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SEDIMENT STUDIES ON THE GORDA RIDGE

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EXECUTIVE SUMMARY

Coring operations during two cruises in 1985 recovered five gravity cores from the northern Gorda Ridge and twelve from the Escanaba Trough in the south. Sediment studies on this material have revealed that recent volcanic activity and related hydrothermal activity can be discerned and dated within the Escanaba Trough by means of sulfide-rich tuffaceous flow deposits derived locally from volcanic centers within the basin. Based upon tentative correlations we estimate that the volcanic center at 40° 45'N was active about 2400 years ago and that the volcanic center at 41° N was active about 3000 years ago. In addition we can also date hydrothermal activity by means of sulfur preserved from plume material in both northern Gorda and Escanaba Trough sediments.

NOTICE

This report is based on results of a research program directed by the joint federal-state Gorda Ridge Technical Task Force, managed by the Oregon Department of Geology and Mineral Industries and funded by the Minerals Management Service, U.S. Department of the Interior, through Cooperative Agreement. Opinions expressed are those of the authors and do not constitute endorsement by the sponsoring agencies or the Task Force.

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I. INTRODUCTION

I.1 PROGRAM OBJECTIVES

The Gorda Ridge is unusual among active spreading centers in being located proximal to continental sources and, in the southern portion, underlain by a thick section of Pleistocene terrigenous turbidites. The thick sediment cap provides an insulating blanket profoundly affecting the thermal regime and underlying crustal formation processes. Confined hydrothermal circulation, restricted by the impervious sediment, can result in high upper crustal temperatures and intense sediment diagenesis, causing localized hydrothermal deposits that are much larger than those found in unsedimented spreading centers.

As part of the Minerals Management Service program to evaluate the resource potential of the Exclusive Economic Zone, integrated sediment studies of the Gorda Ridge were undertaken using sediment geochemistry, paleo/rock magnetism, and sedimentology. The overall goals of the project are to examine the sediment historical record for evidence of hydrothermal and/or volcanic activity and to establish the extent, duration, and frequency of such events. An important aspect of this research is to determine the influences of the ambient redox environment on preserving volcanogenic signals or remobilizing metals within the sediment column.

The specific objectives of this work are:

- To determine whether and how hydrothermal mineralization is preserved in axial valley sediments,
- To establish a time scale and to examine the spatial extent of fallout from hydrothermal plumes,
- To evaluate the effects of ambient geochemical conditions on the preservation of metal enriched phases associated with hydrothermal plume fallout,
- To assess the timing and spatial extent of volcanic events or tilting associated with dome building as recorded in axial valley sediments.

Sediments were obtained from two cruises in 1985. The L6-85-NC cruise aboard the USGS research vessel LEE concentrated on the Escanaba Trough of to the Southern Gorda Ridge. Cores from this cruise are designated here as L cores. The W8508AA cruise on the Oregon State University ship WECOMA focussed on the Northern Gorda and cores from this area are herein called W cores.

I.2 BACKGROUND

I.2.1 Tectonic Setting of the Gorda Ridge

Regional Setting: The Gorda Ridge is a slow-spreading mid-ocean ridge (3 cm/yr full rate) located within 200 miles of the Oregon-California coastline. The ridge is bounded on the south by the Mendocino fracture zone at 40° 20'N, and on the north by the Blanco fracture zone at ~43° 05'N. Unlike the Juan de Fuca Ridge to the north (Malahoff et al., 1982), the axial valley of the Gorda Ridge is bounded by faults and uplifted terraces (Atwater and Mudie, 1973; Fowler and Kulm, 1970, Heinrichs, 1970). The axial valley is more than 3200 m deep and the marginal ridges on either side typically rise one or two kilometers above the axial valley (McManus, 1967), similar to the slow spreading Mid-Atlantic Ridge.

The Gorda ridge is divided into three separate segments, each with a different spreading history (Atwater and Mudie, 1973; Riddihough, 1980). The northern section (Figure 2b) is marked by a relatively fast total opening rate of 5.8 cm/yr, which decreases to a total opening rate of 3.0 cm/yr on the southern and central ridge segments (Riddihough, 1980). Some workers have suggested that the ridge is spreading asymmetrically at present (Solano-Borrego, 1982). Riddihough (1980) and workers with access to SEABEAM bathymetry (A. Malahoff, oral comm.) conclude, however, that asymmetric spreading of the south and central sections of the Gorda Ridge ceased about 2 m.y. ago. Some bathymetric evidence supports recent oblique spreading on the northern Gorda (A. Malahoff, oral comm.).

The southern segment of the Gorda Ridge (Escanaba Trough, Figure 1), is offset from the central and northern segments of the Gorda Ridge by a small fracture zone. Sediments cover the axial valley to about 41° 15'N, or for about the southernmost 80 km of the rise axis. The valley is filled with more than 500 meters of sediment in the south, but the sediment thins to the north where the axial valley shoals. Much of this sediment flowed off the continents as turbidites during Pleistocene low sealevel stands. During the Holocene, major continentally-derived turbidites are not observed and sedimentation appears to be better described as hemipelagic (see below). Within the axial valley are several volcanic centers where sediments have been uplifted 50-100 meters above the surrounding turbidite plain and in some cases where basalts pierce the sediment and form hills.

Domes or Volcanic Centers: Separate volcanic centers in the Escanaba Trough have been identified by the L6-85-NC cruise to the Gorda Ridge. Several of these domes had been crossed previously during a site survey for DSDP Site 35 (Moore,1970; Moore and Sharman, 1970) but were interpreted as one long continuous basement ridge due to the lack of adequately spaced seismic reflection lines. The more closely spaced seismic reflection work in 1985 was sufficient to delineate 5 discrete volcanic centers in the sedimented part of the axial valley generally offset to the west of the center of the valley (Figure 1) . These volcanic edifices can be traced upward through the 300-to-500 meter-thick sedimentary fill and are in places exposed on the seafloor. A detailed transponder-navigated survey of one center at 41° N showed it to be composed of several smaller, overlapping volcanic hills.

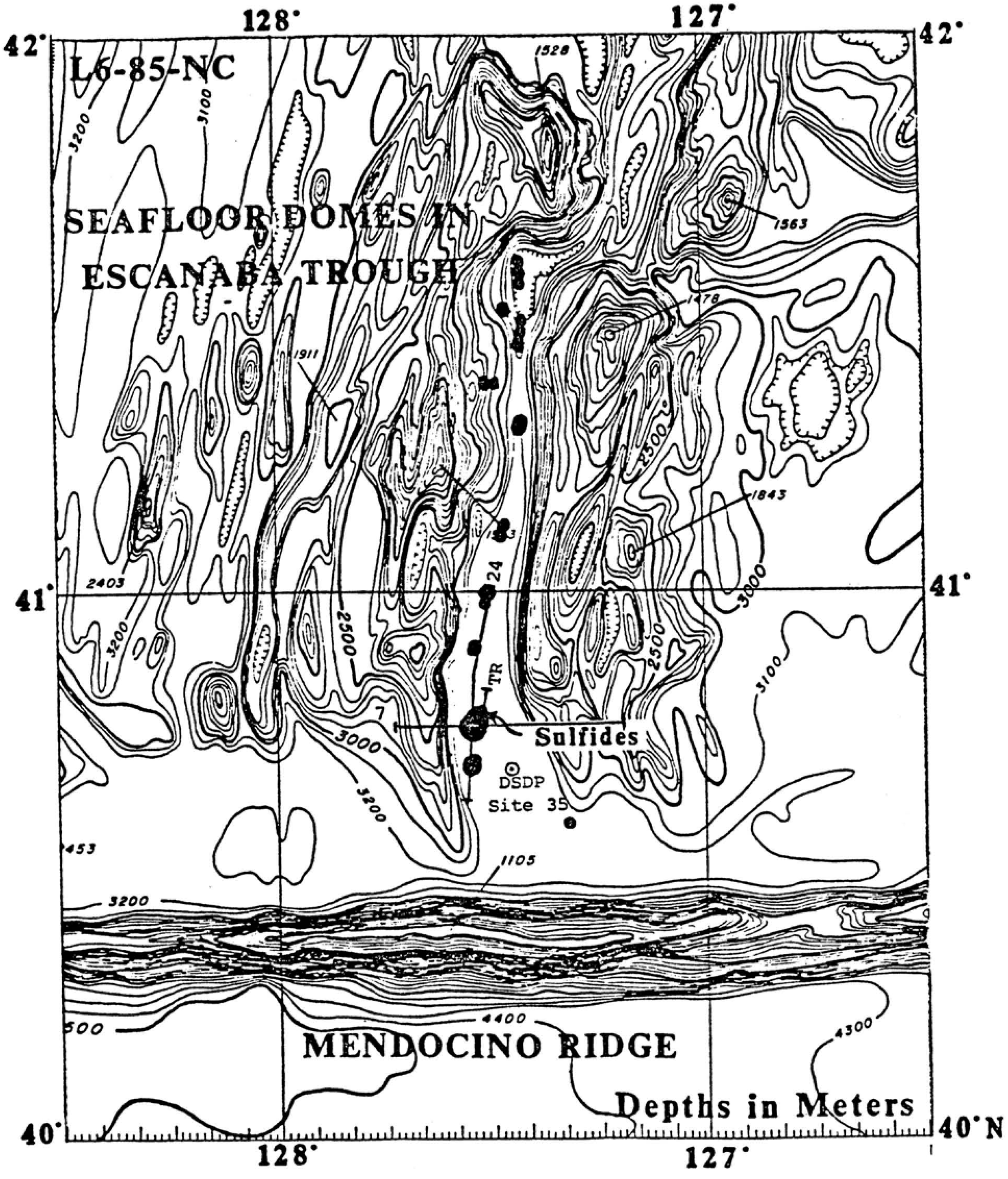


Figure 1. Location of volcanic centers in the Escanaba Trough based upon single channel seismic reflection lines from the L6-85-NC cruise in September 1985.

The sediments have been uplifted over and adjacent to these volcanic edifices, but the absence of large-scale drag folding in the reflector sequences around the margins of the intrusive zones indicates that these structures either predate much of the sedimentary fill or have grown contemporaneously with the sedimentary section. Small-scale superficial deformation of the sediments surrounding the volcanic centers supports the latter interpretation.

I.2.2 Sedimentation on the Gorda Ridge

Sediments in the Gorda Ridge area are derived from terrigenous, biogenic, volcanic, and, possibly, hydrothermal sources. The terrigenous components include mainly chlorite, illite, plagioclase, quartz, and minor mafic minerals from metamorphic and volcanic terrains of the Northern California Coast Ranges and Klamath Mountains of Oregon, as well as lesser abundances of smectites from the Columbia River Basin (Karlin, 1980; Phipps, 1974; Spigai, 1971). Except for Phipps (1974) and Heath et al. (1976), little work has been done in characterizing sedimentary biogenic constituents in the ridge environment. However, on the Southern Oregon margin and in the Cascadia Basin, Holocene olive-grey muds show a dominance of radiolaria over foraminifera in the coarse grain fraction, whereas in glacial grey lutites, planktonic forams dominate (Duncan, et al., 1970; Barnard and McManus, 1973).

In ridge sediments, volcanic components can be derived from primary extrusive activity and dispersion by nepheloid, plume or turbidite transport on the seafloor. The main evidence of neo-volcanic activity is the presence of volcanic glass and lithic fragments associated with extrusion. Given sufficient core coverage, areal changes in volcanic grain size can be used to map a given volcanic event, but hydraulic sorting due to turbidite transport can complicate interpretations. Volcanic glass in sediments can also be derived from exposed volcanic structures due to shedding and reworking processes.

Hydrothermal sedimentary components along the Gorda Ridge could be derived from primary venting and hydrothermal plumes such as observed over open, unsedimented ridge crests. If massive sediment-hosted sulfide deposits are present, mass wasting, slumping, seismically-induced turbidite activity, or tectonic tilting can cause remobilization and redeposition of hydrothermal material. However, the nature of hydrothermal mineralization in the sediments of the Gorda Ridge may depend on the ambient geochemical environment in which the metal-rich phases are deposited.

I.2.3 Effect of the Redox Environment on Hydrothermal Mineralization

Typical hemipelagic sediments show a red-brown oxic surface layer, a tan/olive transitional zone overlying grey-green sediment. This zonation is due to the progressive consumption of oxidants, proceeding from O_2, NO_3, and Mn(IV) in the brown zone, to Fe(III) and eventually SO_4 in the green zone. These diagenetic processes are reflected in the sediments as high Mn concentrations in the surface sediments. When sulfate reduction is present, diagenetic sulfides are precipitated at depth. In a given depositional regime, the sequence of reactions can be telescoped or compressed, and later reactions (e.g. sulfate reduction) may or may not be present at depth, depending primarily on the input of metabolizable organic carbon and sediment accumulation rates.

In pelagic regions containing hydrothermal input, hydrothermal fallout from plumes is usually evidenced in anomalously high levels of Mn and Fe. Hydrothermal sulfur is usually rapidly oxidized to sulfate and diffuses to the seawater in such oxic environments and is not present in the sediments.

In Gorda Ridge sediments, because of more rapid sedimentation and higher organic input, manganese is remobilized at depth and reprecipitated near the surface. In such sediments, a hydrothermal Mn signal could be obscured or removed by bacterially mediated organic matter decomposition reactions. Iron, in contrast, is not remobilized to the same extent as Mn, because it rapidly transforms into other crystalline phases. However, iron is a common component of terrigenous, volcanic, as well as hydrothermal sources; thus, separating hydrothermal input from other competing sources can be difficult. Similarly, sulfur in sediments can be due to either (or both) hydrothermal input or diagenetic sulfides.

II. METHODS

Sediment cores from the S.P. LEE L6-85-NC and WECOMA W8508AA cruises were obtained using a three meter gravity corer with 4" diameter plastic barrels. A magnetic compass/tilt meter was used on four of the LEE cores to obtain absolute orientations and measurements of core tilting upon penetration. Cores were cut into 1.5 m lengths, capped then stored in a refrigerated van until arrival at Newport, whereupon they were transferred to the OSU core storage facility in Corvallis.

At the OSU core laboratory, whole core magnetic susceptibility (K) measurements at 1 cm intervals were made using a Barthington M.S.2 Susceptibility Meter. Due to the ring sensor geometry, the system response is a cosine-shaped with a bandwidth of +/- 5 cm. Thus, each measurement is a center-weighted integration of susceptibilities within 5 cm of the sensor position. After these measurements, cores were split into archive and working halves with twin routers. Standard core descriptions and smear slides were made immediately after opening. Color pictures of the core sections were kindly provided by Mr. T. Chase (USGS, Menlo Park).

Soon after the initial descriptions, samples for paleomagnetism, chemistry, and water contents were taken from the working core halves. Paleomagnetic sampling was done at 5-10 cm intervals, using a thin-walled square stainless steel tube, mounted in an orienting jig, to minimize disturbance. All samples for rock/paleomagnetism were kept cold and in a low field environment to inhibit water loss and prevent viscous remanence acquistion. Natural remanent magnetization measurements were made on the Schoenstadt spinner magnetometer at OSU and a SCT cryogenic magnetometer at the University of Washington. Instrumental precision was ~1%; however, due to unavoidable viscous and storage effects, replicability was usually 5% or better.

Samples were prepared for chemical analyses by freeze-drying and disaggregation in a ball mill, then pressing the powdered samples into pellets. Since the samples were undiluted, trace elements could be measured at concentrations of less than 100 parts per million. Chemical analyses were done on the OSU X-ray fluorescence (XRF) facility. Raw data were collected with a Phillips PW1600 X-ray Fluorescence Spectrometer with 25 fixed element detectors and 2 scanning LiF detectors to calculate X-ray background at each peak. Backgrounds were calculated from empirical relations established using blanks of different mean atomic number between measured background points and background at each peak. Backgrounds were stripped and the stripped data were normalized to a monitor standard run between each sample to eliminate minor machine drift. Concentrations were calculated using the XRF11G program (Chriss Software) calibrated with over 100 NBS, USGS, Canadian, French, and South African geological standards, and mixtures of these standards with each other or CaCO3. Precision based upon multiple measurements of an in-house sediment standard was approximately 3% for Na and 1% or less for the other elements.

The chemical data for each element were further corrected for porewater sea salt dilution (left in the sample during the drying process) by measuring Cl content of each sample and by assuming that the porewater composition was the same as seawater. A mass of sea salt was then calculated and concentrations of each element were then corrected for dilution by the additional salt mass in the sample. In addition, Na, Mg, Ca, K, and S sea salt contributions were calculated and subtracted from the raw elemental concentrations. We also corrected for calcite dilution in each sample based upon a normative calculation using Ca (Dymond et al, 1976). The purpose of this correction is to remove the dilution effect of one of the major biogenic components upon elemental concentrations. The corrected data are reported in Appendix IX.5.

Carbon-14 analyses were carried out by Radiocarbon Ltd. on roughly 200 gm samples in 4 to 5 intervals from 4 cores: L1,L8,L12, and W9. The samples were treated before analysis with weak phosphoric acid to remove calcite. The ages are thus derived from the organic fraction.

III. RESULTS

III.1 CORING OPERATIONS

On the R/V LEE L6-85-NC cruise in 1985, 12 gravity cores were recovered from the southern Gorda Ridge and Escanaba Trough (Figure 2). Seven cores came from the ridge axis, one from the east flank and four from the west flank of the Trough. Five cores were taken from the northern ridge during the WECOMA W8508AA cruise (Figure 3). In the north, one core was located at the axis,

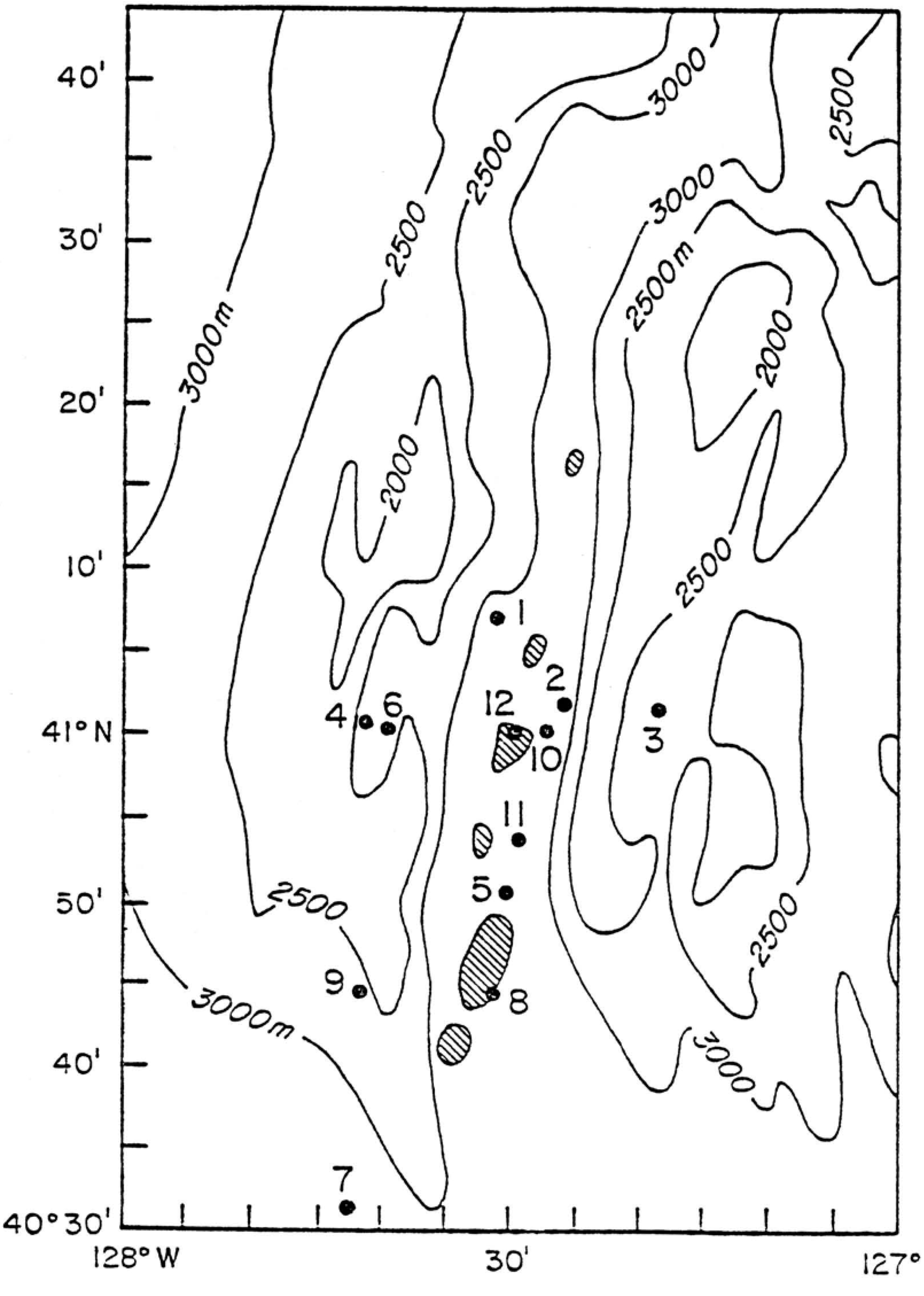


Figure 2. Location of gravity cores from the L6-85-NC cruise to the Escanaba Trough. Seven cores were recovered from the axial valley proper.

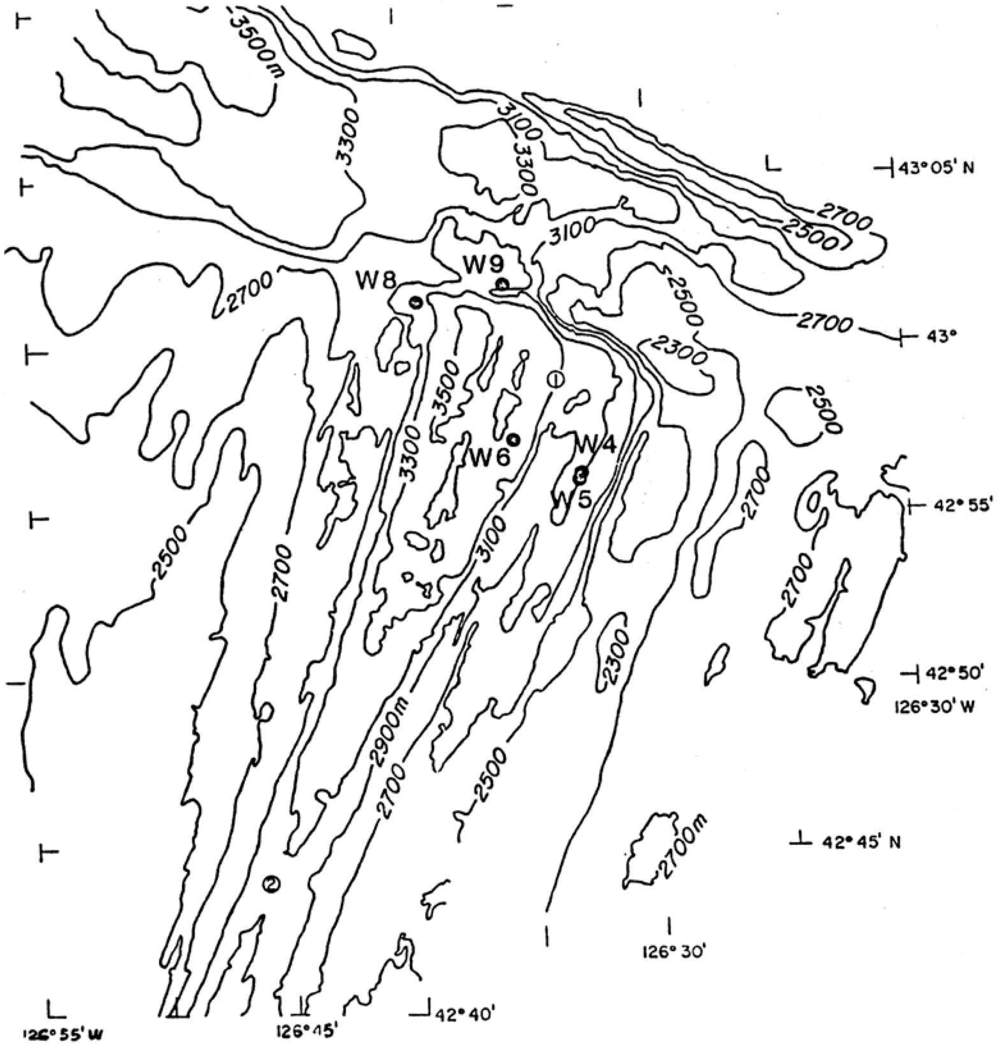


Figure 3. The locations of the 5 gravity cores recovered during the August 1985 W8508AA cruise to the northern Gorda Ridge.

two came from an elevated bench on the eastern valley wall, and two were taken on an elevated bench at the Gorda Ridge-Blanco Transform intersection.

III.2 LITHOLOGY

The overall lithology of the sediments from both the northern and southern Gorda Ridge is similar to other marine sediments found off the Oregon margin. The sediments are silty clays or clayey silts, usually classified as hemipelagic muds, or lutites. The surfaces of all the cores show the prominent, commonly observed color change from brown to gray-green which marks the shift from Mn reduction to Fe reduction (Lyle, 1983). The surficial brown layer usually had thicknesses of about 2 cm, but in some cases, was up to 10 cm thick.

Most of the material in the cores was fine-grained continental detritus with a small, but significant fraction of calcitic and opaline biogenic tests. Diatoms and radiolaria were the typical biogenic material preserved in the northern cores and the axial and eastern cores of the Escanaba Trough. On the west flank, calcareous microfossils became more abundant and dominanted the biogenic fraction. Calcareous microfossil abundances also varied downcore, apparently in response to Pleistocene and Holocene climatic change. The downcore change in calcite abundance thus provides a means of correlating cores on a regional scale.

At the base of the cores from the Escanaba Trough we noted a change in sediment color and texture from a mottled olive grey or dark grey mud to a more homogeneous darker grey clay. As discussed later, this lithologic change was also evidenced in downcore shifts in sediment chemistry, water content, and magnetization. Since the terrigenous source for all of the sediments was the North American land mass to the east, the lithologic boundary probably marks a major shift in sediment supply associated with climatic change at the end of the last glacial period, between 10,000 and 20,000 years ago.

Occasional silty laminated sections were found in two northern cores (W8 and W9), three Escanaba Trough cores (L8, L12, and L11) and one core from the western flank of the Escanaba Trough (L7). These silt bands are probably flow deposits and, in many cases, turbidites. Their presence indicates that some sediment redeposition occurred on the Gorda Ridge. However, because these silt layers were relatively scarce (except in L7), the dominant mode of sediment accumulation was mainly by passive hemipelagic deposition processes, at least in the Holocene.

Four silt-rich intervals were found in three of the Escanaba Trough cores (L8, 22-74 cm; L11, 13-22 cm; and L12, 38-53 cm and 90-120cm). In L8, the sediments from 22-74 cm showed a series of laminations with a sharp bottom contact, suggesting a turbidite or a group of turbidites deposited in short succession. Smear slides from this interval had silty grain sizes and, when compared to the north Gorda cores, were unusual in containing 30 to 35% volcanic glass and several per cent sulfides, including rare hexagonal sulfides which may be pyrrhotite.

L12 contained two unusual silty intervals at 28-53 cm and 94-126 cm. Both intervals were silt-rich, and contained up to 25% volcanic glass and several per cent sulfides. From 28-53 cm, the sediments were better sorted and siltier than in the lower interval and hexagonal sulfides were observed. The lower interval was marked by contorted bedding. The base of the unit made a shar angular unconformity, tilted at ~30 degrees, with the underlying homogenous grey clay, possibly indicative of a slump deposit.

On the northern Gorda Ridge, cores W8 and W9 contained the silty base of a turbidite at about 130 cm which is described in the appendices as a silty laminated section. In W9, this interval extends from 123 to 130 cm. Water contents, shown in figure 4, define the extent of the clay-rich upper part of the turbidite not easily recognizable by visual examination. By this criterion, the turbidite extends from 108 to 130cm. The turbidite is composed primarily of terrigenous clastic material, 5-10 % basalt glass and about 5 % opaque material.

Water content profiles also delineate the turbidite intervals in the Escanaba Trough cores and can be used to demarcate the lithologic change visible at the base of L1, L5, L8, L10, and L12.

III.3 SOUTHERN AREA

III.3.1 ROCK/PALEO MAGNETISM

The initial magnetic susceptibility measures the response of paramagnetic and ferrimagnetic minerals to a small applied field and is sensitive to the concentration and grain size of Fe-bearing minerals. Whole core susceptibility measurements for the cores from the Escanaba Trough are shown in Figure 5. All of the cores in the central axial valley have magnetic highs at depths >150 cm (110 cm in L12), coincident with the lithologic change noted earlier. Core L7, taken in a deep sea channel SW of the mouth of the Escanaba Trough, has downcore susceptibilities with high background levels and numerous large peaks which clearly correlate to coarse silty turbidite layers, presumably reflecting channelized transport. This core and those from the flanks and uplifted basins along the axial ridge, show no clear inter-core correlations.

Core L8, located on the 40^{o} 45'N dome, shows a series of large susceptibility peaks from 10-75 cm. These intervals contain numerous bands, mottles and silty laminations (see Appendix IX.2, Core Descriptions). Similar behavior is not observed in the nearby L5 core, found on the axial valley floor, although L5 clearly shows the lithologic change at 170 cm. seen in the other axial valley cores.

