CRUISE REPORT

Geochemical Evaluation of Deep Sediment Hydrate Deposits on Alaminos Canyon, Block 818, Texas-Louisiana Shelf

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I. OVERVIEW

The project was designed to initiate characterization of deep sediment methane hydrates in the Alaminos Canyon, Block 818, on the Texas-Louisiana Shelf in the Gulf of Mexico. Work included the gathering of geochemical and fluid migration data as well as bacteria samples in a cold seep environment as part of the Seep and Methane Hydrate Advanced Research Initiative (ARI) model development. Fieldwork planning integrated a preliminary geochemical survey for the Chevron-Texaco Joint Industry Program (JIP) drilling on Alaminos Canyon, Block 818 with the NRL ARI on shallow sediment methane seeps. Data acquired during this survey supported both program goals. Locations for field sampling and data collection were based on seismic profiles provide by WesternGeco after review by WesternGeco, NRL, NETL and MMS geophysists and geochemists (Appendixes 1). The NRL data will be compared with evaluation of this region for deep drilling conducted by the JIP to further develop the use of seismic and geochemical data to conduct preliminary site characterization of deep sediment hydrate deposits. The NRL program addresses biogeochemical cycling of methane in shallow sediments.

Data from this survey provide a preliminary shallow porewater geochemical prediction of possible deep sediment methane for hydrate exploration. Geochemical profiles in shallow sediment porewaters were used for spatial comparison of vertical methane flux (advection and diffusion). Heat flow, profiles indicative of vertical fluid migration, was coupled with geochemical profiles to contribute to interpretation of the vertical methane flux. This report provides a preliminary data overview. With analysis of all of the samples taken during this cruise, project objectives relative to the JIP include:

1. Determine porewater gas source(s) in sub-samples from piston cores.
2. Estimate the vertical methane flux in terms of the sulfate-methane interface (SMI) and sulfate gradients.
3. Provide supporting data on vertical methane flux with comparison of chloride, sulfide, dissolved inorganic carbon (DIC), and δ^{13}C DIC analysis of porewater.
4. Integrate data interpretation with seismic, heat flow and geochemical data.

Research objectives related to the NRL ARI include:

1. Assess the influence of deep ocean waters on vertical methane fluxes.
2. Study the shallow biogeochemical cycling of deep sediment methane.
3. Relate the vertical methane flux to horizontal and vertical variation in the microbial community diversity.
4. Characterize this region for methane seeps into the water column.

II. INTRODUCTION

Currently, preliminary evaluation of deep sediment hydrate beds is accomplished using seismic surveys to define zones with strong bottom simulating reflectors (BSRs) of acoustic velocity transitioning through sediment and into free gas. The first observed correlation between BSR and gas hydrate was in seismic data collected at Blake Ridge. This finding was further studied using single and multichannel seismic measurements to summarize BSR profiles for prediction of hydrate reservoirs. Recent research in methane hydrate exploration off the mid-Chilean Margin and Atwater Valley in the Gulf of Mexico coupled seismic data with heat flow data and pore water geochemical profiles to provide a thorough evaluation of methane cycling. Conflicting geochemical and seismic data over strong seismic blanking regions indicate a need to combine these parameters for deep sediment gas hydrate surveys.

The biogeochemical cycles in shallow sediment over methane hydrate beds are active in response to upward vertical methane diffusion and advection from deep sediments, and the downward diffusion of sulfate from seawater. The interface between upward methane diffusion and downward sulfate diffusion is known as the sulfate methane interface (SMI)[1]. At the SMI anaerobic oxidation of methane (AOM) can occur resulting in the oxidation of methane and reduction of sulfate. These coupled metabolic processes are commonly conducted via a synthropic consortium of archaea and bacteria. Anaerobic oxidation of methane is the dominant process responsible for methane oxidation in oceanic sediments around the world.

This expedition on Alaminos Canyon was planned to combine porewater geochemical profiles with thermal gradients and seismic surveys to assess potential deep sediment gas and gas hydrate distribution at and around a seafloor seep. Basic research on microbial community diversity and sulfate and methane cycling was coupled with this field survey. Also pursuant to JIP needs, coring and thermometry in this area was planned to help quantify the lateral variability of flux. A highly variable seafloor flux regime may require closely spaced drill holes to achieve ultimate JIP goals of characterizing the gas hydrate accumulation at this site. The coring and thermometry from this expedition will provide valuable guidance in generating a JIP drilling plan.

III. CRUISE PARTICIPANTS

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[1] SMI (sediment-methane interface) and SMT (sediment-methane transition) are referenced in different publications. Data interpretation for analysis of SMI and SMT are the same.

IV. SITE DESCRIPTION

The Alaminos Canyon (AC), Block 818 (Figure 1) is located in the northwestern Gulf of Mexico off the Texas Deltas with dominant coastal input beyond the base of the slope fan. This site is in the Perdido Fold Belt and contains oil accumulations in a variety of turbidite deposits from sand sheets to amalgamated and leveed channel systems (Meyer et al. 2005). Recent surveys of this area conducted in ROV and manned submersible sub dives found locations for chemosynthetic communities at the sediment water column interface[2].. Seismic reflection maps indicate a series seeps that manifest themselves along the region which is characterized by subtle differences in reflection amplitude that are likely a result of high concentrations of sand below a 10 m thick pelagic drape. The seeps are located along a small ridge associated with the up-thrown side of a fault. No gas chimneys are visible in 3-D seismic data. Sediment piston coring and heat flow probing was conducted around the AC 818 well where sonic and resistivity logs used to estimate depth at the base of gas hydrate stability indicate a thick 5 to 50 meters of hydrate laden, sand-rich sediment. Because the well exists in an area of seafloor seeps, characterizing these seeps (quantifying the nature of fluid and methane flux) is the best way to estimate the flux associated with the suspected occurrence of gas hydrates. Chemical and thermal gradients can be used as inputs (boundary conditions) to finite element models of seafloor fluid flux. This study site, in contrast to another recent site in the Gulf of Mexico, Atwater Valley site, is closer to shore in the proximity of the Mississippi Fan fold belt. The belt runs 300 km eastward across a 50 km wide path and contains basinward-verging anticlines and underlain southern verging thrust faults. Fold strata were formed during the Late Jurassic to the Miocene geologic periods and in some regions are influenced by salt tongues and sheets that may reduce hydrate stability and increase the rate of vertical methane flux to the shallow sediment (Coffin et al., 2008).

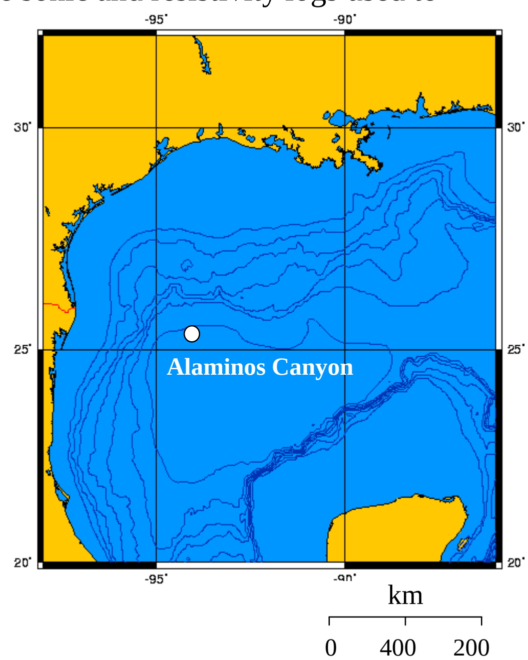


Figure 1. Alaminos Canyon Block 818 location relative to coastal slope fans.

Field work was conducted on board the *RV Cape Haterass* with site selection based on seismic profiles provided by WesternGeco and reviewed by MMS, USGS, NRL, and WesternGeco. Sediment piston coring and heat flow probing was conducted across seismic inlines 986, 1006, 1016, 1026 and 1046 (Figure 2). Selection of the crosslines was based on seismic patterns indicating strong bottom simulating reflection (BSR) and potential vertical fluid migration as well as other information provided by recent surveys in this region. The daily log for field work during this cruise is outlined in Appendix 2.

[2] http://www.oceanexplorer.noaa.gov/explorations/07mexico/welcome.html

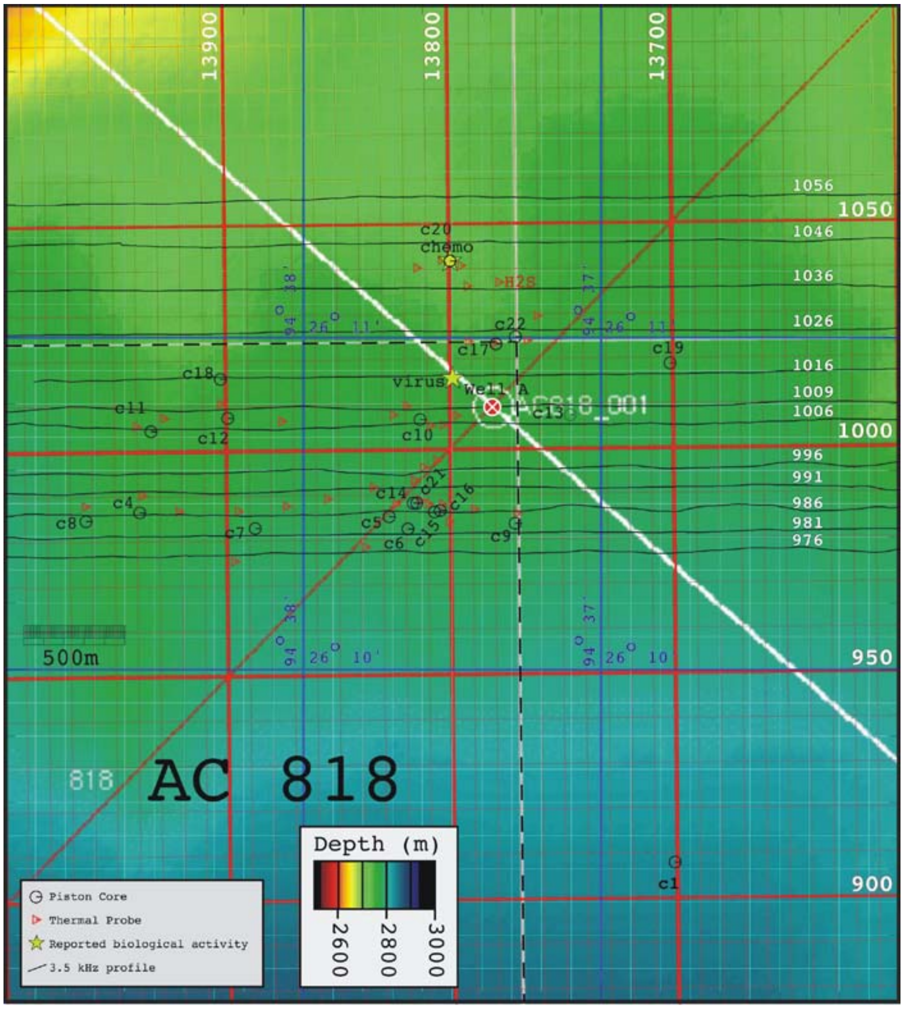


Figure 2: Piston core and heat flow locations along the seismic inlines 986, 1006, 1016, 1026 and 1046. Inline and crossline sample points are converted to latitude and longitude in Table 2.

V. METHODS

A. Acoustic Profiling

Acoustic profiles at 3.5 and/or 12 kHz were collected on a grid through the study region on inlines 986, 1006, 1016, 1026 and 1046. Selection of the piston core and thermal probe locations were determined on board with comparison of this acoustic profiling and the seismic images provided by WesternGeco.

B. Acoustic Positioning

An NRL Sonardyne USBL was used to provide acoustic positioning on all thermal probe deployments and on all but one piston core deployments. Several pre-mature piston core drops in the water column damaged the brackets holding the acoustic transponder to the cable so brackets belonging to the ship were refit to the NRL transponder. On subsequent deployments, the transponder was attached 200-300m above the core head instead of 100m. On the thermal probe deployments the transponder was attached 300-400 m above the weight stand. This instrument provided improved accuracy in positioning as deep currents were responsible for drifts of up to 130 m from the ship‘s position on the surface. The Hatteras was able to maneuver within a range of 10 to 40 m in the range of the acoustic positioning.

C. Piston Coring

The piston coring system provided by Milbar (R. Downer) had been designed to collect samples within the hydrate stability zone. The core weight was approximately 3,000 lbs. The system includes trigger assemblies, trigger weights, wire terminations, piston immobilizers and specially designed N-80 alloy core barrels complete with modified Atlas Bradford connections. Two or three, 3 m core barrels lined with 3” diameter polycarbonate liners were used for each deployment. The safety trigger design for the system was developed by Milbar. Trigger weights were set initially at 12 - 15 meters. Typical core penetration depths were between 6-7m.

D. Shipboard Laboratory Analysis

A thorough presentation of instruments installed for geochemical analysis on the research vessel is available for cruise reports of research conducted of the mid Chilean Margin, Atwater Valley in the Gulf of Mexico and the Hikurangi Margin off New Zealand (Coffin et al., 2006; 2008; 2007). The following text is a brief summary of the on board geochemical laboratory analyses.

1. Porewater Press Loading and Squeezing – After recovery, cores were placed horizontally on deck. Core liners were removed and cut in 10 cm sections at 25 to 45 cm intervals. Sampling intervals were selected based upon observations of dark (black) sediment and hydrogen sulfide odor (observational indicators of sulfide production associated with the SMT) and the appearance of core gas pockets. Fewer samples were taken toward the sediment-water interface and resolution was increased toward the suspected depth of the SMT. On average, 20 sediment sections were sampled from each core. Sediment plugs were immediately collected from each section in a 3 ml polyethylene syringe with the end cut off, and transferred to pre-weighed 20 ml serum vials to measure the headspace CH_4 concentrations (Hoehler et al., 2000). Whole round core sections were then taken to the ship wet laboratory for processing. Approximately 5 g of wet sediment from each section were collected in pre-weighed 31-mm snap-tight Petri-dishes and frozen for measurements of sediment porosity and percent organic carbon. Immediately after the subsample collection, porewater was pressed from the remaining sediment from each section using 70 ml Reeburgh-style PVC press containers pressurized to ~400 KPa (~60 psi) by low-pressure air applied to a latex sheet placed between the core sections and press gas inflow. Porewater was pre-filtered through Grade 1 Qualitative Filter Paper into gas-tight 60-ml polypropylene syringes. It was subsequently filtered through 0.2-μm Acrodisc PES syringe filters (Pall) into ashed (4 h at 450°C) 20 ml vials and dispensed into 1-10 ml ashed vials for analysis. Pressed sediment was wrapped in ashed aluminum foil and stored frozen at -20°C during transport to the land-based laboratory.

2. Sulfate and Chloride Concentrations – Porewater sulfate and chloride concentration were measured with a Dionex DX-120 ion chromatograph equipped with an AS-9HC column, Anion Self-Regenerating Suppressor (ASRS Ultra II), and an AS-40 autosampler. Samples were diluted

1:50 (vol/vol) prior to analysis and measured using standard solutions referenced against a1:50 diluted IAPSO standard seawater (28.9 mM SO_4^{-2}, 559 mM Cl^-). Analytical precision was ±1% of the reference standard. Chloride concentrations lower than values measured in seawater were used to indicate porewater freshening due to hydrate dissociation in the core. The measured porewater sulfate gradient and depth of depleted sulfate concentrations (limits of detection ~0.1 mM) were used to predict the depth of the SMI.

3. Pore Water Methane Concentrations – Methane concentrations were determined from 3-ml sediment plugs using headspace techniques and were quantified against certified gas standards (Scott Gas, Plumbsteadville PA). Headspace analysis was performed on board using a GC-FID Shimadzu GC-14A gas chromatograph equipped with a Hayesep 0.80/100 column. Methane concentrations are presented in millimolar units (mM).

4. Pore Water DIC Concentrations – Porewater DIC concentrations were measured using a UIC CO_2 coulometer and standardized to a certified seawater reference material (University of California, San Diego, CA). Conversion of DIC to CO_2 and separation from interfering sulfides was conducted according to Boehme et al. (1996).

E. Land Based Laboratory Analysis

1. Sediment Porosity – Frozen samples (~5-6 g) were thawed and allowed to equilibrate to room temperature. Samples were then weighed wet and placed in a drying oven (~50-60˚C) for 24-48 hours. Samples were weighed again after drying. Sediment water content was determined by the difference between wet and dry weight, assuming constant pore water (ρ_{pw}) and bottom water (ρ_{sw}) density, and porosity profiles were then determined using the following equation:

$$\text{Porosity } (\phi) = \rho_{sm}WC \text{ x } [1/(\rho_{sm}WC + \rho_{pw} (1\text{-}WC)]$$

Where:

Assumed solid matter density (ρ_{sm}) = 2.50 g/cm^3

2. Sediment Geological Summary – Sediment geological surveys from piston cores were conducted by Kelly Rose at NETL. Lithostratigraphic and subsea geologic evaluation was conducted onboard and in the laboratory. These data will be used to construct a detailed geologic and lithostratigraphic framework for the region and each coring site. Shipboard sedimentology techniques and procedures will include detailed visual core descriptions to help constrain the detailed lithostratigraphy. In the laboratory targeted xrd/xrf analyses, and smear slide and coarse fraction descriptions are used to identify the mineral and biogenic composition of sediments from major and minor lithologies. Sediment subsamples are also collected for particle size analyses correlative with the major and minor lithology sedimentology sample sites. These data contribute to the detailed geologic interpretation at each site and, when integrated with geophysical and other core sample analyses, help identify the geologic controls and constraints on carbon sources and cycling in the region. Geological data are in Appendix 5.

3. Porewater Cation Analysis – Major cation concentrations (Na^+, Ca^{+2}, Mg^{+2}, K^+) were measured in sediment porewater in the laboratory using a Dionex DX-120 ion chromatograph

equipped with an AS-40 autosampler. A 20mM methanesulfonic acid (CH_3SO_2OH) eluent was used with a CS-12 column and a Cation Self-Regenerating Suppressor (CSRS Ultra II) at a flow rate of ~ 0.7 ml/min. Samples were diluted 1:50 (vol/vol). Calibration standards were prepared in the laboratory and diluted (1:50) IAPSO standard seawater was used as a reference standard. Analytical precision was ± 2-3%. (Cation data will be presented in subsequent manuscripts. The data are not included in this report. Contact Joseph Smith (joseph.smith@nrl.navy.mil).)

F. Seismic Data Interpretation

Seismic blanking on seismic reflection records can indicate the presence and relative concentration of methane hydrates above the BSR. The BSR is not always present and an absence does not exclude the presence of methane hydrates. Regions of strong "wipe out or amplitude blanking" of acoustic signature often occur above the BSR. Blanking or reduction of amplitude of the acoustic reflectors above the BSR may indicate the presence of gas hydrates in the pore space which can act as a cement that reduces the velocity and density contrasts between the various strata and thus lessens the intensity of the return. Gas hydrate in sediments acts as a higher velocity material for seismic transmission relative to sediment filled with porewater. When water is preferentially replaced with hydrate, velocity becomes near or equal that of the adjacent, faster strata and thus eliminates the acoustic impedance contrast and any reflection at the strata boundary. More ill-defined BSRs reflect the subsequent dissociation of the methane hydrate and the upward migration of methane gas, especially along existing faults or stratigraphic pinchouts. Areas of seismic blanking above the BSR may reflect methane hydrate accumulations. With this interpretation of seismic profiles, methane hydrate formation is assumed within the HSZ where T and P conditions are at stable conditions. Vertical migration of gas will preferentially occur along faults, and will reach the sea floor where these faults extend upwards and intersect it. For preliminary seismic data interpretation four different features were surveyed; 1) a high amplitude reflector located above the BSR; 2) the BSR; 3) zones of amplitude blanking above the BSR; and 4) zones of amplitude blanking below the BSR containing varying amounts of free gas in the pore spaces.

G. Heat Flow

Thermal data collected in the upper few meters of the seafloor using a heat flow instrument has proven to be reliable for a proxy for fluid flow and helps define the limits of active flows around methane seeps and mud volcanoes associated with methane seeps and hydrates. The heat flow instrument used was a 3.5-meter-long "violin bow" or "Lister-type" instrument (Figure 3) consisting of eleven thermistors arranged 30 centimeters apart in a 1-cm-diameter tube held in tension parallel to a solid steel strength member. There was also a temperature sensor mounted on the top of the weight stand which recorded the water temperature near the sediment-water interface. The system measures both the temperature gradient and thermal conductivity in-

Figure 3: Lister-type heatflow probe.

situ. Sediment temperatures were calculated from the decay of the frictional heat caused by penetration of the instrument into the sediment. Thermal conductivity was determined from the decay of a calibrated thermal pulse applied after a preset period of time. Heat flow values were determined at each station by computing thermal resistance values at each thermistor,

$$R = \int (1/\lambda)\, dz,$$

where λ is the thermal conductivity. In a situation of steady-state conductivity the heat flow is equal to the slope of the line on a Bullard Plot, a plot of temperature vs. thermal resistance. For each station, any non-linear data that might be attributed to bottom water warming were removed so as not to bias the statistics. A heat flow value was determined from the slope of the linear regression fit to the remaining data. All heat flow values were corrected for instrument tilt. High resolution transects were done over the seeps and mounds to get an accurate summary of elevated thermal signatures. Stations were typically set no more than 100 meters apart to allow for the distinction of local fluid flow variations as opposed to those associated with the lateral distribution of seafloor seeps. Data showed clear anomalies in sediment temperature and heat flow associated with the mounds and seeps.

VI. RESULTS

A. Seismic Data Overview

As previously stated, Alaminos Canyon seismic data were provided by WesternGeo, Inc. to assist in the selection of porewater geochemistry and heat flow sample. In the seismic profiles, the base of the gas hydrate (solid phase) stability field is assumed to manifest as a bottom simulating reflector (BSR). Regions of high-amplitude acoustic reflectors often occur beneath the BSR. Enhanced reflection signal strength below the BSR appears to be caused by strong acoustic impedance contrasts due to the presence of free gas. Our approach for identifying methane hydrates and free gas in this area is similar to the approach used in other margins. The BSR seen in the seismic data is used as a first indicator of the regional base of hydrate stability. We assume that the methane transport responsible for the emplacement of methane at and around the BSR is diffusion dominated with linear geothermal profiles. Where the geothermal profiles are non-linear we expect a locally advective system, with a decreased depth to free gas, higher overall concentrations CH_4 and elevated sulfate SO_4^{-2} gradients in sediment porewater recovered from shallow piston cores.

Various features in the sub-bottom strata were identified and delineated with visual reviews (Figures 4-8). Immediately recognizable and present from one seismic profile to another were the sea floor, BSR's, major subbottom-anticlinal folds, faults, areas of seismic blanking (greatly reduced amplitude), and high amplitude reflectors. An anticlinal fold is recognizable below the BSR in the inline 986 seismic profile as well as in the four other west-east transects. The existence of a seismic wipeout on western limb of each crossing of the anticline suggests the source of methane above the basal BSR is towards the west in the adjacent syncline (Figure 4). The presence of methane gas in the eastern end of each profile is also interpreted, although the absence of severe faulting may have helped trapped this gas at the very strong BSR and limited its vertical assent. The presence of faults above the western limb of the anticline and possible existence of an additional, shallow BSR suggests upward migration of gas and/or fluids from depth and subsequent accumulation of hydrate in the region above basal BSR. This shallower BSR may be an example of a "perched" BSR. This suggests that the base of hydrate stability zone may have a significant temporal component.

