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Las Palmas (Canary Islands) – Cadiz (Spain)
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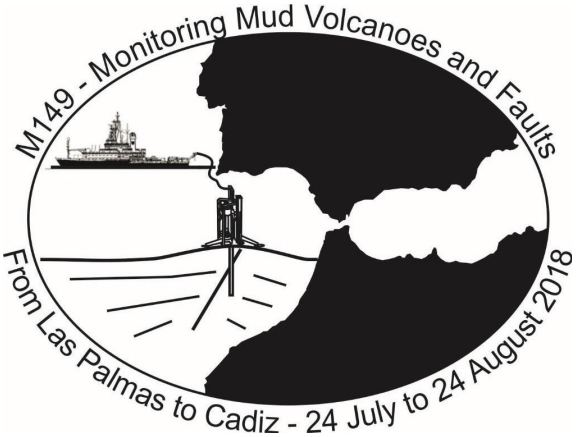

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DER UNIVERSITÄT BREMEN

Preliminary Results of R/V METEOR Cruise M149: Shipboard and Post-Cruise Analysis

Recurrence of tsunamigenic hazards from MeBo drilling records and hazard mitigation using MeBo observatories

Chief Scientist: A. Hüpers

24.07.2018 – 24.08.2018,
Las Palmas (Canary Islands, Spain) – Cadiz (Spain)

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MARUM – Zentrum für Marine Umweltwissenschaften
Universität Bremen

2020

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1 Cruise Summary

1.1 Summary

Historical earthquakes such as the 1755 Lisbon earthquake and tsunami demonstrated that the plate boundary between Eurasia and Africa constitutes a significant earthquake and tsunami threat to neighboring coastal communities. Cruise M149 of R/V Meteor aimed at collecting short and long sediment cores and installing borehole observatories with the seafloor drill rig MARUM-MeBo70 (Meeresboden-Bohrgerät) to obtain records of the past and current tectonic activity of the plate boundary in the Gulf of Cadiz and Alboran Sea (W Mediterranean Sea). Shipboard sampling of gas and pore waters from the recovered cores further aimed at the post-cruise study of fluid-rock interaction and fluid flow processes at depth. These activities, flanked with comprehensive seafloor mapping and in situ heat flow and borehole measurements, focused on 1) two NNW-SSE trending strike-slip faults (Lineament Center and South) cutting through the Gulf of Cadiz accretionary prism, 2) two SW-NE trending strike-slip faults in the Alboran Sea, and 3) adjacent mud volcanoes that are supposed to be hydraulically connected to deeper levels of the fault zones and plates interface. From July 24 to August 24, 2018, the M149 cruise collected in total 383.2 m of core, conducted 38 in situ heat flow measurements, mapped approximately 12500 km^2 of seafloor and installed 3 borehole observatories. Three new mud volcanoes were discovered during the cruise (and at least two more supposed buried), of which one is located on the SW edge of the accretionary prism - outside of the predominant mud volcano distribution. We also re-visited various small mud volcanoes (Meknes, Rabat, El Cid, Almanzor) and the known Yuma and Ginsburg in the Gulf of Cadiz. We installed one of the borehole observatories at Ginsburg and sampled younger mud flows with thinner hemipelagic cover closer to the summit, and older flows on the slopes of the edifices. The recovered cores (n=15) at the two latter mud volcanoes reflect a set of individual mud flows that will provide insight into the episodicity of the mud volcanoes and the activity of the adjacent fault systems. Onboard salinity analyses of collected pore waters further show a systematic trend for these mud volcanoes with salinity being: 1) lower compared to background sediments for crest sediments, 2) similar to the background sediment for flank sediments and 3) higher than the background sediment for the mud volcano rim with values up to 14.6% salinity that are consistent with electrical borehole measurements at the rim. This distribution suggests a novel fluid pathway system within these mud volcanoes that may explain the presence of a fracture filling biofilm sampled at the rim of Ginsburg mud volcano. Salinity profiles of cores recovered along transtensional zones of the studied strike-slip-faults in the Gulf of Cadiz and Alboran Sea are similar to the brines found at the Ginsburg mud volcano rim. This previously undocumented seafloor discharge of saline fluids along fault zones in the Gulf of Cadiz accretionary prism is corroborated by elevated heat flow values at the same locations. Visual core description further showed that the sedimentary infill of such transtensional zones – in particular the small pull-apart basins – hosts multiple fining upward sequences degrading from foraminifera-rich ooze at the bottom to hemipelagic nannofossil ooze at the top, which accumulated probably through seafloor gravitational movements in response to the tectonic activity of the faults. Hence, these deposits provide sedimentary records that are ideally suited for paleoseismological studies. In combination with the two observatories installed into strike-slip-faults – one in the Gulf of Cadiz and the other in the Alboran Sea – the M149 cruise fulfilled its primary objective of collecting long and short term records (i.e. sediment cores) of the tectonic activity associated with the plate

boundary between Eurasia and Africa offshore SW Europe, which will provide the basis for further post-cruise research.

1.2 Zusammenfassung

Historische Erdbeben wie das Lissabon Beben und dessen resultierender Tsunami im Jahr 1755 zeigen, dass die Plattengrenze zwischen Eurasien und Afrika eine große Naturgefahr für die angrenzenden Küstengebiete darstellt. Die Ausfahrt M149 mit dem Forschungsschiff Meteor hatte zum Ziel dem Meeresboden kurze und lange Sedimentkerne zu entnehmen und Bohrlochobservatorien mit dem Meeresbodenbohrgerät MARUM-MeBo70 zu installieren, die dazu dienen werden die historische als auch rezente Aktivität der besagten Plattengrenze im Golf von Cadiz sowie der Alboran See (W Mittelmeer) zu untersuchen. Zudem stehen auch Fluid-Gesteins-Interaktionsprozesse im Fokus, die die Deformation in der Tiefe beeinflussen und an den gewonnenen Porenwasserproben nach der Ausfahrt untersucht werden sollen. Dieses Maßnahmenpaket, dass durch die Kartierung des Meeresbodens, sowie in situ Wärmestrom- und Bohrlochmessungen flankiert worden ist, fokussierte auf zwei NNW-SSE streichende Blattverschiebungen (Lineament Center and South) im Golf von Cadiz, zwei ca. NE-SW streichende Blattverschiebungen in der Alboran See, sowie benachbarte Schlammvulkane, die nach derzeitigem Stand des Wissens mit tiefen Fluiden aus den Störungen gespeist werden. Es wurden während der Ausfahrt M149 Sedimentkerne mit einer Gesamtlänge von 383,2 m gewonnen, 38 Wärmestrommessungen durchgeführt, 12500 km^2 Meeresboden kartiert und 3 Bohrlochobservatorien installiert. Die Kartierung führte zur Entdeckung von 3 bisher unbekannten Schlammvulkanen im Forschungsgebiet, von denen einer außerhalb des bisherigen Verteilungsmusters liegt. Zudem wurden die bereits bekannten Schlammvulkane Ginsburg und Yuma intensiv beprobt und eines der Bohrlochobservatorien dort installiert. Die gewonnenen Sedimentabfolgen zeigen von hemipelagischen Decksedimenten überlagerte Schlammbrekzien, wobei erstere in ihrer Mächtigkeit vom Gipfel bis zum Fuß der Schlammvulkane zunehmen. Dies weist auf verschiedene Generationen der darunterliegenden Schlammströme hin, die durch weiterführende Untersuchungen im Nachgang der Ausfahrt wichtige Rückschlüsse auf die Aktivität der beiden Schlammvulkane und des benachbarten Störungssystems geben können. Einfache Salinitätsbestimmungen der Porenwässer an Bord zeigen weiterhin einen systematischen Trend relativ zu Referenzsedimenten abseits der beiden Schlammvulkane mit geringeren Salinitäten am Gipfel, ähnlichen Salinitätswerten an der Flanke und höheren Werten am Fuß der Schlammvulkane. Die stark erhöhte Salinität (bis zum 3½-fachen des Meerwassers) wurde durch elektrische Bohrlochmessungen bestätigt. Diese Salinitätsverteilung lässt ein bisher nicht dokumentiertes Strömungssystem innerhalb des Schlammvulkans vermuten, welches womöglich auch in Zusammenhang mit einem bruchfüllenden Biofilm steht, der am Fuß des Ginsburg Schlammvulkans abgeteuft wurde. Porenwässer mit vergleichbar hohen Salinitäten wurden zudem entlang transtensionaler Bereiche der Blattverschiebungen im Golf von Cadiz und der Alboran See angetroffen. In Einklang mit erhöhten Wärmestromwerten scheinen die transtensionalen Abschnitte der Störungen bevorzugte Bereiche des Strömungstransports zu sein an denen salinare Fluide aus der Tiefe aufsteigen. Die gewonnenen Sedimentabfolgen in den transtensionalen Bereichen – insbesondere kleiner pull-apart Becken – weisen zahlreiche Schichten mit gradueller Korngrößenabnahme zum Top auf (fining upward), was auf Massentransportablagerungen in

Folge der Aktivität der Störungen hindeutet. Entlang der Blattverschiebungen wurden zwei Bohrlochobservatorien installiert, je eines im Golf von Cadiz und in der Alboran See, die zusammen mit den gekernten Sedimentabfolgen das anvisierte Archiv bilden, dass die historische als auch rezente Aktivität der Plattengrenze zwischen Eurasien und Afrika im SW Europe abdeckt und die Basis für weiterführende paleoseismologische Studien bilden wird.

2 Participants

2.1 Scientific Party

Name	Discipline	Institution
Dr. Andre Hüpers	Chief-scientist	MARUM
Alba Gonzales Lanchas	Biostratigraphy/Observer	U. Salamanca
Anh Mai	MeBo	MARUM
Christopher Klaembt	Physical Properties	MARUM
Erik Linowski	MeBo	MARUM
Jan-Niklas Schmidt	Heat Flow	MARUM
Jutta Bülten	MeBo	MARUM
Kai Kaszemeik	MeBo	MARUM
Katharina Moreno Unger	Hydroacoustics	MARUM
Katja Stanislowski	Physical Properties	MARUM
Kees Noorlander	MeBo	MARUM
Lina Heine	Heat Flow	MARUM
Mafalda Maria Petisca	Sedimentology	IPMA
Valério Lanhoso de Freitas		
Martin Stelzner	Ship‘s meteorological station	DWD
Peter Mazerath	Biostratigraphy	MARUM
Philipp Haberkorn	Sedimentology	MARUM
Rouven Brune	Hydroacoustics	MARUM
Samuel Pereira	Geochemistry	MARUM
Sebastian Meckel	MeBo	MARUM
Siefke Fröhlich	MeBo	MARUM
Dr. Tim Freudenthal	MeBo/CPT	MARUM
Timo Fleischmann	Heat Flow/Observatories/CPT	MARUM
Dr. Vitor Hugo da Silva Magalhaes	Sedimentology/Observer	IPMA
Dr. Walter Menapace	Sedimentology	MARUM
Werner Schmidt	MeBo	MARUM
William Meservy	Hydroacoustics	ICM

Fig. 2.1 Group photo of the science party.

2.2 Participating Institutions

MARUM	Zentrum für Marine Umweltwissenschaften der Universität Bremen (Germany)
U.Salamanca	Universidad de Salamanca (Spain)
DWD	Deutscher Wetterdienst, Geschäftsfeld Seeschifffahrt (Germany)
IPMA	Instituto Português do Mar e da Atmosfera (Portugal)
ICM	Instituto de Ciencias del Mar (Spain)

2.3 Crew

Name	Rank	Name	Rank
Detlef Korte	Master	Piotr Bußmann	Ship Mechanic
Heike Dugge	Chief officer	Alexander Durst	Ship Mechanic
Dirk Kahnke	1st Officer	Hans-Joachim Behlke	Ship Mechanic
Magnus Keller	2nd Officer	Hubert Hildebrandt	Ship Mechanic
Michael Hinz	Ship's doctor	Torsten Kruzona	Ship Mechanic
Peter Neumann	Chief Engineer	Merlin Till Pleuler	Ship Mechanic
Ralf Heitzer	2nd Engineer	Michael Zeigert	Ship Mechanic
Björn Brandt	2nd Engineer	Rainer Götze	Chief Cook
Rudolf Freitag	Electrician	Peter Wernitz	2nd Cook
Heinz Voigt-Wenzel	Chief Electronics Eng.	Jan Parlow	Chief Steward
Harry Scholz	Electronics Engineer	Petra Zimmermann	Steward
Bernhard Bagyura	System Manager	Monika Jürgens	Steward
Gerhard Lange	Fitter	Guomin Zhang	Laundryman
Lukas Eller	Motorman	Tom Ederleh	Apprentice
Jannik Hageleit	Motorman	Christoph Weber	Apprentice
Klaus Kudraß	Motorman	Alexander Wolf	Bosun

3 Research Program

Earthquakes pose an enormous societal threat as demonstrated by recent events such as the 11 March 2011 Tohoku earthquake off NE Honshu, Japan, and the 26 December 2004 Sumatra earthquake off W Indonesia. Both earthquakes attained unexpected high moment magnitudes and resultant tsunami destruction (Stein and Okal, 2005; Henstock et al., 2006; Ammon et al., 2011; Ito et al., 2011), showing that the factors governing earthquake nucleation, rupture propagation and the seismic cycle remain an incompletely understood scientific phenomena. Some of the largest earthquakes in the last decades occurred along the circum-Pacific ring of fire, where the oceanic Pacific seaplate subducts beneath an adjacent continental plate (e.g., 2011 Tohoku earthquake off NE Japan, 2010 Maule earthquake off Chile or the 1964 Alaska earthquake (Plafker, 1965; Moreno et al., 2010; Ammon et al., 2011). However, from historical records evidence exists that the collision zone between Eurasia and Africa hosted earthquakes and tsunamis with similar magnitude in the past.

The largest documented historical earthquake in W Europe, the Lisbon 1755 event, occurred in the Gulf of Cadiz with an estimated magnitude of M8.5-9 (e.g., Martins & Mendez Victor, 1990). The resulting tsunami was highly destructive and reached the nearby coasts (Iberia, NW Africa), Azores and Cape Verde, and crossed the Atlantic (Baptista et al., 1998). The exact location of the 1755 Lisbon event remains a subject of debate. One reason for this is the uncertain present-day location of the plate boundary between Eurasia and Africa in the Gulf of Cadiz. Recently, a swath bathymetric study of the Gulf of Cadiz identified a 600 km wide WNW-ESE trending band of dextral strike-slip faults that connects two segments of the plate boundary between Eurasia and Africa: the Gloria fault to the west and the Riff-Tell fault zone to the east (Zitellini et al. 2009). This newly discovered band has important implications on the understanding of the plate tectonic framework and the generation of earthquakes and tsunamis in this region.

In the eastern Alboran Sea (western end of the Mediterranean Sea) a complex distribution of sinistral SW-NE and dextral SE-NW trending strike-slip faults exist between the Moroccan and the Spanish margin. Similar to the Gulf of Cadiz, this region has suffered large earthquakes in the past, which repeatedly destroyed coastal communities between the 15th and 19th century, such as the cities of Vera and Almeria (Gràcia et al., 2006 and references therein). Some of these faults extend up to 100 km in the Alboran Sea and continue on land, e.g. the Carboneras fault in southern Spain, which has been identified as a potential candidate of large earthquakes of up to M7.2 (Gràcia et al., 2006). Therefore, the fault system in the Alboran Sea constitutes a significant earthquake and tsunami threat to coastal communities neighboring the western Mediterranean Sea (Gràcia et al., 2019).

Cruise M149 set out to collect records of past and current tectonic and fluid flow activity, associated with the plate boundary between Eurasia and Africa in the Gulf of Cadiz and the Alboran Sea. These records will provide the basis for post-cruise research aiming to address the following objectives:

- What do sedimentary records reveal about the past tectonic and seismic activity in the Atlantic and Alboran study areas?
- What do borehole observatories tell us about their current activity of the fault zones and their coupling to mud volcano activity?
- What can we learn from sampled pore fluids about the geological processes at depth?

To achieve these expedition goals an integrated program of 1) seafloor mapping, 2) in situ heat flow measurements, 3) short and long core sampling of mud volcanoes and fault zones and 4) the installation of borehole observatories using the seafloor drill rig MARUM-MeBo70 (hereafter abbreviated with MeBo (Meeresboden-Bohrgerät); Freudenthal and Wefer, 2007) has been envisioned; in which mud volcanoes may serve as a window to depth, given their hydraulic connection to deeper (potentially seismogenic) levels of the fault zones.

4 Narrative of the Cruise

After extensive operations in the port of Las Palmas (Gran Canaria, Spain), well into the evening of July 24, the research vessel Meteor left the port in the morning of July 25. The vessel steamed directly to the Gulf of Cadiz and arrived in the study area offshore Morocco in the evening of July 27. During that same night the seafloor was mapped using the ship-mounted multibeam and Parasound systems. The mapping continued in the following nights and provided the basis for the subsequent seafloor sampling and measurements (Fig. 4.1). On the following day two mud volcanoes (MVs), known as Ginsburg MV and Yuma MV, and the surrounding seafloor were sampled down to a maximum depth of ~530 cmbsf (cm below seafloor) using a gravity corer. These mud volcanoes have been sampled in several expeditions before but no extensive coring has been previously done. The scientists collected numerous sediment and fluid samples immediately after the gravity corer was retrieved onboard for post-expedition gas and fluid analyses.. In addition, detailed sedimentological descriptions and biostratigraphic and physical properties analyses were performed upon splitting the cores, and samples collected for post-cruise analyses.

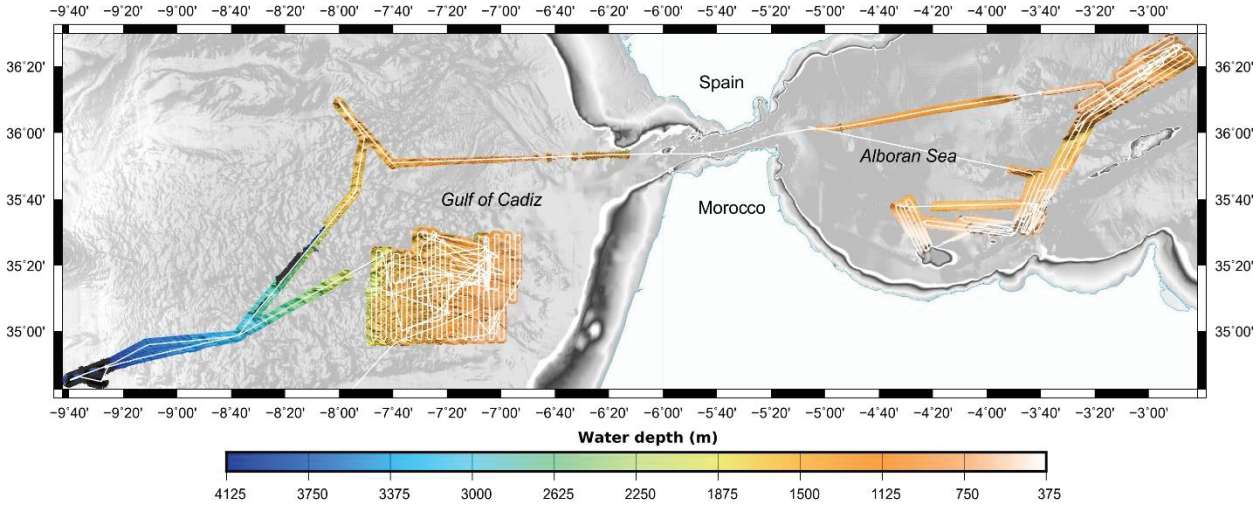

Fig. 4.1 Shiptrack of R/V Meteor during cruise M149 (white line) with acquired bathymetry map (colored).

Several attempts using the seafloor drill rig MeBo resulted in a ~18 m long borehole into the summit of the Ginsburg MV, which was eventually completed by sealing the borehole with an observatory on August 3. The observatory will record fluid pressure, temperature and fluid conductivity in the borehole over the next few years and document the activity of the mud volcano. Afterwards, both gravity coring and heat flow measurements were conducted to detect areas of active fluid flow. The sampling and heat flow profiles extend in a north-south direction from the Yuma MV to Meknes MV and intersect two prominent strike-slip faults: The Lineament Center

and Lineament South. The two faults belong to the WNW-ESE trending band of dextral strike-slip faults that connects two segments of the plate boundary between Eurasia and Africa.

The MeBo was then deployed at the foot of the Ginsburg MV to sample possible mud flow events, as spotted on seismic images acquired on previous expeditions (Grácia et al., 2018). During the first dive on August 5, the prototype of a CPT (cone penetration testing) device was successfully used with the sea floor drill rig. The CPT was pushed 30 m into the seafloor and recorded the force acting on the tip and sleeve of the probe, as well as the pore water pressure. Dissipation tests were conducted at 6 and 30 m below seafloor, respectively, to determine the in situ pore water pressure in the sediment layers. The CPT was then exchanged with a downhole logging tool, which measured the natural gamma radiation of the sediment during the recovery of the drill pipes. The planned drilling at the site was postponed due to technical issues. During the MeBo repair works, sampling of Lineament Center and Lineament South continued. In a second dive two days later, the MeBo drilled 40 m into the foot of the Ginsburg mud volcano with a core recovery of 92%. During the retrieval of the drill pipe the electrical conductivity of the sediment was measured with a downhole logging tool.

Subsequent seafloor drilling in the Gulf of Cadiz focused on the strike-slip faults. The seafloor drill rig was deployed at the Lineament Center directly south of Ginsburg MV, where pilot heat flow measurements gave evidence for fluid flow activity. The borehole reached the target depth of 20 m below seafloor and was successfully capped with an observatory in the early morning of August 10. This second observatory is located 13 km south of the Ginsburg MV and will provide important information on the interplay of mud volcano and fault zone activities in this region.

A day later, the MeBo drilled 50 m into a pull-apart basin along the Hermes fault, an east-west trending strike-slip fault branching from the Lineament Center. Another 40 m long sediment core was retrieved 2 days later from a pull-apart basin along the Lineament South. Between the MeBo deployments further mud volcanoes (Rabat, Almanzor and El Cid) were sampled using the gravity corer – including two newly discovered mud volcanoes, which the participants named „R2“ and „D2“. The last gravity cores in the main study area were taken on August 14 after which R/V Meteor moved first west to deeper waters (Fig. 4.1), where salt diapirs in the Seine abyssal plain were sampled, and then steamed to the Alboran sea (Fig. 4.1). During the transit across the Gulf of Cadiz additional gravity cores from potential mud volcanoes and salt diapirs in Portuguese and Moroccan waters were taken. A new mud volcano was discovered during the two days of transit and has been named „Funky Monkey“.

R/V Meteor entered the Alboran Sea on August 17 and headed to the Carboneras fault - a NE-SW trending strike-slip fault, which continues from the Spanish mainland into the Mediterranean Sea. After a pre-survey by seafloor mapping, gravity coring and heat flow measurements, the MeBo was deployed for the last time during cruise M149 and sampled the fault zone down to 20 m below seafloor. The borehole was closed with the remaining observatory to measure water pressure and temperature variations in response to the seismic sediment deformation in the next few years. Furthermore, the Al-Idrissi fault, a strike-slip fault offshore Morocco, was investigated by gravity coring and heat flow measurements as well as the adjacent Marrakesh MV to the west. However, the gravity cores taken in the Alboran Sea were not split onboard for sedimentological descriptions and physical property analyses due to a shortage in packing and processing material. Splitting and analyses were done post-cruise in Bremen and the data added to this report.

Final multibeam and parasound surveys were conducted until midday of August 23 and revealed a buried mass transport deposit (MTD) offshore Morocco. The R/V Meteor arrived in the morning of August 24 in the port of Cadiz. The cruise M149 equipment was unloaded on the same day and the scientists left the vessel on August 25.

5 Preliminary Results

5.1 Hydroacoustics

(R. Brune, W. Meservy, K. Moreno Unger)

5.1.1 Methodology

The hydroacoustic studies onboard included seafloor mapping and profiling of the uppermost subseafloor sediments. The aim of the seafloor mapping is to gain new high resolution bathymetry data, to determine MeBo drilling and gravity coring sites and to identify new mud volcanoes. For the acquisition of bathymetric data a hull mounted multibeam system from Kongsberg was used, the Kongsberg Simrad system EM122. The major aim of the sub bottom profiling was to provide further insights into the uppermost sediments of the investigated mud volcanoes and fault zones. Therefore, the focus was on the identification of mass wasting deposits (e.g. submarine landslides, outflow structures), fault planes and acoustic blank areas, which indicate a higher gas content in the sediment. For the sub bottom profiling R/V Meteor's hull-mounted sediment echosounder Atlas Parasound P70 was used. In the following, the individual systems are described in more detail.

The EM122 operated with a frequency of 12 kHz, a maximum opening angle of 65° (130° in total) and 432 beams per ping. In deep waters (> 2000 m) the across coverage reduced to 60°. The emission beam is 130° wide in across track and 1° in along-track direction. Reception is obtained from 432 beams, with widths of 2° across track and 20° along track. Thus the actual footprint of a single beam has a dimension of 1° by 2°. The equidistant beam spacing ensured a high beam density on the edge of the swath, together with the dual swath mode which adjusted the transmission of the swath to the vessel speed, ping rate and depth, to provide uniform along ship sampling of the seafloor. Achievable swath width on a flat bottom will normally be up to six times the water depth dependent on the sound velocity and the character of the seafloor. The sound velocity profiles were updated at least once a week or when if a major change in the physical properties of the water column was expected. The profiles were calculated from either CTD down casts – using the R/V Meteor's SBE911PLUS Conductivity-Temperature-Depth (CTD) Rosette, or from the Sippican sound velocity probe.

The EM122 also records backscatter data (amplitude of the signal) that can be used to create backscatter maps from the seafloor. The backscatter data holds valuable information about the morphology and the physical properties near the sea floor. With the proper radiometric and geometric correction, acoustic backscatter mosaics can aid in the mapping of surficial seafloor features and facies, an important task toward remote seafloor characterization.

Monitoring and quality control of the data was conducted with the Kongsberg Seafloor Information System (SIS). The software controls the sector coverage (angle, beam spacing), depth settings (swath mode, ping mode) and transmission control (pitch stabilization). The data was stored every 30 minutes as an *.ALL file with all required information about ship motion, GPS, vessel speed, number of beams, total time and track. The multibeam data was continuously updated and processed with the programs MB-Systems and Generic Mapping Tool (GMT). The task of MB-Systems was to convert the data and, when necessary, included data cleaning and processing. GMT was used for gridding and visualization.

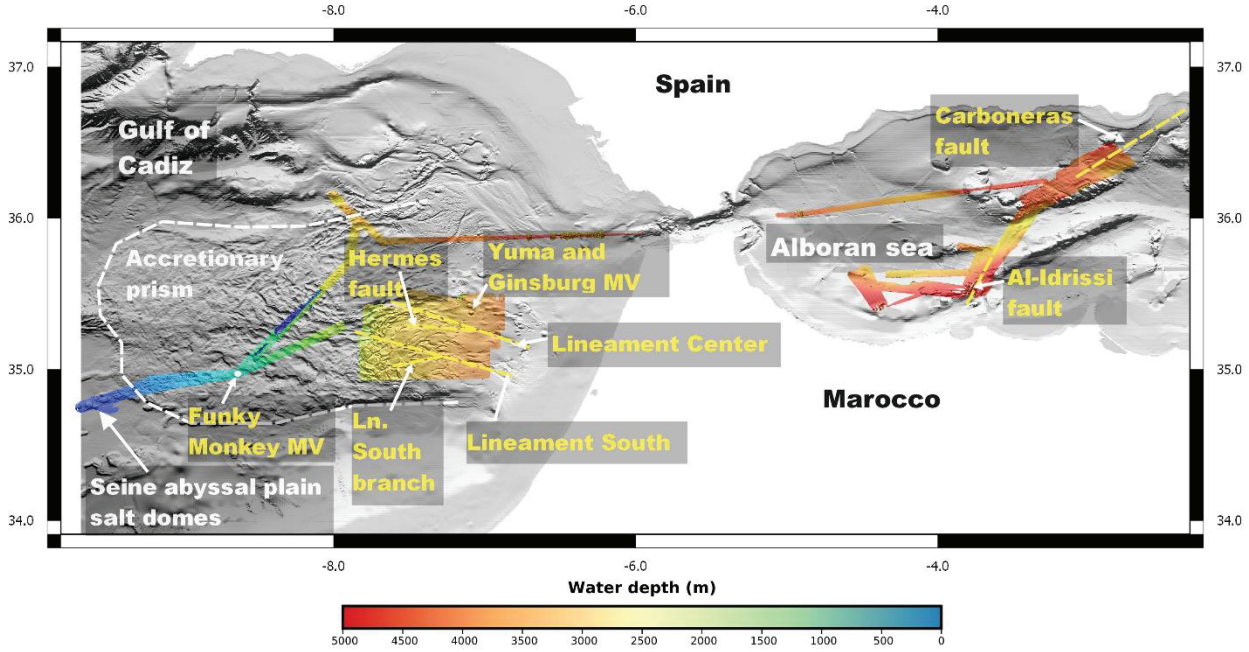

Fig. 5.1 Overview of the acquired multibeam bathymetry data (colored) and major tectonic structures studied during cruise M149.

Information about the uppermost subseafloor sediments was collected with the Atlas Parasound P70 system. The system emits two high frequencies (18 kHz and 22 kHz) simultaneously which produce an additional low frequency (4 kHz) due to non-linear behavior of the acoustic waves. The low frequency is travelling in the emission cone of the two high frequencies and penetrates the seafloor with a footprint size of 7% of the water depth.

The Parasound system recorded during the cruise 50 m of the water column above the seafloor and 150 m of the penetrated sediment while using the equidistant transmission mode with burst of pulses at 500 ms intervals in shallow water and 1000 ms in deep waters until the first echo returns. The transmission sequence was set to quasi-equidistant transmission with a rectangular pulse of a continuous wave. This configuration allowed a vertical resolution of 0.188 m with a pulse length of 0.25 ms.

For the system monitoring and quality control of the incoming data the digital data acquisition software Parastore was used. The software controls the data recording, processing and visualization. The data was stored as *.SEGY and *.PS3 files, every 150 mb or 60 min, with the carrier frequency and the necessary geographical coordinates while the raw *.asd files were untouched. The acquired data was imported to the IHS Kingdom Suite for further interpretation

and visualization. Further data processing included the calculation of the envelope for each profile and filtering with a band pass filter to improve the signal-to-noise ratio.

5.1.2 Gulf of Cadiz – Mud Volcanoes

The studied mud volcanoes can be found on the Gulf of Cadiz accretionary prism with most of them being located close to Lineament Center and Lineament South (Fig. 5.1). These structures are characterized on the bathymetry map by a cone-shaped structure with one or more domes (e.g., Yuma MV) and, for some mud volcanoes, with a morphological depression along their outer rim (e.g., Ginsburg MV). Furthermore, terraces, landslide features and individual flows could be recognized for several MVs. Six potential mud volcanoes were identified in the bathymetry maps of which three could be verified by gravity cores (cf., chapter 5.2). Two mud volcanoes, R2 & D2, are located in close vicinity to each other and their position is approximately 30 km west of the two largest mud volcanoes in that area (Yuma and Ginsburg MV, Fig. 5.2). The two new mud volcanoes are less than 1 km in diameter and up to 65 m high. The third mud volcano was discovered during the transit to the working area in the Seine abyssal plain and named Funky Monkey (Fig. 5.1). Funky Monkey is located close to the southwestern edge of the accretionary prism and in the vicinity of a W-E trending branch of the Lineament South. The mud volcano is circa 67 m high and 1.4 km in diameter.

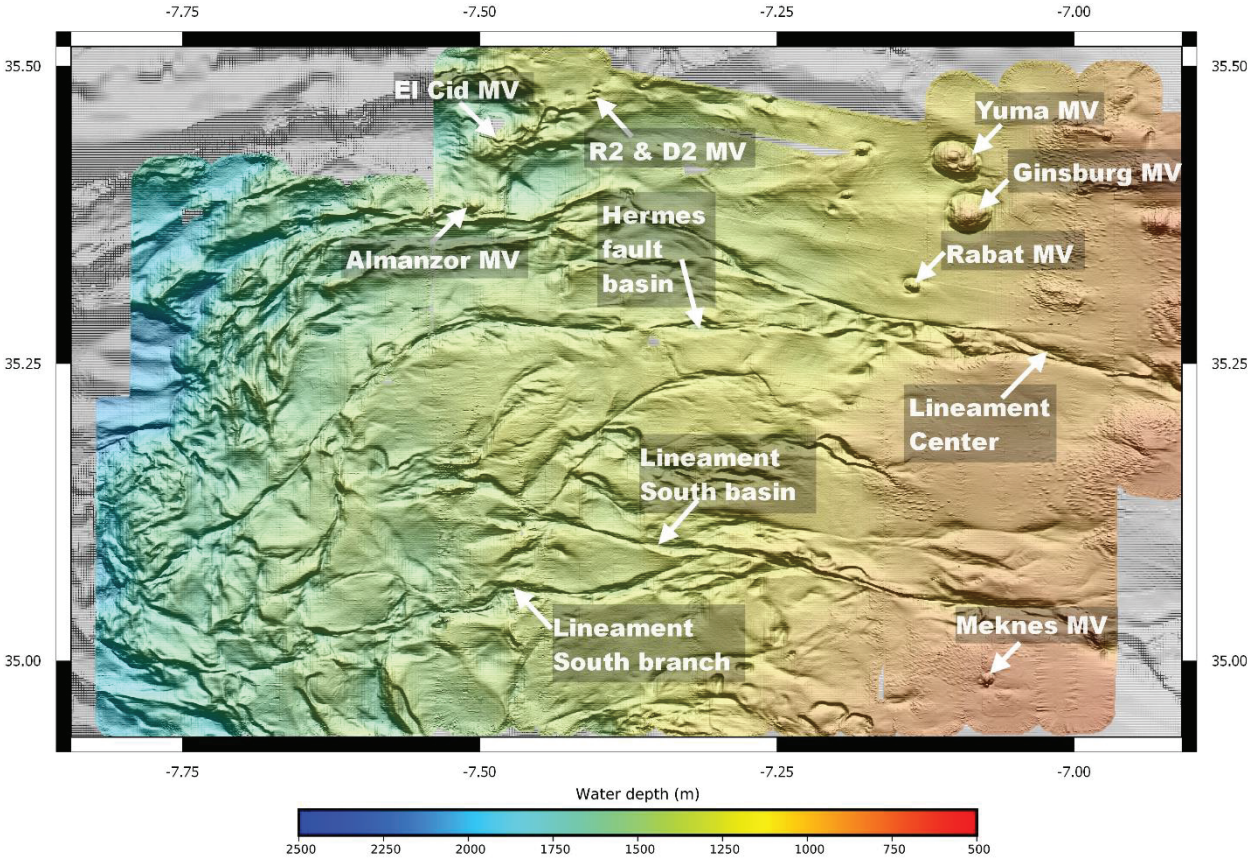

Fig. 5.2 Overview of the acquired multibeam bathymetry map (colored, the mapped area covers approx. 60 km by 80 km) and sampled tectonic structures of the Gulf of Cadiz accretionary prism.

The mud volcanoes were also investigated using the sediment echosounder system. For example in the case of Ginsburg MV, a parametric sub-bottom profile running from WSW to ENE across the edifice displays parallel and laminated acoustic facies leading to a depressed rim around the volcano's western edge. Evidence of possible slope failures, seen as transparent, somewhat chaotic acoustic facies on the western flanks, are visible and correlate with scarps seen in the bathymetry. From the east, sedimentary facies leading towards Ginsburg's depressed rim are somewhat more chaotic. A larger slope failure, or mass transport deposit, is visible on Ginsburg's eastern flank as a transparent sediment layer overlying another darker chaotic layer. In a S-N parametric sub-bottom profile of Yuma MV, we acquired possible evidence of the volcano's "Christmas tree"-like internal structure [see Kopf (2002) for more details] that is visible to the south as transparent acoustic lenses interspersed with parallel, laminated sedimentary layers (Fig. 5.3). Yuma's depressed rim is slightly more prominent to the north and possible slope failures are visible on either side of the volcano. In a SW-NE acoustic profile, this mud volcano shows parallel, laminated sedimentary layers leading to a small depression around the volcano. Chaotic reflectors along its steep, double-peaks provide little definition of its internal structure.

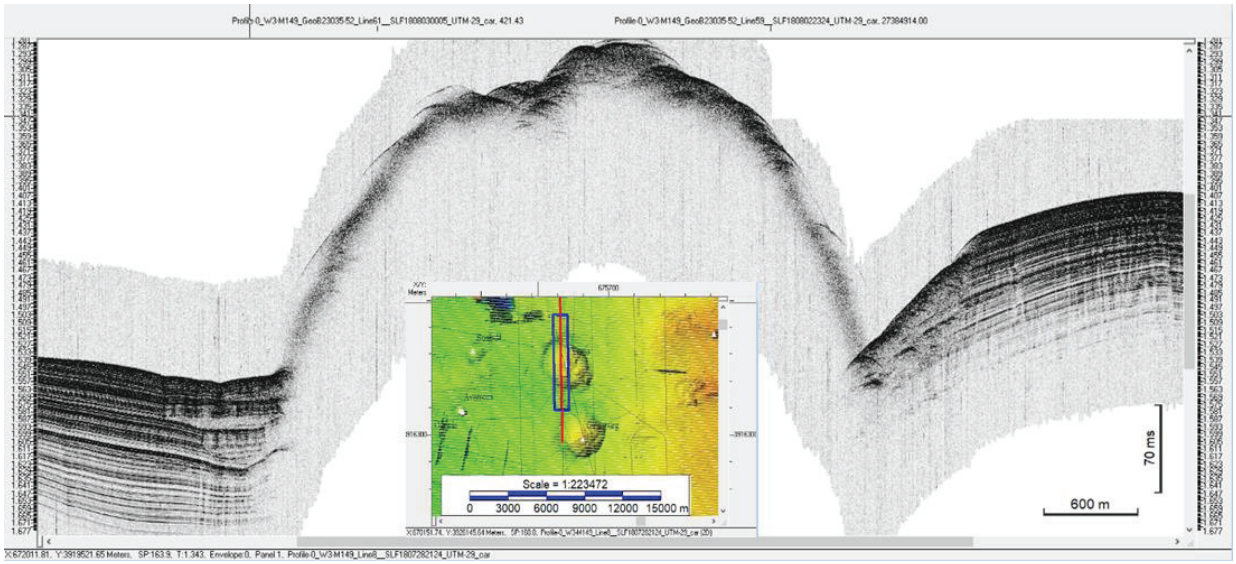

Fig. 5.3 S-N trending parametric sub bottom profile of the Yuma mud volcano.

5.1.3 Gulf of Cadiz – Lineaments

The Lineament Center and South are right lateral strike-slip faults that can be traced throughout the mapped accretionary prism. Both lineaments show branches, of which the most prominent are trending W-E (Fig. 5.2). In the bathymetry maps the fault zones are recognizable as a morphological depression, whose bottom is filled with hemipelagic sediment as shown by gravity and MeBo drilling cores. In the sampled area the depression caused by Lineament Center is on average ca. 100 m deep and ca. 1.5 km wide. The Lineament South is 150 m deep and 2.5 km wide. Transpressional and transtensional features are multifold and clearly observable, such as pressure ridges and small pull- apart basins. The largest of the rhombic-shaped pull-apart basins is located along the Lineament Center branch and measures ca. 1.3 km by 1 km. The seafloor in the basins is slightly deeper than in the fault's depression.

The parametric sub bottom profiling of Lineament Center shows mostly transparent, but parallel, sedimentary layers of different sizes overlying one another at the bottom of the basin (Fig. 5.4). The acoustic "roughness" of these layers suggest that they may be the result of slope failures along the structure's steep edges and may be related to the seismicity of the fault. A S-N parametric sub-bottom profile of a pull-apart basin found along the Lineament South displays possible sediment layering in the basin and evidence of slope failure along the basin's southern edge, suggesting that this extension of the fault could be an important archive of its paleoseismicity.

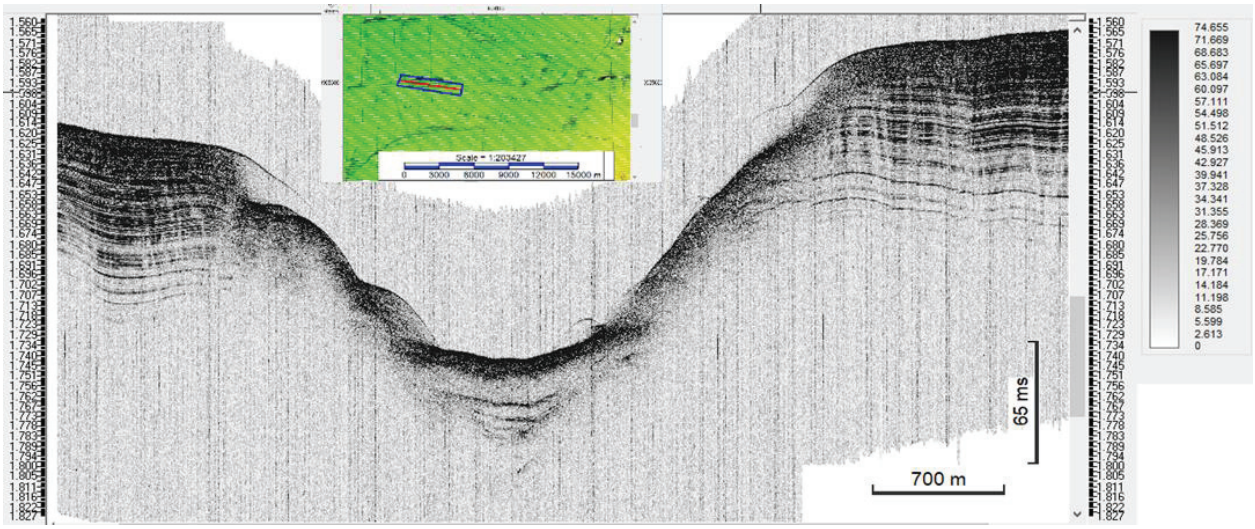

Fig. 5.4 WNW-ESE trending parametric sub bottom profile of the pull-apart basin at Hermes fault.

5.1.4 Gulf of Cadiz – Salt Domes

The salt diapirs are located south-west of the accretionary prism in the Seine abyssal plain, at 4000 m water depth (Fig. 5.1). The ca. 300 m high domes have round to elongated shapes and steep slopes. In sub-bottom profiles the salt domes are visible as shallow, chaotic reflectors with steep sides. In between the domes can be seen several parallel, laminated sedimentary facies.

5.1.5 Alboran Sea – Strike-Slip Faults

In the Alboran Sea, we gathered hydroacoustic data at water depths on average much shallower than those in the Gulf of Cadiz and usually ranging between 150-1500 meters. Prominent features investigated and imaged in the Alboran Sea include the Carboneras fault and the Al-Idrissi fault (Fig. 5.1). The Carboneras fault zone is a NE-SW trending strike slip fault that extends from land in southwest direction into the Alboran Sea (Gràcia et al., 2006). The fault forms a morphological depression that can be traced over the length of circa 100 km on the seafloor. A transpressional character is observable by sub bottom profiles perpendicular to the Carboneras fault, showing that the structure has a thrust component, whose hanging wall is on the north. The fault offsets parallel, laminated, acoustic layers in each profile, and there is evidence of concave-down flexure of the layering on the footwall, directly before the fault. To the south, there are several other offsets as well.

The Al-Idrissi fault zone is a NNW-SSE trending strike-slip fault that hosted the 2016 M6.4 earthquake offshore Morocco (Gràcia et al., 2019). The trace of the Al-Idrissi fault zone is best recognizable by the morphological depression, where it is cutting through the Alboran ridge. In the acoustic profile, strong reflectors visible in the subsurface against an otherwise transparent backdrop define the Al-Idrissi fault. A potential mass transport deposit can be seen to the northwest of the fault, as a blank acoustic facies (Fig. 5.5).

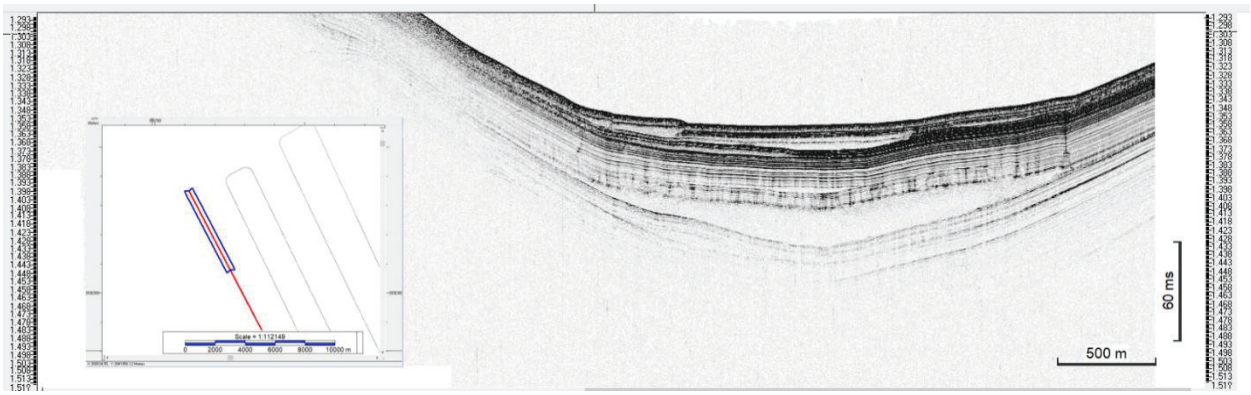

Fig. 5.5 NW-SE Parametric SBP of a potential mass transport deposit (blank acoustic facies).

5.2 Sediment Sampling and Sedimentological Description

(W. Menapace, V. Magalhaes, M. Freitas, P. Haberkorn, T. Freudenthal)

5.2.1 Methodology

The main purpose of cruise M149 was to sample the subseafloor for paleoseismological studies. Short cores were obtained using a gravity corer with a 6 m long barrel and a top weight of 1.5 tons that is lowered to the seafloor at a velocity of 1 m/s. After arrival of the gravity corer on deck the liner (12 cm diameter) was removed from the core barrel, cut into 1 m sections and labelled according to the GeoB scheme, which is employed at the University of Bremen for data management purposes. Time sensitive sampling of head space and pore water specimen were conducted on the whole round sections immediately after cutting and labeling of the sections (see geochemistry). Core sections were then split lengthwise into an archive and working half. Archive halves were used for sediment description and photo imaging, whereas samples for post-cruise and shipboard measurements were taken from the working halves. After completion of the shipboard analysis, the split cores were packed and stored in a container at a temperature of +5°C. Due to limited storage capabilities of half rounds, gravity cores recovered in the Alboran Sea were not split onboard such that only head space and pore water samples were taken. The unsplit core section were also stored in the container at 5°C and further processing of these cores was conducted post-cruise at the MARUM following the shipboard methodology.

The remotely operated seafloor drill rig MARUM-MeBo70 was employed to obtain long cores of up to 50 m and to install borehole observatories. The recovered MeBo cores were drilled in the push mode using core barrels of 250 cm length (Freudenthal and Wefer, 2007). The cores were processed similarly to the gravity cores by cutting the MeBo core liners (5.5 cm diameter) into sections of up to 1.5 m length, followed by sampling for head space and pore water, splitting into

an archive and working half and shipboard analyses. The total lengths of recovered gravity cores are reported in chapter 7 (Station List) and further details of the MeBo core recovery are listed in table 5.1.

All core sections were imaged immediately after being split by using the SmartCIS 1600LS line scanning system of the MARUM GeoB Core Repository (www.marum.de /en/Infrastructure/GeoBsmartCIS-1600-Line-Scanner.html). It was useful to freshly scrape the cores immediately prior to imaging in order to capture the ephemeral nature of some sedimentary features and colors. All images were acquired at a 500 dpi resolution. In order to retain the relative variability in core color within each hole, we found it more expedient to fix the aperture of the camera at f/8. This has imaged most cores without the need for further adjustment. Care was taken to ensure that the system was correctly calibrated using the "white tile" procedure prior to scanning each core and that the camera position was correctly set up. Output from the SmartCIS includes a jpeg file for each scanned section with a digital ruler on the right side of the image.

Tab. 5.1 List of MeBo core recovery.

Ship station	GeoB no.	Drilled length (cm)	Cored length (cm)	Core recovery (cm)	Core recovery (%)
M149-33	23024-2	530	260	37	14.2
M149-53	23024-4	2030	1760	634	36.0
M149-59	23047-1	780	510	325	63.7
M149-60	23047-2	780	510	492	96.5
M149-65	23047-3	4030	3760	3566	94.8
M149-75	23060-1	2030	1760	1390	78.0
M149-84	23069-1	5030	4760	4145	87.1
M149-88	23073-1	4530	4260	4223	99.1
M149-109	23091-1	2030	1760	1717	97.6
Sum		21770	19340	16529	Average = 74.1

Detailed sedimentological observations and descriptions were recorded manually for each gravity core and MeBo core section on visual core description (VCD) sheets. A wide variety of features that characterize the sediments were documented and the information was synthesized for each core in a Corel Draw template (see Appendix). Hand-written core descriptions were transferred to digitized one-page composite core logs compiled for each core with depths in centimeters below seafloor (cmbsf). The core logs show the graphical lithology and give information on major and minor lithologies, primary sedimentary structures, accessories, bioturbation, and coring disturbance, which are indicated by patterns and symbols in the graphic logs. Classification of sediments for the graphical core descriptions (e.g. silty clay) followed the conventional Ocean Drilling Program (ODP) and Integrated Ocean Drilling Program (IODP) procedures for recording sedimentological information (Mazzullo and Graham, 1988). Grain size variations of the sediments were determined by visual observation and through sampling of the sediments with a toothpick. Sediment texture (defined by the relative proportions of sand, silt, and clay) was determined using a simple hand-lens and smear-slide analysis, following the classification of Shepard (1954). Additional biostratigraphic information about the sediments was implemented through the initial examination of smear slides at sea. The Munsell color designation

(hue, value and chroma) of the sediments was determined by visual comparison with the Munsell soil color chart (Munsell Color Co., 1975). The extensive sedimentological results including core images and core-log descriptions are attached in the Appendix.

5.2.2 Gulf of Cadiz – Mud Volcanoes

A total of 31 gravity cores and 2 long MeBo cores were collected from mud volcanoes located on the Gulf of Cadiz accretionary prism focusing on the mud volcanoes Ginsburg, Yuma, Rabat, Meknes, Almanzor, El Cid and the three new mud volcanoes discovered during M149: R2, D2 and Funky Monkey. Generally, the sediments recovered at all the mud volcanoes correspond to structureless greenish gray to dark grey mud breccias with hemipelagic coverage of variable-thickness, composed of yellowish brown to brown foraminifera-bearing nannofossil ooze, mostly bioturbated (Fig. 5.6).

During the first phases of cruise M149, sampling concentrated on the Yuma and Ginsburg MVs. Despite their discovery in the Gulf of Cadiz two decades ago (Kenyon et al., 2000), they have not been extensively sampled so far. Therefore, we conducted a sampling transect in NNW-SSE direction across Yuma MV, consisting of 5 gravity cores: GeoB23028-1, GeoB23003-1, GeoB23013-1, GeoB23012-1, GeoB23025-2 and GeoB23004-1 (Fig. 5.7). The cores are constituted by two main facies: A hemipelagic sediment cover on top of the mud volcano sediment (similar to Fig. 5.6) except for core GeoB23004-1 that was taken between the mud volcanoes Yuma and Ginsburg as a background reference and consists of hemipelagic sediment only. For the other cores we observe an increasing thickness of the hemipelagic cover from core GeoB23028-1 (5 cm hemipelagic cover) at the summit of the northernmost emission site to core GeoB23025-2 (454 cm hemipelagic cover) at the southern rim. Core GeoB23028-1 seems therefore located on a younger mud flow whereas GeoB23025-2 is located on an older flow. This observation is in good agreement with the generic model of mud volcano evolution, according to which younger flows locate around the sediments emission loci (normally the summit) and older flows at the rim of a mud volcano structure (e.g., Kopf, 2002). Moreover, gas expansion cracks and moussy texture have been observed in mud breccia sediments of core GeoB23028-1, as well as a strong H_2S smell in cores GeoB23003-1, GeoB23013-1 and GeoB23012-1. Remnants of Gasteropoda, Scleractinian cold-water corals, sponges' spicules and shell fragments were observed throughout the hemipelagic sediments. Clasts with variable lithologies (poor to well-lithified siltstones and sandstones) and a maximum diameter of approximately 7 cm are ubiquitously present in the mud breccia.

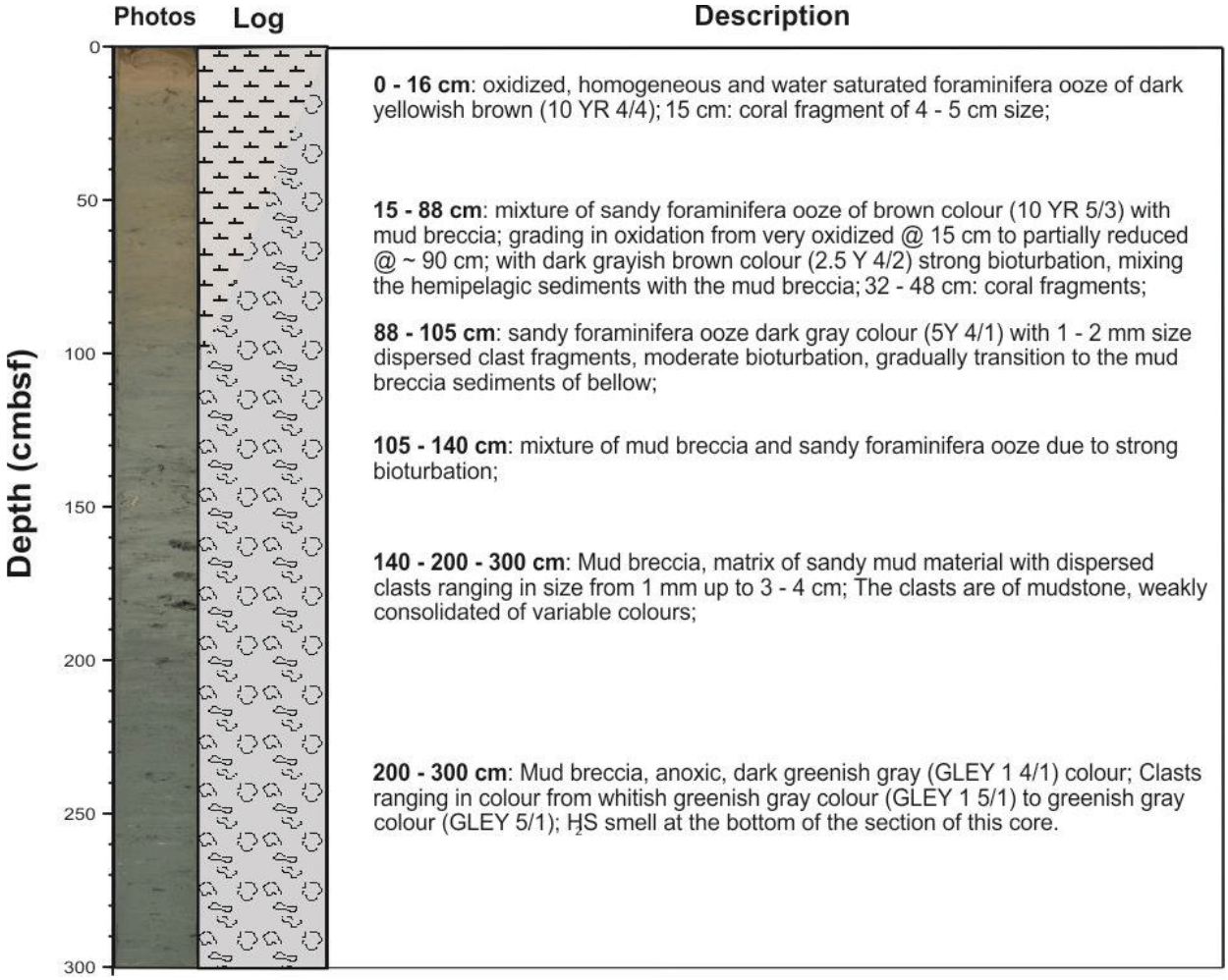

Fig. 5.6 Typical succession of sampled mud volcanoes lithologies consist of a hemipelagic sediment cover (brownish color) on top of mud breccia (greenish color) (core GeoB23006-1).

Across the Ginsburg MV two transects were cored of which one is N-S oriented and the other W-E (Fig. 5.7). The N-S transect consists of 4 gravity cores and 2 MeBo cores: GeoB23024-2, GeoB23024-3, GeoB23024-4, GeoB23006-1, GeoB23007-1and GeoB23008-1 (Fig. 5.7). Again the cores are constituted of a hemipelagic sediment cover on top of the mud volcano sediments. An exception to this are cores GeoB23007-1 and GeoB23008-1 that were taken south of the mud volcano as background references and consist of hemipelagic sediment only. Similar to the Yuma MV cores, we observe an increasing thickness of the hemipelagic cover from core GeoB23024-3 (1-3 cm hemipelagic cover) at the main sediment emission site to core GeoB23006-1 (140 cm hemipelagic cover) at the southern rim. Core GeoB23024-3 is therefore located on a younger mud flow whereas GeoB23006-1 is located on an older one.

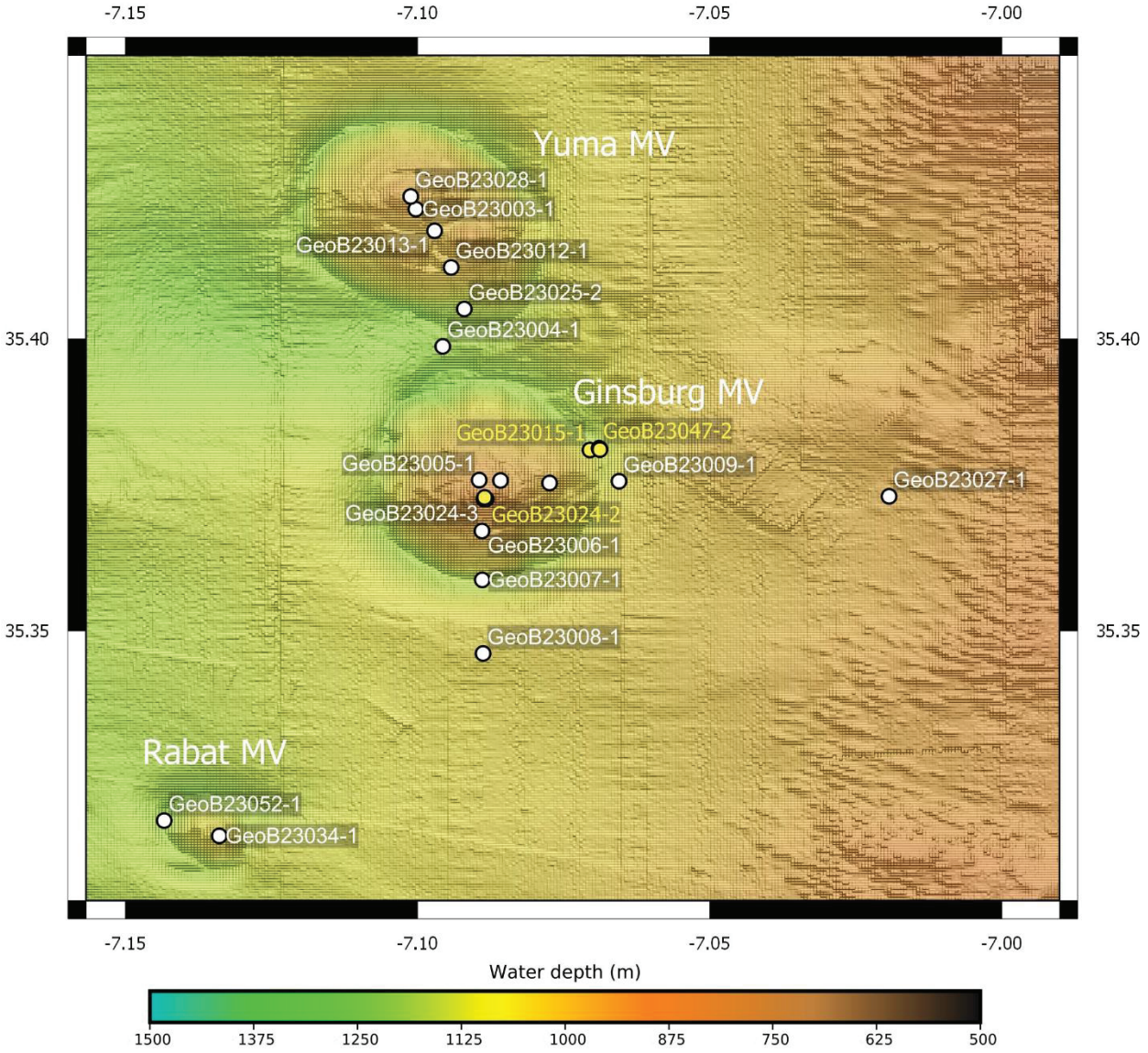

Fig. 5.7 Bathymetric map with locations of MeBo (yellow) and GC (white) sampling sites at the Yuma, Ginsburg and Rabat MVs.

The W-E transect consists of 5 gravity cores and 3 MeBo cores: GeoB23005-1, GeoB23011-1, GeoB23010-1, GeoB23009-1, GeoB23047-1, GeoB23047-2, GeoB23047-3 and GeoB23027-1 (Fig. 10). Consistent with the N-S transect the cores GeoB23005-1, GeoB23011-1, GeoB23010-1 and GeoB23009-1 are composed of a hemipelagic sediment cover on top of mud breccia. Cores GeoB23047-1, GeoB23047-2, GeoB23047-3 and GeoB23027-1 sampled the seafloor east of the Ginsburg MV as background references and to investigate the hydrogeological and sedimentological processes at the rim of Ginsburg MV. We observe an increasing thickness of the hemipelagic sediments from core GeoB23005-1 (1-4 cm hemipelagic cover), located north of the main sediment emission site, to core GeoB23010-1 (98 cm hemipelagic cover) that is located on the eastern slope. We therefore infer that GeoB23005-1 is located on a younger mud flow whereas GeoB23010-1 is located on an older one. Further observations comprise gas expansion cracks and moussy textures in mud breccia sediments of core GeoB23024-3 and GeoB23024-4 and strong H_2S smell in cores GeoB23024-3, GeoB23006-1, GeoB23005-1, GeoB23011-1 and GeoB23010-1 (Fig. 5.7). Remnants of Gasteropoda, Scleractinian cold-water corals, sponges' spicules and shell

fragments were observed throughout the hemipelagic sediments. Clasts with a maximum diameter of circa 5 cm were ubiquitously present in the mud breccia and consist of poor to well-lithified mudstones, siltstones and sandstones. Euhedral calcite crystals with pyrite were found on a millimetric clast in core GeoB23005-1.

Special mention deserves the MeBo core GeoB23047-3, which is composed of a regular succession of olive grey nannofossil ooze intercalated with dark grey to black nannofossil ooze throughout the entire 40 m cored (cf., Appendix). The black nannofossil ooze contains pyritized borrows and shells, as well as dispersed sub-millimetric pyrite crystals. The black material is made of either organic-rich or sulphide-rich precipitates; in the more dense or larger spots a rubber-like sulfur smell can be felt. These layers could be interpreted as anoxic and organic rich, possibly indicative of deeper seepage of hydrocarbon fluids. Fluid-induced structures oriented in direction to the sediment surface have been spotted at various depths in the whole core.

Extended sampling focused also on the Meknes MV due to its proximity to the Lineament South (6.8 km south of it, Fig. 5.2) and its isolated location away from other expulsion structures. Similar to the Yuma and Ginsburg MVs, this mud volcano was discovered more than one decade ago during TTR-14 in the Gulf of Cadiz (Kenyon et al., 2006), but has not been extensively sampled since. Sampling of Meknes MV occurred along an E-W oriented transect, consisting of 8 gravity cores: GeoB23038-1, GeoB23039-1, GeoB23040-1, GeoB23041-1, GeoB23041-2, GeoB23043-1, GeoB23043-2 and GeoB23044-1 (Fig. 5.8).

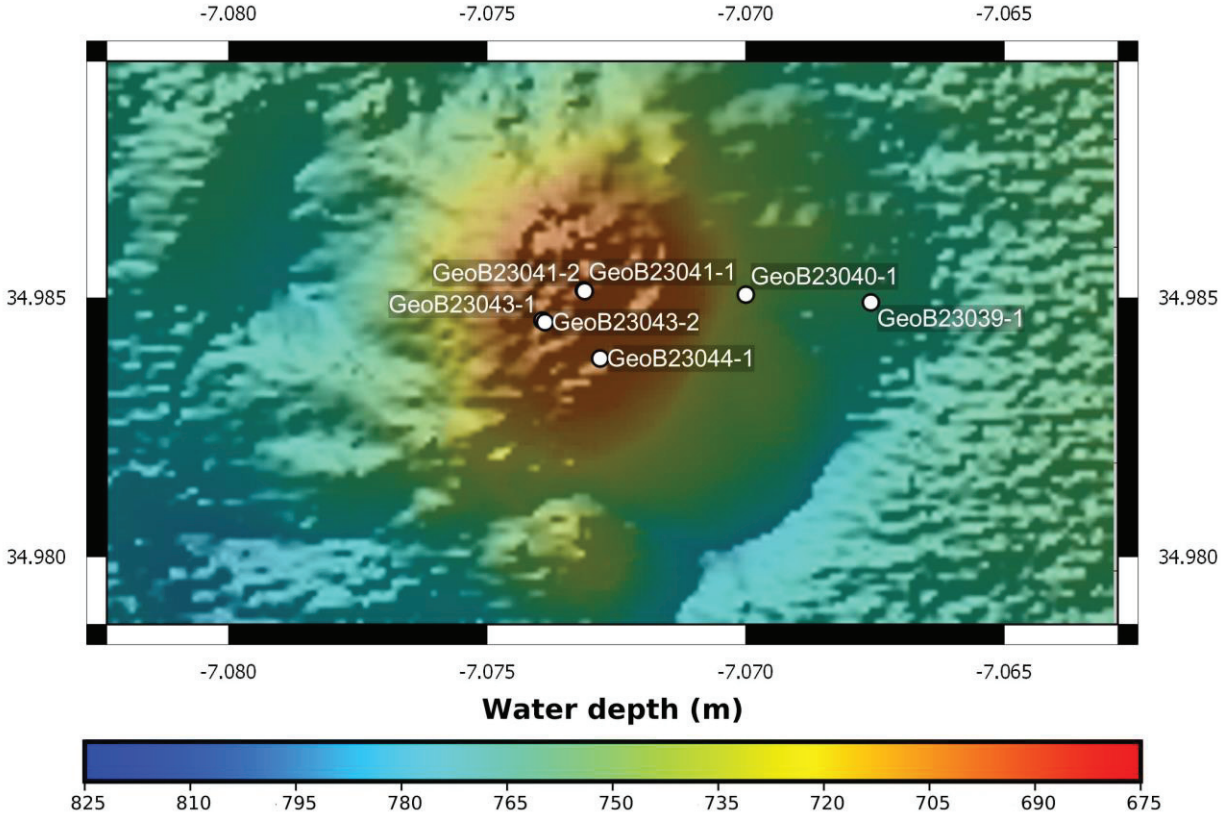

Fig. 5.8 Bathymetric map showing the locations of gravity cores on and in the vicinity of the Meknes MV.

