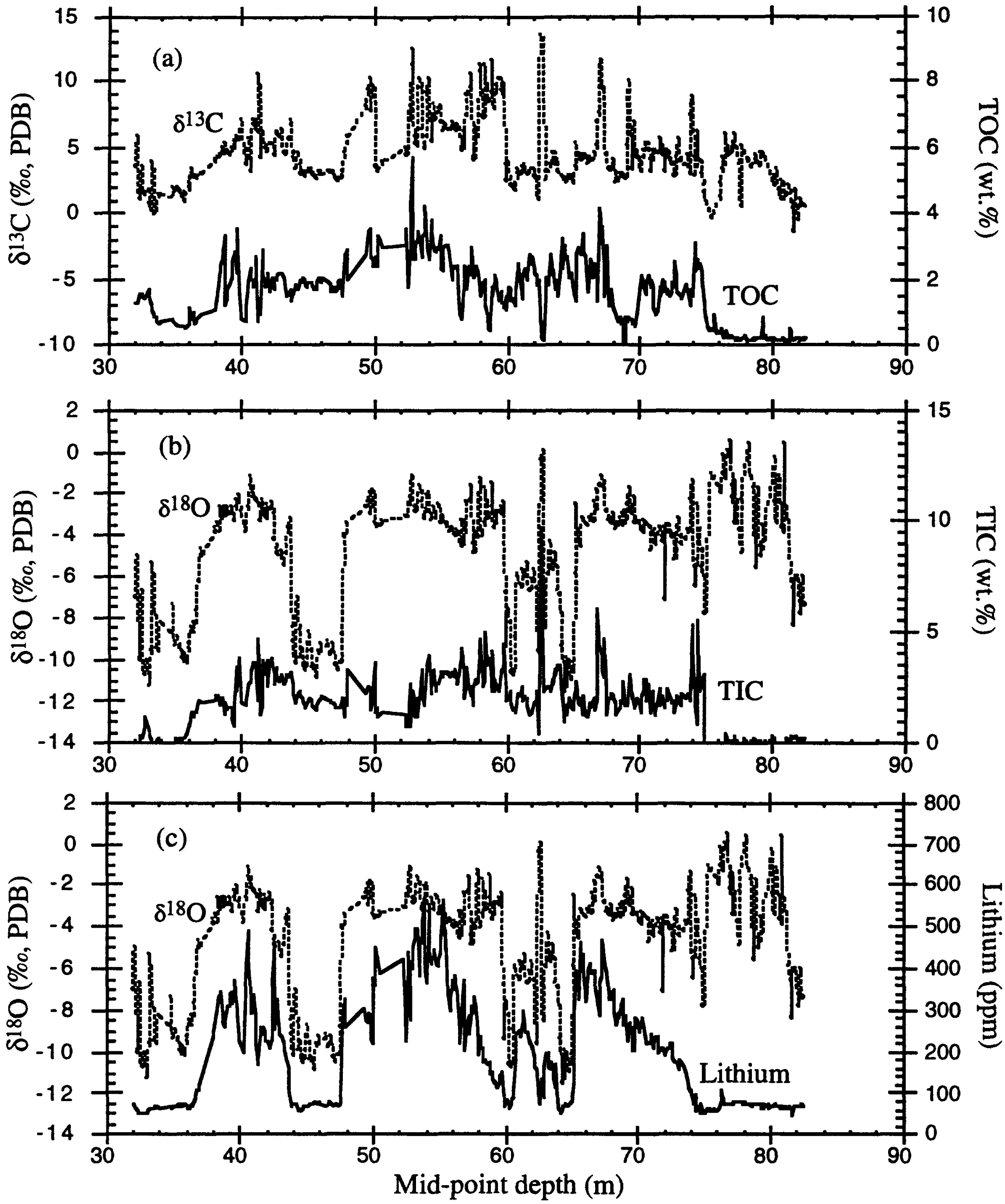


Fig. 3 (a) Similar patterns between $\delta^{13}C$ and total organic carbon (TOC) indicate that the $\delta^{13}C$ record mainly reflects changes in lake productivity. (b) Comparison of $\delta^{18}O$ with total inorganic carbon (TIC) in the sediments of core OL-92. (c) Comparison of $\delta^{18}O$ with lithium concentration in the sediments of core Ol-92, showing a strong correlation between the two properties from 36 to 75 m. Data sources for TOC, TIC and Lithium are from Bischoff et al. in this volume.

Table 1 Carbon and oxygen isotopic compositions (PDB) of carbonates in core OL-92 from Owens Lake, California. Depth in core refers to the mid-point depth of each 10-cm sampling interval. Age assignments are based on the chronology of Bischoff et al. (1997b).

| Sample No. | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) | Sample No. | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.05 | 46.22 | 3.53 | -6.99 | 45 | 38.15 | 56.38 | 4.27 | -3.44 |
| 2 | 32.15 | 46.40 | 5.85 | -4.97 | 46 | 38.25 | 56.53 | 4.46 | -3.83 |
| 3 | 32.25 | 46.58 | 1.02 | -10.00 | 47 | 38.35 | 56.69 | 4.46 | -2.64 |
| 4 | 32.35 | 46.76 | 1.71 | -9.97 | 48 | 38.45 | 56.84 | 4.64 | -3.20 |
| 5 | 32.45 | 46.94 | 3.48 | -6.62 | 49 | 38.55 | 57.00 | 4.91 | -2.74 |
| 6 | 32.55 | 47.12 | 1.72 | -9.52 | 50 | 38.65 | 57.16 | 5.23 | -2.59 |
| 7 | 32.65 | 47.30 | 1.41 | -10.73 | 51 | 38.75 | 57.31 | 4.52 | -3.05 |
| 8 | 32.75 | 47.48 | 1.57 | -10.20 | 52 | 38.85 | 57.47 | 4.57 | -2.84 |
| 9 | 32.85 | 47.66 | 1.60 | -10.06 | 53 | 38.95 | 57.63 | 4.79 | -2.62 |
| 10 | 32.95 | 47.84 | 1.78 | -10.74 | 54 | 39.05 | 57.78 | 4.48 | -3.00 |
| 11 | 33.05 | 48.02 | 0.83 | -11.27 | 55 | 39.15 | 57.93 | 4.97 | -2.98 |
| 12 | 33.15 | 48.19 | 0.24 | -9.55 | 56 | 39.25 | 58.08 | 4.64 | -2.58 |
| 13 | 33.25 | 48.36 | 3.99 | -5.28 | 57 | 39.35 | 58.23 | 5.12 | -3.32 |
| 14 | 33.35 | 48.53 | 3.30 | -5.91 | 58 | 39.45 | 58.37 | 5.46 | -2.91 |
| 15 | 33.45 | 48.70 | -0.03 | -7.44 | 59 | 39.55 | 58.52 | 5.83 | -2.58 |
| 16 | 33.55 | 48.86 | 0.38 | -7.92 | 60 | 39.65 | 58.67 | 5.74 | -2.24 |
| 17 | 33.65 | 49.03 | 0.93 | -9.52 | 61 | 39.75 | 58.81 | 5.54 | -2.04 |
| 18 | 33.75 | 49.20 | 1.48 | -9.55 | 62 | 39.90 | 59.03 | 7.13 | -2.82 |
| 19 | 33.85 | 49.37 | 1.48 | -8.24 | 63 | 40.25 | 59.55 | 3.66 | -3.60 |
| 20 | 34.75 | 50.89 | 1.32 | -8.73 | 64 | 40.35 | 59.69 | 4.85 | -3.90 |
| 21 | 34.85 | 51.06 | 1.95 | -7.39 | 65 | 40.45 | 59.84 | 5.68 | -2.66 |
| 22 | 34.95 | 51.23 | 1.89 | -9.15 | 66 | 40.55 | 59.99 | 3.22 | -1.64 |
| 23 | 35.05 | 51.40 | 1.58 | -9.41 | 67 | 40.65 | 60.13 | 4.05 | -1.20 |
| 24 | 35.15 | 51.57 | 1.90 | -8.93 | 68 | 40.75 | 60.28 | 6.72 | -1.94 |
| 25 | 35.25 | 51.74 | 1.62 | -9.32 | 69 | 40.85 | 60.43 | 7.01 | -2.12 |
| 26 | 35.35 | 51.91 | 1.76 | -9.42 | 70 | 40.95 | 60.57 | 6.29 | -2.26 |
| 27 | 35.45 | 52.08 | 1.25 | -9.61 | 71 | 41.03 | 60.69 | 6.99 | -2.18 |
| 28 | 35.55 | 52.25 | 1.21 | -9.87 | 72 | 41.09 | 60.77 | 6.25 | -2.25 |
| 29 | 35.65 | 52.41 | 0.87 | -10.12 | 73 | 41.16 | 60.88 | 10.56 | -2.43 |
| 30 | 35.75 | 52.58 | 1.57 | -9.67 | 74 | 41.25 | 61.01 | 9.78 | -2.60 |
| 31 | 35.85 | 52.75 | 1.39 | -10.19 | 75 | 41.35 | 61.16 | 4.27 | -3.34 |
| 32 | 35.95 | 52.92 | 1.91 | -9.45 | 76 | 41.45 | 61.31 | 6.26 | -2.70 |
| 33 | 36.05 | 53.09 | 2.27 | -9.27 | 77 | 41.55 | 61.45 | 5.54 | -2.31 |
| 34 | 36.15 | 53.25 | 3.41 | -8.50 | 78 | 41.65 | 61.60 | 5.35 | -2.73 |
| 35 | 36.25 | 53.41 | 3.00 | -8.67 | 79 | 41.75 | 61.75 | 4.93 | -3.06 |
| 36 | 36.35 | 53.56 | 2.75 | -8.66 | 80 | 41.85 | 61.90 | 5.22 | -2.46 |
| 37 | 36.45 | 53.72 | 2.73 | -8.26 | 81 | 41.95 | 62.04 | 4.56 | -3.14 |
| 38 | 36.55 | 53.88 | 2.61 | -8.27 | 82 | 42.05 | 62.19 | 5.34 | -2.69 |
| 39 | 36.65 | 54.03 | 2.91 | -7.67 | 83 | 42.15 | 62.33 | 5.28 | -2.57 |
| 40 | 36.75 | 54.19 | 2.87 | -6.19 | 84 | 42.25 | 62.47 | 5.35 | -2.45 |
| 41 | 36.85 | 54.35 | 3.12 | -4.68 | 85 | 42.35 | 62.61 | 5.02 | -2.97 |
| 42 | 36.95 | 54.50 | 3.11 | -4.96 | 86 | 42.45 | 62.76 | 4.43 | -4.20 |
| 43 | 37.95 | 56.06 | 4.15 | -3.90 | 87 | 42.55 | 62.90 | 5.94 | -4.69 |
| 44 | 38.05 | 56.22 | 3.91 | -3.67 | 88 | 42.65 | 63.04 | 6.16 | -4.89 |

Table 1 continued

| Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) | Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) |
|---|---|---|---|---|---|---|---|---|---|
| 89 | 42.75 | 63.18 | 5.90 | -4.96 | 142 | 49.95 | 73.21 | 9.37 | -1.94 |
| 90 | 42.85 | 63.32 | 6.29 | -4.78 | 143 | 50.05 | 73.35 | 3.64 | -3.40 |
| 91 | 43.15 | 63.74 | 4.53 | -5.40 | 144 | 50.15 | 73.49 | 3.64 | -3.53 |
| 92 | 43.25 | 63.88 | 4.49 | -4.83 | 145 | 50.25 | 73.63 | 3.23 | -3.63 |
| 93 | 43.35 | 64.02 | 4.56 | -4.88 | 146 | 50.35 | 73.77 | 3.39 | -3.50 |
| 94 | 43.45 | 64.16 | 5.63 | -3.61 | 147 | 50.45 | 73.91 | 3.85 | -3.33 |
| 95 | 43.55 | 64.30 | 6.69 | -3.19 | 148 | 52.25 | 76.47 | 4.98 | -3.05 |
| 96 | 43.65 | 64.45 | 7.12 | -3.58 | 149 | 52.35 | 76.61 | 4.51 | -3.08 |
| 97 | 43.75 | 64.59 | 4.63 | -8.41 | 150 | 52.45 | 76.75 | 4.68 | -3.03 |
| 98 | 43.85 | 64.73 | 4.20 | -9.12 | 151 | 52.55 | 76.90 | 8.20 | -2.20 |
| 99 | 43.95 | 64.87 | 3.38 | -10.15 | 152 | 52.65 | 77.04 | 7.15 | -2.49 |
| 100 | 44.05 | 65.01 | 3.32 | -9.79 | 153 | 52.75 | 77.19 | 12.45 | -1.16 |
| 101 | 44.15 | 65.15 | 4.69 | -7.01 | 154 | 52.85 | 77.33 | 11.25 | -1.33 |
| 102 | 44.25 | 65.29 | 3.77 | -8.61 | 155 | 52.95 | 77.47 | 5.92 | -2.67 |
| 103 | 44.35 | 65.43 | 3.07 | -9.94 | 156 | 53.05 | 77.62 | 5.31 | -2.80 |
| 104 | 44.45 | 65.57 | 3.20 | -9.48 | 157 | 53.15 | 77.76 | 5.75 | -2.61 |
| 105 | 44.55 | 65.71 | 3.19 | -9.53 | 158 | 53.25 | 77.90 | 5.18 | -2.71 |
| 106 | 44.65 | 65.85 | 2.88 | -10.52 | 159 | 53.35 | 78.05 | 10.15 | -1.57 |
| 107 | 44.75 | 65.99 | 3.17 | -10.18 | 160 | 53.45 | 78.19 | 9.56 | -1.90 |
| 108 | 44.85 | 66.13 | 3.20 | -10.34 | 161 | 53.55 | 78.34 | 6.41 | -2.45 |
| 109 | 44.95 | 66.28 | 3.26 | -9.97 | 162 | 53.65 | 78.48 | 5.24 | -3.20 |
| 110 | 45.05 | 66.42 | 3.43 | -8.71 | 163 | 53.75 | 78.62 | 4.89 | -3.10 |
| 111 | 45.15 | 66.56 | 3.33 | -9.54 | 164 | 53.85 | 78.77 | 5.91 | -2.71 |
| 112 | 45.25 | 66.69 | 3.10 | -10.34 | 165 | 53.95 | 78.91 | 9.21 | -2.02 |
| 113 | 45.35 | 66.83 | 3.01 | -10.30 | 166 | 54.05 | 79.05 | 10.16 | -1.91 |
| 114 | 45.45 | 66.97 | 2.95 | -10.45 | 167 | 54.15 | 79.20 | 5.45 | -3.29 |
| 115 | 45.55 | 67.11 | 2.75 | -10.82 | 168 | 54.25 | 79.35 | 7.01 | -3.01 |
| 116 | 45.65 | 67.25 | 2.92 | -10.63 | 169 | 54.35 | 79.50 | 8.25 | -2.62 |
| 117 | 45.75 | 67.39 | 3.22 | -9.56 | 170 | 54.45 | 79.65 | 7.03 | -2.66 |
| 118 | 45.85 | 67.52 | 3.15 | -9.24 | 171 | 54.55 | 79.81 | 7.33 | -3.15 |
| 119 | 45.95 | 67.66 | 3.01 | -9.58 | 172 | 54.65 | 79.96 | 7.66 | -3.01 |
| 120 | 46.43 | 68.33 | 3.30 | -9.17 | 173 | 54.75 | 80.11 | 7.96 | -2.46 |
| 121 | 46.55 | 68.49 | 3.23 | -9.65 | 174 | 54.85 | 80.26 | 8.21 | -2.61 |
| 122 | 46.65 | 68.63 | 3.01 | -9.81 | 175 | 54.95 | 80.41 | 6.81 | -3.40 |
| 123 | 46.75 | 68.77 | 3.14 | -9.24 | 176 | 55.05 | 80.56 | 6.16 | -3.17 |
| 124 | 46.85 | 68.91 | 3.05 | -9.55 | 177 | 55.15 | 80.72 | 6.97 | -3.12 |
| 125 | 46.95 | 69.05 | 2.87 | -9.67 | 178 | 55.25 | 80.87 | 6.53 | -3.40 |
| 126 | 47.05 | 69.18 | 2.64 | -10.21 | 179 | 55.43 | 81.13 | 6.30 | -3.60 |
| 127 | 47.15 | 69.32 | 2.52 | -10.51 | 180 | 55.55 | 81.32 | 6.31 | -3.42 |
| 128 | 47.25 | 69.46 | 2.73 | -10.23 | 181 | 55.65 | 81.47 | 6.40 | -3.84 |
| 129 | 47.35 | 69.60 | 2.76 | -10.14 | 182 | 55.75 | 81.63 | 6.57 | -3.65 |
| 130 | 47.45 | 69.74 | 2.85 | -10.01 | 183 | 55.85 | 81.78 | 6.90 | -3.68 |
| 131 | 47.55 | 69.88 | 3.23 | -8.82 | 184 | 55.95 | 81.93 | 6.54 | -3.94 |
| 132 | 47.65 | 70.01 | 4.55 | -4.08 | 185 | 56.05 | 82.08 | 6.35 | -3.98 |
| 133 | 47.75 | 70.15 | 4.64 | -3.92 | 186 | 56.15 | 82.23 | 6.20 | -4.04 |
| 134 | 47.85 | 70.29 | 5.24 | -3.92 | 187 | 56.25 | 82.38 | 6.80 | -3.76 |
| 135 | 47.95 | 70.43 | 5.92 | -3.42 | 188 | 56.35 | 82.54 | 6.31 | -3.82 |
| 136 | 49.33 | 72.34 | 8.20 | -2.64 | 189 | 56.45 | 82.69 | 5.04 | -4.51 |
| 137 | 49.45 | 72.52 | 9.44 | -2.37 | 190 | 56.55 | 82.84 | 4.75 | -3.35 |
| 138 | 49.55 | 72.66 | 10.24 | -1.96 | 191 | 56.65 | 82.99 | 6.27 | -3.29 |
| 139 | 49.65 | 72.80 | 7.80 | -2.96 | 192 | 56.75 | 83.14 | 4.97 | -4.41 |
| 140 | 49.75 | 72.93 | 9.12 | -2.42 | 193 | 56.85 | 83.29 | 7.37 | -3.62 |
| 141 | 49.85 | 73.07 | 9.76 | -1.89 | 194 | 56.95 | 83.45 | 8.99 | -2.42 |

Table 1 continued

| Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) | Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) |
|---|---|---|---|---|---|---|---|---|---|
| 195 | 57.05 | 83.60 | 9.12 | -2.41 | 247 | 62.25 | 92.32 | 2.79 | -6.53 |
| 196 | 57.15 | 83.75 | 9.59 | -2.33 | 248 | 62.35 | 92.50 | 1.13 | -9.62 |
| 197 | 57.25 | 83.91 | 10.59 | -1.63 | 249 | 62.45 | 92.67 | 13.59 | -0.38 |
| 198 | 57.35 | 84.07 | 4.23 | -4.43 | 250 | 62.63 | 93.00 | 13.19 | 0.07 |
| 199 | 57.45 | 84.24 | 4.11 | -4.91 | 251 | 62.83 | 93.34 | 2.50 | -8.45 |
| 200 | 57.55 | 84.40 | 6.63 | -3.84 | 252 | 62.95 | 93.55 | 3.15 | -6.63 |
| 201 | 57.65 | 84.56 | 4.14 | -4.88 | 253 | 63.05 | 93.73 | 3.26 | -5.90 |
| 202 | 57.75 | 84.73 | 5.90 | -4.02 | 254 | 63.15 | 93.90 | 3.69 | -4.35 |
| 203 | 57.85 | 84.89 | 10.83 | -1.47 | 255 | 63.25 | 94.09 | 3.72 | -5.62 |
| 204 | 57.95 | 85.05 | 11.28 | -1.33 | 256 | 63.35 | 94.27 | 3.89 | -5.70 |
| 205 | 58.05 | 85.22 | 7.43 | -3.86 | 257 | 63.45 | 94.46 | 4.57 | -5.34 |
| 206 | 58.15 | 85.38 | 7.17 | -4.09 | 258 | 63.55 | 94.65 | 4.65 | -4.88 |
| 207 | 58.25 | 85.54 | 7.58 | -3.37 | 259 | 63.65 | 94.83 | 3.82 | -5.46 |
| 208 | 58.35 | 85.70 | 11.29 | -1.71 | 260 | 63.75 | 95.02 | 4.14 | -5.57 |
| 209 | 58.45 | 85.87 | 9.64 | -2.40 | 261 | 63.85 | 95.21 | 3.24 | -6.64 |
| 210 | 58.55 | 86.03 | 8.49 | -3.20 | 262 | 63.95 | 95.39 | 2.98 | -6.89 |
| 211 | 58.65 | 86.19 | 8.74 | -2.93 | 263 | 64.05 | 95.58 | 2.84 | -7.78 |
| 212 | 58.75 | 86.36 | 9.24 | -2.64 | 264 | 64.15 | 95.77 | 2.86 | -9.31 |
| 213 | 58.85 | 86.52 | 11.59 | -1.47 | 265 | 64.25 | 95.95 | 2.71 | -10.17 |
| 214 | 58.95 | 86.68 | 8.00 | -3.63 | 266 | 64.35 | 96.14 | 2.52 | -11.47 |
| 215 | 59.05 | 86.85 | 9.42 | -2.93 | 267 | 64.45 | 96.33 | 2.72 | -9.95 |
| 216 | 59.15 | 87.01 | 9.62 | -2.88 | 268 | 64.55 | 96.51 | 2.38 | -11.28 |
| 217 | 59.25 | 87.17 | 9.09 | -3.36 | 269 | 64.65 | 96.70 | 2.85 | -10.06 |
| 218 | 59.35 | 87.34 | 10.15 | -2.84 | 270 | 64.75 | 96.89 | 2.80 | -10.95 |
| 219 | 59.45 | 87.50 | 10.24 | -2.58 | 271 | 64.85 | 97.07 | 2.74 | -10.41 |
| 220 | 59.55 | 87.66 | 9.27 | -2.98 | 272 | 64.95 | 97.26 | 2.56 | -10.58 |
| 221 | 59.65 | 87.82 | 8.92 | -2.84 | 273 | 65.05 | 97.45 | 2.32 | -10.14 |
| 222 | 59.75 | 87.99 | 9.96 | -2.43 | 274 | 65.15 | 97.63 | 3.56 | -5.86 |
| 223 | 59.85 | 88.15 | 3.68 | -6.76 | 275 | 65.25 | 97.82 | 5.39 | -2.47 |
| 224 | 59.95 | 88.31 | 2.53 | -9.39 | 276 | 65.35 | 98.01 | 4.38 | -3.73 |
| 225 | 60.05 | 88.48 | 3.93 | -7.54 | 277 | 65.45 | 98.19 | 4.31 | -4.39 |
| 226 | 60.15 | 88.64 | 2.51 | -8.28 | 278 | 65.55 | 98.38 | 4.06 | -4.56 |
| 227 | 60.25 | 88.81 | 2.13 | -10.64 | 279 | 65.65 | 98.57 | 4.22 | -3.20 |
| 228 | 60.35 | 88.99 | 2.14 | -10.48 | 280 | 65.75 | 98.75 | 4.42 | -3.21 |
| 229 | 60.45 | 89.16 | 2.05 | -10.70 | 281 | 65.85 | 98.94 | 4.25 | -3.41 |
| 230 | 60.55 | 89.34 | 1.75 | -10.57 | 282 | 65.95 | 99.13 | 4.47 | -3.40 |
| 231 | 60.65 | 89.51 | 2.32 | -8.92 | 283 | 66.05 | 99.31 | 3.76 | -3.50 |
| 232 | 60.75 | 89.69 | 3.11 | -6.03 | 284 | 66.15 | 99.50 | 4.24 | -3.19 |
| 233 | 60.85 | 89.87 | 3.40 | -5.91 | 285 | 66.25 | 99.69 | 4.14 | -3.20 |
| 234 | 60.95 | 90.04 | 3.02 | -6.35 | 286 | 66.35 | 99.89 | 4.14 | -3.10 |
| 235 | 61.05 | 90.22 | 3.30 | -6.55 | 287 | 66.45 | 100.08 | 4.01 | -3.34 |
| 236 | 61.15 | 90.39 | 3.56 | -5.69 | 288 | 66.55 | 100.28 | 4.10 | -3.36 |
| 237 | 61.25 | 90.57 | 3.55 | -5.97 | 289 | 66.65 | 100.48 | 4.69 | -2.40 |
| 238 | 61.35 | 90.74 | 3.66 | -5.90 | 290 | 66.75 | 100.67 | 5.10 | -2.77 |
| 239 | 61.45 | 90.92 | 3.12 | -5.29 | 291 | 66.85 | 100.87 | 6.89 | -1.87 |
| 240 | 61.55 | 91.09 | 3.11 | -6.00 | 292 | 66.95 | 101.06 | 7.63 | -1.59 |
| 241 | 61.65 | 91.27 | 3.14 | -6.61 | 293 | 67.05 | 101.26 | 11.61 | -1.11 |
| 242 | 61.75 | 91.45 | 3.34 | -6.64 | 294 | 67.15 | 101.46 | 11.54 | -1.16 |
| 243 | 61.85 | 91.62 | 3.45 | -6.11 | 295 | 67.25 | 101.65 | 9.34 | -1.58 |
| 244 | 61.95 | 91.80 | 3.38 | -5.69 | 296 | 67.35 | 101.85 | 9.53 | -1.75 |
| 245 | 62.05 | 91.97 | 2.92 | -6.14 | 297 | 67.45 | 102.05 | 4.52 | -2.82 |
| 246 | 62.15 | 92.15 | 2.68 | -6.60 | 298 | 67.55 | 102.24 | 4.48 | -2.89 |

Table 1 continued

| Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) | Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) |
|---|---|---|---|---|---|---|---|---|---|
| 299 | 67.65 | 102.44 | 3.32 | -3.33 | 352 | 72.95 | 113.20 | 5.62 | -3.18 |
| 300 | 67.75 | 102.63 | 3.30 | -3.43 | 353 | 73.05 | 113.41 | 4.02 | -4.04 |
| 301 | 67.85 | 102.83 | 3.25 | -3.26 | 354 | 73.15 | 113.62 | 3.87 | -4.39 |
| 302 | 67.95 | 103.03 | 4.15 | -2.99 | 355 | 73.55 | 114.46 | 3.73 | -4.20 |
| 303 | 68.05 | 103.22 | 3.81 | -3.16 | 356 | 73.65 | 114.67 | 4.41 | -3.77 |
| 304 | 68.15 | 103.42 | 3.19 | -3.50 | 357 | 73.75 | 114.89 | 3.12 | -3.83 |
| 305 | 68.25 | 103.62 | 2.29 | -3.74 | 358 | 73.85 | 115.10 | 7.35 | -2.28 |
| 306 | 68.35 | 103.81 | 2.63 | -3.45 | 359 | 73.95 | 115.31 | 8.75 | -1.39 |
| 307 | 68.45 | 104.01 | 2.96 | -3.44 | 360 | 74.05 | 115.52 | 8.44 | -1.70 |
| 308 | 68.55 | 104.21 | 2.73 | -3.13 | 361 | 74.15 | 115.73 | 4.23 | -5.57 |
| 309 | 68.65 | 104.40 | 3.07 | -3.54 | 362 | 74.25 | 115.94 | 2.90 | -6.39 |
| 310 | 68.75 | 104.60 | 2.84 | -2.92 | 363 | 74.35 | 116.15 | 3.65 | -5.21 |
| 311 | 68.85 | 104.79 | 2.79 | -2.89 | 364 | 74.45 | 116.36 | 6.16 | -2.48 |
| 312 | 68.95 | 104.99 | 2.62 | -3.39 | 365 | 74.55 | 116.57 | 4.13 | -4.22 |
| 313 | 69.05 | 105.19 | 2.72 | -3.32 | 366 | 74.65 | 116.79 | 3.85 | -4.81 |
| 314 | 69.15 | 105.38 | 5.16 | -2.55 | 367 | 74.75 | 117.00 | 2.99 | -5.51 |
| 315 | 69.25 | 105.58 | 10.01 | -1.67 | 368 | 74.85 | 117.21 | 2.18 | -5.95 |
| 316 | 69.35 | 105.79 | 3.45 | -2.95 | 369 | 74.95 | 117.42 | 1.61 | -7.81 |
| 317 | 69.45 | 105.99 | 5.82 | -2.69 | 370 | 75.05 | 117.63 | 0.92 | -7.82 |
| 318 | 69.55 | 106.20 | 6.84 | -2.20 | 371 | 75.15 | 117.84 | nm | nm |
| 319 | 69.65 | 106.40 | 4.72 | -3.40 | 372 | 75.25 | 118.05 | nm | nm |
| 320 | 69.75 | 106.61 | 4.25 | -3.32 | 373 | 75.35 | 118.27 | -1.33 | 1.07* |
| 321 | 69.85 | 106.81 | 4.77 | -3.23 | 374 | 75.45 | 118.49 | -0.23 | -1.03 |
| 322 | 69.95 | 107.01 | 4.32 | -3.46 | 375 | 75.55 | 118.70 | nm | nm |
| 323 | 70.05 | 107.22 | 3.23 | -3.73 | 376 | 75.65 | 118.92 | nm | nm |
| 324 | 70.15 | 107.42 | 3.97 | -3.59 | 377 | 75.75 | 119.13 | nm | nm |
| 325 | 70.25 | 107.63 | 4.22 | -3.87 | 378 | 75.85 | 119.35 | nm | nm |
| 326 | 70.35 | 107.83 | 4.80 | -3.33 | 379 | 75.95 | 119.57 | nm | nm |
| 327 | 70.45 | 108.04 | 5.13 | -3.54 | 380 | 76.05 | 119.78 | 1.31 | -1.84 |
| 328 | 70.55 | 108.24 | 5.31 | -3.57 | 381 | 76.15 | 120.00 | 2.38 | -1.95 |
| 329 | 70.65 | 108.45 | 5.30 | -3.49 | 382 | 76.25 | 120.22 | 3.43 | -1.07 |
| 330 | 70.75 | 108.65 | 4.10 | -3.67 | 383 | 76.35 | 120.43 | 4.31 | -0.18 |
| 331 | 70.85 | 108.85 | 3.17 | -4.77 | 384 | 76.45 | 120.65 | 3.76 | -0.92 |
| 332 | 70.95 | 109.06 | 4.22 | -4.28 | 385 | 76.55 | 121.48 | 5.95 | -1.27 |
| 333 | 71.05 | 109.26 | 4.73 | -3.83 | 386 | 76.65 | 121.30 | 4.41 | 0.03 |
| 334 | 71.15 | 109.47 | 4.88 | -3.76 | 387 | 76.75 | 121.51 | 4.40 | -0.28 |
| 335 | 71.25 | 109.67 | 4.67 | -4.37 | 388 | 76.85 | 121.73 | 4.57 | 0.51 |
| 336 | 71.35 | 109.88 | 4.57 | -4.01 | 389 | 76.95 | 121.95 | 4.93 | -2.12 |
| 337 | 71.45 | 110.08 | 4.68 | -3.69 | 390 | 77.05 | 122.16 | 4.72 | -1.61 |
| 338 | 71.55 | 110.29 | 5.64 | -3.63 | 391 | 77.15 | 122.38 | 6.01 | -3.38 |
| 339 | 71.65 | 110.49 | 4.44 | -4.09 | 392 | 77.25 | 122.59 | 5.14 | -1.38 |
| 340 | 71.75 | 110.69 | 5.13 | -4.33 | 393 | 77.35 | 122.81 | 5.05 | -2.54 |
| 341 | 71.85 | 110.90 | 4.80 | -3.69 | 394 | 77.45 | 123.03 | 4.97 | -3.26 |
| 342 | 71.95 | 111.10 | 3.26 | -7.12 | 395 | 77.55 | 123.24 | 3.77 | -3.75 |
| 343 | 72.05 | 111.31 | 4.30 | -3.90 | 396 | 77.65 | 123.46 | 0.52 | -4.87 |
| 344 | 72.15 | 111.51 | 4.71 | -3.47 | 397 | 77.75 | 123.68 | 5.07 | -2.31 |
| 345 | 72.25 | 111.72 | 4.41 | -3.50 | 398 | 77.85 | 123.89 | nm | nm |
| 346 | 72.35 | 111.93 | 3.73 | -4.09 | 399 | 77.95 | 124.11 | nm | nm |
| 347 | 72.45 | 112.14 | 4.05 | -3.84 | 400 | 78.05 | 124.32 | nm | nm |
| 348 | 72.55 | 112.35 | 3.68 | -4.02 | 401 | 78.15 | 124.54 | 0.42 | 2.28* |
| 349 | 72.65 | 112.56 | 2.93 | -5.19 | 402 | 78.25 | 124.76 | 3.89 | 0.42 |
| 350 | 72.75 | 112.77 | 3.03 | -4.97 | 403 | 78.35 | 124.98 | 3.59 | 1.55* |
| 351 | 72.85 | 112.99 | 4.27 | -4.51 | 404 | 78.45 | 125.20 | 3.55 | -1.11 |

Table 1 continued

| Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) | Sample | Depth (m) | Age (kyrs) | $\delta^{13}C$ (‰) | $\delta^{18}O$ (‰) |
|---|---|---|---|---|---|---|---|---|---|
| 405 | 78.55 | 125.42 | nm | nm | 425 | 80.55 | 129.83 | 1.89 | -1.13 |
| 406 | 78.65 | 125.64 | 3.66 | -1.76 | 426 | 80.65 | 130.05 | 1.18 | -3.59 |
| 407 | 78.75 | 125.86 | 4.10 | -5.49 | 427 | 80.75 | 130.27 | 2.51 | -2.50 |
| 408 | 78.85 | 126.08 | 4.40 | -3.84 | 428 | 80.85 | 130.49 | 2.32 | -3.85 |
| 409 | 78.95 | 126.30 | 3.92 | -1.68 | 429 | 80.95 | 130.71 | 1.16 | 0.46 |
| 410 | 79.05 | 126.52 | 3.59 | -4.57 | 430 | 81.05 | 130.93 | 1.23 | -2.62 |
| 411 | 79.15 | 126.74 | 4.69 | -4.97 | 431 | 81.15 | 131.15 | -2.25 | 1.92* |
| 412 | 79.25 | 126.97 | 4.39 | -4.63 | 432 | 81.25 | 131.38 | 2.18 | -3.33 |
| 413 | 79.35 | 127.19 | 4.54 | -3.53 | 433 | 81.35 | 131.60 | 1.39 | -5.90 |
| 414 | 79.45 | 127.41 | 4.29 | -4.31 | 434 | 81.45 | ** | ** | ** |
| 415 | 79.55 | 127.63 | 2.28 | 4.99* | 435 | 81.55 | 132.05 | 0.33 | -6.56 |
| 416 | 79.65 | 127.85 | nm | nm | 436 | 81.65 | 132.27 | -1.38 | -8.40 |
| 417 | 79.75 | 128.07 | 2.86 | 7.45* | 437 | 81.75 | 132.50 | 1.76 | -6.05 |
| 418 | 79.85 | 128.29 | 1.72 | 4.13* | 438 | 81.85 | 132.72 | 1.69 | -6.10 |
| 419 | 79.95 | 128.51 | 3.25 | 1.94* | 439 | 81.95 | 132.95 | -0.48 | -5.95 |
| 420 | 80.05 | 128.73 | 2.77 | 1.44* | 440 | 82.05 | 133.17 | 1.05 | -7.20 |
| 421 | 80.15 | 128.95 | 2.25 | -0.25 | 441 | 82.15 | 133.40 | 0.66 | -7.84 |
| 422 | 80.25 | 129.17 | 2.85 | -2.37 | 442 | 82.25 | 133.62 | 0.67 | -6.05 |
| 423 | 80.35 | 129.39 | 2.82 | -3.44 | 443 | 82.35 | 133.84 | 0.84 | -7.19 |
| 424 | 80.45 | 129.61 | 3.45 | -1.38 | 444 | 82.45 | 134.07 | 0.55 | -7.50 |

nm = not measurable due to too low carbonate contents.
* questionable data, see explanation in text,
** sample lost.

Table 2 Summary of stable isotope data and their paleoenvironmental inferences for interval 32–83 m in core OL-92.

| Period | I | II | III | IV | V* | VI | VII** |
|---|---|---|---|---|---|---|---|
| Sample No. | 1–42 | 43–96 | 97–131 | 132–222 | 223–274 | 275–366 | 367–444 |
| Depth (m) | 32.05–36.95 | 37.95–43.65 | 43.75–47.55 | 47.65–59.75 | 59.85–65.15 | 65.25–74.65 | 74.75–82.45 |
| Age (ka)*** | 46.22-54.50 | 56.06-64.45 | 64.59-69.88 | 70.01-87.99 | 88.15-97.63 | 97.82-116.79 | 117.0-134.07 |
| Probable age# | 58-66 ka | 67-76 ka | 76-81 ka | 81-99 ka | 99-109 ka | 109-128 ka | 128-145 ka |
| Deep-sea $\delta^{18}O$ stage | 4 | 5a | 5b | 5c | 5d | 5e | 6 |
| Average $\delta^{18}O$ (‰, PDB) | −8.59±1.69 | −3.10±0.92 | −9.69±0.76 | −3.01±0.82 | −7.61±2.10 | −3.46±1.01 | −3.47±2.50 |
| $\delta^{18}O$ range (‰, PDB) | −11.27~−4.68 | −5.40~−1.20 | −10.82~−7.01 | −4.91~−1.16 | −11.28~-5.29 | −6.39~−1.11 | −8.40~0.46 |
| Average $\delta^{13}C$ (‰, PDB) | 2.03±1.13 | 5.42±1.32 | 3.20±0.48 | 7.35±2.21 | 3.44±2.12 | 4.67±1.84 | 2.82±1.78 |
| $\delta^{13}C$ range (‰, PDB) | −0.03~5.85 | 3.91~10.56 | 2.52~4.69 | 3.23~12.45 | 1.13~4.65 | 2.29~11.61 | −1.38~6.01 |
| Hydrological condition | Open lake, fresh water | Closed lake, saline, alkaline | Fast through-flow open lake | Closed lake, saline, alkaline | Mostly an open lake | Closed lake, saline | Cold fresh water |
| Lake productivity | Very low | High | Low | Very high | Low | High | Very low |
| Climate | Wet/Cold | Dry/Warm | Very wet/Cold | Dry/Warm | Wet/Cool | Dry/Warm | Very cold/wet |

* Isotope data not include those of the two dolomite samples at 62.63 and 62.83 m.
** $\delta^{18}O$ data not include values greater than 0.5‰.
*** Ages according to the time-depth model of Bischoff et al. (1997b).
\# Ages based on assuming that the age boundary between Periods VI and VII correspond to Terminal II (128 ka) of the marine record.

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## Carbonate Mineralogy in Owens Lake, California from 145 to 45 ka: A Proxy of Lake Hydrology and Productivity

by
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## Introduction

Studies of isotopic, chemical, and mineralogical compositions of closed-basin lake sediments have provided valuable paleoclimatic and paleoenvironmental information. Owens Lake is one of several closed-basin lakes located in east-central California, lakes that are the remains of ice-age pluvial lakes in the Great Basin. In 1992, the USGS recovered a 323-m-long core, OL-92, from near the depo-center of the lake. It represents a continuous record of lacustrine sedimentation spanning the last 800,000 years. Studies made on the core have shown that weight percent (wt.%) $CaCO_3$, or total inorganic carbon (TIC), in the core may serve as a proxy for lake level oscillations (Smith and Bischoff, 1997; Benson et al., 1996; Bischoff et al., 1997a, 1997b, 1997c; Menking et al., 1997). Calcium and carbonate ions in Owens Lake are trapped under closed-lake conditions, whereas during overflow, they are transported downstream to precipitate in the lower basins (Bischoff et al., 1997b). Therefore, wt.% $CaCO_3$ or TIC in Owens Lake sediments was low during wet/cold glacial periods and high during dry/warm interglacial periods. This use of the $CaCO_3$-abundance proxy, however, is under the constraint that the source and chemistry of the inflow water remain unchanged. If these parameters did change, as in Lake Manly (the lake that periodically flooded Death Valley during the late Pleistocene), the TIC-lake level relationship would not hold and could even be reversed. For example, in Lake Manly sediments Li et al. (1997) found that relatively small amounts of calcite formed during dry periods from 10 to 0 ka and 100 to 60 ka and relatively abundant calcite formed during wet periods from 10 to 60 ka. To circumvent the inflow problem and to avoid the uncertainty whether the TIC proxy can be used when a lake does not experience overflow, we attempt here to use aragonite abundance in closed-basin lake sediments as a lake-level tracer.

In a reconnaissance study, Bischoff et al. (1997a) carried out XRD analyses of OL-92 at about 7000-year intervals. The major carbonate mineral was identified as calcite, with minor amounts of aragonite and dolomite. Later, Bischoff et al. (1997b) and Menking et al. (1997) studied the core at a higher resolution of ~1500 years by measuring the total inorganic carbon distribution between 160 and 10 ka. In this report, we present the result of our measurements on the calcite, aragonite and dolomite contents in the core between the depth interval of 32–83 m, corresponding in age between 145 and 45 ka (Li et al., this volume). The measurements were made on 443 samples by XRD. The time resolution was about 170 years. Our goal is to use the aragonite variability to deduce lake level changes of Owens Lake, as it has been shown by Li (1995) that in sediments of Mono Lake, a closed-basin lake located 200 km north of Owens Lake, variations in the aragonite concentration strongly correlate with lake level fluctuations. We also intend to examine the extent to which the presence of dolomite will affect the use of oxygen and carbon isotope compositions of total carbonate in sediments as proxies for lake-level history.

## Analytical Method and Results

The XRD analyses were done on sediment samples with interstitial salts having been removed by washing with de-ionized water. About 0.2 g of sample material were ground into fine power, mixed with 1 ml of acetone and placed on a glass slide where acetone was allowed to evaporate before analysis. Measurements of the carbonate minerals and their relative abundance were made using a Rikagu D/Max X-ray Diffractometer incorporated with a Multi CPU Controller.

The XRD spectra showed the presence of three carbonate minerals: calcite, aragonite and dolomite, and quartz as a major detrital mineral. The identification of the X-ray peaks ($CuK_\alpha$) for these minerals were: aragonite at 33.1°2θ, quartz at 26.5°2θ, calcite at 29.5°2θ, and dolomite at 31.2°2θ. The choice of 33.1°2θ rather than 26.1°2θ for estimating the aragonite peak intensity was to avoid the interference of the quartz peak at 26.5°2θ which was usually rather large. We used the peak intensity of quartz as a qualitative measure of the extent of detrital contribution to the sample.

Table 1 lists the XRD results on quartz (Q), calcite (C), aragonite (A) and dolomite (D) for the 443 samples analyzed. The peak intensity, expressed numerically in some arbitrary units for the area under the peak, was estimated via a computer program supplied by the instrument manufacturer. The major uncertainty of such an estimation involves the baseline level introduced by clay minerals. Correction for this background is difficult because clay contents vary from sample to sample. The data reported here are background-uncorrected. Thus the low-intensity peaks will have larger uncertainties than the high-intensity peaks. As the characteristic peaks of different minerals have different intensities, we made standard curves for calibrating the aragonite and calcite abundance by mixing various proportions of pure aragonite and calcite tufas collected from Mono Lake. Figure 1 shows the standard curves for the two minerals, both giving good linear relationships between wt.% and the peak intensities at 33.1°2θ for aragonite and at 29.5°2θ for calcite. In a 50-50 wt.% mixture, the standard gives an aragonite peak intensity of about 125 and a calcite peak intensity of about 550. The peak intensities of quartz and dolomite are also stronger than that of aragonite, e.g., the maximum intensities for quartz and dolomite are 490 (corresponding to ~15 wt.%) and 780 (~80 wt.%), respectively (Tables 1 and 2). Therefore, estimates on the aragonite abundance bear relatively large errors due to small peak intensity/background ratios in the XRD spectra. For aragonite and calcite with less than 5 wt.%, their respective peak intensities of 35 and 100 are close to the baseline value, hence are considered undetectable (Fig. 1). For quartz and dolomite, we took a peak intensity value of 100 similar to that of calcite as their detection limits of 5 wt.% (see Fig. 4a for illustration of the detection limit for dolomite).

Figure 2 plots the intensity data for various minerals listed in Table 1 against depth in core, with the horizontal dashed lines denoting the detection limits. In order to relate the response of carbonate minerals to climate changes, we separate the depth profiles into seven periods based on the stable isotope records (Li et al, this volume). It is seen that all three carbonate minerals are near or below their detection limits for Periods I and VII. In general, calcite is abundant from 38 to 75 m, and its abundance decreases with increasing aragonite and dolomite. Aragonite shows high abundance in Period II and late Period VI, and moderate abundance in Period IV. Dolomite appears minor only in Periods II and IV but exhibits several high but narrow peaks from 38 to 75 m depth. The salient feature for the quartz distribution is its low abundance in Period I and high abundance in Period VII. Since there are no other detectable carbonate minerals, the total carbonate abundance in a sample can be taken as the sum of the peak intensities for calcite (C), aragonite (A) and dolomite (D). The peak intensity ratios C/Q, A/Q, and D/Q, where Q is the peak intensity of quartz and gives a measure of the detrital contribution to the sample, reflect the abundance of carbonate minerals relative to detrital sediments (Fig. 3a).

### XRD Analysis as a Quantitative Measure of Carbonate Minerals

Based on the comparison of XRD and chemical analyses on Mono Lake sediments, Li (1995) has demonstrated that the XRD method can quantitatively measure the aragonite and calcite contents. We have compared the XRD results with the TIC results obtained by Bischoff et al. (this volume). The comparison shows an apparent correlation (R = 0.83) between the two sets of data (Fig. 3a), suggesting that variations in the ratio (C+A+D)/Q may reflect changes in wt.% of total carbonate in Owens Lake sediments. Figure 3b shows that the correlation between calcite and TIC has a coefficient of 0.6. The lower correlation coefficient (0.6 vs. 0.83) implies that aragonite and dolomite contribute significantly to TIC.

In order to assess the extent to which the abundance of dolomite is represented by its peak intensity, we performed the following experiment on seven samples having strong dolomite peaks (Fig. 2 and Table 2). About 0.5 g of each high-dolomite samples were leached with 5 ml of 1N HCl at room temperature. After about 30 minutes when the $CO_2$ bubbles subsided (pH of the solution ~7), an additional 0.5 ml of concentrated HCl was added to the solution. It took about another 60 minutes to complete the reaction for all samples except OL-92-249, which required the addition of another 0.5 ml of concentrated HCl. The final pH of the leachate solutions was <1. After centrifugation and decantation of the supernatants, the samples were washed three times with 30 ml of de-ionized water until the supernatant liquids had a pH of 7. The weight loss of each sample, listed in Table 2, was estimated after the residues were oven-dried at 70°C. As the samples were removed of their salt contents before the leaching, and as little organic matter dissolution is expected to have occurred during the leaching process, the weight loss is used to calculate the wt.% carbonate. We noted that all 80% of the dolomite in sample OL-92-249 were dissolved in cold 1N HCl with ease, in contrast to the common experience that dolomite rocks are difficult to dissolve in this concentration. Whether the contrast is caused by a difference in structure or grain size between this dolomite and dolomite rocks is not clear.

Figure 4 shows the linear correlations between the XRD and acid leaching results. The linear correlation between peak intensity and wt.% loss by acid leaching for dolomite in Fig. 4a gives that the peak intensity will be ~100 when wt.% is 5%, a detection limit for dolomite discussed above. Since these samples contain mainly dolomite, the low peak intensities of calcite and aragonite introduce a fairly large uncertainty into the total carbonate abundance estimates. Hence the correlation with wt.% lost using dolomite peaks alone is stronger than the correlation using peak intensities of D+A and C+D+A. Figure 4 also shows that the peak intensities of carbonate minerals normalized to the quartz peak intensity represent the carbonate wt.% better than the carbonate peak intensities without normalization, since the wt.% is also related to detrital content. In summary, the strong correlations as shown in Fig. 4 indicate that XRD analysis can be used as a quantitative method to determine the weight percent of carbonate minerals in sediments.

## Data implications

*Authigenic Dolomite as an Indicator of Abnormally Dry Climate*

We have found that high-dolomite samples generally show heavy $\delta^{18}O$ and $\delta^{13}C$ values which reflect sharp drops in lake level under abnormally dry climates (Table 2). Comparisons of the isotopic values and dolomite abundance between these high-dolomite samples (e.g., OL-92 153 and 249) and the adjacent low-dolomite samples (OL-92 154 and 250) indicate that the isotopic fractionation of the dolomite is close to those of calcite and aragonite in the lake. If isotopic fractionation of dolomite were very different from those of calcite and aragonite, the large difference in dolomite abundance would lead to a significant difference in the isotopic values of the two adjacent pairs of sediments. But no such a difference is seen in Table 2. Furthermore, the lake $\delta^{18}O$ and $\delta^{13}C$ values increased markedly prior to the formation of the high dolomite layers (Table 2). This means that a decrease in lake level lead to an increase in $Ca^{2+}$, $Mg^{2+}$, and $CO_3^{2-}$ concentrations which favor dolomite precipitation.

*Aragonite Abundance as a Proxy for Lake Hydrology and Productivity*

Aragonite formation in a closed-basin lake is a function of lake salinity, alkalinity, pH, biological activity, and the supply of $Ca^{2+}$, $Mg^{2+}$ and $SO_4^{2-}$ to the lake, all of which in turn depend on lake level and climate changes (Bischoff et al., 1991; Dunn, 1953; Cloud, 1962; Herbst and Bradley, 1989; Newton, 1994; Scholl and Taft, 1964; Taft, 1962). In general, when a lake level declines, increases in salinity, alkalinity, pH, water temperature, $Mg^{2+}$, $Sr^{2+}$ and biological activities favor the formation of aragonite over calcite. Figure 5 shows that the aragonite/quartz ratio matches well the total organic carbon concentration, indicating that high productivity favors aragonite formation. Figure 6 exhibits a positive correlation between the aragonite/quartz ratio and the acid-leachable Sr concentration measured by Bischoff et al. (this volume).

As can be seen in Fig. 7, high aragonite contents (A/Q) are found at depths of 38.75-44, 52.25-56.35, 59.25, and 65.15-67.65 m, occurring mostly during the closed lake Periods II, IV and VI reflected by the $\delta^{18}O$ curve (Li et al., in this volume). Examining the corresponding changes in A/Q, C/Q and (C+A+D)/Q ratios to the lake level fluctuations reflected by the $\delta^{18}O$ curve, one may find that the A/Q ratio has a better correlation with lake level change than the other two. During Period VII (corresponding to marine oxygen isotope stage 6), the lake was cold and overflowing. Detrital sediments might have been carried into the lake by meltwater, and any formation of carbonate in the lake was at an undetectable level (Fig. 7). The $\delta^{18}O$ signals of sediments deposited then do not reflect the hydrologic balance of the lake (Li et al., this volume).

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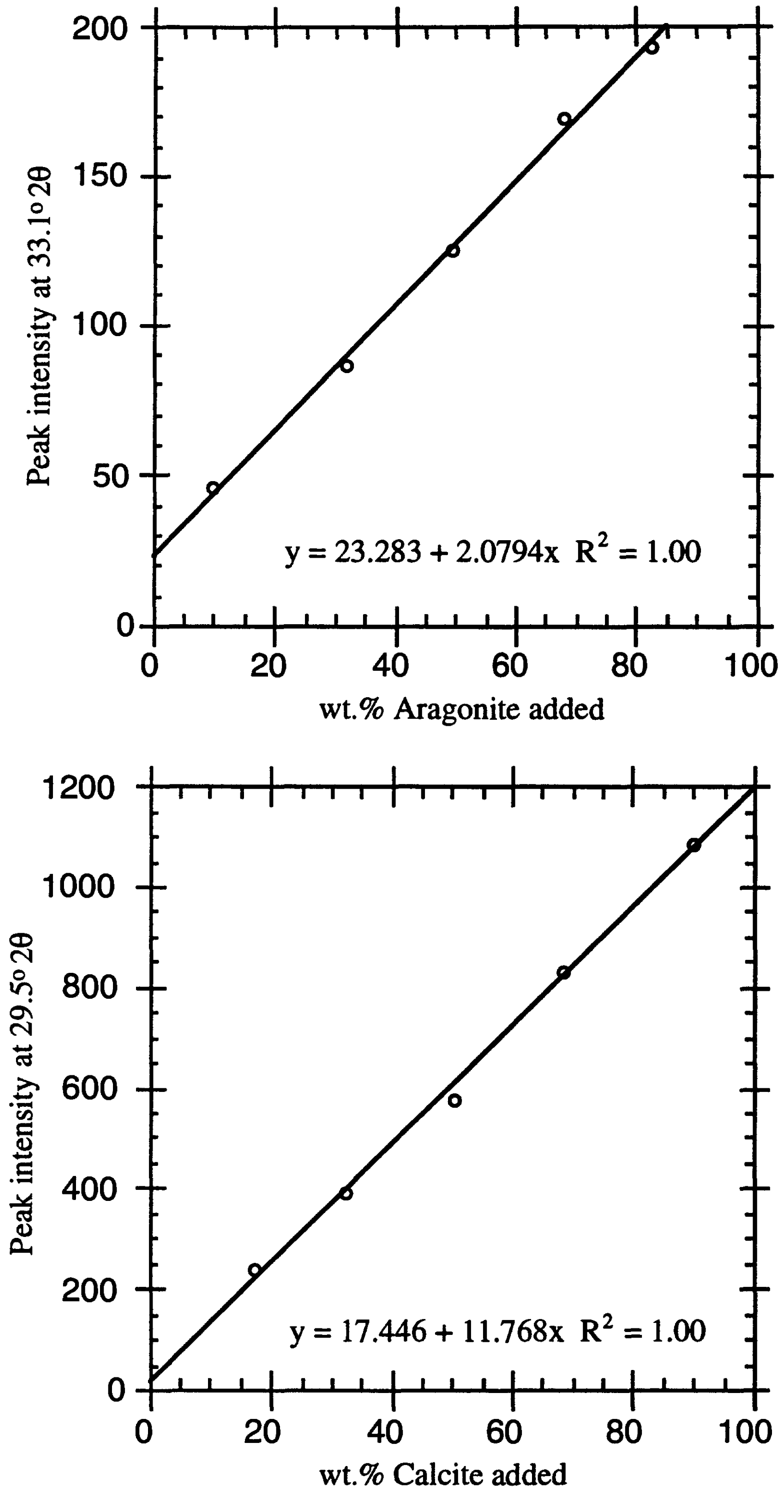


Fig. 1 Working standard curves for XRD analyss of aragonite and calcite in Owens Lake sediments. The standards are made from mixtures of pure aragonite and pure calcite tufas collected from Mono Lake, CA.

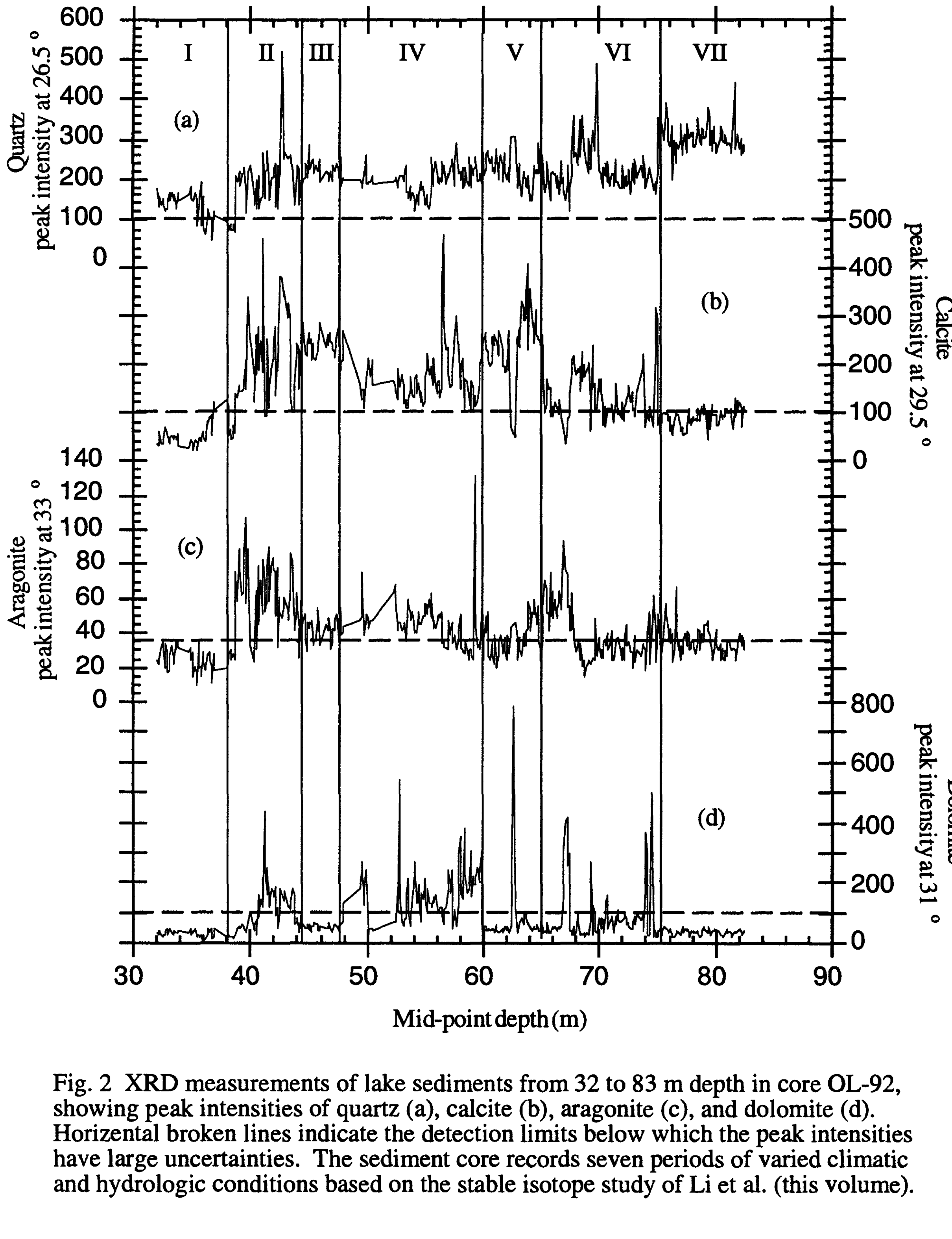


Fig. 2 XRD measurements of lake sediments from 32 to 83 m depth in core OL-92, showing peak intensities of quartz (a), calcite (b), aragonite (c), and dolomite (d). Horizental broken lines indicate the detection limits below which the peak intensities have large uncertainties. The sediment core records seven periods of varied climatic and hydrologic conditions based on the stable isotope study of Li et al. (this volume).

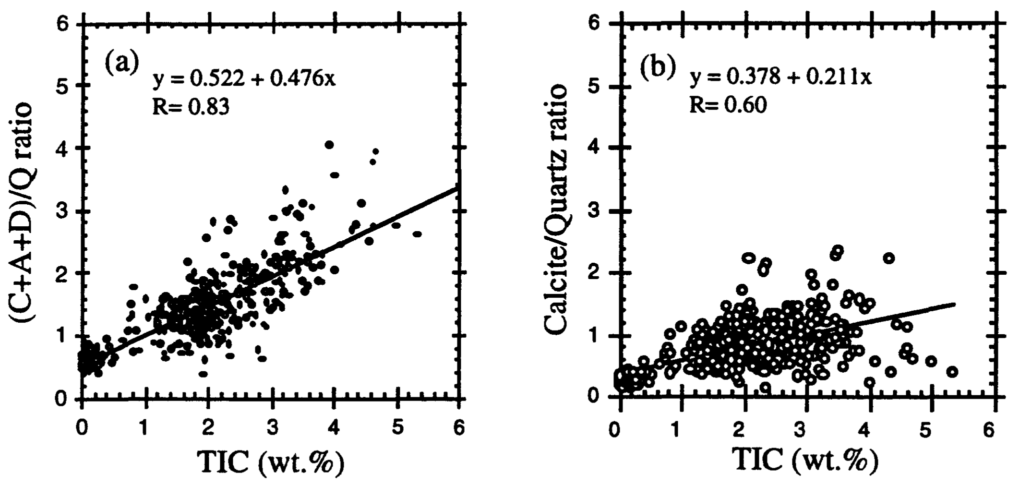


Fig. 3 Plots showing corelations between XRD analyses (calcite, aragonite, dolomite, and quartz) and chemical analyses of total inorganic carbon (TIC) in core OL-92 from Owens Lake. The correlation shown in (a) serves to validate the XRD technique as a semi-quantitative method of determining the carbonate concentration in sediments. The plots in (b) gives a correlation coefficient (R) that is lower than that of the plots shown in (a), indicating that aragonite and dolomite are not negligible compared to calcite.