The seismic lines parallel to line 986 cuts cross the same anticlinal feature, although the anticline plunges to the south on successive profiles from 1046 towards 986 (Figures 4 to 8). The seismic wipeout on the western limb of each crossing is again observed, as are numerous faults with vertical offsets, possible perched and relict BSRs, areas of apparent seismic blanking, and other high amplitude reflectors. The depth to the BSR is deeper on the eastern side of the anticline on each profile suggesting far less extensive faulting in the east, so the interpretation of methane hydrate and free gas is relatively easier on the eastern ends of the five profiles. We expect free gas exists beneath the very clearly defined BSR. Within the sedimentary sequence above this BSR there are areas of apparent seismic blanking interspersed with weak seismic reflectors. We expect methane hydrate to be present (in at least small amounts) above the BSR at various depths, with variable lateral extent, and therefore variable total volumes. This semi-quantitative overview of the seismic profiles was made with the interpretation of subsequent heat flow and porewater geochemical profiles. On the western limb of this anticlinal feature, crossed on lines 986, 1006, 1016, 1026 and 1046, free gas is present closer to the present ocean floor and might occur beneath both the perched BSR and the deeper BSR. We expect ethane hydrate accumulations should occur within the shallow sequence above the perched BSR and between the perched and deeper BSRs. Accumulations of free gas are predicted to be larger and more localized in the west but the presence of buried faults must be taken into consideration as they provide the avenues for the vertical migration of the free gas.

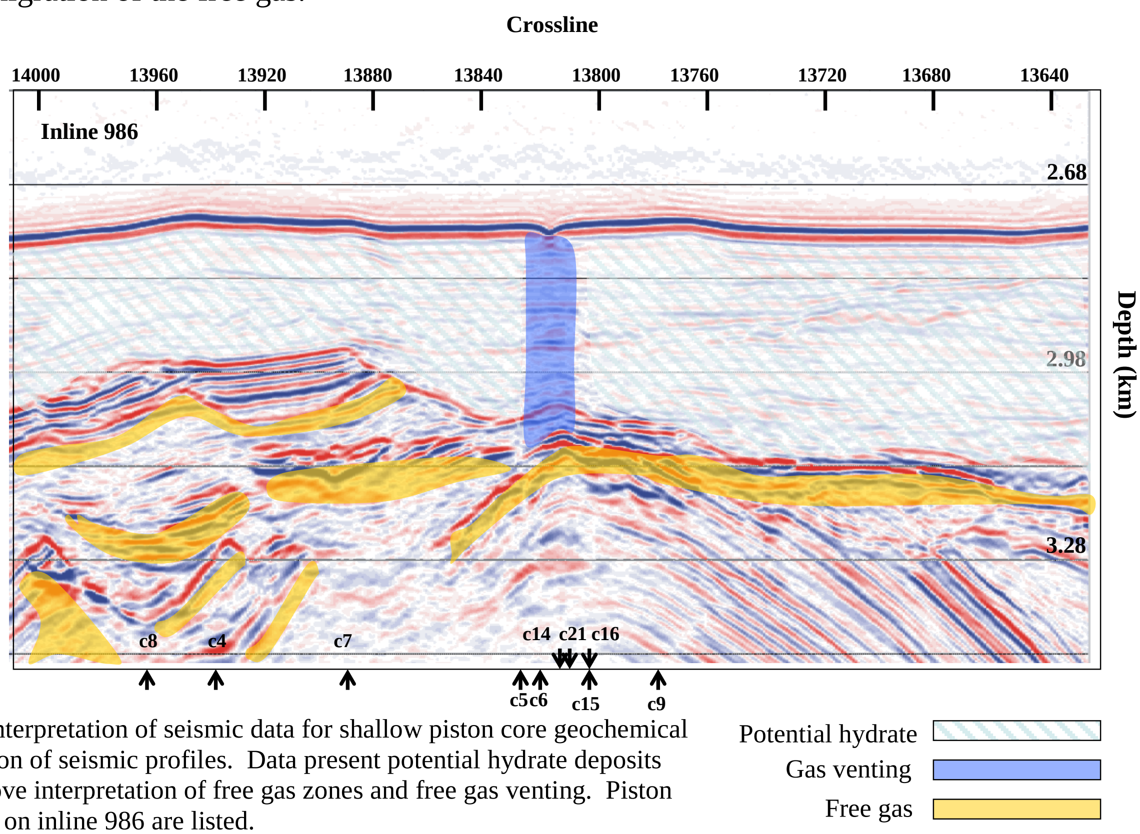


Figure 4: Interpretation of seismic data for shallow piston core geochemical interpretation of seismic profiles. Data present potential hydrate deposits located above interpretation of free gas zones and free gas venting. Piston core points on inline 986 are listed.

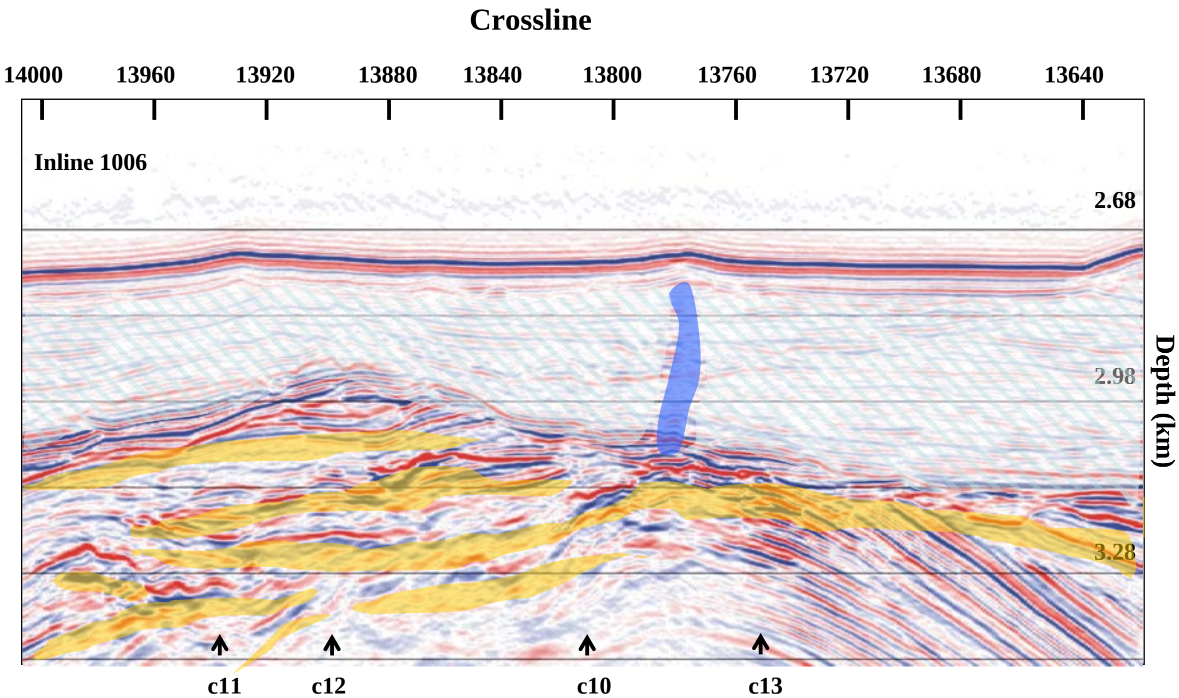


Figure 5: Interpretation of seismic data for shallow piston core geochemical interpretation of seismic profiles. Data present potential hydrate deposits located above interpretation of free gas zones and free gas venting. Piston core points on inline 1006 are listed.

Potential hydrate
Gas venting
Free gas

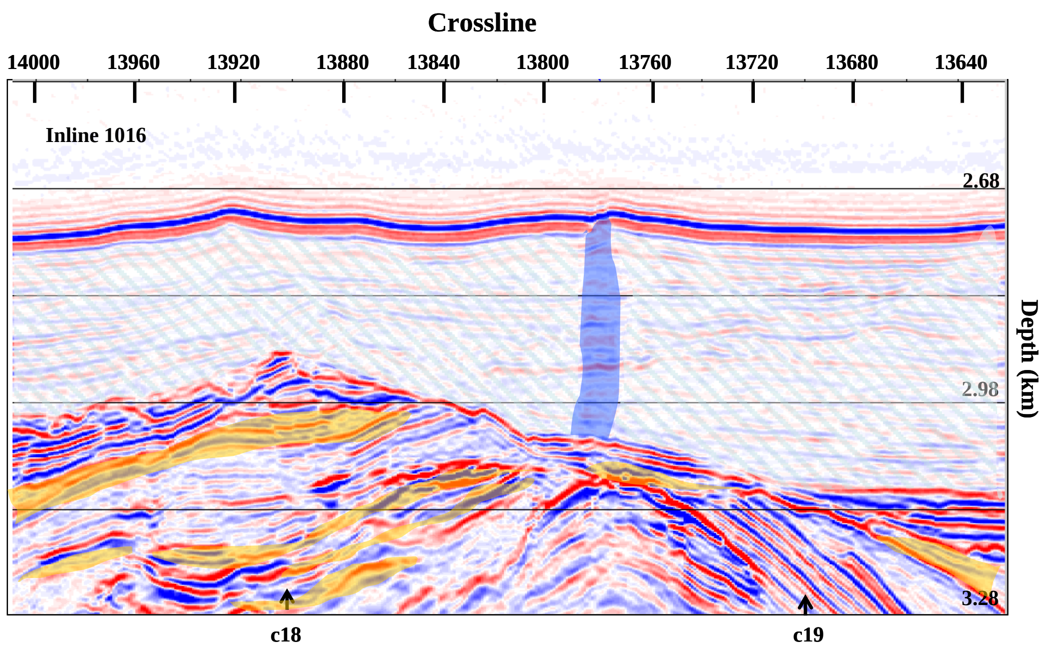


Figure 6: Interpretation of seismic data for shallow piston core geochemical interpretation of seismic profiles. Data present potential hydrate deposits located above interpretation of free gas zones and free gas venting. Piston core points on inline 1016 are listed.

Potential hydrate
Gas venting
Free gas

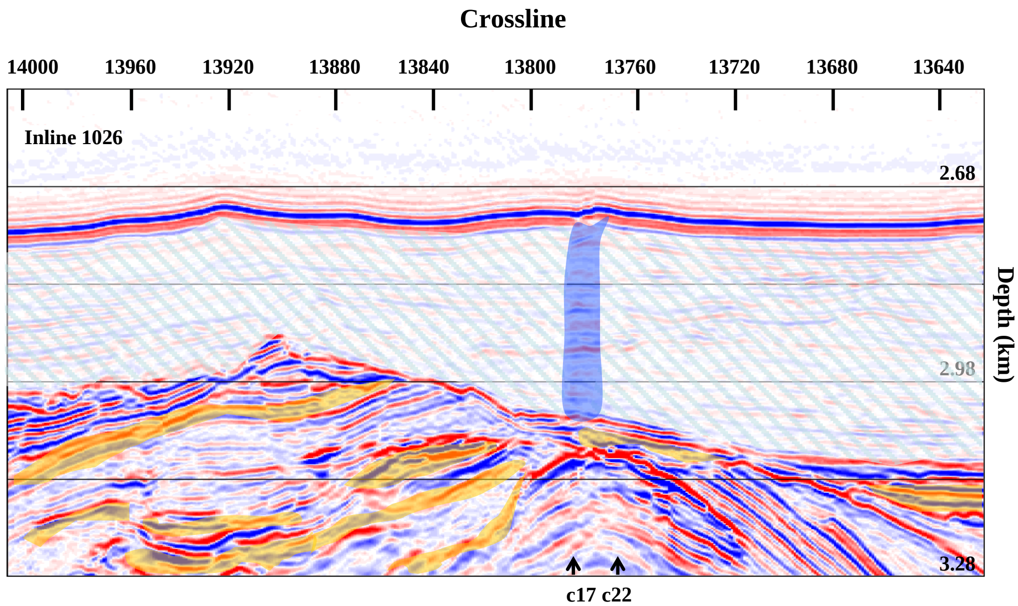


Figure 7: Interpretation of seismic data for shallow piston core geochemical interpretation of seismic profiles. Data present potential hydrate deposits located above interpretation of free gas zones and free gas venting. Piston core points on inline 1026 are listed.

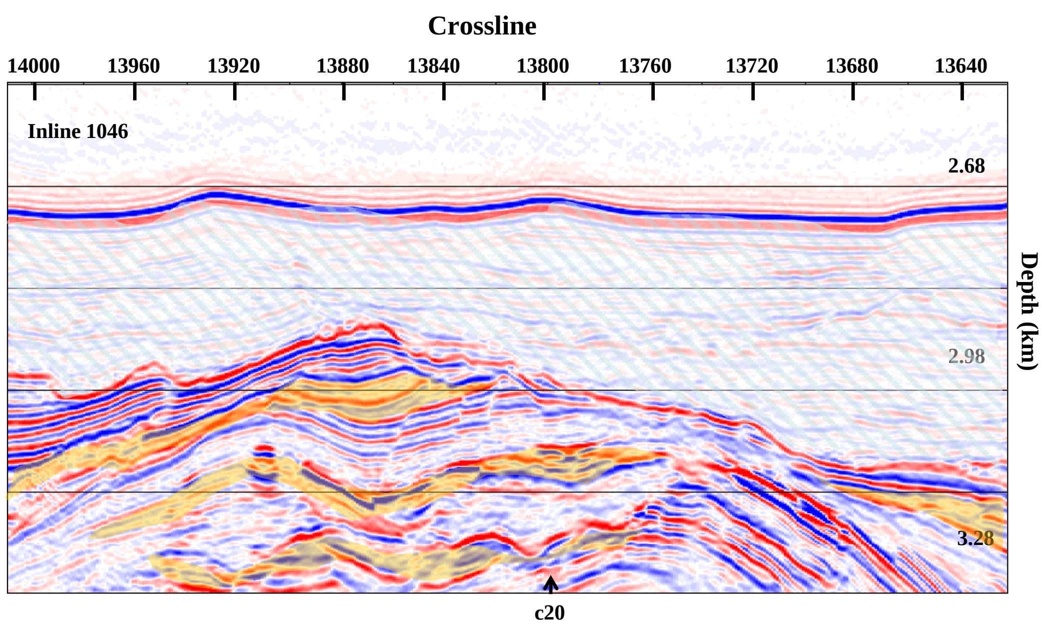


Figure 8: Interpretation of seismic data for shallow piston core geochemical interpretation of seismic profiles. Data present potential hydrate deposits located above interpretation of free gas zones and free gas venting. Piston core points on inline 1046 are listed.

B. Geochemical Data Overview

Twenty piston cores were retrieved during 22 deployments (Figure 2, Table 2). Core lengths ranged from 2.76 to 7.51 m. Onboard geochemical analysis included sediment (headspace) methane, and porewater sulfate, chloride, sulfide, and dissolved inorganic carbon concentrations (Appendix 3). Detailed descriptions were logged for each core that noted visually recognizable variations in core composition, specifically the noting the presence of clay, silt and sand layers (Appendix 5). Stable carbon isotope ratios, sediment porosity, and other sediment chemical parameters were measure at the onshore laboratory. Initial data interpretation used porewater CH_4 and SO_4^{-2} profiles to estimate CH_4 fluxes and suggest relative rates of uncoupled organoclastic SO_4^{-2} reduction (SR) and SR coupled to the anaerobic oxidation of methane (AOM) (Borowski et al., 1999). Anaerobic oxidation of methane is conducted through a metabolic partnership between methanogen-like archaea that oxidize CH_4 and SO_4^{-2} reducing bacteria. The net equation describing AOM can be written as:

$$CH_4 + SO_4^{2-} \rightarrow HCO^{3-} + HS^- + H_20$$

In many marine locations organoclastic SR is the dominant biogeochemical pathway for sediment sulfate consumption. However, in sediments over CH_4 gas seeps and hydrates with vertical CH_4 flux, AOM is the dominant pathway for SO_4^{-2} reduction (Borowski et al., 1996; Boetius et al., 2000; Pancost et al., 2000). In such locations, rates of AOM are controlled by the rate of vertical CH_4 flux (diffusive and advective) and downward SO_4^{-2} diffusion (Borowski et al., 1996; 1999). where they are consumed through AOM at a 1:1 stoichiometric ratio is known as the sulfate methane interface (SMI) (Borowski et al., 1999; Valentine, 2002). Where AOM is the dominant process for reduction of porewater SO_4^{-2}, an estimate of the SO_4^{-2} diffusion rate can be used to estimate the CH_4 vertical flux. Quantifying lateral variations in SMI depths and SO_4^{-2} diffusion rates across features on the seafloor or in the subsurface (imaged by seismic data) can assist in locating areas with significant CH_4 fluxes and potentially significant methane hydrate deposits (Borowski et al., 1999; Paull et al., 2005). Porewater DIC concentrations are influenced by microbial CO_2 respiration and assimilation, DIC advection, and porewater DIC solubility so these data assist in providing some qualitative interpretation of the SO_4^{-2} and CH_4 flux and transport in the core profiles. Stable carbon isotope analysis of porewater DIC also provides additional interpretation of methane oxidation and contribution to the DIC pool.

Table 2. Core locations and background information.

PC #	GMT at hit Bottom	Lngth (m)	Ship Deg.	Lat. Min.	Ship Deg.	Lon Min.	Rng dist	deg	X	y	Core Lt. Min.	Core Ln. Min	Comments
1	206:17:36:36	6.48	26	9.428	94	36.724	50	251	-47.2759	-16.2784	9.419	36.752	Control, No visible seeps
2	0	0	26	0.000	94	0.000	0	0	0.0000	0.0000	0.000	0.000	Misfire in water column
3	0	0	26	0.000	94	0.000	0	0	0.0000	0.0000	0.000	0.000	Misfire in water column
4	208:00:00:36	7.18	26	10.470	94	38.550	0	0	0.0000	0.0000	10.470	38.550	Inline 986, bathy high
5	209:03:50:43	7.56	26	10.459	94	37.562	250	270	-250.0000	0.0000	10.459	37.712	Inline 986 off pckmk
6	209:15:36:10	3.04	26	10.435	94	37.616	60	247	-55.2303	-23.4439	10.422	37.649	Inline 986 pckmk center
7	209:21:01:13	7.51	26	10.450	94	38.126	78	230	-59.7515	-50.1374	10.423	38.162	Inline 986, East shldr
8	210:01:01:10	7.51	26	10.455	94	38.709	40	240	-34.6410	-20.0000	10.444	38.730	Inline 986, West shldr
9	210:14:23:53	7.69	26	10.460	94	37.269	50	220	-32.1394	-38.3022	10.439	37.288	Inline 986, E. of pckmrk
10	210:17:18:40	6.99	26	10.760	94	37.572	62	254	-59.5982	-17.0895	10.751	37.608	Inline 1006, near well A
11	210:20:55:44	6.87	26	10.738	94	38.485	63	224	-43.7635	-45.3184	10.714	38.511	Inline 1006, west mound
12	211:00:25:36	7.26	26	10.746	94	38.199	93	280	-91.5871	16.1493	10.755	38.254	Inline 1006, East shldr
13	211:14:13:20	6.93	26	10.751	94	37.087	40	315	-28.2843	28.2843	10.766	37.104	Inline 1006, E of Well A
14	211:16:59:44	7.01	26	10.481	94	37.610	50	315	-35.3553	35.3553	10.500	37.631	Inline 986, Pckmk Cntr
15	211:20:10:18	2.76	26	10.484	94	37.543	34	234	-27.5066	-19.9847	10.473	37.560	Inline 986, Pckmk E. Flank
16	212:014540	6.85	26	10.483	94	37.541	10	170	1.7365	-9.8481	10.478	37.540	Inline 986, Pckmk E. Flank
17	212:14:30:00	7.49	26	10.972	94	37.358	15	35	8.6036	12.2873	10.979	37.353	Inline 1016, N. of Well
18	212:17:50:22	6.8	26	10.871	94	38.265	24	273	-23.9671	1.2561	10.872	38.279	Inline 1016, West mound pk
19	212:21:07:10	7.1	26	10.939	94	36.757	36	211	-18.5414	-30.8580	10.922	36.768	Inline 1016, W. Shldr
20	212:23:58:26	7.24	26	11.229	94	37.466	70	270	-70.0000	0.0000	11.229	37.508	Chemo site from NOAA
21	213:14:49:08	7.22	26	10.473	94	37.632	55	24	22.3705	50.2450	10.500	37.619	Inline 986, Pckmk
22	213:18:35:10	4.9	26	10.985	94	37.291	30	12	6.2374	29.3444	11.001	37.287	NE Corner of AC818

Sediment headspace methane gas concentrations varied by 7 orders of magnitude within all samples. In general, lower concentrations were found in the shallow core subsamples and higher concentrations in deeper sections (Figure 9). Cores 6, 10, 14, 15, and 21 contained the highest CH_4 concentrations with a range from the limits of detection (LTD) to 21.3 mM. In Core 6, values ranged from 2.2 mM to 21.3 mM CH_4 and the core contained visible gas hydrates. All of these cores were taken near the seismic crossline 13780, on inlines 986 and 1006 in close proximity to the seismic blanking profiles indicative of vertical CH_4 flux and fluid migration (Figures 4 and 5). Sediment headspace methane gas concentrations decreased rapidly away from this region with most cores containing methane concentrations ranging between 8.68 x 10^{-6} mM to 2.17 mM. Many cores were depleted below 10^{-3} mM through the entire profiles.

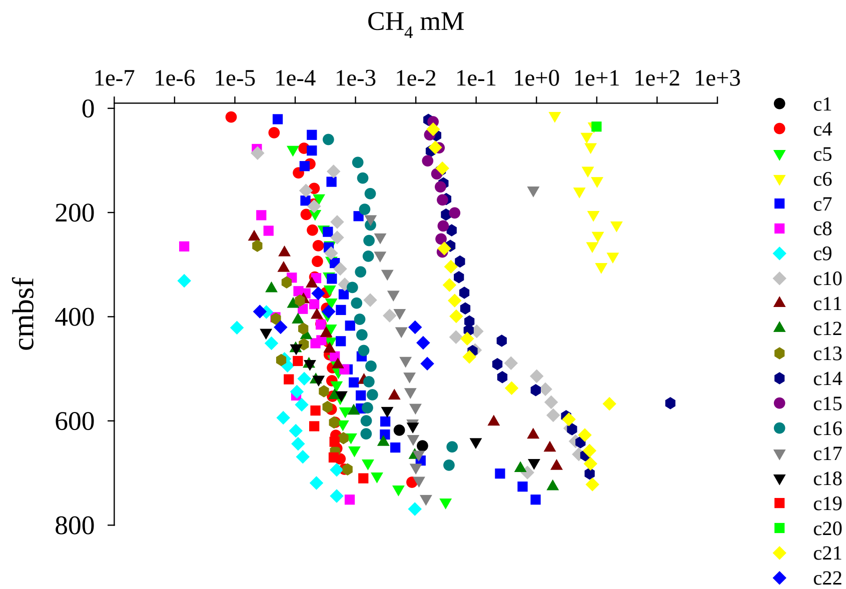


Figure 9: Sediment methane concentration through vertical core profiles.
A spatial description for the variations in concentrations is presented in the text.

Porewater chloride concentrations were generally near the background value of open ocean seawater (559 mM, Figure 10). The control site, core 1, was moderately lower with a range of 522 mM to 541 mM, perhaps resulting from lower coastal ocean salinities nearshore. Core 6 was observed to have substantially lower chloride concentrations with a range of 390 mM to 502 mM. This core contained methane hydrate samples and the lower chloride concentrations are a result of hydrates destabilization during core retrieval and processing. Moderately lower values were also measured in some sections of core 10, with values ranging from 529 mM to 585 mM. This location was found to have high sediment gas methane concentrations and the lower chloride concentrations may represent small amounts of hydrates dissociated during the processing. A key finding of this data set was that porewater chloride concentrations did not significantly exceed seawater background concentrations. In a geochemical survey of another Gulf of Mexico site, Atwater Valley, porewater chloride concentrations as high as 1000 mM were found likely due to the upward migration of deeper, more saline porewaters. This is consistent with reports of abundant salt intrusions and diapirs in the northern Gulf of Mexico (Weimer and Buffler, 1992; Grando and McClay, 2004; Stewart, 2006). Higher salinity has been suggested to decrease hydrate stability resulting in increased deep hydrate dissociation and higher vertical methane diffusion and advection (Coffin et al., 2008).