The cores are constituted by a hemipelagic sediment cover on top of a mud volcano breccia. An exception to this is core GeoB23038-1 that is located east of Meknes MV, as a background reference. The hemipelagic draping on the mud breccia oscillates between 0-7 cm. Moreover, an

authigenic carbonate layer have been observed at shallow depths (<1m) in mud breccia sediments of cores GeoB23041-2, GeoB23043-1 and GeoB23044-1, as well as a strong H_2S smell in cores GeoB23039-1, GeoB23040-1, GeoB23041-2, GeoB23043-1, GeoB23043-2 and GeoB23044-1. Gas expansion cracks and moussy textures were observed in mud breccia sediments of core GeoB23041-2, GeoB23043-1, GeoB23043-2 and GeoB23044-1. Remnants of Gasteropoda, Scaphopoda, Scleractinian cold-water corals, sponges' spicules and shell fragments were observed throughout the hemipelagic sediments. Clasts with a maximum diameter of up to 12 cm are ubiquitously present in the mud breccia and consist of poor to well-lithified siltstones and sandstones. Dispersed millimetric pyrite crystals and pyrite bearing sandstone clasts are sparse through the mud breccia, especially in proximity of the authigenic carbonate layers.

Further mud volcanoes were sampled during the expedition either because of their locations on or close to main tectonic lineaments, i.e. El Cid (GeoB23056-1), Almanzor (GeoB23057-1) and Rabat MVs (GeoB23034-1, GeoB23052-1), or to confirm their new discovery with ground truthing, i.e. R2 (GeoB23053-1), D2 (GeoB23054-1) and Funky Monkey MVs (GeoB23081-1). All cores are constituted by a hemipelagic sediment cover on top of mud volcano breccia.

Additionally, cores GeoB23077-1, GeoB23082-1 and GeoB23085-1 were taken in areas of suspected MVs. Even if these cores were not able to sample mud breccias, a fine-grained grayish sediment matrix was retrieved in all the cores, with additional intense H2S smell in cores GeoB23077-1 and GeoB23082-1.

5.2.3 Gulf of Cadiz – Lineaments

In order to investigate the role of the WNW-ESE trending band of dextral strike-slip faults on the plate tectonic framework, the generation of earthquakes and tsunamis in the Golf of Cadiz, and their relationship with the mud volcanoes, extensive coring focused on the Lineaments Center and South and two W-E trending branches of the faults.

South of the Ginsburg mud volcano the following gravity and MeBo cores were taken close or along the track of Lineament Center: GeoB23022-2, GeoB23030-1, GeoB23032-1, GeoB23033-1, GeoB23048-1, GeoB23049-1, GeoB23060-1 and GeoB23071-1. Moreover, 3 gravity cores (GeoB23031-1, GeoB23066-1 and GeoB23067-1) and 1 MeBo core (GeoB23069-1) were sampled inside a pull apart basin along an E-W trending branch of Lineament Center: the Hermes Fault (Crutchley et al., 2011) (Fig. 5.9).

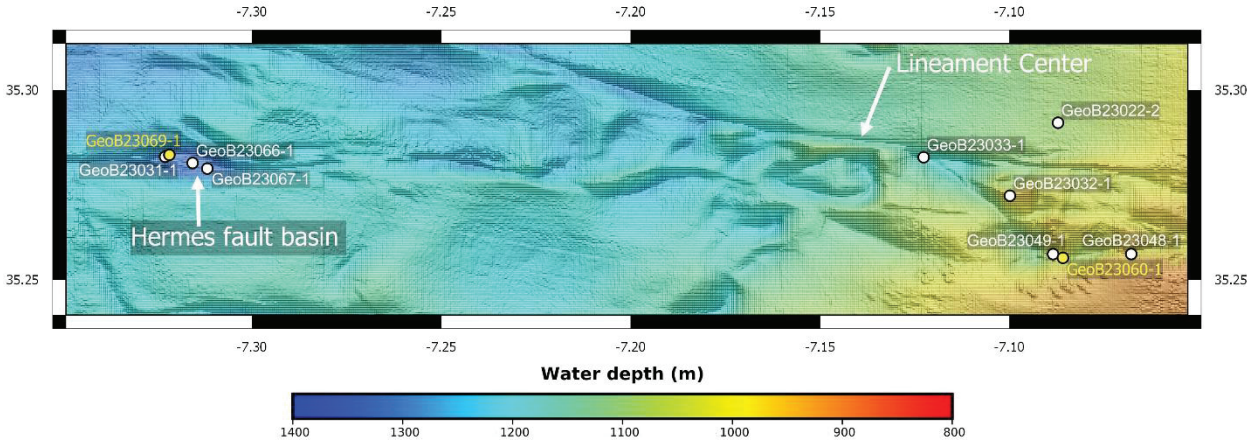

Fig. 5.9 Bathymetric map showing the locations of gravity cores (white dots) and MeBo cores (yellow dots) along the Lineament Center and the E-W trending Hermes fault.

Cores GeoB23022-2, GeoB23032-1, GeoB23048-1, GeoB23071-1, GeoB23066-1 and GeoB23067-1 sampled hemipelagic sediments, which are mainly composed of olive brown foraminifera-bearing nannofossils ooze. The sediment is light to heavy bioturbated, locally pseudo-layered; with dispersed patches of black material <1 cm in size and oxidized at the top. Fluid seepage structures are also present in some of the cores.

Cores GeoB23030-1, GeoB23031-1, GeoB23033-1, GeoB23049-1, GeoB23060-1 and GeoB23069-1 instead include centimetric to decimetric coarser successions (Fig. 5.10) represented by a series of fining upward sequences, degrading from foraminifera sands at the bottom to hemipelagic nannofossil ooze at the top of the layers. We speculate that these sediments accumulated through seafloor gravitational movements (Mass Transport Deposits) in response to the regional tectonic activity. This interpretation is supported by sharp contacts and tectonically displaced layers at different depths in the cores.

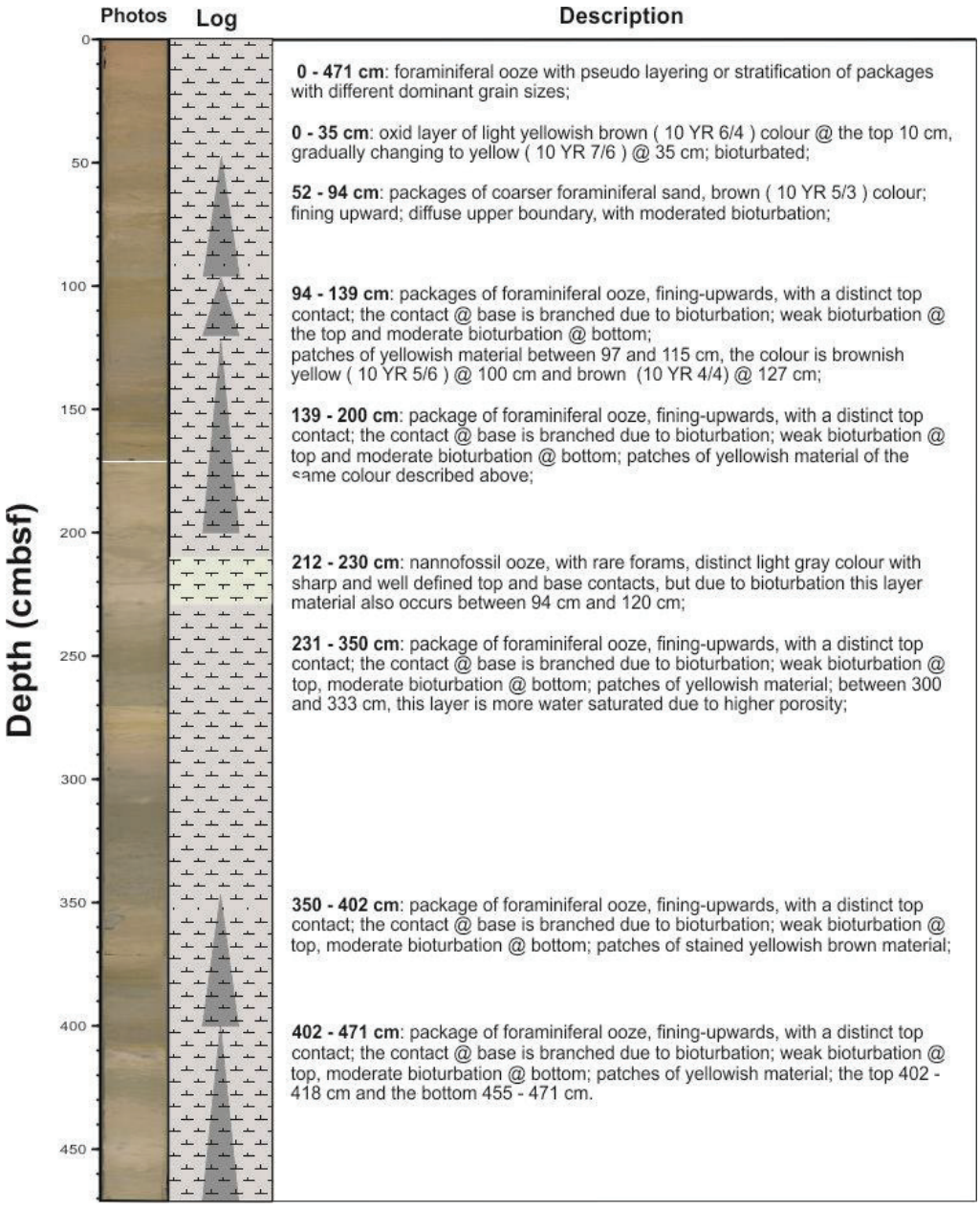

Fig. 5.10 Typical lithological succession of sediment sampled along the fault zones with several turbidites identified by fining upward sequences (gray triangles) (core GeoB23030-1).

The following gravity cores were taken close or along the track of Lineament South: GeoB23036-1, GeoB23037-1, GeoB23045-1 and GeoB23076-1. Moreover, 3 gravity cores and 1 MeBo core sampled two pull apart basin-like structures along the Lineament South: GeoB23062-1, GeoB23063-1, GeoB23064-1 and GeoB23073-1 (Fig. 5.11). The cores are mainly composed of olive brown foraminifera-bearing nannofossils ooze, which are light to heavy bioturbated, locally pseudo-layered, with dispersed patches of black material < 1 cm in size and oxidized at the top. Fluid seepage structures are also present in some of the cores.

Core GeoB23045-1 also shows a series of centimetric to decimetric fining upward sequences that degrade from foraminifera ooze at the bottom to hemipelagic nannofossil ooze at the top. These layers probably are turbiditic successions, which were accumulated through seafloor gravitational movements due to tectonic activity. The core also show gradual layer contacts and inclined layers beddings at different depths of the core.

Two additional cores were taken in the northern part of the Gulf of Cadiz, namely GeoB23083-1 and GeoB23084-1, respectively located on the south and on the summit of the Lolita Salt Dome. Both cores are constituted mainly by a homogeneous nannofossil ooze.

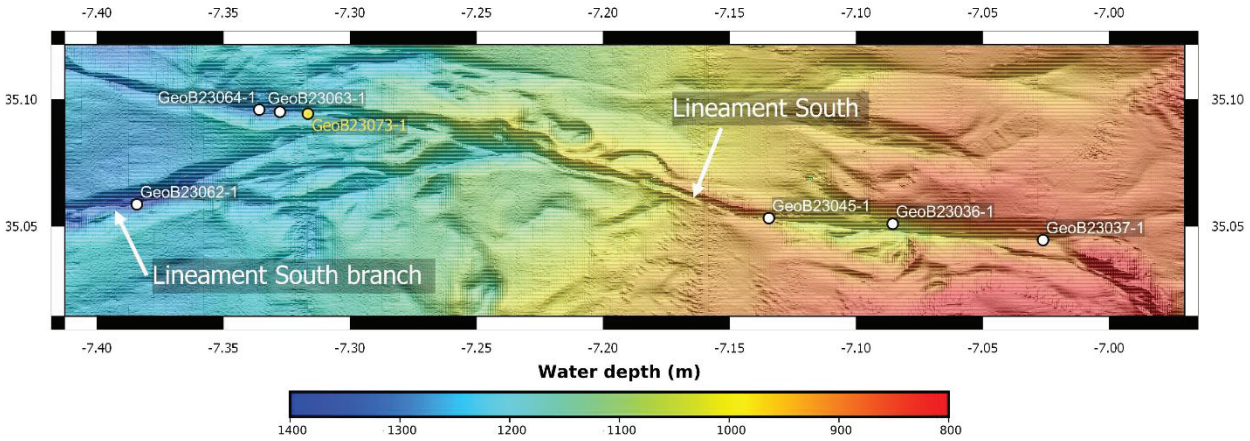

Fig. 5.11 Acquired bathymetric map by cruise M149 with locations of gravity cores (white dots) and MeBo cores (yellow dots) along the Lineament South and its E-W trending branch.

5.2.4 Gulf of Cadiz – Salt Domes

The cores recovered from the Seine abyssal plain focused on dome-like structures S-W of the accretionary prism but were not opened nor described onboard during cruise M149. In these locations, we retrieved 3 GCs: GeoB23078-1, GeoB23079-1, GeoB23080-1 (Fig. 5.12).

The sedimentological description of the cores conducted in Bremen show several packages of foraminiferal sands, interpreted as turbidites, which have oftentimes sharp erosional basal surfaces and are organized in fining upward sequences. At the top of a turbidite sequence bioturbation is common. The turbidites packages have a coarser granulometry in core GeoB23079-1 compared to cores GeoB23078-1 and GeoB23080-1 on top of the domes (Fig. 5.12). The elevated location on the summits may be therefore more difficult to reach by the bigger, heavier grains transported during a turbiditic event.

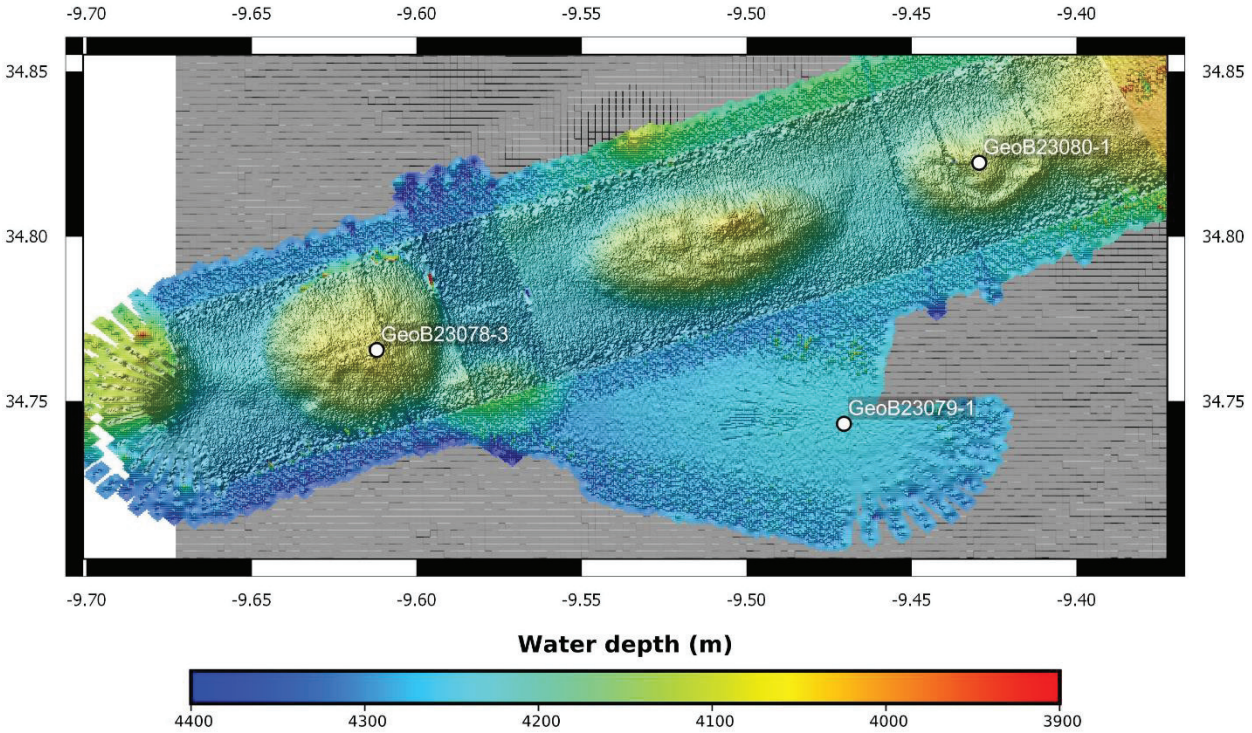

Fig. 5.12 Acquired bathymetric map with locations of gravity cores adjacent to and on the summit of salt domes in the Seine abyssal plain.

5.2.5 Alboran Sea – Strike-Slip Faults

The cores recovered from the Carboneras and Al-Idrissi fault zones and Marrakesh MV were not opened nor described onboard during cruise M149 with the exception of the MeBo core (GeoB23091-1) (Fig. 5.13). Along the Carboneras Fault, we retrieved 4 GCs and 1 MeBo core: GeoB23086-2, GeoB23087-1, GeoB23088-1, GeoB23089-1, GeoB23091-1. The MeBo core GeoB23091-1 is mainly constituted by a greenish gray silty mud, oftentimes cross-cutted by several fractures subperpendicular to the core liner. The sediments in all the other GCs are mainly greenish gray nannofossil oozes with occasional patches of foraminifers, shells and plant remnants.

Along the Al-Idrissi fault, we retrieved 4 GCs: GeoB23092-1, GeoB23093-1, GeoB23094-1 and GeoB23095-1 (Fig. 5.13). In contrast to the Carboneras fault cores, these sediments are mostly olive gray in color, and their granulometry is coarser, being constituted mostly of foraminiferal ooze with abundant shell fragments. Mostly in core GeoB23094-1, but also less markedly in core GeoB23093-1, the sediments seem to be organized in fining upward packages with erosive bottom surfaces. This points towards turbidite-like structures which could have developed following fault-related earthquake shaking. The gravity core recovered from the Marrakesh MV (GeoB23097-1) is manly constituted by nannofossil ooze, making the Marrakesh MV either an inactive mud volcano or our sampling spot too far away from the main mud emission loci to sample mud breccia.

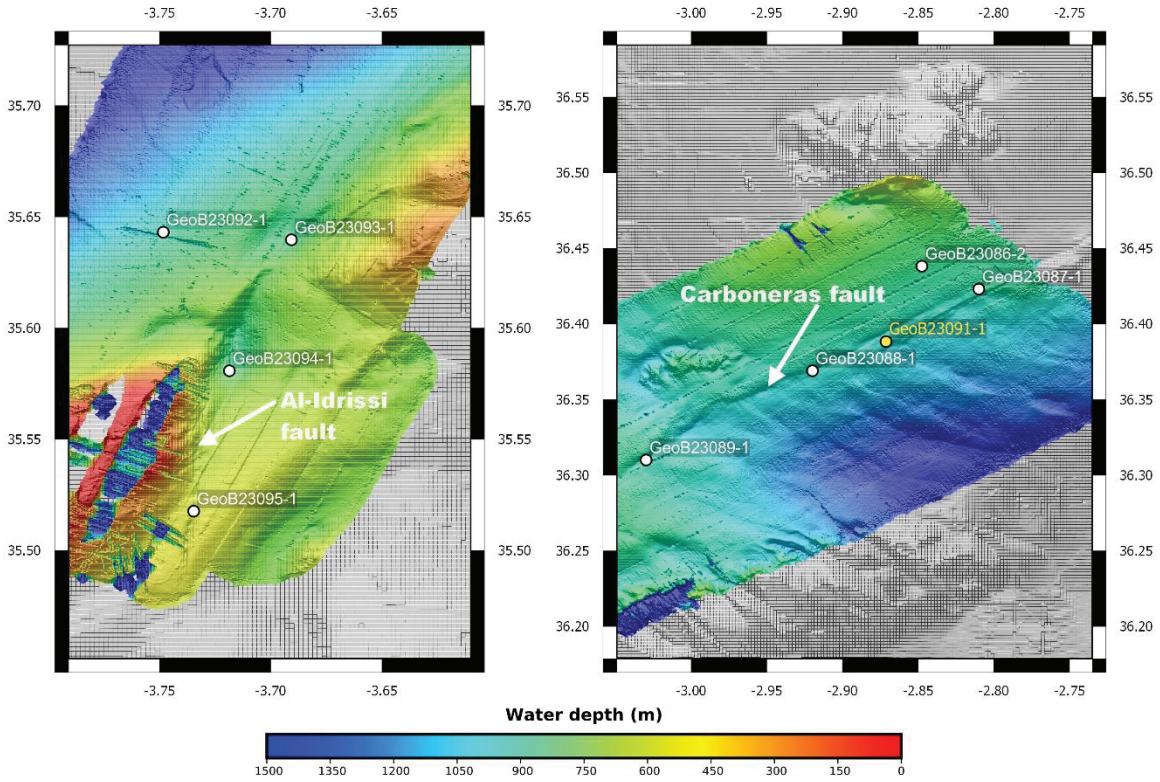

Fig. 5.13 Bathymetric map showing the locations of gravity cores (white dots) and the MeBo core (yellow dot) in the Alboran Sea.

5.3 Biostratigraphy

(A. Gonzales Lanchas, P. Mazerath)

5.3.1 Methodology

Biostratigraphic analysis during cruise M149 focused on the calcareous nannoplankton fossils (calcareous nannofossils) assemblage in the recovered sediment. The nannofossils represent a powerful age control tool in ocean sedimentary sequences because of their small size, wide dispersion (since their first appearance in the Triassic) and full adaptation to different oceanic environments and photic zone water column depths. Micropaleontological samples for age control were obtained from the core catcher of every recovered core. Additional samples were selected during the core description to better characterize the lithologic variability of the sediment and to provide a more refined age determination. Those samples were also described regarding the percentage of the main components.

Nannofossils were studied for morphological species identification using an OLYMPUS transmitted-light microscope with a 1250× magnification. For sample preparation, a small amount of sediment was placed on glass slide. Due to the small amount of sediment material required; the samples were taken from the archive half of the core. After adding a drop of distilled water, the samples were delicately spread on the slides with toothpicks. This was followed by a brief heating of the slides on a hotplate to dry the sediment. Then a drop of adhesive (Norland Optical Adhesive 61) was added to the cooled sediment sample which was covered with a MENZEL coverslip. For curing, the smear slides were placed under blacklight (UV) for ~ 15 minutes.

For each sample a semiquantitative observation was made, in order to characterize the nannofossil assemblage. Calcareous nannofossil age events are assigned in core catcher samples and additional ones based on the following terminology: FO = first occurrence, LO = last occurrence, FcO = first common occurrence, LcO = last common occurrence, FaO = first abundant occurrence, LaO = last abundant occurrence, LrO = last regular occurrence, T = top, B = bottom, AB = acme bottom.

Several information sources are used for the classification of the calcareous nannofossil taxa. The general taxonomy mainly follows the concepts explained in the reference works for calcareous nannofossil biostratigraphy (Bown, 1998), Cenozoic calcareous nannofossils (Perch-Nielsen, 1985) and in the updated online dataset Nannotax (http://ina.tmsoc.org/Nannotax3/index.php?dir=Coccolithophores). The calibrations of the Miocene to Quaternary events are derived mainly from Raffi et al. (2006) and by correlation to the geomagnetic polarity timescale (GPTS) of Lourens et al. (2004a, b). Additionally, Martini (1971) and Okada and Bukry (1980) standard zonal schemes were adopted. For calcareous nannofossil biozonation and calibration of Paleogene events we followed Agnini et al. (2014), based on data acquired from key low- and middle-latitude deep-sea drilling sequences and marine onland sections of the Tethyan region (Agnini et al. 2014). Additionally, Martini (1971) and Okada and Bukry (1980) standard zonal schemes are adopted. Biostratigraphy of the Upper Cretaceous is described with reference to both the global Upper Cretaceous UC biozonation of Burnett (1998) and the older CC biozonation of Sissingh (1977), as modified by Perch-Nielsen (1979, 1983, 1985).

5.3.2 Gulf of Cadiz – Mud Volcanoes

The analyses of the calcareous nannofossil assemblage in the recovered mud volcano sediments is based on the study of CC (core catcher) samples and additional samples from working half sections. Two well differentiated contexts, related to the content of calcareous nannofossils, have been observed in the samples that reflect the facies of the hemipelagic cover and the underlying mud breccia (Fig. 5.14).

For the hemipelagic cover the calcareous nannofossil content is always representative of an autochthonous nannoplankton assemblage, which is widely dominated by Gephyrocapsa spp. (small Gephyrocapsa, G. caribbeanica, G. oceanica and G. muellerae), Calcidiscus leptoporus (subsp. leptoporus, quadriperforatus and small), Coccolithus pelagicus (subsp. pelagicus, braarudi and azorinus) Umbilicosphaera spp., Syracosphaera spp., Rhabdosphaera clavigera, Florisphaera profunda, Helicopshaera carteri, Helicosphaera inversa and Calcisolenia brassilensis. Due to the general absence of Pseudoemiliania lacunosa, a lower age limit of 0.47 Ma is established for the hemipelagic sediments based on the biohorizon top of that species. Presence of small placoliths of Emiliania huxleyi could not be specified on board due to technical limitations but, based on general shape of the Gephyrocapsa spp. assemblage (low relative G. caribbeanica), we assume the closeness or the later age of some of these sediments with respect to 0.29 Ma (biohorizon base of E. huxleyi). Only in few samples the clear presence of the large Emiliania morphotype (>4 μm) was detected, setting that sediments as younger than 0.29 Ma. In essence, the hemipelagic sediment cover represents a Quaternary age. Only in the cases in which lower intervals markers (lower Pleistocene - Pliocene) were identified a specific description has been made. Preservation of

calcareous nannofossils in the hemipelagic sediments is generally very good to excellent. Overgrowth and dissolution patterns are not observed in any case.

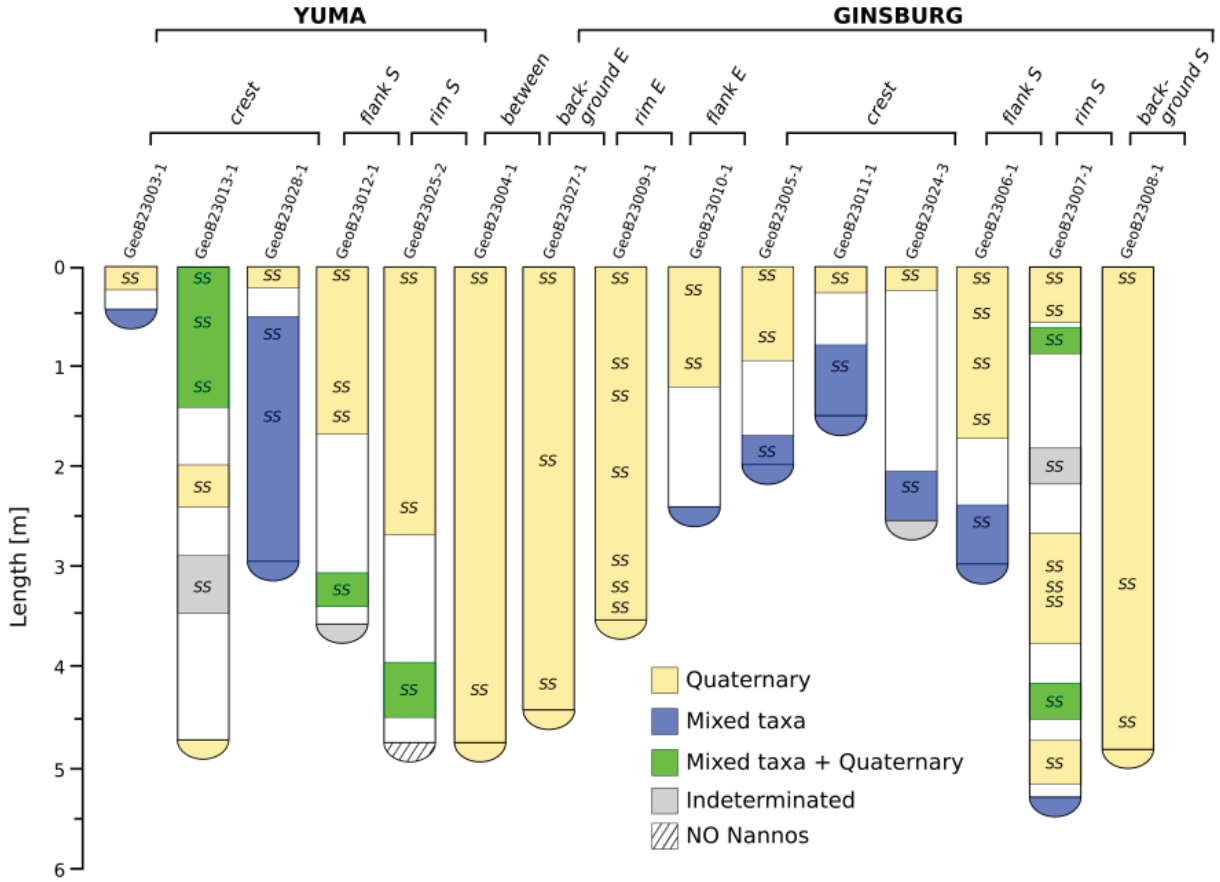

Fig. 5.14 Summary of the biostratigraphic analyses showing the distribution of quaternary assemblages and mixing of specimens of different ages in mud breccias that constitute an unnatural species aggrupation non-representative of any nannoplankton specific age (=mixed taxa).

The calcareous nannofossil content in mud breccias is characterized by the mixing of specimens of different ages that constitute, in a similar proportion, an unnatural species aggrupation non-representative of any nannoplankton specific age assemblage. Because many species observed in the mud breccias are characterized by very broad age ranges / dispersion over time (i.e. Reticulofenestra spp., Coccolithus spp.), the observation focused on biomarkers with more narrow age dispersion, trying to delimit the main time interval or intervals of the materials. It is, therefore, a preliminary analysis lacking precise quantitative or semiquantitative character that could limit in-depth interpretations of these sediments. However, a mixture of taxa is observable, in which the Paleocene-Eocene and Middle Miocene biomarker content stands out. Some species with Oligocene and Pliocene-Pleistocene ranges are also present. Upper Cretaceous specimens also appear with a significantly higher proportion in certain cases. It is important to highlight the systematic observation of some nannofossils after Pleistocene age that are included in the mud volcano samples but always in a scattered proportion (e.g., Gephyrocapsa spp.). Only in those cases in which the Quaternary content is present in similar proportion to the old taxa, a mixing between both groups is referred to (Mixed taxa + Quaternary in Fig. 5.14). Preservation of nannofossils in mud breccia samples is moderate to poor. Evidence of regrowth, breakage

(especially significant in large species i.e. Discoaster spp.) and dissolution have been observed systematically in these specimens.

5.3.3 Gulf of Cadiz – Lineaments

Biostratigraphic analysis of sediments sampled along the lineaments and their branches focused on the small pull-apart basin structures – in particular the long MeBo cores (GeoB23069-1 along the Hermes fault (Fig. 5.09) and GeoB23073-1 along Lineament South (Fig. 5.11)). Calcareous nannofossil content in those cores is dominated, similar to the hemipelagic apron of the mud volcanoes, by Gephyrocapsa spp. (small Gephyrocapsa, G. caribbeanica, G. oceanica and G. muellerae), Calcidiscus leptoporus (subsp. leptoporus, quadriperforatus and small), Coccolithus pelagicus (subsp. pelagicus, braarudi and azorinus), Umbilicosphaera spp., Syracosphaera spp., Rhabdosphaera clavigera, Florisphaera profunda, Helicopshaera carteri, Helicosphaera inversa and Calcisolenia brassilensis. Helicosphaera sellii, P. lacunosa and Reticulofenestra asanoi are also present. Conservation of nannoplankton is high in almost all samples, showing a very good to excellent preservation state.

The calcareous nannofossils studied for MeBo core GeoB23069-1 (Hermes fault basin) is based on core catcher samples from core barrels GeoB23069-1_19P to GeoB23069-1_1P. The chronological framework for GeoB23069-1 is based on calcareous nannofossil events suggesting an age record until early to middle Pleistocene (Fig. 5.15). The identification of Helicosphaera selli in the lowermost core catcher (CC), together with the absence of Calcidiscus macintyrei, limits the age of the lowermost sequence after 1.60 Ma, the biohorizon top of Calcidiscus macintyrei. Biohorizon top of Helicosphaera sellii (1.26 Ma) is placed in GeoB23069-1_15P_CC. Some specimens of Reticulofenestra asanoi are observed between GeoB23069-1_12P_CC and GeoB23069-1_6P.CC (Fig. 18). The age interval of 1.14 - 0.91 Ma for the range of occurrence of this species is assigned to GeoB23069-1_10P.CC - GeoB23069-1_9P.CC, where the morphotype larger than 6.5 μm is observed in a high proportion in the assemblage (bloom). The stratigraphy of the last ~0.6 Ma is well-constrained up to the seafloor by the biohorizon base of the Gephyrocapsa caribbeanica acme (0.60 Ma), located in GeoB23069-1_10P_CC. The interval of high relative abundance of this taxon relative to the other Gephyrocapsa species appears widely recorded in the sediment until the uppermost CC sample of the core, with a high content of G. caribbeanica that dominates the complete assemblage in all samples. Biohorizon top of P. lacunosa (0.44 Ma; base Zone NN20) is well defined in sample GeoB23069-1_3P_CC (Fig. 5.15). Gravity core GeoB23066-1, which is also located in the Hermes fault basin (Fig. 5.9), shows an absence of P. lacunosa, placing the age of that sequence at least above 0.47 Ma (base Zone NN20). Gravity core GeoB23067-1 shows a calcareous nannoplankton assemblage corresponding to the same time interval. Despite that, some specimens of that taxon appear in a scattered occurrence together with other lower Pleistocene species up to the top of the sequence.

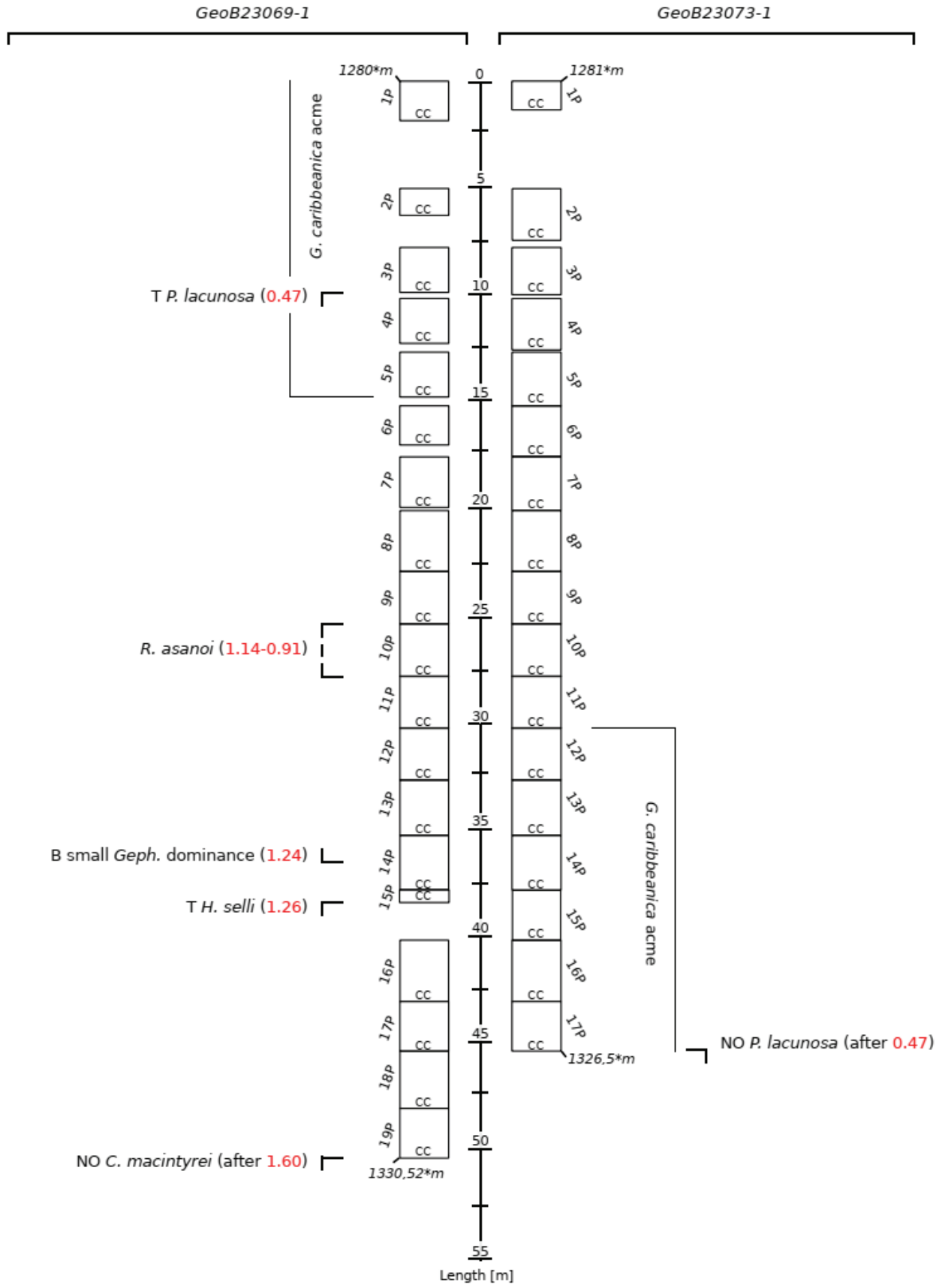

Fig. 5.15 Summary of the biostratigraphic analyses of calcareous nannofossils in core catcher samples from MeBo cores GeoB23069-1 (Hermes fault) and GeoB23073-1 (Lineament South). * Water depth in (m).

The biostratigraphic record of MeBo core GeoB23073-1, located along the Lineament South, is based on the study of calcareous nannofossils in core catcher samples from core barrels GeoB23073-1_17P to GeoB23069-1_1P (Fig. 5.15). The chronological framework for GeoB23073-1 suggests a late Pleistocene (late Pleistocene/Holocene?) record. The interval between the lowermost GeoB23073-1_17P_CC and GeoB23073-1_11P_CC is characterized by the dominium of the assemblage by Gephyrocapsa caribbeanica (Fig. 5.15). The identification of the acme of this species, with no content of P. lacunosa, limits the age of the sequence to the last 0.47 Ma (biohorizon top of P. lacunosa). E. huxleyi was not clearly identified in the rest of the sequence. Calcareous nannofossil content in the gravity core GeoB23031-1, also located in the basin, registers to the late Pleistocene (late Pleistocene/Holocene?) with the absence of P. lacunosa in all samples. Some specimens of early to middle Pleistocene age (C. macyntirei, H. selli and R. asanoi) appear in a scattered occurrence up to the top of both sequences, with some samples in which the content of some older biomarkers is increased. Further gravity coring along Lineament South was conducted at stations GeoB23062-1, GeoB23063-1, GeoB23064-1 and GeoB23066-1 (Fig. 5.11). Similar to MeBo core GeoB23073-1, the nannofossil content in these cores is constrained to the last 0.47 Ma because the absence of P. lacunose. A G. caribbeanica acme interval is also not identified in these samples. Instead the identification of scattered early to middle Pleistocene age biomarkers (C. macyntirei, H. selli and R. asanoi) is frequent in some samples. No E. huxleyi morphotipes have been clearly identified here.

5.3.4 Gulf of Cadiz – Salt Domes

Core catcher samples of gravity cores GeoB23078-3, GeoB23079-1 and GeoB23080-1 were studied to characterize the calcareous nannoplankton in the sediment covering the diapiric ridges and salt domes in the Seine abyssal plain (Fig. 5.12). The preservation of calcareous nannofossils in the investigated samples is very good to excellent showing a Quaternary age assemblage dominated by Gephyrocapsa spp. (small Gephyrocapsa, G. oceanica and G. muellerae), Calcidiscus leptoporus (subsp. leptoporus, quadriperforatus and small), Coccolithus pelagicus (subsp. pelagicus, braarudi and azorinus) and Florisphaera profundal. Umbilicosphaera spp., Syracosphaera spp., Rhabdosphaera clavigera, Helicopshaera carteri are also present. Some specimens of large Emiliania are observed within the assemblage in GeoB23079-1_CC and GeoB23080-1_CC, allowing us to suggest an age after 0.29 Ma (biohorizon base E. huxleyi) for these sediments. This species was not clearly observed in GeoB23078-3_CC. However, P. lacunosa is absent in all these samples, setting a lower age limit at 0.47 Ma (biohorizon top P. lacunosa).

5.3.5 Alboran Sea – Strike-Slip Faults

The preliminary study of the calcareous nannofossil content in cores recovered along the Carboneras and Al-Idrissi fault zones registers Quaternary age material. Calcareous nannofossils are abundant in these samples, with a very good to excellent preservation state. The assemblages are characteristically dominated by Gephyrocapsa spp. (small Gephyrocapsa, G. oceanica and G. muellerae), Calcidiscus leptoporus (subsp. leptoporus, quadriperforatus and small), Coccolithus

pelagicus (subsp. pelagicus, braarudi and azorinus) and Florisphaera profundal. Umbilicosphaera spp., Syracosphaera spp., Rhabdosphaera clavigera and Helicopshaera carteri are also present as well as the large morphotype of E. huxleyi (>4 µm). The P. lacunosa biomarker is absent in all samples studied for this sector of Alboran Sea, limiting the age of the sediments to the last 0.47 Ma (biohorizon top of P. lacunosa). G. caribbeanica is also absent or appearing in rare morphotypes. The high abundance of large Emiliania is frequent through these samples (not in all), establishing a lower age limit of 0.29 (biohorizon base E. huxleyi) for these sediments (Fig.5.16).

The Carboneras fault sediments were biostratigraphically analyzed based on the study of calcareous nannofossils in core catcher samples from gravity cores GeoB23086-1, GeoB23087-1, GeoB23088-1 and GeoB23089-1 and from core catchers of MeBo core GeoB230691-1_7P to GEOB 23069-1_1P (Fig. 5.13). In cores GeoB23086-1 and GeoB23087-1 large Emiliania were identified as part of the calcareous nannoplakton assemblage, setting the lower age limit after 0.29 Ma (Fig.5.16). In GeoB23088-1_CC and GeoB23089-1_CC this precision could not be carried out because of an unclear observation of these species. In MeBo core GeoB23091-1 specimens of large Emiliania were only observed in the CC of the lowermost barrel (GeoB23091-1_1P_CC), setting for this core an age limit after 0.29 Ma (biohorizon base of E. huxleyi) (Fig.5.16).

Core catcher samples from the Al-Idrissi fault zone GeoB23092-1, GeoB23093-1, GeoB23094-1 and GeoB23095-1 were also studied for their calcareous nannofossil content (Fig. 5.13). P. lacunosa is absent in these samples, whereas large Emiliania species were identified in GeoB23092-1_CC and GeoB23095-1_CC. This sets the lower age limit to 0.29 Ma (biohorizon base of E. huxleyi) for these cores.

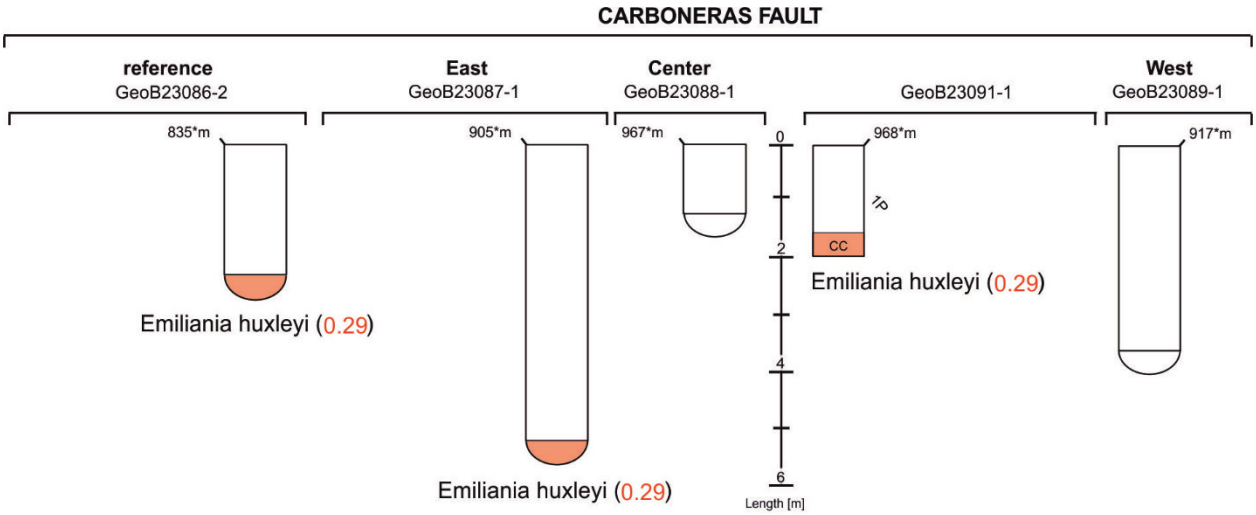

Fig. 5.16 Summary of the biostratigraphic analyses of calcareous nannofossils in core catcher samples from cores sampled along the Carboneras fault. *Water depth in (m).

5.4 Physical Properties

(K. Stanisloswki, C. Klaembt)

5.4.1 Methodology

Physical property measurements provide fundamental information on lithostratigraphic units. Therefore undrained shear strength (Su), water content, porosity, bulk and grain density were measured during cruise M149. In addition to pycnometer measurements, the post-cruise analysis included non-destructive measurements of bulk density, p-wave velocity and magnetic susceptibility using MARUM's GEOTEK MSCL (Multi Sensor Core Logger) apparatus.

Undrained shear strength measurements were conducted onboard using fall cone penetrometer and vane shear tests (e.g., Hansbo, 1957; Blum, 1997). The employed fall cone penetrometer from Wykeham Farrance, consists of a cone with a fixed mass, a mechanism to let the cone fall into a sediment and a dial gauge to measure the penetration into the sediment. For each measurement, the tip of the cone is placed directly over the sediment and the position of the cone measured. The cone is then dropped into the sediment and the penetration-depth is measured. The undrained shear strength is calculated according to:

$$S_u = \frac{m \cdot g \cdot k}{d^2}$$

where m is the mass of the cone, g is the gravitational acceleration, k is the cone factor and d is the penetration depth. Up to four measurements were performed per 100 cm core.

The undrained shear strength was also determined by application of a vane shear probe (also from Wykeham Farrance). For each measurement the vane is inserted into the sediment such that the top of the four bladed vane levels with the sediment surface. The vane is then rotated at a constant rate by a motor until the sediment fails. The applied torque T is inferred from the deformation of a spring in the device and calibration equations relate the rotation angle of the spring to the torque. The torque is normalized to the vane parameter K, which is a function of the vane size and geometry:

$$S_u = \frac{T}{K}$$

The vane shear measurements were typically performed once or twice per 100 cm core.

Water content, porosity, bulk and grain density measurements largely followed the methodology of Blum (1997) and included shipboard and post-cruise analyses. The water content was measured onboard using a motion-compensated balance by measuring differences between the specimen's bulk (M_b) and dry mass (M_d) after a period of 24 hours in the oven at a temperature of ca. 105°C. The pore water volume is given by:

$$V_w = \frac{M_b - M_d}{(1 - s)\rho_w}$$

where ρ_w is the seawater density (ρ_w=1.024 g/cm³) and s is the standard seawater salinity (s=0.035). The water content is expressed throughout the report in relation to the bulk mass:

$$w = \frac{\frac{(\mathrm{M_b} - \mathrm{V_d})}{(1 - 0.035)}}{M_b} \cdot 100\%$$

Porosity, bulk and grain density of each sample taken onboard were calculated post-cruise. For these calculations each sample dried onboard was transported in a sealed bag to Bremen, where they were re-dried and weighted ($M_{d\text{-}Bremen}$) before their volume was measured using a Quantachrome penta-pycnometer (V_{py}). The volume of the dry sample is corrected for the precipitated salt:

$$V_{s-Bremen} = V_{py} - \frac{(\mathrm{M_b} - \mathrm{M_{d)}} \cdot s}{(1 - \mathrm{s})} \cdot \frac{1}{\rho_{salt}}$$

where ρ_{salt}=2.20 g/cm³ is the salt density value. Using the mass and volume of the re-dried samples we calculated the grain density (ρ_g):

$$\rho_g = \frac{M_{d-Bremen} - \frac{(\mathrm{M_b} - \mathrm{M_{d)}} \cdot s}{(1 - \mathrm{s})}}{V_{s-Bremen}}$$

Although the dried masses onboard and post-cruise are usually similar, we noticed in some cases a loss or gain in the post-cruise values that affected the resulting values slightly. For the porosity (Φ) and bulk density (ρ_b) calculations we therefore determined the volume of the shipboard measured dry mass (V_s) by dividing through the grain density:

$$V_s = \frac{\frac{(\mathrm{M_d} - \mathrm{s} \cdot \mathrm{M_{b)}}}{(1 - \mathrm{s})}}{\rho_g}$$

such that

$$p_b = \frac{M_b}{V_s}$$

and

$$\Phi = \frac{V_w}{V_w + V_s}$$

The MSCL measurements were performed at a sampling step of 2 cm along the vertical axis of the archive halves of gravity and MeBo cores. The cores were retrieved from the core repository several hours before the measurement such that their temperature equilibrated to room temperature. Furthermore, the sediment surface was covered with foil for the measurement.

The bulk density is determined from the attenuation of a gamma beam that is emitted from a Caesium-137 source with an energy of 0.662 MeV. To convert gamma ray measurements into bulk density values, a calibration curve is determined at the beginning of each measurement session from the analysis of a reference specimen with known densities.

The P-wave velocity is determined from the travel time for the distance between two transducers that are placed on the outside of the core liner and on the sediment surface of the archive half, respectively. Water is added to the contact points between the core and the transducers to achieve a better acoustic coupling. The measured travel times are corrected for the delay caused

by transducer faces and electronic circuitry, peak detection procedure, and transit time through the core liner plus foil, which was determined by the measurement of a water filled core liner.

Magnetic susceptibility is a material property, which corresponds to the degree of magnetization by an external magnetic field. It is measured with a loop sensor (Bartington Instruments), that is operating at a frequency of 565 Hz and an alternating field of 80 A/m (0.1 mT). In response to the magnetic susceptibility of the core material a change in the oscillator frequency is caused, which is converted into magnetic susceptibility values. The sensitivity range of the instrument was set to a setting of 1.0 Hz.

The quality of the MSCL measurements degrades when the sediment core is disturbed and/or the sediment core is not of similar size as the liner. This common problem of MSCL measurements mainly affects the MeBo cores because gravity cores are in general of good quality. Another issue is the 3 month period between the splitting of the cores and the MSCL measurements. Although the cores were covered with foil and stored at 4°C pore, pore water evaporated during that period. The pore water loss is documented by higher bulk densities and lower porosities compared to values obtained by the shipboard based pycnometer analysis. The magnetic susceptibility should not be affected by the water loss because it depends mainly on the solid material. Due to the poor data quality and also because the MSCL measurements are not shipboard analysis, the MSCL data are not discussed in the preliminary results. All data, however, remain useful for lithostratigraphic correlations and are therefore attached to this report and publicly available.

5.4.2 Gulf of Cadiz – Mud Volcanoes

At the crests of all mud volcanoes the uppermost sediments exhibit relatively low shear strength of 3 to 19 kPa. Below ~50 - 75 cmbsf, shear strength values of several MVs increase up to 69 kPa. A larger scatter can be observed in the fall cone data in comparison to the vane shear data, which could be related to the fall cone hitting mud/rock clasts or fossils covered in the fine-grained matrix. This may explain unusually high S_u values of up to 188 kPa and 120 kPa for sediments of core GeoB23053-1 and GeoB23076-1. Water content as well as porosity of most crests range from 26 to 39% and 55 to 65%, respectively, and reflect lithological variability, gas hydrate abundance and in long MeBo cores also compaction. In the following, the data of the more extensively cored mud volcanoes Ginsburg, Yuma, Meknes, and Rabat is described in more detail.

Cores GeoB23005-1, GeoB23011-1, and GeoB23024-3 were taken at the crest of Ginsburg MV and reveal a relatively constant undrained shear strength of 3 to 19 kPa throughout the core lengths, which are similar to the background sediments in form of foraminifera-bearing nannofossil ooze (GeoB23008-1). The only exception is observed in fall cone measurements on core GeoB23005-1 at depths between 130 and 190 cmbsf with values of 25 to 36 kPa. S_u data of cores from flanks (GeoB23006-1 and GeoB23010-1) reveal higher values than background sedimentation and crest. Generally, they show decreasing values in the first 100 cmbsf (foraminifera-bearing ooze gradually transitioning to mud breccia) from 43 to 3 kPa, and an increase from 3 to 31 kPa below 100 cmbsf (mud breccia). Cores of the eastern rim (GeoB23009-1, GeoB23047-3) have values similar to the background sediments for the uppermost 500 cm, whereas the core at the southern rim (GeoB23007-1) scatters up to 154 kPa. In detail, cores GeoB23007-1 and GeoB23047-3 follow a general trend of increasing S_u with depth from 0.5 kPa at the seafloor to 154 kPa at 532 cmbsf, and from 3 to 63 kPa downcore to 3594 cmbsf, respectively (Fig. 5.17). Nevertheless, both

cores show a high variability in S_u. Notable peaks in the S_u data of core GeoB23047-3 occur at 665 - 695, 1980, and 2570 - 2780 cmbsf (Fig. 5.17) and correlate with sediment dark layers described in chapter 5.2.1. The ratio of shear strength to overburden stress (Fig. 5.17) does not exceed 0.22. According to Skempton (1969), sediments of core GeoB23047-3 could be therefore underconsolidated, with the exception of horizons at 665 to 695 and 1980 cmbsf, possibly indicating excess pore water pressures that could be evidence for fluid migration at the eastern rim of Ginsburg MV.

Nearly all cores recovered at Ginsburg MV are characterized by relatively constant values of water content and porosity with 31 - 41% and 55 - 65%, respectively. However, core GeoB23007-1 exhibits lower water contents and porosities, which are decreasing with depth from 31 to 27% water content and 54 to 48% porosity. For core GeoB23047-3 the water content and the porosity decrease from 36% and 60% at the seafloor, respectively, continuously to 32% and 50% (Fig. 5.17).

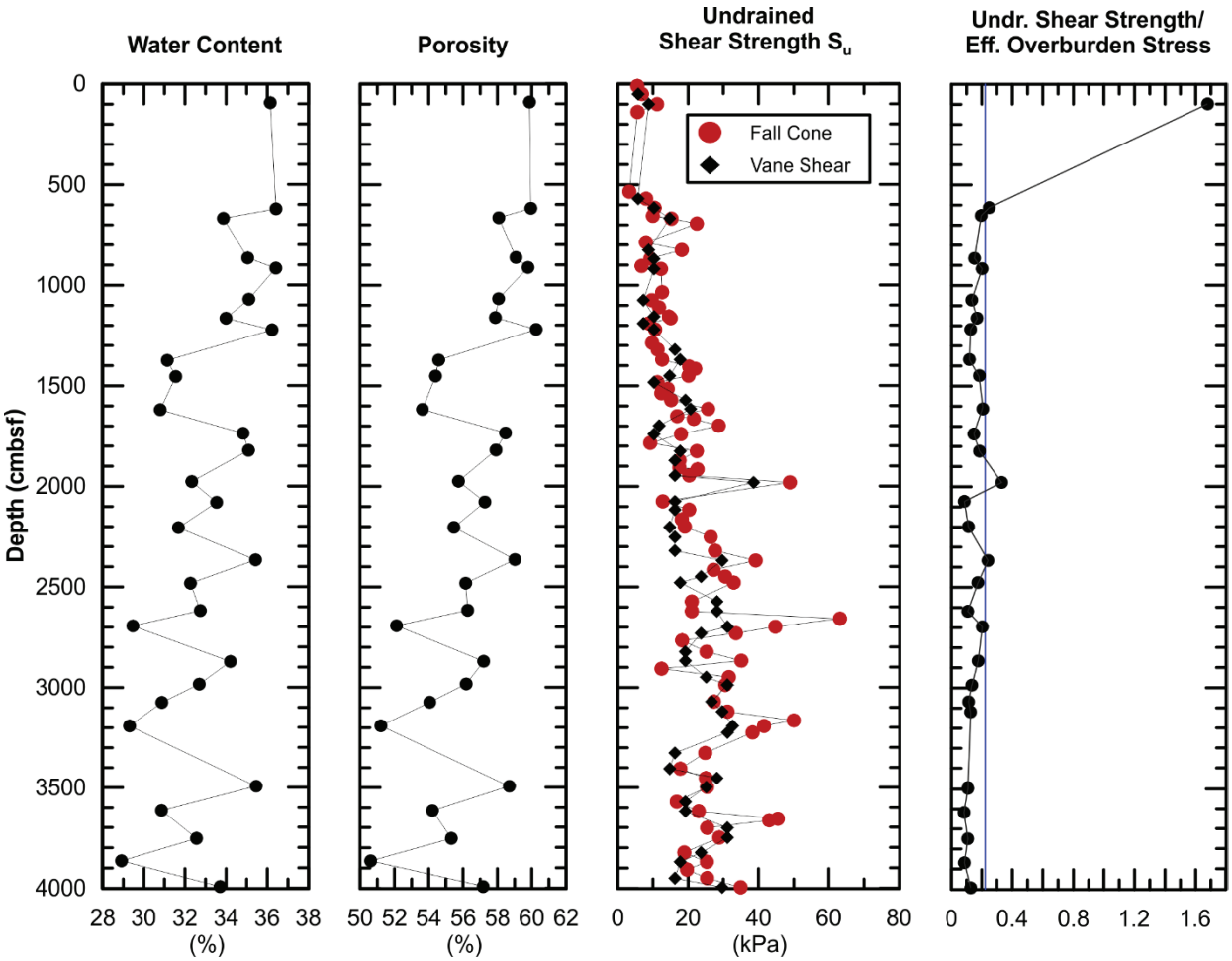

Fig. 5.17 Composite plot of water content, porosity, undrained shear strength from both vane shear and fall cone data, and ratio of shear strength and overburden stress for core GeoB23047-3, eastern rim of Ginsburg MV.

The crest of Yuma (core GeoB23028-1) is characterized by relatively low values of 3 - 15 kPa. By contrast, core GeoB23013-1, also taken at the crest but between the three summits, scatters at higher values ranging from 10 to even 109 kPa. The explanation is given by the litholog: while

GeoB23028-1 consists of mud breccia, GeoB23013-1 is formed by foraminifera and nannofossil ooze. The nannofossil-bearing foraminiferous ooze obtained at the southern rim of Yuma (core GeoB23025-2) shows similarly low Su values ranging from 4 to 19 kPa as the mud breccia of core GeoB23028-1. Interestingly, even though the southern flank (core GeoB23012-1) below 135 cmbsf consists of mud breccia, its undrained shear strength rather scatters at higher values of 8 to 64 kPa similar to core GeoB23013-1.

All cores taken at crest, rim, and flank of Meknes MV (GeoB23039-1, GeoB23040-1, GeoB23041-2, GeoB23043-1, GeoB23043-2, and GeoB23044-1) show undrained shear strength values of 5 to 15 kPa. One exception is observed in core GeoB23040-1 (crest) with higher values of 16 to 83 kPa below a depth of 35 cmbsf. Unlike Ginsburg or Meknes, undrained shear strength measurements of the mud breccia found at 200 cmbsf below the crest of Rabat MV (core GeoB23034-1) ranging from 26 to 82 kPa are higher than background sedimentation (core GeoB23052-1) with 4 to 21 kPa. S_u values for El Cid MV (GeoB23056-1) are up to up to 67 kPa, for Funky Monkey MV (GeoB23081-1) up to 69 kPa and for Almanzor (GeoB23057-1) up to 54 kPa.

5.4.3 Gulf of Cadiz – Lineaments

Lineament Center was sampled at five stations directly south of Ginsburg MV (GeoB23022-2, GeoB23032-1, GeoB23033-1, GeoB23049-1, and GeoB23060-1, Fig. 5.9). The recovered cores exhibit undrained shear strength values of 4 kPa to 55 kPa. However, there are two exceptions in fall cone measurements: in core GeoB23049-1 at 309 cmbsf S_u peaks at 300 kPa, and in core GeoB23022-2 at 419 cmbsf S_u peaks at 116 kPa. One prominent feature observed in cores GeoB23032-1, GeoB23033-1 and GeoB23049-1 are elevated S_u values of up to 34 kPa at a depth of approx. 25 to 30 cmbsf. For the long MeBo core (GeoB23060-1) the undrained shear strength increases gradually to 22 kPa at 1860 cmbsf.

Undrained shear strength measured on the three gravity cores from the pull-apart basin along the Hermes fault (GeoB23031-1, GeoB23066-1 and GeoB23067-1, Fig. 5.09) ranges from 1 to 37 kPa, with nearly constant values of water content (~37%) and porosity (~60%). At a depth range of 55 to 80 cmbsf all three cores reveal elevated S_u values of ~25 kPa in both vane shear and in fall cone data. The long MeBo core GeoB23069-1 exhibits a gradual increase in undrained shear strength with depth from 5 kPa near the seafloor to 50 kPa at 4820 cmbsf. In contrast, water content and porosity of this core first increase from 36 to 44 % and 60 to 67% up to 3000 cmbsf, then decrease to 29% and 52% at 3740 cmbsf, and increase again to 32% and 55% at 4950 cmbsf, respectively.

For Lineament South the undrained shear strength values were obtained for two gravity cores (GeoB23036-1, GeoB23037-1, Fig. 14), which scatter from 3 to 13 kPa, whereas S_u of gravity core GeoB23045-1 increases linearly with depth from 5 kPa to approx. 24 kPa. The three circa 450 cm long gravity cores recovered from the pull-apart basin of Lineament South (GeoB23062-1, GeoB23063-1, GeoB23064-1, Fig. 5.11) exhibit shear strength values that scatter from 3 to 34 kPa and relatively constant water content and porosity values of 38% and 62%, respectively. Shear strength values of MeBo core GeoB23073-1 increase gradually with depth from 8 kPa near the seafloor to ~40 kPa at 4360 cmbsf (Fig. 5.18). Water content and porosity of this core increase from the seafloor to a depth of 2320 cmbsf from 36 to 48% and 60 to 71%, respectively, and then

decrease to 43% and 67% at 4450 cmbsf (Fig. 5.18). The ratio of undrained shear strength and overburden stress is characterized mainly by values higher than 0.22 above 2800 cmbsf (Fig. 5.18). Below that depth the ratio is dominantly lower than 0.22. Hence, this interval might be underconsolidated due to fluid flow (see Geochemistry chapter) but further analysis such as consolidation tests are required to support this possibility.

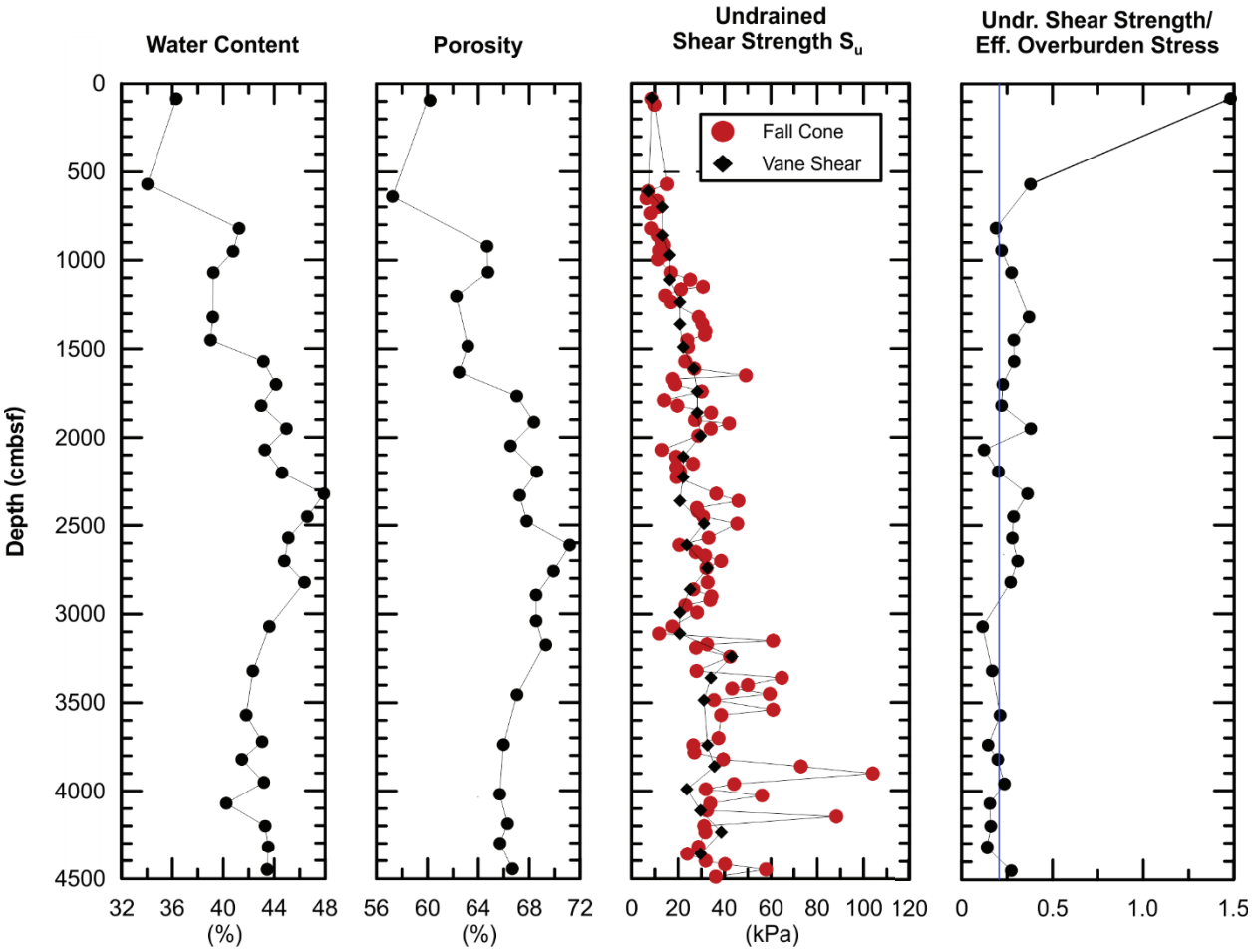

Fig. 5.18 Composite plot of water content, porosity, undrained shear strength from both vane shear and fall cone data, and ratio of undrained shear strength and effective overburden stress for core GeoB23073-1, pull-apart basin in Lineament South.

5.4.4 Gulf of Cadiz – Salt Domes

Physical properties were performed post-cruise in Bremen on gravity cores recovered in the Seine abyssal plain (GeoB23078-3, GeoB23079-1 and GeoB23080-1, Fig. 14). All measurements were conducted similar to the shipboard analyses immediately after splitting of the core liners. Undrained shear strength values range between 0.5 kPa and 33 kPa. All cores exhibit a decrease in undrained shear strength in the upper 75 to 100 cmbsf to minimum values of 3 to 6 kPa. Below that depth undrained shear strength increases downcore to values of 10 to 20 kPa between 350 and 517 cmbsf. Porosity and water content are relatively uniform among the sites and range between 63% to 70% and 39% to 46%, respectively, with higher values for samples closer to the seafloor.

5.4.5 Alboran Sea – Strike-Slip Faults

Physical properties of cores recovered along the Carboneras and Al-Idrissi fault zones were determined after the opening of the cores in Bremen – except for the MeBo core GeoB23091-1. Four cores were taken along the fault trace of the Carboneras fault (GeoB23087-1, GeoB23088-1, GeoB23089-1 and GeoB23091-1) and 1 gravity core off the fault as a reference (GeoB23086-2, Fig. 15). All gravity cores show an increase in undrained shear strength with depth. Neglecting outliers from these trends, the maximum S_u values range between 15 and 65 kPa for the fall cone measurements. In unison with the findings from the gravity cores the undrained shear strength data for the MeBo core shows an increase for the upper 500 cmbsf (fall cone data) to 800 cmbsf (vane shear data). Below that depth fall cone and vane shear data remain constant and scatter between 40 and 70 kPa. The water content and porosity of cores from the Carboneras fault range from 37% to 44% and 61 to 68%, respectively. Samples closest to seafloor are typically characterized by the highest values. Samples for cores GeoB23086-2 and GeoB23088-1 do not show clear trends due to the limited number of samples (n=2). A decrease in water content and porosity with depth can be observed for cores GeoB23089-1 and GeoB23091-1.