The cores proxial to the 41^{o} N volcanic center (L12, L10, L2, and L1) show a degree of inter-correlation with magnetic 'events' near the surface a 60-80 cm depth (38-53 cm in L12). Nearby off-axis cores (L3 and L6) do not show similar behavior, suggesting that, if the core sedimentation rates are comparable, the source of the magnetic anomaly is confined to axial valley

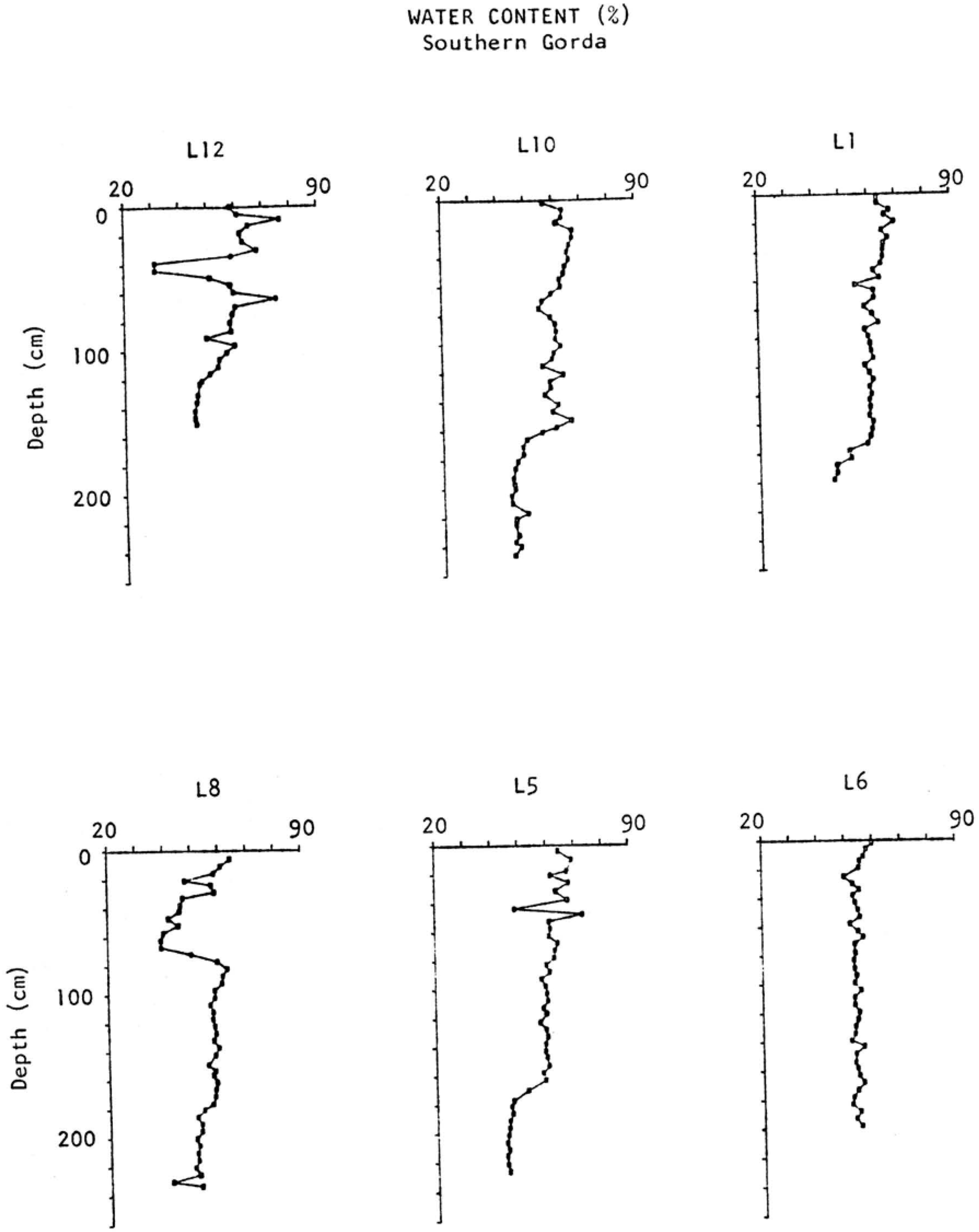


Figure 4a. Water contents from the Escanaba Trough cores. The water contents can be used to discern turbidite intervals and to determine the level of the lithologic change in the Escanaba Trough.

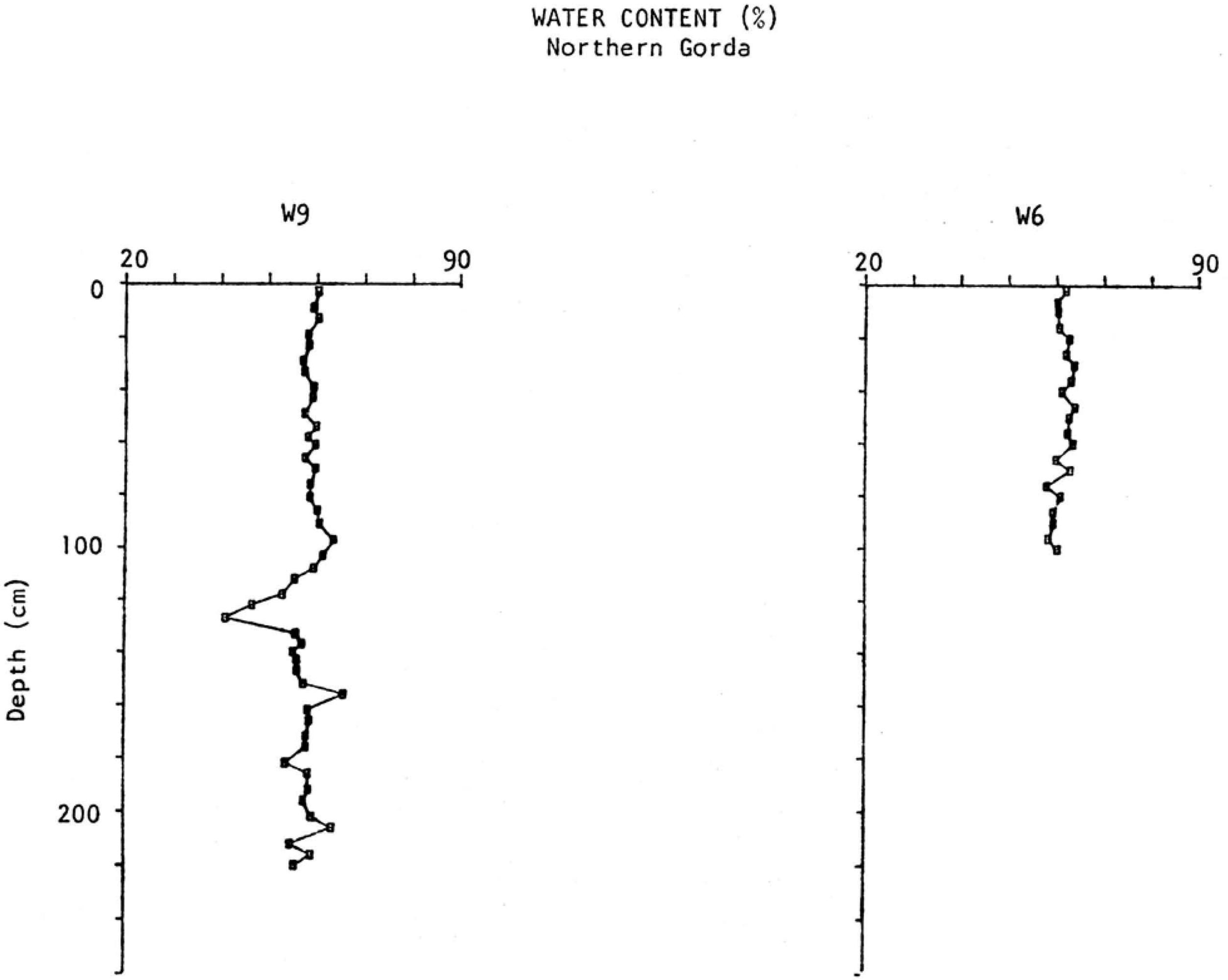


Figure 4b. Water contents from the North Gorda Ridge cores. The water contents can be used to discern turbidite intervals and to determine the level of the lithologic change in the Escanaba Trough.

sediments. Since Core L5 is located between the two domes, the lack of obvious features in Core L5 which are correlable to Cores L8 and L12 implies that the causes of the large susceptibilities in the cores on the 40° 45'N and 41° N domes are distinct.

Downcore profiles of natural remanent magnetization (NRM) intensities for individual samples from the southern Gorda cores (Figure 6) show essentially the same behavior as seen in the whole core susceptibility profiles. This indicates that the initial susceptibility is controlled by ferrimagnetic minerals (e.g., magnetites, certain sulfides) rather than by paramagnetic species, such as Fe-bearing clays or pyrites. The NRM intensities clearly show the basal lithologic change in the axial valley cores; a correlable magnetic high at ~60-80 cm between L10, L2, L1, and possibly, L12; and dramatic intensity highs at 35-50 cm in L12 and 25-70 cm in L8.

With the exception of the large peaks in L8 and L12, NRM intensities (normalized by wet weight) of the cores from the Escanaba Trough are very similar to the uppermost sections of cores taken along the Oregon margin. However, in the margin cores, Fe reduction and subsequent sulfide formation causes dissolution of the magnetic fraction and large, systematic NRM intensity decreases downcore (Karlin and Levi, 1983; Karlin and Levi, 1985). In the Gorda cores, the lack of such downcore NRM intensity changes suggests that the sedimentation regime in the Escanaba area is not subject to sulfate reduction at depth and is less reducing than in the higher productivity regions nearer shore. Thus, diagenetic sulfides might not be expected.

Downcore profiles of NRM inclinations for the various cores are shown in Figure 7. Without demagnetizations to isolate stable components of the remanence, we hesitate, at present, to make interpretations of the downcore inclination trends in terms of intercore correlations or time scale determinations. However, certain features of the profiles are worthy of note. In cores L8 and L12, the zones of anomalously high intensities and susceptibilities and low water contents have no corresponding anomalous inclinations. The lack of inclination variations within these sections is consistent with deposition of the sulfidic, glassy silt as a turbidite rather than as mass slump or debris flow. Moreover, within the anomalous zones, the inclinations among and between horizons is essentially constant, suggesting rapid deposition.

Core L12, located on the flank of the volcanic edifice, shows large variations in inclination which are significantly different than expected at the site from a geocentric axial dipole (60°) or seen in the inclination profiles of the other cores from the axial valley. The compass/tilt meter on the core barrel apparently tripped properly and showed a dip of less than 3°, suggesting that non-vertical core penetration was minimal. In the homogenous grey clay found below the steep angular unconformity at 115-120 cm, the mean inclination is relatively shallow (~45°). Whether this feature is due to tilting of the entire sediment column or a manifestation of the ambient geomagnetic field will be unclear until we obtain dates on the cores and perform the necessary demagnetizations. However, inclinations in the zone from 85-115 cm immediately above the unconformity are highly disturbed and variable, while the NRM intensities are relatively low. Since the carbonate maxima found in the other cores (see Sediment Chemistry) is missing here, this zone may represent a mass slumping event. The mean

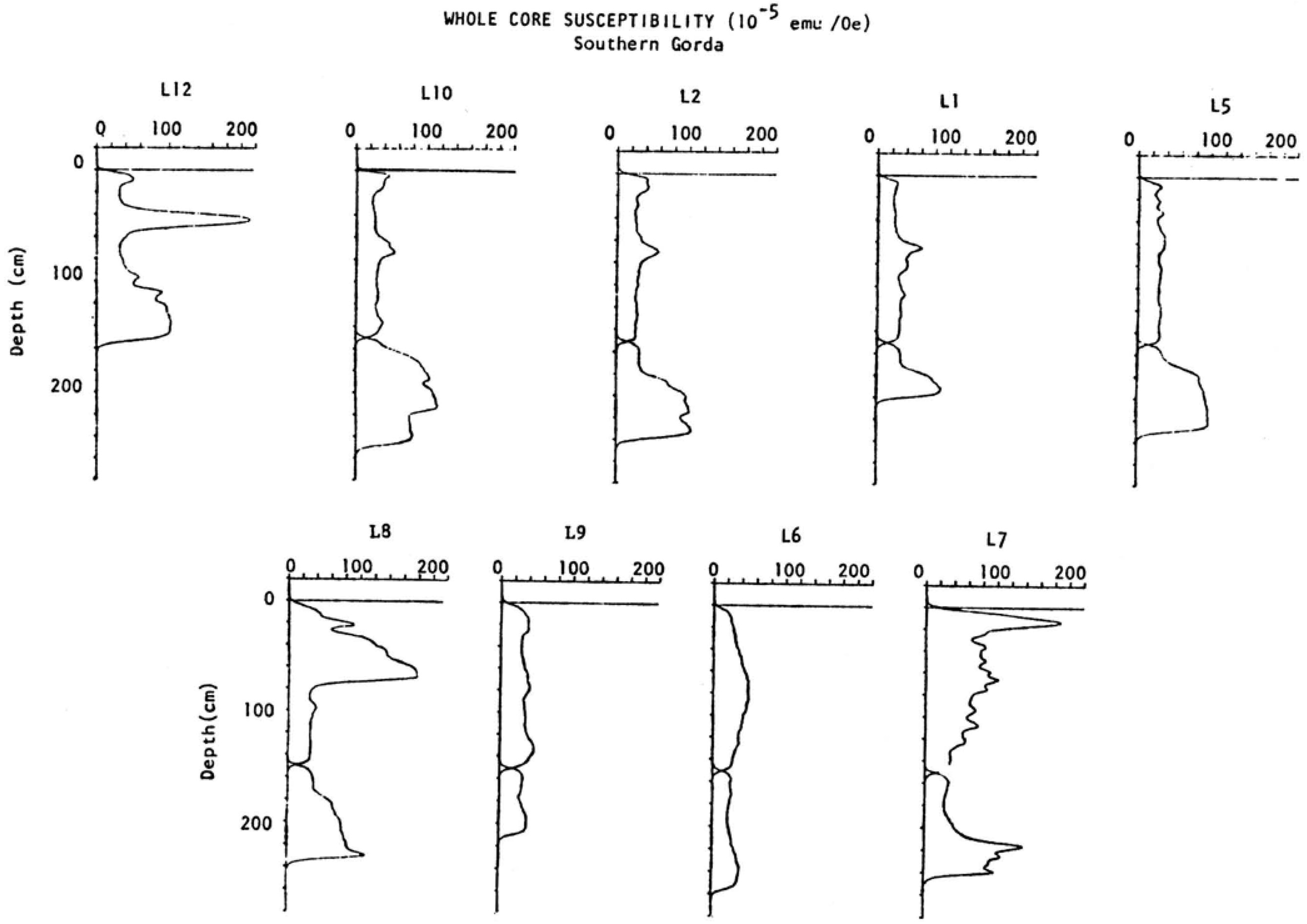


Figure 5a. Whole core magnetic susceptibility measurements for the Escanaba Trough cores. Turbidite intervals are marked by higher magnetic susceptibilities, as is the lithologic change in the Escanaba Trough.

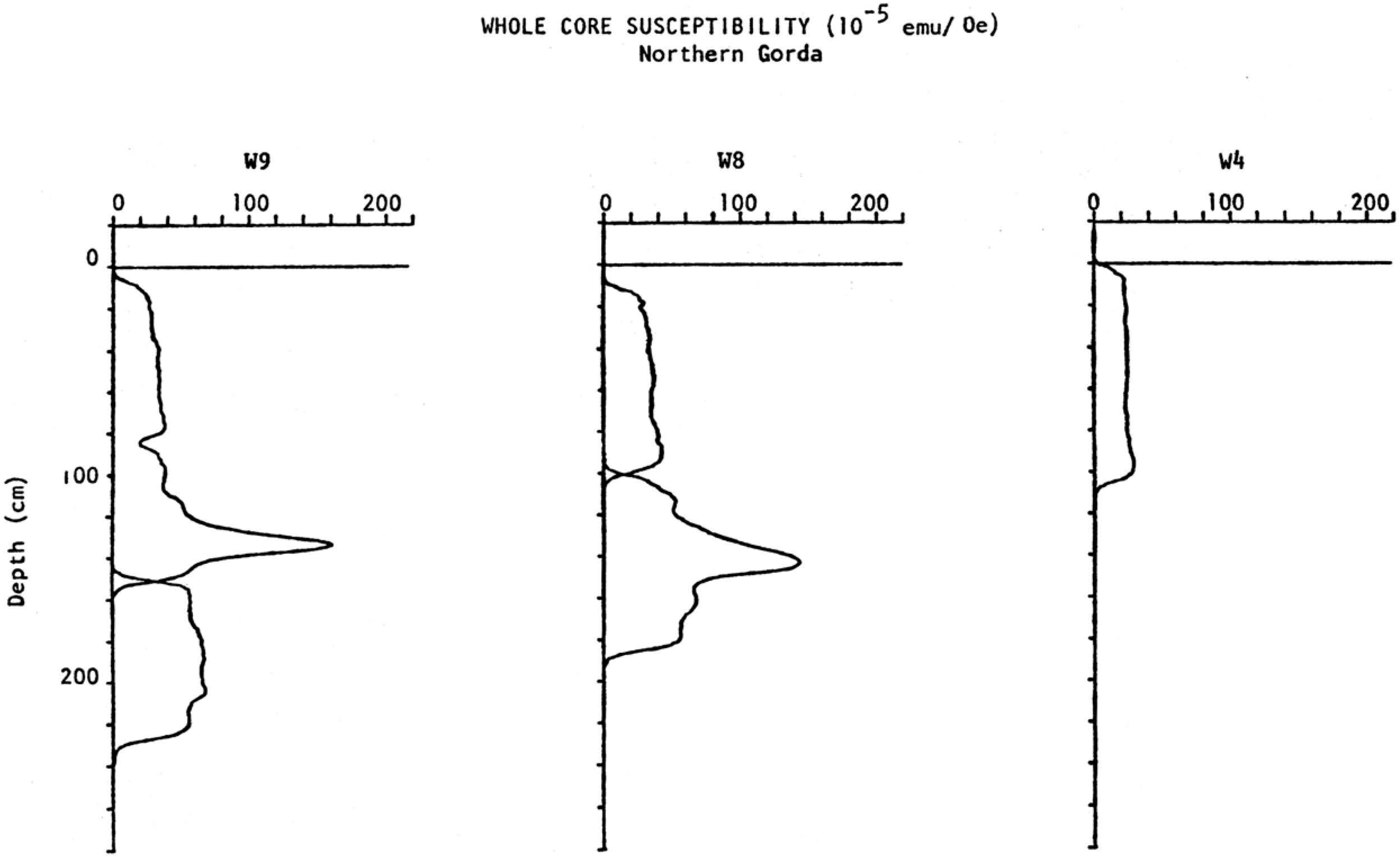


Figure 5b. Whole core magnetic susceptibility measurements for the North Gorda Ridge cores. Turbidite intervals are marked by higher magnetic susceptibilities.

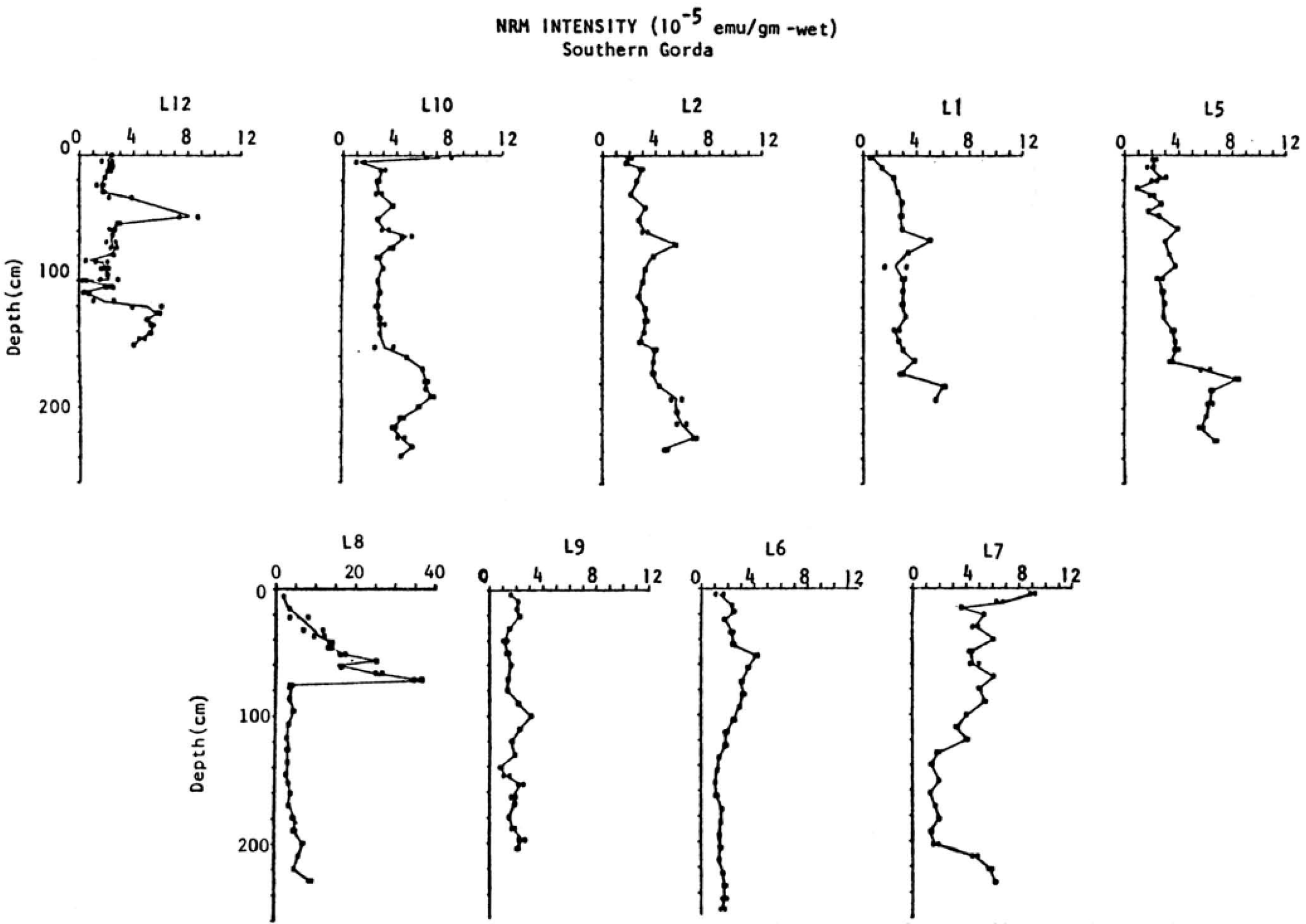


Figure 6a. NRM intensities in Escanaba Trough cores, normalized per gram of wet sediment weight. The turbidite intervals show high NRM intensities, and in addition, a magnetic high can be discerned in cores L10, L2, and L1. This high can be correlated with the turbidite interval in L12 between 38 and 53 cm. Note: Difference in L8 horizontal scale.

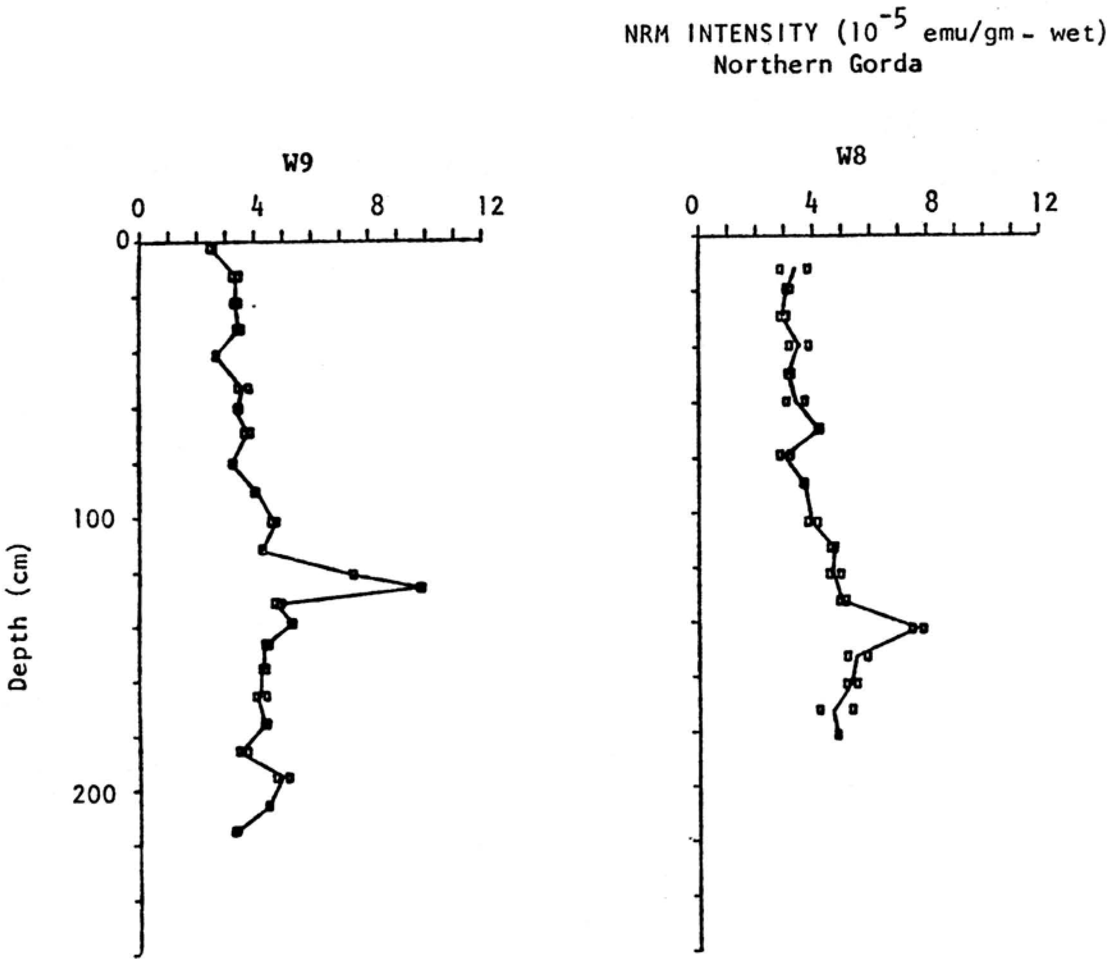


Figure 6b. NRM intensities in North Gorda Ridge cores, normalized per gram of wet sediment weight. The turbidite intervals show high NRM intensities.

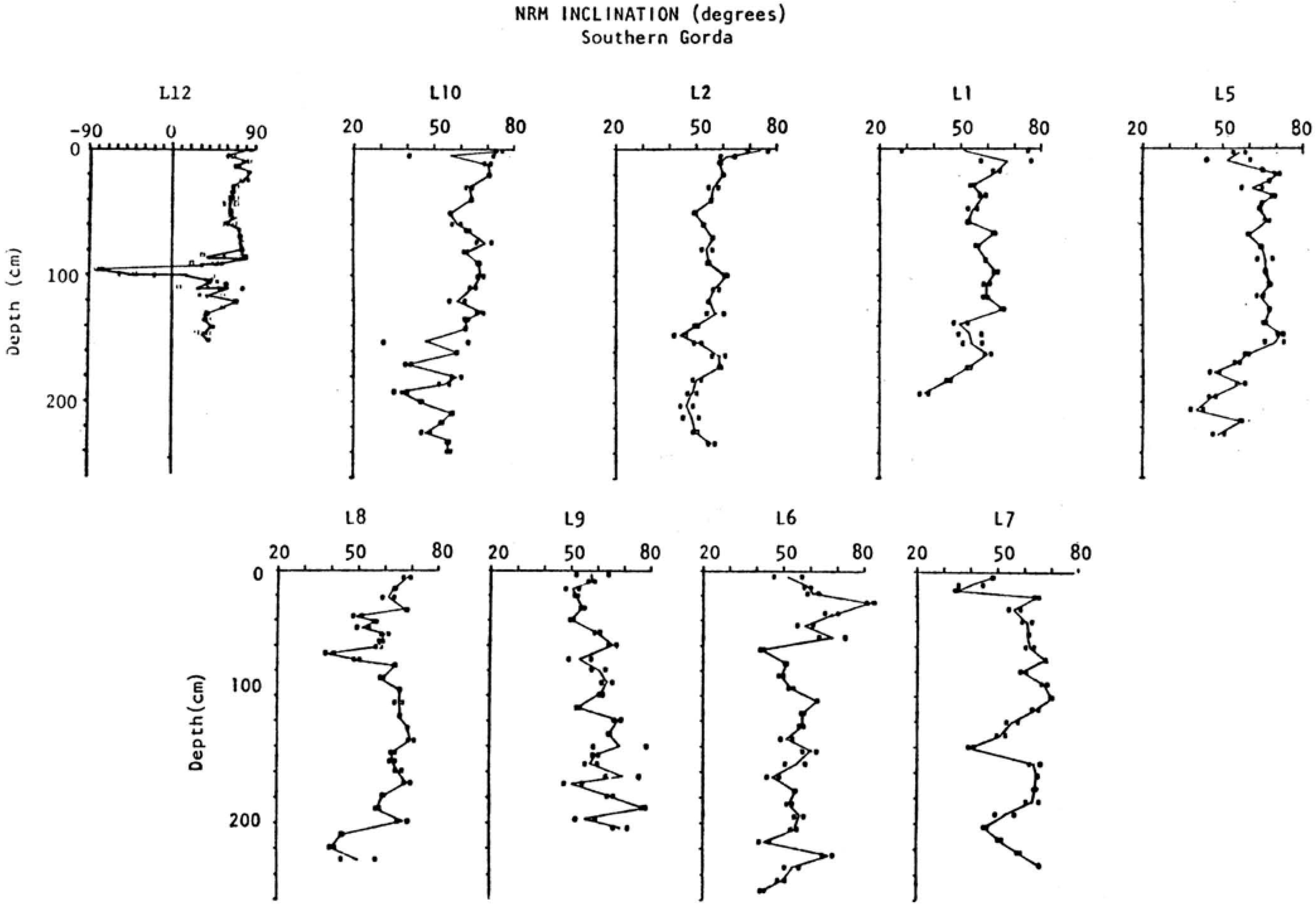


Figure 7a. NRM inclinations (degrees) in Escanaba Trough cores. A disturbed interval can be discerned between 85 and115 cm in core L12.