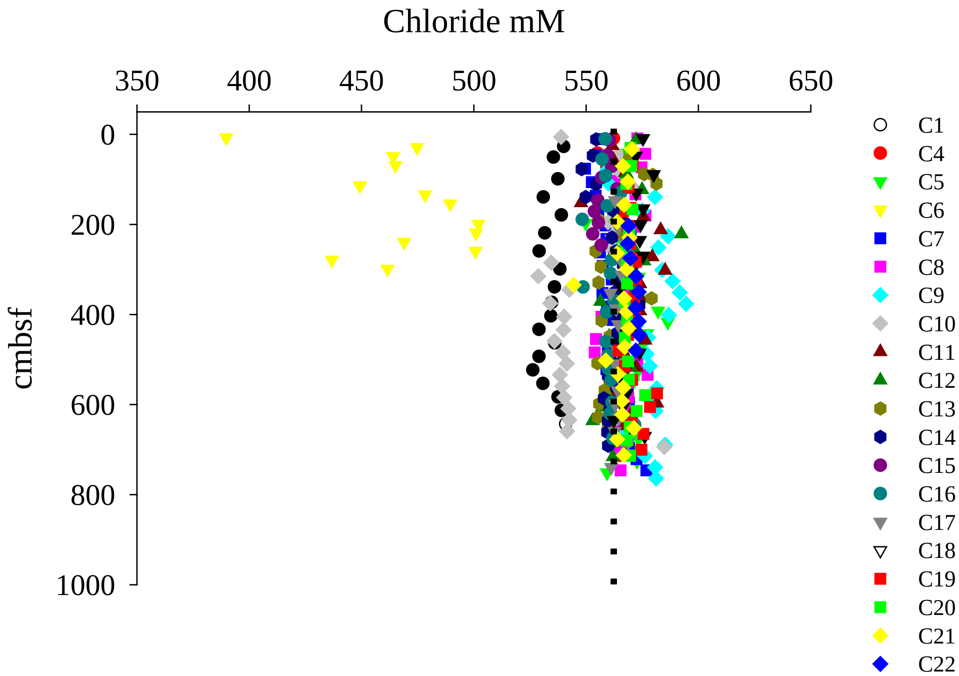


Figure 10: Porewater chloride concentration profiles through piston cores taken on Block 818. The dashed vertical line represents the background seawater chloride concentration of 559 mM.

Sediment porewater sulfate and DIC profiles are presented with a comparison of the inline shallow and deep seismic profiles (Figures 11-16). The primary focus during this expedition was inline 986. Porewater sulfate in the near surface subsamples of the core averaged 26.4±2.3 mM (n=16). Core 6 and 15 were not included in the average because shallow porewaters were depleted relative to the over lying seawater due to coring artifacts. There was a large variation in the minimum porewater sulfate concentrations in cores. In cores collected on inline 986 near crossline 13780, minimum sulfate concentrations ranged from 0.62 mM to 1.19 (Figure 11). Cores 17, 22 and 20 located on inlines 1026 and 1046, near crossline 13780, had minimum sulfate concentrations of 9.61 mM, 15.4 mM, and 3.31 mM, respectively. Cores on all of the inlines away from the crossline 13780 had the smallest changes in the porewater sulfate concentrations with a minimum down to 15.83 mM (Figure 16). The SMI depth estimated from these sulfate concentration profiles are presented below. The trends in the sulfate and methane profiles matched the preliminary observations of the seismic data. More shallow sulfate depletion, indicative of more rapid vertical CH_4 fluxes, were observed in regions where shallow sediment and deep seismic profiles were interpreted to be regions of active fluid or gas migration.

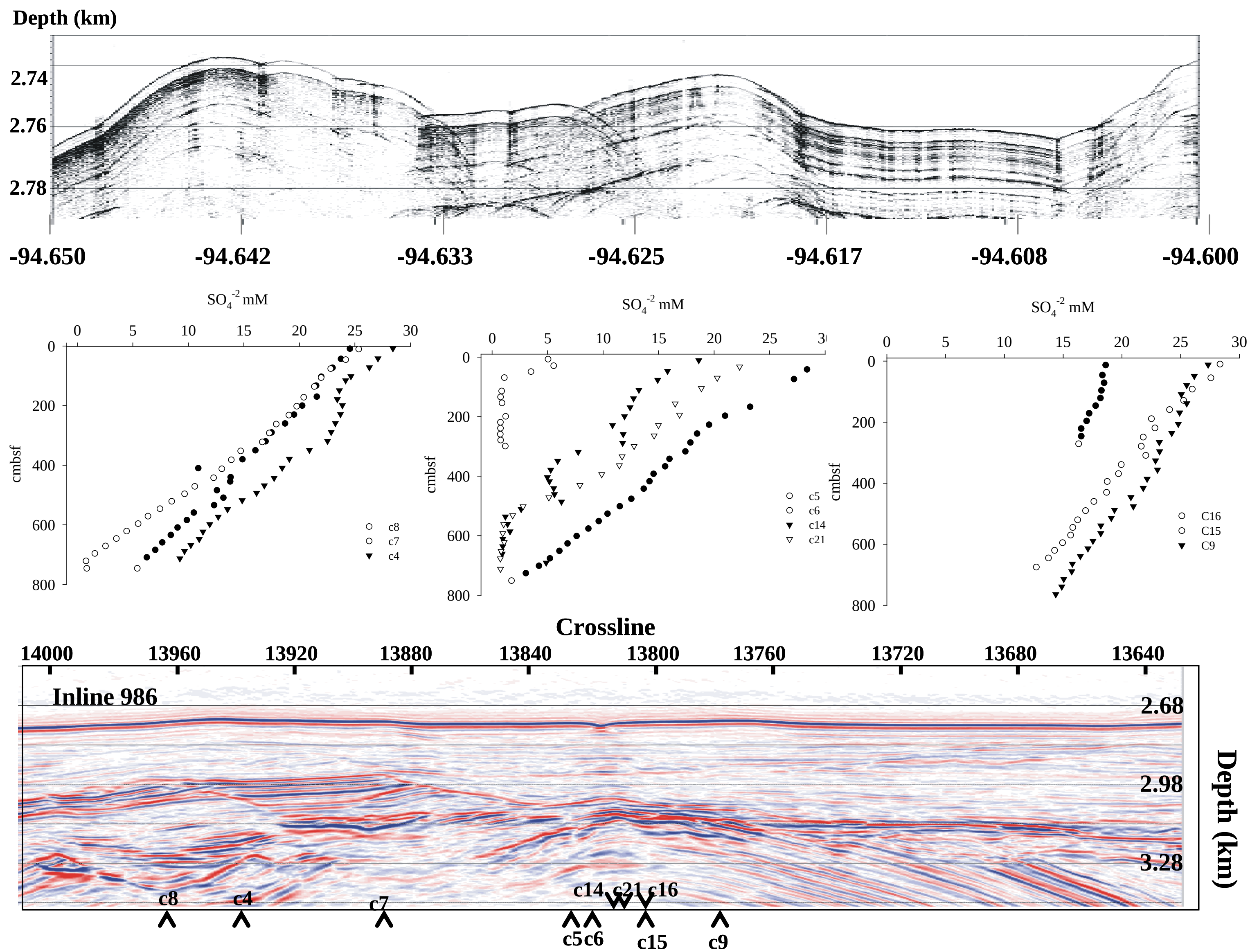


Figure 11: Piston core porewater sulfate profiles compared to shallow 3.5 kHz and deep seismic data. Data in the three plots are separated along inline 986 for western, mid and eastern seismic line data groups.

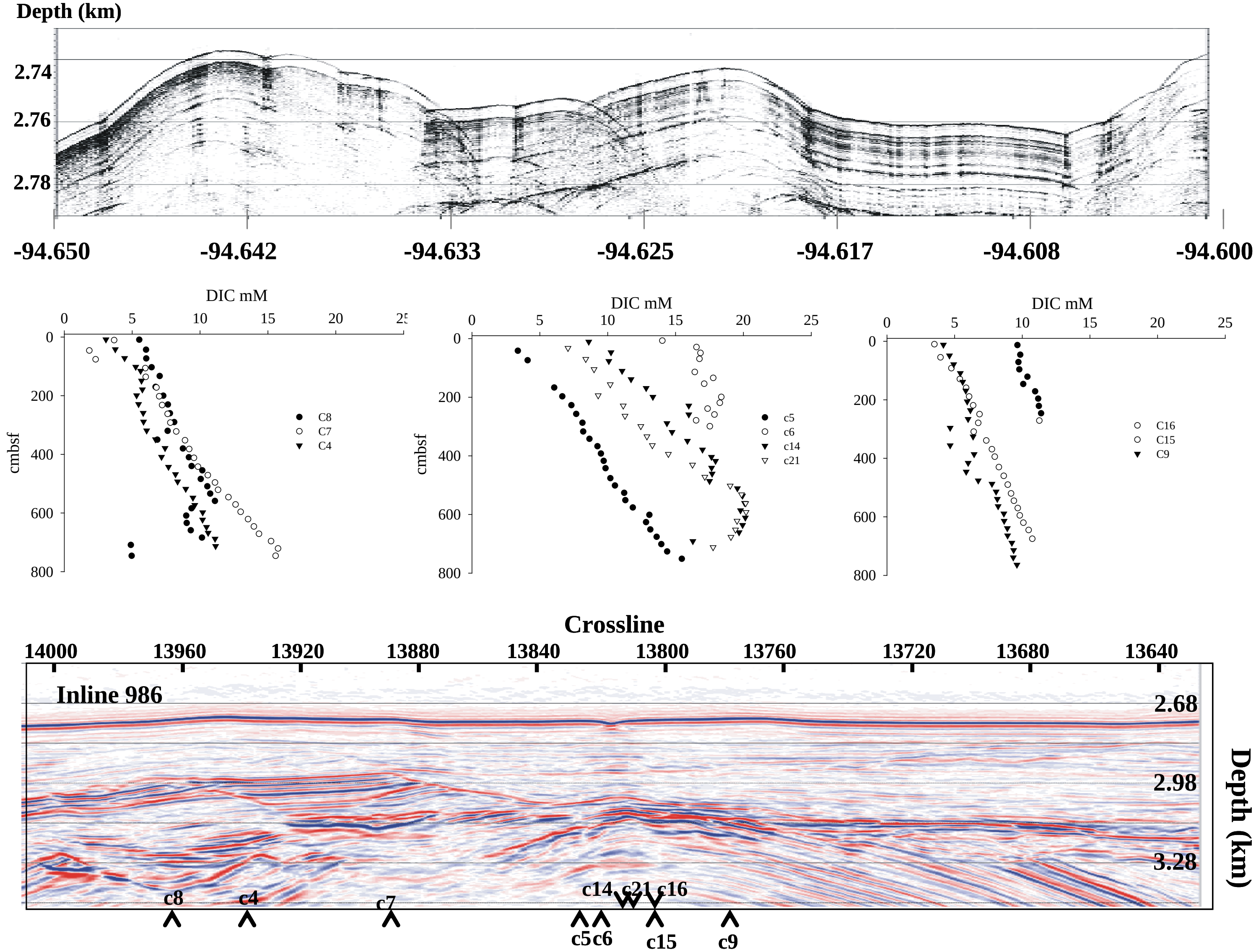


Figure 12: Piston core porewater DIC profiles compared to shallow 3.5 kHz and deep seismic data. Data in the three plots are separated along inline 986 for western, mid and eastern seismic line data groups.

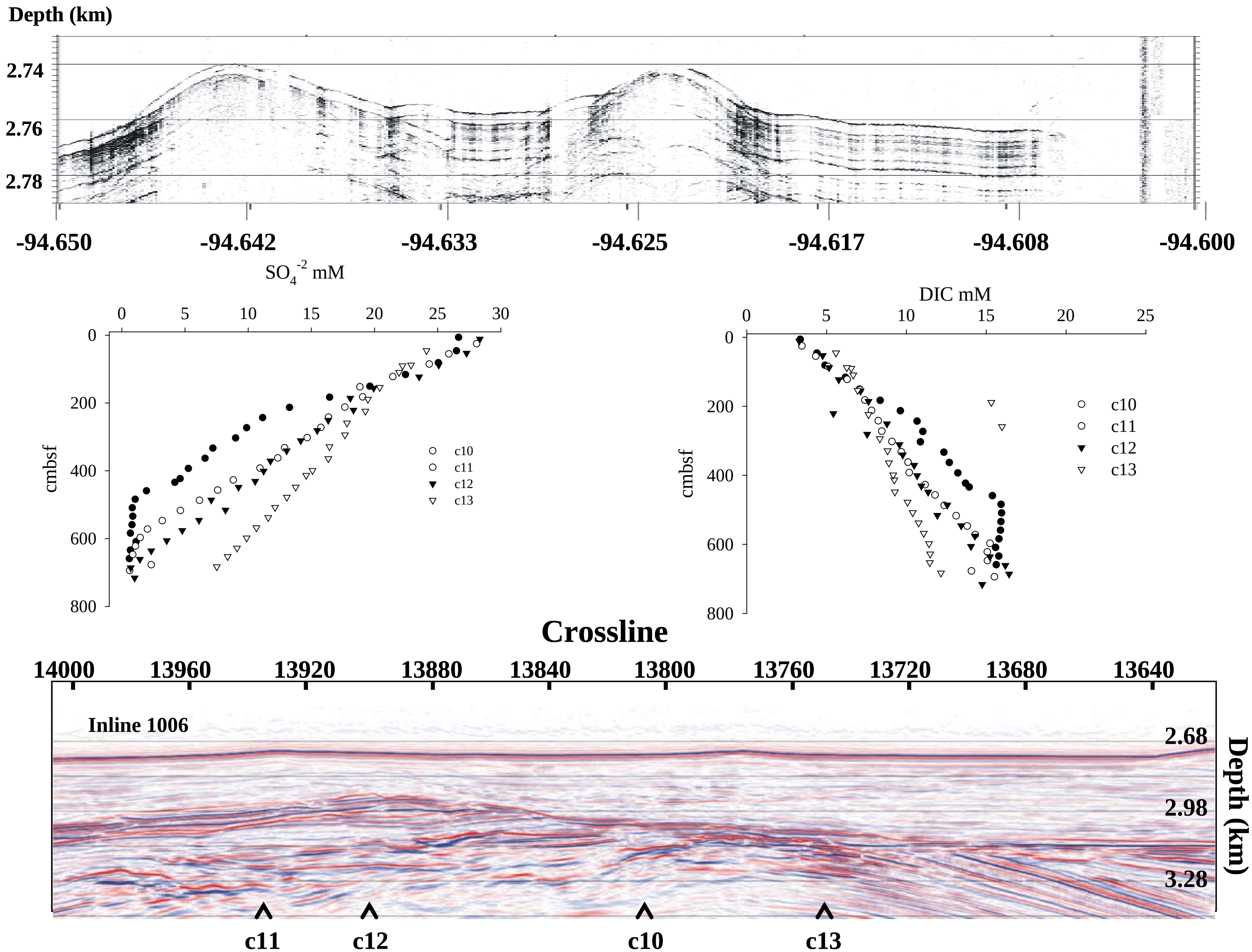


Figure 13: Piston core porewater sulfate and DIC profiles compared to shallow 3.5 kHz and deep inline 1006 seismic data. Porewater data are plotted separately for the sulfate and DIC concentrations.

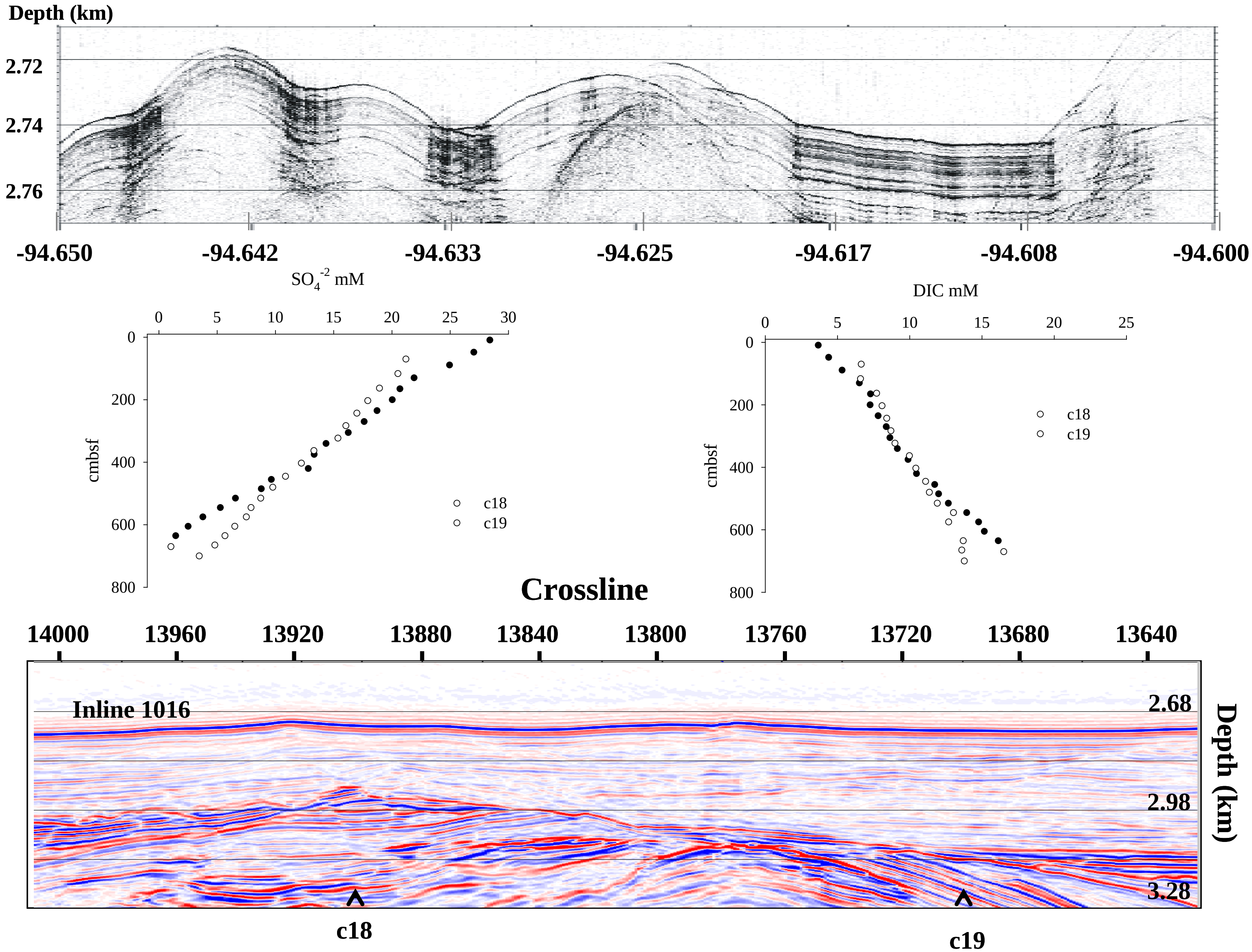


Figure 14: Piston core porewater sulfate and DIC profiles compared to shallow 3.5 kHz and deep inline 1016 seismic data. Porewater data are plotted separately for the sulfate and DIC concentrations.

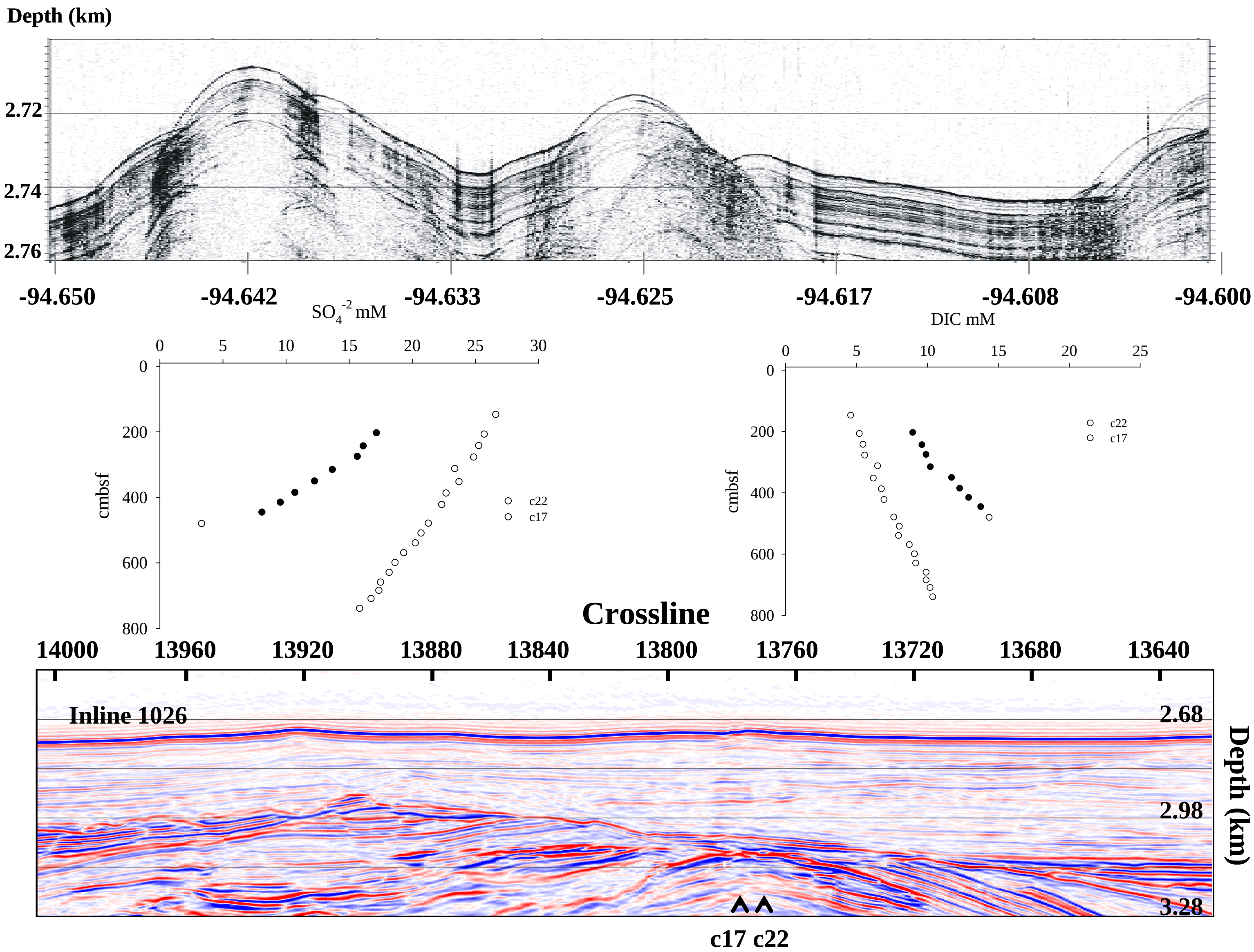


Figure 15: Piston core porewater sulfate and DIC profiles compared to shallow 3.5 kHz and deep inline 1026 seismic data. Porewater data are plotted separately for the sulfate and DIC concentrations.