Undrained shear strength values of the three gravity cores (GeoB23093-1, GeoB23094-1, GeoB23095-1) sampled along the Al-Idrissi fault trace exhibit values between 2 kPa and 232 kPa due to the large scatter in measurements for core GeoB23093-1. S_u values for cores GeoB23094-1 and GeoB23095-1, similar to the reference core GeoB23092-1, increase continuously with depth. The minimum shear strength ranges for these cores between 2 and 6 kPa and maximum values between 40 and 89 kPa. The water content and porosity of cores from the Al-Idrissi fault range from 37% to 44% and 52 to 68%, respectively. Samples closest to seafloor are typically characterized by the highest values. The reference core, GeoB23092-1, sampled approximately 5 km off the fault trace, is characterized by a continuous decrease in water content and porosity that range from 39% to 50% and 63% to 72%, respectively.

5.5 Geochemistry

(S. Pereira, A. Hüpers)

5.5.1 Methodology

Pore fluid geochemistry is an important tool for the investigation of fluid flow and water-rock interaction, and fluid sources determination. One purpose of cruise M149 was to collect pore water samples from potentially hydrogeologically active structures for post-cruise analyses. Sampling occurred immediately after the cores were recovered. Holes were drilled into the liners and rhizons attached to syringes created a vacuum to obtain the fluids without damaging the cores (Seeberg-Elverfeldt et al., 2005). Three samples per 100 cm sediment were taken for fluid analysis from the gravity cores, while three samples per 120 cm were taken from the MeBo cores. Up to 10 ml pore water was extracted using this technique. During the extraction process, the cores were stored in a cold room at 4°C until the pore water was collected. The extracted fluids were later transferred into 20 ml air tight PTFE vials and stored at ~4°C. A complete list is attached to this report (chapter 12.2). Further sampling for onshore analysis included the collection of sedimentary gas using the headspace technique. Once the cores were retrieved on deck, approx. 3 cm^3 of sediment from the

bottom part of each core section was collected and transferred to a glass container containing 10 ml of a 1M KCl solution and crimped with a rubber stopper and a metal casing.

Salt diapirism and clay dehydration processes play a crucial role for the pore water geochemistry in the study area (Haffert et al., 2013). In this context, salinity measurements are of particular interest because they provide preliminary information on brine formation associated with leaching of salts, or on pore water freshening due to gas hydrate dissociation and mineral dehydration processes. Onboard salinity analysis were conducted with a digital refractometer from the manufacturer A. Kruss Optronic (model DR101-60) and their results are described as follows.

5.5.2 Gulf of Cadiz – Mud Volcanoes

Multiple cores were taken at mud volcanoes on the Gulf of Cadiz accretionary prism with the gravity corer and MeBo of which the pore water was analyzed onboard for salinity. With few exceptions, the cores from mud volcanoes indicate three trends of salinity with depth: 1) Pore water samples originating from the crest dominantly show salinities lower than the background sediment off the mud volcanoes, 2) Pore water samples originating from the flanks show salinities similar to the background sediment and 3) Pore water samples originating from the rim of the mud volcanoes dominantly show salinities higher than the background sediment (Fig. 5.19). The lowest salinities were found at Meknes MV where minimum values of down to 1.6% were obtained. Maximum values occurred along the Ginsburg MV rim where salinity continuously increases with depth up to a value of 14.3% at 39700 cmbsf for the MeBo core (GeoB23047-3).

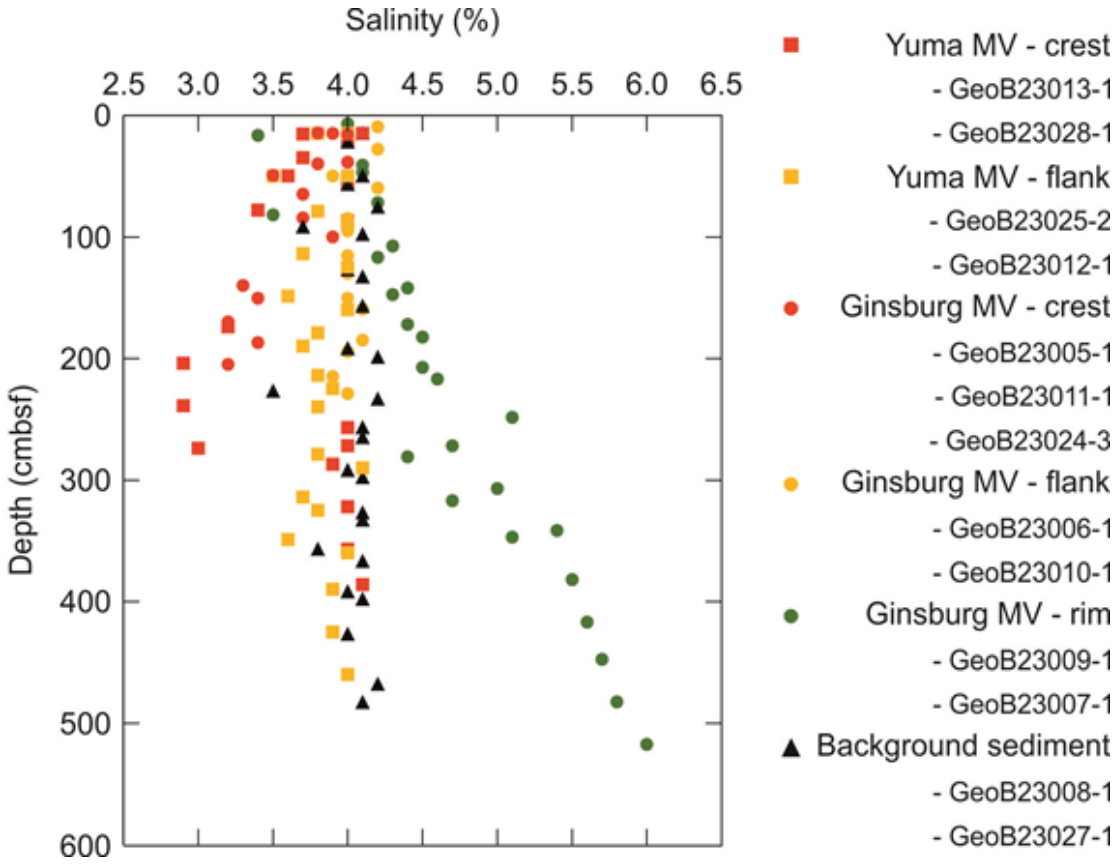

Fig. 5.19 Salinity depth profiles of gravity cores sampled from Yuma and Ginsburg mud volcanoes with cores GeoB23008-1 and GeoB23027-1 off the mud volcanoes as references.

5.5.3 Gulf of Cadiz – Lineaments

Salinity profiles of cores recovered along the fault zones (Fig. 5.9 and Fig. 5.11) varied between profiles similar to that of the reference locations with constant values between 3.5% to 4% downcore and profiles similar to the mud volcano rims with increasing salinities downcore up to values of 14.6% (GeoB23069-1). Due to their larger sampling depth, the highest salinity values are typically found in MeBo cores. When comparing salinity-depth gradients, systematic changes can be found amongst the fault zones. Lowest gradients can be found typically along the Lineament Center, followed by cores from Lineament South whereas the largest gradients occur along the Hermes fault (Fig. 5.20). The concave downward curvature of the salinity profiles in MeBo cores GeoB23069-1 and GeoB23073-1 further indicates active fluid flow. We also notice that salinity-depth gradients exhibit a large variability along individual faults suggesting that fluid flow is facilitated along transtensional areas along the faults.

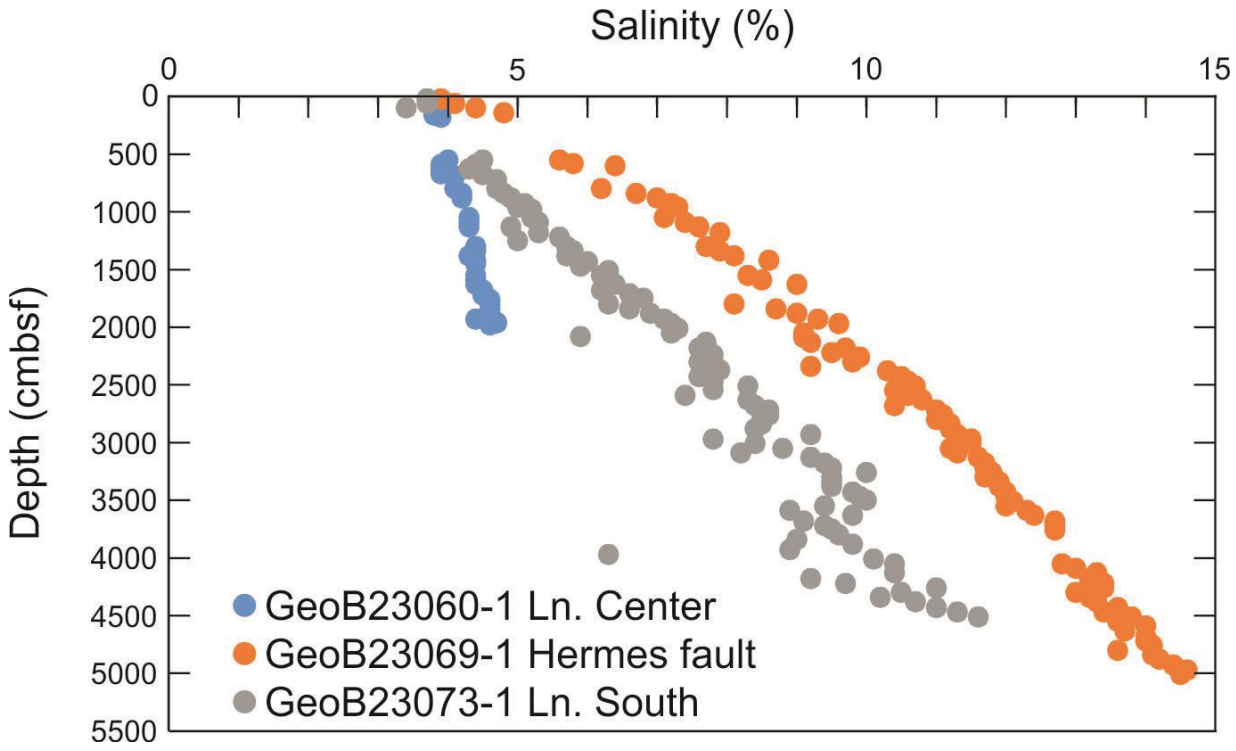

Fig. 5.20 Salinity depth profiles of long MeBo cores sampled along the strike-slip faults Lineament Center, the Lineament Center branch (Hermes fault), and the Lineament South.

5.5.4 Gulf of Cadiz – Salt Domes

Three gravity cores were recovered in the Seine abyssal plain of which two sampled the topmost part of prominent salt domes (Core GeoB23078-1 and GeoB23080-1) and one gravity core sampled abyssal plain as a reference core (GeoB23079-1). Another salt diapir was sampled during the transit to the Alboran Sea, the so-called Lolita salt dome (GeoB23084-1). Salinity profiles of these locations are characterized by constant values, typical for background/reference cores recovered on the accretionary prism (e.g., GeoB23027-1).

5.5.5 Alboran Sea – Strike-Slip Faults

In total 10 cores from the Alboran Sea were analyzed for pore water salinity of which: 5 cores belong to the Carboneras fault, 4 cores originate from the Al-Idrissi fault and one core from the Marrakech MV. Pore water salinities of cores from the Carboneras fault (GeoB23086-2, GeoB23087-1, GeoB23088-1, GeoB23089-1 and GeoB23091-1) are characterized by a narrow range of salinities between 3.7% and 4.2% that do not change downcore. Also the salinity profile of the long MeBo core (GeoB23091-1) follows this pattern. Salinities of pore waters extracted from the sediments recovered along the Al-Idrissi fault, instead, increase with depth and range between ~4.1% at the seafloor to 4.3 - 4.9% at 370 cmbsf. The respective gradients are comparable to those observed for MeBo cores in the Gulf of Cadiz (Fig. 5.20). Salinity of pore waters extracted from the core recovered at the Marrakech MV is constant downcore with values dominantly between 3.8% and 4.1%.

5.6 In Situ Measurements

5.6.1 Heat Flow

(T. Fleischmann, J.-N. Schmidt, L. Heine)

During Meteor cruise M149, we used the 6 m long Bremen heat flow probe that was operated in a pogo-style mode. The heat probe is constructed in the classical “violin bow” design (Hyndman et al., 1979; Villinger et al., 2010), with 21 thermistors distributed over an active length of 5.2 m in 0.26 m intervals. The thermistors are mounted inside an oil filled hydraulic tube (outer diameter: 14 mm), which is attached to a strength member (outer diameter: 130 mm). The sensor tube also contains a heater wire for the generation of high energy heat pulses, typically on the order of 800 J/m for in situ thermal conductivity measurements, according to the “pulsed needle probe” method (Lister, 1979). Stainless steel is used for the heat probe, with special high strength non corrosive steel for the strength member and the fins attaching the sensor tube. The data acquisition unit and power supply is located in a pressure housing inside the probe’s weight stand. The batteries for the heat pulses are in a second pressure housing. The signal of the temperature sensors is measured with a resolution of 20-bit at a sample rate of 1 sec, resulting in a final temperature lower than 1 mK at ambient seafloor temperatures. A calibrated PT-100 seawater sensor on top of the weight stand allows to measure the absolute bottom water temperature and to check the calibration of the sensor string in deep water with high accuracy. Inclination and acceleration of the probe is measured to monitor the penetration process into the sediments and potential disturbances during the actual measurement period.

The heat probe was operated in a completely autonomous mode with internal data storage and automated heat pulses. Winch speed of the heat probe for penetration into the sediment is 0.8 to 1.0 m/s. After penetration of the seafloor each measurement takes 7 to 8 minutes to equilibrate to in situ temperatures and additional 8 minutes for the heat pulse to decay. The mean duration of one measurement, including transit of about 1 km between waypoints, is about 1 to 1.5 h per single point of measurement. A Posidonia pinger mounted to the wire 50 meters above the instrument allowed monitoring of the heat probe flow position at depth.

Thirty-eight in situ heat flow measurements were conducted during cruise M149; twenty-six of them in the Gulf of Cadiz and twelve in the Alboran Sea. The heat flow investigation in the Gulf of Cadiz focused mainly along a N-S transect between the Yuma and Meknes MVs (n=22, Fig. 5.21). Additional measurements offside the transect were conducted close to the MeBo drilling locations at the Hermes fault basin and Lineament South (n=3, Fig. 5.21). Most values are close to or fall into the range of 41 to 57 mW/m^2 previously reported for the Gulf of Cadiz accretionary prism (Grevemeyer et al., 2008). Values higher than the background ones were obtained along transtensional intervals of Lineament Center and South, and the Hermes fault with values ranging between 73 and 121 mW/m^2 (locations GeoB23018-1, GeoB23050-3, GeoB23070-1 and GeoB23074-1). The three investigated MVs Yuma, Ginsburg and Meknes show only at the crest of Yuma (GeoB23003-2) and Meknes (GeoB23050-6) high heat flow values of 109 and 120 mW/m^2, respectively. For the locations with elevated heat flow, a convex shaped temperature distribution over depth can be observed, which could originate from fluid advection processes / migrating pore water and/or escaping gas.

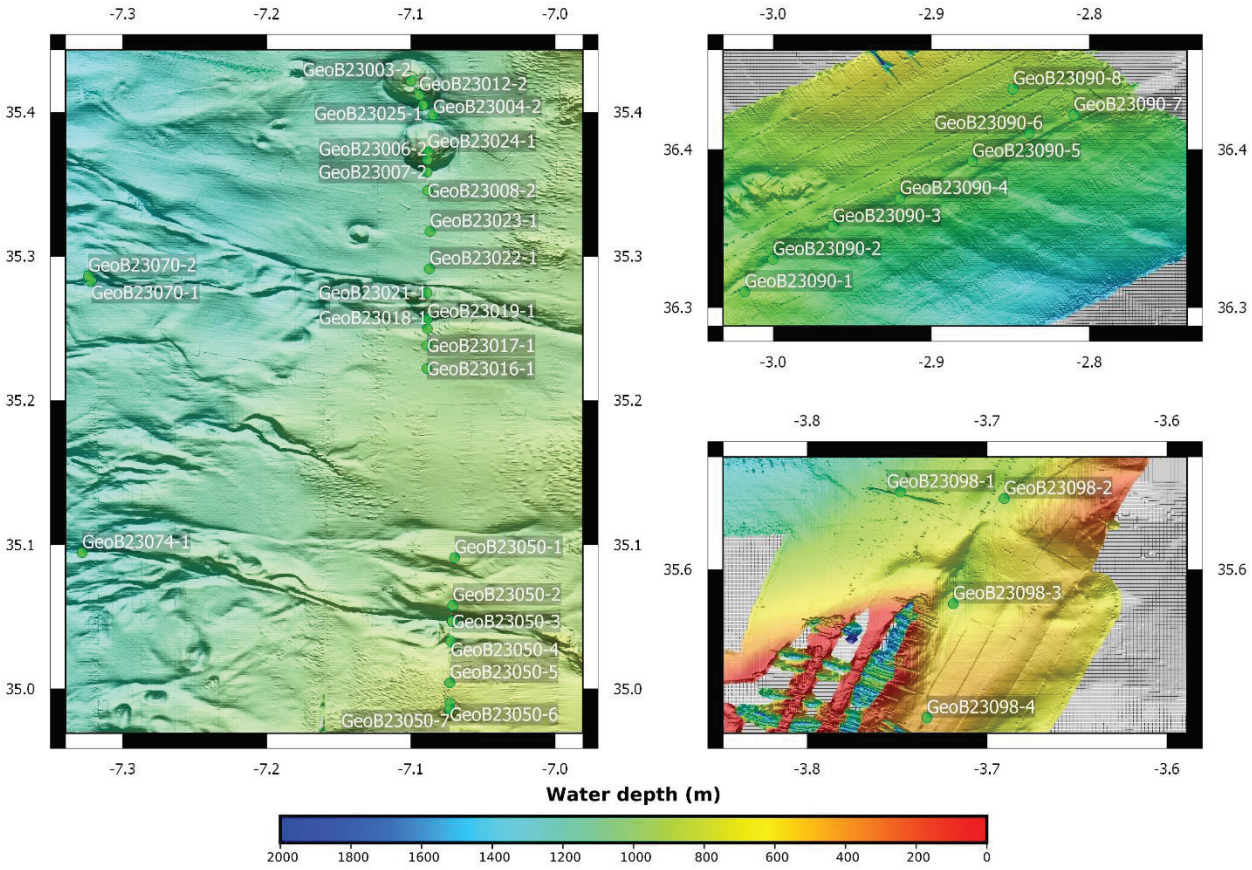

Fig. 5.21 Bathymetric map showing the locations of the heat flow measurements in the Gulf of Cadiz (left) and the Alboran Sea (right)

The heat flow measurements in the Alboran Sea were conducted along the Carboneras and Al-Idrissi fault traces and adjacent to the faults to obtain background reference values (n=8 and n=4, respectively, Fig. 5.21). The obtained heat flow values along the Carboneras fault range between 85 and 108 mW/m^2 and correlate inversely with the topography (heat flow values increase towards topographic lows). For further use of the data, a correction for the topographic effect may be required as outlined in Grevemeyer et al. (2008). In contrast, measurements along the Al-Idrissi

fault show clearly elevated heat flow values of 120 and 112 mW/m^2 for stations GeoB23098-2 and GeoB23096-3, respectively, compared to the value of reference off the fault (GeoB23098-2, 62 mW/m^2).

5.6.2 Borehole Logging

(T. Freudenthal)

Two different borehole logging probes were deployed with the MARUM-MeBo70, a SGR (Spectrum Gamma Ray) probe and a Dual Induction probe. Both probes are equipped with a logger unit that has its own battery source. They can conduct measurements within the borehole in autonomous mode. When the maximum coring depth is reached, the inner core barrel is replaced by the probe. The probe is hooked up in the borehole together with the drill pipe during recovery of the drill string (logging while tripping). Alternatively, the SGR probe can be hooked up inside the drill string using a wire.

The SGR probe is equipped with a 25 cm long scintillation crystal combined with a photo-multiplier. Light impulses that are generated by gamma ray collisions with the scintillation crystal are counted and analysed concerning the energy spectrum. The three naturally occurring gamma ray emitters - potassium, uranium and thorium - generate different energy spectra. A GeoBase software package is used to calculate a best fit for the spectra. By combining the results of the spectrum fit with the gammy ray counts the concentrations of K, U, and Th are calculated.

The Dual Induction Instrument is used for acquiring resistivity profiles in the bore hole. It measures formation electrical conductivity and provides two measurements: 1) Deep induction measured with a 50 kHz drive signal and a depth range of 1.3 m and 2) medium induction measured with a 100 kHz drive signal and a depth range of 0.65 m. The resistivity range is 0.5 – 100 Ωm, the vertical resolution is about 0.8 m. The data logger of this probe lands on the drill bit while the 1.9 m long probe below the logger measures in the open hole below the drill bit.

The Dual Induction instrument was used at station GeoB23047-3 (Ginsburg MV rim). The resistivity values obtained by the tool decrease from 0.55 ohmm at the seafloor down to 0.37 ohmm at 34000 cmbsf. This trend is in unison with the observed increase in salinity with depth at that site and is opposed to the typical increase in resistivity-depth profiles derived from the porosity reduction with depth (Rider and Kennedy, 2002).

The SGR tool was employed four times in total: At the Ginsburg MV rim (GeoB23047-1 in logging while tripping mode), Hermes fault (GeoB23069-1), Lineament South (GeoB23073-1) and Carboneras fault (GeoB23091-1; all in wireline operations). The total gamma spectrum ranges between 19 to 47 gAPI when considering all locations (Fig. 5.22). This data range is lower compared to typical values for mudstones in deep boreholes (e.g., Rider and Kennedy, 2002) probably because of the higher porosity of shallow sediments and a dilution effect from the biogenic carbonate content in the foraminiferal oozes. Furthermore, we note a higher natural gamma radiation for the GeoB23091-1 (Carboneras fault, 30 to 47 gAPI) compared to the measurements in the Gulf of Cadiz (17 to 42 gAPI).

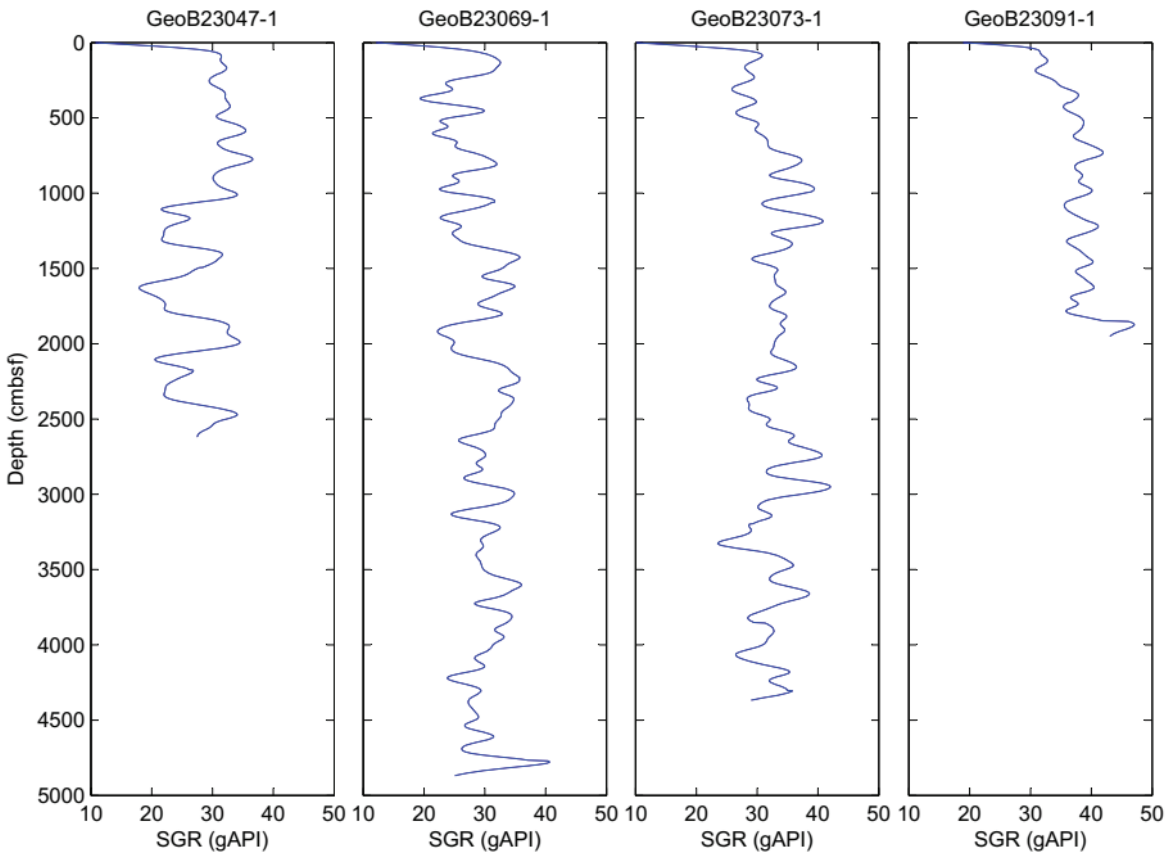

Fig. 5.22 Depth profiles of the spectrum gamma ray (SGR) borehole measurements.

5.6.3 MeBo CPT

(T. Fleischmann)

During cruise M149 a prototype of a static cone penetration testing (CPT) tool for the seafloor drill rig MeBo was tested for the first time in the field. The probe consists of a rod with a commercial CPT tip purchased from "Geomil Equipment B.V" and a pressure housing that sits in the drill string during the operation and hosts the datalogger and the battery packs (Fig.5.23). The commercial CPT probe measures cone resistance and sleeve friction. Furthermore, a water pressure port behind the cone is connected to a Keller^{TM} 200 bar absolute pressure transducer in the CPT housing. Cone resistance, sleeve friction and pore water pressure are recorded continuously at rate of 100 Hz. Battery and pressure resistance of the CPT-housing allow operations of more than 30 hours at a water depth of up to 2000 m.

The MeBo-CPT was tested at the rim of MV Ginsburg, on station GeoB23047-1. At the beginning of the test a 530 cmbsf hole was drilled, which is necessary for the installation of the tool into the drill string. Accordingly, the first push of the CPT started at 530 cmbsf and penetrated 1 m into the formation. For a subsequent dissipation test, the CPT remained in position for one hour. After another 40 cm push the CPT was retrieved into the MeBo body for an optical inspection. Following the re-installation into the drill string, the CPT was pushed continuously down to 3100 cmbsf in steps of 230 cm with an average velocity of ~1.5 cm/s. A second dissipation test was conducted for 1 hour at the maximum depth. The test ended with the recovery of the tool and the drill string (Fig. 5.23).

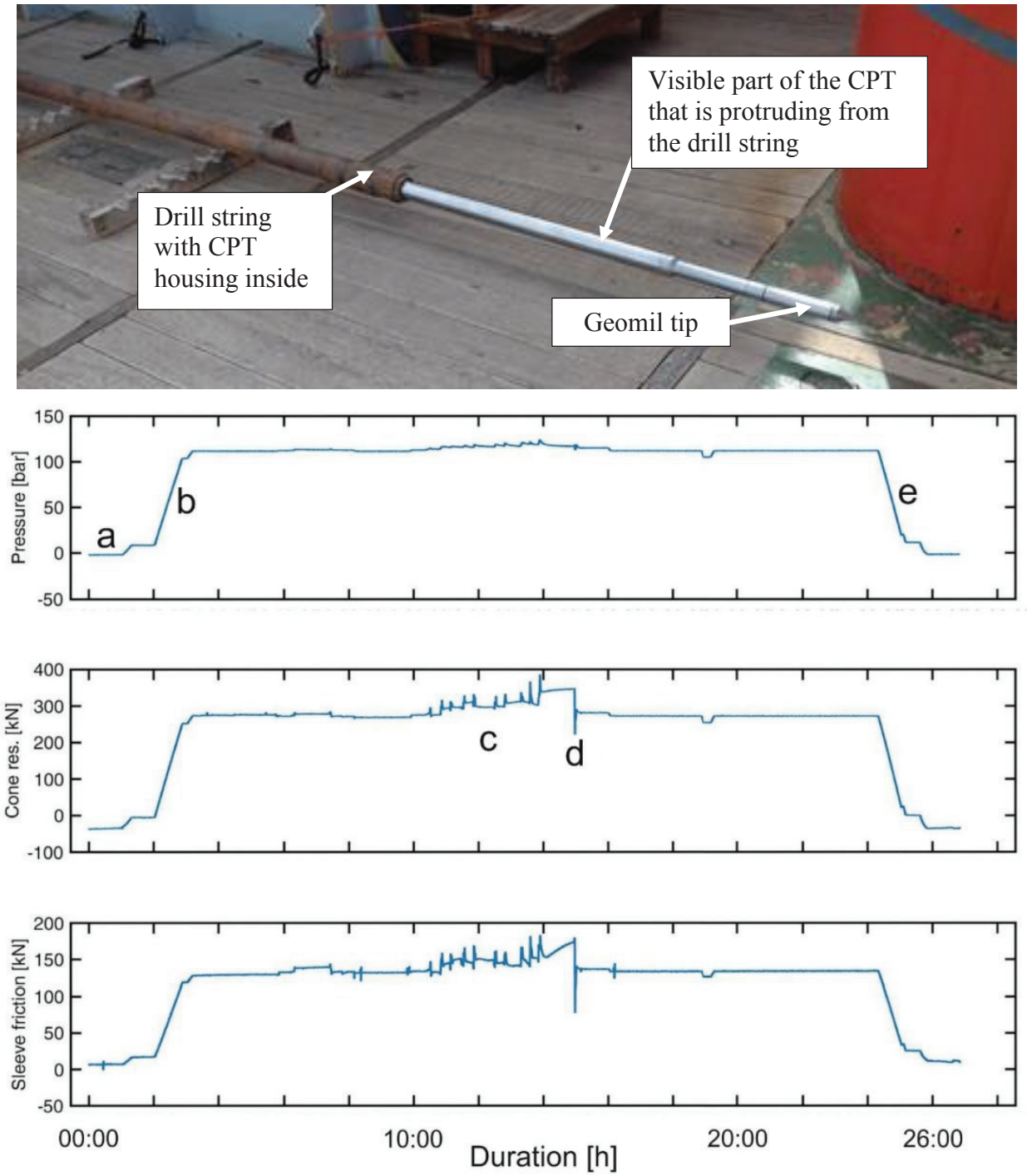

Fig. 5.23 Picture: Test setup of the MeBo CPT on deck of R/V Meteor. The CPT protrudes 1.4 m from the drill barrel, as it does during the operation. Diagram: Record of the Mebo-CPT deployment showing pore pressure (upper panel), cone resistance (middle panel) and sleeve friction (lower panel) data. The total duration of approx. 27 hours represents the complete operation time at station GeoB21847-1 with initiation of the data logger onboard R/V Meteor (a), submergence of the drilling platform (b), the period in which the CPT probe is pushed down to 30 m into the seafloor (c), removal of the CPT probe from the borehole at the end of the push test (d) and recovery of the drill rig (e).

5.6.4 Borehole Observatories

(T. Fleischmann, A. Hüpers)

In total three borehole observatories were installed at the seafloor during cruise M149 using the drill rig MeBo (Tab. 5.2). In the Gulf of Cadiz, one observatory was installed at the summit of the Ginsburg MV and another one at the Lineament Center, approximately 15 km south of Ginsburg MV. The reason for the close proximity of the two observatories is to test the hypothesis that mud volcanoes in the Gulf of Cadiz are fed by fluids ascending along fault zones. The Lineament Center is therefore a probable candidate as a fluid conduit for the Ginsburg MV. The comparison of the pressure and temperature data record will provide important insight into the hydraulic connection between the two structures. An additional conductivity sensor installed into the observatory of Ginsburg MV will further shed light on the variability of deep fluids originating from clay dehydration. The third observatory was installed in the Alboran Sea, along the Carboneras fault.

Tab. 5.2 List of installed observatories

Obs. no.	GeoB no.	Date/Time of finished installation	Lat./Long.	Borehole depth (cmbsf)	Water depth (m)	Remarks
1	GeoB23024-4	03.08.2018 21:36 UTZ	35°22.3728'N 7°5.3115'N	2030	909	Summit of Ginsburg MV
2	GeoB23060-1	09.08.2018 09:44 UTZ	35°15.3459'N 7°5.1579'W	2030	1025	Lineament Center
3	GeoB23091-1	14.08.2018 06:56 UTZ	36°23.308'N 2°52.275'W	2030	967	Carboneras fault

For the installation of each observatory, a borehole was drilled into the seafloor with MeBo - including coring of the sediment. After reaching the target depth, the final drill rod was replaced with one which had the observatory already screwed on. The observatory on top of the last drill rod seals the borehole from the overlying ocean water (Fig. 5.24). The whole assembly was pushed down the seafloor so that approximately 50-100 cm drill pipe protrude into the water column. Recovery of the observatory will be conducted with a ROV (Remotely Operated Vehicle) by unscrewing the observatory from the drill string.

Fig. 5.24 Picture showing the observatory sealing the drill string that is reaching 20 m into the summit of Ginsburg MV shortly before the MeBo is lifted from the seafloor.

Each observatory consists of a tubular stainless steel pressure housing that is 667 mm long (Fig. 5.25), has a diameter of 76 mm and is able to withstand pressure equivalent to 2000 m water depth. From the lower end of the pressure housing a temperature sensor, and for the Ginsburg MV observatory a conductivity sensor are protruding into the borehole. The temperature sensor is a high precision, long-term stable model from the IST company (Modell TSIC 501F with a -10 to 60°C measurement range and an accuracy of ±0.1K) (Fig. 5.25). The conductivity sensor was purchased from Sea & Sun Technology. The sensor measures in a range from 0-60 mS/cm with an accuracy of 0.002 mS/cm. An additional port connects the borehole to a differential pressure transducer (High Precision Pressure Transmitter 33X purchased from manufacturer Keller, 0-100 kPa differential pressure range with an accuracy of 0.05% FS). The other side of the pressure transducer is connected to the seafloor (Fig. 5.25).

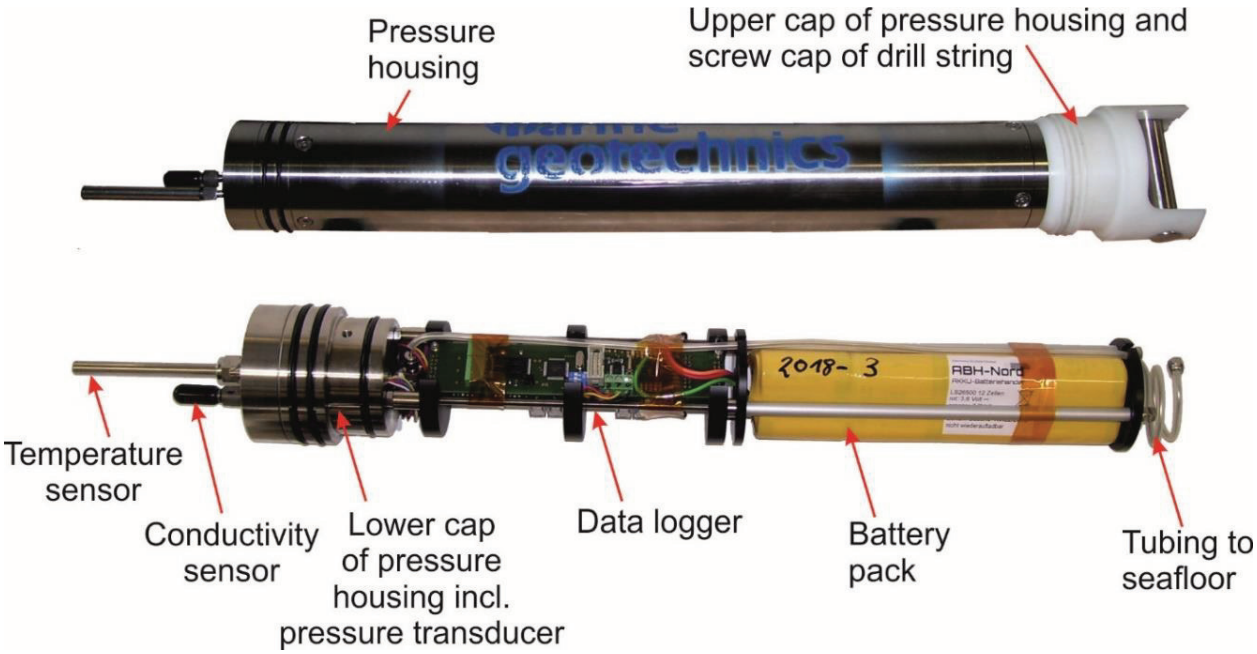

Fig. 5.25 Upper picture shows the pressure housing of an observatory with the screw cap on the right side that is visible in Fig. 5.24. Lower picture shows the interior of an observatory. See text for details.

6 Ship 's Meteorological Station

(M. Stelzner)

The research vessel Meteor left the port of Las Palmas around noon on the 15th of July 2018. At the beginning of the voyage RV Meteor was located on the southeastern flank of an extensive high pressure area around 38°N 48°W. On the 2-day transit into the Gulf of Cádiz north to northeasterly winds of 5 to 6 Bft and a NE'ly swell of 1.5 m were experienced. In the afternoon of the 27th RV Meteor reached the working area. The wind shifted to the northwest and weakened to 3-4 Bft, at times only weak and variable winds were experienced. The swell also turned to the northwest and dropped to 1 m. With many hours of sunshine per day, due to mostly clear, partly cloudless skies and temperatures of 20-21°C, the overall working weather was very pleasant.

On the July 28 the North Atlantic high shifted slightly eastwards, however, continued to remain largely stable over the Azores. For another 5 days RV Meteor remained at 35°30'N / 7°10'W in the working area with no significant change in the weather conditions.

On August 1 a low pressure area formed offshore Morocco south of the working area, deepening in the following days while migrating first to the west later to the north. Due to the low and the jet effect in the strait a storm field of up to 8 Bft was built up west of the Strait of Gibraltar influencing RV Meteor. The wind shifted to the east and increased to 5-6 Bft which was too strong to continue the work with the gravity corer and the MeBo. Thus, RV Meteor shifted 40 nm to the south for 2 days with the result only experiencing the weaker part of the storm field. While the storm field also produced a strong E'ly wind sea, the prevailing northwesterly swell drifted to the west. On August 2 a second northeasterly swell set in becoming dominant later and reaching the working area of the RV Meteor.

On the 3rd of August, RV Meteor meanwhile back in the previous work area, the above mentioned low shifted to the north while at the same time another low formed close to the southwest of the work area. The low developed south to southwesterly winds of 2-3 Bft, at times only weak and variable winds were experienced accompanied by morning fog. On the night to August 5 the low shifted to the southwest coast of the Iberian Peninsula. At the same time a heat low was present over Algeria, extending a low pressure trough along the coast of Morocco, across the working area to the previous mentioned low on the southwest coast of the Iberian Peninsula. Temporarily the wind blew from the northeast about 3 Bft with the NE'ly swell persisting with 1m, at times even with lower waves. On the 6th the stable Azores high shifted a little to the east with a ridge extending into the working area controlling the weather for RV Meteor. The wind shifted to the northwest and varied between 3 Bft during the day and 5 Bft at night. The swell turned back to the northwest and rose to 1.5 m. Almost clear skies dominated the weather until the 14th. On the 15th RV Meteor made a day trip to the working area at 34°45'N / 9°36'W. Apart from cloudy weather nothing changed. On the 16th, with some intermediate stops, RV Meteor headed towards the Strait of Gibraltar. With weak W'ly winds of 3 Bft and an equally weak W'ly swell of less than 1 m RV Meteor crossed the Strait of Gibraltar in the morning hours of 17th with a record-breaking 15.5 kn ship speed. With the move from the Gulf of Cádiz into the Alboran Sea, both the wind and the swell shifted to the east, but remained very weak, the wind around 3 Bft, the swell less than 1m. However the situation changed on the last weekend of the trip. On the 18th at noon the wind freshened up to 5 Bft, in the evening rose further up to 7 Bft and then blew almost constantly until late of the 19th. Later the wind dropped and reached 3-4 Bft in the night to the 21st. The significant wave height showed similar signs.

With the increase of the wind, Wind Sea and swell rose and reached a maximum value of 3m on the 19th. During the course of the 20th the swell slowly decreased to 1m on the morning of 21th. The calm weather lasted until the morning of August 24th when RV Meteor entered the harbor of Cádiz and finished the voyage M149.

7 Station List M149

7.1 Station List of deployed equipment

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/Recovery
METEOR	MARUM	2018		[UTC]	[°N]	[°W]	[m]	Posidonia coordinates in decimal format
M149-1	GeoB 23001-1	27.07.	CTD + RO	18:43	35°06.821'N	07°08.555'W	968	Plain between Linement Center and South
M149-3	GeoB 23003-1	28.07.	GC	06:18	35°25.332'N	07°06.011'W	956	Yuma MV, Bottom contact = Posidonia coordinates, Recovery: 49 cm
M149-4	GeoB 23004-1	28.07.	GC	07:45	35°23.923'N	07°05.074'W	1661	Depression between Yuma and Ginsburg MV, Bottom contact = Posidonia coordinates, Recovery: 474 cm
M149-5	GeoB 23005-1	28.07.	GC	09:17:00	35°22.550'N	07°05.361'W	887	Crest of Ginsburg MV, Posidonia: 35.37575062 / -7.08912983, Recovery: 200 cm
M149-6	GeoB 23006-1	28.07.	GC	10:30:00	35°22.027'N	07°05.338'W	965	Southern flank of Ginsburg, Posidonia: 35.367007 / -7.088689, Recovery: 300 cm
M149-7	GeoB 23007-1	28.07.	GC	12:00:00	35°21.525'N	07°05.335'W	1121	Southern rim of Ginsburg MV, Posidonia: 35.35862267 / -7.08865800, Recovery: 532 cm
M149-8	GeoB 23008-1	28.07.	GC	13:40:00	35°20.769'N	07°05.321'W	1060	Southern backround sed. of Ginsburg MV, Posidonia: 35.34603983 /-7.08850917, Recovery: 483 cm
M149-9	GeoB 23009-1	28.07.	GC	15:06:00	35°22.538'N	07°03.931'W	1072	Eastern rim of Ginsburg MV, Posidonia: 35.37550917 / -7.06526083, Recovery: 357 cm
M149-10	GeoB 23010-1	28.07.	GC	16:21:00	35°22.520'N	07°04.644'W	977	Eastern flank of Ginsburg MV, Posidonia: 35.3751 / -7.07715, Recovery: 245 cm
M149-12	GeoB 23012-1	28.07.	GC	19:00:00	35°24.734'N	07°05.655'W	996	Southern flank of Yuma MV, Posidonia: 35.41220983 / -7.09392883, Recovery: 364 cm
M149-13	GeoB 23013-1	28.07.	GC	20:13:00	35°25.110'N	07°05.825'W	987	Crest of Yuma MV, Posidonia: 35.41838267 / -7.09680583, Recovery: 472 cm
M149-11	GeoB 23011-1	28.07.	GC	17:40:00	35°22.546'N	07°05.148'W	923	Crest of Ginsburg MV, Posidonia: 35.375587 / -7.08554867, Recovery: 150 cm
M149-15	GeoB 23015-1	29.07.	MeBo	07:30:00	35°22.859'N	07°04.229'W		Crest of Ginsburg MV, Failed deployment
M149-16	GeoB 23016-1	29.07.	HF	13:32:00	35°13.338'N	07°05.334'W	944	Location in plain south of Lineament Center, Bottom contact = Posidonia coordinates
M149-17	GeoB 23017-1	29.07.	HF	14:35:00	35°14.304'N	07°05.334'W	941	Location in plain south of Lineament Center, Bottom contact = Posidonia coordinates
M149-18	GeoB 23018-1	29.07.	HF	15:39:00	35°15.000'N	07°05.316'W	965	Southern rim of Lineament Center, Bottom contact = Posidonia coordinates
M149-19	GeoB 23019-1	29.07.	HF	16:24:00	35°15.396'N	07°05.310'W	1021	Lineament Center to South, Bottom contact = Posidonia coordinates
M149-31	GeoB 23003-2	30.07.	HF	19:47:00	35°25.327'N	07°06.001'W	956	Yuma MV, Bottom contact = Posidonia coordinates

M149-28	GeoB 23004-2	30.07.	HF	17:15:00	35°23.910'N	07°05.074'W	1164	Depression between Yuma and Ginsburg MV, Bottom contact = Posidonia coordinates
M149-26	GeoB 23006-2	30.07.	HF	15:13:00	35°22.026'N	07°05.328'W	958	Southern flank of Ginsburg, Bottom contact = Posidonia coordinates
M149-25	GeoB 23007-2	30.07.	HF	14:06:00	35°21.521'N	07°05.335'W	1141	Southern rim of Ginsburg MV, Bottom contact = Posidonia coordinates
M149-30	GeoB 23012-2	30.07.	HF	18:54:00	35°24.733'N	07°05.659'W	1021	Southern flank of Yuma MV, Bottom contact = Posidonia coordinates
M149-21	GeoB 23021-1	30.07.	HF	07:32:00	35°16.500'N	07°05.336'W	1017	Lineament Center to South, Bottom contact = Posidonia coordinates
M149-22	GeoB 23022-1	30.07.	HF	10:26:00	35°17.490'N	07°05.231'W	1058	Northern rim of Lineament Center, Bottom contact = Posidonia coordinates
M149-23	GeoB 23023-1	30.07.	HF	11:44:00	35°19.047'N	07°05.208'W	1064	Plain between Ginsburg MV & Lineament South, Bottom contact = Posidonia coordinates
M149-27	GeoB 23024-1	30.07.	HF	15:52:00	35°22.356'N	07°05.295'W	908	Ginsburg MV Crest, Bottom contact = Posidonia coordinates
M149-29	GeoB 23025-1	30.07.	HF	18:16:00	35°24.300'N	07°05.510'W	1128	Southern rim of Yuma MV, Bottom contact = Posidonia coordinates
M149-24	GeoB 23008-2	30.07.	HF	13:11:00	35°20.748'N	07°05.310'W	1059	Southern backround sed. of Ginsburg MV, Bottom contact = Posidonia coordinates
M149-33	GeoB 23024-2	31.07.	MeBo	07:00:00	35°22.356'N	07°05.295'W		Crest of Ginsburg MV, Deployment successful but operations stopped due to technical issues, Recovery: 19 cm
M149-34	GeoB 23024-3	31.07.	GC	14:35:00	35°22.356'N	07°05.319'W	908	Crest of Ginsburg MV, Posidonia: 35.37274917 / -7.08841467, Recovery: 255 cm
M149-36	GeoB 23025-2	31.07.	GC	17:25:00	35°24.307'N	07°05.520'W	1124	Southern rim of Yuma MV, Posidonia: 35.40497100 / -7.09179800, Recovery: 475 cm
M149-35	GeoB 23027-1	31.07.	GC	15:54:00	35°22.383'N	07°01.151'W	962	Backround east of Ginsburg MV, Posidonia: 35.37289917 / -7.01904550, Recovery: 442 cm
M149-37	GeoB 23028-1	31.07.	GC	18:35:00	35°25.463'N	07°06.007'W	959	Crest of Yuma MV, Posidonia: 35.42421517 / -7.10691967, Recovery: 289 cm
M149-39	GeoB 23030-1	01.08.	GC	08:37:00	35°19.737'N	07°25.129'W	1206	S of Lineament Center, Posidonia: 35.32887 / -7.41858, Recovery: 471 cm
M149-40	GeoB 23031-1	01.08.	GC	10:29:00	35°16.945'N	07°19.307'W	1300	Pull-apart basin Lineam. Center branch, Posidonia: 35.28233 / -7.32202, Recovery: 388 cm
M149-41	GeoB 23032-1	01.08.	GC	12:43:00	35°16.329'N	07°05.995'W	953	Lineament Center, Posidonia: 35.27205 / -7.09961, Recovery: 145 cm
M149-42	GeoB 23033-1	01.08.	GC	13:59:00	35°16.938'N	07°07.361'W	1176	Depression in Lineament Center, Posidonia: 35.28217 / -7.12241, Recovery: 291 cm
M149-43	GeoB 23022-2	01.08.	GC	15:22:00	35°17.483'N	07°05.233'W	1053	Northern rim of Lineament Center, Posidonia: 35,29122 / -7,0870, Recovery: 449 cm
M149-44	GeoB2303 4-1	01.08.	GC	16:49:00	35°18.896'N	07°08.036'W	1039	Crest of Rabat MV, Posidonia: 35.31478 / -7.13369, Recovery: 294 cm
M149-46	GeoB 23036-1	02.08.	GC	07:33:00	35°03.059'N	07°05.135'W	998	Depression in Lineament South, Posidiona: 35.05064 / -7.08583, Recovery: 464 cm
M149-47	GeoB 23037-1	02.08.	GC	08:56:00	35°02.675'N	07°01.507'W	901	Depression in Lineament South, Posidonia: 35.04431 / -7.02629, Recovery: 413 cm
M149-48	GeoB 23038-1	02.08.	GC	10:26:00	34°59.122'N	07°02.031'W	744	Background east of Meknes MV, Posidonia: 34.985098 / -7.034090, Recovery: 376 cm
M149-49	GeoB 23039-1	02.08.	GC	11:49:00	34°59.095'N	07°04.055'W	749	Eastern rim of Meknes MV, Posidonia: 34.98464 / -7.06774, Recovery: 223 cm
M149-50	GeoB 23040-1	02.08.	GC	13:00:00	34°59.104'N	07°04.200'W	735	Eastern flank of Meknes MV, Posidonia: 34.98484 / -7.07013, Recovery: 169 cm

M149-51	GeoB 23041-1	02.08.	GC	14:52:00	34°59.109'N	07°04.388'W	687	Crest of Meknes MV, Posidonia: 34.98484 / -7.07327 - NO core recovery, Recovery: 0 cm
M149-51	GeoB 23041-2	02.08.	GC	14:52:00	34°59.108'N	07°04.381'W	687	Crest of Meknes MV, Posidonia: 34.98484 / -7.07329, Recovery: 75 cm
M149-53	GeoB 23024-4	03.08.	MeBo	08:00:00	35°22.372'N	07°05.311'W	906	Crest of Ginsburg MV, Deployment successful but operations stopped due to technical issues, Recovery: 637 cm
M149-55	GeoB 23043-1	04.08.	GC	12:39:00	34°59.074'N	07°04.436'W	687	Crest of Meknes MV / CC Test, Posidonia: 34.98429 / 7.0740, Recovery: 140 cm
M149-55	GeoB 23043-2	04.08.	GC	13:36:00	34°59.072'N	07°04.433'W	694	Crest of Meknes MV / CC Test, Posidonia: 34.98426 / -7.07400, Recovery: 144 cm
M149-56	GeoB 23044-1	04.08.	GC	14:35:00	34°59.030'N	07°04.369'W	695	Crest of Meknes MV, Posidonia: 34.98354 / -7.0729, Recovery: 77 cm
M149-57	GeoB 23045-1	04.08.	GC	16:12:00	35°03.194'N	07°08.007'W	943	Depression in Lineament South, Posidonia: 35.05306 / -7.13434, Recovery: 485 cm
M149-58	GeoB 23045-2	04.08.	CTD + RO	17:51:00	35°03.194'N	07°08.007'W		Depression in Lineament South
M149-59	GeoB 23047-1	06.08.	MeBo	07:00:00	35°22.871'N	07°04.128'W	1116	Ginsburg eastern rim, CPT and SGR logging, Recovery: 325 cm
M149-60	GeoB 23047-2	06.08.	MeBo	07:00:00	35°22.877'N	07°04.136'W	1115	Ginsburg eastern rim, Operations stopped due to technical issues, Recovery: 492 cm
M149-61	GeoB 23048-1	06.08.	GC	09:52:00	35°15.407'N	07°04.007'W	961	Lineament Center, Posidonia: 35.25662 / -7.068096 - NO core recovery, Recovery: 0 cm
M149-62	GeoB 23049-1	06.08.	GC	12:00:00	35°15.406'N	07°05.311'W	1031	Lineament Center, Posidonia: 35.25693 / -7,08874, Recovery: 339 cm
M149-63	GeoB 23050-1	06.08.	HF	13:45:00	35°05.467'N	07°04.189'W	867	Lineament South / Meknes MV
M149-63	GeoB 23050-2	06.08.	HF	15:36:00	35°03.484'N	07°04.264'W	862	Lineament South / Meknes MV, Posidonia: 35.05833 / -7.07109
M149-63	GeoB 23050-3	06.08.	HF	16:30:00	35°02.811'N	07°04.281'W	1016	Lineament South / Meknes MV, Posidonia: 35.04708 / -7.07153
M149-63	GeoB 23050-4	06.08.	HF	17:20:00	35°01.983'N	07°04.344'W	883	Lineament South / Meknes MV, Posidonia: 35.03329 / -7.0725
M149-63	GeoB 23050-5	06.08.	HF	18:43:00	35°00.259'N	07°04.380'W	759	Lineament South / Meknes MV, Posidonia: 35.0042 / -7.0726
M149-63	GeoB 23050-6	06.08.	HF	19:46:00	34°59.404'N	07°04.380'W	786	Lineament South / Meknes MV, Posidonia: 34.9898 / -7.07298
M149-63	GeoB 23050-7	06.08.	HF	20:10:00	34°59.139'N	07°04.390'W	693	Lineament South / Meknes MV, Posidonia: 34.98543 / -7.07288
M149-65	GeoB 23047-3	07.08.	MeBo	08:00:00	35°22.863'N	07°04.128'W	1126	Ginsburg eastern rim, Dual Induction logging, Recovery: 3594 cm
M149-66	GeoB 23052-1	08.08.	GC	10:01:00	35°19.053'N	07°08.602'W	1186	Eastern rim of Rabat MV, Posidonia: 35.31744 / -7.14308, Recovery: 415 cm
M149-67	GeoB 23053-1	08.08.	GC	12:56:00	35°28.494'N	07°24.253'W	1163	Crest of R2 MV, Posidonia: 35.4748 / -7.4040, Recovery: 200 cm
M149-68	GeoB 23054-1	08.08.	GC	14:24:00	35°28.817'N	07°24.091'W	1194	Crest of D2 MV, Posidonia: 35.480 / -7.40126, Recovery: 35 cm
M149-70	GeoB 23056-1	08.08.	GC	17:34:00	35°26.462'N	07°28.922'W	1229	Crest of El Cid MV, Posidonia: 35.44103 / -7.48202, Recovery: 144 cm
M149-71	GeoB 23057-1	08.08.	GC	19:10:00	35°22.978'N	07°30.352'W	1230	Crest of Amanzor, Posidonia: 35.38279 / -7.50573, Recovery: 178 cm
M149-75	GeoB 23060-1	09.08.	MeBo	14:00:00	35°15.347'N	07°05.155'W	1013	Lineament center, Recovery: 1390 cm
M149-77	GeoB 23062-1	10.08. 18	GC	08:59:00	35°03.519'N	07°23.055'W	1334	Pull-apart basin, Lineament South branch, Posidonia: 35,05864 / -7,38419, Recovery: 450 cm
M149-78	GeoB 23063-1	10.08. 18	GC	10:33:00	35°05.705'N	07°19.664'W	1282	Pull-apart basin, Lineament South, Posidonia: 35,09494 / -7,32753, Recovery: 481 cm
M149-79	GeoB 23064-1	10.08. 18	GC	11:50:00	35°05.756'N	07°20.153'W	1278	Pull-apart basin, Lineament South, Posidonia: 35,09583 / -7,33562, Recovery: 437 cm

M149-81	GeoB 23066-1	10.08. 18	GC	15:35:00	35°16.847'N	07°18.941'W	1310	Pull-apart basin, Lineament Center branch, Posidonia: 35.28072 / -7.31543, Recovery: 513 cm
M149-82	GeoB 23067-1	10.08. 18	GC	16:46:00	35°16.759'N	07°18.071'W	1304	Pull-apart basin, Lineament Center branch, Posidonia: 35.27933 / -7.31177, Recovery: 375 cm
M149-84	GeoB 23069-1	11.08.	MeBo	08:00:00	35°16.976'N	07°19.309'W	1280	Pull-apart basin, Lineament Center branch, , Recovery: 4145 cm
M149-85	GeoB 23070-1	12.08. 18	HF	13:25:00	35°16.968'N	07°19.306'W	1309	Pull-apart basin Lineament Center, Posidonia: 35.28275 / -7.32148
M149-86	GeoB 23070-2	12.08. 18	HF	13:25:00	35°17.195'N	07°19.431'W	1309	Pull-apart basin Lineament Center, Posidonia: 35.28645 / -7.32369
M149-86	GeoB 23071-1	12.08.	GC	17:51:00	35°20.794'N	07°41.429'W	1810	Lineament Center branch, Posidonia: 35.34649 / -7.69035, Recovery: 385 cm
M149-88	GeoB 23073-1	13.08.	MeBo	07:00:00	35°05.661'N	07°19.000'W	1281	Pull-apart basin Lineament South, Recovery: 4223 cm
M149-89	GeoB 23074-1	14.08.	HF	09:18:00	35°05.675'N	07°19.683'W	1274	Pull-apart basin Lineament South, Posidonia: 35,09452 / -7,32783,
M149-90	GeoB 23076-1	14.08.	GC	12:39:00	35°00.020'N	07°37.048'W	1302	Lineament South Branch, Posidonia: 35.00035 / -7.61720, Recovery: 336 cm
M149-91	GeoB 23077-1	14.08.	GC	16:25:00	35°22.953'N	07°43.990'W	1651	Buried MV#1, Posidonia: 35.38248 / -7.73304, Recovery: 563 cm
M149-93	GeoB 23078-1	15.08.	CTD+ RO	07:25:00	34°45.933'N	09°36.072'W	4054	Salt dome west
M149-93	GeoB 23078-2	15.08.	HF	08:58:00	34°45.935'N	09°36.072'W	4048	Salt dome west, calibration only, no penetration
M149-93	GeoB 23078-3	15.08.	GC	14:30:00	34°45.934'N	09°36.073'W	4052	Salt dome west, Posidonia: 34.76737 / -9.6041, Recovery: 464 cm
M149-94	GeoB 23079-1	15.08.	GC	18:30:00	34°44.592'N	09°28.230'W	4260	Seine Abyssal Plain, Posidonia: 34.74548 / -9.46307, Recovery: 522 cm
M149-95	GeoB 23080-1	15.08.	GC	21:44:00	34°49.342'N	09°25.071'W	4084	Salt dome east, Posiodina: 35.8222 / -9.42970, Recovery: 400 cm
M149-96	GeoB 23081-1	16.08.	GC	04:09:00	34°58.441'N	08°37.952'W	3143	Crest of Funky Monkey MV, Posidonia: 34.97401 / -8.63234, Recovery: 274 cm
M149-97	GeoB 23082-1	16.08.	GC	11:00:00	35°41.784'N	07°54.424'W	1481	Potentioal MV, Posidonia: 35.69635 / -7.90686, Recovery: 480 cm
M149-98	GeoB 23083-1	16.08.	GC	14:50:00	35°58.646'N	07°50.073'W	1309	N Gulf of Cadiz background, Posidonia: 35.97742 / -7.84526, Recovery: 387 cm
M149-99	GeoB 23084-1	16.08.	GC	17:12:00	36°09.213'N	08°00.362'W	1269	Lolita salt dome, Posidonia: 36.15341 / -7.00586, Recovery: 436 cm
M149-100	GeoB 23085-1	16.08.	GC	20:40:00	35°50.816'N	07°40.491'W	1288	Potential MV, Posidonia: 35.84682 / -7.67483, Recovery: 433 cm
M149-102	GeoB 23086-1	18.08.	CTD + RO	06:46:00	36°26.297'N	02°50.855'W	840	Carboneras fault reference
M149-102	GeoB 23086-2	18.08.	GC	07:43:00	36°26.298'N	02°50.854'W	835	Carboneras fault reference, Posidonia: 36.4382 / -2.84791, Recovery: 233 cm
M149-103	GeoB 23087-1	18.08.	GC	09:14:00	36°25.390'N	02°48.596'W	905	Carboneras fault east, Posidonia: 36.42312 / -2.81025, Recovery: 524 cm
M149-104	GeoB 23088-1	18.08.	GC	10:53:00	36°22.148'N	02°55.192'W	967	Carboneras fault center, Posidonia: 36.36908 / -2.92021, Recovery: 129 cm
M149-105	GeoB 23089-1	18.08.	GC	12:50:00	36°18.609'N	03°01.079'W	917	Carboneras fault west, Posidonia: 36.31045 / -3.03017, Recovery: 377 cm
M149-107	GeoB 23090-1	19.08.	HF	08:09:00	36°18.604'N	03°01.079'W	917	Carboneras fault, Posidonia: 36.30993 / -3.03009
M149-107	GeoB 23090-2	19.08.	HF	09:33:00	36°19.834'N	03°00.009'W	1023	Carboneras fault, Podidonia: 36.33044 / -3.00046
M149-107	GeoB 23090-3	19.08.	HF	10:55:00	36°21.087'N	02°57.735'W	987	Carboneras fault, Posidonia: 36.35140 / -2.96256
M149-107	GeoB 23090-4	19.08.	HF	12:15:00	36°22.149'N	02°55.193'W	968	Carboneras fault, Posidonia: 36.36874 / -2.9208
M149-107	GeoB 23090-5	19.08.	HF	13:46:00	36°23.557'N	02°52.441'W	958	Carboneras fault, Posidonia: 36.41023 / -2.83841
M149-107	GeoB 23090-6	19.08.	HF	14:59:00	36°24.614'N	02°50.282'W	935	Carboneras fault, Posidonia: 36.41023 / -2.83841
M149-107	GeoB 23090-7	19.08.	HF	16:12:00	36°25.318'N	02°48.590'W	907	Carboneras fault, Posidonia: 36.42286 / -2.81023
M149-107	GeoB 23090-8	19.08.	HF	18:02:00	36°26.307'N	02°50.895'W	842	Carboneras fault, Posidonia: 36.438410 / -2.84859

M149-109	GeoB 23091-1	20.08.	MeBo	07:00:00	36°23.308'N	02°52.208'W	968	Carboneras fault, , Recovery: 1717 cm
M149-111	GeoB 23092-1	21.08.	GC	07:51:00	35°38.588'N	03°44.898'W	899	Al Idrissi fault zone reference, Posidonia: 35.64290 / -3.74849, Recovery: 555 cm
M149-112	GeoB 23093-1	21.08.	GC	09:11:00	35°38.383'N	03°41.446'W	829	Al Idrissi fault north, Posidonia: 35.63943 / -3.69080, Recovery: 537 cm
M149-113	GeoB 23094-1	21.08.	GC	10:30:00	35°34.850'N	03°43.111'W	798	Al Idrissi fault center, Posidonia: 35.58056 / -3.71870, Recovery: 390 cm
M149-114	GeoB 23095-1	21.08.	GC	11:51:00	35°31.065'N	03°44.008'W	530	Al Idrissi fault south, Posidonia: 35.51746 / -3.73418, Recovery: 542 cm
M149-116	GeoB 23096-1	22.08.	CTD + RO	06:29:00	35°37.975'N	04°29.656'W	1120	Marrakech MV
M149-117	GeoB 23097-1	22.08.	GC	07:52:00	35°37.766'N	04°29.939'W	1066	Marrakech MV, Posidonia: 35.62960 / -4.49914, Recovery: 565 cm
M149-118	GeoB 23098-1	22.08.	HF	12:52:00	35°38.593'N	03°44.893'W	910	Al-Idrissi fault, Posidonia: 35.64294 / -3.74828 (reference)
M149-118	GeoB 23098-2	22.08.	HF	15:18:00	35°38.373'N	03°41.433'W	838	Al-Idrissi fault, Posidonia: 35.63928 / -3.69057 (north)
M149-118	GeoB 23098-3	22.08.	HF	17:02:00	35°34.868'N	03°43.131'W	797	Al-Idrissi fault, Posidonia: 35.58049 / -3.71862 (center)
M149-118	GeoB 23098-4	22.08.	HF	18:45:00	35°31.064'N	03°44.007'W	529	Al-Idrissi fault, Posidonia: 35.51746 / -3.73476 (south)

7.2 Station List of Multibeam and Parasound Profiles

Ship station	Date	Time	Action	Latitude	Longitude	Water Depth
Meteor	2018	[UTC]		[°N]	[°W]	[m]
M149-2	27.07.	20:34	profile start	35° 07.049' N	007° 08.499' W	965
M149-2	28.07.	00:07	alter course	35° 28.161' N	007° 08.512' W	1062
M149-2	28.07.	00:35	alter course	35° 28.417' N	007° 04.970' W	1114
M149-2	28.07.	03:09	alter course	35° 12.998' N	007° 04.616' W	929
M149-2	28.07.	03:39	alter course	35° 12.666' N	007° 01.263' W	935
M149-2	28.07.	05:15	profile end	35° 21.911' N	007° 00.992' W	960
M149-14	28.07.	21:26	profile start	35° 28.358' N	007° 06.346' W	1105
M149-14	28.07.	23:57	alter course	35° 12.874' N	007° 06.359' W	947
M149-14	29.07.	00:29	alter course	35° 12.674' N	007° 02.803' W	916
M149-14	29.07.	01:17	alter course	35° 17.260' N	007° 02.395' W	958
M149-14	29.07.	03:33	alter course	35° 20.216' N	007° 18.523' W	1253
M149-14	29.07.	03:48	alter course	35° 18.840' N	007° 18.852' W	1251
M149-14	29.07.	05:12	alter course	35° 16.898' N	007° 08.907' W	1171
M149-14	29.07.	05:26	alter course	35° 15.532' N	007° 08.592' W	1101
M149-14	29.07.	05:47	profile end	35° 15.563' N	007° 10.881' W	1162
M149-20	29.07.	17:48	profile start	35° 19.907' N	007° 08.569' W	1138
M149-20	29.07.	19:17	alter course	35° 21.280' N	007° 18.786' W	1278
M149-20	29.07.	20:03	alter course	35° 15.656' N	007° 18.642' W	1174
M149-20	29.07.	21:26	alter course	35° 13.972' N	007° 08.617' W	1027
M149-20	29.07.	21:43	alter course	35° 15.493' N	007° 08.680' W	1100
M149-20	29.07.	23:21	alter course	35° 17.059' N	007° 20.548' W	1215
M149-20	30.07.	01:05	alter course	35° 27.353' N	007° 20.879' W	1338

