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Stratigraphy, Sedimentology, Paleontology, and Paleomagnetism of Pliocene-Early Pleistocene Lacustrine Deposits in Two Cores from Western Utah

by

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INTRODUCTION

We are investigating the paleoclimatic history of western Utah as part of the USGS Global Change and Climate History Program studies of long-term climatic changes in the western United States. Our initial objective is to document the environmental conditions during the mid-Pliocene period of warmer-than-modern global climates (the focus of the USGS Pliocene Research, Interpretation, and Synoptic Mapping [PRISM] project). We also seek to determine how and when these conditions gave way to the late Quaternary pattern of climatic variations (in which short periods of very moist climates have been separated by long periods of arid conditions). This is a collaborative project involving specialists from the USGS, Kansas State University, and the University of California-Davis in paleontology (Thompson, Buchner, Forester, Bradbury), stratigraphy and sedimentology (Oviatt, Kelsey, Bracht), and paleomagnetism and environmental magnetism (Roberts). The data presented herein represent our preliminary findings of the analyses of two cores of Pliocene and early Pleistocene sediments from the eastern Great Basin.

MATERIALS AND METHODS

Localities and Setting.

Two cores were collected from Millard County in western Utah in the summer of 1993 (Fig. 1). The Black Rock core site is on top of an early Pleistocene basalt flow east of the abandoned rail siding at Black Rock, Utah (NW 1/4, Section 23, T24S, R10W; 4930 ft [1503 m] elevation; 38°42'55"N, 112°56'59"W). The Pit of Death core site lies on the northwest margin of the presently dry Sevier Lake Basin (NE 1/4, Section 32, T20S, T12W; 4535 ft [1383 m] elevation; 39°02'02"N, 113°13'00"W). The Bishop Ash (~759 ka) is present within the surficial sediments at both sites, and as discussed below, both sediment cores provide continuous coverage back to the middle Pliocene. The regional climate today is arid, with hot dry summers and a dominance of winter precipitation. Although no weather stations occur near the core sites, shadscale-dominated vegetation, such as that at the core sites, typically grows in climates with ~3.1 to ~5.7 inches (79 to 145 mm) of mean annual precipitation (Billings, 1949). The mean annual precipitation at the Black Rock site probably approaches the higher figure, whereas that at the more xeric Pit of Death site probably falls closer to the lower figure.

Dry steppe vegetation is present today at the Black Rock Site, with shadscale (*Atriplex confertifolia*) and greasewood (*Sarcobatus vermiculatus*) being the dominant

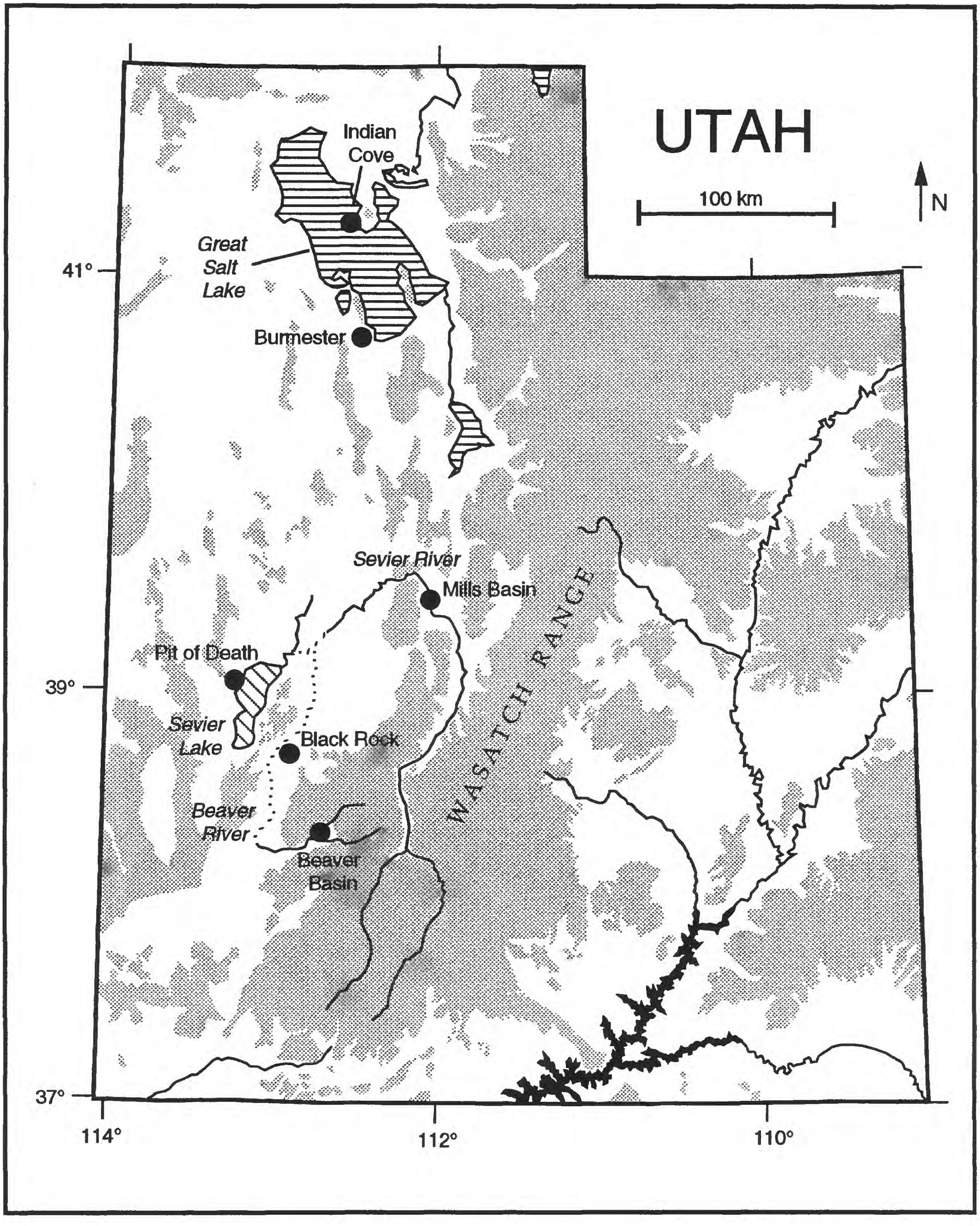

Figure 1. Locations of sites discussed in text. The shaded areas represent elevations above 6000 ft (1829 m). Woodland and forest vegetation generally occurs above this elevation, steppe and desert below.

plants, with snakeweed, Indian ricegrass, and horsebrush (*Gutierrezia sarothrae, Oryzopsis hymenoides*, and *Tetradymia* sp.) occurring as common elements. Cheatgrass, rabbitbrush, and mormon-tea (*Bromus tectorum*, *Chrysothamnus nauseosus*, and *Ephedra nevadensis*) are present but less abundant, and sheepbane and tumbleweed (*Halogeton* and *Salsola*) dominate disturbed areas around the site. Big sagebrush (*Artemisia tridentata*) occurs as a very rare plant within approximately a kilometer of the site; it becomes more abundant on sites several kilometers to the east at slightly higher elevations. The vegetation at the Pit of Death site is similar to that at Black Rock, but is more sparse, reflecting more arid conditions. Mormon-tea is dominant at the Pit of Death, with shadscale, horsebrush, greasewood, and other Chenopodiaceae present as common elements in the vegetation.

The regional vegetation of the eastern Great Basin is characterized by a general elevational progression of zones following the gradient from hot-dry environments on the lowest valley floors to cool-moist environments at high elevations. Sparse shadscale and greasewood steppe associations (such as that at the Pit of Death site) occur in the hottest and driest locales, giving way to more dense and slightly more diverse steppe communities on the upper bajadas. Sagebrush intermingles with these xeric elements on the upper bajadas and lower mountain slopes, and then continues as an understory element in higher elevation woodland and forest associations. Utah juniper (*Juniperus osteosperma)* is generally the lowest occurring tree in the region, and it forms pygmy-conifer woodlands with pinyon pine (*Pinus monophylla*) on the lower to middle mountain slopes. Ponderosa pine (*Pinus ponderosa*), fir/Douglas fir (*Abies/Pseudotsuga*), and aspen (*Populus tremuloides*) forest assemblages occur with increasing elevation. The arid mountain ranges of westernmost Utah generally support limber pine / bristlecone (*Pinus flexilis / P. longaeva*) subalpine forests at high elevations, whereas the more massive Wasatch Range captures more precipitation and hosts spruce (*Picea*) forests at high elevations. The Wasatch Range also hosts oak- (*Quercus*-) dominated mountain brush communities that are not present in the more arid Great Basin ranges. Regional studies of the modern pollen rain (e.g. Davis, 1984; Thompson, 1992) indicate that the major vegetation assemblages of the Great Basin are reflected in the pollen rain.

Methods

Core collection and curation. The Black Rock and Pit of Death sediment cores were drilled in July, August, and September of 1993 with a Portadrill 524-3A rotary drilling rig that took a 3" (7.62 cm) diameter core. The cores are archived at the USGS Core Repository on the Denver Federal Center. The coring equipment and original records are in English units, and to maintain continuity with those records, core depths are reported here in English units.

Stratigraphy and sedimentology. Core sediments were logged in the field, and the stratigraphy and sedimentology was studied in greater detail in the laboratory by Oviatt and Kelsey (Black Rock) and Oviatt and Bracht (Pit of Death). These researchers have analyzed samples for carbonate, sand, and mud contents at approximately one-foot (30 cm) intervals throughout both cores. X-ray analysis is on-going for carbonate minerals from representative samples from both cores.

Paleomagnetism. Oriented paleomagnetic samples were taken by carving pedestals into the cores and slipping plastic boxes (2.5 x 2.5 x 1.5 cm) over the pedestals. In general, samples were collected at 1 m (3.3 ft) intervals throughout the length of both cores. For paleomagnetic studies, 307 and 139 samples were analyzed from the Black Rock and Pit of Death cores respectively. The samples were stepwise demagnetized by either alternating field (AF) or thermal methods. AF demagnetization was generally carried out at successive peak fields of 0, 10, 20, 25, 40, and 60 mT, and in some cases, additional intermediate steps were included at peak fields of 5, 15, 30, and 50 mT. Thermal demagnetization was carried out at successive steps of 20, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, and 600°C. Magnetic susceptibility was measured at each thermal demagnetization level to monitor for thermal alteration. Remanence measurements were made on a 2G Enterprises cryogenic magnetometer. AF demagnetization was carried out with a Schonstedt AF demagnetizer and thermal demagnetization was carried out with a Schonstedt thermal demagnetizing unit. Magnetic susceptibility was measured with a Bartington Instruments magnetic susceptibility meter.

Characteristic remanence directions were determined from stably magnetized samples by linear regression fits to the demagnetization data. Three types of demagnetization behavior are evident and are designated as types A, B, and C. Type A behavior is displayed by demagnetization data that decay to the origin of vector component plots with little deviation from linearity (Figure 2a, d). Type B behavior is displayed by samples that yield more scattered demagnetization data, nevertheless, the direction of magnetization can be unambiguously determined (Figure 2b, e). Type C behavior is displayed by samples for which no stable direction of remanence, or even an indication of polarity, can be determined (Figure 2c, f). In general, the data quality from the Pit of Death core are of substantially higher quality than those from the Black Rock core. Of the 139 samples analyzed from the Pit of Death core, 81%, 16%, and 3% of the samples displayed behavior of types A, B, and C, respectively. Of the 307 samples analyzed from the Black Rock core, 17%, 54%, and 29% of the samples displayed behavior of types A, B, and C,

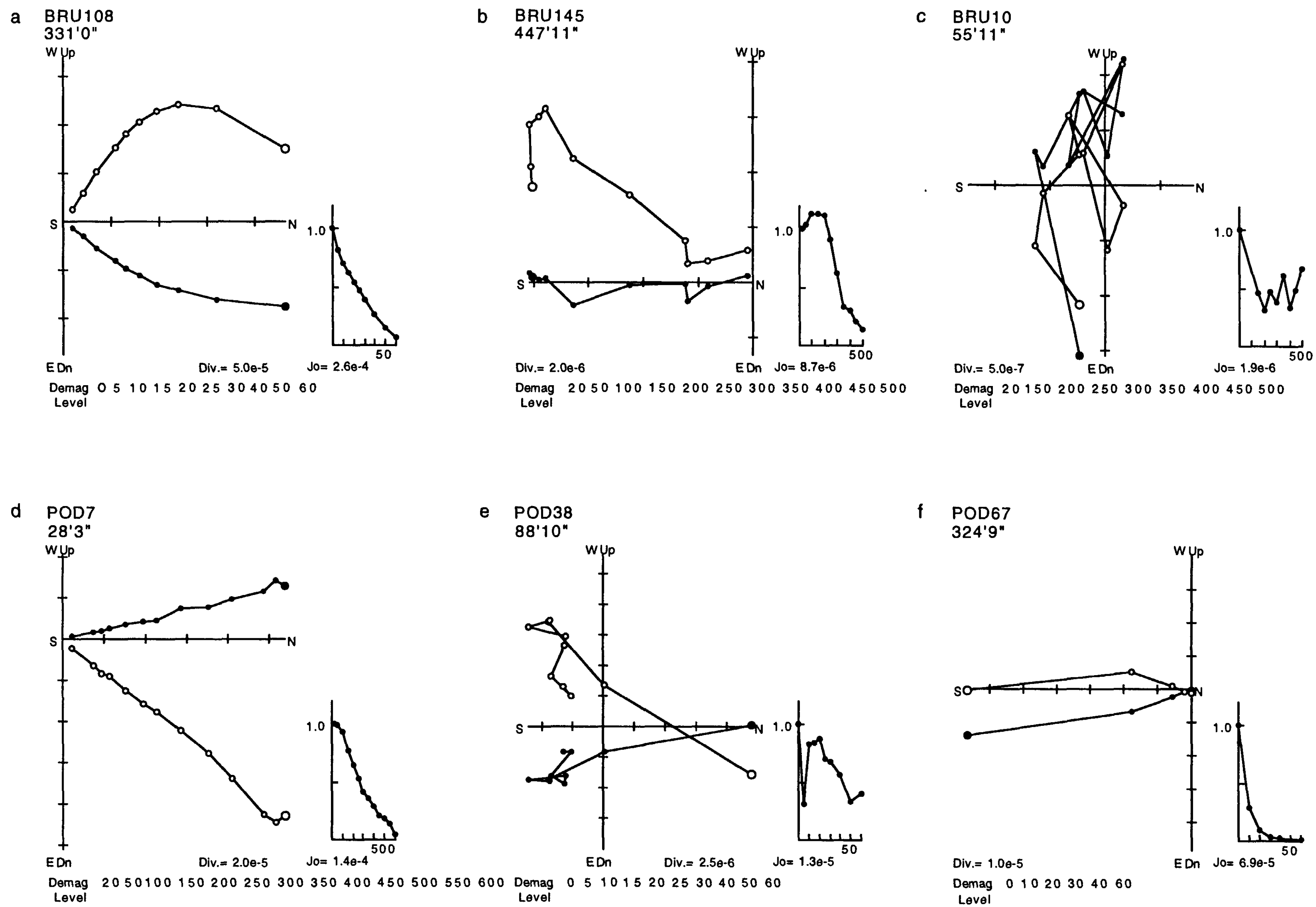

Figure 2. Vector component diagrams illustrating representative demagnetization behavior for types A (a and d), B (b and e), and C (c and f), as described in the text. Sample names and depths of samples in core are shown for each sample. Open (closed) symbols represent projections onto the vertical (horizontal) plane. Decay of remanence intensity with stepwise demagnetization is shown on the lower right hand side of each plot. Samples measured at 0 to 60 mT levels were demagnetized by AF methods and samples measured at 0 to 500 or 600°C were demagnetized by thermal methods.

respectively. The Black Rock and Pit of Death cores were azimuthally unoriented. The paleomagnetic polarity was therefore determined solely from inclination data. All ages of paleomagnetic datums follow those of Cande and Kent (1992).

Magnetic susceptibility. The magnetic susceptibility of the Black Rock and Pit of Death core sediments was measured by analyzing selected depth intervals with a Sapphire whole-core pass-through susceptometer. For susceptibility studies, 766 levels were measured from the Black Rock core and 411 from the Pit of Death core.

Palynology. Sediment samples from the Black Rock and Pit of Death cores were processed with chemical reagents (HCl, HF, heavy liquids) to remove unwanted mineral materials. The sample residues were analyzed under 400X to 1000X magnification, and a minimum of 300 terrestrial pollen grains were counted from each sample (except for samples above ~150 ft in the Black Rock core, where pollen concentrations were so low that only 200 grain counts were possible). Of the 159 samples processed from the Black Rock site, 142 contained sufficient pollen for analysis. Ten samples were processed from the Pit of Death core, and all were barren of pollen.

Plant macrofossil analysis. Seeds and leaf fragments and *Ruppia* and other plants are present throughout most of the Black Rock core. The occurrences of these plant macrofossils has been recorded during the sediment descriptions and by examination of slides prepared for ostracode analysis (see below).

Ostracode Analysis. Sediment samples for ostracode analysis were split into two fractions, a larger fraction for isotopic analysis of ostracode shells (~15 g) and a smaller fraction for ostracode counts (~5 g). The samples were subjected to a freeze/thaw process to disaggregate clay particles and then washed with hot water over a 100 μm mesh screen. Approximately 920 samples have been prepared from the Black Rock core, and 10 from the Pit of Death Core.

Diatom Analysis. Preliminary analysis of diatoms from the two cores were conducted using water mounts of unprocessed sediment smears. Twenty-four samples have been analyzed from the Black Rock core and 10 from the Pit of Death core.

BLACK ROCK CORE RECORD

Approximately 8 ft (2.4 m) of tan silt overlies 17 ft (5.2 m) of basalt at the Black Rock site. The Bishop Ash is present in this silt unit at a locale several hundred meters to the south of the core site. The coring process did not recover any of the silt or basalt (although some of the silt was recovered in Shelby tubes), nor was it possible to recover

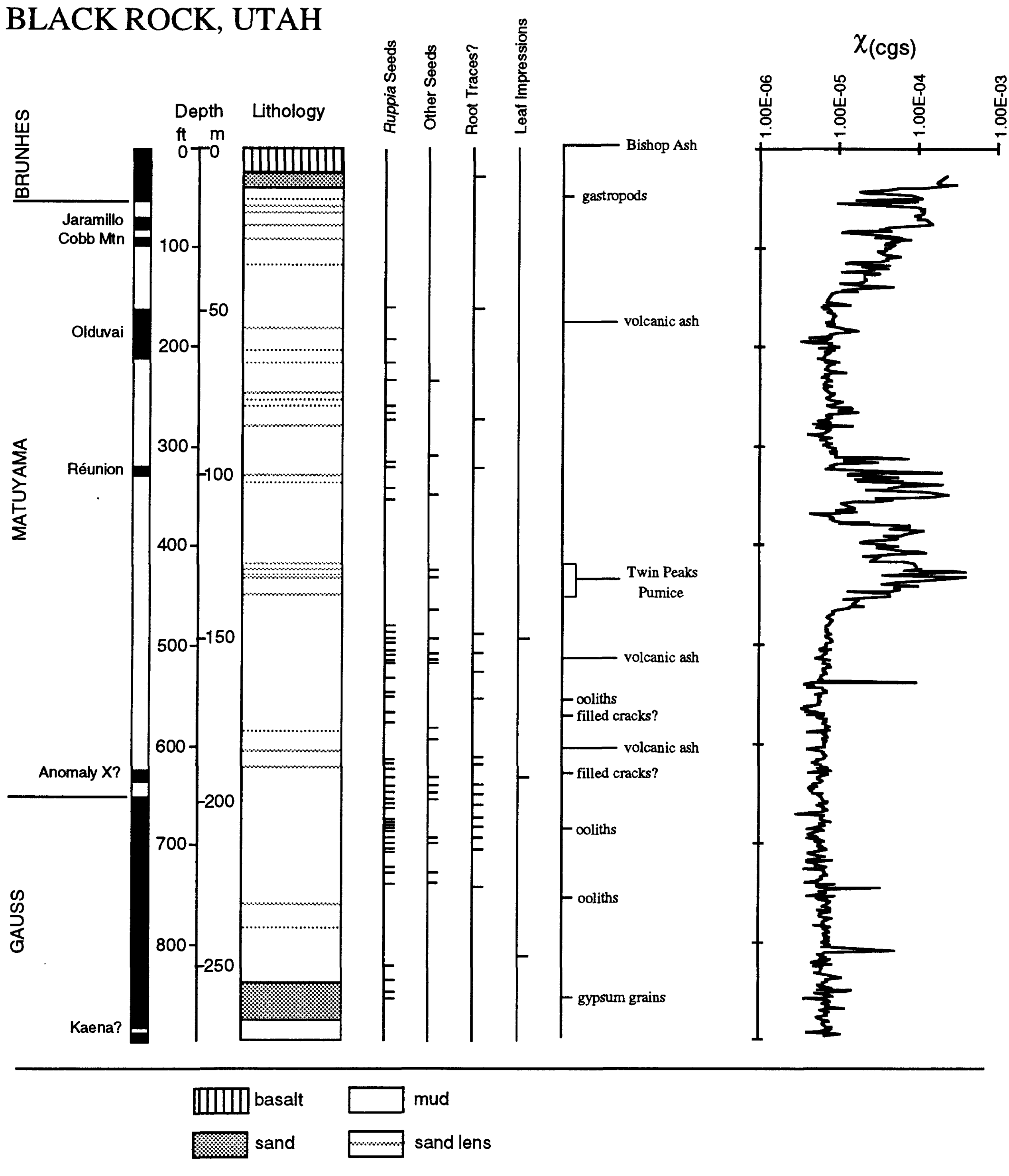

Figure 3. Black Rock core stratigraphy plotted against the magnetostratigraphy, macrofossil occurrences, and magnetic susceptibility.

the uppermost few feet of sediment underlying the basalt. Core recovery began at 25.25 ft (7.7 m) and extended down to 896.83 ft (273.35 m). As shown in Appendix 1, core recovery was excellent throughout most of this depth range.

Core Description.

Sediments in the Black Rock core are primarily calcareous mud that typically has dry colors of light gray to pale yellow (Fig. 3). At the time of drilling the mud was largely unoxidized and was greenish gray to black. The mud is massive, to finely bedded (beds between 5 and 8 mm thick and separated by thin silt or very fine sand partings), to laminated (laminae less than 5 mm thick). Soft-sediment deformation is common throughout the length of the core in intervals less than about one foot in thickness. Except for laminated zones, most bedding is wavy. Laminated intervals are several inches to several feet in thickness, and the laminations are laterally discontinuous. Mud samples from the upper 400 feet of the core average approximately 40% carbonate minerals and 60% mud, with small amounts of sand in some samples. Carbonate content is generally inversely correlated with mud content, and carbonate ranges from about 30 to 80%. Preliminary X- ray diffraction studies indicate that the carbonate is in the form of dolomite and calcite.

There are three sandy intervals in the core, although thin sand beds or laminae are present throughout the core. The three sandy intervals are approximately from 0 to 100 ft, from 350 to 450 ft, and from 750 ft to the bottom of the core at 897 ft (Figure 2). Most of the sand is fine to very fine and is flat laminated to low-angle ripple-laminated, to finely cross-bedded. The sand is medium-grained in the upper 35 ft. Sand throughout the core is uncemented except for four thin intervals, each about 2 inches thick, between 29 and 36 ft, where it is well cemented with calcite. In the lower part of the core, from 865 to 875 ft, the fine sand is cemented with gypsum. Between depths of 858 and 861 ft the sand is composed of rounded gypsum grains that were probably transported to the depositional site by wind or some other mechanism. Euhedral selenite crystals and selenite veins are common throughout the core. Most of the sand in the core is poorly sorted, interlaminated with mud, and less than one inch thick, except for the medium sand in the upper part of the core. Analyses of samples from the upper 400 feet indicate that sand content ranges from 0 to over 80% in the upper 100 feet, but ranges between 0 and 40% below 100 feet. Sand percentage is zero in many samples, especially between 100 and 350 ft (Figure 2).

No evidence of soil development or extended periods of drying was observed anywhere in the core. A few features interpreted as mud cracks are poorly developed and probably indicate minor hiatuses. The sandy to silty, finely-bedded sediments suggest shallow-water deposition. In addition, vertical, irregular tube-shaped color stains, which are interpreted as root traces, probably from aquatic plants such as *Ruppia*, also suggest shallow water. *Ruppia* seeds are commonly present in the same intervals as the root traces and are distributed throughout much of the core, especially in the mud intervals (Fig. 3). Impressions of filamentous leaves, possibly of *Ruppia*, were logged at about 495 and 817 ft, and gastropods were observed between 51 and 63 ft.

Taken together, the observations suggest that a shallow lake existed at the Black Rock site for the entire period recorded by the core. Shifts in sand content are related to changes in the sediment influx rate, which may have been caused by changes in the depositional sites of rivers or streams that entered the lake, or by changes in lake level or tectonics. Uplift in the vicinity of Cove Creek dome, 18 km east of the Black Rock site, is known to have occurred in late Pliocene time (Crecraft and others, 1981), and possibly as recently as the late Pleistocene (Oviatt, 1991). Uplift, delta progradation, or lake-level lowering would each cause an increase in sand deposition.

Paleomagnetism.

The magnetic polarity stratigraphy obtained using the data interpretation procedures outlined above is presented in Figure 4 and in Appendix 2. As mentioned above, the Bishop ash (0.759 Ma) is preserved in silts that were deposited in hollows on the surface of the Black Rock lava flow. The normal polarity directions obtained from the lacustrine record immediately below the Black Rock basalt are therefore interpreted as representing the lowermost part of the Brunhes Chron (< 0.78 Ma). This interpretation is inconsistent with K-Ar age determinations of 0.97 ± 0.25 (Condie and Barsky, 1972) and 1.32 ± 0.09 Ma (Crecraft et al., 1981) on the Black Rock basalt. However, the paleomagnetic stratigraphy is internally consistent and it is possible that the radiometric age determinations may be in error. A thick zone of reversed-polarity dominance is recorded between 53 and 658 ft, which we interpret to represent the Matuyama Chron. Several zones of normal polarity are recorded in this interval. These zones are interpreted to represent the Jaramillo, Cobb Mountain, Olduvai and Réunion subchrons, respectively. A thick zone of normal polarity from 658 to 896 ft is interpreted to represent the Gauss normal Chron. A short interval of normal polarity (626 to 635 ft) immediately above the Gauss/Matuyama boundary may represent the so-called "X-anomaly" (2.42 to 2.41 Ma). However, there is only weak magnetostratigraphic evidence for the existence of the X-anomaly (Cande and Kent, 1992). Therefore we do not correlate this zone in our magnetostratigraphic scheme. A short zone of reversed polarity near the bottom of the Black Rock core is tentatively identified as the Kaena subchron.

Black Rock Inclination Record

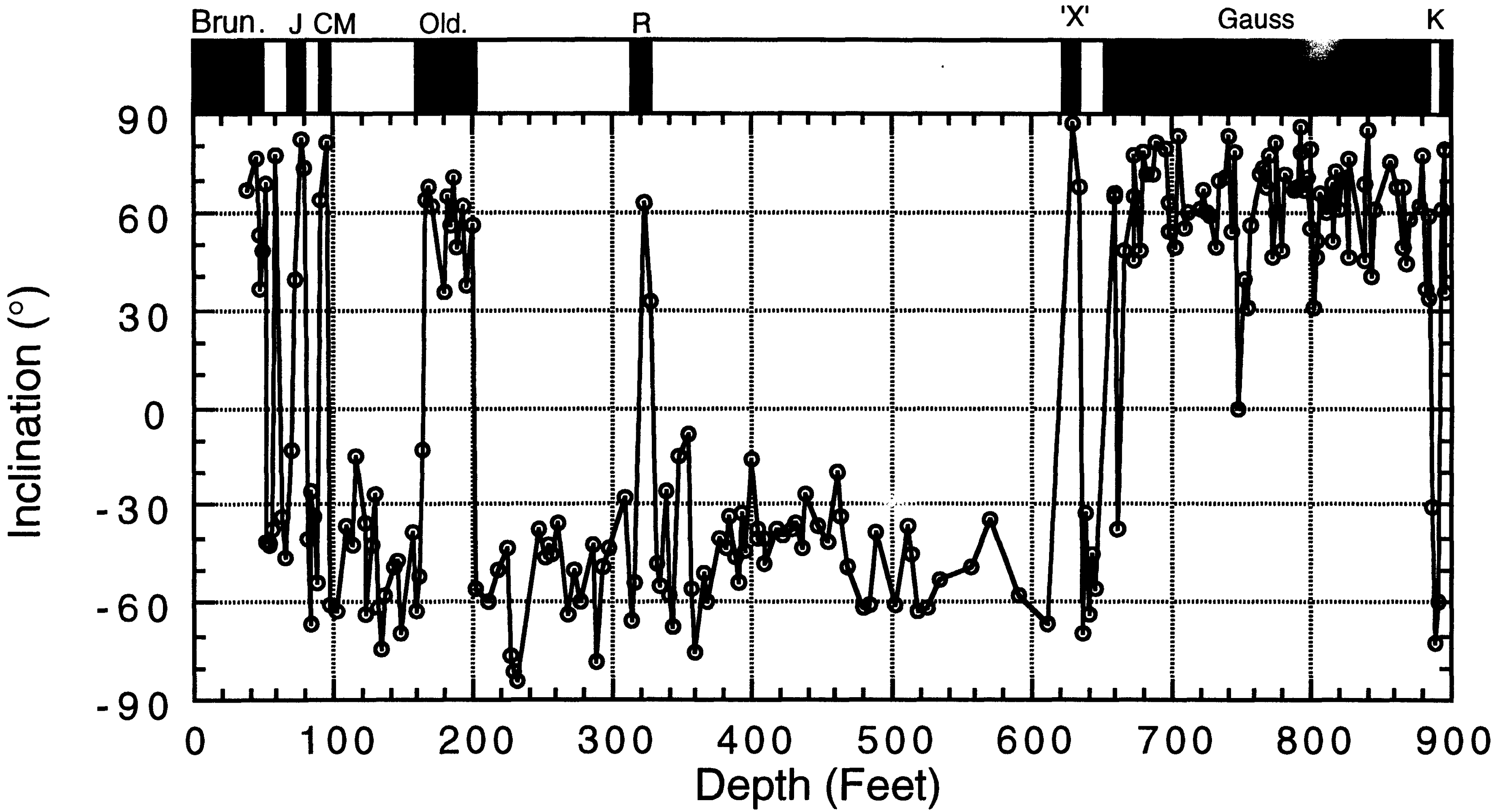

Figure 4. Black Rock core paleomagnetic inclination record. Brun. = Brunhes, J = Jaramillo, CM = Cobb Mountain, Old.=Olduvai, R = Réunion, 'X' = Anomaly X, and K=Kaena.