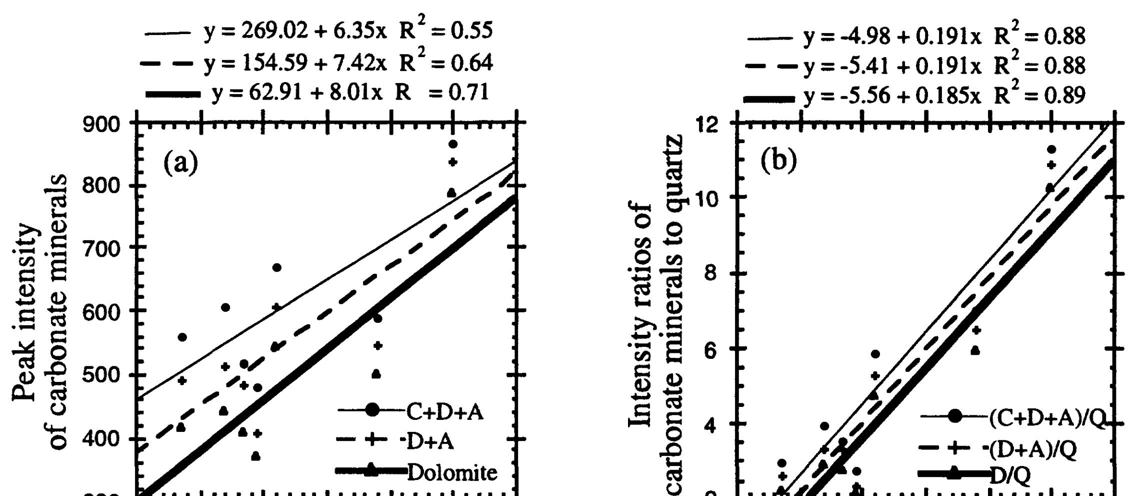


Fig. 4 (a) Linear correlations between XRD peak intensities of carbonate minerals and the weight % loss by 1N HCl leaching of sediments. (b) Linear correlations between intensity ratios of carbonate minerals to quartz determined by XRD and the wt.% loss of sediment by 1N HCl leaching. The correlations indicate that the XRD analyses can be a semi-quantitative way to determine carbonate contents in sediments. These samples contain high dolomite contents. Intensity ratio of carbonate mineral to quartz is better proxy for wt.% than intensity of the mineral only.

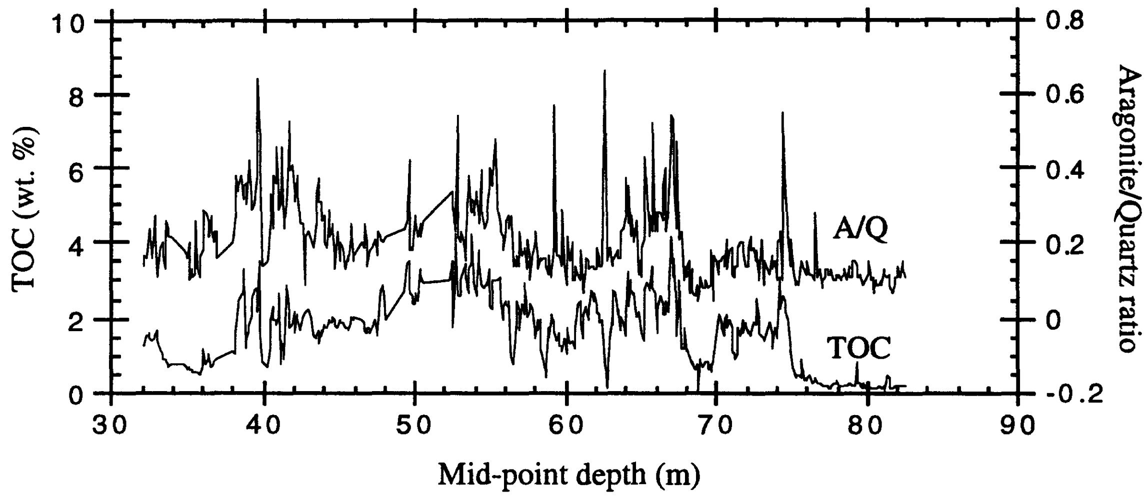


Fig. 5 Plots showing co-variance between aragonite/quartz ratio and total organic carbon content in core OL-92, indicating that aragonite may be used as a proxy for lake productivity.

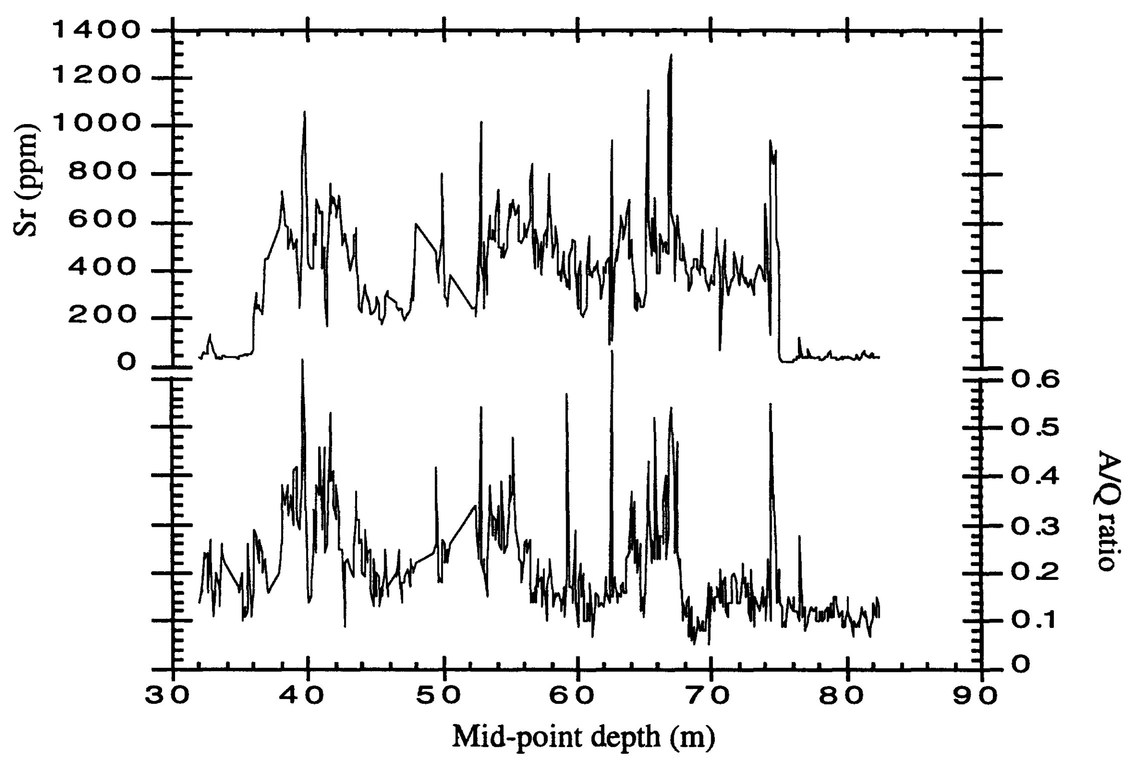


Fig. 6 Comparison of aragonite/quartz ratio with Sr concentration in the sediemnts of core OL-92. Similar patterns between the two parameters indicate that Sr concentration of lake water strongly influences aragonite formation. Correlation coefficient (R) between the two parameters for all data is 0.62, and is 0.65 if the data of Period I are excluded.

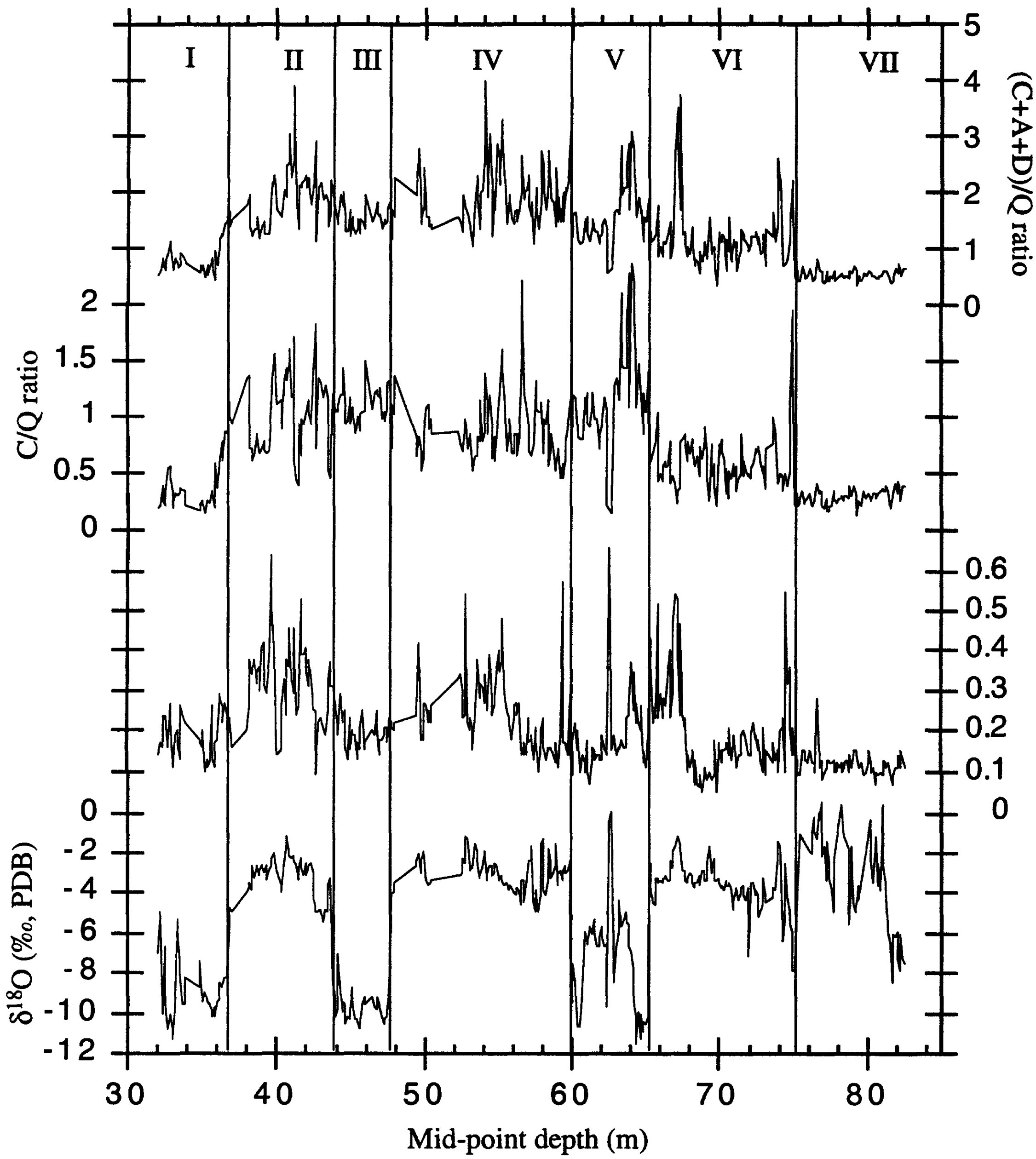


Fig. 7 Comparison of $\delta^{18}O$ record with aragonite/quartz, calcite/quartz and total carbonate/quartz ratios in core OL-92 from 32 to 83 m depth. The plots show that sediment abundance of aragonite, which is favored to form in a lake with relatively high salinity, alkalinity and productivity, may serve to trace past lake level fluctuations. The seven divisions of the core shown in the plots are based on interpretation of the $\delta^{18}O$ record (Li et al., 1998).

Table 1 Peak intensity values for quartz and carbonate minerals of lake sediments from core OL-92. Sampling interval is 10 cm and depth from the core top is at the middle point of each interval. Q = quartz, peak at 26.5° 2θ; C = calcite, peak at 29.5° 2θ; D = dolomite, peak at 31.2° 2θ; and A = aragonite, peak at 33.1° 2θ. Baseline values for quartz, calcite and dolomite is relatively high. When the peak intensities for these minerals have values less than 100, no peaks can be identified. In this case, the intensity for each mineral is calculated by taking 0.2° on each side of the designed degrees above.

| Samp. | Depth (m) | Q | C | D | A | Samp. | Depth (m) | Q | C | D | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.05 | 178 | 33 | 33 | 25 | 45 | 38.15 | 73 | 52 | 21 | 28 |
| 2 | 32.15 | 131 | 30 | 30 | 22 | 46 | 38.25 | 90 | 65 | 19 | 31 |
| 3 | 32.25 | 155 | 60 | 42 | 25 | 47 | 38.35 | 72 | 43 | 21 | 25 |
| 4 | 32.35 | 134 | 36 | 26 | 32 | 48 | 38.45 | 73 | 49 | 20 | 28 |
| 5 | 32.45 | 153 | 33 | 24 | 35 | 49 | 38.55 | 87 | 73 | 16 | 28 |
| 6 | 32.55 | 136 | 47 | 27 | 32 | 50 | 38.65 | 69 | 56 | 29 | 24 |
| 7 | 32.65 | 123 | 66 | 27 | 20 | 51 | 38.75 | 209 | 140 | 31 | 76 |
| 8 | 32.75 | 127 | 72 | 39 | 34 | 52 | 38.85 | 193 | 130 | 49 | 58 |
| 9 | 32.85 | 128 | 59 | 48 | 29 | 53 | 38.95 | 218 | 159 | 54 | 89 |
| 10 | 32.95 | 148 | 52 | 25 | 17 | 54 | 39.05 | 185 | 146 | 52 | 78 |
| 11 | 33.05 | 167 | 34 | 48 | 18 | 55 | 39.15 | 206 | 143 | 56 | 63 |
| 12 | 33.15 | 144 | 47 | 49 | 27 | 56 | 39.25 | 212 | 144 | 61 | 62 |
| 13 | 33.25 | 168 | 52 | 34 | 33 | 57 | 39.35 | 216 | 147 | 59 | 64 |
| 14 | 33.35 | 149 | 44 | 28 | 26 | 58 | 39.45 | 229 | 157 | 47 | 86 |
| 15 | 33.45 | 163 | 52 | 44 | 22 | 59 | 39.55 | 167 | 211 | 42 | 107 |
| 16 | 33.55 | 134 | 49 | 37 | 35 | 60 | 39.65 | 114 | 149 | 35 | 57 |
| 17 | 33.65 | 126 | 44 | 37 | 30 | 61 | 39.75 | 218 | 340 | 72 | 89 |
| 18 | 33.75 | 165 | 56 | 36 | 37 | 62 | 39.90 | 233 | 256 | 103 | 33 |
| 19 | 33.85 | 146 | 32 | 42 | 32 | 63 | 40.25 | 157 | 180 | 42 | 23 |
| 20 | 34.75 | 160 | 28 | 33 | 29 | 64 | 40.35 | 137 | 123 | 62 | 36 |
| 21 | 34.85 | 185 | 43 | 51 | 32 | 65 | 40.45 | 200 | 263 | 80 | 65 |
| 22 | 34.95 | 154 | 42 | 25 | 25 | 66 | 40.55 | 125 | 180 | 30 | 30 |
| 23 | 35.05 | 144 | 34 | 41 | 29 | 67 | 40.65 | 210 | 280 | 164 | 79 |
| 24 | 35.15 | 144 | 23 | 33 | 15 | 68 | 40.75 | 126 | 187 | 85 | 45 |
| 25 | 35.25 | 166 | 45 | 52 | 21 | 69 | 40.85 | 153 | 248 | 146 | 71 |
| 26 | 35.35 | 146 | 38 | 24 | 16 | 70 | 40.95 | 156 | 183 | 122 | 51 |
| 27 | 35.45 | 85 | 21 | 27 | 10 | 71 | 41.03 | 201 | 246 | 215 | 58 |
| 28 | 35.55 | 136 | 49 | 27 | 36 | 72 | 41.09 | 267 | 461 | 140 | 83 |
| 29 | 35.65 | 152 | 50 | 23 | 20 | 73 | 41.16 | 154 | 92 | 440 | 71 |
| 30 | 35.75 | 191 | 38 | 27 | 21 | 74 | 41.25 | 222 | 95 | 253 | 53 |
| 31 | 35.85 | 86 | 50 | 17 | 15 | 75 | 41.35 | 225 | 90 | 161 | 58 |
| 32 | 35.95 | 159 | 61 | 25 | 29 | 76 | 41.45 | 272 | 252 | 251 | 81 |
| 33 | 36.05 | 79 | 50 | 10 | 23 | 77 | 41.55 | 169 | 111 | 150 | 90 |
| 34 | 36.15 | 64 | 41 | 17 | 18 | 78 | 41.65 | 149 | 146 | 119 | 58 |
| 35 | 36.25 | 106 | 83 | 25 | 28 | 79 | 41.75 | 204 | 192 | 184 | 79 |
| 36 | 36.35 | 124 | 76 | 51 | 27 | 80 | 41.85 | 204 | 214 | 169 | 84 |
| 37 | 36.45 | 106 | 92 | 33 | 29 | 81 | 41.95 | 224 | 236 | 151 | 77 |
| 38 | 36.55 | 105 | 89 | 41 | 25 | 82 | 42.05 | 239 | 277 | 185 | 75 |
| 39 | 36.65 | 105 | 95 | 48 | 21 | 83 | 42.15 | 131 | 137 | 89 | 50 |
| 40 | 36.75 | 47 | 53 | 14 | 11 | 84 | 42.25 | 234 | 217 | 122 | 78 |
| 41 | 36.85 | 121 | 122 | 21 | 28 | 85 | 42.35 | 126 | 187 | 50 | 32 |
| 42 | 36.95 | 112 | 105 | 49 | 18 | 86 | 42.45 | 247 | 361 | 96 | 61 |
| 43 | 37.95 | 94 | 126 | 22 | 19 | 87 | 42.55 | 209 | 381 | 178 | 53 |
| 44 | 38.05 | 84 | 115 | 27 | 23 | 88 | 42.65 | 521 | 377 | 163 | 49 |

Table 1 continued

| Samp. | Depth (m) | Q | C | D | A | Samp. | Depth (m) | Q | C | D | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 89 | 42.75 | 253 | 338 | 137 | 55 | 142 | 49.95 | 189 | 164 | 243 | 51 |
| 90 | 42.85 | 271 | 354 | 174 | 61 | 143 | 50.05 | 189 | 204 | 47 | 49 |
| 91 | 43.15 | 252 | 297 | 121 | 54 | 144 | 50.15 | 192 | 213 | 47 | 43 |
| 92 | 43.25 | 254 | 326 | 123 | 48 | 145 | 50.25 | 195 | 174 | 50 | 48 |
| 93 | 43.35 | 256 | 294 | 115 | 63 | 146 | 50.35 | 211 | 208 | 49 | 47 |
| 94 | 43.45 | 260 | 136 | 143 | 86 | 147 | 50.45 | 187 | 158 | 45 | 48 |
| 95 | 43.55 | 222 | 101 | 180 | 82 | 148 | 52.25 | 191 | 166 | 69 | 63 |
| 96 | 43.65 | 137 | 100 | 164 | 42 | 149 | 52.35 | 200 | 154 | 71 | 68 |
| 97 | 43.75 | 137 | 166 | 62 | 43 | 150 | 52.45 | 206 | 143 | 67 | 61 |
| 98 | 43.85 | 211 | 222 | 73 | 54 | 151 | 52.55 | 179 | 125 | 187 | 41 |
| 99 | 43.95 | 233 | 246 | 82 | 63 | 152 | 52.65 | 194 | 191 | 104 | 46 |
| 100 | 44.05 | 224 | 232 | 51 | 44 | 153 | 52.75 | 114 | 63 | 542 | 62 |
| 101 | 44.15 | 135 | 150 | 38 | 26 | 154 | 52.85 | 211 | 152 | 144 | 46 |
| 102 | 44.25 | 197 | 234 | 98 | 58 | 155 | 52.95 | 210 | 179 | 68 | 42 |
| 103 | 44.35 | 173 | 206 | 60 | 38 | 156 | 53.05 | 191 | 154 | 56 | 44 |
| 104 | 44.45 | 200 | 288 | 65 | 47 | 157 | 53.15 | 215 | 118 | 75 | 46 |
| 105 | 44.55 | 205 | 225 | 50 | 51 | 158 | 53.25 | 236 | 126 | 85 | 36 |
| 106 | 44.65 | 238 | 224 | 50 | 37 | 159 | 53.35 | 165 | 107 | 171 | 38 |
| 107 | 44.75 | 226 | 217 | 51 | 29 | 160 | 53.45 | 167 | 110 | 218 | 60 |
| 108 | 44.85 | 204 | 240 | 65 | 46 | 161 | 53.55 | 151 | 125 | 96 | 57 |
| 109 | 44.95 | 286 | 266 | 39 | 43 | 162 | 53.65 | 185 | 146 | 53 | 52 |
| 110 | 45.05 | 227 | 245 | 60 | 46 | 163 | 53.75 | 149 | 173 | 77 | 47 |
| 111 | 45.15 | 242 | 254 | 38 | 45 | 164 | 53.85 | 170 | 133 | 160 | 53 |
| 112 | 45.25 | 245 | 207 | 53 | 47 | 165 | 53.95 | 150 | 130 | 222 | 40 |
| 113 | 45.35 | 249 | 243 | 54 | 33 | 166 | 54.05 | 121 | 170 | 275 | 41 |
| 114 | 45.45 | 214 | 215 | 73 | 36 | 167 | 54.15 | 153 | 178 | 130 | 40 |
| 115 | 45.55 | 237 | 208 | 60 | 36 | 168 | 54.25 | 164 | 141 | 130 | 41 |
| 116 | 45.65 | 222 | 228 | 62 | 47 | 169 | 54.35 | 134 | 160 | 196 | 52 |
| 117 | 45.75 | 221 | 230 | 43 | 55 | 170 | 54.45 | 163 | 155 | 139 | 45 |
| 118 | 45.85 | 251 | 264 | 43 | 37 | 171 | 54.55 | 191 | 122 | 69 | 46 |
| 119 | 45.95 | 191 | 289 | 57 | 33 | 172 | 54.65 | 174 | 144 | 166 | 45 |
| 120 | 46.43 | 221 | 236 | 48 | 45 | 173 | 54.75 | 181 | 113 | 147 | 50 |
| 121 | 46.55 | 213 | 260 | 46 | 41 | 174 | 54.85 | 137 | 123 | 219 | 50 |
| 122 | 46.65 | 194 | 241 | 69 | 49 | 175 | 54.95 | 142 | 175 | 139 | 57 |
| 123 | 46.75 | 220 | 264 | 51 | 43 | 176 | 55.05 | 160 | 192 | 96 | 56 |
| 124 | 46.85 | 214 | 250 | 52 | 31 | 177 | 55.15 | 137 | 221 | 183 | 51 |
| 125 | 46.95 | 194 | 246 | 34 | 34 | 178 | 55.25 | 124 | 178 | 133 | 60 |
| 126 | 47.05 | 236 | 232 | 42 | 43 | 179 | 55.43 | 167 | 195 | 136 | 49 |
| 127 | 47.15 | 220 | 228 | 66 | 41 | 180 | 55.55 | 254 | 179 | 120 | 63 |
| 128 | 47.25 | 222 | 212 | 60 | 47 | 181 | 55.65 | 183 | 159 | 153 | 43 |
| 129 | 47.35 | 241 | 255 | 53 | 51 | 182 | 55.75 | 215 | 212 | 130 | 48 |
| 130 | 47.45 | 213 | 279 | 43 | 36 | 183 | 55.85 | 244 | 163 | 163 | 43 |
| 131 | 47.55 | 205 | 270 | 59 | 47 | 184 | 55.95 | 209 | 140 | 114 | 48 |
| 132 | 47.65 | 254 | 186 | 61 | 55 | 185 | 56.05 | 196 | 164 | 108 | 50 |
| 133 | 47.75 | 183 | 205 | 65 | 39 | 186 | 56.15 | 190 | 164 | 108 | 51 |
| 134 | 47.85 | 202 | 207 | 72 | 40 | 187 | 56.25 | 203 | 131 | 120 | 49 |
| 135 | 47.95 | 197 | 271 | 131 | 44 | 188 | 56.35 | 191 | 149 | 122 | 52 |
| 136 | 49.33 | 197 | 163 | 180 | 47 | 189 | 56.45 | 244 | 369 | 93 | 34 |
| 137 | 49.45 | 190 | 125 | 237 | 50 | 190 | 56.55 | 213 | 472 | 61 | 35 |
| 138 | 49.55 | 179 | 149 | 272 | 76 | 191 | 56.65 | 234 | 292 | 115 | 32 |
| 139 | 49.65 | 217 | 150 | 123 | 39 | 192 | 56.75 | 188 | 232 | 116 | 32 |
| 140 | 49.75 | 209 | 108 | 183 | 39 | 193 | 56.85 | 215 | 235 | 175 | 31 |
| 141 | 49.85 | 260 | 164 | 242 | 48 | 194 | 56.95 | 204 | 185 | 241 | 47 |

Table 1 continued

| Samp. | Depth (m) | Q | C | D | A | Samp. | Depth (m) | Q | C | D | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 195 | 57.05 | 224 | 154 | 199 | 39 | 247 | 62.25 | 194 | 205 | 33 | 28 |
| 196 | 57.15 | 228 | 151 | 168 | 41 | 248 | 62.35 | 306 | 70 | 54 | 44 |
| 197 | 57.25 | 239 | 155 | 242 | 46 | 249 | 62.45 | 77 | 28 | 787 | 51 |
| 198 | 57.35 | 253 | 193 | 49 | 34 | 250 | 62.63 | 309 | 48 | 110 | 46 |
| 199 | 57.45 | 182 | 242 | 99 | 38 | 251 | 62.83 | 202 | 259 | 37 | 38 |
| 200 | 57.55 | 233 | 249 | 111 | 39 | 252 | 62.95 | 178 | 241 | 38 | 25 |
| 201 | 57.65 | 291 | 302 | 55 | 30 | 253 | 63.05 | 239 | 274 | 73 | 38 |
| 202 | 57.75 | 216 | 225 | 131 | 37 | 254 | 63.15 | 201 | 237 | 67 | 31 |
| 203 | 57.85 | 216 | 245 | 302 | 44 | 255 | 63.25 | 155 | 329 | 82 | 27 |
| 204 | 57.95 | 222 | 150 | 355 | 51 | 256 | 63.35 | 218 | 317 | 65 | 40 |
| 205 | 58.05 | 197 | 195 | 170 | 32 | 257 | 63.45 | 203 | 290 | 100 | 33 |
| 206 | 58.15 | 229 | 213 | 149 | 30 | 258 | 63.55 | 203 | 293 | 98 | 33 |
| 207 | 58.25 | 178 | 204 | 176 | 29 | 259 | 63.65 | 185 | 336 | 85 | 42 |
| 208 | 58.35 | 188 | 105 | 383 | 28 | 260 | 63.75 | 178 | 408 | 60 | 43 |
| 209 | 58.45 | 231 | 169 | 229 | 37 | 261 | 63.85 | 211 | 230 | 73 | 58 |
| 210 | 58.55 | 193 | 164 | 169 | 30 | 262 | 63.95 | 149 | 353 | 52 | 55 |
| 211 | 58.65 | 185 | 133 | 182 | 25 | 263 | 64.05 | 162 | 359 | 54 | 41 |
| 212 | 58.75 | 256 | 133 | 192 | 31 | 264 | 64.15 | 149 | 302 | 43 | 52 |
| 213 | 58.85 | 180 | 102 | 307 | 30 | 265 | 64.25 | 235 | 266 | 55 | 51 |
| 214 | 58.95 | 237 | 166 | 157 | 27 | 266 | 64.35 | 224 | 242 | 51 | 60 |
| 215 | 59.05 | 209 | 152 | 223 | 24 | 267 | 64.45 | 212 | 312 | 46 | 47 |
| 216 | 59.15 | 224 | 101 | 194 | 42 | 268 | 64.55 | 227 | 262 | 62 | 45 |
| 217 | 59.25 | 228 | 135 | 193 | 131 | 269 | 64.65 | 212 | 256 | 48 | 56 |
| 218 | 59.35 | 257 | 115 | 219 | 44 | 270 | 64.75 | 292 | 252 | 40 | 36 |
| 219 | 59.45 | 193 | 122 | 254 | 32 | 271 | 64.85 | 207 | 250 | 45 | 32 |
| 220 | 59.55 | 199 | 158 | 200 | 34 | 272 | 64.95 | 228 | 240 | 72 | 24 |
| 221 | 59.65 | 215 | 200 | 238 | 31 | 273 | 65.05 | 187 | 263 | 55 | 35 |
| 222 | 59.75 | 186 | 214 | 308 | 54 | 274 | 65.15 | 263 | 210 | 36 | 55 |
| 223 | 59.85 | 244 | 262 | 66 | 35 | 275 | 65.25 | 167 | 102 | 45 | 71 |
| 224 | 59.95 | 265 | 245 | 51 | 24 | 276 | 65.35 | 196 | 118 | 36 | 66 |
| 225 | 60.05 | 208 | 248 | 53 | 38 | 277 | 65.45 | 244 | 169 | 69 | 53 |
| 226 | 60.15 | 226 | 266 | 55 | 50 | 278 | 65.55 | 189 | 148 | 38 | 51 |
| 227 | 60.25 | 260 | 229 | 40 | 40 | 279 | 65.65 | 181 | 151 | 43 | 42 |
| 228 | 60.35 | 271 | 226 | 43 | 53 | 280 | 65.75 | 145 | 151 | 34 | 76 |
| 229 | 60.45 | 261 | 209 | 47 | 27 | 281 | 65.85 | 215 | 93 | 41 | 50 |
| 230 | 60.55 | 242 | 195 | 43 | 24 | 282 | 65.95 | 222 | 114 | 55 | 65 |
| 231 | 60.65 | 254 | 205 | 48 | 35 | 283 | 66.05 | 214 | 92 | 48 | 49 |
| 232 | 60.75 | 219 | 259 | 47 | 27 | 284 | 66.15 | 216 | 124 | 58 | 60 |
| 233 | 60.85 | 230 | 238 | 44 | 22 | 285 | 66.25 | 176 | 109 | 45 | 49 |
| 234 | 60.95 | 215 | 262 | 37 | 39 | 286 | 66.35 | 207 | 115 | 52 | 54 |
| 235 | 61.05 | 268 | 250 | 62 | 26 | 287 | 66.45 | 167 | 95 | 56 | 58 |
| 236 | 61.15 | 276 | 254 | 42 | 20 | 288 | 66.55 | 162 | 126 | 50 | 65 |
| 237 | 61.25 | 201 | 218 | 38 | 27 | 289 | 66.65 | 248 | 102 | 53 | 56 |
| 238 | 61.35 | 224 | 271 | 36 | 35 | 290 | 66.75 | 187 | 90 | 53 | 54 |
| 239 | 61.45 | 261 | 255 | 43 | 39 | 291 | 66.85 | 205 | 47 | 152 | 97 |
| 240 | 61.55 | 235 | 230 | 50 | 31 | 292 | 66.95 | 174 | 71 | 315 | 94 |
| 241 | 61.65 | 196 | 195 | 35 | 28 | 293 | 67.05 | 146 | 35 | 405 | 77 |
| 242 | 61.75 | 269 | 197 | 57 | 38 | 294 | 67.15 | 188 | 67 | 416 | 74 |
| 243 | 61.85 | 221 | 185 | 57 | 29 | 295 | 67.25 | 233 | 87 | 255 | 55 |
| 244 | 61.95 | 198 | 186 | 43 | 25 | 296 | 67.35 | 119 | 93 | 297 | 56 |
| 245 | 62.05 | 203 | 195 | 54 | 39 | 297 | 67.45 | 176 | 140 | 41 | 42 |
| 246 | 62.15 | 229 | 269 | 44 | 36 | 298 | 67.55 | 207 | 179 | 44 | 43 |

Table 1 continued

| Samp. | Depth (m) | Q | C | D | A | Samp. | Depth (m) | Q | C | D | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 299 | 67.65 | 270 | 208 | 25 | 63 | 352 | 72.95 | 189 | 107 | 91 | 39 |
| 300 | 67.75 | 359 | 218 | 54 | 35 | 353 | 73.05 | 249 | 91 | 61 | 23 |
| 301 | 67.85 | 257 | 203 | 27 | 37 | 354 | 73.15 | 203 | 145 | 97 | 31 |
| 302 | 67.95 | 266 | 179 | 32 | 29 | 355 | 73.55 | 234 | 179 | 76 | 27 |
| 303 | 68.05 | 235 | 190 | 105 | 34 | 356 | 73.65 | 203 | 202 | 99 | 34 |
| 304 | 68.15 | 251 | 184 | 68 | 37 | 357 | 73.75 | 261 | 221 | 39 | 33 |
| 305 | 68.25 | 351 | 195 | 29 | 25 | 358 | 73.85 | 213 | 94 | 177 | 31 |
| 306 | 68.35 | 258 | 144 | 35 | 34 | 359 | 73.95 | 176 | 72 | 369 | 18 |
| 307 | 68.45 | 347 | 226 | 27 | 25 | 360 | 74.05 | 198 | 99 | 290 | 40 |
| 308 | 68.55 | 358 | 167 | 25 | 21 | 361 | 74.15 | 200 | 97 | 29 | 42 |
| 309 | 68.65 | 271 | 200 | 36 | 25 | 362 | 74.25 | 231 | 83 | 27 | 52 |
| 310 | 68.75 | 275 | 174 | 24 | 15 | 363 | 74.35 | 227 | 113 | 36 | 22 |
| 311 | 68.85 | 241 | 188 | 34 | 21 | 364 | 74.45 | 84 | 41 | 500 | 46 |
| 312 | 68.95 | 216 | 197 | 29 | 23 | 365 | 74.55 | 177 | 69 | 24 | 57 |
| 313 | 69.05 | 305 | 206 | 29 | 24 | 366 | 74.65 | 172 | 90 | 47 | 62 |
| 314 | 69.15 | 275 | 132 | 76 | 22 | 367 | 74.75 | 191 | 217 | 38 | 40 |
| 315 | 69.25 | 227 | 61 | 272 | 22 | 368 | 74.85 | 162 | 317 | 19 | 23 |
| 316 | 69.35 | 317 | 241 | 29 | 26 | 369 | 74.95 | 214 | 294 | 21 | 45 |
| 317 | 69.45 | 323 | 153 | 124 | 26 | 370 | 75.05 | 355 | 75 | 42 | 51 |
| 318 | 69.55 | 270 | 160 | 95 | 24 | 371 | 75.15 | 279 | 93 | 39 | 37 |
| 319 | 69.65 | 275 | 106 | 39 | 49 | 372 | 75.25 | 354 | 80 | 47 | 33 |
| 320 | 69.75 | 491 | 110 | 38 | 27 | 373 | 75.35 | 319 | 80 | 30 | 33 |
| 321 | 69.85 | 221 | 171 | 81 | 38 | 374 | 75.45 | 339 | 94 | 45 | 29 |
| 322 | 69.95 | 222 | 146 | 87 | 33 | 375 | 75.55 | 298 | 100 | 57 | 46 |
| 323 | 70.05 | 215 | 171 | 51 | 26 | 376 | 75.65 | 378 | 96 | 46 | 57 |
| 324 | 70.15 | 205 | 144 | 87 | 30 | 377 | 75.75 | 392 | 100 | 47 | 50 |
| 325 | 70.25 | 178 | 113 | 77 | 26 | 378 | 75.85 | 344 | 96 | 45 | 43 |
| 326 | 70.35 | 230 | 76 | 33 | 36 | 379 | 75.95 | 296 | 84 | 36 | 35 |
| 327 | 70.45 | 207 | 114 | 91 | 35 | 380 | 76.05 | 284 | 93 | 49 | 43 |
| 328 | 70.55 | 240 | 69 | 131 | 33 | 381 | 76.15 | 282 | 61 | 43 | 34 |
| 329 | 70.65 | 192 | 101 | 158 | 40 | 382 | 76.25 | 336 | 76 | 31 | 40 |
| 330 | 70.75 | 244 | 109 | 50 | 31 | 383 | 76.35 | 198 | 53 | 23 | 23 |
| 331 | 70.85 | 183 | 108 | 71 | 33 | 384 | 76.45 | 296 | 85 | 24 | 31 |
| 332 | 70.95 | 216 | 105 | 83 | 42 | 385 | 76.55 | 242 | 100 | 32 | 67 |
| 333 | 71.05 | 208 | 118 | 90 | 24 | 386 | 76.65 | 295 | 97 | 42 | 40 |
| 334 | 71.15 | 216 | 78 | 33 | 24 | 387 | 76.75 | 277 | 97 | 37 | 31 |
| 335 | 71.25 | 185 | 83 | 45 | 25 | 388 | 76.85 | 277 | 93 | 37 | 36 |
| 336 | 71.35 | 253 | 127 | 90 | 36 | 389 | 76.95 | 299 | 70 | 30 | 25 |
| 337 | 71.45 | 194 | 163 | 65 | 37 | 390 | 77.05 | 337 | 63 | 38 | 33 |
| 338 | 71.55 | 192 | 94 | 114 | 38 | 391 | 77.15 | 259 | 72 | 59 | 28 |
| 339 | 71.65 | 187 | 110 | 74 | 37 | 392 | 77.25 | 282 | 52 | 36 | 36 |
| 340 | 71.75 | 180 | 96 | 73 | 32 | 393 | 77.35 | 314 | 55 | 48 | 40 |
| 341 | 71.85 | 177 | 86 | 75 | 24 | 394 | 77.45 | 269 | 59 | 44 | 33 |
| 342 | 71.95 | 235 | 120 | 79 | 32 | 395 | 77.55 | 339 | 71 | 52 | 41 |
| 343 | 72.05 | 177 | 82 | 83 | 25 | 396 | 77.65 | 304 | 107 | 36 | 39 |
| 344 | 72.15 | 203 | 110 | 100 | 38 | 397 | 77.75 | 303 | 79 | 22 | 31 |
| 345 | 72.25 | 207 | 123 | 87 | 45 | 398 | 77.85 | 317 | 86 | 41 | 32 |
| 346 | 72.35 | 185 | 127 | 65 | 33 | 399 | 77.95 | 307 | 76 | 40 | 36 |
| 347 | 72.45 | 193 | 141 | 73 | 36 | 400 | 78.05 | 318 | 92 | 34 | 35 |
| 348 | 72.55 | 227 | 159 | 56 | 35 | 401 | 78.15 | 280 | 81 | 42 | 33 |
| 349 | 72.65 | 162 | 121 | 47 | 29 | 402 | 78.25 | 283 | 87 | 34 | 28 |
| 350 | 72.75 | 242 | 143 | 51 | 29 | 403 | 78.35 | 320 | 84 | 40 | 34 |
| 351 | 72.85 | 203 | 103 | 71 | 20 | 404 | 78.45 | 357 | 108 | 32 | 43 |

Table 1 continued

| Samp. | Depth (m) | Q | C | D | A | Samp. | Depth (m) | Q | C | D | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 405 | 78.55 | 309 | 95 | 24 | 41 | 425 | 80.55 | 317 | 88 | 30 | 32 |
| 406 | 78.65 | 298 | 85 | 24 | 30 | 426 | 80.65 | 298 | 97 | 21 | 26 |
| 407 | 78.75 | 286 | 112 | 27 | 40 | 427 | 80.75 | 291 | 92 | 34 | 25 |
| 408 | 78.85 | 329 | 105 | 44 | 36 | 428 | 80.85 | 314 | 109 | 32 | 30 |
| 409 | 78.95 | 322 | 98 | 54 | 36 | 429 | 80.95 | 295 | 108 | 47 | 27 |
| 410 | 79.05 | 301 | 119 | 47 | 45 | 430 | 81.05 | 288 | 102 | 35 | 37 |
| 411 | 79.15 | 310 | 102 | 44 | 45 | 431 | 81.15 | 294 | 100 | 39 | 36 |
| 412 | 79.25 | 354 | 46 | 32 | 48 | 432 | 81.25 | 283 | 111 | 34 | 30 |
| 413 | 79.35 | 382 | 103 | 53 | 42 | 433 | 81.35 | 265 | 90 | 23 | 31 |
| 414 | 79.45 | 355 | 91 | 32 | 39 | 434 | 81.45 | | | | |
| 415 | 79.55 | 286 | 65 | 31 | 35 | 435 | 81.55 | 351 | 67 | 34 | 32 |
| 416 | 79.65 | 325 | 118 | 43 | 29 | 436 | 81.65 | 446 | 132 | 42 | 31 |
| 417 | 79.75 | 273 | 94 | 40 | 24 | 437 | 81.75 | 275 | 92 | 33 | 24 |
| 418 | 79.85 | 334 | 98 | 43 | 32 | 438 | 81.85 | 307 | 126 | 45 | 33 |
| 419 | 79.95 | 294 | 96 | 46 | 34 | 439 | 81.95 | 316 | 104 | 41 | 36 |
| 420 | 80.05 | 290 | 94 | 45 | 43 | 440 | 82.05 | 277 | 123 | 48 | 40 |
| 421 | 80.15 | 268 | 76 | 41 | 33 | 441 | 82.15 | 302 | 108 | 34 | 33 |
| 422 | 80.25 | 287 | 74 | 44 | 30 | 442 | 82.25 | 259 | 69 | 26 | 39 |
| 423 | 80.35 | 305 | 99 | 31 | 34 | 443 | 82.35 | 288 | 114 | 40 | 36 |
| 424 | 80.45 | 333 | 106 | 30 | 24 | 444 | 82.45 | 264 | 106 | 37 | 30 |

Table 2 Comparison of XRD results with chemical and stable isotope analyses on several high dolomite and their adjacent samples in core OL-92. Q, C, D and A represent peak intensity of quartz, calcite, dolomite and aragonite, respectively. $CaCO_3$ wt.% is determined from the weight loss of samples by 1N HCl leaching. Except for OL-92 251, dolomite to calcite+aragonite ratio in all samples ranges from 0.7 to 10. There is no correlation between this ratio and the $\delta^{18}O$ value, indicating that the isotopic composition of dolomite also reflects lake history. The $\delta^{18}O$ value increases from -8.45 to 0.07‰ between OL-92 251 and 250, indicating a sharp decline of lake level. Following this decline, a 10-cm thick of dolomitic layer formed.

| Sample | Depth (m) | Q | C | D | A | $CaCO_3$ wt.% | $CaCO_3$* wt.% | D/(C+A) ratio | $\delta^{13}C$ (‰, PDB) | $\delta^{18}O$ (‰, PDB) |
|---|---|---|---|---|---|---|---|---|---|---|
| OL-92 73 | 41.16 | 154 | 92 | 440 | 71 | 44 | 47 | 2.7 | 10.56 | -2.43 |
| OL-92 74 | 41.25 | 222 | 95 | 253 | 53 | | 36 | 1.7 | 9.78 | -2.60 |
| OL-92 153 | 52.75 | 114 | 63 | 542 | 62 | 52 | 57 | 4.3 | 12.45 | -1.16 |
| OL-92 154 | 52.85 | 211 | 152 | 144 | 46 | | 35 | 0.7 | 11.25 | -1.33 |
| OL-92 249 | 62.45 | 77 | 28 | 787 | 51 | 80 | 85 | 10.0 | 13.59 | -0.38 |
| OL-92 250 | 62.63 | 309 | 48 | 110 | 46 | | 30 | 1.2 | 13.19 | 0.07 |
| OL-92 251 | 62.83 | 202 | 259 | 37 | 38 | | 35 | 0.1 | 2.50 | -8.45 |
| OL-92 293 | 67.05 | 146 | 35 | 405 | 77 | 47 | 45 | 3.6 | 11.61 | -1.11 |
| OL-92 294 | 67.15 | 188 | 67 | 416 | 74 | 37 | 42 | 3.0 | 11.54 | -1.16 |
| OL-92 295 | 67.25 | 233 | 87 | 255 | 55 | | 35 | 1.8 | 9.34 | -1.58 |
| OL-92 296 | 67.35 | 119 | 93 | 297 | 56 | | 46 | 2.0 | 9.53 | -1.75 |
| OL-92 358 | 73.85 | 213 | 94 | 177 | 31 | | 33 | 1.4 | 7.35 | -2.28 |
| OL-92 359 | 73.95 | 176 | 72 | 369 | 38 | 49 | 40 | 3.4 | 8.75 | -1.39 |
| OL-92 360 | 74.05 | 198 | 99 | 290 | 40 | | 37 | 2.1 | 8.44 | -1.70 |
| OL-92 364 | 74.45 | 84 | 41 | 500 | 46 | 68 | 63 | 5.7 | 6.16 | -2.48 |

* $CaCO_3$ wt.% in this column is calculated from the relationship between (C+D+A)/Q and wt.% loss shown in Fig. 4b. These results have about 10% uncertainty from the measurements.

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## Sediment Magnetic Data (83-18 m depth) and XRF Geochemical Data (83-32 m depth) from Lacustrine Sediment in Core OL-92 from Owens Lake, California

by

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## INTRODUCTION

This report presents data and describes methods of sediment magnetic and geochemical measurements on dominantly silty clay lacustrine lake sediments recovered in a portion of a 323-m-deep core (OL-92) from Owens Lake, California. The core, drilled in 1992 near the depositional center of the basin, records climatic cycles of mainly precipitation, reflected by alternating closed and overflowing lake conditions, over the past 800,000 years (Smith and Bischoff, 1997; Bischoff and others, 1997a).

This report is one in a group that lists data from a depth interval of 83 to 32 m. This interval corresponds to the time period between about 134 to 46 kyr (estimated by Bischoff and others, 1997b) and thereby encompasses marine oxygen isotope stage 5 (OIS-5, the last interglaciation) as well as OIS-4 (about 65 to 50 kyr, a glacial stage) and the latter part of OIS-6 (the penultimate glaciation). For this report we also present sediment magnetic data from 32 to 18 m, corresponding in time to about 46 to 26.4 kyr, a period that encompasses most of OIS-3.

## METHODS AND RESULTS

**Sampling**: Samples used for magnetic susceptibility and laboratory induced magnetizations were taken in continuous channels, each 10 cm in length. According to the time-depth age model by Bischoff and others (1997b) for the 83 to 32 m depth interval, this 10-cm depth span corresponds to about 170 years. The samples were dried, lightly disaggregated and homogenized , and then packed into plastic cubes, each having a volume of 3.2 $cm^3$. A total of 537 samples were measured for magnetic properties and 164 samples for geochemistry.

**Magnetic Susceptibility** (Table 1): Magnetic susceptibility (MS) was measured using a susceptometer with a sensitivity better than about 4 x $10^{-7}$ $m^3$/kg. Samples were measured in a 0.1 mT (milliTesla) induction at a low frequency of 600 Hz ($MS_{lf}$) and high frequency of 6000 Hz ($MS_{hf}$). Each MS value was determined as the mean of four measurements.

**Laboratory induced magnetization** (Table 1): Anhysteretic remanent magnetization (ARM) and isothermal remanent magnetization (IRM) were measured with a high speed spinner magnetometer. ARM was imparted in a decreasing alternating field from a peak induction of 100 mT and a DC bias of 0.1 mT. After ARM acquisition, IRM magnetizations were generated at room temperature using an impulse magnetizer. First IRM was imparted in a 1.2T induction ($IRM_{1.2T}$). The samples were then magnetized in the opposite direction using an induction of 0.3T ($IRM_{-0.3T}$). Hard isothermal remanent magnetization (HIRM) and the S-parameter were calculated as follows (King and Channel, 1991):

$$HIRM=(IRM_{1.2T}-IRM_{-0.3T})/2;$$

$$S=IRM_{-0.3T}/IRM_{1.2T}..$$

**Minor-element and Trace-element Geochemistry** (Table 2): Elemental abundance was determined on selected samples using energy-dispersive X-ray fluorescence analysis at the University of Colorado's Department of Geological Sciences. Contents of Ba, Ce, Cr, Cs, Cu, Fe, La, Mn, Mo, Nb, Ni, Rb, Sb, Sn, Sr, Ti, V, Y, Zn, and Zr were measured.

**Variations in Magnetic and Chemical Properties**: Depth profiles of MS and IRM/MS reveal strong variations in the amounts and magnetic grain size of magnetic minerals (Fig. 1). Preliminary petrographic analysis from a few samples indicate that the variations in magnetic property data arise from varying distributions of different magnetic minerals. Identified minerals include varieties of detrital iron and iron-titanium oxides, as well as greigite. The Fe and Fe-Ti oxides occur in a number of different textures and associations, from which their different origins can be interpreted. For example, in one sample (75.3-75.4 m), the magnetic mineral population is dominated by poorly sorted, silt-sized angular grains of optically homogeneous magnetite, apparently derived from granitic rocks. In another interval (comprising two channel samples at 64.8-64.9 m and 65.0-65.1 m), the magnetic signal appears to be dominated by very small oxides (<1 μm) that occur in large (coarse silt) volcanic rock fragments; greigite is also present in this sample. Petrographic observations of varying distribution of different detrital Fe-Ti oxide minerals are consistent with strong variations in Zr/Ti that imply changes in provenance. Moreover, sulfidic diagenesis has in some intervals produced pyrite that formed at the expense of detrital magnetite. These cursory observations indicate that changes in erosional, depositional, and diagenetic processes, along with intermittent shifts in provenance, have produced changes in the magnetic mineralogy. Magnetic property variations are also related to the effects of dilution by chemically precipitated minerals.

Evidence for glacial activity in the Sierra Nevada might be found in magnetic properties of Owens Lake sediment (see Benson and others, 1996). For this reason, our preliminary petrographic analysis focused on a few intervals that might have diagnostic magnetic and chemical records of glacial sediment or water chemistry. Indicators of water chemistry (reflecting open, or closed to intermediate, hydrologic conditions) might be found in the absence, or presence and types, of iron sulfide minerals. As an example using the interval between 83 and 76.2 m, the high content of ferrimagnetic minerals (high MS), with coarse magnetic grain size (low values of IRM/MS), results from input of detrital magnetite from Sierran granitic rocks, apparently weathered mechanically by glaciers and carried in rivers to the lake as glacial flour. This interval is characterized chemically by high Ti and Fe contents and low Zr/Ti values (Fig. 1). In contrast, the combination of moderate to high MS and small magnetic grain size (high values of IRM/MS and ARM/MS) reflects either very fine grained detrital magnetite or diagenetic greigite ($Fe_3S_4$, magnetic sulfide; Reynolds and others, 1994). Such intervals that are dominated by abundant greigite, as confirmed petrographically, are indicated in the dark shaded pattern in figure 1. Other zones of abundant greigite may be present but have not been examined. Examined intervals that do not contain greigite, or in which greigite is present in minor amounts with little contribution to the magnetic signal, are shown in a lighter shaded pattern.

The presence of greigite in OIS-3 equivalent sediments from a different core at Owens Lake was inferred by Benson and others (1996). They considered the greigite to indicate the intensity of glacial erosion, assuming that the greigite formed as a post-depositional replacement of glacially derived magnetite. Benson and others (1996) did not confirm the identity of either mineral or such origins. Although this hypothesis may be valid, other possibilities should be examined. One possibility is that greigite formed in this lake during conditions intermediate between closed and stagnant vis-à-vis open and through flowing. Such greigite might then represent conditions of increased freshness in an otherwise saline environment, or it might represent conditions of increased salinity in an otherwise fresh, open setting. The production of greigite at the boundary zone (about 75 m) between OIS-6 and OIS-5 sediments might reflect the transition from fresh to saline waters. Saline conditions would promote pyrite formation, given sufficient sulfur, organic matter, and iron in the system. A magnetic-mineral separate from two samples encompassing 72.15-72.35 m contains pyrite, some of which has replaced large detrital magnetite grains, and lacks greigite. Another example comes from the occurrence of greigite that yields the high MS and high IRM/MS values near 46.8 m depth. Samples below and above this depth (about 55.9 m and 41.9 m) lack greigite but contain pyrite, some of which has replaced detrital Fe-Ti oxide minerals.

In contrast to the greigite-bearing interval near 46.8 m, the greigite occurrence centered at 36.65 m is different in some important ways. First, it is within sediment that is enriched in Fe and Ti relative to most of the underlying OIS-5 deposits. Second, samples below (38.8-39.2 m) and above (33.1-33.4 m) the greigite-bearing interval lack pyrite and contain large, rounded to subrounded, detrital Fe-Ti oxides, including magnetic ilmenite varieties. Third, the greigite-bearing sample contains sparse, small (fine silt size), angular particles of ilmenite that might represent glacial flour. These very preliminary observations suggest that this greigite occurrence is bounded by sediments representing relatively more open conditions, perhaps preceding and postdating an influx of minor amounts of glacial flour under conditions that also promoted greigite formation. Whereas iron is certainly not a limiting factor in the production of iron sulfide minerals in these OIS-5 sediments, perhaps the surface area provided by fine-grained iron oxides increased iron availability.

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## TABLE 1. Sediment Magnetic Data

**Sample number.**: A unique sample number assigned to samples that are placed into plastic cubes for magnetic mineral studies.

**Depth (m)**: Depth of sample in centimeters from top of core. The depth shown is the midpoint of a channel sample that encompasses a 10-cm depth interval.

**MSLF**: Low-frequency magnetic susceptibility in $m^3/kg$.

**ARM**: Anhysteretic remanent magnetization in $Am^2/kg$.

**IRM 1.2T**: Isothermal remanent magnetization imparted by a 1.2 Tesla induction at room temperature. Expressed in $Am^2/kg$.

**IRM 0.3T**: Isothermal remanent magnetization imparted by a -0.3 Tesla induction at room temperature, following the acquisition and measurement of IRM at 1.2 T. Expressed in $Am^2/kg$.

**HIRM**: Hard isothermal remanent magnetization: HIRM is calculated as:
$(IRM_{1.2T}-IRM_{-0.3T})/2$ and expressed in $Am^2/kg$.