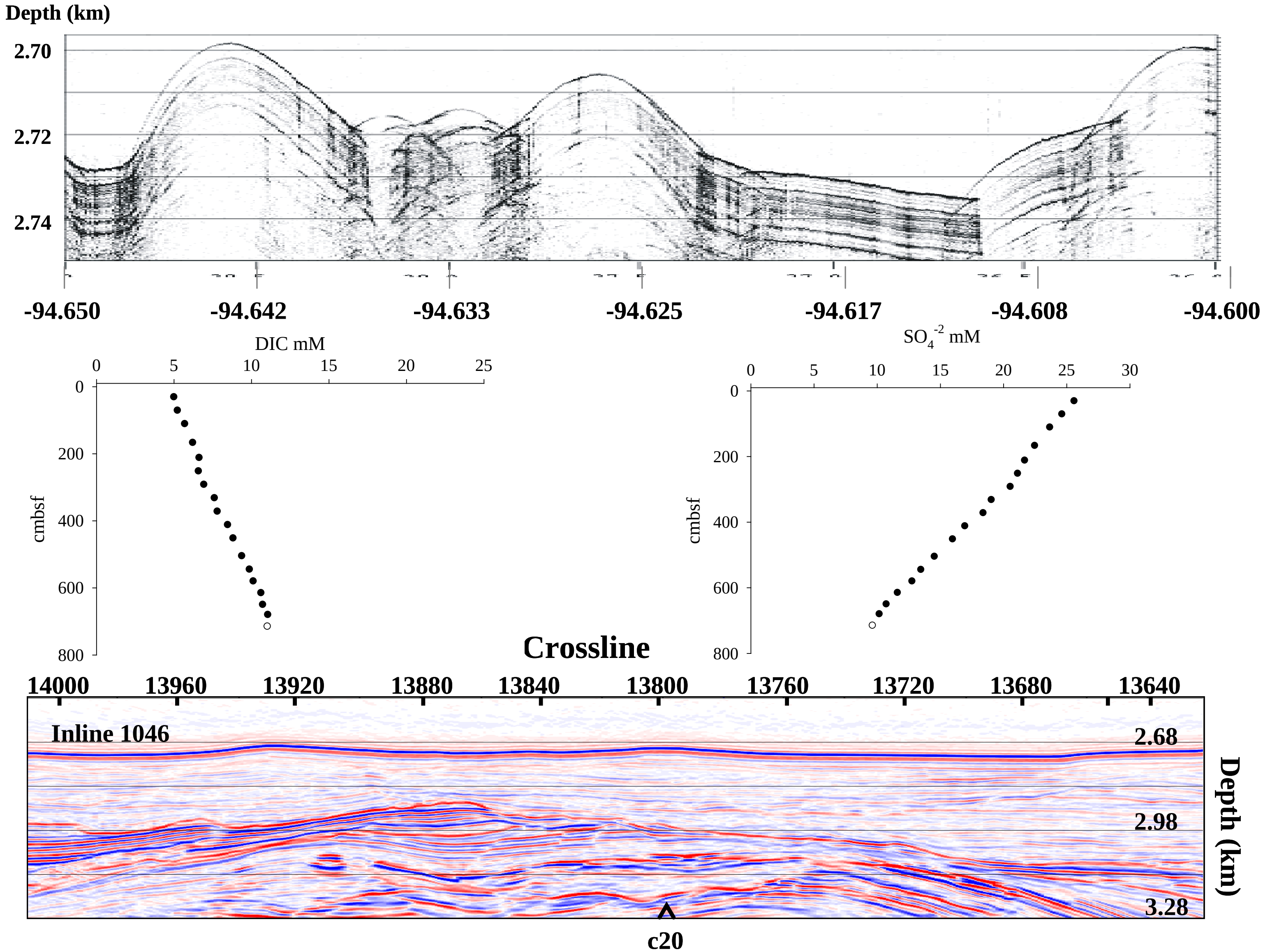


Figure 16: Piston core porewater sulfate and DIC profiles compared to shallow 3.5 kHz and deep inline 1046 seismic data. Porewater data are plotted separately for the sulfate and DIC concentrations.

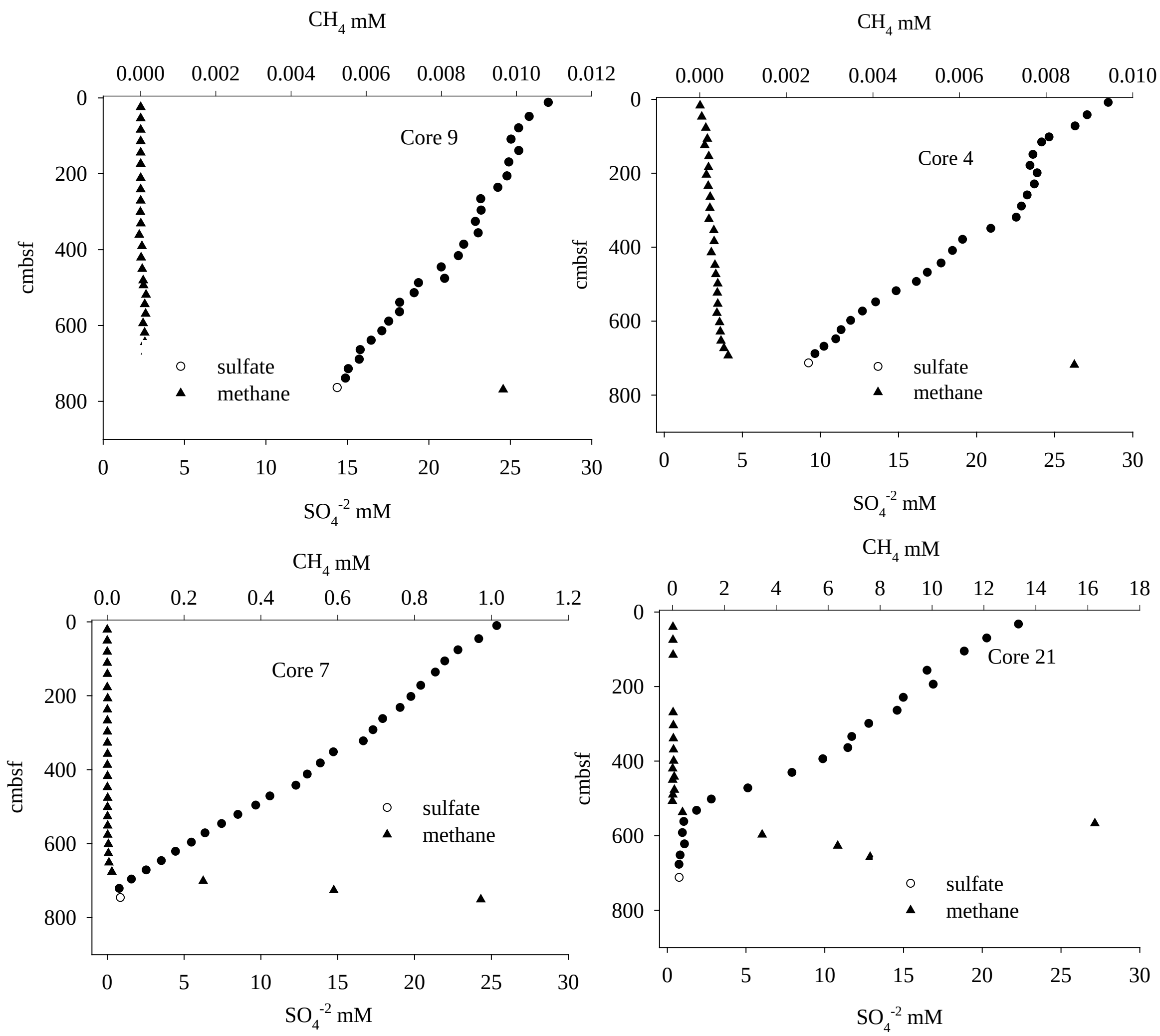
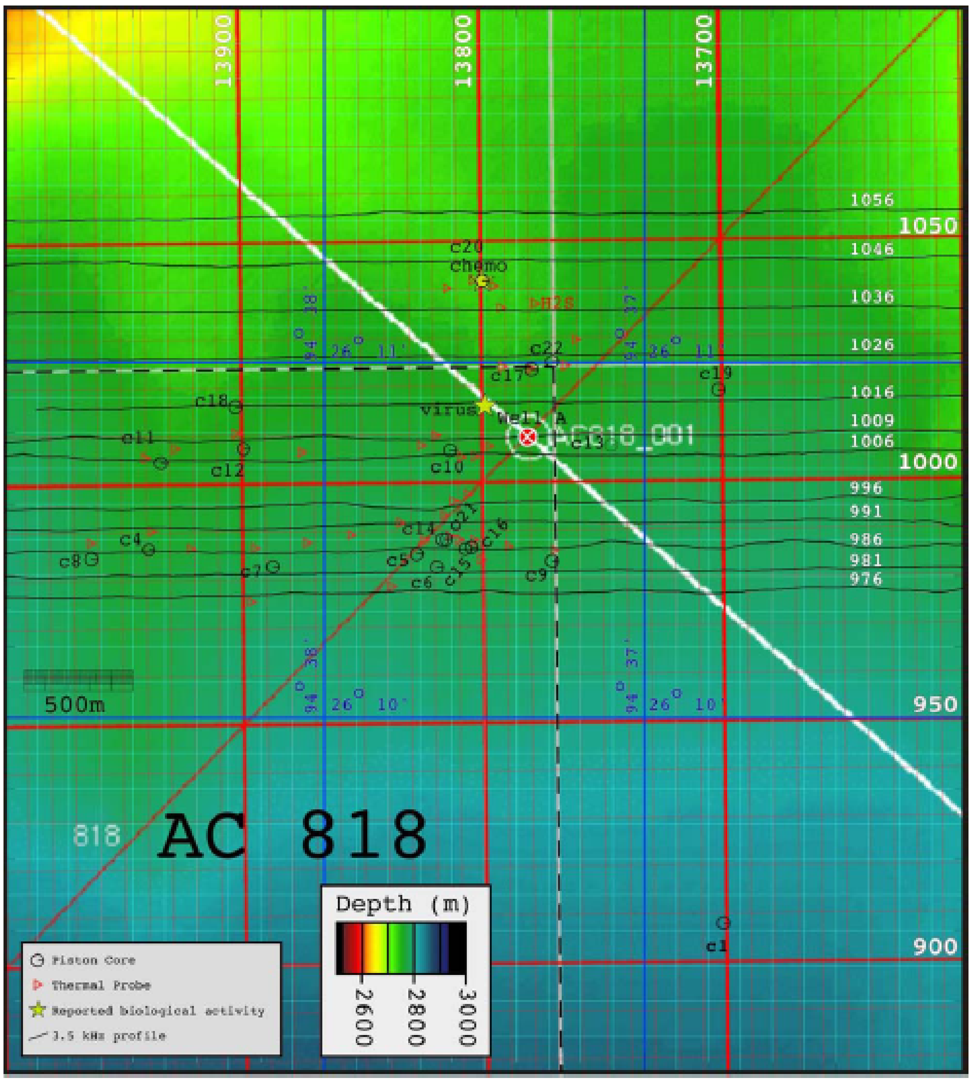


Figure 17: Selected porewater sulfate and sediment methane profiles to provide an overview of the spatial variation in profiles. Note the variation in the scaling of methane concentrations.

An overview of sediment porewater sulfate and methane profiles is presented in Figure 17. Cores taken most distal from the observed seismic blanking on crossline 13780 had the lowest sulfate gradient. In cores 4 and 9 the lowest porewater sulfate concentration was 9.32 mM and 14.4 mM in the deepest core subsample. Sediment headspace methane concentrations showed a slight increase in concentration at the similar depths. Toward crossline 13780, the slope in the sulfate concentration was substantially steeper and observed to have a significant increase in headspace methane concentrations at the depth of sulfate depletion. The concentration gradient profiles are generally linear, with the exception of a couple of potential outliers in mid core depths and a moderately concave down profile observed in core 10. The linear trend in the combined methane and sulfate profiles was used to estimate the SMI depths through the inlines. Where vertical methane diffusion was slower and sharp increases in the methane concentration did not coincide with sharp sulfate gradients, the slope of the sulfate profile was used to extrapolate the depth of sulfate depletion for calculation of the SMI.

A summary of the estimated SMI depths is presented in Figure 18. The SMI depths through the coring region ranged from 1793 cm to 308 cm. Shallow SMIs were measured in two different locations. In one region a shallow SMI was found to transition from west to east between the crosslines 13820 to 13770 and south to north from inlines 986 to 1026 where depths ranges from 308 cm to 589 cm (core 6 and core 22). The SMI in core 6 was an estimate because hydrates retrieved in this core resulted in watered sediments and a large variation in the porewater sulfate and methane profiles. Eastward of this line a rapid deepening of the SMI was observed with values ranging from 828 cm to 1550 cm for cores 19 and 9, respectively. Westward the SMI showed a rapid deep transition, with a value of 1628 cm for core 17, taken close to core 22. The line for predicted high vertical methane flux through the sample region was narrow moving northeast off of inline 986 up to inline 1026. The other region with a shallow SMI was along crossline 13900 where values were measured in a range of 761 cm to 672 cm for cores 7, 12 and 18. Westward from this crossline the SMI deepened with values ranging from 920 cm to 949 cm for cores 4 and 8.



Core	SMI (cm)	R^2
C1	633	0.899
C4	920	0.981
C5	800	0.98
C6	***308***	***0.805***
C7	761	0.993
C8	949	0.973
C9	1550	0.972
C10	469	0.952
C11	621	0.992
C12	672	0.981
C13	995	0.996
C14	642	0.903
C15	1793	0.94
C16	1242	0.989
C17	1628	0.992
C18	679	0.994
C19	828	0.997
C20	1107	0.995
C21	607	0.971
C22	589	0.936

Figure 18: Sediment SMI depths calculated from sediment porewater profiles and core sites located on the inline and cross line points. Core 6 contained hydrates and showed a wide variation in the vertical porewater profiles.

C. Heat Flow Data Overview

Alaminos Canyon heat flow data were collected from inline 986 northward up to inline 1047 and from crossline 13960 eastward to crossline 13750 (Figure 19). The data range of vertical heat profiles for this survey was 36.8 mW m^{-2} to 54.6 mW m^{-2}. These data showed similar trends to the porewater shallow SMI with two distinct regions with higher thermal gradients. One elevate region was through on crossline 13900 where a maximum value was measured at 54.6 mW m^{-2}. The other region with an elevated thermal gradient was in the region of crossline 13800 where the values ranged from 48.7 mW m^{-2} to 54.6 mW m^{-2}. Higher heat flow values corresponded to the regions with shallow SMI. However, the range in heat flow data in this regions low relative to the data collected on Atwater Valley in the Gulf of Mexico where values were near 40 mW m^{-2} and maximum data up to 160 mW m^{-2} (Coffin et al., 2008).

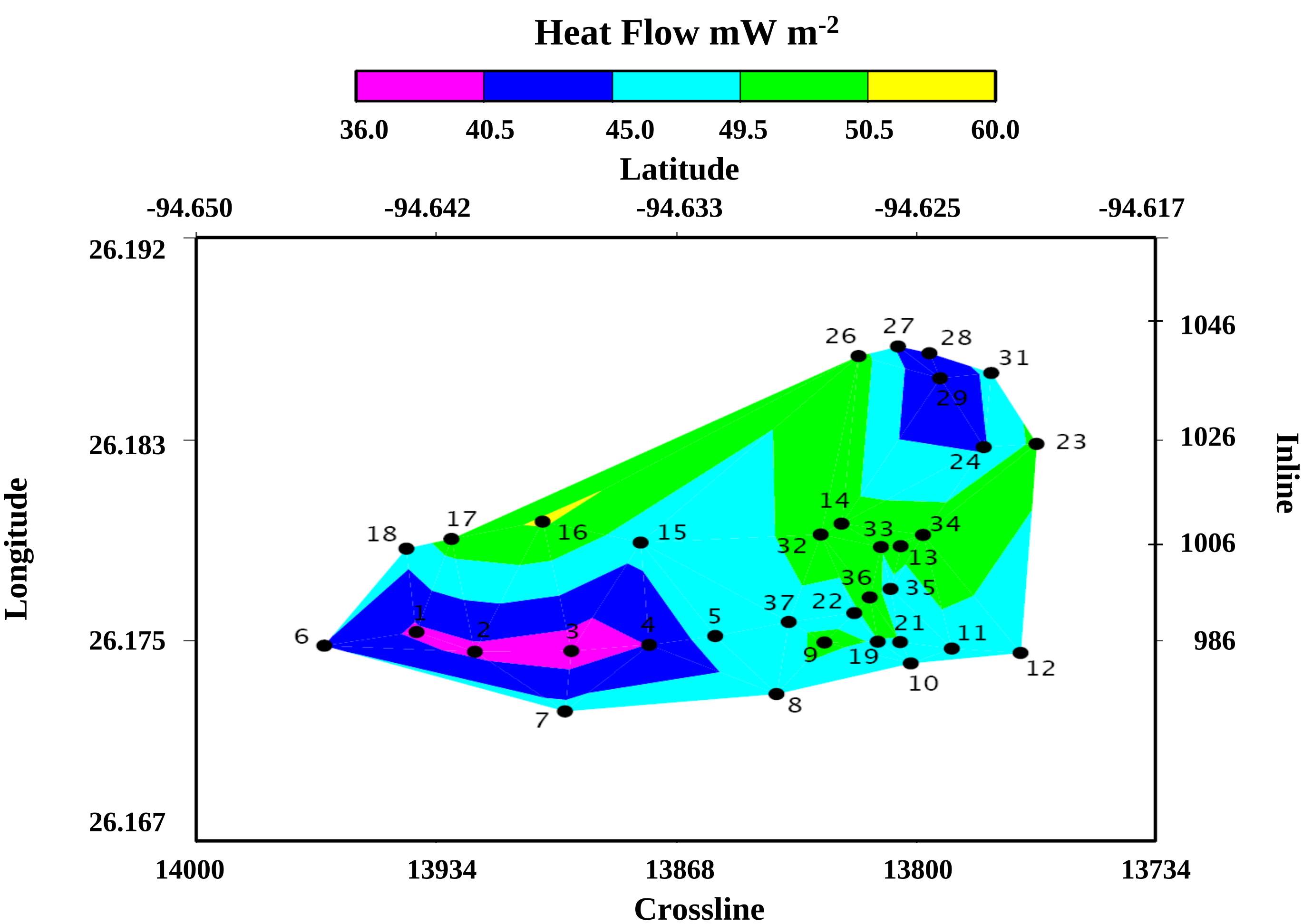


Figure 19: Geothermal gradients measured through crosslines from inline 986 up to inline 1046.

VII. SUMMARY

Geochemical and heat flow data are used to interpret the spatial variation in vertical methane fluxes in Alaminos Canyon Block 818. Goals of this fieldwork were to provide a hydrate pre-drilling data base, further develop calibration of shallow geochemical interpretation of deep seismic surveys of hydrate deposits, and continue basic research on the biogeochemical influence on shallow sediment methane cycling. The following points outline the results of the current data set and plans for further data interpretation.

1. Preliminary estimates of SMI depths for Alaminos Canyon are generally deeper than data collected in the Gulf of Mexico, mid Chilean Margin and off the coast of New Zealand. The water column depth at these other location ranged from 1100 to 1400 meters, while this study site was 2900 to 3000 meters. Further data interpretation of upward methane and downward sulfate gradients will consider the influence of water column depth pressure on the hydrate stability and vertical methane flux. This factor needs calibration for geochemical data interpretation between different coastal regions. Shallow SMI data were observed in regions with elevated heat flow and seismic signatures that indicated possible vertical fluid and/or gas fluxes. Sediment porosity will be analyzed to provide calculations of the vertical methane flux rates through the study region.
2. Heat flow ranged from 36.8 mW m^{-2} to 54.6 mW m^{-2}. These values were in the same range as low background data collected on Atwater Valley in the Gulf of Mexico. Regions with high vertical fluxes up to 160 mW m^{-2} in Atwater Valley were observed on top of a mound where high vertical methane fluxes were believed to result from deep sediment hydrate instability created by salt layers below the methane hydrate stability zone. Lower heat flow data on Atwater Valley were observed across a region off the mound with deep level BSR and deeper SMIs.
3. Stable carbon isotope and gas speciation analysis of porewater and sediment will be conducted to determine the gas source and cycling in this region.
4. Microbial community diversity will be surveyed through varying SMI depths in this study region. These data will be couple with comparisons of microbial community diversity off the coast of Chile, New Zealand and other location in the Gulf of Mexico.
5. Stable carbon isotope analysis in methane, dissolved inorganic carbon, and organic sediment carbon will be coupled with the percent organic carbon in the sediment to survey the contribution of methane to the shallow sediment carbon cycling.
6. A semi-quantitative data analysis will be conducted on the seismic profiles and compared with geochemical and heatflow data to assist in preliminary evaluation of the deep sediment methane hydrate deposits.
7. Future piston coring is being planned to approximately 1 km to the northeast of our study site. This will cover the hydrate drilling location.
8. Deep drill data sets will be compared with this data set for calibration of shallow sediment porewater data interpretation to survey deep sediment hydrate deposits.

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Appendix 1: Daily activity log.

23 July 2007

1. Researchers arrived to Ingleside Navy Base and started loading equipment on board the RV Cape Hateras and installing instruments.
2. Labs were well setup by evening hours.
3. Plans were set to leave for Alaminos Canyon by 12:00 AM on 24 July.

24 July 2007

1. RV Cape Hateras set for Alaminos Canyon by 13:15.
2. Lab instrument calibrations were set and all instruments were operating.
3. Wood and Coffin discussed the preliminary core site selection and steps for the first day on Alaminos Canyon. It was decided to run a preliminary shallow seismic profile on xx line 903 on Block 808 and xx line xxxxx. This would be followed by coring in a region selected for a control site. Heat flow was planned to be run across the same seismic line and correlated with the control geochemical data.
4. Discussions on piston core trigger depth (Bryant, Downer and Coffin) addressed wire stretching concerns to set trigger depth. The decision was made to set the trigger at 15 feet and measure piston core dead space for the next deployment.
5. Wire couple was set up and tested at 11,000 pound pull.
6. Piston core weight, barrels and sleeves were set up for morning use.

25 July 2007

1. On site at approximately 07:30.
2. First operation was a CTD to assist in calibration of heat flow and acoustics profiles. CTD deployed at 07:30.
3. Accoustics run at 12 and 3.5 kHz. These provide shallow sediment profiles over the core area. These data will be coupled with WesternGeco seismic profiles of the same region for a thourough observation of the core location. This selection of the background core was based on the BSR depth and shallow seismic profiles.
4. Piston core (core 1) was dropped at 11:30. Trigger wire was set at 15 ft. Wire was run to 100 meter and the acoustic depth profile was attached to the wire. Deployment was set at 60 m min-1 to 100 m off the sediment floor and the rate was slowed to 10 m min-1. The final core deployment site was set with observation of a relatively deep BSR and a level ocean floor. The deployment depth was in the range of 2800 to 2900 m.
5. Core return started at 12:37 on a 9300 pull out. Core length was 648 cm. Preliminary observation tan with a few black spots mid core depth. No hydrates no gas pockets.
6. Core barrel and liners were replaced and the winch wire was turned over for heat flow probing.
7. Core pulled wire coupling and the coupling had to be reset and tested. The testing held at 14,000 pound pull.
8. Set up for heat flow probing started at 15:00.

9. Seas picked up and stations could not be held for 20 minutes that are required for heat flow. It was decided to pick up on the acoustic profiles while the seas were rough.
10. Under hull bubbles interrupted the acoustic signatures. Activity was cancelled for the day. Plans for the next morning are heat flow if seas are lower. If not piston coring will be conducted.

26 July 2007

1. There were concerns about deploying the heat flow probes in the morning seas.. Piston coring was planned for a new site west of 818 (Core 2 on WG inline 986). During the coring deployment the core trigger was lost and with retrival to the deck the messenger bar was bent. It was decided to repair the core system and wait for the seas to go down.
2. No further research was conducted on this day. While seas were not exceptionally rough. The crane setting on the back deck was subject to high rises in the raised seas.

27 July 2007

1. Seas still too high to run piston coring, acoustics and heat flow.
2. 12:15 PM seas dropped. Piston core was set up and deployed at 14:30.
3. Core 3 loss messenger mid way through. Upon early retrival is was observed that the depth finder had been broken off the line. The safety cable saved the pinger. The trip anchor was maintained.
4. 2 80 pound torpedo anchor weights were deployed on the next core (core 4) at the same core location (2 and 3). This core trip with a 9700 lb pull at 7:05. Core was 718 cm. Kelly Rose took on providing geologic observation of the core segment that would not be saved. This was continuation of WG inline 986 and WG crossline 13815 (~).
5. Core 5 over at 9:30. Depth finder/position locator was included with this core.
6. Part of the shallow section of core 5 spilled on the deck. The total surface core section was 132 cm, 60 cm was estimated to be the spill section. This section was the bottom of the core liner. The total core length was 732 cm. Check the deck notes to confirm. The was continuation of WG inline 986 on WG crossline 13817 (~).
7. Core 5 was reported to have higher gas concentrations. The location of the core was off the set station by 250 meters. This station was located on the line and near the vertical seismic pattern. It was decided for core 6 to be on the intended core 5, vertical seismic pattern.
8. The piston core sleeves and barrels were set for the next morning.
9. Heat flow took over at 12:30 and was deployed at 2:00AM.