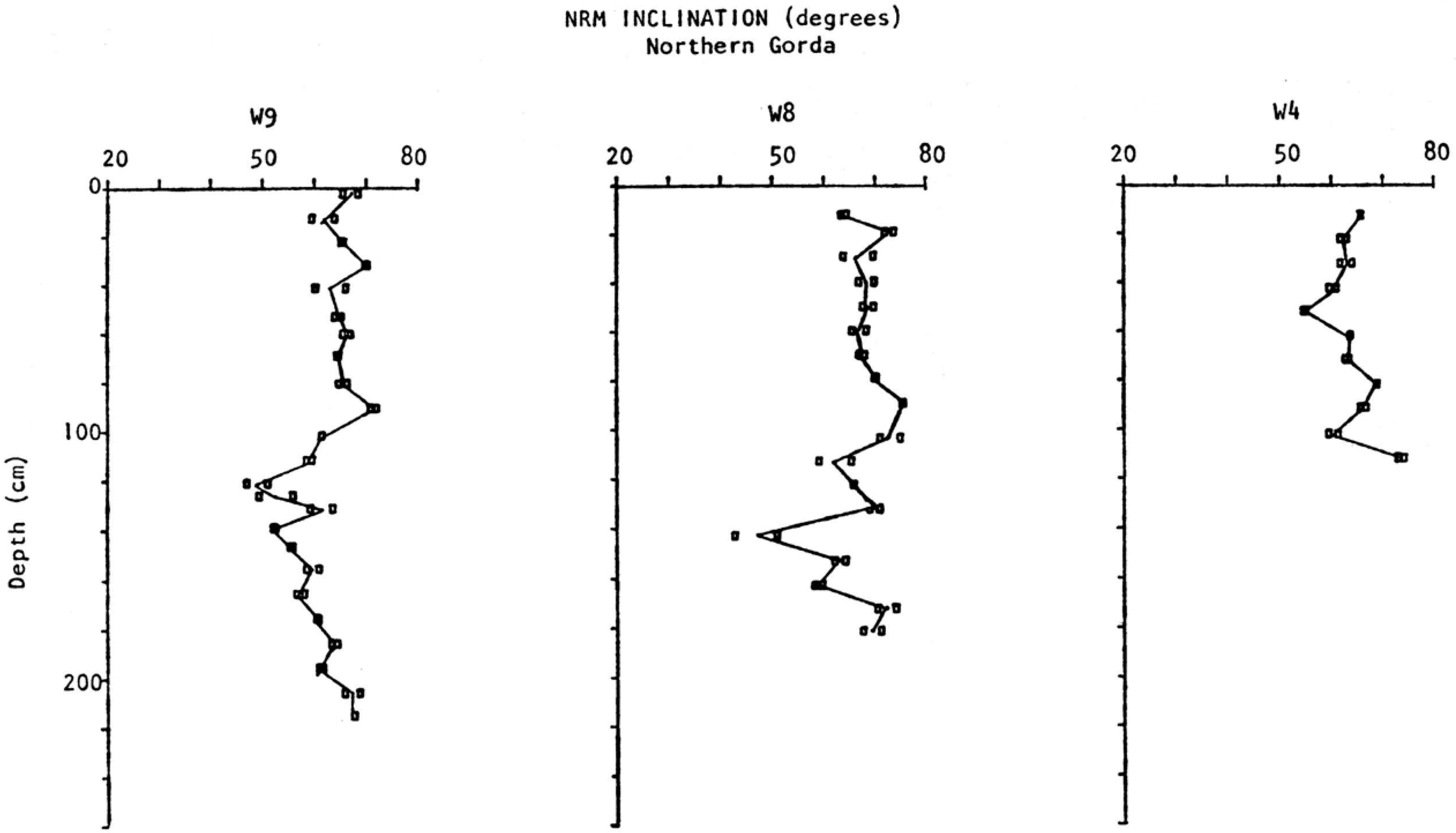


Figure 7b. NRM inclinations (degrees) in North Gorda Ridge cores.

inclination in the top 80 cm is significantly steeper (~72°) than the expected dipole inclination and may be due to recent tilting of the sediments after deposition of the sulfidic turbidite. Thus, L12 may contain a record of tilting, mass slumping, and turbidite deposition, presumably associated with uplift of the dome and deformation of the surrounding sediments.

III.3.2 SEDIMENT CHEMISTRY

Bulk elemental concentrations in sediments result from the mixing of several classes of sedimentary components during deposition. For certain elements such as Mn, Fe, and S, post-depositional early diagenetic processes can modify downcore primary abundances through remobilization and precipitation reactions. At the Gorda Ridge the sediments consist primarily of a mixture of clays and other aluminosilicate detritus, biogenic planktonic material, and a small hydrothermal precipitate fraction.

Characteristic elements are often associated with each class of sedimentary material. For example, Al, Ti, Cr, and Rb are primarily associated with the detrital aluminosilicate fraction, while Ca is typically associated with calcitic biogenic debris. In addition, Mn and S are highly enriched in hydrothermal precipitates. Other elements often are combinations of more than one class. Iron, for example is one of the major components of both the detrital and hydrothermal fractions, while Si is important in both the biogenic and detrital fractions. Since most terrigenous material in the Gorda area is derived from continental volcanic sources, differentiating primary local volcanogenic sources from detrital terrigenous sources by chemical means can only be done by examining variations in suites of elements rather than by using a single chemical tracer.

In the Escanaba Trough we can distinguish two types of detrital aluminosilicates and one possible biogenic elemental association based upon an elemental correlation matrix. Three groups of elemental associations can be distinguished all having intra-group correlations greater than 0.8 . The first of the detrital associations is the group of elements typical in felsic rocks: Na, Al, P, K, and Ti (Figures 8 and 9). This group is enriched in the turbidites and in the Pleistocene sediments within the lower lithologic unit. This group's enrichment in the turbidites seems due to the high abundance of feldspars in the coarse fraction of Escanaba Trough sediments and the sorting and concentration of this coarse fraction during turbidite transport. Apparently, the Pleistocene sediments (>11,000 yrs BP) are enriched by inputs from a continental source rich in these elements, since the average grain size of the Pleistocene sediments is finer than that of the Holocene section.

The second group of elements (Mg, Cr, Ni, Zn, and Ba) is more mafic and shows high correlations to water content (Figures 10 and 11). Its enrichment in the Holocene section and water content association suggests that these elements are contained in clay minerals, since fine-grained clays often have high water contents. This component is probably derived from the ophiolites of southwestern Oregon and Northern California (Karlin, 1980). The third group of elements--Si, Cu, Ba, and Pb--may primarily represent

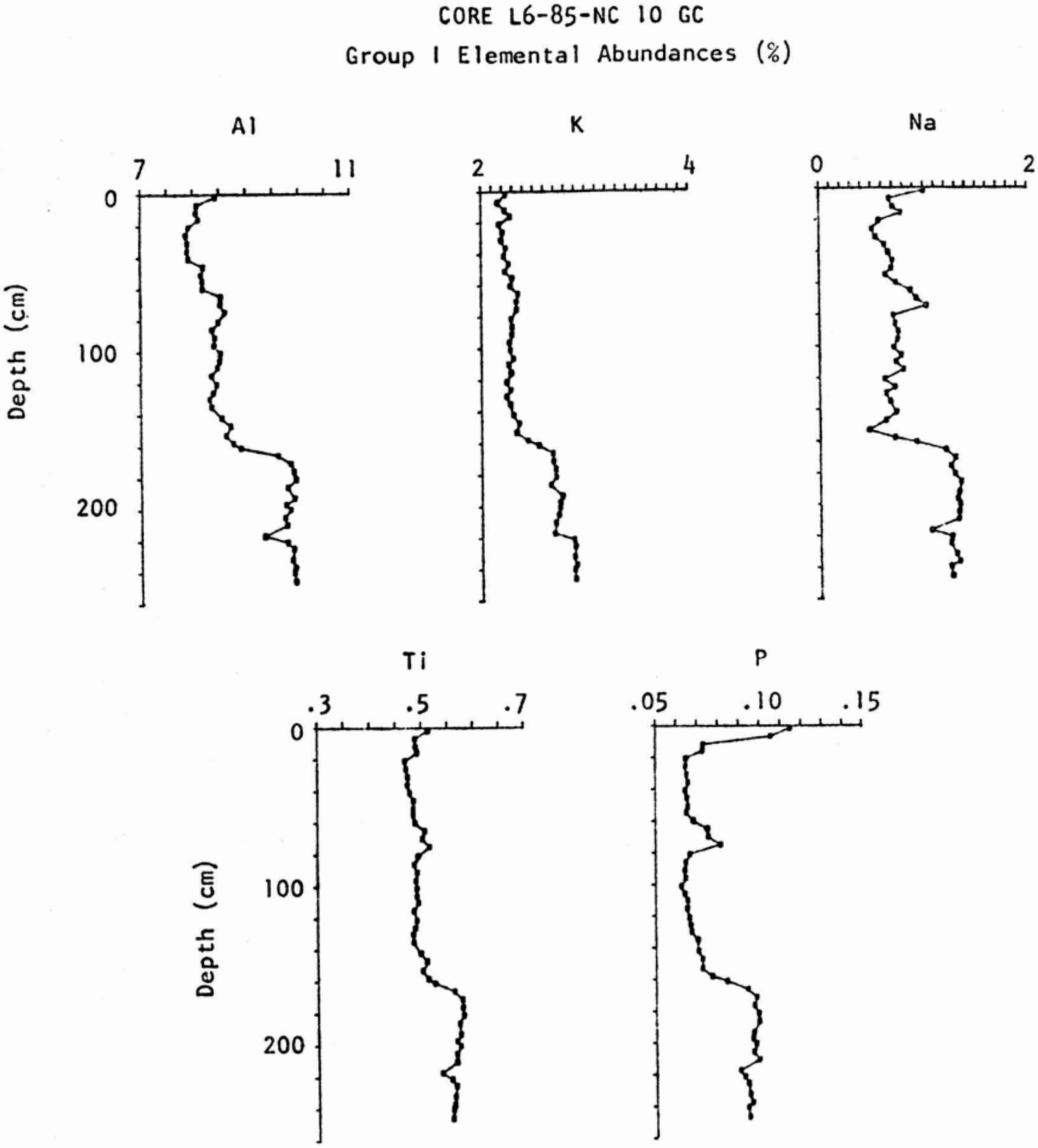
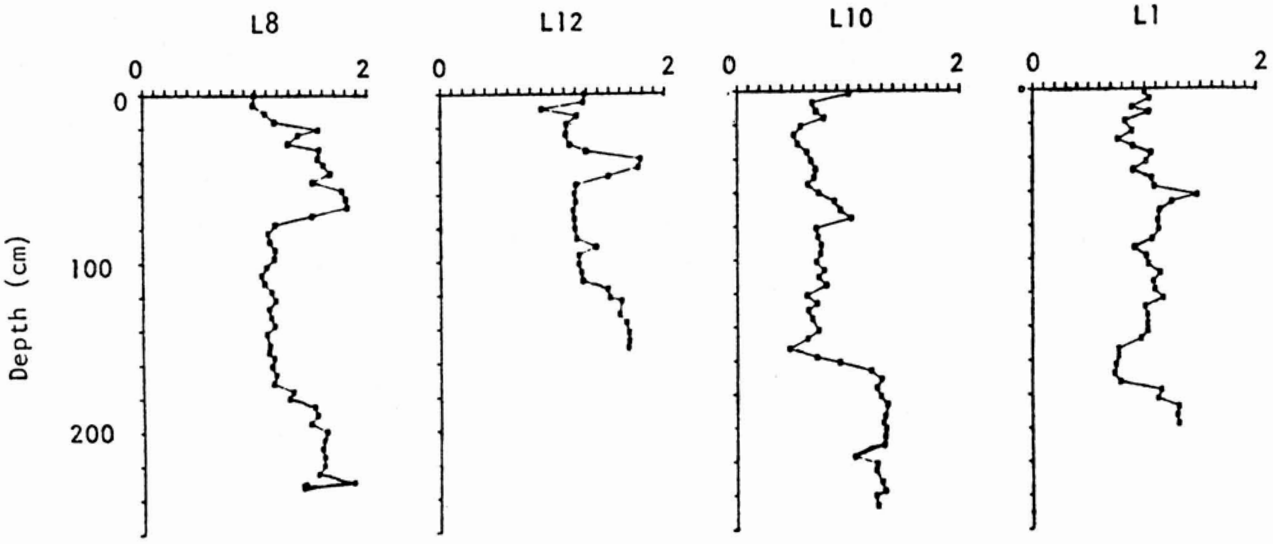


Figure 8. Group I detrital elements as determined by interelement correlations in core L10. The group consists of Al, K, Na, Ti, and P and probably represents felsic detrital material.

SODIUM (%)
Southern Gorda



SODIUM (%)
Northern Gorda

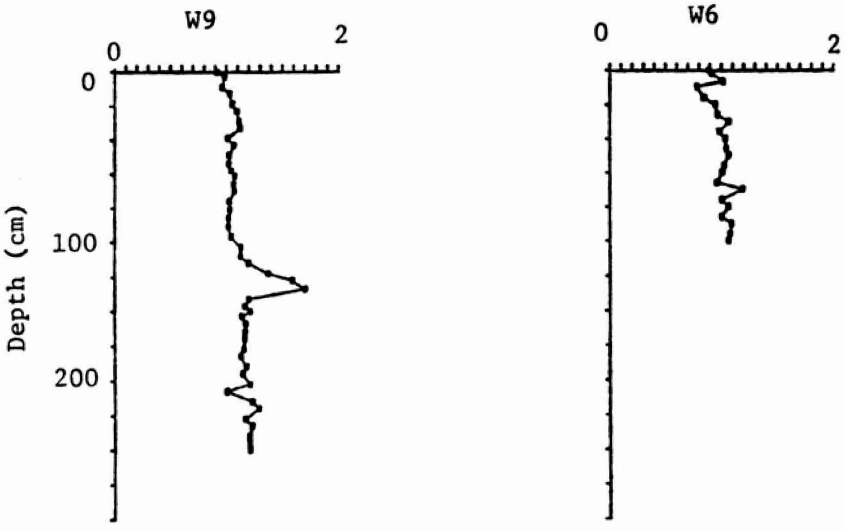


Figure 9. Variation of Group I elements (here represented by sodium) in cores from the Escanaba Trough and North Gorda Ridge. The Group I elements are enriched in the turbidite sections and in the lower lithologic unit.

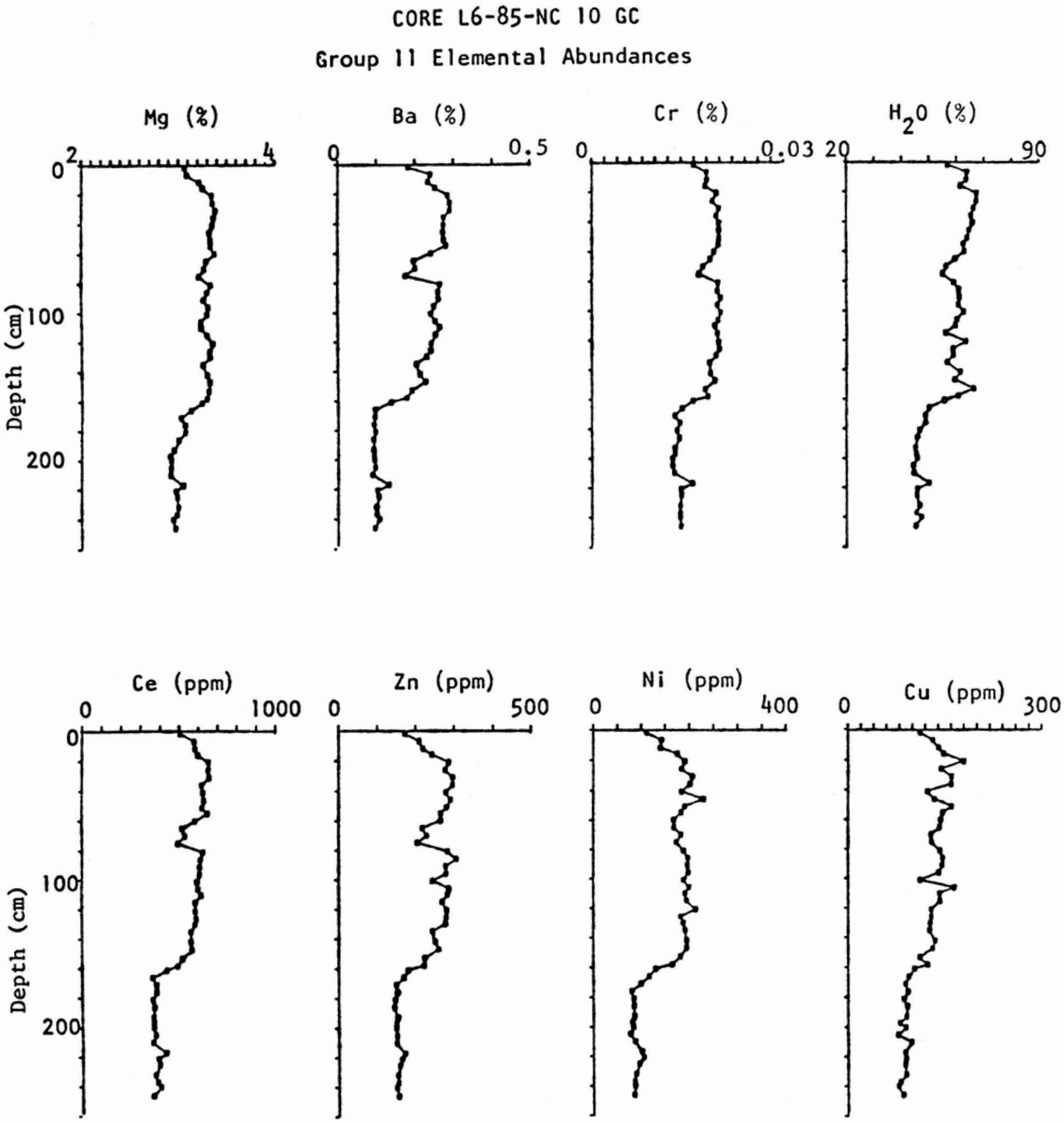
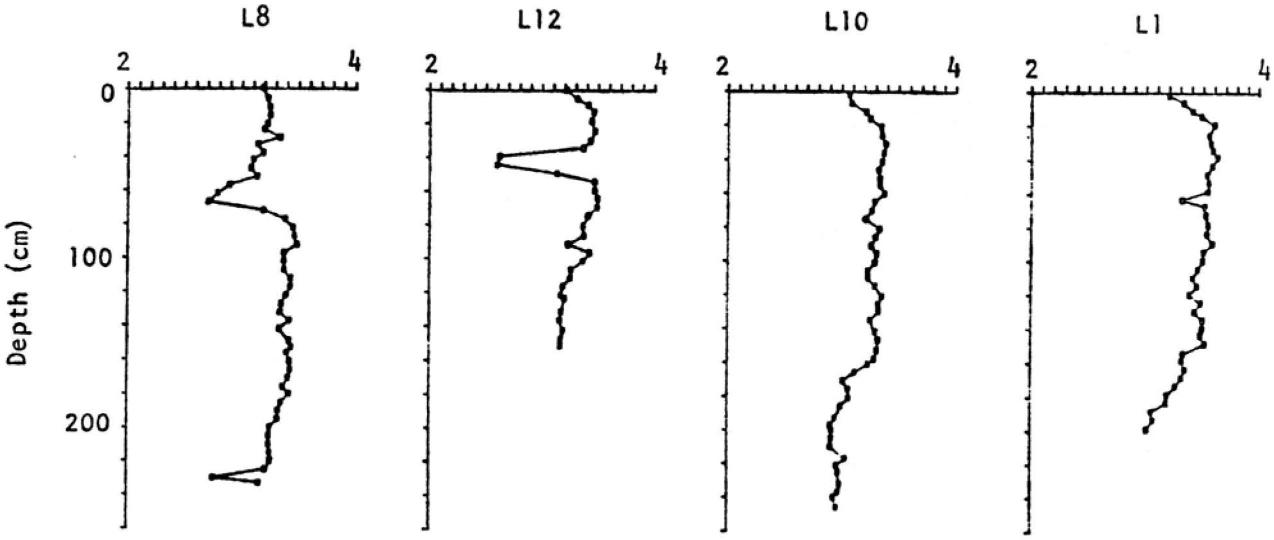


Figure 10. Group II detrital elements, as illustrated by downcore elemental variations in L10. The elements in this group are Mg, Ba, Cr, Ce, Zn, Ni, Cu, and H20 and probably represent more mafic detritus.

MAGNESIUM (%)
Southern Gorda



MAGNESIUM (%)
Northern Gorda

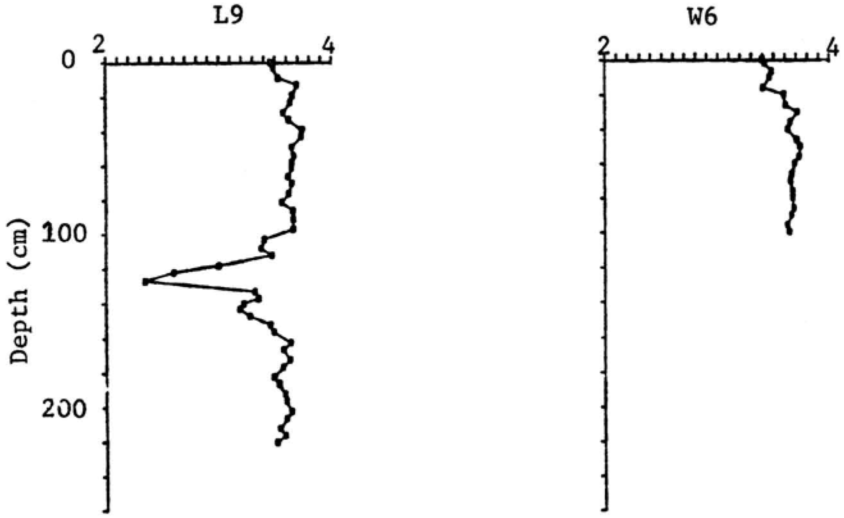


Figure 11. Variation of Group II elements as represented by magnesium in the Escanaba Trough and North Gorda Ridge cores. Turbidite intervals and the lower lithologic unit are marked by lower Group II concentrations.

biogenic input of opaline silica, barite, and organic matter rich in copper (Figures 12 and 13).

Mn is a more sensitive element than Fe to redox conditions, and was typically highest in the top most sediment samples (up to as high as 2% by weight) and decreased to low concentrations below the top few centimeters due to the reductive dissolution of Mn(IV) oxides. A distinctive hydrothermal fraction of manganese and iron oxides and hydroxyoxides could not be distinguished in Escanaba Trough sediments (Figure 14), probably because of early diagenetic processes. Mn and Fe oxyhydroxides can be easily reduced during the oxidation of organic carbon in the surface sediments. When they contact oxygenated bottom waters within the uppermost sediments, the two elements may reprecipitate. Because of this process, the surface sediments at the Gorda Ridge are enriched in manganese and may be enriched in iron (Figure 14, Appendix IX.5). It is more difficult to assess iron diagenesis because a large amount of iron is fixed in detrital silicates and will be unaffected by reductive dissolution.

Large manganese peaks occur downcore in L8 and L12, immediately beneath the turbidite sections in each core (Figure 14). These high concentrations of manganese are probably not due to hydrothermal activity, but represent trapping of a surface layer rich in manganese by the turbidite. In such a case, the surface layer is buried by the turbidite deeply enough to prevent its diffusive escape back to the ocean.

From the evidence we have assembled so far, the sulfur record in the sediments of the Escanaba Trough may preserve a record of hydrothermal plume activity in the Escanaba Trough (Figure 15). Hydrothermal sulfur occurs in a reduced form, as sulfides, and will not be dissolved during the reductive diagenetic processes that destroy the Mn and Fe records. The sulfur record may be confused, however, by reduction of porewater sulfate to a sulfide and its precipitation in the sediments. In such a case, one would expect the sulfur content of the sediments to increase downcore. As explained in the magnetics section, one would also expect the sediment magnetizations to decrease because of the dissolution of magnetite and transformation into iron sulfides. In the Escanaba Trough neither feature is observed. The magnetization intensities, aside from lithologic changes, is roughly constant. Core profiles of sulfur show peaks rather than a monotonic increase. Part of the variation of the sulfur records is due to the sulfide-enriched turbidites in L8 and L12, but not all the character of the records can be due to this. For example, sulfur is higher than background sedimentary values immediately below the turbidite in L8, as well as at a depth of 220 cm. In the northern end of the Escanaba Trough the records are marked by a single broad peak, which is roughly correlable. In the absence of evidence to indicate sulfate reduction in porewaters, we interpret these sulfur peaks to indicate periods of high hydrothermal activiity.

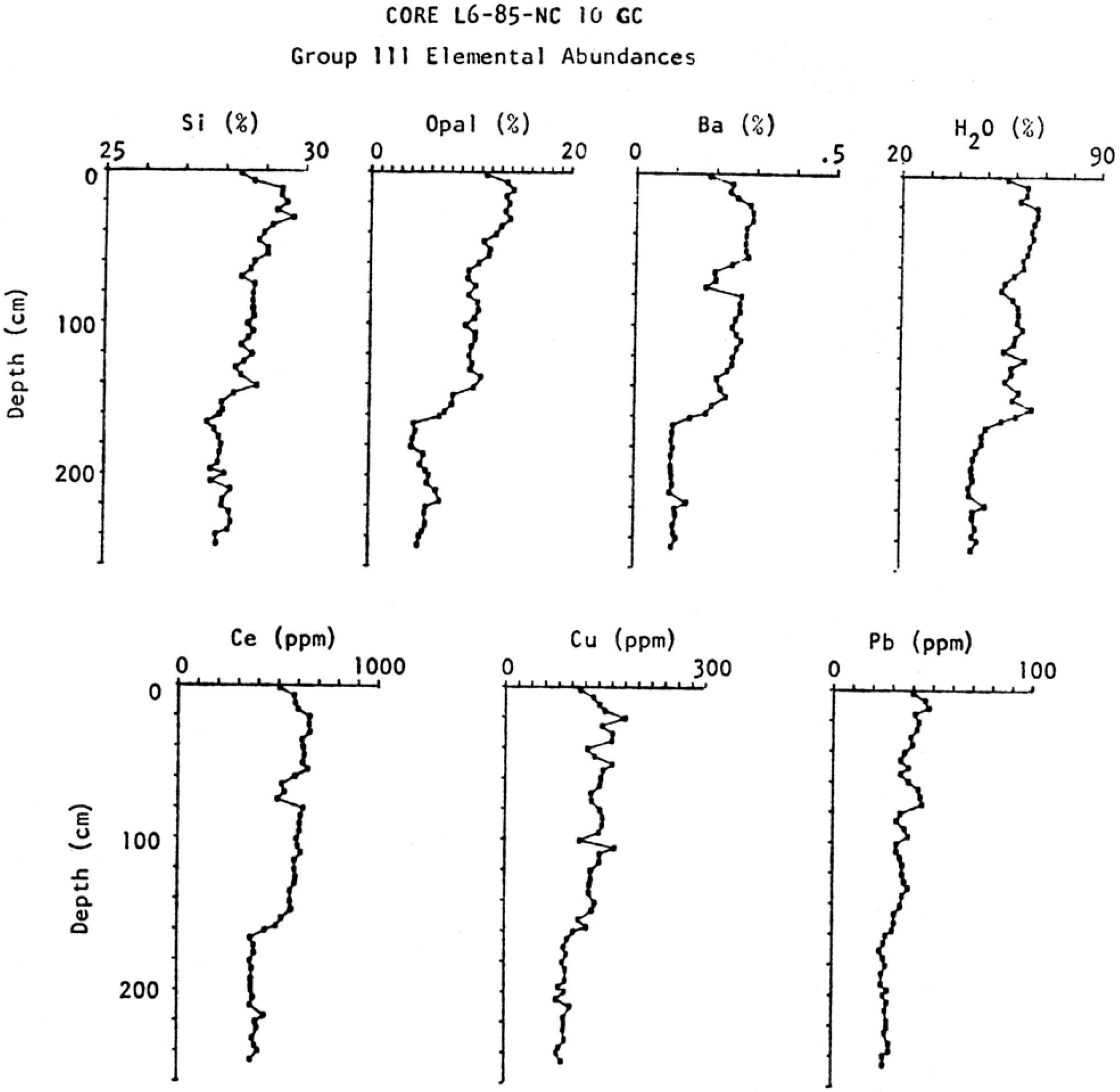
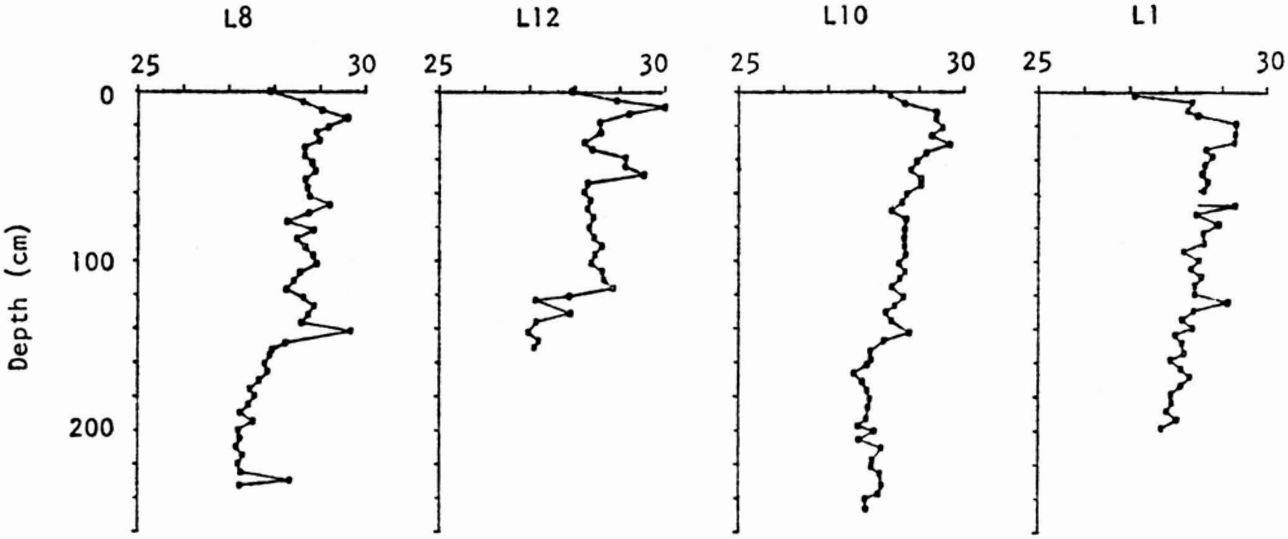
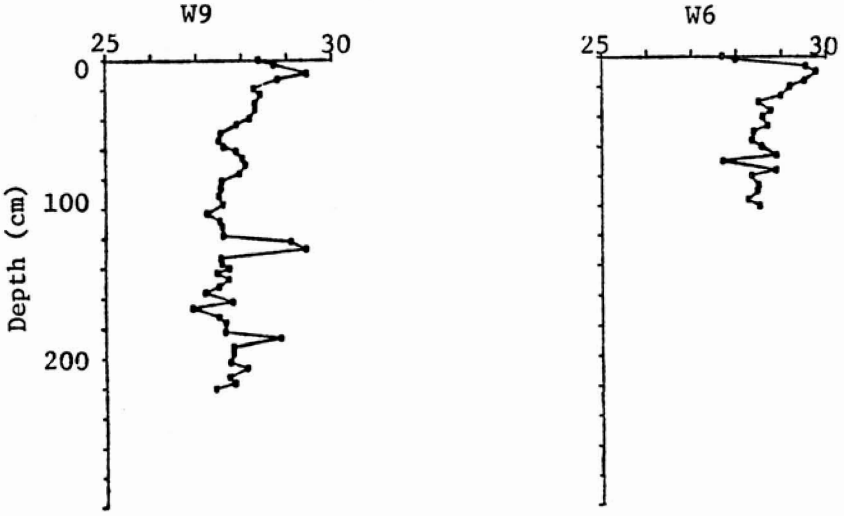


Figure 12. Group III elements in core L10. The elements in this group include Si, Ba, Cu, Pb, and Ce, as well as H2O and opal. This fraction may represent biogenic siliceous debris.