**S**: (S Ratio) calculated as: $IRM_{-0.3T}/IRM_{1.2T}$.

| Sample No. | Depth (m) | MSLF ($m^3$/kg) | ARM ($Am^2$/kg) | IRM1.2T ($Am^2$/kg) | IRM 0.3T ($Am^2$/kg) | HIRM ($Am^2$/kg) | S |
|---|---|---|---|---|---|---|---|
| 18.05 | 18.05 | 2.03E-07 | 2.94E-05 | 8.03E-04 | 7.48E-04 | 2.73E-05 | 0.93 |
| 18.15 | 18.15 | 2.10E-07 | 2.52E-05 | 6.58E-04 | 6.00E-04 | 2.89E-05 | 0.91 |
| 18.25 | 18.25 | 2.01E-07 | 2.16E-05 | 5.74E-04 | 5.26E-04 | 2.42E-05 | 0.92 |
| 18.35 | 18.35 | 1.57E-07 | 2.61E-05 | 4.70E-04 | 4.18E-04 | 2.60E-05 | 0.89 |
| 18.45 | 18.45 | 1.06E-07 | 2.31E-05 | 4.02E-04 | 3.56E-04 | 2.32E-05 | 0.88 |
| 18.55 | 18.55 | 1.08E-07 | 2.43E-05 | 4.38E-04 | 3.91E-04 | 2.33E-05 | 0.89 |
| 18.65 | 18.65 | 8.73E-08 | 2.27E-05 | 4.44E-04 | 3.99E-04 | 2.22E-05 | 0.90 |
| 18.75 | 18.75 | 8.13E-08 | 1.99E-05 | 3.86E-04 | 3.41E-04 | 2.27E-05 | 0.88 |
| 18.85 | 18.85 | 7.29E-08 | 1.87E-05 | 3.43E-04 | 3.02E-04 | 2.03E-05 | 0.88 |
| 18.95 | 18.95 | 5.94E-08 | 2.19E-05 | 4.12E-04 | 3.66E-04 | 2.27E-05 | 0.89 |
| 19.025 | 19.025 | 4.07E-08 | 2.15E-05 | 4.08E-04 | 3.70E-04 | 1.92E-05 | 0.91 |
| 20.25 | 20.25 | 5.97E-08 | 1.99E-05 | 3.43E-04 | 2.97E-04 | 2.29E-05 | 0.87 |
| 20.35 | 20.35 | 3.65E-08 | 2.43E-05 | 4.10E-04 | 3.64E-04 | 2.32E-05 | 0.89 |
| 20.45 | 20.45 | 4.72E-08 | 2.18E-05 | 3.82E-04 | 3.38E-04 | 2.20E-05 | 0.88 |
| 20.55 | 20.55 | 6.50E-08 | 2.04E-05 | 3.59E-04 | 3.10E-04 | 2.45E-05 | 0.86 |
| 20.65 | 20.65 | 4.61E-08 | 2.56E-05 | 4.06E-04 | 3.61E-04 | 2.26E-05 | 0.89 |
| 20.75 | 20.75 | 3.79E-08 | 2.31E-05 | 3.41E-04 | 3.08E-04 | 1.66E-05 | 0.90 |
| 20.85 | 20.85 | 3.99E-08 | 2.25E-05 | 3.57E-04 | 3.24E-04 | 1.65E-05 | 0.91 |
| 20.95 | 20.95 | 1.09E-08 | 2.01E-05 | 3.46E-04 | 3.16E-04 | 1.51E-05 | 0.91 |
| 21.05 | 21.05 | 1.09E-08 | 2.29E-05 | 3.81E-04 | 3.45E-04 | 1.81E-05 | 0.91 |
| 21.15 | 21.15 | 4.10E-08 | 1.66E-05 | 2.92E-04 | 2.60E-04 | 1.61E-05 | 0.89 |
| 21.25 | 21.25 | 2.31E-08 | 1.98E-05 | 3.89E-04 | 3.60E-04 | 1.43E-05 | 0.93 |
| 21.35 | 21.35 | 1.95E-08 | 1.96E-05 | 3.81E-04 | 3.44E-04 | 1.86E-05 | 0.90 |
| 21.45 | 21.45 | 4.78E-08 | 1.92E-05 | 3.20E-04 | 2.86E-04 | 1.74E-05 | 0.89 |
| 21.75 | 21.75 | 5.78E-08 | 2.00E-05 | 4.12E-04 | 3.74E-04 | 1.93E-05 | 0.91 |
| 21.85 | 21.85 | 2.57E-08 | 2.59E-05 | 4.22E-04 | 3.83E-04 | 1.96E-05 | 0.91 |
| 21.95 | 21.95 | 4.52E-08 | 2.31E-05 | 3.20E-04 | 2.81E-04 | 1.96E-05 | 0.88 |
| 22.05 | 22.05 | 1.14E-08 | 2.69E-05 | 4.23E-04 | 3.89E-04 | 1.69E-05 | 0.92 |
| 22.15 | 22.15 | -1.22E-08 | 2.75E-05 | 4.29E-04 | 3.98E-04 | 1.59E-05 | 0.93 |
| 22.25 | 22.25 | 1.72E-08 | 2.29E-05 | 3.48E-04 | 3.12E-04 | 1.76E-05 | 0.90 |
| 22.35 | 22.35 | 3.00E-08 | 2.12E-05 | 3.45E-04 | 3.07E-04 | 1.89E-05 | 0.89 |
| 22.45 | 22.45 | 2.11E-08 | 2.16E-05 | 3.33E-04 | 3.01E-04 | 1.61E-05 | 0.90 |
| 22.55 | 22.55 | 4.25E-08 | 2.06E-05 | 3.31E-04 | 2.92E-04 | 1.99E-05 | 0.88 |
| 22.65 | 22.65 | 3.51E-08 | 2.25E-05 | 3.49E-04 | 3.10E-04 | 1.96E-05 | 0.89 |
| 22.75 | 22.75 | 4.51E-08 | 2.10E-05 | 3.51E-04 | 3.11E-04 | 2.01E-05 | 0.89 |
| 22.85 | 22.85 | 5.79E-08 | 2.07E-05 | 3.23E-04 | 2.75E-04 | 2.36E-05 | 0.85 |
| 22.95 | 22.95 | 4.90E-08 | 2.21E-05 | 3.60E-04 | 3.06E-04 | 2.72E-05 | 0.85 |
| 23.05 | 23.05 | 7.74E-08 | 4.02E-05 | 1.30E-03 | 1.07E-03 | 1.15E-04 | 0.82 |
| 23.15 | 23.15 | 1.30E-07 | 1.15E-04 | 5.38E-03 | 4.60E-03 | 3.88E-04 | 0.86 |
| 23.25 | 23.25 | 5.33E-08 | 2.88E-05 | 4.73E-04 | 4.23E-04 | 2.54E-05 | 0.89 |
| 23.35 | 23.35 | 1.03E-07 | 2.46E-05 | 4.49E-04 | 3.99E-04 | 2.52E-05 | 0.89 |
| 23.45 | 23.45 | 1.72E-08 | 2.42E-05 | 4.45E-04 | 3.75E-04 | 3.50E-05 | 0.84 |
| 23.55 | 23.55 | 4.91E-08 | 2.50E-05 | 4.62E-04 | 4.08E-04 | 2.70E-05 | 0.88 |
| 23.65 | 23.65 | 5.04E-08 | 2.23E-05 | 3.64E-04 | 3.31E-04 | 1.68E-05 | 0.91 |
| 23.75 | 23.75 | 3.99E-08 | 2.28E-05 | 3.47E-04 | 3.14E-04 | 1.65E-05 | 0.90 |
| 23.85 | 23.85 | 5.93E-08 | 2.60E-05 | 3.83E-04 | 3.43E-04 | 1.96E-05 | 0.90 |
| 23.95 | 23.95 | 3.04E-08 | 2.90E-05 | 4.02E-04 | 3.70E-04 | 1.62E-05 | 0.92 |
| 24.05 | 24.05 | 3.57E-08 | 2.76E-05 | 4.14E-04 | 3.79E-04 | 1.77E-05 | 0.91 |
| 24.15 | 24.15 | 3.49E-08 | 2.56E-05 | 3.83E-04 | 3.47E-04 | 1.82E-05 | 0.91 |
| 24.25 | 24.25 | 6.58E-08 | 2.71E-05 | 3.69E-04 | 3.28E-04 | 2.06E-05 | 0.89 |
| 24.35 | 24.35 | 6.02E-08 | 2.25E-05 | 3.34E-04 | 2.99E-04 | 1.77E-05 | 0.89 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 24.45 | 24.45 | 7.65E-08 | 2.58E-05 | 3.93E-04 | 3.52E-04 | 2.03E-05 | 0.90 |
| 24.55 | 24.55 | 8.26E-08 | 2.56E-05 | 3.91E-04 | 3.53E-04 | 1.89E-05 | 0.90 |
| 24.65 | 24.65 | 7.88E-08 | 2.67E-05 | 4.71E-04 | 4.27E-04 | 2.17E-05 | 0.91 |
| 24.75 | 24.75 | 7.20E-08 | 2.21E-05 | 3.42E-04 | 3.06E-04 | 1.83E-05 | 0.89 |
| 24.85 | 24.85 | 1.08E-07 | 2.33E-05 | 5.24E-04 | 4.78E-04 | 2.27E-05 | 0.91 |
| 24.95 | 24.95 | 7.76E-08 | 2.22E-05 | 3.71E-04 | 3.34E-04 | 1.85E-05 | 0.90 |
| 25.05 | 25.05 | 8.31E-08 | 2.35E-05 | 3.78E-04 | 3.36E-04 | 2.12E-05 | 0.89 |
| 25.15 | 25.15 | 6.03E-08 | 2.23E-05 | 3.82E-04 | 3.49E-04 | 1.63E-05 | 0.91 |
| 25.25 | 25.25 | 8.45E-08 | 2.09E-05 | 3.38E-04 | 3.04E-04 | 1.69E-05 | 0.90 |
| 25.35 | 25.35 | 7.85E-08 | 2.56E-05 | 4.15E-04 | 3.79E-04 | 1.77E-05 | 0.91 |
| 25.45 | 25.45 | 6.60E-08 | 2.41E-05 | 3.45E-04 | 3.10E-04 | 1.74E-05 | 0.90 |
| 25.55 | 25.55 | 8.56E-08 | 2.69E-05 | 4.42E-04 | 4.00E-04 | 2.09E-05 | 0.91 |
| 25.65 | 25.65 | 9.82E-08 | 2.41E-05 | 4.50E-04 | 4.07E-04 | 2.15E-05 | 0.90 |
| 25.75 | 25.75 | 1.22E-07 | 3.51E-05 | 7.84E-04 | 7.32E-04 | 2.59E-05 | 0.93 |
| 25.85 | 25.85 | 8.37E-08 | 3.24E-05 | 5.00E-04 | 4.52E-04 | 2.41E-05 | 0.90 |
| 25.95 | 25.95 | 7.51E-08 | 3.14E-05 | 4.57E-04 | 4.10E-04 | 2.31E-05 | 0.90 |
| 26.05 | 26.05 | 9.66E-08 | 2.88E-05 | 4.86E-04 | 4.32E-04 | 2.69E-05 | 0.89 |
| 26.15 | 26.15 | 1.16E-07 | 3.32E-05 | 5.98E-04 | 5.46E-04 | 2.64E-05 | 0.91 |
| 26.25 | 26.25 | 9.78E-08 | 2.43E-05 | 3.97E-04 | 3.52E-04 | 2.21E-05 | 0.89 |
| 26.35 | 26.35 | 6.30E-08 | 2.33E-05 | 3.68E-04 | 3.33E-04 | 1.79E-05 | 0.90 |
| 26.45 | 26.45 | 8.70E-08 | 2.70E-05 | 4.40E-04 | 3.98E-04 | 2.10E-05 | 0.90 |
| 26.55 | 26.55 | 7.21E-08 | 2.24E-05 | 3.78E-04 | 3.45E-04 | 1.67E-05 | 0.91 |
| 26.65 | 26.65 | 6.40E-08 | 2.47E-05 | 3.93E-04 | 3.49E-04 | 2.22E-05 | 0.89 |
| 26.75 | 26.75 | 5.84E-08 | 3.13E-05 | 4.86E-04 | 4.39E-04 | 2.35E-05 | 0.90 |
| 26.85 | 26.85 | 6.88E-08 | 2.92E-05 | 4.76E-04 | 4.33E-04 | 2.14E-05 | 0.91 |
| 26.95 | 26.95 | 6.48E-08 | 3.10E-05 | 5.23E-04 | 4.74E-04 | 2.46E-05 | 0.91 |
| 27.05 | 27.05 | 6.72E-08 | 2.83E-05 | 4.80E-04 | 4.36E-04 | 2.19E-05 | 0.91 |
| 27.15 | 27.15 | 7.82E-08 | 2.40E-05 | 4.02E-04 | 3.60E-04 | 2.10E-05 | 0.90 |
| 27.25 | 27.25 | 8.46E-08 | 2.27E-05 | 3.98E-04 | 3.53E-04 | 2.21E-05 | 0.89 |
| 27.35 | 27.35 | 8.18E-08 | 2.65E-05 | 4.92E-04 | 4.37E-04 | 2.75E-05 | 0.89 |
| 27.45 | 27.45 | 9.27E-08 | 2.38E-05 | 4.25E-04 | 3.77E-04 | 2.38E-05 | 0.89 |
| 27.55 | 27.55 | 1.25E-07 | 2.47E-05 | 4.39E-04 | 3.93E-04 | 2.34E-05 | 0.89 |
| 27.65 | 27.65 | 1.46E-07 | 2.63E-05 | 5.34E-04 | 4.83E-04 | 2.54E-05 | 0.90 |
| 27.75 | 27.75 | 1.82E-07 | 2.66E-05 | 6.42E-04 | 5.93E-04 | 2.45E-05 | 0.92 |
| 30.9 | 30.9 | 1.37E-07 | 2.87E-05 | 9.85E-04 | 9.46E-04 | 1.95E-05 | 0.96 |
| 31 | 31 | 1.79E-07 | 2.75E-05 | 7.03E-04 | 6.50E-04 | 2.67E-05 | 0.92 |
| 31.1 | 31.1 | 1.73E-07 | 2.51E-05 | 1.07E-03 | 1.02E-03 | 2.38E-05 | 0.96 |
| 31.2 | 31.2 | 8.34E-08 | 2.32E-05 | 4.55E-04 | 4.09E-04 | 2.30E-05 | 0.90 |
| 31.3 | 31.3 | 1.23E-07 | 2.63E-05 | 5.63E-04 | 5.07E-04 | 2.79E-05 | 0.90 |
| 31.4 | 31.4 | 1.22E-07 | 3.04E-05 | 6.47E-04 | 5.77E-04 | 3.50E-05 | 0.89 |
| 31.5 | 31.5 | 1.62E-07 | 3.34E-05 | 7.90E-04 | 7.12E-04 | 3.88E-05 | 0.90 |
| 31.6 | 31.6 | 1.73E-07 | 3.78E-05 | 9.80E-04 | 8.81E-04 | 4.95E-05 | 0.90 |
| 31.7 | 31.7 | 1.61E-07 | 3.49E-05 | 8.43E-04 | 7.56E-04 | 4.35E-05 | 0.90 |
| 31.8 | 31.8 | 1.51E-07 | 3.40E-05 | 8.31E-04 | 7.43E-04 | 4.43E-05 | 0.89 |
| 31.9 | 31.9 | 1.66E-07 | 3.29E-05 | 8.23E-04 | 7.41E-04 | 4.14E-05 | 0.90 |
| 32 | 32 | 1.29E-07 | 2.89E-05 | 6.74E-04 | 6.03E-04 | 3.58E-05 | 0.89 |
| 1 | 32.05 | 1.89E-07 | 6.49E-05 | 2.01E-03 | 1.82E-03 | 9.16E-05 | 0.91 |
| 2 | 32.15 | 2.23E-07 | 5.94E-05 | 2.25E-03 | 2.07E-03 | 8.89E-05 | 0.92 |
| 3 | 32.25 | 1.23E-07 | 4.35E-05 | 1.12E-03 | 9.80E-04 | 6.99E-05 | 0.88 |
| 4 | 32.35 | 1.06E-07 | 4.15E-05 | 9.92E-04 | 8.71E-04 | 6.04E-05 | 0.88 |
| 5 | 32.45 | 9.79E-08 | 3.90E-05 | 9.62E-04 | 8.44E-04 | 5.92E-05 | 0.88 |

| Sample No. | Depth (m) | MSLF ($m^3$/kg) | ARM ($Am^2$/kg) | IRM1.2T ($Am^2$/kg) | IRM 0.3T ($Am^2$/kg) | HIRM ($Am^2$/kg) | S |
|---|---|---|---|---|---|---|---|
| 6 | 32.55 | 8.72E-08 | 3.28E-05 | 8.10E-04 | 7.06E-04 | 5.20E-05 | 0.87 |
| 7 | 32.65 | 8.48E-08 | 8.76E-07 | 7.80E-04 | 6.80E-04 | 4.99E-05 | 0.87 |
| 8 | 32.75 | 8.10E-08 | 3.55E-05 | 6.91E-04 | 6.08E-04 | 4.17E-05 | 0.88 |
| 9 | 32.85 | 7.73E-08 | 4.37E-05 | 7.49E-04 | 6.64E-04 | 4.28E-05 | 0.89 |
| 10 | 32.95 | 7.80E-08 | 3.94E-05 | 7.29E-04 | 6.40E-04 | 4.47E-05 | 0.88 |
| 11 | 33.05 | 9.43E-08 | 3.93E-05 | 7.19E-04 | 6.30E-04 | 4.48E-05 | 0.88 |
| 12 | 33.15 | 1.35E-07 | 5.27E-05 | 1.09E-03 | 9.56E-04 | 6.67E-05 | 0.88 |
| 13 | 33.25 | 1.79E-07 | 6.67E-05 | 1.51E-03 | 1.31E-03 | 9.57E-05 | 0.87 |
| 14 | 33.35 | 2.14E-07 | 6.62E-05 | 1.58E-03 | 1.42E-03 | 8.02E-05 | 0.90 |
| 15 | 33.45 | 1.79E-07 | 7.23E-05 | 1.76E-03 | 1.58E-03 | 8.79E-05 | 0.90 |
| 16 | 33.55 | 1.96E-07 | 7.29E-05 | 1.80E-03 | 1.63E-03 | 8.72E-05 | 0.90 |
| 17 | 33.65 | 2.23E-07 | 8.12E-05 | 2.19E-03 | 2.01E-03 | 8.64E-05 | 0.92 |
| 18 | 33.75 | 2.02E-07 | 8.18E-05 | 2.15E-03 | 1.98E-03 | 8.53E-05 | 0.92 |
| 19 | 33.85 | 2.30E-07 | 9.26E-05 | 2.61E-03 | 2.41E-03 | 1.01E-04 | 0.92 |
| 20 | 34.75 | 2.74E-07 | 1.03E-04 | 3.60E-03 | 3.39E-03 | 1.06E-04 | 0.94 |
| 21 | 34.85 | 2.61E-07 | 1.02E-04 | 3.77E-03 | 3.56E-03 | 1.04E-04 | 0.94 |
| 22 | 34.95 | 2.82E-07 | 1.15E-04 | 3.84E-03 | 3.58E-03 | 1.31E-04 | 0.93 |
| 23 | 35.05 | 2.73E-07 | 1.20E-04 | 5.68E-03 | 5.44E-03 | 1.20E-04 | 0.96 |
| 24 | 35.15 | 2.50E-07 | 9.58E-05 | 2.89E-03 | 2.69E-03 | 1.03E-04 | 0.93 |
| 25 | 35.25 | 2.82E-07 | 1.15E-04 | 3.84E-03 | 3.61E-03 | 1.14E-04 | 0.94 |
| 26 | 35.35 | 2.33E-07 | 1.05E-04 | 4.30E-03 | 4.09E-03 | 1.07E-04 | 0.95 |
| 27 | 35.45 | 2.61E-07 | 1.02E-04 | 4.25E-03 | 4.06E-03 | 9.68E-05 | 0.95 |
| 28 | 35.55 | 2.58E-07 | 1.05E-04 | 4.54E-03 | 4.33E-03 | 1.08E-04 | 0.95 |
| 29 | 35.65 | 2.24E-07 | 1.09E-04 | 4.60E-03 | 4.38E-03 | 1.10E-04 | 0.95 |
| 30 | 35.75 | 2.91E-07 | 1.39E-04 | 7.13E-03 | 6.87E-03 | 1.32E-04 | 0.96 |
| 31 | 35.85 | 2.44E-07 | 1.48E-04 | 9.35E-03 | 9.12E-03 | 1.14E-04 | 0.98 |
| 32 | 35.95 | 2.20E-07 | 1.81E-04 | 1.40E-02 | 1.38E-02 | 1.23E-04 | 0.98 |
| 33 | 36.05 | 2.34E-07 | 2.37E-04 | 2.50E-02 | 2.49E-02 | 3.94E-05 | 1.00 |
| 34 | 36.15 | 2.00E-07 | 2.49E-04 | 2.44E-02 | 2.41E-02 | 1.25E-04 | 0.99 |
| 35 | 36.25 | 1.71E-07 | 2.00E-04 | 1.78E-02 | 1.76E-02 | 8.01E-05 | 0.99 |
| 36 | 36.35 | 1.76E-07 | 2.29E-04 | 1.94E-02 | 1.93E-02 | 6.38E-05 | 0.99 |
| 37 | 36.45 | 2.03E-07 | 2.76E-04 | 2.67E-02 | 2.66E-02 | 5.10E-05 | 1.00 |
| 38 | 36.55 | 3.23E-07 | 5.54E-04 | 6.85E-02 | 6.82E-02 | 1.54E-04 | 1.00 |
| 39 | 36.65 | 2.73E-07 | 4.71E-04 | 6.08E-02 | 6.09E-02 | -2.12E-05 | 1.00 |
| 40 | 36.75 | 1.89E-07 | 2.81E-04 | 2.80E-02 | 2.78E-02 | 8.02E-05 | 0.99 |
| 41 | 36.85 | 2.50E-07 | 4.27E-04 | 4.50E-02 | 4.48E-02 | 7.19E-05 | 1.00 |
| 42 | 36.95 | 1.82E-07 | 2.45E-04 | 2.37E-02 | 2.35E-02 | 8.78E-05 | 0.99 |
| 43 | 37.95 | 1.02E-07 | 7.12E-05 | 3.50E-03 | 3.42E-03 | 4.10E-05 | 0.98 |
| 44 | 38.05 | 9.90E-08 | 7.06E-05 | 3.56E-03 | 3.45E-03 | 5.68E-05 | 0.97 |
| 45 | 38.15 | 8.53E-08 | 5.58E-05 | 2.41E-03 | 2.33E-03 | 4.39E-05 | 0.96 |
| 46 | 38.25 | 8.67E-08 | 3.92E-05 | 1.17E-03 | 1.10E-03 | 3.63E-05 | 0.94 |
| 47 | 38.35 | 7.98E-08 | 3.46E-05 | 7.68E-04 | 7.09E-04 | 2.98E-05 | 0.92 |
| 48 | 38.45 | 8.09E-08 | 3.45E-05 | 6.67E-04 | 6.09E-04 | 2.90E-05 | 0.91 |
| 49 | 38.55 | 7.57E-08 | 3.31E-05 | 7.39E-04 | 6.86E-04 | 2.65E-05 | 0.93 |
| 50 | 38.65 | 8.09E-08 | 3.82E-05 | 9.63E-04 | 8.89E-04 | 3.68E-05 | 0.92 |
| 51 | 38.75 | 9.45E-08 | 4.26E-05 | 1.35E-03 | 1.35E-03 | -2.53E-06 | 1.00 |
| 52 | 38.85 | 9.32E-08 | 3.47E-05 | 1.23E-03 | 1.16E-03 | 3.56E-05 | 0.94 |
| 53 | 38.95 | 8.55E-08 | 3.03E-05 | 9.43E-04 | 9.43E-04 | -2.18E-07 | 1.00 |
| 54 | 39.05 | 8.98E-08 | 2.72E-05 | 9.43E-04 | 8.73E-04 | 3.50E-05 | 0.93 |
| 55 | 39.15 | 8.87E-08 | 3.07E-05 | 9.44E-04 | 8.66E-04 | 3.89E-05 | 0.92 |
| 56 | 39.25 | 8.60E-08 | 2.81E-05 | 6.34E-04 | 5.73E-04 | 3.06E-05 | 0.90 |

| Sample No. | Depth (m) | MSLF ($m^3$/kg) | ARM ($Am^2$/kg) | IRM1.2T ($Am^2$/kg) | IRM 0.3T ($Am^2$/kg) | HIRM ($Am^2$/kg) | S |
|---|---|---|---|---|---|---|---|
| 57 | 39.35 | 9.29E-08 | 2.82E-05 | 7.12E-04 | 6.48E-04 | 3.21E-05 | 0.91 |
| 58 | 39.45 | 8.86E-08 | 5.68E-05 | 2.82E-03 | 2.74E-03 | 3.98E-05 | 0.97 |
| 59 | 39.55 | 7.81E-08 | 9.33E-05 | 2.99E-03 | 2.72E-03 | 1.35E-04 | 0.91 |
| 60 | 39.65 | 8.20E-08 | 8.73E-05 | 2.97E-03 | 2.58E-03 | 1.96E-04 | 0.87 |
| 61 | 39.75 | 8.33E-07 | 9.49E-04 | 4.77E-02 | 4.74E-02 | 1.80E-04 | 0.99 |
| 62 | 39.9 | 1.00E-07 | 4.52E-05 | 1.63E-03 | 1.46E-03 | 8.44E-05 | 0.90 |
| 63 | 40.25 | 1.02E-07 | 4.71E-05 | 1.47E-03 | 1.32E-03 | 7.55E-05 | 0.90 |
| 64 | 40.35 | 9.78E-08 | 5.64E-05 | 1.31E-03 | 1.13E-03 | 9.10E-05 | 0.86 |
| 65 | 40.45 | 8.99E-08 | 7.83E-05 | 2.38E-03 | 2.04E-03 | 1.71E-04 | 0.86 |
| 66 | 40.55 | 6.06E-08 | 5.36E-05 | 1.17E-03 | 9.73E-04 | 9.93E-05 | 0.83 |
| 67 | 40.65 | 9.15E-08 | 8.76E-05 | 2.75E-03 | 2.38E-03 | 1.86E-04 | 0.86 |
| 68 | 40.75 | 7.28E-08 | 6.57E-05 | 1.74E-03 | 1.47E-03 | 1.33E-04 | 0.85 |
| 69 | 40.85 | 5.60E-08 | 5.89E-05 | 1.23E-03 | 1.03E-03 | 9.68E-05 | 0.84 |
| 70 | 40.95 | 5.92E-08 | 6.07E-05 | 1.15E-03 | 1.15E-03 | 9.82E-07 | 1.00 |
| 71 | 41.03 | 5.66E-08 | 6.95E-05 | 1.11E-03 | 9.60E-04 | 7.40E-05 | 0.87 |
| 72 | 41.085 | 9.77E-08 | 1.19E-04 | 2.64E-03 | 2.29E-03 | 1.76E-04 | 0.87 |
| 73 | 41.155 | 6.13E-08 | 7.59E-05 | 1.26E-03 | 1.12E-03 | 7.15E-05 | 0.89 |
| 74 | 41.25 | 2.01E-07 | 2.36E-04 | 9.26E-03 | 7.21E-03 | 1.03E-03 | 0.78 |
| 75 | 41.35 | 1.12E-07 | 1.70E-04 | 4.80E-03 | 4.28E-03 | 2.63E-04 | 0.89 |
| 76 | 41.45 | 1.10E-07 | 1.40E-04 | 7.99E-03 | 6.20E-03 | 8.96E-04 | 0.78 |
| 77 | 41.55 | 6.41E-08 | 3.99E-05 | 6.99E-04 | 6.33E-04 | 3.28E-05 | 0.91 |
| 78 | 41.65 | 7.24E-08 | 4.65E-05 | 9.92E-04 | 9.06E-04 | 4.32E-05 | 0.91 |
| 79 | 41.75 | 7.12E-08 | 4.67E-05 | 1.25E-03 | 1.14E-03 | 5.38E-05 | 0.91 |
| 80 | 41.85 | 6.52E-08 | 4.36E-05 | 9.70E-04 | 8.85E-04 | 4.24E-05 | 0.91 |
| 81 | 41.95 | 7.19E-08 | 5.60E-05 | 1.30E-03 | 1.14E-03 | 8.12E-05 | 0.88 |
| 82 | 42.05 | 6.79E-08 | 4.92E-05 | 1.43E-03 | 1.17E-03 | 1.26E-04 | 0.82 |
| 83 | 42.15 | 6.15E-08 | 3.51E-05 | 8.69E-04 | 7.22E-04 | 7.35E-05 | 0.83 |
| 84 | 42.25 | 6.27E-08 | 4.39E-05 | 1.11E-03 | 9.03E-04 | 1.03E-04 | 0.81 |
| 85 | 42.35 | 6.32E-08 | 3.11E-05 | 8.38E-04 | 7.12E-04 | 6.32E-05 | 0.85 |
| 86 | 42.45 | 6.32E-08 | 2.92E-05 | 8.73E-04 | 7.37E-04 | 6.80E-05 | 0.84 |
| 87 | 42.55 | 6.20E-08 | 2.55E-05 | 6.47E-04 | 5.77E-04 | 3.51E-05 | 0.89 |
| 88 | 42.65 | 6.21E-08 | 2.02E-05 | 6.32E-04 | 6.31E-04 | 6.35E-07 | 1.00 |
| 89 | 42.75 | 5.88E-08 | 2.35E-05 | 5.72E-04 | 5.12E-04 | 3.01E-05 | 0.89 |
| 90 | 42.85 | 6.51E-08 | 2.69E-05 | 7.59E-04 | 6.73E-04 | 4.32E-05 | 0.89 |
| 91 | 43.15 | 7.49E-08 | 5.70E-05 | 1.26E-03 | 1.11E-03 | 7.55E-05 | 0.88 |
| 92 | 43.25 | 6.81E-08 | 3.62E-05 | 9.45E-04 | 8.57E-04 | 4.39E-05 | 0.91 |
| 93 | 43.35 | 6.46E-08 | 4.06E-05 | 7.79E-04 | 6.83E-04 | 4.83E-05 | 0.88 |
| 94 | 43.45 | 7.05E-08 | 5.30E-05 | 1.13E-03 | 1.02E-03 | 5.90E-05 | 0.90 |
| 95 | 43.55 | 6.44E-08 | 4.49E-05 | 9.91E-04 | 9.91E-04 | 1.93E-07 | 1.00 |
| 96 | 43.65 | 6.81E-08 | 6.31E-05 | 1.30E-03 | 1.11E-03 | 9.27E-05 | 0.86 |
| 97 | 43.75 | 4.24E-08 | 2.98E-05 | 4.64E-04 | 4.21E-04 | 2.17E-05 | 0.91 |
| 98 | 43.85 | 5.04E-08 | 4.50E-05 | 6.92E-04 | 6.36E-04 | 2.82E-05 | 0.92 |
| 99 | 43.95 | 5.98E-08 | 6.33E-05 | 1.36E-03 | 1.20E-03 | 8.08E-05 | 0.88 |
| 100 | 44.05 | 6.36E-08 | 7.32E-05 | 1.79E-03 | 1.54E-03 | 1.23E-04 | 0.86 |
| 101 | 44.15 | 5.28E-08 | 4.39E-05 | 5.90E-04 | 5.50E-04 | 2.02E-05 | 0.93 |
| 102 | 44.25 | 4.54E-08 | 5.23E-05 | 6.98E-04 | 6.56E-04 | 2.07E-05 | 0.94 |
| 103 | 44.35 | 4.60E-08 | 5.85E-05 | 7.81E-04 | 7.44E-04 | 1.86E-05 | 0.95 |
| 104 | 44.45 | 5.15E-08 | 6.33E-05 | 8.83E-04 | 8.39E-04 | 2.24E-05 | 0.95 |
| 105 | 44.55 | 4.82E-08 | 4.49E-05 | 7.11E-04 | 6.68E-04 | 2.18E-05 | 0.94 |
| 106 | 44.65 | 5.22E-08 | 4.42E-05 | 7.75E-04 | 7.29E-04 | 2.31E-05 | 0.94 |
| 107 | 44.75 | 6.21E-08 | 5.83E-05 | 1.01E-03 | 9.61E-04 | 2.53E-05 | 0.95 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 108 | 44.85 | 6.56E-08 | 7.23E-05 | 1.28E-03 | 1.22E-03 | 2.93E-05 | 0.95 |
| 109 | 44.95 | 9.68E-08 | 1.49E-04 | 2.43E-03 | 2.32E-03 | 5.53E-05 | 0.95 |
| 110 | 45.05 | 1.00E-07 | 1.72E-04 | 3.02E-03 | 2.84E-03 | 9.02E-05 | 0.94 |
| 111 | 45.15 | 9.45E-08 | 1.29E-04 | 2.51E-03 | 2.32E-03 | 9.53E-05 | 0.92 |
| 112 | 45.25 | 7.80E-08 | 8.83E-05 | 1.65E-03 | 1.60E-03 | 2.35E-05 | 0.97 |
| 113 | 45.35 | 8.43E-08 | 9.31E-05 | 1.99E-03 | 1.94E-03 | 2.43E-05 | 0.98 |
| 114 | 45.45 | 9.61E-08 | 1.16E-04 | 2.74E-03 | 2.69E-03 | 2.71E-05 | 0.98 |
| 115 | 45.55 | 8.84E-08 | 9.39E-05 | 2.40E-03 | 2.36E-03 | 2.04E-05 | 0.98 |
| 116 | 45.65 | 1.03E-07 | 1.30E-04 | 3.23E-03 | 3.19E-03 | 1.95E-05 | 0.99 |
| 117 | 45.75 | 1.31E-07 | 2.19E-04 | 4.32E-03 | 4.25E-03 | 3.78E-05 | 0.98 |
| 118 | 45.85 | 1.29E-07 | 2.17E-04 | 4.04E-03 | 3.98E-03 | 2.84E-05 | 0.99 |
| 119 | 45.95 | 1.03E-07 | 1.48E-04 | 3.05E-03 | 3.01E-03 | 2.34E-05 | 0.98 |
| 120 | 46.43 | 1.18E-07 | 1.63E-04 | 3.62E-03 | 3.56E-03 | 3.12E-05 | 0.98 |
| 121 | 46.55 | 1.04E-07 | 1.31E-04 | 3.34E-03 | 3.27E-03 | 3.65E-05 | 0.98 |
| 122 | 46.65 | 1.19E-07 | 1.51E-04 | 5.05E-03 | 5.00E-03 | 2.73E-05 | 0.99 |
| 123 | 46.75 | 1.36E-07 | 1.98E-04 | 5.84E-03 | 5.76E-03 | 4.12E-05 | 0.99 |
| 124 | 46.85 | 1.30E-07 | 1.91E-04 | 5.45E-03 | 5.39E-03 | 3.18E-05 | 0.99 |
| 125 | 46.95 | 1.54E-07 | 1.97E-04 | 5.36E-03 | 5.28E-03 | 3.86E-05 | 0.99 |
| 126 | 47.05 | 1.18E-07 | 1.07E-04 | 4.10E-03 | 4.05E-03 | 2.66E-05 | 0.99 |
| 127 | 47.15 | 9.63E-08 | 1.11E-04 | 4.11E-03 | 4.04E-03 | 3.53E-05 | 0.98 |
| 128 | 47.25 | 1.00E-07 | 1.24E-04 | 3.81E-03 | 3.74E-03 | 3.56E-05 | 0.98 |
| 129 | 47.35 | 7.88E-08 | 8.73E-05 | 2.69E-03 | 2.64E-03 | 2.57E-05 | 0.98 |
| 130 | 47.45 | 1.01E-07 | 1.28E-04 | 4.42E-03 | 4.33E-03 | 4.49E-05 | 0.98 |
| 131 | 47.55 | 1.08E-07 | 1.64E-04 | 5.10E-03 | 5.04E-03 | 3.02E-05 | 0.99 |
| 132 | 47.65 | 7.09E-08 | 5.06E-05 | 9.75E-04 | 8.79E-04 | 4.81E-05 | 0.90 |
| 133 | 47.75 | 6.95E-08 | 4.77E-05 | 9.11E-04 | 8.34E-04 | 3.89E-05 | 0.91 |
| 134 | 47.85 | 6.91E-08 | 4.25E-05 | 8.47E-04 | 7.73E-04 | 3.70E-05 | 0.91 |
| 135 | 47.95 | 6.34E-08 | 5.30E-05 | 1.32E-03 | 1.17E-03 | 7.93E-05 | 0.88 |
| 136 | 49.325 | 5.00E-08 | 3.17E-05 | 6.67E-04 | 5.96E-04 | 3.55E-05 | 0.89 |
| 137 | 49.45 | 5.20E-08 | 3.59E-05 | 7.45E-04 | 6.68E-04 | 3.86E-05 | 0.90 |
| 138 | 49.55 | 6.29E-08 | 3.98E-05 | 8.39E-04 | 7.61E-04 | 3.93E-05 | 0.91 |
| 139 | 49.65 | 7.48E-08 | 4.66E-05 | 1.00E-03 | 9.21E-04 | 4.18E-05 | 0.92 |
| 140 | 49.75 | 6.79E-08 | 3.66E-05 | 8.17E-04 | 7.42E-04 | 3.72E-05 | 0.91 |
| 141 | 49.85 | 7.17E-08 | 4.15E-05 | 8.66E-04 | 7.90E-04 | 3.82E-05 | 0.91 |
| 142 | 49.95 | 5.60E-08 | 3.55E-05 | 6.50E-04 | 5.87E-04 | 3.15E-05 | 0.90 |
| 143 | 50.05 | 6.80E-08 | 4.24E-05 | 8.93E-04 | 7.93E-04 | 4.97E-05 | 0.89 |
| 147 | 50.45 | 6.89E-08 | 4.11E-05 | 1.01E-03 | 9.23E-04 | 4.43E-05 | 0.91 |
| 148 | 52.25 | 8.03E-08 | 2.79E-05 | 5.63E-04 | 5.18E-04 | 2.22E-05 | 0.92 |
| 149 | 52.35 | 8.04E-08 | 3.43E-05 | 8.45E-04 | 7.78E-04 | 3.36E-05 | 0.92 |
| 150 | 52.45 | 4.17E-07 | 2.13E-04 | 7.76E-03 | 7.07E-03 | 3.43E-04 | 0.91 |
| 151 | 52.55 | 6.54E-08 | 3.76E-05 | 8.57E-04 | 7.81E-04 | 3.80E-05 | 0.91 |
| 152 | 52.65 | 6.79E-08 | 3.27E-05 | 6.34E-04 | 5.69E-04 | 3.25E-05 | 0.90 |
| 153 | 52.75 | 5.23E-08 | 3.13E-05 | 7.43E-04 | 6.92E-04 | 2.55E-05 | 0.93 |
| 154 | 52.85 | 6.75E-08 | 4.12E-05 | 8.49E-04 | 7.62E-04 | 4.34E-05 | 0.90 |
| 155 | 52.95 | 7.15E-08 | 4.07E-05 | 8.97E-04 | 7.96E-04 | 5.02E-05 | 0.89 |
| 156 | 53.05 | 7.75E-08 | 3.05E-05 | 6.69E-04 | 5.93E-04 | 3.84E-05 | 0.89 |
| 157 | 53.15 | 7.10E-08 | 4.20E-05 | 8.03E-04 | 7.23E-04 | 4.00E-05 | 0.90 |
| 158 | 53.25 | 7.89E-08 | 3.67E-05 | 7.19E-04 | 6.48E-04 | 3.56E-05 | 0.90 |
| 159 | 53.35 | 7.55E-08 | 3.98E-05 | 7.21E-04 | 6.46E-04 | 3.74E-05 | 0.90 |
| 160 | 53.45 | 6.54E-08 | 4.85E-05 | 9.88E-04 | 8.78E-04 | 5.50E-05 | 0.89 |
| 161 | 53.55 | 6.63E-08 | 3.87E-05 | 7.71E-04 | 6.91E-04 | 3.96E-05 | 0.90 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 162 | 53.65 | 6.92E-08 | 4.13E-05 | 8.37E-04 | 7.50E-04 | 4.40E-05 | 0.90 |
| 163 | 53.75 | 6.30E-08 | 3.26E-05 | 7.62E-04 | 6.84E-04 | 3.89E-05 | 0.90 |
| 164 | 53.85 | 6.26E-08 | 3.97E-05 | 8.26E-04 | 7.39E-04 | 4.35E-05 | 0.89 |
| 165 | 53.95 | 6.45E-08 | 3.91E-05 | 8.47E-04 | 7.53E-04 | 4.72E-05 | 0.89 |
| 166 | 54.05 | 5.93E-08 | 4.28E-05 | 9.82E-04 | 8.81E-04 | 5.08E-05 | 0.90 |
| 167 | 54.15 | 6.06E-08 | 3.73E-05 | 7.43E-04 | 6.62E-04 | 4.03E-05 | 0.89 |
| 168 | 54.25 | 6.61E-08 | 4.87E-05 | 1.05E-03 | 9.35E-04 | 5.81E-05 | 0.89 |
| 169 | 54.35 | 6.24E-08 | 4.79E-05 | 1.10E-03 | 9.39E-04 | 8.07E-05 | 0.85 |
| 170 | 54.45 | 6.02E-08 | 4.05E-05 | 9.69E-04 | 8.53E-04 | 5.77E-05 | 0.88 |
| 171 | 54.55 | 6.41E-08 | 3.66E-05 | 1.01E-03 | 8.85E-04 | 6.18E-05 | 0.88 |
| 172 | 54.65 | 6.18E-08 | 3.44E-05 | 1.18E-03 | 9.95E-04 | 9.41E-05 | 0.84 |
| 173 | 54.75 | 6.38E-08 | 5.24E-05 | 1.00E-03 | 9.16E-04 | 4.39E-05 | 0.91 |
| 174 | 54.85 | 5.39E-08 | 5.29E-05 | 1.07E-03 | 9.78E-04 | 4.63E-05 | 0.91 |
| 175 | 54.95 | 5.85E-08 | 6.07E-05 | 1.27E-03 | 1.14E-03 | 6.83E-05 | 0.89 |
| 176 | 55.05 | 6.43E-08 | 6.37E-05 | 1.52E-03 | 1.36E-03 | 8.27E-05 | 0.89 |
| 177 | 55.15 | 4.52E-08 | 4.34E-05 | 8.29E-04 | 7.47E-04 | 4.10E-05 | 0.90 |
| 178 | 55.25 | 4.15E-08 | 3.87E-05 | 7.95E-04 | 7.24E-04 | 3.54E-05 | 0.91 |
| 179 | 55.425 | 5.28E-08 | 4.41E-05 | 7.96E-04 | 7.21E-04 | 3.76E-05 | 0.91 |
| 180 | 55.55 | 5.11E-08 | 4.05E-05 | 7.48E-04 | 6.76E-04 | 3.59E-05 | 0.90 |
| 181 | 55.65 | 6.25E-08 | 4.89E-05 | 8.85E-04 | 8.04E-04 | 4.03E-05 | 0.91 |
| 182 | 55.75 | 6.52E-08 | 5.62E-05 | 1.11E-03 | 9.99E-04 | 5.75E-05 | 0.90 |
| 183 | 55.85 | 5.98E-08 | 4.26E-05 | 8.03E-04 | 7.24E-04 | 3.98E-05 | 0.90 |
| 184 | 55.95 | 5.88E-08 | 4.22E-05 | 7.74E-04 | 7.02E-04 | 3.59E-05 | 0.91 |
| 185 | 56.05 | 5.62E-08 | 4.44E-05 | 8.09E-04 | 7.32E-04 | 3.86E-05 | 0.90 |
| 186 | 56.15 | 6.12E-08 | 4.44E-05 | 7.82E-04 | 7.13E-04 | 3.44E-05 | 0.91 |
| 187 | 56.25 | 6.63E-08 | 5.28E-05 | 9.10E-04 | 8.27E-04 | 4.16E-05 | 0.91 |
| 188 | 56.35 | 7.50E-08 | 7.32E-05 | 1.31E-03 | 1.20E-03 | 5.78E-05 | 0.91 |
| 189 | 56.45 | 6.88E-08 | 8.02E-05 | 1.56E-03 | 1.41E-03 | 7.55E-05 | 0.90 |
| 190 | 56.55 | 6.21E-08 | 8.16E-05 | 1.62E-03 | 1.46E-03 | 8.13E-05 | 0.90 |
| 191 | 56.65 | 6.28E-08 | 5.42E-05 | 1.02E-03 | 9.12E-04 | 5.38E-05 | 0.89 |
| 192 | 56.75 | 6.80E-08 | 5.55E-05 | 8.66E-04 | 7.84E-04 | 4.12E-05 | 0.90 |
| 193 | 56.85 | 6.44E-08 | 4.67E-05 | 9.13E-04 | 8.38E-04 | 3.76E-05 | 0.92 |
| 194 | 56.95 | 6.03E-08 | 4.84E-05 | 9.05E-04 | 8.09E-04 | 4.80E-05 | 0.89 |
| 195 | 57.05 | 6.00E-08 | 3.92E-05 | 7.18E-04 | 6.46E-04 | 3.62E-05 | 0.90 |
| 196 | 57.15 | 6.81E-08 | 4.42E-05 | 7.72E-04 | 6.98E-04 | 3.69E-05 | 0.90 |
| 197 | 57.25 | 6.30E-08 | 3.98E-05 | 7.33E-04 | 6.61E-04 | 3.60E-05 | 0.90 |
| 198 | 57.35 | 6.65E-08 | 3.66E-05 | 6.39E-04 | 5.77E-04 | 3.09E-05 | 0.90 |
| 199 | 57.45 | 6.69E-08 | 4.72E-05 | 8.00E-04 | 7.27E-04 | 3.65E-05 | 0.91 |
| 200 | 57.55 | 5.64E-08 | 3.62E-05 | 6.57E-04 | 5.96E-04 | 3.02E-05 | 0.91 |
| 201 | 57.65 | 5.95E-08 | 4.72E-05 | 8.29E-04 | 7.47E-04 | 4.11E-05 | 0.90 |
| 202 | 57.75 | 6.11E-08 | 4.31E-05 | 7.51E-04 | 6.88E-04 | 3.18E-05 | 0.92 |
| 203 | 57.85 | 5.39E-08 | 7.37E-05 | 1.44E-03 | 1.29E-03 | 7.52E-05 | 0.90 |
| 204 | 57.95 | 5.22E-08 | 6.10E-05 | 1.15E-03 | 1.02E-03 | 6.13E-05 | 0.89 |
| 205 | 58.05 | 6.17E-08 | 5.20E-05 | 9.38E-04 | 8.39E-04 | 4.97E-05 | 0.89 |
| 206 | 58.15 | 5.21E-08 | 3.28E-05 | 6.09E-04 | 5.49E-04 | 2.98E-05 | 0.90 |
| 207 | 58.25 | 6.38E-08 | 4.41E-05 | 7.54E-04 | 6.94E-04 | 3.03E-05 | 0.92 |
| 208 | 58.35 | 6.09E-08 | 4.78E-05 | 8.99E-04 | 8.17E-04 | 4.07E-05 | 0.91 |
| 209 | 58.45 | 6.37E-08 | 5.02E-05 | 1.17E-03 | 1.17E-03 | -4.75E-08 | 1.00 |
| 210 | 58.55 | 6.57E-08 | 4.11E-05 | 8.09E-04 | 7.27E-04 | 4.11E-05 | 0.90 |
| 211 | 58.65 | 7.05E-08 | 4.67E-05 | 2.51E-03 | 2.42E-03 | 4.23E-05 | 0.97 |
| 212 | 58.75 | 7.14E-08 | 4.73E-05 | 1.31E-03 | 1.15E-03 | 7.67E-05 | 0.88 |

| Sample No. | Depth (m) | MSLF ($m^3$/kg) | ARM ($Am^2$/kg) | IRM1.2T ($Am^2$/kg) | IRM 0.3T ($Am^2$/kg) | HIRM ($Am^2$/kg) | S |
|---|---|---|---|---|---|---|---|
| 213 | 58.85 | 6.13E-08 | 3.50E-05 | 6.28E-04 | 5.77E-04 | 2.58E-05 | 0.92 |
| 214 | 58.95 | 7.08E-08 | 5.87E-05 | 1.13E-03 | 1.04E-03 | 4.64E-05 | 0.92 |
| 215 | 59.05 | 6.77E-08 | 4.49E-05 | 8.18E-04 | 7.43E-04 | 3.71E-05 | 0.91 |
| 216 | 59.15 | 6.34E-08 | 3.35E-05 | 6.07E-04 | 5.60E-04 | 2.37E-05 | 0.92 |
| 217 | 59.25 | 7.08E-08 | 4.50E-05 | 8.78E-04 | 8.13E-04 | 3.23E-05 | 0.93 |
| 218 | 59.35 | 6.56E-08 | 3.98E-05 | 8.47E-04 | 7.20E-04 | 6.39E-05 | 0.85 |
| 219 | 59.45 | 6.21E-08 | 3.46E-05 | 5.98E-04 | 5.49E-04 | 2.42E-05 | 0.92 |
| 220 | 59.55 | 6.53E-08 | 3.80E-05 | 7.15E-04 | 6.60E-04 | 2.74E-05 | 0.92 |
| 221 | 59.65 | 6.45E-08 | 3.98E-05 | 7.30E-04 | 6.70E-04 | 3.02E-05 | 0.92 |
| 222 | 59.75 | 5.45E-08 | 3.50E-05 | 5.89E-04 | 5.45E-04 | 2.23E-05 | 0.92 |
| 223 | 59.85 | 7.13E-08 | 8.87E-05 | 1.41E-03 | 1.35E-03 | 3.09E-05 | 0.96 |
| 224 | 59.95 | 8.19E-08 | 1.16E-04 | 2.36E-03 | 2.32E-03 | 2.15E-05 | 0.98 |
| 225 | 60.05 | 1.09E-07 | 1.94E-04 | 4.22E-03 | 4.14E-03 | 3.93E-05 | 0.98 |
| 226 | 60.15 | 1.21E-07 | 2.69E-04 | 5.26E-03 | 5.17E-03 | 4.28E-05 | 0.98 |
| 227 | 60.25 | 1.61E-07 | 2.64E-04 | 1.06E-02 | 1.06E-02 | -2.76E-05 | 1.01 |
| 228 | 60.35 | 1.16E-07 | 1.86E-04 | 4.65E-03 | 4.55E-03 | 4.93E-05 | 0.98 |
| 229 | 60.45 | 1.12E-07 | 1.49E-04 | 4.93E-03 | 4.84E-03 | 4.46E-05 | 0.98 |
| 230 | 60.55 | 1.41E-07 | 1.92E-04 | 1.48E-02 | 1.47E-02 | 4.28E-05 | 0.99 |
| 231 | 60.65 | 1.99E-07 | 2.72E-04 | 3.25E-02 | 3.25E-02 | -7.84E-06 | 1.00 |
| 232 | 60.75 | 9.70E-08 | 7.90E-05 | 6.52E-03 | 6.43E-03 | 4.70E-05 | 0.99 |
| 233 | 60.85 | 7.86E-08 | 4.11E-05 | 1.10E-03 | 1.02E-03 | 3.66E-05 | 0.93 |
| 234 | 60.95 | 7.79E-08 | 4.38E-05 | 1.01E-03 | 9.34E-04 | 3.76E-05 | 0.93 |
| 235 | 61.05 | 7.98E-08 | 5.08E-05 | 1.07E-03 | 9.74E-04 | 4.58E-05 | 0.91 |
| 236 | 61.15 | 7.51E-08 | 5.54E-05 | 1.06E-03 | 9.52E-04 | 5.21E-05 | 0.90 |
| 237 | 61.25 | 7.39E-08 | 4.66E-05 | 8.97E-04 | 8.10E-04 | 4.39E-05 | 0.90 |
| 238 | 61.35 | 7.49E-08 | 4.63E-05 | 9.51E-04 | 8.65E-04 | 4.31E-05 | 0.91 |
| 239 | 61.45 | 8.53E-08 | 6.87E-05 | 2.15E-03 | 2.04E-03 | 5.72E-05 | 0.95 |
| 240 | 61.55 | 8.66E-08 | 7.67E-05 | 2.62E-03 | 2.50E-03 | 5.86E-05 | 0.96 |
| 241 | 61.65 | 7.94E-08 | 5.12E-05 | 1.12E-03 | 1.03E-03 | 4.59E-05 | 0.92 |
| 242 | 61.75 | 6.99E-08 | 5.13E-05 | 6.47E-04 | 5.84E-04 | 3.15E-05 | 0.90 |
| 243 | 61.85 | 7.43E-08 | 3.57E-05 | 8.35E-04 | 7.64E-04 | 3.55E-05 | 0.91 |
| 244 | 61.95 | 7.60E-08 | 4.60E-05 | 9.05E-04 | 8.40E-04 | 3.29E-05 | 0.93 |
| 245 | 62.05 | 8.07E-08 | 4.91E-05 | 1.07E-03 | 9.83E-04 | 4.27E-05 | 0.92 |
| 246 | 62.15 | 7.73E-08 | 5.31E-05 | 1.23E-03 | 1.14E-03 | 4.64E-05 | 0.92 |
| 247 | 62.25 | 7.20E-08 | 4.57E-05 | 1.13E-03 | 1.05E-03 | 4.16E-05 | 0.93 |
| 248 | 62.35 | 8.84E-08 | 5.21E-05 | 1.14E-03 | 1.05E-03 | 4.86E-05 | 0.92 |
| 249 | 62.45 | 2.54E-08 | 1.90E-05 | 3.55E-04 | 3.22E-04 | 1.66E-05 | 0.91 |
| 250 | 62.63 | 8.15E-08 | 5.19E-05 | 9.74E-04 | 8.78E-04 | 4.80E-05 | 0.90 |
| 251 | 62.83 | 6.51E-08 | 9.52E-05 | 1.43E-03 | 1.37E-03 | 3.10E-05 | 0.96 |
| 252 | 62.95 | 7.55E-08 | 5.00E-05 | 1.00E-03 | 9.24E-04 | 3.78E-05 | 0.92 |
| 253 | 63.05 | 7.92E-08 | 4.74E-05 | 9.48E-04 | 8.63E-04 | 4.25E-05 | 0.91 |
| 254 | 63.15 | 7.20E-08 | 5.10E-05 | 9.79E-04 | 8.90E-04 | 4.44E-05 | 0.91 |
| 255 | 63.25 | 6.15E-08 | 3.72E-05 | 7.15E-04 | 6.53E-04 | 3.11E-05 | 0.91 |
| 256 | 63.35 | 6.43E-08 | 4.17E-05 | 7.53E-04 | 6.86E-04 | 3.38E-05 | 0.91 |
| 257 | 63.45 | 6.67E-08 | 4.17E-05 | 7.48E-04 | 6.80E-04 | 3.38E-05 | 0.91 |
| 258 | 63.55 | 6.53E-08 | 4.24E-05 | 7.69E-04 | 6.99E-04 | 3.48E-05 | 0.91 |
| 259 | 63.65 | 5.97E-08 | 4.11E-05 | 7.48E-04 | 6.82E-04 | 3.29E-05 | 0.91 |
| 260 | 63.75 | 5.53E-08 | 5.04E-05 | 8.67E-04 | 7.94E-04 | 3.67E-05 | 0.92 |
| 261 | 63.85 | 6.78E-08 | 4.82E-05 | 9.53E-04 | 8.70E-04 | 4.13E-05 | 0.91 |
| 262 | 63.95 | 3.78E-08 | 2.72E-05 | 6.25E-04 | 5.89E-04 | 1.78E-05 | 0.94 |
| 263 | 64.05 | 2.96E-08 | 1.94E-05 | 4.21E-04 | 3.98E-04 | 1.17E-05 | 0.94 |