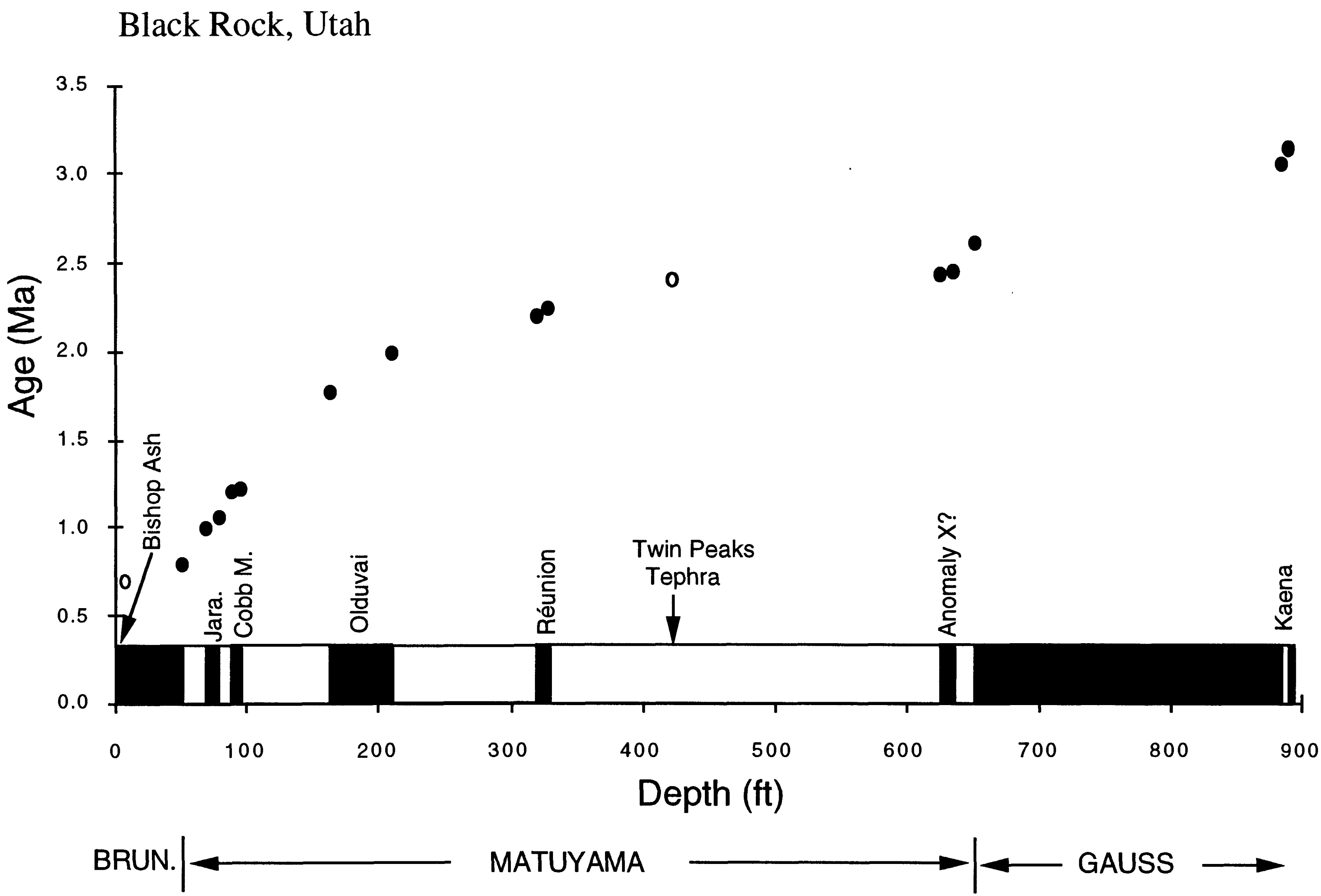

Figure 5. Black Rock core depths versus age. Paleomagnetically-based age estimates are shown as filled circles and tephra as an open circle.

The sedimentation history inferred from the magnetic stratigraphy is shown in Figure 5 in a plot of age versus depth. Sedimentation rates were apparently relatively uniform at about 18 cm/kyr from Kaena to Olduvai time. Deposition slowed down to rates of 9 cm/kyr at around Olduvai time and continued until the Matuyama/Brunhes boundary. Inspection of the whole core susceptibility record reveals extremely low and uniform values in the interval from 896 and ~450 ft (Figure 3). Intensities of natural remanent magnetization are also uniformly low in this interval. Macroscopic examination of the core indicates extensive pyritization of the sediment. Ostracode samples are also pyritized in this interval. These observations are indicative of significant sulfate-reduction which would be expected in sediments deposited at rates as high as 18 cm/kyr. Dissolution of detrital magnetic minerals should be ubiquitous in sulfate-reducing environments (e.g. Canfield and Berner, 1987; Roberts and Turner, 1993). The low susceptibilities and remanence intensities can therefore be accounted for by dissolution of detrital magnetic minerals during early burial. The uniformly low values over several hundred feet of core suggests that dissolution destroyed all but a constant amount of material. Post-depositional alteration of the paleomagnetic record is therefore the most likely explanation for the generally lower quality of data from the Black Rock core than from the Pit of death core. Despite the negative effects of magnetic mineral dissolution, it is clear that a reliable detrital signal has been preserved.

Pollen Analysis.

Pollen data from the Black Rock core are illustrated in Figures 6 and 7, and are listed in Appendix 3. As discussed above, no core was recovered from the upper ~26 ft of sediment at basalt at the Black Rock site. Pollen samples from ~26 to ~147 ft are either barren or have extremely low pollen concentrations. The pollen assemblages recovered from this interval are probably highly altered by diagenesis and may not accurately reflect the vegetation growing at the time the sediments were deposited. Consequently, these samples are ignored in the following discussions.

The pollen flora present throughout the Black Rock record is indistinguishable from that of the modern eastern Great Basin. The extremely rare occurrences of elm (*Ulmus*), *Fremontodendron*, and a few other minor types may be the only holdovers of earlier Tertiary floras, or they may represent rebedded grains. The Black Rock pollen record overall suggests that taxa dominant today at slightly higher and cooler sites, such as pine, juniper, and sagebrush, were present near the site throughout much of the period from ~3.1 to ~1.6 Ma (Figure 6). The modern pollen rain at the site (as shown by the two uppermost samples of the profile) is dominated by Chenopodiaceae/*Amaranthus*, which reflects the

Black Rock Pollen Percentages

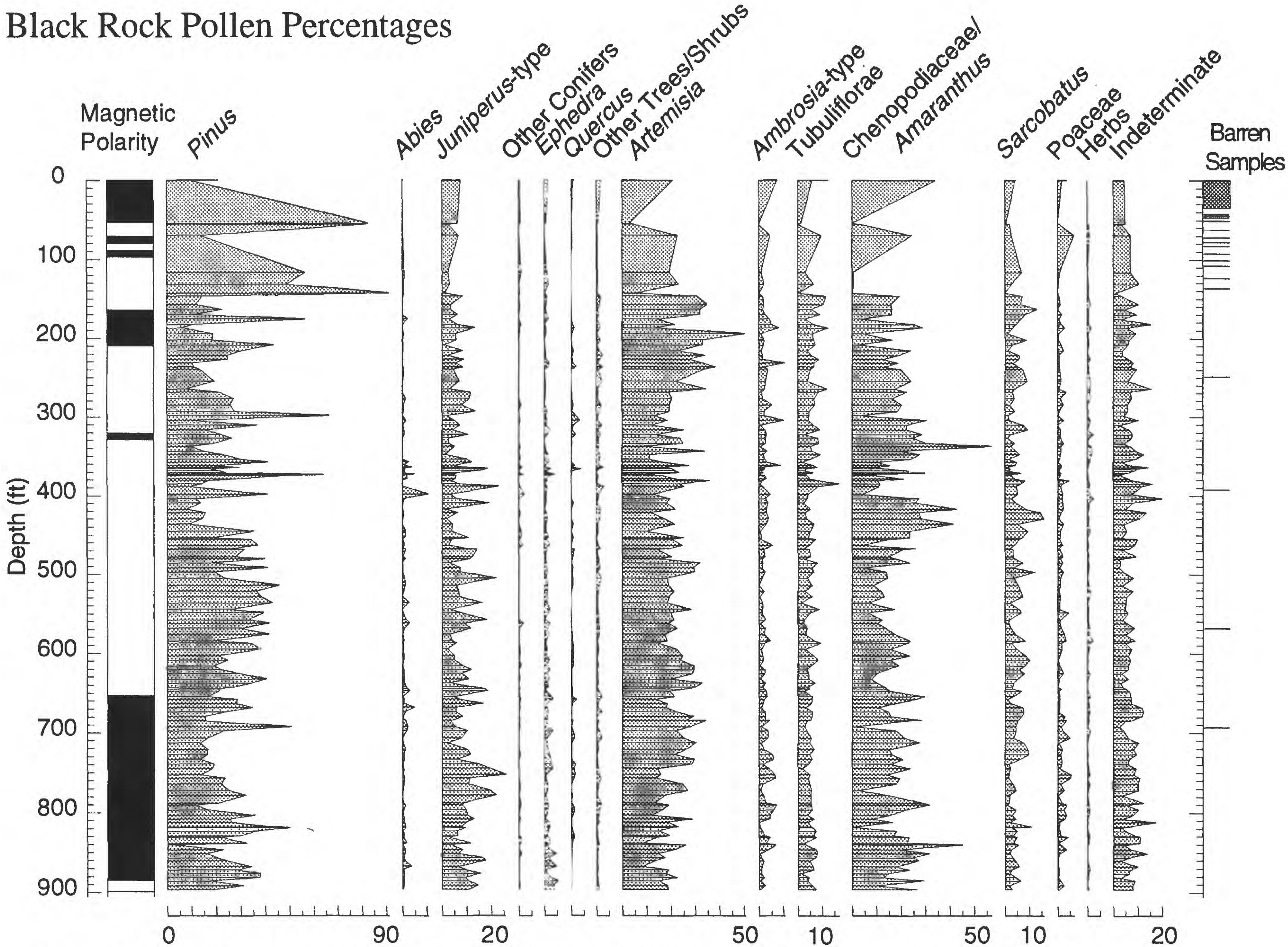

Figure 6. The Black Rock core terrestrial pollen record plotted by depth (magnetostratigraphy shown on left). Cross-hatched area in furthest right-hand column indicates no core recovery.

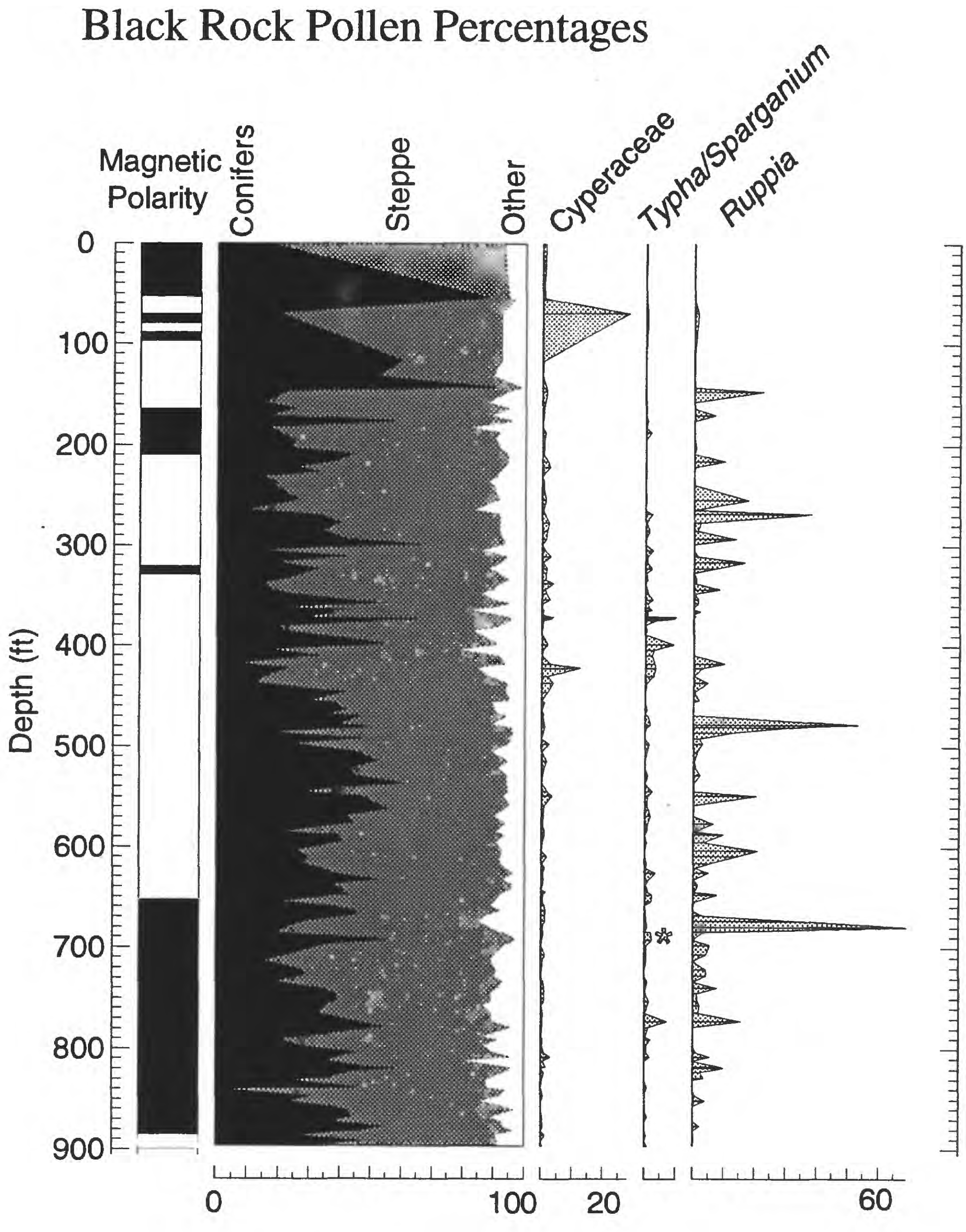

Figure 7. Summary diagram (on the left) of conifers vs. steppe plants vs. other taxa from the Black Rock core pollen record plotted against aquatic pollen types.

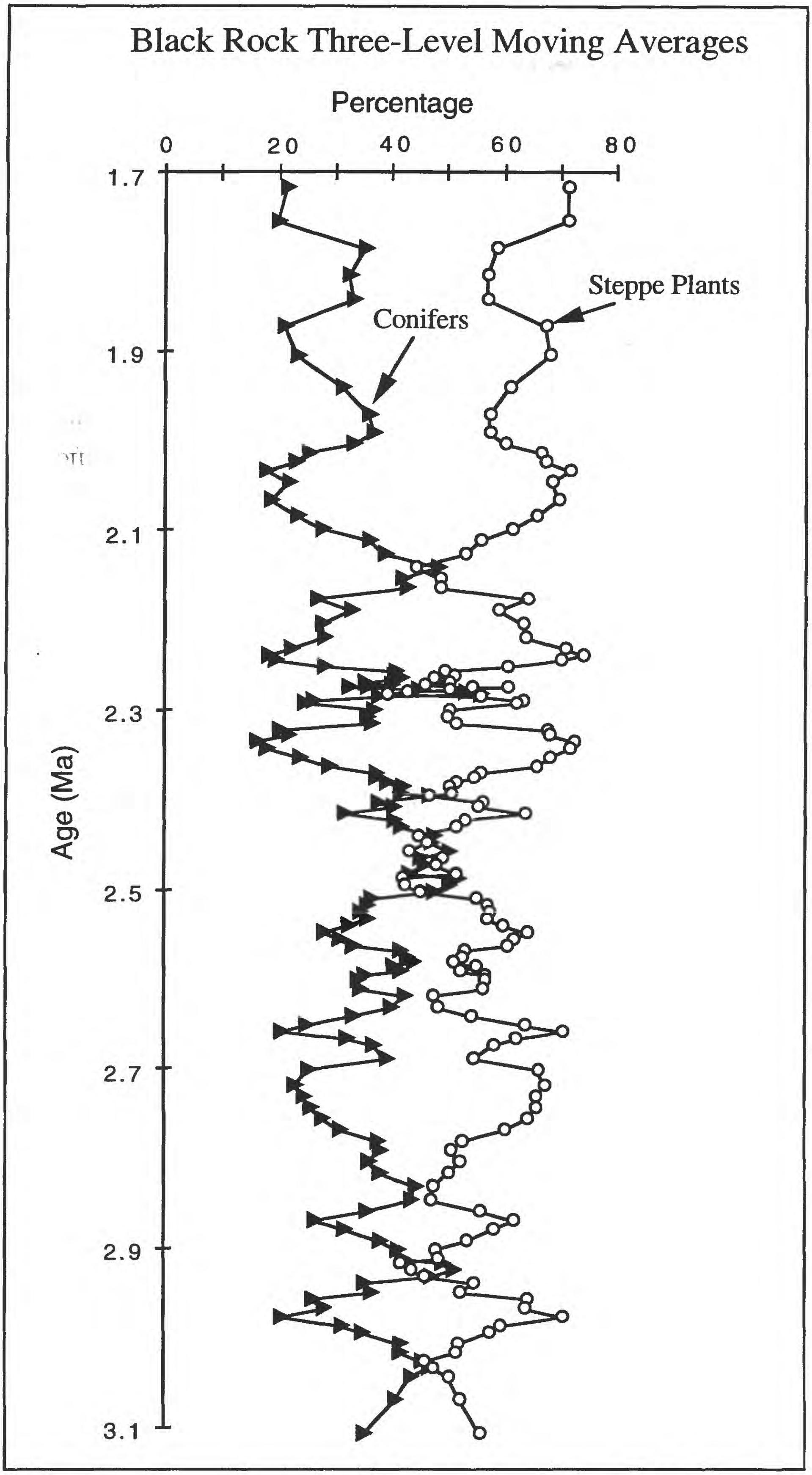

Figure 8. Three-level moving averages of conifer and steppe pollen from the Black Rock record plotted against time.

abundance of shadscale and other Chenopodiaceae living at the site. With the exceptions of samples in the 300 - 340 ft and 415 - 430 ft core intervals, the Black Rock pollen record does not include Chenopodiaceae/*Amaranthus* pollen percentages approaching those of today, and we conclude that conditions were slightly wetter than today throughout most of the middle and late Pliocene and early Pleistocene. During this time, the climate was never wet enough to support abundant spruce, hemlock, or oak, and it was never apparently warm or dry enough that desert taxa dispersed into the region from the south.

The major trends in conifers (representing moist conditions) versus steppe plants (indicating dry conditions) through the Black Rock core record are shown in Figure 7. This diagram also includes the major aquatic pollen types found in the Black Rock core: ditchweed *(Ruppia),* cattail *(Typha/Sparganium),* and sedges (Cyperaceae). *Ruppia* pollen (Fig. 7) and seeds (Fig. 2) are present throughout most of the record below ~150 ft, and indicate the presence of a permanent shallow saline lake (Vance and Mathewes, 1994) from approximately 3.1 to 1.6 Ma. The slight increases in sedge and cattail pollen in the 440 to 400 ft range suggests that the lake may have been replaced by a marsh for a period. The abundance of sedge pollen at ~70 ft also suggests marsh conditions during some interval of time after the demise of the saline lake.

As illustrated in Figure 8, there is a strong quasi-cyclic pattern in the alternation of conifer and steppe dominance through the Black Rock record. We indicate the conifer periods as reflecting moister climate intervals and the steppe periods as indicating dry climates. There are 14 to 15 steppe peaks in the 1.4 myr represented by this diagram, and thus these variations could be an expression of a 100-kyr Milankovitch frequency climatic oscillation. However, the age-model does not provide sufficient temporal resolution to investigate this possibility through spectral analysis. Similar variations in forest vs. steppe dominance are present in late-Gauss Chron pollen spectra from southern Idaho (Thompson, in press).

<u>Ostracode Analysis.</u>

Ostracodes and other calcareous microfossils were extracted from samples from the Black Rock core at approximately 1 ft (30 cm) intervals. Two sub-samples were processed from each sample, one for ostracode counts and curation, and the second to provide ostracode and other carbonate for stable and radiogenic isotopic analyses. Approximately 900 sample pairs have been processed thus far, and although quantitative studies have not yet been conducted on these samples, preliminary paleoenvironmental interpretations are possible from visual scans of the ostracode slides.

The ostracode assemblages from the lower portion of the Black Rock core indicate a cyclic and somewhat predictable expansion and contraction of a saline, probably shallow, lake to wetland complex. In contrast, the upper part of the core contains ostracodes that suggest irregular and unpredictable sequence of fresh to saline wetlands and shallow lakes. The older cycles have three primary components. The first involves a shallow, and typically saline, wetland to spring environment similar to the Clear Lake wetlands present today 50-km northeast of the Black Rock site. These ostracode assemblages imply waters enriched in calcium and depleted in carbonate, which in turn may indicate water/rock interactions involving sedimentary rocks. The dissolved-ion chemistry of these waters was similar to that of ocean water, and accordingly these assemblages contain estuarine as well as continental ostracodes. In other instances, the saline ostracode assemblage is represented by a single continental saline species (*Limnocythere staplini*), which was common in the Stansbury phase of the Bonneville lake cycle. Deep-basin ground waters and perhaps limited stream input probably supported this environment.

The second step in the environmental sequence, a step that may be absent in some sections of the core, involves the complete loss of the first assemblage and the appearance of an assemblage dominated by *Elkocythereis bramlettei*, an extinct ostracode that is the probable ancestor of the modern *Limnocythere bradburyi*. The presence of *Elkocythereis bramlettei* (and associated species) implies that the major dissolved ion chemistry of the lake has shifted from a calcium-enriched and carbonate-depleted environment to a calcium-depleted and carbonate-enriched environment. Waters having the latter dissolved-ion chemistry are often derived from water/rock interactions involving volcanic rocks rather than sedimentary rocks. Thus the change from the first to the second assemblage implies a change in source waters and may indicate increased stream input.

The third step in the environmental sequence involves the replacement of the *Elkocythereis bramlettei* assemblage with a *Limnocythere ceriotuberosa* assemblage, which suggests similar water chemistry but either the lake was deeper (and thus colder) or the salinity was above the tolerance range of *E. bramlettei*. A larger lake with colder bottom waters is the more probable explanation, but the data are insufficient to select among one of these or other possibilities.

A similar transition from the first to the third assemblage occurred during the late Pleistocene rise of Lake Bonneville from the Stansbury phase toward levels coincident with the Provo shoreline. The Bonneville sequence, however, also included a change from the *Limnocythere ceriotuberosa* assemblage to a specific kind of candonid assemblage. *Candona* remains are rare to non-existent in the samples examined thus far from the Black

Rock core, which indicates that the Black Rock lake did not become fresh enough for most types of candonas to survive.

The ostracodes examined to date from the lower part of the Black Rock core imply a somewhat predictable climatic oscillation from a dry climate where lake waters are derived from local basin sources, to a wetter climate where various kinds of saline lakes are supported by streams entering the basin. The details of these transitions await completion of ostracode species counts.

The upper portion of the core contains an array of taxa that live in the region today and are often associated with wetlands located adjacent to streams. However, too few samples have been examined from this part of the core to characterize it further.

Diatom Analysis.

Twenty-four samples from the Black Rock core between depths of 54 and 876 ft were examined for diatoms in water mounts at a magnification of 400X. Only 6 samples were productive. Diatoms are rare to common and fairly well preserved at 236, 514, 562, 619.85, 713, and 736 ft. The diatom assemblages are characterized by distinctive species such as *Surirella striatula*, *Campylodiscus clypeus*, *Navicula peregrina*, *N. subinflatoides*, *N. pygmaea*, *Scoliopleura peisonis*, *Nitzschia granulata*, *N. hustedtii*, and *Amphora coffaeiformis* that indicate shallow, alkaline and chloride-rich saline water. Some levels have diatoms of coastal marine affinities such as *Melosira dubia* and *Hyalodiscus scoticus* that indicate shallow brackish water dominated by Na^+ and Cl^- ions. In general, the samples productive for diatoms are characterized by large percentages of *Artemisia* pollen, possibly indicating cool climates with some summer moisture. Barren samples were either dominated by pollen of Chenopodiaceae/*Amaranthus* or *Pinus*.

No samples examined contain large numbers of planktic, freshwater diatoms that would suggest deep, through-flowing lacustrine environments, although freshwater benthic diatoms (*Epithemia turgida, Cocconeis placentula*) are occasionally present that were probably introduced to the lake from marginal freshwater marsh environments associated with incoming streams.

Shallow, alkaline to saline water diatom assemblages are also found in well cuttings in the upper 300 m of drill holes in the northern part of the Great Salt Lake basin (~ 41.5° N, 112.6° W). Although correlations to the Black Rock core at similar depths are only speculative, they are consistent with a predominance of saline, shallow water environments throughout the Great Salt Lake basin in early Quaternary and Pliocene time.

PIT OF DEATH CORE RECORD

Core Description.

The Pit of Death core is composed predominantly of massive mud (Figure 9, Appendix 4). A few thin laminated zones several inches thick are present but rare, and disrupted laminae of silt are common throughout. The mud color ranges from brownish hues (10YR, 7.5YR), to grayer or greener hues (2.5Y, 5Y). The contrasting hues give the mud the appearance of alternating between brown or pink and green or olive gray, although the color differences are subtle. The brown hues dominate. Near-vertical selenite veins cut the mud at all depths in the core.

Features referred to in the log as filled cracks are conspicuous in the Pit of Death core. The structures are vertical and planar in form, suggesting that they originated as cracks, but they are not flat — they curve, pinch, and swell along their length. They vary in thickness from less than 1/2 inch to several inches, and in length from a few inches to several feet. Some cracks contain what appear to be angular to rounded clasts of the surrounding mud, although in general the grain size of the fill is similar to that of the matrix. The fill is different in color than the surrounding sediment, and is uniform in some but mixed in others. The cracks are interpreted as mud cracks that formed in partially dried mud, were filled with sediment reworked from the surface, and were deformed by compaction after burial. The upper boundaries of the filled cracks are diffuse in most cases, and it is not possible to identify a clearly defined surface of origin, suggesting that the episodes of drying that produced them were short-lived and were insufficient in length for soils or other indicators of disconformity to be formed. Filled cracks are present throughout the core, both in greenish mud and brown mud. Their positions are plotted in Figure 9.

Gravel and sand in the upper foot of the Pit of Death core were deposited in a Holocene barrier beach. The gravel disconformably overlies lacustrine mud and sand that contains the Bishop ash (0.759 Ma). Sand interbedded with the lacustrine mud above the Bishop is cross-bedded. Outcrops nearby expose lenses of gypsum-cemented, cross-bedded sand within the muddy lake beds. The sand lenses are elongate in the direction of the probable paleoshoreline (north-south), and probably were deposited as offshore bars in the shallow lake water.

The only other sand or gravel of significant thickness is near the bottom of the core. Pebbly mud in the interval between 428 and 431 ft overlies an interval of about 40 ft of sand and gravel, from which no core was recovered. From 472 ft to the base of the core at 512 ft, is a sequence of moderately cemented, poorly sorted, tuffaceous sand. Pumice

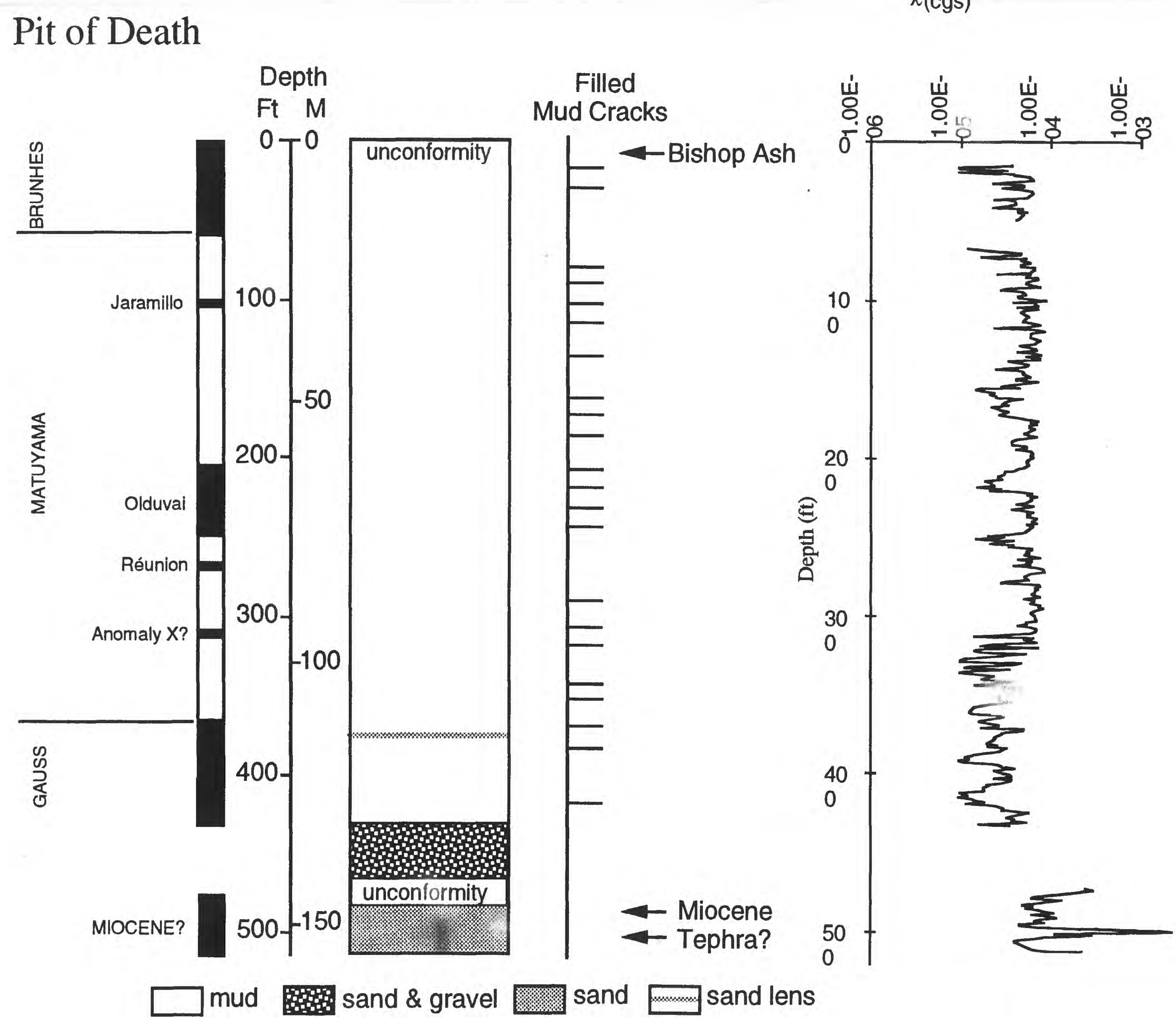

Figure 9. Pit of Death core stratigraphy plotted against the magnetostratigraphy, filled mudcrack occurrences, and magnetic susceptibility.

lumps ranging from sand size to 2.5 inches in long dimension are common. Microprobe analyses of the glass indicate a likely correlation with a 6 Ma tephra previously collected near Adrian, Oregon (W.P. Nash, written communication, 1994). Therefore, the unrecovered sand and gravel at the base of the mud section is interpreted as marking an unconformity between the Miocene tuffaceous sand and the Plio-Pleistocene muddy lake beds. Paleomagnetic results suggest that the unconformity may date to younger than the Kaena subchron at approximately 3.1 Ma.