SILICA (%)
Southern Gorda



SILICA (%)
Northern Gorda

Figure 13. Variation of Group III elements in Escanaba Trough and North Gorda Ridge cores, as represented by Si. The Holocene intervals in all the cores apparently are enriched in this Group.

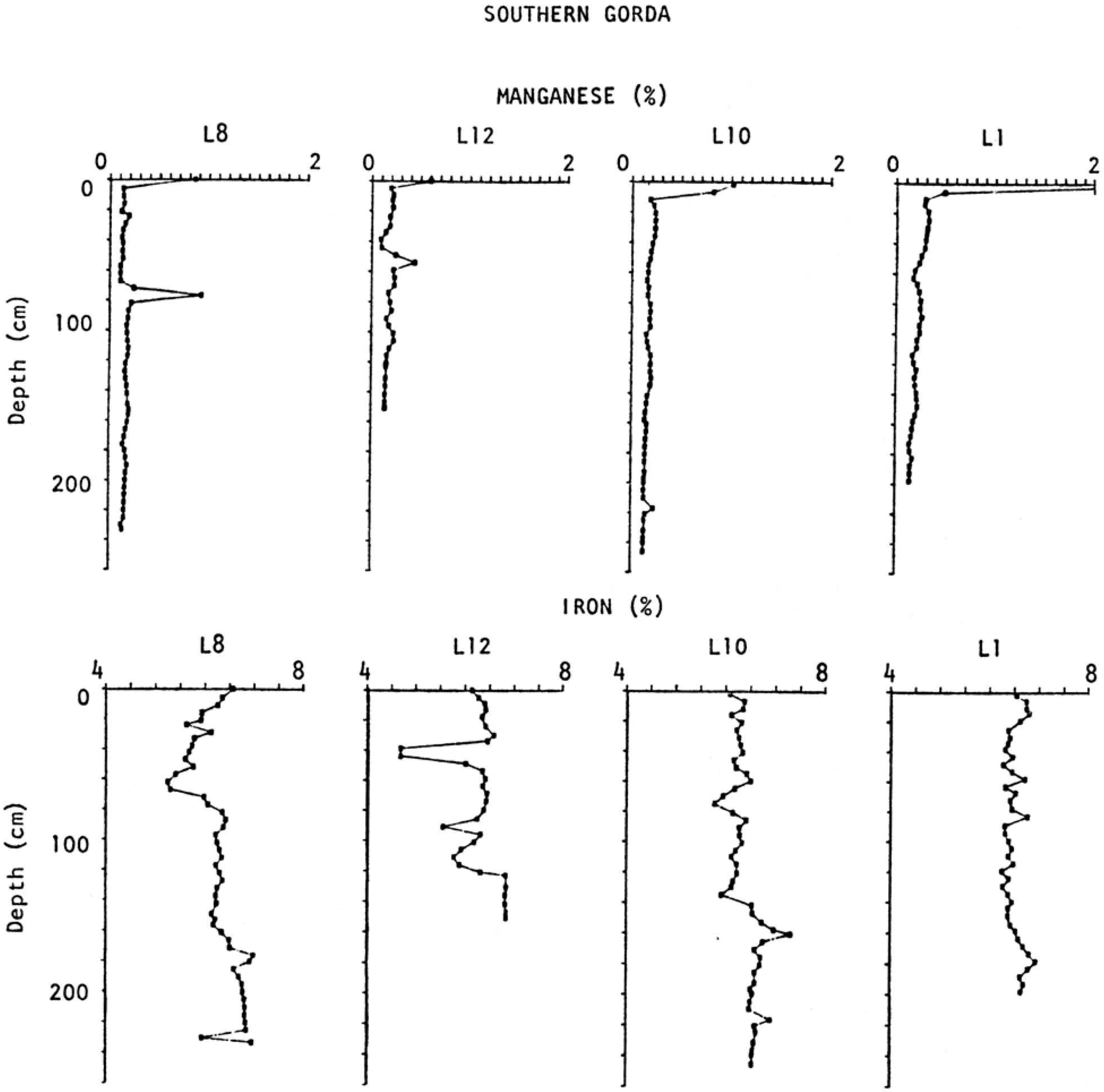


Figure 14a. Fe and Mn contents of Escanaba Trough cores. Normally these elements are diagnostic of hydrothermal events. Sediments of the Gorda Ridge are sufficiently reducing, however, that Mn has been reduced and remobilized to the sediment-water interface. Downcore Mn highs mark surface layers trapped underneath turbidites. Iron contents of the detrital fraction are sufficiently high to preclude interpretation of the downcore variation as a hydrothermal signal.

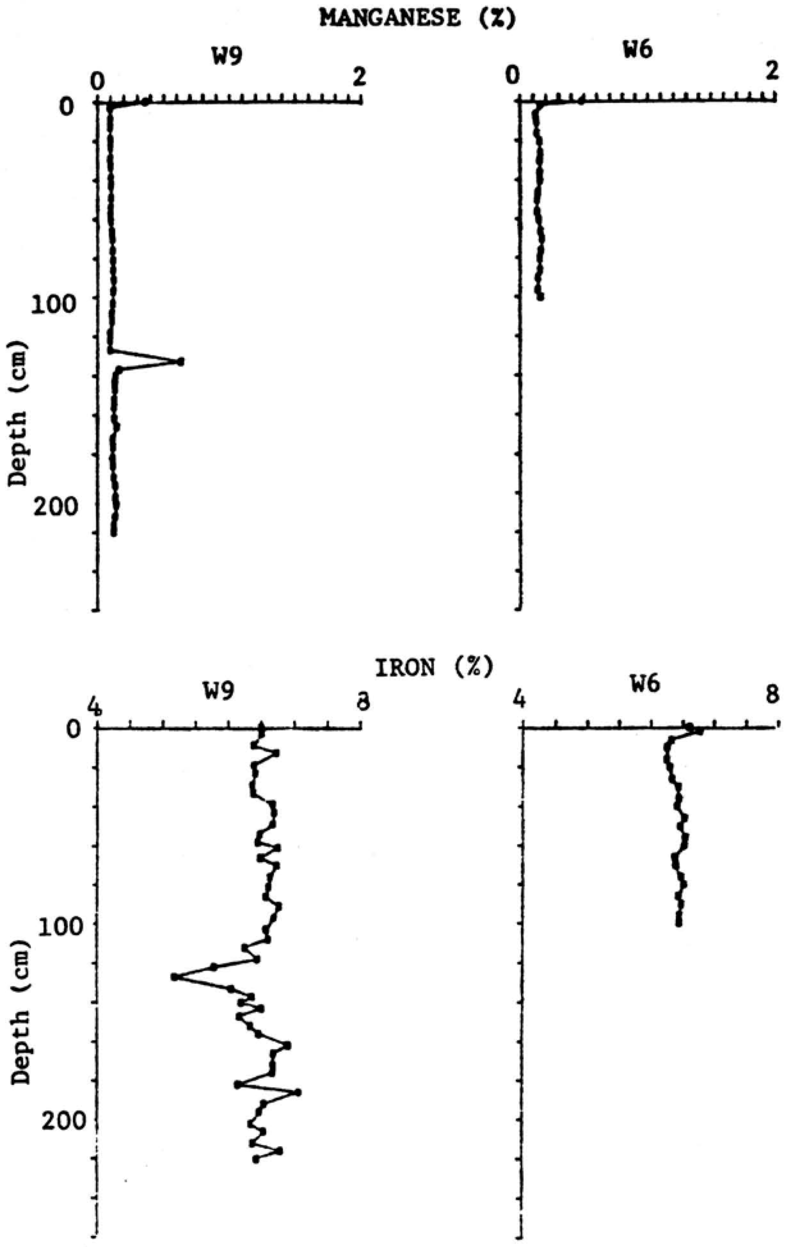
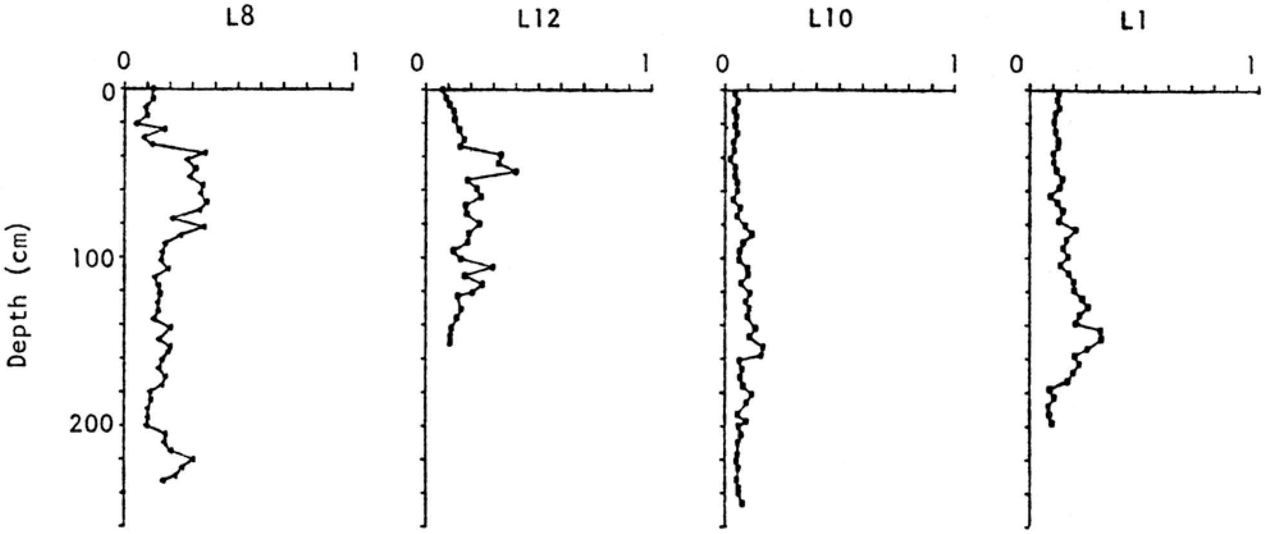


Figure 14b. Fe and Mn contents of North Gorda cores. Normally these elements are diagnostic of hydrothermal events. Sediments of the Gorda Ridge are sufficiently reducing, however, that Mn has been reduced and remobilized to the sediment-water interface. Downcore Mn highs mark surface layers trapped underneath turbidites. Iron contents of the detrital fraction are sufficiently high to preclude interpretation of the downcore variation as a hydrothermal signal.

SULFUR (%)
Southern Gorda



SULFUR (%)
Northern Gorda

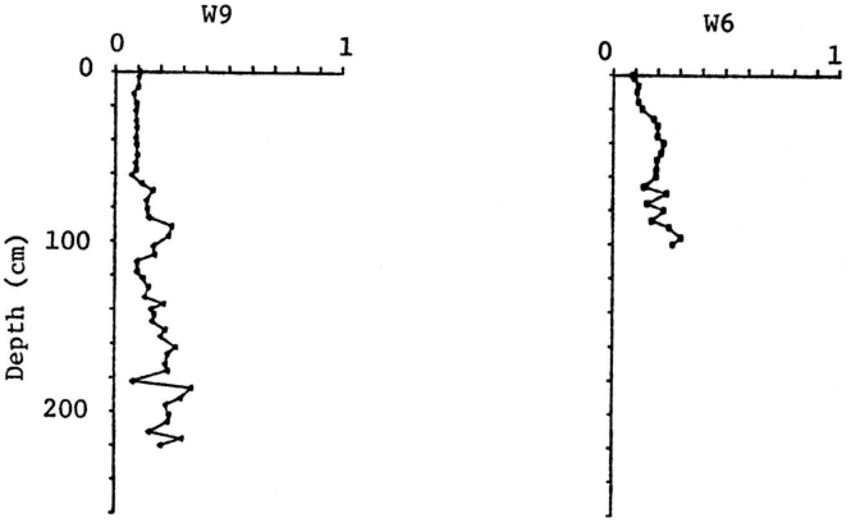


Figure 15. Sulfur contents of Escanaba Trough and North Gorda Ridge cores. Sulfur is elevated in the Escanaba Trough turbidite sections due to their enrichment in sulfides. Sulfur is also enriched downcore probably due to preservation of sulfur from hydrothermal plumes

III.4 NORTHERN GORDA RIDGE

III.4.1 PALEOMAGNETISM

Whole core susceptibilities and NRM intensities for cores W4, W8, and W9 from the Northern Gorda Ridge are shown in Figures 5 and 6. As in the Southern Gorda area, NRM intensities are comparable to values found in the top layers of sediments from the Oregon margin. Similarly, a downcore intensity decrease in these cores is not observed; therefore, redox conditions in the Northern Gorda sediments do not seem to be conducive to diagenetic sulfide formation. Also, susceptibility and NRM trends track each other well in each of the cores, suggesting that the susceptibilities are controlled by the ferrimagnetic fraction.

The NRM intensities and susceptibilities of cores W8 and W9 show similar downcore behavior. Intensities are low in the top 90 cm of W8 and W9, then increase. A large peak is associated with silty layers at 140 cm in W8 and 120 cm in W9, presumably due to turbidite deposition (see Sediment Chemistry). Below these intervals, the magnetic properties show higher values than in the top of the section. Core W4 (0-110 cm) has similar values to the top 120 cm of W8, perhaps implying a somewhat higher sedimentation rate for W4.

III.4.2 SEDIMENT CHEMISTRY

Sediments in the northern Gorda Ridge have similar bulk chemical compositions to cores from the south. The same three groups of elements, two detrital and one biogenic can be observed here as well as in the south (Figures 8 through 13). In the northern cores, however, Ba and Zn are much more strongly associated with what may be termed the biogenic fraction of the sediments. Variations in sulfur content can also be observed in the northern cores, and are strongest in the axial core W6. Unlike the cores to the south, there is no sulfur signal associated with the turbidite in W9. < W9 has much higher calcite at depth than the Escanaba Trough cores, but high calcite values are not observed in W6. We believe that the lack of calcite variation in W6 is due to a much higher sedimentation rate than in W9, as will be discussed in the next section.

IV. DISCUSSION

IV.1 AGES OF THE GORDA RIDGE SEDIMENTS

Cores in both the northern Gorda Ridge and in the Escanaba Trough can be correlated by their magnetic and chemical properties. Correlatable layers in several cores were dated by C-14 for an absolute time scale which can be compared with other stratigraphic methods such as O-18 stratigraphy.

The results of the radiocarbon dating are presented in Table 1 and in Figures 16 through 19. All the cores dated have non-zero age surface sediments, a feature common to C-14 dating of sediments where bioturbation causes mixing of old and new carbon. We have estimated surface ages for each core (Table 1) based upon interpolation of sediment-depth curves (Figures 16-19) to zero depth, assuming the ratio of new/old carbon was constant through time. The surface ages were then subtracted from the raw ages at each depth to determine the actual age of deposition.

In L1 and L8 from the Escanaba Trough, we find relatively constant sedimentation rates outside of the instantaneously deposited turbidite intervals. The anomalously old sediments in L1 (Figure 16) which were identified as a turbidite from their magnetic properties fits well with this interpretation. Turbidites are primarily older sediments which have been reworked and redeposited. In L8 (Figure 17), we have dated the time of deposition of the turbidite by dating the interval immediately underneath. After subtracting the surface age, we obtain an age of 2400 years before present for the event.

Core L12 (Figure 18) has the most complicated age profile, which fits with the complexity of the paleomagnetic signals in the core. The age profile is inverted between 81 and 95 cm. This interval had an extreme amount of scatter in measured inclinations and an anomalously shallow mean inclination. The interval above this section may have behaved as a relatively competent slump block that slid over and deformed the immediately underlying sediments. If this interpretation is correct, the slumping occurred about 1700 years ago. The turbidite at 40-50 cm occurred ~3000 years ago, based upon dating of the immediately underlying interval.

We can extrapolate ages of correlatable horizons in each dated core to determine if the intervals behave as time stratigraphic events (Table 2). Provided the correlation horizons are coeval, they can be used to establish a time framework which can be extended to the undated cores. We have performed this extrapolation on two horizons that were evident in most of the cores in the area: the calcite increase and the underlying lithologic change to homogenous grey clay. The results indicate that the horizons mark time events, with the calcite horizon dating at ~7100 years old and the lithologic change at ~11,000 years ago, i.e., the Pleistocene-Holocene boundary. We have used the age of the lithologic change to obtain average Holocene sedimentation rates (Table 3).

IV.2 EVIDENCE OF VOLCANISM AND HYDROTHERMAL ACTIVITY

In the northern portion of the Escanaba Trough, the axial valley cores L10, L2, and L1 show NRM and susceptibility highs, water content lows, and enrichments in the elements Na, Al, P, K, and Ti at ~60-80 cm depth. While there is no visual evidence of a lithology difference at this depth, water contents and elemental changes are consistent with this layer being a distal turbidite containing an enhanced felsic component. From the depth of the layer relative to the surface, and the levels of the downcore carbonate and lithologic changes, this layer seems to have been deposited at the same time

TABLE 1. RADIOCARBON AGES OF DATED SAMPLES

CORE	DEPTH	RADIOCARBON AGE	ZERO-AGE*	CORRECTED AGE**
L1	0-10	3600	3200	400
	65-75	8410		5210
	115-125	9670		6470
	150-160	12380		9180
	190-200	15570		12370
L8	0-12	4140	3700	440
	70-80	6150		2450
	110-120	8950		5250
	180-190	14430		10730
	224-234	18650		14950
L12	0-10	5360	5000	360
	53-63	7990		2990
	81-95	6720		1720
	120-130	16500		11500
W8	0-10	4530	3500	1030
	40-50	12090		8590
	110-120	17240		13740
	209-219	26500		23000

* Extrapolated radiocarbon age for freshly deposited sediment

** Radiocarbon age with zero age subtracted--the best estimate of actual age of sample

TABLE 2. ESTIMATED AGES FOR EVENTS BASED ON C-14 PROFILES

EVENT	CORE	AGE (years)
CALCITE INCREASE		
	L1	7200
	L8	6500
	W9	7500
		7100 MEAN
LITHOLOGIC CHANGE		
	L1	11000
	L8	10800
	L12	11500
		11100 MEAN
40° 45′N TURBIDITE		
	L8	2400
41° N TURBIDITE		
	L1	3000
	L12	3000

TABLE 3. ESTIMATED SEDIMENTATION RATES FOR GORDA RIDGE CORES

CORE	SEDIMENTATION RATE (CM/1000YR.)	
	WITH TURBIDITIES	WITHOUT TURBIDITIES
L1	16.0	15.1
L2	16.5	15.2
L5	13.4	---
L7	18.9	>9.
L8	17.7	13.0
L10	15.3	---
L12	11.3	10.
W6	15.0	
W9	5.6	

* MEAN SEDIMENTATION RATE OVER HOLOCENE INTERVAL (0-10,000 YRS B.P.)

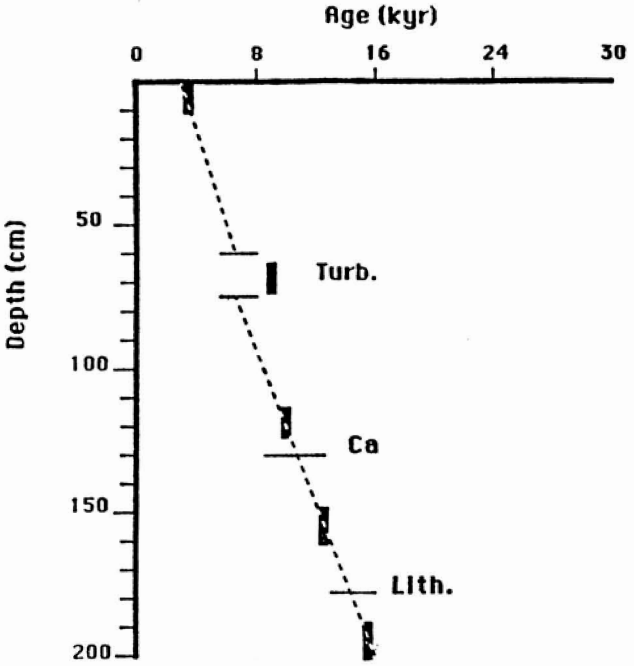


Figure 16. Age-depth profile of gravity core L1 based upon radiocarbon dating. Turb marks the depth of a distal turbidite located by magnetics. Note the anomalous age of the sample in this interval. Ca marks the level of calcite increase in the core and Lith marks a prominent lithologic boundary.

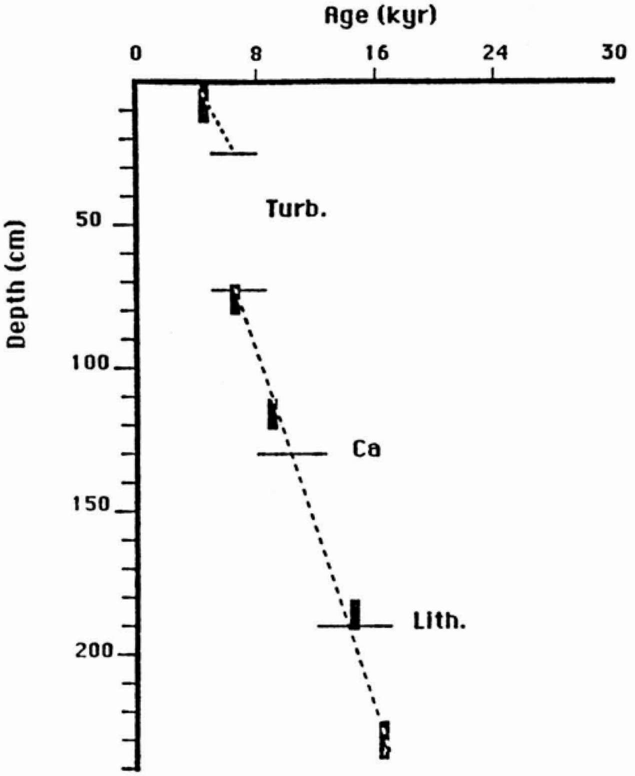


Figure 17. Age-depth profile of gravity core L8. Turb marks the major turbidite interval noted in the core descriptions. Ca and Lith mark the same boundaries as in core L1

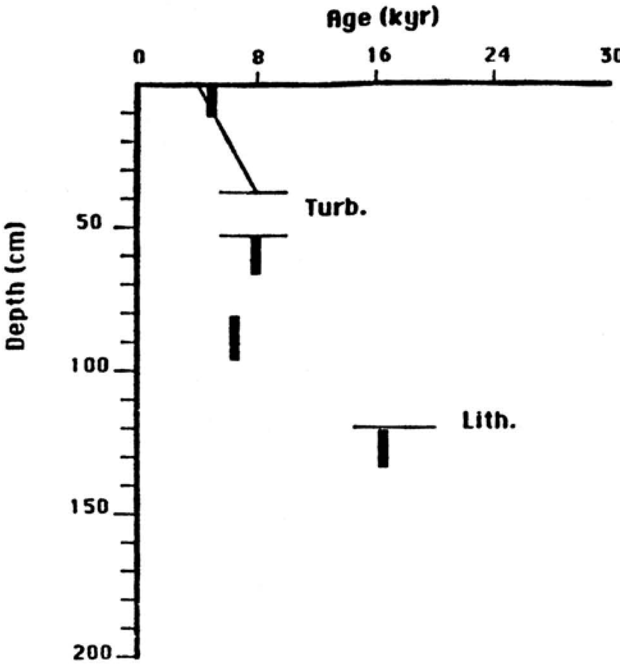


Figure 18. Age-depth plot of radiocarbon data for gravity core L12. Turb marks a prominent turbidite from 38-53 cm in the core, while Lith marks the lithologic boundary seen in all Escanaba Trough cores. Note the age inversion at 81-95 cm in a section with contorted bedding and anomalous magnetic inclinations. This unit has apparently been distorted by a slump deposit sliding over it.

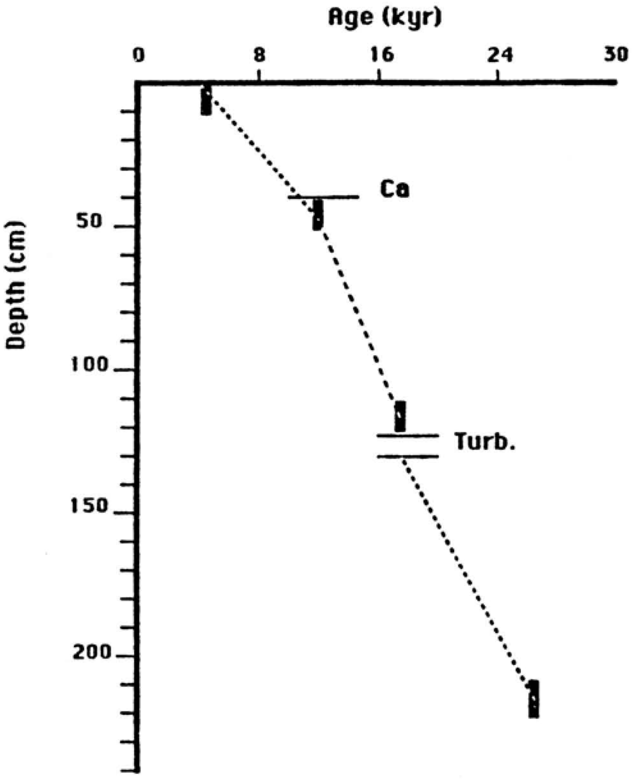


Figure 19. Age-depth plot of radiocarbon data for core W9 on the northern Gorda Ridge. Note the slower overall sedimentation rate. Ca marks the calcite increase noted also in the Escanaba Trough cores and Turb marks a prominent turbidite.

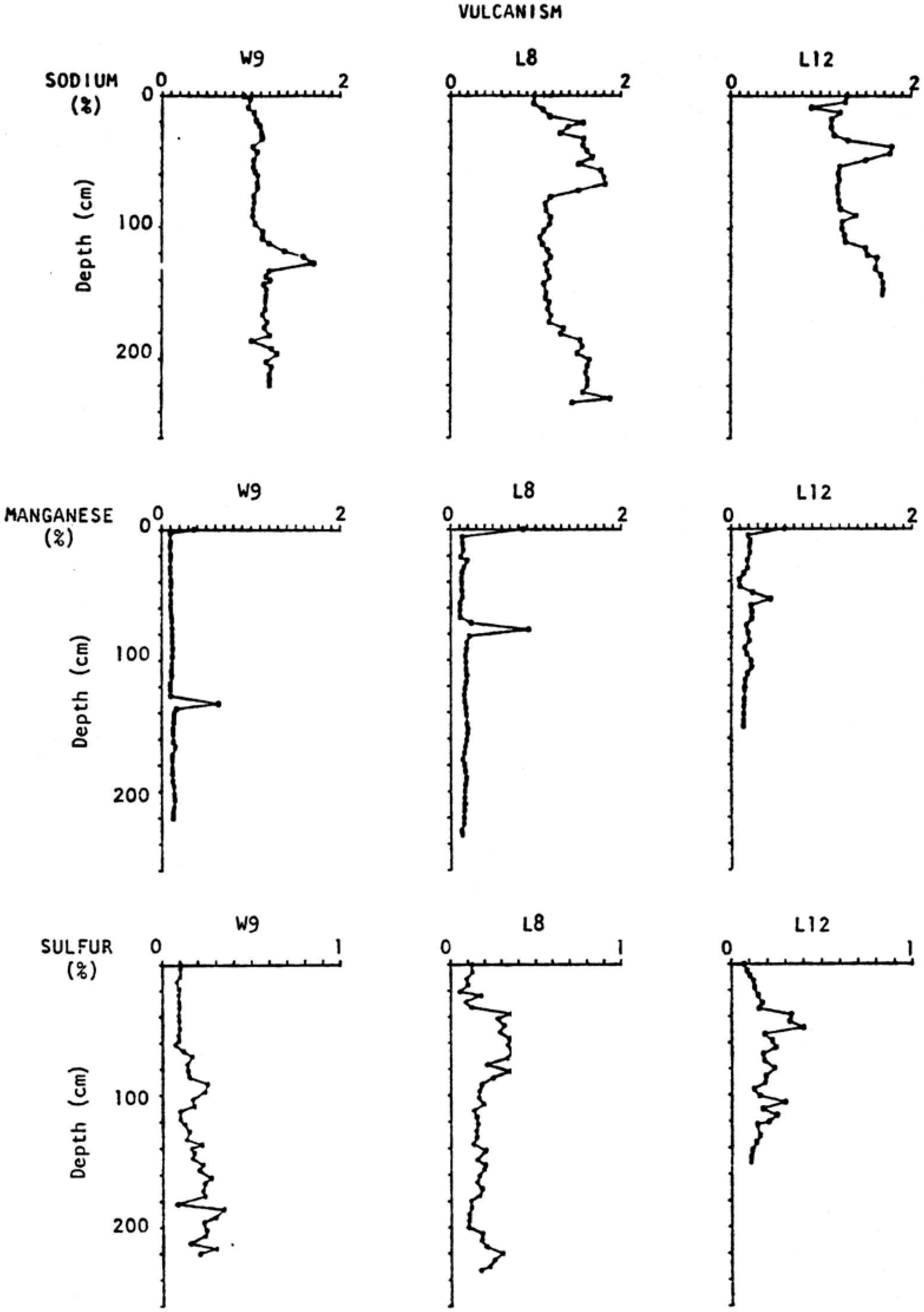


Figure 20. A comparison of two turbidite sections in L8 and L12 from the Escanaba Trough to W9 from the North Gorda Ridge. All three turbidite sections are from local flows, but only L8 and L12 turbidites are related to volcanic centers. The three cores show the characteristic enrichment of felsic elements in the turbidite sections and all have trapped a surface Mn-rich layer underneath them. Only the turbidites associated with the volcanic centers are enriched in sulfides, however.

in each of the cores, and in fact has the same radiocarbon 3000 yr age in cores L12 and L1. Since the feature was isolated to the Northern Escanaba Trough, it seems reasonable to ascribe a local source for the turbidite.