| Sample No. | Depth (m) | MSLF ($m^3$/kg) | ARM ($Am^2$/kg) | IRM1.2T ($Am^2$/kg) | IRM 0.3T ($Am^2$/kg) | HIRM ($Am^2$/kg) | S |
|---|---|---|---|---|---|---|---|
| 264 | 64.15 | 3.14E-08 | 2.32E-05 | 4.33E-04 | 4.05E-04 | 1.42E-05 | 0.93 |
| 265 | 64.25 | 4.61E-08 | 4.65E-05 | 8.37E-04 | 8.01E-04 | 1.84E-05 | 0.96 |
| 266 | 64.35 | 5.93E-08 | 8.18E-05 | 1.66E-03 | 1.60E-03 | 3.08E-05 | 0.96 |
| 267 | 64.45 | 6.06E-08 | 9.45E-05 | 1.85E-03 | 1.80E-03 | 2.79E-05 | 0.97 |
| 268 | 64.55 | 5.90E-08 | 7.76E-05 | 1.98E-03 | 1.93E-03 | 2.41E-05 | 0.98 |
| 269 | 64.65 | 6.12E-08 | 8.72E-05 | 2.22E-03 | 2.16E-03 | 3.17E-05 | 0.97 |
| 270 | 64.75 | 7.98E-08 | 1.30E-04 | 3.18E-03 | 3.12E-03 | 3.18E-05 | 0.98 |
| 271 | 64.85 | 7.75E-08 | 1.13E-04 | 2.72E-03 | 2.64E-03 | 3.73E-05 | 0.97 |
| 272 | 64.95 | 8.90E-08 | 1.67E-04 | 3.94E-03 | 3.84E-03 | 5.06E-05 | 0.97 |
| 273 | 65.05 | 7.26E-08 | 1.15E-04 | 2.32E-03 | 2.25E-03 | 3.32E-05 | 0.97 |
| 274 | 65.15 | 6.14E-08 | 5.89E-05 | 1.75E-03 | 1.45E-03 | 1.47E-04 | 0.83 |
| 275 | 65.25 | 6.16E-08 | 5.17E-05 | 8.53E-04 | 7.83E-04 | 3.48E-05 | 0.92 |
| 276 | 65.35 | 6.43E-08 | 3.91E-05 | 6.60E-04 | 6.05E-04 | 2.75E-05 | 0.92 |
| 277 | 65.45 | 6.69E-08 | 4.34E-05 | 7.84E-04 | 7.16E-04 | 3.41E-05 | 0.91 |
| 278 | 65.55 | 6.57E-08 | 3.21E-05 | 6.92E-04 | 6.32E-04 | 3.01E-05 | 0.91 |
| 279 | 65.65 | 6.60E-08 | 3.71E-05 | 6.46E-04 | 5.91E-04 | 2.74E-05 | 0.92 |
| 280 | 65.75 | 6.29E-08 | 3.74E-05 | 6.52E-04 | 5.99E-04 | 2.63E-05 | 0.92 |
| 281 | 65.85 | 7.46E-08 | 4.23E-05 | 7.36E-04 | 6.66E-04 | 3.46E-05 | 0.91 |
| 282 | 65.95 | 7.97E-08 | 4.15E-05 | 7.22E-04 | 6.57E-04 | 3.25E-05 | 0.91 |
| 283 | 66.05 | 8.88E-08 | 4.51E-05 | 8.09E-04 | 7.34E-04 | 3.73E-05 | 0.91 |
| 284 | 66.15 | 8.00E-08 | 4.01E-05 | 7.09E-04 | 6.44E-04 | 3.22E-05 | 0.91 |
| 285 | 66.25 | 7.73E-08 | 3.62E-05 | 6.31E-04 | 5.71E-04 | 3.00E-05 | 0.90 |
| 286 | 66.35 | 7.48E-08 | 3.66E-05 | 6.57E-04 | 5.94E-04 | 3.15E-05 | 0.90 |
| 287 | 66.45 | 7.84E-08 | 4.16E-05 | 7.47E-04 | 6.67E-04 | 3.97E-05 | 0.89 |
| 288 | 66.55 | 7.62E-08 | 4.24E-05 | 7.84E-04 | 6.87E-04 | 4.85E-05 | 0.88 |
| 289 | 66.65 | 7.47E-08 | 4.20E-05 | 7.55E-04 | 6.76E-04 | 3.96E-05 | 0.90 |
| 290 | 66.75 | 8.19E-08 | 4.33E-05 | 8.62E-04 | 7.77E-04 | 4.25E-05 | 0.90 |
| 291 | 66.85 | 2.00E-07 | 5.99E-05 | 2.10E-03 | 2.02E-03 | 3.66E-05 | 0.97 |
| 292 | 66.95 | 1.84E-07 | 4.62E-05 | 1.52E-03 | 1.52E-03 | 2.24E-06 | 1.00 |
| 293 | 67.05 | 5.28E-08 | 3.57E-05 | 6.07E-04 | 5.41E-04 | 3.29E-05 | 0.89 |
| 294 | 67.15 | 7.27E-08 | 3.32E-05 | 6.47E-04 | 5.94E-04 | 2.66E-05 | 0.92 |
| 295 | 67.25 | 1.05E-07 | 5.70E-05 | 1.03E-03 | 9.56E-04 | 3.75E-05 | 0.93 |
| 296 | 67.35 | 1.25E-07 | 4.48E-05 | 9.91E-04 | 9.39E-04 | 2.64E-05 | 0.95 |
| 297 | 67.45 | 2.06E-07 | 6.74E-05 | 1.58E-03 | 1.50E-03 | 3.94E-05 | 0.95 |
| 298 | 67.55 | 2.48E-07 | 7.55E-05 | 1.91E-03 | 1.81E-03 | 5.34E-05 | 0.94 |
| 299 | 67.65 | 2.66E-07 | 1.09E-04 | 2.79E-03 | 2.64E-03 | 7.55E-05 | 0.95 |
| 300 | 67.75 | 2.59E-07 | 1.03E-04 | 2.58E-03 | 2.43E-03 | 7.51E-05 | 0.94 |
| 301 | 67.85 | 2.65E-07 | 9.12E-05 | 2.41E-03 | 2.30E-03 | 5.72E-05 | 0.95 |
| 302 | 67.95 | 4.61E-07 | 1.17E-04 | 3.66E-03 | 3.53E-03 | 6.92E-05 | 0.96 |
| 303 | 68.05 | 6.85E-07 | 1.30E-04 | 4.86E-03 | 4.72E-03 | 6.69E-05 | 0.97 |
| 304 | 68.15 | 4.81E-07 | 1.24E-04 | 4.24E-03 | 4.08E-03 | 8.05E-05 | 0.96 |
| 305 | 68.25 | 1.30E-07 | 9.24E-05 | 1.98E-03 | 1.85E-03 | 6.67E-05 | 0.93 |
| 306 | 68.35 | 1.47E-07 | 1.09E-04 | 2.36E-03 | 2.18E-03 | 8.92E-05 | 0.92 |
| 307 | 68.45 | 1.40E-07 | 1.23E-04 | 2.50E-03 | 2.32E-03 | 8.80E-05 | 0.93 |
| 308 | 68.55 | 1.45E-07 | 1.34E-04 | 2.72E-03 | 2.54E-03 | 9.35E-05 | 0.93 |
| 309 | 68.65 | 1.44E-07 | 1.23E-04 | 2.45E-03 | 2.28E-03 | 8.64E-05 | 0.93 |
| 310 | 68.75 | 1.51E-07 | 1.24E-04 | 2.56E-03 | 2.37E-03 | 9.57E-05 | 0.93 |
| 311 | 68.85 | 1.34E-07 | 1.21E-04 | 2.43E-03 | 2.25E-03 | 8.89E-05 | 0.93 |
| 312 | 68.95 | 1.28E-07 | 1.40E-04 | 2.88E-03 | 2.67E-03 | 1.07E-04 | 0.93 |
| 313 | 69.05 | 1.08E-07 | 1.16E-04 | 2.22E-03 | 2.03E-03 | 9.31E-05 | 0.92 |
| 314 | 69.15 | 9.87E-08 | 1.11E-04 | 2.10E-03 | 1.91E-03 | 9.55E-05 | 0.91 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 315 | 69.25 | 1.02E-07 | 9.82E-05 | 1.90E-03 | 1.72E-03 | 9.10E-05 | 0.90 |
| 316 | 69.35 | 1.16E-07 | 1.40E-04 | 2.80E-03 | 2.56E-03 | 1.20E-04 | 0.91 |
| 317 | 69.45 | 1.16E-07 | 1.28E-04 | 2.33E-03 | 2.17E-03 | 7.83E-05 | 0.93 |
| 318 | 69.55 | 1.15E-07 | 1.38E-04 | 2.51E-03 | 2.37E-03 | 6.57E-05 | 0.95 |
| 319 | 69.65 | 1.31E-07 | 1.76E-04 | 3.77E-03 | 3.55E-03 | 1.14E-04 | 0.94 |
| 320 | 69.75 | 1.18E-07 | 9.90E-05 | 2.10E-03 | 1.98E-03 | 6.22E-05 | 0.94 |
| 321 | 69.85 | 1.67E-07 | 1.16E-04 | 3.08E-03 | 2.89E-03 | 9.61E-05 | 0.94 |
| 322 | 69.95 | 1.03E-07 | 7.40E-05 | 1.65E-03 | 1.52E-03 | 6.22E-05 | 0.92 |
| 323 | 70.1 | 9.05E-08 | 5.58E-05 | 1.14E-03 | 1.05E-03 | 4.82E-05 | 0.92 |
| 324 | 70.15 | 8.09E-08 | 4.77E-05 | 9.67E-04 | 8.78E-04 | 4.48E-05 | 0.91 |
| 325 | 70.25 | 9.16E-08 | 6.44E-05 | 1.37E-03 | 1.25E-03 | 6.06E-05 | 0.91 |
| 326 | 70.35 | 8.56E-08 | 6.76E-05 | 1.58E-03 | 1.37E-03 | 1.02E-04 | 0.87 |
| 327 | 70.45 | 8.03E-08 | 4.99E-05 | 9.04E-04 | 8.26E-04 | 3.94E-05 | 0.91 |
| 328 | 70.55 | 9.59E-08 | 6.70E-05 | 1.21E-03 | 1.13E-03 | 4.01E-05 | 0.93 |
| 329 | 70.65 | 7.88E-08 | 5.35E-05 | 8.32E-04 | 7.63E-04 | 3.45E-05 | 0.92 |
| 330 | 70.75 | 9.07E-08 | 6.99E-05 | 1.11E-03 | 9.86E-04 | 6.11E-05 | 0.89 |
| 331 | 70.85 | 8.54E-08 | 4.71E-05 | 7.35E-04 | 6.56E-04 | 3.95E-05 | 0.89 |
| 332 | 70.95 | 8.75E-08 | 6.87E-05 | 1.19E-03 | 1.07E-03 | 6.11E-05 | 0.90 |
| 333 | 71.05 | 9.51E-08 | 7.38E-05 | 1.24E-03 | 1.11E-03 | 6.35E-05 | 0.90 |
| 334 | 71.15 | 1.04E-07 | 1.24E-04 | 2.12E-03 | 1.90E-03 | 1.08E-04 | 0.90 |
| 335 | 71.25 | 1.02E-07 | 9.96E-05 | 1.73E-03 | 1.54E-03 | 9.49E-05 | 0.89 |
| 336 | 71.35 | 9.80E-08 | 1.04E-04 | 1.78E-03 | 1.61E-03 | 8.57E-05 | 0.90 |
| 337 | 71.45 | 9.10E-08 | 7.07E-05 | 1.23E-03 | 1.10E-03 | 6.44E-05 | 0.89 |
| 338 | 71.55 | 9.83E-08 | 8.42E-05 | 1.55E-03 | 1.38E-03 | 8.37E-05 | 0.89 |
| 339 | 71.65 | 8.65E-08 | 6.14E-05 | 1.02E-03 | 8.97E-04 | 5.93E-05 | 0.88 |
| 340 | 71.75 | 9.17E-08 | 8.06E-05 | 1.36E-03 | 1.20E-03 | 7.89E-05 | 0.88 |
| 341 | 71.85 | 1.30E-07 | 8.19E-05 | 1.31E-03 | 1.16E-03 | 7.43E-05 | 0.89 |
| 342 | 71.95 | 9.20E-08 | 8.15E-05 | 1.35E-03 | 1.20E-03 | 7.33E-05 | 0.89 |
| 343 | 72.05 | 9.19E-08 | 7.80E-05 | 1.24E-03 | 1.09E-03 | 7.27E-05 | 0.88 |
| 344 | 72.15 | 8.61E-08 | 6.22E-05 | 9.87E-04 | 8.89E-04 | 4.87E-05 | 0.90 |
| 345 | 72.25 | 8.94E-08 | 7.17E-05 | 1.12E-03 | 1.00E-03 | 6.11E-05 | 0.89 |
| 346 | 72.35 | 8.94E-08 | 6.94E-05 | 1.09E-03 | 9.71E-04 | 5.97E-05 | 0.89 |
| 347 | 72.45 | 9.28E-08 | 6.51E-05 | 1.07E-03 | 9.63E-04 | 5.36E-05 | 0.90 |
| 348 | 72.55 | 9.14E-08 | 7.08E-05 | 1.24E-03 | 1.12E-03 | 6.03E-05 | 0.90 |
| 349 | 72.65 | 9.33E-08 | 6.89E-05 | 1.38E-03 | 1.24E-03 | 6.84E-05 | 0.90 |
| 350 | 72.75 | 9.64E-08 | 7.78E-05 | 1.29E-03 | 1.17E-03 | 6.17E-05 | 0.90 |
| 351 | 72.85 | 9.48E-08 | 7.18E-05 | 1.12E-03 | 1.02E-03 | 5.00E-05 | 0.91 |
| 352 | 72.95 | 9.41E-08 | 8.76E-05 | 1.32E-03 | 1.19E-03 | 6.32E-05 | 0.90 |
| 353 | 73.05 | 9.82E-08 | 7.24E-05 | 1.12E-03 | 1.01E-03 | 5.68E-05 | 0.90 |
| 354 | 73.15 | 9.27E-08 | 6.89E-05 | 1.04E-03 | 9.54E-04 | 4.52E-05 | 0.91 |
| 355 | 73.55 | 9.34E-08 | 6.56E-05 | 1.08E-03 | 9.86E-04 | 4.84E-05 | 0.91 |
| 356 | 73.65 | 8.71E-08 | 5.65E-05 | 9.17E-04 | 8.32E-04 | 4.22E-05 | 0.91 |
| 357 | 73.75 | 8.72E-08 | 7.57E-05 | 1.37E-03 | 1.27E-03 | 5.40E-05 | 0.92 |
| 358 | 73.85 | 9.05E-08 | 7.19E-05 | 1.10E-03 | 1.02E-03 | 3.98E-05 | 0.93 |
| 359 | 73.95 | 6.63E-08 | 4.56E-05 | 6.85E-04 | 6.24E-04 | 3.03E-05 | 0.91 |
| 360 | 74.05 | 8.29E-08 | 4.52E-05 | 1.17E-03 | 1.12E-03 | 2.66E-05 | 0.95 |
| 361 | 74.15 | 7.99E-08 | 5.80E-05 | 8.87E-04 | 8.18E-04 | 3.48E-05 | 0.92 |
| 362 | 74.25 | 8.22E-08 | 6.28E-05 | 8.40E-04 | 7.76E-04 | 3.18E-05 | 0.92 |
| 363 | 74.35 | 9.49E-08 | 7.84E-05 | 1.28E-03 | 1.19E-03 | 4.42E-05 | 0.93 |
| 364 | 74.45 | 4.24E-08 | 3.96E-05 | 5.78E-04 | 5.37E-04 | 2.07E-05 | 0.93 |
| 365 | 74.55 | 6.54E-08 | 5.13E-05 | 7.14E-04 | 6.63E-04 | 2.57E-05 | 0.93 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 366 | 74.65 | 7.78E-08 | 1.03E-04 | 1.43E-03 | 1.38E-03 | 2.84E-05 | 0.96 |
| 367 | 74.75 | 7.23E-08 | 7.89E-05 | 1.03E-03 | 9.79E-04 | 2.37E-05 | 0.95 |
| 368 | 74.85 | 2.18E-07 | 5.20E-04 | 7.30E-03 | 7.19E-03 | 5.61E-05 | 0.98 |
| 369 | 74.95 | 1.90E-07 | 3.16E-04 | 8.34E-03 | 8.27E-03 | 3.84E-05 | 0.99 |
| 370 | 75.05 | 1.09E-07 | 1.07E-04 | 3.83E-03 | 3.76E-03 | 3.14E-05 | 0.98 |
| 371 | 75.15 | 9.84E-08 | 8.28E-05 | 1.80E-03 | 1.72E-03 | 3.62E-05 | 0.96 |
| 372 | 75.25 | 1.12E-07 | 9.85E-05 | 4.67E-03 | 4.58E-03 | 4.60E-05 | 0.98 |
| 373 | 75.35 | 1.18E-07 | 9.99E-05 | 4.42E-03 | 4.32E-03 | 4.88E-05 | 0.98 |
| 374 | 75.45 | 1.25E-07 | 1.56E-04 | 7.63E-03 | 7.50E-03 | 6.54E-05 | 0.98 |
| 375 | 75.55 | 1.14E-07 | 1.10E-04 | 5.91E-03 | 5.77E-03 | 6.74E-05 | 0.98 |
| 376 | 75.65 | 1.09E-07 | 9.72E-05 | 4.72E-03 | 4.59E-03 | 6.46E-05 | 0.97 |
| 377 | 75.75 | 1.15E-07 | 1.07E-04 | 5.14E-03 | 4.97E-03 | 8.54E-05 | 0.97 |
| 378 | 75.85 | 1.19E-07 | 1.07E-04 | 4.79E-03 | 4.58E-03 | 1.06E-04 | 0.96 |
| 379 | 75.95 | 1.40E-07 | 1.24E-04 | 7.59E-03 | 7.35E-03 | 1.19E-04 | 0.97 |
| 380 | 76.05 | 1.62E-07 | 1.56E-04 | 9.89E-03 | 9.52E-03 | 1.86E-04 | 0.96 |
| 381 | 76.15 | 1.84E-07 | 1.82E-04 | 1.09E-02 | 1.04E-02 | 2.19E-04 | 0.96 |
| 382 | 76.25 | 5.35E-07 | 1.29E-04 | 6.54E-03 | 6.41E-03 | 6.52E-05 | 0.98 |
| 383 | 76.35 | 8.73E-07 | 1.61E-04 | 1.10E-02 | 1.08E-02 | 7.64E-05 | 0.99 |
| 384 | 76.45 | 8.50E-07 | 1.74E-04 | 1.35E-02 | 1.34E-02 | 8.24E-05 | 0.99 |
| 385 | 76.65 | 8.67E-07 | 2.25E-04 | 1.68E-02 | 1.66E-02 | 9.49E-05 | 0.99 |
| 386 | 76.75 | 1.21E-06 | 2.25E-04 | 1.94E-02 | 1.93E-02 | 5.37E-05 | 0.99 |
| 387 | 76.85 | 1.11E-06 | 2.53E-04 | 2.31E-02 | 2.29E-02 | 9.16E-05 | 0.99 |
| 388 | 76.95 | 1.04E-06 | 2.71E-04 | 2.43E-02 | 2.42E-02 | 4.38E-05 | 1.00 |
| 389 | 77.05 | 1.11E-06 | 2.77E-04 | 2.51E-02 | 2.50E-02 | 4.07E-05 | 1.00 |
| 390 | 77.15 | 9.86E-07 | 2.59E-04 | 2.38E-02 | 2.37E-02 | 8.75E-05 | 0.99 |
| 391 | 77.25 | 9.36E-07 | 2.36E-04 | 2.29E-02 | 2.28E-02 | 7.34E-05 | 0.99 |
| 392 | 77.35 | 9.96E-07 | 2.75E-04 | 2.76E-02 | 2.74E-02 | 7.05E-05 | 0.99 |
| 393 | 77.45 | 9.71E-07 | 2.06E-04 | 2.15E-02 | 2.13E-02 | 7.64E-05 | 0.99 |
| 394 | 77.55 | 9.88E-07 | 2.24E-04 | 2.41E-02 | 2.39E-02 | 8.24E-05 | 0.99 |
| 395 | 77.65 | 9.99E-07 | 2.22E-04 | 2.37E-02 | 2.37E-02 | 4.00E-05 | 1.00 |
| 396 | 77.75 | 9.70E-07 | 2.24E-04 | 2.34E-02 | 2.32E-02 | 8.17E-05 | 0.99 |
| 397 | 77.85 | 1.03E-06 | 2.72E-04 | 2.67E-02 | 2.65E-02 | 1.11E-04 | 0.99 |
| 398 | 77.95 | 8.50E-07 | 1.72E-04 | 1.61E-02 | 1.59E-02 | 8.00E-05 | 0.99 |
| 399 | 78.05 | 1.04E-06 | 1.75E-04 | 1.55E-02 | 1.53E-02 | 7.51E-05 | 0.99 |
| 400 | 78.15 | 7.99E-07 | 2.13E-04 | 2.00E-02 | 1.97E-02 | 1.35E-04 | 0.99 |
| 401 | 78.25 | 8.53E-07 | 1.85E-04 | 1.62E-02 | 1.60E-02 | 1.02E-04 | 0.99 |
| 402 | 78.35 | 7.16E-07 | 1.42E-04 | 1.08E-02 | 1.07E-02 | 7.65E-05 | 0.99 |
| 403 | 78.45 | 7.29E-07 | 1.52E-04 | 1.21E-02 | 1.19E-02 | 7.84E-05 | 0.99 |
| 404 | 78.55 | 7.92E-07 | 1.71E-04 | 1.51E-02 | 1.50E-02 | 8.80E-05 | 0.99 |
| 405 | 78.65 | 8.33E-07 | 1.93E-04 | 1.67E-02 | 1.64E-02 | 1.24E-04 | 0.99 |
| 406 | 78.75 | 7.09E-07 | 1.82E-04 | 1.54E-02 | 1.52E-02 | 9.94E-05 | 0.99 |
| 407 | 78.85 | 7.87E-07 | 1.90E-04 | 1.61E-02 | 1.59E-02 | 9.71E-05 | 0.99 |
| 408 | 78.95 | 7.37E-07 | 1.59E-04 | 1.18E-02 | 1.16E-02 | 9.01E-05 | 0.98 |
| 409 | 79.05 | 7.24E-07 | 1.26E-04 | 8.98E-03 | 8.86E-03 | 5.74E-05 | 0.99 |
| 410 | 79.15 | 5.92E-07 | 1.06E-04 | 7.06E-03 | 6.93E-03 | 6.35E-05 | 0.98 |
| 411 | 79.25 | 7.37E-07 | 1.45E-04 | 1.25E-02 | 1.24E-02 | 5.53E-05 | 0.99 |
| 412 | 79.35 | 9.10E-07 | 1.72E-04 | 1.50E-02 | 1.49E-02 | 6.82E-05 | 0.99 |
| 413 | 79.45 | 1.32E-06 | 2.39E-04 | 2.42E-02 | 2.40E-02 | 8.66E-05 | 0.99 |
| 414 | 79.55 | 1.33E-06 | 1.96E-04 | 1.81E-02 | 1.79E-02 | 7.96E-05 | 0.99 |
| 415 | 79.65 | 7.48E-07 | 1.58E-04 | 1.38E-02 | 1.36E-02 | 9.04E-05 | 0.99 |
| 416 | 79.75 | 1.08E-06 | 4.06E-04 | 3.10E-02 | 3.06E-02 | 1.63E-04 | 0.99 |

| Sample No. | Depth (m) | MSLF ($m^3/kg$) | ARM ($Am^2/kg$) | IRM1.2T ($Am^2/kg$) | IRM 0.3T ($Am^2/kg$) | HIRM ($Am^2/kg$) | S |
|---|---|---|---|---|---|---|---|
| 417 | 79.85 | 1.01E-06 | 3.29E-04 | 2.64E-02 | 2.61E-02 | 1.40E-04 | 0.99 |
| 418 | 79.95 | 1.48E-06 | 3.07E-04 | 3.12E-02 | 3.10E-02 | 1.01E-04 | 0.99 |
| 419 | 80.05 | 1.03E-06 | 1.90E-04 | 1.87E-02 | 1.85E-02 | 1.04E-04 | 0.99 |
| 420 | 80.15 | 7.83E-07 | 1.67E-04 | 1.43E-02 | 1.40E-02 | 1.32E-04 | 0.98 |
| 421 | 80.25 | 4.43E-07 | 9.47E-05 | 4.83E-03 | 4.71E-03 | 5.91E-05 | 0.98 |
| 422 | 80.35 | 4.55E-07 | 8.62E-05 | 3.92E-03 | 3.78E-03 | 7.22E-05 | 0.96 |
| 423 | 80.45 | 8.77E-07 | 2.81E-04 | 2.33E-02 | 2.29E-02 | 1.73E-04 | 0.99 |
| 424 | 80.55 | 1.13E-06 | 2.74E-04 | 2.75E-02 | 2.70E-02 | 2.66E-04 | 0.98 |
| 425 | 80.65 | 1.01E-06 | 3.59E-04 | 3.07E-02 | 3.03E-02 | 2.27E-04 | 0.99 |
| 426 | 80.75 | 1.10E-06 | 4.76E-04 | 3.60E-02 | 3.55E-02 | 2.75E-04 | 0.98 |
| 427 | 80.85 | 1.13E-06 | 3.80E-04 | 2.96E-02 | 2.91E-02 | 2.50E-04 | 0.98 |
| 428 | 80.95 | 1.03E-06 | 3.40E-04 | 3.00E-02 | 2.96E-02 | 2.12E-04 | 0.99 |
| 429 | 81.05 | 1.12E-06 | 3.11E-04 | 2.68E-02 | 2.65E-02 | 1.30E-04 | 0.99 |
| 430 | 81.15 | 9.35E-07 | 2.31E-04 | 1.87E-02 | 1.83E-02 | 1.68E-04 | 0.98 |
| 431 | 81.25 | 1.02E-06 | 2.24E-04 | 1.87E-02 | 1.83E-02 | 2.27E-04 | 0.98 |
| 432 | 81.35 | 1.07E-06 | 2.50E-04 | 2.12E-02 | 2.07E-02 | 2.69E-04 | 0.97 |
| 433 | 81.45 | 9.32E-07 | 1.93E-04 | 1.64E-02 | 1.61E-02 | 1.56E-04 | 0.98 |
| 434 | 81.55 | 9.07E-07 | 1.53E-04 | 1.23E-02 | 1.20E-02 | 1.21E-04 | 0.98 |
| 435 | 81.65 | 1.06E-06 | 1.32E-04 | 1.23E-02 | 1.21E-02 | 1.00E-04 | 0.98 |
| 436 | 81.75 | 1.90E-06 | 2.72E-04 | 2.98E-02 | 2.97E-02 | 6.39E-05 | 1.00 |
| 437 | 81.85 | 7.56E-07 | 1.31E-04 | 1.07E-02 | 1.05E-02 | 7.70E-05 | 0.99 |
| 438 | 81.95 | 7.52E-07 | 1.33E-04 | 1.01E-02 | 9.88E-03 | 9.02E-05 | 0.98 |
| 439 | 82.05 | 8.20E-07 | 1.26E-04 | 9.89E-03 | 9.74E-03 | 7.80E-05 | 0.98 |
| 440 | 82.15 | 7.19E-07 | 1.31E-04 | 1.13E-02 | 1.11E-02 | 1.02E-04 | 0.98 |
| 441 | 82.25 | 7.85E-07 | 1.58E-04 | 1.40E-02 | 1.38E-02 | 9.60E-05 | 0.99 |
| 442 | 82.35 | 7.72E-07 | 1.22E-04 | 9.08E-03 | 8.93E-03 | 7.54E-05 | 0.98 |
| 443 | 82.45 | 6.40E-07 | 1.07E-04 | 8.60E-03 | 8.48E-03 | 6.20E-05 | 0.99 |
| 444 | 82.55 | 8.64E-07 | 1.16E-04 | 8.37E-03 | 8.21E-03 | 8.29E-05 | 0.98 |

**TABLE 2. Elemental Abundance from X-ray Fluorescence**

**Sample No.**: A unique sample number assigned to sediment samples placed in vials.

**Depth (cm)**: Depth of sample in centimeters from top of core. The depth shown is the midpoint of a channel sample that encompasses a 10-cm depth interval.

**Elements**: The elements analyzed are listed below. The units are either weight percent (Wt%) or parts per million (ppm).

| | |
|---|---|
| Ti: Titanium-Wt % | V: Vanadium-ppm |
| Cr: Chromium-ppm | Mn: Manganese-ppm |
| Fe: Iron- Wt% | Ni: Nickel-ppm |
| Cu: Copper-ppm | Zn: Zinc-ppm |
| Rb: Rubidium-ppm | Sr: Strontium-ppm |
| Y: Yttrium-ppm | Zr: Zirconium-ppm |
| Nb: Niobium-ppm | Mo: Molybdenum-ppm |
| Sn: Tin-ppm | Sb: Antimony-ppm |
| Cs: Cesium-ppm | Ba: Barium-ppm |
| La: Lanthanum-ppm | Ce: Cerium-ppm |

| Sample Number | Depth (m) | Ti wt.% | V ppm | Cr ppm | Mn ppm | Fe wt. % | Ni ppm | Cu ppm | Zn ppm | Rb ppm | Sr ppm | Y ppm | Zr ppm | Nb ppm | Mo ppm | Sn ppm | Sb ppm | Cs ppm | Ba ppm | La ppm | Ce ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.05 | 0.29 | 107 | 0 | 643 | 3.74 | 24 | 41 | 104 | 155 | 214 | 19 | 104 | 14 | 3 | 5 | 4 | 0 | 620 | 62 | 33 |
| 2 | 32.15 | 0.30 | 72 | 0 | 651 | 3.69 | 28 | 41 | 102 | 137 | 211 | 23 | 112 | 15 | 4 | 4 | 5 | 12 | 803 | 232 | 233 |
| 3 | 32.25 | 0.28 | 44 | 0 | 727 | 3.60 | 27 | 42 | 92 | 121 | 194 | 15 | 105 | 11 | 3 | 2 | 3 | 0 | 578 | 8 | 44 |
| 5 | 32.45 | 0.28 | 90 | 39 | 719 | 3.39 | 30 | 50 | 110 | 122 | 197 | 19 | 86 | 11 | 12 | 10 | 4 | 22 | 611 | 34 | 57 |
| 7 | 32.65 | 0.25 | 72 | 0 | 740 | 3.40 | 22 | 35 | 83 | 130 | 235 | 19 | 101 | 15 | 4 | 3 | 4 | 0 | 501 | 51 | 43 |
| 11 | 33.05 | 0.26 | 80 | 0 | 744 | 3.58 | 31 | 40 | 90 | 129 | 226 | 13 | 97 | 15 | 4 | 8 | 3 | 0 | 487 | 40 | 18 |
| 13 | 33.25 | 0.31 | 96 | 0 | 734 | 3.90 | 27 | 43 | 105 | 155 | 231 | 16 | 108 | 15 | 4 | 5 | 4 | 14 | 795 | 234 | 245 |
| 17 | 33.65 | 0.31 | 127 | 17 | 871 | 3.72 | 22 | 52 | 129 | 155 | 225 | 8 | 115 | 28 | 16 | 16 | 3 | 30 | 751 | 25 | 51 |
| 20 | 34.75 | 0.31 | 88 | 0 | 734 | 3.74 | 35 | 43 | 103 | 168 | 225 | 11 | 109 | 14 | 2 | 3 | 3 | 15 | 813 | 216 | 202 |
| 23 | 35.05 | 0.33 | 68 | 38 | 1000 | 3.89 | 32 | 54 | 137 | 160 | 237 | 27 | 114 | 14 | 4 | 4 | 2 | 52 | 801 | 25 | 50 |
| 24 | 35.15 | 0.33 | 73 | 32 | 998 | 4.03 | 28 | 49 | 145 | 174 | 234 | 22 | 101 | 15 | 4 | 4 | 3 | 41 | 892 | 16 | 105 |
| 26 | 35.35 | 0.34 | 78 | 55 | 1100 | 3.96 | 30 | 50 | 145 | 155 | 231 | 26 | 95 | 7 | 4 | 4 | 6 | 73 | 1000 | 57 | 2 |
| 29 | 35.65 | 0.33 | 78 | 24 | 895 | 3.88 | 33 | 54 | 141 | 156 | 234 | 7 | 102 | 28 | 20 | 7 | 2 | 58 | 835 | 26 | 38 |
| 31 | 35.85 | 0.33 | 70 | 47 | 824 | 3.83 | 26 | 51 | 150 | 150 | 234 | 10 | 107 | 29 | 18 | 7 | 3 | 63 | 853 | 47 | 55 |
| 33 | 36.05 | 0.25 | 77 | 30 | 1300 | 3.16 | 25 | 46 | 113 | 132 | 377 | 13 | 92 | 13 | 5 | 9 | 2 | 49 | 660 | 23 | 62 |
| 35 | 36.25 | 0.27 | 110 | 21 | 1400 | 3.18 | 25 | 51 | 117 | 112 | 379 | 2 | 78 | 31 | 18 | 10 | 5 | 72 | 841 | 47 | 61 |
| 38 | 36.55 | 0.3 | 19 | 49 | 979 | 3.55 | 29 | 52 | 131 | 150 | 406 | 2 | 68 | 30 | 18 | 23 | 6 | 96 | 1500 | 62 | 65 |
| 42 | 36.95 | 0.33 | 136 | 10 | 949 | 3.64 | 28 | 56 | 133 | 141 | 650 | 2 | 68 | 28 | 41 | 15 | 8 | 23 | 1000 | 44 | 50 |
| 45 | 38.15 | 0.27 | 81 | 10 | 795 | 2.98 | 24 | 59 | 115 | 149 | 941 | 10 | 62 | 20 | 27 | 11 | 7 | 30 | 1000 | 44 | 38 |
| 48 | 38.45 | 0.28 | 101 | 20 | 717 | 3.21 | 24 | 60 | 131 | 156 | 794 | 14 | 45 | 18 | 33 | 14 | 8 | 19 | 964 | 22 | 28 |
| 51 | 38.75 | 0.30 | 107 | 0 | 745 | 3.52 | 23 | 49 | 107 | 186 | 817 | 7 | 67 | 10 | 6 | 6 | 6 | 13 | 948 | 185 | 214 |
| 53 | 38.95 | 0.29 | 97 | 0 | 753 | 3.47 | 3 | 54 | 116 | 187 | 740 | 1 | 64 | 13 | 5 | 4 | 4 | 5 | 859 | 231 | 203 |
| 56 | 39.25 | 0.30 | 124 | 0 | 747 | 3.72 | 27 | 50 | 115 | 194 | 519 | 1 | 57 | 12 | 5 | 1 | 5 | 11 | 794 | 201 | 176 |
| 60 | 39.65 | 0.14 | 49 | 0 | 356 | 1.74 | 20 | 16 | 43 | 66 | 0 | 13 | 111 | 0 | 2 | 1 | 3 | 10 | 706 | 183 | 168 |
| 61 | 39.75 | 0.16 | 0 | 0 | 415 | 1.92 | 20 | 18 | 53 | 75 | 0 | 16 | 143 | 1 | 1 | 2 | 2 | 0 | 530 | 0 | 34 |
| 62 | 39.9 | 0.33 | 87 | 0 | 922 | 3.91 | 24 | 52 | 123 | 201 | 705 | 12 | 73 | 10 | 5 | 2 | 1 | 0 | 593 | 17 | 41 |
| 64 | 40.35 | 0.31 | 60 | 0 | 774 | 3.45 | 27 | 46 | 107 | 174 | 669 | 11 | 90 | 13 | 4 | 7 | 2 | 0 | 549 | 20 | 42 |
| 65 | 40.45 | 0.21 | 87 | 0 | 587 | 2.78 | 22 | 29 | 60 | 96 | 811 | 9 | 108 | 14 | 6 | 4 | 1 | 10 | 631 | 63 | 182 |
| 66 | 40.55 | 0.18 | 94 | 0 | 540 | 2.36 | 22 | 36 | 57 | 98 | 746 | 7 | 93 | 11 | 8 | 5 | 2 | 0 | 402 | 31 | 20 |
| 67 | 40.65 | 0.16 | 26 | 15 | 409 | 1.98 | 15 | 23 | 45 | 81 | 990 | 8 | 133 | 9 | 7 | 4 | 2 | 0 | 435 | 33 | 36 |
| 69 | 40.85 | 0.18 | 69 | 5 | 504 | 2.2 | 22 | 26 | 53 | 81 | 982 | 1 | 87 | 11 | 7 | 5 | 1 | 0 | 412 | 18 | 40 |
| 73 | 41.155 | 0.18 | 56 | 0 | 486 | 2.19 | 21 | 20 | 58 | 65 | 806 | 10 | 118 | 11 | 5 | 4 | 3 | 9 | 567 | 199 | 164 |
| 74 | 41.25 | 0.27 | 68 | 37 | 628 | 2.43 | 20 | 26 | 68 | 90 | 539 | 22 | 184 | 14 | 14 | 8 | 4 | 42 | 781 | 35 | 74 |
| 76 | 41.45 | 0.26 | 57 | 31 | 762 | 2.64 | 24 | 34 | 84 | 99 | 750 | 7 | 105 | 21 | 34 | 6 | 3 | 44 | 597 | 0 | 22 |
| 77 | 41.55 | 0.24 | 64 | 33 | 717 | 2.43 | 25 | 43 | 85 | 89 | 970 | 7 | 43 | 25 | 48 | 5 | 3 | 17 | 781 | 18 | 56 |
| 79 | 41.75 | 0.25 | 21 | 49 | 748 | 2.60 | 31 | 44 | 94 | 97 | 946 | 5 | 61 | 26 | 42 | 8 | 2 | 37 | 681 | 22 | 31 |
| 82 | 42.05 | 0.23 | 90 | 0 | 572 | 2.55 | 25 | 29 | 67 | 81 | 846 | 8 | 89 | 3 | 4 | 5 | 2 | 10 | 736 | 174 | 197 |
| 86 | 42.45 | 0.18 | 42 | 0 | 530 | 2.46 | 26 | 25 | 62 | 93 | 681 | 9 | 93 | 10 | 9 | 2 | 1 | 16 | 635 | 226 | 201 |
| 89 | 42.75 | 0.19 | 80 | 0 | 558 | 2.63 | 26 | 36 | 85 | 93 | 654 | 10 | 89 | 11 | 8 | 4 | 3 | 0 | 446 | 29 | 47 |
| 91 | 43.15 | 0.24 | 20 | 43 | 738 | 2.72 | 24 | 44 | 91 | 100 | 537 | 14 | 104 | 27 | 34 | 7 | 2 | 10 | 540 | 21 | 46 |
| 93 | 43.35 | 0.22 | 70 | 0 | 618 | 2.76 | 19 | 38 | 79 | 106 | 723 | 15 | 88 | 13 | 7 | 5 | 2 | 0 | 759 | 169 | 215 |
| 96 | 43.65 | 0.24 | 55 | 31 | 837 | 2.79 | 23 | 41 | 96 | 94 | 581 | 2 | 92 | 31 | 39 | 3 | 1 | 0 | 524 | 43 | 52 |
| 97 | 43.75 | 0.18 | 43 | 0 | 528 | 2.54 | 23 | 29 | 61 | 89 | 444 | 9 | 82 | 9 | 6 | 3 | 0 | 11 | 533 | 216 | 222 |
| 100 | 44.05 | 0.22 | 27 | 49 | 611 | 2.57 | 29 | 39 | 85 | 97 | 359 | 15 | 85 | 12 | 5 | 12 | 2 | 37 | 634 | 47 | 68 |
| 101 | 44.15 | 0.22 | 59 | 46 | 879 | 2.65 | 21 | 38 | 85 | 95 | 467 | 19 | 92 | 12 | 5 | 5 | 2 | 18 | 467 | 37 | 18 |
| 104 | 44.45 | 0.19 | 57 | 32 | 663 | 2.25 | 27 | 38 | 74 | 77 | 388 | 5 | 55 | 25 | 17 | 5 | 2 | 23 | 472 | 19 | 40 |
| 105 | 44.55 | 0.19 | 59 | 34 | 614 | 2.37 | 31 | 35 | 82 | 77 | 364 | 2 | 64 | 29 | 19 | 5 | 2 | 66 | 521 | 20 | 2 |
| 106 | 44.85 | 0.21 | 43 | 24 | 576 | 2.41 | 29 | 38 | 87 | 78 | 308 | 2 | 75 | 28 | 20 | 9 | 2 | 9 | 461 | 32 | 2 |
| 110 | 45.05 | 0.21 | 27 | 44 | 713 | 2.51 | 22 | 31 | 84 | 92 | 420 | 11 | 83 | 23 | 18 | 18 | 2 | 32 | 470 | 10 | 28 |
| 112 | 45.25 | 0.21 | 75 | 18 | 577 | 2.46 | 22 | 33 | 83 | 91 | 332 | 5 | 72 | 26 | 17 | 17 | 2 | 25 | 524 | 20 | 46 |
| 115 | 45.55 | 0.23 | 68 | 34 | 559 | 2.73 | 24 | 36 | 90 | 98 | 314 | 14 | 91 | 26 | 16 | 16 | 2 | 50 | 571 | 14 | 45 |
| 117 | 45.75 | 0.19 | 77 | 18 | 550 | 2.62 | 25 | 27 | 63 | 91 | 392 | 15 | 86 | 3 | 0 | 6 | 3 | 0 | 460 | 22 | 26 |
| 119 | 45.95 | 0.18 | 66 | 31 | 639 | 2.33 | 22 | 35 | 81 | 81 | 363 | 2 | 69 | 26 | 17 | 11 | 2 | 39 | 776 | 52 | 53 |
| 121 | 46.55 | 0.22 | 66 | 25 | 662 | 2.55 | 22 | 40 | 91 | 101 | 368 | 8 | 80 | 26 | 17 | 7 | 2 | 44 | 552 | 28 | 37 |
| 123 | 46.75 | 0.22 | 44 | 40 | 522 | 2.61 | 21 | 37 | 93 | 97 | 337 | 7 | 75 | 26 | 16 | 4 | 1 | 43 | 609 | 31 | 2 |
| 126 | 47.05 | 0.20 | 66 | 0 | 537 | 2.72 | 23 | 34 | 71 | 104 | 345 | 18 | 97 | 4 | 0 | 5 | 1 | 0 | 427 | 0 | 40 |
| 129 | 47.35 | 0.21 | 85 | 22 | 619 | 2.65 | 20 | 38 | 80 | 99 | 328 | 15 | 73 | 10 | 4 | 5 | 2 | 20 | 356 | 12 | 34 |
| 131 | 47.55 | 0.21 | 53 | 28 | 646 | 2.49 | 24 | 35 | 86 | 99 | 409 | 12 | 83 | 26 | 16 | 15 | 2 | 45 | 526 | 0 | 66 |
| 132 | 47.65 | 0.25 | 70 | 48 | 738 | 2.91 | 22 | 44 | 107 | 102 | 350 | 2 | 69 | 28 | 36 | 8 | 2 | 28 | 634 | 23 | 34 |
| 134 | 47.85 | 0.22 | 92 | 0 | 600 | 2.96 | 26 | 34 | 78 | 109 | 397 | 6 | 81 | 4 | 5 | 4 | 1 | 10 | 687 | 193 | 210 |
| 135 | 47.95 | 0.19 | 72 | 10 | 622 | 2.29 | 27 | 32 | 71 | 101 | 714 | 2 | 77 | 27 | 40 | 10 | 3 | 5 | 661 | 29 | 2 |
| 139 | 49.85 | 0.25 | 88 | 21 | 659 | 2.91 | 28 | 45 | 108 | 121 | 510 | 10 | 58 | 24 | 29 | 16 | 2 | 30 | 885 | 59 | 71 |
| 143 | 50.05 | 0.22 | 88 | 0 | 624 | 2.90 | 28 | 33 | 82 | 128 | 490 | 7 | 74 | 12 | 7 | 5 | 4 | 0 | 494 | 23 | 3 |
| 147 | 50.45 | 0.22 | 74 | 44 | 517 | 2.60 | 22 | 40 | 94 | 107 | 510 | 2 | 65 | 25 | 36 | 11 | 3 | 32 | 824 | 20 | 52 |

| Sample Number | Depth (m) | Ti wt.% | V ppm | Cr ppm | Mn ppm | Fe wt. % | Ni ppm | Cu ppm | Zn ppm | Rb ppm | Sr ppm | Y ppm | Zr ppm | Nb ppm | Mo ppm | Sn ppm | Sb ppm | Cs ppm | Ba ppm | La ppm | Ce ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | 52.25 | 0.27 | 60 | 41 | 699 | 3.37 | 23 | 53 | 127 | 127 | 340 | 2 | 41 | 25 | 36 | 9 | 3 | 23 | 521 | 9 | 2 |
| 151 | 52.55 | 0.21 | 66 | 25 | 628 | 2.62 | 22 | 44 | 98 | 98 | 566 | 2 | 37 | 25 | 38 | 9 | 2 | 36 | 393 | 28 | 52 |
| 152 | 52.65 | 0.23 | 64 | 31 | 639 | 2.65 | 32 | 37 | 102 | 103 | 414 | 2 | 57 | 27 | 38 | 12 | 2 | 39 | 549 | 22 | 31 |
| 156 | 53.05 | 0.26 | 50 | 42 | 643 | 3.27 | 22 | 44 | 112 | 137 | 371 | 2 | 59 | 22 | 35 | 6 | 2 | 46 | 467 | 8 | 13 |
| 163 | 53.75 | 0.21 | 63 | 27 | 545 | 2.50 | 21 | 36 | 84 | 90 | 576 | 9 | 14 | 25 | 40 | 8 | 3 | 12 | 477 | 0 | 61 |
| 171 | 54.55 | 0.20 | 59 | 36 | 576 | 2.53 | 22 | 39 | 82 | 88 | 554 | 2 | 48 | 25 | 41 | 12 | 3 | 42 | 533 | 36 | 32 |
| 176 | 55.05 | 0.17 | 47 | 29 | 514 | 1.87 | 19 | 23 | 60 | 71 | 732 | 6 | 80 | 23 | 34 | 7 | 3 | 27 | 537 | 16 | 49 |
| 177 | 55.15 | 0.17 | 49 | 31 | 500 | 1.87 | 22 | 31 | 72 | 66 | 769 | 11 | 61 | 23 | 38 | 38 | 3 | 13 | 418 | 17 | 28 |
| 180 | 55.55 | 0.17 | 57 | 23 | 497 | 2.01 | 20 | 29 | 62 | 82 | 750 | 13 | 70 | 10 | 23 | 23 | 3 | 44 | 722 | 25 | 36 |
| 180 | 55.55 | 0.15 | 49 | 0 | 467 | 2.16 | 26 | 22 | 49 | 71 | 776 | 15 | 79 | 1 | 5 | 6 | 2 | 0 | 441 | 20 | 12 |
| 182 | 55.75 | 0.2 | 73 | 34 | 558 | 2.30 | 22 | 35 | 77 | 88 | 652 | 2 | 76 | 25 | 35 | 4 | 3 | 36 | 686 | 24 | 25 |
| 186 | 56.15 | 0.21 | 15 | 28 | 594 | 2.52 | 25 | 40 | 88 | 97 | 768 | 9 | 77 | 27 | 40 | 10 | 4 | 8 | 625 | 18 | 77 |
| 190 | 56.55 | 0.18 | 18 | 36 | 577 | 1.79 | 20 | 25 | 58 | 73 | 958 | 16 | 143 | 21 | 25 | 5 | 3 | 26 | 685 | 34 | 35 |
| 193 | 56.85 | 0.22 | 39 | 35 | 625 | 2.67 | 30 | 36 | 86 | 89 | 564 | 2 | 72 | 25 | 38 | 11 | 3 | 28 | 419 | 13 | 12 |
| 196 | 57.15 | 0.23 | 65 | 42 | 582 | 2.62 | 26 | 33 | 86 | 112 | 596 | 10 | 93 | 21 | 29 | 6 | 2 | 48 | 537 | 10 | 22 |
| 200 | 57.55 | 0.18 | 39 | 37 | 574 | 1.89 | 18 | 23 | 60 | 75 | 898 | 10 | 65 | 21 | 29 | 6 | 2 | 25 | 501 | 20 | 28 |
| 203 | 57.85 | 0.21 | 62 | 43 | 643 | 2.47 | 26 | 36 | 82 | 80 | 599 | 2 | 68 | 25 | 37 | 14 | 3 | 57 | 636 | 5 | 66 |
| 206 | 58.15 | 0.22 | 76 | 27 | 618 | 2.53 | 21 | 39 | 90 | 95 | 580 | 2 | 51 | 28 | 39 | 8 | 3 | 21 | 564 | 44 | 62 |
| 211 | 58.65 | 0.23 | 91 | 27 | 619 | 2.85 | 24 | 41 | 101 | 121 | 534 | 12 | 85 | 23 | 24 | 10 | 2 | 30 | 425 | 4 | 27 |
| 213 | 58.85 | 0.23 | 76 | 25 | 643 | 2.83 | 24 | 43 | 100 | 92 | 573 | 14 | 83 | 10 | 18 | 6 | 4 | 56 | 927 | 50 | 2 |
| 217 | 59.25 | 0.27 | 87 | 39 | 691 | 3.09 | 23 | 47 | 107 | 121 | 500 | 19 | 102 | 27 | 31 | 31 | 1 | 58 | 708 | 47 | 52 |
| 222 | 59.75 | 0.19 | 59 | 23 | 664 | 2.37 | 31 | 37 | 75 | 83 | 712 | 6 | 62 | 25 | 27 | 5 | 5 | 60 | 862 | 42 | 56 |
| 224 | 59.95 | 0.24 | 70 | 42 | 519 | 2.68 | 23 | 43 | 90 | 104 | 379 | 6 | 97 | 25 | 21 | 9 | 2 | 25 | 490 | 32 | 45 |
| 227 | 60.25 | 0.23 | 44 | 45 | 565 | 2.69 | 22 | 39 | 89 | 102 | 351 | 10 | 101 | 27 | 16 | 4 | 2 | 53 | 504 | 32 | 42 |
| 229 | 60.45 | 0.26 | 76 | 42 | 524 | 3.04 | 25 | 39 | 100 | 100 | 325 | 2 | 104 | 31 | 24 | 11 | 3 | 34 | 614 | 44 | 49 |
| 231 | 60.65 | 0.28 | 69 | 33 | 863 | 3.38 | 23 | 46 | 115 | 143 | 557 | 15 | 110 | 23 | 20 | 13 | 3 | 40 | 776 | 63 | 47 |
| 233 | 60.65 | 0.26 | 99 | 38 | 753 | 3.18 | 29 | 47 | 104 | 136 | 550 | 6 | 77 | 28 | 40 | 10 | 3 | 40 | 607 | 18 | 32 |
| 237 | 61.25 | 0.24 | 51 | 52 | 684 | 2.96 | 32 | 36 | 96 | 116 | 549 | 23 | 97 | 14 | 18 | 18 | 3 | 57 | 1000 | 26 | 55 |
| 240 | 61.55 | 0.27 | 81 | 45 | 705 | 3.17 | 44 | 45 | 106 | 122 | 544 | 2 | 76 | 30 | 36 | 36 | 3 | 0 | 603 | 19 | 59 |
| 242 | 61.75 | 0.24 | 80 | 52 | 640 | 3.12 | 26 | 49 | 100 | 105 | 398 | 2 | 95 | 31 | 35 | 15 | 4 | 41 | 804 | 44 | 64 |
| 246 | 62.15 | 0.24 | 98 | 41 | 639 | 3.02 | 31 | 47 | 103 | 122 | 532 | 14 | 97 | 21 | 24 | 9 | 2 | 34 | 605 | 41 | 32 |
| 249 | 62.45 | 0.11 | 29 | 23 | 409 | 1.39 | 25 | 14 | 35 | 33 | 0 | 5 | 18 | 17 | 17 | 8 | 3 | 26 | 561 | 52 | 37 |
| 251 | 62.83 | 0.21 | 55 | 54 | 573 | 2.46 | 22 | 37 | 88 | 99 | 485 | 18 | 97 | 11 | 7 | 7 | 3 | 66 | 703 | 23 | 57 |
| 253 | 63.05 | 0.27 | 71 | 63 | 700 | 3.18 | 32 | 43 | 107 | 118 | 574 | 2 | 70 | 30 | 36 | 7 | 2 | 57 | 695 | 30 | 30 |
| 255 | 63.25 | 0.21 | 59 | 20 | 682 | 2.53 | 32 | 33 | 83 | 91 | 718 | 2 | 35 | 24 | 25 | 9 | 2 | 39 | 645 | 0 | 24 |
| 258 | 63.55 | 0.22 | 47 | 37 | 670 | 2.67 | 35 | 36 | 87 | 97 | 709 | 21 | 100 | 13 | 11 | 11 | 2 | 32 | 650 | 39 | 36 |
| 258 | 63.55 | 0.21 | 38 | 10 | 577 | 2.77 | 27 | 33 | 70 | 102 | 756 | 24 | 79 | 4 | 2 | 4 | 3 | 0 | 504 | 23 | 37 |
| 261 | 63.85 | 0.22 | 59 | 0 | 668 | 3.06 | 32 | 36 | 76 | 106 | 568 | 14 | 82 | 2 | 2 | 3 | 2 | 13 | 702 | 231 | 172 |
| 264 | 64.15 | 0.13 | 22 | 0 | 516 | 2.09 | 21 | 21 | 51 | 74 | 455 | 3 | 60 | 1 | 1 | 5 | 1 | 0 | 331 | 0 | 3 |
| 267 | 64.45 | 0.17 | 91 | 0 | 495 | 2.40 | 20 | 26 | 64 | 86 | 418 | 13 | 76 | 2 | 1 | 6 | 3 | 11 | 554 | 214 | 209 |
| 270 | 64.75 | 0.18 | 78 | 0 | 485 | 2.47 | 21 | 25 | 63 | 82 | 341 | 16 | 70 | 2 | 0 | 3 | 1 | 0 | 404 | 15 | 27 |
| 272 | 64.95 | 0.18 | 57 | 0 | 482 | 2.38 | 3 | 25 | 65 | 99 | 378 | 15 | 90 | 12 | 2 | 3 | 1 | 0 | 414 | 30 | 3 |
| 276 | 65.35 | 0.21 | 65 | 0 | 691 | 2.87 | 21 | 32 | 73 | 93 | 702 | 8 | 62 | 11 | 12 | 6 | 3 | 10 | 693 | 175 | 209 |
| 280 | 65.75 | 0.20 | 47 | 0 | 588 | 2.73 | 23 | 33 | 71 | 88 | 793 | 7 | 65 | 11 | 10 | 4 | 4 | 0 | 530 | 33 | 23 |
| 265 | 68.25 | 0.25 | 93 | 0 | 669 | 3.27 | 23 | 35 | 90 | 145 | 689 | 10 | 62 | 10 | 8 | 6 | 2 | 14 | 743 | 201 | 164 |
| 288 | 66.55 | 0.24 | 89 | 0 | 649 | 3.17 | 26 | 33 | 82 | 125 | 688 | 13 | 80 | 4 | 6 | 6 | 2 | 0 | 548 | 20 | 32 |
| 291 | 68.65 | 0.08 | 22 | 0 | 281 | 1.14 | 21 | 8 | 17 | 39 | 0 | 6 | 105 | 8 | 2 | 5 | 2 | 0 | 589 | 209 | 167 |
| 293 | 67.05 | 0.17 | 73 | 3 | 462 | 2.30 | 19 | 22 | 56 | 87 | 721 | 7 | 69 | 7 | 9 | 5 | 3 | 0 | 410 | 0 | 26 |
| 297 | 67.45 | 0.19 | 33 | 0 | 488 | 2.37 | 22 | 22 | 56 | 75 | 725 | 13 | 92 | 15 | 5 | 4 | 3 | 12 | 691 | 206 | 195 |
| 301 | 67.85 | 0.23 | 77 | 14 | 550 | 2.63 | 30 | 27 | 65 | 88 | 698 | 13 | 121 | 13 | 4 | 6 | 1 | 0 | 525 | 21 | 24 |
| 303 | 68.05 | 0.25 | 57 | 0 | 600 | 2.74 | 30 | 25 | 67 | 105 | 607 | 17 | 138 | 16 | 4 | 2 | 1 | 7 | 663 | 211 | 187 |
| 305 | 68.25 | 0.27 | 67 | 0 | 642 | 3.13 | 25 | 27 | 82 | 128 | 533 | 24 | 123 | 6 | 2 | 3 | 2 | 7 | 834 | 215 | 228 |
| 310 | 68.75 | 0.25 | 55 | 0 | 620 | 2.76 | 24 | 24 | 67 | 107 | 662 | 18 | 136 | 7 | 1 | 3 | 3 | 0 | 544 | 19 | 35 |
| 315 | 69.25 | 0.26 | 96 | 0 | 638 | 2.94 | 28 | 22 | 68 | 108 | 822 | 25 | 117 | 14 | 4 | 6 | 2 | 0 | 563 | 18 | 21 |
| 317 | 69.45 | 0.22 | 71 | 0 | 551 | 2.41 | 24 | 9 | 55 | 90 | 583 | 15 | 140 | 4 | 1 | 3 | 2 | 0 | 580 | 39 | 35 |
| 321 | 69.85 | 0.25 | 102 | 0 | 615 | 2.94 | 26 | 23 | 69 | 106 | 549 | 16 | 142 | 18 | 5 | 5 | 2 | 0 | 556 | 36 | 42 |
| 324 | 70.15 | 0.24 | 93 | 0 | 658 | 3.18 | 27 | 34 | 85 | 124 | 489 | 18 | 104 | 17 | 5 | 3 | 3 | 0 | 500 | 0 | 46 |
| 326 | 70.35 | 0.21 | 116 | 0 | 596 | 2.71 | 35 | 24 | 66 | 83 | 716 | 16 | 98 | 5 | 1 | 4 | 1 | 7 | 814 | 158 | 242 |
| 327 | 70.45 | 0.24 | 43 | 0 | 646 | 2.96 | 24 | 30 | 73 | 107 | 662 | 11 | 103 | 5 | 2 | 3 | 1 | 0 | 580 | 24 | 22 |
| 331 | 70.65 | 0.29 | 77 | 0 | 789 | 3.61 | 35 | 45 | 98 | 115 | 524 | 14 | 95 | 16 | 6 | 3 | 2 | 8 | 783 | 218 | 203 |
| 334 | 71.15 | 0.28 | 92 | 0 | 725 | 3.29 | 27 | 25 | 86 | 133 | 520 | 12 | 142 | 6 | 2 | 3 | 1 | 8 | 850 | 243 | 246 |
| 337 | 71.45 | 0.26 | 103 | 0 | 680 | 3.21 | 37 | 44 | 106 | 111 | 611 | 16 | 121 | 14 | 5 | 4 | 1 | 0 | 614 | 26 | 40 |
| 343 | 72.05 | 0.29 | 91 | 0 | 695 | 3.38 | 29 | 33 | 91 | 124 | 528 | 16 | 119 | 16 | 6 | 2 | 1 | 0 | 611 | 29 | 57 |
| 347 | 72.45 | 0.28 | 79 | 0 | 790 | 3.54 | 30 | 38 | 89 | 132 | 536 | 21 | 114 | 16 | 5 | 4 | 1 | 0 | 624 | 47 | 44 |
| 352 | 72.95 | 0.27 | 98 | 0 | 687 | 3.47 | 25 | 34 | 84 | 118 | 528 | 11 | 115 | 13 | 6 | 5 | 1 | 0 | 628 | 34 | 57 |

| Sample Number | Depth (m) | Ti wt.% | V ppm | Cr ppm | Mn ppm | Fe wt. % | Ni ppm | Cu ppm | Zn ppm | Rb ppm | Sr ppm | Y ppm | Zr ppm | Nb ppm | Mo ppm | Sn ppm | Sb ppm | Cs ppm | Ba ppm | La ppm | Ce ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 355 | 73.55 | 0.29 | 19 | 0 | 749 | 3.76 | 29 | 39 | 94 | 132 | 528 | 13 | 111 | 16 | 8 | 4 | 2 | 8 | 807 | 214 | 240 |
| 361 | 74.15 | 0.28 | 114 | 0 | 703 | 3.53 | 37 | 44 | 88 | 120 | 698 | 13 | 105 | 5 | 5 | 3 | 3 | 0 | 765 | 32 | 59 |
| 364 | 74.45 | 0.14 | 63 | 0 | 570 | 1.95 | 21 | 17 | 44 | 47 | 0 | 9 | 62 | 1 | 1 | 5 | 1 | 10 | 796 | 203 | 168 |
| 367 | 74.75 | 0.24 | 0 | 0 | 1000 | 2.88 | 17 | 34 | 66 | 82 | 971 | 15 | 101 | 3 | 3 | 4 | 2 | 11 | 961 | 231 | 199 |
| 369 | 74.95 | 0.25 | 119 | 22 | 2300 | 3.20 | 30 | 36 | 65 | 89 | 656 | 24 | 135 | 14 | 2 | 4 | 2 | 8 | 853 | 239 | 235 |
| 371 | 75.15 | 0.32 | 139 | 15 | 891 | 4.66 | 22 | 36 | 90 | 134 | 247 | 21 | 127 | 18 | 3 | 3 | 1 | 0 | 604 | 33 | 50 |
| 372 | 75.25 | 0.32 | 61 | 0 | 711 | 4.05 | 24 | 36 | 101 | 148 | 232 | 24 | 112 | 16 | 2 | 2 | 1 | 0 | 676 | 28 | 46 |
| 374 | 75.45 | 0.33 | 63 | 0 | 843 | 4.17 | 26 | 35 | 91 | 136 | 261 | 22 | 161 | 7 | 0 | 3 | 2 | 9 | 866 | 265 | 256 |
| 376 | 75.65 | 0.33 | 93 | 0 | 832 | 4.06 | 19 | 40 | 102 | 175 | 277 | 15 | 107 | 14 | 1 | 3 | 3 | 0 | 697 | 22 | 43 |
| 378 | 75.65 | 0.33 | 129 | 0 | 820 | 4.09 | 21 | 42 | 112 | 174 | 273 | 14 | 110 | 14 | 2 | 5 | 2 | 9 | 946 | 229 | 226 |
| 381 | 76.15 | 0.34 | 72 | 0 | 883 | 4.04 | 21 | 46 | 108 | 158 | 247 | 24 | 99 | 5 | 0 | 4 | 1 | 15 | 990 | 187 | 227 |
| 382 | 76.25 | 0.39 | 126 | 0 | 961 | 4.55 | 34 | 48 | 138 | 232 | 298 | 15 | 84 | 15 | 2 | 4 | 1 | 0 | 1000 | 39 | 3 |
| 384 | 76.45 | 0.41 | 129 | 7 | 1200 | 4.89 | 26 | 58 | 151 | 231 | 275 | 16 | 75 | 18 | 2 | 2 | 1 | 13 | 1100 | 198 | 217 |
| 386 | 76.75 | 0.38 | 124 | 0 | 934 | 4.54 | 31 | 55 | 143 | 205 | 282 | 13 | 81 | 12 | 2 | 3 | 1 | 0 | 1000 | 49 | 60 |
| 389 | 77.05 | 0.40 | 142 | 0 | 959 | 4.82 | 3 | 51 | 151 | 228 | 277 | 13 | 73 | 15 | 2 | 5 | 2 | 0 | 1100 | 14 | 38 |
| 394 | 77.55 | 0.43 | 108 | 0 | 958 | 4.95 | 32 | 48 | 160 | 238 | 273 | 16 | 68 | 17 | 1 | 3 | 1 | 0 | 1200 | 231 | 216 |
| 397 | 77.65 | 0.43 | 41 | 0 | 941 | 5.02 | 27 | 53 | 157 | 237 | 281 | 9 | 68 | 16 | 1 | 3 | 1 | 8 | 1300 | 227 | 224 |
| 398 | 77.95 | 0.44 | 127 | 0 | 1200 | 5.45 | 31 | 49 | 158 | 242 | 280 | 21 | 62 | 16 | 2 | 3 | 2 | 8 | 1200 | 225 | 213 |
| 400 | 78.15 | 0.45 | 165 | 0 | 1300 | 5.20 | 26 | 63 | 165 | 263 | 288 | 14 | 59 | 17 | 0 | 3 | 1 | 0 | 1100 | 52 | 48 |
| 402 | 78.35 | 0.44 | 118 | 0 | 1300 | 5.19 | 27 | 59 | 159 | 255 | 270 | 9 | 65 | 20 | 2 | 3 | 1 | 0 | 1100 | 26 | 49 |
| 406 | 78.75 | 0.44 | 124 | 0 | 1400 | 5.37 | 3 | 54 | 160 | 254 | 298 | 17 | 61 | 17 | 1 | 4 | 1 | 0 | 1200 | 23 | 3 |
| 410 | 79.15 | 0.44 | 163 | 0 | 1500 | 5.45 | 24 | 60 | 159 | 255 | 271 | 19 | 60 | 20 | 2 | 4 | 1 | 0 | 1100 | 19 | 29 |
| 413 | 79.45 | 0.39 | 77 | 0 | 941 | 4.56 | 28 | 49 | 143 | 240 | 313 | 10 | 81 | 17 | 2 | 3 | 2 | 9 | 1200 | 198 | 233 |
| 415 | 79.65 | 0.44 | 174 | 0 | 1300 | 5.17 | 32 | 55 | 159 | 249 | 282 | 14 | 64 | 19 | 1 | 5 | 1 | 7 | 1200 | 210 | 214 |
| 416 | 79.75 | 0.42 | 142 | 33 | 1100 | 4.85 | 26 | 57 | 155 | 244 | 293 | 23 | 68 | 18 | 1 | 4 | 1 | 0 | 1200 | 29 | 55 |
| 419 | 80.05 | 0.42 | 97 | 0 | 1100 | 4.86 | 24 | 52 | 148 | 254 | 308 | 10 | 70 | 18 | 1 | 8 | 1 | 12 | 1200 | 216 | 215 |
| 422 | 80.35 | 0.45 | 136 | 0 | 1300 | 5.23 | 25 | 57 | 154 | 254 | 300 | 22 | 59 | 15 | 1 | 3 | 1 | 0 | 1100 | 29 | 23 |
| 423 | 80.45 | 0.45 | 159 | 0 | 1100 | 5.14 | 26 | 57 | 159 | 264 | 291 | 9 | 67 | 17 | 0 | 3 | 1 | 0 | 1100 | 18 | 67 |
| 426 | 80.75 | 0.43 | 109 | 0 | 925 | 4.90 | 25 | 50 | 156 | 256 | 305 | 20 | 62 | 17 | 1 | 4 | 1 | 0 | 1100 | 26 | 39 |
| 430 | 81.15 | 0.43 | 136 | 0 | 1200 | 4.96 | 24 | 59 | 190 | 242 | 304 | 18 | 66 | 15 | 2 | 4 | 1 | 10 | 1300 | 185 | 212 |
| 434 | 81.55 | 0.44 | 175 | 15 | 1300 | 4.98 | 29 | 57 | 148 | 258 | 317 | 19 | 78 | 18 | 2 | 3 | 1 | 0 | 1100 | 0 | 25 |
| 436 | 81.75 | 0.35 | 87 | 0 | 747 | 3.47 | 17 | 44 | 115 | 226 | 384 | 10 | 116 | 16 | 2 | 3 | 1 | 16 | 969 | 261 | 241 |
| 438 | 81.95 | 0.45 | 116 | 0 | 1400 | 5.30 | 27 | 55 | 151 | 241 | 314 | 21 | 61 | 15 | 2 | 4 | 3 | 0 | 1100 | 31 | 41 |
| 441 | 82.25 | 0.46 | 141 | 0 | 1300 | 5.40 | 31 | 57 | 161 | 265 | 295 | 12 | 55 | 18 | 1 | 3 | 1 | 0 | 1200 | 52 | 47 |
| 443 | 82.45 | 0.46 | 138 | 5 | 1300 | 5.37 | 26 | 60 | 166 | 255 | 273 | 23 | 54 | 18 | 1 | 4 | 1 | 10 | 1200 | 185 | 192 |
| 443 | 82.45 | 0.46 | 138 | 5 | 1300 | 5.37 | 26 | 60 | 166 | 255 | 273 | 23 | 54 | 18 | 1 | 4 | 1 | 10 | 1200 | 185 | 192 |

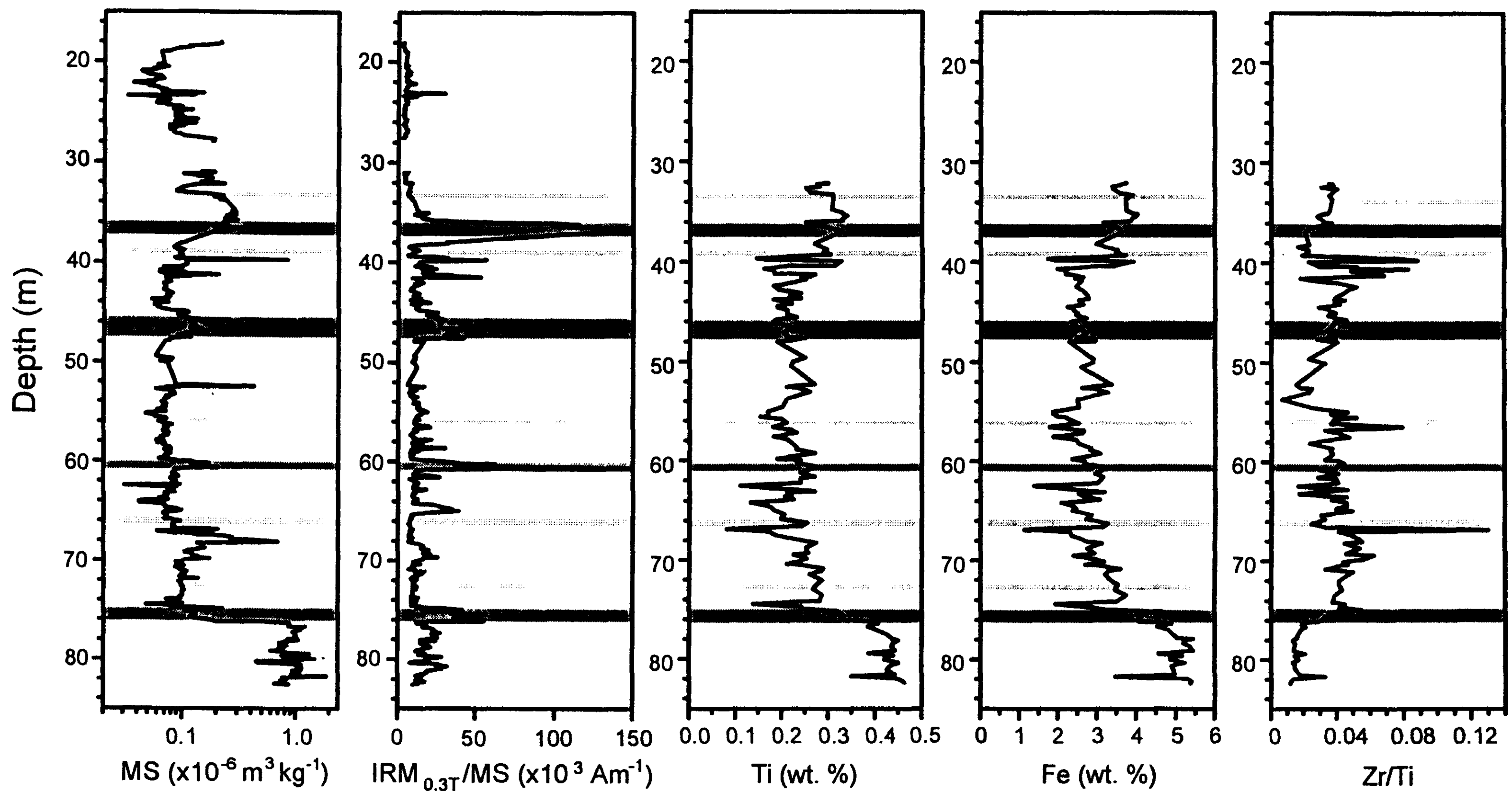


Figure 1. Depth plots of magnetic susceptibility (MS), isothermal remanent magnetization (IRM) divided by MS, titanium (Ti), iron (Fe), and zirconium to Ti (Zr/Ti) ratio. The dark shaded pattern indicates four intervals that contain abundant greigite, on the basis of moderately high MS, very high values of IRM/MS, and, within each interval, petrographically identified greigite in a magnetic-mineral separate from a 10-cm channel sample. Other zones of abundant greigite may be present. The lighter shaded pattern denotes petrographically examined intervals, in which greigite is absent or is very sparse and thus an unimportant contributor to the magnetic signal.