M149-20	30.07.	01:18	alter course	35° 27.584' N	007° 22.400' W	1291
M149-20	30.07.	03:26	alter course	35° 14.907' N	007° 22.672' W	1214
M149-20	30.07.	03:41	alter course	35° 14.575' N	007° 24.196' W	1237
M149-20	30.07.	05:26	profile end	35° 25.308' N	007° 24.620' W	1407
M149-32	30.07.	21:53	profile start	35° 22.974' N	007° 24.494' W	1312
M149-32	30.07.	23:04	alter course	35° 30.104' N	007° 24.655' W	1202
M149-32	30.07.	23:13	alter course	35° 30.224' N	007° 25.700' W	1218
M149-32	31.07.	01:48	alter course	35° 14.808' N	007° 25.899' W	1245
M149-32	31.07.	02:02	alter course	35° 14.650' N	007° 27.441' W	1264
M149-32	31.07.	04:33	alter course	35° 30.043' N	007° 27.501' W	1202
M149-32	31.07.	04:46	alter course	35° 30.333' N	007° 28.926' W	1253
M149-32	31.07.	05:00	profile end	35° 29.097' N	007° 29.307' W	1238
M149-38	31.07.	21:02	profile start	35° 30.124' N	007° 30.763' W	1458
M149-38	31.07.	23:36	alter course	35° 14.972' N	007° 31.132' W	1273
M149-38	31.07.	23:57	alter course	35° 14.723' N	007° 33.421' W	1318
M149-38	01.08.	01:26	alter course	35° 23.399' N	007° 33.683' W	1836
M149-38	01.08.	01:43	alter course	35° 23.458' N	007° 35.452' W	1435
M149-38	01.08.	03:10	alter course	35° 14.841' N	007° 35.715' W	1383
M149-38	01.08.	03:25	alter course	35° 14.663' N	007° 37.355' W	1440
M149-38	01.08.	04:51	alter course	35° 23.200' N	007° 37.737' W	1636
M149-38	01.08.	05:07	alter course	35° 23.435' N	007° 39.720' W	1544
M149-38	01.08.	06:34	profile end	35° 14.779' N	007° 40.156' W	1401
M149-45	01.08.	18:58	profile start	35° 07.782' N	007° 08.454' W	958
M149-45	01.08.	20:44	alter course	34° 57.069' N	007° 08.224' W	811
M149-45	01.08.	8 20:57	alter course	34° 57.109' N	007° 06.757' W	797
M149-45	01.08.	23:22	alter course	35° 12.164' N	007° 06.541' W	937
M149-45	01.08.	23:38	alter course	35° 12.263' N	007° 04.878' W	927
M149-45	02.08.	02:06	alter course	34° 57.609' N	007° 04.540' W	760
M149-45	02.08.	02:22	alter course	34° 57.378' N	007° 02.884' W	751
M149-45	02.08.	05:01	alter course	35° 12.056' N	007° 02.802' W	922
M149-45	02.08.	05:15	alter course	35° 12.298' N	007° 01.332' W	932
M149-45	02.08.	06:21	profile end	35° 05.780' N	007° 00.916' W	908
M149-52	02.08.	16:42	profile start	35° 05.318' N	007° 00.968' W	888
M149-52	02.08.	18:07	alter course	34° 57.585' N	007° 00.884' W	746
M149-52	02.08.	18:23	alter course	34° 57.294' N	006° 59.378' W	728
M149-52	02.08.	21:42	alter course	35° 17.765' N	006° 59.101' W	900
M149-52	02.08.	22:22	alter course	35° 19.579' N	007° 04.252' W	1047
M149-52	02.08.	23:38	alter course	35° 26.950' N	007° 06.673' W	1069
M149-52	03.08.	00:00	alter course	35° 26.890' N	007° 04.762' W	1078
M149-52	03.08.	00:45	alter course	35° 23.317' N	007° 07.701' W	1144
M149-52	03.08.	01:43	alter course	35° 23.144' N	007° 14.850' W	1233
M149-52	03.08.	02:47	alter course	35° 21.300' N	007° 08.086' W	1121
M149-52	03.08.	03:36	alter course	35° 23.485' N	007° 02.616' W	995
M149-52	03.08.	04:32	alter course	35° 28.927' N	007° 02.549' W	1048
M149-52	03.08.	04:50	alter course	35° 29.068' N	007° 00.935' W	1015

M149-52	03.08.	05:55	alter course	35° 22.616' N	007° 00.958' W	960
M149-52	03.08.	06:12	alter course	35° 22.343' N	007° 02.611' W	990
M149-52	03.08.	06:33	profile end	35° 20.253' N	007° 02.772' W	1002
M149-54	03.08.	23:25	profile start	35° 21.317' N	007° 02.744' W	1006
M149-54	03.08.	23:54	alter course	35° 17.496' N	007° 02.797' W	969
M149-54	04.08.	00:17	alter course	35° 17.109' N	006° 59.219' W	913
M149-54	04.08.	01:47	alter course	35° 28.994' N	006° 58.627' W	939
M149-54	04.08.	01:58	alter course	35° 29.197' N	006° 57.128' W	909
M149-54	04.08.	04:26	alter course	35° 09.647' N	006° 56.866' W	767
M149-54	04.08.	04:38	alter course	35° 09.219' N	006° 55.128' W	775
M149-54	04.08.	07:10	alter course	35° 29.006' N	006° 54.790' W	833
M149-54	04.08.	07:22	alter course	35° 28.767' N	006° 53.096' W	768
M149-54	04.08.	09:00	profile end	35° 15.840' N	006° 53.170' W	778
M149-59	04.08.	18:57	profile start	34° 57.085' N	007° 09.240' W	838
M149-59	04.08.	19:16	alter course	34° 57.482' N	007° 11.083' W	880
M149-59	04.08.	20:57	alter course	35° 14.013' N	007° 10.765' W	1083
M149-59	04.08.	21:07	alter course	35° 14.023' N	007° 12.566' W	1141
M149-59	04.08.	22:46	alter course	34° 57.242' N	007° 12.601' W	907
M149-59	04.08.	22:55	alter course	34° 57.286' N	007° 14.296' W	954
M149-59	05.08.	00:37	alter course	35° 14.542' N	007° 14.339' W	1177
M149-59	05.08.	00:46	alter course	35° 14.739' N	007° 15.928' W	1124
M149-59	05.08.	02:32	alter course	34° 57.262' N	007° 16.179' W	1052
M149-59	05.08.	02:40	alter course	34° 57.108' N	007° 17.741' W	1083
M149-59	05.08.	04:38	alter course	35° 17.059' N	007° 17.954' W	1183
M149-59	05.08.	04:46	alter course	35° 17.255' N	007° 19.371' W	1220
M149-59	05.08.	05:26	profile end	35° 10.778' N	007° 19.729' W	1142
M149-64	06.08.	21:54	profile start	34° 57.292' N	007° 18.378' W	1115
M149-64	06.08.	22:04	alter course	34° 57.378' N	007° 20.225' W	1192
M149-64	06.08.	23:47	alter course	35° 14.654' N	007° 20.337' W	1179
M149-64	06.08.	23:54	alter course	35° 14.822' N	007° 21.865' W	1195
M149-64	07.08.	01:39	alter course	34° 57.477' N	007° 22.085' W	1188
M149-64	07.08.	01:47	alter course	34° 57.292' N	007° 23.629' W	1293
M149-64	07.08.	03:27	alter course	35° 13.832' N	007° 23.676' W	1221
M149-64	07.08.	03:36	alter course	35° 14.061' N	007° 25.275' W	1227
M149-64	07.08.	04:30	profile end	35° 05.139' N	007° 25.549' W	1254
M149-69	08.08.	15:24	information	35° 29.122' N	007° 23.876' W	1224
M149-69	08.08.	16:11	alter course	35° 28.059' N	007° 24.480' W	1234
M149-69	08.08.	16:23	profile end	35° 29.178' N	007° 23.904' W	1221
M149-72	08.08.	21:40	profile start	35° 05.489' N	007° 25.576' W	1238
M149-72	08.08.	22:30	alter course	34° 57.278' N	007° 25.868' W	1296
M149-72	08.08.	22:40	alter course	34° 57.625' N	007° 27.460' W	1310
M149-72	09.08.	00:41	alter course	35° 15.769' N	007° 27.262' W	1253
M149-72	09.08.	00:54	alter course	35° 15.962' N	007° 28.834' W	1295
M149-72	09.08.	02:47	alter course	34° 57.419' N	007° 29.485' W	1359
M149-72	09.08.	02:56	alter course	34° 57.257' N	007° 31.087' W	1403

M149-72	09.08.	04:30	profile end	35° 12.075' N	007° 31.045' W	1269
M149-74	09.08.	11:46	profile start	35° 14.056' N	007° 05.167' W	941
M149-74	09.08.	12:22	profile end	35° 17.686' N	007° 05.163' W	1061
M149-76	10.08.	04:35	profile start	35° 11.625' N	007° 31.250' W	1280
M149-76	10.08.	04:58	alter course	35° 15.163' N	007° 31.278' W	1270
M149-76	10.08.	05:07	alter course	35° 15.201' N	007° 32.968' W	1294
M149-76	10.08.	06:56	alter course	34° 57.104' N	007° 33.390' W	1416
M149-76	10.08.	07:05	alter course	34° 56.795' N	007° 34.821' W	1557
M149-76	10.08.	07:24	profile end	34° 59.771' N	007° 34.871' W	1366
M149-80	10.08.	13:12	profile start	35° 06.136' N	007° 21.023' W	1238
M149-80	10.08.	13:32	alter course	35° 05.406' N	007° 18.867' W	1181
M149-80	10.08.	14:03	profile end	35° 07.119' N	007° 19.940' W	1193
M149-83	10.08.	18:44	profile start	35° 15.042' N	007° 34.928' W	1339
M149-83	10.08.	20:33	alter course	34° 56.795' N	007° 35.460' W	1530
M149-83	10.08.	20:42	alter course	34° 57.014' N	007° 37.056' W	1419
M149-83	10.08.	22:30	alter course	35° 14.938' N	007° 37.167' W	1437
M149-83	10.08.	22:38	alter course	35° 14.628' N	007° 38.760' W	1478
M149-83	11.08.	00:24	alter course	34° 57.039' N	007° 38.986' W	1478
M149-83	11.08.	00:33	alter course	34° 56.898' N	007° 40.712' W	1536
M149-83	11.08.	03:17	alter course	35° 24.252' N	007° 40.731' W	1507
M149-83	11.08.	03:26	alter course	35° 24.466' N	007° 42.333' W	1843
M149-83	11.08.	04:45	profile end	35° 11.103' N	007° 42.701' W	1564
M149-87	12.08.	19:25	profile start	35° 12.187' N	007° 42.673' W	1548
M149-87	12.08.	20:58	alter course	34° 56.946' N	007° 43.028' W	1691
M149-87	12.08.	21:06	alter course	34° 56.956' N	007° 44.385' W	1761
M149-87	12.08.	23:49	alter course	35° 24.208' N	007° 44.493' W	1749
M149-87	12.08.	23:58	alter course	35° 24.378' N	007° 46.088' W	1743
M149-87	13.08.	02:44	alter course	34° 56.987' N	007° 46.524' W	1738
M149-87	13.08.	02:51	alter course	34° 56.852' N	007° 47.821' W	1878
M149-87	13.08.	04:30	profile end	35° 12.964' N	007° 48.105' W	2054
M149-92	14.08.	22:05	profile start	34° 58.679' N	008° 37.317' W	3197
M149-92	14.08.	22:17	alter course	34° 58.281' N	008° 38.668' W	3204
M149-92	15.08.	01:33	alter course	34° 55.869' N	009° 08.711' W	3744
M149-92	15.08.	01:51	alter course	34° 55.804' N	009° 10.838' W	3951
M149-92	15.08.	03:23	alter course	34° 50.068' N	009° 23.863' W	4065
M149-92	15.08.	05:35	profile end	34° 45.087' N	009° 39.881' W	4250
M149-101	17.08.	14:47	profile start	36° 09.647' N	003° 11.874' W	889
M149-101	17.08.	15:00	alter course	36° 10.757' N	003° 09.640' W	917
M149-101	17.08.	17:24	alter course	36° 23.052' N	002° 44.938' W	1104
M149-101	17.08.	17:34	alter course	36° 24.372' N	002° 45.851' W	1011
M149-101	17.08.	19:58	alter course	36° 12.670' N	003° 10.820' W	931
M149-101	17.08.	20:07	alter course	36° 13.799' N	003° 10.968' W	890
M149-1011	17.08.	22:39	alter course	36° 25.952' N	002° 47.617' W	886
M149-101	17.08.	22:46	alter course	36° 26.744' N	002° 48.692' W	851
M149-101	18.08.	00:54	alter course	36° 15.870' N	003° 10.988' W	858

M149-101	18.08.	03:23	alter course	36° 27.855' N	002° 50.330' W	753
M149-101	18.08.	03:33	alter course	36° 29.172' N	002° 51.410' W	622
M149-101	18.08.	04:52	profile end	36° 22.064' N	003° 05.791' W	931
M149-106	18.08.	14:03	profile start	36° 16.273' N	003° 02.992' W	849
M149-106	18.08.	14:33	alter course	36° 18.883' N	003° 04.574' W	918
M149-106	18.08.	14:58	alter course	36° 19.877' N	003° 03.068' W	972
M149-106	18.08.	15:30	alter course	36° 17.564' N	003° 01.135' W	933
M149-106	18.08.	15:50	alter course	36° 18.239' N	002° 59.206' W	967
M149-106	18.08.	16:18	alter course	36° 20.685' N	003° 00.548' W	954
M149-106	18.08.	16:42	alter course	36° 21.912' N	002° 58.630' W	917
M149-106	18.08.	17:09	alter course	36° 19.771' N	002° 56.970' W	1072
M149-106	18.08.	17:31	alter course	36° 20.601' N	002° 54.640' W	1074
M149-106	18.08.	18:03	alter course	36° 23.479' N	002° 55.842' W	879
M149-106	18.08.	18:30	alter course	36° 24.706' N	002° 53.432' W	853
M149-106	18.08.	19:07	alter course	36° 22.566' N	002° 51.403' W	1042
M149-106	18.08.	19:25	alter course	36° 23.662' N	002° 49.690' W	1011
M149-106	18.08.	19:49	alter course	36° 25.861' N	002° 50.860' W	861
M149-106	18.08.	20:01	alter course	36° 26.490' N	002° 49.670' W	849
M149-106	18.08.	20:31	alter course	36° 24.312' N	002° 47.667' W	665
M149-106	18.08.	20:50	alter course	36° 23.892' N	002° 45.277' W	1055
M149-106	18.08.	21:14	alter course	36° 21.891' N	002° 43.605' W	1187
M149-106	19.08.	00:49	alter course	36° 03.771' N	003° 21.130' W	1154
M149-106	19.08.	02:31	alter course	35° 48.596' N	003° 30.903' W	1261
M149-106	19.08.	02:42	alter course	35° 49.166' N	003° 32.463' W	1410
M149-106	19.08.	04:31	alter course	36° 04.389' N	003° 23.118' W	989
M149-106	19.08.	05:46	profile end	36° 12.096' N	003° 11.685' W	916
M149-108	19.08.	21:13	profile start	36° 09.431' N	003° 12.648' W	905
M149-108	19.08.	22:13	alter course	36° 04.144' N	003° 23.511' W	1020
M149-108	19.08.	22:39	alter course	36° 00.485' N	003° 25.919' W	1173
M149-108	19.08.	22:49	alter course	36° 00.886' N	003° 27.404' W	1062
M149-108	19.08.	23:22	in the water	36° 05.216' N	003° 24.859' W	915
M149-108	20.08.	00:44	alter course	36° 12.375' N	003° 10.715' W	898
M149-108	20.08.	00:53	alter course	36° 13.598' N	003° 11.294' W	942
M149-108	20.08.	02:16	alter course	36° 06.712' N	003° 25.768' W	844
M149-108	20.08.	02:24	alter course	36° 07.726' N	003° 26.455' W	827
M149-108	20.08.	03:58	profile end	36° 16.321' N	003° 10.255' W	870
M149-110	20.08.	21:31	profile start	36° 00.921' N	003° 27.691' W	1054
M149-110	21.08.	00:57	alter course	35° 30.028' N	003° 47.082' W	1395
M149-110	21.08.	01:11	alter course	35° 29.855' N	003° 45.396' W	994
M149-110	21.08.	03:34	alter course	35° 49.381' N	003° 33.335' W	1443
M149-110	21.08.	03:42	alter course	35° 48.782' N	003° 31.665' W	1367
M149-110	21.08.	05:44	alter course	35° 30.426' N	003° 43.084' W	536
M149-110	21.08.	05:55	alter course	35° 30.117' N	003° 41.492' W	718
M149-110	21.08.	06:28	alter course	35° 35.096' N	003° 38.732' W	643
M149-110	21.08.	7:07	profile end	35° 38.566' N	003° 45.041' W	910

M149-115	21.08.	12:50	profile start	35° 29.866' N	003° 44.383' W	510
M149-115	21.08.	14:16	alter course	35° 42.346' N	003° 36.401' W	678
M149-115	21.08.	14:40	alter course	35° 42.358' N	003° 40.986' W	1078
M149-115	21.08.	15:17	alter course	35° 36.782' N	003° 44.341' W	723
M149-115	21.08.	15:27	alter course	35° 35.375' N	003° 43.698' W	596
M149-115	21.08.	16:02	alter course	35° 29.890' N	003° 46.221' W	434
M149-115	21.08.	16:07	alter course	35° 29.864' N	003° 47.234' W	324
M149-115	21.08.	16:54	alter course	35° 36.207' N	003° 44.576' W	731
M149-115	21.08.	16:58	alter course	35° 36.708' N	003° 45.448' W	768
M149-115	21.08.	17:46	alter course	35° 29.356' N	003° 49.672' W	152
M149-115	21.08.	18:22	alter course	35° 30.027' N	003° 56.736' W	363
M149-115	21.08.	19:00	alter course	35° 30.749' N	004° 04.297' W	324
M149-115	21.08.	20:27	alter course	35° 25.082' N	004° 19.988' W	105
M149-115	21.08.	22:04	alter course	35° 39.878' N	004° 28.682' W	1377
M149-115	21.08.	22:16	alter course	35° 39.436' N	004° 30.128' W	1329
M149-115	21.08.	23:59	alter course	35° 24.709' N	004° 21.591' W	105
M149-115	22.08.	00:07	alter course	35° 23.969' N	004° 22.600' W	104
M149-115	22.08.	01:45	alter course	35° 38.191' N	004° 31.418' W	1116
M149-115	22.08.	01:52	alter course	35° 38.003' N	004° 32.434' W	1021
M149-115	22.08.	03:30	alter course	35° 23.821' N	004° 24.226' W	98
M149-115	22.08.	03:37	alter course	35° 23.305' N	004° 24.958' W	97
M149-115	22.08.	05:14	station end	35° 37.406' N	004° 34.181' W	1007
M149-119	22.08.	20:31	profile start	35° 41.970' N	003° 41.672' W	1065
M149-119	22.08.	21:07	alter course	35° 47.418' N	003° 38.656' W	1399
M149-119	22.08.	21:16	alter course	35° 48.097' N	003° 40.049' W	1412
M149-119	22.08.	23:24	alter course	35° 28.813' N	003° 49.978' W	217
M149-119	23.08.	02:13	alter course	35° 32.252' N	004° 23.483' W	802
M149-119	23.08.	02:21	alter course	35° 33.409' N	004° 23.933' W	991
M149-119	23.08.	8 05:04	alter course	35° 30.049' N	003° 51.118' W	116
M149-119	23.08.	05:11	alter course	35° 30.862' N	003° 50.444' W	112
M149-119	23.08.	06:46	alter course	35° 33.344' N	004° 09.744' W	965
M149-119	23.08.	08:29	alter course	35° 32.579' N	003° 49.784' W	166
M149-119	23.08.	10:00	profile end	35° 46.872' N	003° 42.497' W	1429

8 Data and Sample Storage and Availability

The collected sediment cores are stored at the MARUM and sampling of these cores can be requested via the MARUM GeoB Core Repository. A complete list of recovered cores, including the visual core description, is attached to this report. Shipboard collected pore water and head space samples remain with the Geotechnics group at MARUM (contact person: A. Kopf, akopf@marum.de). CTD samples are stored at the University of Salamanca (contact: A. Gonzales Lanchas). All metadata acquired during cruise M149 will be made publicly available in February 2020 through the data publisher for earth and environmental science "Pangaea" (https://www.pangaea.de) except for the hydroacoustic and CPT data (contact person: A. Kopf, akopf@marum.de).

9 Acknowledgements

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11 Abbreviations

CC	Core catcher
CPT	Cone Penetration Testing
cmbsf	centimeter below seafloor
CTD	Conductivity-Temperature-Depth
HF	Heat flow probe
MeBo	Meeresbodenbohrgerät
MTD	Mass transport deposit
MV	Mud volcano
n	number of data/samples
ROV	Remotely operated vehicle
SGR	Spectral gamma ray
S_u	Undrained shear strength

12 Appendix

Legend for Core Description

Lithology

Terrigenous

- silt
- sand
- silt-bearing mud
- silty clay
- silty mud

Carbonate-dominated sediments

- foraminifer ooze
- nannofossil ooze
- nannofossil foram ooze/ foram nannofossil ooze
- nannofossil-bearing foram ooze/ foram-bearing nannofossil ooze
- foram-bearing mud

Additional major constituents

- foraminifer 50%
- nannofossil 50%
- foram nannofossil 50%

Mud breccia

- mud breccia

Structures

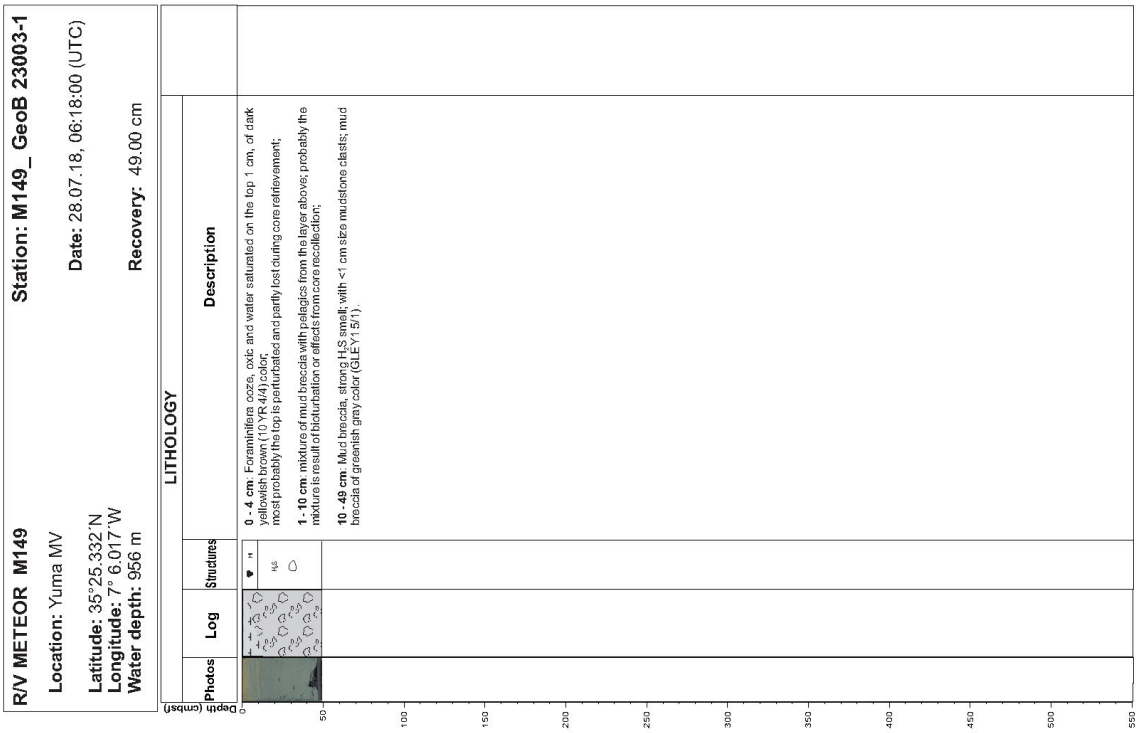
- weakly bedded
- bedded/laminated
- mm / cm / dm — dimension of bedding
- scoured bedding
- WW — wavy bedding
- graded bedding
- erosive contact
- ondulated contact
- fining-upwards
- bedded/laminated
- cross-bedded
- cc — carbonate concretion
- cl — clasts
- gh — gas hydrates
- H_2S — H_2S smell
- py — pyrite
- ? — bioturbated (<30% of sediment)
- ?? — bioturbated (<30-60% of sediment)
- ??? — bioturbated (>60% of sediment)
- single prominent burrow
- turbidite
- ?turbidite — possible turbidite
- erosive fill
- sand layer
- discontinuity
- shear boundary
- mud clast
- interal shear deformation
- slump

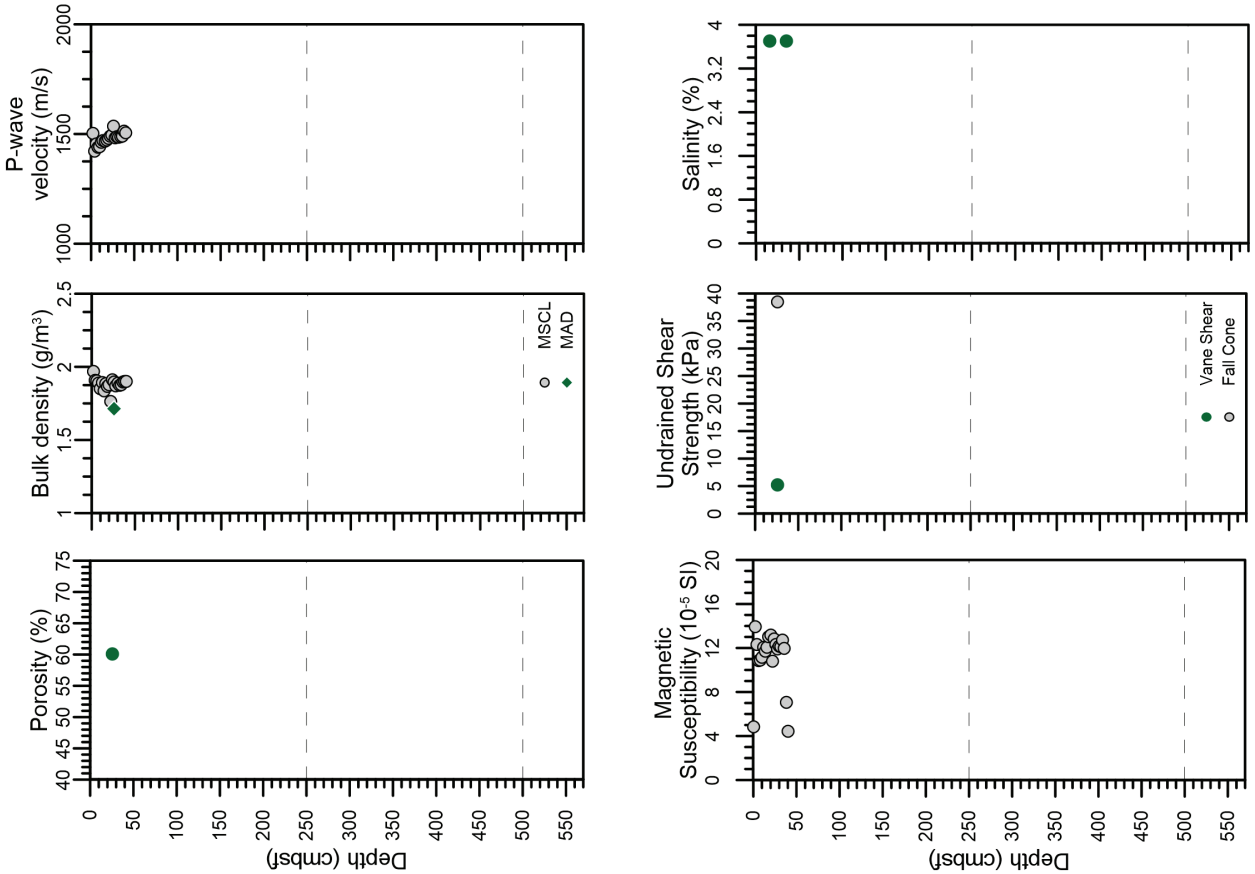
Fossils

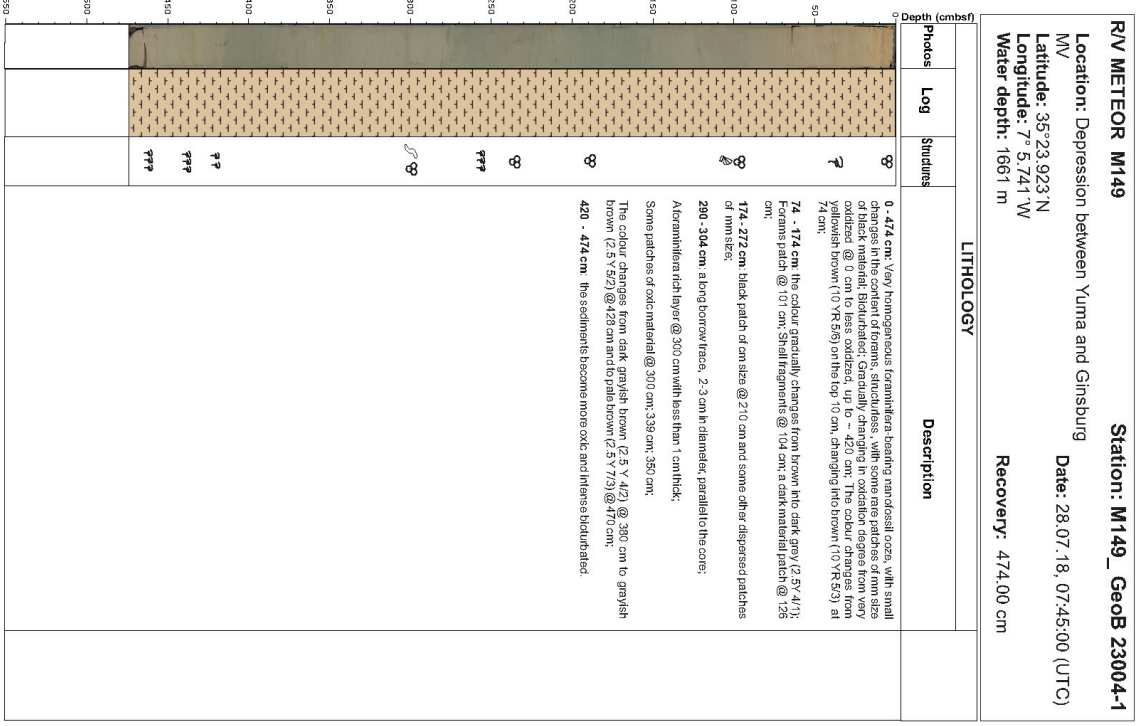
- foraminifera
- shells
- shell fragments
- megafossils
- corals
- gastropod

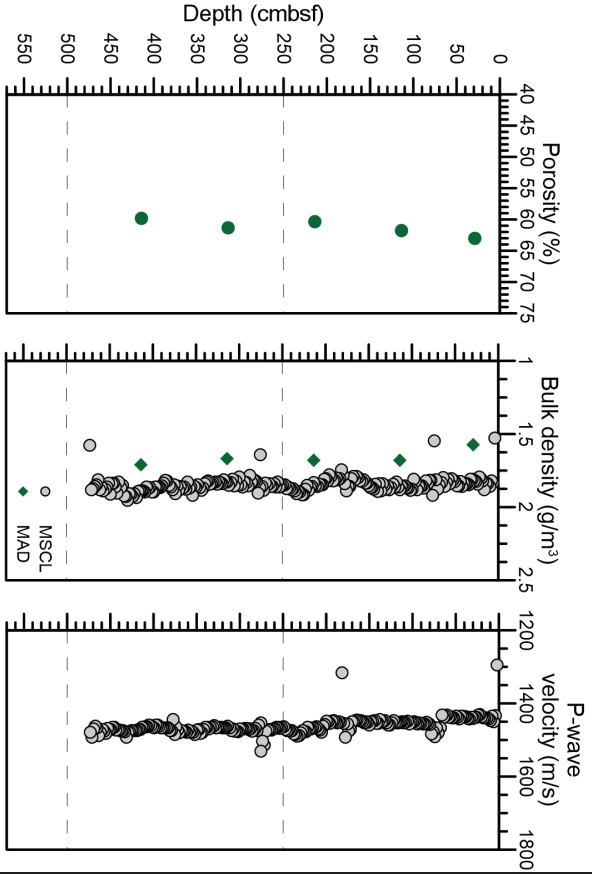
Interpretative Comments

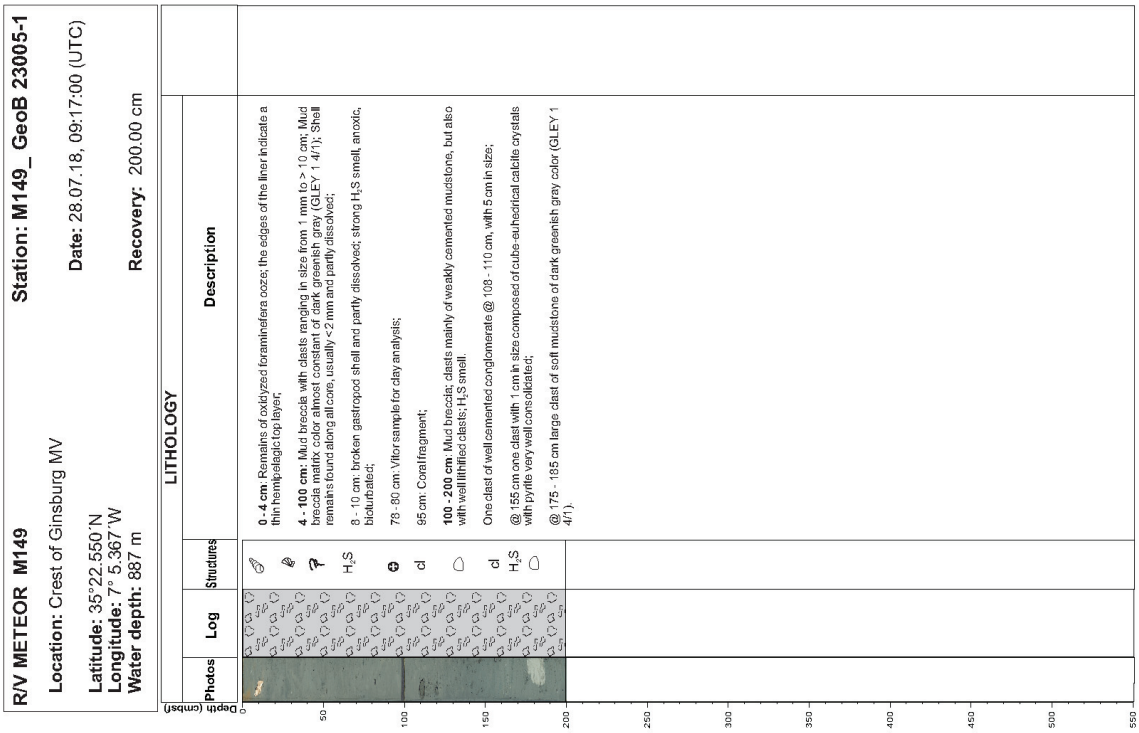
- H — hemipelagite
- D — debrite
- T — turbidite
- slump deposit

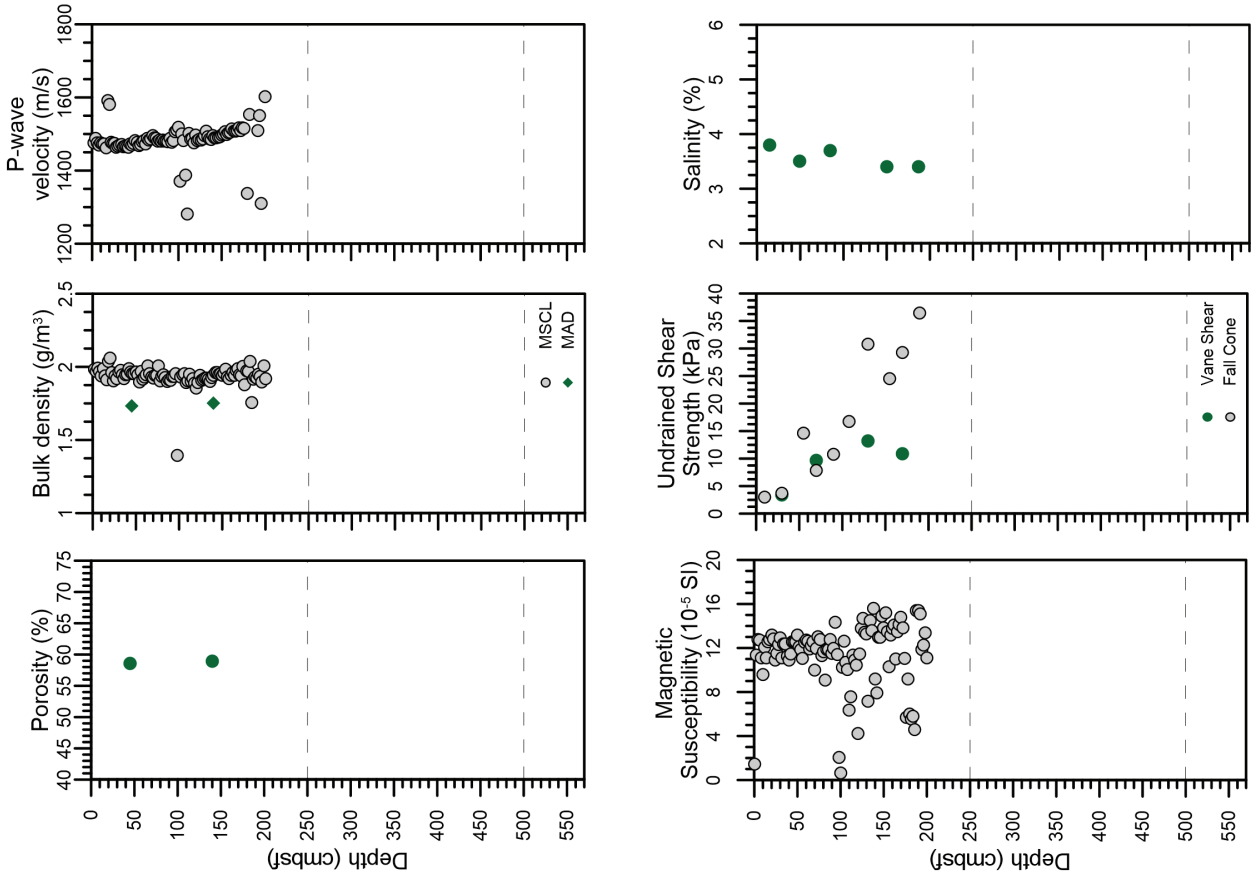

R/V METEOR M149
Station: M149_ GeoB 23003-1
Location: Yuma MV
Date: 28.07.18, 06:18:00 (UTC)
Latitude: 35°25.332'N
Longitude: 7° 6.017'W
Water depth: 956 m
Recovery: 49.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 4 cm: Foraminifera ooze, oxic and water saturated on the top 1 cm, of dark yellowish brown (10 YR 4/4) color; most probably the top is perturbated and partly lost during core retrievement;
1 - 10 cm: mixture of mud breccia with pelagics from the layer above; probably the mixture is result of bioturbation or effects from core recollection;
10 - 49 cm: Mud breccia, strong H2S smell; with <1 cm size mudstone clasts; mud breccia of greenish grey color (GLEY1 5/1).


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23004-1
Location: Depression between Yuma and Ginsburg MV
Latitude: 35°23.923'N
Longitude: 7° 5.741'W
Water depth: 1661 m
Date: 28.07.18, 07:45:00 (UTC)
Recovery: 474.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 474 cm: Very homogeneous foraminifera- bearing nannofossil ooze, with small changes in the content of forams, structurless, with some rare patches of mm size of black material; Bioturbated; Gradually changing in oxication degree from very oxidized @ 0 cm to less oxidized, up to ~ 420 cm; The colour changes from yellowish brown (10 YR 5/6) on the top 10 cm, changing into brown (10 YR 5/3) at 74 cm;
74 - 174 cm: the colour gradually changes from brown into dark grey (2.5Y 4/1); Forams patch @ 101 cm; Shell fragments @ 104 cm; a dark material patch @ 126 cm;
174 - 272 cm: black patch of cm size @ 210 cm and some other dispersed patches of mm size;
290 - 304 cm: a long burrow trace, 2-3 cm in diameter, parallel to the core;
Aforaminifera rich layer @ 300 cm with less than 1 cm thick;
Some patches of oxic material @ 300 cm; 339 cm; 350 cm;
The colour changes from dark grayish brown (2.5 Y 4/2) @ 380 cm to grayish brown (2.5 Y 5/2) @ 428 cm and to pale brown (2.5 Y 7/3) @ 470 cm;
420 - 474 cm: the sediments become more oxic and intense bioturbated.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_ GeoB 23005-1
Location: Crest of Ginsburg MV
Date: 28.07.18, 09:17:00 (UTC)
Latitude: 35°22.550'N
Longitude: 7° 5.367'W
Water depth: 887 m
Recovery: 200.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 4 cm: Remains of oxidyzed foraminifera ooze; the edges of the liner indicate a thin hemipelagic top layer;
4 - 100 cm: Mud breccia with clasts ranging in size from 1 mm to > 10 cm; Mud breccia matrix color almost constant of dark greenish gray (GLEY 1 4/1); Shell remains found along all core, usually <2 mm and partly dissolved;
8 - 10 cm: broken gastropod shell and partly dissolved; strong H2S smell, anoxic; bioturbated;
79 - 80 cm: Vitor sample for clay analysis;
95 cm: Coral fragment;
100 - 200 cm: Mud breccia; clasts mainly of weakly cemented mudstone, but also with well lithified clasts; H2S smell.
One clast of well cemented conglomerate @ 108 - 110 cm, with 5 cm in size;
@ 155 cm one clast with 1 cm in size composed of cube-euhedrical calcite crystals with pyrite very well consolidated;
@ 175 - 185 cm large clast of soft mudstone of dark greenish gray color (GLEY 1 4/1)


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Depth (cmbsf)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23006-1**

Location: Southern flank of Ginsburg

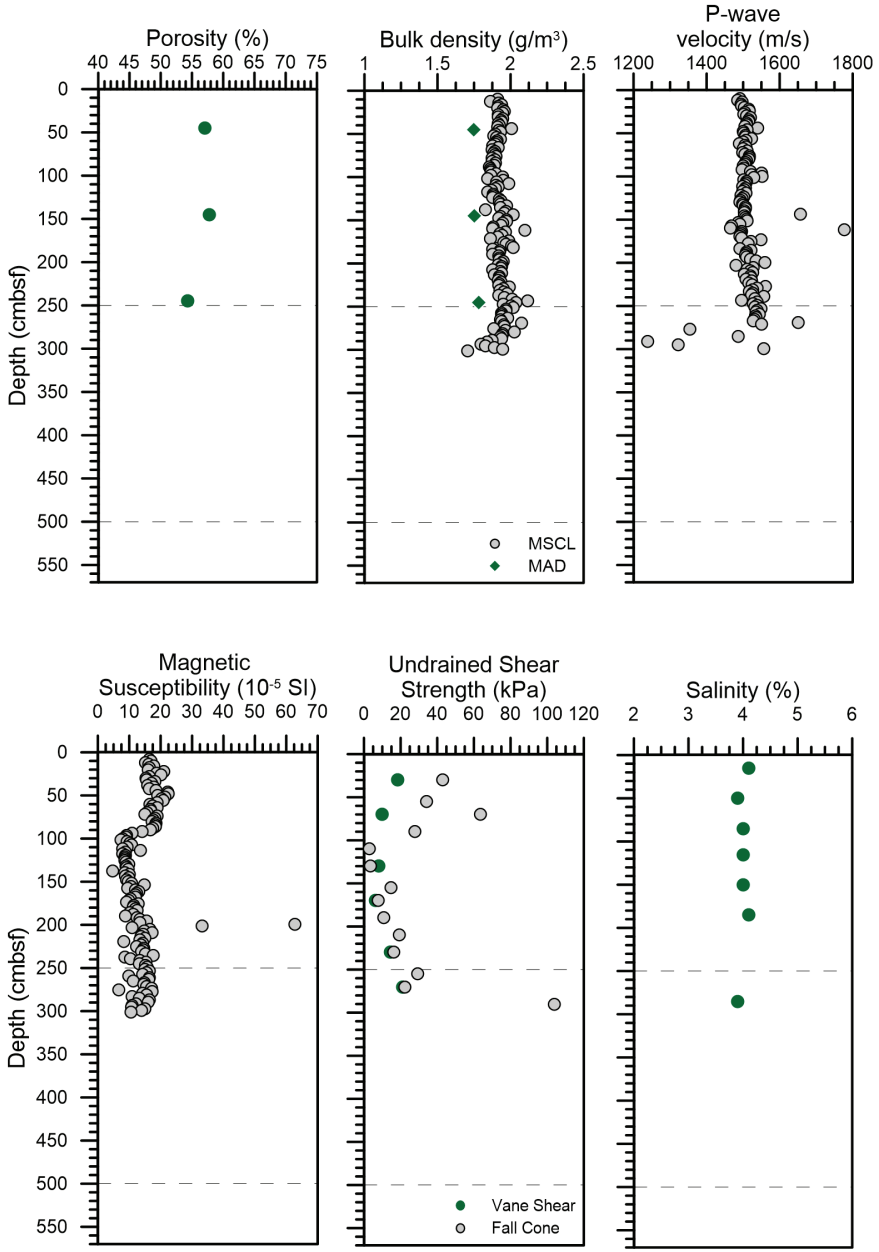
Latitude: 35°22.027´N
Longitude: 7° 5.338´W
Water depth: 965 m

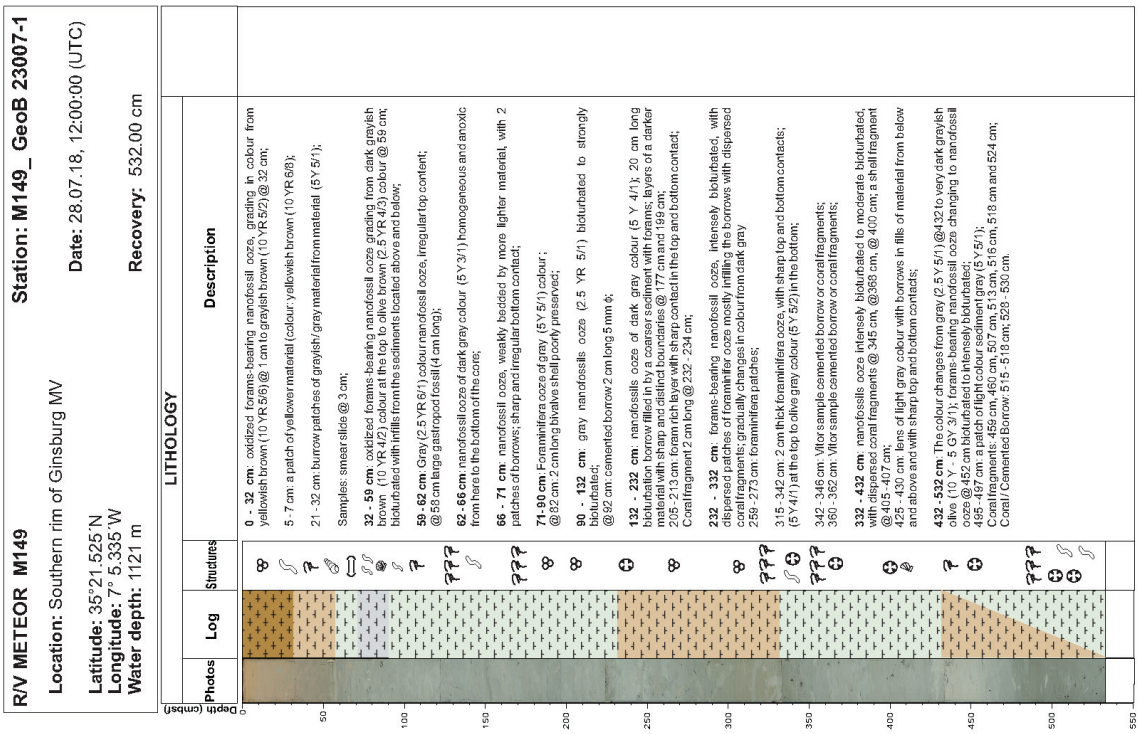
Date: 28.07.18, 10:30:00 (UTC)

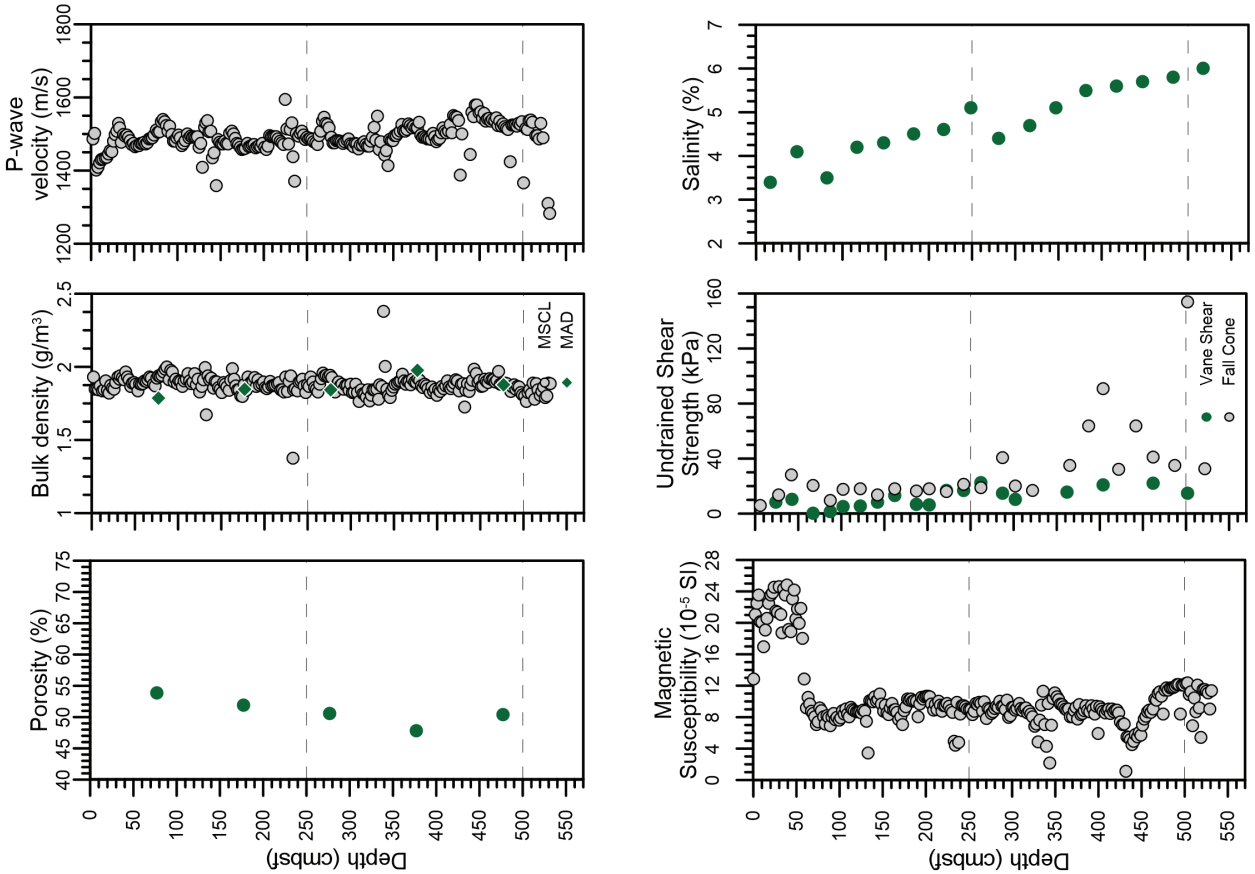
Recovery: 300.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0 - 300			cl, H_2S	**0 - 16 cm**: oxidized, homogeneous and water saturated foraminifera ooze of dark yellowish brown (10 YR 4/4); 15 cm: coral fragment of 4 - 5 cm size; **15 - 88 cm**: mixture of sandy foraminifera ooze of brown colour (10 YR 5/3) with mud breccia; grading in oxidation from very oxidized @ 15 cm to partially reduced @ ~ 90 cm; with dark grayish brown colour (2.5 Y 4/2) strong bioturbation, mixing the hemipelagic sediments with the mud breccia; 32 - 48 cm: coral fragments; **88 - 105 cm**: sandy foraminifera ooze dark gray colour (5Y 4/1) with 1 - 2 mm size dispersed clast fragments, moderate bioturbation, gradually transition to the mud breccia sediments of bellow; **105 - 140 cm**: mixture of mud breccia and sandy foraminifera ooze due to strong bioturbation; **140 - 200 - 300 cm**: Mud breccia, matrix of sandy mud material with dispersed clasts ranging in size from 1 mm up to 3 - 4 cm; The clasts are of mudstone, weakly consolidated of variable colours; **200 - 300 cm**: Mud breccia, anoxic, dark greenish gray (GLEY 1 4/1) colour; Clasts ranging in colour from whitish greenish gray colour (GLEY 1 5/1) to greenish gray colour (GLEY 5/1); H_2S smell at the bottom of the section of this core.



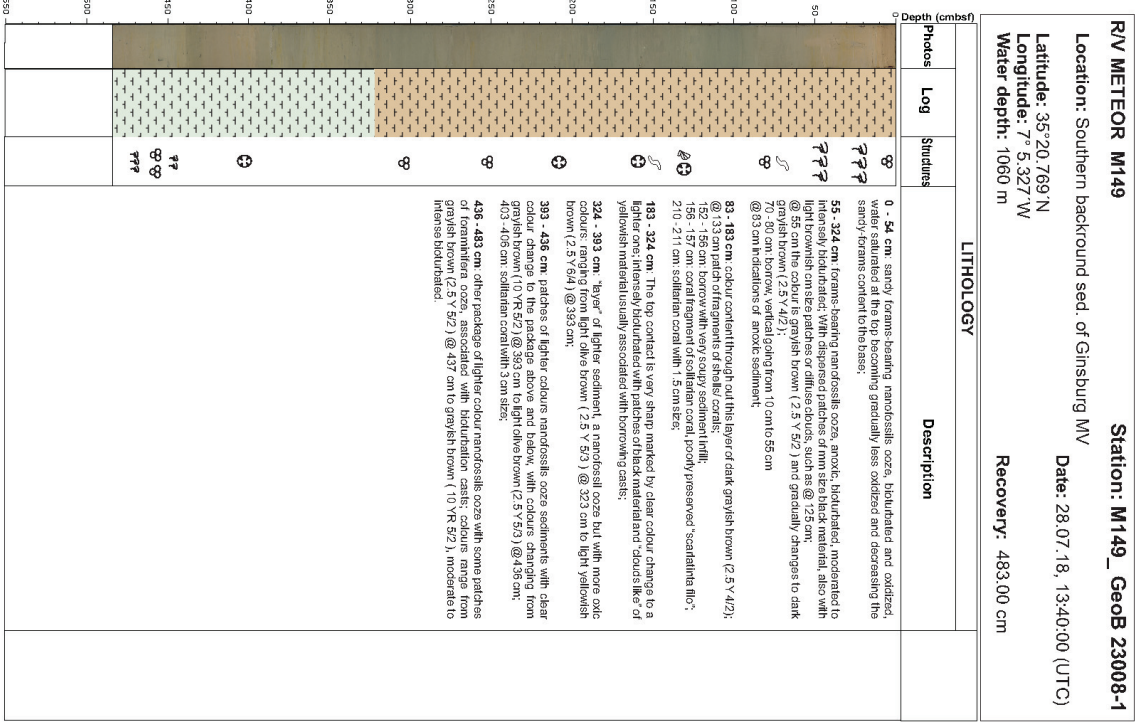

R/V METEOR M149
Station: M149_ GeoB 23007-1
Location: Southern rim of Ginsburg MV
Date: 28.07.18, 12:00:00 (UTC)
Latitude: 35°21.525'N
Longitude: 7° 5.335'W
Water depth: 1121 m
Recovery: 532.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 32 cm: oxidized foram-bearing nannofossil ooze, grading in colour from yellowish brown (10 YR 5/6) @ 1 cm to grayish brown (10 YR 5/2) @ 32 cm;
5 - 7 cm: a patch of yellower material (colour: yellowish brown (10 YR 5/8));
21 - 32 cm: burrow patches of grayish/ gray material from material (5 Y 5/1);
Samples: smear slide @ 3 cm;
32 - 59 cm: oxidized foram- bearing nannofossil ooze grading from dark grayish brown (10 YR 4/2) colour at the top to olive brown (2.5 YR 4/3) colour @ 59 cm; bioturbated with infills from the sediments located above and below;
59 - 62 cm: Gray (2.5 YR 6/1) colour nannofossil ooze, irregular top content; @ 58 cm large gastropod fossil (4 cm long);
62 - 66 cm: nannofossil ooze of dark gray colour (5 Y 3/1) homogeneous and anoxic from here to the bottom of the core;
66 - 71 cm: nannofossil ooze, weakly bedded by more lighter material, with 2 patches of borrows; sharp and irregular bottom contact;
71-90 cm: Foraminifera ooze of grey, (5Y 5/1) colour ; @ 82 cm: 2 cm long bivalve shell poorly preserved;
90 - 132 cm: gray nannofossils ooze (2.5 YR 5/1) bioturbated to strongly bioturbated; @ 92 cm: cemented borrow 2 cm long 5 mm ϕ;
132 - 232 cm: nannofossils ooze of dark gray colour (5 Y 4/1); 20 cm long bioturbation borrow filled in by a coarser sediment with forams; layers of a darker material with sharp and distinct boundaries @ 177 cm and 199 cm; 205 - 213 cm: foram rich layer with sharp contact in the top and bottom contact; Coral fragment 2 cm long @ 232 - 234 cm;
232 - 332 cm: forams-bearing nannofossil ooze, intensely bioturbated, with dispersed patches of foraminifer ooze, mostly infilling the borrows with dispersed coral fragments; gradually changes in colour from dark gray
259 - 273 cm: foraminifera patches;
315 - 342 cm: 2 cm thick foraminifera ooze, with sharp top and bottom contacts; (5 Y 4/1) at the top to olive gray colour (5 Y 5/2) in the bottom;
342 - 346 cm: Vitor sample cemented borrow or coral fragments;
360 - 362 cm: Vitor sample cemented borrow or coral fragments;
332 - 432 cm: nannofossils ooze intensely bioturbated to moderate bioturbated; with dispersed coral fragments @ 345 cm, @ 393 cm, @ 400 cm; a shell fragment @ 405 - 407 cm;
425 - 430 cm: lens of light gray colour with borrows in fills of material from below and above and with sharp top and bottom contacts;
432 - 532 cm: The colour changes from gray (2.5 Y 5/1) @ 432 to very dark grayish olive (10 Y 3/1); forams-bearing nannofossil ooze changing to nannofossil ooze (10 Y 5/2) colour; intensely bioturbated;
495 - 497 cm: a patch of light colour material (5 Y 5/1);
Coral fragments: 456 cm, 460 cm, 507 cm, 513 cm, 516 cm, 518 cm and 524 cm;
Coral / Cemented Borrow: 515 - 518 cm; 528 - 530 cm.