Core L12, located next to he 41° N dome, possesses several interesting features. At 40-50 cm, the glassy, sulfidic silt zone has low water contents, an enriched felsic component, and low inclinations which are consistent with deposition as a proximal turbidite, presumably shed from the 41° N dome. On visual examination, the sulfides occur both as discrete silt -sized particles and as inclusions in volcanic glass. The hexagonal shape of some of the sulfide grains is suggestive of high temperature pyrrhotite (Kissin and Scott, 1982). These features imply that the sulfides probably are derived from a high temperature hydrothermal source.

The interval from 85-115 cm in L12 contains contorted bedding, disturbed inclinations, sulfide peaks, and a lack of carbonate relative to L1, L2, and L10. We interpret this interval as a slump deposit related to the nearby volcanic edifice. The loss of carbonate and the foreshortening of the core features relative to the other cores suggests some erosion associated with this event. The base of this section is underlain by a sharp angular unconformity with the underlying homogenous clay having shallow inclinations by about 30 degrees from the expected field. Lacking good time control and definitive intercore inclination correlations, we hesitate to ascribe too much significance to this anomaly presently, but, if verified, L12 would contain a record of tilting associated with the volcanic intrusion and may allow us to date the sequence of events.

Core L8, located next to the 40° 45′ N dome, also contains evidence of a volcanic shedding event in the upper part of the core. This feature may represent a large mass slump or series of mass wasting events in rapid succession, because of the irregular laminations and bedding, the thick zone of disturbance, and anomalously shallow inclinations. The chemical characteristics of this event(s) area similar to those observed in the 40-50 cm interval of L12. However, based on the carbonate stratigraphy, the timing of this event (at ~2400 yrs BP) does not seem to coincide with the event recorded in L12. Moreover, core L5, located midway between the two edifices, shows no corresponding anomaly in either magnetics or lithology. Thus, this event may have been localized to the 40° 45′N dome, and younger than the event on the 41° N dome.

We suggest that these Holocene turbidites or mass-flow deposits in the Escanaba Trough mark periods of eruption and hydrothermal activity at the different volcanic centers in the axial valley. The reasons we make this interpretation are first, flow deposits from different parts of the valley are locally confined. No single valley-wide event has been found, as would be expected with a major turbidity event from the walls of the Escanaba Trough or with one entering from the outside. Second, in the one flow deposit we believe we can correlate between 4 cores (L12, L10, L2, and L1), the size and coarseness of the deposit decreases away from the 41° N volcanic center as would be expected if it had originated there. Finally, flow deposits found proximally to the 40° 45′ N center and the 41° N center (cores L8 and L12) are enriched in sulfides (possibly, high temperature pyrrhotite) and volcanic glass. The obvious source of the glass and sulfides is the volcanic center, most probably during the eruptive phase of volcanism.

The enrichment of the coarse-grained sulfides and glass could conceivably be caused by hydraulic sorting during turbidite transport of old axial valley sediments not associated with a given volcanic event. However, there are several reasons why we feel that this interpretation less than satisfactory. Pyrohotite and other high temperature sulfides are unstable and rapidly invert to pyrite or oxidize, depending on geochemical conditions in the sediment. These minerals are uncommon in marine sediments, and were not observed elsewhere, either downcore or in other cores in the area. Furthermore, we can compare the turbidite in W9 on the North Gorda Ridge to those in the Escanaba Trough, since it is of similar size and its origin is local to the northern axial valley, though it is not near a volcanic center. As Figure 20 shows, the turbidity flow in W9 also concentrates the felsic (Group I) detrital components as do the Escanaba Trough flows in L8 and L12, but it does not contain elevated contents of sulfur. Smear slides of the W9 turbidite also showed <10% volcanic glass, as compared to 25-35% glass in the Escanaba Trough turbidites. Thus, the simplest explanation for the sulfide and glass enrichments is that the source is a locally-derived volcanic with associated high temperature activity.

If the tuffaceous turbidity flows and other mass wasting events indeed mark eruption events, longer sediment records obtained during future cruises should allow us to estimate the periodicity of volcanic eruptions within the Escanaba Trough. This information is critical for estimating the extent of possible polymetallic sulfide reserves in the axial valley.

IV.3 PLUME-RELATED DEPOSITION OF HYDROTHERMAL MATERIAL

As discussed in the chemistry section, hydrothermal plumes may leave their mark as downcore variations in sulfur, if not obscured by early diagenetic reactions (Figure 15). If this interpretation is correct, sulfur profiles should record when high hydrothermal activity has occurred in the Escanaba Trough.

The southern and northern parts of the Escanaba Trough, around the 40^{o} 45'N and 41^{o} N volcanic edificea, respectively, have different records of plume activity as well as different tuffaceous turbidite records. As measured in core L8, there is a sulfur peak at 220 cm or roughly 15,000 years ago by radiocarbon dating. In addition, sulfur contents of the sediments are high immediately under the turbidite section and peak at 82 cm. These sulfur increases may imply that hydrothermal activity at the 40^{o} 45' N edifice increased immediately prior to a major phase of local volcanic activity. Such an increase would be expected if surface volcanic activity were preceded by intrusion of hot rock at depth. Based upon our correlations, the age of the increase in hydrothermal activity occurred at about 3000 years ago, or about 600 years before the turbidite event.

There is a peak in sulfur content in the northern Escanaba Trough cores (L1, L10, and L12) immediately above the lithologic change. Part of the peakiness may be due to differing background sulfur contents in the two sedimentary units or to variations in sedimentation rates. In this case, low sulfur values below the lithologic change would occur because of dilution with material having low sulfur. However, this hypothesis does not explain why the sulfur contents systematically decrease upcore after the initial peak. If further work substantiates that the peak is in fact due to an increase in sulfur deposition and not due a dilution or diagenetic effect, the data would suggest that a period of hydrothermal activity occurred at 41° N about 10500 years ago.

V. DIRECTIONS OF FUTURE WORK

Several avenues of future work are suggested by the 1985 studies we have completed. First and most important is to obtain more and longer cores from the Escanaba Trough. We do not yet have sufficient core coverage to determine whether other Escanaba Trough volcanic centers have been recently active, nor do we have long enough records to determine the periodicity of volcanic activity at any of the domes.

Studies of the sulfides and glass in the turbidites should also prove fruitful, to determine whether different types of hydrothermal activity can be discerned and to determine the evolution of volcanism at the ridge crest. In addition, it is at present unclear what minerals in the turbidite sections give rise to the large magnetic intensities of the intervals. More work is needed to identify whether the signal arises from oxides or sulfides.

VI. CONCLUSIONS

Our preliminary study of sediments in the Escanaba Trough has shown that there has been both volcanism and hydrothermal activity in the last 10,000 years at two volcanic edifices; at 40° 45′ N about 2400 years ago, and at 41° N about 3000 years ago. In addition to these late Holocene events, there may have been another period of low temperature hydrothermal activity roughly 18,000 years ago at 41° N. At the edifice at 41° N, where we have adequate core coverage for comparison, the observed events can be readily correlated by both rock/paleomagnetism and chemical analyses. We do not have sufficient cores, however, to determine whether any of the three other volcanic edifices are recently active. We point out, however, that a turbidite observed in L11, near the 40° 55′ N edifice, may indicate recent activity there. More coring is necessary to determine the extent and duration of hydrothermal activity and, hence, sulfide deposition, at the other domes throughout the valley.

VII. ACKNOWLEDGEMENTS

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IX. APPENDICES

IX.1 CORE LOCATIONS AND RECOVERY

CORE Name	LATITUDE Degrees N	LONGITUDE Degrees W	CORELENGTH CM.
NORTH GORDA			
W8508AA 4 GC	42° 56.55′	126° 32.06′	119
W8508AA 5 GC	42° 56.47′	126° 31.99′	155
W8508AA 6 GC	42° 57.33′	126° 34.18′	107
W8508AA 8 GC	43° 01.43′	126° 36.47′	184
W8508AA 9 GC	43° 01.80′	126° 34.73′	227
ESCANABA TROUGH			
L6-85-NC 1 GC	41° 07.21′	127° 30.18′	200
L6-85-NC 2 GC	41° 01.73′	127° 26.29′	238
L6-85-NC 3 GC	41° 01.66′	127° 18.47′	240
L6-85-NC 4 GC	41° 01.25′	127° 41.13′	3
L6-85-NC 5 GC	40° 51.04′	127° 30.31′	229
L6-85-NC 6 GC	41° 00.52′	127° 39.24′	259
L6-85-NC 7 GC	40° 31.50′	127° 42.33′	241
L6-85-NC 8 GC	40° 44.52′	127° 31.29′	234
L6-85-NC 9 GC	40° 44.47′	127° 41.11′	211
L6-85-NC 10 GC	41° 00.55′	127° 27.05′	249
L6-85-NC 11 KC	40° 53.50′	127° 29.00′	31
L6-85-NC 12 GC	41° 00.44′	127° 29.86′	154

CORE LOG

Core No. W8508AA-4 GC

Sheet 1 of 1

X- Present
C- Common
A- Abundant
R- Rare

	Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
			sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	SILICO FLAGELLATES	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
																							Section I 10-113 cm Top 10 cm went to Carey for faunal analysis.
		10 cm				R	R-C		C	A	C	A					X						10-113 cm 5GY 5/2 greenish gray clay, becoming slightly silty at base. Open holes (worm tubes?) about 1-2 mm in diameter entire length of core, but more abundant from 10-25 cm, non-calcaleous throughout. ss:10, 60, 110 cm
		60 cm				R	R-C		C	C	C	C											
		110cm				R	R-C		C	C-A	R	R				X	X						

CORE LOG

Core No. W8508AA-5 GC

Sheet 1 of 1

X- Present C- Common
A- Abundant R- Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure				
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	Silico flagellates	Wood fibers	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen
	0															X					X
	10 cm				R	R		C	A	C	C	C									
												Tooth Pick ?									
	60 cm				R	R C		R	C	R	C	C									
	110 cm				R	R C		R	C	R	R	C									
	150				R C	R C		R C	R C	R	R	C			X	X					X

Remarks

Section I 0-154 cm

0-1 cm
10yr 3/2 very dark grayish brown clay, non-calcareous. Transition sharp.

1-154 cm
5GY 5/2 greenish gray clay throughout becoming slightly more silty at base. Open holes (worm tubes?) common to 85 cm, possibly deeper, most commonly 1-2 mm, but some 3-4 mm wide. Homogeneous. At 144-145 cm a faint gray layer of 5y 4/1.
145-154 cm blebs of silty material in clay matrix, non-calcaleous except at base, slightly calcareous.

ss: 10, 60, 110 150 cm

CORE LOG

Core No. W8508AA-6 GC

Sheet 1 of 1

X– Present C– Common

A– Abundant R– Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure				
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	Silico flagellates	Wood fibers / plant	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen
0					—	—		R - C	C	R	R - C	C Tooth pick?			X	X					X
50 cm					—	R		R	C	R	R	C									
100 cm					R	R		R	C	R	R	C			X	X					

Remarks

Section I 0-103 cm

0.0-0.5 cm
10yr 3/2 very dark grayish brown clay, homogeneous, transition gradational.

0.5-5 cm
5y 4/2 olive gray clay, slightly silty, gradational transition.

5-103 cm
5GY 4/2 greenish gray slightly silty clay, becoming slightly darker and more silty at base. Subhorizontal worm burrow at 41-42 cm. Open worm holes approximately 3-5 mm diameter at 51, 53, 59, 66, 72 cm. Unit mottled with small black blobs below about 40 cm.

smear slides: 0, 50, 100 cm

CORE LOG

Core No. W8508AA-8 GC

Sheet 1 of 2

X- Present C- Common
A- Abundant R- Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure				
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	SILICO FLAGELLATES	PLANT FRAGMENTS	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen
0																					
10 cm					–	R		R	C	R	R	C									
												TOOTH PICK ?			X	X				X	
95 cm					C	C		R	R	R	–	C			X	X				X	

Remarks

Section II 10-99 cm

Top 10 cm to D. Carey to do benthic organism sampling.

10-99 cm
5y 4/1 dark gray silty clay, mottled throughout. Slightly more yellowish section 32-67 cm. Large open worm tubes about 5 mm at 39, 63, and 73 cm. Prominent black mottle at 66 cm. Disburbed soupy section at 82-86 cm.

ss: 10, 95 cm.

CORE LOG

Core No. W8508AA-8 GC

Sheet 2 of 2

X– Present
C – Common
A – Abundant
R – Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure				
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	Silico flagellates	Plant-Wood Fibers	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen
99 cm															X	X				X	
115 cm					C-A	C		-	R	-	-	C									
145 cm					—	—		—	—	—	—	—									
180 cm					C-A	C		R-C	R-C	R	–	R			X	X				X	

Remarks

Section I 99-183 cm

99-122 cm
5y 4/2 olive gray silty clay, faintly banded 99-110 cm. Bottom contact transitional.

122-146 cm
5y 5/2 olive gray silty clay banded interval, 144-146 cm Laminated black and gray. Bottom contact sharp, more silty, possible turbidite. Two open worm holes at 124 cm.

146-183 cm
5y 4/2 olive gray silty clay, faintly mottled throughout.

ss: 115, 145, 180 cm

145 cm: large terrigenous silt grains, non-fossiliferous.

CORE LOG

Core No. W8508A GC9

Sheet 1 of 1

X- Present
C- Commo.
A- Abundant
R- Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
																						Styrofoam cap 7 cm wide on top of core liner removed
																						no at base of cap
0 2	10YR 4/2																			X		dark greyish brown non-calcareous mottled clay
	5Y 4/2		X																	X		olive grey non-calcareous clay
4																						
	5Y 4/1		X																	X		dark grey mottled clay non-calcareous to 37cm, then becomes calcareous
72 80																						From 72-78 cm very disturbed soup sediment forming gap (sh mp surface?)
																						Fine black lammations (horiz) in slightly lighter colored clay from 123-130
143																						silt band 1/2-1cm wide at 162, 166, 173, 177, 186, 187
220																						
																						Smear slides at: 0, 36, 40, 90, 124, 136

CORE LOG

Core No. L6-85-NC GC1

Sheet 1 of 1

X – Present C – Commor

A – Abundant R – Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
0	5YR 3/2				R	X		R	X						X	A				X		Dark reddish-brown, slightly silty, non-calcareous clay; mottled with dark brown (7.54R 3/2) In smear slides, red brown aggregates; forams poorly preserved
5			X																			
					R	C			X						X	A						transition zone
10			X																			
10	5Y 4/2				R	C			X						X	A				X		olive-grey, calcareous, very slightly silty clay; irregularly mottled with darker colored clay; fossils poorly preserved
177.5																						
177.5	5Y 4/1			X		X										A					X	Dark grey calcareous plastic homogeneous clay. Slightly darker irregular silt layers 0.5 cm thick at 178.5, 180.5, 184.0, 186.0, 190.0 cm
200																						

CORE LOG

Core No. L6-85-NC GC2

Sheet 1 of 1

X – Present C – Common
A – Abundant R – Rare

			Contact			Biogenous mat.								Grain size				Structure					
	Interval (cm)	Color	sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silico flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	Remarks
SEC II	0 1.5					X	X			C	X	R				X	X						Soupy brown sediment mostly drained out. Red brown aggregates common.
	6.0	7.5YR 3/2			X											X	X						Dark brown non-calcareous silty clay. Red brown aggregates common.
	8.5	10YR 3/2			X	X	C			A	X	R				X	X				X		Transition zone of mottled very dark greyish brown *(5Y4/1) Dark grey silty clay
	150	5Y4/2				X	C		X	A	X	X				X	X				X		Mottled dark grey silty non-calcareous clay with streaks and mottles of darker colored clay. Black streaking common especially at 82-94 cm
SEC I	184				X																		
	238.5	5Y4/1				X	C			R							A					X	Homogenous dark grey slightly calcareous clay with thin (.5-1 cm wide) irregular beds or irregular mottles at 188, 190, 191-194, 199, 205, 213, and a 2cm irregular bed at 218-220.
																							Smear slides at: 0,4,7,10, 20 30, 40, 150 Smear slides at 180, 186, 218.5, 238.0

CORE LOG

Core No. L6-85-NC 3GC

Sheet 1 of 1

X – Present C – Commor
A – Abundant R – Rare

			Contact			Biogenous mat.								Grain size				Structure					
	Interval (cm)	Color	sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silico flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	Remarks
SECTION II	0 17	5Y4/2				X	A		X	C		X				X	A						Highly disturbed olive grey slightly silty non-calcareous clay (possibly double cored)
	17 19.5	5Y4/3	X			X	A		X	C	X	X				R	A						contact disturbed Olive non-calcareous slightly silty clay (probably top of core)
	19.5 128	5Y4/2				X	A		R	C	X	X					A					X	Olive grey non-calcareous homogenous slightly silty clay with numerous small black streaks. The sediment grows more calcareous towards the bare silty zones at 116-121cm. Disturbed homogenous dark grey lense (5Y4/1) 120-125cm. (appears to be angular unconformity) *when core was opened the section above 34cm rotated slightly.
	128 134				X																		128-134 mottled contact
	134 150	5Y4/1				X	A			C	X	X				R	A						Dark grey calcareous homogenous very slightly silty clay with numerous black streaks
SECTION I	240	5Y4/1				X	A			C	X					R	A						Lighter indistinct bands at 168, 213, 219cm. Prominent black streak at 217.5cm
																							Smear slides at: 0, 10, 50, 90, 143, 236

CORE LOG

Core No. L6-85-NC GC5

Sheet 1 of 1

X- Present C- Commor

A- Abundant R- Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
0 3	5Y3/2		X		R	X		X	C	X	X				C	A					X	Soupy dark reddish brown non-calcareous silty clay. Red brown aggregates common.
3 6	5Y4/2		X			X		X	C	X	X				X	A				X		Olive grey non-calcareous silty clay transition zone
11	5Y4/2	X													C	A						Olive grey disturbed, wet silty clay non-calcareous
11 16	5Y4/2														X	A						Broken contact at 11 & 16-17 Very disturbed olive grey non-calcareous clayey silt
17 26	5Y4/1.5	X				X		X	C	X	X				X	A						Dark grey non-calcareous slightly silty clay with prominent rust colored 1cm band at 21-22 cm (horizontal banding)
28 32		X	X			X																Contact at 26-28 cm is irregular angular unconformit with 1cm rust color band overlying a minor color transition from 29-32 cm (10 yr 2/2 very dark brown to 5Y4/1 dark grey)
32 150	5Y4/1.5				X	C	X	X	C	X	X				R	A						Dark grey clay, slightly silty toward the top, growing clayey toward the base. Non-calcareous to ∿ 100cm becoming slightly calcareous at base. Prominent very dark brown band at 43-44 cm.
172 175	5Y4/1				C	A										A						172-175 mottled transition with a silt layer at 175 cm
175 230	5Y4/1				X	X										A						Homogenous dark grey slightly calcareous to calcareous clay with silty bands at 181, 184c Smear slides at: 0, 4.5, 21, 24, 28.5, 37, 43,50,120,145c Smear slides at: 168,130,229

CORE LOG

L6-85-NC
Core No. GC6
Sheet 1 of 1

X – Present C – Commo
A – Abundant R – Rare

Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
		sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
0 2																						Drained
2 5	5Y 4/2				C	C		X	C	X					X	A				X	X	Olive grey mottled calcareous silty clay with forams
5 36.5	5Y 4/1			X	C	A		R		X						A						Mottled dark grey calcareous silty clay. Angular 1cm wide rusty colored bands at 25 cm & 27-29 cm
36.5 150	5Y 4.5/1				C	A										A						Dark grey mottles in homogenous grey and calcareous slightly silty clay. Irregular slightly darker zone of heavy mottling from 62-84cm. Less silt than above. Occasional dark streaks, especially at 110-116 cm. Lighter homogenous mottle at 131-134 cm. Calcareous throughout.
257																						Smear slides at: 5, 19, 52, 64, 120, 255

CORE LOG

Core No. L6-85-NC GC7

Sheet 1 of 1

X- Present C- Common
A- Abundant R-Rare

			Contact			Biogenous mat.								Grain size				Structure					
	Interval (cm)	Color	sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	Remarks
SEC II	0 2	10YR 3/2		X												X	C					X	Soupy, very dark greyish brown non-calcareous silty clay. Some drained off.
	2 8.5-10 8.5	5Y 5/2		X												X	C				X		Faintly mottled olive grey non-calcareous silty clay grading into silty sand at base
	8.5 10																						angular gradational contact
	10	5Y 3/2													C	C	X		X				Dark olive grey sand and silt sand slightly calcareous. Numerous black sand fragments (turbidite)
	12 17		X																				Angular disturbed contact
	17 20	·Y 3.5/1													X	C	X						Dark grey calcareous clayey silt + sand Slightly darker than below
	20 150 188	5Y 4/1	X		X											X	C	X			X		Mottled dark grey calcareous silty clay. Worm holes and black streaks common. 0.3-1cm darker silty beds at 24, 37, 53, 71, 104, 115, 133, 135 cm. Grey (5Y5/1) calc mottled clay sections at 94-104, 110-134 c Num. black streaks at 166-174.
SEC I	188	5Y4/1			X											X	C						Mottled dark grey silty clay. Very subtle darker color than above. More clayey and less calcareous with depth. Prominent H mottle 198-206. Several narrow bands black streaks at 215-221 cm.
	232 240	5Y4/1	X																				Faintly mottled calcareous clay, slightly lighter than above.
																							BEDS TILTED 8° TO RT.

CORE LOG

L6-85-NC

Core No. GC8

Sheet 1 of 1

X– Present C – Common

A – Abundant R – Rare

	Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
			sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
SEC II	0 4	7.5YR 3/2				R	X		X	X	X	X				X	X						Dark brown non-calcareous silty clay section collapsed so spacer put in
	4 6	10YR 3/3 to 5Y4/1		X		R	X		X	X	X	X				X	X						Transition zone of very dark greyish brown (10YR 3/3) to dark grey silty non-calcareous clay
	6 31	5Y 4/1.5		X		R			X	X	X					X	X				X		Faintly mottled dark grey silty non-calcareous clay with streaks and mottles of darker colored clay. Prominent very dark grey irregular band 2 cm wide at 20-22 cm (5Y3/1)
	31 74	5Y3/1	X	X			few fossils									X	X	X			X		Gradational contact to very dark grey non-calcareous silty clay which is siltier than above. Numerous bands, mottles and horizontal parallel lamination throughout, but especially from 67-74. At 69-70 prominent very dark silty band 1 1/2 cm wide. Sulfides?
	74 150	5Y4/1				R	X		X	A	X	X				X	X				X		Same unit as 6-31 cm above
SEC I	177 196				X																X		Mottled transition zone contact
	196 234	5Y4/1				R	X		few fossils								X					X	Homogenous dark grey plastic slightly calcareous to calcareous clay. Occasional mottles and dark streaks.

Smear slides at: 7, 22, 29, 32, 47, 60, 69, 77, 140, 174, 194, 233

CORE LOG

L6-85-NC
Core No. GC9
Sheet 1 of 1

X – Present C – Commo
A – Abundant R – Rare

	Interval (cm)	Color	Contact			Biogenous mat.								Grain size				Structure					Remarks
			sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	
SEC II	0 3	2.5Y 4/2														X	X				X	X	Dark greyish brown calcareou silty clay grades into
	11	2.5Y 5/2		X												X	X				X		mottled greyish brown calcareous silty clay
	11	5Y 4/1														X	X				X		Mottled dark grey calcareous silty clay. Less silty with depth. Worm holes and black streaking common. Below 100-120 cm, becomes less calcareous. Black streaks common.
SEC I	150																						150-165 only very slightly calcareous
	165- 168				X																		angular unconformity
		5Y 5/1															X				X		grey very calcareous mottled clay
	177 187		X		X												X						steep mottled angular unconformity
	211	5Y 4/1															X				X		mottled slightly calcareous dark grey slightly silty clay black streaks

CORE LOG

L6-85-NC

Core No. GC10

Sheet 1 of 1

X- Present C - Commo
A - Abundant R - Rare

			Contact			Biogenous mat.								Grain size				Structure					
	Interval (cm)	Color	sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silica flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	Remarks
SEC II	0 1																						Soupy brown sediment Mostly drained out
	1 3	7.5YR 3/2			X											X	X				X		Dark brown non-calcareous silty clay
	3 7	10YR 3/2		X X																			Transition zone of mottled very dark grey brown + dark grey brown + 5Y 4/1 dark grey silty non-calcareous clay
	7 150	5Y 4/1														X	X				X		Mottled dark grey non-calcareous silty clay with streaks and mottles of darker colored siltier clay, 1 cm band at 80 cm
SEC I	164 170				X																		Mottled contact from 164-170
	170 249	5Y 4/1															X					X	Homogenous dark grey slightly calcareous to calcareous plastic clay Occasional faint dark mottles prominent 1-2cm irregular Slightly darker bands at 90-92, 87-90 Smear slides at: 0, 6, 10, 50, 80 (band), 150 Smear slides at: 160, 167, 191, 210, 240 cm

CORE LOG

L6-85-NC
Core No. GC12
Sheet 1 of 1

X – Present C – Commc
A – Abundant R – Rare

			Contact			Biogenous mat.								Grain size				Structure					
	Interval (cm)	Color	sharp	grad	mottled	foram	calc nanno	pter	rad	diatom	spicules	silic flag	mol shell	gravel	sand	silt	clay	lamin	grd bed	x bed	mottles	homogen	Remarks
SECTION I	0																						(0-1 cm soup)
	1 3	10YR 3/2				X	X		X	C	X	R				C	A					X	Very dark greyish brown silty clay non-calcareous Red brown aggregates common
	3 4	10YR 3/3		X		X	X few fossils			X	X												Gradational contact to dark brown 10YR 3/3
	4 5	5Y 4/1		X												C	A				X		Gradational contact to dark grey silty non-calcareoı clay.
	5 38	5Y4/1		X		X	X		X	C	X	X				C	A				X		Dark grey silty non-calcareoı clay with black basalt silt fragments. Darker blackish streak and mottles irregularl present (esp. 26-38).
	38 53	5Y3/1		X		X	X few fossils		X	X	X	X				C	A	X			X		Very dark grey irregular band. of silty non-calcareous clay with dark grey silty non-calcareous clay (Sulfides?) At 52-54 cm very dark grey grades to dark grey.
	53 118	5Y4/1		X		X	X		X	X						C	A				X		Dark grey silty non-calcareous clay. Prominent very dark grey irregular bands 1-2 cm wide at 94.5-96, 103-110, 112, 116-118. Bands contain black silty fragments.
	118 126		X				X very few fossils			X													Sharp irregular 40° angular unconformity (118-126 cm) Some veining through contact
	126 154	5Y4/1					very few fossils X									R	A					X	Dark grey plastic slightly calcareous clay (Smear slides at: 0, 3, and from 10-150 cm at 10 cm intervals.) Smear slides at: 10 cm intervals.

APPENDIX IX. 3.