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## DIATOM COUNT DATA AND OWENS LAKE PALEOLIMNOLOGY DURING THE LAST INTERGLACIAL

by

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## Introduction

This report contains the diatom species count data for samples of cores OL-92/1 and OL-92/2 from Owens Lake, Inyo County, California, that encompass depths between 32 and 83 m. These depths span estimated ages between 46 ka and 137 ka and thereby encompass most of marine oxygen isotope stages 3, 4, and 5, the last interglacial period. Details regarding coring methodology, core curation, and preliminary analytical data from these cores can be found in Smith and Bischoff (1993, 1997).

## Taxonomy

Diatoms were identified as closely as possible to descriptions and illustrations of taxa in standard texts. However, the diatom flora of the western United States is poorly known, and some taxa from Quaternary deposits of distinctive paleolimnological environments are probably new to science. In some cases such taxa are recorded by "cf." or "aff." (= "compare with" or "with affinities to" respectively) in other cases they are lumped together with the taxon of closest similar morphological appearance.

The diatom count data appear in a spreadsheet (Table 1) with column headers that represent abbreviations of selected species or genera commonly appearing in the analyzed sediments. The taxon abbreviations and equivalent names (in italics) are given in the explanation preceding Table 1. Diatom taxa of rare occurrence or very restricted stratigraphic distribution are not included in this data set. Generic epithets in the Table 1 explanation followed by "spp." include multiple species included within that genus.

## Counts

The numbers in the spreadsheets represent un-modified counts of diatom valves of selected, abundant species or species groups in the Owens Lake cores. Diatom preservation may be poor in Owens Lake sediment because of breakage and corrosion. The counts represent whole valves and (or) large (> 40%) fragments of valves. Samples were processed according to the protocol described in Bradbury (1997a). The diatom species and group profiles presented in figures **1-3** are expressed in percentages. Because counts less than 100 valves are inadequate for establishing ecologically significant proportions of diatoms in fossil assemblages, these counts are down-weighted in the profiles. The assemblages at those levels will not sum to 100 percent on the figures.

## Ecological groups

Diatoms are generally classified into taxa living in, or preferring, fresh (<2 ‰ tds) and saline (>4‰ tds) waters. Many species found in the cores overlap in their salinity preferences and tolerances, and these guidelines cannot be taken too literally. For example, although most of the taxa considered "fresh" have optima well below 1‰ tds, they may inhabit waters 2 to 3 times more saline. "Saline" taxa, on the other hand, often tolerate (or even prosper in) a broad range of salinities above 4‰ tds, but they may be also present in waters below 4 ‰ tds. Today, the Owens River has a salinity of about 0.2‰ tds (200 ppm), and this salinity level may have been typical of Owens Lake when it was overflowing.

The diatoms from Owens Lake can also be grouped into taxa that live in open water suspended by turbulence and those that reside on the bottom, moving along or attached to various substrates within the illuminated zone of the lake. These groups are referred to as planktic (open water) and benthic (bottom dwelling) species respectively. Additional information about the ecology of the diatoms from Owens Lake cores can be found in Bradbury (1997a, b).

Letters in brackets [ ] on the following taxon list (Table 1 explanation) indicate ecological grouping of the taxon: **S** = saline, **F** = freshwater, **p** = planktic, **b** = benthic. Tychoplanktic "*Fragilaria*" and *Synedra* species have been grouped separately because they occupy either benthic or planktic freshwater habitats depending on turbulence. This variable ecological classification is represented by **[Fb-p]** in the Table 1 explanation.

## Paleolimnology of Owens Lake during the last interglacial period

This part of the Owens Lake record begins at 83.7 m (136.6 ka) with a dominance of planktic freshwater diatoms (**Figs. 1 and 2**). Spring-blooming taxa are most abundant, implying that climatic conditions characteristic of spring-like conditions extended well into the summer months, perhaps as a consequence of increased cloudiness and cool weather (e.g., Hostetler and Benson, 1990). Between 83.7 m and 75 m (118 ka) the spring-blooming *Stephanodiscus* taxa steadily decline and are replaced by summer-, fall-, and winter-blooming diatoms (cold season *Aulacoseira* species). These assemblages may suggest that diatom productivity during the spring was impeded by excessive turbidity caused by glacial runoff and that production shifted to seasons later in the year. Significant numbers of *Cyclostephanos* (**Fig. 3**) imply elevated salinities (about 1000 mg/L) during winter months following the major seasons of runoff. The abundance of cold-season *Aulacoseira* species at 76 m (120 ka) could indicate a reduction of turbidity sufficient to allow these species to prosper in the winter and early spring months. The predominant species, *Aulacoseira islandica*, blooms under ice in southern Canada and the Great Lakes today. This part of the core may correlate to the terminal phases of oxygen isotope stage 6.

According to the distribution of saline benthic and planktic diatoms (**Fig. 1**) arid climates that resulted in low, saline-water stages of Owens Lake began at about 74 m depth (116 ka). Although the chronology of core OL-92 remains unconfirmed, freshwater environments at Owens Lake documented between 137 and 118 ka coincide with uranium-series dates on halite inter-beds in lacustrine muds in Death Valley 146 - 127 ka and with bedded salts deposited from a deep saline lake in Death Valley 128 - 120 ka (Lowenstein, 1994). This coincidence lends support to the Owens Lake chronology. On the other hand, the Devils Hole oxygen isotope record (Winograd et al, 1988) implies warmer air temperatures beginning 145 ka and continuing until 118 ka. The relation between warmer air temperatures and precipitation remains unclear although it is possible --assuming all chronologies are accurate-- that moisture supplying Owens Lake and Death Valley came from lower latitudes of the East Pacific Ocean in circulation patterns that resembled the present-day Southwest Monsoon.

Between 74 m and 60 m (116 - 89 ka) there are six well-defined episodes of freshwater conditions in Owens Lake that punctuate the generally saline lacustrine environments that document arid climates presumed to represent oxygen isotope stage 5. Some of these freshwater intervals may correlate with five bedded salt layers (indicating perennial saline lake conditions) recognized near the base of the Death Valley core and above or below a U-series date of 98.6 ka (Li and others, 1996).

Generally saline conditions persisted at Owens Lake from between 60 and 48 m (89 - 70 ka). Fluctuations between saline planktic and saline benthic diatoms may indicate subtle variations in water depth throughout this period. At 48 m (70 ka), freshwater diatoms again predominate, indicating a deep, fresh and overflowing lake in the Owens basin. This interval persists for about 7 ky and abruptly ends at 43 m depth (63 ka). In timing and character, the freshwater lacustrine conditions 70 - 63 ka probably represent oxygen isotope stage 4. Following this freshwater diatom assemblage, Owens Lake again became saline until 36 m depth (54 ka) when freshwater conditions returned and persisted until the Holocene (Bradbury, 1997b).

Overall, the fluctuations between fresh- and saline- water conditions at Owens Lake occurred very rapidly, sometimes between adjacent samples that represent only 200 years. These rapid fluctuations testify to the sensitivity of Owens Lake to climate-mediated hydrologic change.

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## Figure Captions:

Figure 1. Stratigraphic distribution of saline benthic and planktic diatoms, and of freshwater planktic diatoms from Owens Lake cores OL-92/1 and OL-92/2 between the depths of 32 m (46 ka) and 83 m (137 ka). Selected ages taken from the age - depth model of Bischoff and others, 1997).

Figure 2. Stratigraphic distribution of freshwater diatom ecological groups from Owens Lake cores OL-92/1 and OL-92/2 between the depths of 32 m (46 ka) and 83 m (137 ka). "planktic (smr)" and "planktic (spg)"= planktic diatoms blooming in the summer to early fall and in the spring respectively. "*Aulacoseira* (wrm)" and " *Aulacoseira* (cld) = warm season [summer] and cold season [winter / early spring] species of *Aulacoseira* respectively.

Figure 3. Stratigraphic distribution of *Fragilaria*, *Cyclostephanos*, and *Stephanodiscus* "*carconensis*" from Owens Lake cores OL-92/1 and OL-92/2 between the depths of 32 m (46 ka) and 83 m (137 ka).

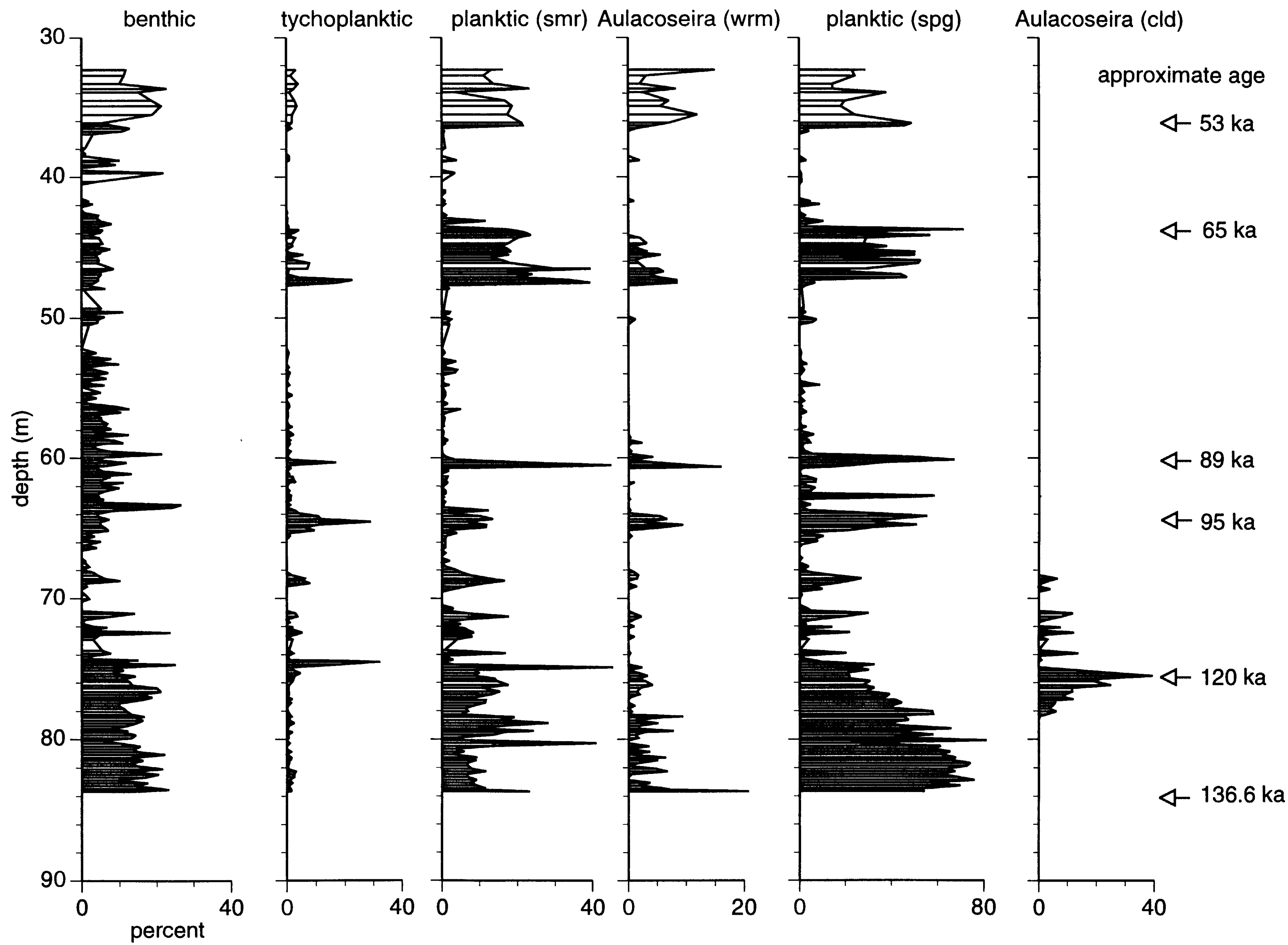

benthic
tychoplanktic
planktic (smr)
Aulacoseira (wrm)
planktic (spg)
Aulacoseira (cld)
approximate age
53 ka
65 ka
89 ka
95 ka
120 ka
136.6 ka
depth (m)
30
40
50
60
70
80
90
0
40
20
80
percent

Fig. 2

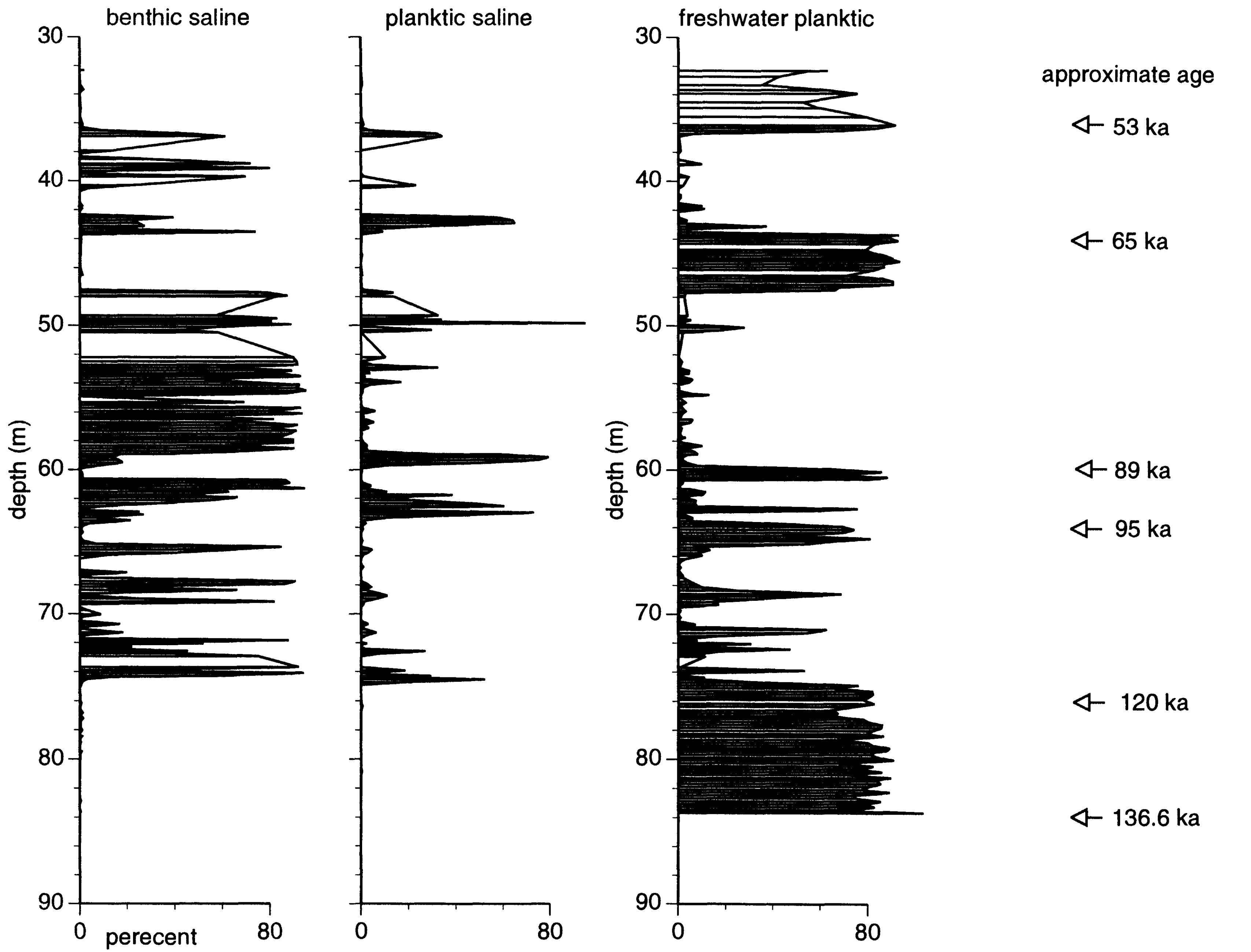
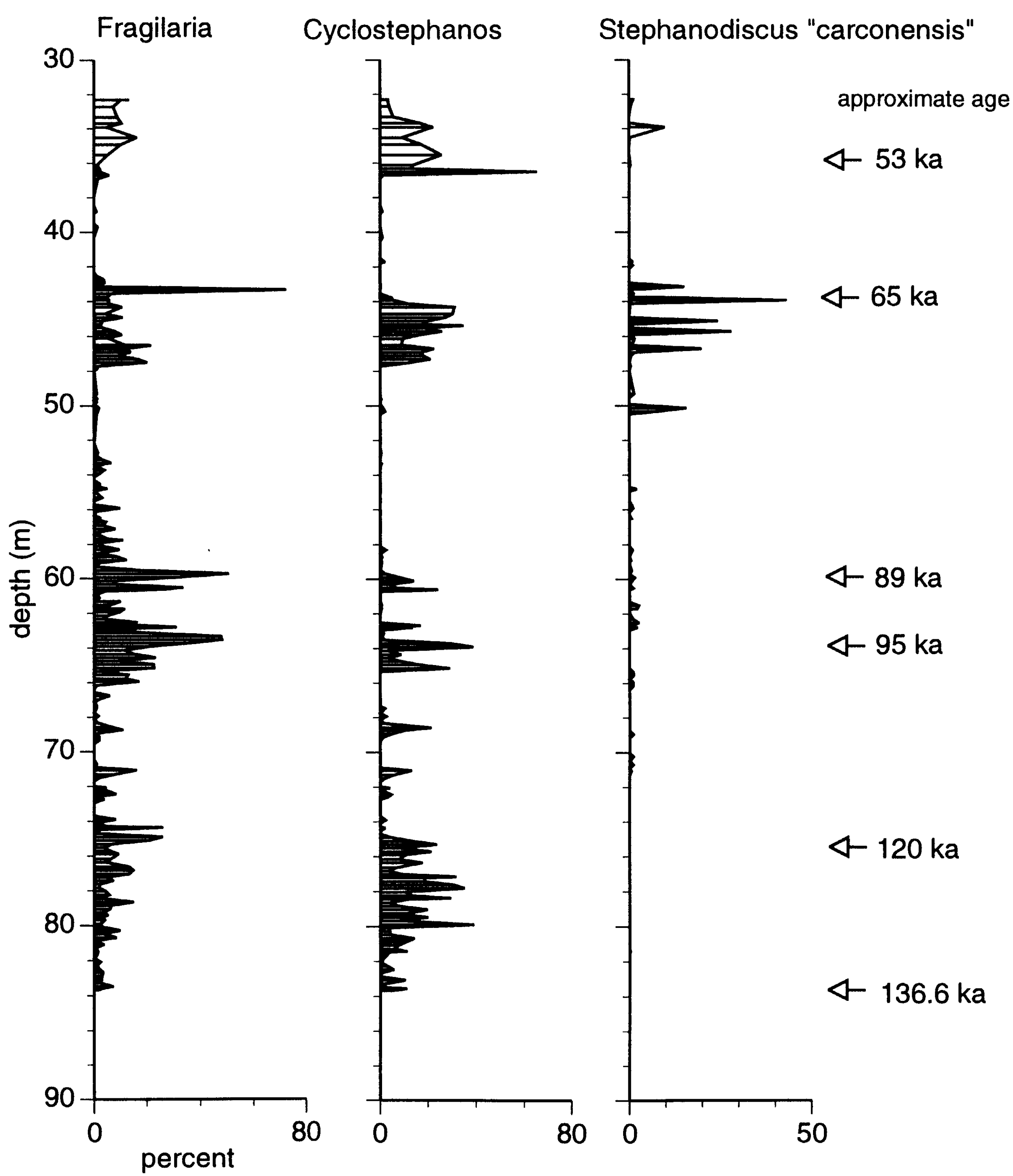

benthic saline
planktic saline
freshwater planktic
depth (m)
depth (m)
30
40
50
60
70
80
90
0
perecent
80
approximate age
53 ka
65 ka
89 ka
95 ka
120 ka
136.6 ka

Fig. 1



Fragilaria
Cyclostephanos
Stephanodiscus "carconensis"
approximate age
53 ka
65 ka
89 ka
95 ka
120 ka
136.6 ka
depth (m)
30
40
50
60
70
80
90
0
80
percent
0
80
0
50


Fig. 3

**Table 1. Abbreviation codes, species names and ecology of selected diatom taxa from Owens Lake cores.**

| code = | taxon | ecology |
|---|---|---|
| ach = | *Achnanthes* spp. | [Fb] |
| am-cof = | *Amphora coffaeiformis* | [Sb] |
| am-mac = | *Amphora macilenta* | [Sb] |
| am-oval = | *Amphora ovalis* | [Fb] |
| am-per = | *Amphora perpusilla* | [Fb] |
| ano-cos = | *Anomoeoneis costata* | [Sb] |
| ast-form = | *Asterionella formosa* | [Fp] |
| au-amb = | *Aulacoseira ambigua* | [Fp] |
| au-gr = | *Aulacoseira granulata* | [Fp] |
| au-isl? = | *Aulacoseira islandica* ? | [Fp] |
| au-sarc = | *Aulacoseira subarctica* | [Fp] |
| au-sol = | *Aulacoseira solida* | [Fp] |
| cal = | *Caloneis* spp. | [Fb] |
| cam-cly = | *Campylodiscus clypeus* | [Sb] |
| chaet = | *Chaetoceros muelleri* (usually spores) | [Sp] |
| coc-pla = | *Cocconeis placentula* | [Fb] |
| coc-dim = | *Cocconeis neodiminuta* | [Fb] |
| coc-dis = | *Cocconeis disculus* | [Fb] |
| cyc-bod = | *Cyclotella bodanica* | [Fp] |
| cyc-dist = | *Cyclotella distinguenda* | [Fp] |
| cyc-men = | *Cyclotella meneghiniana* | [Sp] |
| cyc-oce = | *Cyclotella ocellata* | [Fp] |
| cyc-quil = | *Cyclotella quillensis* | [Sp] |
| cymb = | *Cymbella* spp. | [Fb] |
| cymb-nz = | *Cymbellonitzschia diluviana* | [Fb] |
| cyst-pit = | *Cyclostephanos* sp. | [Fp] |
| cyst#10 = | *Cyclostephanos* sp. | [Fp] |
| epi = | *Epithemia* spp. | [Fb] |
| fr-brv = | *Fragilaria (Pseudostaurosira ) brevistriata* | [Fb-p] |
| fr-cap = | *Fragilaria caupucina* | [Fb-p] |
| fr-con = | *Fragilaria (Staurosira) construens* + varieties | [Fb-p] |
| fr-crot = | *Fragilaria crotonensis* | [Fp] |
| fr-lepto = | *Fragilaria (Staurosirella) leptostauron* | [Fb-p] |
| fr-pin = | *Fragilaria (Staurosirella) pinnata* | [Fb-p] |
| fr-vau = | *Fragilaria vaucheriae* | [Fb-p] |
| gom = | *Gomphonema* spp. | [Fb] |
| gyro = | *Gyrosigma* spp. | [Fb] |
| hz-am = | *Hantzschia amphioxys* | [Fb] |
| marty = | *Martyana martyi* | [Fb] |
| mel-sp. = | *Melosira* species | [Fb] |
| mel-var = | *Melosira varians* | [Fb] |
| nv-fw = | freshwater *Navicula* spp. | [Fb] |
| nv-sal = | saline *Navicula* spp. | [Sb] |
| nz-fw = | freshwater *Nitzschia* spp. | [Fb] |
| nz-fru = | *Nitzschia frustulum* | [Sb] |
| nz-mon = | *Nitzschia monoensis* | [Sb] |
| nz-pus = | *Nitzschia pusilla* | [Sb] |
| nz-rad = | *Nitzschia radicula* | [Fb] |
| nz-sal = | saline *Nitzschia* spp. | [Sb] |
| nz-sin = | *Nitzschia sinuata* type | [Sb} |
| pin = | *Pinnularia* spp. | [Fb] |
| reim = | *Reimeria sinuata* | [Fb] |
| rho-acu = | *Rhopalodia acuminata* | [Sb] |
| rho-con = | *Rhopalodia constricta* | [Sb] |

rho-gbr = *Rhopalodia gibberula* [Sb]
rho-gib = *Rhopalodia gibba* [Fb]
rhoi = *Rhoicosphenia curvata* [Fb]
st-ast = *Stephanodiscus asteroides* [Fp]
st-car = *Stephanodiscus* sp. cf. *St. carconensis* [Fp]
st-car/ast = intermediate between *S. asteroides* and *S. carconensis* [Fp]
st-min = *Stephanodiscus minutulus* type [Fp]
st-nia = *Stephanodiscus niagarae* [Fp]
st-org = *Stephanodiscus oregonicus* [Fp]
st-ovec = *Stephanodiscus* sp. (oval and eccentric form) [Fp]
st-prv = *Stephanodiscus parvus* type [Fp]
su-hof = *Surirella hoefleri* [Sb]
su-ova = *Surirella ovalis* type [Sb]
su-str = *Surirella striatula* [Sb]
sy-acus = *Synedra acus* [Fp]
sy-bero = *Synedra berolinensis* [Fb-p]
sy-maz = *Synedra mazamaensis* [Fb]
sy-rum = *Synedra rumpens* types [Fb]
sy-uln = *Synedra ulna* [Fb]

**Other column identifiers**

z(m) = depth in core in meters.
ka = the estimated ages that correspond to the sample depths for the diatom counts. The age model for the OL-92 cores is from Bischoff and others (1997).
count = total diatom valve count (includes diatom taxa not represented in spreadsheet).
trav = traverse length in mm on microscope slide along which diatoms were enumerated at 1000 X magnification.
D/mm = diatom valves per mm of microscope traverse at 1000 X.

| z(m) | ka | ach | am-cof | am-mac | am-oval | am-per | ano-cos | ast-form | au-amb | au-gr | au-isl? | au-sarc | au-sol | cal | cam-cly | chaet | coc-pla | coc-dim | coc-dis | cyc-bod | cyc-dist | cyc-men | cyc-oce | cyc-quil | cymb | cymb-nz | cyst-pit | cyst#10 | epi | fr-brv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.31 | 46.68 | 0 | 0 | 0 | 1 | 13 | 3 | 11 | 73 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 18 | 1 | 4 | 43 |
| 32.32 | 47 | 5 | 0 | 0 | 0 | 11 | 0 | 8 | 94 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 14 | 0 | 5 | 27 |
| 32.72 | 47.4 | 2 | 0 | 0 | 1 | 6 | 0 | 0 | 164 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 17 | 0 | 13 | 15 |
| 33.32 | 48.45 | 3 | 0 | 0 | 1 | 6 | 1 | 8 | 205 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 2 | 25 | 2 | 14 | 28 |
| 33.68 | 49.08 | 2 | 0 | 0 | 3 | 17 | 0 | 38 | 32 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 10 | 2 | 56 | 20 | 18 | 28 |
| 33.92 | 49.5 | 2 | 0 | 0 | 1 | 6 | 0 | 3 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 60 | 0 | 4 |
| 34.52 | 50.56 | 0 | 0 | 0 | 0 | 23 | 0 | 19 | 54 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 6 | 28 | 22 | 18 | 55 |
| 34.92 | 51.26 | 4 | 0 | 0 | 1 | 26 | 0 | 25 | 41 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 64 | 26 | 14 | 25 |
| 35.53 | 52.3 | 6 | 0 | 0 | 4 | 16 | 0 | 56 | 24 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 76 | 48 | 18 | 11 |
| 36.12 | 53.23 | 2 | 0 | 0 | 2 | 1 | 0 | 36 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 46 | 25 | 6 | 4 |
| 36.32 | 53.543 | 0 | 0 | 0 | 1 | 2 | 0 | 18 | 28 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 54 | 3 | 4 |
| 36.52 | 53.857 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 8 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 12 | 0 | 3 | 8 | 10 | 146 | 108 | 12 | 8 |
| 36.72 | 54.17 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 5 | 0 | 0 | 0 | 0 | 2 | 0 | 42 | 0 | 0 | 2 | 0 | 1 | 4 |
| 36.92 | 54.484 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 20 | 0 | 71 | 0 | 0 | 0 | 0 | 0 | 4 |
| 37.92 | 56.05 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 38.12 | 56.362 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.32 | 56.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.51 | 56.96 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.82 | 57.42 | 1 | 8 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 |
| 38.92 | 57.566 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.12 | 57.86 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.32 | 58.157 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.52 | 58.454 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.72 | 58.75 | 0 | 3 | 0 | 0 | 0 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 58 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| 40.32 | 59.63 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 1 | 0 | 0 | 0 |
| 40.52 | 59.939 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.72 | 60.246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.92 | 60.52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.96 | 60.57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.12 | 60.796 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.32 | 61.092 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.52 | 81.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.72 | 61.69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 |
| 41.79 | 61.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.92 | 61.975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42.12 | 62.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42.32 | 62.544 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42.52 | 62.827 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 104 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 170 | 0 | 0 | 0 | 0 | 1 | 3 |
| 42.72 | 63.11 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 98 | 0 | 0 | 0 | 0 | 1 | 4 |
| 42.92 | 63.395 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 | 0 | 0 | 0 | 0 | 3 | 8 |
| 43.13 | 63.696 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 79 | 6 | 5 | 0 | 0 | 0 | 0 | 34 | 0 | 63 | 0 | 1 | 1 | 0 | 3 | 1 |
| 43.32 | 63.97 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 5 | 5 | 0 | 0 | 8 | 252 |
| 43.52 | 64.26 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 145 | 10 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 4 | 1 | 0 | 0 | 0 | 7 | 11 |
| 43.72 | 64.546 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 7 | 0 | 8 |
| 43.75 | 64.59 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 19 | 5 | 8 | 2 |
| 43.92 | 64.83 | 1 | 0 | 0 | 1 | 6 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 15 | 5 | 4 | 3 |
| 44.12 | 65.113 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 44 | 4 | 15 |
| 44.32 | 65.396 | 0 | 0 | 0 | 1 | 3 | 2 | 10 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 56 | 102 | 1 | 9 |
| 44.72 | 65.958 | 1 | 0 | 0 | 1 | 3 | 0 | 7 | 58 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 54 | 89 | 4 | 2 |
| 44.92 | 66.236 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 39 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 46 | 83 | 0 | 14 |
| 45.12 | 66.51 | 1 | 0 | 0 | 2 | 2 | 1 | 5 | 16 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 1 | 58 | 37 | 3 | 7 |
| 45.32 | 66.779 | 0 | 0 | 0 | 1 | 6 | 0 | 10 | 21 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 49 | 1 | 7 |
| 45.38 | 66.86 | 2 | 0 | 0 | 1 | 1 | 0 | 4 | 15 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 96 | 68 | 1 | 3 |
| 45.52 | 67.049 | 1 | 0 | 0 | 0 | 4 | 1 | 21 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 25 | 64 | 2 | 4 |
| 45.72 | 67.32 | 2 | 0 | 0 | 0 | 5 | 0 | 4 | 41 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 85 | 37 | 0 | 2 |
| 45.92 | 67.591 | 0 | 0 | 0 | 1 | 9 | 0 | 0 | 12 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 41 | 3 | 8 |
| 46.12 | 67.863 | 0 | 0 | 0 | 1 | 2 | 1 | 5 | 20 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 19 | 29 | 1 | 2 |
| 46.5 | 68.38 | 0 | 0 | 0 | 2 | 4 | 0 | 4 | 37 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 0 | 19 | 18 | 3 | 5 |
| 46.52 | 68.407 | 1 | 0 | 0 | 0 | 3 | 0 | 2 | 69 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 25 | 27 | 3 | 9 |
| 46.72 | 68.68 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 20 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 61 | 34 | 1 | 9 |
| 46.92 | 68.955 | 0 | 0 | 0 | 1 | 3 | 0 | 12 | 16 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 66 | 0 | 7 |
| 47.12 | 69.231 | 1 | 0 | 0 | 0 | 6 | 0 | 17 | 19 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 | 61 | 1 | 3 |
| 47.32 | 69.51 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 40 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 60 | 30 | 4 | 10 |
| 47.52 | 69.793 | 0 | 0 | 0 | 2 | 5 | 0 | 35 | 42 | 5 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 13 | 43 | 0 | 41 |
| 47.72 | 70.077 | 0 | 0 | 0 | 1 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 38 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 4 |
| 47.92 | 70.36 | 0 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 4 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

OL-92 (5+6) #

| z (m) | ka | ach | am-cof | am-mac | am-oval | am-per | ano-cos | ast-form | au-amb | au-gr | au-isl? | au-sarc | au-sol | cal | cam-cly | chaet | coc-pla | coc-dim | coc-dis | cyc-bod | cyc-dist | cyc-men | cyc-oce | cyc-quil | cymb | cymb-nz | cyst-pit | cyst#10 | epi | fr-brv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47.99 | 70.458 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49.32 | 72.334 | 2 | 4 | 0 | 0 | 0 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 95 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 3 |
| 49.52 | 72.63 | 0 | 6 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 1 | 0 | 0 | 0 | 0 |
| 49.6 | 72.75 | 1 | 7 | 0 | 0 | 0 | 18 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 46 | 11 | 8 | 0 | 0 | 0 | 0 | 3 | 0 | 82 | 0 | 0 | 1 | 0 | 3 | 4 |
| 49.72 | 72.921 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 1 | 0 | 0 | 0 | 1 | 0 |
| 49.82 | 73.061 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 201 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49.92 | 73.2 | 0 | 4 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50.12 | 73.479 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 43 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 3 | 3 |
| 50.32 | 73.76 | 0 | 0 | 0 | 1 | 1 | 117 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 38 | 110 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 3 | 5 | 1 | 4 |
| 50.49 | 74 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 52.2 | 76.411 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52.5 | 76.83 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 52.72 | 77.136 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| 52.92 | 77.417 | 0 | 0 | 17 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 190 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| 53.12 | 77.7 | 0 | 8 | 1 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 53.32 | 77.986 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 5 | 2 |
| 53.35 | 78.03 | 2 | 0 | 1 | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 10 |
| 53.52 | 78.269 | 1 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| 53.72 | 78.55 | 0 | 2 | 1 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| 53.92 | 78.842 | 0 | 0 | 0 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 29 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 1 |
| 54.12 | 79.14 | 0 | 3 | 0 | 0 | 0 | 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 12 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 54.32 | 79.44 | 0 | 6 | 1 | 0 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 54.52 | 79.74 | 0 | 0 | 3 | 0 | 0 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 54.7 | 80.016 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 4 |
| 54.8 | 80.17 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| 54.92 | 80.36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55.32 | 80.97 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| 55.52 | 81.27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 55.72 | 81.577 | 0 | 4 | 0 | 0 | 0 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 |
| 55.92 | 81.884 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56.12 | 82.19 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 56.32 | 82.49 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 56.5 | 82.76 | 1 | 7 | 1 | 0 | 2 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 7 |
| 56.52 | 82.791 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 56.72 | 83.1 | 0 | 6 | 3 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 2 |
| 56.92 | 83.419 | 0 | 7 | 0 | 0 | 2 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57.12 | 83.743 | 2 | 10 | 2 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 250 | 14 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 1 | 0 | 4 | 13 |
| 57.32 | 84.07 | 0 | 13 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 114 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| 57.52 | 84.398 | 1 | 5 | 3 | 0 | 2 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 114 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| 57.72 | 84.724 | 1 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 63 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 |
| 57.76 | 84.79 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| 57.92 | 85.048 | 0 | 10 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| 58.12 | 85.369 | 0 | 6 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| 58.32 | 85.689 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 3 | 3 | 5 | 13 |
| 58.52 | 86.012 | 0 | 8 | 0 | 1 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 197 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 4 | 0 |
| 58.72 | 86.338 | 3 | 6 | 0 | 0 | 2 | 15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 201 | 0 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | 2 | 0 | 3 | 0 | 6 | 19 |
| 58.92 | 86.67 | 4 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 2 | 90 | 45 | 3 | 0 | 0 | 0 | 0 | 27 | 0 | 11 | 2 | 4 | 0 | 1 | 6 | 18 |
| 58.95 | 86.72 | 3 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 48 | 8 | 7 | 0 | 0 | 0 | 0 | 227 | 0 | 7 | 0 | 0 | 2 | 0 | 0 | 16 |
| 59.12 | 87.009 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 250 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 9 | 0 | 0 | 2 | 0 | 4 | 4 |
| 59.32 | 87.349 | 3 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 174 | 1 | 0 | 0 | 0 | 0 | 117 | 0 | 32 | 2 | 0 | 1 | 0 | 6 | 3 |
| 59.52 | 87.689 | 5 | 2 | 0 | 1 | 0 | 6 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 75 | 196 | 4 | 0 | 0 | 0 | 0 | 83 | 0 | 32 | 0 | 7 | 1 | 0 | 9 | 85 |
| 59.72 | 88.029 | 1 | 0 | 0 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 3 | 2 | 0 | 0 | 0 | 0 | 48 | 0 | 3 | 4 | 9 | 7 | 5 | 33 | 256 |
| 59.92 | 88.369 | 0 | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 30 | 5 | 100 |
| 60.12 | 88.709 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 1 | 59 | 14 | 1 | 29 |
| 60.32 | 89.049 | 3 | 0 | 0 | 4 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 9 | 10 | 10 | 5 |
| 60.52 | 89.34 | 0 | 0 | 0 | 1 | 2 | 0 | 18 | 0 | 27 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 5 | 23 | 4 | 9 |
| 60.63 | 89.53 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 141 | 1 | 20 |
| 60.72 | 89.69 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| 60.92 | 90.03 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 |
| 61.12 | 90.38 | 0 | 1 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 7 |
| 61.32 | 90.599 | 0 | 16 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61.32 | 90.7 | 0 | 0 | 0 | 0 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 6 | 15 |
| 61.52 | 91.07 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 97 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 1 | 0 | 3 | 8 |
| 61.72 | 91.41 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 3 | 4 |
| 61.73 | 91.43 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 44 | 24 | 5 | 0 | 0 | 1 | 0 | 21 | 0 | 28 | 1 | 1 | 0 | 1 | 3 | 10 |
| 61.92 | 91.76 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 115 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 1 | 0 | 0 | 0 | 3 | 16 |

| z(m) | ka | ach | am-cof | am-mac | am-ovai | am-per | ano-cos | ast-form | au-amb | au-gr | au-isl? | au-sarc | au-sol | cal | cam-cly | chaet | coc-pia | coc-dim | coc-dis | cyc-bod | cyc-dist | cyc-men | cyc-oce | cyc-quil | cymb | cymb-nz | cyst-pit | cyst#10 | epi | fr-brv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62.12 | 92.1 | 2 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 92 | 16 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 37 | 1 | 5 | 0 | 0 | 8 | 5 |
| 62.32 | 92.44 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 | 3 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 141 | 1 | 8 | 0 | 0 | 3 | 0 |
| 62.52 | 92.79 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 234 | 1 | 0 | 0 | 0 | 6 | 46 |
| 62.685 | 93.086 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 1 | 2 | 4 | 72 | 5 | 58 |
| 62.72 | 93.1 | 0 | 0 | 0 | 4 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 47 | 1 | 64 |
| 62.8 | 93.4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 5 | 0 | 9 | 59 | 3 | 98 |
| 62.925 | 93.51 | 1 | 0 | 0 | 4 | 0 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 73 | 7 | 0 | 0 | 0 | 0 | 0 | 148 | 0 | 65 | 0 | 8 | 4 | 6 | 3 | 12 |
| 62.96 | 93.58 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 5 | 0 | 2 | 0 | 0 | 0 | 261 | 0 | 4 | 0 | 6 | 0 | 0 | 4 | 24 |
| 63.125 | 93.86 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 1 | 0 | 0 | 0 | 43 | 0 | 115 | 0 | 0 | 1 | 4 | 5 | 44 |
| 53.325 | 94.23 | 2 | 0 | 0 | 11 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 2 | 0 | 0 | 1 | 0 | 53 | 0 | 11 | 3 | 25 | 1 | 3 | 15 | 232 |
| 63.525 | 94.6 | 2 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 5 | 5 | 1 | 25 | 154 |
| 63.725 | 94.97 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 8 | 0 | 4 | 6 | 7 | 76 | 105 | 7 | 205 |
| 63.925 | 95.35 | 0 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 27 | 169 | 1 | 93 |
| 64.135 | 95.55 | 0 | 0 | 0 | 0 | 3 | 0 | 13 | 0 | 14 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 6 | 3 | 12 | 3 | 38 |
| 64.355 | 96.15 | 1 | 0 | 0 | 1 | 11 | 0 | 30 | 1 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 11 | 31 | 1 | 55 |
| 64.555 | 96.52 | 1 | 0 | 0 | 0 | 10 | 0 | 5 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 14 | 4 | 76 |
| 64.755 | 96.89 | 0 | 0 | 0 | 0 | 7 | 0 | 32 | 0 | 17 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 10 | 36 | 3 | 37 |
| 64.94 | 97.19 | 0 | 0 | 0 | 0 | 6 | 1 | 14 | 2 | 9 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 8 | 2 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 6 | 57 | 0 | 45 |
| 65.155 | 97.64 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 31 | 93 | 3 | 71 |
| 65.355 | 98.01 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 65.555 | 98.39 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 22 |
| 65.775 | 98.8 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 |
| 65.94 | 99.07 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 15 |
| 66.175 | 99.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 66.375 | 99.94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68.575 | 100.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66.765 | 100.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 66.975 | 101.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 67.145 | 101.45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67.345 | 101.84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 57.49 | 102.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| 67.745 | 102.63 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67.945 | 103.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| 68.145 | 103.41 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68.345 | 103.8 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| 68.59 | 104.29 | 2 | 0 | 0 | 1 | 2 | 0 | 6 | 0 | 0 | 10 | 12 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 8 | 1 | 25 | 3 | 0 | 0 | 2 | 0 | 72 | 3 | 17 |
| 68.745 | 104.59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 11 | 1 | 0 | 0 | 0 | 2 | 9 | 2 | 4 |
| 68.945 | 104.98 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 |
| 69.145 | 105.37 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 69.345 | 105.78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 69.545 | 106.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69.745 | 106.6 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.035 | 107.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.235 | 107.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.495 | 108.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.695 | 108.54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 70.895 | 108.95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71.06 | 109.38 | 1 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 1 | 15 | 13 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 4 | 0 | 0 | 3 | 2 | 0 | 31 | 0 | 22 |
| 71.295 | 109.76 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 8 | 3 | 6 |
| 71.495 | 110.17 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| 71.695 | 110.58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71.835 | 110.87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 71.985 | 111.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72.06 | 111.43 | 4 | 3 | 0 | 0 | 3 | 10 | 2 | 0 | 0 | 21 | 17 | 0 | 2 | 2 | 4 | 6 | 1 | 0 | 4 | 0 | 8 | 0 | 0 | 1 | 0 | 0 | 20 | 5 | 13 |
| 72.135 | 111.48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 72.285 | 111.79 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 72.435 | 112.11 | 6 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 9 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 5 | 3 | 8 |
| 72.585 | 112.43 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 14 | 9 | 4 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 1 |
| 72.735 | 112.74 | 0 | 9 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 72.93 | 113.15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 73.695 | 114.77 | 1 | 5 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73.895 | 115.19 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 23 | 20 | 0 | 0 | 4 | 7 | 2 | 0 | 0 | 6 | 0 | 51 | 4 | 0 | 2 | 0 | 6 | 1 | 1 | 9 |
| 74.095 | 115.61 | 2 | 0 | 0 | 0 | 0 | 64 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| 74.295 | 116.04 | 1 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 50 | 2 | 0 | 0 | 2 | 1 | 51 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 4 |
| 74.37 | 116.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 10 |
| 74.515 | 116.5 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 31 | 0 | 0 | 0 | 0 | 0 | 187 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 |

| z(m) | ka | ach | am-cof | am-mac | am-oval | am-per | ano-cos | ast-form | au-amb | au-gr | au-isl? | au-sarc | au-sol | cal | cam-cly | chaet | coc-pla | coc-dim | coc-dis | cyc-bod | cyc-dist | cyc-men | cyc-oce | cyc-quil | cymb | cymb-nz | cyst-pit | cyst#10 | epi | fr-brv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74.715 | 116.92 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 0 | 0 | 0 | 0 | 101 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 13 |
| 74.915 | 117.34 | 2 | 0 | 0 | 0 | 5 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 96 | 0 | 0 | 0 | 1 | 0 | 4 | 17 | 5 | 48 |
| 75.115 | 117.77 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 25 | 34 | 0 | 2 | 0 | 0 | 7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 48 | 6 | 70 |
| 75.315 | 118.19 | 7 | 0 | 0 | 0 | 1 | 0 | 9 | 1 | 0 | 55 | 74 | 0 | 1 | 0 | 0 | 4 | 3 | 0 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 15 | 101 | 1 | 6 |
| 75.515 | 118.63 | 4 | 0 | 0 | 1 | 5 | 0 | 16 | 0 | 0 | 187 | 2 | 0 | 0 | 0 | 0 | 9 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 36 | 2 | 11 |
| 75.715 | 119.06 | 5 | 0 | 0 | 0 | 6 | 0 | 9 | 0 | 0 | 110 | 0 | 0 | 0 | 0 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 26 | 82 | 2 | 11 |
| 75.6975 | 119.45 | 9 | 0 | 0 | 0 | 2 | 0 | 14 | 0 | 0 | 91 | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 41 | 5 | 13 |
| 76.165 | 120.03 | 11 | 0 | 0 | 0 | 6 | 0 | 20 | 0 | 0 | 120 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 2 | 35 | 8 | 20 |
| 76.365 | 120.46 | 11 | 0 | 0 | 2 | 3 | 1 | 6 | 0 | 0 | 44 | 0 | 0 | 0 | 0 | 0 | 9 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 14 | 53 | 12 | 6 |
| 76.625 | 121.03 | 12 | 0 | 0 | 0 | 3 | 0 | 7 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 9 | 22 | 19 | 28 |
| 76.625 | 121.46 | 9 | 0 | 0 | 2 | 3 | 1 | 8 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 14 | 11 | 29 |
| 77.025 | 121.89 | 12 | 0 | 0 | 2 | 6 | 0 | 2 | 0 | 0 | 38 | 0 | 0 | 2 | 0 | 0 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 39 | 16 | 26 |
| 77.16 | 122.15 | 8 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 64 | 0 | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 3 | 0 | 168 | 6 | 27 |
| 77.225 | 122.32 | 5 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 39 | 39 | 5 | 11 |
| 77.425 | 122.76 | 4 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 25 | 53 | 2 | 26 |
| 77.625 | 123.19 | 7 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 53 | 65 | 1 | 0 |
| 77.625 | 123.62 | 7 | 0 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 137 | 1 | 6 |
| 78.025 | 124.05 | 5 | 0 | 0 | 0 | 6 | 1 | 3 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 22 | 30 | 10 | 17 |
| 78.245 | 124.53 | 6 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 17 | 51 | 12 | 18 |
| 78.39 | 124.87 | 3 | 0 | 0 | 0 | 3 | 0 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 45 | 123 | 22 | 10 |
| 78.445 | 124.97 | 4 | 0 | 0 | 0 | 6 | 1 | 17 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 30 | 10 | 6 |
| 78.645 | 125.41 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 1 | 12 | 11 | 48 |
| 78.645 | 125.85 | 3 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 10 | 9 | 13 |
| 79.045 | 126.29 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 13 | 42 | 9 | 12 |
| 79.245 | 126.73 | 2 | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 16 | 28 | 2 | 7 |
| 79.405 | 127.09 | 1 | 0 | 0 | 0 | 2 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 19 | 10 | 1 |
| 79.485 | 127.26 | 1 | 0 | 0 | 0 | 6 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 37 | 3 | 7 |
| 79.675 | 127.68 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 7 | 12 | 4 | 5 |
| 79.9 | 126.23 | 2 | 0 | 0 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 42 | 139 | 4 | 12 |
| 80.075 | 126.56 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 2 | 6 |
| 60.275 | 129 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 6 | 8 |
| 60.475 | 129.44 | 2 | 0 | 0 | 0 | 2 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 1 | 3 | 6 |
| 60.675 | 129.86 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 14 | 7 | 12 |
| 80.675 | 130.33 | 1 | 0 | 0 | 0 | 4 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 7 | 22 | 4 | 0 |
| 81.075 | 130.77 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 7 | 2 |
| 81.275 | 131.21 | 5 | 0 | 0 | 0 | 3 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 11 | 2 | 2 |
| 81.42 | 131.61 | 0 | 0 | 0 | 0 | 4 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 14 | 32 | 4 | 4 |
| 81.475 | 131.66 | 0 | 0 | 0 | 0 | 6 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 5 | 1 | 1 |
| 81.675 | 132.11 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 7 | 1 | 0 |
| 81.875 | 132.55 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 6 | 0 |
| 62.075 | 133 | 2 | 0 | 0 | 0 | 3 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| 62.275 | 133.45 | 1 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 8 | 2 | 3 |
| 82.475 | 133.9 | 2 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 18 | 4 | 3 |
| 82.675 | 134.35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 5 | 2 |
| 82.875 | 134.8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 5 |
| 83.075 | 135.25 | 6 | 0 | 0 | 0 | 10 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 1 | 36 | 11 | 5 |
| 83.275 | 135.69 | 5 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 8 | 4 | 6 |
| 83.475 | 136.14 | 2 | 0 | 0 | 0 | 5 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 5 | 8 | 14 |
| 83.55 | 136.37 | 2 | 0 | 0 | 1 | 15 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 54 | 7 | 11 |
| 83.675 | 136.59 | 0 | 0 | 0 | 0 | 11 | 0 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 16 | 1 | 1 |

OL-92 (5+6) #

| z(m) | ka | fr-cap | fr-con | fr-crot | fr-lepto | fr-pin | fr-vau | gom | gyro | hz-am | marty | mel-sp | mel-var | nv-fw | nv-sal | nz-fw | nz-rad | nz-sal | nz-fru | nz-mon | nz-pus | nz-sin | pin | reim | rho-acu | rho-con | rho-gbr | rho-gib | rhol | st-ast | st-car | st-car/ast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.31 | 46.68 | 0 | 18 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 129 | 2 | 0 |
| 32.32 | 47 | 0 | 10 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 92 | 5 | 2 |
| 32.72 | 47.4 | 0 | 14 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 107 | 2 | 0 |
| 33.32 | 48.45 | 11 | 12 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 81 | 0 | 0 |
| 33.68 | 49.08 | 0 | 15 | 0 | 0 | 5 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 2 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 58 | 0 | 0 |
| 33.92 | 49.5 | 0 | 8 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 11 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 102 | 28 | 0 |
| 34.52 | 50.58 | 0 | 28 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 19 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 101 | 1 | 0 |
| 34.92 | 51.26 | 2 | 24 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 21 | 0 | 21 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 2 | 88 | 0 | 0 |
| 35.53 | 52.3 | 0 | 12 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 4 | 5 | 100 | 0 | 0 |
| 36.12 | 53.23 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 8 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 213 | 2 | 0 |
| 36.32 | 53.543 | 0 | 4 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 188 | 0 | 0 |
| 36.52 | 53.857 | 0 | 2 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 |
| 36.72 | 54.17 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 |
| 36.92 | 54.484 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37.92 | 56.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 38.12 | 56.362 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.32 | 56.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.51 | 56.98 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38.82 | 57.42 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 |
| 38.92 | 57.566 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.12 | 57.86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 39.32 | 58.157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.52 | 58.454 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39.72 | 58.75 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 |
| 40.32 | 59.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 40.52 | 59.939 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.72 | 60.246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.92 | 60.52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40.96 | 60.57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.12 | 60.796 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.32 | 61.092 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.52 | 61.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.72 | 61.69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 2 |
| 41.79 | 61.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41.92 | 61.975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 4 |
| 42.12 | 62.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42.32 | 62.544 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42.52 | 62.827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 42.72 | 63.11 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 42.92 | 63.395 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| 43.13 | 63.896 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14 | 54 | 24 |
| 43.32 | 63.97 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 2 | 0 | 0 |
| 43.52 | 64.28 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 3 | 1 |
| 43.72 | 64.548 | 0 | 2 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 342 |
| 43.75 | 64.59 | 12 | 9 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 199 | 50 | 0 |
| 43.92 | 64.83 | 4 | 1 | 18 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 39 | 165 | 0 |
| 44.12 | 65.113 | 0 | 0 | 11 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 27 | 0 | 257 |
| 44.32 | 65.396 | 16 | 11 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 1 | 134 |
| 44.72 | 65.958 | 8 | 2 | 10 | 0 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 31 | 0 | 101 |
| 44.92 | 66.238 | 10 | 8 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 19 | 0 | 164 |
| 45.12 | 66.51 | 0 | 0 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 3 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 118 | 0 |
| 45.32 | 66.779 | 2 | 4 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 14 | 0 | 230 |
| 45.38 | 66.86 | 2 | 2 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 198 | 4 | 0 |
| 45.52 | 67.049 | 26 | 0 | 9 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 2 | 225 |
| 45.72 | 67.32 | 2 | 2 | 33 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 70 | 133 | 0 |
| 45.92 | 67.591 | 16 | 6 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 243 |
| 46.12 | 67.863 | 38 | 2 | 23 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 254 |
| 46.5 | 68.38 | 23 | 8 | 38 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 4 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 117 | 3 | 0 |
| 46.52 | 68.407 | 3 | 8 | 93 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 11 | 3 | 75 |
| 46.72 | 68.68 | 2 | 5 | 35 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 84 | 0 |
| 46.92 | 68.955 | 1 | 4 | 58 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 210 |
| 47.12 | 69.231 | 19 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 223 |
| 47.32 | 69.51 | 97 | 2 | 58 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 47.52 | 69.793 | 81 | 9 | 44 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| 47.72 | 70.077 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 0 | 0 | 0 | 3 | 1 | 5 |
| 47.92 | 70.38 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 0 | 0 |

| z(m) | ka | fr-cap | fr-con | fr-crot | fr-lepto | fr-pin | fr-vau | gom | gyro | hz-am | marty | mel-sp | mel-var | nv-fw | nv-sai | nz-fw | nz-rad | nz-sai | nz-fru | nz-mon | nz-pus | nz-sin | pin | reim | rho-acu | rho-con | rho-gbr | rho-gib | rhoi | st-ast | st-car | st-car/ast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47.99 | 70.458 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49.32 | 72.334 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 13 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 6 | 4 | 0 |
| 49.52 | 72.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 6 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 74 | 1 | 0 | 0 | 3 | 0 | 0 |
| 49.6 | 72.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 8 | 1 | 4 | 3 | 0 | 26 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 5 | 1 | 0 | 6 | 0 | 0 |
| 49.72 | 72.921 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 | 0 |
| 49.82 | 73.061 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49.92 | 73.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 2 | 0 | 0 |
| 50.12 | 73.479 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 25 | 6 |
| 50.32 | 73.76 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 0 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 10 | 29 | 12 |
| 50.49 | 74 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 52.2 | 76.411 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 144 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52.5 | 76.83 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 65 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| 52.72 | 77.136 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 5 | 126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 52.92 | 77.417 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 39 | 0 | 62 | 76 | 10 | 6 | 0 | 0 | 0 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 1 |
| 53.12 | 77.7 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 14 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 53.32 | 77.966 | 0 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 4 | 62 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 1 | 0 | 5 | 0 | 1 |
| 53.35 | 78.03 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 1 | 13 | 0 | 0 | 35 | 80 | 117 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 |
| 53.52 | 78.269 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 170 | 16 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| 53.72 | 76.55 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 17 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 53.92 | 78.842 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 4 | 3 | 18 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 54.12 | 79.14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 4 | 0 | 6 | 3 | 37 | 88 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54.32 | 79.44 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 18 | 23 | 45 | 0 | 0 | 0 | 17 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| 54.52 | 79.74 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 30 | 6 | 23 | 0 | 1 | 0 | 189 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 54.7 | 80.016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 15 | 9 | 7 | 0 | 0 | 0 | 89 | 0 | 0 | 0 | 0 | 4 | 0 | 5 |
| 54.8 | 80.17 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 8 | 2 | 0 |
| 54.92 | 80.36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55.32 | 80.97 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 55.52 | 81.27 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55.72 | 81.577 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 4 | 46 | 12 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 55.92 | 81.884 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 8 | 35 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 56.12 | 62.19 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 115 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 56.32 | 82.49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 18 | 2 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56.5 | 82.76 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 7 | 29 | 0 | 0 | 66 | 4 | 123 | 0 | 0 | 0 | 0 | 0 | 26 | 1 | 0 | 0 | 2 | 0 |
| 56.52 | 82.791 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 2 | 11 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 56.72 | 83.1 | 0 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 18 | 0 | 0 | 72 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 1 | 0 | 0 |
| 56.92 | 83.419 | 0 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 4 | 7 | 0 | 11 | 30 | 7 | 32 | 0 | 0 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57.12 | 83.743 | 0 | 27 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 8 | 11 | 0 | 2 | 39 | 1 | 11 | 0 | 0 | 0 | 36 | 0 | 0 | 1 | 0 | 2 | 0 | 0 |
| 57.32 | 84.07 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 0 | 0 | 36 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 1 | 0 | 0 |
| 57.52 | 84.398 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 11 | 0 | 9 | 16 | 2 | 4 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 57.72 | 84.724 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 1 | 2 | 0 | 0 |
| 57.76 | 84.79 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 38 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 1 | 0 | 0 |
| 57.92 | 85.048 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 26 | 27 | 0 | 13 | 81 | 4 | 130 | 0 | 0 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58.12 | 85.369 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 58.32 | 85.689 | 0 | 9 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 5 | 4 | 1 | 0 | 2 | 11 | 0 | 0 | 0 | 1 | 0 | 19 | 0 | 0 | 1 | 1 | 0 | 2 | 15 |
| 56.52 | 86.012 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 3 | 10 | 0 | 0 | 0 | 1 | 0 | 56 | 0 | 0 | 0 | 1 | 6 | 1 | 0 |
| 58.72 | 86.338 | 0 | 9 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 4 | 0 | 22 | 0 | 0 | 3 | 3 | 7 | 0 | 7 |
| 58.92 | 86.67 | 0 | 16 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 5 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 11 | 1 | 0 |
| 58.95 | 86.72 | 0 | 19 | 0 | 0 | 6 | 2 | 5 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 0 |
| 59.12 | 87.009 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 59.32 | 87.349 | 0 | 4 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 4 |
| 59.52 | 87.689 | 0 | 17 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | 3 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 6 | 0 | 0 | 3 | 8 |
| 59.72 | 88.029 | 0 | 9 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 47 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 5 | 2 | 0 | 0 | 14 |
| 59.92 | 88.369 | 0 | 17 | 4 | 1 | 19 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 3 | 6 | 213 |
| 60.12 | 88.709 | 0 | 8 | 9 | 1 | 0 | 8 | 1 | 0 | 0 | 1 | 0 | 0 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 3 | 293 |
| 60.32 | 89.049 | 75 | 18 | 6 | 0 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 6 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 156 |
| 60.52 | 89.34 | 0 | 16 | 112 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 81 | 4 | 0 |
| 60.63 | 89.53 | 0 | 60 | 78 | 1 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 56 | 0 | 0 |
| 60.72 | 89.69 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 1 | 0 | 2 | 0 | 0 |
| 60.92 | 90.03 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 33 | 0 | 0 | 0 | 0 | 0 |
| 61.12 | 90.38 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 47 | 36 | 0 | 0 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 113 | 0 | 1 | 1 | 0 | 0 |
| 61.32 | 90.599 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 1 | 0 | 2 | 10 | 0 | 0 | 0 | 1 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 61.32 | 00.7 | 0 | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 5 | 0 | 0 |
| 61.52 | 91.07 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 12 | 4 | 0 |
| 61.72 | 91.41 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 6 | 2 | 0 |
| 61.73 | 91.43 | 0 | 12 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 6 | 0 | 0 |
| 61.92 | 91.76 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 |