Few fossils have been observed in the Pit of Death core. Impressions of filamentous leaves (*Ruppia*?) were logged between 336 and 347 ft, and are associated with ostracodes. Impressions of broader parallel-veined leaves, possibly of *Typha*, were observed in a pit exposure about 2 to 3 ft below the Bishop ash near the Pit of Death core site in 1992. Ostracodes and poorly preserved gastropods (*Lymnaea* ?) were associated with the leaf impressions. The leaf fossils and the filled cracks suggest shallow water and repeated lowering of lake level to expose mud flats to at least partial drying. With the exception of the gravel at the base of the mud section, however, there is no indication of major breaks in deposition between 431 ft and the top of the core.

Paleomagnetism.

The Bishop ash crops out in lacustrine clays along the northwestern shore of Sevier Lake (Oviatt, 1994) and occurs at a depth of about 13 ft in the Pit of Death core. Normal polarity directions are recorded in the uppermost part of the Pit of Death core to a depth of 58' where the Matuyama/Brunhes boundary is recorded (Cui et al., 1994). This suggests that sedimentation was extremely rapid between the time of the Matuyama/Brunhes polarity transition and Bishop ash time (about 65 cm/kyr). Unambiguous paleomagnetic directions were determined from 97% of the samples from the Pit of Death. These data reveal a straightforward magnetic polarity stratigraphy (Figure 10). Within the reversed polarity Matuyama Chron, we can identify the Jaramillo and Olduvai subchrons, as well as likely matches for the Réunion and X-anomaly cryptochrons although full normal polarity is not achieved in these two zones. In contrast to the Black Rock core, we are unable to identify the Cobb Mountain subchron in the Pit of Death core. The thick zone of normal polarity from 369 to 420 ft is interpreted to represent the upper part of the Gauss Chron. A sequence of gravels was encountered at depths of 420 - 470 ft and tephrochronology from below the gravels indicates that the lower lacustrine sequence below the gravels is of Miocene age. We cannot unambiguously correlate the short zone of normal polarity below the gravels with the geomagnetic polarity timescale, therefore we are unable to assign a

Pit of Death Inclination Record

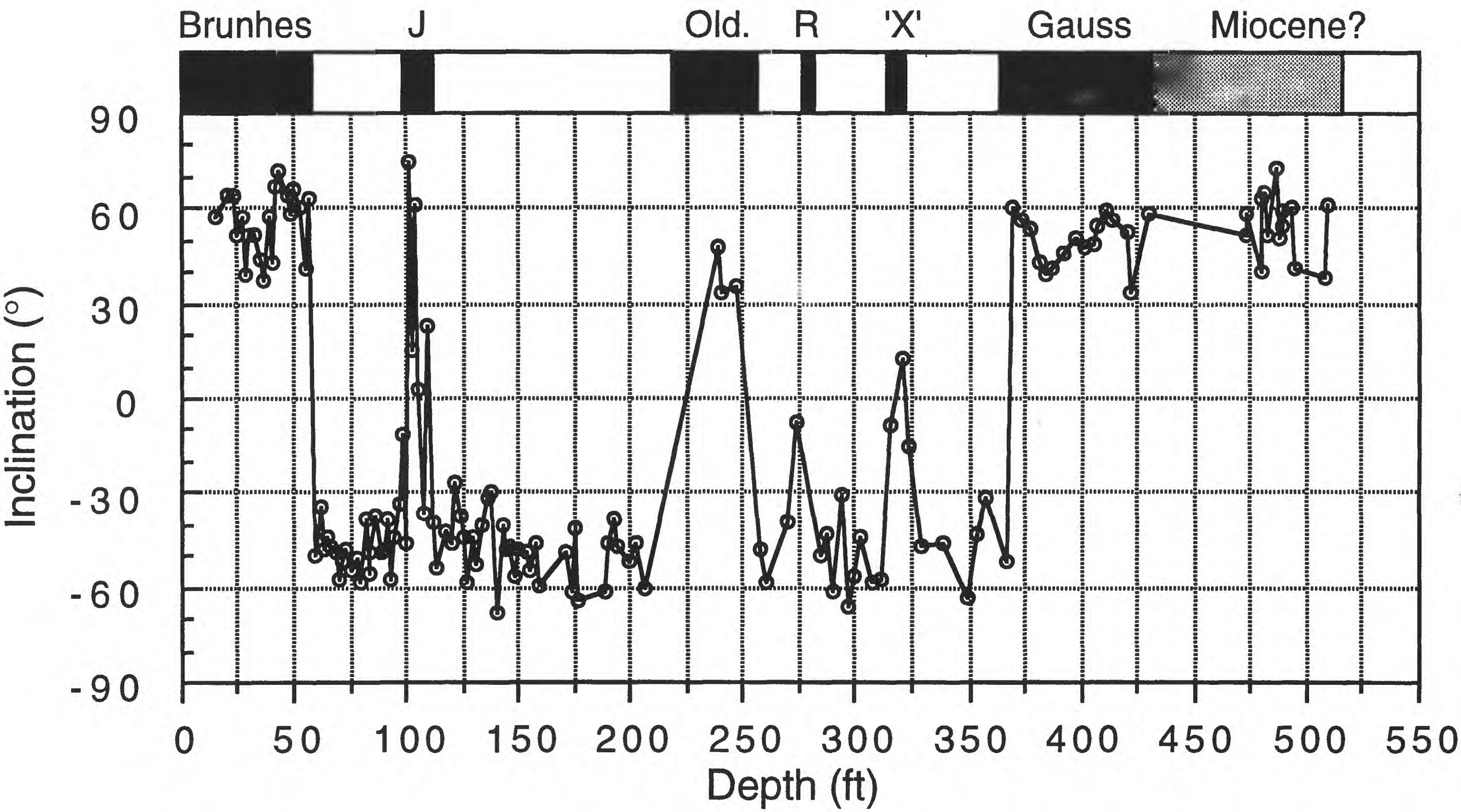

Figure 10. Pit of Death core paleomagnetic inclination record. Brunhes, J = Jaramillo, Old.=Olduvai, R = Réunion, and 'X' = Anomaly X.

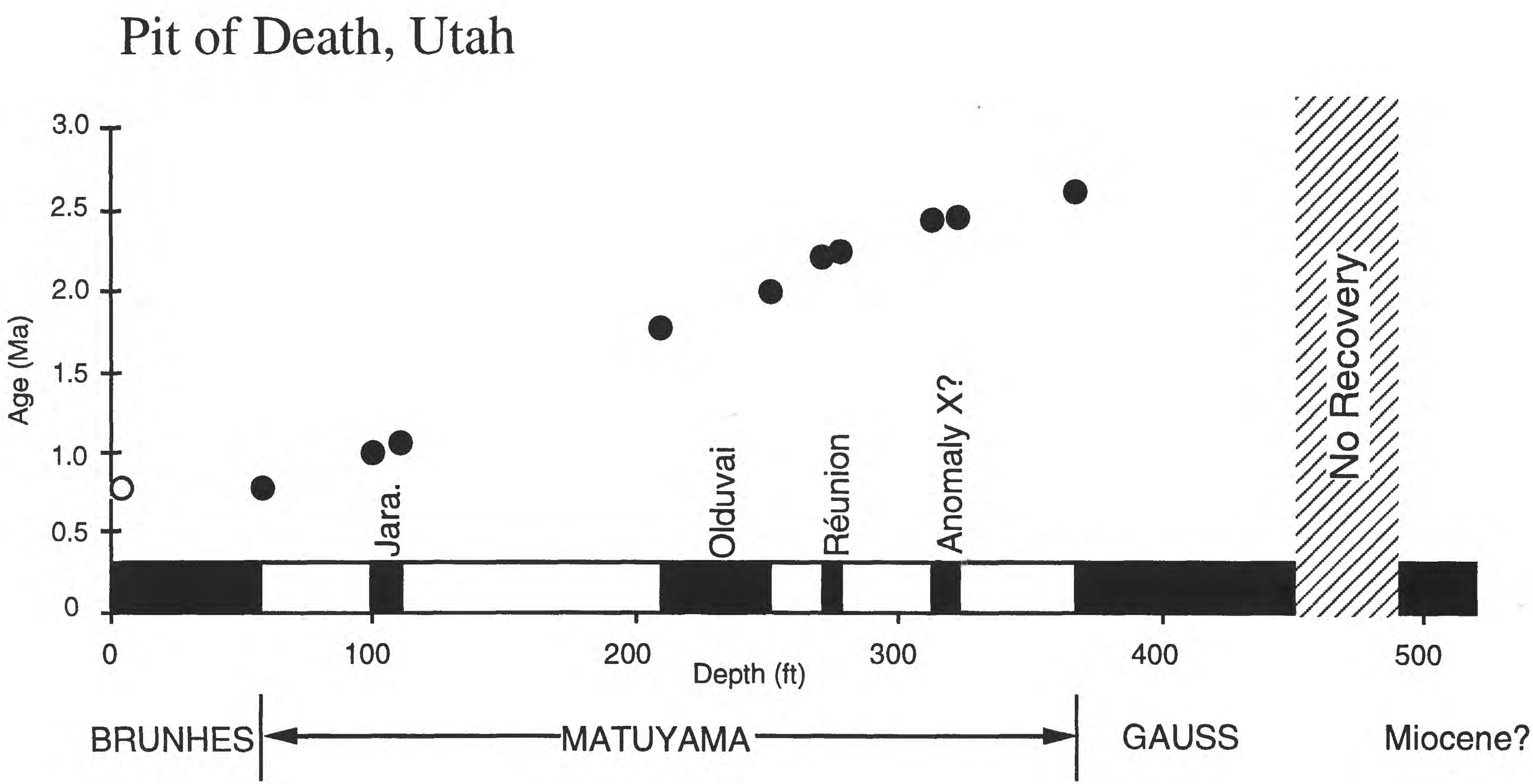

Figure 11. Pit of Death core depths versus age. Paleomagnetically-based age estimates are shown as filled circles and tephra as an open circle.

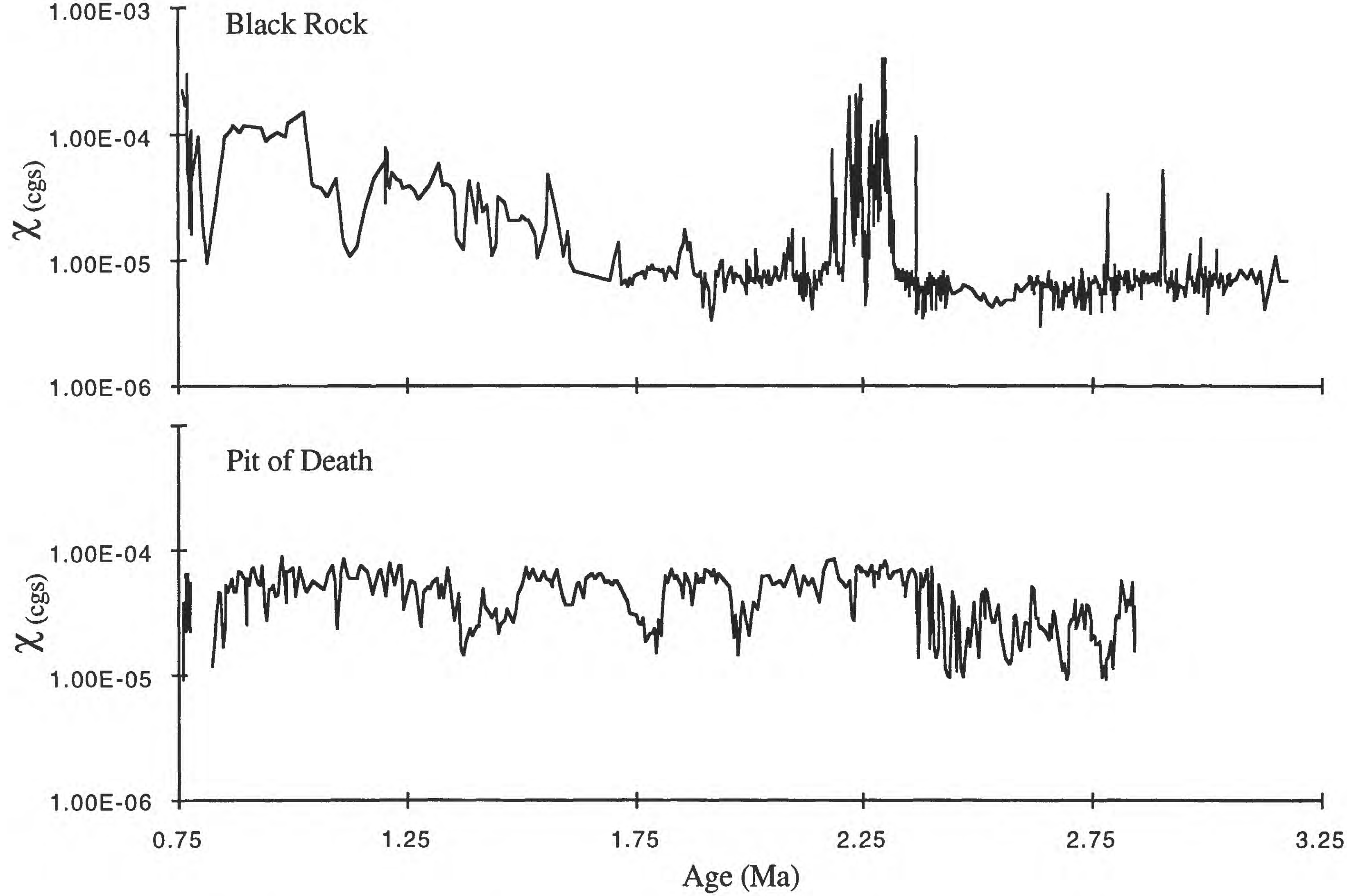

Figure 12. Comparison of Black Rock and Pit of Death core magnetic susceptibility records (plotted by age).

precise age to the lowermost part of the core. Overall, however, the records from the Black Rock and Pit of Death cores reveal essentially coeval sedimentation histories.

The sedimentation history inferred from the magnetic stratigraphy is shown in Figure 11 and it indicates a remarkably uniform deposition rate of about 5 cm/kyr throughout the entire Matuyama Chron (0.78 - 2.60 Ma). This inference is supported by the short normal zones that are correlated with the Réunion and X-anomaly cryptochrons, which suggests that such short polarity zones can be accurately recorded if sedimentation rates are sufficiently high. At rates of 5 cm/kyr, the X-anomaly would be expected to be recorded over a stratigraphic interval of 1 m, which is easily resolvable considering that normal remanence lock-in depths in sediments are considered to be about 16 cm (DeMenocal et al., 1990). Although full normal polarity directions are not recorded, the adopted sampling strategy enabled reasonable definition of this cryptochron which is defined by samples at three stratigraphic levels.

Greater paleomagnetic stability of samples from the Pit of Death core, relative to the Black Rock core, is likely to result from the consistently higher remanence intensities of the sediment from the Pit of Death core. Fine structures are preserved in the susceptibility record from the Pit of Death (Figure 9), which indicates that post-depositional dissolution has not affected the Pit of Death record as significantly as is the case for the Black Rock record. It is often possible to correlate susceptibility profiles from lake catchments with sediment derived from the same parent material (e.g. Verosub and Roberts, in press), however, the lack of similarity between the two profiles with respect to age (Fig. 12) suggests that reductive diagenesis has significantly obscured the magnetic signal from detrital material in the Black Rock core.

Pollen Analysis.

Ten samples from the Pit of Death were processed for pollen analysis (at the approximate depths of 20, 71, 93, 133, 175, 201, 223, 225, 381, 465 ft), and all samples were barren.

Ostracode Analysis.

Ten samples were examined from the Pit of Death Core, and the ostracodes present exhibit variable states of preservation and are composed of various mixtures of the three assemblages noted in the Black Rock ostracode discussion above. The mixing of apparently environmentally-incompatible taxa implies that material was reworked to this site from eroding lake sediments on the valley floor or margin.

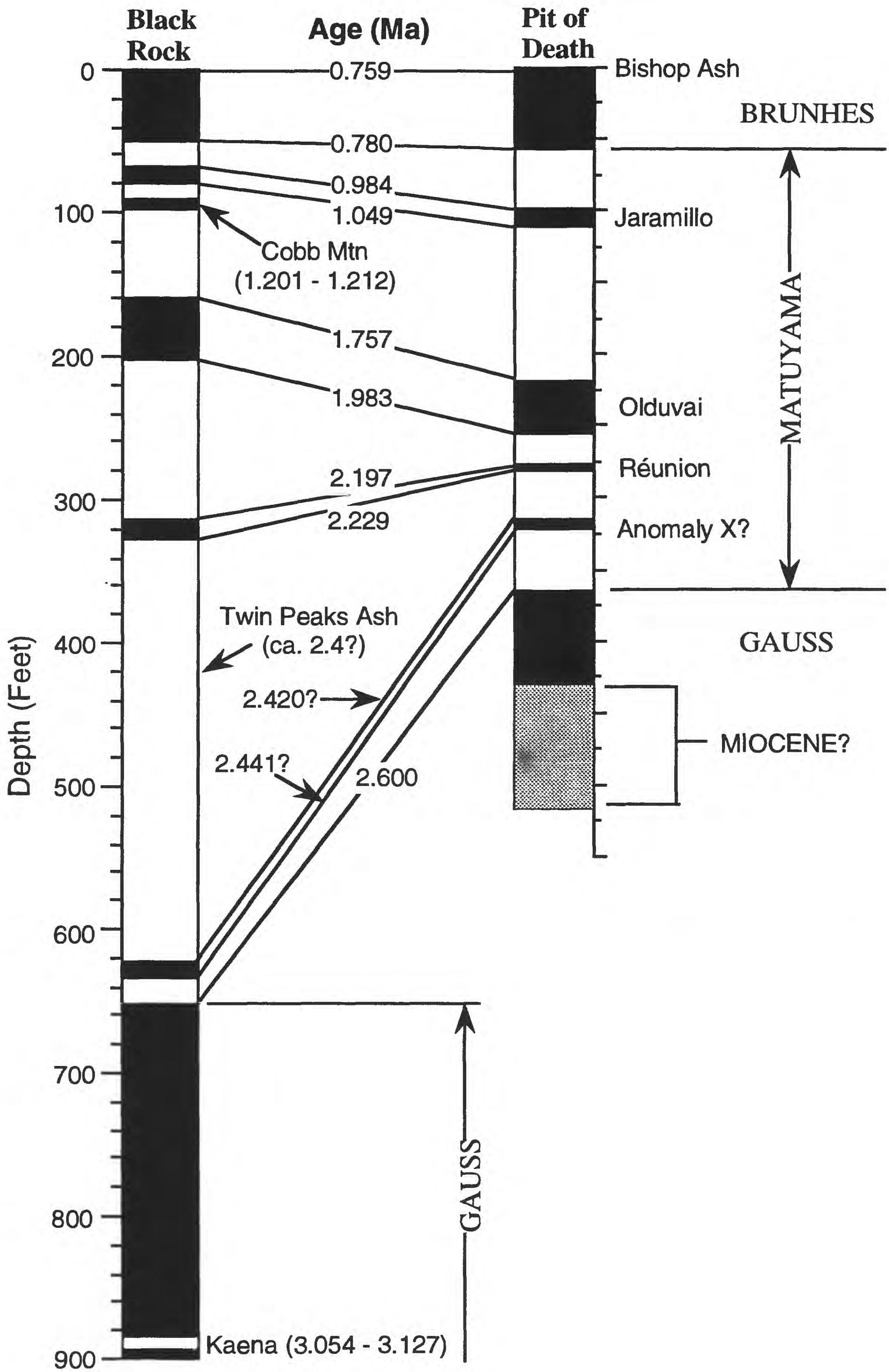

Figure 13. Comparison of Black Rock and Pit of Death chronologies and depositional rates.

Diatom Analysis.

Fifteen samples from the Pit of Death were examined for diatom analysis (at the approximate depths of 18, 21, 68, 87, 101, 112, 122, 133, 162, 201, 259, 306, 354, 408, and 484 ft), and all samples were barren.

DISCUSSION

The magnetostratigraphies of the Black Rock and Pit of Death cores suggest that they cover essentially the same time range, although their depositional rates differed considerably through time. The Pit of Death sediments appear to have accumulated at a relatively constant rate (Fig. 11), whereas the Black Rock sediments accumulated at a more rapid rate than at Pit of Death throughout the core, but underwent a major decline in deposition above the Olduvai Subchron. Sediment accumulation rates in the Black Rock core above the Olduvai subchron are much slower than those below this horizon in this core.

The general impression is that the Pit of Death core, which spans essentially the same time interval as the Black Rock core, contains sediments that indicate drier conditions or lower lake levels than the Black Rock core, although both sites underwent virtually continuous deposition. The Black Rock site is in a valley through which the modern Beaver River flows. Machette (1985) showed that the Beaver River did not exit the Beaver basin, southeast of the Black Rock site, as a through-flowing stream until after about 0.75 Ma, possibly in response to climate change that produced greater runoff from the mountains. Even without the Beaver River in its modern form, it is likely that some ancestral version of the Beaver River emptied into the Sevier Desert near Black Rock during Pliocene and Pleistocene time. It is unlikely that a major river discharged sediment directly to the Pit of Death site at any time, although both the Sevier and Beaver Rivers probably supplied fine-grained sediment to the basin margins that would have been redistributed to distal sites such as this. Muddy lake beds similar to those in the Sevier Desert were being deposited along the Sevier River drainage system in Mills Valley, east of the Canyon Range (Figure 1), between at least 2 and 0.65 Ma (Oviatt, 1992), and in the Beaver basin between about 2.5 and 0.75 Ma (Machette, 1985), suggesting that the shallow-lake/wet-mudflat/marsh environment represented in the Pit of Death and Black Rock cores was widespread and long-lived in this region. The Black Rock pollen record indicates that significant variations in moisture occurred during the period from 3.1 to 1.6 Ma, although the paleontological and paleohydrological data collectively indicate that conditions remained wetter than those of today throughout this interval, as they did at other sites across the western United States (Thompson, 1991).

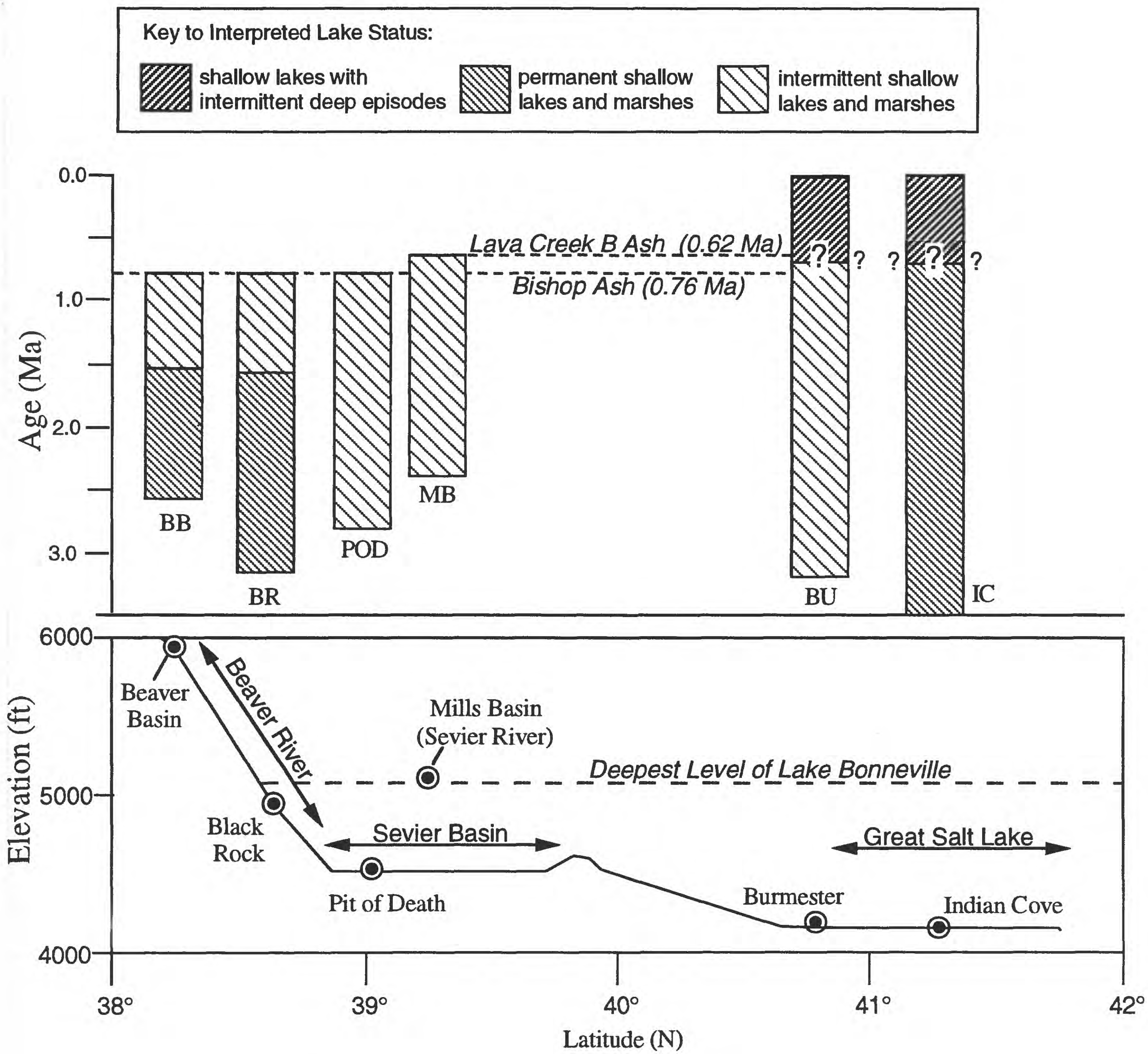

Figure 14. Comparison of lacustrine histories of Pliocene-Pleistocene sites in western Utah.

The Black Rock and Pit of Death records can be integrated with other data from western Utah to provide a synoptic view of changing hydrological and climatic conditions since the middle Pliocene (Fig. 14). The Beaver Basin (Machette, 1985) and Black Rock sites both had relatively rapid and apparently constant depositional rates from Gauss (Black Rock) or early Matuyama time (Beaver Basin) until ~1.7 to ~1.6 Ma. Depositional rates are much slower after this time, although waters were at least episodically present at both sites until ~0.76 to 0.75 Ma. Shallow intermittent lakes were also present at the Pit of Death and Mills Basin (Oviatt, 1992) sites through the same time span (and may have persisted somewhat longer in the Mills Basin). Farther north, preliminary examination of the Burmester core (Eardley et al., 1973; Williams, 1994) from near modern Great Salt Lake suggests that shallow intermittent lakes, wet playas, and marshes were probably present from prior to 3 Ma until above the Bishop Ash. Palynological data from well-cuttings of Pliocene and early Pleistocene sediments from Indian Cove in Great Salt Lake (Davis, 1993) indicate shallow marsh environments were present throughout this period.

Collectively the data discussed above indicate that slightly wetter-than-modern conditions persisted through much of the Pliocene and early Pleistocene in western Utah. The modernity of the Black Rock pollen flora suggests that the modern climate with winter-precipitation dominance and dry summers was established by this time. Although the Black Rock pollen record indicates that there was an oscillation between wetter and drier conditions during the Pliocene and early Pleistocene, these fluctuations were of much smaller amplitude than those of the late Quaternary. Scattered evidence suggests that the late Quaternary climatic pattern of high amplitude climatic fluctuations (where wet climate episodes with lakes as deep as Lake Bonneville [Fig. 14] were present for perhaps 10 kyr and were separated by perhaps 90 kyr or more) began prior to the deposition of the Lava Creek B tephra at 0.62 Ma.

ACKNOWLEDGMENTS

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Appendix 1. Key to Black Rock Core Log.