WATER CONTENTS FROM CHEMISTRY SAMPLES

Escanaba Trough Cores - Cruise L6-85-NC

CORE	ACC NO.	DEPTH	% WATER	CORE	ACC NO.	DEPTH	% WATER
GC 1	25808	2	63.9	GC 5	25849	4	64.8
GC 1	25809	6	63.9	GC 5	25850	10	69.4
GC 1	25810	11	68.3	GC 5	25851	18	67.7
GC 1	25811	14	66.5	GC 5	25852	21	61.8
GC 1	25812	19	69.9	GC 5	25853	26	68.1
GC 1	25813	25	65.5	GC 5	25854	32	63.5
GC 1	25814	30	67.5	GC 5	25855	38	68.0
GC 1	25815	34	66.1	GC 5	25856	44	49.0
GC 1	25816	38	65.8	GC 5	25857	48	73.2
GC 1	25817	43	65.7	GC 5	25858	53	61.2
GC 1	25818	48	64.9	GC 5	25859	58	61.6
GC 1	25819	53	62.1	GC 5	25860	63	61.0
GC 1	25820	58	64.2	GC 5	25861	68	64.1
GC 1	25821	63	55.4	GC 5	25862	73	63.1
GC 1	25822	67	62.1	GC 5	25863	78	62.9
GC 1	25823	72	62.1	GC 5	25864	83	59.9
GC 1	25824	78	58.6	GC 5	25865	88	61.2
GC 1	25825	83	61.3	GC 5	25866	93	58.2
GC 1	25826	89	63.6	GC 5	25867	98	59.7
GC 1	25827	94	58.6	GC 5	25868	103	60.1
GC 1	25828	99	59.9	GC 5	25869	108	60.4
GC 1	25829	104	60.5	GC 5	25870	113	58.7
GC 1	25830	109	60.9	GC 5	25871	117	59.8
GC 1	25831	114	61.5	GC 5	25872	123	57.6
GC 1	25832	119	58.5	GC 5	25873	128	59.7
GC 1	25833	124	60.0	GC 5	25874	133	60.2
GC 1	25834	129	61.4	GC 5	25875	138	59.4
GC 1	25835	134	60.1	GC 5	25876	143	59.3
GC 1	25836	139	60.8	GC 5	25877	147	59.9
GC 1	25837	143	60.0	GC 5	25878	153	60.4
GC 1	25838	148	60.3	GC 5	25879	158	58.4
GC 1	25839	154	59.8	GC 5	25880	163	59.2
GC 1	25840	158	61.2	GC 5	25881	170	53.0
GC 1	25841	163	60.8	GC 5	25882	177	47.7
GC 1	25842	168	60.1	GC 5	25883	181	46.8
GC 1	25843	173	59.0	GC 5	25884	186	47.3
GC 1	25844	178	52.3	GC 5	25885	191	46.1
GC 1	25847	193	47.9	GC 5	25886	196	45.8
GC 1	25848	198	46.7	GC 5	25887	201	45.5
GC 1	25845	183	53.1	GC 5	25888	206	45.0
GC 1	25846	188	47.8	GC 5	25890	215	44.9
				GC 5	25891	221	45.2
				GC 5	25892	226	45.8
				GC 5	25889	211	45.6

Escanaba Trough Cores - Cruise L6-85-NC

CORE	ACC NO.	DEPTH	% WATER	CORE	ACC NO.	DEPTH	% WATER
GC 6		5	60.2	GC 8	25710	6	64.6
GC 6		14	58.0	GC 8	25711	11	61.2
GC 6		19	57.0	GC 8	25712	16	58.8
GC 6		24	55.7	GC 8	25713	21	48.3
GC 6		29	55.4	GC 8	25714	24	57.9
GC 6		35	50.1	GC 8	25715	29	58.9
GC 6		39	53.1	GC 8	25716	33	47.6
GC 6		44	55.4	GC 8	25717	38	46.6
GC 6		49	53.1	GC 8	25718	42	46.3
GC 6		53	53.9	GC 8	25719	47	42.2
GC 6		58	54.9	GC 8	25720	52	45.9
GC 6		63	55.6	GC 8	25721	57	40.3
GC 6		69	52.0	GC 8	25722	62	39.4
GC 6		74	54.9	GC 8	25723	67	39.5
GC 6		79	56.6	GC 8	25724	72	50.3
GC 6		84	53.6	GC 8	25725	77	59.8
GC 6		89	53.7	GC 8	25726	82	63.3
GC 6		94	53.3	GC 8	25727	87	61.7
GC 6		99	53.5	GC 8	25728	92	61.3
GC 6		104	54.2	GC 8	25729	97	58.8
GC 6		109	53.5	GC 8	25730	102	58.7
GC 6		114	55.7	GC 8	25731	107	57.1
GC 6		119	53.4	GC 8	25732	112	58.1
GC 6		124	53.4	GC 8	25733	117	58.0
GC 6		129	55.0	GC 8	25734	122	58.6
GC 6		134	54.5	GC 8	25735	127	59.0
GC 6		139	53.7	GC 8	25736	132	58.1
GC 6		144	53.4	GC 8	25737	137	59.9
GC 6		148	52.1	GC 8	25738	142	58.5
GC 6		154	56.6	GC 8	25739	149	56.0
GC 6		159	53.7	GC 8	25740	153	58.5
GC 6		164	53.5	GC 8	25741	156	57.7
GC 6		169	54.2	GC 8	25742	161	59.1
GC 6		175	54.7	GC 8	25743	166	58.5
GC 6		180	56.4	GC 8	25744	171	58.3
GC 6		185	54.1	GC 8	25745	176	57.5
GC 6		190	52.5	GC 8	25746	180	54.2
GC 6		195	52.0	GC 8	25747	185	51.8
GC 6		200	54.9	GC 8	25748	190	53.2
GC 6		205	53.4	GC 8	25749	195	53.2
GC 6		210	55.3	GC 8	25750	200	51.3
GC 6		215	54.3	GC 8	25751	205	52.2
GC 6		220	56.8	GC 8	25752	210	51.6
GC 6		225	55.4	GC 8	25753	215	51.9
GC 6		230	53.8	GC 8	25754	220	50.7
GC 6		235	56.2	GC 8	25755	225	52.4
GC 6		240	56.6	GC 8	25756	230	42.5
GC 6		245	54.9	GC 8	25757	233	53.0
GC 6		253	56.6				

Escanaba Trough Cores - Cruise L6-85-NC

CORE	ACC NO.	DEPTH	% WATER	CORE	ACC NO.	DEPTH	% WATER
GC 9	25895	3	60.3	GC 10	25758	2	57.0
GC 9	25896	9	59.3	GC 10	25759	7	63.9
GC 9	25897	13	60.3	GC 10	25760	12	63.7
GC 9	25898	19	58.1	GC 10	25761	16	61.5
GC 9	25899	23	58.3	GC 10	25762	21	67.4
GC 9	25900	29	57.1	GC 10	25763	26	67.4
GC 9	25901	33	57.4	GC 10	25764	31	66.3
GC 9	25902	39	59.3	GC 10	25765	36	65.4
GC 9	25903	43	59.2	GC 10	25766	41	66.0
GC 9	25904	49	57.6	GC 10	25767	46	64.7
GC 9	25905	54	60.0	GC 10	25768	51	64.0
GC 9	25906	58	58.2	GC 10	25769	55	62.6
GC 9	25907	61	59.8	GC 10	25770	60	62.9
GC 9	25908	66	57.6	GC 10	25771	65	59.6
GC 9	25909	70	59.8	GC 10	25772	70	56.4
GC 9	25910	76	58.7	GC 10	25773	75	55.1
GC 9	25911	81	58.6	GC 10	25774	81	59.2
GC 9	25912	86	60.2	GC 10	25775	86	60.9
GC 9	25913	91	60.7	GC 10	25776	91	61.2
GC 9	25914	97	63.6	GC 10	25777	96	60.9
GC 9	25915	103	61.4	GC 10	25778	101	62.7
GC 9	25916	108	59.5	GC 10	25779	106	60.2
GC 9	25917	112	55.6	GC 10	25780	110	59.7
GC 9	25918	118	53.0	GC 10	25781	115	56.1
GC 9	25919	122	46.6	GC 10	25782	121	63.5
GC 9	25920	127	41.1	GC 10	25783	126	58.8
GC 9	25921	133	55.8	GC 10	25784	130	59.0
GC 9	25922	137	57.1	GC 10	25785	135	56.8
GC 9	25923	140	55.2	GC 10	25786	142	61.6
GC 9	25924	143	56.0	GC 10	25787	147	59.5
GC 9	25925	147	56.1	GC 10	25788	153	66.3
GC 9	25926	152	57.4	GC 10	25789	158	60.8
GC 9	25927	156	65.8	GC 10	25790	161	55.7
GC 9	25928	162	58.4	GC 10	25791	166	50.1
GC 9	25929	166	58.6	GC 10	25792	171	48.8
GC 9	25930	172	58.0	GC 10	25793	176	48.9
GC 9	25931	176	58.0	GC 10	25794	181	46.8
GC 9	25932	182	53.7	GC 10	25795	186	45.8
GC 9	25933	186	58.5	GC 10	25796	193	45.1
GC 9	25934	192	58.6	GC 10	25797	197	45.5
GC 9	25935	196	57.6	GC 10	25798	200	45.8
GC 9	25936	202	59.3	GC 10	25799	205	44.3
GC 9	25937	206	63.5	GC 10	25800	210	44.6
GC 9	25938	212	54.9	GC 10	25801	217	50.2
GC 9	25939	216	59.2	GC 10	25802	221	45.9
GC 9	25940	220	55.8	GC 10	25803	225	45.7
				GC 10	25804	232	46.7
				GC 10	25805	237	45.5
				GC 10	25806	240	47.3
				GC 10	25807	246	45.2

Escanaba Trough - Cruise L6-85-NC

CORE	ACC NO.	DEPTH	% WATER
GC 12	25678	0	58.8
GC 12	25679	5	61.3
GC 12	25680	9	76.7
GC 12	25681	13	65.2
GC 12	25682	18	62.2
GC 12	25683	24	63.1
GC 12	25684	30	68.3
GC 12	25685	34	59.1
GC 12	25686	39	31.3
GC 12	25687	44	31.3
GC 12	25688	49	51.2
GC 12	25689	54	58.6
GC 12	25690	59	59.8
GC 12	25691	64	75.2
GC 12	25692	69	60.2
GC 12	25693	74	59.3
GC 12	25694	80	58.3
GC 12	25695	86	58.7
GC 12	25696	91	49.8
GC 12	25697	96	59.8
GC 12	25698	101	56.9
GC 12	25699	106	54.3
GC 12	25700	111	53.8
GC 12	25701	116	50.8
GC 12	25702	121	47.9
GC 12	25703	123	47.0
GC 12	25704	131	46.3
GC 12	25705	136	46.0
GC 12	25707	147	45.3
GC 12	25708	151	45.8
GC 12	25706	142	45.2

Northern Gorda - Cruise W8508AA

CORE	ACC NO.	DEPTH	% WATER
W 6	25942	2	62.0
W 6	25943	6.5	60.1
W 6	25944	10	60.3
W 6	25945	16	60.7
W 6	25946	20	62.8
W 6	25947	26	62.2
W 6	25948	30	63.9
W 6	25949	36	63.2
W 6	25950	40	61.3
W 6	25951	46	64.0
W 6	25952	50	62.8
W 6	25953	56	62.5
W 6	25954	60	63.6
W 6	25955	66	60.0
W 6	25956	70	63.0
W 6	25957	76	58.1
W 6	25958	80	61.1
W 6	25959	86	59.6
W 6	25960	90	59.6
W 6	25961	96	58.5
W 6	25962	100	60.4

Water contents calculated from weights of chemistry vials, according to:

% water = (wet weight - dry weight) / wet weight

Water contents are not corrected for salt concentrations.

APPENDIX IX. 4.

GORDA RIDGE PALEOMAGNETISM NRM DIRECTIONS AND INTENSITIES

NRM Intensity in 10^{-5} emu/gm wet

Escanaba Trough Cores - Cruise L6-85-NC

CORE	DEPTH	SAMP	DECL	INCL	NRM	CORE	DEPTH	SAMP	DECL	INCL	NRM
1	2	1	-77.4	75.0	0.479	2	2	1	18.3	76.7	1.900
1	2	2	221.2	28.1	0.686	2	2	2	10.4	69.2	2.200
1	10	1	177.9	57.6	1.448	2	6.2	1	6.0	64.4	1.734
1	10	2	-0.6	76.4	1.388	2	6.2	2	14.8	59.1	1.836
1	18	1	161.1	64.6	2.306	2	11	1	17.3	59.2	2.774
1	18	2	166.1	62.1	2.267	2	11	2	24.3	58.6	3.036
1	29.2	1	175.4	55.1	2.605	2	20.5	1	13.1	60.2	2.536
1	29.2	2	171.6	53.5	2.653	2	20.5	2	14.5	60.1	2.621
1	37.2	1	161.6	59.5	2.917	2	30.7	1	17.5	54.6	2.162
1	37.2	2	165.9	57.1	2.982	2	30.7	2	20.5	58.3	2.077
1	47.5	1	176.1	56.1	2.955	2	41	1	5.9	55.5	3.201
1	47.5	2	177.3	52.7	2.764	2	41	2	11.9	55.7	3.280
1	58	1	167.3	52.3	2.934	2	50.5	1	17.1	49.8	2.709
1	58	2	165.6	53.1	2.904	2	50.5	2	17.3	49.2	2.810
1	66.6	1	161.6	62.0	5.044	2	60	1	7.4	52.8	3.440
1	66.6	2	159.2	62.9	4.973	2	60	2	10.0	52.5	2.991
1	76.8	1	161.0	55.4	3.320	2	70.2	1	2.5	56.2	5.507
1	76.8	2	162.3	56.5	3.401	2	70.2	2	2.5	56.0	5.553
1	88.3	1	162.1	59.3	3.213	2	79.7	1	2.1	52.0	3.799
1	88.3	2	155.8	59.0	1.580	2	79.7	2	5.2	56.0	3.895
1	97.8	1	169.1	63.7	3.151	2	90	1	-1.5	54.8	3.187
1	97.8	2	163.8	62.2	2.887	2	90	2	2.0	54.0	3.295
1	107	1	169.9	58.4	2.910	2	99.9	1	2.9	60.7	3.094
1	107	2	170.0	60.8	3.026	2	99.9	2	8.1	61.6	3.012
1	117.5	1	165.7	58.2	3.020	2	111.1	1	13.8	58.4	2.693
1	117.5	2	171.2	59.9	2.857	2	111.1	2	15.3	56.3	2.780
1	127	1	167.6	66.1	3.200	2	120.6	1	1.7	54.6	3.320
1	127	2	169.7	65.0	3.192	2	120.6	2	7.6	54.5	3.176
1	137.8	1	177.7	52.5	2.296	2	130	1	2.9	53.9	3.452
1	137.8	2	179.5	47.4	2.720	2	130	2	-1.0	60.3	3.194
1	146.5	1	156.4	57.7	2.695	2	139.6	1	7.8	50.7	3.179
1	146.5	2	169.9	49.1	2.627	2	139.6	2	10.8	49.3	3.112
1	153.5	1	168.1	50.8	3.001	2	147	1	10.5	41.8	2.935
1	153.5	2	161.0	58.0	2.944	2	147	2	10.1	46.2	2.744
1	162	1	163.7	59.1	3.867	2	153	1	180.0	49.2	4.090
1	162	2	161.8	61.5	3.834	2	153	2	176.1	52.0	3.840
1	172.5	1	161.8	53.8	3.001	2	163	1	186.8	60.9	3.860
1	172.5	2	169.6	52.5	2.756	2	163	2	176.2	56.0	3.801
1	182.5	1	160.2	46.4	6.173	2	171.8	1	174.7	58.7	3.764
1	182.5	2	163.1	44.7	6.042	2	171.8	2	170.2	59.4	3.930
1	193	1	163.9	38.1	5.377	2	181.8	1	181.0	51.9	4.315
1	193	2	163.4	34.9	5.433	2	181.8	2	177.8	48.7	4.270
						2	192.5	1	172.5	50.2	5.981
						2	192.5	2	173.0	46.8	5.197

2	202.6	1	175.7	48.8	5.650
2	202.6	2	172.1	44.1	5.553
2	212	1	164.8	51.0	6.307
2	212	2	167.3	45.0	5.597
2	223.3	1	169.0	50.5	7.084
2	223.3	2	176.7	48.7	6.837
2	232.5	1	145.2	57.0	4.660
2	232.5	2	164.2	54.5	4.907

CORE	DEPTH	SAMP	DECL	INCL	NRM
5	3.5	1	234.3	54.1	2.038
5	3.5	2	-73.0	58.6	2.355
5	9.5	1	-88.9	60.4	2.159
5	9.5	2	-37.0	44.0	1.652
5	17.5	1	28.8	64.9	2.580
5	17.5	2	29.0	65.1	3.064
5	20.5	1	55.2	71.4	2.001
5	20.5	2	39.0	69.2	2.422
5	26	1	-32.0	67.4	0.917
5	31.5	1	-9.3	57.1	1.885
5	31.5	2	6.5	64.8	2.239
5	38	1	-23.8	68.3	2.778
5	38	2	-26.7	69.6	2.707
5	43.8	1	-17.6	64.5	1.817
5	43.8	2	-16.6	64.8	1.763
5	47.5	1	-20.3	63.4	2.572
5	47.5	2	-18.4	64.1	2.566
5	57.5	1	-29.7	67.4	3.920
5	57.5	2	-26.7	65.5	3.978
5	68	1	-23.3	59.4	2.959
5	68	2	-18.8	59.9	3.018
5	78	1	-27.8	64.6	3.288
5	78	2	-30.4	63.9	3.252
5	87.7	1	-32.0	68.5	3.744
5	87.7	2	-24.1	62.7	3.706
5	97.5	1	-28.2	65.7	2.806
5	97.5	2	-41.6	65.8	2.316
5	107.7	1	-33.8	67.1	2.694
5	107.7	2	-26.3	67.8	2.903
5	117	1	-36.8	64.9	2.924
5	117	2	-28.9	62.4	2.997
5	127.6	1	-27.8	67.5	2.890
5	127.6	2	-31.0	67.2	2.928
5	138.2	1	-38.1	64.9	3.731
5	138.2	2	-31.7	65.9	3.518
5	147	1	-26.3	70.5	3.791
5	147	2	-31.6	72.5	3.732
5	153	1	160.0	65.5	4.025
5	153	2	161.5	72.8	3.668
5	162.5	1	174.8	57.9	3.569
5	162.5	2	176.0	59.5	3.306
5	169.2	1	171.2	56.2	5.677
5	169.2	2	168.1	54.2	6.383

CORE	DEPTH	SAMP	DECL	INCL	NRM
6	4.6	1	220.5	46.5	1.679
6	4.6	2	227.3	56.8	1.079
6	13.4	1	203.6	57.7	2.315
6	13.4	2	206.5	60.2	2.311
6	18.2	1	198.3	63.0	2.541
6	18.2	2	203.3	58.9	2.427
6	24.3	1	191.3	80.5	1.833
6	24.3	2	236.7	82.1	1.729
6	34.5	1	205.0	65.3	2.465
6	34.5	2	219.4	70.2	2.216
6	44	1	212.0	60.9	2.558
6	44	2	214.6	55.1	2.374
6	53.2	1	190.9	63.2	4.314
6	53.2	2	196.5	72.8	4.102
6	63	1	202.1	42.6	3.497
6	63	2	204.3	41.4	3.663
6	74.1	1	200.9	50.6	3.160
6	74.1	2	203.5	51.3	3.011
6	84	1	190.3	50.0	3.131
6	84	2	192.5	48.3	3.322
6	94	1	202.4	52.0	2.936
6	94	2	200.8	53.7	2.907
6	104	1	177.0	62.6	2.418
6	104	2	167.0	62.4	2.583
6	114	1	188.6	57.7	1.997
6	114	2	189.1	56.6	1.830
6	124.2	1	178.4	55.8	1.812
6	124.2	2	179.7	57.5	1.912
6	134	1	178.8	53.2	1.321
6	134	2	177.9	48.9	1.394
6	144	1	171.2	57.1	1.212
6	144	2	182.7	62.2	1.238
6	153.8	1	168.7	50.6	1.055
6	153.8	2	167.6	58.1	1.090
6	164.1	1	176.8	43.9	1.257
6	164.1	2	171.1	48.4	1.071
6	174.8	1	174.7	54.1	1.597
6	174.8	2	173.0	54.6	1.607
6	185	1	171.4	53.3	1.507
6	185	2	172.8	51.3	1.521
6	195	1	171.7	57.6	1.384
6	195	2	172.6	54.1	1.408
6	205	1	174.6	55.2	1.540

5	176.6	1	176.0	44.9	8.297	6	205	2	172.1	52.8	1.431
5	176.6	2	178.8	48.6	8.600	6	214.7	1	168.8	45.0	1.393
5	185.5	1	171.6	58.2	6.444	6	214.7	2	162.3	41.1	1.344
5	185.5	2	173.4	55.1	6.639	6	225.2	1	191.8	64.7	1.597
5	196	1	180.5	47.1	6.629	6	225.2	2	178.8	68.5	1.705
5	196	2	185.0	44.5	6.178	6	234.5	1	145.5	56.0	1.710
5	206.1	1	181.2	42.4	6.168	6	234.5	2	153.7	50.6	1.916
5	206.1	2	181.1	37.7	6.108	6	244.6	1	184.9	48.0	1.957
5	215.2	1	159.0	56.6	5.567	6	244.6	2	172.3	50.8	1.583
5	215.2	2	160.7	57.2	5.947	6	252.7	1	170.2	43.2	1.819
5	225.7	1	170.6	50.5	6.747	6	252.7	2	176.5	41.6	1.470
5	225.7	2	167.6	46.3	6.964						

CORE	DEPTH	SAMP	DECL	INCL	NRM	CORE	DEPTH	SAMP	DECL	INCL	NRM
7	4.5	1	31.5	48.3	8.856	8	6	1	86.8	69.5	1.997
7	4.5	2	30.1	47.8	9.237	8	6	2	120.1	66.7	1.987
7	10.7	1	51.2	44.4	6.297	8	15.2	1	100.7	63.3	3.481
7	10.7	2	43.7	35.3	6.808	8	15.2	2	85.9	64.0	3.478
7	15	1	1.1	35.1	3.633	8	22.2	1	105.2	63.3	8.106
7	15	2	1.7	34.0	3.736	8	22.2	2	120.0	59.0	3.472
7	20.4	1	0.3	63.8	5.420	8	32.3	1	108.1	68.4	6.944
7	20.4	2	4.4	65.2	5.380	8	32.3	2	104.9	67.7	11.850
7	30.3	1	6.5	53.9	4.547	8	37.1	1	100.6	51.1	9.545
7	30.3	2	11.0	58.3	4.980	8	37.1	2	109.2	48.0	12.228
7	40	2	13.6	58.9	6.070	8	41.7	1	107.0	55.7	13.360
7	40.4	1	13.6	62.5	6.151	8	41.7	2	111.3	56.8	14.253
7	50	1	-4.8	61.5	4.540	8	46.2	1	102.8	49.5	14.026
7	50	2	-8.9	61.2	4.251	8	46.2	2	117.6	53.9	13.009
7	60.1	1	-9.5	63.3	4.339	8	51.5	1	88.9	58.6	17.390
7	60.1	2	-4.9	60.2	5.023	8	51.5	2	94.1	61.3	15.998
7	70	1	-4.1	67.7	6.131	8	57	1	93.1	57.7	25.129
7	70.1	2	-0.4	67.7	6.134	8	57	2	99.8	59.2	25.308
7	79.7	1	0.0	58.2	-8.826	8	61.4	1	86.2	56.6	16.573
7	79.7	2	-1.7	60.5	-9.033	8	61.4	2	92.1	58.5	16.185
7	89.8	1	7.7	66.2	-9.660	8	66.5	1	105.0	37.9	26.681
7	89.8	2	3.0	68.4	5.543	8	66.5	2	100.5	40.9	24.928
7	100.4	1	-5.8	69.5	4.099	8	71.7	1	104.7	48.4	36.689
7	100.4	2	-4.1	70.3	4.045	8	71.7	2	98.5	50.5	34.653
7	110	1	5.3	65.1	3.458	8	76.3	1	94.4	64.0	3.731
7	110	2	8.7	62.7	3.237	8	76.3	2	90.0	63.5	4.130
7	119.9	1	6.0	57.3	4.025	8	86.2	1	91.3	58.2	3.322
7	119.9	2	5.1	53.1	4.197	8	86.2	2	92.4	59.4	3.427
7	130.2	1	5.0	52.6	2.062	8	96.2	1	99.9	65.5	4.269
7	130.2	2	4.7	49.4	1.794	8	96.2	2	99.2	65.7	4.727
7	139.7	1	15.7	40.7	1.336	8	106.2	1	93.5	63.7	3.161
7	139.7	2	12.1	38.8	1.504	8	106.2	2	94.0	66.7	3.370
7	153	1	2.5	65.7	1.992	8	117	1	99.1	65.6	2.806
7	153	2	-3.8	61.6	2.024	8	117	2	96.4	65.7	2.864
7	162.3	1	6.0	64.5	1.314	8	126	1	96.8	68.5	2.893
7	162.3	2	4.5	64.9	1.360	8	126	2	90.0	68.7	3.290
7	172.6	1	0.1	64.4	1.686	8	136.1	1	84.5	68.8	3.046
7	172.6	2	-3.5	63.2	1.736	8	136.1	2	95.9	71.0	3.138
7	182.6	1	-10.0	65.2	2.020	8	145.7	1	80.5	63.9	2.556

7	182.6	2	1.4	60.4	1.977	8	145.7	2	83.2	62.3	2.860
7	192.6	1	-36.0	49.0	1.319	8	152.3	1	81.1	61.8	3.324
7	192.6	2	-62.8	56.2	1.445	8	152.3	2	94.7	64.0	3.398
7	202.6	1	-12.0	46.0	1.566	8	160	1	87.4	66.4	4.056
7	202.6	2	6.1	44.8	1.949	8	160	2	85.1	64.0	3.835
7	212.1	1	0.3	50.2	4.891	8	169.5	1	86.1	69.7	3.385
7	212.1	2	-6.4	51.5	4.491	8	169.5	2	91.7	67.2	3.557
7	222.2	1	10.5	57.4	5.680	8	179	1	88.5	59.0	4.310
7	222.2	2	12.8	58.6	5.973	8	179	2	96.0	59.7	4.843
7	232.4	1	-40.3	65.7	6.266	8	189.2	1	53.3	58.0	4.546
7	232.4	2	-19.5	65.4	6.124	8	189.2	2	56.0	56.5	5.112
						8	199.5	1	25.6	64.8	7.249
						8	199.5	2	17.4	68.5	6.872
						8	209.3	1	40.3	43.8	5.905
						8	209.3	2	46.9	44.4	5.921
						8	219.5	1	59.4	39.7	4.663
						8	219.5	2	63.2	41.5	4.821
						8	228.6	1	37.4	43.8	8.510
						8	228.6	2	34.7	56.5	9.390

CORE	DEPTH	SAMP	DECL	INCL	NRM	CORE	DEPTH	SAMP	DECL	INCL	NRM
9	3.4	1	190.4	52.0	1.592	10	1.5	1	-37.6	73.2	8.126
9	3.4	2	208.7	64.0	1.599	10	1.5	2	-49.0	75.6	6.213
9	9	1	203.3	56.4	2.170	10	5.5	1	-81.1	72.2	0.941
9	9	2	203.8	58.9	2.141	10	5.5	2	-16.0	40.8	1.570
9	15	1	190.7	52.9	2.074	10	11.7	1	-15.7	69.0	3.154
9	15	2	189.8	48.0	2.025	10	11.7	2	-11.9	71.3	2.757
9	20.6	1	177.3	51.4	2.318	10	20.6	1	-31.4	70.6	2.487
9	20.6	2	188.5	52.7	2.274	10	20.6	2	-28.7	70.9	2.722
9	30.5	1	201.8	53.7	1.452	10	30.5	1	-18.5	64.4	2.460
9	30.5	2	204.3	55.2	1.566	10	30.5	2	-18.9	62.3	2.904
9	40	1	194.2	49.7	1.026	10	40.1	1	-29.4	64.4	3.630
9	40	2	195.6	51.1	1.327	10	40.1	2	-26.0	64.0	3.781
9	50	1	202.2	61.1	1.491	10	50.7	1	-18.2	56.1	2.655
9	50	2	221.9	59.1	1.247	10	50.7	2	-15.1	56.6	2.563
9	59.8	1	187.0	64.4	1.659	10	59.1	1	-29.8	60.2	3.440
9	59.8	2	194.1	67.3	1.608	10	59.1	2	-26.2	57.0	2.914
9	71	1	198.4	57.9	1.407	10	64.2	1	-21.6	62.3	5.178
9	71	2	194.5	49.5	1.346	10	64.2	2	-19.3	63.6	4.386
9	79.5	1	-83.6	58.2	1.336	10	73.7	1	-26.1	66.2	3.781
9	79.5	2	233.5	63.3	1.357	10	73.7	2	-41.0	71.8	3.506
9	89.8	1	210.8	61.9	2.112	10	81.3	1	-23.4	62.7	2.542
9	89.8	2	207.1	65.8	2.226	10	81.3	2	-28.8	61.3	2.825
9	99.5	1	191.0	60.9	3.177	10	90.3	1	-20.7	67.4	3.027
9	99.5	2	196.8	62.2	-5.178	10	90.3	2	-19.6	66.5	3.093
9	110	1	203.4	53.6	-3.962	10	100.5	1	-22.3	68.7	2.654
9	110	3	196.9	52.4	-3.685	10	100.5	2	-19.0	66.5	2.669
9	119.7	1	118.3	69.2	1.599	10	109.7	1	-25.9	63.6	2.896
9	119.7	2	166.7	66.3	1.725	10	109.7	2	-25.1	65.8	2.804
9	130.6	1	188.9	64.2	1.917	10	120.2	1	-16.3	61.6	2.751
9	130.6	2	197.4	64.9	1.872	10	120.2	2	-15.6	55.8	2.526
9	140.5	1	251.0	78.5	0.772	10	129.7	1	-32.4	66.1	2.847
9	140.5	2	238.4	58.7	0.915	10	129.7	2	-40.6	68.6	2.960

9	147.2	1	180.1	60.6	1.489
9	147.2	2	257.2	58.5	1.061
9	154	1	183.8	60.2	2.147
9	154	2	182.4	55.6	2.545
9	163.9	1	137.5	75.8	1.614
9	163.9	2	148.5	63.3	1.960
9	169.5	1	185.8	54.6	1.907
9	169.5	2	191.0	47.8	1.845
9	179.4	1	184.0	66.1	1.451
9	179.4	2	180.2	63.9	1.453
9	188.4	1	186.7	76.8	1.894
9	188.4	2	196.9	78.3	1.640
9	197.4	1	148.5	59.4	2.201
9	197.4	2	161.6	52.0	2.670
9	204.2	1	145.3	66.1	2.167
9	204.2	2	164.8	71.5	2.063

10	134.8	1	-38.5	61.4	2.840
10	134.8	2	-34.6	63.0	3.260
10	142	1	-33.9	62.0	2.876
10	142	2	-35.4	61.9	2.900
10	153	1	-43.9	31.2	3.900
10	153	2	-33.0	63.0	2.496
10	161	1	-46.2	58.8	4.900
10	161	2	-51.5	58.5	4.900
10	170.3	1	-52.9	41.5	6.128
10	170.3	2	-49.8	39.5	6.080
10	180.3	1	-48.3	56.9	6.539
10	180.3	2	-62.1	60.5	6.245
10	186	1	-67.2	52.1	6.330
10	186	2	-65.4	55.9	6.372
10	192.2	1	-78.6	35.2	6.969
10	192.2	2	-88.3	40.3	6.654
10	200	1	-37.6	45.1	5.869
10	200	2	-38.9	45.9	5.733
10	209.1	1	-51.7	57.4	4.365
10	209.1	2	-50.8	56.6	4.691
10	216.5	1	-80.9	52.7	4.055
10	216.5	2	-70.5	53.5	3.783
10	224.5	1	-75.3	45.6	4.228
10	224.5	2	-73.6	48.9	4.740
10	231.8	1	-39.9	56.0	5.243
10	231.8	2	-46.7	55.0	5.352
10	239.2	1	-56.6	56.6	4.492
10	239.2	2	-58.1	55.2	4.409

Escanaba Trough Cores - L6-85-NC

CORE	DEPTH	SAMP	DECL	INCL	NRM
12	0	1	177.6	85.3	2.403
12	5	1	178.3	66.9	1.667
12	5	2	175.8	62.7	2.429
12	9	1	123.0	84.7	2.196
12	9	2	51.7	77.7	2.513
12	13	1	73.3	74.2	2.070
12	13	2	49.4	69.5	2.363
12	18	1	-22.0	87.2	1.914
12	18	2	265.6	85.2	1.904
12	24	1	72.7	84.1	1.299
12	24	2	40.6	76.9	1.824
12	29.3	1	0.9	67.9	1.852
12	29.3	2	-14.0	71.1	1.757
12	33.5	1	-15.8	66.8	2.210
12	33.5	2	-20.3	65.8	3.913
12	38.5	1	-36.3	70.5	24.665
12	38.5	2	-14.3	63.9	22.668
12	43.1	1	-48.4	57.6	14.298
12	43.1	2	-63.6	70.5	16.622
12	49	1	-37.7	64.8	8.799