28 July 2007

1. Heat flow was returned to the deck at 7:30 am with 5 data sites acquired.
2. Piston core was set for core 6 (WG inline 986 and WG crossline 13817 (~)) on the seismic wipe out that was intended for core 5.
3. Core position was over at 10:45. Positioning took a long time a location was off by 50 m. The approach was to deploy the core while positioning and hold the last 10 m until on site. This protocol was not accurate. Ability to position differs between the ship drivers.

4. Core 6 was recovered at 11:45. On core recovery there was a large gas flux coming from the front of the core barrel. With the core sleeve removed on the deepest core section cold spots were felt and hydrates were observed. After cleaning the core sleeve large gas pockets were observed.
5. In addition to the normal porewater and sediment, core pocket gases, hyrates and hydrate gases were sampled.
6. The middle core sleeve collaped and could not be removed from the core barrel. There was a large amount of compress plastic in the barrel. The only samples were obtained from the deep core sleeve. No other samples were obtained.
7. Core 6 was located on WG inline 986 WG crossline 13817 (~).
8. The coring system was rebuilt and coring stated again.
9. Prior to the next core acoustics was run again.
10. Core 7 went over at 14:00 this site was on the same line on a mound to the west along WG inline 986 WG crossline 13880 (~).
11. Core 7 was retrieved at 15:00. This was one of the longer cores at approximately 7.5 m.
12. The coring system was deployed for Core 8 at 7:00 at a site most western on the same seismic line, WG inline 986 WG crossline 13980 (~).
13. This was the last core for the day.
14. Following the core acoustics was run while the heat flow was prepared.
15. Acoustics was initiated at 23:00.

29 July 2007

1. Heat flow was back on deck and cables transferred for coring at 07:00.
2. Piston core C9 was started on WG inline 986 WG crossline 13765 (~).
3. at 08:30. Pull out 9300 lbs.
4. Piston core C9 out at 10:15. Good core, long grey no gas pockets
5. Piston core C10 over at 11:30 on WG inline 1006 crossline 13810 (~).
6. Core location was near the well 818.
7. Pull out for C10 at 12:35. 9700 lbs pull out.
8. Core 11 was deployed at 15:00 on WG inline 1006 WG crossline 13935 (~).
9. Core 11 pull out was lower at 8750 lb.
10. Core 12 was deployed at 18:30 on WG inline 1006 and crossline 13900 (~).
11. Acoustic profiles were run while the heat flow was set.
12. Heat flow was over at 23:00

30 July 2007

1. Heat flow heat pulse cable was damage after first probe.
2. Heat flow was back on board by 7:00.
3. Damage to the heat flow probe is being checked for repair.
4. Core 13 was over at 08:30. WG inline 1006 and crossline 13735 (~). This site finishes the inline 1006 coring. Pull out 10406 lb. Over view in preliminary methane data was vertical methane diffusion at a moderate rate with methane profile slopes appearing between 4 and 7 mbsf.
5. Piston core up at 10:30.

6. Piston core 14 over at 11:15. Back on the Core 5 depression area. It is intended to take 2-3 more cores in this region to look at the vertical methane migration.
7. Pull out was above 10,000 lbs.
8. Piston core 14 back up at 13:30. Core contained small granular hydrates. This core was about 50 m away from the focus point where there are depressions on the seismic chart.
9. Piston core 15 was over at 14:30. Extra care was taken to drop the core on the focus point for the seismic chart. Pull out on this core was 10,108
10. This core imploded in the top two cylinders. The sediment retrieved was one barrel and was though to be intact for this location. Two barrels were damaged beyond use.
11. Acoustic surveys were run during the core repair time.
12. A subsequent core, piston core 16 was taken at a nearby location to complete sampling in this region. This piston core was over at 20:00. Pull out on the core was 9352 lbs.
13. Core 16 was retrieved at 22:00. The core was over 6 m and small fragments of hydrates were observed through the core. In addition to the hydrates there was large vertical tube worms through the core. Discussion with Kelly Rose resulted in a comment that the tube worms had been observed in other cores. This needs to be considered in review of the sulfate profiles for non conservative mixing.
14. Heat flow was deployed at 23:00.

31 July 2007

1. Heat flow was up at 07:00. There was a problem with the data cable and the tow connection. Data was not acquired. This puts a need for rescheduling the cruise for more time on the heat flow probe.
2. Piston core 17 was over at 08:30. The coring region was north of the drill site at WG inline 1016 and crossline 13780 (~) This region was selected for coring because in provides more data around the JIP drill site 818.
3. Core 17 was back on the deck at 10:30. Retrival of the core found broken liner pieces in the shallow segment. It is suspected that these liners are old and not in good condition.
4. Core 18 was taken at inline 1016, east of core 17 at xxxxxxx. Core over at 11:45.
5. Core 18 back on deck at 13:55. Upper core sleeve broke and needed to be replaced.
6. Core 19 was over at 15:15. It took 45 min to navigate to station. Pull on the retreat was 9300.
7. Core was back on deck at 17:00. High impact on the last segment of the core drop damaged the trigger arm.
8. Core 20 was over at 18:00. Pull on the retreat was 9154.
9. Discussions on the final coring were held and the focus area was decided to be down around Cores 5 and 6.
10. Core 20 was back on the deck at 20:15.
11. Heat flow was setup and deployed at 22:00.

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1. Heat flow was back on the deck at 08:00. Joan Gardner noted hydrogen sulfide odor on the heat flow probe. Changes in coring plan moved the final three cores north of the drill site.

2. Core 21 was deployed at 09:00. Core pull was 10,500 lb.
3. Core was returned to the deck at 11:00.
4. Core 22 site was located in the northeast corner of block 818. This core was set at 13:30.
5. Core 22 pull out was 9357 lbs.
6. Core was returned to the deck at 15:45. The core was collapsed in the second barrel. The core length through the second barrel was measured at 193cm. The collapse in the barrel resulted from poor core liners, aged in the sun.
7. Coring was cancelled at this point because of damage to the coring system and poor core liner quality.
8. Acoustic profiles were taken on new line while attempting to repair the core.
9. Heat flow started at 20:00.

APPENDIX 2: Preliminary porewater data.

Core	Pore Water Sed Depth (cm)	Chloride (mM)	Sulfate (mM)	DIC (mM)	Gas Sample Sediment Depth (cm)	Gas Sample #	CH_4 (mM)
1	643	540.9	1.13	13.98	648	1	0.0129
1	613	539.0	1.86	13.83	618	2	0.0053
1	583	537.4	8.89	11.04	588	3	0.0000
1	553	530.7	18.12	6.34	558	4	0.0000
1	523	526.2	15.35	7.61	528	5	0.0000
1	493	529.0	18.81	7.23	498	6	0.0000
1	463	536.0	19.85	6.87	468	7	0.0000
1	433	529.0	20.54	6.44	438	8	0.0000
1	403	534.3	21.04	6.46	408	9	0.0000
1	373	534.7	21.46	6.22	378	10	0.0000
1	339	535.9	22.09	5.62	344	11	0.0000
1	299	538.3	23.10	5.66	304	12	0.0000
1	259	529.0	24.04	5.10	264	13	0.0000
1	219	531.6	24.53	5.10	224	14	0.0000
1	179	538.9	25.66	4.55	184	15	0.0000
1	139	531.0	26.14	4.14	144	16	0.0000
1	99	537.4	27.23	3.82	104	17	0.0000
1	51	535.4	28.10	3.38	64	18	0.0000
1	27	540.0	28.57	3.23	37	19	0.0000
4	713	564.6	9.24	11.15	718	20	0.0087
4	688	561.9	9.65	11.11	693	21	0.0007
4	668	564.9	10.22	10.60	673	22	0.0006
4	648	566.9	10.98	10.48	653	23	0.0005
4	623	561.3	11.32	10.19	628	24	0.0005
4	598	561.0	11.93	10.20	603	25	0.0005
4	573	561.9	12.69	9.61	578	26	0.0004
4	548	560.7	13.53	9.48	553	27	0.0004
4	518	562.4	14.85	8.95	523	28	0.0004
4	493	562.9	16.15	8.35	498	29	0.0004
4	468	562.3	16.85	8.19	473	30	0.0004
4	443	566.9	17.73	7.68	448	31	0.0004
4	409	564.3	18.45	7.16	414	32	0.0003
4	379	570.9	19.10	7.42	384	33	0.0003
4	349	571.7	20.91	6.72	354	34	0.0003
4	319	571.1	22.54	6.07	324	35	0.0002
4	289	570.8	22.87	5.84	294	36	0.0002
4	259	569.9	23.24	5.81	264	37	0.0002
4	229	568.3	23.70	5.47	234	38	0.0002

4	199	566.9	23.88	5.33	204	39	0.0002
4	179	566.1	23.42	5.75	184	40	0.0002
4	149	565.1	23.61	5.69	154	41	0.0002
4	116	568.0	24.17	5.62	124	42	0.0001
4	102	566.6	24.65	5.26	107	43	0.0002
4	72	559.3	26.31	4.44	77	44	0.0001
4	42	555.1	27.08	3.76	47	45	0.0000
4	9	562.2	28.43	3.07	17	46	0.0000
5	751	559.3	1.75	15.46	756	47	0.0313
5	726	572.6	3.04	14.38	731	48	0.0052
5	701	569.5	4.22	13.95	706	49	0.0023
5	676	573.3	5.21	13.61	681	50	0.0016
5	651	567.4	6.07	13.14	656	51	0.0010
5	626	564.2	6.80	12.83	631	52	0.0008
5	601	569.0	7.62	13.07	606	53	0.0006
5	576	566.4	8.67	11.85	581	54	0.0007
5	551	570.9	9.61	11.30	556	55	0.0006
5	526	573.1	10.40	11.22	531	56	0.0005
5	501	564.4	11.50	10.54	506	57	0.0005
5	476	574.2	12.54	10.20	481	58	0.0004
5	442	577.1	13.66	9.84	447	59	0.0004
5	417	586.4	14.18	9.71	422	60	0.0004
5	392	582.1	14.55	9.50	397	61	0.0003
5	367	575.3	15.59	9.25	372	62	0.0004
5	342	573.1	15.98	8.66	347	63	0.0004
5	317	573.4	17.41	8.20	322	64	0.0004
5	287	572.6	17.86	8.14	292	65	0.0004
5	257	565.9	18.47	7.68	262	66	0.0004
5	227	563.9	19.54	7.33	232	67	0.0003
5	197	549.8	20.99	6.66	202	68	0.0002
5	167	573.2	23.24	6.06	172	69	0.0002
5	74	562.8	27.20	4.10	79	70	0.0001
5	42	566.3	28.37	3.38	49	71	0.0000
6	299	461.6	1.19	17.53	304	72	11.9115
6	279	436.8	0.77	16.52	284	73	18.5136
6	259	500.7	0.74	17.87	264	74	8.4550
6	239	469.0	0.76	17.36	244	75	10.4520
6	219	501.0	0.75	18.26	224	76	21.3354
6	199	502.1	1.22	18.37	204	77	8.8222
6	154	489.5	0.89	17.11	159	78	5.1528
6	134	478.3	0.77	17.78	139	79	10.1720
6	114	449.2	0.87	16.42	119	80	7.1275

6	69	465.1	1.11	16.76	74	81	7.9333
6	49	464.1	3.50	16.84	54	82	6.8548
6	29	474.7	5.55	16.54	34	83	8.9910
6	7	389.7	5.04	14.03	14	84	2.0176
7	746	576.8	0.85	15.57	751	85	0.9724
7	721	572.5	0.78	15.75	726	86	0.5898
7	696	569.1	1.57	15.23	701	87	0.2496
7	671	567.4	2.54	14.34	676	88	0.0120
7	646	570.4	3.52	13.97	651	89	0.0046
7	621	567.7	4.44	13.54	626	90	0.0031
7	596	569.0	5.47	12.99	601	91	0.0031
7	571	565.2	6.36	12.62	576	92	0.0012
7	546	564.4	7.44	12.09	551	93	0.0012
7	521	559.0	8.50	11.33	526	94	0.0009
7	496	562.1	9.66	11.10	501	95	0.0007
7	471	559.7	10.58	10.57	476	96	0.0013
7	442	566.7	12.27	9.85	447	97	0.0006
7	412	561.8	13.01	9.55	417	98	0.0008
7	382	559.3	13.87	9.20	387	99	0.0006
7	352	557.3	14.71	8.89	357	100	0.0006
7	322	561.4	16.66	8.25	327	101	0.0004
7	292	557.4	17.29	7.81	297	102	0.0005
7	262	556.2	17.92	7.61	267	103	0.0004
7	232	559.0	19.05	7.21	237	104	0.0003
7	202	558.6	19.76	6.99	207	105	0.0011
7	172	555.4	20.39	6.79	177	106	0.0001
7	136	554.3	21.35	6.00	141	107	0.0004
7	106	552.5	21.96	5.97	111	108	0.0001
7	76	549.5	22.82	2.31	81	109	0.0002
7	46	554.1	24.17	1.84	51	110	0.0002
7	11	556.9	25.35	3.67	21	111	0.0001
8	746	565.3	5.40	4.96	751	112	0.0008
8	709	563.0	6.26	4.90	576	113	0.0000
8	684	563.7	7.02	10.14	551	114	0.0001
8	659	562.5	7.65	9.32	526	115	0.0000
8	634	570.4	8.42	9.02	501	116	0.0007
8	609	567.2	9.03	8.98	476	117	0.0005
8	584	568.8	9.86	9.37	451	118	0.0002
8	559	568.5	10.49	11.10	426	119	0.0000
8	534	577.3	12.32	10.75	401	120	0.0000
8	509	572.8	13.15	10.54	376	121	0.0002
8	484	553.9	12.57	10.05	351	122	0.0001

8	455	554.4	13.77	10.17	326	123	0.0002
8	440	556.8	13.81	9.38	445	124	0.0003
8	410	568.6	10.89	9.18	415	125	0.0003
8	380	570.0	14.88	8.74	385	126	0.0001
8	350	570.4	16.04	6.85	355	127	0.0001
8	320	569.4	16.96	7.61	325	128	0.0001
8	290	572.5	17.50	8.10	295	129	0.0000
8	260	568.5	18.71	7.78	265	130	0.0000
8	230	569.0	19.52	7.63	235	131	0.0000
8	200	571.6	20.25	7.29	205	132	0.0000
8	170	576.5	21.57	6.72	175	133	0.0000
8	133	572.0	21.52	7.03	138	134	0.0000
8	103	562.9	21.98	6.43	108	135	0.0000
8	73	574.7	22.99	6.04	78	136	0.0000
8	43	576.4	23.75	6.02	48	137	0.0000
8	9	572.8	24.55	5.52	18	138	0.0000
9	764	581.2	14.37	9.61	769	139	0.0096
9	739	580.7	14.88	9.34	744	140	0.0005
9	714	576.2	15.05	9.36	719	141	0.0002
9	689	585.2	15.73	9.23	694	142	0.0005
9	664	565.5	15.78	8.92	669	143	0.0001
9	639	569.7	16.46	8.90	644	144	0.0001
9	614	580.9	17.11	8.66	619	145	0.0001
9	589	579.5	17.54	8.64	594	146	0.0001
9	564	581.5	18.20	8.22	569	147	0.0001
9	539	565.9	18.21	8.16	544	148	0.0001
9	514	578.4	19.09	8.07	519	149	0.0001
9	488	576.9	19.37	7.76	494	150	0.0001
9	476	577.5	20.97	6.75	481	151	0.0001
9	446	572.1	20.76	5.86	451	152	0.0000
9	416	586.9	21.82	6.00	421	153	0.0000
9	386	594.5	22.14	6.44	391	154	0.0000
9	356	591.7	23.03	4.67	361	155	0.0000
9	326	588.5	22.86	6.37	331	156	0.0000
9	296	583.9	23.21	4.67	301	157	0.0000
9	266	569.0	23.18	6.00	271	158	0.0000
9	236	582.2	24.24	6.17	241	159	0.0000
9	206	586.5	24.79	5.93	211	160	0.0000
9	169	575.0	24.91	5.83	174	161	0.0000
9	139	580.7	25.52	5.60	144	162	0.0000
9	109	559.9	25.05	5.42	114	163	0.0000
9	79	559.5	25.51	4.93	84	164	0.0000

9	49	560.1	26.15	4.62	54	165	0.0000
9	12	571.3	27.33	4.17	24	166	0.0000
10	694	584.8	0.62	15.51	699	167	0.7100
10	659	541.6	0.59	15.63	664	168	5.0524
10	634	542.5	0.68	15.79	639	169	4.4507
10	609	542.1	1.12	15.59	614	170	3.6210
10	584	540.2	0.68	15.80	589	171	1.8999
10	559	539.2	0.80	15.89	564	172	1.7553
10	534	538.3	0.86	15.92	539	173	1.4108
10	509	541.4	0.83	15.96	514	174	1.0109
10	484	539.6	1.06	15.93	489	175	0.3789
10	459	535.9	1.95	15.39	464	176	0.0962
10	434	539.9	4.19	13.93	439	177	0.0465
10	423	540.2	4.62	13.70	428	178	0.1025
10	393	534.0	5.27	13.22	398	179	0.0037
10	363	542.5	6.59	12.69	368	180	0.0018
10	333	528.7	7.21	12.35	338	181	0.0007
10	303	534.5	9.00	10.88	308	182	0.0006
10	273	561.3	9.88	11.03	278	183	0.0004
10	243	561.8	11.14	10.67	248	184	0.0005
10	213	559.7	13.27	9.62	218	185	0.0005
10	183	561.3	16.45	8.36	188	186	0.0002
10	151	564.5	19.63	7.07	158	187	0.0002
10	116	570.4	22.45	6.18	121	188	0.0004
10	81	564.7	25.05	4.90	86	189	0.0000
10	46	564.5	26.49	4.40	51	190	0.0000
10	6	538.8	26.65	3.35	11	191	0.0000
11	677	561.8	2.33	14.07	687	192	2.1652
11	647	567.1	0.86	15.08	652	193	1.6734
11	622	570.0	1.07	15.07	627	194	0.8856
11	597	581.5	1.45	15.24	602	195	0.1962
11	572	561.6	2.03	14.31	577	196	0.0000
11	547	562.5	3.20	13.81	552	197	0.0044
11	517	572.5	4.64	13.12	522	198	0.0014
11	487	567.1	6.15	12.37	492	199	0.0005
11	457	576.3	7.58	11.79	462	200	0.0004
11	427	566.7	8.82	11.17	432	201	0.0003
11	392	574.0	10.93	10.18	397	202	0.0002
11	362	574.1	12.35	10.10	367	203	0.0001
11	332	574.0	12.88	9.68	337	204	0.0002
11	302	585.2	14.67	9.09	307	205	0.0001
11	272	579.5	15.76	8.46	277	206	0.0001

11	242	568.2	16.36	8.24	247	207	0.0000
11	212	583.2	17.65	7.82	217	208	0.0000
11	182	575.5	19.06	7.40	187	209	0.0000
11	152	547.7	18.84	7.10	157	210	0.0000
11	122	568.3	21.45	6.29	127	211	0.0000
11	85	567.4	24.33	5.10	90	212	0.0000
11	55	562.0	25.88	4.32	60	213	0.0000
11	25	561.7	28.08	3.45	30	214	0.0000
12	716	561.9	1.01	14.75	726	215	1.8659
12	686	561.7	0.70	16.43	691	216	0.5440
12	661	560.5	1.43	16.20	666	217	0.0096
12	636	552.9	2.33	15.23	641	218	0.0029
12	606	557.2	3.55	14.05	611	219	-0.0011
12	576	559.4	4.78	14.29	581	220	0.0009
12	546	566.3	6.11	13.43	551	221	0.0005
12	516	569.7	8.21	11.94	521	222	0.0002
12	486	560.8	7.07	12.56	491	223	0.0002
12	449	560.3	9.24	11.36	461	224	0.0001
12	431	569.6	10.55	10.94	436	225	0.0002
12	401	568.6	11.22	10.67	406	226	0.0001
12	371	556.4	11.76	10.49	376	227	0.0001
12	341	572.0	13.05	9.77	346	228	0.0000
12	311	567.2	14.16	9.57	316	229	0.0000
12	281	575.8	15.46	7.54	286	230	0.0000
12	251	571.0	16.34	8.78	256	231	0.0000
12	221	592.4	18.33	5.43	226	232	0.0000
12	186	563.1	18.09	7.63	191	233	0.0000
12	156	562.6	19.94	7.13	161	234	0.0000
12	123	574.9	23.53	5.77	128	235	0.0000
12	88	568.1	25.08	5.16	93	236	0.0000
12	53	568.3	27.29	4.76	58	237	0.0000
12	12	572.2	28.34	3.29	23	238	0.0000
13	683	568.5	7.52	12.16	693	239	0.0007
13	653	559.7	8.38	11.47	658	240	0.0005
13	628	555.4	9.11	11.49	633	241	0.0006
13	598	555.8	9.88	11.42	603	242	0.0004
13	568	558.3	10.65	11.09	573	243	0.0003
13	538	566.2	11.59	10.76	543	244	0.0003
13	508	555.0	12.13	10.40	513	245	0.0000
13	478	565.6	13.06	10.07	483	246	0.0001
13	448	560.5	13.76	9.28	453	247	0.0001
13	414	556.9	14.59	9.24	423	248	0.0001

13	399	563.8	15.09	9.17	404	249	0.0000
13	364	579.1	16.34	8.90	369	250	0.0001
13	329	555.5	16.44	8.82	334.00	251	0.0001
13	294	556.6	17.67	8.34	299.00	252	0.0000
13	259	554.2	17.82	15.99	264	253	0.0000
13	224	566.9	19.28	7.63	229	254	0.0000
13	189	555.5	19.48	15.32	194	255	0.0000
13	154	564.6	20.41	6.95	159	256	0.0000
13	110	581.3	21.94	6.67	124	257	0.0000
13	90	579.7	22.22	6.55	95	258	0.0000
13	88	575.8	22.89	6.27	93	259	0.0000
13	46	569.3	24.12	5.59	58.00	260	0.0000
14	691	559.8	4.87	16.28	701.00	261	7.6381
14	661	559.5	0.92	19.68	666	262	6.4755
14	636	559.7	0.96	19.94	641	263	5.3893
14	611	560.5	0.97	20.14	616	264	3.8975
14	586	558.0	1.61	19.79	591	265	3.1084
14	561	563.3	1.40	20.09	566	266	166.5352
14	536	559.7	1.20	19.94	541	267	0.9762
14	511	563.8	2.61	19.56	516	268	0.2725
14	486	561.7	6.25	17.51	491	269	0.2258
14	461	565.9	5.62	17.70	466	270	0.0873
14	441	564.0	5.55	17.66	446	271	0.2656
14	418	565.3	5.17	17.95	426	272	0.0755
14	404	563.9	4.98	17.65	409	273	0.0776
14	379	573.7	5.29	16.99	384	274	0.0662
14	349	563.2	5.91	15.88	354	275	0.0639
14	319	565.0	7.76	14.74	324	276	0.0519
14	289	566.4	11.77	14.37	294	277	0.0541
14	259	563.3	11.81	15.98	264	278	0.0374
14	229	561.5	10.85	15.98	234	279	0.0393
14	199	567.2	11.93	13.33	204	280	0.0317
14	169	562.1	12.43	12.84	174	281	0.0319
14	139	549.8	12.74	11.72	144	282	0.0288
14	111	554.4	13.22	11.06	119	283	0.0260
14	77	548.0	14.92	10.09	82	284	0.0177
14	47	553.0	15.81	10.25	52	285	0.0218
14	11	554.5	18.62	8.61	22	286	0.0162
15	271	562.4	16.32	11.26	276	287	0.0276
15	246	556.7	16.54	11.39	251	288	0.0263
15	221	552.9	16.53	11.23	226	289	0.0285
15	196	555.5	16.99	11.18	201	290	0.0441