Key to Grain size codes:

vcs	very coarse sand
cs	coarse sand
c/mds	coarse to medium sand
s	sand
mds	medium sand
md/fs	medium to fine sand
fs	fine sand
f/vfs	fine to very fine sand
vfs	very fine sand
sm	sandy mud
very mfs	very muddy fine sand
vfsm	very fine sandy mud
fsm	fine sandy mud
mdsm	medium sandy mud
csm	coarse sandy mud
f/mdsm	fine to medium sandy mud
mc/md/fs	muddy coarse to medium to fine sand
mmds	muddy medium sand
ms	muddy sand
mfs	muddy fine sand
mmd/fs	muddy medium to fine sand
mf/vfs	muddy fine to very fine sand
mvfs	muddy very fine sand
m	mud
org. m	organic mud
c/mdssi	coarse to medium sandy silt
si/vfs	silt to very fine sand
sism	silty sandy mud
sim	silty mud
si	silt
c	clay
carb.	carbonate

Key to color codes:

N8	white
N7	light gray
N6	gray
N5	gray
N4	dark gray
N3	very dark gray
10yr6/4	light yellowish brown
10yr6/3	pale brown
10yr6/2	light brownish gray
10yr5/6	yellowish brown
10yr5/4	yellowish brown
10yr5/3	brown
10yr4/4	dark yellowish brown
10yr4/3	brown
10yr4/2	dark grayish brown
7.5yr7/2	pinkish gray
7.5yr6/4	light brown
7.5yr6/3	light brown
7.5yr6/2	pinkish gray
7.5yr5/6	strong brown
7.5yr5/4	brown
7.5yr5/3	brown
7.5yr4/6	strong brown
7.5yr4/4	dark brown
7.5yr4/3	dark brown
5yr5/4	reddish brown
5yr4/5	red-yellowish brown
5yr4/4	reddish brown
2.5yr6/2	pale red
2.5yr5/4	reddish brown
5y7/3	pale yellow
5y7/2	light gray
5y7/1	light gray

Appendix 1. Key to Black Rock Core Log (continued).

5y6/3	pale olive
5y6/2	light olive gray
5y5/4	olive
5y5/3	olive
5y5/2	olive gray
2.5y8/1	white
2.5y6/3	light yellowish brown
2.5y6/2	light brownish gray
2.5y5/4	light olive brown
2.5y5/3	light olive brown
5g5/1	greenish gray

<u>Bedding & miscellaneous:</u>

fb	finely bedded (5-8 mm thick)
lam	laminated (< 5 mm thick)
ssd	soft-sediment deformation
org	organic
gyp	gypsum
sel	selenite
pyr	pyrite

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
0.00	0.00	soil in shelby tubes and basalt (no recovery)			
24.58	7.49	Drilling mud & cuttings			
25.25	7.70	f/vfs	10yr5/4	disturbed .	
25.33	7.72	md/fs	5yr4/4	disturbed	in shoe - Length???
25.75	7.85	NO RECOVERY			
26.00	7.92	fs	7.5yr4/4	massive	
26.75	8.15	mds	10yr4/2	massive	disturbed?
27.00	8.23	mds & fs	fs=7.5yr4/4	cryptic; mottled	root traces?
			mds=10yr4/3		
27.29	8.32	c/mds	5yr4/5	massive?	
27.63	8.42	fs	5yr4/5	~1cm beds	
27.92	8.51	mds	10yr4/3		
28.08	8.56	md/fs	5yr4/4		
28.17	8.59	vcs	blk to brn	disturbed?	
28.21	8.60	md/fs	10yr4/2		
28.38	8.65	md/fs	7.5yr4/4	disturbed	in shoe
29.00	8.84	mds	7.5yr4/4	massive	
29.50	8.99	fs	7.5yr4/6	massive	gradual boundary
29.67	9.04	NO RECOVERY			
29.83	9.09	fs	7.5yr6/3	massive; soil carbonate?	well cemented
30.00	9.14	NO RECOVERY			
32.83	10.01	mmd/fs	7.5yr5/4		
33.00	10.06	very mfs	7.5yr5/4		
33.13	10.10	mmds	7.5yr5/4	soil carbonate	moderately well cemented
33.38	10.17	mds	7.5yr4/3	bedded	
33.63	10.25	md/fs	7.5yr5/4		
34.79	10.60	f/vfs	7.5yr5/4		
34.00	10.36	md/fs	7.5yr4/3	bedded; soil carbonate	
34.58	10.54	NO RECOVERY			
34.83	10.62	md/fs	10yr5/4		
35.00	10.67	mds	7.5yr6/4	soil carbonate	well cemented
35.13	10.71	fs	7.5yr5/4		
35.29	10.76	f/vfs	5yr5/4		
35.50	10.82	mc/md/fs	5yr5/4	bedded	
35.92	10.95	sm	5yr5/4		

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
36.04	10.99	md/fs	7.5yr6/2	soil carbonate	well cemented
36.21	11.04	md/fs	7.5yr5/4		
36.75	11.20	fs	7.5yr5/6		
37.00	11.28	NO RECOVERY			
38.83	11.84	m	7.5yr5/4		
39.25	11.96	vfsm	7.5yr5/4		
39.38	12.00	m	7.5yr6/3	bands of different colors, in varying widths	
			and 10yr6/2		
39.96	12.18	vfs	7.5yr7/2		
40.04	12.20	vfsm	10yr6/3		
40.21	12.26	mfs	10yr5/3		
40.25	12.27	f/vfs	2.5yr5/4		
40.38	12.31	vfs	10yr6/3		
40.54	12.36	f/vfs	10yr5/4		
40.58	12.37	mf/vfs	2.5yr6/2		
40.92	12.47	m	5y7/3		
41.33	12.60	mf/vfs	10yr5/3		
41.50	12.65	m	2.5y6/2		
41.83	12.75	NO RECOVERY			
42.00	12.80	m	5y6/3		
42.75	13.03	fsm	5y6/3	mottles of 2.5y6/4	
42.92	13.08	m	5y6/3		
43.50	13.26	m	5y6/3	lt. gray carbonate nodules (5y7/2)	
44.67	13.61	m w/ sm lens	5y6/3		
45.00	13.72	sm	5y6/3	lt. gray carbonate nodules (5y7/2)	
45.92	14.00	ms	5y6/3		
46.00	14.02	fsm	5y6/3	lt. gray carbonate nodules (5y7/2)	
46.38	14.14	fsm & m	5y6/3	laminated	abrupt boundary
46.67	14.22	mfs	5y6/2	pale yellow carbonate nodules (5y7/3)	
47.75	14.55	m	5y6/3		
48.75	14.86	f/vfs	5y6/3 to		gradual boundary
			7.5yr5/6		
50.17	15.29	m & sm	7.5yr5/6	1-2cm beds	
50.83	15.49	m	5y6/3		distinct boundary
51.08	15.57	mfs	7.5yr5/6		gastropods

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
51.17	15.60	fsm	5y6/3	carbonate	gastropods
51.58	15.72	m	5y6/3		gastropods
51.83	15.80	mmd/fs	5y6/3		gastropods (sample at 52'2")
52.00	15.85	m	10yr5/4	mottles of 5y6/3	
53.00	16.15	vfsm	10yr5/3		
53.75	16.38	m	10yr5/3to		gradual boundary
			5y6/2grad		
54.50	16.61	vfsm	5y6/2		
54.92	16.74	m	5y6/2	carbonate mud & nodules	
56.33	17.17	OVERLAP			
56.00	17.07	m	5y6/3		
56.17	17.12	sm	5y6/2	abrupt boundary	gastropods (sample at 56'3")
57.25	17.45	f/vfs	2.5y6/3	mud nodules; abrupt bound.	gastropods
58.00	17.68	fs	2.5y6/3		lots of gastropods
59.00	17.98	mfs	2.5y6/3		
59.50	18.14	m	10yr5/3		abrupt bound.
63.08	19.23	m & mfs	10yr5/3	1-2 cm beds	gradual bound.
64.83	19.76	NO RECOVERY			
65.00	19.81	m	10yr5/3	mottles of 5y6/3	
65.33	19.91	fs	10yr5/3		
65.50	19.96	m	10yr5/3	iron oxide nodules	
65.92	20.09	m	10yr4/4		abrupt bound.
66.50	20.27	m	10yr5/2		wavy abrupt bound.
67.50	20.57	m	10yr5/3		wavy abrupt bound.
68.00	20.73	f/vfsm	10yr5/3		
68.67	20.93	m	10yr5/3		
69.33	21.13	fsm	5y5/3		
70.25	21.41	m	10yr5/3	bedded in transition zone	diffuse bound.
71.25	21.72	mfs	10yr5/3		
71.42	21.77	m & mfs	10yr5/3	finely bedded	
72.17	22.00	m	5y5/3		
72.58	22.12	m & vfs	10yr5/3	finely bedded	wavy diffuse bound.
72.75	22.17	NO RECOVERY			
76.00	23.16	f/vfs	10yr5/3	crossbedded	
76.25	23.24	sm	10yr5/3	crossbedded	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
76.33	23.27	f/vfs	10yr5/3	crossbedded	
76.92	23.44	sm	10yr5/3	crossbedded	
77.00	23.47	f/vfs	10yr5/3	crossbedded	
77.25	23.55	m	10yr5/3	crossbedded	
77.50	23.62	NO RECOVERY			
78.00	23.77	m	10yr5/3	green mud inclusions	
78.50	23.93	m	7.5yr5/4	massive; carbonate nodules	
80.00	24.38	m	5y4/6		
81.33	24.79	m	5y4/6		carbonate rich layer
82.00	24.99	m & si	5y4/6	finely laminated	carbonate silt
83.17	25.35	m & si	5y5/3	gradual bound.	red inclusions & carb veins
86.58	26.39	m	10yr5/3	carbonate layers	
88.00	26.82	sim	10yr4/6		carbonate rich
88.50	26.97	m & si	10yr4/6	finely laminated	
89.08	27.15	si & vfs	5y6/2		contains mud clasts
89.25	27.20	m	5y6/3	small carbonate nodules	
89.75	27.36	m	2.5y5/3	mottled	
90.50	27.58	vfs & sim	7.5yr5/4	laminated	abrupt bound.
90.67	27.64	m	7.5yr5/4		
90.75	27.66	f/vfs	7.5yr5/4	crossbedded	
91.50	27.89	mf/vfs	7.5yr5/4	bedded	
91.83	27.99	m	7.5yr4/4		
94.25	28.73	m	7.5yr4/4	carbonate layer	
95.25	29.03	OVERLAP			
95.00	28.96	sm	7.5yr4/4	finely bedded	carbonate rich
96.25	29.34	csm	7.5yr4/4	finely bedded	carbonate rich
98.58	30.05	mdsm	7.5yr4/4	bedded?	carbonate rich
100.00	30.48	fsm	7.5yr4/4	bedded?	carbonate rich
101.33	30.89	fsm & si	7.5yr4/4	finely laminated	carbonate rich
102.17	31.14	NO RECOVERY			
103.00	31.39	fsm	7.5yr4/4	finely bedded	
104.17	31.75	mfs	7.5yr4/4	crossbedded?	
104.75	31.93	NO RECOVERY			
106.00	32.31	mfs	7.5yr4/4	finely bedded	
106.17	32.36	fsm	7.5yr4/4	cryptic	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
106.50	32.46	m & fsm	7.5yr4/4	finely bedded	
106.83	32.56	fsm & m	7.5yr4/4	finely bedded	some very small
					green mud inclusions
108.42	33.05	NO RECOVERY			
109.00	33.22	m	7.5yr5/4		few carbonate layers
110.00	33.53	m	10yr5/3	swirls of 2.5y6/3	
111.17	33.88	m	10yr5/3	mottles of 2.5y6/3	
112.00	34.14	m	10yr5/2	mottles of 2.5y6/3	carbonate silt layer
112.50	34.29	m	10yr5/3	mottles of 2.5y6/3	carbonate silt layer
112.83	34.39	m	10yr4/4		carbonate silt layer
114.33	34.85	NO RECOVERY			
115.17	35.10	mfs	2.5y6/2		
115.33	35.15	m	5y6/2		
115.58	35.23	mfs	2.5y6/2		
115.75	35.28	m	5y6/2		
116.00	35.36	m	5y5/2		
116.92	35.64	s	5y5/2		
117.00	35.66	m	10yr5/3		
117.33	35.76	m	10yr5/3	mottles of 5y5/2	
118.00	35.97	m	10yr5/3	bedded; mottles of 5y52	
118.75	36.19	f/vfsm & m	10yr5/3	mottles of 5y5/2	disturbed in tube
120.42	36.70	NO RECOVERY			
121.00	36.88	m	10yr5/3		
121.25	36.96	mfs	10yr5/3		
121.42	37.01	m	2.5y5/3	wavy bedding	gradual bound.
121.75	37.11	fsm	2.5y5/3		
121.83	37.13	m	5y5/3		
122.33	37.29	vfsm	5y5/3		
122.50	37.34	m	5y5/4		
122.83	37.44	m	5yr5/4 &	finely laminated	beds of alternating colors
			5y5/3		
123.83	37.74	m	5y6/3	laminated	marbled appearance
124.92	38.07	m	2.5y6/3	laminated	marbled appearance
125.17	38.15	m	5y6/3	laminated	marbled appearance
125.58	38.28	m	10yr6/3	massive	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
126.17	38.46	m	5y6/3	massive	carbonate nodules
127.08	38.73	vfs/sim	7.5yr5/3		
127.25	38.79	m	2.5y6/3	laminated.	
127.92	38.99	NO RECOVERY			
128.00	39.01	m	2.5y6/2	laminated	
128.50	39.17	m	5y6/2	laminated; ssd	
129.25	39.40	si	5y6/2	laminated; ssd	
129.33	39.42	m	7.5yr5/4	laminated; ssd	
129.67	39.52	m	2.5y6/3	massive	
130.33	39.73	m	5y5/3	massive	
130.50	39.78	si/vfs	5yr5/4	mottled w/ brown	
130.58	39.80	sim	5y5/4	massive	
132.00	40.23	m	5y6/2	mottles of 7.5yr5/4	marbled appearance
132.42	40.36	sim	5y6/2	mottles of 7.5yr5/5	marbled appear; grad. bound
133.42	40.67	very sim	5yr5/4	cryptic laminations	abrupt bound.
134.00	40.84	very sim	5yr5/4 &	1-2mm laminations	
			7.5yr5/3		
134.58	41.02	sim	10yr5/4	1-3mm laminations	gradual bound.
135.67	41.35	m	5y6/2	mottled w/ brown	abrupt bound.
137.00	41.76	sim	5y6/2	massive	
137.33	41.86	sim	10yr5/3	mottled w/ green; diffuse bound	biscuits missing beds?
139.00	42.37	sim	10yr5/3	fine mottles/bedding	
139.58	42.54	m	5y5/3	mottled w/ brown	
140.00	42.67	NO RECOVERY			
142.00	43.28	m	5y6/2	mottled w/ brown	
142.50	43.43	m	10yr5/3		
142.75	43.51	m	5y6/2		
144.17	43.94	m & si	10yr5/3	laminated	tiny green clay(?) inclusions
144.50	44.04	m & si & s	5y6/2	lots of silt layers	tiny green clay(?) inclusions
146.00	44.50	m & si	5y6/2	laminated	mangan stain & small faults
146.42	44.63	si	5y5/2	laminated	manganese staining
146.46	44.64	m	5y5/2	laminated	manganese staining
146.75	44.73	m & si/fs	5y4/2	1-2mm beds	soft sed. deformation
147.00	44.81	NO RECOVERY			
155.67	47.45	m & si	7.5y5/2	laminated	disturbed, true depth unknown

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
156.83	47.80	sis	7.5y5/2	cryptic	disturbed, true depth unknown
157.25	47.93	m & si	5y6/2	2-3cm beds	
157.50	48.01	m & si	5y6/2	laminated.	
158.50	48.31	org. m	N3 & N4	mottled	iron ox. concretion (~20mm)
159.00	48.46	very sim	5y5/1		
159.25	48.54	org.m &	grey,	finely bedded	iorn oxide stained
		m & si & s	orange		s & si beds,
			& black		starved ripples?
160.42	48.89	OVERLAP			
160.00	48.77	si & m	2.5y6/2	1-10mm beds	irregular stains of 10yr6/4
161.00	49.07	org. m	N3	laminated	
161.42	49.20	si & c	5b6/1	1-5cm beds	root traces? Ruppia?
162.00	49.38	m	5gy5/1	wavy beds	lots of organic material
163.08	49.71	m & si	5g5/1	cryptic	
164.00	49.99	m	5y5/2	3-10mm beds	lots of organic
					material in gray &
					black layers &
					manganese stains
166.67	50.80	vfs/si	5y5/2	thin bed	
166.71	50.81	org. m	N3 & N4	wavy bedded	
167.25	50.98	OVERLAP			
167.00	50.90	m	5y5/1	wavy bedded	
167.58	51.08	f/vfsm	5y5/1		turbidites???
167.75	51.13	si	5y5/1	thin bed	
167.83	51.16	m & sm & si	5y5/1	wavy to cryptic	
170.42	51.94	s, si & m	5y5/1	wavy to cryptic	
171.50	52.27	m	5y6/2	cryptic to massive	
174.00	53.04	sism	5y6/2	1-2mm beds	
175.50	53.49	OVERLAP			
175.00	53.34	very sm	5y5/2	1-2cm beds	
175.08	53.37	sim & si	5y6/2	fine wavy bedding	
175.75	53.57	m	5y6/2	medium wavy bedding	lots of Mn staining
					& tiny green clay? inclusions
177.00	53.95	m & si	5y6/2	laminated/mottled	
				appearance	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
178.83	54.51	m & si	5y6/2	laminated	
179.75	54.79	m & si	5y6/2	laminated	large gray stain (organic? Mn?)
181.00	55.17	m & si	varied	finely bedded	
			10yr6/2, N4,		
			5y6/2		
181.33	55.27	mds	N2		tephra (sample at 181'4")
181.42	55.30	m & si	5y6/2	finely bedded	
182.00	55.47	m & si	5y6/2	cryptic	tephra in silt
183.17	55.83	OVERLAP			
183.00	55.78	m	5y6/2		
183.25	55.85	si & m	5y7/2	very finely laminated	silt is tephra, iron oxide
					nodule, starved ripple?
183.42	55.91	m & si	5y6/2	cryptic	Mn staining
187.00	57.00	sm	5y6/2	massive to cryptic	tephra in sand, Fe oxide stains
189.00	57.61	m	5y6/2	wavy laminations	
190.00	57.91	s & vfsm	5y6/2	wavy laminations	
190.58	58.09	org. m	N3	1-3mm beds	
190.75	58.14	md/fs & sm	7.5yr4/6	1-3mm beds	oxidized organic material
190.92	58.19	very sim	5y7/2	1-3mm beds	
191.17	58.27	very sim	5y7/2	massive	
191.67	58.42	very sim	5y7/2	finely bedded	
192.67	58.72	very sim	5g6/1	cryptic	lots of organic material,
					black organic blobs (Ruppia?)
193.00	58.83	very sim	5y7/2	wavy bedding	
195.67	59.64	OVERLAP			
195.00	59.44	sim	2.5y8/1	crossbedded	
195.42	59.56	sim &	sim=5y7/2	1-3cm beds	
		carb. si/s	carb=2.5y8/1		
196.17	59.79	sim	2.5y8/2	massive to cryptic	
197.75	60.27	sim	5y5/2	finely bedded	gradual bound.
199.00	60.66	sim	2.5y8/2	finely bedded	gradual bound.
199.17	60.71	m & si	5y4/1	massive w/ minor	distinct bound.
				bedded silt	
200.17	61.01	vfsm	5g5/1	massive	organic; abrupt bound.
200.67	61.16	vfsm	2.5y7/2	massive	oxidized organic mud

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
201.75	61.49	OVERLAP			
201.00	61.26	msi	5y6/2	cryptic	
202.33	61.67	sim	5y6/2	cryptic	gradual bound.
202.50	61.72	f/vfs	5y6/2	finely bedded; sand lens	
202.67	61.77	sim	5y6/2	finely bedded	
203.33	61.98	sim	5y6/2	cryptic	organic staining along a fracture
203.75	62.10	s	5y6/2	cryptic; sand layer	Fe oxide staining
203.79	62.12	sim	5y6/2	cryptic	
205.17	62.53	m	5y6/2	cryptic	Fe oxide staining
205.67	62.69	sim	5y6/2	cryptic	
206.00	62.79	sim	5y6/2	cryptic to finely bedded	pebble in sample
207.42	63.22	m	5y6/2	cryptic to finely bedded	
207.58	63.27	sim	5y6/2	cryptic to finely bedded	
207.67	63.30	sivfs	5y3/2	cryptic to finely bedded	
208.17	63.45	m	5y8/1	massive	black organic blobs
209.00	63.70	sim	5y6/2	cryptic	
210.00	64.01	sim	5y6/2	wavy laminations	Fe oxide staining
210.83	64.26	sim	5y6/2	cryptic	
212.50	64.77	sim	10yr6/4	cryptic to laminated	microfaults
213.00	64.92	sim	10yr6/4	laminated	
213.50	65.07	sim	5y7/1	laminated	
214.33	65.33	NO RECOVERY			
215.00	65.53	sifs	5y6/2	massive	
215.58	65.71	sim	5y6/2	cryptic	
216.33	65.94	s	5y6/2	finely bedded	
216.35	65.94	si & m	5y6/2	finely bedded	seeds!! (Ruppia?)
217.17	66.19	org. m	5y5/1	massive	
217.58	66.32	m & si	5y6/2	laminated	
218.17	66.50	org. m	5y5/1	massive to laminated	
218.25	66.52	sim	5y6/2	massive to laminated	
219.00	66.75	m & fsi	5y6/2	laminated	
220.08	67.08	org. m	5y5/1	massive to finely bedded	
220.50	67.21	m & si	5y6/2	cryptic to swirled	minor black sands
221.58	67.54	sim	5y6/2	massive	minor yellow sands
					(Fe oxide stain)

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
222.50	67.82	sim	5y6/2	finely bedded	
223.08	68.00	org. m	5y5/1	finely bedded	
223.17	68.02	m & si	5y6/2	finely bedded	
225.33	68.68	org. m	5y5/1	disturbed	
225.83	68.83	OVERLAP			
225.17	68.63	m & si	5y6/2	laminated	
226.00	68.88	m & si	5y6/2	massive to laminated	
226.67	69.09	m & si	5y6/2	finely bedded	
228.00	69.49	m & si	2.5y6/3	finely bedded	
228.50	69.65	sim	5y7/2	cryptic	gradual bound.
229.17	69.85	sim	5y7/2	finely bedded	filled fracture
229.67	70.00	sim	5y6/2	finely bedded	
231.00	70.41	sim	5y6/2	finely bedded	
232.08	70.74	sim & s	10yr5/4	disturbed	selenite vein
232.50	70.87	org. m	N3 & N4	marbled	
232.67	70.92	sim	5y6/2	disturbed	in bags
234.00	71.32	sim	5y6/2	finely bedded	
235.67	71.83	sim	5y6/2	finely bedded	cracks filled with Mn stain
236.50	72.09	cr/mdssi	5y6/2	massive	
236.67	72.14	OVERLAP			
236.00	71.93	sim & m	5y6/2	laminated	
238.17	72.59	sim &m	5y6/2	laminated	mud filled cracks
239.25	72.92	sim & m	5y6/2	laminated	Mn staining in dots
240.75	73.38	org. m & sim	N3	laminated	
241.00	73.46	sim & m	2.5y5/3	finely bedded	
241.83	73.71	sm	5y6/2	disturbed	
242.00	73.76	org. m	5y6/2	disturbed	
242.17	73.81	NO RECOVERY			
246.00	74.98	s	N3	massive to cryptic	lots of organics
246.08	75.01	sim	5y6/2	massive to cryptic	
247.17	75.34	sism	5y7/2	cryptic to finely bedded	black sand stringer,
247.33	75.39	vfsi	5y7/2	massive	
248.00	75.59	m & sim	5y6/2	massive	
248.17	75.64	OVERLAP			
247.00	75.29	m & si	5y6/2	finely bedded	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
247.67	75.49	m & si	5y6/2	wavy fine bedded	selenite
248.67	75.79	m & sim	2.5y6/2	wavy fine bedded	
249.58	76.07	m & sim	5y6/2	wavy fine bedded	lots of selenite
250.00	76.20	m & sim	5y6/2	1-50mm beds	swirly iron staining
251.17	76.56	m & sim	5y7/2	finely bedded	
252.00	76.81	org. m & si	N3 & 10yr5/2	finely bedded	
252.42	76.94	sim	5y7/2	finely bedded to massive	
253.00	77.11	sim	5y7/2	finely bedded	
253.42	77.24	s	N5	disturbed???	
253.58	77.29	org. m & si	5y5/1	cryptic	
253.92	77.39	sim	5y7/2	finely bedded	
255.42	77.85	OVERLAP			
255.25	77.80	m & si & s	5y6/2	finely bedded	
256.00	78.03	m & sim	5y6/2	finely bedded	
257.00	78.33	s	5y6/2	finely bedded	
257.17	78.38	m & sim	5y6/2	finely bedded	
260.33	79.35	m & sim	2.5y6/2	finely bedded	
260.83	79.50	m & sim	5y6/2	finely bedded	Seeds!!!
263.67	80.37	NO RECOVERY			
264.00	80.47	m & sim	5y6/2	laminated	
265.00	80.77	m & sim	5y6/2	swirly to massive	
266.33	81.18	m & sim	5y6/2	cryptic	
267.00	81.38	m & sim	5y6/2	cryptic	Seeds!!!
267.75	81.61	m & sim	10yr4/4	cryptic	
268.50	81.84	m & sim	5y6/2	cryptic	
269.00	81.99	m & sim	5y6/2	laminated	root traces?, Seeds!!
270.00	82.30	m & sim	5y6/2	disturbed	
271.00	82.60	m & sim	5y6/2	cryptic	
271.75	82.83	m & sim	5y6/2	laminated; abrupt bound.	Seeds in next foot
272.33	83.01	s org.	10yr5/4	cryptic	abrupt bound.
272.42	83.03	m & sim	5y6/2	cryptic	
273.00	83.21	sim	5y6/2	massive	
275.50	83.97	NO RECOVERY			
276.00	84.12	m	5y6/2	massive	
278.25	84.81	vfs	5y6/2	massive	pellets