Northern Gorda Cores - W8508AA

CORE	DEPTH	SAMP	DECL	INCL	NRM
W 4	12.7	1	116.7	65.8	2.694
W 4	22.3	1	120.9	61.8	2.881
W 4	22.3	2	121.6	63.1	2.895
W 4	32.4	1	113.2	64.2	3.105
W 4	32.4	2	119.7	61.8	3.326
W 4	42.6	1	108.6	59.7	-4.047
W 4	42.6	2	119.0	61.1	2.894
W 4	52	1	123.8	55.2	2.708
W 4	52	2	119.0	54.7	2.985
W 4	62.2	1	108.4	63.9	-5.749
W 4	62.2	2	110.2	63.8	-5.127
W 4	71.8	1	100.0	62.8	3.741
W 4	71.8	2	100.7	63.7	3.899
W 4	82.1	1	113.6	69.0	3.559
W 4	82.1	2	114.7	68.9	3.564
W 4	91.5	1	115.8	65.8	3.169
W 4	91.5	2	112.9	66.9	3.151
W 4	102.2	1	113.6	59.6	3.611
W 4	102.2	2	108.1	61.4	3.669
W 4	112.1	1	96.8	73.0	3.968

12	49	2	-33.2	65.5	7.414
12	53.9	1	4.8	64.8	3.016
12	53.9	2	2.9	69.7	2.805
12	58.7	1	-16.5	68.7	2.670
12	58.7	2	-15.4	59.2	2.218
12	63.5	1	-16.7	73.6	2.493
12	63.5	2	-16.7	74.1	2.451
12	69.1	1	74.0	74.8	2.024
12	69.1	2	81.2	76.0	2.714
12	73.8	1	-13.1	76.5	2.801
12	73.8	2	-24.9	77.2	2.343
12	79.3	1	1.5	76.0	2.523
12	79.3	2	-13.0	78.3	2.551
12	84.2	3	156.3	33.3	0.497
12	84.2	4	-29.6	57.4	1.195
12	85.3	1	-25.2	76.3	1.240
12	85.3	2	-18.8	81.9	2.118
12	90.2	3	71.6	47.4	2.043
12	90.2	4	75.5	49.5	1.964
12	90.6	1	44.7	21.0	2.233
12	90.6	2	82.1	55.8	1.656
12	95.7	1	175.4	-82.2	2.106
12	95.7	2	144.3	-75.9	2.183
12	99.4	3	-80.0	-57.7	1.597
12	99.4	4	-40.6	-40.4	2.886
12	100.2	1	228.9	-19.7	0.281
12	100.2	2	258.1	46.2	0.590
12	104.7	3	44.6	39.2	1.938
12	104.7	4	52.5	38.1	2.391
12	105.3	1	49.2	40.6	2.554
12	105.3	2	45.9	49.4	2.100
12	109.4	3	227.3	7.6	0.320
12	109.4	4	208.6	39.9	0.637
12	110.3	1	-68.8	52.5	0.745
12	110.3	2	249.8	78.3	0.833
12	115.7	1	-62.0	29.7	1.080
12	115.7	2	231.9	56.6	2.589
12	120.7	1	9.1	69.6	6.112
12	120.7	2	38.0	72.0	3.959
12	125.7	1	13.6	56.7	5.739
12	125.7	2	19.6	56.8	6.000
12	130.5	1	19.1	37.9	5.010
12	130.5	2	19.0	38.5	5.089
12	135.1	1	9.3	34.7	5.536
12	135.1	2	11.3	40.9	5.292
12	141.6	1	-0.5	45.0	5.221
12	141.6	2	1.2	45.7	5.382
12	146.1	1	6.9	41.4	4.861
12	146.1	2	-12.4	30.8	4.453
12	150.9	1	15.4	39.4	3.995
12	150.9	2	16.9	42.2	4.061

W 4 112.1 2 103.3 74.1 3.711

Northern Gorda Cores - Cruise W8508AA

CORE	DEPTH	SAMP	DECL	INCL	NRM	CORE	DEPTH	SAMP	DECL	INCL	NRM
W 8	12.2	1	230.6	64.5	2.895	W 9	2.5	1	-77.1	65.6	2.466
W 8	12.2	1	227.7	63.5	-6.291	W 9	2.5	2	-79.3	68.5	2.598
W 8	19.3	1	228.0	73.8	-5.094	W 9	12.7	1	-88.1	59.6	3.511
W 8	19.3	2	224.4	72.0	-5.255	W 9	12.7	2	-82.2	64.0	3.276
W 8	29.2	1	219.6	69.7	3.100	W 9	22.3	1	-89.4	65.3	3.498
W 8	29.2	2	219.0	63.9	2.869	W 9	22.3	2	-84.6	65.7	3.336
W 8	39.7	1	223.8	69.9	3.878	W 9	32	1	-77.0	69.9	3.593
W 8	39.7	2	210.9	66.9	3.188	W 9	32	2	-77.7	70.3	3.423
W 8	49.8	1	213.1	67.7	3.269	W 9	41.3	1	243.6	66.1	2.709
W 8	49.8	2	214.2	69.8	3.134	W 9	41.3	2	221.1	60.3	2.733
W 8	59.7	1	216.9	68.4	3.735	W 9	53	1	-72.6	64.0	3.476
W 8	59.7	2	212.9	65.6	3.081	W 9	53	2	-84.8	65.2	3.869
W 8	69.5	1	214.5	67.0	4.277	W 9	60.2	1	-85.0	65.6	3.455
W 8	69.5	2	219.4	68.1	4.208	W 9	60.2	2	257.4	67.0	3.527
W 8	79	1	218.3	70.3	2.860	W 9	69	1	-86.3	64.7	3.919
W 8	79	2	213.9	70.0	3.231	W 9	69	2	-85.6	64.4	3.709
W 8	89.4	1	223.1	75.6	3.686	W 9	80.4	1	246.8	66.3	3.277
W 8	89.4	2	214.8	75.4	3.725	W 9	80.4	2	241.0	64.7	3.325
W 8	103.6	1	198.8	74.9	3.841	W 9	90.6	1	247.0	70.9	4.037
W 8	103.6	2	204.6	71.0	4.182	W 9	90.6	2	239.9	72.0	4.104
W 8	113	1	215.1	65.4	4.774	W 9	101.7	1	263.7	61.5	4.615
W 8	113	2	209.8	59.1	4.619	W 9	101.7	2	258.5	61.4	4.810
W 8	122.5	1	203.2	66.0	4.579	W 9	111.7	1	262.2	59.6	4.296
W 8	122.5	2	205.4	65.7	4.989	W 9	111.7	2	264.7	58.5	4.324
W 8	132.3	1	210.0	70.9	5.177	W 9	121	1	-62.9	47.1	7.479
W 8	132.3	2	213.4	69.0	4.943	W 9	121	2	-65.8	51.1	7.472
W 8	142.9	1	230.0	51.0	7.490	W 9	126	1	-53.2	56.0	9.898
W 8	142.9	2	223.0	42.8	7.885	W 9	126	2	-46.1	49.4	9.810
W 8	153	1	208.5	64.3	5.214	W 9	131.2	1	-89.0	63.6	4.726
W 8	153	2	210.2	62.2	5.905	W 9	131.2	2	-87.9	59.2	4.975
W 8	162.9	1	208.8	59.8	5.543	W 9	139	1	263.6	52.3	5.298
W 8	162.9	2	206.2	58.3	5.170	W 9	139	2	263.9	52.7	5.382
W 8	172.3	1	180.3	74.1	5.373	W 9	146.6	1	63.3	55.4	4.391
W 8	172.3	2	201.7	70.5	4.211	W 9	146.6	2	67.9	55.9	4.526
W 8	181.4	1	233.8	71.2	4.848	W 9	155.5	1	50.9	60.9	4.298
W 8	181.4	2	226.0	67.7	4.852	W 9	155.5	2	45.8	58.6	4.427
						W 9	165.4	1	67.6	58.1	4.450
						W 9	165.4	2	81.7	56.6	4.071
						W 9	175.5	1	73.9	60.4	4.367
						W 9	175.5	2	70.2	60.8	4.456
						W 9	185.5	1	43.7	63.3	3.464
						W 9	185.5	2	46.6	64.4	3.776
						W 9	195.4	1	62.4	60.9	5.215
						W 9	195.4	2	65.4	61.6	4.775
						W 9	205.7	1	33.8	65.8	4.506
						W 9	205.7	2	42.3	68.7	4.502
						W 9	215	1	33.5	67.6	3.409
						W 9	215	2	39.4	67.7	3.305

IX.5 BULK CHEMICAL ANALYSES

ESCANABA TROUGH L6 - 85 - NC CORE 1
ELEMENTAL CONCENTATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	Na %	Mg %	Al %	Si %	P %	S %	K %	Ti %	Cr %	Mn %	Fe %	Co ppm	Ni ppm	Cu ppm	Zn ppm	Rb ppm	Sr ppm	Ba ppm	Ce ppm	Pb ppm	CaCO3 %	Salt %	Cl-H2O %	SumOx %
25808	2	1.003	3.198	8.002	27.098	0.132	0.125	2.100	0.477	0.018	2.371	6.543	285	193	340	220	97	315	2593	1268	119	0.80	9.10	73.60	93.40
25809	6	1.044	3.327	8.226	28.350	0.112	0.119	2.193	0.489	0.019	0.482	6.749	306	194	370	248	105	283	2649	1458	102	1.10	9.40	74.20	94.00
25810	11	0.887	3.406	8.029	28.247	0.092	0.127	2.167	0.469	0.019	0.290	6.750	311	215	356	276	107	253	2891	1400	103	1.10	10.40	76.30	92.60
25811	14	1.042	3.485	7.807	28.476	0.079	0.110	2.184	0.465	0.020	0.278	6.805	302	231	331	294	97	234	3075	1302	42	1.10	10.30	76.10	93.10
25812	19	0.827	3.600	8.291	29.310	0.077	0.104	2.229	0.473	0.021	0.320	6.621	314	251	381	319	103	249	3142	1579	64	1.70	12.10	79.30	94.40
25813	25	0.888	3.553	8.477	29.289	0.077	0.110	2.275	0.477	0.020	0.322	6.381	309	257	352	325	105	250	3124	1342	51	1.60	10.20	75.90	95.40
25814	30	0.762	3.572	8.512	29.271	0.078	0.122	2.275	0.476	0.020	0.311	6.416	308	245	328	318	112	261	2910	1094	80	1.70	10.70	76.90	95.00
25815	34	0.898	3.589	8.007	28.653	0.076	0.122	2.254	0.474	0.020	0.299	6.376	292	224	268	303	107	255	2881	1502	72	1.70	9.90	75.30	93.50
25816	38	1.060	3.627	8.104	28.788	0.076	0.101	2.221	0.478	0.020	0.291	6.320	299	244	301	317	104	250	2895	1361	50	1.70	10.20	75.90	93.90
25817	43	1.015	3.584	8.149	28.635	0.075	0.103	2.258	0.478	0.020	0.282	6.470	301	228	278	301	108	247	2901	1515	63	1.40	10.10	75.80	93.80
25818	48	0.900	3.536	8.211	28.575	0.075	0.115	2.213	0.479	0.021	0.250	6.283	296	238	314	317	109	254	2955	1418	55	1.60	9.40	74.30	93.60
25819	53	1.064	3.551	8.296	28.691	0.075	0.141	2.288	0.487	0.021	0.229	6.459	293	224	295	297	108	253	2990	1414	57	1.50	8.60	72.40	94.90
25820	58	1.087	3.544	8.262	28.610	0.078	0.129	2.274	0.484	0.020	0.184	6.723	303	215	327	280	109	259	2685	1382	60	1.60	9.50	74.40	94.50
25821	63	1.471	3.315	8.764	23.263	0.086	0.089	2.324	0.498	0.017	0.171	6.325	278	153	206	232	112	318	1804	1032	91	1.80	6.80	66.90	85.60
25822	67	1.244	3.516	8.532	29.287	0.082	0.120	2.357	0.506	0.020	0.209	6.530	276	170	219	238	97	232	2348	1267	55	0.60	9.00	73.20	96.50
25823	72	1.135	3.526	8.474	28.434	0.078	0.144	2.331	0.500	0.020	0.231	6.420	268	178	196	265	103	252	2564	1176	45	1.60	9.00	73.40	94.50
25824	78	1.121	3.546	8.605	28.927	0.083	0.126	2.351	0.505	0.020	0.247	6.459	282	211	213	268	106	279	2471	1303	76	2.50	8.00	70.80	96.30
25825	83	1.130	3.533	8.249	28.592	0.079	0.198	2.308	0.492	0.020	0.243	6.771	312	203	270	284	97	246	2390	1107	54	1.80	8.60	72.20	95.10
25826	89	1.071	3.585	8.455	28.615	0.076	0.160	2.265	0.493	0.020	0.258	6.313	287	233	282	314	103	256	2796	1395	36	2.30	9.30	74.00	94.60
25827	94	0.913	3.505	8.171	28.163	0.076	0.144	2.262	0.480	0.021	0.233	6.314	283	221	269	313	104	260	2772	1422	44	2.20	6.40	65.70	94.10
25828	99	1.019	3.498	8.304	28.499	0.076	0.166	2.273	0.485	0.020	0.238	6.386	284	225	246	289	105	266	2660	1333	51	2.60	7.60	69.60	94.80
25829	104	1.039	3.459	8.283	28.329	0.076	0.133	2.288	0.487	0.019	0.210	6.449	294	213	269	275	97	258	2431	1180	41	2.20	8.10	70.90	94.20
25830	109	1.142	3.412	8.434	28.561	0.076	0.169	2.278	0.492	0.019	0.208	6.379	298	219	304	265	95	250	2406	1363	27	2.20	8.40	71.80	94.70
25831	114	1.084	3.447	8.569	28.408	0.074	0.191	2.293	0.497	0.021	0.165	6.483	299	227	328	257	102	226	2525	1206	39	1.20	8.30	71.50	94.70
25832	119	1.094	3.383	8.519	28.406	0.074	0.192	2.275	0.495	0.020	0.177	6.247	292	215	298	298	105	253	2666	1348	54	2.00	7.10	68.10	94.80
25833	124	1.171	3.478	8.603	29.125	0.078	0.227	2.341	0.499	0.021	0.204	6.392	273	253	330	305	100	259	2701	1398	32	2.50	7.70	70.00	96.70
25834	129	1.010	3.427	8.457	28.388	0.076	0.252	2.236	0.494	0.020	0.190	6.272	300	221	278	297	109	257	2610	1295	60	2.30	7.80	70.10	94.40
25835	134	1.030	3.497	8.325	28.137	0.077	0.215	2.240	0.489	0.020	0.195	6.379	302	225	319	287	107	281	2520	1214	53	3.20	7.90	70.30	93.90
25836	139	1.031	3.492	8.335	28.367	0.079	0.199	2.240	0.481	0.020	0.209	6.458	298	233	322	309	103	293	2549	1425	45	4.20	8.00	70.60	94.50
25837	143	1.032	3.476	8.117	27.990	0.079	0.308	2.248	0.477	0.020	0.213	6.381	257	232	327	309	102	308	2529	1335	41	4.70	7.30	68.80	93.50
25838	148	0.973	3.516	8.399	28.131	0.079	0.311	2.264	0.488	0.020	0.220	6.376	322	245	344	305	102	305	2439	1353	45	4.90	7.70	70.00	94.10
25839	154	0.773	3.328	8.403	28.176	0.072	0.250	2.289	0.502	0.020	0.197	6.432	42	209	140	277	117	295	2282	565	35	4.10	7.00	68.60	97.20
25840	158	0.773	3.314	8.548	27.884	0.071	0.196	2.318	0.499	0.019	0.178	6.534	38	193	113	264	115	290	2216	554	32	4.00	7.50	70.20	97.00
25841	163	0.749	3.344	8.758	28.106	0.072	0.214	2.336	0.509	0.020	0.168	6.592	42	203	136	262	117	289	2169	556	32	4.10	7.50	70.30	98.00
25842	168	0.738	3.313	8.736	28.304	0.074	0.188	2.381	0.506	0.020	0.159	6.693	44	198	136	260	117	295	2139	553	36	4.50	7.00	68.70	98.50
25843	173	0.792	3.264	8.818	28.108	0.075	0.165	2.407	0.515	0.019	0.142	6.809	40	167	137	241	116	272	1951	502	30	3.00	6.70	67.90	98.40
25844	178	1.156	3.189	9.480	27.893	0.092	0.086	2.699	0.562	0.016	0.146	6.951	44	111	102	172	120	279	1062	385	25	1.80	5.00	60.40	100.10
25845	183	1.126	3.180	9.366	27.913	0.092	0.105	2.636	0.557	0.015	0.171	6.797	36	101	74	172	115	296	1199	406	24	2.90	5.00	60.60	99.60
25846	188	1.310	3.052	9.707	27.798	0.099	0.080	2.727	0.579	0.014	0.150	6.633	39	91	78	154	118	315	895	357	24	2.90	4.20	56.00	99.90
25847	193	1.296	3.068	9.673	28.027	0.099	0.084	2.695	0.577	0.013	0.148	6.703	39	90	68	154	123	317	1007	383	27	2.90	4.60	58.60	100.40
25848	198	1.310	3.013	9.614	27.681	0.100	0.095	2.708	0.575	0.013	0.144	6.647	39	84	79	150	121	318	958	376	26	2.90	4.10	55.80	99.40

*CaCo3 calculated from Ca abundances, assuming 0.7% noncarbonate Ca

ESCANABA TROUGH L6 - 85 - NC CORE 8
ELEMENTAL CONCENTRATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	NA %	MG %	AL %	SI %	P %	S %	K %	TI %	CR %	MN %	FE %	CO ppm	NI ppm	CU ppm	ZN ppm	RB ppm	SR ppm	BA ppm	CE ppm	PB ppm	CaCO3 %	SALT %	CL-H2O %	SUM OX %
25709	0	0.991	3.191	7.947	27.914	0.103	0.121	2.113	0.479	0.019	0.856	6.574	313	204	351	254	104	269	2960	1286	78	0.60	9.90	75.40	92.40
25710	6	0.980	3.227	8.066	28.627	0.082	0.125	2.193	0.480	0.018	0.132	6.356	285	192	310	266	108	267	2748	1323	75	1.40	8.80	73.00	93.20
25711	11	1.091	3.246	8.395	29.042	0.085	0.093	2.337	0.500	0.017	0.136	6.267	284	174	299	251	107	280	2272	1228	63	1.30	8.40	71.80	95.00
25712	16	1.174	3.248	8.907	29.598	0.087	0.100	2.379	0.513	0.018	0.143	5.942	279	192	292	237	101	289	2518	1303	43	1.80	8.20	71.40	96.90
25713	21	1.562	3.223	9.247	29.186	0.099	0.051	2.578	0.522	0.014	0.116	5.924	255	107	201	177	104	329	1239	1098	48	1.30	5.70	62.70	98.40
25714	24	1.383	3.198	8.520	28.923	0.094	0.175	2.340	0.509	0.016	0.191	5.629	248	182	251	212	112	314	1896	1204	58	1.50	7.40	69.10	95.00
25715	29	1.291	3.338	8.351	28.982	0.084	0.086	2.342	0.505	0.018	0.155	6.136	278	165	303	240	104	268	2431	1547	43	1.00	7.90	70.40	95.30
25716	33	1.568	3.141	8.618	28.662	0.099	0.120	2.393	0.523	0.015	0.132	5.788	259	140	268	182	108	311	1418	953	55	1.40	5.10	60.00	96.10
25717	38	1.557	3.188	9.170	28.665	0.105	0.354	2.480	0.539	0.015	0.121	5.741	291	112	230	170	105	322	1176	1195	48	1.50	4.70	58.10	97.30
25718	42	1.608	3.101	9.089	28.827	0.103	0.277	2.454	0.528	0.014	0.131	5.681	263	119	220	174	105	327	1281	1080	43	2.10	5.20	60.20	97.20
25719	47	1.667	3.079	9.076	28.900	0.105	0.315	2.444	0.530	0.014	0.126	5.606	260	114	230	165	107	333	1147	989	60	1.90	4.30	55.40	97.60
25720	52	1.508	3.134	8.840	28.678	0.099	0.289	2.408	0.528	0.014	0.132	5.770	265	124	219	178	103	311	1463	1196	49	1.60	4.60	57.50	96.70
25721	57	1.769	2.890	8.475	28.727	0.107	0.345	2.289	0.527	0.014	0.107	5.410	256	105	224	149	89	320	1027	1053	22	1.90	3.70	51.50	95.00
25722	62	1.803	2.789	8.410	28.776	0.106	0.336	2.257	0.521	0.013	0.107	5.251	240	91	188	137	91	338	974	1009	29	2.10	3.80	52.20	95.40
25723	67	1.818	2.707	8.489	29.215	0.106	0.363	2.238	0.515	0.012	0.109	5.305	246	103	192	141	92	322	938	918	21	2.00	3.40	49.50	96.50
25724	72	1.504	3.191	9.075	28.759	0.103	0.332	2.431	0.543	0.015	0.243	5.997	299	223	260	200	99	281	1423	1153	29	1.30	5.50	61.90	97.40
25725	77	1.177	3.384	8.154	28.287	0.083	0.210	2.224	0.483	0.020	0.921	6.075	287	213	318	296	100	255	2978	1507	35	1.70	7.70	70.00	94.60
25726	82	1.115	3.454	8.370	28.868	0.076	0.350	2.293	0.490	0.020	0.218	6.366	306	242	281	306	103	244	3026	1549	25	1.20	9.20	73.90	94.80
25727	87	1.130	3.464	8.292	28.499	0.076	0.247	2.280	0.492	0.020	0.188	6.439	299	233	303	308	107	265	2938	1414	37	2.00	8.50	72.00	94.40
25728	92	1.177	3.488	8.412	28.678	0.078	0.179	2.311	0.493	0.020	0.184	6.389	295	227	312	312	104	253	2755	1313	49	1.50	8.30	71.60	95.10
25729	97	1.168	3.374	8.667	28.851	0.080	0.166	2.334	0.503	0.019	0.171	6.234	298	208	289	265	103	255	2507	1376	37	1.40	7.30	68.80	95.90
25730	102	1.099	3.375	8.850	28.939	0.078	0.162	2.360	0.502	0.020	0.177	6.263	295	226	317	294	109	259	2727	1321	52	1.90	7.60	69.70	96.30
25731	107	1.054	3.376	8.532	28.575	0.075	0.194	2.300	0.492	0.021	0.179	6.313	291	228	300	302	102	247	2795	1354	35	1.60	6.30	65.30	95.60
25732	112	1.084	3.433	8.213	28.436	0.075	0.135	2.278	0.490	0.020	0.189	6.360	296	229	299	304	102	259	2712	1352	38	2.10	6.90	67.30	94.70
25733	117	1.146	3.431	8.116	28.274	0.074	0.151	2.252	0.489	0.020	0.184	6.235	293	224	300	291	97	251	2634	1232	34	1.90	6.80	67.10	94.10
25734	122	1.180	3.394	8.609	28.645	0.073	0.158	2.320	0.496	0.021	0.164	6.312	309	226	296	266	110	232	2654	1319	51	0.90	7.10	68.00	95.70
25735	127	1.121	3.352	8.667	28.871	0.074	0.147	2.314	0.503	0.020	0.159	6.372	291	216	275	276	106	237	2606	1365	46	1.10	7.40	69.00	96.00
25736	132	1.140	3.342	8.534	28.751	0.076	0.150	2.333	0.502	0.020	0.165	6.262	300	221	305	300	104	259	2692	1330	48	1.80	7.00	67.70	95.60
25737	137	1.171	3.420	8.377	28.603	0.077	0.130	2.284	0.502	0.020	0.177	6.235	300	234	303	300	102	268	2606	1354	34	2.40	7.70	70.00	94.80
25738	142	1.102	3.335	9.380	29.684	0.079	0.204	2.441	0.514	0.020	0.183	6.249	296	234	300	286	104	275	2577	1331	42	3.00	7.70	70.00	98.70
25739	149	1.129	3.421	8.267	28.245	0.078	0.154	2.276	0.497	0.019	0.191	6.147	292	237	311	292	104	309	2537	1485	39	4.10	6.20	64.70	94.60
25740	153	1.119	3.440	8.267	27.956	0.079	0.202	2.285	0.496	0.019	0.202	6.225	308	247	313	296	106	315	2448	1377	42	4.40	7.10	68.00	93.70
25741	156	1.166	3.401	8.400	27.906	0.080	0.194	2.350	0.504	0.020	0.197	6.185	302	239	274	283	110	313	2386	1225	51	4.20	7.00	67.80	93.90
25742	161	1.148	3.427	8.388	27.799	0.079	0.167	2.295	0.502	0.020	0.187	6.352	315	232	303	266	105	301	2297	1398	34	4.00	7.30	68.80	93.70
25743	166	1.186	3.433	8.462	27.858	0.081	0.153	2.345	0.508	0.020	0.170	6.507	332	223	270	264	107	289	2238	1273	46	3.70	7.20	68.40	94.20
25744	171	1.164	3.411	8.513	27.676	0.081	0.183	2.331	0.505	0.020	0.158	6.520	308	223	322	263	105	293	2180	1311	31	3.70	7.10	67.80	94.00
25745	176	1.335	3.369	8.769	27.471	0.088	0.167	2.499	0.516	0.017	0.141	7.001	319	190	300	216	115	280	1621	990	42	2.40	6.70	66.70	95.00
25746	180	1.301	3.423	8.795	27.575	0.089	0.115	2.494	0.521	0.017	0.163	6.926	297	166	243	204	106	276	1705	1148	28	2.20	5.50	61.90	95.80
25747	185	1.529	3.354	9.386	27.440	0.100	0.117	2.629	0.554	0.015	0.171	6.603	313	164	302	206	113	307	1352	1063	24	2.90	5.20	60.60	96.70
25748	190	1.553	3.326	9.591	27.265	0.101	0.104	2.678	0.560	0.015	0.185	6.702	315	148	266	196	116	306	1199	830	37	2.60	5.60	62.20	96.70
25749	195	1.494	3.319	9.519	27.535	0.099	0.104	2.639	0.556	0.015	0.172	6.775	310	145	273	188	112	302	1323	977	29	2.70	5.70	62.80	97.10
25750	200	1.639	3.251	9.763	27.220	0.108	0.100	2.722	0.572	0.014	0.165	6.782	307	121	273	165	117	315	987	829	36	2.80	5.20	60.60	97.30
25751	205	1.613	3.244	9.778	27.249	0.107	0.181	2.738	0.570	0.014	0.161	6.815	316	124	311	167	113	309	1018	976	24	2.80	5.30	61.10	97.30
25752	210	1.595	3.243	9.769	27.174	0.107	0.177	2.719	0.571	0.013	0.160	6.829	330	140	356	176	120	319	996	882	44	2.80	5.10	60.10	97.20
25753	215	1.617	3.249	9.821	27.309	0.108	0.205	2.739	0.571	0.013	0.156	6.824	314	124	305	167	122	318	986	842	46	2.80	5.20	60.60	97.60
25754	220	1.612	3.254	9.725	27.212	0.108	0.303	2.708	0.568	0.014	0.153	6.844	317	123	310	166	122	321	943	655	50	2.80	4.80	58.20	97.40
25755	225	1.563	3.214	9.846	27.266	0.108	0.255	2.725	0.567	0.013	0.152	6.856	315	123	302	168	109	309	988	919	17	2.80	5.40	61.60	97.30
25756	230	1.880	2.757	9.067	28.346	0.114	0.225	2.419	0.551	0.013	0.126	5.956	289	122	298	151	100	362	1026	1069	25	3.70	3.10	47.30	97.30
25757	233	1.439	3.157	9.484	27.247	0.102	0.172	2.713	0.554	0.014	0.137	6.971	312	122	270	169	115	295	1168	979	27	2.10	5.20	60.60	96.60