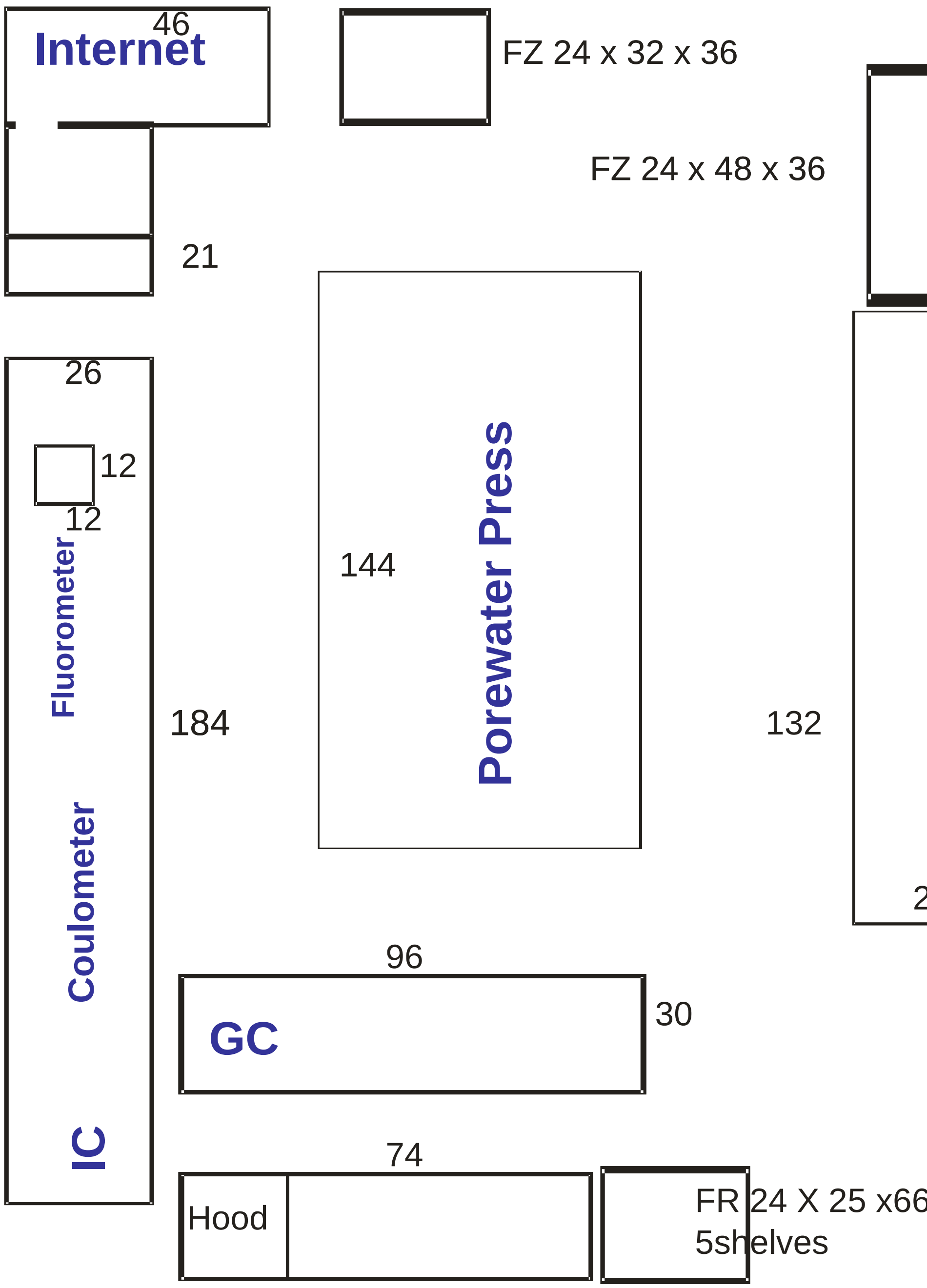
15	171	553.7	17.21	10.95	176	291	0.0277
15	146	555.1	17.76	10.07	151	292	0.0256
15	121	563.7	18.17	10.38	126	293	0.0223
15	96	556.9	18.25	9.78	101	294	0.0158
15	71	561.4	18.48	9.72	76	295	0.0244
15	46	559.4	18.34	9.85	51	296	0.0170
15	13	560.4	18.62	9.64	26	297	0.0194
16	675	561.9	12.72	10.74	685	298	0.0356
16	645	571.6	13.75	10.47	650	299	0.0401
16	620	560.6	14.27	10.08	625	300	0.0015
16	595	561.5	14.95	9.82	600	301	0.0015
16	570	567.9	15.63	9.67	575	302	0.0016
16	545	561.1	15.82	9.38	550	303	0.0019
16	520	559.8	16.23	9.17	525	304	0.0017
16	490	559.8	16.90	8.93	495	305	0.0018
16	460	558.8	17.61	8.63	465	306	0.0014
16	430	570.8	18.70	8.27	435	307	0.0013
16	395	559.1	18.75	7.97	405	308	0.0012
16	369	562.4	19.70	7.76	374	309	0.0010
16	339	548.7	19.94	7.34	344	310	0.0009
16	309	560.8	22.03	6.41	314	311	0.0012
16	279	561.3	21.64	6.75	284	312	0.0016
16	249	568.9	21.81	6.84	254	313	0.0017
16	219	569.6	22.81	6.37	224	314	0.0018
16	189	548.3	22.51	6.07	194	315	0.0014
16	159	559.4	24.05	5.85	164	316	0.0018
16	129	565.5	25.25	5.39	134	317	0.0013
16	92	558.7	25.98	4.76	104	318	0.0011
16	55	557.1	27.57	3.96	60	319	0.0004
16	10	558.5	28.35	3.51	20	320	0.0000
17	739	561.1	15.83	10.38	749	321	0.0147
17	709	569.8	16.73	10.19	714	322	0.0113
17	684	568.6	17.35	9.91	689	323	0.0100
17	659	562.8	17.49	9.91	664	324	0.0112
17	629	564.6	18.17	9.17	634	325	0.0091
17	599	562.9	18.63	9.09	604	326	0.0088
17	569	564.1	19.31	8.72	574	327	0.0099
17	539	564.5	20.23	7.96	544	328	0.0082
17	509	562.9	20.69	8.02	514	329	0.0079
17	479	563.7	21.26	7.63	484	330	0.0068
17	422	564.3	22.33	6.94	427	331	0.0058
17	387	563.4	22.67	6.75	392	332	0.0054

17	352	560.9	23.69	6.19	357	333	0.0043
17	312	565.8	23.36	6.49	317	334	0.0034
17	277	565.2	24.86	5.58	282	335	0.0026
17	242	567.3	25.26	5.46	247	336	0.0026
17	207	564.3	25.70	5.20	212	337	0.0018
17	147	562.9	26.61	4.59	157	338	0.8872
18	670	576.1	1.03	16.51	680	339	0.9123
18	635	562.4	1.44	16.13	640	340	0.0988
18	605	566.5	2.51	15.16	610	341	0.0089
18	575	568.0	3.77	14.77	580	342	0.0034
18	545	566.3	5.27	13.94	550	343	0.0006
18	515	568.7	6.57	12.67	520	344	0.0002
18	485	573.7	8.79	12.00	490	345	0.0002
18	455	568.2	9.65	11.73	460	346	0.0001
18	420	571.6	12.82	10.47	430	347	0.0000
18	375	568.4	13.32	9.88	380	348	0.0000
18	340	565.9	14.34	9.14	345	349	0.0000
18	305	569.9	16.25	8.63	310	350	0.0000
18	270	575.3	17.61	8.37	275	351	0.0000
18	235	573.9	18.72	7.81	240	352	0.0000
18	200	574.3	20.03	7.26	205	353	0.0000
18	165	575.4	20.68	7.28	170	354	0.0000
18	130	572.3	21.90	6.51	135	355	0.0000
18	89	580.1	24.95	5.32	100	356	0.0000
18	48	572.1	27.03	4.39	53	357	0.0000
18	9	575.3	28.40	3.67	18	358	0.0000
19	700	574.6	3.46	13.78	710	359	0.0014
19	665	575.5	4.80	13.60	670	360	0.0004
19	635	570.1	5.67	13.70	640	361	0.0005
19	605	578.4	6.51		610	362	0.0002
19	575	581.6	7.51	12.69	580	363	0.0002
19	545	570.5	7.91	13.03	550	364	0.0000
19	515	567.4	8.74	11.91	520	365	0.0001
19	480	564.5	9.77	11.36	485	366	0.0001
19	445	568.8	10.86	11.10	450	367	0.0000
19	403	571.8	12.23	10.42	408	368	0.0000
19	363	571.3	13.30	9.98	368	369	0.0000
19	323	572.1	15.36	8.98	328	370	0.0000
19	283	572.0	16.05	8.70	288	371	0.0000
19	243	569.5	16.99	8.41	248	372	0.0000
19	203	568.5	17.92	8.08	208	373	0.0000
19	163	569.8	18.93	7.71	168	374	0.0000

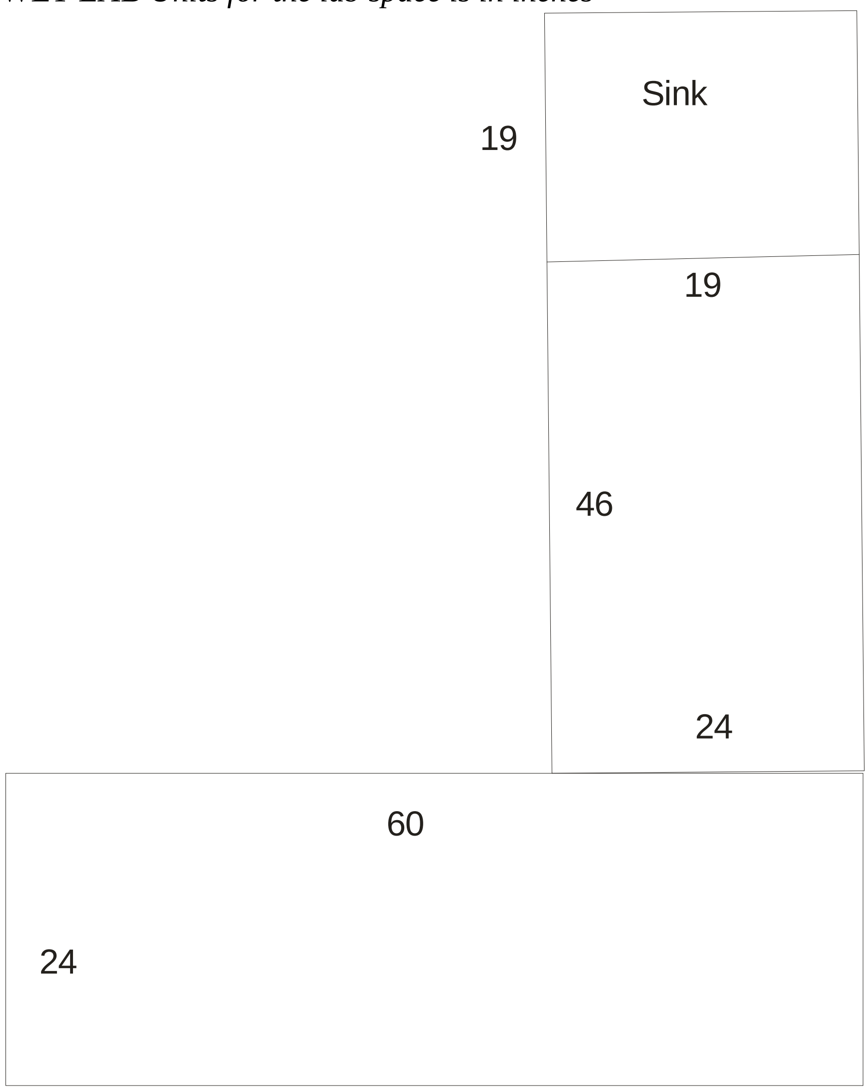
19	117	568.9	20.51	6.59	128	375	0.0000
19	70	570.7	21.20	6.64	75	376	0.0000
20	714	569.6	9.61	11.01	724	377	0.0000
20	679	568.0	10.15	11.04	684	378	0.0000
20	649	569.4	10.70	10.71	654	379	0.0000
20	614	572.5	11.59	10.60	619	380	0.0000
20	579	576.3	12.74	10.10	584	381	0.0000
20	544	569.0	13.44	9.86	549	382	0.0000
20	504	568.7	14.51	9.36	514	383	0.0000
20	451	567.2	15.95	8.80	458	384	0.0000
20	411	568.2	16.92	8.45	416	385	0.0000
20	371	567.2	18.37	7.78	376	386	0.0000
20	331	568.3	19.02	7.60	336	387	0.0000
20	291	568.3	20.52	6.92	296	388	0.0000
20	251	567.4	21.10	6.57	256	389	0.0000
20	211	569.1	21.66	6.61	216	390	0.0000
20	166	570.6	22.45	6.20	176	391	0.0000
20	110	568.0	23.64	5.68	115	392	0.0000
20	70	570.1	24.61	5.21	75	393	0.0000
20	30	569.8	25.57	4.98	35	394	9.9194
21	712	566.8	0.75	17.77	722	395	8.5063
21	677	563.8	0.74	19.08	682	396	7.8952
21	652	571.2	0.81	19.42	657	397	7.6172
21	622	566.2	1.09	19.53	627	398	6.3649
21	592	565.9	0.96	20.20	597	399	3.4578
21	562	566.5	1.04	20.17	567	400	16.2701
21	532	564.2	1.86	19.86	537	401	0.3881
21	502	558.8	2.79	19.03	507	402	-0.0004
21	472	567.2	5.12	17.16	477	403	0.0774
21	431	568.9	7.91	16.25	442	404	0.0714
21	394	568.2	9.88	14.47	399	405	0.0470
21	364	566.9	11.47	13.29	369	406	0.0442
21	334	544.4	11.71	12.89	339	407	0.0362
21	299	568.1	12.79	12.44	304	408	0.0382
21	264	563.8	14.60	11.28	269	409	0.0297
21	229	569.3	14.98	11.15	115	410	0.0276
21	194	563.8	16.89	9.30	75	411	0.0210
21	157	566.9	16.49	10.19	40	412	0.0194
21	105	568.6	18.86	9.00	490	413	0.0156
21	70	566.4	20.28	8.39	450	414	0.0133
21	33	570.4	22.30	7.08	420	415	0.0097
22	480	572.1	3.31	14.35	390	416	0.0004

22	445	573.8	8.08	13.76	355	417	0.0002
22	415	573.4	9.54	12.91	420	418	0.0001
22	385	572.0	10.70	12.27	390	419	0.0000
22	350	573.4	12.25	11.70	355	420	0.0000
22	315	572.3	13.66	10.21	320	421	0.0000
22	275	569.8	15.64	9.90	280	422	0.0000
22	243	568.5	16.11	9.61	248	423	0.0000
22	203	568.9	17.15	8.96	213	424	0.0000

Appendix 3: On board Chemistry Lab lay out.
Lab space (inches) and instrument layout (including freezers FZ and refrigerator FR) for the main lab.



WET LAB *Units for the lab space is in inches*



Appendix 4: Core Descriptions

Core	Section	Section length (cm)	Pore water distance from top of core (cm) top	bottom	Average cmbsf	Sample Thickness cm	Sample #	Lithology clay, sand	Color	Fossils bivalves, gastropod, forams, other	Diagenesis Rare, Common, Abundant	Bioturbation Rare, Common, Abundant	Disturbance Moussey, Soupy,	Clay Consistency Firm, malleable, etc	Other	Sample	Photos	Written Descriptions
No description for Core 1, Cores 2 & 3 were failed pulls																		
4	I	304	693	708	701	15	KR4 01	clay	very light gray	Foram bearing	FeS mottling rare							Very light gray, foram bearing clay, rare FeS mottling throughout
4	I	304	673	683	678	10	KR4 02	clay	very light gray	Foram bearing	FeS mottling rare							Very light gray, foram bearing clay, rare FeS mottling throughout
4	I	304	653	663	658	10	KR4 03	clay	light gray	Foram bearing	FeS mottling common							Light gray, foram bearing clay with common FeS mottling throughout
4	I	304	628	643	636	15	KR4 04	clay	light gray	Foram bearing	FeS mottling common							Light gray, foram bearing clay with common FeS mottling throughout
4	I	304	603	618	611	15	KR4 05	clay	light gray	Foram bearing	FeS mottling common							Light gray, foram bearing clay with common FeS mottling throughout
4	I	304	578	593	586	15	KR4 06	clay	light gray	Foram bearing	FeS mottling common							Light gray, foram bearing clay with common FeS mottling throughout
4	I	304	553	568	561	15	KR4 07	>4cm thick rich quartz sand layer, bounded by clay	sand, lt gray clay, light gray	Foram bearing	FeS mottling common							>4cm medium grained, moderately well sorted, well rounded, quartz rich sand layer; Surrounded by light gray, foram bearing clay with common FeS mottling throughout
4	I	304	523	538	531	15	KR4 08	clay	light gray	Foram bearing	FeS mottling common							Light gray, foram bearing clay with common FeS mottling throughout
4	I	304	498	513	506	15	KR4 09	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay, FeS mottling rare throughout
4	I	304	473	488	481	15	KR4 10	>5cm thick rich quartz sand layer, bounded by clay	sand, lt gray clay, light gray	Foram bearing	FeS mottling rare							>5cm medium grained, moderately well sorted, well rounded, quartz rich sand layer; Surrounded by light gray, foram bearing clay with rare FeS mottling throughout
4	I	304	448	463	456	15	KR4 11	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay, FeS mottling rare throughout
4	I	304	414	438	426	24	KR4 12	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay, FeS mottling rare throughout
4	II	307	384	404	394	20	KR4 13	clay	very dark gray	Foram bearing	FeS mottling rare							Dark gray, foram bearing clay, FeS mottling rare throughout
4	II	307	354	374	364	20	KR4 14	clay	very dark gray	Foram bearing	FeS mottling common							Dark gray, foram bearing clay, FeS mottling common throughout
4	II	307	324	344	334	20	KR4 15	clay w/ 2cm diameter sand pocket	sand, lt gray clay, vry dk gray	Foram bearing	FeS mottling common							2cm diameter, medium grained, quartz rich sand pocket; Surrounded by dark gray, foram bearing clay, FeS mottling common throughout
4	II	307	294	314	304	20	KR4 16	clay	very dark gray	Foram bearing	FeS mottling common							Dark gray, foram bearing clay, FeS mottling common throughout
4	II	307	264	284	274	20	KR4 17	quartz rich sand layer, bounded by clay	sand white/lt gray; clay vry dk gray	Foram bearing	FeS mottling common							>10cm thick, medium grained, quartz rich sand layer (*also was present in porewater sample Sec. 2, 150T). Clay same as sample KR18
4	II	307	234	254	244	20	KR4 18	clay	very dark gray	Foram bearing	FeS mottling common							Dark gray, foram bearing clay, FeS mottling common throughout
4	II	307	204	224	214	20	KR4 19	clay	very dark gray	Foram bearing	FeS mottling common							Dark gray, foram bearing clay, FeS mottling common throughout
4	II	307	184	194	189	10	KR4 20	clay	very dark gray	Foram bearing	FeS mottling rare							Dark gray, foram bearing clay, FeS mottling rare throughout
4	II	307	154	174	164	20	KR4 21	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay; FeS mottling rare throughout
4	II	307	124	144	134	20	KR4 22	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay; FeS mottling rare throughout
4	III	107	77	97	87	20	KR4 23	clay	light gray	Foram bearing	FeS mottling rare							Light gray, foram bearing clay; FeS mottling rare throughout
4	III	107	47	67	57	20	KR4 24	clay	light gray	Foram bearing								Light gray, foram bearing clay; FeS mottling rare throughout
4	III	107	17	37	27	20	KR4 25	clay	light gray					watery				Light gray, foram bearing clay; FeS mottling rare throughout; Top of sample very wet/maleable
5	I	309	731	746	739	15	KR5 01	clay	light brown-gray	Foram bearing	FeS mottling rare			firm				Light brown-gray, foram bearing, clay; solid/firm consistency; Rare FeS mottling
5	I	309	706	721	714	15	KR5 02	silt/sand pockets, <1cm	light brown-gray	Foram bearing	FeS mottling rare			firm				Light brown-gray, foram bearing, clay; with <1cm diamgeter silt/very fine grained sand pockets; Rare FeS mottling
5	I	309	681	696	689	15	KR5 03	clay	light brown-gray	Foram bearing	FeS mottling rare			firm				Light gray-brown, foram bearing clay with Rare FeS mottling
5	I	309	656	671	664	15	KR5 04	clay	light brown-gray	Foram bearing	FeS mottling rare							Light gray-brown, foram bearing clay with Rare FeS mottling
5	I	309	631	646	639	15	KR5 05	clay	light brown-gray	Foram bearing	FeS mottling rare				or FeS nodules, sampled, <1/4cm diameter	X		Light gray-brown, foram bearing clay with Rare FeS mottling; <1/4cm diameter carbonate or gray siltstone nodules (Sampled)
5	I	309	606	621	614	15	KR5 06	clay	light gray	Shell fragmnets (bivalve); Foram bearing	FeS mottling rare					X		Light gray, foram bearing clay; Rare FeS mottling; fragments of bivalve shell present (Sampled)

5	**I**	309	531	546	539	15	**KR5 09**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**I**	309	506	521	514	15	**KR5 10**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**I**	309	481	496	489	15	**KR5 11**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**I**	309	547	471	509	-76	**KR5 12**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	422	437	430	15	**KR5 13**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	397	412	405	15	**KR5 14**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	372	387	380	15	**KR5 15**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	347	362	355	15	**KR5 16**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	322	337	330	15	**KR5 17**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	292	312	302	20	**KR5 18**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	262	282	272	20	**KR5 19**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	232	252	242	20	**KR5 20**	silt/sand pockets, <1cm	light gray	Shell fragments (sampled); Foram bearing	FeS mottling rare				X	Light gray, foram bearing clay; Rare FeS mottling; small sand pockets, <1cm diameter; shell fragment (Sampled)
5	**II**	308	202	222	212	20	**KR5 21**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	172	192	182	20	**KR5 22**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**II**	308	139	162	151	23	**KR5 23**	clay	light gray	Foram bearing	FeS mottling rare					Light gray, foram bearing clay; Rare FeS mottling
5	**III***	139	109	129	119	20	**KR5 24**	clay	light gray	Foram bearing	FeS mottling rare		watery			Light gray, foram bearing clay; Rare FeS mottling; lots of seawater contamination
6	**I**	304	284	294	289	10	**KR6 01**	clay	light gray	Foram bearing	rare	Salmon texture				
6	**I**	304	264	274	269	10	**KR6 02**	clay	light gray	Foram bearing	rare	Salmon texture				
6	**I**	304	244	254	249	10	**KR6 03**	clay	light gray	Foram bearing	rare	Salmon texture				
6	**I**	304	224	234	229	10	**KR6 04**	clay	light gray	Foram bearing	rare	Salmon texture				
6	**I**	304	204	214	209	10	**KR6 05**	~1cm sand pocket with	light gray	Foram bearing	FeS mottling rare			~1cm oil stain		
6	**I**	304	159	194	177	35	**KR6 06**	clay	light gray	Forams rare	FeS mottling rare			void, ~10+cm		
6	**I**	304	139	149	144	10	**KR6 07**	clay	light gray	Forams rare	rare					
6	**I**	304	119	129	124	10	**KR6 08**	clay	light gray	Forams rare	rare			stain		
6	**I**	304	74	109	92	35	**KR6 09**	clay	light gray	Forams rare	rare			void		
6	**I**	304	54	64	59	10	**KR6 10**	clay; small sand/silt lens	light gray	Foram bearing	FeS mottling rare					
6	**I**	304	34	44	39	10	**KR6 11**	clay	light gray	Foram bearing	rare	Salmon texture				
6	**I**	304	14	24	19	10	**KR6 12**	clay	light gray	Foram bearing	FeS mottling rare	Moussey throughout except at top near hydrate sample #2 where it is soupy		light oil stain?		
7	**I**	304	726	741	734	15	**KR7 01**	clay	light green-gray	Foram bearing	rare: visible pyrite, <1mm; copper colored streaks/mottl					light green, foram bearing clay; FeS mottling rare throughout, <1mm diameter pyrite grains present?; Copper colored mottling rare throughout
7	**I**	306	701	716	709	15	**KR7 02**	clay	light green-gray	Foram bearing	rare: visible; copper colored streaks/mottl					light green, foram bearing clay; FeS mottling rare throughout, <1mm diameter pyrite grains present?; Copper colored mottling rare throughout
7	**I**	306	676	691	684	15	**KR7 03**	clay	light green-gray	Foram bearing	rare: visible; copper colored streaks/mottles; 2cm long nodule within FeS patch				X	light green, foram bearing clay; FeS mottling rare throughout, <1mm diameter pyrite grains present?; Copper colored mottling rare throughout; 2cm long, narrow nodule within FeS pocket (Sampled)
7	**I**	306	651	666	659	15	**KR7 04**	clay	light green-brown	Foram bearing	FeS mottles rare; pyrite grains <1mm					light green, foram bearing clay; FeS mottling rare throughout, <1mm diameter pyrite grains present?; Copper colored mottling rare throughout
7	**I**	306	626	641	634	15	**KR7 05**	clay	light brown-flesh-green clay	Foram bearing	FeS mottles rare; pyrite grains <1mm					light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
7	**I**	306	601	616	609	15	**KR7 06**	clay	light brown-flesh-green clay	Foram bearing	FeS mottles rare; pyrite grains <1mm					light brown-flesh-green, foram bearing clay; Distinct FeS patches which are semi-cohesive
7	**I**	306	576	591	584	15	**KR7 07**	clay	light brown-flesh-green clay	Foram bearing	FeS mottles rare; pyrite grains <1mm					light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout