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
279.08	85.06	m	5y6/2	finely bedded	
279.17	85.09	vfs	10yr6/4	finely bedded	
280.00	85.34	mmds	5y5/2	massive	
281.00	85.65	f/mdsm	5y5/2	massive	
281.17	85.70	m	5y7/2	massive	
282.00	85.95	m	5y7/2	massive	black staining
282.50	86.11	m	5y7/2	massive	
285.25	86.94	OVERLAP			
285.08	86.89	m	5y7/2	massive to cryptic	selenite vein
287.17	87.53	org. m	5y5/2	massive	
287.83	87.73	m	5y7/2	laminated	
289.08	88.11	m & si	5y7/2	laminated	
290.00	88.39	m & si	10yr5/6	laminated	disturbed; gradual bound.
290.33	88.49	OVERLAP			
290.00	88.39	mcs	5y6/2	cryptic to massive	
290.33	88.49	f/vfsm	5y6/2	cryptic to massive	
291.33	88.80	m	5y6/2	massive	
292.00	89.00	m & si & s	5y6/2	massive	cracks filled w/ white mud
292.75	89.23	m & si	2.5y5/4	laminated	
294.58	89.79	m & si	5y5/2	laminated	mottles of 2.5y5/4
296.33	90.32	m & si	5y6/2	massive to cryptic	
297.42	90.65	OVERLAP			
297.00	90.53	m & s & si	5y6/2	cryptic to laminated	
297.50	90.68	m & si	5y6/2		
299.67	91.34	m & si	5y6/2	laminated	lots of selenite
300.42	91.57	m & si	5y6/2	cryptic	large blobs of mud in silt
301.00	91.74	m	5y5/2	cryptic	
302.33	92.15	m & si	5y6/2	cryptic	
303.00	92.35	m & si	5y6/2	finely bedded	
303.50	92.51	m & si	5y6/2	cryptic	
304.50	92.81	m & si	5y6/2	massive	
307.00	93.57	m & si	5y6/2	finely bedded	
307.83	93.83	OVERLAP			
307.50	93.73	m & si	5y6/2	laminated	
310.33	94.59	m	5y6/2	massive	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
310.58	94.67	m & si	5y5/2	laminated	
311.92	95.07	m & si	2.5y6/2	laminated	gradual bound.
312.17	95.15	m & si	5y6/2	massive w/ silt laminations	
313.33	95.50	m f/vfs	2.5y5/4	finely bedded w/ crossbeds	concretions
314.50	95.86	sim	5y5/2	massive	seeds?
315.25	96.09	NO RECOVERY			
316.00	96.32	m & si	5y5/2	massive w/ silt laminations	
316.67	96.52	sim & org. m	2.5y5/3	finely bedded	
317.50	96.77	sim	5y5/2	massive w/ fine sand beds	
318.83	97.18	sim	5y5/2	disturbed	in shoe
319.08	97.26	OVERLAP			
318.25	97.00	m & si	5y5/2	massive	seeds? root traces?
319.25	97.31	m & sim	5y5/2	laminated	
320.25	97.61	m & sim	5y6/2	laminated	
320.58	97.71	m & sim	2.5y5/4	laminated	wavy bound.
321.00	97.84	m & sim	5y6/2	laminated	
321.42	97.97	m & sim	2.5y5/4	laminated	
322.75	98.37	sim	5y7/1	massive	
323.08	98.48	sim	2.5y5/4	laminated	
323.83	98.70	m	N8	massive	mottled
324.75	98.98	NO RECOVERY			
325.00	99.06	m	5y7/2	massive w/ some swirls	
326.17	99.42	m	5y7/2	massive	cracks filld w/ green clay?
327.50	99.82	sim	5y5/3	massive w/ some swirls	
328.25	100.05	fs	5y5/3	massive w/ some swirls	
328.33	100.08	sim & si	5y5/3	laminated	
328.75	100.20	NO RECOVERY			
329.25	100.36	m & si	5y5/3	laminated	
329.92	100.56	msi	2.5y5/3	massive	
330.17	100.63	sis	2.5y5/3	finely bedded w/ crossbeds	
330.58	100.76	sim	5y5/3	massive w/ silt laminations	Mn staining
331.67	101.09	sism	5y5/3	disturbed	
332.58	101.37	OVERLAP			
332.50	101.35	sim & si	2.5y6/3	massive w/ silt laminations	
333.42	101.63	sim & si	5y6/2	massive w/ silt laminations	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
334.83	102.06	sim & si	5y6/2	laminated	microfaults, Mn staining
335.50	102.26	mds	7.5yr5/6	massive	
335.54	102.27	sim & si	5y6/2	laminated.	
336.92	102.69	m f/vfs	5y6/2	finely bedded to swirly	
338.17	103.07	NO RECOVERY			
339.00	103.33	m f/vfs	5y5/3	disturbed	
340.17	103.68	f/vfsm	5y5/3	cryptic	
341.00	103.94	sim	2.5y5/4	massive	
341.75	104.17	m	2.5y5/4	massive	
343.00	104.55	m & si & sim	2.5y5/4	laminated to cryptic	
343.58	104.72	m & si & sim	5y5/2	laminated to cryptic	seeds
345.33	105.26	m & sim	2.5y4/4	laminated to cryptic	
346.17	105.51	msi	2.5y4/4	laminated to cryptic	
346.75	105.69	NO RECOVERY			
347.00	105.77	si & vfs	2.5y6/3	crossbedded	
347.75	105.99	si & vfs	2.5y6/3	crossbedded	
349.00	106.38	sim	2.5y5/3	massive	
349.25	106.45	si & vfs	2.5y6/3	crossbedded	
351.08	107.01	m & si	5y5/2	massive w/ silt laminations	seeds
352.50	107.44	m & si	2.5y5/2	massive w/ silt laminations	
352.92	107.57	m & si	5y5/2	massive w/ silt laminations	
353.17	107.65	si & vfs	2.5y5/2	finely bedded to laminated	
353.50	107.75	m & si	5y5/2	finely bedded to laminated	
354.42	108.03	NO RECOVERY			
355.00	108.20	m & si	5y5/2	massive	
357.00	108.81	si & org. m	2.5y5/2	laminated	
357.42	108.94	si & m	5y5/2	massive w/ silt laminations	
359.00	109.42	m	5y6/2	disturbed	
360.00	109.73	m	5y5/2	massive	
363.00	110.64	NO RECOVERY			
363.50	110.79	m	5y5/2	massive	
364.92	111.23	NO RECOVERY			
365.00	111.25	sim	5y5/2	massive	
365.83	111.51	si & m	5y5/2	laminated	
366.50	111.71	sim	5y6/2	massive	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
367.83	112.12	NO RECOVERY			
368.00	112.17	m & si	5y5/2	massive	
368.25	112.24	m & si	5y5/2	laminated.	
368.58	112.34	m & si	2.5y8/1	laminated	
369.00	112.47	m & si	2.5y8/1	massive	
369.58	112.65	m & si	5y6/2	swirly	
369.92	112.75	org. m & si	2.5y5/4	laminated	
370.25	112.85	sim	5y6/2	massive	
371.50	113.23	m & sim	5y6/2	cryptic to laminated	
373.00	113.69	sim	5y6/2	massive	
374.33	114.10	sim	5y6/2	massive	
374.58	114.17	NO RECOVERY			
375.00	114.30	sim	5y6/2	massive	
375.25	114.38	m & sim	5y6/2	laminated	
376.33	114.71	sim	5y6/2	cryptic to massive	
377.00	114.91	m & sim	5y6/2	laminated w/ wavy crossbeds	
378.00	115.21	m f/mds	5y5/3	crossbedded	
378.50	115.37	sim	5y5/2	massive	
379.00	115.52	m	5y5/2	massive	
379.67	115.72	msi	2.5y5/3	laminated w/ crossbedded	
381.33	116.23	NO RECOVERY			
381.83	116.38	m & si	5y5/2	laminated	
382.50	116.59	m & si	10yr5/3	laminated w/ crossbeds	
385.50	117.50	m	5y5/2	massive	
388.00	118.26	sim	10yr5/3	masive to cryptic	silt filled cracks
392.50	119.63	sim	2.5y5/2	mottled	
392.75	119.71	sim	10yr5/3	massive to cryptic	
394.00	120.09	NO RECOVERY			
395.00	120.40	sim	10yr5/3	massive	
395.42	120.52	sim	5y5/2	massive	brown filled cracks
395.75	120.62	m vfs	2.5y5/2	laminated	
396.33	120.80	m	5y5/2	massive	
398.42	121.44	msi & vfs	2.5y5/2	massive w/ silt laminations	
398.75	121.54	m & sim	5y5/2	massive w/ silt laminations	
399.58	121.79	m & si	5y6/2	laminated	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
399.83	121.87	m & si	2.5y5/2	laminated	
400.92	122.20	m	5y5/2	massive	staining in clay (5yr4/6)
401.00	122.22	m & sim	2.5y5/2	laminated.	staining in clay (5yr4/6)
402.75	122.76	m vfs	2.5y5/2	massive	
403.08	122.86	m & si	multi	laminated	
403.50	122.99	msi	2.5y7/2	massive	
404.17	123.19	si & m	5y5/3	laminated	
404.42	123.27	NO RECOVERY			
405.00	123.44	m & si	5y6/2	laminated	
405.75	123.67	si & sim	2.5y5/3	laminated	green clay pellets
406.50	123.90	si & vfs	2.5y5/3	laminated w/ crossbeds	
407.83	124.31	m & si	5y5/3	laminated	
408.25	124.43	sim	5y5/3	massive	
408.50	124.51	sim	5y5/3	disturbed	
409.00	124.66	sim	5y5/3	laminated	
414.33	126.29	NO RECOVERY			
415.50	126.64	sim	5y5/3	laminated	
416.00	126.80	si & m	5y5/3	crossbedded	
416.08	126.82	sim	5y5/3	massive to laminated	
417.17	127.15	pumice s	5y5/3	cryptic	
417.25	127.18	sim	5y5/3	cryptic	
417.33	127.20	m f/vfs	5y5/3	laminated w/ crossbeds	
419.00	127.71	si	5y5/3	massive	
419.58	127.89	NO RECOVERY			
421.00	128.32	m	5y5/3	massive	
422.00	128.63	s & m	N6	disturbed	pumice
422.67	128.83	vfs	5y6/2	laminated (lam) = 1-5 mm thick	poss. organics
423.83	129.18	si,sic,m,vfs	10yr4/2	lam	organic frags.
425.00	129.54	fs	N7	lam	organics; pumice lumps
					pumice lump coll. @ 425'
					weak carb cement in fs
425.50	129.69	vfs	5y5/2	lam, massive, x-bed	
428.42	130.58	sic	5y2/2	lam, disrp	some org in lam
431.50	131.52	m, si, vfs	2.5y6/2		
432.33	131.78	vfs	5y5/2	x-lam, hor lam	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
434.25	132.36	m	5y5/2	lam, fine-bedded (fb)	soft sediment deformation (ssd)
				fb, beds .5-.8 cm thick, mud separated	
435.08	132.61	NO RECOVERY		by thin c silt or vfs partings, irregular	
436.00	132.89	m, vfs lam	5y7/2 silt	fb, to lam to mas	org flecks; selenite (sel), pyrite (py
			5gy5/1 clay	some ssd	
443.33	135.13	NO RECOVERY			
443.75	135.25	vfs to si	5y7/2	x-bed, ripples	
444.33	135.43	m	5y7/2	lam, disrpt. lam	
446.92	136.22	NO RECOVERY			
447.33	136.35	m	5gy7/1 (lgg)	lam,ssd	mottling from vfs or
				lgg = light greenish gray	silt mixed with clay
448.17	136.60	vfs			
448.33	136.65	mud	5y7/2	fb, mottled	
450.25	137.24	mud, vfs	5y7/2	lam to fb, wavy, pumiceous beds ~1-6"	
		pumice lumps		ripple-lam, clay intraclasts	
				pumice sample @ 451'6"	
				at least one pumice bed is graded	
				pyr along bedding planes	
454.08	138.40	NO RECOVERY			
454.75	138.61	m, thin sands	5y7/1	masssive (mas) to lam	pumice mixed in mud
456.75	139.22	NO RECOVERY			
459.42	140.03	m	same	lam to mottled to ssd to fine-bedde	some pumice on
					surface of core
					... core twisted @461'
				euhedral selenite xls (<1 cm) below 466"	
				5" overlap btwn drv 83 & 84	
469.33	143.05	NO RECOVERY			
470.00	143.26	m	same	fb to mas	selenite xls >3cm
471.00	143.56	NO RECOVERY			
472.17	143.92	m	lt gg to	bedd. disrupt. by selenite in upper 2'	
			pale yell	silt lam spaced 0.5-8cm	
			2.5y7/3	pyr in thin sand partings	
				selenite common except 476'2-47	Ruppia seeds @ 480.4', 480.8',
				root traces? @ 486'	484.6', 487.4', 488.0', 488.5', 493.0
				root traces? @ 488'	494.0'

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
				small fault @ 490'	
494.92	150.85	NO RECOVERY			
495.00	150.88	m	same	fb to lam to faintly lam	
					leaf impressions (filamentous)
					at 498'6"; Ruppia seeds @ 498.5',
					499.6', 500.4', 503.4', 504.2',504.3'
505.50	154.08	m	lt gry-wht	mas	drk gray organics(?); Ruppia seeds
					@505.5', 507.5'
507.75	154.76	m	lgg -	lam to fb	root traces?
			pale yell		
				small fault @ ~510	
					tephra samp @ 514'6
					poss org flecks
					at ~515 & 518
				fb, beds .5-.8 cm thick, mud separated	
				by thin c silt or vfs partings, irregular	
				some lam @ 521 4 & 521 10	
				root traces? @ 524	
					small org? flecks
				small faults @ 528	
				selenite vein @ 530	Ruppia seeds @ 508.4', 509.5',
				black org? blobs	512.0', 530.2', 532.0', 552.0'
				black org? blobs @ 530, 533, 535	
				carb pellets @ 534 6	
				black org? blobs @ 539	
				sample @ 543 6 ?	
				large Candonas @ 546 10 in sand lam	
				selenite veins @549	
				root traces? @ 551	
				fb deformed more-or-less below 553	
				fb dipping 20-30^o 557-561	
				black org? blobs @ 560	
				oolitic(?) black org? blobs	
				selenite veins	
				poss fine ooids @ 566 1	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
				abd ostracodes @ 569 4	
				vertical mud-crack? structure @ 570	
				abd ostracodes @ 573 4,	
				some stained black	
				diatoms @`574	
				ostracodes 577-581	
				thin sand lam @ 585	
				Nitzschia-type? diatoms @ 587	
595.83	181.61	NO RECOVERY			
596.00	181.66	m	lgg	fb, as above	
				fb to mas	
				tephra samp @ 604 1	
				thin sand @ 604 1 ~ 30% tephra	
				root traces? @ 609 5	
				root traces? @ 611 2 & 611 4	
				root traces? @ 615	
				root traces? @ 616	
					some selenite
				weak root traces? @ 619, 621	
				white bed @ 618 6-618 8	
				vfs @622 9 (<1")	black org? blobs @623, 625
				mas btwn 623-634	
				vertical filled crack structures @ 628	
					black org? blobs @ 628
				leaf or stem impress, Ruppia seeds	
				@ 634	paper slips (samples taken)
					@ 635 2 & 635 6
				root traces? @ 636	black org? blobs @ 652, 653
				root traces? @ 640	Ruppia seeds @ 615, 616, 619, 62
				mas 646-646 7	634, 636, 638.5, 640, 642, 647,
				root traces? @ 647	652.5, 653, 656, 657, 659, 661, 67
				root traces? @ 650	681, 683, 685, 687, 689
				root traces? @ 656, 658, 660	
				root traces? @ 661	
				thin selenite veins @ 659-665	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
				root traces? @ 671	
				root traces? @ 677	
				root traces? @ 679, 681, 683, 685-690	
				root traces? @ 689	
689.92	210.29	m	white	mas	oolitic?
690.83	210.57	m	lgg-py	fb-mas-lam	black org? blobs @ 691
				root traces? @ 693	Ruppia seeds @ 693, 694, 697,
				selenite 692-705	698, 702.5, 706, 723.3, 727, 737,
				0.5 cm white bed @ 699	739
				root traces? @ 702	
					ostracodes @ 704
				lam mud samp taken @ 704 10-705 1	
				selenite @ 719-723	
				white bed @ 721 7 to 8	
					black org? blobs @ 728
				selenite xls 729-736 (blades)	
				mas to coarse bedded 727-736	
				selenite xls & veins 736-772	
				root traces? @ 739	
				micro faults @ 739	
					black org? blobs @ 740
744.83	227.03	m, vfs	same	thin vfs beds in mud, < 1"	
747.83	227.94	m	same		
751.42	229.03	m, vfs	same	thin vfs beds in mud	
754.42	229.95	m	same		
757.67	230.94	vfs	same	x-lam	
757.83	230.99	m	white	oolitic?, pelletal?	
757.92	231.01	m	lgg, py	minor micro faulting	
				lam, fb, coarser bedded, mas	
				some deformed beds @ 762 5	
775.67	236.42	vfs, m	lgg, py, wht	x-lam, sand; white mud lenses	
778.92	237.41	vfs	lgg, py	flat-lam	
780.92	238.02	mud, vfs	same	mud w/ thin (~1cm) beds throughout	
809.42	246.71	m	lgg, py		Ruppia seeds @ 820.6'
				leaf impressions 816 6-817 5	

Appendix 1: Black Rock Core Log (Oviatt and Kelsey)

Depth Ft	Depth m	Grain size	Color	Bedding/sed. structures	Misc. Notes
				selenite 817-819	
825.00	251.46	m, vfs	lgg, py	mud w/ few thin vfs beds	
833.08	253.92	NO RECOVERY			
837.17	255.17	vfs, fs, m	py , lgg	interbedded sand and mud	Ruppia seeds @ 848.1, 853.1
			2.5y6/3	some lt yel brown in sand	
855.58	260.78	NO RECOVERY			
855.83	260.86	fs, vfs, m	same	horizontally bedded, hard calc sandstone	
858.83	261.77	m, cs	lg to wht	mud w/ sand-size, rounded selenite	
				grains; transported?	
859.83	262.08	fs, vfs, m	lg	lam m & gyp grains @860 7-861 2	
861.50	262.59	NO RECOVERY			
863.50	263.19	fs, vfs, mud	lgg	fb to mas	
				sand cemented by gyp from ~865-875	
872.33	265.89	NO RECOVERY			
873.00	266.09	sf, vfs, m	lgg	gyp sandy mud	
				white mud bed @ 877-877 2	
877.17	267.36	NO RECOVERY			
879.00	267.92	sandy m	lgg, py	lt gray to wht in some beds	
				gyp vein @ 880	
				large euhedral gyp 893-896	
896.83	273.35	bottom		bottom of core	

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 1	39.62	12.08	225.1	66.8	0.1	1.60E-04	N	AF
BRU 2	44.58	13.59	329.5	76.2	0.1	2.00E-05	N	TH
BRU 3	47.42	14.46	130.2	53.4	0.4	4.00E-05	N	AF
BRU 4	48.42	14.76	135.5	36.2	0.2	1.40E-04	N	AF
BRU 5	50.17	15.30	114.3	48.2	0.5	1.30E-04	N	TH
BRU 6	51.75	15.78	237.1	68.3	0.1	3.80E-05	N	AF
BRU 7	53.08	16.18	72.2	-40.8	0.6	3.90E-05	R	TH
BRU 8	54.42	16.59	71.0	-40.8	3.3	6.60E-06	R	AF
BRU 9	54.50	16.62	296.5	-42.0	0.7	3.70E-06	R	TH
BRU 10	55.92	17.05				1.90E-06	R	TH
BRU 11	56.04	17.09	23.5	-37.6	2.6	9.80E-06	R	AF
BRU 12	59.92	18.27	8.5	77.0	0.6	2.80E-04	R??	AF
BRU 13	62.58	19.08	356.5	-33.3	0.1	8.80E-05	R	TH
BRU 14	66.17	20.17	230.1	-46.5	0.1	4.10E-05	R	AF
BRU 15	69.83	21.29	347.5	-13.2	0.7	2.00E-05	T	TH
BRU 16	72.17	22.00	40.2	39.1	0.7	2.90E-05	N	AF
BRU 17	76.58	23.35	216.5	82.3	0.5	2.90E-04	N	TH
BRU 18	79.21	24.15	191.2	73.2	0.2	1.20E-04	N	AF
BRU 19	80.75	24.62	325.7	-40.2	0.1	5.40E-05	R	TH
BRU 20	83.58	25.48	48.2	-66.6	1.3	1.60E-06	R	TH
BRU 21	84.67	25.81	118.2	-25.8	3.5	4.10E-06	R	TH
BRU 22	87.00	26.52	276.4	-33.0	2.9	5.80E-05	R	AF
BRU 23	88.42	26.96	285.5	-53.9	0.1	3.70E-05	R	TH
BRU 24	90.17	27.49	205.6	63.5	0.2	1.00E-04	N?	AF
BRU 25	95.92	29.24	244.8	81.8	0.1	5.40E-05	N?	AF
BRU 26	98.33	29.98	154.8	-60.8	0.1	3.50E-05	R	TH
BRU 27	101.25	30.87	109.2	-63.1	0.0	5.20E-05	R	TH
BRU 28	103.58	31.58				3.70E-05	?	AF
BRU 29	108.08	32.95	4.1	-36.0	1.3	5.90E-05	R	TH
BRU 30	109.83	33.49				5.90E-05	?	AF
BRU 31	113.50	34.60	168.4	-42.6	0.3	3.30E-05	R	AF
BRU 32	116.50	35.52	83.6	-15.3	3.7	2.90E-06	?	TH
BRU 33	118.50	36.13				1.40E-05	R	AF
BRU 34	122.08	37.22	235.6	-35.5	5.0	1.10E-05	R	TH
BRU 35	123.83	37.75	279.7	-63.4	5.4	2.30E-06	R	AF
BRU 36	126.83	38.67	119.6	-42.3	1.3	3.50E-06	R	TH
BRU 37	129.00	39.33	337.0	-27.0	1.1	2.50E-06	R	AF
BRU 38	131.50	40.09	189.2	-62.0	0.5	1.10E-05	R	TH
BRU 39	134.50	41.01	20.0	-74.2	4.1	2.40E-06	R	AF
BRU 40	135.33	41.26				8.20E-06	R	TH
BRU 41	137.33	41.87	196.7	-58.0	0.2	7.40E-06	R	TH
BRU 42	142.83	43.55	154.8	-48.9	0.8	4.10E-06	R	AF
BRU 43	144.75	44.13	156.2	-47.1	2.4	1.40E-06	R	TH
BRU 44	146.75	44.74	169.1	-69.8	0.2	9.10E-07	R	AF
BRU155.83	155.83	47.51	215.8	-38.2	0.9	3.60E-06	R	
BRU 45	157.75	48.10				1.10E-06	R	TH
BRU 46	159.92	48.76	18.3	-62.6	1.1	7.20E-07	R	AF
BRU 47	160.67	48.99	224.0	-52.0	0.4	2.30E-06	R	TH

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 48	163.42	49.82	180.8	-13.1	3.5	1.60E-06	T	AF
BRU 49	165.92	50.59	105.3	63.4	2.4	2.60E-06	N	TH
BRU 50	167.42	51.04	206.2	67.6	0.7	1.80E-05	N	AF
BRU 51	170.92	52.11	339.2	61.4	4.0	1.10E-06	N	TH
BRU 52	174.08	53.07				2.50E-06	R?	AF
BRU 53	175.75	53.58				2.00E-06	N??	TH
BRU 54	178.92	54.55	312.1	35.6	0.4	5.20E-06	N	AF
BRU 55	182.50	55.64	224.7	65.2	2.1	4.90E-06	N	TH
BRU 56	183.83	56.05	2.7	55.8	0.0	2.60E-05	N	AF
BRU 57	186.83	56.96	210.4	70.5	0.0	7.50E-05	N	TH
BRU 58	189.00	57.62	279.6	48.8	0.5	6.40E-06	N	AF
BRU 59	191.17	58.28				9.90E-07	N?	TH
BRU 60	194.00	59.15	99.7	61.9	2.3	1.30E-06	N?	AF
BRU 61	196.25	59.83	326.3	37.3	1.3	2.90E-06	N	TH
BRU 62	199.67	60.88	170.5	55.8	6.7	5.00E-06	N	AF
BRU 63	202.33	61.69	38.4	-55.7	2.8	4.50E-06	R	TH
BRU 64	205.00	62.50				3.50E-06	?	AF
BRU 65	208.42	63.54				2.40E-06		TH
BRU 66	211.58	64.51	209.7	-59.6	1.2	7.60E-07	R	AF
BRU 67	215.83	65.80				7.10E-06	?	TH
BRU 68	219.17	66.82	74.4	-50.0	0.8	1.70E-06	R	AF
BRU 69	221.67	67.58				2.50E-06	R	TH
BRU 70	223.92	68.27	35.5	-43.4	2.8	1.40E-06	R	AF
BRU 71	226.25	68.98	190.8	-76.3	0.0	7.10E-06	R	TH
BRU 72	229.00	69.82	264.0	-81.4	1.0	7.10E-06	R	AF
BRU 73	231.42	70.56	180.0	-84.5	0.3	5.30E-07	R	TH
BRU 74	234.50	71.49				2.30E-06	R	AF
BRU 75	236.58	72.13				6.50E-06	R	TH
BRU 76	239.42	72.99				3.30E-06	?	AF
BRU 77	247.50	75.46	357.9	-37.1	0.4	3.30E-06	R	TH
BRU 78	248.17	75.66				5.60E-06	R?	AF
BRU 79	249.92	76.20				4.90E-06	T	TH
BRU 80	252.67	77.03	186.8	-46.1	0.0	2.60E-06	R	AF
BRU 81	254.67	77.64	260.3	-42.7	0.3	1.30E-06	R	TH
BRU 82	257.42	78.48	37.0	-44.9	0.0	2.90E-04	R	AF
BRU 83	259.83	79.22				1.00E-06	R	TH
BRU 84	261.25	79.65	35.0	-35.4	0.0	5.10E-05	R	AF
BRU 85	264.50	80.64				6.50E-06	?	TH
BRU 86	268.33	81.81	282.2	-63.8	0.8	6.00E-06	R	AF
BRU 87	270.92	82.60				9.00E-08	R	TH
BRU 88	273.83	83.49	199.7	-50.4	0.0	1.70E-06	R	AF
BRU 89	277.00	84.45	327.1	-59.6	2.4	5.40E-06	R	TH
BRU 90	281.17	85.72				2.50E-06	R	AF
BRU 91	285.00	86.89				2.30E-06	R	TH
BRU 92	286.33	87.30	84.2	-41.9	0.4	5.60E-06	R	AF
BRU 93	288.58	87.98	36.9	-78.0	4.9	6.40E-07	R	TH
BRU 94	291.17	88.77				2.90E-05	?	AF
BRU 95	293.25	89.41	340.8	-49.3	2.1	3.40E-06	R	TH

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 96	296.50	90.40				2.00E-06	?	AF
BRU 97	298.50	91.01	38.4	-43.0	5.2	5.00E-06	R	TH
BRU 98	302.33	92.17				8.10E-06	N?	AF
BRU 99	304.50	92.84				5.20E-07	?	TH
BRU 100	306.50	93.45				6.30E-07	R?	AF
BRU 101	308.25	93.98	358.3	-27.4	3.4	4.70E-06	T?	TH
BRU 102	310.67	94.72				6.90E-06	?	AF
BRU 103	314.50	95.88	179.5	-66.0	0.1	1.40E-05	R	TH
BRU 104	316.50	96.49	334.1	-53.8	0.0	2.50E-05	R	AF
BRU 105	319.58	97.43				2.40E-06	R	TH
BRU 106	322.58	98.35	331.0	62.4	0.6	3.10E-06	N	AF
BRU 107	327.00	99.70	315.6	32.4	0.8	6.10E-06	N	TH
BRU 108	331.00	100.91	36.4	-47.7	0.0	2.60E-04	R	AF
BRU 109	333.75	101.75	105.3	-54.9	0.7	3.30E-06	R	TH
BRU 110	337.50	102.90	345.6	-25.9	0.0	7.70E-05	R	AF
BRU 111	340.83	103.91	297.9	-57.6	0.1	6.10E-05	R	TH
BRU 112	343.42	104.70	8.6	-67.5	0.3	4.20E-05	R	TH
BRU 113	345.67	105.39						
BRU 114	348.00	106.10	166.2	-15.3	0.0	4.40E-04	T	AF
BRU 115	353.83	107.87	295.7	-7.8	0.2	8.70E-05	T	TH
BRU 116	355.83	108.48	17.8	-55.7	0.1	1.80E-05	R	AF
BRU 117	358.33	109.25	87.9	-75.3	1.8	1.10E-06	R	AF
BRU 118	364.08	111.00				6.80E-07	?	AF
BRU 119	366.00	111.59	39.7	-51.3	0.3	6.20E-06	R	TH
BRU 120	368.42	112.32	53.3	-60.2	0.1	8.70E-06	R	AF
BRU 121	370.67	113.01				2.40E-06	?	AF
BRU 122	373.17	113.77				8.70E-07	R?	TH
BRU 123	376.08	114.66				5.50E-06	R	AF
BRU 124	378.17	115.30	97.8	-40.2	8.8	2.30E-06	R	AF
BRU 125	381.08	116.18	136.3	-43.5	0.2	1.20E-05	R	AF
BRU 126	382.42	116.59						
BRU 127	385.08	117.40	38.9	-33.8	0.0	2.00E-04	R	AF
BRU 128	388.33	118.39	125.0	-46.2	0.0	9.50E-05	R	TH
BRU 129	390.75	119.13	109.8	-53.9	0.0	7.40E-05	R	AF
BRU 130	393.58	119.99	206.0	-32.6	0.0	3.70E-05	R	TH
BRU 131	395.58	120.60	293.6	-44.6	1.6	5.80E-06	R	AF
BRU 132	399.33	121.75				1.00E-05	?	TH
BRU 133	401.00	122.26	187.0	-16.1	0.1	4.30E-05	T	AF
BRU 134	403.83	123.12	105.7	-37.7	0.0	4.30E-04	R	TH
BRU 135	405.33	123.58	0.4	-40.3	0.1	1.50E-05	R	AF
BRU 136	408.08	124.41	227.5	-40.4	0.1	1.90E-05	R	TH
BRU 137	409.33	124.80	230.5	-48.4	0.0	4.20E-05	R	AF
BRU 138	412.58	125.79				2.20E-06	R	TH
BRU 139	418.00	127.44	247.5	-37.0	0.1	3.30E-05	R	AF
BRU 140	421.67	128.56	91.8	-39.1	0.0	4.70E-05	R	TH
BRU 141	429.50	130.95	171.4	-37.3	0.1	1.40E-05	R	TH
BRU 142	431.92	131.68	16.9	-35.5	0.2	1.40E-04	R	AF
BRU 143	436.33	133.03	276.5	-43.4	0.0	2.00E-05	R	TH

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 144	439.17	133.89	311.7	-27.0	0.1	5.50E-05	R	AF
BRU 145	447.92	136.56	177.4	-36.4	0.6	8.70E-06	R	TH
BRU 146	453.75	138.34	356.4	-40.9	0.2	5.50E-06	R	AF
BRU 147	455.58	138.90				1.70E-06	R?	TH
BRU 148	461.42	140.68	147.5	-19.4	0.1	8.90E-06	T	AF
BRU 149	463.17	141.21	286.5	-33.1	0.2	3.20E-06	R	TH
BRU 150	465.42	141.90				2.40E-07	R	AF
BRU 151	468.50	142.84	261.6	-49.2	4.8	8.80E-07	R	AF
BRU 152-1	475.75	145.05				1.20E-06		
BRU 153-1	477.67	145.63				5.50E-07	?	
BRU 154-1	480.58	146.52	155.1	-61.9	1.1	9.70E-07	R	
BRU 155-1	483.42	147.38	27.2	-60.8	0.3	4.00E-07	R	
BRU 156-1	486.00	148.17						
BRU 157-1	488.08	148.80	132.2	-38.5	1.1	9.00E-07	R	
BRU 152-2	491.67	149.90						TH
BRU 153-2	494.42	150.74					R	AF
BRU 154-2	497.00	151.52						
BRU 155-2	501.17	152.80	27.2	-60.8	0.3	4.00E-07	R	AF
BRU 156-2	504.75	153.89						
BRU 157-2	511.08	155.82	158.6	-36.3	0.9	9.00E-07	R	AF
BRU 158	514.08	156.73	59.1	-44.7	1.1	2.90E-06	R	
BRU 159	517.25	157.70	321.3	-62.6	0.8	7.20E-07	R	AF
BRU 160	521.75	159.07				1.90E-06	R	
BRU 161	524.42	159.88	272.7	-61.4	2.8	3.00E-07	R	AF
BRU 162	528.25	161.05				2.70E-07	R	
BRU 163	533.08	162.52	97.1	-53.4	1.6	3.60E-07	R	AF
BRU 164	536.25	163.49				2.70E-07	R	
BRU 165	544.17	165.91				8.20E-07	R	AF
BRU 166	546.92	166.74						
BRU 167	548.58	167.25				9.00E-07	?	AF
BRU 168	555.08	169.23				3.70E-07	R	
BRU 169	557.83	170.07	48.0	-49.2	3.0	5.40E-07	R	AF
BRU 170	568.00	173.17						
BRU 171	571.50	174.24	271.5	-34.4	0.0	7.00E-06	R	AF
BRU 172	576.25	175.69				3.10E-07	R?	
BRU 173	580.83	177.08				5.50E-07	R	AF
BRU 174	584.50	178.20				9.60E-07	R	
BRU 175	590.33	179.98	36.4	-57.9	0.4	1.90E-06	R	AF
BRU 176	594.92	181.38				6.80E-08	R	
BRU 177	598.58	182.49				2.00E-06	R	AF
BRU 178	603.25	183.92				1.50E-06	R	
BRU 179	608.67	185.57				1.50E-06	R	AF
BRU 500	611.00	186.28	136.3	-66.1	5.8	8.70E-07	R	
BRU 180	612.67	186.79				2.70E-07	R?	
BRU 181	615.67	187.70				5.90E-07	R	AF
BRU 501	621.00	189.33				5.70E-07	T?	
BRU 502	623.50	190.09				1.40E-06	R	
BRU 503	628.92	191.74	201.0	86.7	4.2	9.60E-07	N	