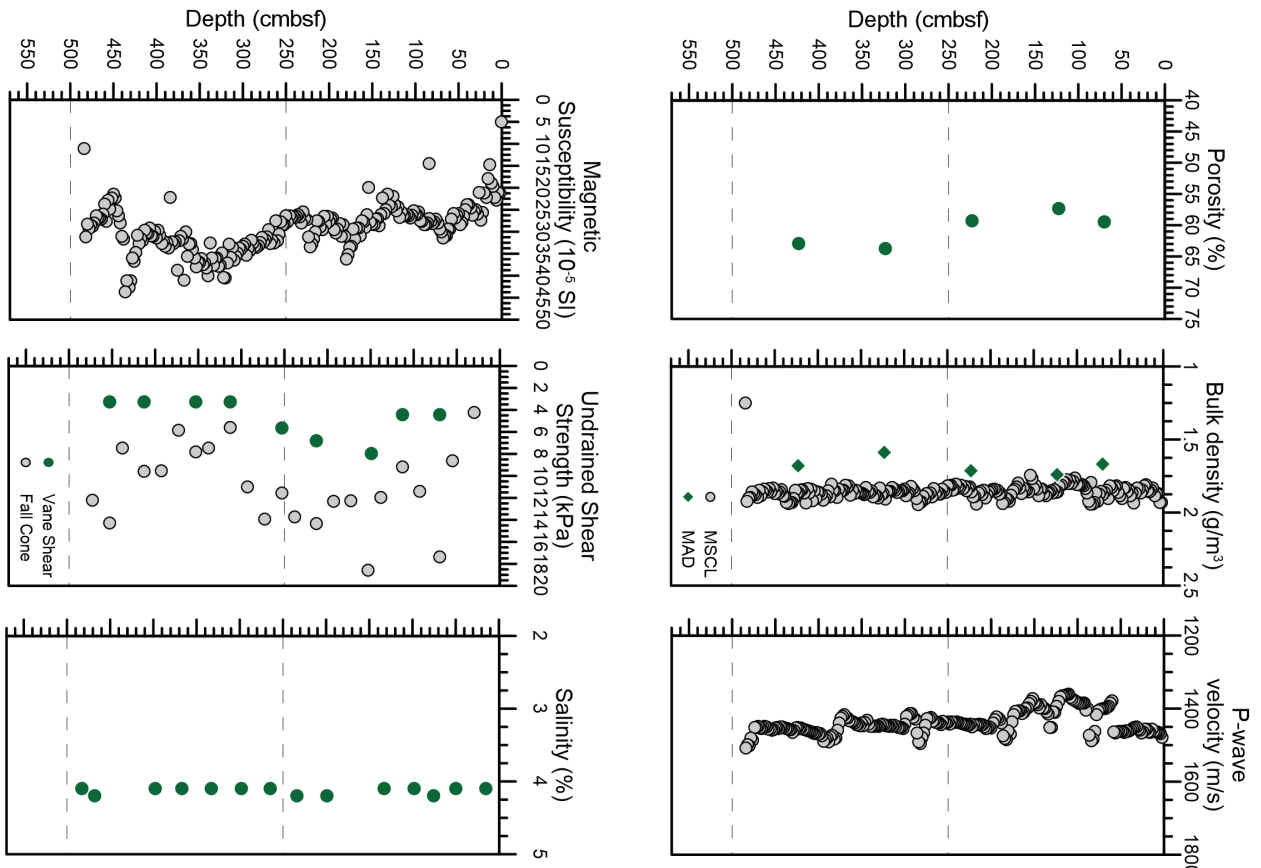

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Depth (cmbsf)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

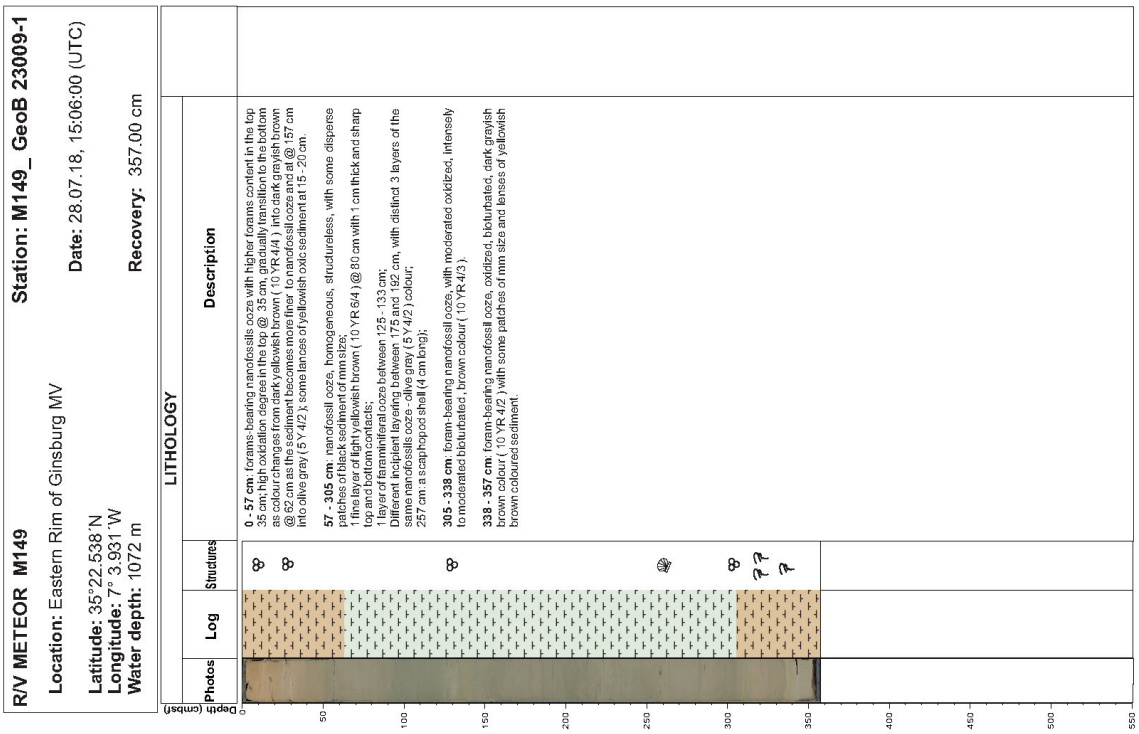
R/V METEOR M149 **Station: M149_ GeoB 23008-1**

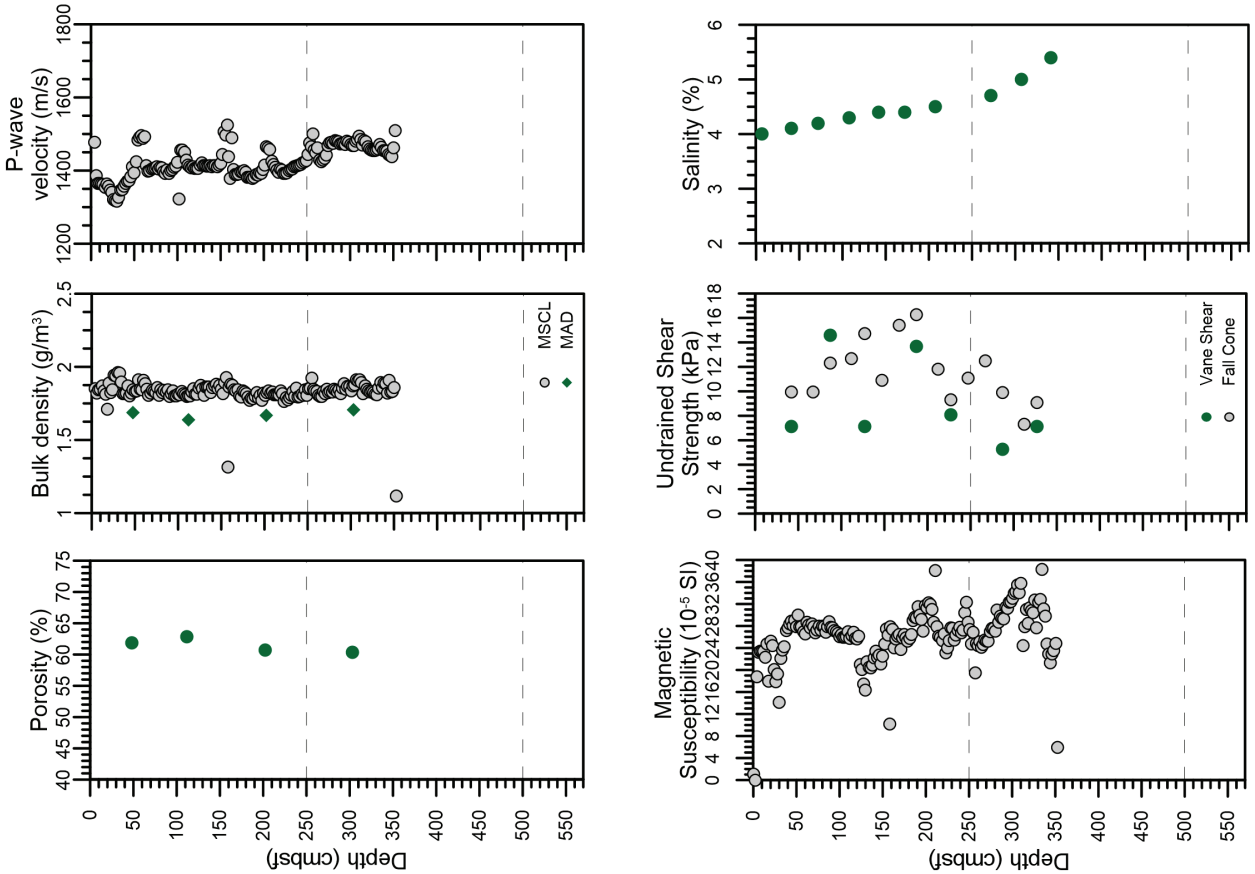
Location: Southern backround sed. of Ginsburg MV **Date:** 28.07.18, 13:40:00 (UTC)

Latitude: 35°20.769'N
Longitude: 7° 5.327'W
Water depth: 1060 m **Recovery:** 483.00 cm






R/V METEOR M149
Station: M149_ GeoB 23009-1
Location: Eastern Rim of Ginsburg MV
Date: 28.07.18, 15:06:00 (UTC)
Latitude: 35°22.538'N
Longitude: 7° 3.931'W
Water depth: 1072 m
Recovery: 357.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 57 cm: foramis-bearing nanofossils ooze with higher forams content in the top 35 cm, high oxidation degree in the top @ 35 cm, gradually transition to the bottom as colour changes from dark yellowish brown (10 YR 4/4) into dark grayish brown @ 52 cm as the sediment becomes richer in nanofossil ooze and @ 57 cm into olive gray (5 Y 4/2); some lenses of yellowish oxic sediment at 15 - 20 cm;
57 - 305 cm: nanofossil ooze, homogeneous, structureless, with some disperse patches of black sediment of mm size;
1 fine layer of light yellowish brown (10 YR 6/4) @ 80 cm with 1 cm thick and sharp top and bottom contacts;
1 layer of foraminiferal ooze between 125 - 133 cm;
Different incipient layering between 175 and 192 cm, with distinct 3 layers of the same nanofossils ooze - olive gray (5 Y 4/2) colour;
257 cm: a scaphopod shell (4 cm long);
305 - 338 cm: foram-bearing nanofossil ooze, with moderated oxidized, intensely to moderated bioturbated , brown colour (10 YR 4/3);
338 - 357 cm: foram-bearing nanofossil ooze, oxidized, bioturbated, dark grayish brown colour (10 YR 4/2) with some patches of mm size and lenses of yellowish brown coloured sediment.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23010-1**

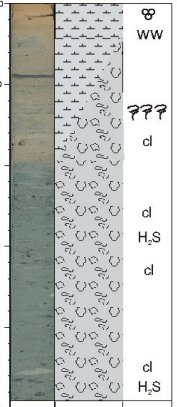
Location: Eastern Flank of Ginsburg MV

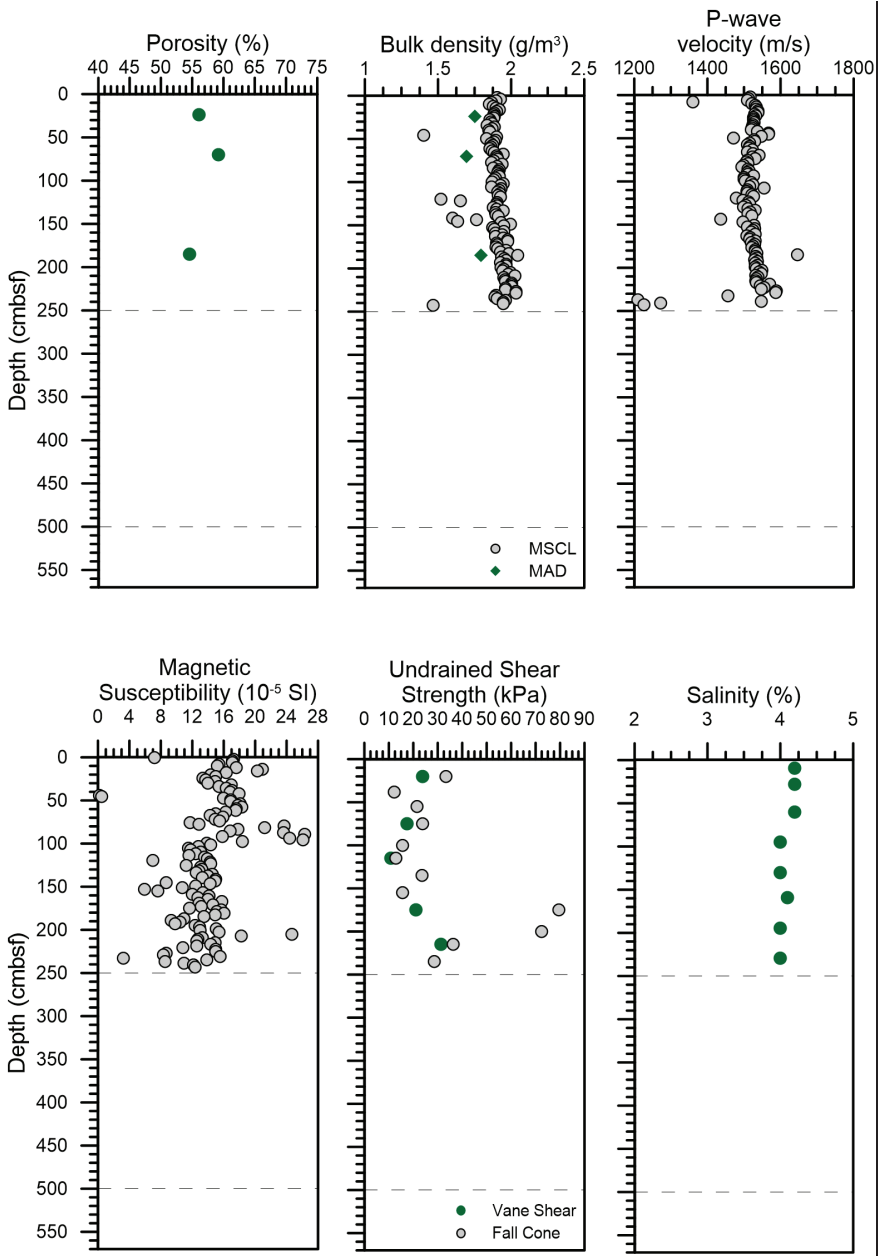
Date: 28.07.18, 16:21:00 (UTC)

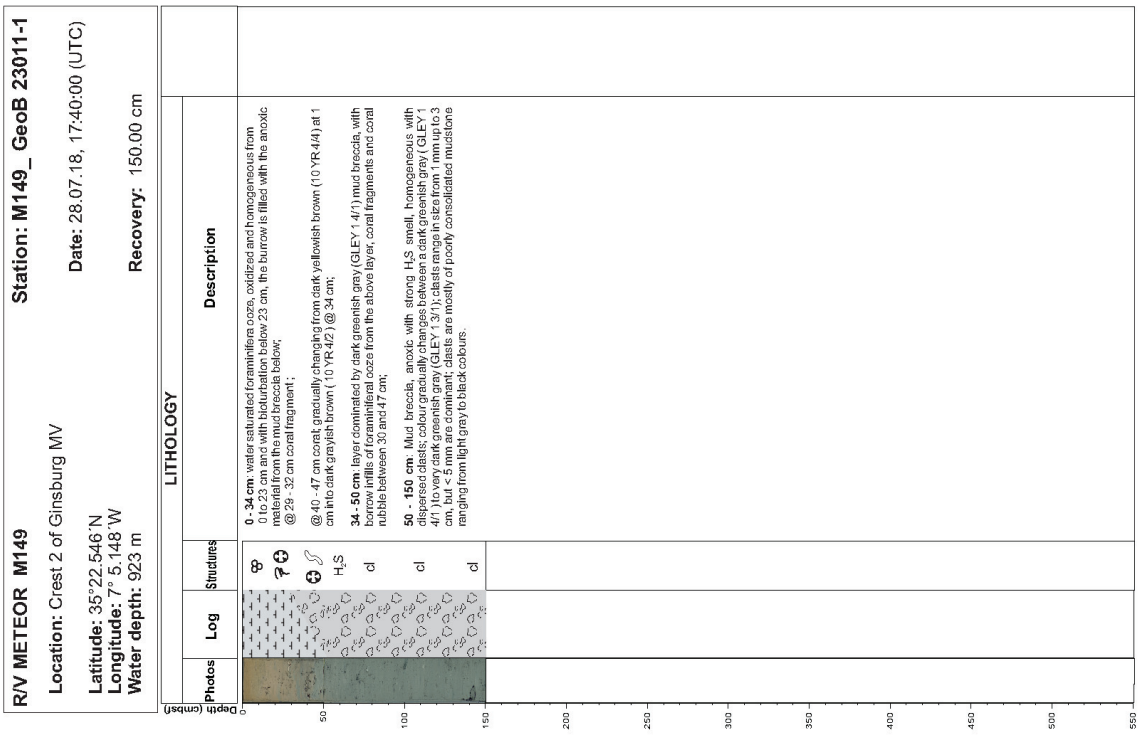
Latitude: 35°22.520´N
Longitude: 7° 4.644´W
Water depth: 977 m

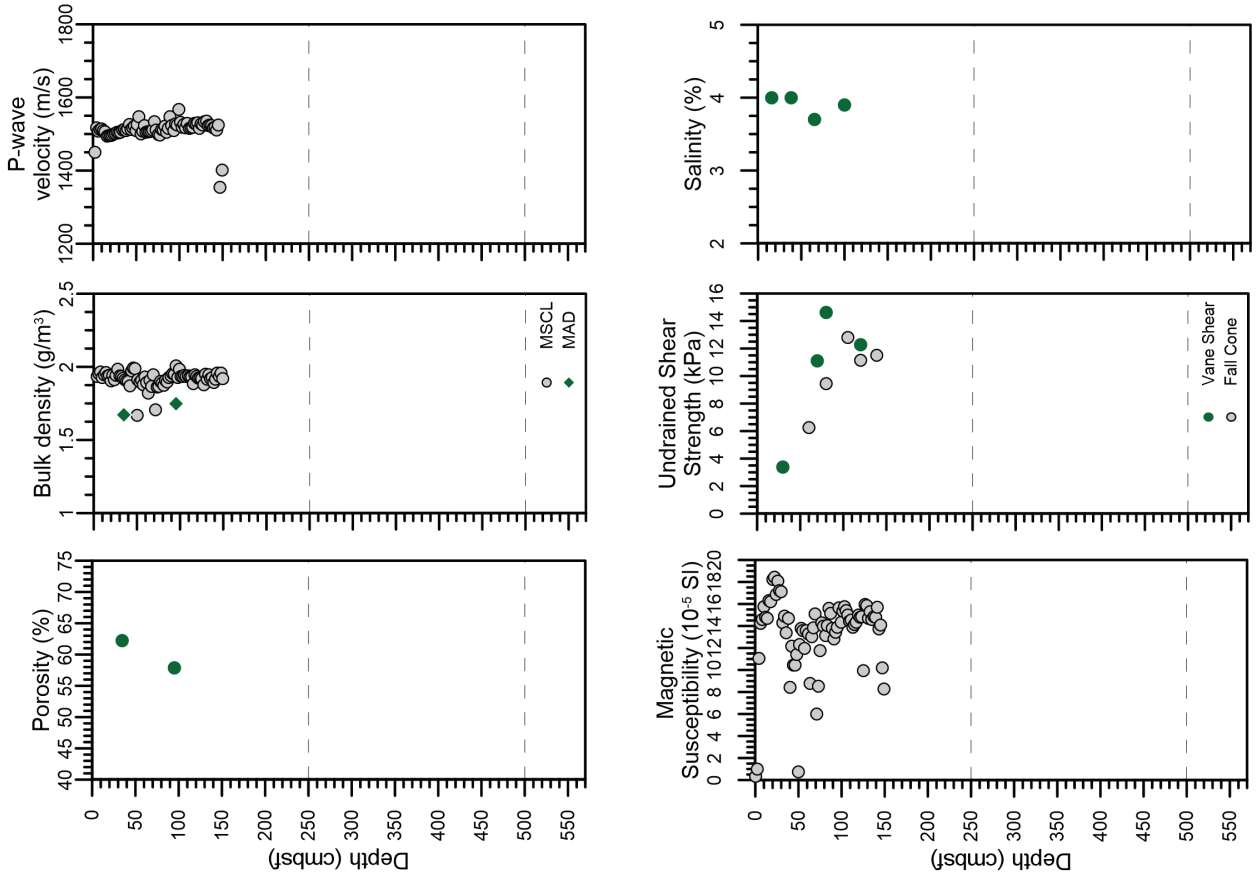
Recovery: 245.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0			WW cl cl H_2S cl cl H_2S	**0 - 23 cm**: Foraminiferal ooze, oxic, water saturated on top becoming less soapy to the base; colour gradually changing from yellowish brown (10 YR 5/4) @ 1 cm to grayish brown (2.5 Y 5/2); The bottom contact to the layer below is sharp but ondulated, probably due to borrowing effects. **23 - 98 cm**: mixture of mud breccia sediment with foraminiferal ooze where bioturbation is very strong; clasts of various lithologies, dominated by poorly consolidated mudstones, but also with well consolidated siltstones and sandstones; a clast of well consolidated sandstone @ 82 - 87 cm. **98 - 245 cm**: mud breccia, very homogeneous with clasts of variable lithologies, dominated by poorly consolidated mudstone clasts of sizes ranging from 1 mm up to 10 cm; clasts of well consolidated siltstones, sandstones are also found throughout this layer, some of them with submillimetric pyrite crystals; strong H_2S smell. 134 - 135 cm: clast with 1 cm in size of well lithified siltstone with pyrite crystals of < 1 mm size, 225 - 229 cm: a large clast of greenish gray (GLEY 1 5/1) colour with 4 x 10 cm of poorly consolidated mudstone;




R/V METEOR M149
Station: M149_ GeoB 23011-1
Location: Crest 2 of Ginsburg MV
Date: 28.07.18, 17:40:00 (UTC)
Latitude: 35°22.546'N
Longitude: 7° 5.148'W
Water depth: 923 m
Recovery: 150.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 34 cm: water saturated foraminiferal ooze, oxidized and homogeneous from 0 to 23 cm and with bioturbation below 23 cm, the burrow is filled with the anoxic material from the mud breccia below;
@ 29 - 32 cm coral fragment ;
@ 40 - 47 cm coral; gradually changing from dark yellowish brown (10 YR 4/4) at 1 cm into dark grayish brown (10 YR 4/2) @ 34 cm;
34 - 50 cm: layer dominated by dark greenish gray (GLEY 1 4/1) mud breccia, with borrow infills of foraminiferal ooze from the above layer, coral fragments and coral rubble between 30 and 47 cm;
50 - 150 cm: Mud breccia, anoxic with strong H2S smell, homogeneous with dispersed clasts; colour gradually changes between a dark greenish gray (GLEY 1 4/1)to very dark greenish gray (GLEY 1 3/1); clasts range in size from 1 mm up to 3 cm, but < 5 mm are dominant; clasts are mostly of poorly consolidated mudstone ranging from light grey to black colours.
H2S
cl


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23012-1**

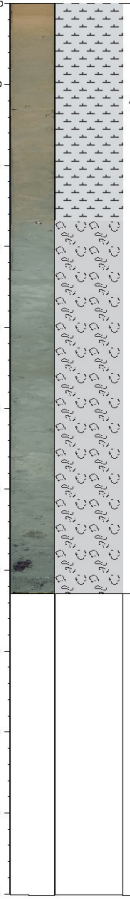
Location: Southern Flank of Yuma MV

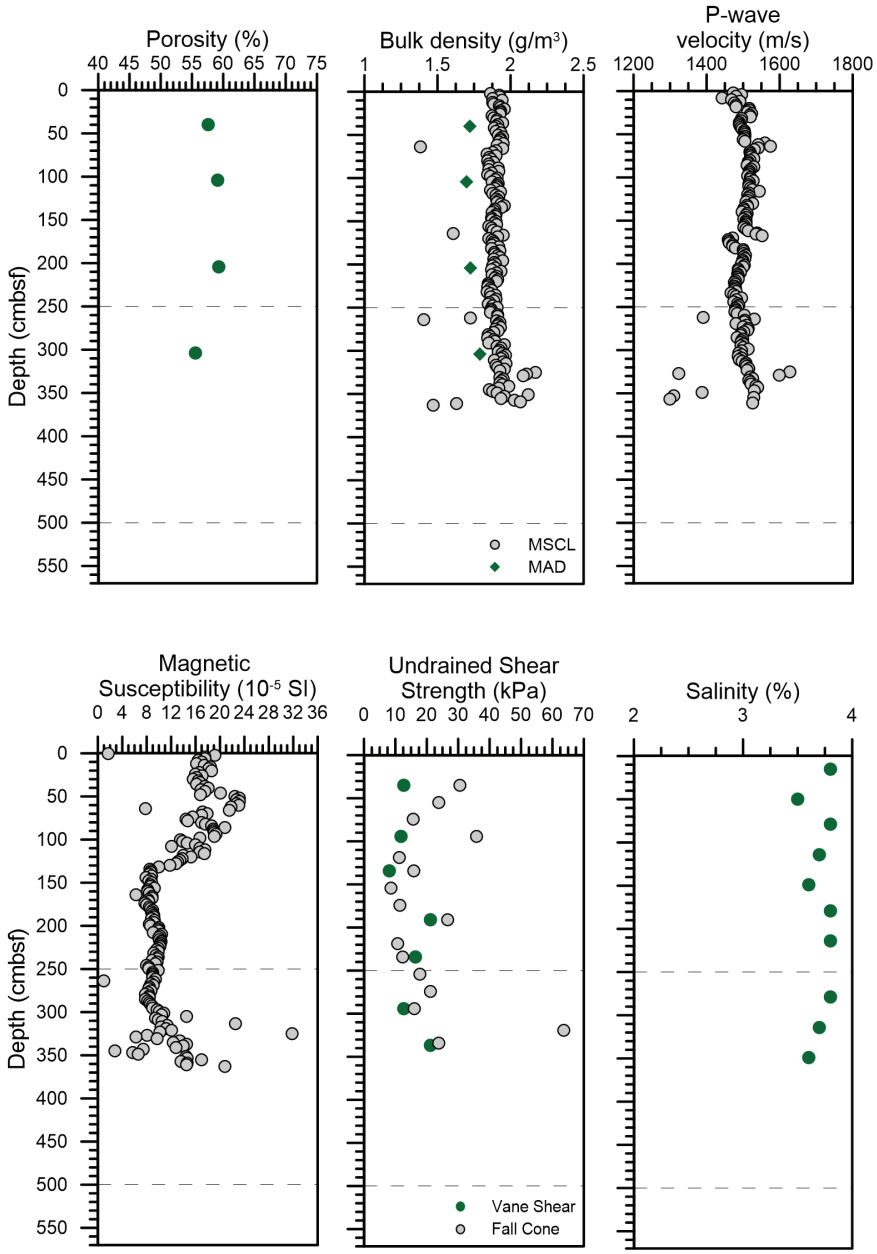
Date: 28.07.18, 19:00:00 (UTC)

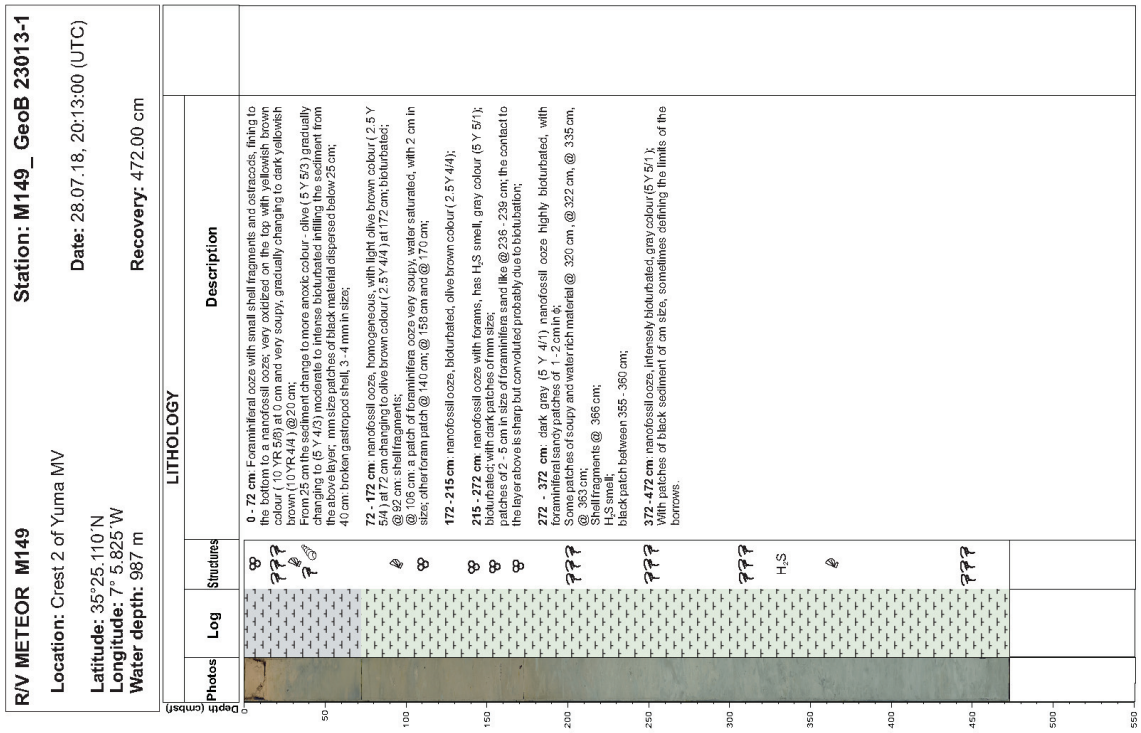
Latitude: 35°24.734´N
Longitude: 7° 5.655´W
Water depth: 996 m

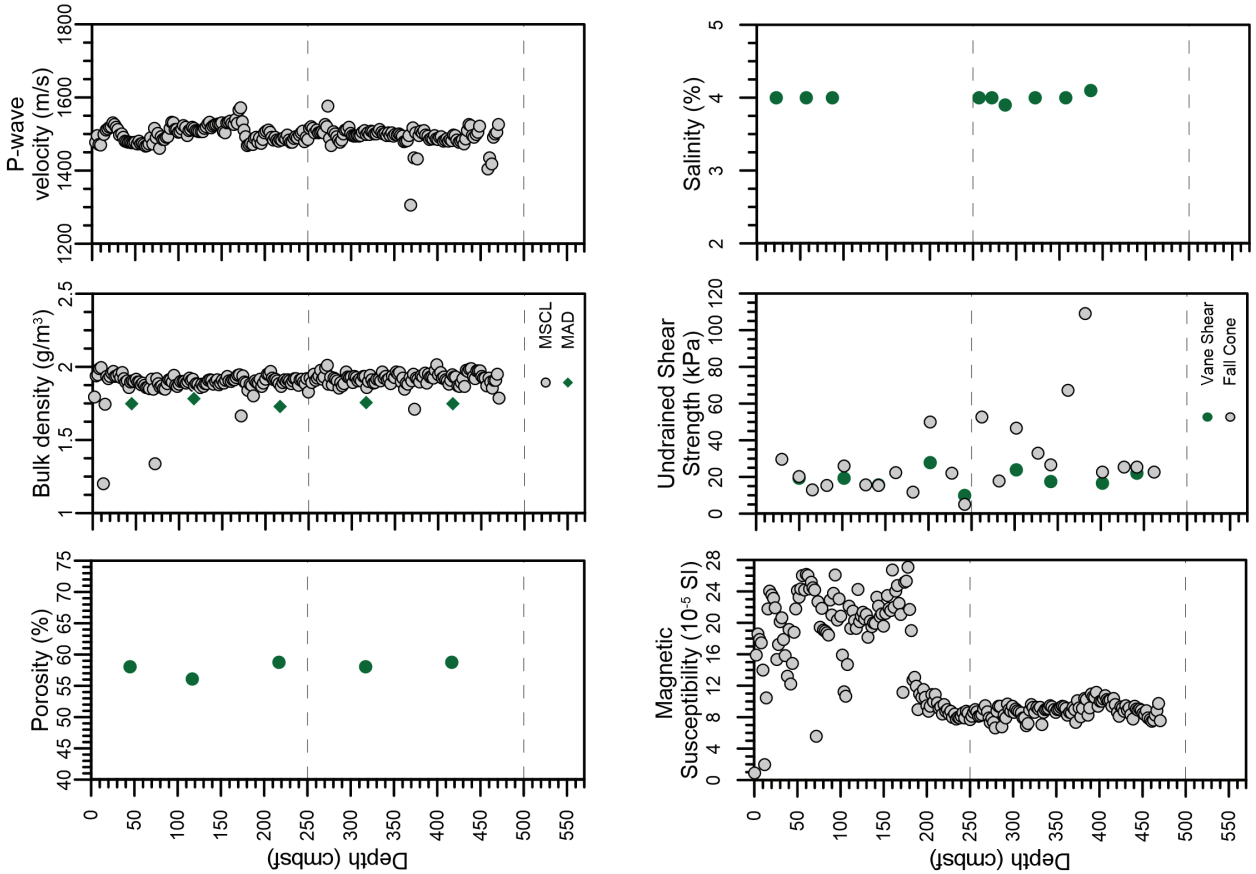
Recovery: 364.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550			cl, H_2S	**0 - 134 cm**: sandy foraminifera ooze, oxidized, water saturated, in the top with the colour yellowish brown colour (10 YR 5/4) gradually changing to dark gray colour (2.5 Y 4/1); moderate to intensely bioturbated, and the bioturbation casts are sometimes infilled by mud breccia material from below; **134 - 364 cm** : Mud breccia, anoxic, with H_2S smell from 134 - 322 cm; only small < 1 cm clasts are found above 322 cm, below 322 cm large clasts are found, some with 7 cm in size; clasts are of poorly lithified mudstones; well lithified silt and sandstones or shales; Solitarian coral (1,5 cm size) @ 134 cm; From 242 cm the mud breccia increases the stiffness/ hardness - can this be an indication of carbonate formation at this depth? Below 310 cm: occurrence of dispersed clasts of white fine and poorly consolidated material (fine gypsum?) 323 - 327 cm: large poorly consolidated mudstone clast; 345 - 350 cm: large shale clast.




R/V METEOR M149
Station: M149_ GeoB 23013-1
Location: Crest 2 of Yuma MV
Date: 28.07.18, 20:13:00 (UTC)
Latitude: 35°25.110'N
Longitude: 7° 5.825'W
Water depth: 987 m
Recovery: 472.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 72 cm: Foraminiferal ooze with small shell fragments and ostracods, fining to the bottom to a nanofossil ooze; very oxidized on the top with yellowish brown colour (10 YR 5/6) at 0 cm and very soupy, gradually changing to dark yellowish brown (10 YR 4/4) @ 20 cm;
From 25 cm the sediment change to more anoxic colour - olive (5 Y 5/3) gradually changing to (5 Y 4/3) moderate to intense bioturbated infilling the sediment from the above layer; mm size patches of black material dispersed below 25 cm;
40 cm: broken gastropod shell, 3 - 4 mm in size;
72 - 172 cm: nanofossil ooze, homogeneous, with light olive brown colour (2.5 Y 5/4) at 72 cm changing to olive brown colour (2.5 Y 4/4) at 172 cm; bioturbated;
@ 92 cm: shell fragments;
@ 106 cm: a patch of foraminifera ooze very soupy, water saturated, with 2 cm in size; other foram patch @ 140 cm; @ 158 cm and @ 170 cm;
172 - 215 cm: nanofossil ooze, bioturbated, olive brown colour (2.5Y 4/4);
215 - 272 cm: nanofossil ooze with forams; has H_2S smell, gray colour (5 Y 5/1); bioturbated; with dark patches of mm size;
patches of 2 - 5 cm in size of foraminifera sand like @ 236 - 239 cm; the contact to the layer above is sharp but convoluted probably due to bioturbation;
272 - 372 cm: dark gray (5 Y 4/1) nanofossil ooze highly bioturbated, with foraminiferal sandy patches of 1 - 2 cm in size;
Some patches of soupy and water rich material @ 320 cm , @ 322 cm, @ 335 cm, @ 353 cm;
Shell fragments @ 366 cm;
H_2S smell;
black patch between 355 - 360 cm;
372 - 472 cm: nanofossil ooze, intensely bioturbated, gray colour (5 Y 5/1);
With patches of black sediment of cm size, sometimes defining the limits of the borrows.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23022-2**

Location: Northern Rim of Lineament Center

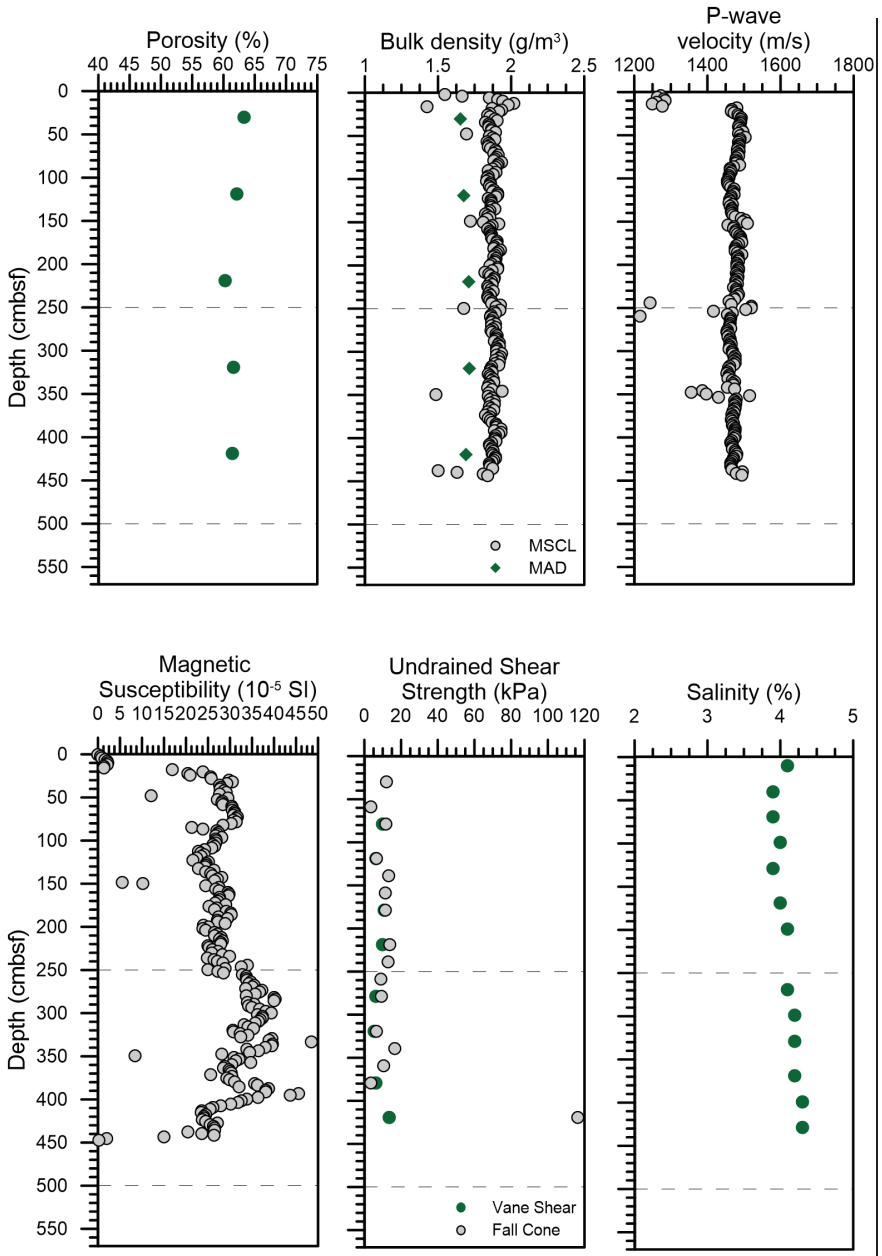
Date: 02.08.18, 15:22:00 (UTC)

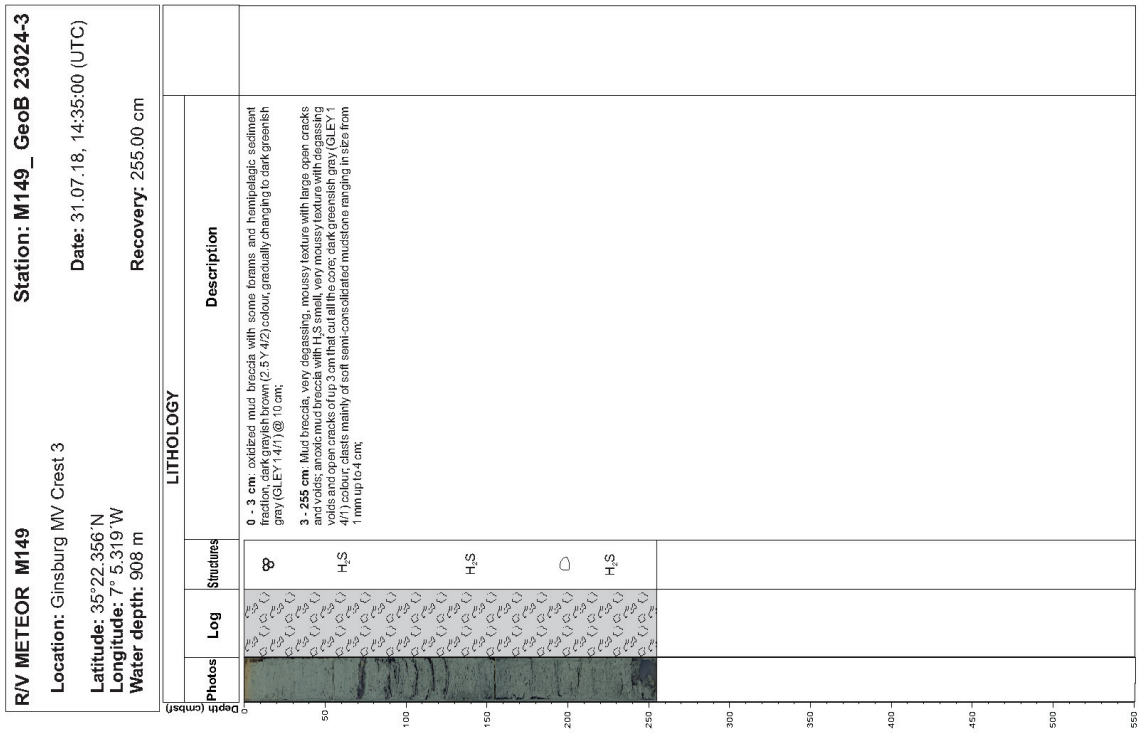
Latitude: 35°17.483´N
Longitude: 7° 5.233´W
Water depth: 1053 m

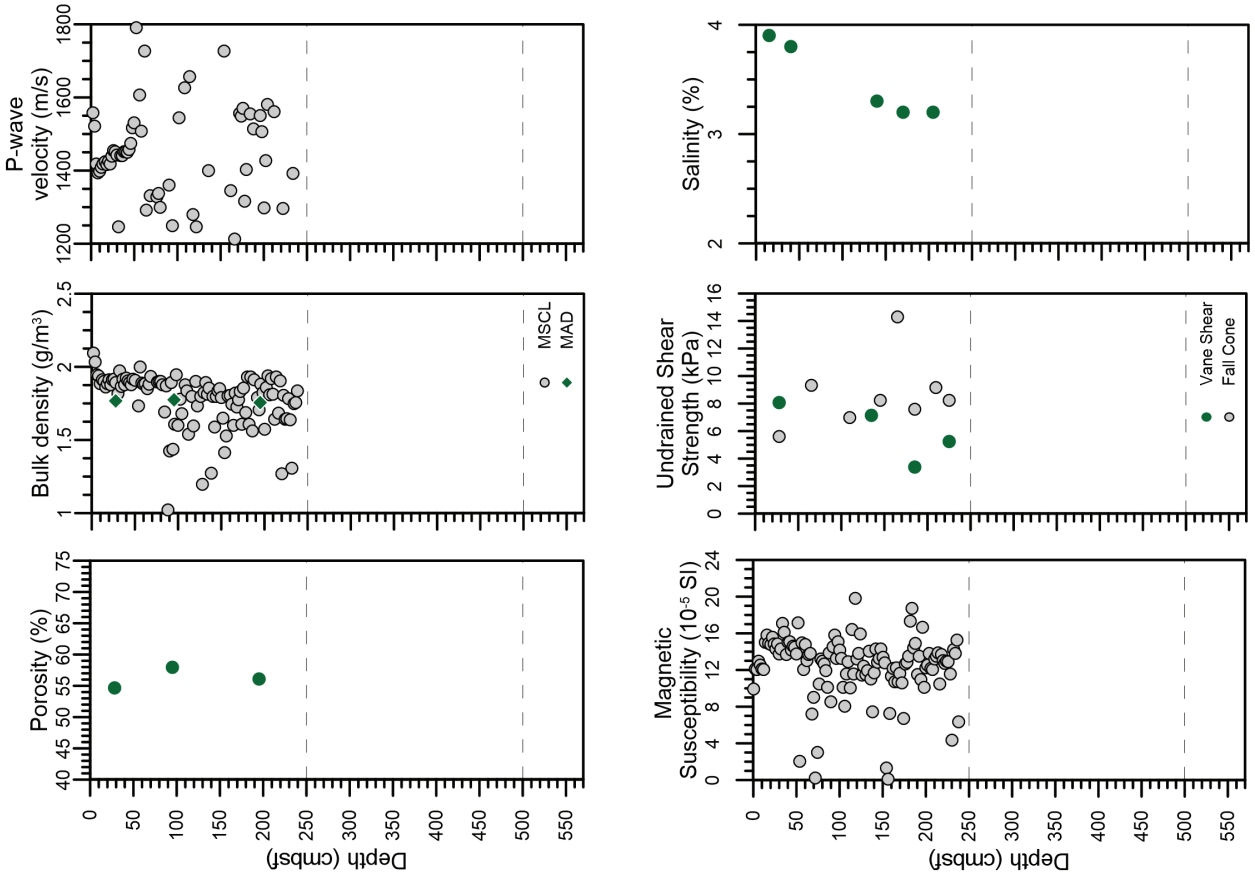
Recovery: 449.00 cm

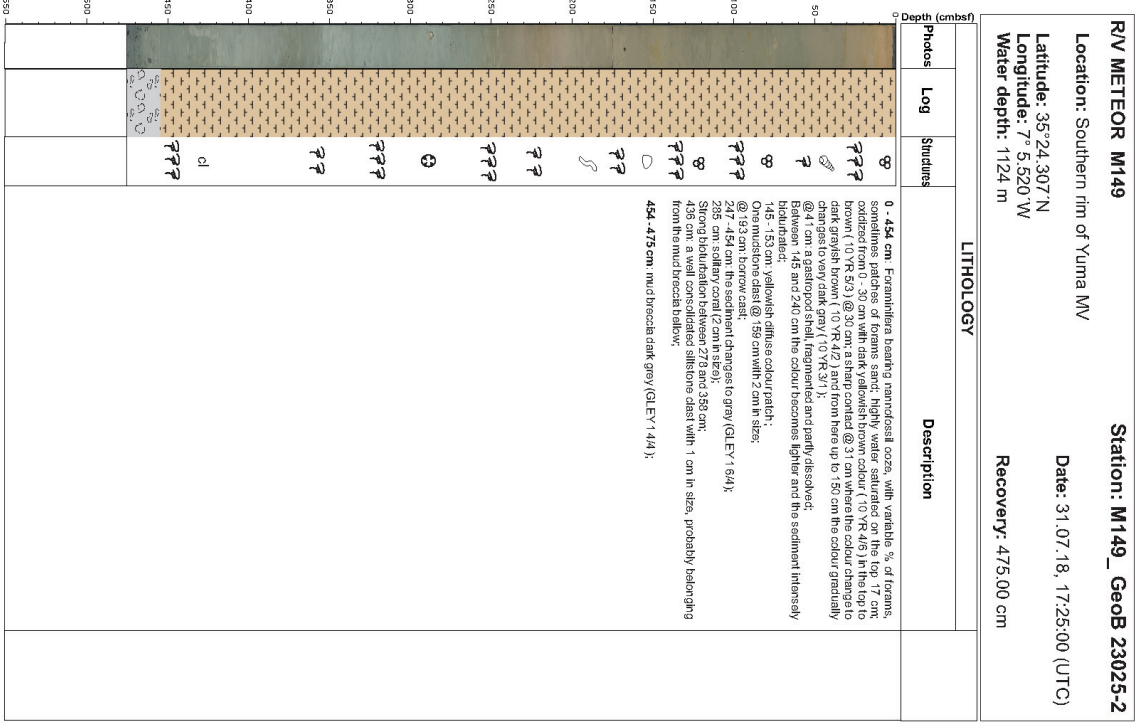
LITHOLOGY

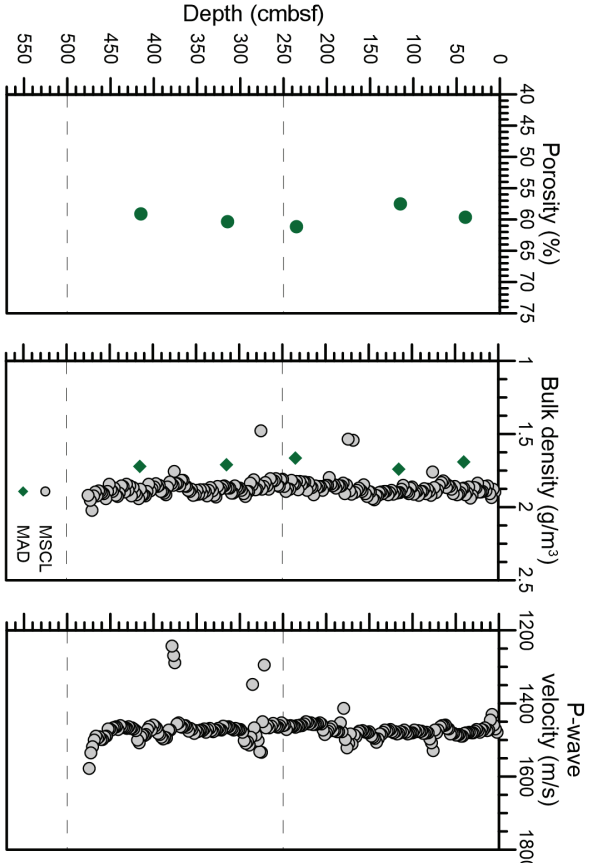
Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550				**0 - 106 cm**: foram-bearing nanofossil ooze, bioturbated; locally with pseudo layering; with dispersed patches of black material < 1 cm in size; with disperse patches of yellowish material; oxidized from the top, with dark yellowish brown colour (10 YR 4/2) from 0 up to 1 cm; very soupy and disturbed due to core recovery effects; From 18 cm up to 106 cm the colour gradually changes from dark yellowish brown (10 YR 4/2) up to very dark grayish brown (2.5 3/2) @ 106 cm, indicator of anoxic environment; 84 -87 cm: solitarian coral with 3 cm size; 82 - 88 cm: spicule of a sea "ouriço" 5 cm long; 81 - 89 cm: borrow cast; **106 - 144 cm**: the sediment shows higher grain size; foraminiferal ooze, with a clear and sharp top contact and a diffuse bottom contact; this package is olive brown (2.5 Y 4/3) in colour; **144 - 359 cm**: foram-bearing nanofossil ooze, bioturbated, locally with pseudo-layering; with dispersed patches of black colour material of < 1 cm; dispersed patches of yellowish material; **359 - 449 cm**: foram-bearing nanofossil ooze of ligher colour than the package above, ranging in colour from grayish brown (2.5 Y 5/2) @ 359 cm to olive brown (2.5 Y 4/6) @ 440 cm.

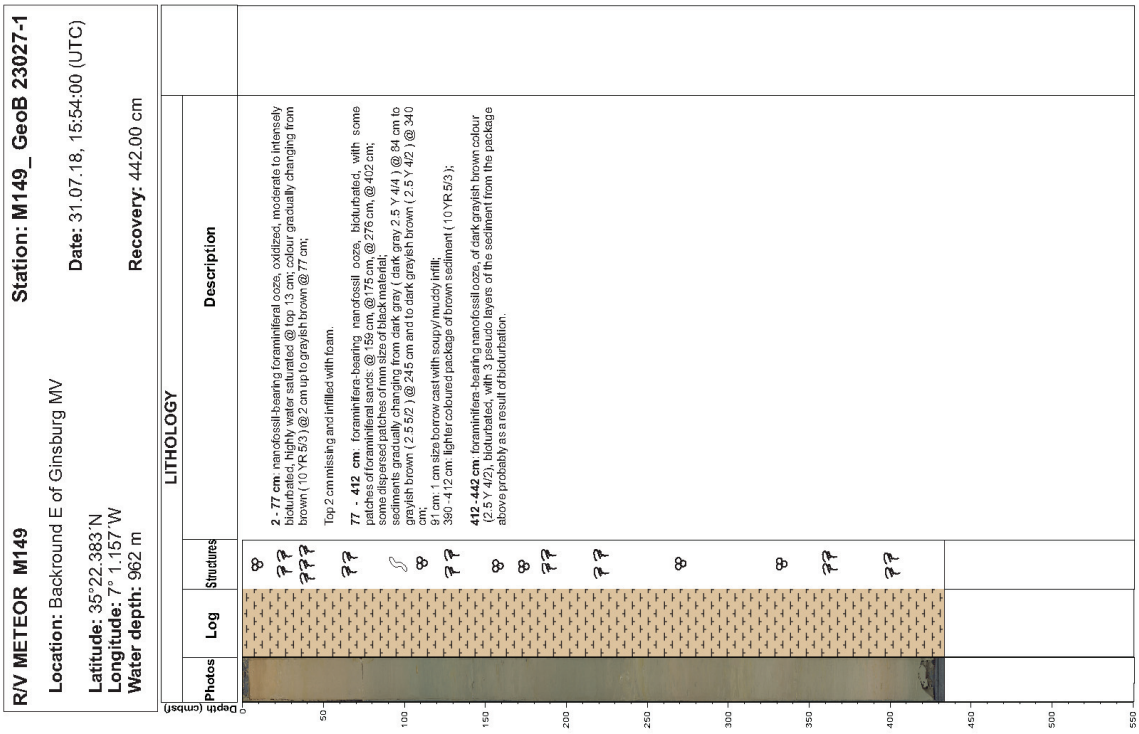


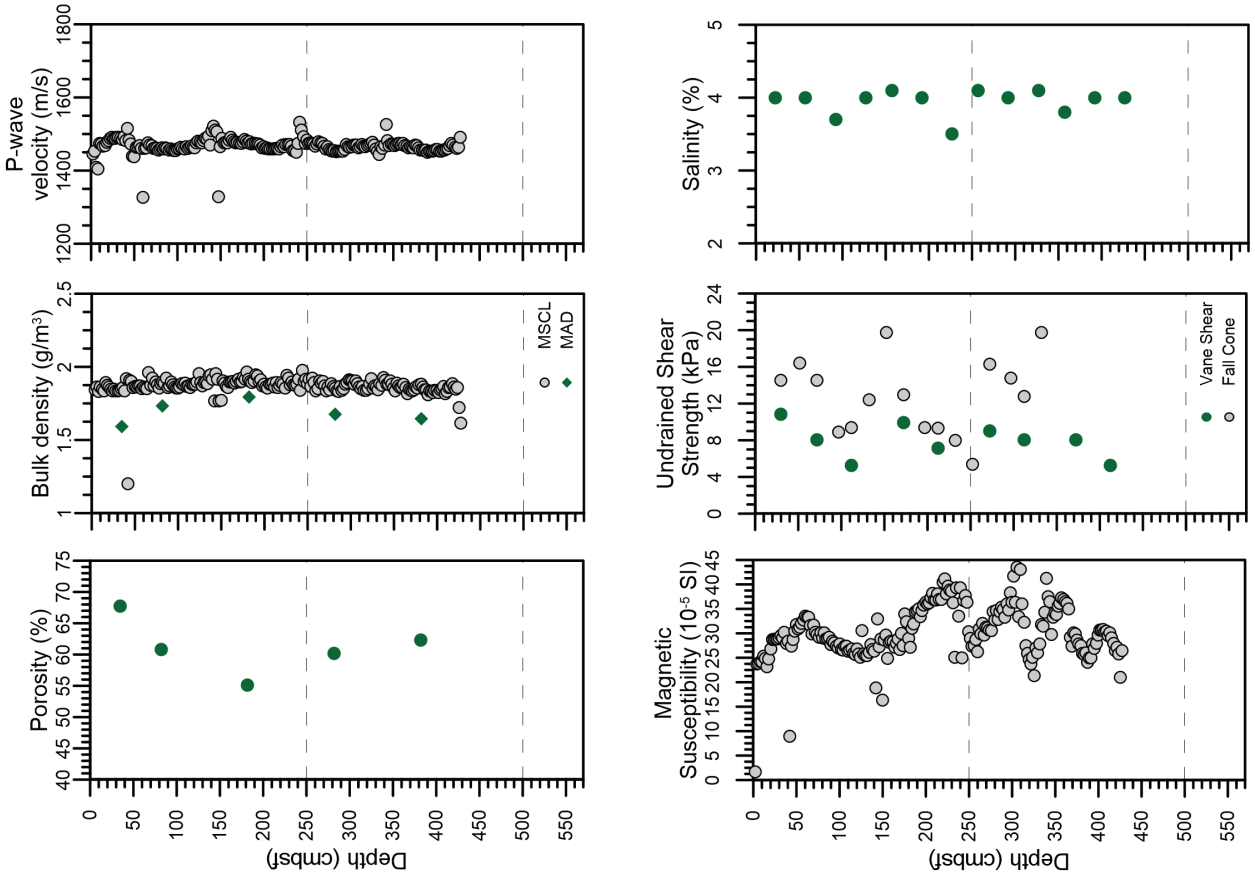

R/V METEOR M149
Station: M149_ GeoB 23024-3
Location: Ginsburg MV Crest 3
Date: 31.07.18, 14:35:00 (UTC)
Latitude: 35°22.356'N
Longitude: 7° 5.319'W
Water depth: 908 m
Recovery: 255.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 3 cm: oxidized mud breccia with some forams and hemipelagic sediment fraction, dark grayish brown (2.5 Y 4/2) colour, gradually changing to dark greenish gray (GLEY 1 4/1) @ 10 cm;
3 - 255 cm: Mud breccia, very degassing, moussy texture with large open cracks and voids; anoxic mud breccia with H2S smell, very moussy texture with degassing voids and open cracks of up 3 cm that cut all the core; dark greenish gray (GLEY 1 4/1) colour, clasts mainly of soft semi-consolidated mudstone ranging in size from 1 mm up to 4 cm;
H2S
H2S
H2S

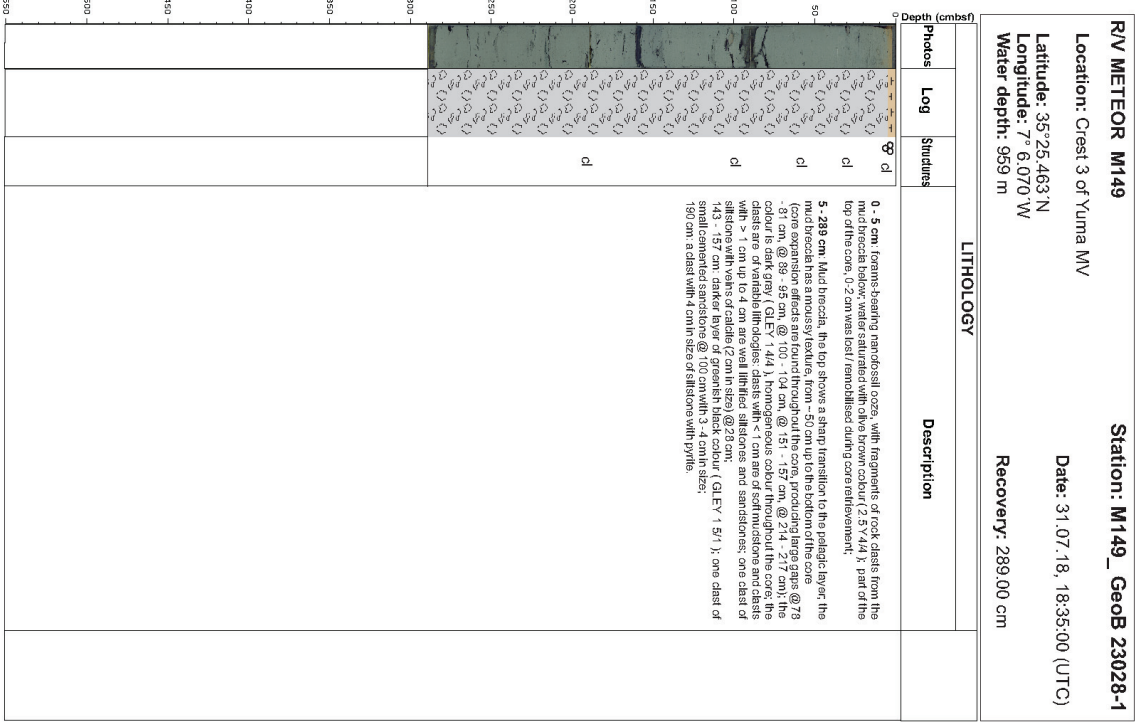

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

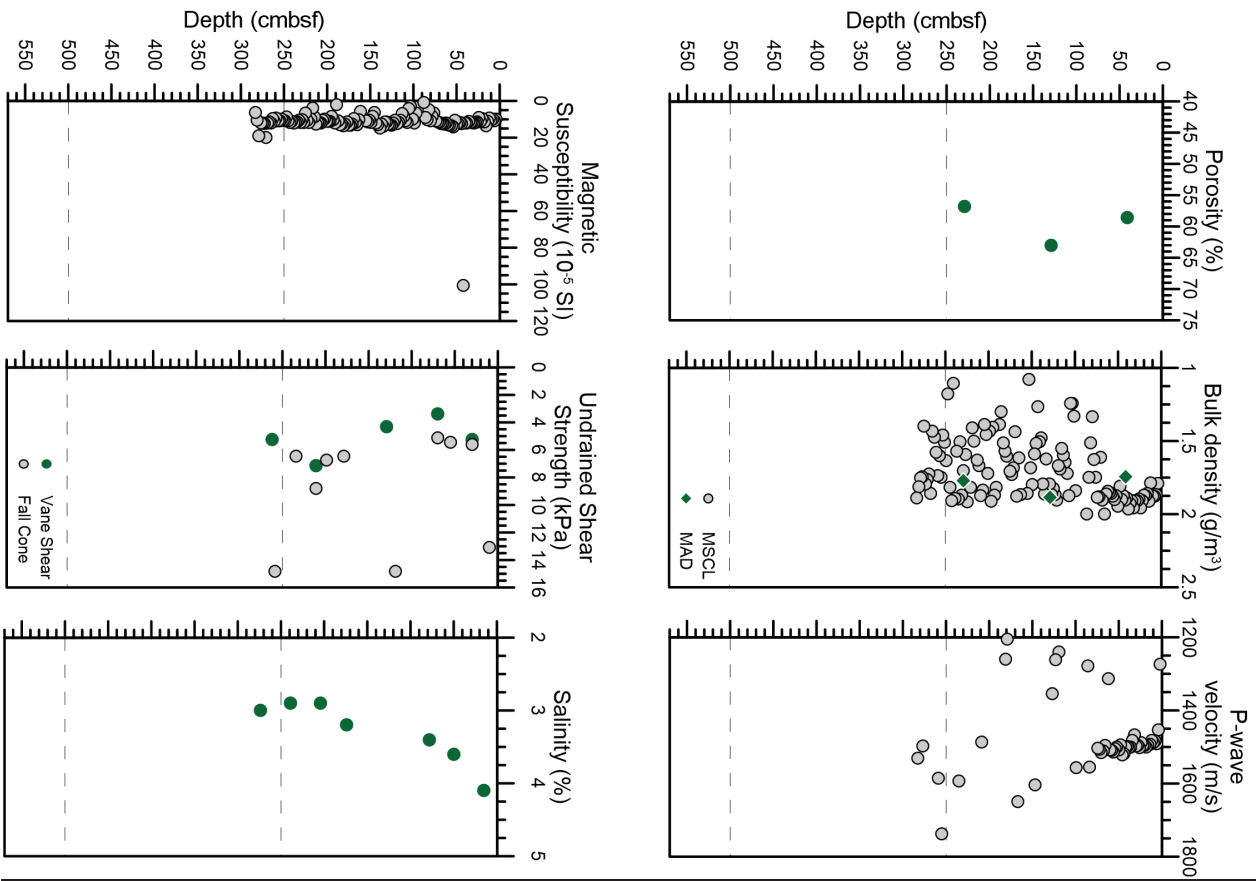

R/V METEOR M149
Station: M149_ GeoB 23025-2
Location: Southern rim of Yuma MV
Latitude: 35°24.307'N
Longitude: 7° 5.520'W
Water depth: 1124 m
Date: 31.07.18, 17:25:00 (UTC)
Recovery: 475.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 454 cm: Foraminifera bearing nannofossil ooze, with variable % of forams; sometimes patches of forams sand; highly water saturated on the top, 17 cm; oxidized from 0 - 30 cm with dark yellowish brown colour (10 YR 4/6) in the top to brown (10 YR 5/3) @ 30 cm; a sharp contact @ 31 cm where the colour change to dark grayish brown (10 YR 4/2) and from here up to 150 cm the colour gradually changes to very dark gray (10 YR 3/1);
@ 41 cm: a gastropod shell, fragmented and partly dissolved;
Between 145 and 240 cm the colour becomes lighter and the sediment intensely bioturbated;
145 - 153 cm: yellowish diffuse colour patch ;
One mudstone datel @ 159 cm with 2 cm in size;
@ 193 cm: borrow cast;
247 - 454 cm: the sediment changes to gray (GLEY 1 6/4);
Shell fragments (2 cm in size);
Strong bioturbation observed at 270 and 359 cm;
436 cm: a well consolidated siltstone datel with 1 cm in size, probably belonging from the mud breccia bellow;
454 -475 cm: mud breccia dark grey (GLEY 1 4/4);

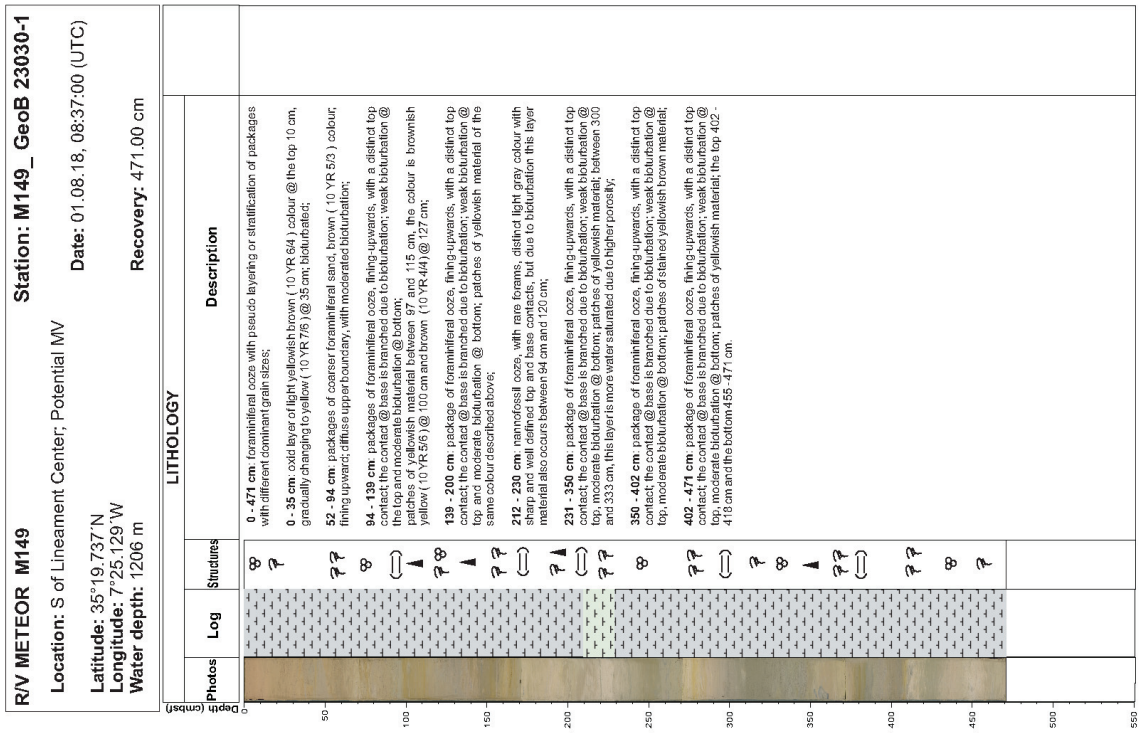

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)

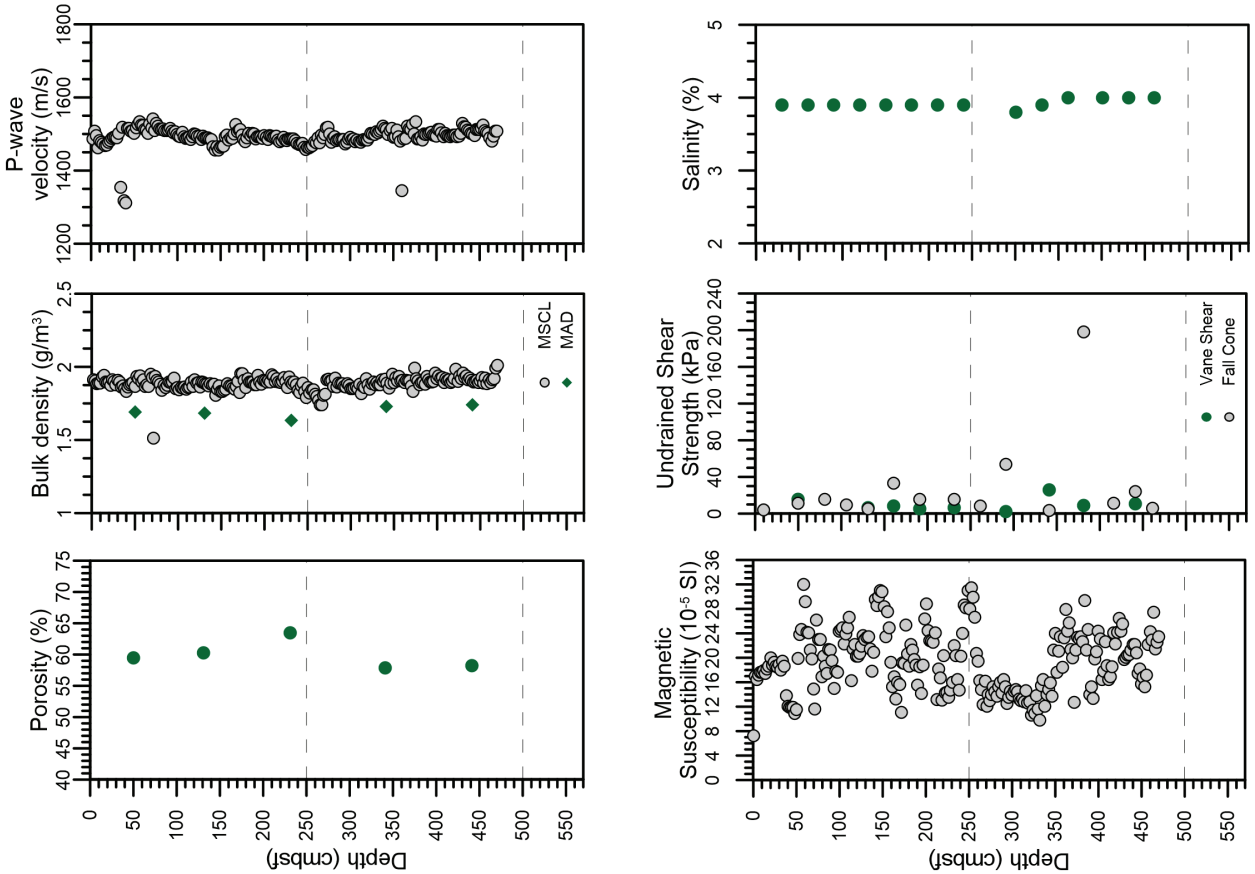

R/V METEOR M149
Station: M149_ GeoB 23027-1
Location: Backround E of Ginsburg MV
Date: 31.07.18, 15:54:00 (UTC)
Latitude: 35°22.383'N
Longitude: 7°1.157'W
Water depth: 962 m
Recovery: 442.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
2 - 77 cm: nannofossil-bearing foraminiferal ooze, oxidized, moderate to intensely bioturbated, highly water saturated @ top 13 cm; colour gradually changing from brown (10 YR 5/3) @ 2 cm up to grayish brown @ 77 cm;
Top 2 cm missing and infilled with foam.
77 - 412 cm: foraminifera-bearing nannofossil ooze, bioturbated, with some patches of foraminiferal sands @ 159 cm, @ 175 cm, @ 276 cm, @ 402 cm; some dispersed patches of mm size of black material; sediments gradually changing from dark gray (dark gray 2.5 Y 4/4) @ 84 cm to grayish brown (2.5 5/2) @ 245 cm and to dark grayish brown (2.5 Y 4/2) @ 340 cm;
91 cm: 1 cm size borrow cast with soupy/ muddy infill;
380 -412 cm: lighter coloured package of brown sediment (10 YR 5/3);
412 -442 cm: foraminifera-bearing nannofossil ooze, of dark grayish brown colour (2.5 Y 4/2), bioturbated, with 3 pseudo layers of the sediment from the package above probably as a result of bioturbation.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23028-1
Location: Crest 3 of Yuma MV
Latitude: 35°25.463'N
Longitude: 7° 6.070'W
Water depth: 959 m
Date: 31.07.18, 18:35:00 (UTC)
Recovery: 289.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 5 cm: foram-bearing nannofossil ooze, with fragments of rock clasts from the mud breccia below; water saturated with olive brown colour (2.5 Y 4/4); part of the top of the core, 0-2 cm was lost / remobilised during core retrievement;
5 - 289 cm: Mud breccia, the top shows a sharp transition to the pelagic layer, the mud breccia has a moussy/texture, from ~ 50 cm up to the bottom of the core (core expansion effects are found throughout the core, producing large gaps @ 79 - 81 cm, @ 89 - 95 cm, @ 100 - 104 cm, @ 151 - 157 cm, @ 214 - 217 cm); the colour is dark gray (GLEY 1 4/4), homogeneous colour throughout the core; the clasts are of variable lithologies: clasts with < 1 cm are of soft mudstone and clasts with > 1 cm up to 4 cm are well lithified siltstones and sandstones; one clast of siltstone with veins of calcite (2 cm in size) @ 23 cm;
143 - 157 cm: darker layer of greenish black colour (GLEY 1 5/1); one clast of sandstone with calcite veins @ 100 cm with 3 cm in size;
180 cm: a clast with 4 cm in size of siltstone with pyrite.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_ GeoB 23030-1
Location: S of Lineament Center; Potential MV
Date: 01.08.18, 08:37:00 (UTC)
Latitude: 35°19.737'N
Longitude: 7°25.129'W
Water depth: 1206 m
Recovery: 471.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 471 cm: foraminiferal ooze with pseudo layering or stratification of packages with different dominant grain sizes;
0 - 35 cm: oxid layer of light yellowish brown (10 YR 6/4) colour @ the top 10 cm, gradually changing to yellow (10 YR 7/6) @ 35 cm; bioturbated;
52 - 94 cm: packages of coarser foraminiferal sand, brown (10 YR 5/3) colour, fining upward; diffuse upper boundary, with moderated bioturbation;
94 - 139 cm: packages of foraminiferal ooze, fining-upwards, with a distinct top contact; the contact @ base is branched due to bioturbation; weak bioturbation @ the top and moderate bioturbation @ bottom;
patches of yellowish material between 97 and 115 cm, the colour is brownish yellow (10 YR 5/6) @ 100 cm and brown (10 YR 4/4) @ 127 cm;
139 - 200 cm: package of foraminiferal ooze, fining-upwards, with a distinct top contact; the contact @ base is branched due to bioturbation; weak bioturbation @ top and moderate bioturbation @ bottom; patches of yellowish material of the same colour described above;
212 - 230 cm: nannofossil ooze, with rare forams, distinct light gray colour with sharp and well defined top and base contacts, but due to bioturbation this layer material also occurs between 94 cm and 120 cm;
231 - 350 cm: package of foraminiferal ooze, fining-upwards, with a distinct top contact; the contact @ base is branched due to bioturbation; weak bioturbation @ top, moderate bioturbation @ bottom; patches of yellowish material; between 300 and 333 cm, this layer is more water saturated due to higher porosity;
350 - 402 cm: package of foraminiferal ooze, fining-upwards, with a distinct top contact; the contact @ base is branched due to bioturbation; weak bioturbation @ top; moderate bioturbation @ bottom; patches of stained yellowish brown material;
402 - 471 cm: package of foraminiferal ooze, fining-upwards, with a distinct top contact; the contact @ base is branched due to bioturbation; weak bioturbation @ top; moderate bioturbation @ bottom; patches of yellowish material; the top 402 - 418 cm and the bottom 455 -471 cm.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