| z(m) | ka | fr-cap | fr-con | fr-crot | fr-lepto | fr-pin | fr-vau | gom | gyro | hz-am | marty | mel-sp | mel-var | nv-fw | nv-sal | nz-fw | nz-rad | nz-sal | nz-fru | nz-mon | nz-pus | nz-sin | pin | reim | rho-acu | rho-con | rho-gbr | rho-gib | rhol | st-ast | st-car | st-car/ast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62.12 | 92.1 | 0 | 7 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 17 | 1 | 0 |
| 62.32 | 92.44 | 0 | 11 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 16 | 3 | 0 |
| 62.52 | 92.79 | 0 | 15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 4 | 0 | 16 | 10 | 0 |
| 62.685 | 93.086 | 0 | 10 | 0 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 257 | 1 | 0 |
| 62.72 | 93.1 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 201 | 3 | 0 |
| 82.8 | 93.4 | 0 | 62 | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 11 | 207 |
| 62.925 | 93.51 | 0 | 7 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 3 | 1 | 0 | 0 | 2 |
| 62.96 | 93.56 | 0 | 3 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| 63.125 | 93.86 | 0 | 19 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 2 | 0 | 0 |
| 63.325 | 94.23 | 0 | 36 | 0 | 0 | 0 | 6 | 2 | 0 | 1 | 0 | 0 | 0 | 7 | 1 | 77 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 2 | 0 | 0 |
| 63.525 | 94.6 | 0 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 36 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 |
| 63.725 | 94.97 | 0 | 13 | 0 | 0 | 4 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 7 | 1 | 13 | 0 | 0 |
| 63.925 | 95.35 | 0 | 12 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 34 | 0 | 96 |
| 64.135 | 95.55 | 36 | 16 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 251 | 0 | 0 |
| 64.355 | 96.15 | 55 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 166 | 0 | 0 |
| 64.555 | 96.52 | 135 | 30 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 133 | 0 | 0 |
| 64.755 | 96.89 | 49 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 253 | 0 | 2 |
| 64.94 | 97.19 | 23 | 34 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 122 | 0 | 0 |
| 65.155 | 97.64 | 8 | 23 | 0 | 0 | 3 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 65.355 | 96.01 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 65.555 | 98.39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 13 | 2 | 1 |
| 65.775 | 98.8 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 7 | 0 | 0 |
| 65.94 | 99.07 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 6 | 1 | 0 |
| 66.175 | 99.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 66.375 | 99.94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 66.575 | 100.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66.765 | 100.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66.975 | 101.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67.145 | 101.45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 87.345 | 101.84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67.49 | 102.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67.745 | 102.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 65 | 0 | 0 | 0 | 5 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| 67.945 | 103.02 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 71 | 0 | 0 | 0 | 7 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 68.145 | 103.41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68.345 | 103.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 2 | 0 | 0 | 0 | 1 | 16 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 16 | 0 | 0 |
| 68.59 | 104.29 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 91 | 0 | 0 |
| 68.745 | 104.59 | 0 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 |
| 68.945 | 104.98 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 0 |
| 69.145 | 105.37 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 31 | 0 | 0 | 0 | 0 | 0 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 8 | 0 | 0 |
| 69.345 | 105.78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| 69.545 | 106.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69.745 | 106.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 70.035 | 107.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.235 | 107.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 70.495 | 108.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70.695 | 108.54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 7 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 |
| 70.895 | 108.95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| 71.06 | 109.38 | 0 | 12 | 0 | 0 | 4 | 0 | 2 | 0 | 2 | 2 | 0 | 0 | 7 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 68 | 1 | 0 |
| 71.295 | 109.76 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 16 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 1 | 25 | 0 | 0 |
| 71.495 | 110.17 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 0 | 0 |
| 71.695 | 110.58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71.835 | 110.87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 4 | 42 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| 71.985 | 111.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 29 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72.06 | 111.43 | 0 | 5 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 20 | 207 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 0 | 0 |
| 72.135 | 111.48 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| 72.285 | 111.79 | 0 | 4 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 0 | 0 |
| 72.435 | 112.11 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 5 | 0 | 0 | 0 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 24 | 0 | 0 |
| 72.585 | 112.43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72.735 | 112.74 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 7 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 72.93 | 113.15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 38 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 4 | 0 | 0 |
| 73.695 | 114.77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 12 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73.895 | 115.19 | 0 | 14 | 0 | 0 | 3 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 5 | 8 | 2 | 0 | 0 | 0 | 7 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 49 | 0 | 0 |
| 74.095 | 115.61 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 176 | 0 | 0 | 0 | 2 | 4 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 74.295 | 116.04 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 75 | 1 | 0 | 0 | 0 | 1 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 |
| 74.37 | 116.2 | 0 | 14 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 4 | 4 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| 74.515 | 116.5 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

| z(m) | ka | fr-cap | fr-con | fr-crot | fr-lepto | fr-pin | fr-vau | gom | gyro | hz-am | marty | mel-sp | mel-var | nv-fw | nv-sal | nz-fw | nz-rad | nz-sai | nz-fru | nz-mon | nz-pus | nz-sin | pin | reim | rho-acu | rho-con | rho-gbr | rho-gib | rhol | st-ast | st-car | st-car/ast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74.715 | 116.92 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 64 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| 74.915 | 117.34 | 0 | 15 | 56 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 12 | 0 | 5 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 100 | 0 | 0 |
| 75.115 | 117.77 | 0 | 18 | 0 | 0 | 11 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 19 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 141 | 0 | 0 |
| 75.315 | 118.19 | 0 | 26 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 3 | 0 | 0 | 15 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 67 | 0 | 0 |
| 75.515 | 116.63 | 0 | 6 | 0 | 1 | 2 | 5 | 2 | 1 | 0 | 6 | 0 | 0 | 7 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 105 | 0 | 0 |
| 75.715 | 119.06 | 0 | 19 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 3 | 105 | 0 | 0 |
| 75.8975 | 119.45 | 0 | 24 | 0 | 0 | 8 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 23 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 143 | 0 | 0 |
| 76.165 | 120.03 | 0 | 7 | 0 | 0 | 4 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 11 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 5 | 129 | 0 | 0 |
| 76.365 | 120.46 | 0 | 5 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 18 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 2 | 117 | 0 | 0 |
| 76.625 | 121.03 | 0 | 33 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 13 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 129 | 0 | 0 |
| 76.825 | 121.46 | 0 | 19 | 0 | 0 | 14 | 0 | 1 | 0 | 1 | 6 | 0 | 0 | 6 | 1 | 9 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 153 | 0 | 0 |
| 77.025 | 121.89 | 0 | 25 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 8 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 155 | 0 | 0 |
| 77.16 | 122.15 | 0 | 5 | 0 | 2 | 8 | 2 | 4 | 0 | 0 | 2 | 0 | 2 | 18 | 0 | 13 | 1 | 0 | 4 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 1 | 2 | 1 | 131 | 0 | 0 |
| 77.225 | 122.32 | 0 | 9 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 | 0 | 2 | 13 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 1 | 5 | 170 | 0 | 0 |
| 77.425 | 122.76 | 0 | 3 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 11 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 2 | 175 | 0 | 0 |
| 77.625 | 123.19 | 0 | 9 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 5 | 0 | 2 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 9 | 172 | 0 | 0 |
| 77.825 | 123.62 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 6 | 0 | 0 | 4 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 162 | 0 | 0 |
| 78.025 | 124.05 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 9 | 0 | 7 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 280 | 0 | 0 |
| 78.245 | 124.53 | 0 | 8 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 18 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 262 | 0 | 0 |
| 78.39 | 124.87 | 0 | 2 | 0 | 2 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 179 | 0 | 0 |
| 78.445 | 124.97 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 7 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 129 | 0 | 0 |
| 78.645 | 125.41 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 2 | 0 | 1 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 160 | 0 | 0 |
| 76.845 | 125.65 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 74 | 0 | 0 |
| 79.045 | 126.29 | 0 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 121 | 0 | 0 |
| 79.245 | 126.73 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 4 | 237 | 0 | 0 |
| 79.405 | 127.09 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 0 | 0 |
| 79.485 | 127.26 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 106 | 0 | 0 |
| 79.675 | 127.68 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 5 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 138 | 0 | 0 |
| 79.9 | 128.23 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 14 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 164 | 0 | 0 |
| 80.075 | 128.56 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 200 | 0 | 0 |
| 80.275 | 129 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 |
| 80.475 | 129.44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 102 | 0 | 0 |
| 80.675 | 129.88 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 94 | 0 | 0 |
| 80.875 | 130.33 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 7 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 165 | 0 | 0 |
| 61.075 | 130.77 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 64 | 0 | 0 |
| 61.275 | 131.21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 5 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 166 | 0 | 0 |
| 81.42 | 131.61 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 257 | 1 | 0 |
| 81.475 | 131.66 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 114 | 0 | 0 |
| 81.675 | 132.11 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 8 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 167 | 0 | 0 |
| 81.875 | 132.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 121 | 0 | 0 |
| 82.075 | 133 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | 117 | 0 | 0 |
| 82.275 | 133.45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 9 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 166 | 0 | 0 |
| 82.475 | 133.9 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 25 | 6 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 203 | 0 | 0 |
| 82.675 | 134.35 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 161 | 0 | 0 |
| 82.675 | 134.8 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 144 | 0 | 0 |
| 83.075 | 135.25 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 183 | 0 | 0 |
| 83.275 | 135.69 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 2 | 0 | 12 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 256 | 0 | 0 |
| 83.475 | 136.14 | 0 | 8 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 11 | 7 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 9 | 171 | 0 | 0 |
| 83.55 | 136.37 | 0 | 7 | 0 | 0 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 19 | 12 | 0 | 20 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 11 | 205 | 0 | 0 |
| 63.675 | 136.59 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 9 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 221 | 0 | 0 |

| z(m) | ka | st-min | st-nia | st-org | st-ovec | st-prv | su-hof | su-ova | su-str | sy-acus | sy-bero | sy-maz | sy-rum | sy-uln | count | trav | D/mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.31 | 46.68 | 1 | 69 | 13 | 1 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 497 | 5 | 99.4 |
| 32.32 | 47 | 1 | 51 | 8 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 447 | 10 | 44.7 |
| 32.72 | 47.4 | 0 | 50 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 449 | 5 | 89.8 |
| 33.32 | 48.45 | 4 | 60 | 6 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 4 | 495 | 10.8 | 45.8 |
| 33.68 | 49.08 | 4 | 69 | 5 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 6 | 458 | 7 | 65.4 |
| 33.92 | 49.5 | 0 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 287 | 17.6 | 16.3 |
| 34.52 | 50.56 | 0 | 73 | 7 | 2 | 0 | 0 | 2 | 0 | 14 | 0 | 0 | 0 | 2 | 551 | 17 | 32.4 |
| 34.92 | 51.26 | 0 | 73 | 7 | 0 | 0 | 0 | 1 | 0 | 16 | 0 | 0 | 0 | 1 | 525 | 14 | 37.5 |
| 35.53 | 52.3 | 6 | 26 | 9 | 0 | 3 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 1 | 484 | 14 | 34.6 |
| 36.12 | 53.23 | 0 | 72 | 21 | 0 | 16 | 0 | 1 | 6 | 9 | 0 | 0 | 0 | 1 | 511 | 10 | 51 |
| 36.32 | 53.543 | 15 | 72 | 8 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 418 | 12 | 34.8 |
| 36.52 | 53.857 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 2 | 0 | 0 | 0 | 2 | 385 | 8 | 48.1 |
| 36.72 | 54.17 | 0 | 1 | 1 | 0 | 0 | 0 | 13 | 20 | 0 | 0 | 0 | 0 | 0 | 139 | 35 | 3.9 |
| 36.92 | 64.484 | 0 | 1 | 0 | 0 | 0 | 1 | 110 | 28 | 0 | 0 | 0 | 0 | 0 | 268 | 35 | 7.7 |
| 37.92 | 56.05 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 16 | 35 | 0.5 |
| 38.12 | 56.362 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 35 | 0.03 |
| 38.32 | 56.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 35 | 0.06 |
| 38.51 | 56.98 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 1 | 31 | 35 | 0.09 |
| 38.82 | 57.42 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 95 | 35 | 2.7 |
| 38.92 | 57.566 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 35 | 0.04 |
| 39.12 | 57.86 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 89 | 35 | 2.5 |
| 39.32 | 58.157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 36 | 0.4 |
| 39.52 | 58.454 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 39.72 | 58.75 | 0 | 5 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 142 | 35 | 4.1 |
| 40.32 | 59.63 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 35 | 1.5 |
| 40.52 | 59.939 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 35 | 0.1 |
| 40.72 | 60.246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 40.92 | 60.52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 40.96 | 60.57 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 36 | 0.03 |
| 41.12 | 60.796 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 36 | 0.03 |
| 41.32 | 61.092 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 41.52 | 61.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 41.72 | 61.69 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 37 | 0.4 |
| 41.79 | 61.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 41.92 | 61.975 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 36 | 0.4 |
| 42.12 | 62.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 42.32 | 82.544 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 42.52 | 62.827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 297 | 36 | 8.3 |
| 42.72 | 63.11 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 161 | 35 | 4.6 |
| 42.92 | 63.395 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 1 | 247 | 17.5 | 14.1 |
| 43.13 | 63.896 | 0 | 42 | 0 | 0 | 0 | 0 | 2 | 14 | 0 | 0 | 0 | 0 | 1 | 361 | 35 | 10.3 |
| 43.32 | 63.97 | 7 | 3 | 2 | 0 | 0 | 0 | 4 | 15 | 0 | 0 | 0 | 0 | 1 | 353 | 17 | 20.8 |
| 43.52 | 64.26 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 26 | 0 | 0 | 0 | 0 | 2 | 241 | 36 | 6.7 |
| 43.72 | 64.548 | 6 | 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 488 | 13 | 37.5 |
| 43.75 | 64.59 | 60 | 79 | 7 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 1 | 502 | 5 | 100.4 |
| 43.92 | 64.83 | 13 | 65 | 3 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 384 | 13 | 29.5 |
| 44.12 | 65.113 | 0 | 106 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 501 | 9 | 55.7 |
| 44.32 | 65.396 | 1 | 59 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 511 | 8.5 | 60.1 |
| 44.72 | 65.958 | 0 | 66 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 474 | 13.5 | 35.1 |
| 44.92 | 66.236 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 480 | 8.5 | 56.5 |
| 45.12 | 66.51 | 0 | 70 | 2 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 480 | 12 | 40 |
| 45.32 | 66.779 | 2 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 487 | 12 | 40.6 |
| 45.38 | 66.86 | 0 | 40 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 472 | 5 | 94.4 |
| 45.52 | 67.049 | 0 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 467 | 8 | 58.4 |
| 45.72 | 67.32 | 0 | 24 | 5 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 476 | 8 | 59.5 |
| 45.92 | 67.591 | 3 | 39 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 484 | 8 | 60.5 |
| 48.12 | 67.863 | 0 | 62 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 501 | 6.5 | 77.1 |
| 46.5 | 68.38 | 0 | 79 | 0 | 0 | 0 | 0 | 1 | 1 | 5 | 0 | 0 | 0 | 0 | 402 | 8 | 50.3 |
| 46.52 | 68.407 | 3 | 103 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 501 | 10 | 50.1 |
| 46.72 | 68.68 | 0 | 35 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 427 | 7 | 61 |
| 46.92 | 68.955 | 1 | 49 | 5 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 496 | 7 | 70.9 |
| 47.12 | 69.231 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 480 | 7 | 68.4 |
| 47.32 | 69.51 | 5 | 57 | 15 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 434 | 8.1 | 53.6 |
| 47.52 | 69.793 | 3 | 110 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 480 | 12 | 40 |
| 47.72 | 70.077 | 0 | 0 | 0 | 0 | 0 | 13 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 288 | 38 | 8 |
| 47.92 | 70.36 | 0 | 4 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 192 | 34 | 5.6 |

| z(m) | ka | st-min | st-nia | st-org | st-ovec | st-prv | su-hof | su-ova | su-str | sy-acus | sy-bero | sy-maz | sy-rum | sy-uin | count | trav | D/mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47.99 | 70.458 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 202 | 36 | 5.6 |
| 49.32 | 72.334 | 0 | 1 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 316 | 36 | 8.8 |
| 49.52 | 72.63 | 0 | 1 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 232 | 17.5 | 13.3 |
| 49.6 | 72.75 | 2 | 6 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 263 | 34.9 | 8.1 |
| 49.72 | 72.921 | 0 | 5 | 0 | 0 | 0 | 0 | 3 | 68 | 0 | 0 | 0 | 0 | 0 | 272 | 35 | 7.8 |
| 49.82 | 73.061 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 213 | 2.5 | 85.2 |
| 49.92 | 73.2 | 0 | 1 | 1 | 0 | 0 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 151 | 35 | 4.3 |
| 50.12 | 73.479 | 1 | 4 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 161 | 36 | 4.5 |
| 50.32 | 73.76 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 384 | 35 | 11 |
| 50.49 | 74 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 35 | 1.8 |
| 52.2 | 76.411 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 207 | 36 | 5.8 |
| 52.5 | 76.83 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 129 | 35 | 3.7 |
| 52.72 | 77.136 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 216 | 36 | 6.1 |
| 52.92 | 77.417 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 595 | 17.5 | 34 |
| 53.12 | 77.7 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 133 | 35 | 3.8 |
| 53.32 | 77.986 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 184 | 36 | 5.1 |
| 53.35 | 76.03 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 387 | 35.6 | 10.9 |
| 63.52 | 78.269 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 270 | 36 | 7.5 |
| 53.72 | 78.55 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 35 | 1.9 |
| 53.92 | 78.842 | 0 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 173 | 36 | 4.9 |
| 54.12 | 79.14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 305 | 36 | 8.5 |
| 54.32 | 79.44 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 230 | 35 | 6.6 |
| 54.52 | 79.74 | 0 | 0 | 0 | 0 | 0 | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 370 | 18 | 20.6 |
| 54.7 | 80.016 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 183 | 36 | 5.1 |
| 54.8 | 80.17 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 84 | 34 | 2.5 |
| 54.92 | 80.36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 55.32 | 80.97 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 36 | 2.2 |
| 55.52 | 81.27 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 35 | 0.2 |
| 55.72 | 81.577 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 178 | 36 | 4.9 |
| 55.92 | 81.884 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 101 | 36 | 2.8 |
| 56.12 | 82.19 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 133 | 35 | 3.8 |
| 56.32 | 82.49 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 47 | 36 | 1.3 |
| 56.5 | 82.76 | 0 | 1 | 0 | 0 | 0 | 15 | 15 | 0 | 0 | 0 | 2 | 0 | 0 | 383 | 28.3 | 13.5 |
| 56.52 | 82.791 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 36 | 2.1 |
| 56.72 | 83.1 | 3 | 4 | 3 | 0 | 0 | 42 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 222 | 35.7 | 6.2 |
| 56.92 | 83.419 | 0 | 0 | 0 | 0 | 0 | 27 | 20 | 1 | 0 | 0 | 0 | 0 | 2 | 398 | 36 | 11.1 |
| 57.12 | 83.743 | 0 | 4 | 1 | 0 | 0 | 31 | 21 | 1 | 1 | 0 | 0 | 0 | 1 | 547 | 36 | 15.2 |
| 57.32 | 84.07 | 0 | 2 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 269 | 34.8 | 6.3 |
| 57.52 | 84.398 | 0 | 1 | 0 | 0 | 0 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 269 | 36 | 7.5 |
| 57.72 | 84.724 | 0 | 1 | 0 | 0 | 0 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 181 | 36 | 5 |
| 57.76 | 84.79 | 1 | 0 | 1 | 0 | 0 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 96 | 35 | 2.7 |
| 57.92 | 85.048 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 439 | 36 | 12.2 |
| 58.12 | 85.369 | 0 | 1 | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 221 | 36 | 6.1 |
| 58.32 | 85.689 | 0 | 1 | 1 | 0 | 0 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 4 | 250 | 36 | 5.7 |
| 58.52 | 86.012 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 318 | 36 | 8.8 |
| 58.72 | 86.338 | 0 | 6 | 1 | 0 | 0 | 3 | 5 | 12 | 0 | 0 | 0 | 0 | 3 | 376 | 36 | 10.4 |
| 58.92 | 86.67 | 0 | 1 | 3 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 294 | 36 | 8.2 |
| 58.95 | 86.72 | 2 | 4 | 2 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 3 | 398 | 17.6 | 22.8 |
| 59.12 | 87.009 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 333 | 6.1 | 54.6 |
| 59.32 | 87.349 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 432 | 11 | 39.3 |
| 59.52 | 87.689 | 1 | 0 | 5 | 0 | 1 | 0 | 9 | 5 | 3 | 0 | 0 | 0 | 3 | 598 | 18 | 33.2 |
| 59.72 | 88.029 | 15 | 0 | 0 | 0 | 0 | 0 | 9 | 7 | 1 | 0 | 0 | 0 | 0 | 523 | 11 | 47.5 |
| 59.92 | 66.369 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 449 | 7 | 64 |
| 60.12 | 88.709 | 15 | 9 | 40 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 522 | 4 | 130.5 |
| 60.32 | 89.049 | 2 | 79 | 7 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 450 | 9 | 50 |
| 60.52 | 69.34 | 21 | 57 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 2 | 418 | 18 | 23.2 |
| 60.63 | 89.53 | 29 | 77 | 3 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 624 | 7.4 | 84.3 |
| 60.72 | 89.69 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 143 | 36 | 4 |
| 60.92 | 90.03 | 0 | 3 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 165 | 36 | 4.6 |
| 61.12 | 90.38 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 334 | 34.7 | 9.6 |
| 61.32 | 90.599 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 199 | 36 | 5.5 |
| 61.32 | 90.7 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 88 | 34.8 | 2.5 |
| 61.52 | 91.07 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 2 | 166 | 36 | 4.6 |
| 61.72 | 91.41 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 75 | 34.4 | 2.2 |
| 61.73 | 91.43 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 2 | 190 | 35 | 5.4 |
| 61.92 | 91.76 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 1 | 220 | 35.6 | 6.2 |

| z(m) | ka | st-min | st-nia | st-org | st-ovec | st-prv | su-hof | su-ova | su-str | sy-acus | sy-bero | sy-maz | sy-rum | sy-uln | count | trav | D/mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62.12 | 92.1 | 0 | 0 | 1 | 0 | 0 | 6 | 1 | 24 | 0 | 0 | 0 | 0 | 0 | 262 | 36 | 7.3 |
| 62.32 | 92.44 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 15 | 0 | 0 | 0 | 1 | 0 | 315 | 35 | 9 |
| 62.52 | 92.79 | 0 | 4 | 1 | 0 | 0 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 391 | 17.6 | 22.2 |
| 62.685 | 93.086 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 450 | 9.5 | 47.4 |
| 62.72 | 93.1 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 362 | 12.5 | 29 |
| 62.8 | 93.4 | 7 | 3 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 519 | 6.1 | 85.1 |
| 62.925 | 93.51 | 7 | 0 | 9 | 0 | 0 | 0 | 3 | 14 | 1 | 0 | 0 | 0 | 0 | 395 | 18 | 21.9 |
| 62.96 | 93.56 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 3 | 369 | 10.1 | 36.5 |
| 63.125 | 93.86 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 334 | 36 | 9.3 |
| 63.325 | 94.23 | 15 | 1 | 7 | 0 | 4 | 0 | 13 | 3 | 0 | 0 | 0 | 0 | 1 | 561 | 18 | 31.2 |
| 63.525 | 94.6 | 2 | 2 | 0 | 0 | 0 | 0 | 29 | 16 | 0 | 0 | 0 | 0 | 0 | 332 | 36 | 9.2 |
| 63.725 | 94.97 | 4 | 76 | 7 | 0 | 0 | 0 | 2 | 10 | 8 | 0 | 0 | 0 | 0 | 617 | 18 | 34.3 |
| 63.925 | 95.35 | 15 | 9 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 8 | 1 | 0 | 507 | 5 | 101.4 |
| 64.135 | 95.55 | 4 | 37 | 5 | 0 | 13 | 0 | 0 | 0 | 7 | 0 | 7 | 0 | 1 | 492 | 6 | 82 |
| 64.355 | 96.15 | 6 | 35 | 13 | 0 | 10 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 461 | 6 | 80.2 |
| 64.555 | 96.52 | 4 | 28 | 19 | 0 | 6 | 0 | 0 | 0 | 12 | 0 | 2 | 0 | 0 | 512 | 5.7 | 89.8 |
| 64.755 | 96.69 | 1 | 29 | 8 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 520 | 4 | 130 |
| 64.94 | 97.19 | 0 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 386 | 4 | 97 |
| 65.155 | 97.64 | 77 | 5 | 2 | 0 | 17 | 0 | 15 | 1 | 5 | 0 | 0 | 15 | 1 | 426 | 5 | 85.6 |
| 65.355 | 96.01 | 0 | 4 | 1 | 0 | 0 | 3 | 29 | 0 | 0 | 0 | 0 | 0 | 1 | 99 | 36 | 2.75 |
| 65.555 | 96.39 | 3 | 2 | 1 | 0 | 0 | 3 | 35 | 0 | 1 | 0 | 1 | 0 | 0 | 171 | 36 | 4.75 |
| 65.775 | 98.6 | 0 | 1 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 36 | 1.8 |
| 65.94 | 99.07 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 47 | 35 | 1.3 |
| 66.175 | 99.55 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 36 | 0.17 |
| 86.375 | 99.94 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 36 | 0.1 |
| 66.575 | 100.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 66.765 | 100.7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 36 | 0.2 |
| 66.975 | 101.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 36 | 0.06 |
| 67.145 | 101.45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 36 | 0.6 |
| 67.345 | 101.84 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 36 | 0.1 |
| 67.49 | 102.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 35 | 0.1 |
| 67.745 | 102.63 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 99 | 36 | 2.75 |
| 67.945 | 103.02 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 36 | 3.3 |
| 68.145 | 103.41 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 36 | 0.8 |
| 68.345 | 103.8 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 121 | 36 | 3.4 |
| 66.59 | 104.29 | 0 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 1 | 340 | 37 | 9.2 |
| 68.745 | 104.59 | 3 | 17 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 109 | 38 | 3 |
| 66.945 | 104.96 | 0 | 10 | 3 | 0 | 2 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 1 | 77 | 36 | 2.1 |
| 69.145 | 105.37 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 144 | 36 | 4 |
| 69.345 | 105.78 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 36 | 0.6 |
| 69.545 | 106.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 69.745 | 106.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 36 | 0.2 |
| 70.035 | 107.19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 36 | 0.3 |
| 70.235 | 107.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 36 | 0.06 |
| 70.495 | 108.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 70.695 | 108.54 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 36 | 0.8 |
| 70.895 | 108.95 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 36 | 0.3 |
| 71.06 | 109.38 | 0 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 3 | 236 | 35 | 6.7 |
| 71.295 | 109.76 | 0 | 17 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 1 | 136 | 36 | 3.8 |
| 71.495 | 110.17 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 36 | 0.7 |
| 71.695 | 110.58 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 36 | 0.1 |
| 71.835 | 110.87 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 97 | 36 | 2.7 |
| 71.985 | 111.17 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 36 | 1.1 |
| 72.06 | 111.43 | 0 | 15 | 3 | 2 | 7 | 0 | 3 | 0 | 11 | 0 | 0 | 0 | 0 | 495 | 31.4 | 15.8 |
| 72.135 | 111.48 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 26 | 36 | 0.7 |
| 72.285 | 111.79 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 47 | 36 | 1.3 |
| 72.435 | 112.11 | 2 | 8 | 0 | 0 | 3 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 4 | 131 | 36 | 3.6 |
| 72.585 | 112.43 | 1 | 9 | 1 | 0 | 4 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 1 | 126 | 36 | 3.5 |
| 72.735 | 112.74 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 36 | 1.8 |
| 72.93 | 113.15 | 0 | 4 | 0 | 0 | 0 | 1 | 6 | 0 | 1 | 0 | 0 | 0 | 1 | 92 | 36 | 2.6 |
| 73.695 | 114.77 | 0 | 1 | 0 | 0 | 0 | 2 | 41 | 0 | 0 | 0 | 0 | 0 | 1 | 131 | 36 | 3.6 |
| 73.895 | 115.19 | 2 | 43 | 1 | 0 | 12 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 314 | 36 | 8.7 |
| 74.095 | 115.61 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 328 | 18 | 18.2 |
| 74.295 | 116.04 | 0 | 5 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 1 | 350 | 36 | 9.7 |
| 74.37 | 116.2 | 0 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 86 | 36 | 2.4 |
| 74.515 | 116.5 | 0 | 1 | 0 | 0 | 40 | 0 | 10 | 0 | 131 | 0 | 0 | 0 | 0 | 418 | 3 | 139.3 |

| z(m) | ka | st-min | st-nia | st-org | st-ovec | st-prv | su-hof | su-ova | su-str | sy-acus | sy-bero | sy-maz | sy-rum | sy-uin | count | trav | D/mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74.715 | 116.92 | 0 | 18 | 98 | 0 | 98 | 0 | 7 | 0 | 114 | 0 | 0 | 0 | 0 | 618 | 3 | 206 |
| 74.915 | 117.34 | 2 | 53 | 5 | 0 | 1 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 1 | 459 | 7.1 | 64.6 |
| 75.115 | 117.77 | 0 | 41 | 1 | 0 | 1 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 2 | 471 | 11 | 42.8 |
| 75.315 | 118.19 | 4 | 19 | 11 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 2 | 494 | 6 | 82.3 |
| 75.515 | 118.63 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 479 | 10 | 47.9 |
| 75.715 | 119.06 | 2 | 62 | 4 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 510 | 18 | 25 |
| 75.8975 | 119.45 | 2 | 56 | 3 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 480 | 18 | 26.7 |
| 76.165 | 120.03 | 3 | 64 | 2 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 479 | 18 | 26.6 |
| 76.365 | 120.46 | 4 | 32 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 380 | 18 | 21.1 |
| 76.625 | 121.03 | 0 | 65 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 471 | 28 | 16.8 |
| 76.825 | 121.46 | 0 | 48 | 11 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 418 | 29 | 14.6 |
| 77.025 | 121.89 | 5 | 40 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 443 | 21 | 21.1 |
| 77.16 | 122.15 | 0 | 14 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 3 | 0 | 0 | 530 | 4.3 | 123.3 |
| 77.225 | 122.32 | 1 | 49 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 421 | 25 | 16.8 |
| 77.425 | 122.76 | 6 | 48 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 420 | 24 | 17.5 |
| 77.625 | 123.19 | 2 | 33 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 450 | 36 | 12.5 |
| 77.825 | 123.62 | 2 | 30 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 470 | 18 | 26.1 |
| 78.025 | 124.05 | 1 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 492 | 36 | 13.7 |
| 78.245 | 124.53 | 14 | 26 | 17 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 504 | 17 | 29.6 |
| 78.39 | 124.87 | 0 | 32 | 4 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 571 | 6.4 | 89.2 |
| 78.445 | 124.97 | 2 | 39 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 292 | 36 | 8.1 |
| 78.645 | 125.41 | 0 | 51 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 346 | 36 | 9.6 |
| 78.845 | 125.65 | 0 | 45 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 195 | 36 | 5.4 |
| 79.045 | 126.29 | 1 | 41 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 279 | 36 | 7.75 |
| 79.245 | 126.73 | 3 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 365 | 27 | 13.5 |
| 79.405 | 127.09 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 205 | 36 | 5.7 |
| 79.485 | 127.26 | 1 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 247 | 36 | 6.9 |
| 79.675 | 127.68 | 1 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 239 | 36 | 6.6 |
| 79.9 | 128.23 | 0 | 11 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 464 | 7 | 66.3 |
| 80.075 | 128.56 | 0 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 248 | 26 | 6.9 |
| 80.275 | 129 | 3 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 90 | 36 | 2.5 |
| 80.475 | 129.44 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 168 | 36 | 4.7 |
| 80.675 | 129.88 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 162 | 36 | 4.5 |
| 60.875 | 130.33 | 7 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 269 | 36 | 7.5 |
| 61.075 | 130.77 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 104 | 36 | 2.9 |
| 61.275 | 131.21 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 248 | 36 | 6.9 |
| 61.42 | 131.61 | 0 | 3 | 14 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 406 | 6.4 | 63.4 |
| 81.475 | 131.66 | 6 | 6 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 197 | 36 | 5.5 |
| 81.675 | 132.11 | 4 | 13 | 26 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 266 | 36 | 7.4 |
| 81.875 | 132.55 | 6 | 13 | 11 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 190 | 36 | 5.3 |
| 82.075 | 133 | 6 | 6 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 204 | 36 | 5.7 |
| 82.275 | 133.45 | 7 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 265 | 18 | 7.4 |
| 82.475 | 133.9 | 0 | 22 | 15 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 2 | 0 | 0 | 357 | 36 | 9.9 |
| 62.675 | 134.35 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 236 | 36 | 6.6 |
| 82.875 | 134.6 | 0 | 18 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 198 | 36 | 5.5 |
| 83.075 | 135.25 | 12 | 15 | 15 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 371 | 36 | 10.3 |
| 83.275 | 135.69 | 8 | 29 | 19 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 406 | 36 | 11.3 |
| 83.475 | 136.14 | 1 | 18 | 10 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 329 | 36 | 9.1 |
| 83.55 | 136.37 | 19 | 8 | 12 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 491 | 7 | 70.1 |
| 83.675 | 136.59 | 9 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 438 | 25 | 17.2 |

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## OSTRACODES FROM OWENS LAKE CORE OL-92 AND THE PALEOENVIRONMENT OF THE LAST INTERGLACIAL

by

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Open-File Report 98-132 (part 8)



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## ABSTRACT

The Owens Lake core taken by the U. S. Geological Survey in 1992 (OL-92) was sampled at 20 cm intervals in the section from 32 m to 89.6 m deep (46 ka to about 150 ka) in order to establish the nature of short-term limnologic and climatic variability within this system. Ostracode species were found in most samples including the environmentally well- known *Cytherissa lacustris*, *Candona caudata*, *Limnocythere ceriotuberosa*, and *L. sappaensis*. These species show that the paleoenvironment varied from a freshwater boreal-forest like lake to a high-alkalinity saline lake. Those environments appear to be associated with known changes in regional climate and can be related to the magnitude and persistence of surface versus base flow in the Owens River. The timing of polar air retreat from this region using the Owens Lake age model is consistent with the timing of that event in Devils Hole. The penultimate interglacial apparently was much wetter than the Holocene and may have been cooler.

## INTRODUCTION

A long sedimentary core was taken from Owens Lake, California in 1992 by the U.S.Geological Survey in order to acquire a continuous climate record of the last 800,000 years (Smith and Bischoff, 1993). Results from studies of that core are described in Smith and Bischoff (1997a). Recently the core was sampled for ostracodes in more detail in the interval from the penultimate glacial (oxygen isotope stage 6, about 135-170 ka) to about 46 ka to obtain a better understanding of the variability of the paleoenvironment and to better understand the nature of the previous interglacial (oxygen isotope stage 5, about 70-135 ka). This report focuses on the general nature of the ostracode data in those samples and provides a preliminary interpretation of the ostracode data (see section on ostracodes and their environmental preferences, below).

## MATERIALS AND METHODS

Ostracodes were sampled by taking 5-cm-thick samples, usually weighing 50 to 80 g, every 20 cm. Each sample was then split into two fractions. The first fraction, weighing about 15 g, was processed to obtain an ostracode species valve count. The remaining material was used in other studies such as stable-isotope analysis of the ostracode shells. Sample preparation followed a standard procedure (Forester, 1991; Carter, 1997). The prepared sediment was then examined for ostracodes and any adult valves were counted. The resulting valve counts are presented in tabular form in Table 1 and in graphic form in Fig. 1.

## OSTRACODES AND THEIR ENVIRONMENTAL PREFERENCES

Ostracodes are small bivalved crustaceans having a carapace consisting of two valves (shells) made of calcite. The ostracode valve can be easily identified to species by its distinctive ornamentation and shape. Ostracodes live in many continental aquatic environments including ground water, springs and seeps, streams, wetlands, and lakes (Forester, 1987, 1991). In fact, many ostracode species are limited to a particular hydrological environment such as a spring or a lake, and as such, provide environmental information.

Ostracode species are also sensitive to the temperature of the water in which they live. As a consequence of their temperature sensitivity, ostracode species have discrete biogeographic distributions. In the case of lacustrine species, their biogeographic distributions may be described in climate terms. Similarly, ostracode species are sensitive to the chemistry of their environment (Delorme, 1969, 1989; Forester, 1983, 1986, 1987), particularly the ratio of alkalinity to calcium in their environment (Forester, 1991).

When an ostracode species' environmental preference (e.g. spring or lake) and its temperature and chemistry requirements are both known, the identification of that species provides detailed paleoenvironmental information. Ground-water and ground-water-discharge ostracodes provide information about past hydrology. In the case of lacustrine and, to some extent, wetland taxa, they give information on climate (Forester and Smith, 1994; Forester and others, 1994).

## SUMMARY PALEOENVIRONMENTAL HISTORY, 65-150 KA

Table 1 shows the abundance, expressed in adult valves per sample, of ostracode species found in each sample from the Owens Lake core between 32 m and 89.6 m below the surface. The most common ostracodes in this interval are *Limnocythere ceriotuberosa* Delorme and *L. sappaensis* Staplin. *Candona caudata* Kaufmann and *Cytherissa lacustris* (Sars) are also present. The stratigraphic distribution of these four species, expressed in valves per gram of raw sediment, is graphically depicted in Fig. 1. Other species identified from these samples (see table 1) are either rare or are taxa with little environmental data. These other taxa are not considered further in this report.

The following paleoenvironmental interpretation of Owens Lake is based on the biogeographic distribution and chemical preferences of these species derived from largely unpublished ostracode and chemical data. These data were collected from springs, wetlands, lakes, and a few streams at about 800 localities throughout the United States by Don Palmer and Alison Smith (Kent State University), Brandon Curry (Illinois State Geological Survey), and many people from the USGS. L. Denis Delorme (1989) collected ostracodes and environmental data from over 3500 sites in Canada.

*Cytherissa lacustris, Candona caudata, Limnocythere ceriotuberosa,* and *L. sappaensis* all live in lakes, but the chemical and thermal characteristics of the lakes inhabited by these species are quite different (Delorme, 1989; Forester, 1986, 1987, unpublished data). In addition, *C. caudata* is a common inhabitant of streams and *L. sappaensis* occurs in some spring pools and wetlands. *Limnocythere ceriotuberosa* and *L. sappaensis* commonly live in slightly saline to saline water having a high alkalinity to calcium ion (alk / Ca) ratio (Forester, 1983, 1986).

Within the Owens Lake drainage, *C. caudata* presently lives in the Owens River and in a number of lakes at up to about 3,000 m elevation in the Sierra Nevada mountains. *Limnocythere sappaensis* lives in slightly saline to saline springs, such as Dirty Sock, and in wetlands having high alk/Ca (meq/L) ratios (> 7) along the Owens River. *Limnocythere ceriotuberosa* lives in Diaz Reservoir, which varies seasonally in volume and total dissolved solids (TDS) and has a moderately elevated alk/Ca ratio of just over 3, but it has not been found elsewhere in the Owens River drainage.

*Cytherissa lacustris* does not live in the Owens River drainage, nor in any lake south of Canada with the exception of rare occurrences in the Great Lakes and in Yellowstone Lake. In Canada and Alaska, *C. lacustris* lives in dilute cold lakes in the boreal forest and northward into the arctic circle. Delorme (1989) reports the upper TDS tolerance of *C. lacustris* at 300 mg/L. TDS alone, however, does not account for the distribution of *C. lacustris.* It is a species of both cold lakes and lakes that are chemically and thermally stable from season to season, either not changing or changing gradually.

The biogeographic distribution and temperature and chemical preferences of these four ostracode species provide a means of understanding the probable climate history of the Owens Lake area from 46-150 ka. A preliminary and simplified interpretation of the ostracode data is as follows: the presence of *C. lacustris* implies the residence of polar-air in the Owens Lake region, the same air mass found today in the boreal regions of Canada and southern Alaska. The residence of polar air in the Owens Lake drainage implies the existence of continental ice sheets on the North American landscape that force and maintain polar air to the south. When *C. lacustris* disappears from the Owens Lake fossil record (the core), it suggests that the polar air has retreated northward, and further implies the initiation of deglaciation.

*Candona caudata* co-occurs with *C. lacustris* in the fossil and modern-day records, but also lives in lakes and streams well south of Alaska and Canada. In fact, the southern-most distribution of this species is in southern Nevada (Forester, unpublished data). Its upper TDS limit is about 3,000 mg/L, so the presence of *C. caudata* and the absence of *C. lacustris* implies freshwater, but probably with higher air temperatures. For these ostracodes to survive, flow in the Owens River must also have been sufficient on a seasonal basis to maintain freshwater, river-like, conditions within the lake basin. Because evaporation on the valley bottom today is quite high (Smith and Bischoff, 1997b) and the lake basin is saucer shaped, which promotes evaporation, flow in the Owens River would presumably have to be higher and/or evaporation lower than today to maintain a *C. caudata* environment.

*Limnocythere ceriotuberosa* typically lives in lakes that exhibit strong seasonality in volume and associated chemistry. It is has been found living in lakes with a TDS as low as 400 mg/L and as high as 12,000 mg/L (unpublished data). A common setting for this species would be a lake that becomes larger and is freshened by a seasonal gain in surface water flow, but that later becomes smaller and more saline when the stream returns to base-flow. Typically, such lakes are found in semi-arid settings located within the temperate latitudes. When the abundance of *L. ceriotuberosa* increases in the Owens Lake core, it implies seasonality in surface water discharge in the river. *Limnocythere ceriotuberosa* often appears in the Owens Lake record during climate transitions, such as those from or to (inter)glacial conditions or during wet phases within the interglacial.

*Limnocythere sappaensis* commonly lives in wetlands and lakes that remain saline or maintain a saline, alkaline-enriched solute composition (Forester, 1983, 1986) throughout the year. It has been found living in wetlands and lakes with a salinity as low as 650 mg/L and as high as 110,000 mg/L (unpublished data). Its solute and salinity preferences suggest it would live in Owens Lake during the drier phases within interglacials, when baseflow predominated in the Owens River during a typical year. The presence of *L. sappaensis* does not imply the absence of seasonal surface water flow, but only that such flow didn't dominate the lake's volume and chemistry. Present day flow, if it were allowed to enter Owens Lake, would likely support a *L. sappaensis* environment.

The relative abundances, over time, of the four species discussed above provide an insight into the environmental history of Owens Lake. A *C. lacustris*-dominated ostracode assemblage implies a glacial climate with cool to cold summers and moderately high flow in the Owens River. As the assemblage abundances shift away from *C. lacustris* toward *C. caudata*, glacial conditions are waning, summers are likely warmer, but flow remains high in the Owens River. Similarly, as *L. ceriotuberosa* becomes common, so does climatic and limnologic seasonality, signaling a transition into a glacial from an interglacial or from an interglacial into a glacial or a wet phase within an interglacial. Finally, as *L. sappaensis* dominates, it identifies a lake that is saline throughout the year and is largely supported by baseflow in the Owens River with limited surface-water-discharge events. *Limnocythere sappaensis* identifies the drier phases within the interglacial climate state.

The abundance and stratigraphic succession of these species, along with the core chronology (Bischoff and others, 1997), provide a means of assessing the rates, durations, and magnitudes of past climate events on glacial-interglacial and stadial-interstadial time scales. *Cytherissa lacustris* is relatively abundant at the base of the core segment in this study, presumably reflecting the penultimate glacial (oxygen isotope stage 6), but then its abundance tails off dramatically around 138-136 ka. Spotty occurrences of *C. lacustris* in sediments younger than about 138 ka may represent reworking of older shells into younger sediments or an environment only marginally favorable to this taxon. The timing of deglaciation as implied by the loss of *C. lacustris* from the Owens Lake record is quite similar to the timing of the stable isotope record from Devils Hole (Winograd and others, 1992). Providing both records are synchronous, then the loss of *C. lacustris* at this time implies that the change was due to the retreat of the polar front from this region.

*Candona caudata*-dominated assemblages with varying numbers of *L. ceriotuberosa* typify the Owens Lake ostracode record from about 135-85 ka. Their occurrences are not continuous, but are persistent. The presence of those ostracodes and the absence of *L. sappaensis* implies that this interval was wetter and perhaps cooler than the intervals where *L. sappaensis* was a dominant species.

*Limnocythere sappaensis* dominates the interval from about 85-70 ka. The presence of this taxon implies predominantly baseflow in the Owens River as defined above. The lake was saline and had a very high alk/Ca ratio. The presence of *L. sappaensis* and absence through most of the interval of *L. ceriotuberosa* or other ostracodes suggest the lake's TDS was typically above about 15,000 mg/L. *Limnocythere sappaensis* exhibits a continuous distribution through this interval, suggesting that although the climate was dry, there was sufficient flow in the Owens River to sustain a saline lake throughout the interval. By contrast, there are intervals within the Holocene when no ostracodes are present, possibly representing very low or no flow in the Owens River.

*Candona caudata* occurs in the lake from about 70 ka to 65 ka, implying cooler and wetter climates that supported moderately high flow in the Owens River. The rarity of *C. lacustris* suggests that, unlike in the penultimate glacial, year round polar conditions were infrequent.

*Limnocythere ceriotuberosa* appeared around 65 ka and was followed at about 60 ka by *Limnocythere sappaensis*, which was abundant until about 52 ka. At 52 ka, *L. ceriotuberosa* reappeared followed by abundant *Candona caudata*, which remained abundant to the top of the interval of interest (46 ka, 32 m). The transition from *C. caudata* to *L. ceriotuberosa* and then to *L. sappaensis* implies a change from a large fresh-water lake to one with seasonal changes in lake-level to a low-level saline lake. Then the lake shifts from a low-level saline lake back to a large fresh-water lake, even supporting *Cytherissa lacustris* for a brief period. Such systematic and rapid changes in the environmental characteristics of Owens Lake indicates a transition to interglacial like climate and then a progressive shift back to glacial climate. Such changes were likely controlled by the relative persistence of polar air mass activity in the region.

## SUMMARY

The high resolution ostracode record from 150 ka to 65 ka shows dramatic changes in Owens Lake environments. Those changes appear to be climate driven and may be understood from the changes in atmospheric circulation associated with glacial and interglacial climates. The last interglacial appears to have been wetter and perhaps cooler than the current interglacial.

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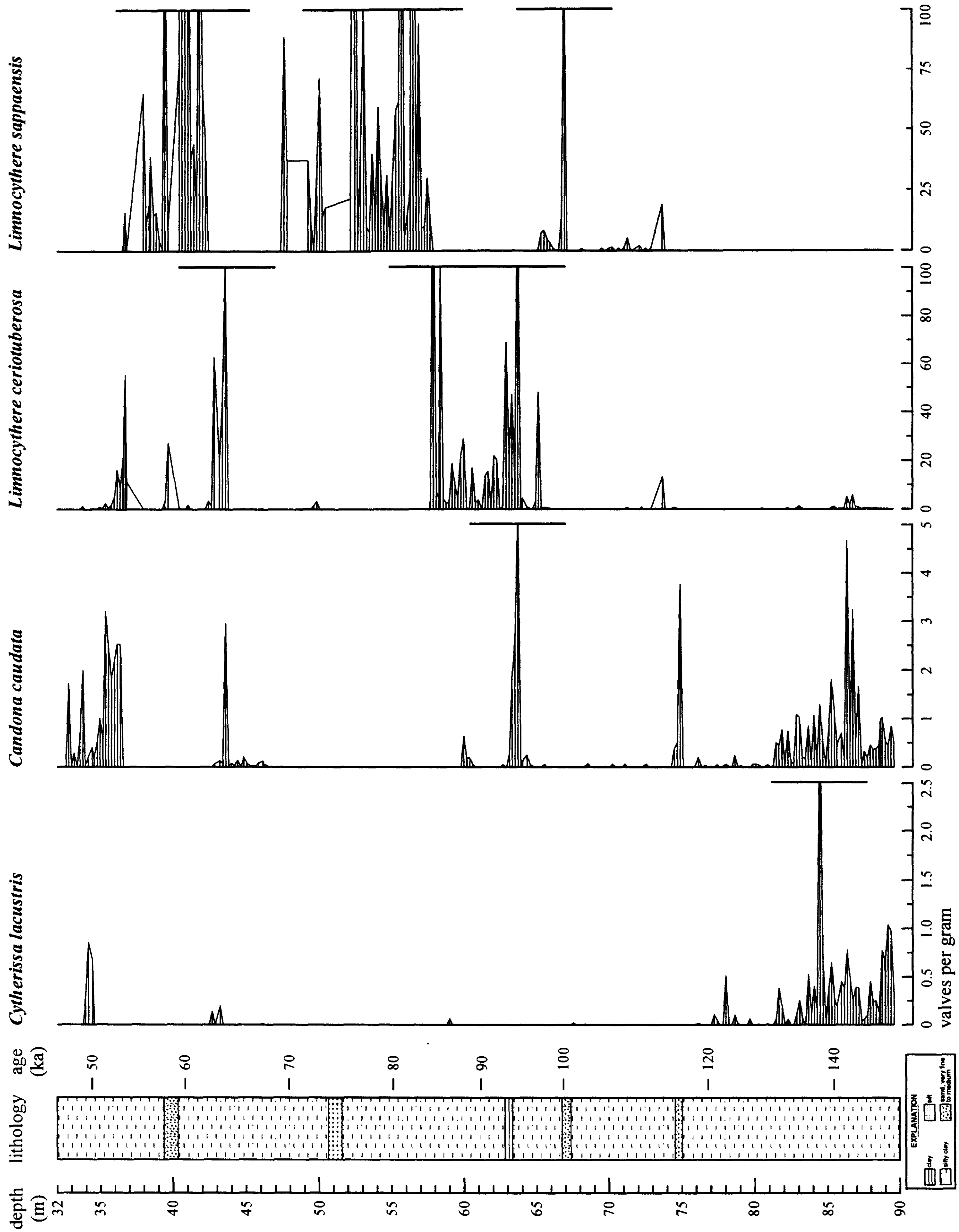


Figure 1. Common ostracode species abundance in valves per gram of sediment.