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 504	634.50	193.45	333.4	67.9	0.2	6.30E-07	N	
BRU 506	636.58	194.08	338.6	-69.1	1.0	7.30E-07	R	
BRU 508	637.67	194.41	44.4	-32.2	1.3	2.40E-06	R	
BRU 505	640.42	195.25	258.0	-63.2	2.9	6.80E-07	R	
BRU 507	642.75	195.96	282.2	-45.4	2.7	1.20E-06	R	
BRU 182	644.83	196.59	120.6	-55.9	0.3	4.10E-07	R	
BRU 510	646.17	197.00				1.10E-06	R	
BRU 515	647.83	197.51				3.60E-07	N	
BRU 509	649.58	198.04				1.30E-06	R	
BRU 511	652.08	198.80				9.90E-07		
BRU 513	653.92	199.37				1.20E-06	T?	
BRU 512	658.25	200.69	293.3	65.1	1.7	1.40E-06	N	
BRU 514	660.08	201.24	92.5	66.0	1.1	1.40E-06	N	
BRU 516	661.33	201.63	75.0	-37.4	1.7	1.60E-06	R	
BRU 517	665.75	202.97	152.0	48.2	1.4	1.50E-06	N	
BRU 518	672.08	204.90	334.9	64.5	0.3	1.60E-06	N	
BRU 521	673.33	205.28	354.6	45.0	0.9	1.10E-06	N	
BRU 183	673.83	205.44	287.2	77.1	1.3	1.80E-06	N	AF
BRU 522	676.33	206.20				1.70E-06	N	
BRU 523	677.42	206.53	293.8	48.0	5.9	1.50E-06	N	
BRU 184	677.83	206.66				4.00E-07	?	
BRU 519	679.92	207.29	282.2	78.4	0.7	1.30E-06	N	
BRU 520	682.00	207.93	116.6	71.2	0.2	2.00E-06	N	
BRU 524	683.92	208.51				9.30E-07	R	
BRU 525	686.00	209.15	301.1	71.4	0.2	1.20E-06	N	
BRU 526	687.83	209.70	158.8	81.5	1.9	2.70E-06	N	
BRU 527	689.92	210.34				2.00E-06	R?	
BRU 528	691.92	210.95				9.20E-07	R?	
BRU 186	693.25	211.36				7.10E-07	?	
BRU 529	695.92	212.17	100.9	79.7	0.6	1.50E-06	N	
BRU 530	697.17	212.55	72.0	63.2	0.1	2.10E-06	N	
BRU 531	698.33	212.91	23.3	53.8	0.4	2.00E-06	N	
BRU 532	701.58	213.90				1.60E-06	R	
BRU 187	702.58	214.20	271.0	49.3	1.2	1.90E-06	N	AF
BRU 533	705.42	215.07	163.6	83.6	0.1	1.40E-06	N	
BRU 188	706.83	215.50				2.00E-07	?	
BRU 534	709.33	216.26	277.7	54.7	0.3	1.70E-06	N	
BRU 535	710.58	216.64	100.4	59.6	2.4	9.10E-07	N	
BRU 189	713.00	217.38				1.40E-06	?	AF
BRU 536	714.42	217.81				1.20E-06	R	
BRU 190	716.92	218.57				2.20E-06	?	
BRU 537	719.00	219.21				1.10E-06	N	
BRU 191	721.25	219.89	98.3	61.1	0.7	2.10E-06	N	AF
BRU 538	722.67	220.33	186.7	66.6	9.5	6.40E-07	N	
BRU 539	724.67	220.94	51.3	60.2	11.5	1.30E-06	N	
BRU 540	726.50	221.49	188.7	59.4	1.4	9.10E-07	N	
BRU 541	728.75	222.18				7.90E-07	N	
BRU 192	730.58	222.74						

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 542	732.67	223.37	266.8	49.3	0.4	1.90E-06	N	
BRU 543	734.00	223.78	236.7	69.6	0.2	1.60E-06	N	
BRU 193	736.67	224.59				2.20E-06	?	AF
BRU 544	739.75	225.53	111.0	70.9	0.5	2.10E-06	N	
BRU 545	742.00	226.22	108.5	82.8	0.1	1.50E-06	N	
BRU 546	743.83	226.78	130.5	54.5	1.7	1.10E-06	N	
BRU 194	745.00	227.13	76.2	78.9	0.5	1.70E-06	N	
BRU 547	747.42	227.87	187.5	-0.1	1.2	2.00E-06	??	
BRU 548	751.25	229.04						
BRU 195	752.75	229.50	302.7	39.7	0.9	3.00E-06	N	AF
BRU 549	754.83	230.13	304.9	31.0	12.2	2.10E-06	N	
BRU 550	757.25	230.87	72.1	56.0	0.1	1.80E-06	N	
BRU 551	760.17	231.76				1.60E-06	N	
BRU 552	763.08	232.65				4.10E-07	?	
BRU 553	766.67	233.74	198.6	73.5	0.4	2.40E-06	N	
BRU 554	768.33	234.25	40.9	68.0	2.1	1.40E-06	N	
BRU 196	769.33	234.55				1.80E-06		
BRU 197	764.33	233.03	105.2	71.5	0.1	3.20E-06	N	AF
BRU 557	770.58	234.93	136.9	77.1	0.8	1.20E-06	N	
BRU 198	772.42	235.49	10.0	46.5	4.1	1.80E-06	N	
BRU 555	774.33	236.08	185.5	60.2	1.4	1.30E-06	N	
BRU 556	776.00	236.59	258.3	81.8	0.5	1.50E-06	N	
BRU 199	778.42	237.32	343.9	48.5	2.8	2.90E-06	N	AF
BRU 558	781.08	238.13	239.7	71.6	0.3	1.80E-06	N	
BRU 560	785.83	239.58				5.30E-06	N	
BRU 200	787.83	240.19	232.1	67.1	0.2	1.40E-06	N	
BRU 559	790.00	240.85	174.1	68.0	1.4	1.80E-06	N	
BRU 561	792.17	241.52	21.4	86.3	0.1	2.40E-06	N	
BRU 562	793.83	242.02	151.4	78.4	1.0	2.10E-06	N	
BRU 563	794.92	242.35	323.1	66.3	0.4	1.50E-06	N	
BRU 564	796.83	242.94	41.1	70.7	0.2	2.10E-06	N	
BRU 565	799.17	243.65	338.9	54.7	3.3	5.70E-06	N	
BRU 566	800.83	244.16	237.6	79.0	0.2	3.40E-06	N	
BRU 201	801.17	244.26	20.4	30.8	0.4	2.00E-06	N	AF
BRU 567	803.67	245.02	201.9	51.2	0.4	2.00E-06	N	
BRU 568	805.17	245.48	42.5	46.5	0.2	3.80E-06	N	
BRU 569	806.83	245.98	82.9	65.8	0.2	2.90E-06	N	
BRU 202	807.75	246.27				1.90E-06	?	
BRU 570	810.75	247.18	91.2	62.3	0.5	2.10E-06	N	
BRU 203	812.00	247.56	58.1	60.2	0.3	2.40E-06	N	AF
BRU 571	814.92	248.45	203.2	68.6	1.6	2.60E-06	N	
BRU 572	816.67	248.98	45.5	51.5	0.2	2.20E-06	N	
BRU 204	817.67	249.29	132.0	72.1	0.0	1.20E-06	N	
BRU 573	820.00	250.00	337.0	60.8	0.4	2.10E-06	N	
BRU 574	821.75	250.53	77.4	69.6	0.1	2.30E-06	N	
BRU 575	824.67	251.42	19.4	70.3	0.3	2.40E-06	N	
BRU 576	826.42	251.96	121.5	46.0	0.1	3.10E-06	N	
BRU 576A	827.92	252.41	89.0	76.3	0.1	2.40E-06	N	

Appendix 2: Black Rock Paleomagnetic Data (Roberts)

SAMPLE	Depth (Feet)	Depth (m)	Declination (°)	Inclination (°)	Delta (°)	Intensity	Polarity	Demag
BRU 577	831.33	253.45				2.90E-06	R	INV??
BRU 205	838.42	255.62	148.5	45.0	0.3	8.90E-06	N	AF
BRU 578	838.75	255.72	311.1	68.4	0.4	7.40E-06	N	
BRU 579	840.08	256.12	163.7	85.4	0.6	4.00E-06	N	
BRU 581	842.42	256.84				4.90E-06	?	
BRU 206	843.50	257.16	12.5	40.6	1.5	7.50E-06	N	
BRU 207	846.50	258.08	343.7	61.0	1.4	6.10E-06	N	AF
BRU 580	852.42	259.88				2.70E-06	R?	
BRU 582	854.83	260.62				9.90E-06	?	
BRU 208	856.42	261.10	256.4	75.9	0.0	4.50E-06	N	
BRU 584	859.33	261.99				1.80E-06	?	
BRU 585	860.92	262.48	49.9	68.2	0.8	6.70E-06	N	
BRU 587	864.92	263.70	292.1	49.1	0.7	9.10E-06	N	
BRU 588	867.00	264.33	110.5	67.5	0.1	4.00E-06	N	
BRU 209	867.75	264.56	102.0	44.0	2.2	1.10E-05	N	AF
BRU 589	868.33	264.73				1.30E-06	?	
BRU 590	870.83	265.50	168.4	57.9	1.2	7.10E-06	N	
BRU 591	876.17	267.12	278.8	61.6	1.1	1.80E-06	N	
BRU 210	876.58	267.25				1.70E-06	N	
BRU 592	880.25	268.37	1.1	77.5	1.0	2.90E-06	N	
BRU 594	881.50	268.75	37.5	36.3	0.5	3.30E-06	N	
BRU 211	883.17	269.26	255.4	34.0	0.5	2.00E-06	N	AF
BRU 595	883.92	269.49	27.5	58.8	1.1	2.80E-06	N	
BRU 596	886.00	270.12	4.8	-30.5	2.3	1.40E-05	R	
BRU 597	888.08	270.76	95.3	-72.5	0.4	9.60E-06	R	
BRU 212	891.83	271.90	122.7	-59.7	3.6	2.70E-06	R	
BRU 593	894.17	272.61	62.2	61.2	0.2	1.00E-06	N	
BRU 213	896.17	273.22	267.3	79.8	1.8	2.30E-06	N	AF
BRU 595A	896.33	273.27	57.5	35.3	2.8	1.50E-05	N	

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Key to pollen categories.

Abbreviation	Category	Abbreviation	Category
Depth	Depth in feet	Ambr.	*Ambrosia-type*
Sum	Terrestrial Pollen Sum	Arte.	*Artemisia*
Abies	*Abies*	Tubu.	Tubuliflorae
Junip.	*Juniperus-type*	Ligu.	Liguliflorae
Picea	*Picea*	Ch.Am.	Chenopodiaceae/Amaranthus
Pinus	*Pinus*	Sarc.	*Sarcobatus*
Ps./La.	*Pseudotsuga/Larix*	Poac.	*Poaceae*
Ts.he.	*Tsuga heterophylla*	Apia.	Apiaceae
Ve.un.	Vesiculate conifer undif.	Bras.	Brassicaceae
Ep.tr.	*Ephedra trifurca-type*	Cary.	Caryophyllaceae
Ep.vi.	*Ephedra viridis-type*	Erio.	*Eriogonum*
Acer	*Acer*	Euph.	Euphorbiaceae
Alnus	*Alnus*	Faba.	Fabaceae
Arce.	*Arceuthobium*	Gili.	*Gilia-type*
Betula	*Betula*	Onag.	Onagraceae
Celtis	*Celtis*	Phlox	*Phlox*
Cerc.	*Cercocarpus-type*	Pole.	*Polemonium*
Frax.	*Fraxinus*	Poly.	Polygonaceae
Frem.	*Fremontodendron?*	Sola.	*Solanaceae*
Holo.	*Holodiscus-type*	Thal.	*Thalictrum*
Popu.	*Populus*	Unkn.	Unknown
Pote.	*Potentilla*	Inde.	Indeterminate
Pter.	*Pterocarya?*	Mono.	Monlete spores
Quer.	*Quercus*	Tril.	Trilete spores
Rham.	*Rhamnaceae*	Cype.	Cyperaceae
Rosa.	*Rosaceae*	Myri.	*Myriophyllum*
Salix	*Salix*	Ty.Sp.	*Typha/Sparganium*
Sh./E.	*Shepherdia/Elaegnus*	Pota.	*Potamogeton*
Symp.	*Symphoricarpos/Lonicera*	Rupp.	*Ruppia*
Ulmus	*Ulmus*	Botr.	*Botryococcus*
		Pedi.	*Pediastrum*

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Sum	Abies	Junip.	Picea	Pinus	Ps./La.	Ts.he.	Ve.un.	Ep.tr.	Ep.vi.	Acer	Alnus	Arce.	Betula	Celtis	Cerc.	Frax.	Frem.	Holo.	Popu.
Surf1	326	1	17	0	69	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Surf 2	305	0	23	0	30	0	0	1	0	4	0	0	0	1	0	0	0	0	0	3
54.42	208	0	13	0	172	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0
55.92	200	0	5	0	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69.83	328	1	22	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116.50	328	3	8	1	185	2	0	1	0	3	0	1	0	0	0	0	0	0	0	0
131.50	326	2	10	0	159	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0
142.83	327	2	4	1	298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146.75	326	1	27	0	47	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
157.33	327	0	12	0	38	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0
163.42	325	0	11	0	73	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
170.08	326	0	21	0	37	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
175.75	330	7	10	0	187	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
182.50	326	1	20	1	35	0	0	2	0	0	0	0	0	2	0	0	0	1	0	0
186.83	328	0	44	0	21	0	0	1	0	2	1	0	0	0	0	0	0	0	0	0
194.33	325	2	18	0	61	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
202.33	325	1	19	0	60	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
208.42	325	1	3	0	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215.83	331	1	28	0	101	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
221.75	326	0	7	0	80	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0
226.75	327	1	29	0	81	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
231.42	325	0	18	0	33	0	0	0	1	5	0	0	0	1	0	0	0	0	0	0
236.58	328	1	28	0	36	0	0	0	2	3	1	0	0	1	0	2	0	0	0	0
239.42	326	2	15	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254.67	327	1	23	0	63	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
264.50	326	0	10	0	25	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
268.33	326	0	38	0	70	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
276.92	328	5	37	0	89	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
285.00	326	2	26	2	84	0	0	1	0	0	0	0	1	3	0	1	0	0	0	0
293.25	325	2	45	0	90	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0
298.50	327	0	6	0	217	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
304.50	326	5	16	0	31	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0
310.67	329	1	24	0	121	0	0	0	0	2	0	0	0	0	0	2	0	0	1	0
316.50	326	2	14	0	51	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0
322.58	329	3	35	0	73	0	0	0	1	3	0	0	0	1	0	2	0	0	1	0
327.00	326	0	9	0	86	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
333.75	326	0	9	0	62	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Sum	Abies	Junip.	Picea	Pinus	Ps./La.	Ts.he.	Ve.un.	Ep.tr.	Ep.vi.	Acer	Alnus	Arce.	Betula	Celtis	Cerc.	Frax.	Frem.	Holo.	Popu.
337.50	326	0	17	0	31	0	0	2	0	1	2	0	0	0	0	0	0	0	0	0
343.42	329	0	10	0	49	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
348.00	326	1	5	0	75	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0
353.83	326	0	34	1	99	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0
357.50	328	9	40	0	135	0	0	0	3	3	0	0	0	0	0	1	0	0	0	0
361.83	328	2	15	0	62	0	0	1	0	1	0	0	0	4	0	0	0	0	0	0
364.08	326	13	34	2	96	0	0	2	0	1	0	0	0	7	2	0	0	0	0	0
366.00	325	2	60	0	57	0	0	2	4	5	0	0	0	1	0	2	0	0	0	0
368.42	326	4	51	0	71	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0
370.67	325	3	20	0	79	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0
371.50	325	2	21	0	67	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0
373.17	324	16	14	0	208	0	0	6	0	14	0	0	0	1	0	0	0	0	0	0
374.50	326	6	19	0	159	0	0	0	0	7	0	0	0	1	0	0	0	0	0	0
378.83	327	7	18	0	94	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0
381.08	328	0	12	0	55	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0
385.08	326	1	23	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
388.33	325	0	74	0	29	0	1	0	2	1	0	0	0	0	0	3	0	0	0	0
398.50	326	35	11	4	133	1	0	2	0	2	0	0	0	2	0	0	0	0	0	0
403.83	329	3	20	0	38	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
409.33	326	1	63	0	45	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
417.50	326	0	4	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
421.67	325	2	21	0	51	1	0	1	0	2	0	1	0	1	0	0	0	0	0	0
429.50	326	1	6	0	47	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0
436.33	326	0	14	0	29	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
445.50	326	5	13	0	116	0	1	2	0	2	0	0	0	0	0	0	0	0	0	0
453.75	326	4	36	3	60	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
455.58	326	1	13	0	111	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
463.17	325	3	9	3	121	0	0	2	1	6	0	0	0	1	0	0	0	0	0	0
467.50	326	1	34	0	86	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
468.50	327	5	47	0	103	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0
477.67	328	1	41	0	91	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
480.58	328	4	37	0	130	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
485.50	326	0	9	0	58	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0
491.67	325	1	24	0	133	0	0	0	0	3	1	0	0	0	0	1	0	0	1	0
497.00	327	0	24	0	63	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0
504.75	326	3	71	0	76	0	0	0	0	2	1	0	0	1	1	1	0	0	0	0
514.08	327	4	19	0	149	0	0	0	1	3	0	0	0	0	0	1	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Sum	Abies	Junip.	Picea	Pinus	Ps./La.	Ts.he.	Ve.un.	Ep.tr.	Ep.vi.	Acer	Alnus	Arce.	Betula	Celtis	Cerc.	Frax.	Frem.	Holo.	Popu.
521.58	325	2	22	0	118	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0
528.25	326	0	23	0	124	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0
536.25	327	9	53	0	140	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0
544.42	327	0	11	0	84	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0
548.58	327	1	25	0	129	0	0	0	1	4	0	0	0	0	0	1	0	0	0	0
557.83	328	5	60	0	109	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
562.25	326	10	30	6	136	0	0	0	1	6	0	0	0	0	0	2	0	0	0	0
568.50	327	3	38	0	98	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0
576.25	325	0	10	0	134	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0
584.50	325	2	13	0	60	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
587.00	326	1	19	0	110	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
594.92	325	1	7	0	124	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0
603.25	325	2	16	0	67	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
608.67	325	2	16	0	80	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0
615.67	325	0	27	1	62	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0
620.50	326	2	39	0	71	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0
625.50	325	2	26	0	95	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0
632.42	326	3	36	0	132	0	0	1	4	2	0	0	0	0	0	0	0	0	0	0
637.50	326	3	10	0	113	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0
642.50	326	5	41	0	89	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0
644.83	302	6	52	0	65	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
647.50	326	10	61	0	69	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0
654.67	327	1	17	1	54	0	0	0	3	6	0	1	0	4	0	1	1	0	0	0
658.00	328	2	23	1	93	0	0	1	1	10	0	1	0	0	0	1	0	0	0	0
663.50	306	1	51	0	86	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
668.42	327	16	18	0	114	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0
673.83	326	4	18	0	77	0	0	0	1	3	0	3	0	0	0	2	0	0	0	0
679.50	326	1	27	0	50	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
684.50	329	2	15	1	51	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
684.75	306	4	10	0	40	0	0	0	2	1	0	0	0	2	0	0	0	0	0	0
692.50	324	7	17	0	164	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0
697.50	325	6	33	0	75	0	0	0	1	10	0	0	0	2	0	0	0	0	0	0
706.83	328	0	26	0	54	0	0	0	1	2	0	0	0	3	0	1	1	0	0	0
713.00	327	1	8	0	44	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
721.25	327	4	34	0	54	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
727.50	325	2	38	0	53	0	0	2	1	5	0	0	0	0	0	0	0	0	0	0
733.50	326	3	20	0	44	0	0	0	0	8	0	0	0	1	0	0	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Sum	Abies	Junip.	Picea	Pinus	Ps./La.	Ts.he.	Ve.un.	Ep.tr.	Ep.vi.	Acer	Alnus	Arce.	Betula	Celtis	Cerc.	Frax.	Frem.	Holo.	Popu.
739.50	326	1	49	0	62	0	0	0	0	8	0	0	0	1	0	0	0	0	0	0
745.00	326	2	64	0	60	0	0	0	1	10	0	0	0	0	0	1	0	0	0	0
752.75	327	1	84	0	45	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
757.08	325	3	36	0	76	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
764.33	328	2	35	1	72	0	0	0	2	2	1	0	0	0	0	0	0	1	0	0
772.42	326	1	64	0	82	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0
778.25	306	0	67	0	98	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
787.83	325	1	29	0	69	0	0	2	1	3	0	0	0	1	0	0	0	1	0	0
790.50	306	4	25	1	35	0	0	1	3	1	0	0	0	4	0	0	0	0	0	0
796.42	327	2	32	0	54	0	0	1	0	4	0	0	0	2	0	0	0	0	0	0
803.42	327	1	34	0	117	0	0	0	0	3	0	1	0	1	0	0	0	0	0	0
807.75	328	3	43	0	84	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0
812.00	327	3	33	0	85	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0
817.67	326	4	25	0	132	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0
818.92	327	5	31	0	164	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
822.83	325	1	20	0	120	0	0	0	5	0	0	0	0	0	0	1	0	0	0	0
828.92	326	3	21	0	97	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
830.75	328	2	9	0	71	0	0	3	2	4	0	0	0	1	0	0	0	0	0	0
838.42	325	5	38	0	105	0	0	2	3	3	0	0	0	1	1	0	0	0	0	0
840.50	305	0	11	0	7	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0
846.58	304	3	25	0	69	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0
851.50	304	3	20	0	49	0	0	3	5	10	0	0	0	0	0	0	0	0	0	0
856.50	305	2	50	0	62	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0
860.42	306	3	54	0	74	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0
867.75	327	12	21	0	112	0	0	0	2	14	0	0	0	0	0	0	0	0	0	0
871.83	306	1	30	0	87	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
876.50	326	3	51	0	124	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
881.50	306	2	28	0	115	0	0	0	2	5	0	1	0	0	0	0	0	0	0	0
885.50	326	2	35	0	56	0	0	0	10	8	0	0	0	0	0	0	0	0	0	0
891.50	305	2	45	0	95	0	0	1	4	7	0	1	0	1	0	0	0	0	0	0
896.50	326	1	35	0	63	0	0	0	3	10	1	0	0	0	0	0	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Pote.	Pter.	Quer.	Rham.	Rosa.	Salix	Sh./E.	Symp.	Ulmus	Ambr.	Arte.	Tubu.	Ligu.	Ch.Am.	Sarc.	Poac.	Apia.	Bras.	Cary.	Erio.
Surf1	0	0	4	0	0	1	0	0	0	20	50	41	0	79	15	13	0	0	0	0
Surf 2	0	0	2	0	0	1	0	0	0	23	63	18	0	104	13	6	0	0	0	0
54.42	0	0	0	0	0	0	0	0	0	0	6	3	0	0	1	0	0	0	0	0
55.92	0	0	0	0	0	0	0	0	0	0	10	0	0	8	4	2	0	0	0	1
69.83	0	0	1	0	0	0	1	0	0	15	74	32	1	80	9	22	1	0	0	0
116.50	0	0	0	0	0	0	0	0	0	3	63	10	0	1	22	3	0	0	0	0
131.50	0	0	0	0	0	0	0	0	0	7	75	21	0	2	9	1	0	0	0	0
142.83	0	0	0	0	0	0	0	0	0	0	19	1	0	0	0	0	0	0	0	0
146.75	1	0	0	0	1	3	0	0	0	5	99	38	0	63	23	2	0	0	0	0
157.33	0	0	0	0	0	1	2	0	0	7	114	34	0	52	21	4	0	0	0	3
163.42	0	0	0	0	0	0	1	0	0	5	104	18	0	53	43	0	0	0	0	1
170.08	0	0	0	0	0	2	1	0	0	8	104	30	0	53	27	6	0	0	1	1
175.75	0	0	0	0	0	0	0	0	0	14	48	10	0	13	22	2	0	0	0	0
182.50	0	0	2	0	0	1	0	0	0	17	70	21	0	82	15	5	0	0	0	2
186.83	0	0	4	0	2	1	0	0	0	27	44	41	1	95	11	10	0	0	0	0
194.33	0	0	1	0	0	0	0	0	0	3	164	20	0	16	4	2	0	0	0	1
202.33	0	0	0	0	0	0	3	0	0	7	107	21	0	53	29	1	0	0	0	0
208.42	0	0	0	0	0	0	0	0	0	6	107	23	0	9	10	5	0	0	0	0
215.83	0	0	3	0	0	1	1	0	0	3	75	13	0	79	4	8	0	0	0	0
221.75	0	0	1	1	3	1	1	0	0	5	110	18	0	62	19	2	0	0	0	1
226.75	0	0	1	0	0	1	3	0	0	4	89	28	0	41	19	3	0	0	1	1
231.42	0	0	2	0	0	0	0	0	0	34	107	22	0	61	11	3	0	0	0	0
236.58	0	0	7	0	1	1	2	0	0	7	125	22	1	43	18	3	0	1	0	0
239.42	0	0	0	0	0	1	1	0	0	12	110	17	0	65	24	3	0	0	0	1
254.67	0	0	0	0	1	2	4	0	0	9	72	13	0	79	30	5	0	0	1	0
264.50	0	0	0	0	0	0	1	0	0	8	112	40	0	57	14	2	0	0	0	2
268.33	0	0	1	0	0	0	1	0	0	4	62	28	0	73	10	12	0	0	2	1
276.92	0	0	1	0	0	1	0	0	0	5	67	22	0	54	13	4	0	0	0	1
285.00	0	0	3	0	0	1	0	0	0	18	63	23	0	66	7	8	0	0	0	0
293.25	0	0	1	0	0	1	1	0	0	7	63	15	0	60	13	2	0	0	0	0
298.50	0	0	6	0	0	1	0	0	0	7	44	15	0	11	4	1	0	0	0	0
304.50	0	0	11	0	0	0	0	0	0	34	60	14	1	99	6	8	0	0	0	2
310.67	0	0	3	0	0	0	4	0	0	2	40	21	0	73	25	0	0	1	0	0
316.50	0	0	1	1	0	0	0	0	0	8	82	30	0	73	31	4	0	0	0	0
322.58	0	0	6	0	0	1	0	0	0	10	45	9	2	94	8	4	0	0	0	3
327.00	0	0	0	0	0	1	0	0	0	9	77	27	0	81	4	4	0	0	0	1
333.75	0	0	1	0	0	0	1	0	0	9	81	28	0	99	13	8	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Pote.	Pter.	Quer.	Rham.	Rosa.	Salix	Sh./E.	Symp.	Ulmus	Ambr.	Arte.	Tubu.	Ligu.	Ch.Am.	Sarc.	Poac.	Apia.	Bras.	Cary.	Erio.
337.50	0	0	0	0	0	0	0	0	0	2	27	17	3	186	8	5	0	0	0	0
343.42	0	0	0	0	0	2	0	0	0	11	112	19	0	67	15	5	2	0	0	3
348.00	0	0	0	0	0	1	3	0	0	6	37	31	1	90	20	4	0	0	1	1
353.83	0	0	0	0	0	1	3	0	0	8	37	17	0	79	5	3	0	0	0	1
357.50	0	0	0	0	0	1	0	0	0	11	54	6	0	33	16	1	1	1	0	0
361.83	0	0	5	0	0	0	0	0	0	30	90	22	0	51	14	6	0	0	0	0
364.08	0	0	0	0	0	0	0	0	0	5	52	26	0	30	2	5	0	0	0	1
366.00	0	0	13	0	0	0	0	0	0	8	68	12	0	48	8	4	0	0	0	0
368.42	0	0	2	0	0	0	0	0	0	4	71	10	0	76	4	2	0	0	0	0
370.67	0	0	1	0	0	0	0	0	0	6	76	21	0	74	17	4	0	0	0	0
371.50	0	0	0	0	0	0	0	0	0	1	67	20	0	97	22	5	0	0	0	1
373.17	0	0	0	0	0	0	0	0	0	2	23	4	0	15	7	3	0	0	0	0
374.50	0	0	0	0	0	0	1	0	0	8	54	13	0	34	9	4	0	0	0	1
378.83	0	0	0	0	0	0	0	0	0	10	71	17	0	69	14	1	0	0	0	0
381.08	0	0	0	0	0	0	0	0	0	4	118	30	0	34	27	16	0	0	0	0
385.08	0	0	0	0	0	0	1	0	0	2	77	55	2	37	21	7	0	0	0	1
388.33	0	0	0	0	3	0	3	0	0	5	82	27	0	36	15	4	0	2	0	0
398.50	0	0	0	0	0	0	0	0	0	15	41	14	1	14	17	7	0	0	0	1
403.83	0	0	0	1	0	1	0	0	0	9	64	13	0	90	9	6	0	2	0	3
409.33	0	0	3	0	0	0	0	0	0	12	59	8	0	84	15	7	0	0	0	1
417.50	0	0	0	0	0	4	1	0	0	10	71	17	0	139	28	8	0	0	0	2
421.67	0	0	0	0	0	0	2	0	0	10	38	10	0	89	47	5	0	0	0	0
429.50	0	0	0	0	0	1	3	0	0	13	56	12	0	92	52	2	0	0	0	2
436.33	0	0	3	0	1	0	0	0	0	10	70	22	0	135	17	8	0	0	0	0
445.50	0	0	0	0	0	0	2	0	0	2	32	17	1	77	31	4	0	0	0	2
453.75	0	0	3	0	0	0	0	0	0	4	82	14	0	77	23	4	0	0	0	0
455.58	0	0	2	0	0	0	0	0	0	3	66	24	0	50	19	3	0	0	0	0
463.17	0	0	0	0	0	1	0	0	0	18	80	16	0	14	13	7	0	0	1	0
467.50	0	0	0	0	0	3	1	0	0	11	64	8	0	85	6	2	0	0	0	1
468.50	0	0	4	0	0	0	0	0	0	7	47	16	0	68	11	4	0	0	0	0
477.67	0	0	2	0	0	0	0	0	0	8	66	17	0	49	11	7	0	0	0	1
480.58	0	0	1	0	1	1	0	0	0	4	51	9	0	60	14	4	0	0	0	0
485.50	0	0	0	0	0	1	0	0	0	5	104	26	0	77	24	7	0	0	1	1
491.67	0	0	2	0	0	0	1	0	0	4	95	19	0	16	11	3	0	1	0	0
497.00	0	0	1	0	0	0	0	0	0	8	97	21	0	46	40	8	0	0	0	1
504.75	0	0	2	0	0	1	1	0	0	4	60	13	0	47	12	4	0	0	0	0
514.08	0	0	2	0	0	1	1	0	0	0	62	19	0	29	18	4	0	0	0	1