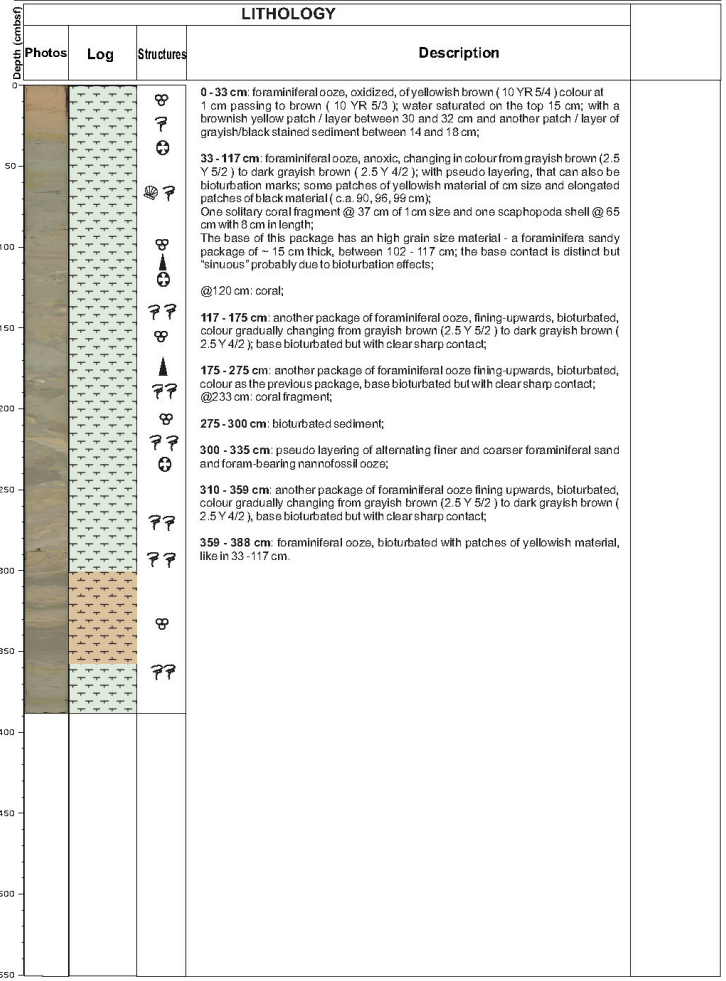
R/V METEOR M149 **Station: M149_ GeoB 23031-1**

Location: Pull-apart basin; Lineament Center

Date: 01.08.18, 10:29:00 (UTC)

Latitude: 35°16.945´N
Longitude: 7°19.307´W
Water depth: 1300 m

Recovery: 388.00 cm



0 - 33 cm: foraminiferal ooze, oxidized, of yellowish brown (10 YR 5/4) colour at 1 cm passing to brown (10 YR 5/3); water saturated on the top 15 cm; with a brownish yellow patch / layer between 30 and 32 cm and another patch / layer of grayish/black stained sediment between 14 and 18 cm;

33 - 117 cm: foraminiferal ooze, anoxic, changing in colour from grayish brown (2.5 Y 5/2) to dark grayish brown (2.5 Y 4/2); with pseudo layering, that can also be bioturbation marks; some patches of yellowish material of cm size and elongated patches of black material (c.a. 90, 96, 99 cm);
One solitary coral fragment @ 37 cm of 1 cm size and one scaphopoda shell @ 65 cm with 8 cm in length;
The base of this package has an high grain size material - a foraminifera sandy package of ~ 15 cm thick, between 102 - 117 cm; the base contact is distinct but "sinuous" probably due to bioturbation effects;

@120 cm: coral;

117 - 175 cm: another package of foraminiferal ooze, fining-upwards, bioturbated, colour gradually changing from grayish brown (2.5 Y 5/2) to dark grayish brown (2.5 Y 4/2); base bioturbated but with clear sharp contact;

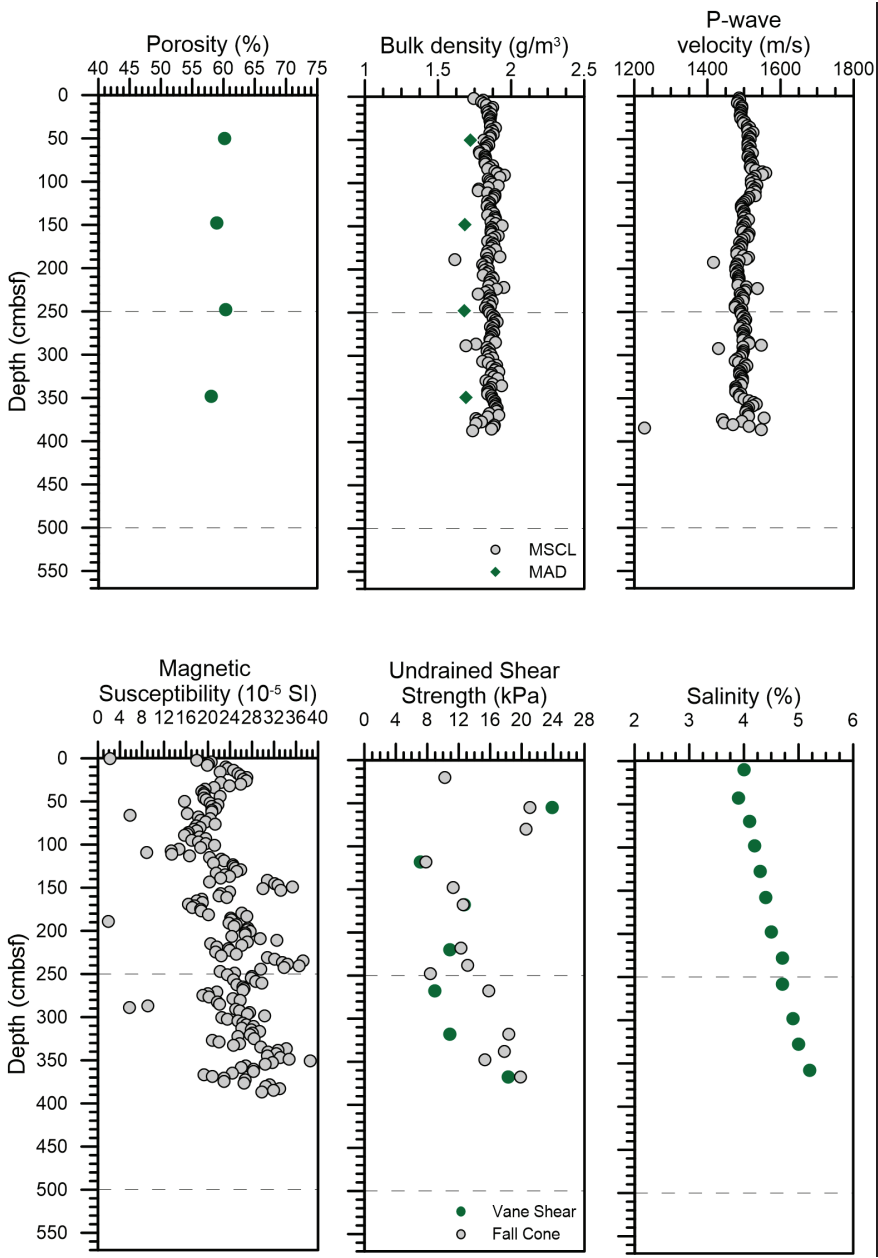
175 - 275 cm: another package of foraminiferal ooze fining-upwards, bioturbated, colour as the previous package, base bioturbated but with clear sharp contact;
@233 cm: coral fragment;

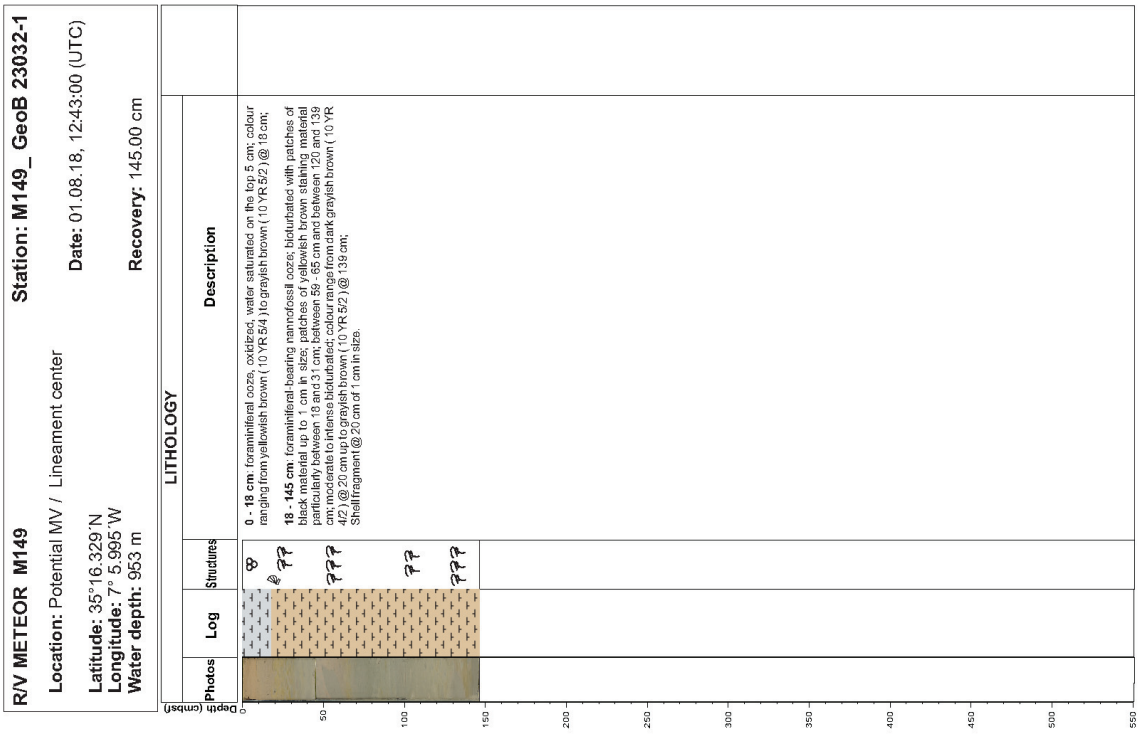
275 - 300 cm: bioturbated sediment;

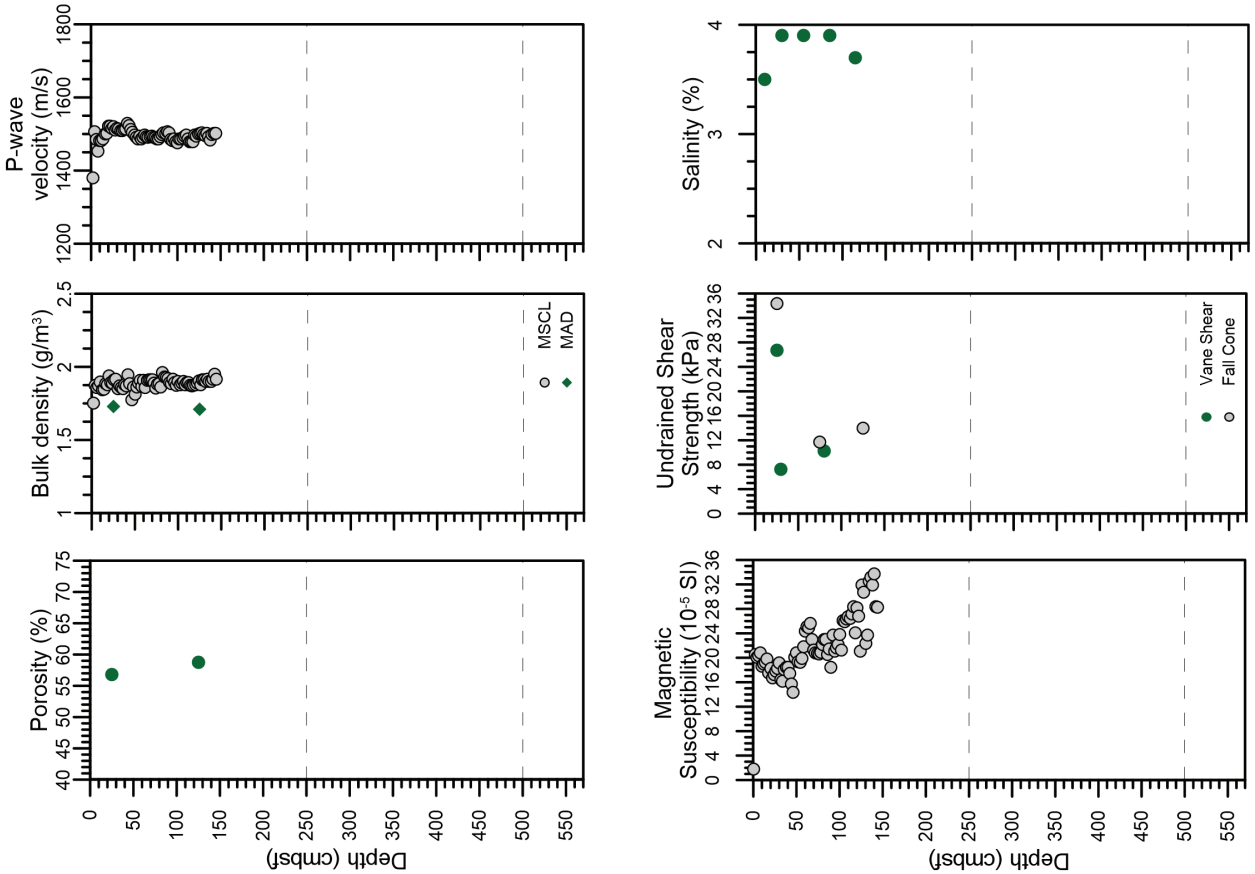
300 - 335 cm: pseudo layering of alternating finer and coarser foraminiferal sand and foram-bearing nannofossil ooze;

310 - 359 cm: another package of foraminiferal ooze fining upwards, bioturbated, colour gradually changing from grayish brown (2.5 Y 5/2) to dark grayish brown (2.5 Y 4/2), base bioturbated but with clear sharp contact;

359 - 388 cm: foraminiferal ooze, bioturbated with patches of yellowish material, like in 33 - 117 cm.




R/V METEOR M149
Station: M149_ GeoB 23032-1
Location: Potential MV / Lineament center
Date: 01.08.18, 12:43:00 (UTC)
Latitude: 35°16.329'N
Longitude: 7° 5.995'W
Water depth: 953 m
Recovery: 145.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 18 cm: foraminiferal ooze, oxidized, water saturated; on the top 5 cm: colour ranging from yellowish brown (10 YR 5/4) to grayish brown (10 YR 5/2) @ 18 cm;
18 - 145 cm: foraminiferal-bearing nannofossil ooze; bioturbated with patches of black material up to 1 cm in size; patches of yellowish brown staining material particularly between 18 and 31 cm; between 59 - 65 cm and between 120 and 139 cm; moderate to intense bioturbated; colour range from dark grayish brown (10 YR 4/2) @ 20 cm up to grayish brown (10 YR 5/2) @ 139 cm;
Shell fragment @ 20 cm of 1 cm in size.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23033-1**

Location: Depression in Lineament Center (1)

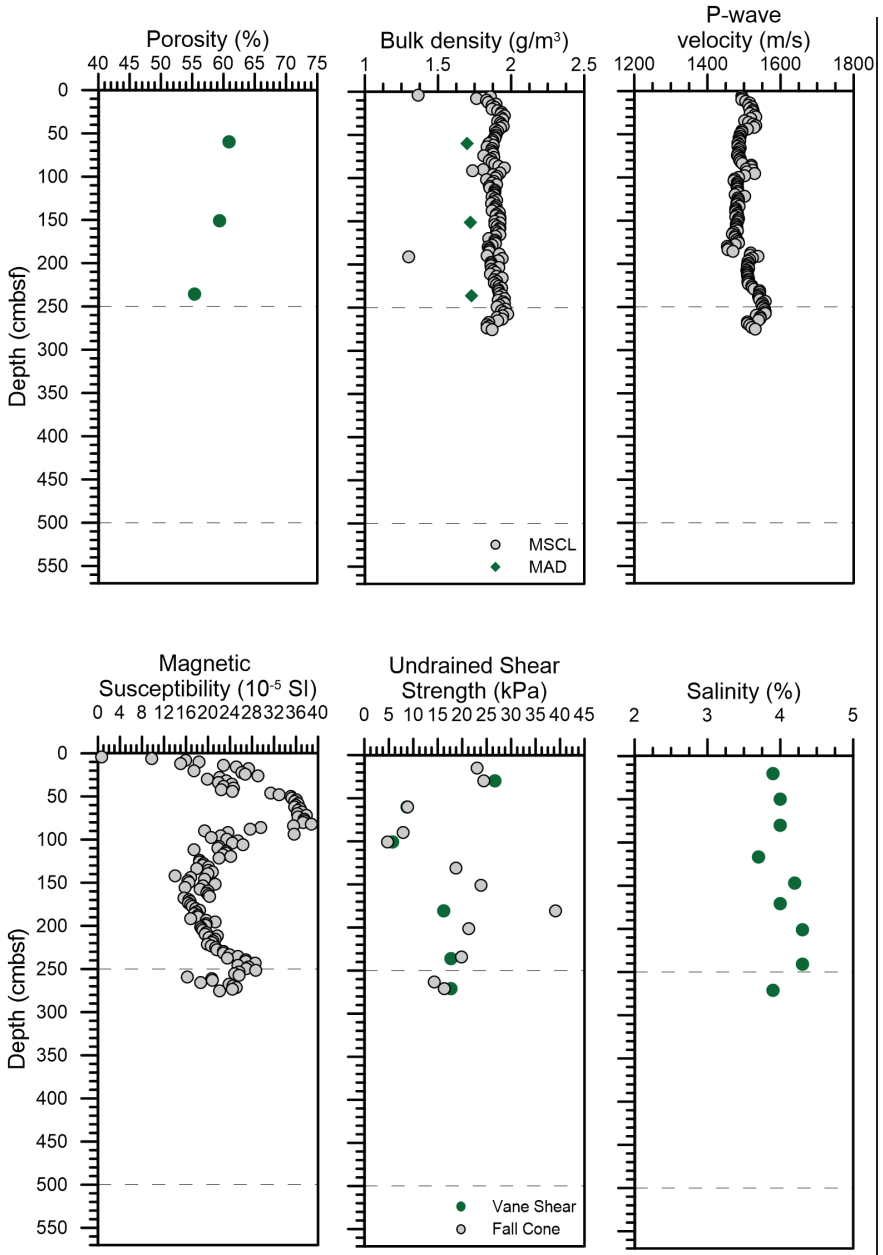
Date: 01.08.18, 13:59:00 (UTC)

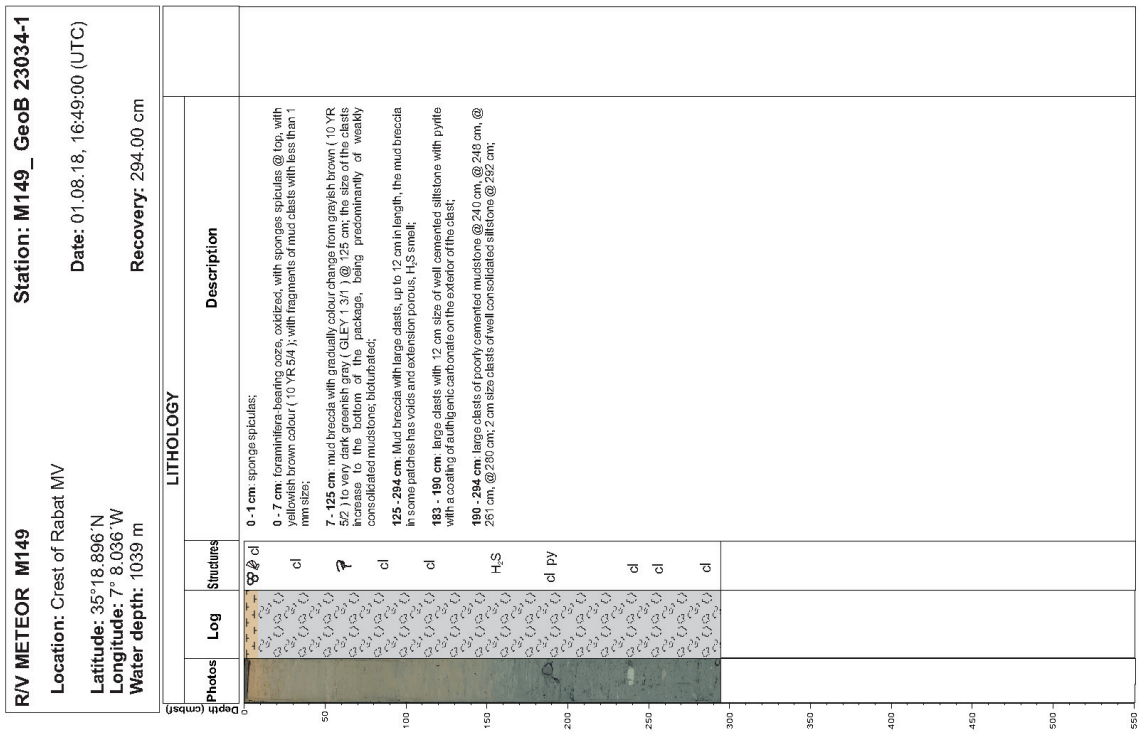
Latitude: 35°16.938´N
Longitude: 7° 7.361´W
Water depth: 1176 m

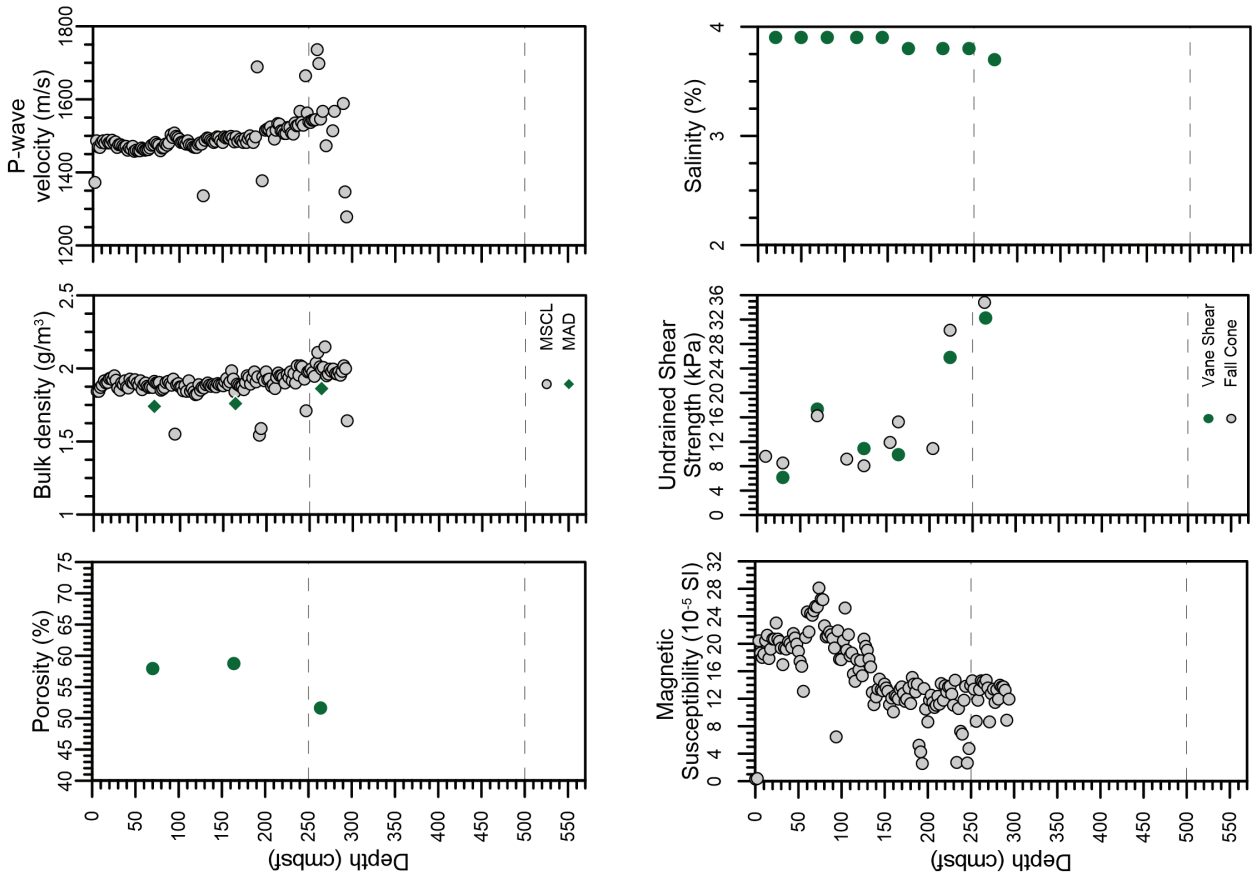
Recovery: 291.00 cm

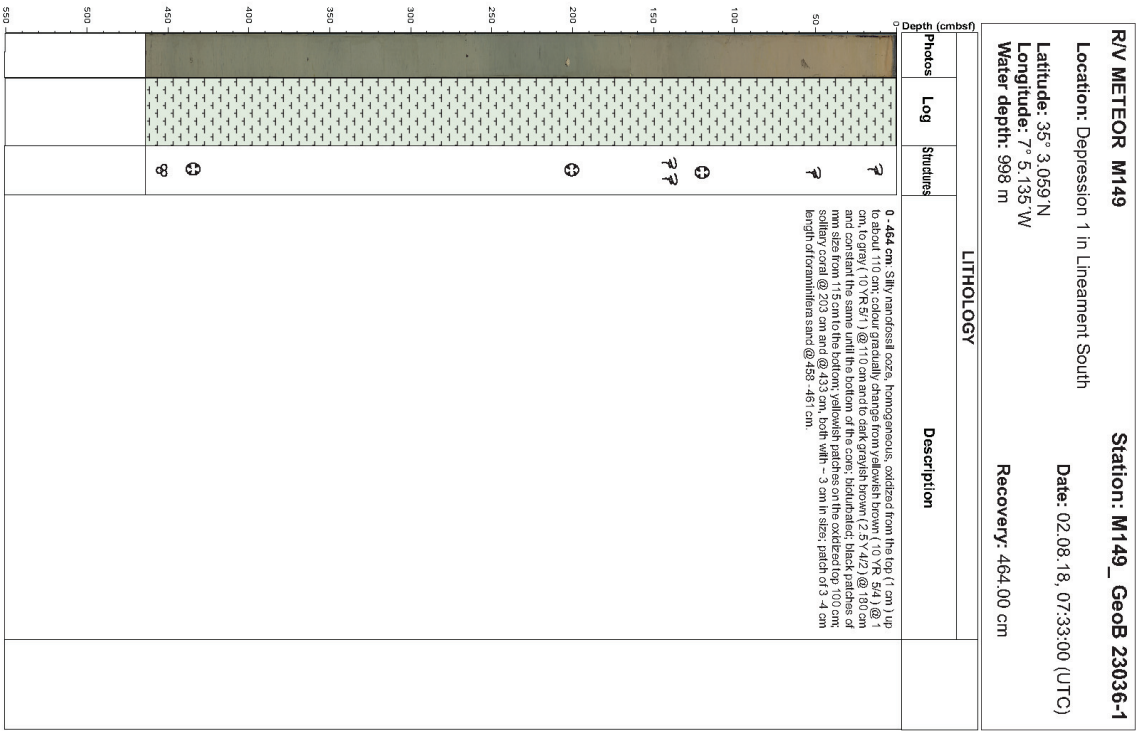
LITHOLOGY

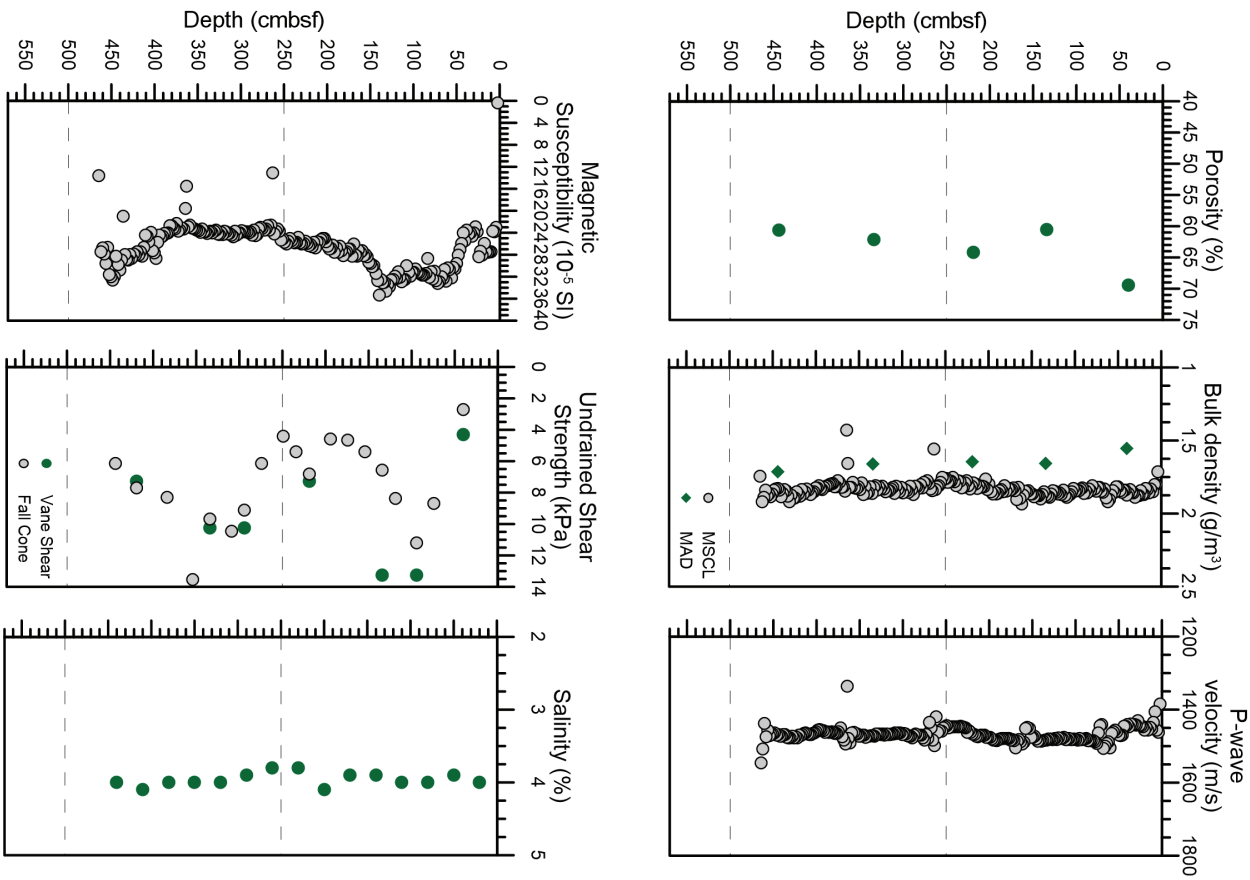
Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550				**0 - 2 cm**: foam infill; **2 - 26 cm**: oxidyzed foraminiferal ooze, water saturated on the top 6 cm; of brown colour (10 YR 5/3), bioturbated at the base, with a gradual transition to the layer below; **26 - 47 cm**: foram-bearing nannofossil ooze fining-upwards, bioturbated; dark grayish brown (2.5 Y 4/2) colour; the base contact is sharp, undulated and marked by a 5 mm thick sandy foram layer; **47 - 120 cm**: foram-bearing nannofossil ooze @ 47 cm, gradually increasing in grain size to the base, to a nannofossil-bearing foraminiferal ooze @ 120 cm; the colour gradually changes from dark grayish brown (2.5 Y 4/2) colour to very dark grayish brown @ 115 cm; moderate to intense bioturbation, especially @ the base where borrow infills of sediment from the layer below occur and form pseudo layering; **120 - 230 cm**: nannofossil ooze, of pale brown (10 YR 6/3) colour, with variable minor content of forams, with weak lamination such as @ 169 - 179 cm; bioturbated @ top, between 120 and 140 cm; the base contact is sharp but undulated; **230 - 268 cm**: foram-bearing nannofossil ooze, grading downward; bioturbated; and dispersed along the right edge of the liner; **268 - 278 cm**: oxidyzed foraminifeara ooze, brown colour (10 YR 5/3) very similar to the top layer of the core; this layer has a sharp top contact and is interpreted as the repetition of the top of the core (layer between 2 and 26 cm); **234 - 291 cm**: along the edge of the core @ the liner right side there is a 1 to 4 cm thick vertical infill of nannofossil-bearing foraminiferal ooze, probably a coring effect that filled the sediment of the layer bellow 280 cm upwards along the core liner edge; 279 - 291 cm: core catcher void; **280 - 291 cm**: nannofossil-bearing foraminiferal ooze, gray (10 YR 6/1) colour, with a distinct contact to the layer above this layer is interpreted as the repetition of part of the layer @ top of the core (26 - 47 cm).

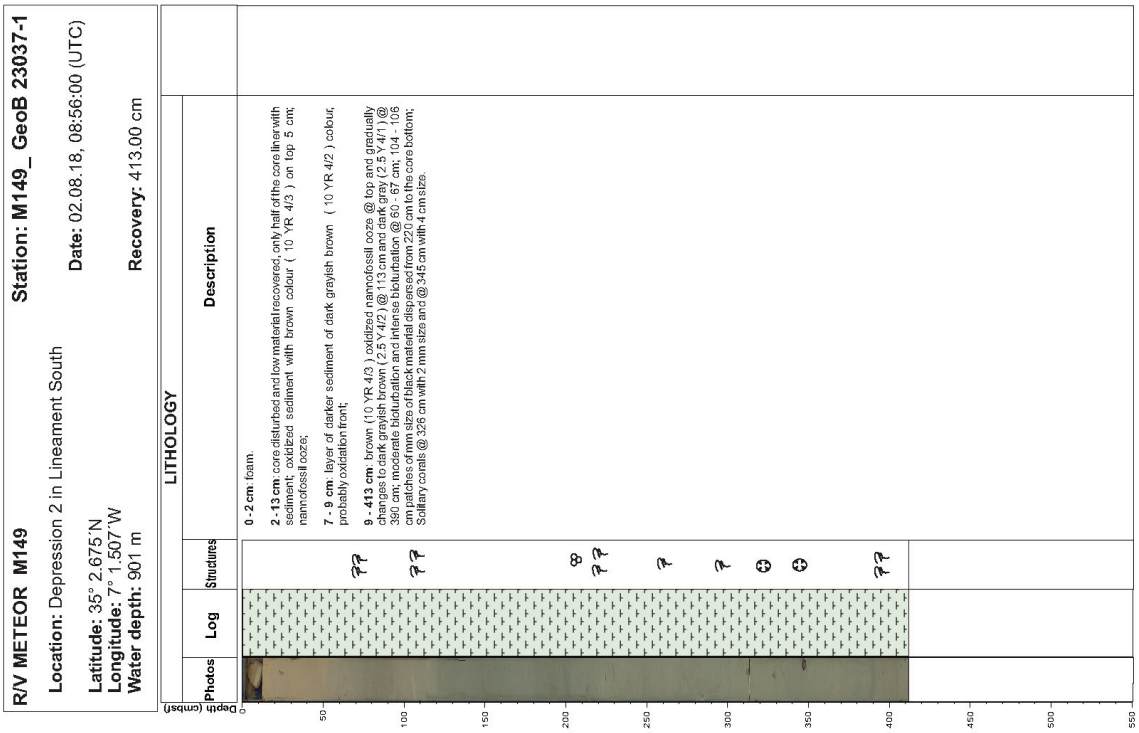


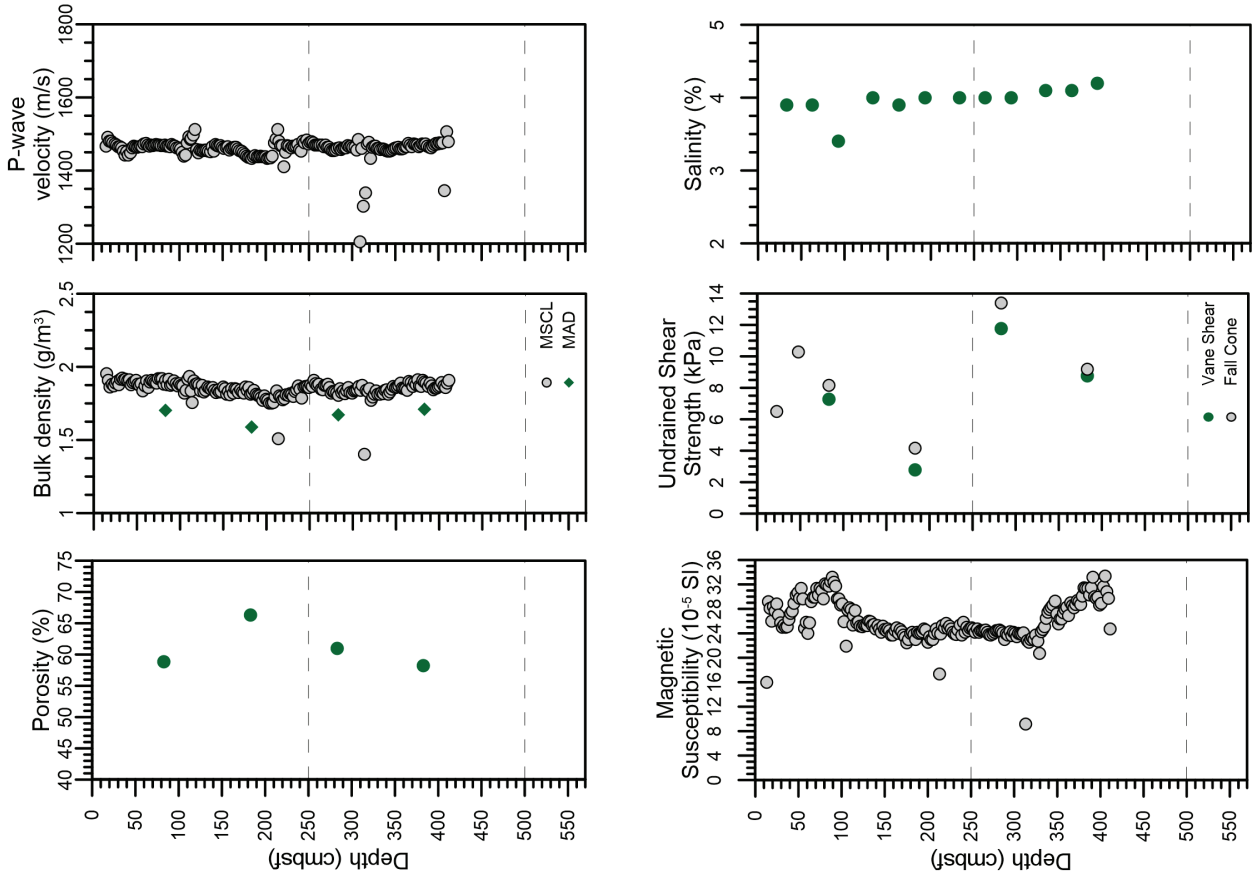

R/V METEOR M149
Station: M149_ GeoB 23034-1
Location: Crest of Rabat MV
Date: 01.08.18, 16:49:00 (UTC)
Latitude: 35°18.896'N
Longitude: 7° 8.036'W
Water depth: 1039 m
Recovery: 294.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 1 cm: sponge spicules;
0 - 7 cm: foraminifera-bearing ooze, oxidized, with sponges spicules @ top, with yellowish brown colour (10 YR 5/4); with fragments of mud clasts with less than 1 mm size;
7 - 125 cm: mud breccia with gradually colour change from greyish brown (10 YR 5/2) to very dark greenish gray (GLEY 1 3/1) @ 125 cm; the size of the clasts increase to the bottom of the package., being predominantly of weakly consolidated mudstone; bioturbated;
125 - 294 cm: Mud breccia with large clasts, up to 12 cm in length; the mud breccia in some patches has voids and extension porous, H2S smell;
183 - 190 cm: large clasts with 12 cm size of well cemented siltstone with pyrite with a coating of authigenic carbonate on the exterior of the clast;
190 - 294 cm: large clasts of poorly cemented mudstone @ 240 cm, @ 248 cm, @ 261 cm, @ 280 cm; 2 cm size clasts of well consolidated siltstone @ 292 cm;
cl
py
H2S


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23036-1
Location: Depression 1 in Lineament South
Latitude: 35° 3.059'N
Longitude: 7° 5.135'W
Water depth: 998 m
Date: 02.08.18, 07:33:00 (UTC)
Recovery: 464.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 464 cm: Silty nannofossil ooze, homogeneous, oxidized from the top (1 cm) up to about 110 cm; colour gradually change from yellowish brown (10 YR 5/4) @ 1 cm, to gray (10 YR 5/1) @ 110 cm and to dark grayish brown (2.5 Y 4/2) @ 180 cm and constant the same until the bottom of the core; bioturbated; black patches of mm size from 115 cm to the bottom; yellowish patches on the oxidized top 100 cm; solitary coral @ 203 cm and @ 433 cm; both with ~ 3 cm in size; patch of 3 -4 cm length of foraminifera sand @ 458 - 461 cm.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_ GeoB 23037-1
Location: Depression 2 in Lineament South
Latitude: 35° 2.675'N
Longitude: 7° 1.507'W
Water depth: 901 m
Date: 02.08.18, 08:56:00 (UTC)
Recovery: 413.00 cm
LITHOLOGY
Description
Photos
Log
Structures
Depth (cmbsf)
0 - 2 cm: foam.
2 - 13 cm: core disturbed and low material recovered, only half of the core liner with sediment; oxidized sediment with brown colour (10 YR 4/3) on top 5 cm; nannofossil ooze;
7 - 9 cm: layer of darker sediment of dark greyish brown (10 YR 4/2) colour, probably oxidation front;
9 - 413 cm: brown (10 YR 4/3) oxidized nannofossil ooze @ top and gradually changes to dark greyish brown (2.5 Y 4/2) @ 113 cm and dark gray (2.5 Y 4/1) @ 390 cm; moderate bioturbation and intense bioturbation @ 60 - 67 cm; 104 - 106 cm patches of mm size of black material dispersed from 220 cm to the core bottom; Solitary corals @ 326 cm with 2 mm size and @ 345 cm with 4 cm size.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Depth (cmbsf)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23038-1**

Location: Background east of Meknes MV

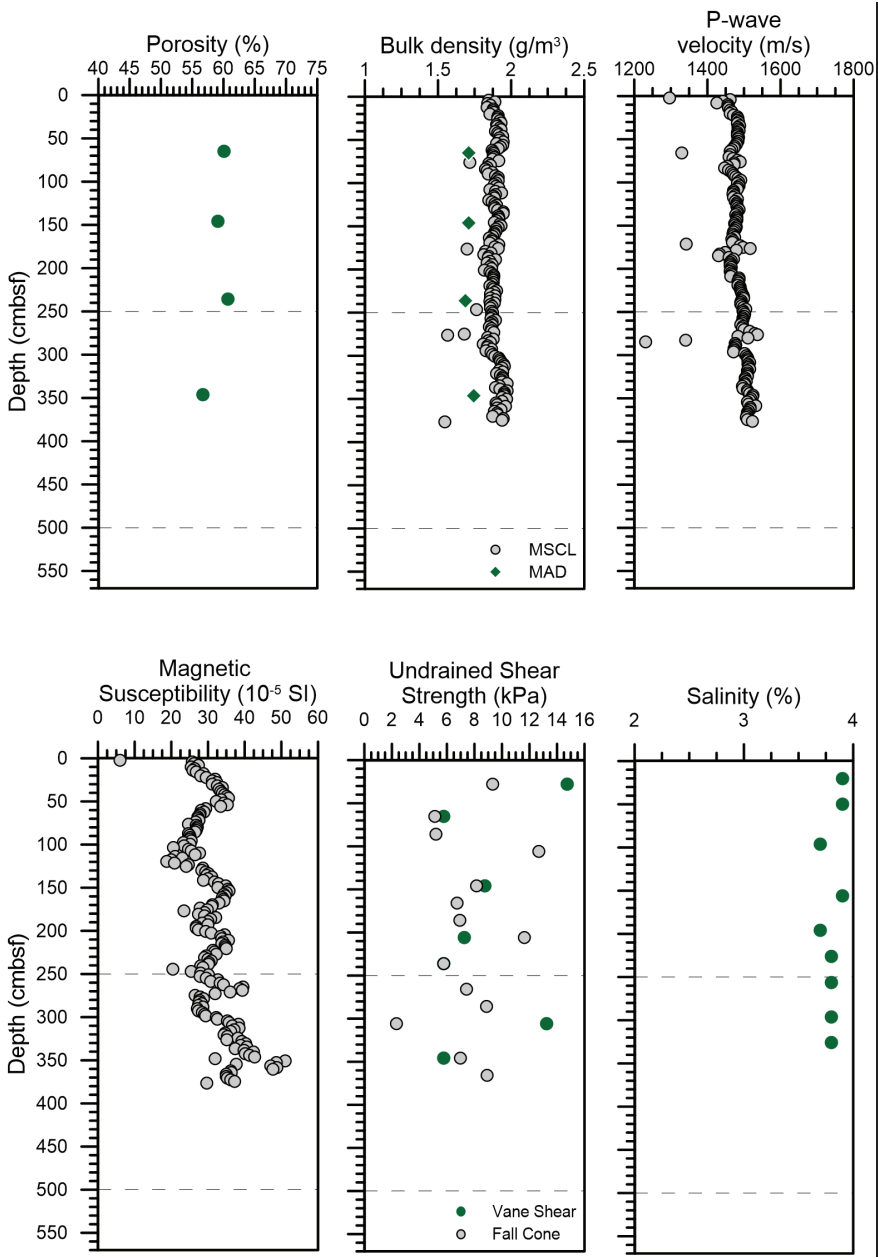
Date: 02.08.18, 10:26:00 (UTC)

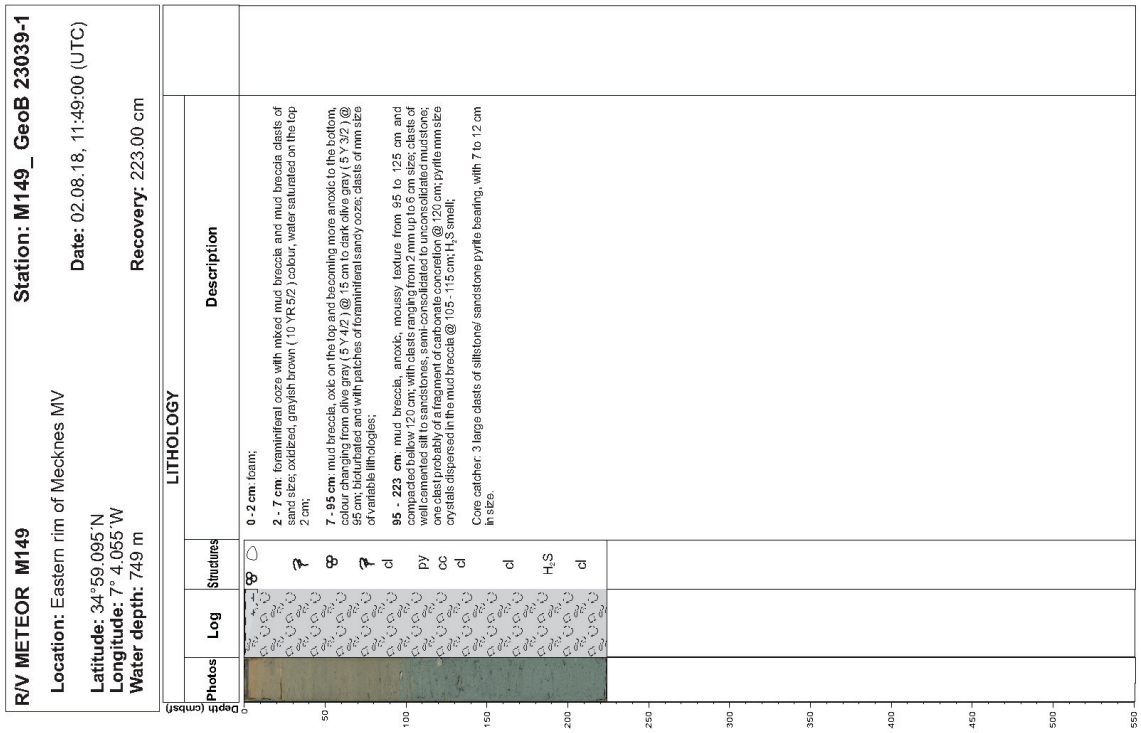
Latitude: 34°59.122´N
Longitude: 7° 2.031´W
Water depth: 744 m

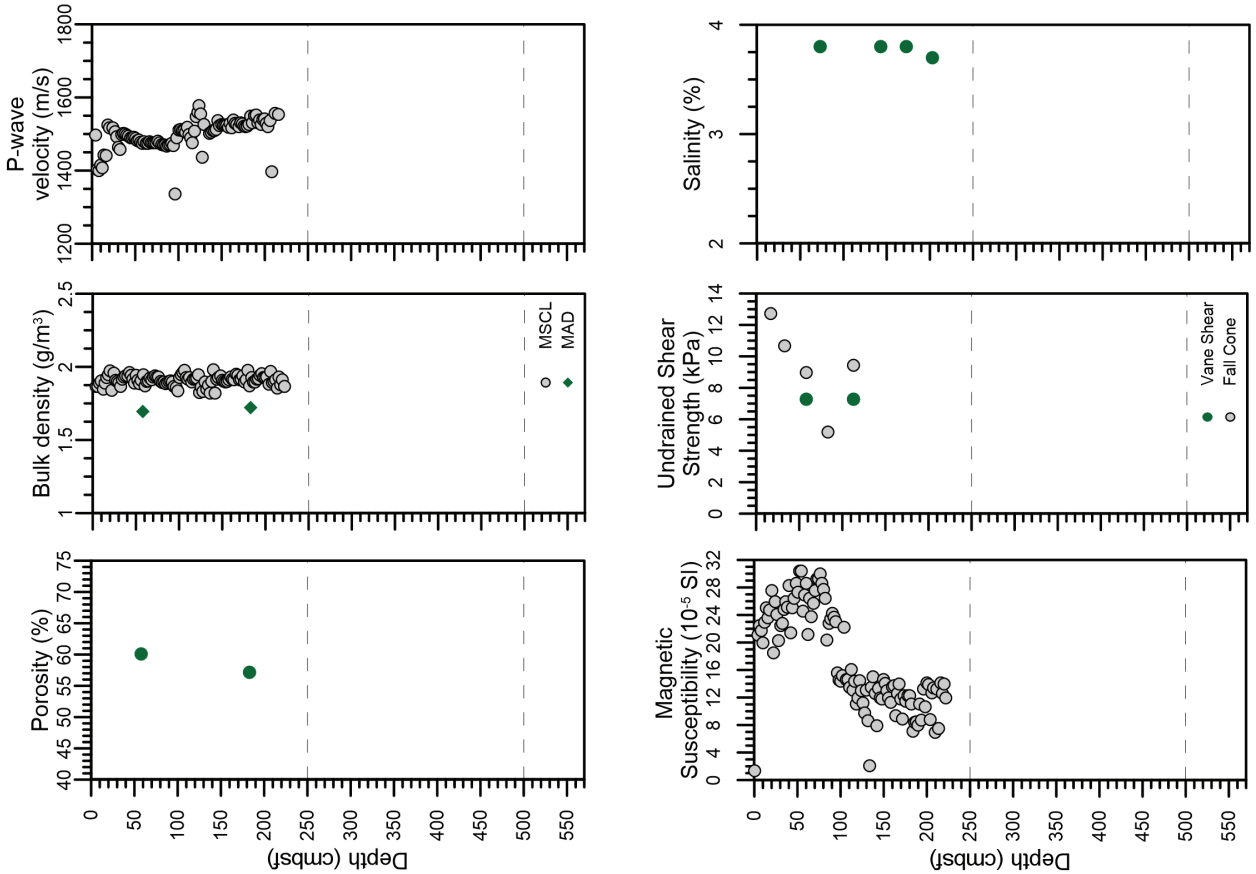
Recovery: 376.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550				**0 - 2 cm**: foam. **2 - 356 cm**: silty foram-bearing nannofossil ooze, bioturbated; oxidized @ the top 31 cm, water saturated in the top 9 cm; colour gradually changes from brown (10 YR 4/3) @ 2 cm, to dark grayish brown (10 YR 4/2) @ 30 cm; with a sharp transition to olive brown (2.5 Y 4/3) below 30 cm; and from then the colour gradually changes to dark gray (2.5 Y 4/1); from the top up to 82 cm a sampling recollection effect of the top sediments as recognized along 1 - 2 cm down the right edge of the core liner up to 82 cm; bioturbated to intense bioturbated; patches of black material of mm up to 1 cm size; 76 - 176 cm: 2 gastropod shells (1 cm size); intense bioturbation from 91 to 125 cm; 244 - 249 cm: Scaphopoda shell, 5 cm long; Apatch of foraminiferal ooze @ 348 cm, 1 cm in size; from 316 to 376 cm downwards weakly bedding can be identified by small changes in the sediment colour, locally disturbed by bioturbation; **356 - 376 cm**: foram-bearing nannofossil ooze, bioturbated @ top, dark greenish brown (10 YR 4/2) colour;




R/V METEOR M149
Station: M149_ GeoB 23039-1
Location: Eastern rim of Mecknes MV
Date: 02.08.18, 11:49:00 (UTC)
Latitude: 34°59.095'N
Longitude: 7° 4.055'W
Water depth: 749 m
Recovery: 223.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 2 cm: foam;
2 - 7 cm: foraminiferal ooze with mixed mud breccia and mud breccia clasts of sand size; oxidized, grayish brown (10 YR 5/2) colour, water saturated on the top 2 cm;
7 - 95 cm: mud breccia, oxic on the top and becoming more anoxic to the bottom, colour changing from olive gray (5 Y 4/2) @ 15 cm to dark olive gray (5 Y 3/2) @ 95 cm; bioturbated and with patches of foraminiferal sandy ooze; clasts of mm size of variable lithologies;
95 - 223 cm: mud breccia, anoxic, mousy texture from 95 to 125 cm and compacted bellow 120 cm; with clasts ranging from 2 mm up to 6 cm size; clasts of well cemented silt to sandstones; semi-consolidated to unconsolidated mudstone; one clast probably of a fragment of carbonate concretion @ 120 cm; pyrite mm size crystals dispersed in the mud breccia @ 105 - 115 cm; H2S smell;
Core catcher: 3 large clasts of siltstone/ sandstone pyrite bearing, with 7 to 12 cm in size.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23040-1**

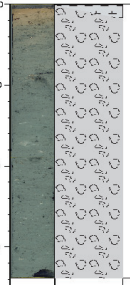
Location: Eastern flank of Meknes MV

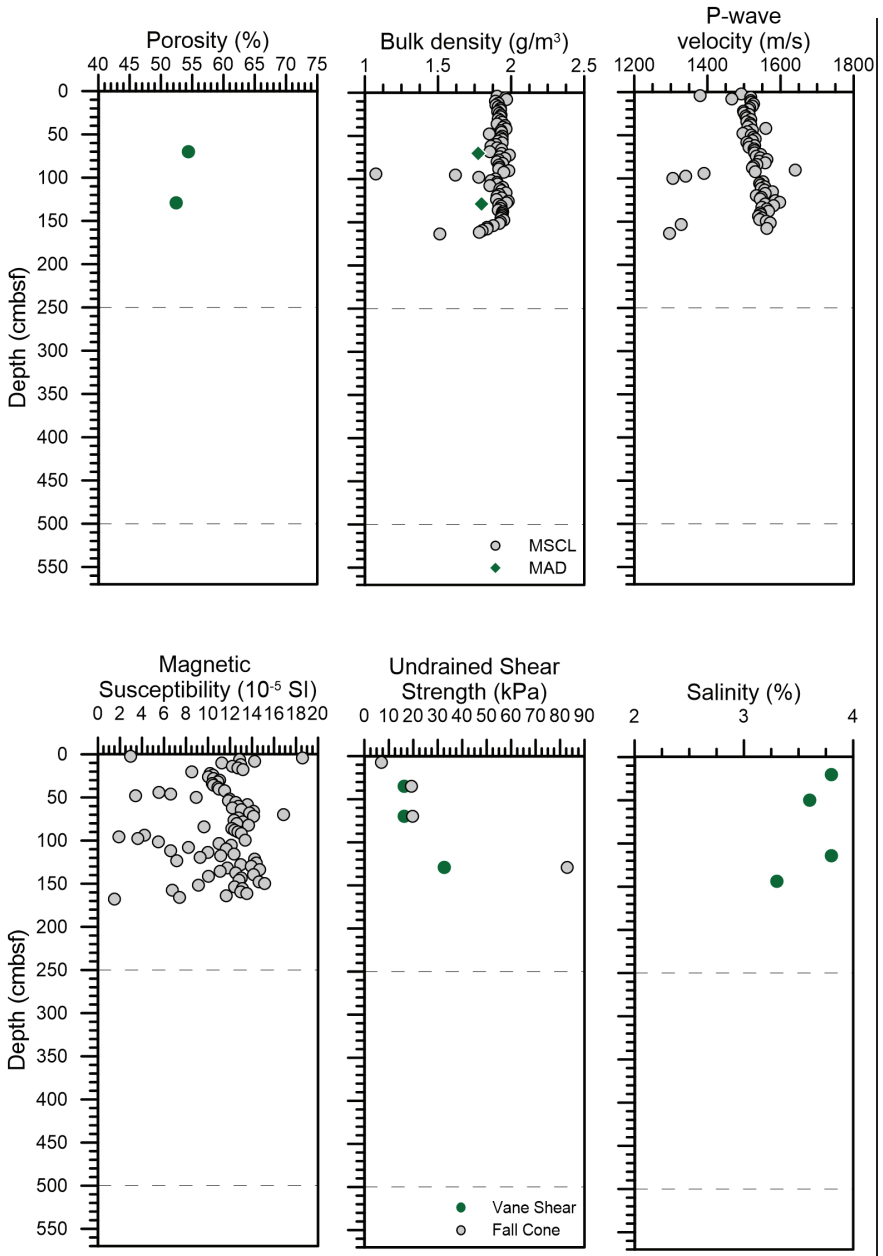
Date: 02.08.18, 13:00:00 (UTC)

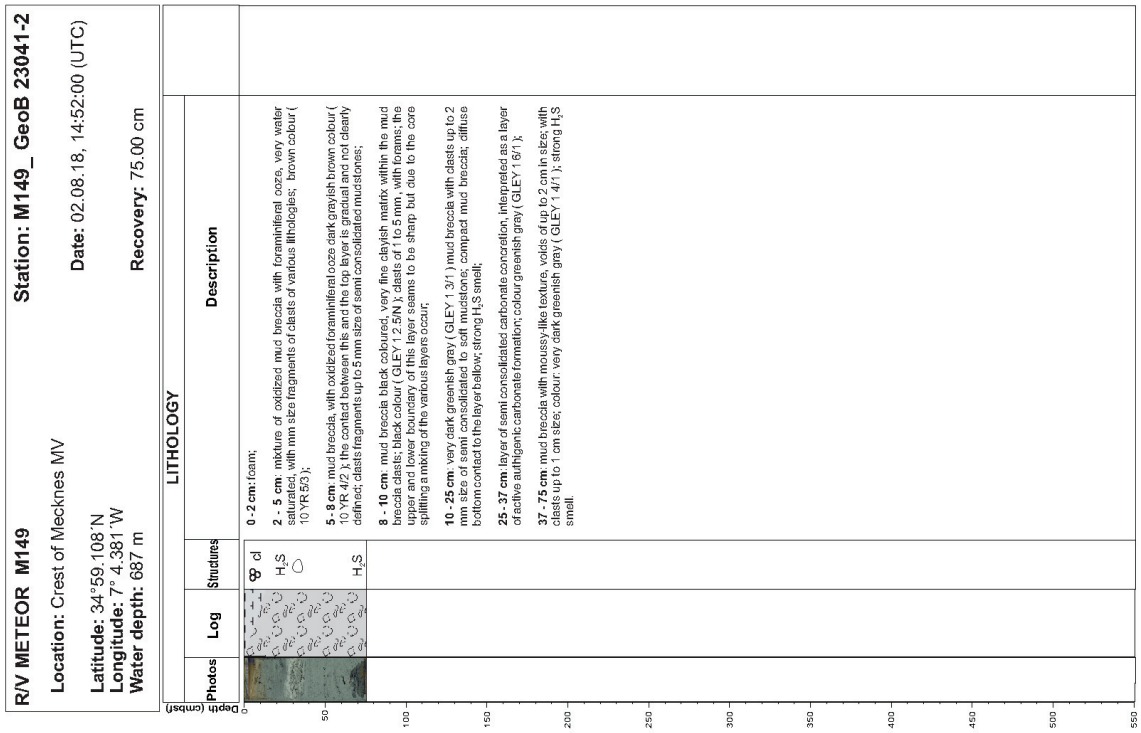
Latitude: 34°59.104´N
Longitude: 7° 4.200´W
Water depth: 735 m

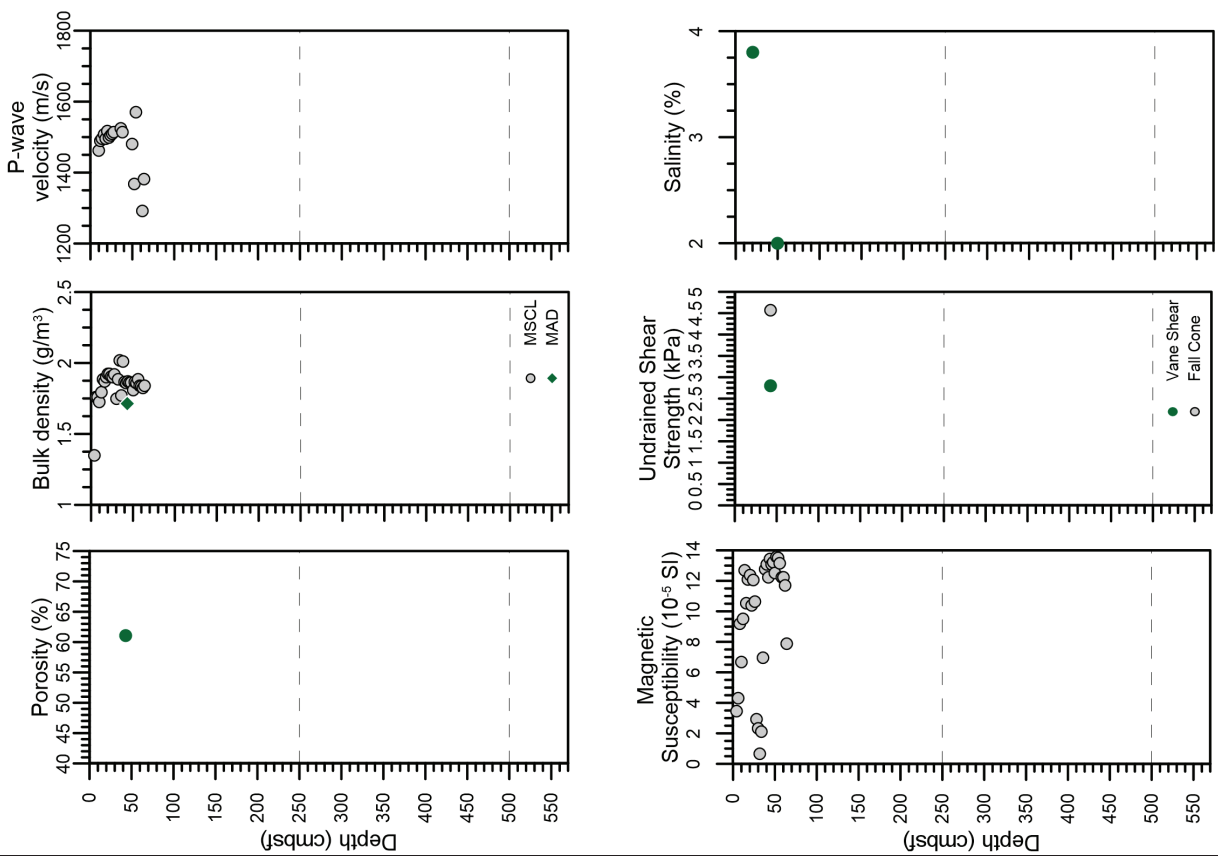
Recovery: 169.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0			py, cc, H_2S	**0 - 2 cm**: foam **2 - 5 cm**: foraminiferal ooze, with mm size clasts fragments from the mud breccia below; oxidized, yellowish brown colour (10YR 5/6); water saturated; **5 - 12 cm**: mud breccia mixed with foraminiferal ooze; oxidized, of dark grayish brown (2.5 Y 4/2) colour, clasts of mm size; 8 - 9 cm: coral fragments of 2 cm; **12 - 169 cm**: Mud breccia, anoxic and very thick, colour changing from dark gray (2.5 Y 4/1) @ 15 cm to very dark greenish gray (GLEY 1 3/1) and being the same up to the bottom; clasts mainly of semi consolidated to weak consolidated mudstone up to 2 cm in size; H_2S smell; @ 49 cm: a large clast of siltstone, 5 cm with pyrite crystals on surface; @ 85 cm: carbonate concretion, plate like 1 mm thick and 4 x 5 cm wide, possibly being a layer of carbonate pp. 165 - 169 cm: large void due to core retrieving.
50				
100				
150				
200				
250				
300				
350				
400				
450				
500				
550				




R/V METEOR M149
Station: M149_ GeoB 23041-2
Location: Crest of Mecknes MV
Latitude: 34°59.108´N
Longitude: 7° 4.381´W
Water depth: 687 m
Date: 02.08.18, 14:52:00 (UTC)
Recovery: 75.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 2 cm: foam;
2 - 5 cm: mixture of oxidized mud breccia with foraminiferal ooze, very water saturated, with mm size fragments of clasts of various lithologies; brown colour (10 YR 5/3);
5 - 8 cm: mud breccia, with oxidized foraminiferal ooze dark greyish brown colour (10 YR 4/2); the contact between this and the top layer is gradual and not clearly defined; clasts fragments up to 5 mm size of semi consolidated mudstones;
8 - 10 cm: mud breccia black coloured, very fine clayish matrix within the mud breccia clasts; black colour (GLEY 1 2.5/N); clasts of 1 to 5 mm , with forams; the upper and lower boundary of this layer seams to be sharp, but due to the core splitting a mixing of the various layers occur;
10 - 25 cm: very dark greenish gray (GLEY 1 3/1) mud breccia with clasts up to 2 mm size of semi consolidated to soft mudstone; compact mud breccia; diffuse bottom contact to the layer bellow; strong H2S smell;
25 - 37 cm: layer of semi consolidated carbonate concretion, interpreted as a layer of active authigenic carbonate formation; colour greenish gray (GLEY 1 6/1);
37 - 75 cm: mud breccia with mousy-like texture, voids of up to 2 cm in size; with clasts up to 1 cm size; colour: very dark greenish gray (GLEY 1 4/1); strong H2S smell.