*CaCO3 calculated from Ca abundances, assuming 0.7% noncarbonate free

ESCANABA TROUGH L6 - 85 - NC CORE L10
ELEMENTAL CONCENTRATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	Na %	Mg %	Al %	Si %	P %	S %	K %	Ti %	Cr %	Mn %	Fe %	Co ppm	Ni ppm	Cu ppm	Zn ppm	Rb ppm	Sr ppm	Ba ppm	Ce ppm	Pb ppm	Opal SiO2(%)	CaCO3 %	Salt %	Cl-H2O %	SumOx %
25758	2	1.009	3.068	8.436	28.370	0.115	0.044	2.239	0.514	0.016	1.015	6.088	31	112	112	173	107	315	1823	506	40	11.50	1.20	7.10	69.10	98.40
25759	7	0.677	3.089	8.086	28.701	0.106	0.057	2.164	0.489	0.018	0.819	6.375	32	143	132	210	111	296	2406	578	46	13.60	1.10	8.50	73.20	98.00
25760	12	0.710	3.215	8.070	29.400	0.073	0.041	2.232	0.490	0.018	0.182	6.349	32	141	141	220	114	279	2344	584	48	14.20	1.90	8.80	73.80	98.70
25761	16	0.786	3.253	8.117	29.378	0.073	0.051	2.284	0.493	0.018	0.215	6.114	36	176	149	243	114	268	2529	598	41	13.50	1.60	8.00	71.70	98.70
25762	21	0.576	3.346	7.931	29.522	0.065	0.045	2.177	0.470	0.020	0.232	6.324	36	191	180	286	120	256	2848	654	43	13.80	1.60	10.00	76.40	98.70
25763	26	0.512	3.355	7.883	29.282	0.065	0.055	2.212	0.472	0.019	0.234	6.225	33	185	145	277	118	253	2911	652	42	13.40	1.50	9.50	75.60	98.00
25764	31	0.546	3.386	7.913	29.685	0.065	0.038	2.197	0.475	0.020	0.231	6.268	39	207	161	297	115	250	2909	657	39	13.90	1.60	9.50	75.40	99.00
25765	36	0.632	3.369	7.908	29.162	0.066	0.041	2.241	0.474	0.020	0.228	6.306	36	202	160	296	111	253	2756	618	40	13.00	1.80	9.20	74.90	98.10
25766	41	0.667	3.355	7.931	28.955	0.065	0.023	2.221	0.478	0.020	0.205	6.346	37	185	123	279	114	243	2745	625	36	12.50	1.30	9.50	75.50	97.70
25767	46	0.708	3.325	8.206	28.829	0.066	0.046	2.269	0.486	0.020	0.194	6.172	35	230	134	291	116	255	2733	630	34	11.30	1.60	9.10	74.60	97.80
25768	51	0.694	3.336	8.162	29.053	0.066	0.045	2.230	0.485	0.020	0.184	6.216	39	191	161	281	118	256	2748	621	38	11.90	1.70	8.90	74.00	98.20
25769	55	0.638	3.338	8.188	29.052	0.065	0.055	2.301	0.486	0.020	0.166	6.424	39	184	147	265	115	245	2806	648	34	11.80	1.40	8.10	72.00	98.50
25770	60	0.737	3.377	8.194	28.731	0.068	0.055	2.283	0.489	0.019	0.164	6.508	37	169	144	265	114	262	2413	585	38	10.80	1.80	8.30	72.60	98.10
25771	65	0.878	3.293	8.536	28.629	0.075	0.037	2.358	0.507	0.019	0.153	6.184	40	169	142	218	116	280	1975	518	43	9.80	1.60	7.40	70.00	98.20
25772	70	0.933	3.269	8.524	28.396	0.076	0.068	2.342	0.503	0.017	0.170	5.951	35	184	129	229	116	302	2005	532	44	9.70	2.40	6.50	67.10	97.30
25773	75	1.031	3.219	8.611	28.724	0.082	0.055	2.345	0.516	0.017	0.162	5.785	33	174	130	205	118	322	1759	497	45	10.50	2.90	6.70	67.70	98.00
25774	81	0.714	3.337	8.490	28.688	0.067	0.091	2.291	0.494	0.020	0.188	6.148	38	189	143	283	114	262	2648	626	34	9.80	2.40	6.80	68.30	98.00
25775	86	0.730	3.302	8.370	28.682	0.065	0.120	2.302	0.487	0.020	0.189	6.417	38	198	147	305	113	258	2604	613	32	10.70	2.40	7.50	70.50	98.10
25776	91	0.760	3.267	8.419	28.685	0.064	0.081	2.297	0.493	0.020	0.182	6.277	39	197	146	278	117	262	2617	608	36	10.80	2.50	7.60	70.70	98.00
25777	96	0.753	3.313	8.410	28.713	0.065	0.066	2.273	0.490	0.020	0.189	6.282	39	199	141	279	119	256	2501	608	38	10.40	2.10	7.70	71.10	98.10
25778	101	0.715	3.300	8.526	28.564	0.063	0.063	2.282	0.492	0.020	0.148	6.332	36	189	112	244	113	225	2420	594	32	9.50	1.00	7.80	71.40	97.90
25779	106	0.786	3.238	8.513	28.696	0.064	0.101	2.312	0.492	0.020	0.158	6.207	37	200	165	286	111	244	2531	600	32	10.50	1.70	7.30	69.70	98.00
25780	110	0.738	3.238	8.470	28.585	0.066	0.104	2.266	0.495	0.019	0.168	6.124	35	192	142	283	114	264	2649	615	34	10.50	2.30	6.80	68.00	97.50
25781	115	0.807	3.301	8.354	28.406	0.065	0.072	2.292	0.486	0.020	0.193	6.224	37	195	142	269	110	250	2539	585	35	10.10	1.90	5.70	63.90	97.30
25782	121	0.628	3.358	8.452	28.672	0.066	0.111	2.245	0.492	0.020	0.192	6.236	36	213	129	281	116	277	2437	585	35	9.90	3.20	8.30	72.70	97.90
25783	126	0.722	3.330	8.391	28.472	0.067	0.091	2.285	0.488	0.020	0.192	6.156	32	183	129	279	115	300	2422	590	36	10.20	4.20	6.50	67.20	97.30
25784	130	0.644	3.331	8.320	28.271	0.068	0.108	2.245	0.484	0.020	0.201	6.125	38	188	127	277	115	298	2311	584	38	10.00	4.10	6.50	67.10	96.60
25785	135	0.680	3.260	8.356	28.397	0.070	0.101	2.283	0.485	0.019	0.192	5.925	31	192	126	244	115	360	2049	563	35	11.10	6.50	7.10	69.20	96.60
25786	142	0.736	3.303	8.547	28.799	0.071	0.135	2.313	0.499	0.019	0.162	6.538	40	195	135	251	118	296	2144	563	34	10.40	4.10	7.80	71.10	98.80
25787	147	0.636	3.329	8.716	28.228	0.073	0.110	2.368	0.511	0.019	0.153	6.545	41	195	131	260	117	304	2285	569	31	8.30	4.40	7.50	70.30	97.90
25788	153	0.472	3.318	8.626	27.930	0.073	0.169	2.338	0.503	0.018	0.144	6.732	42	182	111	224	117	313	1931	521	31	8.20	4.90	7.00	68.80	97.10
25789	158	0.719	3.295	8.769	27.950	0.077	0.161	2.451	0.513	0.018	0.137	6.975	45	166	123	222	116	269	1793	495	30	7.50	2.60	6.40	66.60	98.20
25790	161	0.928	3.242	8.906	27.861	0.084	0.065	2.557	0.527	0.016	0.157	7.306	46	131	103	182	119	272	1397	439	27	7.00	1.90	5.60	63.70	99.00
25791	166	1.206	3.129	9.610	27.572	0.094	0.076	2.693	0.564	0.014	0.153	6.753	46	117	94	169	123	306	974	365	26	4.40	2.60	4.50	57.80	99.30
25792	171	1.297	3.024	9.849	27.752	0.099	0.069	2.697	0.579	0.013	0.147	6.594	40	100	89	150	116	313	957	383	24	4.60	2.90	4.50	58.10	99.90
25793	176	1.256	3.070	9.906	27.864	0.097	0.082	2.722	0.580	0.014	0.145	6.716	42	81	93	153	122	312	935	384	26	4.30	2.80	4.70	59.10	100.50
25794	181	1.292	3.072	9.948	27.921	0.099	0.120	2.721	0.581	0.013	0.141	6.701	41	85	87	147	121	313	975	364	27	4.20	2.90	4.20	56.00	100.70
25795	186	1.350	3.002	9.789	27.882	0.100	0.097	2.672	0.574	0.014	0.139	6.599	41	86	92	145	116	315	927	373	25	5.40	3.00	4.00	55.10	100.10
25796	193	1.330	2.953	9.918	27.837	0.097	0.057	2.784	0.576	0.013	0.140	6.595	41	86	91	154	124	314	926	368	25	5.10	2.80	4.00	54.90	100.20
25797	197	1.313	2.912	9.757	27.659	0.097	0.095	2.758	0.569	0.013	0.134	6.514	39	82	81	150	126	322	942	370	28	5.70	2.90	3.70	52.80	99.30
25798	200	1.336	2.923	9.842	28.012	0.098	0.062	2.759	0.575	0.013	0.133	6.550	41	84	90	150	123	318	953	370	26	6.00	3.00	4.20	55.90	100.30
25799	205	1.328	2.920	9.735	27.673	0.097	0.072	2.747	0.567	0.013	0.130	6.507	37	78	78	151	123	321	972	379	28	5.80	3.00	3.60	52.40	99.30
25800	210	1.323	2.914	9.774	28.172	0.100	0.058	2.717	0.568	0.013	0.133	6.490	44	88	99	151	125	323	903	365	27	6.70	3.00	4.00	55.00	100.40
25801	217	1.061	3.044	9.352	27.973	0.091	0.056	2.706	0.539	0.016	0.229	6.915	45	102	89	172	128	299	1324	434	28	7.10	2.50	4.70	59.40	99.70
25802	221	1.257	2.971	9.786	27.950	0.093	0.051	2.896	0.558	0.014	0.149	6.595	44	106	90	164	135	321	1035	392	28	5.70	2.70	4.00	54.90	100.30
25803	225	1.251	2.984	9.898	28.138	0.095	0.061	2.904	0.566	0.014	0.136	6.627	44	97	89	159	132	319	1066	399	27	5.60	2.80	4.20	56.40	101.00
25804	232	1.302	2.996	9.877	28.182	0.095	0.052	2.897	0.564	0.014	0.133	6.579	43	90	91	154	135	324	1001	377	29	5.70	2.80	4.10	55.70	101.00
25805	237	1.330	2.981	9.934	28.105	0.096	0.062	2.915	0.563	0.014	0.132	6.557	42	87	82	155	133	325	1011	389	29	5.40	2.80	3.90	54.50	101.00
25806	240	1.248	2.943	9.911	27.817	0.094	0.062	2.899	0.561	0.014	0.129	6.548	42	88	79	151	130	321	1073	404	26	5.10	2.80	4.20	56.40	100.10
25807	246	1.262	2.966	9.934	27.830	0.095	0.078	2.906	0.559	0.014	0.128	6.540	39	86	86	156	128	318	965	367	26	4.90	2.80	3.60	52.40	100.20

*CaCO3 calculated from Ca abundances, assuming 0.7% noncarbonate Ca

ESCANABA TROUGH L6 - 85 - NC CORE 12
ELEMENTAL CONCENTRATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	NA	MG	AL	SI	P	S	K	TI	CR	MN	FE	CO	NI	CU	ZN	RB	SR	BA	CE	PB	CaCO3	SALT	CL-H2O	SUM OX
		%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%
25678	0	1.287	3.216	8.038	27.945	0.103	0.075	2.186	0.493	0.017	0.597	6.143	277	155	265	208	106	289	2173	1037	82	0.60	7.70	69.80	93.10
25679	5	1.274	3.311	8.468	28.936	0.094	0.090	2.307	0.503	0.017	0.193	6.278	276	159	235	236	103	274	2190	1076	68	1.10	8.90	73.10	95.10
25680	9	0.900	3.412	9.368	29.992	0.081	0.106	2.389	0.499	0.020	0.218	6.403	276	205	206	294	105	256	2835	1197	58	1.60	10.80	77.00	97.80
25681	13	1.216	3.463	8.494	29.200	0.082	0.125	2.316	0.501	0.019	0.206	6.419	266	196	182	281	114	265	2672	1434	67	1.60	10.10	75.90	95.40
25682	18	1.123	3.441	8.336	28.568	0.079	0.129	2.276	0.493	0.020	0.214	6.353	280	209	231	290	107	252	2768	1410	54	1.20	8.80	72.80	94.30
25683	24	1.116	3.471	8.416	28.589	0.078	0.150	2.297	0.498	0.021	0.185	6.420	291	226	276	291	106	249	2897	1388	47	1.20	9.00	73.40	94.50
25684	30	1.152	3.431	8.220	28.224	0.078	0.172	2.278	0.489	0.020	0.186	6.591	272	179	177	252	107	245	2606	1146	56	0.80	8.70	72.70	93.70
25685	34	1.298	3.370	8.243	28.397	0.087	0.154	2.301	0.500	0.018	0.143	6.458	273	153	236	230	107	288	2078	1285	72	1.60	8.00	70.90	94.30
25686	39	1.785	2.618	8.127	29.131	0.108	0.334	2.147	0.491	0.011	0.093	4.695	223	89	171	123	92	351	877	944	47	2.60	2.60	42.10	94.90
25687	44	1.763	2.598	8.091	29.121	0.106	0.324	2.144	0.502	0.012	0.100	4.694	219	89	170	122	93	363	892	805	39	2.70	2.90	45.60	94.60
25688	49	1.499	3.131	9.568	29.528	0.096	0.401	2.458	0.528	0.017	0.241	6.023	284	213	239	213	99	274	1779	1179	48	1.30	5.90	63.60	99.60
25689	54	1.207	3.468	8.371	28.291	0.080	0.186	2.292	0.495	0.020	0.439	6.364	300	215	292	288	102	251	2663	1240	52	1.50	7.40	69.00	95.00
25690	59	1.194	3.469	8.265	28.222	0.079	0.227	2.269	0.492	0.020	0.222	6.418	289	212	269	296	102	260	2602	1314	45	1.80	7.80	70.10	94.20
25691	64	1.205	3.497	8.212	28.357	0.077	0.246	2.253	0.493	0.020	0.231	6.372	302	233	289	319	103	259	2810	1457	42	2.20	7.80	70.10	94.40
25692	69	1.183	3.491	8.085	28.289	0.075	0.178	2.247	0.488	0.020	0.231	6.452	304	233	290	295	99	239	2640	1256	36	1.60	7.70	69.80	94.10
25693	74	1.192	3.412	8.385	28.421	0.075	0.183	2.276	0.494	0.021	0.173	6.438	296	221	288	272	98	230	2651	1378	38	1.00	7.60	69.60	94.80
25694	80	1.199	3.369	8.339	28.326	0.076	0.239	2.272	0.488	0.020	0.190	6.391	279	201	238	289	99	242	2634	1451	38	1.50	7.30	68.70	94.50
25695	86	1.215	3.373	8.323	28.437	0.079	0.192	2.270	0.491	0.020	0.203	6.251	283	203	243	282	107	261	2613	1437	58	1.70	7.50	69.30	94.50
25696	91	1.391	3.233	8.353	28.609	0.093	0.187	2.259	0.503	0.016	0.154	5.572	267	166	268	223	96	305	1824	1052	39	2.00	6.00	63.90	94.60
25697	96	1.234	3.427	8.307	28.465	0.082	0.124	2.280	0.492	0.019	0.175	6.323	302	194	309	258	104	269	2439	1300	61	1.50	8.30	71.50	94.30
25698	101	1.233	3.368	8.248	28.377	0.083	0.157	2.251	0.491	0.018	0.225	6.195	277	178	252	244	97	276	2345	1235	44	1.60	7.60	69.50	94.20
25699	106	1.259	3.261	8.220	28.622	0.086	0.300	2.232	0.490	0.017	0.228	5.932	284	199	286	256	93	325	2197	1347	35	3.40	7.20	68.30	94.30
25700	111	1.271	3.255	8.313	28.655	0.087	0.174	2.286	0.487	0.016	0.183	5.785	271	147	230	212	101	325	2013	1028	54	1.80	7.20	68.40	94.30
25701	116	1.494	3.189	8.887	28.868	0.098	0.251	2.393	0.526	0.016	0.158	5.895	272	150	232	193	105	298	1554	1134	47	1.50	5.80	62.90	96.80
25702	121	1.514	3.169	9.056	27.879	0.103	0.208	2.487	0.536	0.015	0.153	6.324	287	125	219	178	110	319	1272	789	50	2.40	4.80	58.40	96.30
25703	123	1.617	3.202	9.714	27.132	0.110	0.143	2.694	0.569	0.014	0.150	6.841	311	118	262	172	119	317	1048	828	41	2.80	4.40	56.00	97.30
25704	131	1.599	3.174	10.389	27.905	0.113	0.158	2.810	0.578	0.014	0.148	6.848	302	114	249	166	114	313	1011	879	30	2.80	4.20	54.80	100.30
25705	136	1.661	3.165	9.635	27.144	0.110	0.139	2.687	0.568	0.014	0.145	6.826	304	116	253	170	112	320	1029	960	29	2.90	4.20	55.20	97.22
25706	142	1.682	3.190	9.424	26.972	0.110	0.115	2.660	0.565	0.014	0.142	6.830	297	111	213	163	114	316	1047	984	34	2.80	4.10	54.20	96.60
25707	147	1.686	3.172	9.782	27.201	0.111	0.110	2.705	0.569	0.014	0.141	6.847	310	116	263	167	118	318	1054	1070	39	2.80	4.10	54.20	97.80
25708	151	1.677	3.168	9.720	27.106	0.111	0.109	2.690	0.568	0.014	0.140	6.842	309	121	272	170	113	312	938	657	30	2.80	4.20	55.10	97.40

*CaCO3 calculated from Ca abundances, assuming 0.7% noncarbonate free

NORTHERN GORDA RIDGE W8508AA CORE W6
ELEMENTAL CONCENTRATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	NA %	MG %	AL %	SI %	P %	S %	K %	TI %	CR %	MN %	FE %	CO ppm	NI ppm	CU ppm	ZN ppm	RB ppm	SR ppm	BA ppm	CE ppm	PB ppm	CaCO3 %	SALT %	CL-H2O %	SUM OX %
25941	0	0.891	3.403	8.213	27.698	0.083	0.086	2.036	0.495	0.023	0.485	6.611	324	237	308	233	106	209	2669	1283	41	0.20	9.20	73.90	92.30
25942	2	0.917	3.423	7.855	27.991	0.074	0.095	2.011	0.476	0.023	0.153	6.775	328	213	293	239	100	186	2733	1225	36	0.00	8.80	72.80	92.10
25943	6.5	1.016	3.483	8.100	29.552	0.070	0.114	2.141	0.485	0.024	0.120	6.319	320	251	392	296	106	201	2782	1324	33	0.50	8.30	71.70	95.60
25944	10	0.784	3.465	8.498	29.773	0.069	0.106	2.129	0.485	0.023	0.127	6.262	294	234	293	276	102	208	2732	1232	26	0.90	8.50	72.20	96.20
25945	16	0.845	3.409	8.422	29.524	0.066	0.114	2.142	0.479	0.023	0.130	6.252	299	233	296	278	95	197	2692	1273	19	0.70	8.40	71.80	95.60
25946	20	0.945	3.594	7.928	29.196	0.066	0.131	2.107	0.483	0.023	0.149	6.298	293	238	254	285	101	206	2660	1437	21	0.70	8.90	73.00	94.40
25947	26	0.968	3.609	7.937	28.995	0.066	0.184	2.095	0.478	0.023	0.156	6.335	299	235	279	281	103	200	2583	1412	33	0.80	8.60	72.40	94.20
25948	30	1.065	3.714	7.712	28.503	0.065	0.200	2.081	0.477	0.023	0.152	6.431	281	233	240	281	98	197	2559	1319	19	0.60	9.00	73.30	93.00
25949	36	0.982	3.651	8.312	28.779	0.067	0.200	2.152	0.483	0.023	0.152	6.442	301	233	246	274	104	202	2482	1301	34	0.70	9.20	73.80	94.40
25950	40	1.035	3.632	8.211	28.597	0.067	0.227	2.155	0.481	0.023	0.153	6.411	299	246	295	277	96	199	2602	1262	24	0.70	8.10	71.10	94.40
25951	46	1.045	3.713	8.354	28.704	0.068	0.215	2.186	0.489	0.024	0.138	6.532	309	238	293	264	104	200	2591	1310	33	0.60	9.40	74.40	94.50
25952	50	1.066	3.742	8.461	28.397	0.068	0.197	2.204	0.493	0.024	0.130	6.459	312	244	335	262	104	191	2561	1306	33	0.30	8.70	72.60	94.50
25953	56	1.024	3.733	8.495	28.365	0.067	0.195	2.205	0.493	0.025	0.132	6.539	322	259	371	273	102	193	2528	1304	26	0.60	8.70	72.50	94.50
25954	60	1.007	3.694	8.630	28.578	0.067	0.193	2.221	0.496	0.024	0.145	6.525	296	237	252	290	101	194	2418	1123	29	0.60	9.40	74.20	94.80
25955	66	0.959	3.667	8.760	28.905	0.068	0.139	2.236	0.498	0.024	0.157	6.374	310	250	335	285	106	200	2418	1177	35	0.80	8.20	71.30	96.00
25956	70	1.188	3.658	7.848	27.712	0.066	0.240	2.110	0.486	0.022	0.167	6.387	307	247	280	284	97	204	2474	1323	19	1.00	8.20	71.40	92.20
25957	76	1.006	3.674	8.718	28.893	0.068	0.155	2.262	0.503	0.024	0.159	6.462	313	252	309	267	105	199	2470	1158	43	0.60	7.10	67.90	96.60
25958	80	1.063	3.675	8.405	28.353	0.067	0.229	2.199	0.485	0.024	0.152	6.512	350	270	365	277	89	188	2407	1291	16	0.80	8.20	71.40	94.50
25959	86	1.002	3.687	8.511	28.511	0.068	0.175	2.225	0.495	0.024	0.153	6.425	305	240	287	261	99	186	2415	1211	21	0.40	7.30	68.60	95.30
25960	90	1.087	3.666	8.624	28.481	0.069	0.253	2.246	0.497	0.023	0.139	6.473	310	253	349	263	102	193	2344	1252	36	0.50	7.60	69.70	95.40
25961	96	1.075	3.627	8.599	28.278	0.067	0.305	2.247	0.495	0.023	0.135	6.442	310	245	343	272	108	197	2326	1077	44	0.40	7.20	68.30	95.10
25962	100	1.062	3.644	8.566	28.530	0.068	0.268	2.235	0.493	0.023	0.158	6.439	322	272	320	275	103	195	2364	1258	33	0.30	7.80	70.20	95.20

*CaCO3 calculated from Ca abundances, assuming 0.7% noncarbonate Ca

NORTHERN GORDA RIDGE W8508AA CORE W9
ELEMENTAL CONCENTRATIONS (SALT AND CARBONATE FREE)

NO.	DEPTH	NA %	MG %	AL %	SI %	P %	S %	K %	TI %	CR %	MN %	FE %	CO ppm	NI ppm	CU ppm	ZN ppm	RB ppm	SR ppm	BA ppm	CE ppm	PB ppm	CaCO3 %	SALT %	CL-H2O %	SUM OX %
25894	0	0.918	3.464	8.246	28.384	0.084	0.106	2.012	0.497	0.024	0.361	6.506	309	231	313	230	96	198	2768	1161	22	0.00	8.60	72.40	93.80
25895	3	0.988	3.487	8.100	28.730	0.070	0.101	2.027	0.485	0.024	0.097	6.508	303	229	302	275	98	191	2802	1163	21	0.10	7.90	70.40	94.30
25896	9	0.964	3.531	9.060	29.449	0.069	0.100	2.247	0.507	0.024	0.099	6.391	296	242	320	290	102	197	2750	1531	38	0.30	7.90	70.60	97.50
25897	13	1.032	3.694	8.758	28.801	0.068	0.080	2.231	0.509	0.025	0.097	6.730	292	230	245	257	97	181	2610	1351	21	0.10	8.00	70.70	96.40
25898	19	1.055	3.653	8.508	28.281	0.068	0.093	2.214	0.509	0.025	0.101	6.390	313	227	266	278	98	183	2506	1118	25	0.20	7.00	67.60	94.90
25899	23	1.097	3.635	8.502	28.425	0.068	0.090	2.223	0.514	0.024	0.100	6.410	291	229	273	278	102	198	2462	1095	31	0.60	7.20	68.40	95.20
25900	29	1.115	3.572	8.414	28.304	0.068	0.092	2.191	0.507	0.024	0.098	6.363	292	223	266	253	106	195	2454	1227	44	0.20	6.60	66.40	94.90
25901	33	1.124	3.620	8.517	28.310	0.069	0.094	2.208	0.515	0.024	0.101	6.379	304	233	287	270	101	196	2348	1165	38	0.40	6.80	67.00	95.10
25902	39	1.016	3.740	8.465	28.184	0.072	0.091	2.194	0.512	0.024	0.104	6.676	336	255	322	271	96	214	2121	1357	21	1.90	7.40	69.00	94.90
25903	43	1.067	3.730	8.505	27.899	0.071	0.094	2.222	0.512	0.024	0.105	6.697	315	245	278	259	99	217	2116	1278	29	1.80	7.30	68.80	94.60
25904	49	1.025	3.649	8.390	27.549	0.071	0.097	2.207	0.498	0.023	0.104	6.676	309	235	266	244	101	211	2036	1006	27	1.60	6.60	66.30	93.70
25905	54	1.022	3.666	8.713	27.515	0.074	0.090	2.243	0.512	0.024	0.102	6.481	302	223	245	233	104	233	1795	983	32	2.30	7.60	69.50	93.60
25906	58	1.044	3.648	8.750	27.620	0.075	0.093	2.259	0.512	0.024	0.101	6.447	297	221	246	224	104	243	1879	1046	29	2.70	7.10	68.10	94.10
25907	61	1.074	3.648	8.594	27.892	0.075	0.073	2.249	0.500	0.023	0.103	6.755	320	228	321	223	100	258	1950	1345	19	3.30	7.90	70.30	94.50
25908	66	1.066	3.617	8.945	28.027	0.076	0.117	2.306	0.513	0.022	0.110	6.491	315	235	311	230	104	291	1903	1212	28	4.40	7.10	67.90	95.50
25909	70	1.070	3.650	8.911	28.102	0.076	0.167	2.301	0.509	0.022	0.115	6.738	316	218	232	225	101	287	1927	1180	27	4.40	7.90	70.40	95.60
25910	76	1.027	3.622	8.903	27.960	0.077	0.139	2.272	0.515	0.022	0.117	6.637	340	227	282	243	103	283	1904	1137	34	4.50	7.40	68.90	95.30
25911	81	1.032	3.563	8.771	27.571	0.078	0.142	2.274	0.519	0.021	0.120	6.615	330	232	337	240	105	303	1851	1204	35	5.10	7.40	69.00	94.20
25912	86	1.019	3.659	8.829	27.545	0.079	0.149	2.267	0.528	0.022	0.119	6.568	323	232	340	235	107	344	1906	1462	33	6.80	8.10	71.10	94.10
25913	91	1.017	3.662	8.569	27.509	0.079	0.251	2.238	0.515	0.022	0.126	6.774	320	222	302	224	100	383	1760	1181	23	8.70	8.10	71.00	93.90
25914	97	1.043	3.662	8.643	27.595	0.079	0.236	2.241	0.525	0.020	0.122	6.695	318	216	270	210	108	410	1682	1113	38	9.20	9.30	74.10	93.60
25915	103	1.129	3.405	8.565	27.251	0.082	0.170	2.289	0.538	0.019	0.116	6.581	315	196	303	190	110	396	1612	1255	31	8.80	8.30	71.50	92.80
25916	108	1.126	3.378	8.713	27.526	0.085	0.177	2.311	0.542	0.017	0.110	6.608	324	184	301	179	108	447	1512	1395	42	10.80	7.70	69.90	94.00
25917	112	1.199	3.473	8.769	27.583	0.080	0.098	2.234	0.531	0.020	0.113	6.257	302	189	304	198	100	390	1668	1394	26	8.40	6.50	66.00	94.30
25918	118	1.372	3.001	8.637	27.606	0.086	0.099	2.279	0.560	0.014	0.097	6.453	315	134	265	156	106	332	1074	1221	37	5.80	5.70	62.50	94.10
25919	122	1.584	2.601	9.070	29.093	0.094	0.125	2.236	0.576	0.012	0.097	5.792	280	124	273	143	94	316	838	854	30	4.60	4.30	55.70	97.20
25920	127	1.700	2.347	8.880	29.431	0.100	0.149	2.152	0.585	0.011	0.097	5.188	264	113	239	127	93	331	833	1056	32	4.20	3.80	52.10	96.60
25921	133	1.197	3.324	9.108	27.552	0.087	0.133	2.240	0.545	0.017	0.637	6.052	313	182	333	188	101	497	1505	1209	40	13.10	6.90	67.20	95.10
25922	137	1.165	3.358	8.769	27.571	0.081	0.217	2.269	0.538	0.018	0.166	6.364	325	195	319	192	100	468	1452	1200	22	12.10	7.20	68.20	94.20
25923	140	1.212	3.221	8.842	27.734	0.082	0.162	2.298	0.540	0.016	0.142	6.197	318	195	335	187	106	471	1476	1190	21	12.40	6.70	66.60	94.40
25924	143	1.140	3.189	8.648	27.467	0.083	0.175	2.274	0.532	0.017	0.137	6.510	326	191	331	178	100	449	1501	1245	19	10.90	6.80	66.80	93.70
25925	147	1.169	3.279	8.874	27.721	0.083	0.167	2.309	0.539	0.017	0.135	6.172	317	195	334	183	104	467	1529	1166	21	11.50	6.90	67.50	94.30
25926	152	1.163	3.458	8.788	27.506	0.080	0.224	2.253	0.532	0.018	0.128	6.341	329	207	346	181	100	468	1610	1157	26	11.50	7.40	68.90	94.00
25927	156	1.160	3.490	8.617	27.205	0.080	0.204	2.175	0.515	0.019	0.129	6.467	344	217	347	184	97	501	1711	1187	26	12.50	7.30	68.50	93.30
25928	162	1.153	3.636	8.700	27.808	0.081	0.270	2.260	0.521	0.020	0.130	6.914	363	240	410	209	103	452	1748	1356	39	10.80	7.70	69.70	95.30
25929	166	1.128	3.575	8.599	26.927	0.075	0.235	2.170	0.516	0.020	0.152	6.690	343	224	331	208	105	427	1704	1254	37	9.70	7.50	69.20	92.90
25930	172	1.177	3.631	8.922	27.508	0.077	0.224	2.236	0.523	0.021	0.120	6.680	321	217	342	194	110	384	1657	1173	49	7.70	7.30	68.60	94.80
25931	176	1.147	3.569	8.977	27.652	0.074	0.235	2.245	0.530	0.020	0.122	6.676	341	230	366	191	101	331	1645	1247	24	5.80	7.30	68.50	95.00
25932	182	1.208	3.489	8.935	27.636	0.078	0.080	2.233	0.531	0.020	0.119	6.150	317	212	353	188	99	387	1687	1190	21	7.90	6.00	63.80	94.80
25933	186	1.004	3.533	10.027	28.860	0.078	0.338	2.347	0.527	0.021	0.121	7.077	329	214	298	191	92	340	1692	1106	19	6.90	8.10	70.90	99.30
25934	192	1.230	3.588	8.927	27.820	0.078	0.293	2.215	0.532	0.020	0.127	6.547	331	216	314	197	98	341	1669	914	28	6.00	7.50	69.40	95.00
25935	196	1.290	3.601	8.947	27.817	0.081	0.228	2.170	0.550	0.019	0.138	6.477	324	225	324	197	94	351	1583	1219	28	6.40	7.20	68.30	95.20
25936	202	1.170	3.645	9.021	27.754	0.075	0.243	2.221	0.533	0.021	0.142	6.342	327	241	314	207	101	357	1725	1316	33	7.00	7.80	70.20	94.00
25937	206	1.228	3.601	9.076	28.122	0.075	0.235	2.239	0.537	0.021	0.147	6.542	323	247	318	208	96	316	1678	1049	25	5.70	8.10	71.10	95.70
25938	212	1.205	3.543	8.963	27.732	0.074	0.152	2.216	0.535	0.021	0.139	6.375	317	224	322	193	96	314	1665	1087	23	5.40	6.40	65.60	95.10
25939	216	1.206	3.587	9.033	27.854	0.072	0.297	2.211	0.541	0.022	0.129	6.796	319	220	265	177	90	254	1570	998	18	3.30	8.10	70.90	95.20
25940	220	1.210	3.515	8.884	27.430	0.072	0.205	2.203	0.530	0.021	0.127	6.434	315	224	318	191	95	301	1622	1133	28	5.10	6.70	66.70	94.00

*CaCO3 calculated from Ca abundances, assuming 0.7% noncarbonate Ca