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Pote.	Pter.	Quer.	Rham.	Rosa.	Salix	Sh./E.	Symp.	Ulmus	Ambr.	Arte.	Tubu.	Ligu.	Ch.Am.	Sarc.	Poac.	Apia.	Bras.	Cary.	Erio.
521.58	0	0	0	0	0	0	1	0	0	7	69	10	0	39	21	2	0	0	0	3
528.25	0	0	[illegible]	0	0	0	0	0	0	1	63	19	0	43	24	4	0	0	0	2
536.25	0	0	1	0	0	0	0	0	0	5	60	5	0	23	7	3	0	0	0	0
544.42	0	0	0	0	0	1	0	0	0	5	93	29	0	57	19	3	0	0	0	0
548.58	0	0	0	0	0	1	0	0	0	4	65	17	0	21	22	15	0	0	0	0
557.83	0	0	1	0	0	0	0	0	0	9	69	9	0	40	6	4	0	0	0	1
562.25	0	0	0	0	0	1	0	0	0	2	62	8	0	34	5	3	0	0	0	0
568.50	0	0	0	0	0	1	0	0	0	8	73	12	1	45	8	5	1	0	0	0
576.25	0	0	1	0	1	0	2	0	0	7	56	10	1	57	14	9	0	0	1	1
584.50	0	0	1	0	0	0	0	0	0	15	59	22	2	77	27	11	1	0	1	3
587.00	0	0	2	0	0	0	1	0	0	8	47	31	0	74	8	5	1	0	1	0
594.92	0	0	3	0	0	1	0	0	0	3	72	10	0	51	16	6	0	0	1	1
603.25	0	0	2	0	0	0	1	0	0	5	80	21	0	77	28	3	0	0	0	0
608.67	0	0	2	0	0	0	0	0	0	6	77	27	0	51	33	1	0	0	1	0
615.67	0	0	3	0	2	0	0	0	0	1	95	18	0	62	27	3	0	0	0	0
620.50	0	0	0	0	0	0	0	0	0	8	96	12	0	46	19	6	0	0	0	0
625.50	0	0	0	0	0	0	0	0	0	8	94	15	1	33	26	8	0	0	0	2
632.42	0	0	0	0	0	1	0	0	0	2	65	15	0	26	17	2	0	0	0	1
637.50	0	0	0	0	0	0	0	0	0	9	107	23	0	33	12	2	0	0	0	0
642.50	0	0	1	0	0	0	0	0	0	5	99	14	0	44	10	0	0	0	0	0
644.83	0	0	1	1	0	0	0	0	0	7	79	15	0	43	10	5	0	0	0	0
647.50	0	0	1	0	1	1	0	0	0	10	63	9	0	51	22	2	0	0	1	0
654.67	0	0	1	0	0	0	0	0	0	11	70	19	1	96	11	3	0	1	0	1
658.00	0	0	7	1	0	0	0	0	0	7	44	19	0	87	3	3	0	0	0	0
663.50	0	0	1	0	0	1	0	0	0	5	56	17	0	52	8	2	0	0	0	1
668.42	0	0	0	0	0	1	0	0	0	3	58	11	0	35	24	3	1	0	1	0
673.83	0	0	0	0	0	1	1	0	0	8	73	19	0	48	25	1	1	0	2	0
679.50	0	0	0	0	0	0	0	0	0	8	95	19	0	52	22	10	0	0	0	1
684.50	0	0	0	0	0	0	0	0	0	8	86	17	1	93	17	7	0	0	0	0
684.75	0	0	2	0	0	0	0	0	0	13	105	12	0	71	16	11	0	0	0	2
692.50	0	0	0	0	0	0	0	0	0	3	90	9	0	3	14	5	0	0	0	0
697.50	0	0	2	0	1	0	0	0	0	12	72	12	1	58	15	7	0	0	0	2
706.83	0	0	5	0	1	0	0	1	0	12	83	18	0	71	12	17	0	0	0	0
713.00	0	0	0	0	0	1	0	0	0	3	99	16	0	90	26	2	0	0	0	0
721.25	0	0	0	0	1	0	1	0	0	7	85	22	0	50	31	7	0	0	0	0
727.50	0	0	0	0	0	0	0	0	0	18	70	16	1	53	32	4	0	0	0	0
733.50	0	0	0	0	0	0	0	0	0	20	97	19	0	68	20	6	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Pote.	Pter.	Quer.	Rham.	Rosa.	Salix	Sh./E.	Symp.	Ulmus	Ambr.	Arte.	Tubu.	Ligu.	Ch.Am.	Sarc.	Poac.	Apia.	Bras.	Cary.	Erio.
739.50	0	0	6	0	0	0	0	0	0	6	93	15	1	52	6	6	0	0	0	0
745.00	0	0	3	0	0	1	0	0	0	13	47	6	0	77	7	3	0	0	0	0
752.75	0	0	5	0	1	2	0	0	0	21	51	16	1	46	5	18	0	0	0	1
757.08	0	0	3	0	0	2	0	0	2	22	45	14	0	63	5	17	0	0	0	0
764.33	0	0	0	0	0	0	0	0	0	5	81	16	3	59	11	4	0	0	0	0
772.42	0	1	0	0	0	0	0	0	0	2	87	18	1	8	15	9	0	0	0	0
778.25	0	0	1	0	0	0	0	0	0	6	54	16	0	45	6	1	0	0	0	0
787.83	0	0	0	0	0	2	0	0	1	9	43	17	0	93	6	6	0	0	0	2
790.50	0	0	2	0	0	1	1	0	0	22	58	17	0	97	3	12	0	0	0	2
796.42	0	0	5	0	0	0	1	0	0	20	54	19	1	72	15	9	0	0	0	1
803.42	0	0	2	0	1	0	0	0	0	15	39	13	0	50	10	12	0	0	0	0
807.75	0	0	0	0	0	0	0	0	0	15	94	22	0	27	15	10	0	0	0	0
812.00	0	0	0	0	0	3	0	0	0	0	60	14	1	54	7	3	0	0	0	0
817.67	0	0	0	0	0	0	0	0	0	2	75	18	0	6	36	3	0	0	0	0
818.92	0	0	1	0	0	0	0	0	0	2	65	21	0	10	10	1	0	0	0	0
822.83	0	0	2	0	0	0	0	0	0	5	49	24	1	59	17	4	0	0	0	0
828.92	0	0	4	0	1	0	0	0	0	8	64	21	0	56	11	4	0	0	0	2
830.75	0	0	4	0	0	0	0	0	0	15	48	25	0	76	16	14	0	0	0	0
838.42	0	0	1	0	0	0	0	0	0	9	27	9	0	73	11	1	0	0	0	1
840.50	0	0	0	0	0	1	1	0	0	21	79	10	0	137	17	4	0	0	0	0
846.58	0	0	0	0	0	0	1	0	0	12	65	23	0	59	8	11	0	0	0	0
851.50	0	0	0	0	0	0	0	0	0	1	44	24	0	96	6	2	0	0	0	0
856.50	0	0	1	0	1	0	0	0	0	3	53	22	0	76	10	1	0	0	0	0
860.42	0	0	0	0	0	0	0	0	0	6	41	15	0	83	13	1	0	0	0	0
867.75	0	0	1	0	0	1	0	0	0	4	27	20	2	58	19	1	0	0	0	0
871.83	0	0	0	0	0	0	1	0	0	3	58	20	1	72	8	2	0	0	0	2
876.50	0	0	1	0	0	0	0	0	0	3	58	5	0	47	7	2	0	0	1	0
881.50	0	0	0	0	0	0	0	0	0	7	68	14	0	39	14	1	0	0	0	1
885.50	0	0	0	0	0	1	0	0	0	2	49	13	0	96	21	4	0	0	0	0
891.50	0	0	0	0	0	0	0	0	0	8	56	18	0	29	6	8	0	0	0	0
896.50	0	1	0	0	0	0	0	0	0	2	61	24	1	86	9	2	0	0	0	1

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Euph.	Faba.	Gili.	Onag.	Phlox	Pole.	Poly.	Sola.	Thal.	Unkn.	Inde.	Mono.	Tril.	Cype.	Myri.	Ty.Sp.	Pota.	Rupp.	Botr.	Pedi.
Surf1	0	0	0	0	0	0	0	0	0	0	13	0	2	1	0	0	0	0	0	0
Surf 2	0	0	0	0	0	0	0	0	0	0	14	0	0	3	0	1	0	0	0	0
54.42	0	0	0	0	0	0	0	0	0	0	10	0	0	1	0	0	0	0	0	2
55.92	0	0	0	0	0	0	0	0	0	0	7	0	2	5	0	0	0	0	0	0
69.83	0	0	0	1	0	0	0	0	0	0	23	0	0	92	0	2	0	4	1	16
116.50	0	0	0	0	0	0	0	0	0	0	23	0	2	1	0	0	0	0	0	0
131.50	0	0	0	0	0	1	0	0	0	0	34	0	0	0	0	0	0	0	0	0
142.83	0	0	0	0	0	1	0	0	0	0	3	0	0	4	0	0	0	1	2	79
146.75	0	0	0	0	1	0	0	0	0	0	12	0	0	5	0	0	0	73	0	0
157.33	0	0	0	0	0	0	0	0	0	1	34	0	0	3	0	1	0	0	0	0
163.42	0	0	0	0	0	0	0	0	0	0	15	0	0	1	0	0	0	0	0	0
170.08	0	0	0	0	0	0	0	0	0	0	31	0	0	1	0	0	0	22	0	0
175.75	0	0	1	0	0	0	0	0	0	0	11	0	0	0	0	2	0	0	0	0
182.50	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0
186.83	2	0	0	0	1	0	0	0	0	1	19	0	0	3	0	6	0	0	0	0
194.33	0	0	0	0	0	0	0	0	0	0	30	0	0	2	0	0	0	0	0	0
202.33	0	0	0	0	0	0	1	0	0	0	21	0	0	2	1	0	0	2	0	0
208.42	0	0	0	0	1	1	0	0	0	0	19	0	1	1	0	0	0	0	1	2
215.83	0	0	0	0	0	0	0	0	0	0	12	0	0	6	0	0	0	33	2	1
221.75	0	0	0	0	0	0	0	0	0	0	12	0	0	8	2	0	0	1	0	0
226.75	0	0	0	0	1	0	0	0	0	1	21	0	0	3	0	1	0	0	0	1
231.42	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
236.58	0	0	0	0	0	0	0	0	0	0	23	0	0	2	10	0	1	1	17	3
239.42	0	0	0	0	0	0	0	0	0	0	31	0	0	1	0	0	0	0	2	0
254.67	1	0	0	0	0	0	0	0	2	0	20	0	0	4	0	1	0	58	0	0
264.50	0	0	0	0	2	0	0	0	0	0	51	0	0	1	0	0	0	0	0	0
268.33	0	0	0	0	0	0	0	0	0	0	23	0	0	3	0	7	0	124	0	1
276.92	0	0	0	0	1	0	0	0	2	0	25	0	0	7	0	1	0	7	1	1
285.00	0	0	0	0	0	0	0	0	0	0	19	0	1	5	1	4	1	4	1	0
293.25	0	0	0	0	0	1	0	0	0	0	19	0	0	4	0	0	0	44	0	0
298.50	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	2	0
304.50	0	0	0	0	0	0	0	0	0	1	33	0	0	3	0	8	0	0	0	0
310.67	0	0	0	1	0	0	0	0	0	0	8	0	0	9	1	2	0	4	5	2
316.50	0	0	0	0	0	0	0	0	0	0	22	0	0	1	0	2	0	54	0	0
322.58	3	0	0	0	0	0	0	0	0	0	26	0	0	5	0	7	0	24	0	1
327.00	0	0	0	0	1	0	0	0	0	0	25	0	0	4	0	1	0	0	0	0
333.75	0	0	0	0	0	0	0	0	0	0	14	0	0	4	0	2	0	3	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Euph.	Faba.	Gili.	Onag.	Phlox	Pole.	Poly.	Sola.	Thal.	Unkn.	Inde.	Mono.	Tril.	Cype.	Myri.	Ty.Sp.	Pota.	Rupp.	Botr.	Pedi.
337.50	1	0	0	0	1	0	0	0	0	0	23	0	0	12	2	0	0	2	0	0
343.42	0	0	0	0	1	0	0	0	0	0	31	0	1	3	0	2	0	28	0	0
348.00	0	0	0	0	3	0	0	0	0	0	41	0	1	5	0	3	0	1	0	0
353.83	0	0	0	0	2	0	0	0	0	0	30	0	0	8	0	8	0	5	0	0
357.50	0	0	0	0	0	0	1	0	0	0	12	0	0	1	0	3	0	5	0	0
361.83	0	0	0	1	0	0	0	0	0	0	24	2	1	0	0	4	0	0	0	0
364.08	0	0	0	0	0	0	0	0	0	0	48	0	0	2	0	7	0	0	0	4
366.00	0	0	0	0	0	0	0	0	0	0	32	0	0	1	1	2	0	7	0	0
368.42	0	0	0	0	0	0	0	0	0	0	29	0	0	1	0	3	0	0	0	0
370.67	0	0	0	0	0	0	0	0	0	0	20	0	0	5	1	2	0	2	1	0
371.50	0	0	0	0	0	0	0	0	0	0	15	0	0	12	0	33	0	1	0	0
373.17	0	0	0	0	0	0	0	0	0	0	12	0	0	9	0	30	0	0	1	4
374.50	0	0	0	0	0	0	0	0	0	0	11	0	0	2	1	12	0	0	1	0
378.83	0	1	0	0	0	0	0	0	0	0	22	0	0	1	0	1	0	1	2	0
381.08	0	0	1	0	0	0	0	0	0	0	27	0	0	1	0	1	0	0	0	1
385.08	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	2	0	1	0	0
388.33	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0
398.50	0	0	0	1	0	0	0	0	0	0	25	0	0	6	1	30	0	0	0	1
403.83	1	1	0	1	0	0	0	0	0	0	66	0	0	1	0	9	0	0	0	0
409.33	0	1	0	0	0	0	0	0	0	0	26	0	0	0	0	7	0	0	0	0
417.50	0	0	0	0	0	0	0	0	0	0	16	0	0	9	0	10	0	33	0	0
421.67	0	0	0	0	0	0	0	0	0	0	44	0	0	41	0	11	0	10	0	0
429.50	0	0	0	0	0	0	0	0	0	0	35	0	0	6	0	9	0	0	0	0
436.33	0	0	0	0	1	0	0	0	0	0	14	0	1	12	0	2	3	15	0	0
445.50	0	0	0	0	0	0	0	0	0	1	18	0	0	6	0	0	0	1	1	0
453.75	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	6	0	0
455.58	0	0	0	0	0	0	0	0	0	0	32	0	0	3	0	0	0	0	0	0
463.17	0	0	0	0	1	0	0	0	0	0	29	0	0	0	0	2	0	0	0	0
467.50	0	0	0	0	0	0	0	0	0	0	22	0	0	2	0	0	0	0	0	0
468.50	0	0	0	0	0	0	0	0	0	0	12	0	0	1	0	3	0	0	0	0
477.67	1	0	0	0	0	0	0	0	0	0	31	0	0	3	0	6	1	175	0	0
480.58	0	0	0	0	0	0	0	0	0	0	8	0	0	3	0	2	0	98	0	1
485.50	0	0	0	0	0	0	0	0	0	0	10	0	0	2	0	0	0	43	0	0
491.67	0	0	0	0	0	0	1	0	0	0	8	0	0	0	0	0	0	6	0	0
497.00	0	0	0	0	0	0	0	0	0	0	14	0	0	8	0	5	1	10	0	0
504.75	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	2	0	4	0	0
514.08	0	0	0	1	0	0	0	0	0	0	12	0	0	5	0	0	0	1	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Euph.	Faba.	Gili.	Onag.	Phlox	Pole.	Poly.	Sola.	Thal.	Unkn.	Inde.	Mono.	Tril.	Cype.	Myri.	Ty.Sp.	Pota.	Rupp.	Botr.	Pedi.
521.58	0	0	1	0	0	0	0	0	0	0	26	0	0	2	0	0	0	2	0	0
528.25	0	0	0	0	1	0	0	0	0	0	18	0	0	1	0	3	0	7	0	0
536.25	0	0	0	0	0	0	0	0	0	0	17	0	0	0	2	0	0	0	0	0
544.42	0	0	0	0	1	0	0	0	0	1	16	0	0	6	0	8	0	1	0	0
548.58	0	0	0	0	0	0	0	0	0	1	20	0	0	11	0	3	0	67	0	5
557.83	0	0	0	0	0	0	0	0	0	0	13	0	0	3	0	2	0	1	0	0
562.25	0	0	0	0	0	0	0	0	0	1	19	0	0	2	0	4	0	1	3	0
568.50	0	0	0	0	0	0	1	0	0	0	28	0	0	2	0	6	0	0	0	0
576.25	0	0	0	0	0	0	0	0	0	0	16	0	1	1	0	3	0	21	0	0
584.50	0	0	0	0	0	0	0	0	0	0	29	0	0	3	0	2	0	1	2	1
587.00	0	0	0	0	1	0	0	0	0	0	16	0	0	3	0	0	2	32	1	0
594.92	0	0	0	0	0	0	0	0	0	0	24	0	1	1	0	2	0	11	9	0
603.25	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	68	2	0
608.67	0	0	0	0	0	0	0	0	0	0	23	0	0	6	0	0	0	47	0	0
615.67	0	0	0	0	0	0	0	0	0	0	20	0	0	1	0	2	0	18	0	2
620.50	0	0	0	0	0	0	0	0	0	0	20	0	0	3	0	1	0	2	0	0
625.50	0	0	0	0	0	0	0	0	0	0	11	0	0	1	0	11	0	16	0	0
632.42	0	0	0	0	0	0	0	0	0	0	20	0	0	2	0	4	0	0	0	0
637.50	0	0	0	0	0	0	0	0	0	0	10	0	0	1	0	1	0	5	0	0
642.50	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	3	0	3	0	0
644.83	0	0	0	0	0	0	0	0	0	0	16	0	0	4	0	3	0	0	0	0
647.50	0	0	0	0	0	0	0	0	0	0	22	0	1	1	0	8	0	26	0	0
654.67	0	0	0	1	0	0	0	0	0	0	23	0	2	1	0	7	0	2	0	0
658.00	0	0	0	0	0	0	0	0	0	0	24	0	0	3	0	0	0	0	8	0
663.50	0	0	0	0	1	0	0	0	0	0	22	0	0	4	0	1	0	0	0	2
668.42	0	0	0	0	0	0	0	0	0	0	38	0	0	4	0	1	0	9	0	0
673.83	0	0	0	0	0	0	0	0	0	0	40	0	0	4	0	2	0	115	0	1
679.50	0	0	0	0	0	0	0	0	0	0	38	0	0	1	0	3	0	225	0	0
684.50	0	0	0	1	0	0	0	0	0	0	25	0	1	2	1	0	0	23	2	0
684.75	0	0	0	0	0	0	0	0	0	0	15	0	0	2	0	6	0	10	0	0
692.50	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	8	0	0	12	0
697.50	0	0	0	0	0	0	1	0	0	0	14	0	0	0	2	2	0	18	0	0
706.83	0	0	0	0	0	0	0	1	0	0	20	0	0	4	0	2	0	14	0	0
713.00	0	0	0	0	0	0	0	0	0	0	34	0	0	1	0	2	0	0	1	0
721.25	0	0	0	0	0	0	0	0	0	0	27	0	0	1	0	0	0	14	0	0
727.50	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	14	0	0
733.50	0	0	0	0	0	0	0	0	0	0	21	0	0	2	0	3	0	0	0	0

Appendix 3. Pollen Data From The Black Rock Core (Thompson).

Depth	Euph.	Faba.	Gili.	Onag.	Phlox	Pole.	Poly.	Sola.	Thal.	Unkn.	Inde.	Mono.	Tril.	Cype.	Myri.	Ty.Sp.	Pota.	Rupp.	Botr.	Pedi.
739.50	0	0	0	0	0	0	0	0	0	0	20	0	0	3	0	1	0	25	0	0
745.00	0	0	0	0	0	0	1	0	0	0	30	0	0	3	0	1	0	4	0	0
752.75	0	0	0	1	0	0	0	0	0	0	27	0	0	3	0	5	0	5	1	2
757.08	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	3	0	7	0	0
764.33	0	0	0	0	0	0	0	0	0	0	33	0	1	2	0	1	0	6	38	0
772.42	0	0	0	0	0	0	0	0	0	0	33	0	0	1	0	24	1	51	0	0
778.25	0	0	0	0	0	0	0	0	0	0	11	0	0	1	0	4	0	0	0	0
787.83	0	0	0	0	0	0	0	0	0	0	40	0	1	0	0	1	0	0	1	1
790.50	0	0	0	0	0	0	0	0	0	0	17	0	0	2	0	6	0	0	0	0
796.42	0	0	0	0	0	0	0	0	0	1	34	0	0	1	0	2	0	0	1	1
803.42	0	0	0	0	0	0	0	0	0	2	26	0	0	3	0	2	0	3	1	0
807.75	0	0	0	0	0	0	0	0	0	0	12	0	1	10	0	6	0	18	3	0
812.00	0	0	0	0	0	0	0	0	0	0	58	0	0	2	0	0	0	0	0	0
817.67	0	0	0	0	0	0	0	0	0	0	18	0	0	5	0	0	0	29	0	2
818.92	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	33	0	1
822.83	0	0	0	0	0	0	0	0	0	0	17	0	1	3	0	0	0	8	0	1
828.92	0	0	0	0	1	0	0	0	0	0	30	0	1	2	0	0	0	12	0	0
830.75	1	0	0	1	0	0	0	0	0	0	36	0	0	1	0	0	0	0	2	0
838.42	0	0	0	0	0	0	0	0	0	1	35	0	0	0	0	3	0	0	2	3
840.50	0	0	0	0	0	0	0	0	0	0	13	0	0	1	0	2	0	0	2	0
846.58	0	0	0	0	0	0	0	0	0	0	23	0	0	2	0	0	0	2	0	0
851.50	0	0	0	0	0	0	0	0	0	0	42	0	0	0	0	0	0	12	0	0
856.50	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0
860.42	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
867.75	0	0	0	0	0	0	0	0	0	0	33	0	0	1	0	3	0	0	0	0
871.83	0	0	0	0	0	0	0	0	0	0	21	0	0	1	0	0	0	0	1	0
876.50	0	0	0	0	0	0	0	0	0	0	21	0	0	2	0	0	0	7	0	0
881.50	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
885.50	0	0	0	0	0	0	0	0	0	0	29	0	0	4	0	2	0	1	0	0
891.50	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	1	0	0
896.50	0	0	0	0	0	0	0	0	0	0	26	0	1	1	0	3	0	0	0	0

Appendix 4. Key to Pit of Death Core Log.

Key to Grain Sizes and Types:

s = sand
si = silt
m = mud
vf = very fine
f = fine
md = medium
p = pebble
g = gravel
tuff. = tuffaceous

Descriptive Abbreviations:

d. silt lam. = discontinuous silt laminations in massive mud
filled crack? = vertical planar features interpreted as filled mud cracks

Key to Color Codes:

7.5YR5/4 = brown
7.5YR6/3 = light brown
7.5YR6/4 = light brown
10YR4/3 = brown
10YR5/4 = yellowish brown
10YR6/2 = light brownish grey
10YR6/3 = pale brown
10YR6/4 = light yellowish brown
10YR7/2 = light grey
10YR7/3 = very pale brown
2.5Y6/2 = light brownish grey
2.5Y6/3 = light yellowish brown
2.5Y7/2 = light grey
2.5Y7/3 = light yellow
5Y6/3 = pale olive
5Y7/2 = light grey
5Y7/3 = pale yellow
5GY5/1 = greenish grey

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
0.75	0.23	p s	10YR5/4		disturbed	p=0.5-2.5cm all quartzite
2.00	0.61	s m	10YR6/3	diffuse	"	modern soil carbonate
3.00	0.91	m s	"		"	
4.00	1.22	m s	2.5Y7/2	diffuse	"	
5.00	1.52	f,s	10YR4/3	diffuse	disturbed; X-bedded?	very clean sand
9.00	2.74	NO	RECOVERY			
11.17	3.40	sim	red/green	mixed	disturbed	color mixing
11.67	3.56	m	white	diffuse	"	Bishop ash
11.96	3.64	ms	2.5Y6/3	"	"	sed. highly disturbed in shelby tube
12.25	3.73	msi	"		"	selenite present
12.58	3.84	sim	10YR7/3	diffuse	"	"
14.25	4.34	"	10YR6/3	diffuse		
14.67	4.47	"	2.5Y7/2	diffuse		
14.75	4.50	"	10YR6/3	diffuse	d. silt lam.	
15.00	4.57	"	2.5Y7/2	diffuse	"	
15.75	4.80	"	"		massive	filled cracks?
17.17	5.23	"	"		d. silt lam.	
18.00	5.49	sm	"		"	irregular sandy lenses
19.25	5.87	sim	10YR6/3	diffuse	"	
19.83	6.05	sm	2.5Y7/2	clear		
19.96	6.08	sim	10YR6/3	clear	d. silt lam.	3" grey band w/brown filled crack?
20.92	6.38	NO	RECOVERY			
21.17	6.45	m	10YR6/3		"	color mixing
22.92	6.98	m	"		"	color mixing selenite
35.08	10.69	"	10YR7/3	diffuse	massive	filled cracks?
36.00	10.97	"	"		"	selenite
37.58	11.46	vfsm	"		d. silt lam.	"
37.67	11.48	m	"		"	color mixing selenite
44.50	13.56	"	"		disturbed	selenite vein
45.00	13.72	"	"		d. silt lam.	selenite
46.00	14.02	vfsm	"			
46.08	14.05	m	"		d. silt lam.	color mixing
48.50	14.78	"	"		massive	color mixing selenite

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
51.00	15.54	vfsm	5Y6/3	diffuse	d. silt lam.	color mixing
51.17	15.60	m	"		"	"
51.58	15.72	"	"		massive	"
52.67	16.05	"	"		d. silt lam.	selenite
53.67	16.36	vfsm	"		"	"
54.00	16.46	m	2.5Y7/2	diffuse	"	color mixing
55.17	16.81	"	"		massive	"
56.00	17.07	"	10YR7/3	diffuse	"	
59.17	18.03	"	"		d. silt lam.	
59.58	18.16	"	"		massive	
63.00	19.20	"	"		d. silt lam.	
64.42	19.63	"	"		"	selenite vein
65.17	19.86	fsm	2.5Y7/2	diffuse	"	"
65.25	19.89	m	"		"	"
65.67	20.02	vf-mdsm	"		"	"
66.00	20.12	sim	"		"	color mixing selenite
68.50	20.88	"	"		massive	slight color mixing
69.00	21.03	"	10YR7/3	diffuse	d. silt lam.	"
69.67	21.23	"	2.5Y7/2	diffuse	"	"
70.33	21.44	"	10YR7/3	diffuse	"	"
71.00	21.64	mfs	2.5Y7/2	diffuse	"	
71.50	21.79	m	"		"	
72.75	22.17	"	10YR6/4	diffuse	"	color mixing
74.50	22.71	vfsm	"		"	
74.58	22.73	m	"		"	selenite
75.50	23.01	"	2.5Y6/2	diffuse	"	color mixing
76.92	23.44	"	10YR6/4	diffuse	"	filled cracks? of lt. grey sm
79.83	24.33	vfsm	2.5Y7/2	diffuse	"	
79.92	24.36	m	10YR6/4	diffuse	"	
83.67	25.50	"	"		"	filled cracks? and color mixing
85.58	26.09	vfsm	"		"	vfs in laminations
85.67	26.11	m	10YR7/3	diffuse	d. silt lam.; faulted	sandy filled cracks?
89.50	27.28	vfs-sim	"		"	vfs in laminations

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
90.08	27.46	ms	"		"	color mixing
90.83	27.69	m	10YR7/2	diffuse	"	"
91.83	27.99	vfsm	"		"	selenite vein
92.00	28.04	m	10YR6/4	diffuse	"	color mixing
94.17	28.70	"	2.5Y7/2	diffuse	"	filled crack?
95.00	28.96	vfs-sim	"		"	
95.25	29.03	m	10YR7/3	diffuse	"	selenite vein
96.50	29.41	"	2.5Y7/2	diffuse	"	Mn staining
97.50	29.72	"	10YR6/3	diffuse	"	filled crack? and color mixing
99.17	30.23	"	10YR7/3	diffuse	"	
100.50	30.63	vfsm	2.5Y7/2	diffuse	"	
100.58	30.66	m	10YR7/3	diffuse	"	
100.92	30.76	vfsm	"		"	
101.08	30.81	m	"		"	
101.67	30.99	"	7.5YR6/4	diffuse	"	
103.17	31.45	"	10YR7/2	diffuse	"	filled crack?
104.00	31.70	"	10YR6/3	diffuse	"	blocky color mixing
106.42	32.44	"	10YR7/2	diffuse	"	selenite vein
107.17	32.66	vfsm	"		massive	color mixing
107.33	32.72	m	"		"	color mixing selenite vein
108.75	33.15	NO	RECOVERY			
108.92	33.20	m	7.5YR6/3	unknown	d. silt lam.	
110.00	33.53	"	2.5Y7/3	diffuse	"	filled cracks? selenite vein
112.00	34.14	vfsm	10 YR6/4	diffuse	"	selenite
112.17	34.19	m	"		"	"
112.50	34.29	vfsm	"		"	
112.58	34.32	m	"		"	
112.83	34.39	vfsm	"		"	
113.00	34.44	m	7.5YR5/4	diffuse	"	filled cracks? selenite vein
114.67	34.95	vfsm	2.5Y7/2	diffuse	"	
114.83	35.00	m	7.5YR5/4	diffuse	"	filled crack?
115.58	35.23	NO	RECOVERY			
115.67	35.26	m	2.5Y7/3	diffuse	"	filled crack?