| Table 1. | Owens Lake | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drive# | Sample # (cm) | Interval Depth (m) | Interval midpoint | Age (ka) | Weight (g) | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
| Core OL-92-1 | | | | | | | | | | | | | |
| 17A | 52-57 | 31.99-32.04 | 32.015 | 46.154 | 14.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17A | 72-77 | 32.19-32.24 | 32.215 | 46.514 | 14.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17A | 92-97 | 32.39-32.44 | 32.415 | 46.873 | 58.2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17A | 112-117 | 32.59-32.64 | 32.615 | 47.233 | 15.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17A | 132-137 | 32.79-32.84 | 32.815 | 47.593 | 15 | 1 | 26 | 0 | 0 | 5 | 0 | 0 | 0 |
| 17B | 0-5 | 32.97-33.02 | 32.995 | 47.916 | 55.9 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| 17B | 20-25 | 33.17-33.22 | 33.195 | 48.264 | 51.2 | 4 | 15 | 0 | 0 | 1 | 0 | 0 | 0 |
| 17B | 40-45 | 33.37-33.42 | 33.395 | 48.602 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17B | 60-65 | 33.57-33.62 | 33.595 | 48.94 | 15 | 2 | 10 | 0 | 0 | 1 | 0 | 0 | 0 |
| 17B | 80-85 | 33.77-33.82 | 33.795 | 49.278 | 15 | 21 | 30 | 0 | 0 | 9 | 0 | 0 | 0 |
| 18B | 9-14 | 34.55-34.60 | 34.575 | 50.597 | 66.7 | 4 | 12 | 0 | j | 0 | 0 | 0 | 0 |
| 18B | 29-34 | 34.75-34.80 | 34.775 | 50.935 | 15 | 1 | 8 | 0 | 0 | 1 | 0 | 0 | 0 |
| 18B | 49-54 | 34.95-35.00 | 34.975 | 51.273 | 14.9 | 12 | 15 | 0 | 0 | 3 | 0 | 0 | 0 |
| 18B | 69-74 | 35.15-35.20 | 35.175 | 51.611 | 14.5 | 5 | 8 | 0 | 0 | 2 | 0 | 0 | 0 |
| 18B | 89-94 | 35.35-35.40 | 35.375 | 51.949 | 15 | 36 | 48 | 0 | 0 | 5 | 0 | 0 | 0 |
| 18B | 109-114 | 35.55-35.60 | 35.575 | 52.287 | 14.2 | 7 | 35 | 0 | 0 | 6 | 0 | 0 | 0 |
| 18B | 129-134 | 35.75-35.80 | 35.775 | 52.625 | 14.9 | 24 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18C | 0-5 | 35.97-36.02 | 35.995 | 52.997 | 14.8 | 72 | 33 | 0 | j | 1 | 0 | 0 | 0 |
| 18C | 20-35 | 36.17-36.22 | 36.195 | 53.322 | 14.2 | 230 | 36 | 0 | 0 | 0 | 0 | 0 | 1 |
| 18C | 40-45 | 36.37-36.42 | 36.395 | 53.634 | 15 | 135 | 38 | 0 | 0 | 1 | 0 | 0 | 2 |
| 18C | 60-65 | 36.57-36.62 | 36.595 | 53.947 | 15.6 | 309 | 0 | 0 | 6 | 0 | 0 | 0 | 58 |
| 18C | 80-85 | 36.72-36.77 | 36.745 | 54.181 | 15 | 834 | 0 | 0 | 236 | 0 | 0 | 0 | 0 |
| 18C | 100-105 | 36.82-36.87 | 36.845 | 54.337 | 15.2 | 171 | 0 | 0 | 5 | 0 | 0 | 0 | 0 |
| 19A | 21-26 | 37.17-37.22 | 37.195 | 54.884 | 17.7 | 34 | 9 | 0 | 2 | 0 | 0 | 0 | 0 |
| 19A | 61-66 | 37.57-37.62 | 37.595 | 55.508 | 13.5 | 172 | 6 | 0 | 52 | 0 | 0 | 0 | 3 |
| 19A | 101-106 | 37.97-38.02 | 37.995 | 56.133 | 12.2 | 3 | 0 | 0 | 799 | 0 | 0 | 0 | 0 |
| 19A | 121-126 | 38.17-38.22 | 38.195 | 56.445 | 14.2 | 0 | 0 | 0 | 137 | 0 | 0 | 0 | 0 |
| 19A | 141-146 | 38.37-38.42 | 38.395 | 56.758 | 15.2 | 0 | 0 | 0 | 298 | 0 | 0 | 0 | 0 |
| 19B | 10-15 | 38.47-38.52 | 38.495 | 56.914 | 14.9 | j | 0 | 0 | 582 | 0 | 0 | 0 | 0 |
| 19B | 30-35 | 38.67-38.72 | 38.695 | 57.226 | 14.9 | 0 | 0 | 0 | 218 | 0 | 0 | 0 | 0 |
| 19B | 50-55 | 38.87-38.92 | 38.895 | 57.539 | 14.5 | 0 | 0 | 0 | 225 | 0 | 0 | 0 | 0 |
| 19B | 70-75 | 39.07-39.12 | 39.095 | 57.851 | 13.7 | 3 | 0 | 0 | 58 | 0 | 0 | 0 | 0 |
| 19B | 90-95 | 39.27-39.32 | 39.295 | 58.145 | 42.7 | j | 0 | 0 | 29 | 0 | 0 | 0 | 0 |
| 19B | 110-115 | 39.47-39.52 | 39.495 | 58.439 | 15 | 48 | 0 | 0 | 2156 | 0 | 0 | 0 | 2 |
| 19B | 130-135 | 39.67-39.72 | 39.695 | 58.732 | 14.4 | 393 | 0 | 0 | 145 | 0 | 0 | 0 | 22 |
| 20A | 43-48 | 40.44-40.49 | 40.465 | 59.862 | 15.4 | 6 | j | 0 | 1178 | 0 | 0 | 0 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 63-68 | 40.64-40.69 | 40.665 | 60.156 | 15.1 | 0 | 0 | 0 | 8554 | 0 | 0 | 0 | 0 |
| 20A | 83-88 | 40.84-40.89 | 40.865 | 60.449 | 15 | 0 | 0 | 0 | 1773 | 0 | 0 | 0 | 0 |
| 20A | 103-108 | 41.04-41.09 | 41.065 | 60.743 | 14.6 | 26 | 0 | 0 | 2623 | 0 | 0 | 0 | 0 |
| 20A | 123-128 | 41.24-41.29 | 41.265 | 61.036 | 14.6 | 1 | 0 | 0 | 559 | 0 | 0 | 0 | 0 |
| 20A | 143-148 | 41.44-41.49 | 41.465 | 61.33 | 14.3 | 0 | 0 | 0 | 634 | 0 | 0 | 0 | 0 |
| 20B | 10-15 | 41.64-41.69 | 41.665 | 61.623 | 15.3 | j | 0 | 0 | 267 | 0 | 0 | 0 | 0 |
| 20B | 30-35 | 41.84-41.89 | 41.865 | 61.917 | 13.1 | 0 | 0 | 0 | 2556 | 0 | 0 | 0 | 0 |
| 20B | 50-55 | 42.04-42.09 | 42.065 | 62.21 | 14.5 | j | 0 | 0 | 961 | 0 | 0 | 0 | 0 |
| 20B | 70-75 | 42.24-42.29 | 42.265 | 62.495 | 15 | 6 | 0 | 0 | 692 | 0 | 0 | 0 | 0 |
| 20B | 90-95 | 42.44-42.49 | 42.465 | 62.776 | 15 | 52 | 0 | 0 | 6 | 0 | 0 | 0 | 2 |
| 20B | 110-115 | 42.64-42.69 | 42.665 | 63.058 | 14.4 | 20 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 20B | 130-135 | 42.84-42.89 | 42.865 | 63.339 | 14.8 | 933 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 15-20 | 43.20-43.25 | 43.225 | 63.846 | 15.1 | 309 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 21A | 35-40 | 43.40-43.45 | 43.425 | 64.128 | 15 | 679 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 55-60 | 43.60-43.65 | 43.625 | 64.409 | 14.9 | 1520 | 44 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 75-80 | 43.80-43.85 | 43.825 | 64.691 | 60.2 | j | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 95-100 | 44.00-44.05 | 44.025 | 64.973 | 50.8 | j | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 115-120 | 44.20-44.25 | 44.225 | 65.254 | 65.1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21A | 135-140 | 44.40-44.45 | 44.425 | 65.536 | 14.3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 6-11 | 44.64-44.69 | 44.665 | 65.874 | 14.8 | j | j | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 26-31 | 44.84-44.89 | 44.865 | 66.155 | 53.6 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 46-51 | 45.04-45.09 | 45.065 | 66.437 | 60.7 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 66-71 | 45.24-45.29 | 45.265 | 66.715 | 36.4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 86-91 | 45.44-45.49 | 45.465 | 66.991 | 35.4 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21B | 106-111 | 45.64-45.69 | 45.665 | 67.268 | 53.5 | 2 | 1 | j | 1 | 0 | 0 | 0 | 0 |
| 21B | 126-131 | 45.84-45.89 | 45.865 | 67.545 | 53.6 | j | 5 | 0 | j | 0 | 0 | 0 | 0 |
| 21C | 5-10 | 46.15-46.20 | 46.175 | 67.973 | 53.7 | 21 | 7 | 1 | j | 0 | 0 | 0 | 0 |
| 22A | 9-14 | 46.19-46.24 | 46.215 | 68.029 | 66.1 | 1 | 4 | j | 2 | 0 | 0 | 0 | 0 |
| 22A | 29-34 | 46.39-46.44 | 46.415 | 68.305 | 51.4 | 4 | 2 | j | 3 | 0 | 0 | 0 | 0 |
| 22A | 49-54 | 46.59-46.64 | 46.615 | 68.582 | 54.3 | 2 | j | 0 | 1 | 0 | 0 | 0 | 0 |
| 22A | 69-74 | 46.79-46.84 | 46.815 | 68.859 | 84.8 | 2 | j | 0 | 5 | 0 | 0 | 0 | 0 |
| 22A | 89-94 | 46.99-47.04 | 47.015 | 69.135 | 67.3 | 7 | j | 0 | 2 | 0 | 0 | 0 | 0 |
| 22A | 109-114 | 47.19-47.24 | 47.215 | 69.412 | 53.3 | 5 | j | 0 | 4 | 0 | 0 | 0 | 0 |
| 22A | 129-134 | 47.39-47.44 | 47.415 | 69.689 | 55.7 | j | 1 | 0 | 7 | 0 | 0 | 0 | 0 |
| 22B | 1-6 | 47.63-47.68 | 47.655 | 70.021 | 15.6 | 2 | 0 | 0 | 1393 | 0 | 0 | 0 | 0 |
| 22B | 21-26 | 47.83-47.88 | 47.855 | 70.297 | 15.9 | 0 | 0 | 0 | 593 | 0 | 0 | 0 | 0 |
| 23A | 12-17 | 49.27-49.32 | 49.295 | 72.3 | 15.3 | 4 | j | 0 | 568 | 0 | 0 | 0 | 0 |
| 23A | 32-37 | 49.47-49.52 | 49.495 | 72.579 | 15.5 | 3 | 0 | 0 | 180 | 0 | 0 | 0 | 0 |
| 23A | 52-57 | 49.67-49.72 | 49.695 | 72.858 | 15.2 | 26 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| 23A | 72-77 | 49.87-49.92 | 49.895 | 73.136 | 15.1 | 51 | 0 | 0 | 461 | 0 | 0 | 0 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23A | 92-97 | 50.07-50.12 | 50.095 | 73.415 | 15.2 | 0 | 0 | 0 | 1090 | 0 | 0 | 0 | 0 |
| 23A | 112-117 | 50.27-50.32 | 50.295 | 73.693 | 15.1 | 0 | 0 | 0 | 216 | 0 | 0 | 0 | 0 |
| 23A | 132-137 | 50.47-50.52 | 50.495 | 73.972 | 13.7 | 0 | 0 | 0 | 242 | 0 | 0 | 0 | 0 |
| 24A | 0-5 | 52.20-52.25 | 52.225 | 76.43 | 15 | 0 | 0 | 0 | 326 | 0 | 0 | 0 | 0 |
| 25A | 0-5 | 52.50-52.55 | 52.525 | 76.862 | 15.4 | 0 | 0 | 0 | 5543 | 0 | 0 | 0 | 0 |
| 25A | 20-25 | 52.70-52.75 | 52.725 | 77.149 | 15.2 | 0 | 0 | 0 | 44 | 0 | 0 | 0 | 0 |
| 25A | 40-45 | 52.90-52.95 | 52.925 | 77.437 | 15.4 | 0 | 0 | 0 | 658 | 0 | 0 | 0 | 0 |
| 25A | 60-65 | 53.10-53.15 | 53.125 | 77.724 | 15.7 | 0 | 0 | 0 | 1581 | 0 | 0 | 0 | 0 |
| 25A | 80-85 | 53.30-53.35 | 53.325 | 78.012 | 15.4 | 0 | 0 | 0 | 151 | 0 | 0 | 0 | 0 |
| 25A | 100-105 | 53.50-53.55 | 53.525 | 78.3 | 15.1 | 0 | 0 | 0 | 120 | 0 | 0 | 0 | 0 |
| 25A | 120-125 | 53.70-53.75 | 53.725 | 78.587 | 15.5 | 0 | 0 | 0 | 619 | 0 | 0 | 0 | 0 |
| 25A | 140-145 | 53.90-53.95 | 53.925 | 78.875 | 15.2 | 0 | 0 | 0 | 212 | 0 | 0 | 0 | 0 |
| 25B | 10-15 | 54.10-54.15 | 54.125 | 79.162 | 15.1 | 0 | 0 | 0 | 905 | 0 | 0 | 0 | 0 |
| Drive# | Sample # (cm) | Interval Depth (m) | Interval midpoint | Age (ka) | Weight (g) | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
| 25B | 30-35 | 54.30-54.35 | 54.325 | 79.463 | 14.5 | 0 | 0 | 0 | 438 | 0 | 0 | 0 | 0 |
| 25B | 50-55 | 54.50-54.55 | 54.525 | 79.767 | 14.4 | 0 | 0 | j | 151 | 0 | 0 | 0 | 0 |
| 25B | 70-75 | 54.70-54.75 | 54.725 | 80.07 | 15.4 | 0 | 0 | j | 484 | 0 | 0 | 0 | 0 |
| 25B | 90-95 | 54.90-54.95 | 54.925 | 80.374 | 15.4 | 0 | 0 | 0 | 93 | 0 | 0 | 0 | 0 |
| 25B | 110-115 | 55.10-55.15 | 55.125 | 80.677 | 15.1 | 0 | 0 | 0 | 488 | 0 | 0 | 0 | 0 |
| 26A | 6-11 | 55.31-55.36 | 55.335 | 80.996 | 15.2 | j | 0 | 0 | 881 | 0 | 0 | 0 | 0 |
| 26A | 26-31 | 55.51-55.56 | 55.535 | 81.299 | 15.8 | 0 | 0 | 0 | 982 | 0 | 0 | 0 | 0 |
| 26A | 46-51 | 55.71-55.76 | 55.735 | 81.602 | 15.4 | 0 | 0 | 0 | 4053 | 0 | 0 | 0 | 0 |
| 26A | 66-71 | 55.91-55.96 | 55.935 | 81.906 | 15.5 | 0 | 0 | 0 | 99 | 0 | 0 | 0 | 0 |
| 26A | 86-91 | 56.11-56.16 | 56.135 | 82.209 | 15.2 | 0 | 0 | 0 | 230 | 0 | 0 | 0 | 0 |
| 26A | 106-111 | 56.31-56.36 | 56.335 | 82.513 | 15.1 | 1 | 0 | 0 | 379 | 0 | 0 | 0 | 0 |
| 26A | 126-131 | 56.51-56.56 | 56.535 | 82.816 | 15.5 | 2 | 0 | 0 | 6985 | 0 | 0 | 0 | 0 |
| 26A | 146-151 | 56.71-56.76 | 56.735 | 83.12 | 15.7 | 0 | 0 | 0 | 130 | 0 | 0 | 0 | 0 |
| 26B | 13-18 | 56.89-56.94 | 56.915 | 83.393 | 15.9 | 1 | 0 | 0 | 1504 | 0 | 0 | 0 | 0 |
| 26B | 33-38 | 57.09-57.14 | 57.115 | 83.696 | 15.7 | 0 | 0 | 0 | 149 | 0 | 0 | 0 | 0 |
| 26B | 53-58 | 57.29-57.34 | 57.315 | 84.017 | 15.1 | 0 | 0 | 0 | 147 | 0 | 0 | 0 | 0 |
| 26B | 73-78 | 57.49-57.54 | 57.515 | 84.343 | 15.3 | 0 | 0 | 0 | 460 | 0 | 0 | 0 | 0 |
| 26B | 93-98 | 57.69-57.74 | 57.715 | 84.669 | 15.2 | 0 | 0 | 0 | 208 | 0 | 0 | 0 | 0 |
| 26B | 113-118 | 57.89-57.94 | 57.915 | 84.995 | 15.9 | 2704 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26B | 133-138 | 58.09-58.14 | 58.115 | 85.321 | 15.5 | 114 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26C | 7-12 | 58.28-58.33 | 58.305 | 85.631 | 15.7 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A | 9-14 | 58.38-58.43 | 58.405 | 85.794 | 15.9 | 1595 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A | 29-34 | 58.58-58.63 | 58.605 | 86.12 | 15.4 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A | 49-54 | 58.78-58.83 | 58.805 | 86.446 | 15.3 | 40 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 27A | 69-74 | 58.98-59.03 | 59.005 | 86.772 | 15.5 | 39 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27A | 89-94 | 59.18-59.23 | 59.205 | 87.098 | 15.4 | 290 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A | 109-114 | 59.38-59.43 | 59.405 | 87.424 | 15.4 | 148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A | 129-134 | 59.58-59.63 | 59.605 | 87.751 | 15.3 | 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27A&B | 149-150, 0-4 | 59.78-59.83 | 59.805 | 88.085 | 15.3 | 344 | j | 0 | 0 | 0 | 0 | 0 | 0 |
| 27B | 19-24 | 59.98-60.03 | 60.005 | 88.403 | 15.5 | 449 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27B | 39-44 | 60.18-60.23 | 60.205 | 88.733 | 15.7 | 9 | 3 | 0 | 0 | j | 0 | 0 | 0 |
| 27B | 59-64 | 60.38-60.43 | 60.405 | 89.084 | 78.7 | 12 | 14 | 0 | 22 | 0 | 0 | 0 | 0 |
| 27B | 79-84 | 60.58-60.63 | 60.605 | 89.435 | 15.8 | 270 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27B | 99-104 | 60.78-60.83 | 60.805 | 89.786 | 15.5 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27B | 119-124 | 60.98-61.03 | 61.005 | 90.137 | 15.5 | 61 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 27B | 139-144 | 61.18-61.23 | 61.205 | 90.488 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Core OL-92-2** | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 1A | 0-5 | 61.26-61.31 | 61.285 | 90.629 | 15.9 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1A | 20-25 | 61.46-61.51 | 61.485 | 90.98 | 15.2 | 211 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1A | 40-45 | 61.66-61.71 | 61.685 | 91.331 | 15.5 | 243 | j | 0 | 5 | 0 | 0 | 0 | 0 |
| 1A | 60-65 | 61.86-61.91 | 61.885 | 91.682 | 15.2 | 21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1A | 80-85 | 62.06-62.11 | 62.085 | 92.033 | 15.6 | 345 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1A | 100-105 | 62.26-62.31 | 62.285 | 92.384 | 15.6 | 321 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1A | 120-125 | 62.46-62.51 | 62.485 | 92.735 | 15.4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1A | 140-145 | 62.66-62.71 | 62.685 | 93.086 | 54.5 | 33 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1B | 14-19 | 62.90-62.95 | 62.925 | 93.507 | 15.1 | 1044 | j | 0 | 2 | 0 | 0 | 0 | 0 |
| 1B | 34-39 | 63.10-63.15 | 63.125 | 93.858 | 15.3 | 336 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1B | 54-59 | 63.30-63.35 | 63.325 | 94.225 | 15 | 709 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1B | 74-79 | 63.50-63.55 | 63.525 | 94.598 | 15.5 | 229 | 40 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1B | 94-99 | 63.70-63.75 | 63.725 | 94.972 | 15.2 | 2103 | 81 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1B | 114-119 | 63.90-63.95 | 63.925 | 95.345 | 66.2 | 2 | 7 | 0 | j | 0 | 0 | 0 | 0 |
| 1B&2A | 134-135,0-4 | 64.01-64.06 | 64.035 | 95.55 | 15.1 | 69 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2A | 19-24 | 64.33-64.38 | 64.355 | 96.148 | 15.7 | 14 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2A | 39-44 | 64.53-64.58 | 64.555 | 96.521 | 55.8 | 17 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2A | 59-64 | 64.73-64.78 | 64.755 | 96.894 | 58.6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2A | 79-84 | 64.93-64.98 | 64.955 | 97.268 | 14.8 | 48 | j | 0 | 2 | 0 | 0 | 0 | 0 |
| 2A | 99-104 | 65.13-65.18 | 65.155 | 97.641 | 15.8 | 762 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| 2A | 119-124 | 65.33-65.38 | 65.355 | 98.014 | 14.5 | 7 | 0 | 0 | 103 | 0 | 0 | 0 | 0 |
| 2A | 139-144 | 65.53-65.58 | 65.555 | 98.388 | 15.3 | 13 | 1 | 0 | 125 | 0 | 0 | 0 | 0 |
| 2B | 11-16 | 65.75-65.80 | 65.775 | 98.798 | 15.1 | 10 | j | 0 | 69 | 0 | 0 | 0 | 0 |
| 2B | 31-36 | 65.95-66.00 | 65.975 | 99.172 | 15.2 | 3 | 0 | 0 | 47 | 0 | 0 | 0 | 0 |
| 2B | 51-56 | 66.15-66.20 | 66.175 | 99.545 | 15.3 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 |
| 2B | 71-76 | 66.35-66.40 | 66.375 | 99.936 | 53.7 | 1 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2B | 91-96 | 66.55-66.60 | 66.575 | 100.33 | 53.1 | j | 0 | 0 | 28 | 0 | 0 | 0 | 0 |
| 2B | 110-116 | 66.74-66.79 | 66.765 | 100.7 | 15.6 | 0 | 0 | 0 | 204 | 0 | 0 | 0 | 0 |
| 2B | 131-136 | 66.95-67.00 | 66.975 | 101.11 | 15.4 | 0 | 0 | 0 | 1926 | 0 | 0 | 0 | 0 |
| 3A | 13-18 | 67.12-67.17 | 67.145 | 101.45 | 76.3 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 3A | 33-38 | 67.32-67.37 | 67.345 | 101.84 | 64.6 | 7 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |
| 3A | 53-58 | 67.52-67.57 | 67.545 | 102.23 | 38.6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 3A | 73-78 | 67.72-67.77 | 67.745 | 102.63 | 61.1 | j | j | 0 | j | 0 | 3 | 0 | 0 |
| 3A | 93-98 | 67.92-67.97 | 67.945 | 103.02 | 65.8 | 2 | j | j | 12 | 0 | 0 | 0 | 0 |
| 3A | 113-118 | 68.12-68.17 | 68.145 | 103.41 | 15.6 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| 3A | 133-138 | 68.32-68.37 | 68.345 | 103.8 | 79.2 | 2 | 2 | 1 | 3 | 0 | 4 | 0 | 0 |
| 3B | 3-8 | 68.52-68.57 | 68.545 | 104.2 | 73.4 | 0 | 5 | 0 | 4 | 1 | 1 | 0 | 0 |
| 3B | 23-28 | 68.72-68.77 | 68.745 | 104.59 | 15.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3B | 43-48 | 68.92-68.97 | 68.945 | 104.98 | 55.7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3B | 63-68 | 69.12-69.17 | 69.145 | 105.37 | 15.3 | 0 | 0 | 0 | j | 0 | 0 | 0 | 0 |
| 3B | 83-88 | 69.32-69.37 | 69.345 | 105.78 | 67 | j | j | 0 | 7 | 1 | 2 | 0 | 0 |
| 3B | 103-108 | 69.52-69.57 | 69.545 | 106.19 | 15 | j | j | 0 | 15 | j | 0 | 0 | 0 |
| 3B | 123-128 | 69.72-69.77 | 69.745 | 106.6 | 67 | j | 1 | 0 | 10 | 0 | 0 | 0 | 0 |
| 3C | 2-7 | 70.01-70.06 | 70.035 | 107.19 | 15 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| 3C | 22-27 | 70.21-70.26 | 70.235 | 107.6 | 15.5 | 3 | 1 | 0 | 23 | 0 | 0 | 0 | 0 |
| 4A | 1-6 | 70.47-70.52 | 70.495 | 108.13 | 61.9 | 1 | j | 0 | 8 | j | 0 | 0 | 0 |
| 4A | 21-26 | 70.67-70.72 | 70.695 | 108.54 | 15.1 | j | j | 0 | 12 | 1 | 0 | 0 | 0 |
| 4A | 41-46 | 70.87-70.92 | 70.895 | 108.95 | 51.1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 4A | 61-66 | 71.07-71.12 | 71.095 | 109.36 | 15.4 | 3 | 1 | 0 | 21 | 0 | 0 | 0 | 0 |
| 4A | 81-86 | 71.27-71.32 | 71.295 | 109.76 | 15.1 | 10 | 0 | 0 | 76 | 0 | 0 | 0 | 2 |
| 4A | 101-106 | 71.47-71.52 | 71.495 | 110.17 | 15.3 | 1 | j | 0 | 16 | 0 | 0 | 0 | 0 |
| 4A | 121-126 | 71.67-71.72 | 71.695 | 110.58 | 15.6 | j | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4B | 5-10 | 71.51-71.56 | 71.535 | 110.87 | 54.1 | 2 | 0 | 0 | 16 | 0 | 0 | 0 | 0 |
| 4B | 25-30 | 71.71-71.76 | 71.735 | 111.17 | 50.9 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 |
| 4B | 45-50 | 72.11-72.16 | 72.135 | 111.48 | 15.9 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 4B | 65-70 | 72.26-72.31 | 72.285 | 111.79 | 15.5 | 14 | j | 0 | 17 | 0 | 0 | 0 | 6 |
| 4B | 85-90 | 72.31-72.36 | 72.335 | 112.11 | 51.5 | 4 | 1 | 0 | 6 | 0 | 0 | 0 | 1 |
| 4B | 105-110 | 72.56-72.61 | 72.585 | 112.43 | 15.5 | 5 | 1 | 0 | 12 | 0 | 0 | 0 | 1 |
| 4B | 125-130 | 72.71-72.76 | 72.735 | 112.74 | 55.2 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | j |
| 4B&5A | 145-149,0-1 | 72.91-72.95 | 72.93 | 113.15 | 15.1 | 5 | 0 | 0 | 10 | 0 | 0 | 0 | j |
| 5A | 16-21 | 73.67-73.72 | 73.695 | 114.77 | 15.5 | 208 | 0 | 0 | 293 | 0 | 0 | 0 | 0 |
| 5A | 36-41 | 73.87-73.92 | 73.895 | 115.19 | 91.5 | 2 | 1 | 0 | 12 | 0 | 0 | 0 | 0 |
| 5A | 56-61 | 74.07-74.12 | 74.095 | 115.61 | 56.2 | 3 | j | 0 | 1 | 0 | 0 | 0 | 1 |
| 5A | 76-81 | 74.27-74.32 | 74.295 | 116.04 | 88.2 | 11 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 6A | 7-12 | 74.49-74.54 | 74.515 | 116.5 | 15.4 | 11 | 6 | 0 | 0 | 0 | 0 | j | 0 |
| 6A | 27-32 | 74.69-74.74 | 74.715 | 116.92 | 44.7 | 14 | 23 | 0 | 0 | 0 | 0 | 10 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6A | 47-52 | 74.89-74.94 | 74.915 | 117.34 | 15.1 | 1 | 57 | 0 | 0 | 21 | 0 | 0 | 0 |
| 6A | 67-72 | 75.09-75.14 | 75.115 | 117.77 | 15.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6A | 87-92 | 75.29-75.34 | 75.315 | 118.19 | 15.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6A | 107-112 | 75.49-75.54 | 75.515 | 118.63 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6A | 127-132 | 75.69-75.74 | 75.715 | 119.06 | 15.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6A&B | 147-148,0-3 | 75.89-75.94 | 75.915 | 119.45 | 15.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6B | 18-23 | 76.14-76.19 | 76.165 | 120.03 | 58.5 | 6 | 12 | 1 | 0 | 0 | 2 | 0 | 0 |
| 6B | 38-43 | 76.34-76.39 | 76.365 | 120.46 | 15.1 | 0 | 0 | 0 | j? | 0 | 0 | 0 | 0 |
| 7A | 4-9 | 76.60-76.65 | 76.625 | 121.03 | 76.1 | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 2 |
| 7A | 24-29 | 76.80-76.85 | 76.825 | 121.46 | 15.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7A | 44-49 | 77.00-77.05 | 77.025 | 121.89 | 61 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7A | 64-69 | 77.20-77.25 | 77.225 | 122.32 | 82.1 | j | j | 9 | 0 | 0 | 8 | 0 | 2 |
| 7A | 84-89 | 77.40-77.45 | 77.425 | 122.76 | 56.1 | 1 | 3 | 3 | 1 | 0 | 9 | 0 | 0 |
| 7A | 104-109 | 77.60-77.65 | 77.625 | 123.19 | 15.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7A | 124-129 | 77.80-77.85 | 77.825 | 123.62 | 49.8 | 1 | 1 | 0 | j | 0 | 1 | 0 | 0 |
| 7A | 144-149 | 78.00-78.05 | 78.025 | 124.05 | 15.5 | 1 | 1 | 8 | 0 | 0 | 5 | 0 | 0 |
| 7B | 13-18 | 78.22-78.27 | 78.245 | 124.53 | 78.1 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 0 |
| 7B | 33-38 | 78.42-78.47 | 78.445 | 124.97 | 74.9 | 1 | 1 | 0 | j | 0 | 13 | j | 0 |
| 7B | 53-58 | 78.62-78.67 | 78.645 | 125.41 | 57.3 | 1 | 14 | 6 | 0 | 0 | 12 | 0 | 0 |
| 7B | 73-78 | 78.82-78.87 | 78.845 | 125.85 | 70.8 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7B | 93-98 | 79.02-79.07 | 79.045 | 126.29 | 102.5 | 9 | 3 | 0 | 0 | 0 | 5 | 0 | 0 |
| 7B | 113-118 | 79.22-79.27 | 79.245 | 126.73 | 15.8 | 0 | j | 0 | 0 | 0 | j | 0 | 0 |
| 7B | 133-138 | 79.42-79.47 | 79.445 | 127.09 | 74.5 | 1 | 0 | 0 | j | 0 | 0 | 0 | 0 |
| 7C&D | 2-7 | 79.46-79.51 | 79.485 | 127.26 | 76.1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 8A | 5-10 | 79.65-79.70 | 79.675 | 127.68 | 15 | 0 | j | 1 | j? | 0 | 14 | 0 | 0 |
| 8A | 25-30 | 79.85-79.90 | 79.875 | 128.12 | 15.7 | 2 | 1 | 0 | 2 | 0 | 11 | 0 | 0 |
| 8A | 45-50 | 80.05-80.10 | 80.075 | 128.56 | 15.6 | 1 | 1 | 0 | j | 0 | 8 | 0 | 0 |
| 8A | 65-70 | 80.25-80.30 | 80.275 | 129 | 81 | 0 | 4 | 1 | j | 0 | 22 | 0 | 0 |
| 8A | 85-90 | 80.45-80.50 | 80.475 | 129.44 | 15.3 | 0 | 0 | 0 | j? | 0 | 0 | 0 | 0 |
| 8A | 105-110 | 80.65-80.70 | 80.675 | 129.88 | 89.6 | 9 | j | 0 | 2 | 0 | 0 | 0 | 0 |
| 8A | 125-130 | 80.85-80.90 | 80.875 | 130.33 | 86.1 | 2 | 4 | 1 | 0 | 0 | 93 | 0 | 0 |
| 8A | 145-150 | 81.05-81.10 | 81.075 | 130.77 | 15.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8B | 13-18 | 81.25-81.30 | 81.275 | 131.21 | 74.7 | 3 | 2 | 0 | 0 | 0 | 35 | 0 | 0 |
| 8B | 33-38 | 81.45-81.50 | 81.475 | 131.66 | 15.7 | 1 | 8 | 1 | 0 | 0 | 11 | 0 | 0 |
| 8B | 53-58 | 81.65-81.70 | 81.675 | 132.11 | 15.7 | 0 | 7 | 6 | 0 | 2 | 51 | 0 | 0 |
| 8B | 73-78 | 81.85-81.90 | 81.875 | 132.55 | 15.4 | 1 | 12 | 3 | 0 | 1 | 69 | 0 | 0 |
| 8B | 93-98 | 82.05-82.10 | 82.075 | 133 | 15.5 | 0 | 1 | 0 | 0 | j | 39 | 0 | 0 |
| 8B | 113-118 | 82.25-82.30 | 82.275 | 133.45 | 15.9 | 8 | 12 | 1 | 0 | 0 | 47 | 0 | 0 |
| 8B | 133-138 | 82.45-82.50 | 82.475 | 133.9 | 80.7 | 2 | 10 | 0 | 0 | 0 | 20 | 0 | 0 |
| 9A | 0-5 | 82.65-82.70 | 82.675 | 134.35 | 90.7 | 7 | 6 | j | 5 | 0 | 24 | 0 | 0 |

| Drive# | Sample # | Interval Depth | Interval | Age (ka) | Weight | *L. cerio* | *C. caud* | *C. lacust* | *L. sappa* | *L.aff.itasc* | *L. friabil* | *Cand. sp.* | *L. bradb* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9A | 20-25 | 82.85-82.90 | 82.875 | 134.8 | 15.4 | 4 | 17 | 2 | 0 | 0 | 18 | 0 | 0 |
| 9A | 40-45 | 83.05-83.10 | 83.075 | 135.25 | 15.5 | 20 | 16 | 4 | 0 | j | 29 | 0 | 0 |
| 9A | 60-65 | 83.25-83.30 | 83.275 | 135.69 | 15.7 | 1 | 3 | 1 | 0 | j | 23 | 0 | 0 |
| 9A | 80-85 | 83.45-83.50 | 83.475 | 136.14 | 15.1 | j | 3 | j | 0 | 0 | 21 | 0 | 0 |
| 9A | 100-105 | 83.65-83.70 | 83.675 | 136.59 | 15.2 | 0 | 13 | 8 | 0 | j | 90 | 0 | 0 |
| 9A | 120-125 | 83.85-83.90 | 83.875 | 137.04 | 15.5 | 0 | 2 | 2 | 0 | j | 8 | 0 | 0 |
| 9A | 140-145 | 84.05-84.10 | 84.075 | 137.49 | 15 | 0 | 16 | 6 | 0 | j | 22 | 0 | 0 |
| 9B | 8-13 | 84.25-84.30 | 84.275 | 137.94 | 73.2 | 0 | 11 | 12 | 0 | 0 | 5 | 0 | 0 |
| 9B | 28-33 | 84.45-84.50 | 84.475 | 138.4 | 15.4 | 1 | 20 | 52 | 0 | 0 | 60 | 0 | 0 |
| 9B | 48-53 | 84.65-84.70 | 84.675 | 138.85 | 15.2 | j | 8 | 10 | 0 | j | 31 | 0 | 0 |
| 9B | 68-73 | 84.85-84.90 | 84.875 | 139.31 | 48.8 | 0 | 4 | 2 | 0 | j | 6 | 0 | 0 |
| 9B | 88-93 | 85.05-85.10 | 85.075 | 139.77 | 15.7 | 0 | 12 | 6 | 0 | 3 | 38 | 0 | 0 |
| 9B | 108-113 | 85.25-85.30 | 85.275 | 140.22 | 15.4 | 8 | 28 | 10 | j? | 3 | 16 | 0 | 0 |
| 9B | 128-133 | 85.45-85.50 | 85.475 | 140.68 | 15 | 16 | 17 | 4 | 0 | 1 | 7 | 0 | 0 |
| 9B&10A | 148-149.5 | 85.65-85.78 | 85.72 | 141.22 | 15.3 | 1 | 7 | 3 | j | j | 2 | 0 | 0 |
| 10A | 18-23 | 85.93-85.98 | 85.955 | 141.78 | 15.5 | 3 | 11 | 7 | j | 3 | 11 | 0 | 0 |
| 10A | 38-43 | 86.13-86.18 | 86.155 | 142.23 | 15.6 | 7 | 3 | 6 | 0 | 1 | 1 | 0 | 0 |
| 10A | 58-63 | 86.33-86.38 | 86.355 | 142.69 | 15.4 | 80 | 72 | 12 | 0 | 5 | 17 | 0 | 0 |
| 10A | 78-83 | 86.53-86.58 | 86.555 | 143.15 | 15.1 | 28 | 10 | 7 | 0 | 1 | 4 | 0 | 0 |
| 10A | 98-103 | 86.73-86.78 | 86.755 | 143.61 | 15.4 | 93 | 50 | 4 | 0 | 1 | 12 | 0 | 0 |
| 10A | 118-123 | 86.93-86.98 | 86.955 | 144.06 | 15.2 | 16 | 9 | 6 | 0 | 4 | 5 | 0 | 0 |
| 10A | 138-143 | 87.13-87.18 | 87.155 | 144.52 | 15.6 | 15 | 26 | 6 | 0 | j | 3 | 0 | 0 |
| 10B | 8-13 | 87.34-87.39 | 87.365 | 145 | 79.8 | 7 | 6 | 3 | 0 | 0 | 1 | 0 | 0 |
| 10B | 28-33 | 87.54-87.59 | 87.565 | 145.47 | 15.2 | 7 | 5 | 1 | 0 | 0 | 3 | 0 | 0 |
| 10B | 48-53 | 87.74-87.79 | 87.765 | 145.93 | 84.5 | 23 | 16 | 9 | 0 | 0 | 2 | 0 | 0 |
| 10B | 68-73 | 87.94-87.99 | 87.965 | 146.4 | 15.4 | 5 | 7 | 7 | 0 | j | 4 | 0 | 0 |
| 10B | 88-93 | 88.14-88.19 | 88.165 | 146.86 | 96.1 | 6 | 35 | 23 | 0 | 1 | 10 | 0 | 0 |
| 10B | 108-113 | 88.34-88.39 | 88.365 | 147.33 | 15.9 | 8 | 6 | 4 | 0 | 0 | 3 | 0 | 0 |
| 10B | 128-133 | 88.54-88.59 | 88.565 | 147.8 | 15.2 | 0 | 7 | 2 | 0 | 1 | 10 | 0 | 0 |
| 10B&C | 148-150,0-3 | 88.64-88.69 | 88.665 | 148.03 | 15.3 | 1 | 15 | 6 | 0 | j | 2 | 0 | 0 |
| 11A | 2-7 | 88.77-88.82 | 88.795 | 148.33 | 15.6 | 0 | 16 | 12 | 0 | 0 | 13 | 0 | 0 |
| 11A | 22-27 | 88.97-89.02 | 88.995 | 148.8 | 15.1 | 0 | 8 | 10 | 0 | 0 | 5 | 0 | 0 |
| 11A | 42-47 | 89.17-89.22 | 89.195 | 149.26 | 15.4 | 0 | 7 | 16 | 0 | j | j | 0 | 0 |
| 11A | 62-67 | 89.37-89.42 | 89.395 | 149.73 | 15.3 | 0 | 13 | 15 | 0 | j | 3 | 0 | 0 |
| 11A | 82-87 | 89.57-89.62 | 89.595 | 150.19 | 15.3 | 1 | 8 | 5 | 0 | j | 1 | 0 | 0 |

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## TESTING CLIMATE STABILITY DURING THE LAST INTERGLACIAL INTERVAL: POLLEN EVIDENCE FROM CORE OL-92

by

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## Abstract

Pollen evidence analyzed at decimeter-scale resolution through a 30-m interval in core OL-92, from Owens Lake in the westernmost Great Basin, suggests that the last interglacial period was a time of strongly fluctuating climate, despite also being a time of greatly increased insolation. The "last interglacial" is used here in its most restricted sense: i.e., the terrestrial equivalent of the European Eemian, or the 'pollen-interval' equivalent of marine oxygen isotope (OIS) substage 5e. Fossil pollen assemblages from this interval in core OL-92 show evidence of multiple climatic shifts, and three strong but relatively brief cooling events can be identified. Given the conspicuous and recurrent nature of the climate variability documented in the Great Basin for the last interglacial, it would appear to be premature to characterize the last interglacial as a time of monotonously stable warm climate.


## Introduction

Documenting the past relative stability or instability of terrestrial climate (especially at a millennial- or submillennial-scale) through time sequences that predate or filter out human-induced effects on climate --such as the increase in atmospheric $CO_2$ levels from increasing industrialization-- is an important prerequisite for accurately assessing trends in present day short-term climatic changes. Such documentation provides a basis for determining whether current human-induced (atmospheric) effects on climate are being superimposed on a mostly static or mostly dynamic baseline of natural climate variability.

This study is one such test of climate stability: an assessment of the character and relative magnitude of pollen assemblage (proxy vegetation) changes, at submillennial resolution, in a climatically sensitive area (the northern edge of the Mojave Desert), through a period of proposed high insolation (~ marine oxygen-isotope substage 5e). These conditions make it a suitable geologic interval for assessing short-term relative stability of climate before and during a "warm climate" period.

## Materials and Methods

The following parameters bound this study. The Owens Lake samples used here are a subset of a suite that covers the climatic equivalent of marine oxygen-isotope (OIS) stage 5, taken at 10 cm increments by J.L. Bischoff (Bischoff, this volume). The balance of those samples currently are being analyzed, so that ultimately they will span the entire terrestrial equivalent of OIS 5.

Warm and cold climate intervals in core OL-92--as determined by pollen assemblage characteristics -- were assigned to numbered "pollen intervals" (Litwin et al., 1997; Litwin et al., submitted). These pollen intervals approximately parallel the marine oxygen-isotope stages, but because they were not derived specifically from marine isotopic data, they have been assigned a qualifying symbol in their notation. Pollen intervals within the Owens Lake record therefore are appended here by the superscript "Δ" (to designate each as a pollen-based interval and not an isotopically-based interval). For example, the interval in OL-92 that is believed to correspond to OIS 5 is referenced herein as $5^{\Delta}$, with subdivisions $5a^{\Delta}$, $5b^{\Delta}$, $5c^{\Delta}$, $5d^{\Delta}$, and $5e^{\Delta}$.

The stratigraphic interval examined here from Owens Lake core OL-92 (Fig.1) comprised 85 m to 55 m depth. This correlates to pollen intervals spanning the middle of interval $6^{\Delta}$ to the middle of $5c^{\Delta}$ (Fig. 2). Direct age control was absent between ~30 ka (the maximum $^{14}C$ age deemed reliable in OL-92; Bischoff et al., 1993) and ~759 ka (the age of the Bishop Ash bed, which was penetrated near the base of core OL-92; Sarna-Wojcicki and Pringle, 1992, Sarna-Wojcicki et al., 1997)[1] . Because of this, results of the pollen analyses are plotted here against core depth; ages bounding this stratigraphic interval, here derived from the mass accumulation rate model for OL-92 (Bischoff, 1993; Bischoff et al., 1997a), are presented along the bottom (x-) axis of Figures 2 and 3 for reference to other proxy records. The sampling interval chosen for this study was 20 cm, with a total of 165 + samples. More than 49,500 specimens were identified to establish the baseline for this study; a census of the samples from core OL-92 is provided in Appendix I.

Powdering of the core samples prior to their distribution introduced several complications for pollen analysis. The first was a coarser sample depth-averaging (here, 10 cm vs ~2 cm averaging for other palynological samples), which buffered changes in the pollen response, especially where averaged across sedimentologically heterogeneous intervals. Accordingly, the depth of sampling given here is arbitrarily placed at the mid-point of the sampled interval. Crushing of samples also created substantial breakage in the pollen fraction. This thoroughly disaggregated most colonies of the thin-walled alga *Pediastrum*, which increased the difficulty in counting and identifying all pollen grains. Fully disaggregated but intact *Pediastrum* cells bore resemblance to TCT grains (Taxodiaceae-Cupressaceae-Taxaceae, here mostly *Juniperus* species) and visually obscured other pollen taxa in the sample preparations by their abundance. To counteract this, samples suffering the worst effects, especially those with abundant *Pediastrum*, were counted multiple times on different slide transects to confirm the pollen taxa assemblage composition of those intervals. Below ~79.5 m depth, the R5258 sample series of Bischoff was substituted by 'point' samples taken from an earlier (separate) sampling by the author (designated R5171 series), due to low productivity, insufficient sample volume, and pollen breakage in the former sample suite[2].

## Cold excursions

The results of these pollen analyses suggest that the terrestrial climate through the peak insolation interval ($5e^{\Delta}$) predominantly was dynamic in nature and experienced several episodes of strong cooling (at least in the southwestern Great Basin, Fig. 2), on the basis of increased juniper (TCT) abundance. Although intra-Eemian cooling has been noted in other records (Sarnthein and Tiedemann, 1990; Pinchon et al., 1992; Anklin et al., 1993; Dansgaard et al., 1993; Field et al., 1994; Thouveny et al., 1994; Maslin et al, 1996; Seidenkrantz and Knudsen, 1997; White et al., 1997), it has been reported variously as a single mid-Eemian cold episode (Maslin and Tzedakis, 1996) or as multiple cold pulses within the Eemian (Anklin et al., 1993; Thouveny et al., 1994).

Pollen evidence from the Great Basin examined here strongly supports multiple episodes of cooling within interval $5e^{\Delta}$. In this core, the terrestrial climate of interval $5e^{\Delta}$ was divided into three main warm events that alternated with two major cool events (plus one minor one)[3]. Only a few sustained intervals of relatively "static" climate (either warm or cold) were indicated by the pollen assemblage data. The thickest core interval of relatively unchanging warm pollen assemblages occurred late in subinterval $5e5^{\Delta}$ (between ~69 and ~72.5 m depth, as indicated by the pollen response of the junipers (TCT)), shortly after the insolation maximum (Figs. 2, 3, as determined by total arboreal pollen, composites, chenopods, amaranths, and greasewood). However, the beginning of this "static" warm interval is separated from the insolation peak by an apparently brief but moderately strong cold pulse (Fig. 2, asterisk), that effectively divided subinterval $5e5^{\Delta}$. Subinterval $5e1^{\Delta}$ comprised the second thickest core interval of relatively stable warm pollen assemblages.

Of the three cold events noted in interval $5e^{\Delta}$, the oldest also is apparently the thinnest (shortest?); it occurred immediately after the insolation peak and divided subinterval $5e5^{\Delta}$ (above). The second of these cold pulses (and the most strongly sustained one, based on stratigraphic thickness) is labelled here as subinterval 5e4$^{\Delta}$. It occurred between ~69 m and 67.7 m core depth. The last of these cold pulses is labelled as 5e2$^{\Delta}$, and occurred between ~66.5 m and ~64.8 m core depth. Although the current chronology of this stratigraphic interval in core OL-92 suggests that these three cold pulses are all geologically brief, their strength appears to be significant. All three cold pulses in the OL-92 record had TCT values that ranged from nearly 50% to more than 60% of their full-glacial magnitude.

## Conclusions

The conclusions from these new analyses are: 1.) the pollen serial record through terrestrial interval 5e$^{\Delta}$ in core OL-92 suggests that the last interglacial had a dynamic climate that can be divided into 6 parts: three longer warm intervals (of differing duration) and three shorter cold excursions (also of differing duration); and 2.) abrupt sedimentological change and abrupt vegetational change (in several biological indicators) through the transition from interval 6$^{\Delta}$ to interval 5e$^{\Delta}$ suggests that the climate history record across the termination II transition in OL-92 (at ~75 m) is unconformable, although the duration of this hiatus appears to be relatively short. Further work on comparison of this climate record to other climate records through the last interglacial interval (from other geographic sites) is in progress.

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Endnotes

[1] Although within-Brunhes magnetic reversals were reported in this core (Glen et al., 1993; Glen and Coe, 1997) more recent examination of these excursions (J. Rosenbaum, R. Reynolds, and J. Smoot, USGS) has discovered that some to perhaps most of these may be artifacts that are depth-coincident with core drive-top

slumping and core section spinoffs. Accordingly, these paleomagnetic excursions presently are considered to be suspect until they can be reexamined and confirmed.

[2] In addition, four other samples of the R5171 series were used for this study. Those samples are from the following depths: 62.57 m, 62.72 m, 73.0 m, and 74.5 m.

[3] The notation for these sub-portions of the last interglacial interval follow the precedent of Anklin et al. (1993) and are designated here as $5e1^{\Delta}$, $5e2^{\Delta}$, $5e3^{\Delta}$, $5e4^{\Delta}$, and $5e5^{\Delta}$. Because of the relative thinness of the first cool interval in comparison to the two later cold pulses observed in this record, it was not assigned as a separate subinterval of $5e^{\Delta}$. This conforms to the precedent used for the oldest subinterval of the Eemian in other climate records (e.g., Anklin et al., 1993).

## FIGURE CAPTIONS

1. Generalized map of southeastern California, showing location of the Owens Valley drainage system, the southern Sierra Nevada, Owens Lake (core OL-92), and the lakes it in turn fed during the late Pleistocene: China Lake, Searles Lake, Panamint, and Lake Manly (Death Valley). Question marks denote probable drainage paths from Searles Lake into Panamint Valley and Death Valley during times of spill in Searles Lake.

2. Percent juniper (TCT, or Taxodeaceae-Cupressaceae-Taxaceae) as a relative indicator of climatic change along the eastern flank of the southern Sierra Nevada, core OL-92, Owens Lake, California. Increased abundance of juniper pollen denotes intervals of colder climate. Three cold pulses are observed in the last interglacial interval of the OL-92 core. An asterisk marks the oldest of these cold pulses, that occurs within sub-interval $5e5^{\Delta}$. Ages derived from mass accumulation rate model of Bischoff et al. (1997) are shown along bottom axis, for reference (~94 ka, ~118 ka). "A" and "B" denote two possible placements for termination II. The shallower position ("A") is placed at the greatest change in percent arboreal pollen; this also coincides with the point of greatest lithologic change. The deeper position ("B") is placed at the estimated midpoint along the extended transition from full-glacial to full-interglacial juniper abundances. Interval between these two positions tentatively is assigned to interval $6^{\Delta}$, but noted with a dark hatchured line. Percent arboreal pollen also indicates probable depth interval of maximum insolation during the last interglacial period (i.e., here marked by the greatest sustained minimum of arboreal pollen, i.e., maximum desert conditions within the lake basin).

3. Selected desertscrub taxa in core OL-92. Percent greasewood pollen (*Sarcobatus*) shown on upper graph; composites, chenopods, and amaranths shown on lower graph. Both indicators are desertscrub taxa whose greatest abundance indicates the maximum insolation interval within $5e^{\Delta}$. Ages derived from mass accumulation rate model of Bischoff et al. (1997) shown along bottom axis, for reference (~94 ka, ~118 ka). "A" denotes one of two possible placements for termination II- the one that more closely conforms to the sedimentary structures within this core (see Smoot, this volume). Shaded areas denote extent of the last interglacial interval within core OL-92. Shaded portions indicate warmest subintervals, with the two shorter, interspersed unshaded areas representing intervals of cold climate within the last interglacial period (per Figure 2).

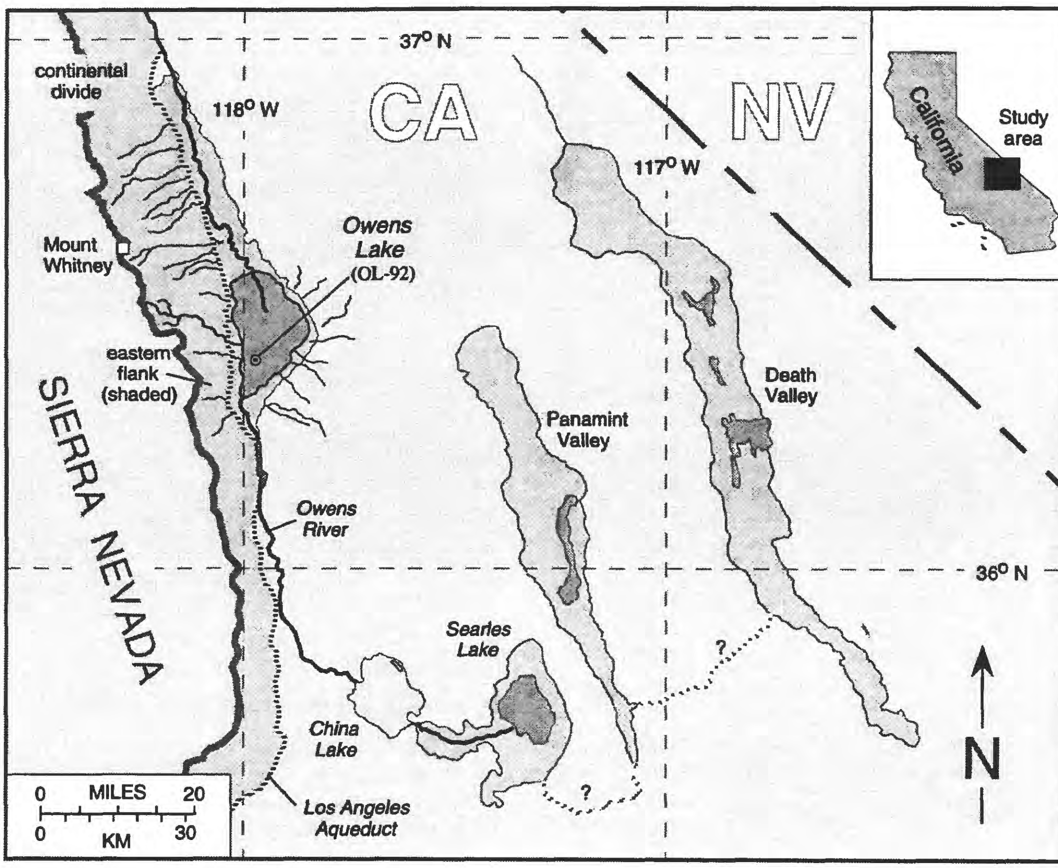


Figure 1. Owens Valley drainage system (southern part)

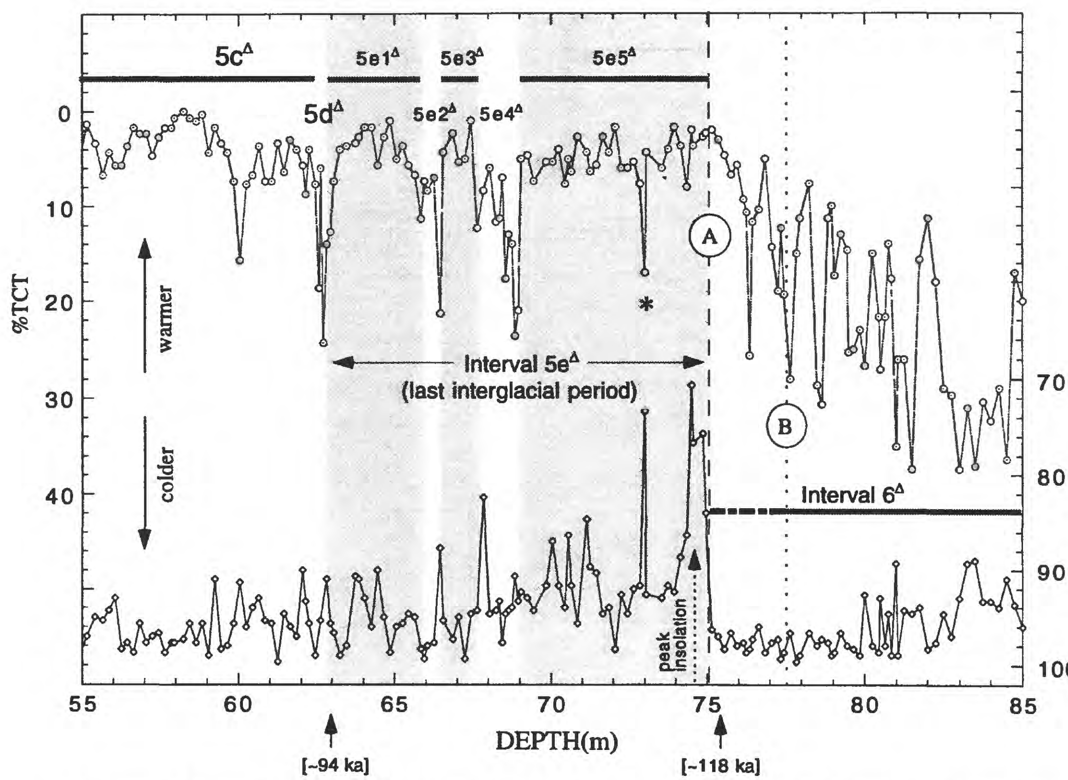


Figure 2. Owens Lake interval $5e^{\Delta}$ (last interglacial period): %TCT and % arboreal pollen

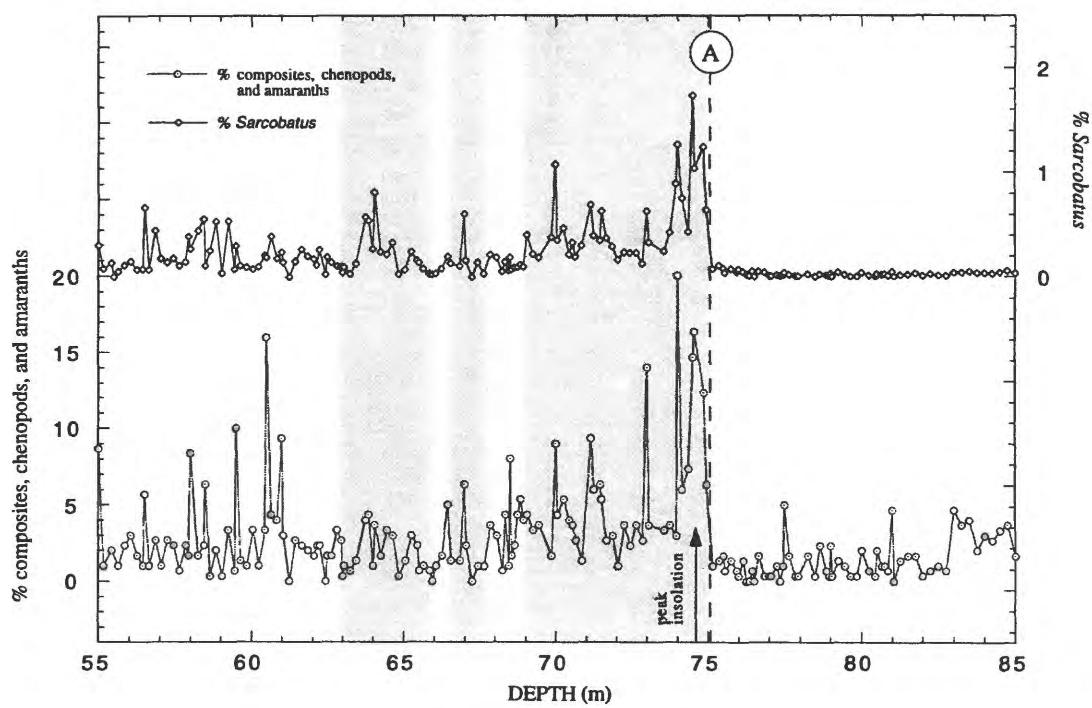


Figure 3. Selected desertscrub vegetation indicating insolation maximum

| Sample | Depth(m) | Sacci/2 | *Pinus* | TPine | TCT | *Abies* | *Alnus* | *Artemisia* | *Carya* | ChenAm | S Cmp | LngCmp | Lig Cmp | *Corylus* | *Ephedra* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 FS | 54.95 | 63.00 | 188.00 | 251.00 | 13.00 | 17.00 | 0.00 | 2.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 FU | 55.15 | 60.00 | 209.00 | 269.00 | 4.00 | 8.00 | 0.00 | 6.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 FW | 55.42 | 72.00 | 188.00 | 260.00 | 10.00 | 7.00 | 0.00 | 7.00 | 0.00 | 4.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 FY | 55.65 | 74.00 | 178.00 | 252.00 | 20.00 | 5.00 | 0.00 | 10.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GA | 55.85 | 55.00 | 193.00 | 248.00 | 13.00 | 13.00 | 0.00 | 8.00 | 0.00 | 5.00 | 0.00 | 2.00 | 0.00 | 0.00 | 2.00 |
| R5258 GC | 56.05 | 71.00 | 179.00 | 250.00 | 17.00 | 5.00 | 0.00 | 11.00 | 0.00 | 7.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GE | 56.25 | 75.00 | 176.00 | 251.00 | 17.00 | 11.00 | 0.00 | 4.00 | 0.00 | 4.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GG | 56.45 | 49.00 | 221.00 | 270.00 | 11.00 | 6.00 | 0.00 | 3.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GI | 56.65 | 40.00 | 238.00 | 278.00 | 5.00 | 9.00 | 0.00 | 1.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 GK | 56.85 | 63.00 | 210.00 | 273.00 | 7.00 | 2.00 | 0.00 | 1.00 | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 GM | 57.05 | 36.00 | 234.00 | 270.00 | 7.00 | 8.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 GO | 57.25 | 38.00 | 228.00 | 266.00 | 14.00 | 5.00 | 0.00 | 1.00 | 0.00 | 6.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 |
| R5258 GQ | 57.45 | 53.00 | 213.00 | 266.00 | 8.00 | 7.00 | 0.00 | 1.00 | 0.00 | 7.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GS | 57.65 | 79.00 | 201.00 | 280.00 | 5.00 | 7.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 GU | 57.85 | 66.00 | 208.00 | 274.00 | 5.00 | 11.00 | 0.00 | 0.00 | 0.00 | 4.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 GV | 57.95 | 51.00 | 234.00 | 285.00 | 2.00 | 4.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 GY | 58.25 | 45.00 | 235.00 | 280.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| R5258 HA | 58.45 | 54.00 | 222.00 | 276.00 | 2.00 | 4.00 | 0.00 | 3.00 | 0.00 | 3.00 | 4.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 HC | 58.65 | 85.00 | 200.00 | 285.00 | 3.00 | 1.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 HE | 58.85 | 95.00 | 177.00 | 272.00 | 1.00 | 4.00 | 0.00 | 5.00 | 0.00 | 4.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| R5258 HG | 59.05 | 68.00 | 208.00 | 276.00 | 13.00 | 4.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 HI | 59.25 | 64.00 | 197.00 | 261.00 | 5.00 | 3.00 | 0.00 | 9.00 | 0.00 | 4.00 | 5.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| R5258 HK | 59.45 | 90.00 | 184.00 | 274.00 | 10.00 | 3.00 | 0.00 | 2.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 HM | 59.65 | 54.00 | 219.00 | 273.00 | 13.00 | 2.00 | 0.00 | 1.00 | 0.00 | 2.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 HO | 59.85 | 131.00 | 123.00 | 254.00 | 22.00 | 5.00 | 0.00 | 2.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 HQ | 60.05 | 99.00 | 112.00 | 211.00 | 47.00 | 2.00 | 0.00 | 12.00 | 0.00 | 6.00 | 3.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 HS | 60.25 | 63.00 | 195.00 | 258.00 | 23.00 | 3.00 | 0.00 | 3.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 5.00 |
| R5258 HU | 60.45 | 57.00 | 195.00 | 252.00 | 20.00 | 1.00 | 0.00 | 3.00 | 0.00 | 6.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 HW | 60.65 | 59.00 | 193.00 | 252.00 | 11.00 | 0.00 | 0.00 | 5.00 | 0.00 | 5.00 | 7.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 HY | 60.85 | 50.00 | 204.00 | 254.00 | 22.00 | 4.00 | 0.00 | 0.00 | 0.00 | 11.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 IA | 61.05 | 70.00 | 192.00 | 262.00 | 22.00 | 1.00 | 0.00 | 3.00 | 0.00 | 7.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 IC | 61.25 | 44.00 | 231.00 | 275.00 | 10.00 | 8.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 IE | 61.45 | 53.00 | 207.00 | 260.00 | 19.00 | 1.00 | 0.00 | 6.00 | 0.00 | 4.00 | 4.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 IG | 61.65 | 65.00 | 212.00 | 277.00 | 9.00 | 1.00 | 0.00 | 4.00 | 0.00 | 6.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 II | 61.85 | 75.00 | 197.00 | 272.00 | 12.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 IK | 62.05 | 40.00 | 206.00 | 246.00 | 17.00 | 2.00 | 0.00 | 19.00 | 0.00 | 3.00 | 2.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 IL | 62.15 | 31.00 | 209.00 | 240.00 | 26.00 | 2.00 | 0.00 | 10.00 | 0.00 | 3.00 | 3.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| R5258 IM | 62.25 | 37.00 | 232.00 | 269.00 | 12.00 | 2.00 | 0.00 | 2.00 | 0.00 | 5.00 | 2.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 IO | 62.45 | 52.00 | 209.00 | 261.00 | 23.00 | 3.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 GX | 62.57 | 28.00 | 179.00 | 207.00 | 56.00 | 3.00 | 0.00 | 13.00 | 0.00 | 5.00 | 3.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 IP | 62.63 | 55.00 | 196.00 | 251.00 | 18.00 | 5.00 | 0.00 | 4.00 | 0.00 | 2.00 | 3.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5171 GY | 62.72 | 50.00 | 163.00 | 213.00 | 73.00 | 3.00 | 0.00 | 3.00 | 0.00 | 1.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 IQ | 62.83 | 31.00 | 187.00 | 218.00 | 42.00 | 3.00 | 0.00 | 12.00 | 0.00 | 5.00 | 3.00 | 2.00 | 0.00 | 0.00 | 4.00 |
| R5258 IR | 62.95 | 76.00 | 165.00 | 241.00 | 38.00 | 1.00 | 0.00 | 2.00 | 0.00 | 7.00 | 1.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 IS | 63.05 | 64.00 | 194.00 | 258.00 | 22.00 | 3.00 | 0.00 | 3.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 IU | 63.25 | 73.00 | 208.00 | 281.00 | 12.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 IW | 63.45 | 72.00 | 205.00 | 277.00 | 11.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 IZ | 63.75 | 61.00 | 190.00 | 251.00 | 10.00 | 1.00 | 0.00 | 9.00 | 0.00 | 7.00 | 2.00 | 3.00 | 0.00 | 0.00 | 4.00 |
| R5258 JA | 63.85 | 88.00 | 165.00 | 253.00 | 8.00 | 3.00 | 0.00 | 9.00 | 0.00 | 8.00 | 2.00 | 3.00 | 0.00 | 0.00 | 3.00 |
| R5258 JC | 64.05 | 110.00 | 154.00 | 264.00 | 5.00 | 2.00 | 1.00 | 1.00 | 0.00 | 10.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 JE | 64.25 | 156.00 | 119.00 | 275.00 | 5.00 | 5.00 | 0.00 | 2.00 | 0.00 | 3.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| R5258 JG | 64.45 | 112.00 | 126.00 | 238.00 | 17.00 | 4.00 | 0.00 | 16.00 | 0.00 | 8.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 JI | 64.65 | 145.00 | 121.00 | 266.00 | 8.00 | 3.00 | 0.00 | 4.00 | 0.00 | 3.00 | 4.00 | 2.00 | 0.00 | 0.00 | 0.00 |
| R5258 JK | 64.85 | 108.00 | 173.00 | 281.00 | 3.00 | 7.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 JM | 65.05 | 139.00 | 128.00 | 267.00 | 15.00 | 3.00 | 0.00 | 6.00 | 0.00 | 3.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 JO | 65.25 | 78.00 | 188.00 | 266.00 | 11.00 | 4.00 | 0.00 | 2.00 | 0.00 | 7.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 |