P-wave velocity (m/s)
Bulk density (g/m³)
Porosity (%)
MSCL
MAD
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23043-1**

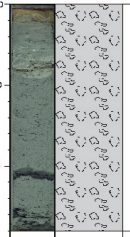
Location: Crest 2 Meknes MV / CC Test

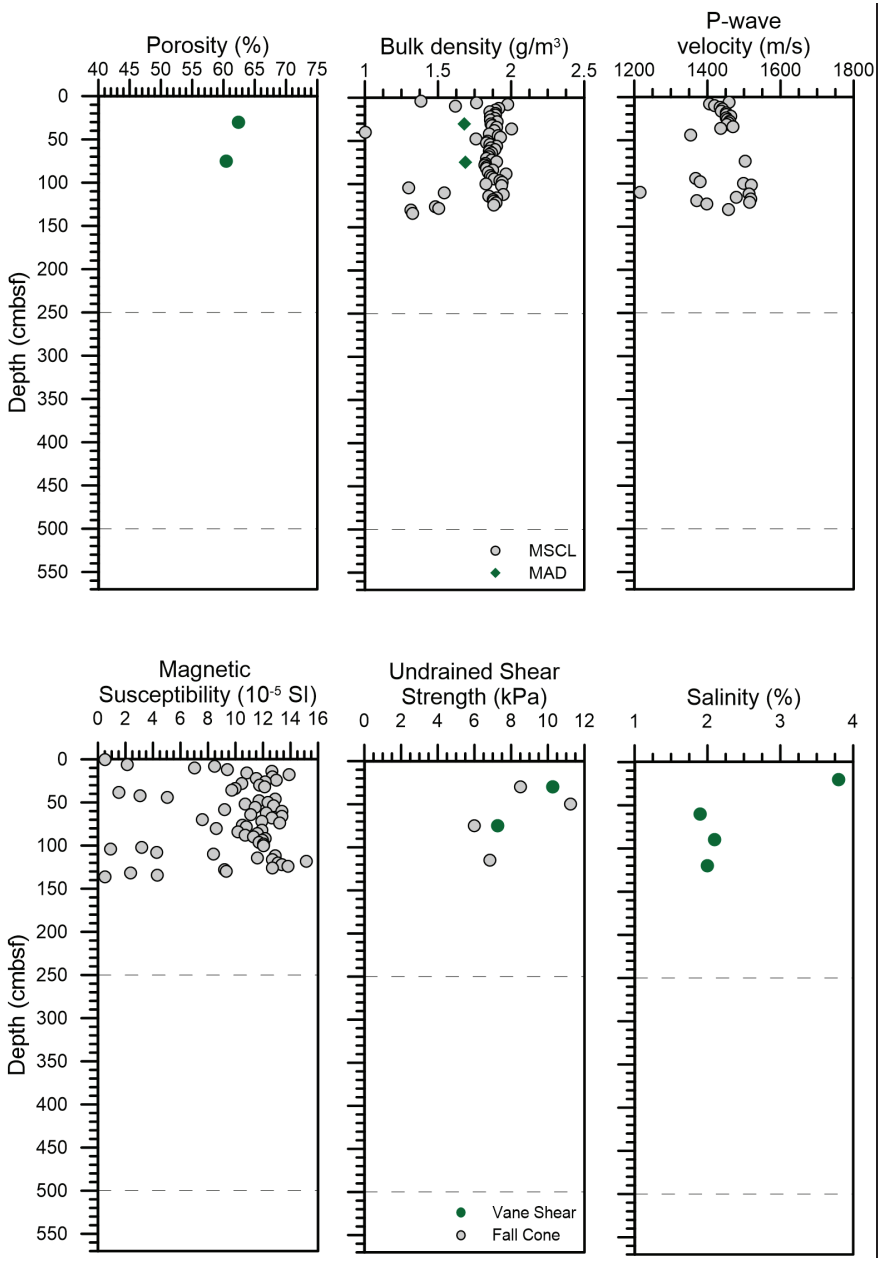
Date: 04.08.18, 12:39:00 (UTC)

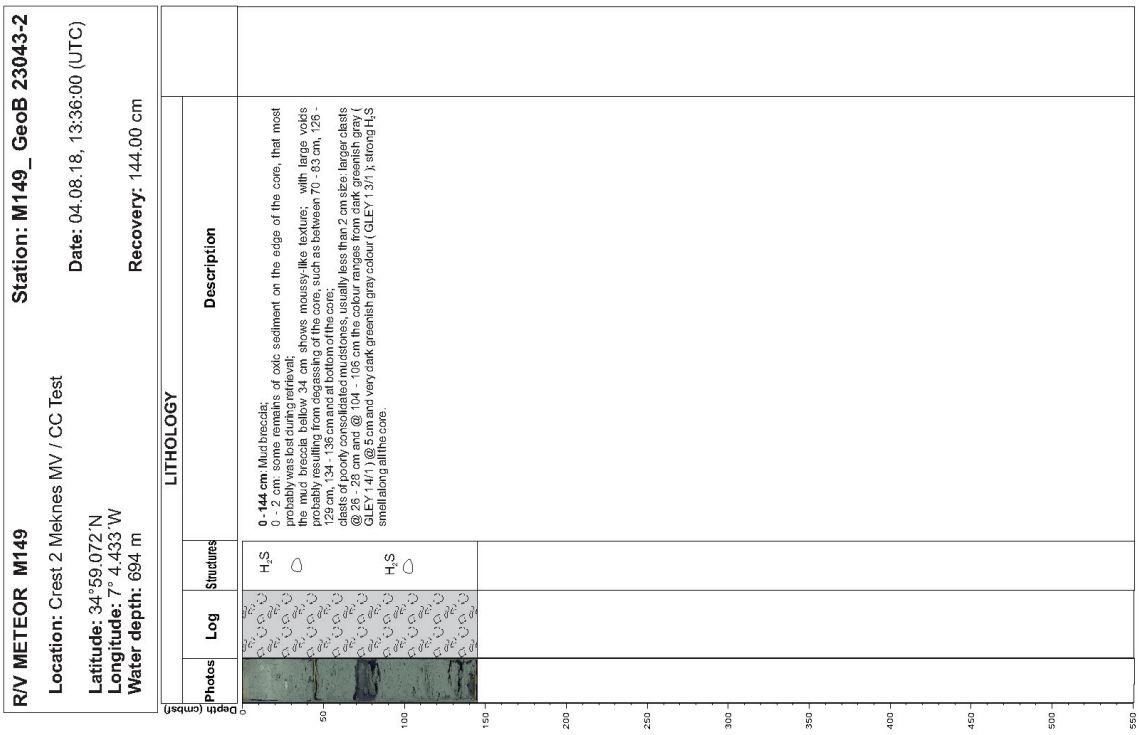
Latitude: 34°59.074´N
Longitude: 7° 4.436´W
Water depth: 687 m

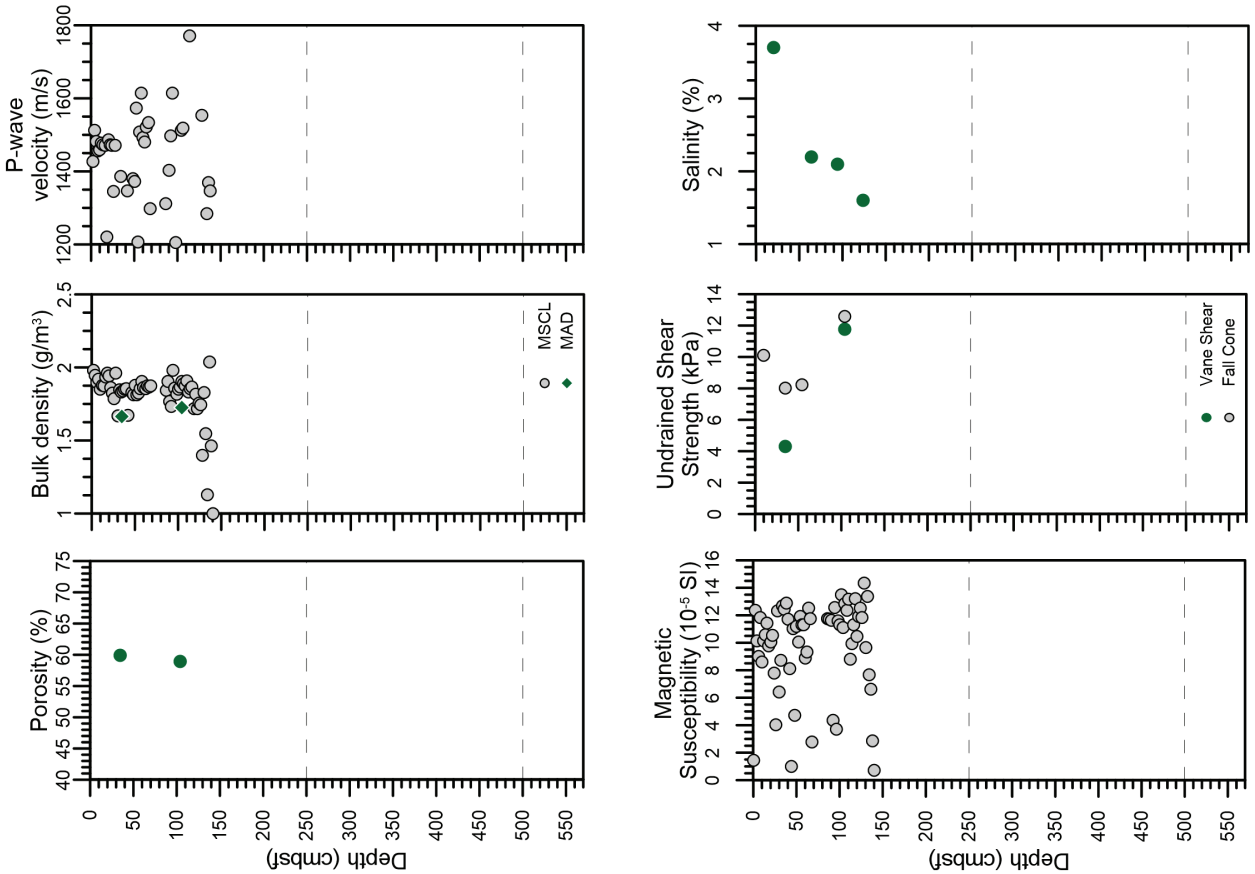
Recovery: 140.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0			H_2S cc py H_2S	0 - 2 cm: foam; **2 - 7 cm**: oxidized mud breccia, olive brown (2.5 Y4/6) color, water saturated, with some foraminiferal tests; **7 - 140 cm**: mud breccia, with H_2S smell and rock clasts of semi consolidated mudstone; 7 - 30 cm: mud breccia relatively stiff, no moussy texture, increasing hardness due to carbonate precipitation on the layer below; 30 - 45 cm: partially cemented layer due to carbonate precipitation; the bottom contact of this layer is sharp and well defined while the upper boundary is diffuse and gradual; 45 - 140 cm: moussy mud breccia, with cm size voids and with large voids as the one between 101 and 106 cm with 5 cm length cutting all the core, voids also @ base of the core; strong H_2S smell; clasts of semi consolidated mudstone of up to 3 cm size; with pyrite crystals dispersed on the matrix.
50				
100				
150				
200				
250				
300				
350				
400				
450				
500				
550				




R/V METEOR M149
Station: M149_ GeoB 23043-2
Location: Crest 2 Meknes MV / CC Test
Date: 04.08.18, 13:36:00 (UTC)
Latitude: 34°59.072'N
Longitude: 7° 4.433'W
Water depth: 694 m
Recovery: 144.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 144 cm: Mud breccia;
0 - 2 cm: some remains of oxic sediment on the edge of the core, that most probably was lost during retrieval;
the mud breccia bellow 34 cm shows moussy-like texture; with large voids probably resulting from degassing of the core, such as between 70 - 83 cm, 126 - 129 cm, 134 - 135 cm and at bottom of the core;
clasts of poorly consolidated mudstones, usually less than 2 cm size; larger clasts @ 26 - 28 cm and @ 104 - 106 cm the colour ranges from dark greenish gray (GLEY 1 4/1) @ 5 cm and very dark greenish gray colour (GLEY 1 3/1); strong H2S smell along all the core.
H2S
H2S


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23044-1**

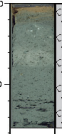
Location: Crest 3 of Meknes MV

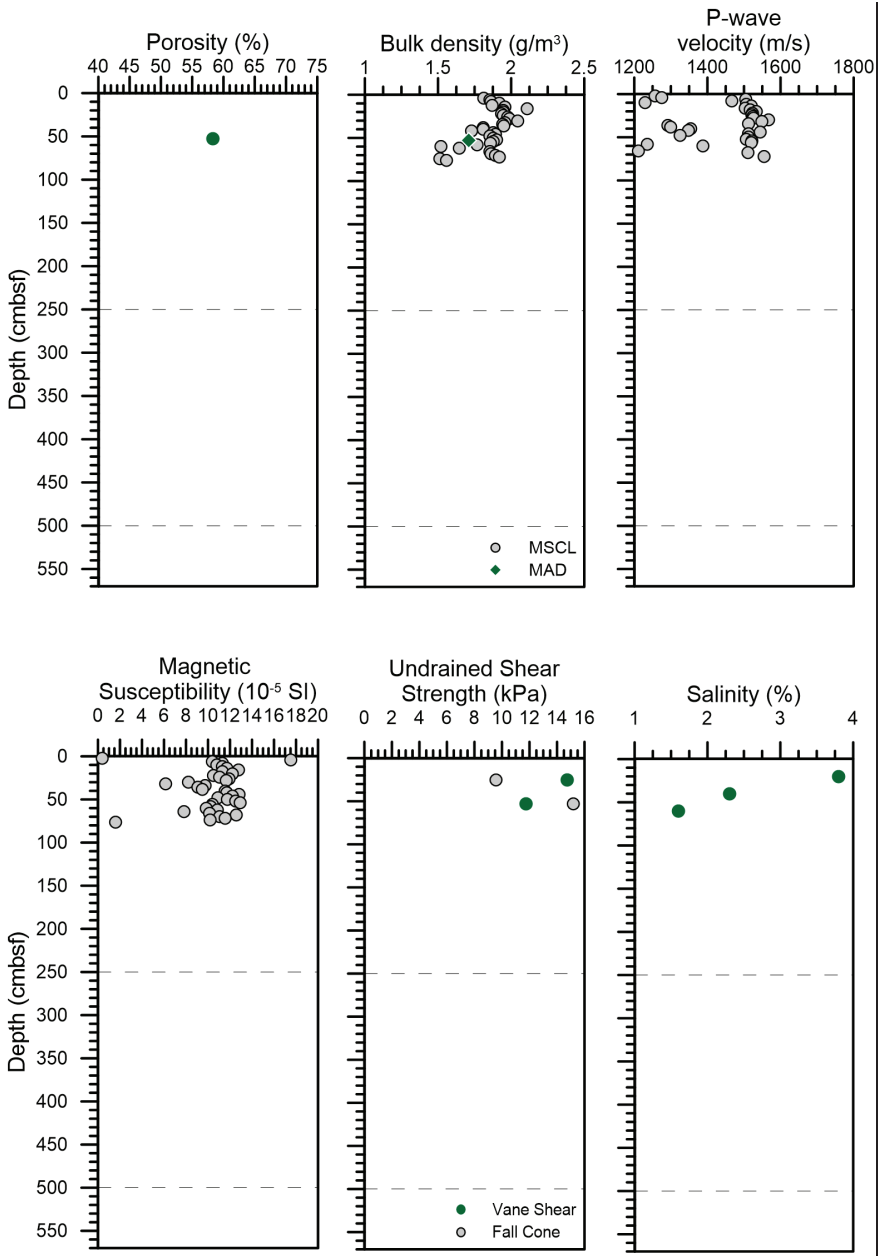
Latitude: 34°59.030´N
Longitude: 7° 4.369´W
Water depth: 695 m

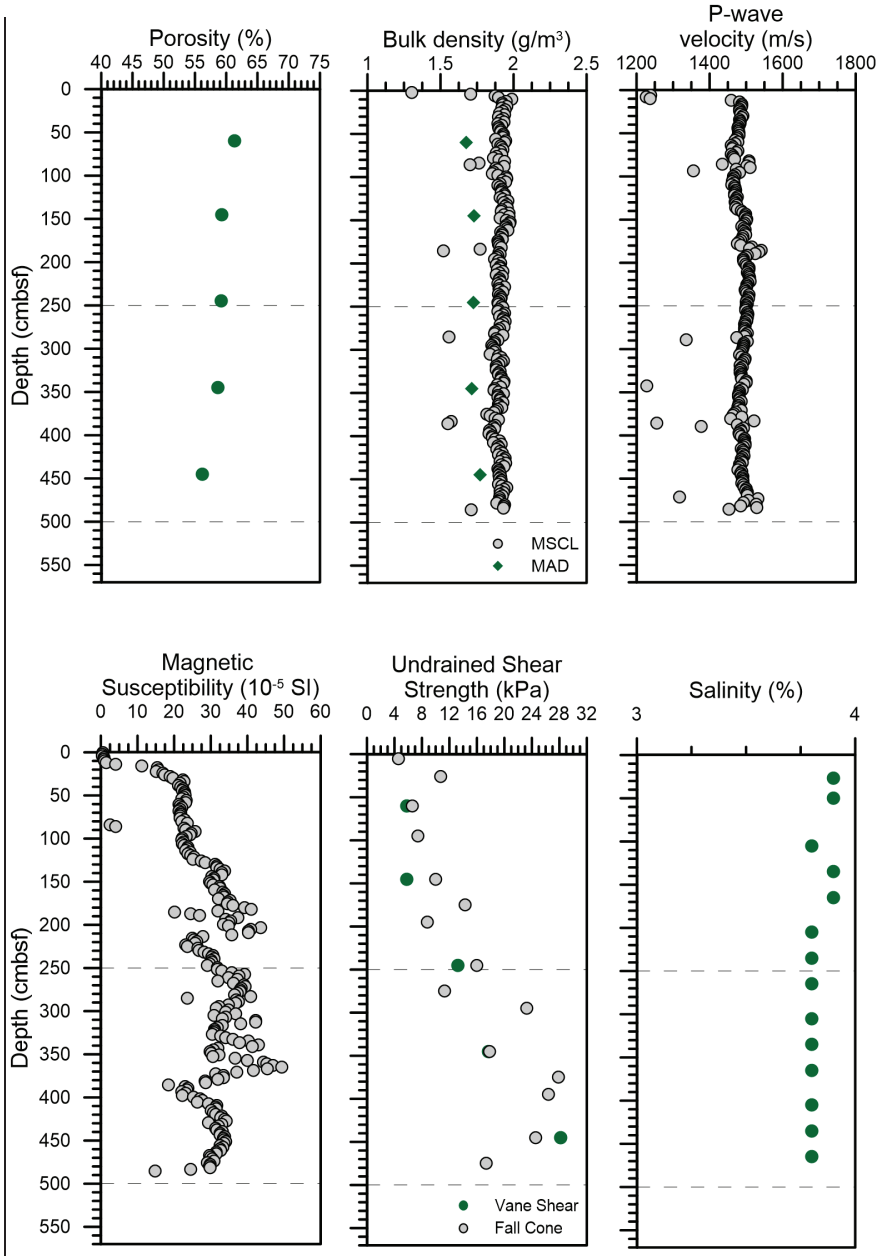
Date: 04.08.18, 14:35:00 (UTC)

Recovery: 77.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0–50			cl cc H_2S	**0 - 2 cm:** foam; **2 - 6 cm**: oxidized mud breccia, olive brown (2.5Y 4/4) colour, with clasts of mm size; **6 - 12 cm**: mud breccia with mixtures of oxidized mud breccia; **12 - 26 cm**: mud breccia, with dark greenish gray colour (GLEY 1 4/1) with clasts of non consolidated mud stone of up to 1.5 cm in size; compacted mud breccia; **26 - 38 cm**: partially cemented layer of greenish gray colour (GLEY 1 6/1), probably due to incipient precipitation of authigenic carbonates; the top of this layer is diffuse and gradual from the mud breccia above; the base of this layer is sharp and clear to the mud breccia below; **38 - 77 cm**: mud breccia with a moussy-like texture; with voids and a open cracks @ base of the core; clasts of semi consolidated mud stones;
50–100				
100–150				
150–200				
200–250				
250–300				
300–350				
350–400				
400–450				
450–500				
500–550				





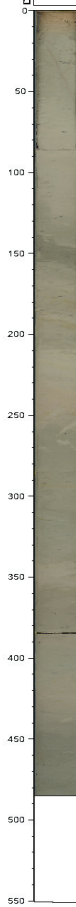
R/V METEOR M149 **Station: M149_ GeoB 23045-1**

Location: Depression 3 Lineament South

Date: 04.08.18, 16:12:00 (UTC)

Latitude: 35° 3.194´N
Longitude: 7° 8.007´W
Water depth: 943 m

Recovery: 485.00 cm



LITHOLOGY

Photos	Log	Structures	Description
			0 - 11 cm: oxidized foraminiferal ooze, water saturated in the top 4 cm gradually decreasing in forams content and consequently decreasing in grain size to the bottom and gradually passing to nannofossil ooze sediment of the layer below; colour gradually changing from brownish yellow (10 YR 6/6) @ 1 cm to grayish brown (10 YR 5/2) @ 11 cm; coral fragment with 1 cm @ 5 cm; some alternations between foram rich mm layers and nannofossils rich layers between 7 and 11 cm that can be result of core disturbance or bioturbance; **11 - 140 cm:** silty nannofossil ooze gradually changing in colour from gray (2.5 Y 6.1) @ 14 cm to dark grayish brown (2.5 Y 4/2) @ 140 cm ; dispersed mm to 1 cm size patch of black material , bioturbated @ bottom; between 11 cm and 51 cm a reddish (brown 7.5 YR 5/2) colour brownish like veins diagonally cross-cut the core, branching upwards are interpreted as bioturbation effects or as reaction fronts due to some fluids migration (?) **144 - 156 cm:** silty foraminiferal ooze layer with distinct upper and bottom contacts, oblique; colour dark greenish gray (GLEY 1 4/1) the top and bottom contacts are distinctive but irregular and oblique to the core, the bottom shows some convolution characteristics, layer rich in black patches; **156 - 209 cm:** nannofossil ooze; very dark grayish brown colour (2.5 Y 3/2) with patches rich in black organic matter of mm size more abundant in the bottom half of the layer; bioturbated; with a distinct bottom contact undulated and affected by bioturbation; **209 - 259 cm:** nannofossils ooze with forams, of lighter colour than the layer above; gray colour (2.5 Y 6/1) @ 215 cm gradually changing to olive brown (2.5 Y 4/3) @ 144 cm; bioturbated between 252 and 277 cm; **259 - 343 cm:** nannofossil ooze of dark grayish brown colour (2.5 YR 4/2) with some colour and amount of black patches to the bottom; bioturbated; boundaries are diffuse and gradual; **343 - 409 cm:** nannofossils ooze of olive brown colour (2.5 Y 5/3) @ 350 cm, changes to dark olive brown (2.5 Y 4/2) from 364 cm up to 409 cm and also showing an increase in forams content, and of black cm size patches, to the bottom; the bottom of this layer is distinctive in colour and oblique to the core; bioturbated; **409 - 485 cm:** nannofossil ooze, of olive brown colour (2.5 Y 5/3) @ 415 cm changing to dark olive brown (2.5 Y 4/2) from 450 cm downwards and showing also an increase in forams content as also in black material patches of mm size.

R/V METEOR M149 **Station: M149_ GeoB 23049-1**

Location: Lineament center; HF Station

Date: 06.08.18, 12:00:00 (UTC)

Latitude: 35°15.406´N
Longitude: 7° 5.311´W
Water depth: 1031 m

Recovery: 339.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0–550				

0 - 2 cm: foam;

2 - 36 cm: foraminiferal ooze, oxidized bioturbated colour ranging from brown (10 YR 4/3) @ 2 cm to dark grayish brown (10 YR 4/2) @ 35 cm; 1 cm size solitary coral fragment @ 27 cm and 1 spicula fragment @ 29 cm; patches of yellowish clouds dispersed throughout the layer; the base of the layer is expressed by a change in colour of the sediment and of minor decrease in grain size , this contact is undulated;

36 - 145 cm: chaotic foraminiferal ooze, very heterogeneous, moderate to intense bioturbated, with a large vertical borrow between 71- 100 cm; between 49 and 67 cm the presence of a fracture/ structure diagonally cutting the entire core; this fracture is 1 - 5 mm thick and infilled by a very fine (clay ?) material of grayish brown colour (10 YR 5/2);

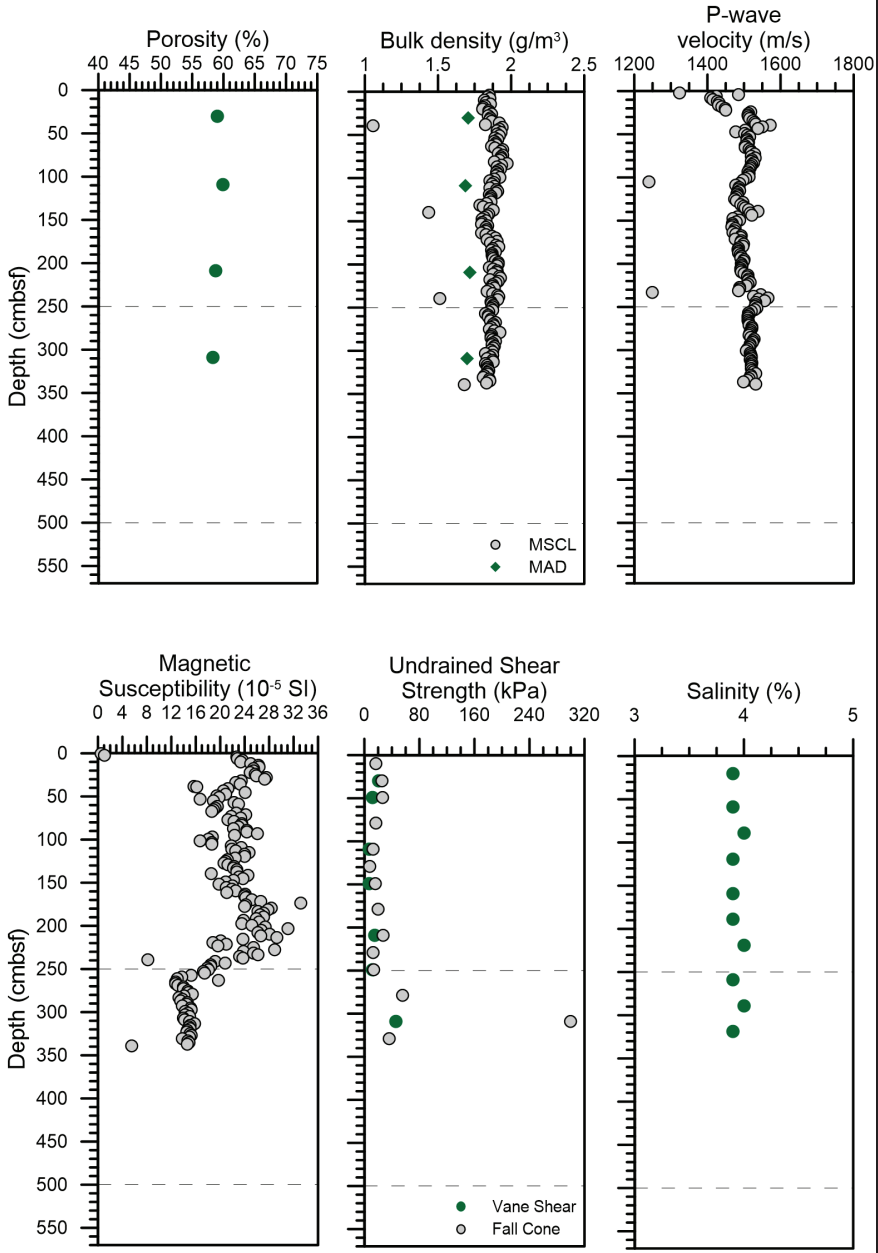
40 - 140 cm: this layer has variable colour and grain size content, ranging in colour from grayish brown (2.5 Y 5/2) to dark grayish brown colour (2.5 Y 4 /2) between 40 and 53 cm coarser sediment is present with detrital grains of very coarse sand, 2 - 3 mm in size are abundant, but no sedimentary structures are observed, probably due to intense bioturbation, but clearly this level marks and high energy event;

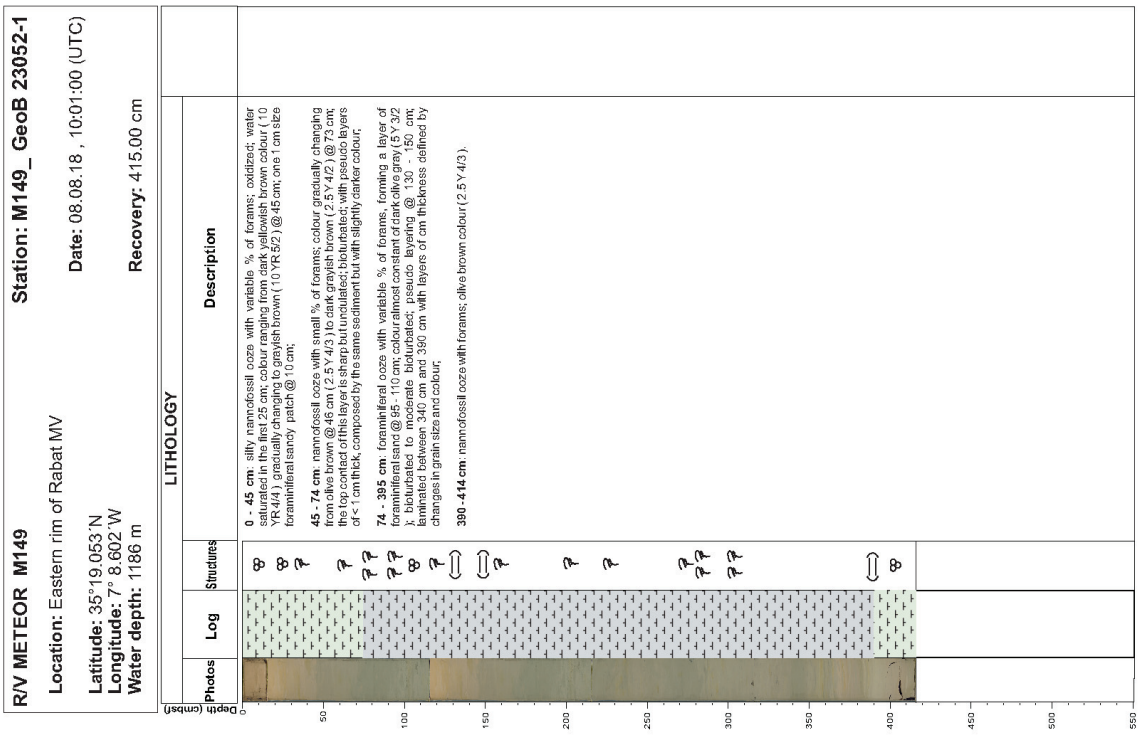
145 - 171 cm: foram-bearing nannofossil ooze, intense bioturbated, with borrow infills from the layer above, dark olive gray (5 Y 3/2) colour, with undulated and diffuse top and bottom contacts;

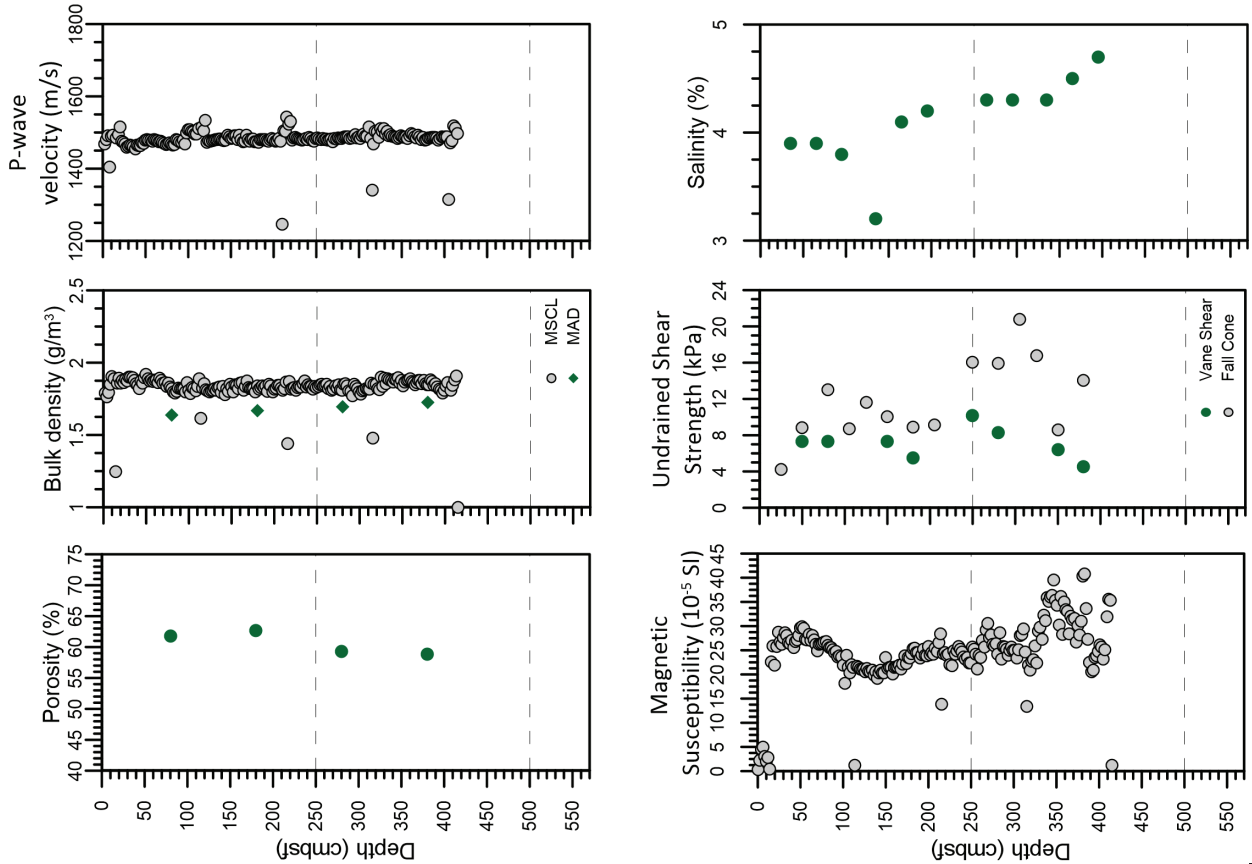
171 - 222 cm: fining upwards sedimentary package, with nannofossil ooze from 171 to 181 cm to dark grayish brown colour (2.5 Y 4/2), with cloudy oxidized patches of yellowish colour, intensely bioturbated; increasing in foram content and grain size to the base; from 200 cm until 222 cm the sediment becomes coarser; a foraminiferal sand between 210 and 222 cm with a crinoid spicula (4 cm long); the colour is dark grayish brown (2.5 Y 4/2) @ 220 cm; the bottom contact of this package is sharp but affected by bioturbation;

222 - 255 cm: other package of fining upwards sediment, foraminiferal ooze at the base and fining upwards to a foram-bearing nannofossil ooze; the bottom contact of this package is sharp but affected by bioturbation;

255 - 339 cm: homogeneous nannofossil ooze of gray colour (5 Y 5/2), with dispersed patches of mm size black organic material; bioturbated only at the top, between 255 and 270 cm.




R/V METEOR M149
Station: M149_ GeoB 23052-1
Location: Eastern rim of Rabat MV
Date: 08.08.18 , 10:01:00 (UTC)
Latitude: 35°19.053'N
Longitude: 7° 8.602'W
Water depth: 1186 m
Recovery: 415.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 45 cm: silty, nannofossil ooze with variable % of forams; oxidized; water saturated in the first 25 cm; colour ranging from dark yellowish brown colour (10 YR 4/4), gradually changing to grayish brown (10 YR 5/2) @ 45 cm; one 1 cm size foraminiferal sandy patch @ 10 cm;
45 - 74 cm: nannofossil ooze with small % of forams; colour gradually changing from olive brown @ 46 cm (2.5 Y 4/3) to dark grayish brown (2.5 Y 4/2) @ 73 cm; the top contact of this layer is sharp but undulated; bioturbated; with pseudo layers of < 1 cm thick, composed by the same sediment but with slightly darker colour;
74 - 395 cm: foraminiferal ooze with variable % of forams, forming a layer of foraminiferal sand @ 95 -110 cm; colour almost constant of dark olive gray (5 Y 3/2); bioturbated to moderate bioturbated; pseudo layering @ 130 - 150 cm; laminated between 340 cm and 390 cm with layers of cm thickness defined by changes in grain size and colour;
390 -414 cm: nannofossil ooze with forams; olive brown colour (2.5 Y 4/3).


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23053-1**

Location: Crest of R2 MV

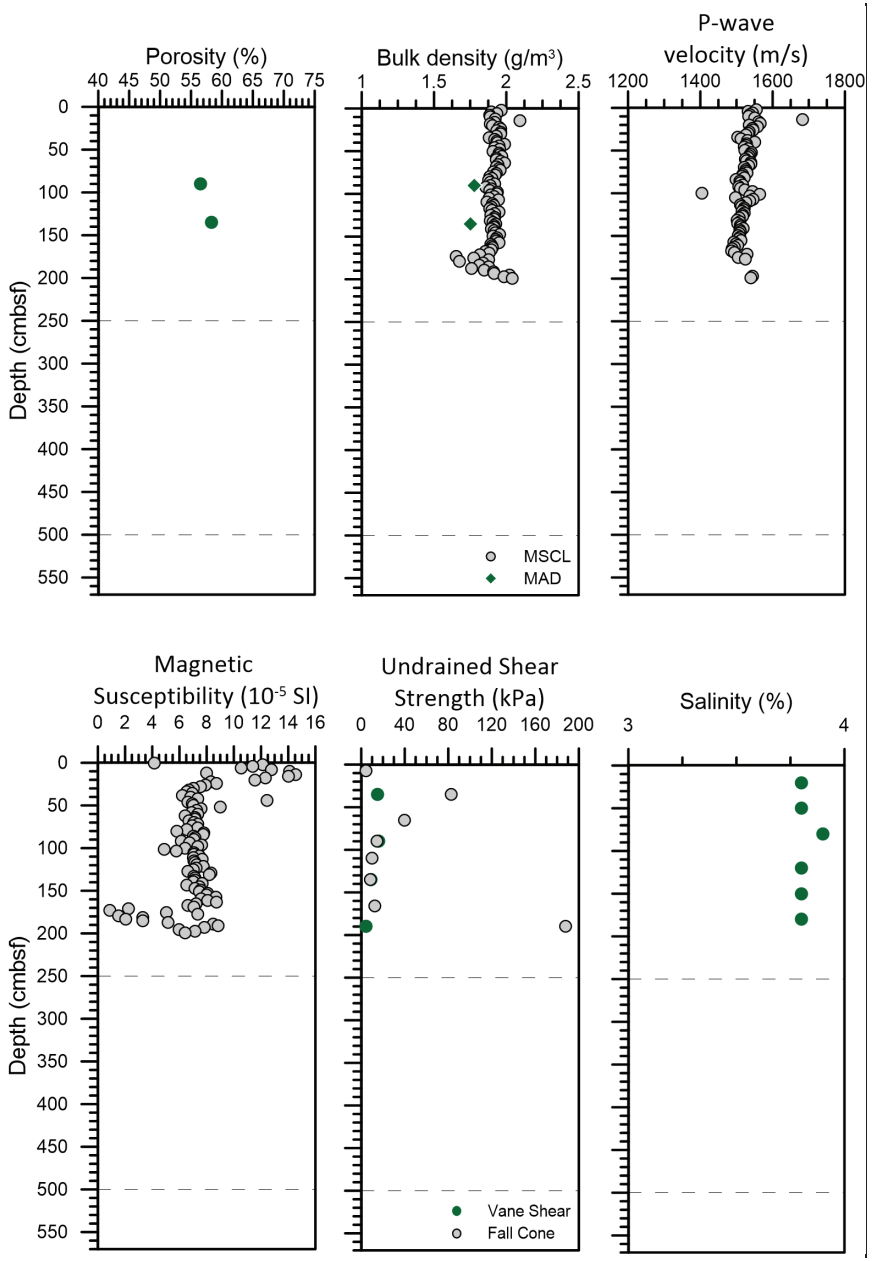
Latitude: 35°28.494´N
Longitude: 7°24.253´W
Water depth: 1163 m

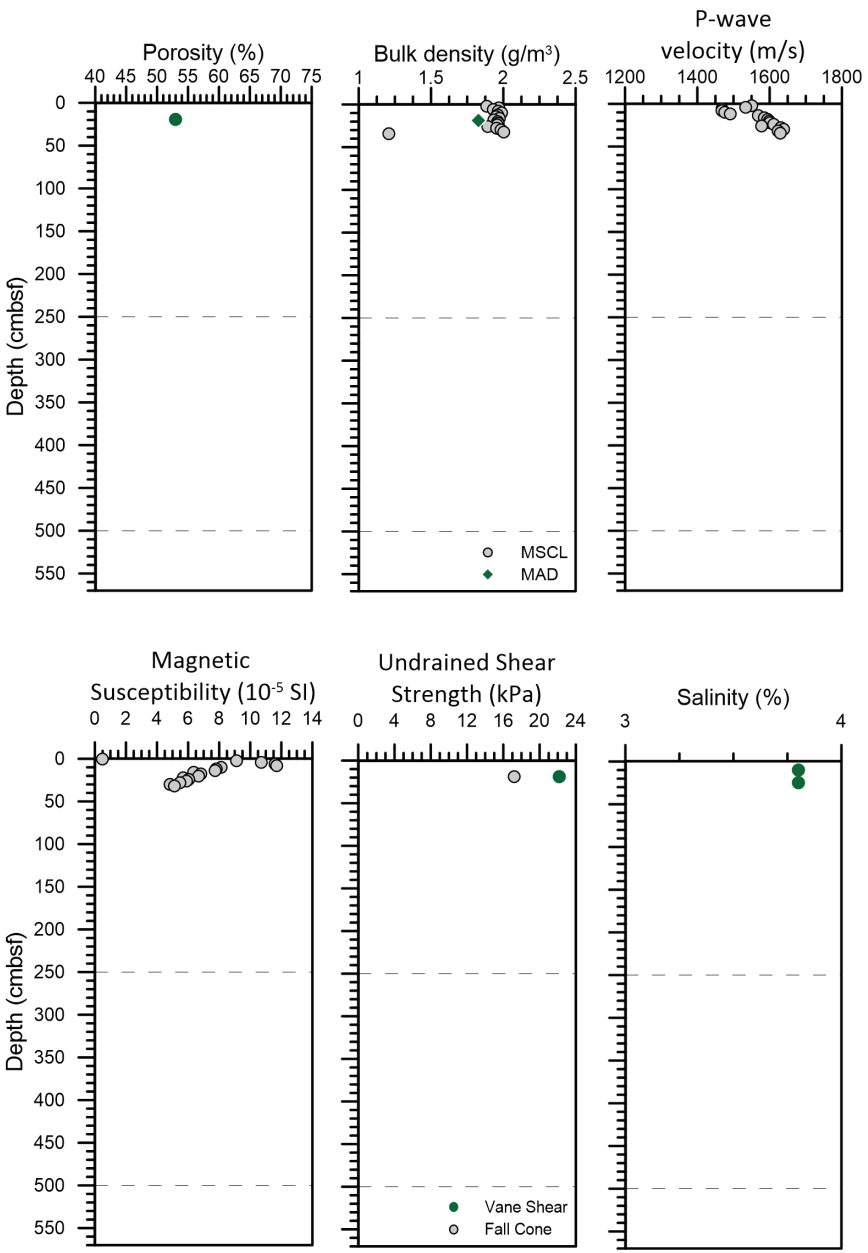
Date: 08.08.18, 12:56:00 (UTC)

Recovery: 200.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550			cc; cc; cc; cc H_2S py cc	**0 - 27 cm**: foraminiferal ooze, oxidized, yellowish brown colour (10 YR 5/8), water saturated up to 10 cm, intense bioturbatuion; coral fragments @ 6, 7, 12 cm; with shell fragments @ 11 cm and @ 22 cm; with yellowish brown patch from 15 to 27 cm, the lower boundary of this package is sharp and clearly defined by a colour change from light olive brown (2.5 Y 5/6) to gray (5 Y 5/1) of the layer bellow; **27 - 143 cm**: foraminiferal ooze, anoxic, of gray colour (5 Y 5/1); highly bioturbated; with < 1 cm size clasts of semi consolidated mudstone and well consolidated 1 - 2 mm clasts of variable lithologies @ 78 - 80 cm: a carbonate concretion clast of planar shape, with a stromatolitic like coating of the clast surfaces; shell fragments @ 45 cm and mm size fragments dispersed through the layer; **143 - 160 cm**: nannofossils ooze layer, greenish gray colour (GLEY 1 5/1); bioturbated , with a 1 cm size shell fragment @ 158 cm; **160 - 168 cm**: layer of fine matrix mud breccia with semi consolidated mud clasts and with a interval prone in clasts / carbonate concretions between 161 and 166 cm; **168 - 173 cm**: semi consolidated layer of greenish gray colour (GLEY 1 6/1) of cemented mud or incipient carbonate concretion (?) **173 - 175 cm**: 2 cm layer of mud breccia material, very dark greenish gray colour (GLEY 1 3/1) with very sharp and straight top and bottom contact; high content of fine disseminated pyrite crystals @ the bottom contact of this layer; strong H_2S smell in this layer; **175 - 187 cm**: mud breccia with large clast > 6 cm of semi consolidated mudstone or carbonate concretion; very sharp boundary @ top with pyrite crystals; the bottom contact is diffuse and gradual; **187 - 200 cm**: mud breccia, dominated by mud matrix, only with small clasts of semi consolidated mudstone; dark greenish gray colour (GLEY 1 4/9).





R/V METEOR M149 — **Station: M149_ GeoB 23054-1**

Location: Crest of D2 MV

Latitude: 35°28.817´N
Longitude: 7°24.091´W
Water depth: 1194 m

Date: 08.08.18, 14:24:00 (UTC)

Recovery: 35.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 20 cm**: foraminiferal ooze, oxidized, colour gradually changing from yellowish brown (10 YR 5/8) @ 1 cm to gray (10 YR 5/1) @ 15 cm; bioturbated with shell fragments and coral fragments of mm size; **20 - 35 cm**: foraminiferal ooze, anoxic, bioturbated and with a mixture of mud breccia that has a foram-dominated matrix, but with clasts of mm size of mud stone poorly consolidated; fragments of mm size of corals and shells dispersed on this layer; @31 cm: a 2 cm size coral fragment very poorly preserved and partly dissolved.

R/V METEOR M149 — **Station: M149_ GeoB 23056-1**

Location: Crest of El Cid MV

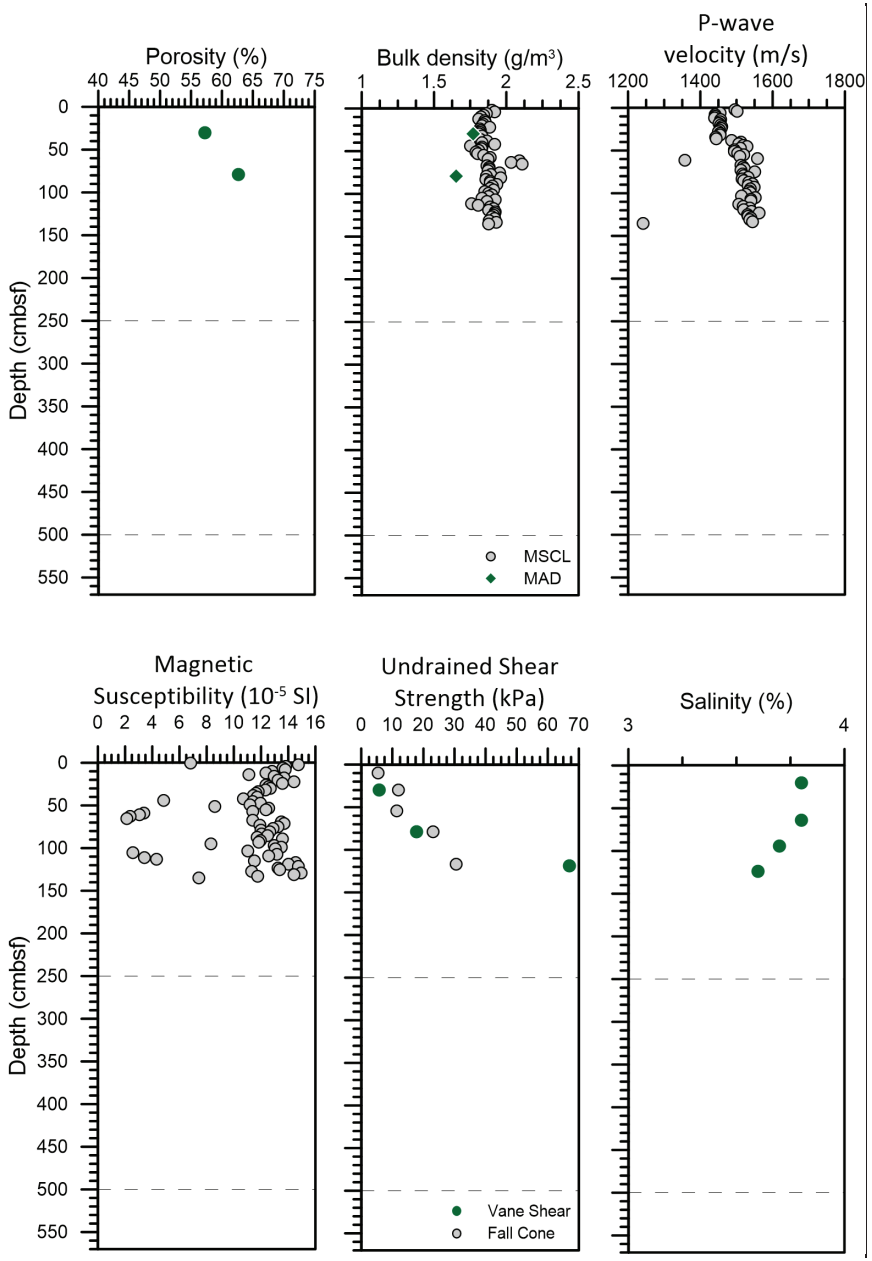
Latitude: 35°26.462´N
Longitude: 7°28.922´W
Water depth: 1229 m

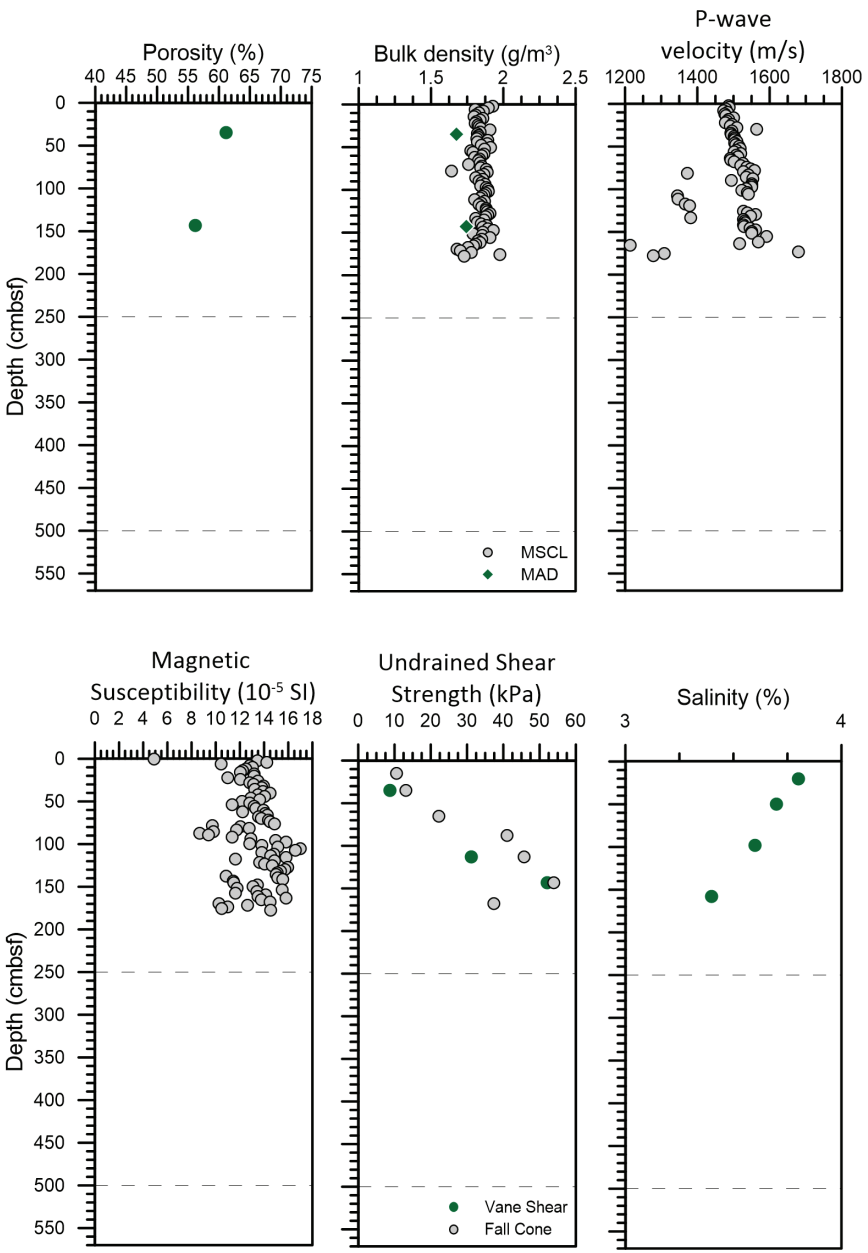
Date: 08.08.18, 17:34:00 (UTC)

Recovery: 144.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 5 cm**: foraminiferal ooze, with mm size clasts of mud breccia, oxidized, light yellowish brown colour (10 YR 6/4);
50			cl	**5 - 37 cm**: mixture of anoxic mud breccia with anoxic pelagics from the top layer; bioturbated; colour gradually changing from light yellowish brown to very dark greenish gray colour (GLEY 1 3/1) @ 40 cm; a spicula fragment @ 15 cm;
100			H_2S cl H_2S	**37 - 144 cm**: mud breccia, with large clasts up to 10 cm of well lithified silt/ sandstone; cm size clasts of poorly lithified mudstone; large clast @ 57 - 67 cm of sandstone well lithified; strong H_2S smell; @110 - 112 cm: clasts of mudstone with incrustation of "stromatolitic" like carbonate precipitate.
150				
200				
250				
300				
350				
400				
450				
500				
550				





R/V METEOR M149 — **Station: M149_ GeoB 23057-1**

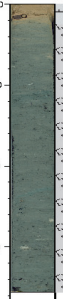
Location: Crest of Amanzor

Latitude: 35°22.978´N
Longitude: 7°30.352´W
Water depth: 1230 m

Date: 08.08.18, 19:10:00 (UTC)

Recovery: 178.00 cm

LITHOLOGY

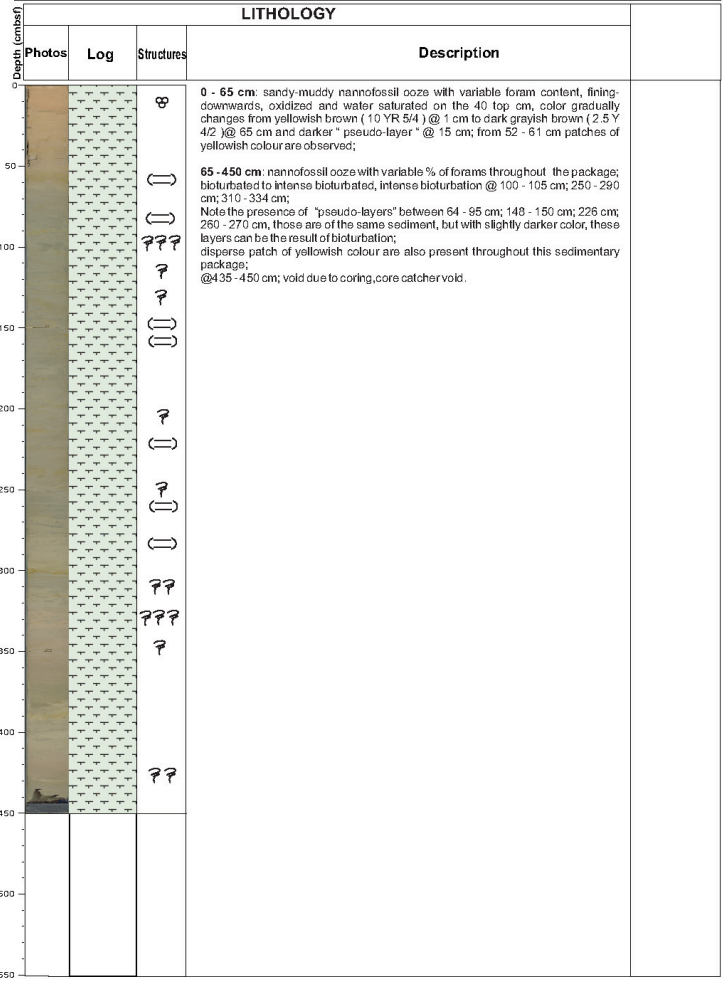
Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 12 cm**: foraminiferal ooze, oxidized and water saturated, light yellowish brown colour (10 YR 6/4) @ 1 cm; mixed with oxidized mud breccia; @7 - 8 cm: Fe/ polimetalic coating of a mudstone clast, 2x4 cm size; **12 - 178 cm**: mud breccia, dark greenish gray colour (GLEY 1 4/1); with a strong H_2S smell; with large % of clasts, mainly of semi consolidated mudstones up to 5 cm of various colours; also large clasts of well lithified silt - sandstones (up to 5 cm).
50			cl	
100			H_2S	
150			cl	
200				
250				
300				
350				
400				
450				
500				
550				

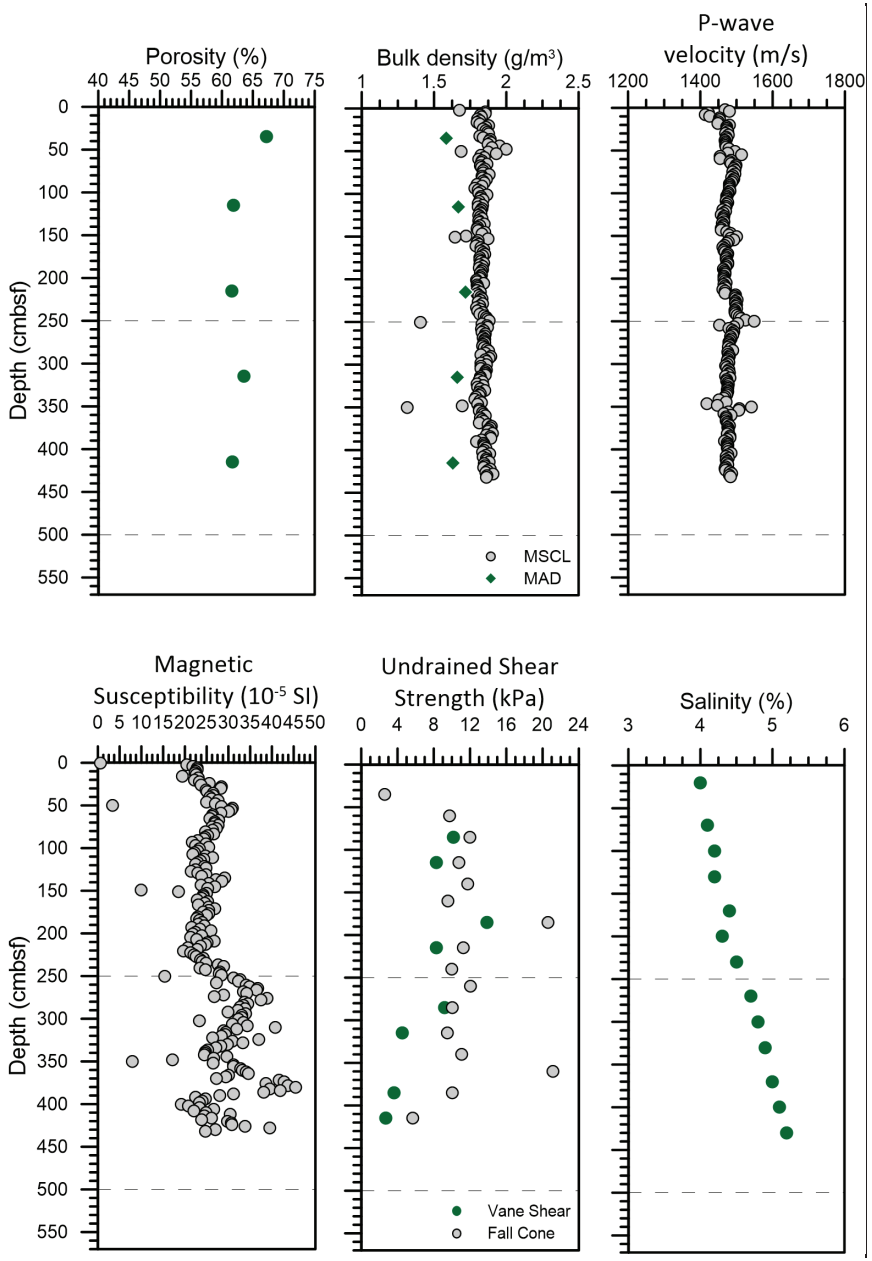
R/V METEOR M149 **Station: M149_ GeoB 23062-1**

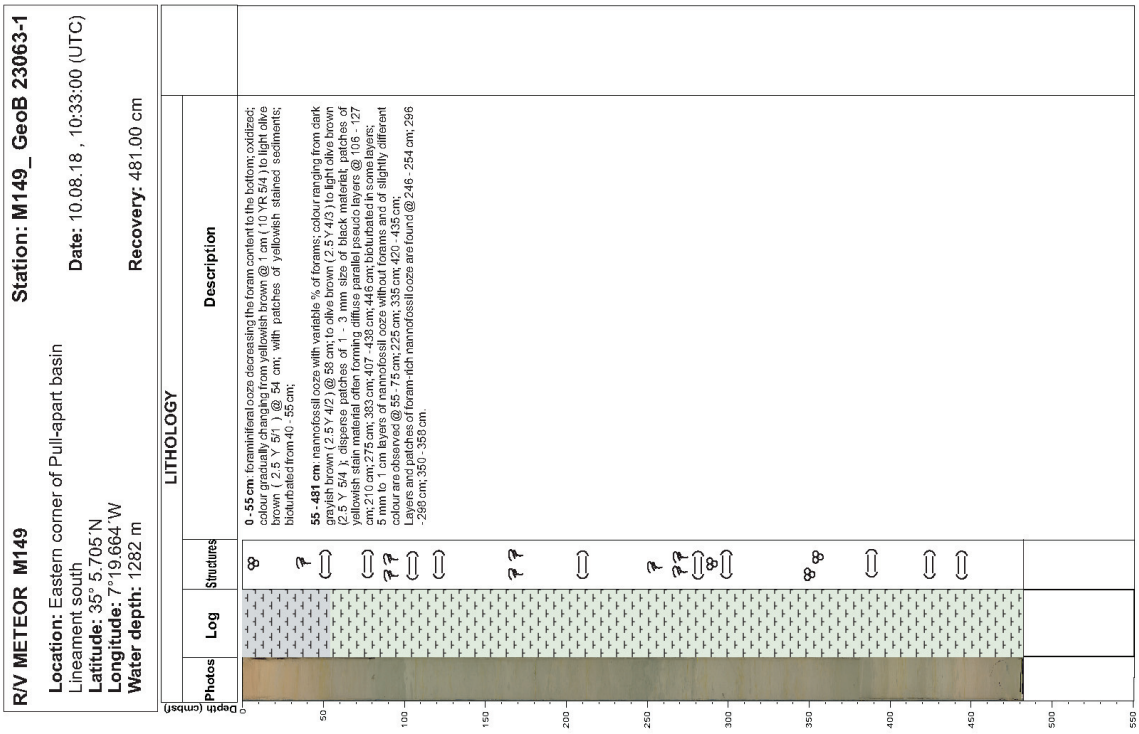
Location: Pull-apart basin, Lineament south branch

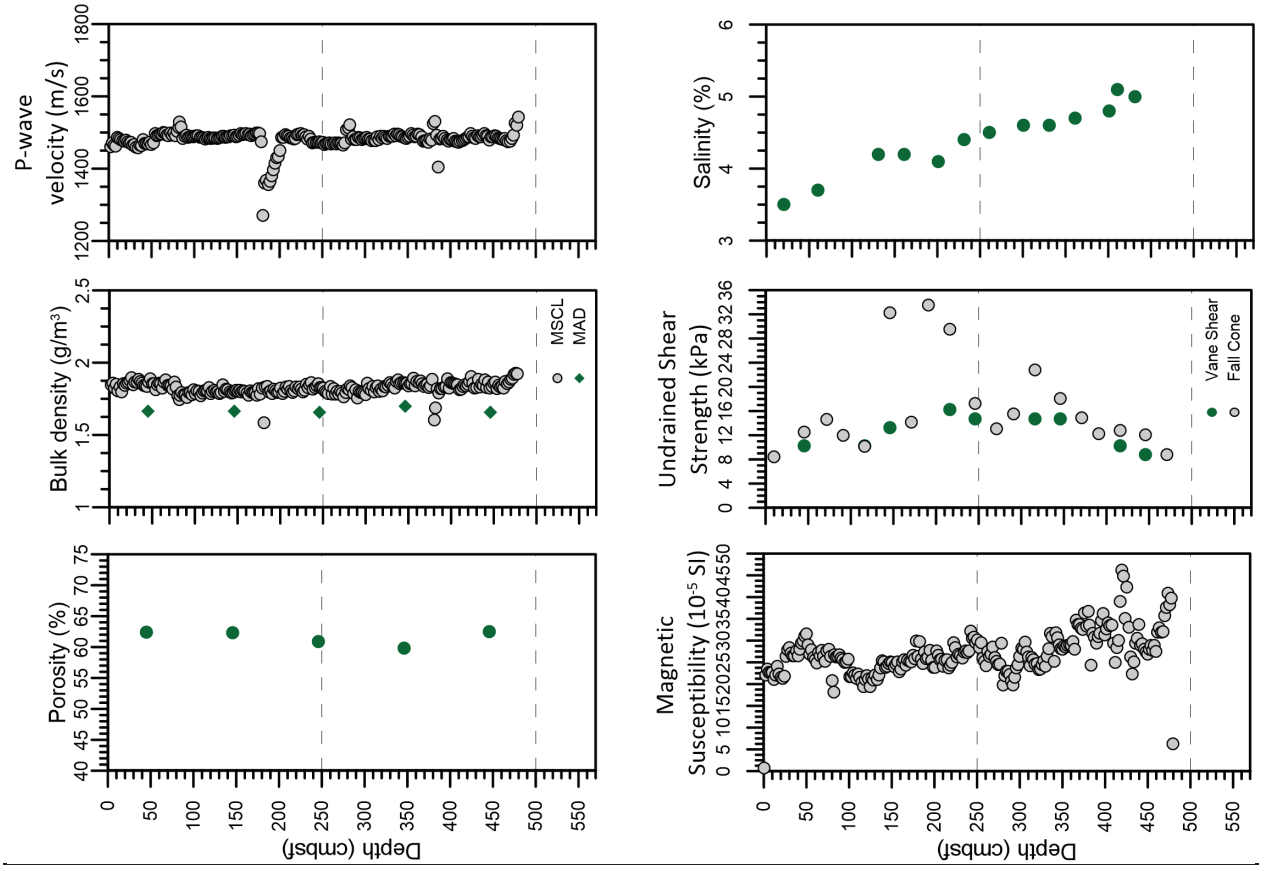
Date: 10.08.18 , 08:59:00 (UTC)