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
116.75	35.59	vfsm	"		"	
117.00	35.66	m	10YR6/4	diffuse	massive	color mixed filled crack?
118.00	35.97	vfsm	"		"	
118.50	36.12	m	7.5YR6/4	diffuse	"	large color mixed filled crack? (7")
121.67	37.08	vfsm	2.5Y6/4	diffuse	"	
121.92	37.16	m	7.5YR6/4	diffuse	d. silt lam.	filled crack? selenite
125.83	38.35	"	10YR6/3	diffuse	"	"
127.08	38.73	vfsm	"		"	selenite
127.25	38.79	m	"		"	"
129.42	39.45	vfsm	"		"	"
129.50	39.47	m	"		"	
130.00	39.62	"	"		massive	color mixing
131.50	40.08	"	2.5Y7/2	diffuse	d. silt lam.	"
133.83	40.79	"	10YR6/4	diffuse	"	
134.00	40.84	"	"		massive	
135.00	41.15	sim	"		d. silt lam.	
136.83	41.71	m	2.5Y7/2	diffuse	"	filled cracks?
138.17	42.11	vfsm	10YR6/4	diffuse	massive	selenite vein
138.92	42.34	sim	"		d. silt lam.	"
141.17	43.03	m	2.5Y7/2	diffuse	"	filled cracks?
142.67	43.48	ms	"		massive	
143.17	43.64	m	"		"	color mixing selenite vein
144.08	43.92	"	10YR6/3	diffuse	"	"
148.92	45.39	vfsm	"		d. silt lam.	color mixing selenite xls
149.33	45.52	sim	"		d. silt lam.; faulted	"
153.00	46.63	"	"		massive	"
154.17	46.99	"	2.5Y7/2	diffuse	d.silt lam.	
155.25	47.32	vfsm	"		massive	filled cracks?
155.42	47.37	sim	"		"	"
157.17	47.90	"	10YR5/4	diffuse	"	"
158.92	48.44	ms	2.5Y7/2	sharp	d.silt lam.	sandy filled crack? selenite
159.83	48.72	m	10YR5/4	diffuse	"	selenite vein
161.00	49.07	"	2.5Y7/2	diffuse	massive	color mixing selenite vein

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
161.58	49.25	"	10YR7/2	diffuse	"	"
162.00	49.38	fsm	"		d.silt lam.	filled cracks?
163.00	49.68	sim	7.5YR6/4	diffuse	"	"
165.00	50.29	"	"		"	some slight color banding
167.00	50.90	ms	5GY5/1	sharp	massive	small selenite xls dolomitic sand
167.33	51.00	m	2.5Y7/2	diffuse	"	selenite
167.50	51.05	"	7.5YR6/4	diffuse	"	"
168.00	51.21	ms	10YR6/4	diffuse	"	"
168.25	51.28	m	"		"	color banding selenite
169.83	51.77	"	10YR6/3	diffuse	d. silt lam.	sandy filled crack?
171.50	52.27	"	"		"	color banding (rippled beds?)
172.33	52.53	ms	"		"	
172.67	52.63	sim	"		"	filled crack?
173.50	52.88	"	"		massive	
174.58	53.21	"	10YR5/4	diffuse	d. silt lam.	filled crack? selenite
179.83	54.81	vfsm	10YR7/2	diffuse	massive	filled crack? selenite
180.33	54.97	m	10YR6/3	diffuse	"	selenite
182.25	55.55	vfsm	"		d.silt lam.	"
182.50	55.63	m	"		"	"
184.00	56.08	vfsm	10YR7/2	diffuse	massive	"
184.25	56.16	m	10YR6/3	diffuse	"	
185.50	56.54	"	"		d. silt lam.	
186.83	56.95	vfsm	2.5Y7/2	diffuse	"	selenite
187.50	57.15	m	"		massive	"
188.67	57.51	"	10YR7/2	diffuse	"	"
189.58	57.78	"	10YR6/3	diffuse	"	filled crack? selenite
190.00	57.91	"	"		d. silt lam.	"
193.50	58.98	"	10YR7/2	diffuse	massive	selenite
194.00	59.13	"	7.5YR6/4	diffuse	"	"
200.33	61.06	vfsm	"		d. silt lam.	
200.58	61.14	m	"		"	
201.00	61.26	"	"		massive	
202.25	61.65	"	10YR7/2	diffuse	d. silt lam.	selenite

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
203.00	61.87	vfsm	7.5YR6/4	diffuse	massive	
203.17	61.93	m	"		"	
204.00	62.18	"	"		d. silt lam.	
204.92	62.46	vfsm	2.5Y7/2	diffuse	"	
205.00	62.48	m	7.5YR6/4	diffuse	massive	selenite
208.17	63.45	"	5Y7/2	diffuse	fine beds	2" of finely bedded silt & mud
208.33	63.50	"	10YR7/3	diffuse	massive	
208.83	63.65	vfsm	"		"	
208.92	63.68	sim	"		"	
209.58	63.88	vfsm	2.5Y7/2	diffuse	"	
209.83	63.96	m	"		"	filled crack? Mn stained dots
212.00	64.62	"	7.5YR6/4	diffuse	"	color mixed filled cracks?
213.42	65.05	fsm	2.5Y7/2	diffuse	massive	
214.00	65.23	sim	"		"	filled crack? selenite
216.08	65.86	m	7.5YR6/4	diffuse	d. silt lam.	
216.67	66.04	"	5Y7/2	diffuse	"	
218.33	66.55	"	10YR6/3	diffuse	massive	color mixed filled crack? cuts lams.
218.83	66.70	vfsm	"		"	
219.00	66.75	m	5Y7/2	diffuse	"	colors about equally mixed
221.00	67.36	"	10YR6/3	diffuse	"	color mixing selenite vein
225.33	68.68	"	"		d. silt lam.	small spotty mottles
226.25	68.96	vfsm	"		"	
226.33	68.99	m	"		"	
227.00	69.19	m	7.5YR5/4	diffuse	"	
228.58	69.67	vfsm	10YR6/3	diffuse	"	
228.75	69.72	m	"		"	
230.25	70.18	vfsm	"		"	
230.42	70.23	sim	"		massive	
230.75	70.33	vfsm	"		"	
230.92	70.38	sim	"		"	
233.08	71.04	vfsm	2.5Y7/2	diffuse	d. silt lam.	sandy filled crack?
233.42	71.15	sim	10YR6/3	diffuse	massive	
235.75	71.86	vfsm	"		"	

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
235.83	71.88	sim	"		"	
236.67	72.14	"	10YR7/2	diffuse	"	filled crack?
237.00	72.24	"	10YR6/3	diffuse	d. silt lam.	selenite
239.50	73.00	fsm	"		"	color mixing selenite
239.67	73.05	m	"		massive	"
242.75	73.99	NO	RECOVERY			
243.00	74.07	m	10YR6/3		massive	color mixing selenite
244.33	74.47	vfsm	"		"	sandy part is greyish-green
244.50	74.52	sim	"		"	
246.25	75.06	vfsm	"		"	sandy part is more grey
246.33	75.08	sim	"		"	
247.00	75.29	vfsm	"		"	sandy part is more grey
247.08	75.31	sim	"		"	
247.92	75.56	vfsm	2.5Y7/2	diffuse		
248.00	75.59	sim	"		"	filled crack? selenite
250.17	76.25	vfsm	"		d. silt lam.	
250.33	76.30	sim	"		massive	
250.92	76.48	m	10YR6/3	diffuse	"	filled crack? selenite
251.67	76.71	"	"		d. silt lam.	"
252.67	77.01	sim	2.5Y7/2	sharp	"	"
254.00	77.42	"	10YR6/3	blocky	"	"
254.83	77.67	"	2.5Y7/2	sharp	massive	"
255.00	77.72	vfsm	"		"	"
255.33	77.83	sim	10YR6/3	blocky	"	"
258.00	78.64	"	"		d. silt lam.	color mixing
259.17	78.99	"	"		massive	"
261.00	79.55	"	2.5Y7/2	blocky	d. silt lam.	
261.25	79.63	"	10YR6/3	clear	"	selenite
266.92	81.36	vfsm	"		"	color mixing selenite
267.00	81.38	m	"		"	selenite
267.58	81.56	"	10YR7/2	diffuse	"	"
268.00	81.69	"	10YR6/3	diffuse	"	"
271.25	82.68	"	7.5YR5/4	diffuse	"	

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
272.33	83.01	fsm	"		"	
272.50	83.06	m	"		"	selenite
274.00	83.52	"	10YR6/3	diffuse	"	
274.92	83.79	vfsm	"		"	
275.42	83.95	sim	"		"	color mixing
277.00	84.43	"	5Y7/2	diffuse	"	
278.00	84.73	vfsm	"		"	
278.17	84.79	sim	10YR6/3	blocky	"	
278.83	84.99	vfsm	"		"	
279.00	85.04	sim	"		"	color mixing
281.17	85.70	"	"		massive	
282.67	86.16	"	10YR7/2	diffuse	"	
283.50	86.41	vfsm	10YR6/3	diffuse	d. silt lam.	selenite
283.67	86.46	m	"		massive	"
285.67	87.07	"	7.5Y5/4	diffuse	"	"
286.17	87.22	"	10YR6/3	diffuse	"	
287.00	87.48	vfsm	"		"	selenite
287.33	87.58	sim	"		"	"
288.00	87.78	vfsm	10YR7/2	diffuse	"	"
288.17	87.83	m	"		"	"
288.83	88.04	"	10YR6/3	diffuse	d. silt lam.	"
290.58	88.57	"	"		massive	sandy filled crack?
292.50	89.15	"	"		d. silt lam.	greyish color band
297.08	90.55	"	7.5YR5/4	diffuse	"	
299.50	91.29	"	10YR6/3	diffuse	"	greyish color bands selenite
307.42	93.70	vfsm	"		"	selenite
307.67	93.78	m	"		"	"
308.58	94.06	"	7.5YR5/4	diffuse	"	
309.42	94.31	"	10YR6/3	diffuse	"	
310.00	94.49	vfsm	"		"	
310.83	94.74	m	"		"	
312.25	95.17	"	5Y7/2	diffuse	massive	
313.17	95.45	"	10YR6/3	diffuse	"	

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
314.00	95.71	vfsm	5Y7/2	diffuse	d. silt lam.	
314.42	95.83	m	10YR6/3	diffuse	"	filled cracks?
317.67	96.82	fsm	5Y7/2	diffuse	"	selenite vein
318.25	97.00	m	"		"	
318.92	97.21	"	10YR6/3	diffuse	"	
319.83	97.49	vfsm	5Y7/2	diffuse	"	
320.00	97.54	m	10YR6/3	diffuse	"	
320.17	97.59	vfsm	5Y7/2	diffuse	"	
320.25	97.61	m	"		"	color mixing
322.25	98.22	vfsm	"		"	filled cracks?
322.42	98.27	m	5Y7/3	diffuse	"	"
322.83	98.40	"	10YR6/3	diffuse	"	sandy filled crack? selenite
326.33	99.47	"	5Y7/2	diffuse	"	"
329.67	100.48	vfsm	10YR6/3	diffuse	"	
329.83	100.53	m	"		"	
331.75	101.12	"	5Y7/2	diffuse	"	green spotty staining? ostracodes
336.00	102.41	"	"		"	ostracodes, leaf impressions,
336.67	102.62	NO	RECOVERY			green stains, vf black lams. 1/2"zone
337.00	102.72	m	5Y7/2		massive	
338.08	103.05	"	"		d. silt lam.	green stains
339.00	103.33	"	"		"	
340.25	103.71	"	10YR6/3	diffuse	"	ostracodes present
342.83	104.50	"	5Y7/2	diffuse	"	vf black laminations- 1/2" zone
343.67	104.75	"	"		"	leaf impressions
344.33	104.95	"	10YR6/3	diffuse	massive	filled cracks? ostracodes
347.00	105.77	"	"		d. silt lam.	leaf impressions
348.67	106.27	"	"		massive	
349.33	106.48	"	2.5Y7/2	diffuse	"	filled crack?
350.00	106.68	"	10YR6/3	diffuse	"	color mixing
353.67	107.80	vfsm	"		"	
354.33	108.00	m	"		d. silt lam.	filled cracks?
355.67	108.41	"	5Y7/2	diffuse	"	
356.00	108.51	ms	"		massive	partially cemented sand

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
357.50	108.97	NO	RECOVERY			
359.75	109.65	vfsm	5Y7/2		massive	
360.50	109.88	m	10YR6/3	diffuse	d. silt lam.	color mixing
361.83	110.29	vfsm	"		"	"
362.08	110.36	m	"		"	"
363.25	110.72	vfsm	"		"	"
363.50	110.79	m	"		"	"
363.75	110.87	vfsm	2.5Y7/2	diffuse	massive	"
364.42	111.07	m	10YR6/3	diffuse	"	"
364.67	111.15	NO	RECOVERY			
365.00	111.25	m	10YR6/3		d. silt lam.	color mixing small sand lens
367.67	112.06	vfsm	"		"	color mixing
367.83	112.12	m	"		"	color mixing selenite
370.00	112.78	"	5Y7/2	diffuse	"	
370.33	112.88	sim	10YR6/3	diffuse	"	color mixed filled cracks? cut lams.
371.50	113.23	vfsm	"		"	
372.17	113.44	m	"		"	filled cracks?
376.00	114.60	fs	"		"	color mixed filled cracks? cut lams.
376.33	114.71	fsm	"		"	sandy filled crack?
376.50	114.76	m	2.5Y7/2	diffuse	"	"
377.00	114.91	"	10YR6/3	diffuse	"	sandy filled crack? selenite vein
379.08	115.54	"	5Y7/2	diffuse	"	selenite vein
379.75	115.75	"	10YR6/3	diffuse	"	filled crack?
381.83	116.38	vfsm	"		"	
382.00	116.43	m	"		"	filled cracks?
383.08	116.76	vfsm	"		"	"
383.25	116.81	m	"		"	"
384.42	117.17	vfsm	"		"	sandy part is greenish
384.67	117.25	m	"		"	filled cracks?
386.33	117.75	vfsm	"		"	sandy part is greenish
386.50	117.81	m	"		"	
387.17	118.01	vfsm	5Y7/2	diffuse	"	filled cracks?
387.50	118.11	m	"		"	"

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
388.75	118.49	NO	RECOVERY			
389.00	118.57	m	5Y7/2		d. silt lam.	
393.25	119.86	"	10YR6/3	diffuse	"	color mixing
395.33	120.50	"	"		massive	"
397.17	121.06	"	"		d. silt lam.	
399.00	121.62	"	"		massive	color mixing
399.42	121.74	NO	RECOVERY			
400.00	121.92	m	10YR6/3		d. silt lam.	color mixing
403.00	122.83	vfsm	"		"	
403.17	122.89	m	"		"	
409.08	124.69	vfsm	"		"	
409.75	124.89	m	"		"	color mixing
411.67	125.48	vfsm	5Y7/2	diffuse	"	"
411.83	125.53	m	"		"	"
412.00	125.58	vfsm	"		"	"
412.58	125.76	NO	RECOVERY			
413.00	125.88	vfsm	5Y7/2		massive	black chert pebbles in sand
414.17	126.24	m	"		"	green clay blobs mixed into mud
417.83	127.36	vfsm	"		d. silt lam.	
418.00	127.41	m	"		"	filled cracks?
419.58	127.89	vfsm	"		"	green clay appears disc. lam.
419.67	127.91	m	10YR6/3	diffuse	"	filled cracks?
420.75	128.24	vfsm	"		"	
420.83	128.27	m	"		massive	
422.00	128.63	vfsm	"		"	
422.33	128.73	m	"		d. silt lam.	dark banding in silt lams.
423.00	128.93	vfsm	"		"	
423.25	129.01	m	"		"	
423.92	129.21	NO	RECOVERY			
424.00	129.24	mfs	10YR6/3		d. silt lam.	
424.58	129.41	m	"		laminated	varying shades of brown lams.
426.00	129.84	vfsm	"		massive	
426.17	129.90	m	"		"	

Appendix 4. Pit of Death Core Description (Oviatt and Bracht)

Depth (ft)	Depth (m)	Grain size	Color	Boundary	Bedding/sed.struc.	Misc. Notes
427.17	130.20	vfsm	"		"	
427.25	130.23	m	"		"	color mixing
428.17	130.51	psm	"		"	chert pebbles
428.75	130.68	m	5Y7/2	diffuse	"	"
429.00	130.76	psm	"		"	"
429.33	130.86	m	"		"	"
430.00	131.06	psm	"		"	"
430.17	131.11	m	"		"	"
430.75	131.29	ms & g	"		bedding?	"
431.50	131.52	NO	RECOVERY			field notes indicate sand & gravel
472.00	143.87	vfs	2.5Y7/2		massive	
472.33	143.97	NO	RECOVERY			
472.50	144.02	tuff. fs	10YR6/2		massive	large filled crack? selenite
474.75	144.70	NO	RECOVERY			
477.00	145.39	tuff. sand	10YR6/2		massive	ult? slickensides? chert & mud in fa
478.00	145.69	m tuff. fs	"		"	
479.17	146.05	"	"		"	partially lithified
482.00	146.91	m	"		"	"
482.33	147.02	tuff. sand	"		vf bedding	"
483.08	147.24	m tuff. fs	"		massive	"
497.00	151.49	m. tuff. ps	"		"	partially lithified chert pebbles
512.00	156.06	"	"		"	"

Appendix 5. Pit of Death Paleomagnetic Data (Roberts)

Sample	Depth (ft)	Depth (m)	Declination (°)	Inclination (°)	Delta	Intensity	Polarity	Demag
POD1	15.33	4.67	140.3	57.7	0.00	2.10E-05	N	AF
POD2	18.00	5.49						
POD3	20.00	6.10	214.7	64.2	0.10	5.30E-05	N	TH
POD4	22.54	6.87	202.1	64.1	0.00	8.50E-05	N	AF
POD5	24.33	7.42	4.6	51.9	0.00	3.20E-04	N	TH
POD6	26.42	8.05	324.6	57.2	0.00	2.50E-04	N	AF
POD7	28.25	8.61	346.8	38.9	0.00	1.40E-04	N	TH
POD8	29.75	9.07	98.2	51.6	0.00	2.20E-04	N	AF
POD9	32.50	9.91	37.6	52.0	0.00	1.80E-04	N	TH
POD10	35.04	10.68	7.8	44.0	0.00	2.40E-04	N	AF
POD11	36.67	11.18	147.7	37.3	0.10	8.10E-05	N	AF
POD12	38.75	11.81	48.9	57.4	0.00	1.30E-04	N	AF
POD13	40.67	12.40	352.1	43.6	0.10	1.10E-04	N	TH
POD14	42.25	12.88	276.3	67.2	0.10	1.00E-04	N	AF
POD15	43.83	13.36	236.1	72.1	0.00	1.50E-04	N	TH
POD16	46.92	14.30	224.0	64.0			N	AF
POD17	48.42	14.76	200.8	58.1	0.00	1.20E-04	N	TH
POD18	50.50	15.40	120.0	66.0			N	AF
POD19	53.08	16.18	172.2	59.9	0.10	1.80E-05	N	TH
POD20	55.58	16.95	160.0	41.0			N	AF
POD21	57.08	17.40	207.3	63.0	0.10	3.50E-05	N	TH
POD22	59.67	18.19	349.0	-50.0			R	AF
POD23	61.58	18.77	352.0	-34.0			R	AF
POD24	63.50	19.36	9.5	-48.0	0.00	2.70E-04	R	AF
POD25	65.33	19.92	359.3	-43.8	0.00	4.00E-05	R	TH
POD26	66.42	20.25	302.0	-47.0			R	AF
POD27	68.42	20.86	11.8	-49.1	0.20	3.10E-05	R	TH
POD28	70.33	21.44	357.0	-57.0			R	AF
POD29	71.21	21.71	226.2	-52.0	0.10	6.10E-05	R	TH
POD30	73.50	22.41	189.1	-47.5	0.10	3.90E-05	R	AF
POD31	75.50	23.02	196.7	-54.8	0.00	7.20E-05	R	TH
POD32	77.83	23.73	151.9	-50.3	0.10	1.40E-04	R	AF
POD33	80.08	24.41	56.2	-58.6	0.00	4.40E-05	R	TH
POD34	82.21	25.06	72.8	-37.8	0.10	1.50E-04	R	AF
POD35	83.50	25.46	12.9	-55.2	0.00	3.60E-05	R	TH
POD36	84.13	25.65	280.2	-48.5	0.00	9.80E-05	R	AF
POD37	86.58	26.40	214.2	-37.0	0.00	1.60E-04	R	TH
POD38	88.88	27.10	135.6	-49.0	0.90	1.30E-05	R	AF
POD39	90.00	27.44	54.7	-47.9	0.70	3.80E-05	R	TH
POD40	91.17	27.80	287.7	-38.1	0.10	5.00E-05	R	AF
POD41	93.00	28.35	206.2	-57.2	0.10	3.30E-05	R	TH
POD42	94.71	28.88	143.6	-43.6	2.70	1.30E-06	R	AF
POD43	96.83	29.52	211.3	-33.7	0.20	1.50E-05	R	TH
POD44	98.67	30.08	118.4	-11.9	0.70	4.30E-05	R	AF
POD45	100.29	30.58	42.6	-46.1	0.00	7.90E-05	R	TH
POD46	100.58	30.66	52.4	74.8	0.40	5.50E-05	N	AF
POD47	102.17	31.15	79.9	15.6	0.00	5.20E-05	N	TH
POD48	103.58	31.58	348.4	61.6	0.40	5.60E-05	N	AF

Appendix 5. Pit of Death Paleomagnetic Data (Roberts)

Sample	Depth (ft)	Depth (m)	Declination (°)	Inclination (°)	Delta	Intensity	Polarity	Demag
POD49	105.38	32.13	25.4	2.7	0.00	1.00E-04	T	TH
POD50	107.50	32.77	165.4	-36.7	0.00	4.80E-05	R	AF
POD51	109.71	33.45	335.9	23.2	0.10	1.20E-04	N	TH
POD67A	112.00	34.15	17.1	-39.1	0.10	1.30E-04	R	AF
POD70A	113.67	34.66	357.9	-53.4	0.00	2.30E-04	R	TH
POD72A	116.17	35.42						
POD68A	117.25	35.75	244.2	-42.4	0.10	9.00E-05	R	TH
POD69A	119.67	36.48	32.9	-46.3	0.10	4.30E-05	R	AF
POD71A	121.75	37.12	217.7	-26.7	0.00	1.30E-04	R	AF
POD73A	123.58	37.68	101.5	-37.2	0.20	9.00E-05	R	AF
POD74A	125.00	38.11	12.7	-44.4	0.00	8.80E-05	R	TH
POD75A	127.25	38.80	44.4	-58.5	0.10	1.10E-04	R	AF
POD76A	129.42	39.46	49.9	-44.4	0.10	3.30E-04	R	TH
POD77A	131.42	40.07	262.0	-52.2	0.10	5.10E-05	R	AF
POD78A	133.42	40.68	256.2	-40.2	0.10	5.00E-05	R	TH
POD79A	135.58	41.34	238.4	-32.0	0.10	1.70E-04	R	AF
POD81A	137.25	41.84	180.7	-29.9	0.10	8.10E-05	R	AF
POD80A	140.25	42.76	214.7	-68.4	0.10	6.50E-05	R	TH
POD82A	142.50	43.45	266.6	-40.3	0.00	9.10E-05	R	TH
POD83A	144.50	44.05	286.4	-47.9	0.00	1.00E-04	R	AF
POD84A	146.25	44.59	263.3	-46.5	0.10	7.40E-05	R	TH
POD85A	148.25	45.20	84.0	-56.9	0.50	5.00E-05	R	AF
POD86A	150.33	45.83	82.0	-48.0	0.00	4.10E-04	R	TH
POD88A	153.25	46.72	343.5	-49.0	0.10	3.10E-04	R	TH
POD89A	155.33	47.36	306.1	-54.9	0.20	4.60E-06	R	AF
POD90A	157.17	47.92	56.3	-45.5	0.50	8.60E-06	R	TH
POD87A	159.08	48.50	3.8	-59.4	0.00	8.00E-04	R	AF
POD171.	171.50	52.29	127.6	-49.1	0.00	1.00E-04	R	AF
POD173.	173.33	52.84	163.8	-61.3	0.00	1.60E-04	R	AF
POD175.	175.17	53.41	61.0	-41.3	0.20	1.30E-04	R	AF
POD176.	176.75	53.89	339.4	-64.0	0.10	1.40E-04	R	AF
POD188.	188.83	57.57	343.2	-61.3	0.10	5.40E-05	R	AF
POD190.	190.75	58.16	276.3	-45.9	0.00	2.20E-04	R	AF
POD193.	193.25	58.92	236.7	-38.5	0.10	2.70E-04	R	AF
POD194.	194.50	59.30	227.3	-47.1	0.10	3.10E-04	R	AF
POD200.	200.25	61.05	24.2	-51.7	0.10	9.90E-05	R	AF
POD202.	202.08	61.61	149.8	-46.2	0.10	2.20E-04	R	AF
POD206.	206.50	62.96	264.6	-60.3	0.10	1.50E-04	R	AF
POD239.	239.00	72.87	338.9	48.0	1.00	1.00E-06	N	AF
POD240.	240.50	73.32	328.3	33.5	0.40	3.40E-06	N	AF
POD246.	246.58	75.18	161.8	35.2	0.60	7.40E-06	N	AF
POD51(2	258.00	78.66	235.8	-47.5	0.00	1.90E-04	R	AF
POD52	260.50	79.42	222.3	-58.0	0.00	2.00E-04	R	AF
POD53	270.08	82.34	187.9	-39.6	0.40	5.20E-05	R	AF
POD54	274.25	83.61	187.2	-7.9	0.20	7.00E-05	T	AF
POD55	284.50	86.74	11.3	-49.8	0.00	2.40E-04	R	AF
POD56	286.75	87.42	166.4	-42.7	0.00	3.50E-04	R	AF
POD57	290.08	88.44	154.4	-60.9	0.10	2.90E-04	R	AF

Appendix 5. Pit of Death Paleomagnetic Data (Roberts)

Sample	Depth (ft)	Depth (m)	Declination (°)	Inclination (°)	Delta	Intensity	Polarity	Demag
POD58	293.58	89.51	275.0	-30.7	0.00	4.60E-04	R	AF
POD59	297.17	90.60	70.5	-66.1	0.00	3.80E-04	R	AF
POD60	299.83	91.41	316.6	-56.1	0.00	1.90E-04	R	AF
POD61	302.17	92.13	325.1	-44.1	0.00	3.70E-04	R	AF
POD62	307.00	93.60	322.3	-58.5	0.00	2.30E-04	R	AF
POD63	311.58	94.99	320.9	-57.1	0.30	4.40E-05	R	AF
POD64	315.83	96.29	340.2	-8.2	0.10	1.90E-04	T	AF
POD65	320.50	97.71	185.7	12.2	3.80	8.40E-06	T	AF
POD66	323.83	98.73	129.5	-15.2	0.20	6.30E-05	T	AF
POD67	324.75	99.01				6.90E-05		AF
POD68	329.08	100.33	345.1	-46.6	0.60	1.50E-05	R	AF
POD69	333.75	101.75	269.4		0.30	2.40E-06	T	AF
POD70	338.33	103.15	74.7	-45.7	0.80	5.00E-06	R	AF
POD71	342.67	104.47	77.5		0.80	2.60E-05	N	AF
POD72	345.92	105.46	21.2		1.70	3.70E-06	R	AF
POD73	349.00	106.40	24.8	-62.9	0.50	5.00E-06	R	AF
POD74	353.08	107.65	106.8	-43.1	0.50	1.10E-05	R	AF
POD75	356.75	108.77	31.3	-31.7	0.30	6.60E-06	R	AF
POD76	361.58	110.24				1.10E-05		AF
POD77	366.92	111.87	269.7	-51.9	0.00	2.70E-05	R	AF
POD78	369.67	112.70	345.5	60.2	0.10	2.90E-05	N	AF
POD79	373.00	113.72	251.6	56.4	0.10	2.10E-05	N	AF
POD80	375.50	114.48				1.10E-05		AF
POD81	377.50	115.09	311.0	53.3	0.00	6.40E-05	N	AF
POD82	382.00	116.46	138.5	42.8	0.10	2.40E-05	N	AF
POD83	384.17	117.13	21.7	39.1	0.00	8.70E-05	N	AF
POD84	386.50	117.84	192.4	41.2	0.20	3.40E-05	N	AF
POD85	392.67	119.72	315.7	45.6	0.00	4.80E-05	N	AF
POD86	397.50	121.19	121.9	50.7	0.00	1.10E-04	N	AF
POD87	401.67	122.46	252.3	48.3	0.00	1.60E-04	N	AF
POD88	405.17	123.53	259.8	49.1	0.00	2.40E-04	N	AF
POD89	407.75	124.31	64.5	54.3	0.00	2.10E-04	N	AF
POD62A	407.92	124.37						
POD90	411.42	125.43	96.4	59.4	0.00	3.00E-05	N	AF
POD91	413.67	126.12						
POD65A	413.75	126.14	48.0	56.7	0.10	7.60E-06	N	AF
POD66A	416.58	127.01						
POD92	418.83	127.69						
POD63A	420.92	128.33	31.3	52.4	0.30	3.90E-05	N	AF
POD60A	422.00	128.66	35.4	33.2	0.10	7.30E-05	N	TH
POD93	422.08	128.68						
POD94	426.58	130.05						
POD95	427.75	130.41						
POD57A	429.75	131.02	188.6	58.5	3.70	8.00E-06	N	AF
POD96	430.67	131.30						
POD59A	473.00	144.21	33.5	51.4	0.20	5.40E-04	N	AF
POD97	473.42	144.34	96.2	58.7	0.00	4.80E-04	N	AF
POD56A	479.42	146.16	214.6	40.4	0.10	4.10E-04	N	TH

Appendix 5. Pit of Death Paleomagnetic Data (Roberts)

Sample	Depth (ft)	Depth (m)	Declination (°)	Inclination (°)	Delta	Intensity	Polarity	Demag
POD98	480.17	146.39	152.7	62.8	0.30	2.40E-04	N	AF
POD58A	481.33	146.75	289.8	65.3	0.20	4.10E-04	N	TH
POD61A	483.00	147.26	15.5	51.8	0.90	9.60E-05	N	AF
POD99	486.08	148.20	170.7	72.8	0.30	5.20E-05	N	AF
POD54A	487.50	148.63	167.2	50.9	0.20	2.20E-04	N	TH
POD100	489.08	149.11	53.2	54.4	0.10	1.00E-04	N	AF
POD55A	489.92	149.37	67.2	59.7	0.10	1.60E-04	N	AF
POD101	493.00	150.30	42.9	60.2	0.10	1.60E-04	N	AF
POD53A	494.33	150.71	129.9	41.4	0.20	5.50E-05	N	AF
POD102	497.83	151.78				2.10E-04		AF
POD103	504.33	153.76				5.00E-05		AF
POD52A	508.67	155.08	345.7	38.3	0.50	1.80E-05	N	TH
POD104	509.58	155.36	22.9	61.3	0.30	1.10E-04	N	AF