7	**I**	306	601	616	609	15	**KR7 06**	clay	light brown-flesh-green clay	Foram bearing	FeS mottles rare; pyrite grains <1mm		
7	**I**	306	576	591	584	15	**KR7 07**	clay	light brown-flesh-green clay	Foram bearing	FeS mottles rare; pyrite grains <1mm		
7	**I**	306	551	566	559	15	**KR7 08**	clay; 1cm thick, FeS stained quartz rich sand layer	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**I**	306	526	541	534	15	**KR7 09**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**I**	306	501	516	509	15	**KR7 10**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**I**	306	476	491	484	15	**KR7 11**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**I**	306	445	466	456	21	**KR7 12**	clay; <1cm thick, fine grained sand layer	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	417	437	427	20	**KR7 13**	clay	light brown-flesh-green clay	Foram rich	FeS mottling rare		
7	**II**	306	387	407	397	20	**KR7 14**	clay; ~1cm diameter sand pocket	light brown-flesh-green clay	Foram rich	FeS mottling rare		
7	**II**	306	357	377	367	20	**KR7 15**	clay	light brown-flesh-green clay	Foram rich	FeS mottling rare		
7	**II**	306	327	347	337	20	**KR7 16**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	297	317	307	20	**KR7 17**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		increased moisture content from KR7 17 to surface
7	**II**	306	267	287	277	20	**KR7 18**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	237	257	247	20	**KR7 19**	clay; ~1cm diameter sand pocket	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	207	227	217	20	**KR7 20**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	177	197	187	20	**KR7 21**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**II**	306	141	167	154	26	**KR7 22**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**III**	141	111	131	121	20	**KR7 23**	diameter sand pocket	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**III**	141	81	101	91	20	**KR7 24**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**III**	141	51	71	61	20	**KR7 25**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
7	**III**	141	21	41	31	20	**KR7 26**	clay	light brown-flesh-green clay	Foram bearing	FeS mottling rare		
8	**I**	304	714	729	722	15	**KR8 01**	clay	light brown	Foram bearing	rare; faint copper colored		firm
8	**I**	304	689	704	697	15	**KR8 02**	clay	light brown	Foram bearing	rare; faint copper colored		firm
8	**I**	304	664	679	672	15	**KR8 03**	clay	light brown	Foram bearing	rare; faint copper colored		firm
8	**I**	304	639	654	647	15	**KR8 04**	clay	light brown	Foram bearing	rare; bold copper colored		firm
8	**I**	304	614	629	622	15	**KR8 05**	clay	light brown	Foram bearing	rare; bold copper colored		malleable
8	**I**	304	589	604	597	15	**KR8 06**	clay	light brown	Foram bearing	rare; bold copper colored		malleable
8	**I**	304	564	579	572	15	**KR8 07**	clay	light brown	Foram bearing	rare; bold copper colored	FeS stained foram patch	malleable
8	**I**	304	539	554	547	15	**KR8 08**	clay	light brown	Foram bearing	rare; bold copper colored	FeS stained foram patch	malleable
8	**I**	304	514	529	522	15	**KR8 09**	clay	light brown	Foram bearing	rare		malleable

KR7 06	light brown-flesh-green, foram bearing clay; Distinct FeS patches which are semi-cohesive
KR7 07	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
KR7 08	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout; FeS stained, fine grained, quartz rich sand layer ~1cm thick
KR7 09	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
KR7 10	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
KR7 11	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
KR7 12	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout; 1cm thick, fine grained, quartz rich sand layer
KR7 13	light brown-flesh-green colored, foram rich clay; rare FeS mottling and pyrite grains throughout
KR7 14	light brown-flesh-green colored, foram rich clay; rare FeS mottling and pyrite grains throughout
KR7 15	light brown-flesh-green colored, foram rich clay; rare FeS mottling and pyrite grains throughout
KR7 16	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout
KR7 17	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout; clay is moister/more watery
KR7 18	light brown-flesh-green colored, foram bearing clay; rare FeS mottling; clay is moister/more watery
KR7 19	light brown-flesh-green colored, foram bearing clay; rare FeS mottling and pyrite grains throughout; clay is moister/more watery

8	**III**	138	18	38	28	20	**KR8 25**	clay	light gray	Foram rich	common; copper colored mottling rare	Sands patches, up to 2cm diameter t-out	extremely malleable		
9	**I**	288	744	769	757	25	**KR9 01**	clay	light green-gray-flesh/brown	Foram bearing	rare; flesh colored mottling rare		firm		
9	**I**	288	719	734	727	15	**KR9 02**	clay	light green-gray-flesh/brown	Foram bearing	rare; flesh colored mottling rare		firm		
9	**I**	288	694	709	702	15	**KR9 03**	clay	light green-gray-with flesh/brown patches	Foram bearing	rare; flesh colored mottling rare		malleable		
9	**I**	288	669	684	677	15	**KR9 04**	clay	light green-gray	Foram bearing	rare; flesh colored mottling rare		malleable		
9	**I**	288	644	659	652	15	**KR9 05**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		malleable		
9	**I**	288	619	634	627	15	**KR9 06**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		malleable		
9	**I**	288	594	609	602	15	**KR9 07**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		malleable		
9	**I**	288	569	584	577	15	**KR9 08**	medium grained, quartz rich sand pockets	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		malleable	X	X
9	**I**	288	544	559	552	15	**KR9 09**	clay	light green-gray-with flesh/brown patches	Foram bearing	rare; flesh colored mottling rare		firm		
9	**I**	288	519	534	527	15	**KR9 10**	thick, medium grained, quartz rich sand layer	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		malleable		
9	**I**	288	494	509	502	15	**KR9 11**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable		
9	**II**	307	451	471	461	20	**KR9 12**	clay; 1 quartz rich sand pocket 1cm diameter	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable		
9	**II**	307	421	441	431	20	**KR9 13**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	391	411	401	20	**KR9 14**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	361	381	371	20	**KR9 15**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	331	351	341	20	**KR9 16**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	301	321	311	20	**KR9 17**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	271	291	281	20	**KR9 18**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	241	261	251	20	**KR9 19**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare		very malleable and increasing moisture		
9	**II**	307	211	231	221	20	**KR9 20**	clay	light green-gray	Foram rich	FeS mottling common	vertical worm burrows rare throughout	very malleable and increasing moisture		
9	**II**	307	174	201	188	27	**KR9 21**	clay	light green-gray	Foram rich	FeS mottling common	vertical worm burrows rare throughout	very malleable and increasing moisture		
9	**III**	174	144	164	154	20	**KR9 22**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare	vertical worm burrows common throughout	extremely malleable and moisture		

9	**II**	307	241	261	251	20	**KR9 19**	clay	light green-gray	Foram bearing	FeS mottling common flesh colored mottling rare			very malleable and increasing moisture		
9	**II**	307	211	231	221	20	**KR9 20**	clay	light green-gray	Foram rich	FeS mottling common	vertical worm burrows rare throughout		very malleable and increasing moisture		
9	**II**	307	174	201	188	27	**KR9 21**	clay	light green-gray	Foram rich	FeS mottling common	vertical worm burrows rare throughout		very malleable and increasing moisture		
9	**III**	174	144	164	154	20	**KR9 22**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare	vertical worm burrows common throughout		extremely malleable and moisture		
9	**III**	174	114	134	124	20	**KR9 23**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare	vertical worm burrows common throughout		extremely malleable and moisture		
9	**III**	174	84	104	94	20	**KR9 24**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare	vertical worm burrows common throughout		extremely malleable and moisture		
9	**III**	174	54	74	64	20	**KR9 25**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare	vertical worm burrows common throughout		extremely malleable and moisture		
9	**III**	174	24	44	34	20	**KR9 26**	clay	light green-gray	Foram rich	FeS mottling common flesh colored mottling rare			very malleable and increasing moisture	silt dispersed in clay matrix	
10	**I**	289	682	697	690	15	**KR10 01**	clay	light green-gray	Forams bearing	rare			Firm		
10	**I**	289	657	672	665	15	**KR10 02**	clay	light green-gray	Forams bearing	FeS mottling rare		gas cracks common t-out	Firm	one gas crack	
10	**I**	289	632	647	640	15	**KR10 03**	clay	light green-gray	Forams bearing	FeS mottling rare		gas cracks common t-out	Firm		
10	**I**	289	607	622	615	15	**KR10 04**	clay	light green-gray	Forams bearing	rare; rare flesh/copper colored		gas cracks rare t-out	Firm		
10	**I**	289	582	597	590	15	**KR10 05**	clay	light green-gray	Forams bearing	rare; rare flesh/copper colored		gas cracks rare t-out	Firm		
10	**I**	289	557	572	565	15	**KR10 06**	clay	light green-gray	Forams bearing	FeS mottling common; Flesh/copper colored patches rare		gas cracks rare t-out	Firm		
10	**I**	289	532	547	540	15	**KR10 07**	clay	light green-gray	Forams bearing	FeS mottling common; Flesh/copper colored patches rare		gas cracks rare t-out	malleable	oil streaks?	
10	**I**	289	507	522	515	15	**KR10 08**	clay	light green-gray	Forams bearing	FeS mottling common; Flesh/copper colored patches rare		gas cracks rare t-out	malleable	oil streaks?	
10	**I**	289	482	497	490	15	**KR10 09**	clay	light green-gray	Forams bearing	FeS mottling common; Flesh/copper colored patches rare		gas cracks rare t-out	malleable	oil streaks? H2S odor	
10	**I**	289	457	472	465	15	**KR10 10**	clay	light green-gray	Forams bearing	common; Flesh/copper colored patches common		gas cracks rare t-out	malleable	oil streaks? H2S odor	
10	**I**	289	428	447	438	19	**KR10 11**	clay	light green-gray	Forams bearing	common; Flesh/copper colored patches common		gas cracks rare t-out	malleable	common oil or iron streaks?	X
10	**II**	307	398	418	408	20	**KR10 12**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare			very malleable		
10	**II**	307	368	388	378	20	**KR10 13**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare			very malleable		
10	**II**	307	338	358	348	20	**KR10 14**	thick, medium grained, quartz rich sand layer	light brown-flesh-gray	Foram bearing	FeS mottling rare			very malleable		
10	**II**	307	308	328	318	20	**KR10 15**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare			very malleable, increased moisture		
10	**II**	307	278	298	288	20	**KR10 16**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare			very malleable, increased moisture		

10	**II**	307	248	268	258	20	**KR10 17**	<1cm diameter, FeS stained sand	light brown-flesh-gray	Foram bearing	FeS mottling rare		very malleable, increased moisture		
10	**II**	307	218	238	228	20	**KR10 18**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare		very malleable, increased moisture		
10	**II**	307	188	208	198	20	**KR10 19**	clay	light brown-flesh-gray	Foram bearing	FeS mottling rare	rare worm burrows throughout	very malleable, increased moisture		
10	**II**	307	158	178	168	20	**KR10 20**	Small,FeS stained sand pockets t-out	light brown-flesh-gray	Foram rich	FeS mottling rare	common worm burrows throughout	very malleable, increased moisture		
10	**II**	307	121	143	132	22	**KR10 21**	Small,FeS stained sand pockets t-out	light brown-flesh-gray	Foram rich	FeS mottling rare	common worm burrows throughout	very malleable, increased moisture		
10	**III**	121	86	111	99	25	**KR10 22**	Small,FeS stained sand pockets t-out	light brown-flesh-gray	Foram rich	FeS mottling rare	common worm burrows throughout	very malleable, increased moisture		
10	**III**	121	51	76	64	25	**KR10 23**	Small,FeS stained sand pockets t-out	light brown-flesh-gray	Foram rich	FeS mottling rare	common worm burrows throughout	very malleable, increased moisture	common oil or iron streaks?	
10	**III**	121	11	41	26	30	**KR10 24**	Small,FeS stained sand pockets t-out	light brown-flesh-gray	Foram rich	FeS mottling rare	common worm burrows throughout	very malleable, increased moisture	common oil or iron streaks?	
11	**I**	290	652	667	660	15	**KR11 01**	clay	light green-gray	Foram bearing	rare		firm		
11	**I**	290	627	642	635	15	**KR11 02**	clay	light green-gray	Foram bearing	rare		firm		
11	**I**	290	602	617	610	15	**KR11 03**	clay	light green-gray	Foram bearing	common; copper color mottles rare		firm		
11	**I**	290	577	592	585	15	**KR11 04**	clay	light green-gray	Foram bearing	abundant; copper color mottles common		firm		X
11	**I**	290	552	567	560	15	**KR11 05**	FeS stained sand pocket ~2cm	light green-gray	Foram bearing	common; copper color mottles rare		firm		
11	**I**	290	522	542	532	20	**KR11 06**	clay	light green-gray	Foram bearing	common; copper color mottles rare		malleable		
11	**I**	290	492	512	502	20	**KR11 07**	clay	light green-gray	Foram bearing	rare		malleable		
11	**I**	290	462	482	472	20	**KR11 08**	clay; 1cm sand lens	light green-gray	Foram bearing	~1-2cm diameter and 1mm thick	vertical worm burrow?	malleable		
11	**I**	290	432	452	442	20	**KR11 09**	clay; 1 FeS stained sand lens	light green-gray	Foram bearing	~1-2cm diameter and 1mm thick rare t-out		malleable		
11	**I**	290	397	422	410	25	**KR11 10**	clay; 11/2cm sand lens	light green-gray	Foram rich	FeS lenses rare		very malleable		
11	**II**	307	367	387	377	20	**KR11 11**	clay; sand lens 1cm diameter	light green-gray	Foram bearing	~1-2cm diameter and 1mm thick rare t-out		very malleable		
11	**II**	307	337	357	347	20	**KR11 12**	clay	light green-gray	Foram bearing	rare		very malleable		
11	**II**	307	307	327	317	20	**KR11 13**	thick sand layer	light green-gray	Foram bearing	FeS mottling rare		very malleable		
11	**II**	307	277	297	287	20	**KR11 14**	clay	light green-gray	Foram bearing	FeS mottling rare		very malleable & moist		
11	**II**	307	247	267	257	20	**KR11 15**	clay	light green-gray	Foram bearing	FeS mottling rare		very malleable & moist		
11	**II**	307	217	237	227	20	**KR11 16**	clay	light green-gray	Foram bearing	FeS mottling common		very malleable & moist		
11	**II**	307	187	207	197	20	**KR11 17**	clay	light green-gray	Foram bearing	FeS mottling common	vertical worm burrows rare throughout	very malleable & moist	<1cm sand patch that is very wet	
11	**II**	307	157	177	167	20	**KR11 18**	clay	light green-gray	Foram bearing	common; copper color mottles rare	vertical worm burrows rare throughout	very malleable & moist		
11	**II**	307	127	147	137	20	**KR11 19**	clay	light green-gray	Foram bearing	common; copper color mottles rare	vertical worm burrows rare throughout	very malleable & moist		
11	**II**	307	90	117	104	27	**KR11 20**	clay	light brown	Foram rich	common; copper color mottles rare	vertical worm burrows rare throughout	very malleable & moist		
11	**III**	90	60	80	70	20	**KR11 21**	clay	light brown	Foram rich	common; copper color mottles rare	vertical worm burrows rare throughout	very malleable & moist		
11	**III**	90	30	50	40	20	**KR11 22**	clay	light brown-flesh clay	Foram rich	common; copper color mottles common	vertical worm burrows rare throughout	very malleable & moist		
11	**III**	90	0	20	10	20	**KR11 23**	clay	Iron-red-brown	Foram-rich; shell fragments common	No distinct FeS apparent	vertical worm burrows rare throughout			X

12	**I**	290	691	706	699	15	**KR12 01**	clay	light green-gray	Foram bearing	common; 1/4cm diameter pyritized			malleable & moist		
12	**I**	290	666	681	674	15	**KR12 02**	clay	light green-gray	Foram bearing	common; copper colored mottling rare			malleable & moist		
12	**I**	290	641	656	649	15	**KR12 03**	clay	light green-gray	Foram bearing	rare; copper colored mottling rare			malleable & moist		
12	**I**	290	611	631	621	20	**KR12 04**	clay	light gray-brown	Foram bearing	rare			malleable		
12	**I**	290	581	601	591	20	**KR12 05**	clay	light gray-brown	Foram bearing	rare			malleable		
12	**I**	290	551	571	561	20	**KR12 06**	clay	light gray-brown	Foram bearing	rare			malleable		
12	**I**	290	521	541	531	20	**KR12 07**	thick, medium grained, quartz rich sand layer	light gray-brown	Foram bearing	FeS mottling rare			malleable & moist		
12	**I**	290	491	511	501	20	**KR12 08**	sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare			malleable & moist		
12	**I**	290	461	481	471	20	**KR12 09**	sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare			malleable & moist		
12	**I**	290	696	716	706	20	**KR12 10**	sand patches t-out	light gray-brown	Foram rich	FeS mottling rare		1cm gas crack?	very wet and malleable		
12	**II**	308	376	396	386	20	**KR12 11**	sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare			malleable & moist		
12	**II**	308	346	366	356	20	**KR12 12**	sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare			malleable & moist		
12	**II**	308	316	336	326	20	**KR12 13**	clay; rare sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare	5cm long, 2cm wide, FeS stained, foram rich burrow		malleable & moist		
12	**II**	308	286	306	296	20	**KR12 14**	clay; rare sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare	3cm long, 1cm wide, FeS stained, foram rich burrow		malleable & moist		
12	**II**	308	256	276	266	20	**KR12 15**	sand patches t-out	light gray-brown	Foram bearing	FeS mottling rare			very malleable & moist		
12	**II**	308	226	246	236	20	**KR12 16**	deck, no sample	[redacted]							
12	**II**	308	191	216	204	25	**KR12 17**	clay	light gray-brown	Foram bearing	FeS mottling common			malleable & moist	X	X
12	**II**	308	161	181	171	20	**KR12 18**	clay	light gray-brown	Foram rich	FeS mottling abundant	vertical worm burrows rare throughout		very malleable & moist		
12	**II**	308	128	151	140	23	**KR12 19**	clay	light gray-brown	Foram rich	FeS mottling abundant	vertical worm burrows rare throughout		very malleable & moist		
12	**III**	128	93	118	106	25	**KR12 20**	clay	light gray-brown	Foram rich	FeS mottling rare	vertical worm burrows abundant throughout		extremely wet & malleable		
12	**III**	128	58	83	71	25	**KR12 21**	clay	light gray-brown	Foram rich	FeS mottling rare	vertical worm burrows abundant throughout		extremely wet & malleable		
12	**III**	128	23	48	36	25	**KR12 22**	clay	light gray-brown	Foram rich	FeS mottling rare	vertical worm burrows abundant throughout		extremely wet & malleable		

13	**I**	289	658	673	666	15	**KR13 01**	clay	light green-brown-gray	Foram bearing	FeS mottling rare; copper mottling rare		malleable			
13	**I**	289	633	648	641	15	**KR13 02**	clay	light green-brown-gray	Foram bearing	rare; copper mottling common		malleable	faint oil streak and H2S odor		X
13	**I**	289	603	623	613	20	**KR13 03**	clay	light green-brown-gray	Foram bearing; Shell fragments rare	rare; copper mottling common		malleable	faint oil streak and H2S odor		
13	**I**	289	573	593	583	20	**KR13 04**	clay	light green-brown-gray	Foram bearing; Shell fragments rare	FeS mottling rare; copper mottling common		malleable	shell and FeS rich layer, including 1	X	X
13	**I**	289	543	563	553	20	**KR13 05**	clay	light green-brown-gray	Foram bearing; Shell fragments rare	rare; copper mottling common		malleable			
13	**I**	289	513	533	523	20	**KR13 06**	clay	light green-brown-gray	Foram bearing; Shell fragments concentrated in 1cm layer	FeS mottling rare; copper mottling common		malleable			
13	**I**	289	483	503	493	20	**KR13 07**	clay	light green-brown-gray	Foram bearing	common; pyrite grains, mm size, rare t-out		malleable			
13	**I**	289	453	473	463	20	**KR13 08**	clay	light green-brown-gray	Foram bearing	common; pyrite grains, mm size, rare t-out		malleable			
13	**I**	289	423	443	433	20	**KR13 09**	clay	light green-brown-gray	Foram bearing; Shell fragments concentrated in 1cm layer	FeS mottling rare; copper mottling rare		malleable & moist			
13	**II**	309	369	394	382	25	**KR13 10**	clay	light green-brown-gray	Foram bearing; Shell fragments concentrated in 1cm layer	FeS mottling rare; copper mottling rare		malleable & moist			
13	**II**	309	334	359	347	25	**KR13 11**	clay	light green-brown-gray	Foram bearing; Shell fragments concentrated in 1cm layer	FeS mottling rare; copper mottling rare		malleable & moist			
13	**II**	309	299	324	312	25	**KR13 12**	stained sand pocket, ~2cm diameter	light gray	foram bear	FeS mottling moderate		very malleable & moist			
13	**II**	309	264	289	277	25	**KR13 13**	clay	light gray	foram rich	FeS mottling moderate	FeS stained foram patches t-out	very malleable & moist			
13	**II**	309	229	254	242	25	**KR13 14**	clay	light gray	foram rich	FeS mottling moderate	FeS stained foram patches t-out	very malleable & moist			
13	**II**	309	194	219	207	25	**KR13 15**	clay	light gray	foram rich	FeS mottling moderate	FeS stained foram patches t-out	very malleable & moist			
13	**II**	309	159	184	172	25	**KR13 16**	clay	light gray	foram rich	FeS mottling moderate	FeS stained foram patches t-out	very malleable & moist			
13	**II**	309	124	149	137	25	**KR13 17**	clay	light gray	foram rich	FeS mottling moderate	Worm burrows rare t-out; FeS stained foram patches t-out	very malleable & moist			
13	**III**	95	60	85	73	25	**KR13 18**	thick, medium grained, quartz rich sand layer; <1cm diameter sand	light gray	foram rich	FeS mottling moderate; copper color mottling rare t-out	Worm burrows rare t-out; FeS stained foram patches t-out	very malleable & moist			
13	**III**	95	25	50	38	25	**KR13 19**	clay; <1cm diameter sand pockets rare t-out	light gray	foram rich	moderate; copper color mottling moderate t-out	Worm burrows common t-out; FeS stained foram patches t-out	very malleable & moist			