Appendix 1. OL-92 pollen counts

| Sample | Poaceae | Larx/Ps | *Picea* | *Populus* | *Quercus* | *Salix* | Sarc | Sheph | T mert | UK/Othr | Sum | Cyper | Typ/Spc | %AP | %TCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 FS | 0.00 | 1.00 | 0.00 | 0.00 | 12.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 1.00 | 0.00 | 98.67 | 4.33 |
| R5258 FU | 0.00 | 0.00 | 1.00 | 0.00 | 7.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 97.00 | 1.33 |
| R5258 FW | 0.00 | 2.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 95.00 | 3.33 |
| R5258 FY | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 | 3.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 1.00 | 0.00 | 95.33 | 6.67 |
| R5258 GA | 0.00 | 0.00 | 0.00 | 0.00 | 7.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 94.33 | 4.33 |
| R5258 GC | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 93.00 | 5.67 |
| R5258 GE | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 5.67 |
| R5258 GG | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 1.00 | 0.00 | 97.67 | 3.67 |
| R5258 GI | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 98.67 | 1.67 |
| R5258 GK | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 2.33 |
| R5258 GM | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 2.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 2.33 |
| R5258 GO | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 97.00 | 4.67 |
| R5258 GQ | 0.00 | 0.00 | 0.00 | 0.00 | 7.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 300 | 1.00 | 0.00 | 96.67 | 2.67 |
| R5258 GS | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 4.00 | 98.67 | 1.67 |
| R5258 GU | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 1.67 |
| R5258 GV | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 0.67 |
| R5258 GY | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 97.33 | 0.00 |
| R5258 HA | 0.00 | 2.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 0.67 |
| R5258 HC | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 2.00 | 0.00 | 1.00 | 2.00 | 300 | 0.00 | 0.00 | 97.67 | 1.00 |
| R5258 HE | 0.00 | 0.00 | 0.00 | 0.00 | 9.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 0.33 |
| R5258 HG | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 4.33 |
| R5258 HI | 0.00 | 2.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 4.00 | 91.00 | 1.67 |
| R5258 HK | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 3.33 |
| R5258 HM | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 98.00 | 4.33 |
| R5258 HO | 1.00 | 0.00 | 0.00 | 0.00 | 5.00 | 1.00 | 2.00 | 1.00 | 0.00 | 1.00 | 300 | 0.00 | 0.00 | 95.67 | 7.33 |
| R5258 HQ | 0.00 | 1.00 | 0.00 | 0.00 | 10.00 | 1.00 | 2.00 | 2.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 91.33 | 15.67 |
| R5258 HS | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 300 | 2.00 | 4.00 | 96.00 | 7.67 |
| R5258 HU | 1.00 | 0.00 | 0.00 | 0.00 | 8.00 | 0.00 | 3.00 | 0.00 | 1.00 | 1.00 | 300 | 3.00 | 0.00 | 94.00 | 6.67 |
| R5258 HW | 0.00 | 0.00 | 0.00 | 0.00 | 11.00 | 0.00 | 1.00 | 1.00 | 5.00 | 1.00 | 300 | 4.00 | 6.00 | 93.00 | 3.67 |
| R5258 HY | 0.00 | 1.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 3.00 | 0.00 | 95.33 | 7.33 |
| R5258 IA | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 7.33 |
| R5258 IC | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 99.67 | 3.33 |
| R5258 IE | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 6.33 |
| R5258 IG | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 96.00 | 3.00 |
| R5258 II | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 4.00 | 97.00 | 4.00 |
| R5258 IK | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 2.00 | 0.00 | 3.00 | 1.00 | 300 | 0.00 | 0.00 | 90.00 | 5.67 |
| R5258 IL | 0.00 | 0.00 | 0.00 | 0.00 | 9.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 93.33 | 8.67 |
| R5258 IM | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 4.00 |
| R5258 IO | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 7.67 |
| R5171 GX | 0.00 | 1.00 | 0.00 | 0.00 | 5.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 0.00 | 91.00 | 18.67 |
| R5258 IP | 0.00 | 1.00 | 0.00 | 0.00 | 6.00 | 0.00 | 2.00 | 0.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 95.33 | 6.00 |
| R5171 GY | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 97.00 | 24.33 |
| R5258 IQ | 1.00 | 2.00 | 0.00 | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 4.00 | 4.00 | 91.00 | 14.00 |
| R5258 IR | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 300 | 1.00 | 1.00 | 95.67 | 12.67 |
| R5258 IS | 0.00 | 1.00 | 0.00 | 0.00 | 5.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 96.67 | 7.33 |
| R5258 IU | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 4.00 |
| R5258 IW | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 0.00 | 98.00 | 3.67 |
| R5258 IZ | 0.00 | 0.00 | 0.00 | 1.00 | 8.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 300 | 1.00 | 0.00 | 90.67 | 3.33 |
| R5258 JA | 0.00 | 0.00 | 0.00 | 0.00 | 7.00 | 0.00 | 2.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 0.00 | 91.00 | 2.67 |
| R5258 JC | 1.00 | 0.00 | 0.00 | 0.00 | 8.00 | 0.00 | 4.00 | 0.00 | 0.00 | 1.00 | 300 | 1.00 | 0.00 | 93.00 | 1.67 |
| R5258 JE | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 2.00 | 1.00 | 0.00 | 1.00 | 300 | 0.00 | 0.00 | 96.00 | 1.67 |
| R5258 JG | 0.00 | 1.00 | 0.00 | 0.00 | 9.00 | 0.00 | 3.00 | 0.00 | 0.00 | 1.00 | 300 | 0.00 | 0.00 | 90.00 | 5.67 |
| R5258 JI | 0.00 | 3.00 | 0.00 | 0.00 | 5.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 4.00 | 95.00 | 2.67 |
| R5258 JK | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 2.00 | 1.00 | 300 | 0.00 | 0.00 | 98.67 | 1.00 |
| R5258 JM | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 300 | 0.00 | 0.00 | 96.00 | 5.00 |
| R5258 JO | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 1.00 | 6.00 | 95.67 | 3.67 |

| Sample | Depth(m) | Sacci/2 | *Pinus* | TPine | TCT | *Abies* | *Alnus* | *Artemisia* | *Carya* | ChenAm | S Cmp | LngCmp | Lig Cmp | *Corylus* | *Ephedra* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 JQ | 65.45 | 75.00 | 188.00 | 263.00 | 17.00 | 1.00 | 0.00 | 6.00 | 0.00 | 6.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 JS | 65.65 | 69.00 | 182.00 | 251.00 | 20.00 | 6.00 | 0.00 | 7.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 JU | 65.85 | 88.00 | 167.00 | 255.00 | 34.00 | 2.00 | 0.00 | 1.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 JV | 65.95 | 75.00 | 193.00 | 268.00 | 22.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 JW | 66.05 | 40.00 | 223.00 | 263.00 | 25.00 | 2.00 | 0.00 | 3.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 JY | 66.25 | 92.00 | 172.00 | 264.00 | 21.00 | 3.00 | 0.00 | 1.00 | 0.00 | 4.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 KA | 66.45 | 56.00 | 126.00 | 182.00 | 64.00 | 1.00 | 0.00 | 16.00 | 0.00 | 11.00 | 4.00 | 0.00 | 0.00 | 0.00 | 5.00 |
| R5258 KB | 66.55 | 67.00 | 202.00 | 269.00 | 13.00 | 2.00 | 0.00 | 5.00 | 0.00 | 3.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 KE | 66.85 | 94.00 | 184.00 | 278.00 | 7.00 | 5.00 | 0.00 | 1.00 | 0.00 | 2.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 KG | 67.05 | 32.00 | 230.00 | 262.00 | 16.00 | 3.00 | 0.00 | 6.00 | 0.00 | 6.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 KI | 67.25 | 27.00 | 247.00 | 274.00 | 15.00 | 5.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 KK | 67.45 | 66.00 | 201.00 | 267.00 | 3.00 | 9.00 | 0.00 | 11.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 KM | 67.65 | 59.00 | 181.00 | 240.00 | 37.00 | 2.00 | 0.00 | 13.00 | 0.00 | 1.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 KO | 67.85 | 26.00 | 190.00 | 216.00 | 25.00 | 1.00 | 0.00 | 36.00 | 0.00 | 9.00 | 2.00 | 0.00 | 0.00 | 0.00 | 6.00 |
| R5258 KQ | 68.05 | 57.00 | 198.0 | 255.00 | 18.0 | 3.00 | 0.00 | 1.00 | 0.00 | 7.00 | 2.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| R5258 KS | 68.25 | 72.00 | 161.00 | 233.00 | 35.00 | 9.00 | 0.00 | 9.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 5.00 |
| R5258 KT | 68.35 | 82.00 | 141.00 | 223.00 | 34.00 | 5.00 | 0.00 | 0.00 | 0.00 | 13.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 KU | 68.45 | 94.00 | 165.00 | 259.00 | 21.00 | 6.00 | 0.00 | 2.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 KV | 68.55 | 76.00 | 142.00 | 218.00 | 53.00 | 4.00 | 0.00 | 1.00 | 0.00 | 3.00 | 2.00 | 0.00 | 0.00 | 0.00 | 7.00 |
| R5258 KW | 68.65 | 86.00 | 145.00 | 231.00 | 39.00 | 10.00 | 0.00 | 4.00 | 0.00 | 4.00 | 3.00 | 0.00 | 0.00 | 0.00 | 6.00 |
| R5258 KX | 68.75 | 57.00 | 178.00 | 235.00 | 42.00 | 4.00 | 0.00 | 5.00 | 0.00 | 4.00 | 9.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 KY | 68.85 | 35.00 | 158.00 | 193.00 | 71.00 | 3.00 | 0.00 | 1.00 | 0.00 | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.00 |
| R5258 KZ | 68.95 | 56.00 | 147.00 | 203.00 | 63.00 | 3.00 | 0.00 | 0.00 | 0.00 | 10.00 | 2.00 | 0.00 | 0.00 | 0.00 | 8.00 |
| R5258 LA | 69.05 | 115.00 | 141.00 | 256.00 | 15.00 | 3.00 | 0.00 | 1.00 | 0.00 | 6.00 | 6.00 | 1.00 | 0.00 | 0.00 | 9.00 |
| R5258 LC | 69.25 | 39.00 | 223.00 | 262.00 | 14.00 | 1.00 | 0.00 | 2.00 | 0.00 | 5.00 | 5.00 | 0.00 | 0.00 | 0.00 | 9.00 |
| R5258 LE | 69.45 | 42.00 | 210.00 | 252.00 | 22.00 | 3.00 | 0.00 | 3.00 | 0.00 | 2.00 | 8.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| R5258 LI | 69.85 | 61.00 | 186.00 | 247.00 | 16.00 | 4.00 | 0.00 | 2.00 | 0.00 | 4.00 | 1.00 | 0.00 | 0.00 | 0.00 | 18.00 |
| R5258 LK | 70.05 | 53.00 | 186.00 | 239.00 | 16.00 | 3.00 | 0.00 | 19.00 | 0.00 | 9.00 | 4.00 | 0.00 | 0.00 | 0.00 | 7.00 |
| R5258 LM | 70.25 | 32.00 | 222.00 | 254.00 | 12.00 | 0.00 | 0.00 | 8.00 | 0.00 | 8.00 | 8.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 LO | 70.45 | 113.00 | 135.00 | 248.00 | 23.00 | 3.00 | 0.00 | 0.00 | 0.00 | 6.00 | 6.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 LP | 70.55 | 52.00 | 182.00 | 234.00 | 15.00 | 5.00 | 0.00 | 20.00 | 0.00 | 8.00 | 3.00 | 0.00 | 0.00 | 0.00 | 8.00 |
| R5258 LQ | 70.65 | 54.00 | 180.00 | 234.00 | 19.00 | 5.00 | 0.00 | 9.00 | 0.00 | 7.00 | 1.00 | 2.00 | 0.00 | 0.00 | 6.00 |
| R5258 LS | 70.85 | 46.00 | 222.00 | 268.00 | 8.00 | 1.00 | 0.00 | 5.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| R5258 LU | 71.15 | 31.00 | 198.00 | 229.00 | 13.00 | 1.00 | 0.00 | 10.00 | 0.00 | 20.00 | 7.00 | 1.00 | 0.00 | 0.00 | 7.00 |
| R5258 LW | 71.25 | 38.00 | 202.00 | 240.00 | 19.00 | 2.00 | 0.00 | 5.00 | 0.00 | 17.00 | 1.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 LY | 71.45 | 52.00 | 188.00 | 240.00 | 17.00 | 3.00 | 0.00 | 8.00 | 0.00 | 17.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 MA | 71.65 | 52.00 | 211.00 | 263.00 | 8.00 | 1.00 | 0.00 | 6.00 | 0.00 | 6.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 MC | 71.85 | 69.00 | 189.00 | 258.00 | 13.00 | 3.00 | 0.00 | 4.00 | 0.00 | 5.00 | 2.00 | 2.00 | 0.00 | 0.00 | 3.00 |
| R5258 ME | 72.05 | 55.00 | 224.00 | 279.00 | 5.00 | 3.00 | 0.00 | 1.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 MG | 72.25 | 44.00 | 208.00 | 252.00 | 18.00 | 2.00 | 0.00 | 7.00 | 0.00 | 9.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| R5258 MI | 72.45 | 91.00 | 169.00 | 260.00 | 18.00 | 1.00 | 0.00 | 3.00 | 0.00 | 3.00 | 3.00 | 1.00 | 0.00 | 0.00 | 5.00 |
| R5258 MK | 72.65 | 83.00 | 167.00 | 250.00 | 16.00 | 3.00 | 0.00 | 11.00 | 0.00 | 8.00 | 1.00 | 2.00 | 0.00 | 0.00 | 2.00 |
| R5258 MM | 72.85 | 72.00 | 169.00 | 241.00 | 23.00 | 3.00 | 0.00 | 15.00 | 0.00 | 5.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 IR | 73.00 | 21.00 | 126.00 | 147.00 | 51.00 | 1.00 | 0.00 | 30.00 | 0.00 | 33.00 | 6.00 | 3.00 | 0.00 | 0.00 | 3.00 |
| R5258 MO | 73.05 | 46.00 | 209.00 | 255.00 | 13.00 | 3.00 | 0.00 | 4.00 | 0.00 | 7.00 | 2.00 | 2.00 | 0.00 | 0.00 | 5.00 |
| R5258 MQ | 73.55 | 54.00 | 191.00 | 245.00 | 18.00 | 4.00 | 0.00 | 4.00 | 0.00 | 6.00 | 3.00 | 1.00 | 0.00 | 0.00 | 4.00 |
| R5258 MS | 73.75 | 43.00 | 208.00 | 251.00 | 12.00 | 2.00 | 0.00 | 6.00 | 0.00 | 2.00 | 9.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 MU | 73.95 | 102.00 | 159.00 | 261.00 | 5.00 | 1.00 | 0.00 | 7.00 | 0.00 | 5.00 | 4.00 | 0.00 | 0.00 | 0.00 | 6.00 |
| R5258 MW | 74.15 | 116.00 | 119.00 | 235.00 | 11.00 | 1.00 | 0.00 | 6.00 | 0.00 | 11.00 | 7.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 MY | 74.35 | 96.00 | 114.00 | 210.00 | 24.00 | 3.00 | 0.00 | 5.00 | 0.00 | 10.00 | 12.00 | 0.00 | 0.00 | 0.00 | 10.00 |
| R5171 IX | 74.50 | 47.00 | 110.00 | 157.00 | 6.00 | 4.00 | 0.00 | 36.00 | 0.00 | 20.00 | 24.00 | 0.00 | 0.00 | 0.00 | 4.00 |
| R5258 NA | 74.55 | 50.00 | 108.00 | 158.00 | 11.00 | 7.00 | 0.00 | 14.00 | 0.00 | 29.00 | 18.00 | 2.00 | 0.00 | 0.00 | 3.00 |
| R5258 NC | 74.85 | 70.00 | 108.00 | 178.00 | 8.00 | 3.00 | 0.00 | 29.00 | 0.00 | 26.00 | 7.00 | 4.00 | 0.00 | 0.00 | 3.00 |
| R5258 NE | 74.95 | 66.00 | 155.00 | 221.00 | 7.00 | 5.00 | 0.00 | 25.00 | 0.00 | 9.00 | 7.00 | 3.00 | 0.00 | 0.00 | 3.00 |
| R5258 NG | 75.15 | 82.00 | 184.00 | 266.00 | 6.00 | 7.00 | 0.00 | 7.00 | 0.00 | 1.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| Sample | Poaceae | Larx/Ps | *Picea* | *Populus* | *Quercus* | *Salix* | Sarc | Sheph | T mert | UK/Oth | Sum | Cyper | Typ/Spc | %AP | %TCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 JQ | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 5.67 |
| R5258 JS | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 5.00 | 0.00 | 300 | 1.00 | 0.00 | 95.00 | 6.67 |
| R5258 JU | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 11.33 |
| R5258 JV | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 99.33 | 7.33 |
| R5258 JW | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 98.00 | 8.33 |
| R5258 JY | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 7.00 |
| R5258 KA | 0.00 | 1.00 | 0.00 | 0.00 | 9.00 | 0.00 | 1.00 | 0.00 | 6.00 | 0.00 | 300 | 2.00 | 0.00 | 87.67 | 21.33 |
| R5258 KB | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 3.00 | 300 | 0.00 | 0.00 | 95.33 | 4.33 |
| R5258 KE | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 300 | 0.00 | 0.00 | 97.33 | 2.33 |
| R5258 KG | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 95.00 | 5.33 |
| R5258 KI | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 99.33 | 5.00 |
| R5258 KK | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 1.00 |
| R5258 KM | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 94.33 | 12.33 |
| R5258 KO | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 82.33 | 8.33 |
| R5258 KQ | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 4.00 | 3.00 | 300 | 0.00 | 0.00 | 94.67 | 6.00 |
| R5258 KS | 0.00 | 3.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 | 1.00 | 300 | 0.00 | 0.00 | 94.33 | 11.67 |
| R5258 KT | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.00 | 3.00 | 300 | 0.00 | 0.00 | 93.33 | 11.33 |
| R5258 KU | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 7.00 |
| R5258 KV | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 5.00 | 3.00 | 300 | 0.00 | 0.00 | 94.67 | 17.67 |
| R5258 KW | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 94.33 | 13.00 |
| R5258 KX | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 2.00 | 94.00 | 14.00 |
| R5258 KY | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 3.00 | 1.00 | 300 | 0.00 | 4.00 | 90.67 | 23.67 |
| R5258 KZ | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 9.00 | 0.00 | 300 | 0.00 | 0.00 | 93.33 | 21.00 |
| R5258 LA | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 92.33 | 5.00 |
| R5258 LC | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 93.00 | 4.67 |
| R5258 LE | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 94.33 | 7.33 |
| R5258 LI | 0.00 | 1.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 91.67 | 5.33 |
| R5258 LK | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 87.00 | 5.33 |
| R5258 LM | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 91.67 | 4.00 |
| R5258 LO | 0.00 | 0.00 | 0.00 | 0.00 | 6.00 | 0.00 | 1.00 | 0.00 | 2.00 | 1.00 | 300 | 0.00 | 0.00 | 94.00 | 7.67 |
| R5258 LP | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 1.00 | 2.00 | 300 | 0.00 | 0.00 | 86.33 | 5.00 |
| R5258 LQ | 0.00 | 1.00 | 0.00 | 0.00 | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 91.67 | 6.33 |
| R5258 LS | 0.00 | 1.00 | 0.00 | 0.00 | 8.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 95.67 | 2.67 |
| R5258 LU | 0.00 | 0.00 | 0.00 | 0.00 | 11.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 300 | 1.00 | 0.00 | 84.67 | 4.33 |
| R5258 LW | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 | 0.00 | 3.00 | 0.00 | 4.00 | 1.00 | 300 | 0.00 | 2.00 | 89.67 | 6.33 |
| R5258 LY | 0.00 | 1.00 | 0.00 | 0.00 | 5.00 | 0.00 | 2.00 | 0.00 | 5.00 | 0.00 | 300 | 1.00 | 0.00 | 90.33 | 5.67 |
| R5258 MA | 0.00 | 1.00 | 0.00 | 0.00 | 7.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 2.67 |
| R5258 MC | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 2.00 | 0.00 | 4.00 | 0.00 | 300 | 1.00 | 0.00 | 94.00 | 4.33 |
| R5258 ME | 0.00 | 1.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 1.67 |
| R5258 MG | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 2.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 0.00 | 92.67 | 6.00 |
| R5258 MI | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 6.00 |
| R5258 MK | 0.00 | 0.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 92.00 | 5.33 |
| R5258 MM | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 91.67 | 7.67 |
| R5171 IR | 1.00 | 0.00 | 0.00 | 0.00 | 21.00 | 0.00 | 2.00 | 0.00 | 0.00 | 2.00 | 300 | 0.00 | 1.00 | 73.33 | 17.00 |
| R5258 MO | 1.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 2.00 | 1.00 | 300 | 0.00 | 0.00 | 92.67 | 4.33 |
| R5258 MQ | 0.00 | 0.00 | 0.00 | 0.00 | 11.00 | 0.00 | 2.00 | 0.00 | 1.00 | 1.00 | 300 | 1.00 | 0.00 | 93.00 | 6.00 |
| R5258 MS | 0.00 | 1.00 | 0.00 | 0.00 | 5.00 | 0.00 | 3.00 | 0.00 | 4.00 | 1.00 | 300 | 0.00 | 0.00 | 91.67 | 4.00 |
| R5258 MU | 0.00 | 0.00 | 0.00 | 0.00 | 6.00 | 0.00 | 1.00 | 0.00 | 4.00 | 0.00 | 300 | 2.00 | 0.00 | 92.33 | 1.67 |
| R5258 MW | 0.00 | 0.00 | 0.00 | 0.00 | 17.00 | 0.00 | 5.00 | 0.00 | 2.00 | 1.00 | 300 | 0.00 | 0.00 | 88.67 | 3.67 |
| R5258 MY | 1.00 | 0.00 | 0.00 | 0.00 | 21.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 86.33 | 8.00 |
| R5171 IX | 0.00 | 1.00 | 0.00 | 0.00 | 43.00 | 1.00 | 4.00 | 0.00 | 0.00 | 0.00 | 300 | 2.00 | 0.00 | 70.67 | 2.00 |
| R5258 NA | 0.00 | 1.00 | 0.00 | 0.00 | 51.00 | 1.00 | 4.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 1.00 | 76.67 | 3.67 |
| R5258 NC | 0.00 | 2.00 | 0.00 | 0.00 | 35.00 | 1.00 | 1.00 | 0.00 | 0.00 | 3.00 | 300 | 5.00 | 4.00 | 75.67 | 2.67 |
| R5258 NE | 0.00 | 1.00 | 0.00 | 0.00 | 18.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 3.00 | 84.00 | 2.33 |
| R5258 NG | 1.00 | 0.00 | 0.00 | 0.00 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 1.00 | 1.00 | 96.33 | 2.00 |

| Sample | Depth(m) | Sacci/2 | *Pinus* | TPine | TCT | *Abies* | *Alnus* | *Artemisia* | *Carya* | ChenAm | S Cmp | LngCmp | Lig Cmp | *Corylus* | *Ephedra* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 NI | 75.35 | 61.00 | 214.00 | 275.00 | 9.00 | 3.00 | 0.00 | 5.00 | 0.00 | 1.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 NK | 75.55 | 63.00 | 211.00 | 274.00 | 14.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 NM | 75.75 | 30.00 | 236.00 | 266.00 | 20.00 | 1.00 | 0.00 | 5.00 | 0.00 | 0.00 | 3.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 NO | 75.95 | 60.00 | 212.00 | 272.00 | 17.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 NQ | 76.15 | 54.00 | 202.00 | 256.00 | 28.00 | 4.00 | 0.00 | 2.00 | 0.00 | 3.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 NR | 76.25 | 44.00 | 204.00 | 248.00 | 32.00 | 2.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 NS | 76.35 | 34.00 | 167.00 | 201.00 | 77.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 NT | 76.45 | 38.00 | 209.00 | 247.00 | 35.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 NU | 76.65 | 54.00 | 188.00 | 242.00 | 31.00 | 4.00 | 0.00 | 5.00 | 0.00 | 3.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 NW | 76.85 | 52.00 | 220.00 | 272.00 | 15.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 NY | 77.05 | 43.00 | 196.00 | 239.00 | 43.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OA | 77.25 | 38.00 | 190.00 | 228.00 | 57.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 OB | 77.35 | 57.00 | 198.00 | 255.00 | 37.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5258 OC | 77.45 | 51.00 | 185.00 | 236.00 | 58.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 OE | 77.65 | 42.00 | 159.00 | 201.00 | 84.00 | 2.00 | 0.00 | 4.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OG | 77.85 | 34.00 | 217.00 | 251.00 | 45.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OH | 77.95 | 55.00 | 193.00 | 248.00 | 34.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OK | 78.25 | 52.00 | 197.00 | 249.00 | 23.00 | 2.00 | 0.00 | 4.00 | 0.00 | 4.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OM | 78.50 | 45.00 | 157.00 | 202.00 | 86.00 | 3.00 | 0.00 | 1.00 | 0.00 | 1.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OO | 78.65 | 36.00 | 154.00 | 190.00 | 92.00 | 2.00 | 0.00 | 0.00 | 0.00 | 2.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OQ | 78.85 | 52.00 | 203.00 | 255.00 | 34.00 | 2.00 | 0.00 | 3.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OR | 78.95 | 46.00 | 215.00 | 261.00 | 30.00 | 6.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| R5258 OS | 79.05 | 42.00 | 192.00 | 234.00 | 52.00 | 5.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OU | 79.25 | 40.00 | 203.00 | 243.00 | 39.00 | 3.00 | 0.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 OW | 79.45 | 39.00 | 209.00 | 248.00 | 44.00 | 1.00 | 0.00 | 2.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 JR | 79.50 | 26.00 | 179.00 | 205.00 | 76.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 OY | 79.65 | 38.00 | 172.00 | 210.00 | 75.00 | 4.00 | 0.00 | 3.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 PA | 79.85 | 44.00 | 180.00 | 224.00 | 69.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 JT | 80.00 | 13.00 | 165.00 | 178.00 | 80.00 | 1.00 | 0.00 | 9.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 PE | 80.25 | 39.00 | 203.00 | 242.00 | 45.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 PG | 80.45 | 52.00 | 175.00 | 227.00 | 65.00 | 3.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 JV | 80.50 | 11.00 | 157.00 | 168.00 | 81.00 | 1.00 | 0.00 | 13.00 | 0.00 | 2.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5258 PI | 80.65 | 25.00 | 199.00 | 224.00 | 65.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5171 JW | 80.75 | 22.00 | 206.00 | 228.00 | 42.00 | 0.00 | 0.00 | 3.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| R5258 PK | 80.85 | 41.00 | 187.00 | 228.00 | 58.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 JX | 81.00 | 10.00 | 113.00 | 123.00 | 105.0 | 0.00 | 0.00 | 10.00 | 0.00 | 4.00 | 10.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5258 PM | 81.05 | 24.00 | 190.00 | 214.00 | 78.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5171 JY | 81.25 | 22.00 | 173.00 | 195.00 | 78.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 JZ | 81.50 | 15.00 | 141.00 | 156.00 | 112.0 | 0.00 | 0.00 | 8.00 | 0.00 | 1.00 | 4.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 KA | 81.75 | 25.00 | 200.00 | 225.00 | 47.00 | 1.00 | 0.00 | 6.00 | 0.00 | 3.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5171 KB | 82.00 | 24.00 | 219.00 | 243.00 | 36.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 |
| R5171 KC | 82.25 | 26.00 | 195.00 | 221.00 | 54.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 KD | 82.50 | 14.00 | 170.00 | 184.00 | 87.00 | 2.00 | 0.00 | 7.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5171 KE | 82.75 | 19.00 | 171.00 | 190.00 | 89.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 KF | 83.00 | 20.00 | 137.00 | 157.00 | 112.0 | 0.00 | 0.00 | 4.00 | 0.00 | 8.00 | 6.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 KG | 83.25 | 11.00 | 142.00 | 153.00 | 93.00 | 4.00 | 0.00 | 6.00 | 0.00 | 0.00 | 10.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 KH | 83.50 | 6.00 | 129.00 | 135.00 | 111.0 | 0.00 | 0.00 | 14.00 | 0.00 | 5.00 | 7.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| R5171 KI | 83.75 | 7.00 | 165.00 | 172.00 | 91.00 | 4.00 | 0.00 | 0.00 | 0.00 | 1.00 | 5.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| R5171 KJ | 84.00 | 14.00 | 151.00 | 165.00 | 97.00 | 1.00 | 0.00 | 9.00 | 0.00 | 3.00 | 6.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 KK | 84.25 | 2.00 | 181.00 | 183.00 | 87.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 3.00 | 1.00 | 0.00 | 1.00 |
| R5171 KL | 84.50 | 11.00 | 140.00 | 151.00 | 109.0 | 0.00 | 0.00 | 11.00 | 0.00 | 4.00 | 6.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 KM | 84.75 | 5.00 | 213.00 | 218.00 | 51.00 | 6.00 | 0.00 | 1.00 | 0.00 | 1.00 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| R5171 KN | 85.00 | 11.00 | 202.00 | 213.00 | 60.00 | 3.00 | 0.00 | 3.00 | 0.00 | 3.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| Sample | Poaceae | Larx/Ps | *Picea* | *Populus* | *Quercus* | *Salix* | Sarc | Sheph | T mert | UK/Othı | Sum | Cyper | Typ/Spç | %AP | %TCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R5258 NI | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 97.00 | 3.00 |
| R5258 NK | 0.00 | 0.00 | 0.00 | 0.00 | 7.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 300 | 1.00 | 2.00 | 98.33 | 4.67 |
| R5258 NM | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 300 | 1.00 | 5.00 | 96.67 | 6.67 |
| R5258 NO | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 | 2.00 | 1.00 | 0.00 | 300 | 4.00 | 1.00 | 98.00 | 5.67 |
| R5258 NQ | 0.00 | 3.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 300 | 1.00 | 1.00 | 97.67 | 9.33 |
| R5258 NR | 0.00 | 2.00 | 0.00 | 0.00 | 9.00 | 0.00 | 1.00 | 0.00 | 3.00 | 0.00 | 300 | 3.00 | 0.00 | 98.67 | 10.67 |
| R5258 NS | 1.00 | 2.00 | 0.00 | 0.00 | 10.00 | 0.00 | 2.00 | 2.00 | 3.00 | 0.00 | 300 | 5.00 | 1.00 | 98.33 | 25.67 |
| R5258 NT | 0.00 | 1.00 | 0.00 | 0.00 | 4.00 | 2.00 | 4.00 | 1.00 | 1.00 | 0.00 | 300 | 1.00 | 0.00 | 97.33 | 11.67 |
| R5258 NU | 0.00 | 2.00 | 0.00 | 0.00 | 9.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 300 | 4.00 | 0.00 | 96.00 | 10.33 |
| R5258 NW | 0.00 | 5.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 98.67 | 5.00 |
| R5258 NY | 0.00 | 4.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 300 | 3.00 | 0.00 | 97.67 | 14.33 |
| R5258 OA | 0.00 | 1.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 3.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 97.33 | 19.00 |
| R5258 OB | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 300 | 0.00 | 0.00 | 99.33 | 12.33 |
| R5258 OC | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 98.67 | 19.33 |
| R5258 OE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 96.67 | 28.00 |
| R5258 OG | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 99.67 | 15.00 |
| R5258 OH | 0.00 | 2.00 | 0.00 | 0.00 | 11.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 11.33 |
| R5258 OK | 0.00 | 1.00 | 0.00 | 0.00 | 9.00 | 1.00 | 0.00 | 0.00 | 5.00 | 1.00 | 300 | 0.00 | 0.00 | 96.67 | 7.67 |
| R5258 OM | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 2.00 | 0.00 | 300 | 0.00 | 1.00 | 98.00 | 28.67 |
| R5258 OO | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 97.33 | 30.67 |
| R5258 OQ | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 300 | 0.00 | 0.00 | 97.67 | 11.33 |
| R5258 OR | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 300 | 0.00 | 1.00 | 99.00 | 10.00 |
| R5258 OS | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 98.67 | 17.33 |
| R5258 OU | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 4.00 | 0.00 | 300 | 0.00 | 0.00 | 96.67 | 13.00 |
| R5258 OW | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 98.00 | 14.67 |
| R5171 JR | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.00 | 300 | 2.00 | 0.00 | 96.00 | 25.33 |
| R5258 OY | 0.00 | 3.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 25.00 |
| R5258 PA | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 23.00 |
| R5171 JT | 0.00 | 0.00 | 0.00 | 0.00 | 15.00 | 0.00 | 2.00 | 3.00 | 4.00 | 0.00 | 300 | 2.00 | 0.00 | 92.67 | 26.67 |
| R5258 PE | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 4.00 | 3.00 | 0.00 | 300 | 2.00 | 0.00 | 98.00 | 15.00 |
| R5258 PG | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 300 | 0.00 | 0.00 | 98.67 | 21.67 |
| R5171 JV | 0.00 | 0.00 | 0.00 | 0.00 | 26.00 | 0.00 | 0.00 | 2.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 93.00 | 27.00 |
| R5258 PI | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 4.00 | 0.00 | 300 | 0.00 | 0.00 | 98.00 | 21.67 |
| R5171 JW | 2.00 | 0.00 | 0.00 | 0.00 | 8.00 | 0.00 | 0.00 | 7.00 | 6.00 | 0.00 | 300 | 1.00 | 0.00 | 94.67 | 14.00 |
| R5258 PK | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 3.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 17.67 |
| R5171 JX | 0.00 | 2.00 | 0.00 | 0.00 | 33.00 | 0.00 | 0.00 | 6.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 89.33 | 35.00 |
| R5258 PM | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.00 | 300 | 0.00 | 0.00 | 99.00 | 26.00 |
| R5171 JY | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.00 | 9.00 | 0.00 | 300 | 1.00 | 0.00 | 94.33 | 26.00 |
| R5171 JZ | 0.00 | 2.00 | 0.00 | 0.00 | 12.00 | 0.00 | 0.00 | 1.00 | 2.00 | 0.00 | 300 | 1.00 | 0.00 | 94.67 | 37.33 |
| R5171 KA | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 6.00 | 6.00 | 0.00 | 300 | 0.00 | 0.00 | 94.00 | 15.67 |
| R5171 KB | 0.00 | 0.00 | 0.00 | 0.00 | 9.00 | 0.00 | 0.00 | 1.00 | 6.00 | 0.00 | 300 | 0.00 | 0.00 | 98.33 | 11.33 |
| R5171 KC | 1.00 | 3.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 2.00 | 9.00 | 0.00 | 300 | 0.00 | 0.00 | 97.67 | 18.00 |
| R5171 KD | 0.00 | 0.00 | 0.00 | 0.00 | 6.00 | 0.00 | 0.00 | 5.00 | 5.00 | 0.00 | 300 | 0.00 | 0.00 | 94.67 | 29.00 |
| R5171 KE | 0.00 | 2.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.00 | 7.00 | 4.00 | 0.00 | 300 | 0.00 | 0.00 | 97.00 | 29.67 |
| R5171 KF | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 3.00 | 7.00 | 0.00 | 300 | 0.00 | 0.00 | 93.00 | 37.33 |
| R5171 KG | 0.00 | 3.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 14.00 | 10.00 | 0.00 | 300 | 0.00 | 0.00 | 89.33 | 31.00 |
| R5171 KH | 0.00 | 3.00 | 0.00 | 0.00 | 16.00 | 0.00 | 2.00 | 3.00 | 2.00 | 0.00 | 300 | 0.00 | 0.00 | 89.00 | 37.00 |
| R5171 KI | 1.00 | 3.00 | 0.00 | 0.00 | 3.00 | 0.00 | 4.00 | 8.00 | 7.00 | 0.00 | 300 | 0.00 | 0.00 | 93.33 | 30.33 |
| R5171 KJ | 0.00 | 3.00 | 0.00 | 0.00 | 6.00 | 0.00 | 1.00 | 1.00 | 8.00 | 0.00 | 300 | 1.00 | 0.00 | 93.33 | 32.33 |
| R5171 KK | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 8.00 | 4.00 | 1.00 | 300 | 0.00 | 0.00 | 94.00 | 29.00 |
| R5171 KL | 1.00 | 2.00 | 0.00 | 0.00 | 8.00 | 0.00 | 4.00 | 1.00 | 3.00 | 0.00 | 300 | 4.00 | 0.00 | 91.00 | 36.33 |
| R5171 KM | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 7.00 | 3.00 | 0.00 | 300 | 1.00 | 0.00 | 93.67 | 17.00 |
| R5171 KN | 0.00 | 4.00 | 0.00 | 0.00 | 2.00 | 0.00 | 2.00 | 2.00 | 6.00 | 0.00 | 300 | 0.00 | 0.00 | 96.00 | 20.00 |

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## THERMOLUMINESCENCE AND OPTICAL DATING OF FINE SILT-SIZE FELDSPARS FROM MUD FROM OWENS LAKE, CALIFORNIA CORE OL-92

by

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## Introduction

The thermoluminescence (TL) signal from most polymineral fine-silt-size samples is dominated by the signal from the feldspar family. As well, the particular optical-dating method employed here (IR-OSL, see below) produces a signal from only the feldspars within a polymineral sample. Thus, this project essentially dates fine-silt-size feldspars.

Preliminary results are reported here for samples collected from the upper 80 m of the 323-m deep core OL-92 from Owens Lake. Based on prior experience (e.g., Berger, 1988, 1990, 1995; Berger and Easterbrook, 1993; Berger and Anderson, 1994) with dating lake sediments by TL, only fine-grained beds were targeted for sampling. These horizons are believed to be most likely to contain the maximum fraction of feldspar grains that have been exposed to daylight before burial. Uniform exposure of all grains to daylight is required to meet the principal assumption of zeroing of luminescence sediment dating. A good basic discussion of other assumptions and principles is provided by Aitken (1985).

A primary objective of this study is to provide the first numeric dating of horizons beyond the usual radiocarbon ($^{14}C$) limit of ~30 ka, and spanning the time interval of the last interglaciation, inferred to be represented in the upper ~80 m of Core OL-92 (Bischoff et al., 1997). For the purposes of this study, the newer optical dating (Huntley et al., 1985) technique is also employed, to attempt to attain a higher resolution than that which traditionally has been provided by the TL method. For this purpose, only the infrared-stimulation version (IR-OSL) (e.g., Berger, 1995; Ollerhead et al., 1994; Wintle, 1994) of optical dating is used, wherein ~880-nm light from light-emitting diodes produces a shorter-wavelength (ultraviolet to red) luminescence. The main advantage of IR-OSL over TL is that the former arises only from the feldspars within a polymineral sample, and the former is far more sensitive to zeroing than is TL, potentially facilitating greater precision in age determination.

## Sampling

Samples reported here (Table 1) were collected by the author at Menlo Park under dark-room conditions, transported to the Desert Research Institute (DRI), and analyses begun. Samples for luminescence work were collected in light-tight tins, after removal under dim amber light of a 3-mm thick zone from the face of the core split. Smaller samples for dosimetry measurements were collected subadjacent to the main samples, also in the form of cohesive chunks. Laboratory sample-preparation procedures have been outlined elsewhere (e.g., Berger, 1990; Wintle and Huntley, 1980).

## Analytical Techniques

A luminescence age $t = D_E/D_R$, where $D_E$ is the so-called "equivalent dose", or sometimes called the paleodose (units Gy, 1 Gy = 100 rads). This is a measure of the post-depositional absorbed ambient ionizing radiation dose, and is derived from luminescence measurements. The term $D_R$ is the effective dose rate (units Gy/ka), and is derived from measurements of U, Th, K and water concentration. For U and Th measurements, the thick-source-alpha-particle-counting (TSAC) technique (Huntley and Wintle, 1981) was used. K was determined by commercial atomic absorption spectrophotometry. Radioactive secular equilibrium is assumed, an assumption confirmed by previous age-check studies with such lake sediments (cited above).

For both TL and IR-OSL measurements, the deep-blue luminescence near the known 410-nm emission from most K-rich feldspars was detected (e.g., Krbetschek et al., 1998). To convert the sample's fossil light to an absorbed-energy equivalent, calibrated laboratory beta ($^{90}Sr$-$^{90}Y$) and alpha ($^{241}Am$) sources were used. Luminescence signal was recorded with an automated, high-capacity Daybreak Nuclear Model 1150 reader. Dose-response curves and other data were processed with author-produced software (e.g., Berger et al., 1987).

## Results and Comments

Dosimetry data are listed in Table 2. Ages and related luminescence data are listed in Table 3. Many more analyses (on some of these and additional samples) remain to be completed before confident interpretation can be made. Of immediate interest are the high Th and U concentrations in some samples (Table 2). At first this was thought to indicate samples having post-depositional enrichments, but a comparison of the ages for samples 22 and 31 and for samples 35 and 37 (Table 3) suggest that these relatively high U and/or Th values do not necessarily manifest such an open-system (hence disequilibrium) behavior.

A second prominent feature of these results is the occurrence of an age reversal for samples 31 and 35. Interpretation of and speculation about these results must await completion the full data set. For example, it is possible that significant age underestimation manifests the presence of malign (anomalous-fading luminescence) plagioclase feldspars. However, it is noteworthy that the IR-OSL ages for the three youngest samples and the TL age for sample 37 all fall closely on the inferred age-depth curve (Fig. 1) of Bischoff et al. (1997).

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**TABLE 1.** Samples from Core OL-92

| Sample | Slug Top (m) | Core/Drive/Slug/Depth (cm) | Total Depth (m) | Texture |
|---|---|---|---|---|
| OWN97-1 | 5.49 | 92-1/6/A/30.0-34.0 | 5.81 | silty mud |
| " -3 | 9.45 | " /8/B/68.5-72.5 | 10.16 | green clay |
| " -5 | 20.19 | " /12/A/131.5-135.5 | 21.51 | silty mud |
| " -22 | 64.14 | 92-2/2/A/123.0-127.0 | 65.39 | laminated silty clay |
| " -31 | 74.42 | " /6/A/16.0-20.0 | 74.60 | silty mud |
| " -37 | 75.96 | " /6/B/31.0-35.0 | 76.29 | silty mud |
| " -35 | 79.60 | " /8/A/115.5-119.5 | 80.78 | green clay |

**Table 2.** Dosimetry Data For Core OL-92

| Sample | Water[a] (±0.05) | $K_2O$ wt.% (±0.05) | $C_t$[b] $ks^{-1} \cdot cm^{-2}$ | $C_{Th}$[b] $ks^{-1} \cdot cm^{-2}$ | Th ppm | U ppm | b value[c] $pGy \cdot m^2$ | Cosmic[d] Gy/ka (±0.02) | Dose rate[e] Gy/ka |
|---|---|---|---|---|---|---|---|---|---|
| OWN97-1 | 1.62 | 2.42 | 0.9436±0.0087 | 0.294±0.025 | 7.89±0.67 | 5.08±0.21 | 0.615±0.067 | 0.10 | 1.853±0.068 |
| OWN97-3 | 0.84 | 3.99 | 1.306±0.010 | 0.519±0.034 | 13.94±0.91 | 6.15±0.28 | 0.600±0.078 | 0.09 | 3.73±0.13 |
| OWN97-5 | 1.97 | 1.75 | 0.9101±0.0088 | 0.289±0.025 | 7.77±0.67 | 4.85±0.21 | 0.60±0.10 | 0.08 | 1.323±0.046 |
| OWN97-22 | 2.09 | 2.15 | 2.464±0.019 | 0.320±0.053 | 8.6±1.4 | 16.75±0.44 | 1.10±0.15 | 0.04 | 3.00±0.15 |
| OWN97-31 | 0.89 | 2.18 | 2.315±0.021 | 0.443±0.064 | 11.9±1.7 | 14.62±0.53 | 0.90±0.16 | 0.04 | 4.61±0.25 |
| OWN97-35 | 0.55 | 3.73 | 1.685±0.019 | 0.655±0.063 | 17.6±1.7 | 8.05±0.51 | 1.0±0.2 | 0.02 | 5.45±0.32 |
| OWN97-37 | 0.53 | 3.47 | 1.558±0.018 | 0.706±0.062 | 19.0±1.7 | 6.66±0.51 | 1.0±0.2 | 0.02 | 5.13±0.30 |

[a] Measured saturation value for ratio of weight of water/weight of dry sample. Uncertainties here and elsewhere are $\pm 1\sigma$.

[b] Total and thorium count rates from finely powdered samples for thick-source-alpha-particle-counting (TSAC) method [Huntley and Wintle, 1981]. $C_u = C_t - C_{Th}$.

[c] Alpha effectiveness factor [Huntley et al., 1988; Berger, 1988].

[d] Estimated from the data of Prescott and Hutton [1988].

[e] Calculated with the conversion factors given by Berger [1988] and includes the cosmic ray component.

**TABLE 3.** TL and IR-OSL Data and Ages for Core OL-92[a]

| Sample | Mode | Preheat[b] | Bleach[c] | $D_E$[d] (Gy) | Temp./Time[e] | Age (ka) | Depth (m) |
|---|---|---|---|---|---|---|---|
| OWN97-1 | TL | 120°C/3d | PB/560(3d) | 12.8±1.8 | 220-310°C | 6.9±1.0 | 5.81 |
| | IRSL | 130°C/3d | TB/780(4h) | 18.5±2.5 | 1-35s | | |
| | IRSL | 150°C/3d | TB/780(4h) | 16.3±2.2 | 1-15s | | |
| | | | Average IRSL $D_E$ = | 17.4±2.0 | | 9.4±1.3 | |
| OWN97-3 | TL | 130°C/3d | TB/400(3d) | 53.1±2.0 | 200-280°C | 14.24±0.73 | 10.16 |
| | IRSL | 130°C/3d | TB/780(4h) | 58.2±3.8 | 1-95s | | |
| | IRSL | 150°C/3d | TB/780(4h) | 57.9±3.4 | 1-95s | | |
| | | | Average IRSL $D_E$ = | 58.0±3.0 | | 15.6±1.2 | |
| OWN97-5 | IRSL | 130°C/3d | TB/780(4h) | 36.7±2.0 | 1-65s | | 21.51 |
| | IRSL | 150°C/3d | TB/780(4h) | 32.9±2.1 | 1-30s | | |
| | | | Average IRSL $D_E$ = | 34.8±2.0 | | 26.3±1.8 | |
| OWN97-22 | IRSL | 140°C/3d | TB/FSL(3h) | 243±23 | 1-65s | | 65.39 |
| | IRSL | 160°C/3d | TB/FSL(3h) | 280±31 | 1-35s | | |
| | | | Average IRSL $D_E$ = | 260±20 | | 87.2±8.1 | |
| OWN97-31 | TL | 145°C/3d | TB/400(3d) | 318±27 | 230-380°C | 69.0±7.0 | 74.60 |
| OWN97-37 | TL | 150°C/3d | TB/400(3d) | 628±82[f] | 330-400°C | 122±17 | 76.29 |
| OWN97-35 | TL | 150°C/3d | TB/400(3d) | 319±40 | 240-380°C | 58.5±8.1 | 80.78 |

[a] For all TL runs, the heating rate was 5C°/sec. The polymineral 4-11 μm size fraction was used for all TL measurements. Both TL and IRSL were detected at the 420±20 nm spectral region (bandpass 390-470 nm at 1% cut).

[b] The chosen pre-readout annealing (see Berger and Anderson, 1994; Berger, 1994; Ollerhead et al., 1994, for rationale).

[c] The value in parentheses specifies the optical bleaching time. PB = "partial-bleach" protocol; TB = "total-bleach" method. Different optical-filter bandpasses were used for bleaching, as follows: 560 = 560-800 nm at 10% cut; 400 = 390-740 nm at 5% cut; 780 = >780 nm solar spectrum passed; FSL = full solar spectrum.

[d] Weighted mean equivalent dose plus average error over temperature or time interval in next column. A weighted-saturating-exponential regression model (Berger et al., 1987) was employed for all samples.

[e] The temperature (TL) or time (IRSL) interval for which $D_E$ is calculated.

[f] The $D_E$ values show a detectable monotonic rise with readout temperature, indicating that a higher annealing temperature should have been used. The estimated $D_E$ average may underestimate somewhat the correct value.

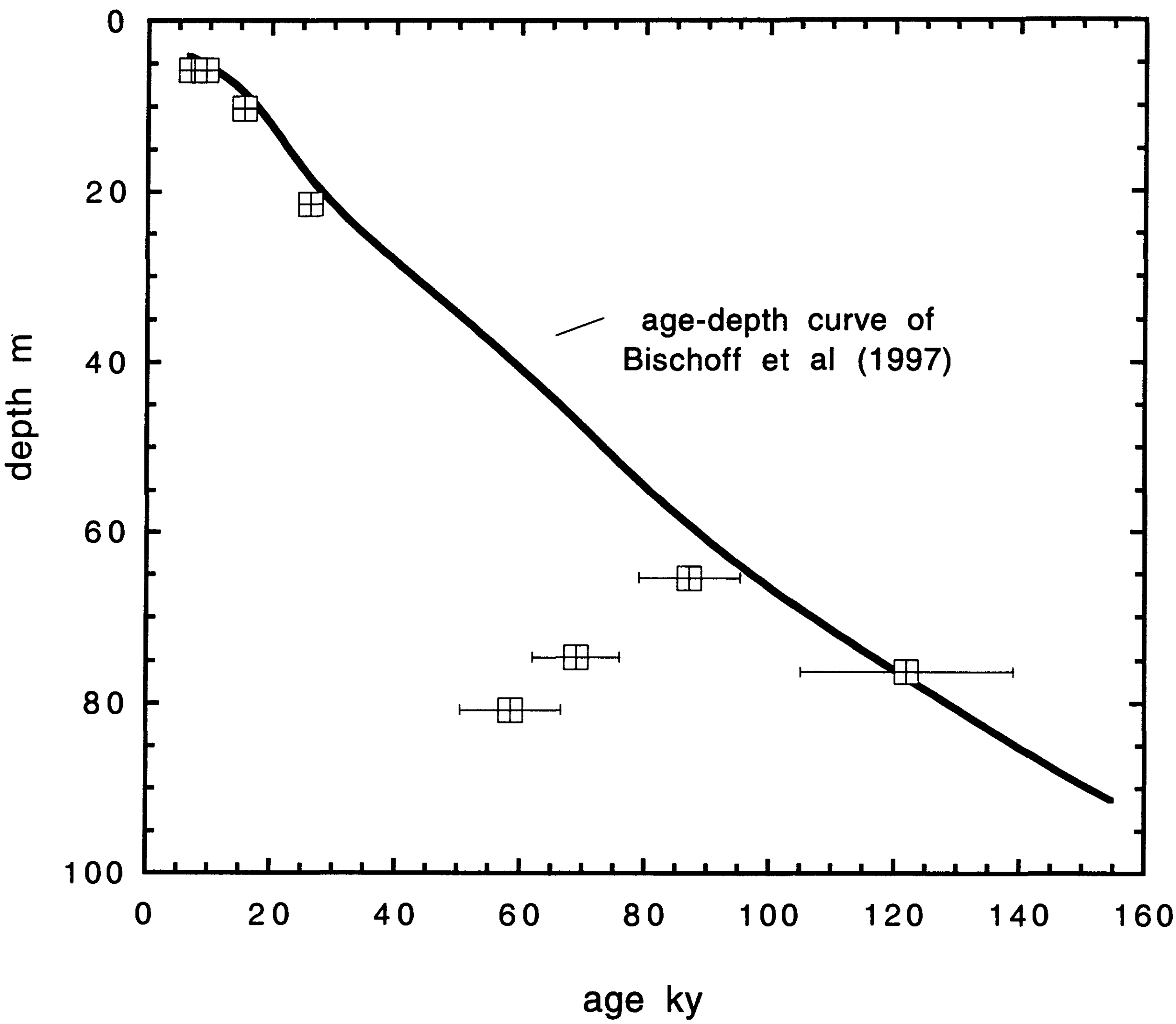


Fig. 1
TL and IR-OSL dates for core OL-92

# U.S. DEPARTMENT OF THE INTERIOR
# U.S. GEOLOGICAL SURVEY

## A TEST OF URANIUM SERIES DATING OF OSTRACODE SHELLS FROM THE LAST INTERGLACIATION AT OWENS LAKE, CALIFORNIA, CORE OL-92

by

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## INTRODUCTION

A major deficiency in most paleoclimatic studies is the lack of good time calibration. Good dates are extremely rare for the time gap between the radiocarbon limit at about 35 kyrs and the Brunhes-Matuyama magnetic reversal at 780 kyrs. This lack makes regional or world-wide correlation of short-lived climatic events from record to record extremely tenuous.

Such is the case at Owens Lake, California, where sediments of the time gap in question show a continuous record with clearly defined short and long-term climate cycling. The time-depth scale for Owens Lake core OL-92 (Bischoff *et al.*, 1997b) is based on radiocarbon control for the uppermost 24 m (to 30,000 yrs), the Bishop ash bed at 304 m (at 759,000 yrs) and the inference of a constant mass-accumulation rate of 51.4 $g/cm^2/1000$ yr. The justification for using a constant mass-accumulation rate for the extrapolation is because the average mass-accumulation rate calculated for the radiocarbon-dated segment, using bulk densities derived from pore-water measurements, was found to be essentially the same as for the entire core down to the Bishop Ash, suggesting that an approximately constant accumulation rate prevailed throughout the last 759,000 yrs. The resulting time-depth curve is reasonably robust back to about 50,000 yrs, but is essentially extrapolated beyond. The position of Termination II (MIS 5/6 boundary) based on the abrupt change in TIC, for example, appears at about 118,000 yrs (Bischoff *et al.*, 1997a) instead of about 128,000 yrs predicted from orbital tuning (Martinson *et al.*, 1987), and about 140,000 yrs B.P. as seen in the nearby Devils Hole record (Winograd *et al.*, 1992). Thus, the time-depth model may be as much as 10 percent in error at around 100,000 yrs, and is subject to modification as future progress is made on absolute dating of the core.

The time interval in question spans the range of U-series dating, which offers the possibility of providing chronological control back to 350 kyrs. Saline phases yielded excellent results on sediments from a drill core taken in downstream Searles Lake (Bischoff, et al. 1985). We had hoped to apply U-series dating to similar material in core Ol-92, but saline minerals are lacking. Therefore, we attempted to apply the technique to ostracode shells. Ostracode shells are found throughout lacustrine sediments and present a heretofore untested material for U-series dating. Ostracodes are microscopic (adults about 0.2 to 3 mm in length) crustaceans having a shell (carapace composed of two valves) made of calcite. Like other arthropods they grow by molting and so produce a number of juvenile (instars) shells in addition to the adult shells. They commonly live in all but highly ephemeral surface water bodies and in oxygenated ground water. They are predominately benthic organisms, but many species can swim from spot to spot on the substrate and a few can be fully nektonic. Their shells are readily preserved as fossils in most sediments deposited in circumneutral to alkaline water bodies.

Ostracode shells have not been tested before because of their small size, their dispersal, and low concentration in a clay matrix presents difficulty in isolating a sufficient amount for analysis (50 mg). The requirement for successful dating is that the shells take up dissolved uranium (but not thorium) from lake water as they are grow. Uranium is generally soluble in natural waters, whereas thorium is insoluble. After death and burial, the shells must be closed to further uptake or loss or uranium. The age is determined by the build-up of $^{230}Th$ which derives from the decay of $^{238}U$ and $^{234}U$. We report here on the separation technique which yields sufficient sample for analysis, and on the results of uranium-series analyses by thermal ionization mass spectrometry (TIMS) for 6 samples from core OL-92. The results are generally encouraging and yield ages in the expected range, but indicate that the shells take up some initial thorium rendering ages somewhat too old.

## METHODS

*Sampling and separation/purification*

We chose 6 ostracode-rich horizons from the interval 30 to 90 m based on Carter's (1997) reports on ostracode abundance in core OL-92. Samples of about 50 grams dry weight were taken at depths of 36.7 m, 40.6 m, 52.5 m, 55.7 m, 57.9 m, and 63.7 m, representing an approximate age range of 50 to 100 kyrs before present. Samples were frozen overnight, thawed, and suspended in 300 mls of hot distilled water to which 10 grams of sodium bicarbonate were added. After cooling, about 60 grams of Calgon (sodium hexametaphospate, sodium carbonate, and soap) were stirred into the solution, and the suspension was allowed to sit for 24 hours. The suspension was then washed through a 100-mesh sieve, the fine fraction discarded and the coarser residue was retained and dried at room temperature. This residue, the sand fraction, contained the ostracode shells along with detrital sand grains. Ostracode shells were then separated from the sand by a combination of mica table, heavy liquids, and magnetic separator. The sample was first placed on a mica table, a vibrating inclined plate used to isolate mica grains. Equant-shaped sand grains like quartz and feldspar tend to roll directly down the vibrating plate whereas platy minerals like micas and ostracode shells traverse a diagonal path. Thus, micas and ostracode shells were caught in a metal cup hung just below the exit point of the platy minerals. Samples were further cleaned using a heavy liquid. Samples were place in tubes filled with varying concentrations of methyliodine and acetone to produce a density gradient. The ostracode shells and contaminants sank to different levels in the column depending on their density. Shells were collected from the solution by filtering and the methyliodine was removed by washing with acetone. And finally, samples were passed through a Frantz magnetic-separator (vibrating inclined plane passing through a magnetic field). Microscopic examination indicated the samples at this stage were essentially 100% ostracode shells. The procedure was repeated once again for splits of samples at 40.6 m, and 55.7 m to determine if increased purification yielded cleaner isotopic results.

*TIMS analysis*

Samples for thermal ionization mass spectrometry (TIMS) were fired at 600° to remove the organic matrix of the shells, and then dissolved in 7N $HNO_3$ and spiked with $^{236}U$ and $^{229}Th$ and passed through anion exchange columns equilibrated with 7n $HNO_3$. Th was stripped from the column using 6N HCl, and U was then stripped using Teflon-distilled $H_2O$. 10µl of 0.15N $H_3PO_4$ was added to the Th fraction. Both Th and U fractions were evaporated to dryness, converted to nitrate form using 8N $HNO_3$, and loaded onto the sample side of a double-Re filament for analysis on a Finnigan MAT 261 solid-source mass spectrometer configured with adjustable faraday collectors and an ion counter. U isotopes were measured using a peak-hopping mode, using the sequence $^{234}U$-$^{238}U$, $^{235}U$, $^{236}U$-$^{238}U$. Ion currents on the $^{238}U$ beam were generally greater than $10^{-12}$ a. Th isotopes were measured using a peak-hopping mode on the ion counter. Count rates for the $^{229}Th$ and $^{230}Th$ peaks were generally greater than 100 cps, and occasionally reached 500 cps which represents excellent ionization efficiency for the 1 to 5 pg Th loads measured here.

Dates were calculated from the resulting isotopic abundances and activities using age equations and half-lives given in Bischoff *et al.* (1995).

## RESULTS

Isotopic analyses (Table 1) show that the ostracode shells contain very high levels of uranium, ranging from 5 to 58 ppm. Thorium ratios ($^{230}Th/^{232}Th$) range from 3.3 to 5.5, and derived ages range from 75 to 155 kyrs, which are within the expected age range of the age-depth model. Analyses of the replicate samples at 40.6 m and 55.7 m for which the purification process was repeated show no significant improvement and indicate no significant extraneous contamination. Ages are shown plotted against depth in Fig. 1.

## Discussion

The nominal dates of 4 of the six samples (36.7 m, 40.6 m, 55.7 m, and 57.9 m, Fig. 1) plot in stratigraphic order on a trend close to that predicted for a SPECMAP predicted age for Termination II. Samples at 52.5 m and 63.7 m, however, plot about 50 kyrs too old for either trend. Although the systematic relations of the 4 samples might suggest the SPECMAP trend is correct, the thorium ratios suggest these ages are somewhat too old by having initial $^{230}Th$.

The index of detrital contamination is given by the $^{230}Th/^{232}Th$ ratio (thorium ratio). Ratios less than about 20 (Bischoff and Fitzpatrick, 1991) generally indicate the presence of excessive extraneous Th, normally harbored by detrital clays that are mechanically inseparable from the authigenic phase. The ostracode shells have thorium rations of 3.3 to 5.5, indicating the presence of significant non-radiogenic thorium. Such thorium generally renders the calculated age somewhat too old. Because the re-purified samples showed no improvement in the thorium ratio, the extraneous thorium must have been accumulated into the shell while the organism was alive. In marine and lake waters, thorium is concentrated on suspended particles, such as fecal pellets. It is likely, therefore, that the ostracodes ingested thorium while grazing on such particles, and incorporated it into their shells or into the organic matrix of the shells. Thus, at death the shells likely had an initial content of $^{230}Th$, and therefore, an initial "finite" $^{230}Th$ age. This initial age depends on the initial $^{230}Th/^{232}Th$, a value which cannot be unequivocally estimated. Detritus from a wide variety of sources including eolian dust, soils, and alluvial sediments have thorium ratios ranging from 0.25 to 1.25 (Szabo and Rosholt, 1982). Using the extremes of this range shows the effects of this initial thorium on the calculated age. The sample at 36.7 m has a nominal age of 78.5 kyrs, and a thorium ratio of 4.0. An initial ratio 0.25 results in a corrected age of 71.7 kyrs, closer to the model age of 53 kyr. An initial ratio of 1.5, however, results in a corrected age of 42.7 kyrs, too young to be reasonable. Thus, it is not possible to make a general correction for initial thorium.

The results, therefore, although encouraging, are not sufficiently robust to yield high-resolution calibration of OL-92 for MISD 5. They do, however, give ages in the expected range, and in approximate stratigraphic order. Therefore, ostracode dating may be useful and worth the effort to provide approximate ages for packages of outcroping lacustrine sediments, for which no other age indicators are available.

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Table 1
U-series analyses and derived nominal ages of ostracod shells from Owens Lake core OL-92*

| Sample depth (m) | U (ppm) | $^{234}U/^{238}U$ | $^{230}Th/^{232}Th$ | $^{230}Th/^{234}Th$ | U date (ka) |
|---|---|---|---|---|---|
| 36.7 | 29.7±0.7 | 1.26±0.06 | 4.0 | 0.53±0.03 | 78.5±6.2 |
| 40.6 | 53.8±0.6 | 1.21±0.02 | 4.6 | 0.51±0.02 | 75.5±3.6 |
| " | 57.8±0.7 | 1.21±0.02 | 4.1 | 0.48±0.02 | 69.5±3.3 |
| 52.5 | 20.3±0.2 | 1.24±0.02 | 3.2 | 0.79±0.03 | 155.1±10.8 |
| 55.7 | 24.2±0.3 | 1.21±0.02 | 5.3 | 0.62±0.02 | 100.3±5.4 |
| " | 26.0±0.3 | 1.23±0.02 | 5.5 | 0.59±0.02 | 92.3±5.0 |
| 57.9 | 7.9±0.1 | 1.21±0.02 | 3.3 | 0.63±0.02 | 104.6±5.8 |
| 63.7 | 5.0±0.1 | 1.20±0.02 | 3.7 | 0.79±0.03 | 155.2±11.1 |

* Isotope ratios are in terms of activities (dpm/g); ditto marks (") refer to replicate analyses on aliquots purified a second time.

Figure 1
Depth plot of U-series ages of ostracode shells from Owens Lake core OL-92.