14	**I**	292	666	681	674	15	**KR14 01**	clay	light green-gray	foram bearing; shell fragments rare t-out	FeS mottling rare		Salmon texture	dry, firm	H2S odor, visible hydrate		
14	**I**	292	641	656	649	15	**KR14 02**	clay	light green-gray	shell fragments including 1 large piece rare t-out	FeS mottling rare	slime, gooey, snot like substance ??? Dead worm???	Salmon texture / Gas cracks	dry, firm	H2S odor, visible hydrate	X	X
14	**I**	292	616	631	624	15	**KR14 03**	clay	light green-gray	foram bearing; shell fragments rare t-out	FeS mottling rare		Salmon texture rare / 3cm diameter moussey pocket with oil stain	dry, firm	H2S odor		X
14	**I**	292	591	606	599	15	**KR14 04**	clay	light green-gray	foram bearing; shell fragments rare t-out	FeS mottling rare		Salmon texture rare / 4cm x 2cm diameter moussey pocket	dry, firm	H2S odor, oil pocket ~1/2cm diameter		X
14	**I**	292	566	581	574	15	**KR14 05**	clay	light green-gray	foram bearing	rare			malleable			
14	**I**	292	541	556	549	15	**KR14 06**	clay	light green-gray	foram bearing	rare			malleable			
14	**I**	292	516	531	524	15	**KR14 07**	clay	light green-gray	foram bearing	FeS mottling rare		2 small moussey pockets, <2cm diameter	malleable			
14	**I**	292	491	506	499	15	**KR14 08**	clay	light green-gray	foram bearing; shell fragments rare t-out	FeS mottling rare			malleable			
14	**I**	292	466	481	474	15	**KR14 09**	clay	light green-gray	foram bearing; shell fragments rare t-out	rare; possible <1cm diameter authigenic carbonate		small moussey pocket near shell fragments, 1cm diameter	malleable			
14	**I**	292	446	456	451	10	**KR14 10**	medium grained, quartz rich sand lens	light green-gray	foram bearing; shell hash abundant at sand pocket	FeS mottling rare t-out			malleable; shell hash/sand area was wet			
14	**I**	292	426	436	431	10	**KR14 11**	clay	light green-gray	2cm thick shell hash-clay interval with whole gastropod	FeS mottling rare		small moussey pocket near shell fragments, <2cm diameter	malleable; shell has area was wet		X	
14	**II**	307	384	399	392	15	**KR14 12**	clay	light green-gray	foram bearing; 2cm thick shell hash-clay interval	FeS mottling rare		small moussey pocket near shell fragments, <2cm diameter	malleable; shell has area was wet		X	
14	**II**	307	354	374	364	20	**KR14 13**	clay	light gray	foram bearing	FeS mottling rare			malleable & moist			
14	**II**	307	324	344	334	20	**KR14 14**	clay	light gray	foram bearing	FeS mottling rare			very malleable & moist			
14	**II**	307	294	314	304	20	**KR14 15**	clay	light gray	foram bearing	FeS mottling rare			very malleable & moist			
14	**II**	307	264	284	274	20	**KR14 16**	clay	light gray	foram bearing	rare; copper colored mottling rare			very malleable & moist	I2S odor t-out		
14	**II**	307	234	254	244	20	**KR14 17**	clay	light gray	foram bearing	rare; copper colored mottling rare			very malleable & moist	I2S odor t-out		
14	**II**	307	204	224	214	20	**KR14 18**	clay	light green-gray	foram rich	FeS mottling rare	pockets of concentrated forams		very malleable & moist			
14	**II**	307	174	194	184	20	**KR14 19**	clay	light green-gray	foram rich	FeS mottling rare	pockets of concentrated forams		very malleable & moist			
14	**II**	307	144	164	154	20	**KR14 20**	clay	light green-gray	foram rich	FeS mottling rare	pockets of concentrated forams		very malleable & moist			
14	**II**	307	119	134	127	15	**KR14 21**	clay	light green-gray	foram rich	FeS mottling rare	vertical worm burrows densely/completely packed with forams		very malleable & moist			
14	**III**	102	82	102	92	20	**KR14 22**	clay	light green-gray	foram rich	FeS mottling rare	vertical worm burrows densely/completely packed with forams		very malleable & moist			
14	**III**	102	52	72	62	20	**KR14 23**	clay	light green-gray	foram rich	FeS mottling rare	vertical worm burrows densely containing foram "nodules"/burrow casts		very malleable & moist			

15	**I**	276	251	266	259	15	**KR15 01**	clay	light gray	foram bearing	FeS mottling rare	vertical burrow lined sparsely with forams		firm	H2S odor	
15	**I**	276	226	241	234	15	**KR15 02**	clay	light gray	foram bearing	FeS mottling rare		2cm wide x 6cm long soupy vug in middle of sample	firm	H2S odor	X
15	**I**	276	201	216	209	15	**KR15 03**	clay	light gray	foram bearing to rich	FeS mottling rare			malleable		
15	**I**	276	176	191	184	15	**KR15 04**	clay	light gray	foram bearing to rich	FeS mottling rare			malleable		
15	**I**	276	151	166	159	15	**KR15 05**	clay	light gray	to rich; intact bivalve shells, 3 of them	FeS mottling rare	vertical burrows rare t-out	2cm diameter soupy void near shells	malleable		
15	**I**	276	126	141	134	15	**KR15 06**	clay	light gray	foram bearing to rich; shell fragments t-out	FeS mottling rare			moist & malleable		
15	**I**	276	101	116	109	15	**KR15 07**	clay	light gray	foram bearing to rich; shell fragments and bivalve shells t-out	FeS mottling rare		soupy voids with higher concentrations of forams	moist & malleable		
15	**I**	276	76	91	84	15	**KR15 08**	clay	light gray	foram bearing to rich; shell fragments and bivalve shells t-out	FeS mottling rare	vertical burrows rare t-out	soupy voids with higher concentrations of forams	moist & malleable		
15	**I**	276	51	66	59	15	**KR15 09**	clay	light gray	shell fragments rare	FeS mottling rare	vertical burrows abundant t-out		very wet and malleable		
15	**I**	276	26	41	34	15	**KR15 10**	clay	light gray	shell fragments rare	FeS mottling rare	vertical burrows abundant t-out		very wet and malleable		
16	**I**	301	857	872	865	15	**KR16 01**	clay	light brown-flesh-gray mottled clay	forams rare t-out	FeS mottling rare			moist but firm		
16	**I**	301	832	847	840	15	**KR16 02**	clay	light brown-flesh-gray mottled clay	forams rare t-out	FeS mottling rare			moist but firm		
16	**I**	301	807	822	815	15	**KR16 03**	clay	light brown-flesh-gray mottled clay	forams rare t-out	FeS mottling rare			moist but firm		
16	**I**	301	782	797	790	15	**KR16 04**	clay	light brown-flesh-gray mottled clay	forams rare t-out	FeS mottling rare			moist but firm	mottling of clay colors	
16	**I**	301	757	772	765	15	**KR16 05**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**I**	301	732	747	740	15	**KR16 06**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**I**	301	702	722	712	20	**KR16 07**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**I**	301	672	692	682	20	**KR16 08**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**I**	301	642	662	652	20	**KR16 09**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**I**	301	612	632	622	20	**KR16 10**	clay	light gray-brown	forams rare t-out	FeS mottling rare			malleable & moist		
16	**II**	304	580	590	585	10	**KR16 11**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, interior is soupy	malleable & moist		
16	**II**	304	550	570	560	20	**KR16 12**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, aperture of 2cm, interior is soupy	malleable & moist		X
16	**II**	304	520	540	530	20	**KR16 13**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, aperture of 2cm, interior is soupy	malleable & moist		X
16	**II**	304	490	510	500	20	**KR16 14**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, aperture of 2cm, interior is soupy	malleable & moist		X
16	**II**	304	460	480	470	20	**KR16 15**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, aperture of 2cm, interior is soupy	malleable & moist		
16	**II**	304	430	450	440	20	**KR16 16**	clay	light gray-brown	forams rare t-out	FeS mottling rare		vertical fracture through entire sample, aperture is narrowing, interior is soupy	very moist & malleable		

17	**I***	302	714	729	722	15	**KR17 01**	clay	light gray	small <1cm length calcareous worm	FeS mottling rare		firm	H2S odor	X	X	*Section III was not sampled but was measured at 137cm total length
17	**I**	302	689	704	697	15	**KR17 02**	clay	light gray	foram bearing	rare; light brown mottles, <1cm		firm	H2S odor			*Section 1 top liner overlapped by 20cm with section 2 liner so 20cm added to section 1 sample depths
17	**I**	302	664	679	672	15	**KR17 03**	clay	light gray	foram bearing	rare; light brown mottles, <1cm		moist but firm	H2S odor faint			
17	**I**	302	634	654	644	20	**KR17 04**	clay	light gray	foram bearing; 1 small pocket of shell hash	FeS mottles common	small pockets of forams rare t-out	moist but firm				Section 2 at base of section interval is very fluid
17	**I**	302	604	624	614	20	**KR17 05**	clay	light gray	foram bearing; 1 small pocket of shell hash	FeS mottles common	small pockets of forams common t-out	moist but firm				Sample 125 taken but porewater sample acquired but volume was not recorded/forgotten
17	**I**	302	574	594	584	20	**KR17 06**	clay	light gray	foram bearing; 1 small pocket of shell hash	common; light green mottling rare t-out	small pockets of forams common t-out	moist & malleable				
17	**I**	302	544	564	554	20	**KR17 07**	clay	light green-gray	foram bearing	FeS mottling rare		moist & malleable				
17	**I**	302	514	534	524	20	**KR17 08**	clay	light green-gray	foram bearing	FeS mottling rare		moist & malleable				
17	**I**	302	484	504	494	20	**KR17 09**	clay	light green-gray	foram bearing	FeS mottling rare	vertical, FeS stained burrow, 1/2 cm diameters and 20 cm long, shell casement from worm is lining the burrow	moist & malleable			X	
17	**I**	302	447	474	461	27	**KR17 10**	disturbed sample									
17	**II**	290	412	437	425	25	**KR17 11**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				
17	**II**	290	377	402	390	25	**KR17 12**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				
17	**II**	290	337	367	352	30	**KR17 13**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out	liner cracked			
17	**II**	290	302	327	315	25	**KR17 14**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				
17	**II**	290	267	292	280	25	**KR17 15**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				
17	**II**	290	232	257	245	25	**KR17 16**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				
17	**II**	290	197	222	210	25	**KR17 17**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out	dropped on deck			
17	**II**	290	177	197	187	20	**KR17 18**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out	dropped on deck			sample dropped on deck but preserved
17	**III**	137	0	137	69	137	**KR17 19**	clay	light green-gray	foram bearing	FeS mottling abundant	burrows abundant	soupy & wet t-out				liner cracked, only part of sample available for analysis

18	**I**	300	640	660	650	20	**KR18 01**	clay	light gray	foram bearing	FeS mottling abundant	bioturbation moderate; FeS stained, foram concentrated pockets		moist & malleable
18	**I**	300	610	630	620	20	**KR18 02**	clay	light gray	foram bearing; shell hash	FeS mottling abundant; flesh colored patches rare	bioturbation moderate; FeS stained, foram concentrated pockets		moist & malleable
18	**I**	300	580	600	590	20	**KR18 03**	clay	light gray	foram bearing; shell hash	FeS mottling abundant; flesh colored patches abundant	bioturbation moderate; FeS stained, foram concentrated pockets		moist & malleable
18	**I**	300	550	570	560	20	**KR18 04**	clay	light gray	foram bearing to rich	FeS mottling rare			malleable
18	**I**	300	520	540	530	20	**KR18 05**	thick, FeS stained sand	light gray	Foram bearing to rich	FeS mottling common			malleable
18	**I**	300	490	510	500	20	**KR18 06**	clay	light gray	foram bearing	rare			malleable
18	**I**	300	460	480	470	20	**KR18 07**	thick sand lens/pocket	light gray	foram bearing	FeS mottling rare			malleable
18	**I**	300	430	450	440	20	**KR18 08**	clay	light gray	foram bearing	rare			malleable
18	**I**	300	380	410	395	30	**KR18 09**	FeS stained sand lens; rare sand pockets <1cm	light gray	foram rich	FeS mottling rare; flesh colored mottling rare	bioturbation/worm burrows rare t-out		moist & malleable
18	**II**	302	345	370	358	25	**KR18 10**	clay; rare sand pockets <1cm t-out	light gray	foram rich	rare; flesh colored mottling rare	bioturbation/worm burrows rare t-out		moist & malleable
18	**II**	302	310	335	323	25	**KR18 11**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		moist & malleable
18	**II**	302	275	300	288	25	**KR18 12**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		moist & malleable
18	**II**	302	240	265	253	25	**KR18 13**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		very moist & malleable
18	**II**	302	205	230	218	25	**KR18 14**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		very moist & malleable
18	**II**	302	170	195	183	25	**KR18 15**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		very moist & malleable
18	**II**	302	135	160	148	25	**KR18 16**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand		very moist & malleable
18	**II**	302	100	125	113	25	**KR18 17**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand	coring related disturbance	extremely moist & malleable
18	**III**	78	53	78	66	25	**KR18 18**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand	coring related disturbance	extremely moist & malleable
18	**III**	78	18	43	31	25	**KR18 19**	clay	light brown -gray	foram rich	FeS mottling abundant	bioturbation/worm burrows common t-out containing forams and sand	coring related disturbance	extremely moist & malleable

19	**I**	302	669	689	679	20	**KR19 01**	clay	light brown-flesh	foram bearing	common and in small patches		firm	
19	**I**	302	639	659	649	20	**KR19 02**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling common and in small patches		firm	
19	**I**	302	609	629	619	20	**KR19 03**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling common and in small patches		firm	
19	**I**	302	579	599	589	20	**KR19 04**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling common and in small patches		firm	
19	**I**	302	549	569	559	20	**KR19 05**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling common and in small patches		firm	
19	**I**	302	519	539	529	20	**KR19 06**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling rare; light gray mottles rare t-out		malleable	
19	**I**	302	484	509	497	25	**KR19 07**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling rare; light gray mottles rare t-out		malleable	
19	**I**	302	449	474	462	25	**KR19 08**	clay	light brown-flesh	rare shell fragments (<mm size) t-out	FeS mottling rare; light gray mottles rare t-out		moist & malleable	
19	**I**	302	407	439	423	32	**KR19 09**	clay	light brown flesh to light gray	rare shell fragments (<mm size) t-out	FeS mottling rare; light gray mottles rare t-out		moist & malleable	
19	**II**	303	367	397	382	30	**KR19 10**	clay	light gray	foram bearing; rare shell fragments (<mm size) t-out	common and in small patches; flesh colored mottles rare t-		moist & malleable	
19	**II**	303	327	357	342	30	**KR19 11**	FeS stained sand pockets ~1cm	light gray	foram bearing	FeS mottling rare		moist & malleable	
19	**II**	303	287	317	302	30	**KR19 12**	clay	light gray	foram bearing	FeS mottling rare		moist & malleable	
19	**II**	303	247	277	262	30	**KR19 13**	clay	light gray	foram bearing	FeS mottling rare		moist & malleable	
19	**II**	303	207	237	222	30	**KR19 14**	clay	light gray	foram bearing	FeS mottling rare		moist & malleable	
19	**II**	303	167	197	182	30	**KR19 15**	clay	light gray	foram bearing	FeS mottling rare	moderate bioturbation/vertic al burrows	very moist & malleable	
19	**II**	303	127	157	142	30	**KR19 16**	clay	light gray	foram bearing	FeS mottling rare	moderate bioturbation/vertic al burrows	very moist & malleable	
19	**III***	105	75	105	90	30	**KR19 17**	clay	light gray	foram bearing	FeS mottling rare	one large vertical burrow lined with forams	extremely moist & malleable	top 65cm of liner cracked, no samples taken

20	**I**	308	684	704	694	20	**KR20 01**	clay	light brown-flesh clay	foram rare	FeS mottling common		malleable	
20	**I**	308	654	674	664	20	**KR20 02**	clay	light brown-flesh clay	foram bearing	FeS mottling common; patches up to 1cm diameter	pods of forams and shell hash rare t-out up to 1cm diameter	malleable	
20	**I**	308	619	644	632	25	**KR20 03**	clay	light brown-flesh clay	foram bearing	FeS mottling common; patches up to 1cm diameter	pods of forams and shell hash rare t-out up to 1cm diameter	malleable	
20	**I**	308	584	609	597	25	**KR20 04**	clay	light brown-flesh clay	foram bearing	common; cohesive FeS patches up to 2cm diameter	pods of forams and shell hash rare t-out up to 1cm diameter	moist & malleable	
20	**I**	308	549	574	562	25	**KR20 05**	clay	light brown-flesh clay	foram bearing	common; cohesive FeS patches up to 2cm diameter	pods of forams and shell hash rare t-out up to 1cm diameter	moist & malleable	
20	**I**	308	514	539	527	25	**KR20 06**	clay	light gray	foram bearing	rare; pyrite grains <1mm		malleable	
20	**I**	308	458	494	476	36	**KR20 07**	clay	light gray	foram bearing	FeS mottles rare	pods of forams and sand t-out up to 3cm diameter	malleable	
20	**I**	308	416	444	430	28	**KR20 08**	clay	light gray	foram bearing	rare; faint flesh and teal colored mottles rare t-	foram pockets rare t-out	moist & malleable	
20	**II**	301	376	406	391	30	**KR20 09**	clay	light gray	foram bearing	rare; faint flesh and teal colored mottles rare t-	foram pockets rare t-out	moist & malleable	
20	**II**	301	336	366	351	30	**KR20 10**	clay	light gray-brown	foram bearing	rare; Cohesive FeS patches, up to 2cm diameter,	<1cm diameter foram pods	moist & malleable	
20	**II**	301	296	326	311	30	**KR20 11**	clay	light gray-brown	foram bearing	rare; Cohesive FeS patches, up to 2cm diameter,	<1cm diameter foram pods	moist & malleable	
20	**II**	301	256	286	271	30	**KR20 12**	clay	light gray-brown	foram bearing	FeS mottling rare	<1cm diameter foram pods	moist & malleable	
20	**II**	301	216	246	231	30	**KR20 13**	clay	light gray-brown	foram bearing	rare; 2cm thick FeS stained granular layer that may be carbonate precipitate, seems	1 worm burrow, vertical and foram lined	moist & malleable	
20	**II**	301	176	206	191	30	**KR20 14**	clay	light gray-brown	foram bearing; small whole bivalve (clam) shell	FeS mottling rare	vertical burrows t-out with concentration of forams within	very moist & malleable	X
20	**II**	301	115	156	136	41	**KR20 15**	clay	light gray-brown	foram bearing	FeS mottling rare	vertical burrows t-out with concentration of forams within	very moist & malleable	
20	**III**	115	75	105	90	30	**KR20 16**	clay	light gray-brown	foram bearing	FeS mottling rare	vertical burrows t-out with concentration of forams within	very moist & malleable	
20	**III**	115	35	65	50	30	**KR20 17**	clay	light gray-brown	foram rich	FeS mottling rare	abundant vertical burrows t-out with concentration of forams within	extremely moist & malleable	
20	**III**	115	0	25	13	25	**KR20 18**	clay	light gray-brown	foram rich	FeS mottling rare	abundant vertical burrows t-out with concentration of forams within	extremely moist & malleable	

21	**I**	303	722	732	710	10	**KR21 01**	clay	gray	up to 3cm diameter bivalve shells whole and fragments	FeS mottling abundant			very dry and firm		X		sample is from core cutting shoe
21	**I**	303	682	702	678	20	**KR21 02**	clay	gray	foram bearing; shell fragments common t-out	FeS mottling common t-out		gas cracks; salmon texture	dry, firm				
21	**I**	303	657	672	651	15	**KR21 03**	clay	gray	foram bearing; shell fragments common t-out	FeS mottling common t-out		gas cracks; salmon texture	firm				
21	**I**	303	627	647	622	20	**KR21 04**	clay	gray	foram bearing; shell fragments common t-out	FeS mottling common t-out		3 soupy pockets ~3cm diameter; salmon texture; gas cracks t-out	moist but firm				
21	**I**	303	597	617	592	20	**KR21 05**	clay	light gray	foram bearing; shell fragments common t-out	FeS mottling common t-out		soupy pockets t-out; salmon texture; gas cracks t-out	moist but firm			X	
21	**I**	303	567	587	562	20	**KR21 06**	clay	light gray	foram bearing	FeS mottling common t-out		1-3cm gas pockets rare t-out with soupy interiors	dry, firm			X	
21	**I**	303	537	557	532	20	**KR21 07**	clay	light gray	foram bearing	FeS mottling rare		1 gas pocket/crack	malleable				
21	**I**	303	507	527	502	20	**KR21 08**	clay	light gray	foram bearing; 1 shell hash lens ~1/2cm	FeS mottling rare			moist & malleable				
21	**I**	303	477	497	471	20	**KR21 09**	clay	light gray	foram rich	FeS mottling rare	1-2cm wide, 8cm long vertical burrow, soupy interior		moist & malleable				
21	**I**	303	442	467	583	25	**KR21 10**	clay	light gray	~2cm thick; foram bearing t-out	rare; light flesh color mottling rare t-			moist & malleable				
21	**II**	304	399	419	394	20	**KR21 11**	clay	light gray	foram bearing t-out	rare; light flesh color mottling rare t-	vertical burrows, 1cm diameter , common t-out		moist & malleable				
21	**II**	304	369	389	364	20	**KR21 12**	clay	light gray	shell hash bearing	FeS mottling rare	vertical burrows common t-out		moist & malleable				
21	**II**	304	339	359	333	20	**KR21 13**	clay	light gray	shell hash bearing	FeS mottling rare	vertical burrows abundant t-out		moist & malleable				
21	**II**	304	304	329	299	25	**KR21 14**	clay	light gray	shell hash bearing	FeS mottling rare	vertical burrows abundant t-out		moist & malleable				
21	**II**	304	269	294	264	25	**KR21 15**	clay	light gray	foram bearing; shell hash bearing	FeS mottling rare	vertical burrows abundant t-out		moist & malleable	abundant lenses, white in			
21	**II**	304	234	259	229	25	**KR21 16**	clay	light gray	foram bearing; shell hash bearing	rare; light gray-white mottling	vertical burrows abundant t-out		moist & malleable				
21	**II**	304	199	224	194	25	**KR21 17**	clay	50% gray - 50% light gray/white mottled together	shell lens with bivalve fragments ~3cm wide	FeS mottling rare	bioturbation common with foram bearing interiors		moist & malleable				
21	**II**	304	164	189	154	25	**KR21 18**	clay										
21	**II**	304	115	149	261	34	**KR21 19**	clay	50% gray - 50% light gray/white mottled together	30cm of bivalve rich clay; 30 cm bed with clam fragments and whole shells abundant t-out; foram rich	FeS mottle rare	bioturbation abundant t-out		very moist & malleable		X	X	
21	**III**	115	75	95	69	20	**KR21 20**	clay	50% gray - 50% light gray/white mottled together	3cm layer of bivalve abundant clay	FeS mottles faint/rare t-out	bioturbation abundant t-out		very moist & malleable				
21	**III**	115	40	65	33	25	**KR21 21**	clay	50% gray - 50% light gray/white mottled together	10cm layer of bivalve abundant clay	FeS mottles faint/rare t-out	bioturbation abundant t-out		very moist & malleable				
21	**III**	115	0	25	49	25	**KR21 22**	clay	light gray	foram rich	FeS mottles rare; pyrite grains <1mm	bioturbation abundant t-out		extremely moist & malleable	disturbed sample due to			

22	**I**	242	450	510	520	20	**KR22 01**	clay	light brown	foram bearing	FeS mottling common; Flesh colored mottling rare	moist but firm	*Section III was not sampled but was measured at 193cm total length
22	**I**	242	420	540	550	20	**KR22 02**	clay	light brown	foram bearing	common; Flesh and teal colored mottling rare	moist but firm	
22	**I**	242	390	570	580	20	**KR22 03**	clay	light brown	foram bearing	common; Flesh and teal colored mottling rare	moist & malleable	
22	**I**	242	355	600	613	25	**KR22 04**	thick, FeS stained, well sorted, medium	light brown	foram bearing	common; Flesh and teal colored mottling rare	moist & malleable	
22	**I**	242	320	635	648	25	**KR22 05**	clay	light brown	foram rich	common; Flesh and teal colored mottling rare	moist & malleable	
22	**I**	242	280	670	685	30	**KR22 06**	clay	light gray	foram rich	FeS mottles common	very moist & malleable	
22	**I**	242	248	710	721	22	**KR22 07**	clay	light gray	foram rich	FeS mottling rare	very moist & malleable	
22	**II**	55	213	258	271	25	**KR22 08**	clay	light gray	foram rich	FeS mottling rare	very moist & malleable	
						7620 Total							