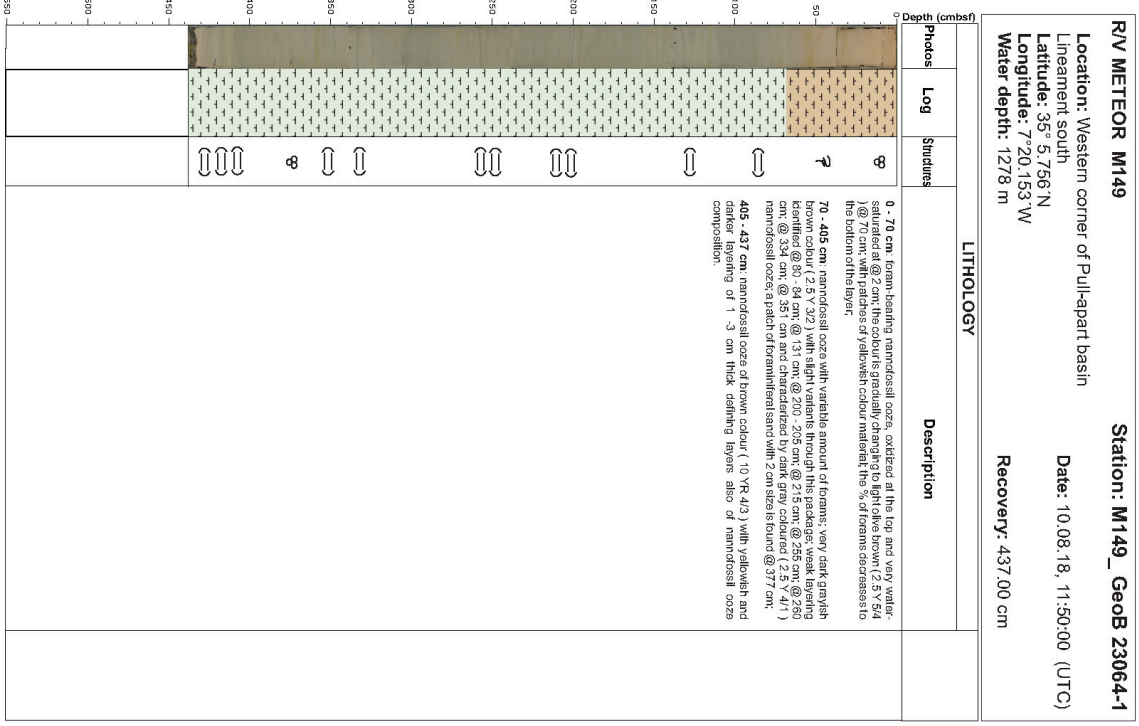
Latitude: 35° 3.519´N
Longitude: 7°23.055´W
Water depth: 1334 m **Recovery:** 450.00 cm

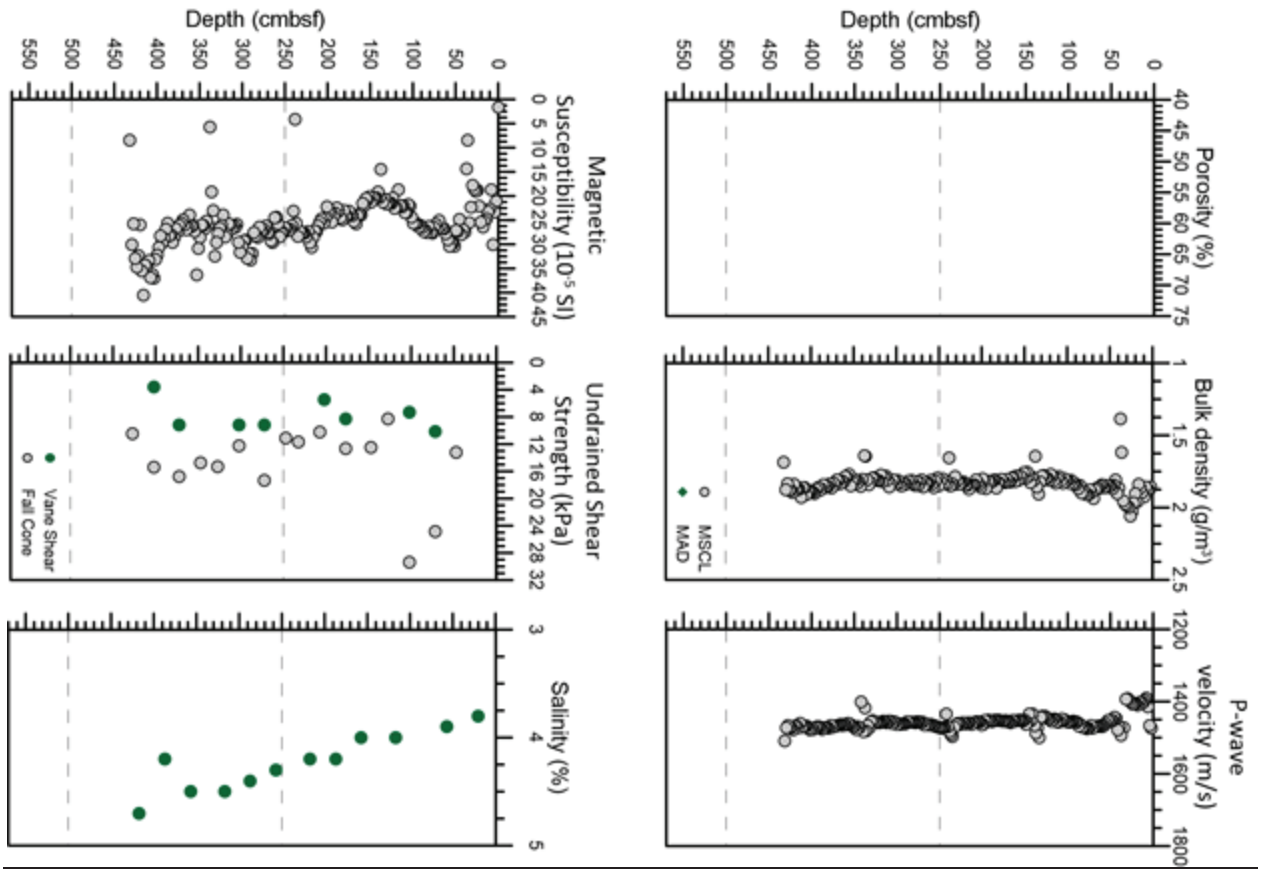


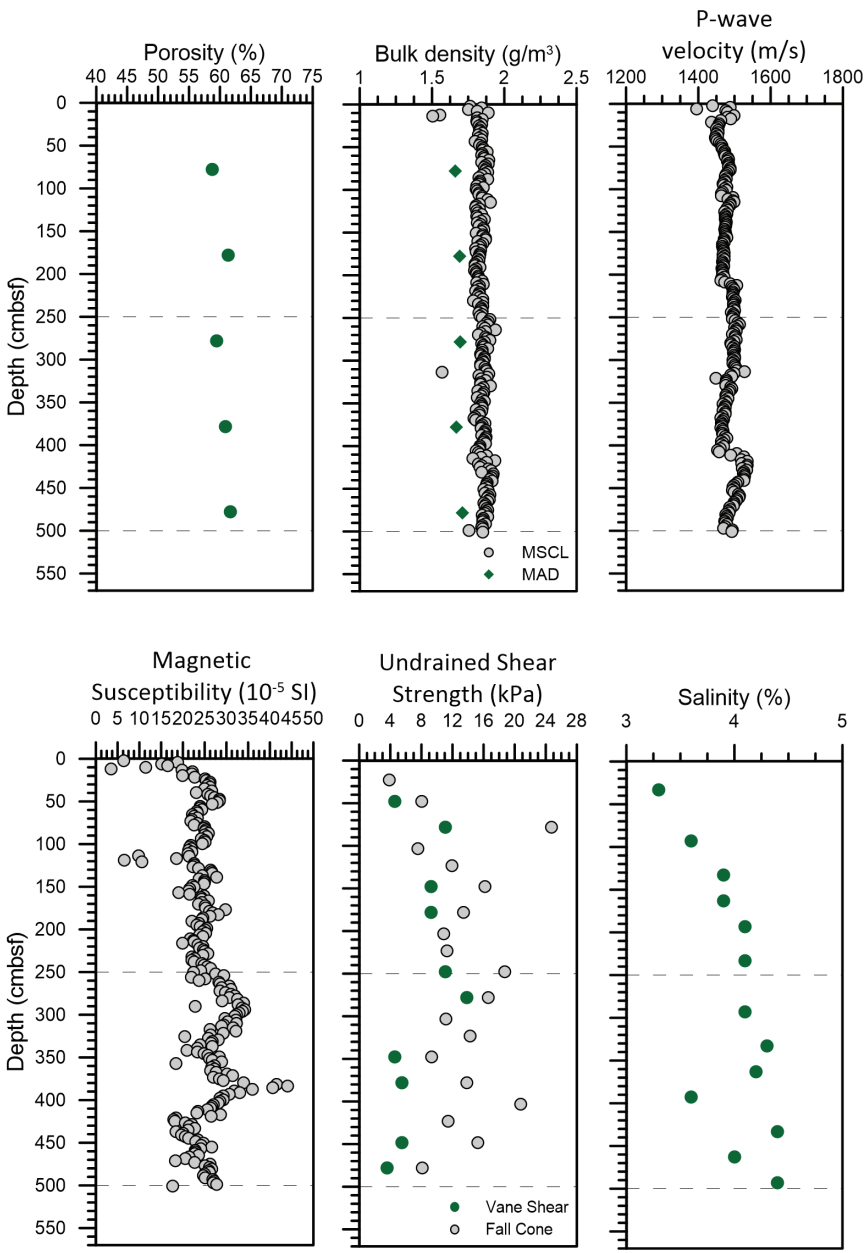



R/V METEOR M149
Station: M149_ GeoB 23063-1
Location: Eastern corner of Pull-apart basin
Lineament south
Latitude: 35° 5.705'N
Longitude: 7°19.664'W
Water depth: 1282 m
Date: 10.08.18 , 10:33:00 (UTC)
Recovery: 481.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 55 cm: foraminiferal ooze,decreasing the foram content to the bottom; oxidized; colour gradually changing from yellowish brown (@ 1 cm (10 YR 5/4) to light olive brown (2.5 Y 5/1) @ 54 cm; with patches of yellowish stained sediments; bioturbated from 40 - 55 cm;
55 - 481 cm: nannofossil ooze with variable % of forams; colour ranging from dark grayish brown (2.5 Y 4/2) @ 58 cm; to olive brown (2.5 Y 4/3) to light olive brown (2.5 Y 5/4); disperse patches of 1 - 3 mm size of black material, patches of yellowish stain material often forming diffuse parallel pseudo layers @ 106 - 127 cm; 210 cm; 275 cm; 383 cm; 407 - 438 cm; 446 cm; bioturbated in some layers; 5 mm to 1 cm layers of nannofossil ooze without forams and of slightly different colour are observed @ 55 - 75 cm; 225 cm; 335 cm; 420 - 435 cm; Layers and patches of foram-rich nannofossil ooze are found @ 246 - 254 cm; 296 - 298 cm; 350 - 358 cm.


P-wave velocity (m/s)
Bulk density (g/m³)
Porosity (%)
MSCL
MAD
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

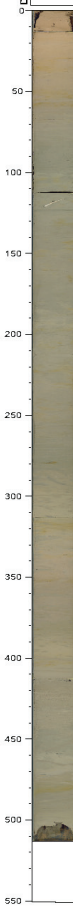

R/V METEOR M149
Station: M149_ GeoB 23064-1
Location: Western corner of Pull-apart basin
Lineament south
Latitude: 35° 5.756'N
Longitude: 7°20.153'W
Water depth: 1278 m
Date: 10.08.18, 11:50:00 (UTC)
Recovery: 437.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 70 cm: foram-bearing nannofossil ooze, oxidized at the top and very water-saturated at @ 2 cm; the colour is gradually changing to light olive brown (2.5 Y 5/4) @ 70 cm; with patches of yellowish colour material; the % of forams decreases to the bottom of the layer.
70 - 405 cm: nannofossil ooze with variable amount of forams; very dark grayish brown colour (2.5 Y 3/2) with slight variants through this package; weak layering identified @ 80 - 84 cm; @ 131 cm; @ 200 - 205 cm; @ 215 cm; @ 255 cm; @ 260 cm; @ 334 cm; @ 351 cm and characterized by dark gray colours (2.5 Y 4/1) nannofossil ooze; a patch of foraminiferal sand with 2 cm size is found @ 377 cm.
405 - 437 cm: nannofossil ooze of brown colour (10 YR 4/3) with yellowish and darker layering of 1 -3 cm thick defining layers also of nannofossil ooze composition.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)



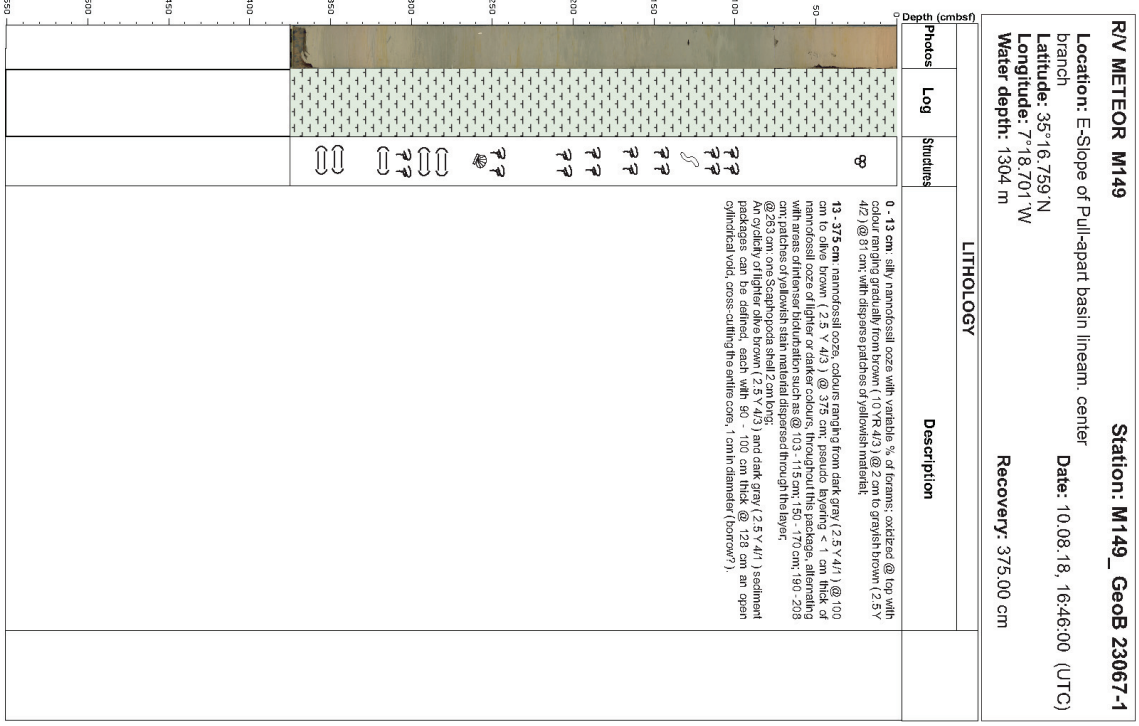
R/V METEOR M149 **Station: M149_ GeoB 23066-1**

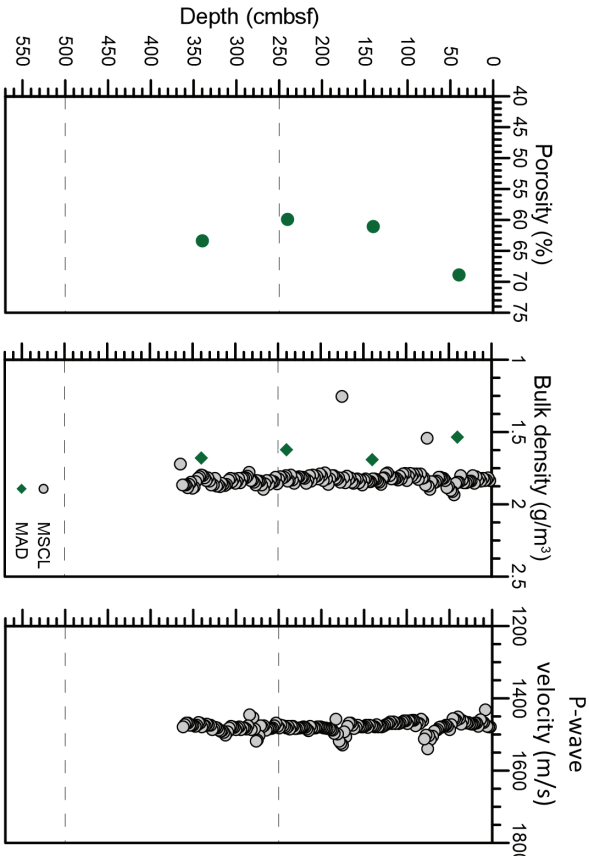
Location: Center of Pull-apart basin, lineament cent. Branch
Latitude: 35°16.847´N
Longitude: 7°18.941´W
Water depth: 1310 m
Date: 10.08.18 , 15:35:00 (UTC)
Recovery: 513.00 cm

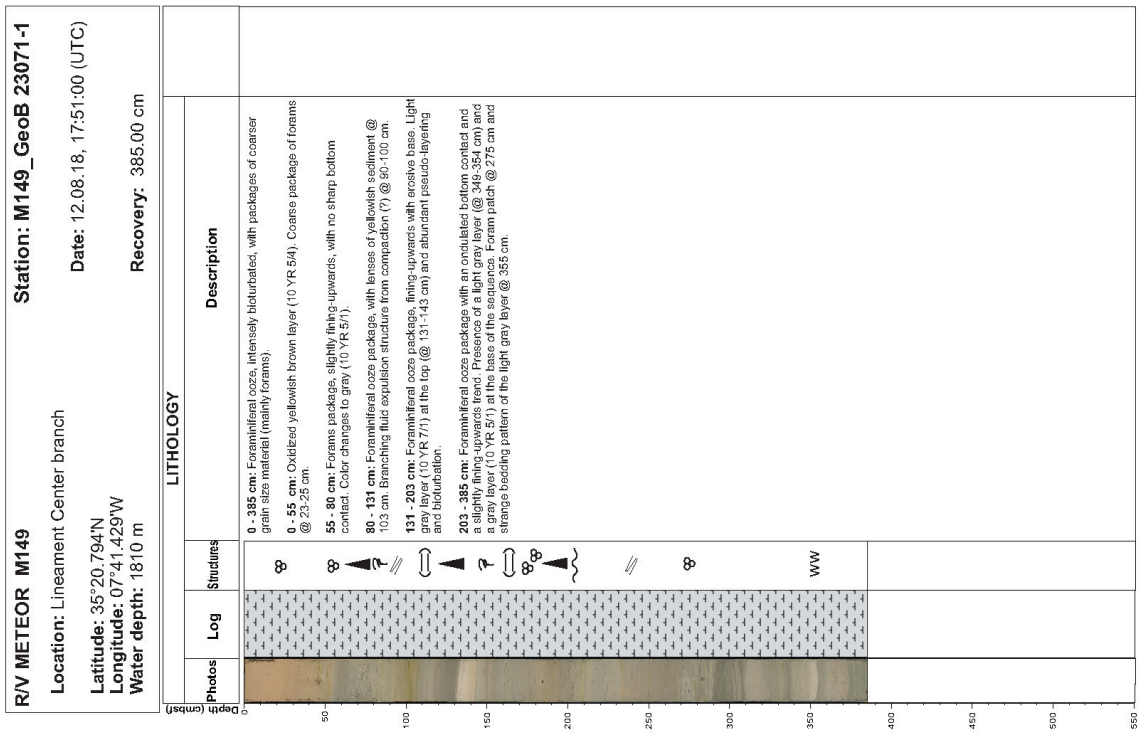


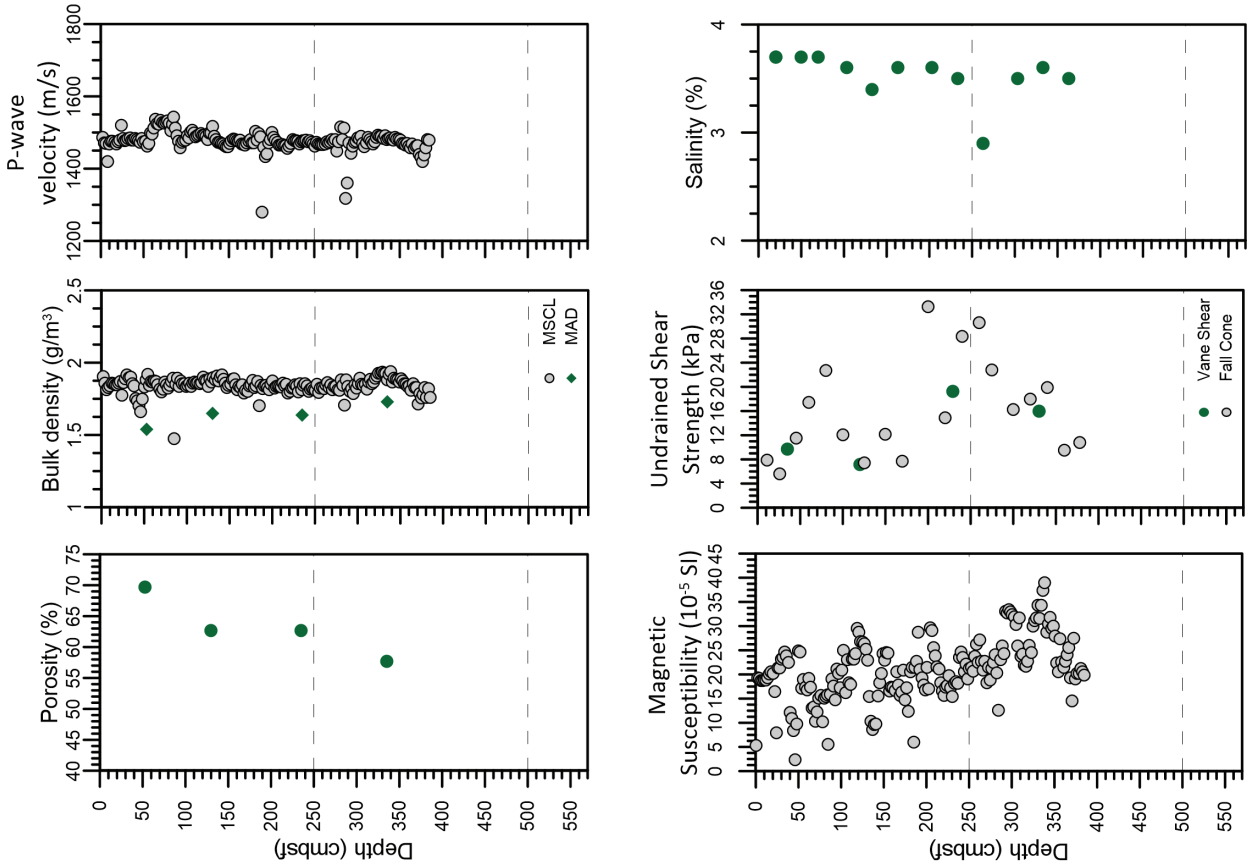
LITHOLOGY

Photos	Log	Structures	Description
			0 - 63 cm: silty nannofossil ooze; yellowish brown colour (10 YR 5/4) at the top gradually changing to grayish brown (10 YR 4/2) @ 66 cm; water saturated on the top 5 cm; with patches of yellowish material between 28 cm and 61 cm; black patches of up to 5 mm between 28 and 53 cm;
			63 - 388 cm: foram-bearing nannofossil ooze; dark gray colour (2.5 Y 4/1); bioturbated; with patches of yellowish material dispersed throughout the layer; with layers of up to 1 cm thick of finer sediment and of slightly different colour; usually these layers are sub horizontal but also are clearly oblique; @ 113 cm shell of Scaphopoda;
			388 - 419 cm: nannofossil ooze; olive brown colour (2.5 4/4), with pseudo layers between 400 and 410 cm; bioturbated in the top;
			419 - 442 cm: foraminiferal ooze; water saturated; dark olive gray colour (5 Y 3/2); with cm thick layers of finer sediment; bioturbated at bottom, with sharp bottom contact but undulated due to bioturbation;
			442 - 513 cm: foram-bearing nannofossil ooze; grayish brown colour (2.5 Y 5/2); week lamination @ bottom of the layer; @ 463 cm one layer of finer sediment between layers of foram-rich package seams to be affected by a normal fault.


R/V METEOR M149
Station: M149_ GeoB 23067-1
Location: E-Slope of Pull-apart basin lineam. center branch
Latitude: 35°16.759'N
Longitude: 7°18.701'W
Water depth: 1304 m
Date: 10.08.18, 16:46:00 (UTC)
Recovery: 375.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 13 cm: silty nannofossil ooze with variable % of forams; oxidized @ top with colour ranging gradually from brown (10 YR 4/3) @ 2 cm to grayish brown (2.5 Y 4/2) @ 81 cm; with dispersed patches of yellowish material;
13 - 375 cm: nannofossil oozes, colours ranging from dark gray (2.5 Y 4/1) @ 100 cm to olive brown (2.5 Y 4/3) @ 375 cm; pseudo layering < 1 cm thick of nannofossil ooze of lighter or darker colours, throughout this package, alternating with areas of intense bioturbation such as @ 103 - 115 cm; 150 - 170 cm; 190 - 208 cm; patches of yellowish stain material dispersed through the layer;
@ 263 cm: one Scaphopodes shell 2 cm long;
An cyclicity of lighter olive brown (2.5 Y 4/3) and dark gray (2.5 Y 4/1) sediment packages can be defined, each with 90 - 100 cm thick @ 128 cm an open cylindrical void, cross-cutting the entire core, 1 cm in diameter (borrow?).


Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Depth (cmbsf)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_GeoB 23071-1
Location: Lineament Center branch
Date: 12.08.18, 17:51:00 (UTC)
Latitude: 35°20.794'N
Longitude: 07°41.429'W
Water depth: 1810 m
Recovery: 385.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 385 cm: Foraminiferal ooze, intensely bioturbated, with packages of coarser grain size material (mainly forams).
0 - 55 cm: Oxidized yellowish brown layer (10 YR 5/4). Coarse package of forams @ 23-25 cm.
55 - 80 cm: Forams package, slightly fining-upwards, with no sharp bottom contact. Color changes to gray (10 YR 5/1).
80 - 131 cm: Foraminiferal ooze package, with lenses of yellowish sediment @ 103 cm. Branching fluid expulsion structure from compaction (?) @ 80-100 cm.
131 - 203 cm: Foraminiferal oozs package, fining-upwards with erosive base. Light gray layer (10 YR 7/1) at the top (@ 131-143 cm) and abundant pseudo-layering and bioturbation.
203 - 385 cm: Foraminiferal oozs package with an undulated bottom contact and a slightly fining-upwards trend. Presence of a light gray layer (@ 349-354 cm) and a gray layer (10 YR 5/1) at the base of the sequence. Foram patch @ 275 cm and strange bedding pattern of the light gray layer @ 355 cm.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23076-1**

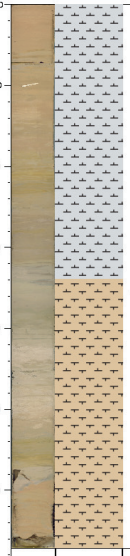
Location: Potential MV along lineament S. branch

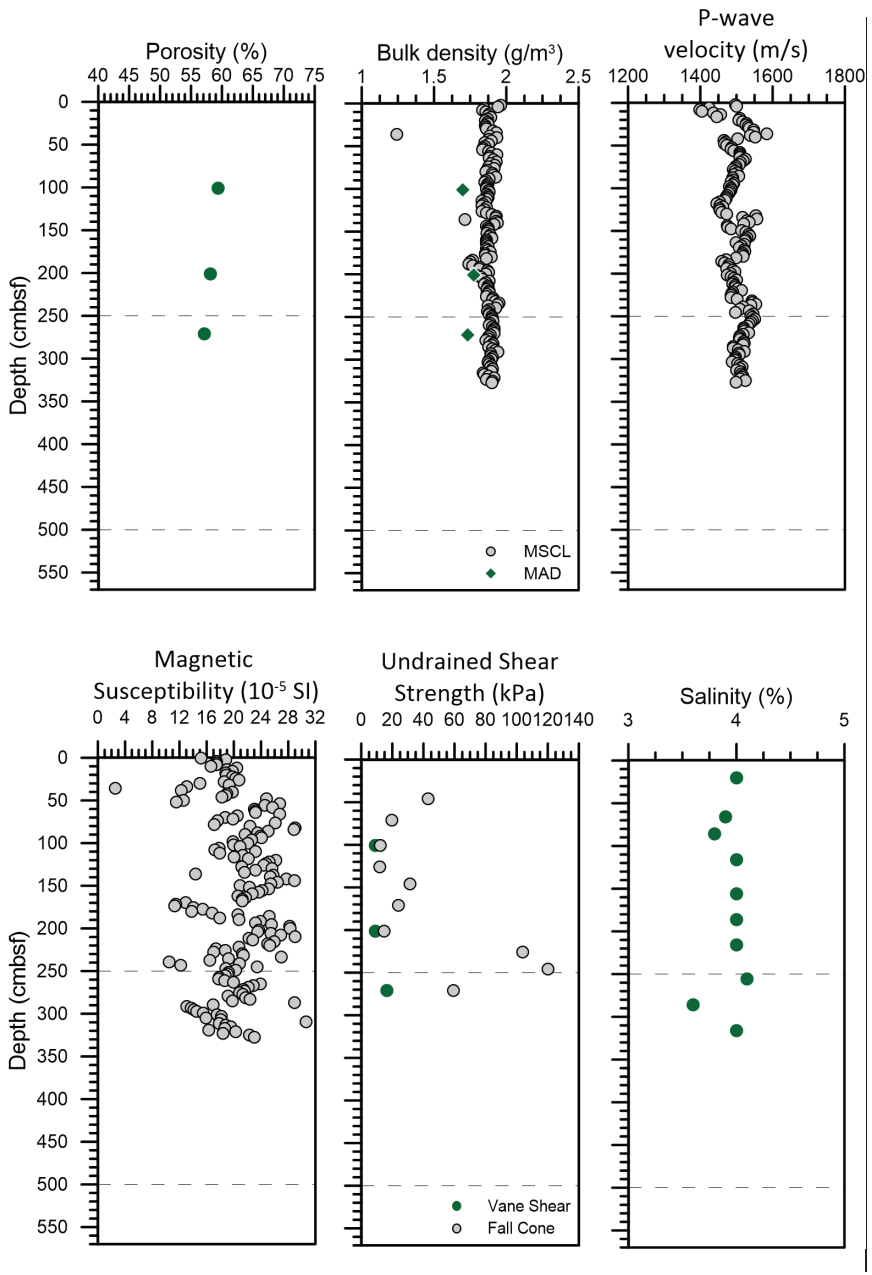
Date: 14.08.18, 12:39:00 (UTC)

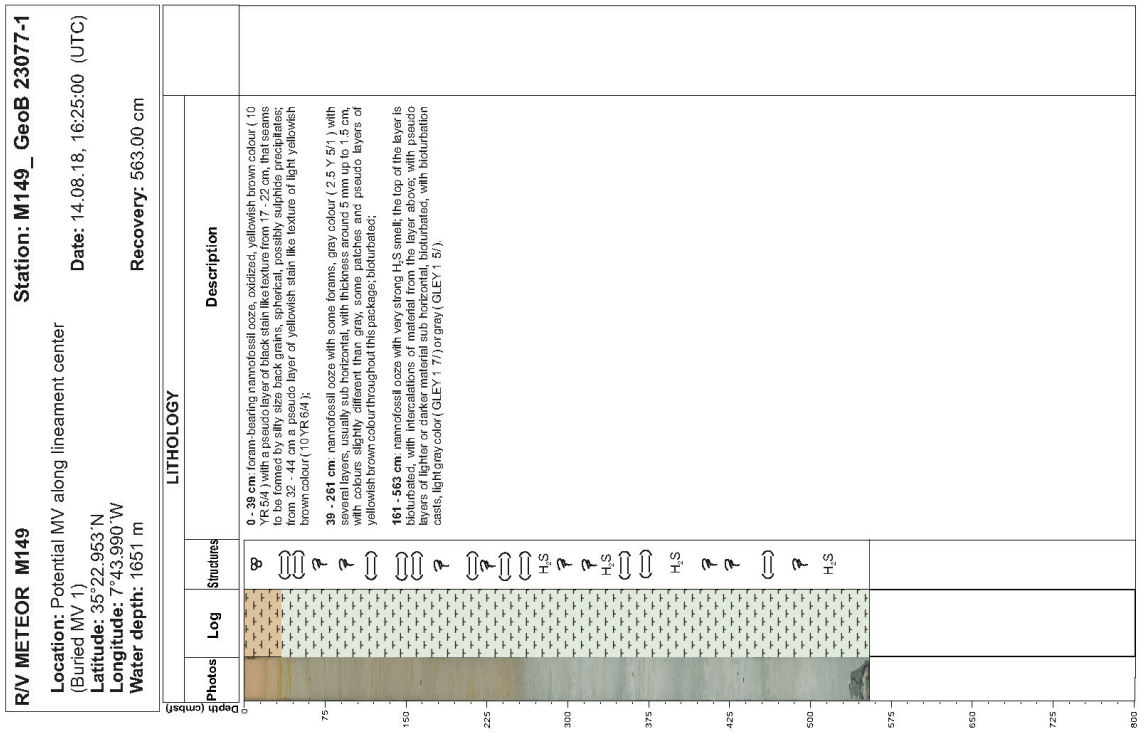
Latitude: 35° 0.020´N
Longitude: 7°37.048´W
Water depth: 1302 m

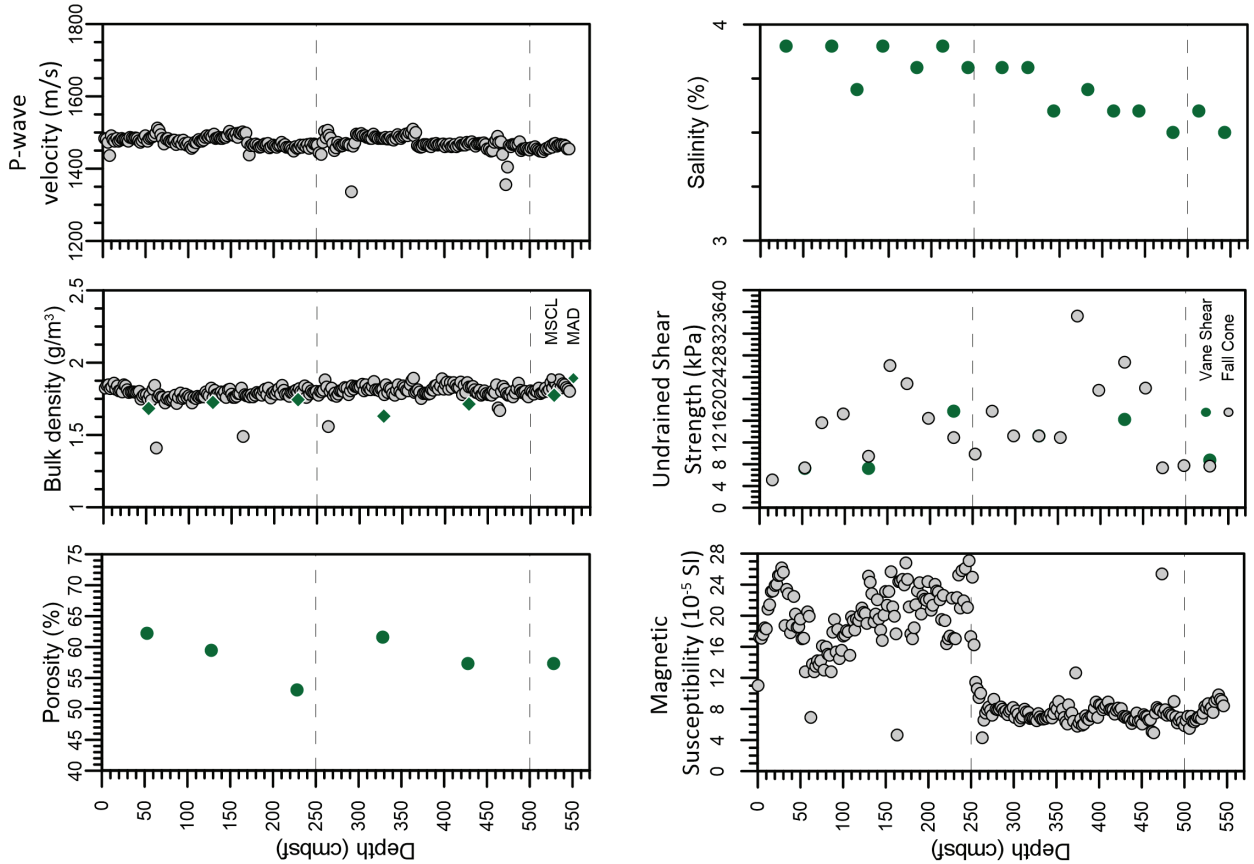
Recovery: 336.00 cm

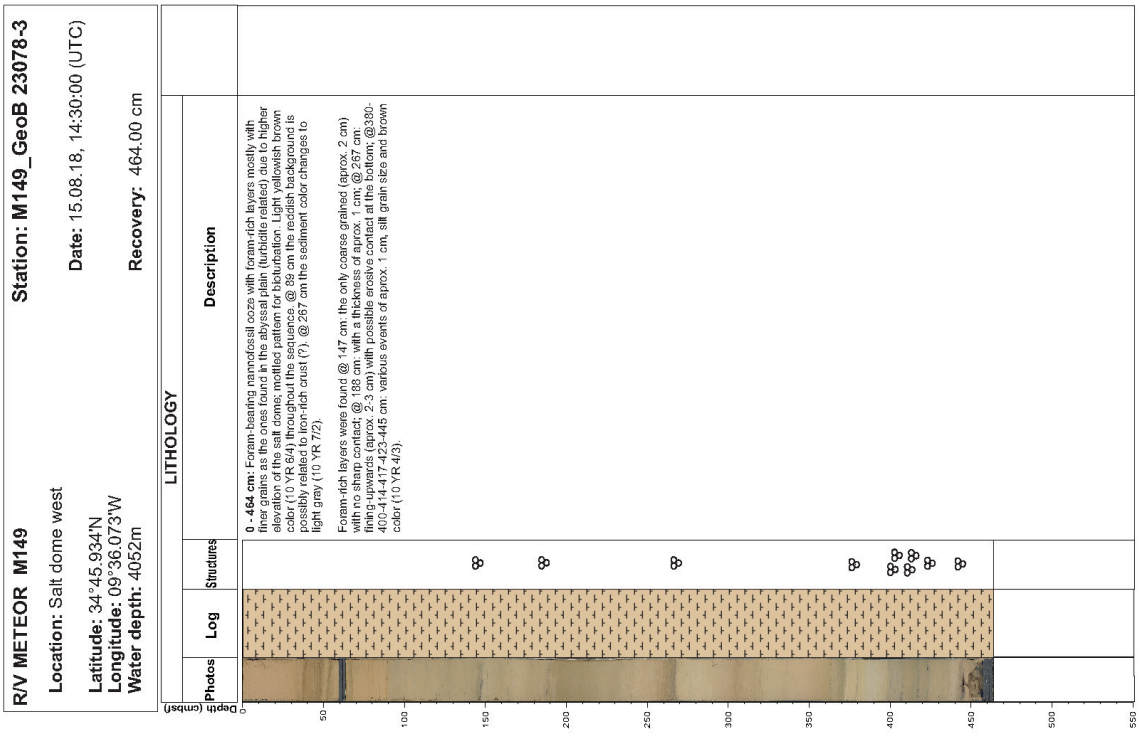
LITHOLOGY

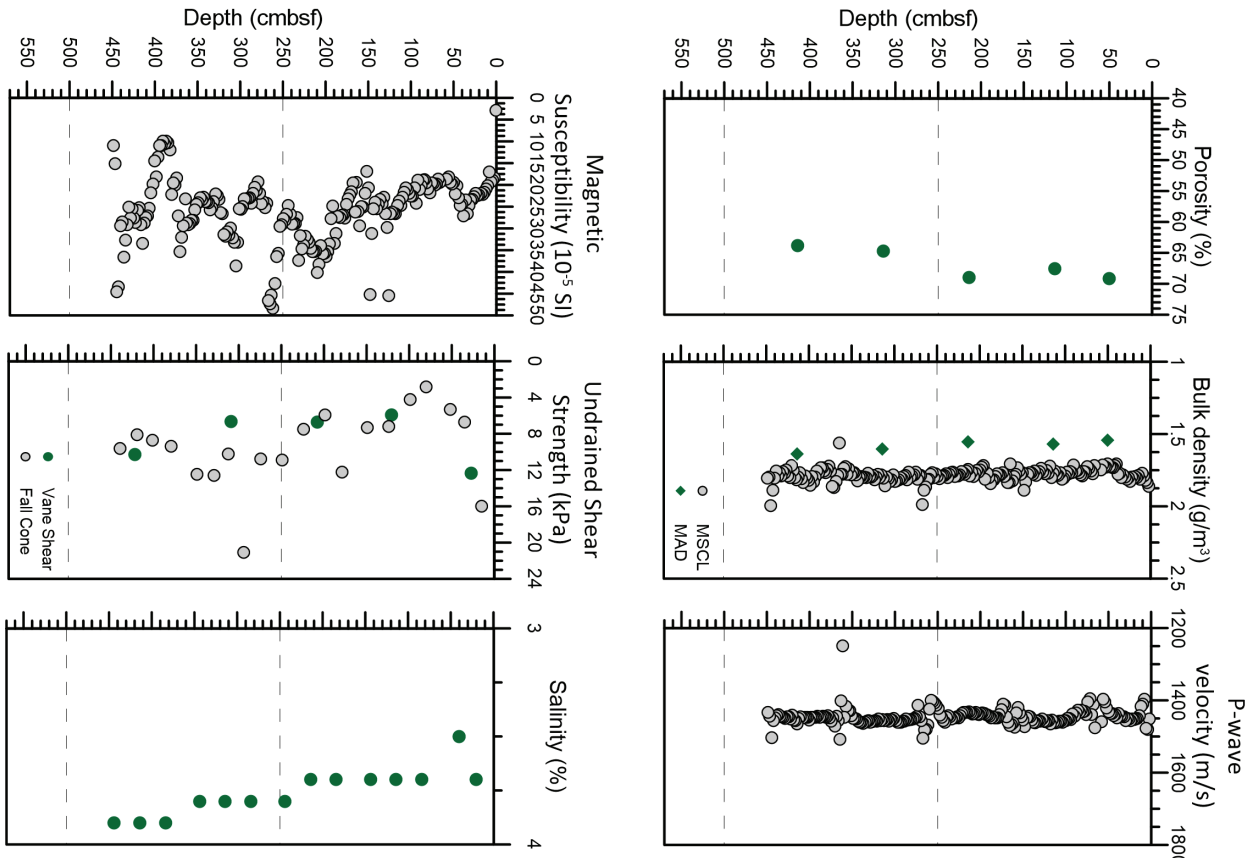
Depth (cmbsf)	Photos	Log	Structures	Description
0 - 550				**0 - 170 cm**: foraminiferal ooze; oxic; bioturbated; colour ranging from brown (10 YR 4/3) @ 2 cm to grayish brown (10 YR 5/2) @ 90 cm to light brownish gray (10 YR 6/2); along this layer several pseudo layers can be observed, mostly horizontal and defined by slight changes in colour of the sediment; some of these layers are characterized by coarser grain size composition and show a sharp and undulated bottom contact, resembling erosive mass wasting package; yellowish brown stained layered patches between 97 - 127 cm; 49 - 51 cm: a Scaphopoda shell, 6 cm long; **170 - 216 cm**: foram-bearing nannofossil ooze, with pseudo layers @ intervals of intense bioturbation; colour range from pale brown (10 YR 2/3) @ 190 cm to light gray (10 YR 7/1) @ 220 cm to yellowish brown (10 YR 5/8) @ 275 - 285 cm in an yellowish stained patch; **296 - 336 cm**: sediment repetition of the top of the core due to double penetration during core recollection, as also indicated by the rope tension record.

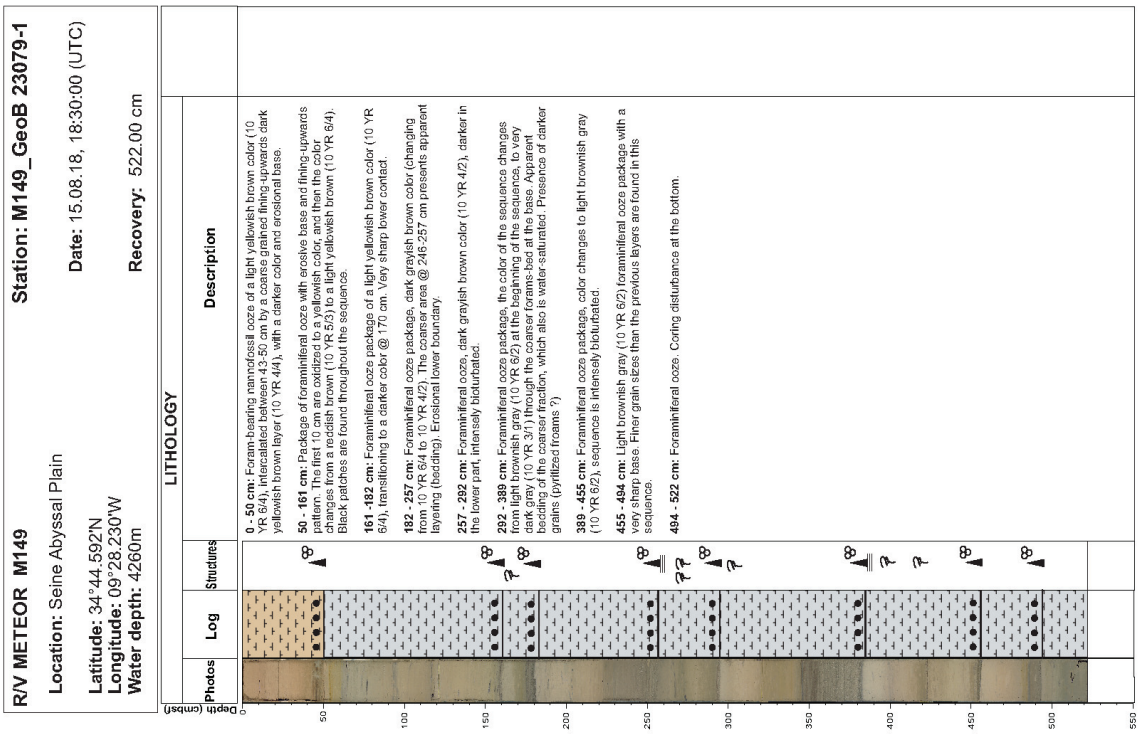


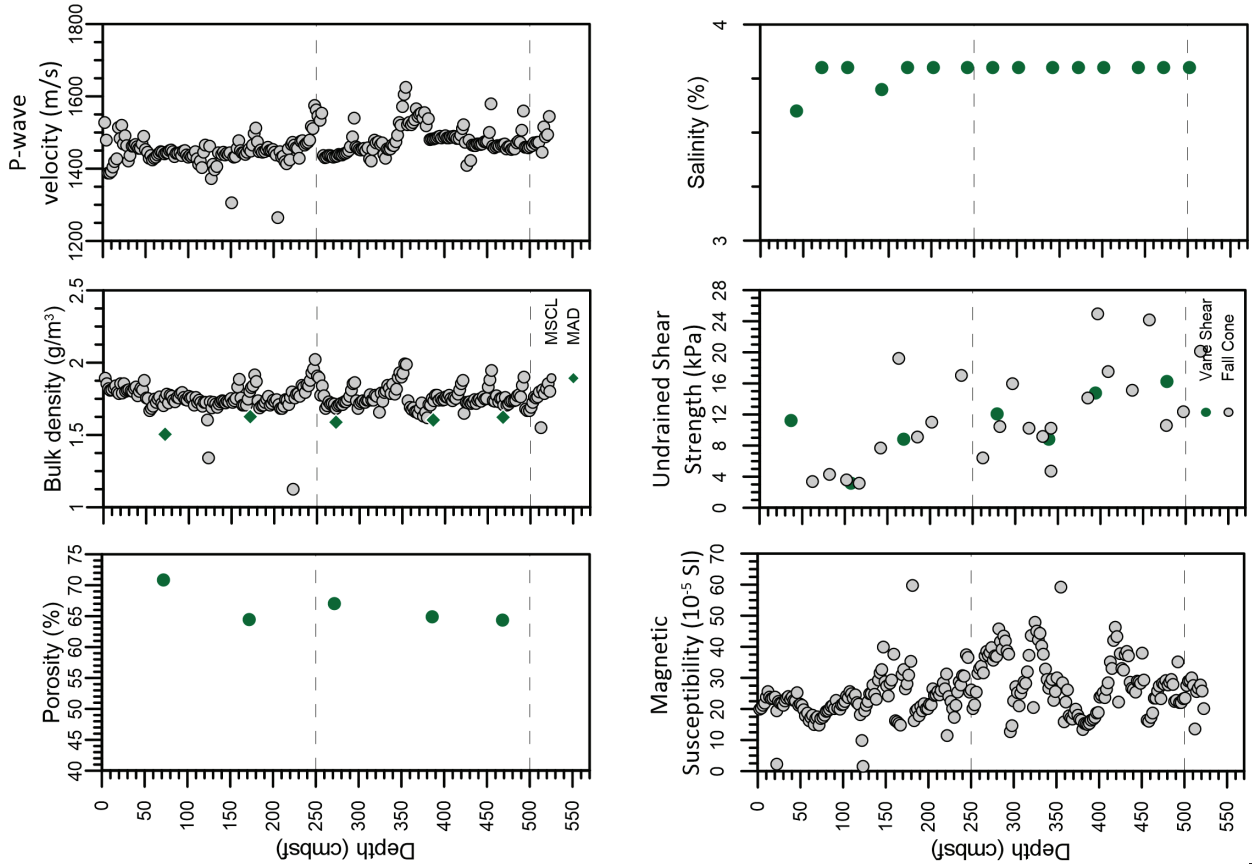

R/V METEOR M149
Station: M149_ GeoB 23077-1
Location: Potential MV along lineament center (Buried MV 1)
Latitude: 35°22.953'N
Longitude: 7°43.990'W
Water depth: 1651 m
Date: 14.08.18, 16:25:00 (UTC)
Recovery: 563.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 39 cm: foram-bearing nannofossil ooze, oxidized, yellowish brown colour (10 YR 5/4) with a pseudo layer of black stain like texture from 17 - 22 cm, that seams to be formed by silty size back grains, spherical, possibly sulphide precipitates; from 32 - 44 cm a pseudo layer of yellowish stain like texture of light yellowish brown colour (10 YR 6/4);
39 - 261 cm: nannofossil ooze with some forams, gray colour (2.5 Y 5/1) with several layers, usually sub horizontal, with thickness around 5 mm up to 1.5 cm, with colours slightly different than gray, some patches and pseudo layers of yellowish brown colour throughout this package; bioturbated;
161 - 563 cm: nannofossil ooze with very strong H2S smell; the top of the layer is bioturbated, with intercalations of material from the layer above; with pseudo layers of lighter or darker material sub horizontal, bioturbated, with bioturbation casts, light gray color (GLEY 1 7/) or gray (GLEY 1 5/).
H2S


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_GeoB 23078-3
Location: Salt dome west
Date: 15.08.18, 14:30:00 (UTC)
Latitude: 34°45.934'N
Longitude: 09°36.073'W
Water depth: 4052m
Recovery: 464.00 cm
LITHOLOGY
Description
Photos
Log
Structures
Depth (cmbsf)
0 - 464 cm: Foram-bearing nannofossil ooze with foram-rich layers mostly with finer grains as the ones found in the abyssal plain (turbidite related) due to higher elevation of the salt dome; mottled pattern for bioturbation. Light yellowish brown color (10 YR 6/4) throughout the sequence. @ 89 cm the reddish background is possibly related to iron-rich crust (?). @ 267 cm the sediment color changes to light gray (10 YR 7/2).
Foram-rich layers were found @ 147 cm: the only coarse grained (aprox. 2 cm) with no sharp contact; @ 188 cm: with a thickness of aprox. 1 cm; @ 267 cm: fining-upwards (aprox. 2-3 cm) with possible erosive contact at the bottom; @380-400-414-417-423-445 cm: various events of aprox. 1 cm, silt grain size and brown color (10 YR 4/3).


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_GeoB 23079-1
Location: Seine Abyssal Plain
Date: 15.08.18, 18:30:00 (UTC)
Latitude: 34°44.592'N
Longitude: 09°28.230'W
Water depth: 4260m
Recovery: 522.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 50 cm: Foram-bearing nannofossil ooze of a light yellowish brown color (10 YR 6/4), interstratied between 43-50 cm by a coarse grained fining-upwards dark yellowish brown layer (10 YR 4/4), with a darker color and erosional base.
50 - 161 cm: Package of foraminiferal ooze with erosive base and fining-upwards pattern. The first 10 cm are oxidized to a yellowish color, and then the color changes from a reddish brown (10 YR 5/3) to a light yellowish brown (10 YR 6/4). Black patches are found throughout the sequence.
161 -182 cm: Foraminiferal ooze package of a light yellowish brown color (10 YR 6/4), transitioning to a darker color @ 170 cm. Very sharp lower contact.
182 - 257 cm: Foraminiferal ooze package, dark grayish brown color (changing from 10 YR 6/4 to 10 YR 4/2). The coarser area @ 246-257 cm presents apparent layering (bedding). Erosional lower bouncdary.
257 - 292 cm: Foraminiferal ooze, dark grayish brown color (10 YR 4/2), darker in the lower part, intensely bioturbated.
292 - 389 cm: Foraminiferal ooze package, the color of the sequence changes from light brownish gray (10 YR 6/2) at the beginning of the sequence, to very dark gray (10 YR 3/1) through the coarser forams-bed at the base. Apparent bedding of the coarser fraction, which also is water-saturated. Presence of darker grains (pyritized froams ?)
389 - 455 cm: Foraminiferal ooze package, color changes to light brownish gray (10 YR 6/2), sequence is intensely bioturbated.
455 - 494 cm: Light brownish gray (10 YR 6/2) foraminiferal ooze package with a very sharp base. Finer grain sizes than the previous layers are found in this sequence.
494 - 522 cm: Foraminiferal ooze. Coring disturbance at the bottom.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_GeoB 23080-1**

Location: Salt dome east

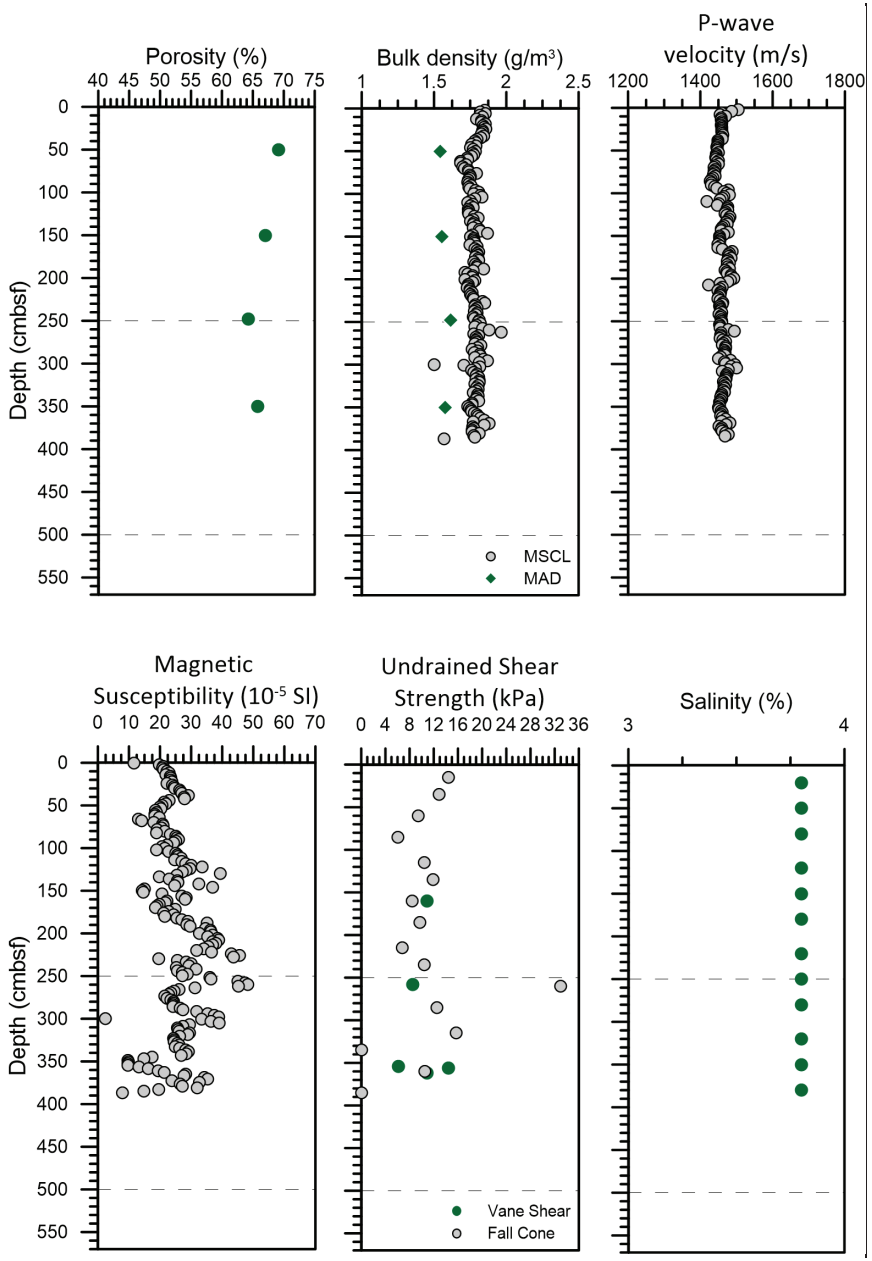
Latitude: 34°49.342'N
Longitude: 09°25.071'W
Water depth: 4084m

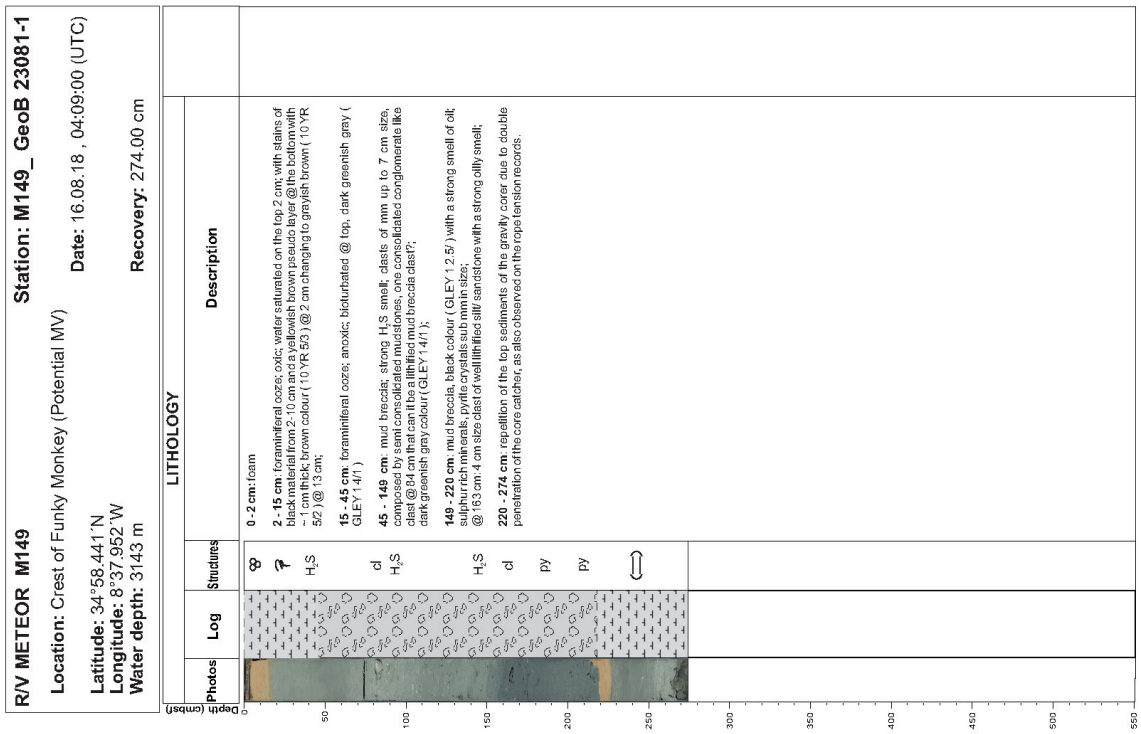
Date: 15.08.18, 21:44:00 (UTC)

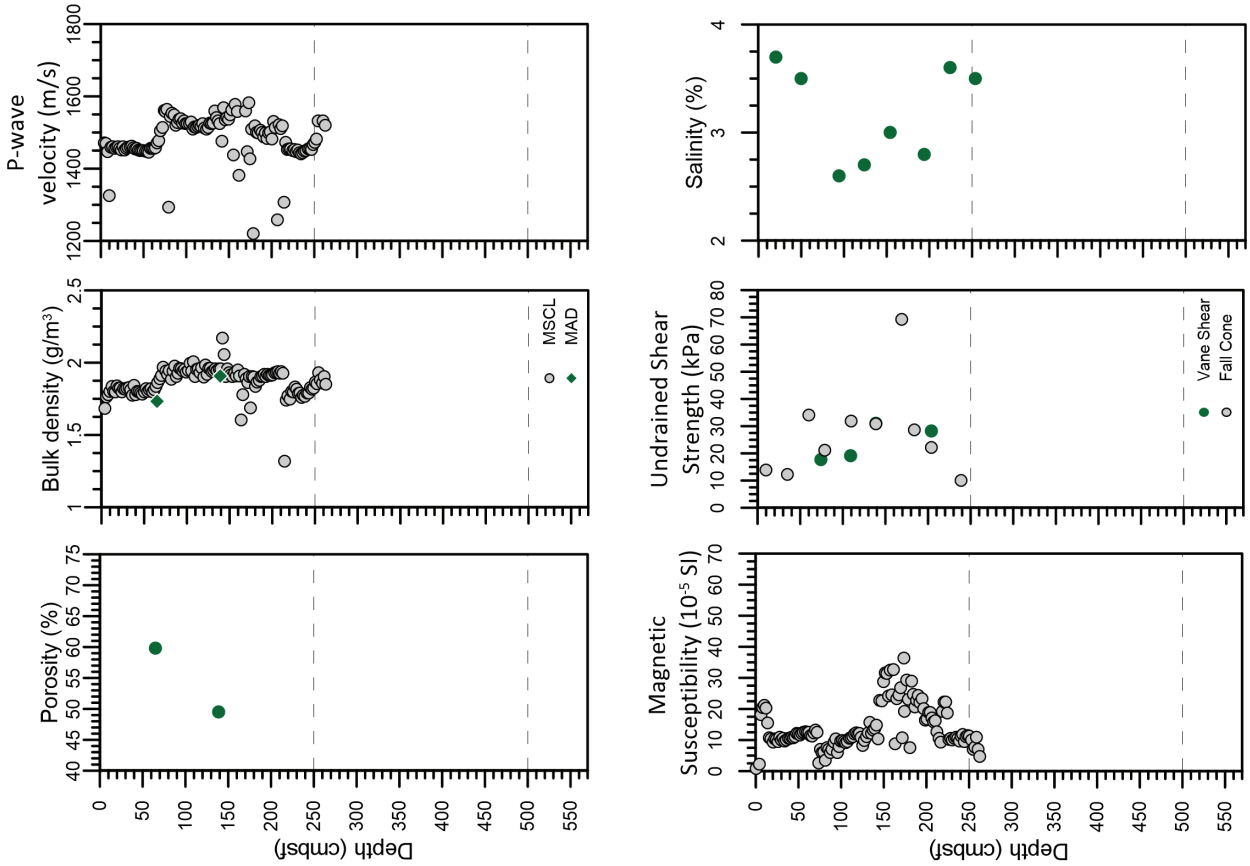
Recovery: 400.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
0–400			cl	**0 - 400 cm:** Foram-bearing nannofossil ooze, with forams layers which have mostly an erosive basal contact and thickness of max. 3-4 cm. Reddish color on top (oxydized). Normal sediment layers are light brownish gray (10 YR 6/2) to light yellowish brown (10 YR 6/4). Color turns darker towards the bottom, until a grey (10 YR 5/1) foram layer is found. @ 66 cm a reddish layer (<1 cm), is possibly related to hardground, and it is also composed of mm-size clasts. Foram-rich layers were found @ 147, 229 and 261 cm. From 343-373 cm, aprox. 6 foram-rich layers were found, with a sharp basal contact. *This core is compositionally similar to GeoB 23078-3.




R/V METEOR M149
Station: M149_ GeoB 23081-1
Location: Crest of Funky Monkey (Potential MV)
Date: 16.08.18 , 04:09:00 (UTC)
Latitude: 34°58.441'N
Longitude: 8°37.952'W
Water depth: 3143 m
Recovery: 274.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 2 cm: foam
2 - 15 cm: foraminiferal ooze; oxic; water saturated on the top 2 cm; with stains of black material from 2-10 cm and a yellowish brown pseudo layer @ the bottom with 1 cm thick; brown colour (10 YR 5/3) @ 2 cm changing to grayish brown (10 YR 5/2) @ 13 cm;
15 - 45 cm: foraminiferal ooze; anoxic; bioturbated @ top, dark greenish gray (GLEY 1 4/1)
45 - 149 cm: mud breccia; strong H2S smell; clasts of mm up to 7 cm size, composed by semi consolidated mudstones, one consolidated conglomerate like clast @ 84 cm that can it be a lithified mud breccia clast?; dark greenish gray colour (GLEY 1 4/1);
149 - 220 cm: mud breccia, black colour (GLEY 1 2.5/) with a strong smell of oil; sulphur rich minerals, pyrite crystals sub mm in size; @ 163 cm 4 cm size clast of well lithified silt/ sandstone with a strong oilly smell;
220 - 274 cm: repetition of the top sediments of the gravity corer due to double penetration of the core catcher, as also observed on the rope tension records.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23082-1**

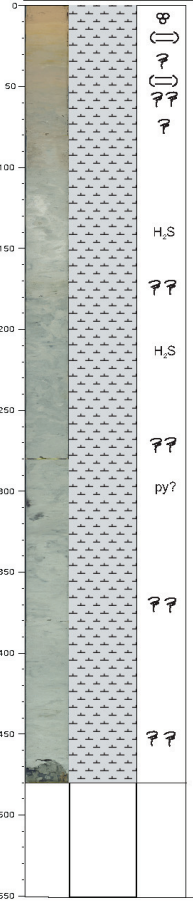
Location: Potential MV (buried MV2)

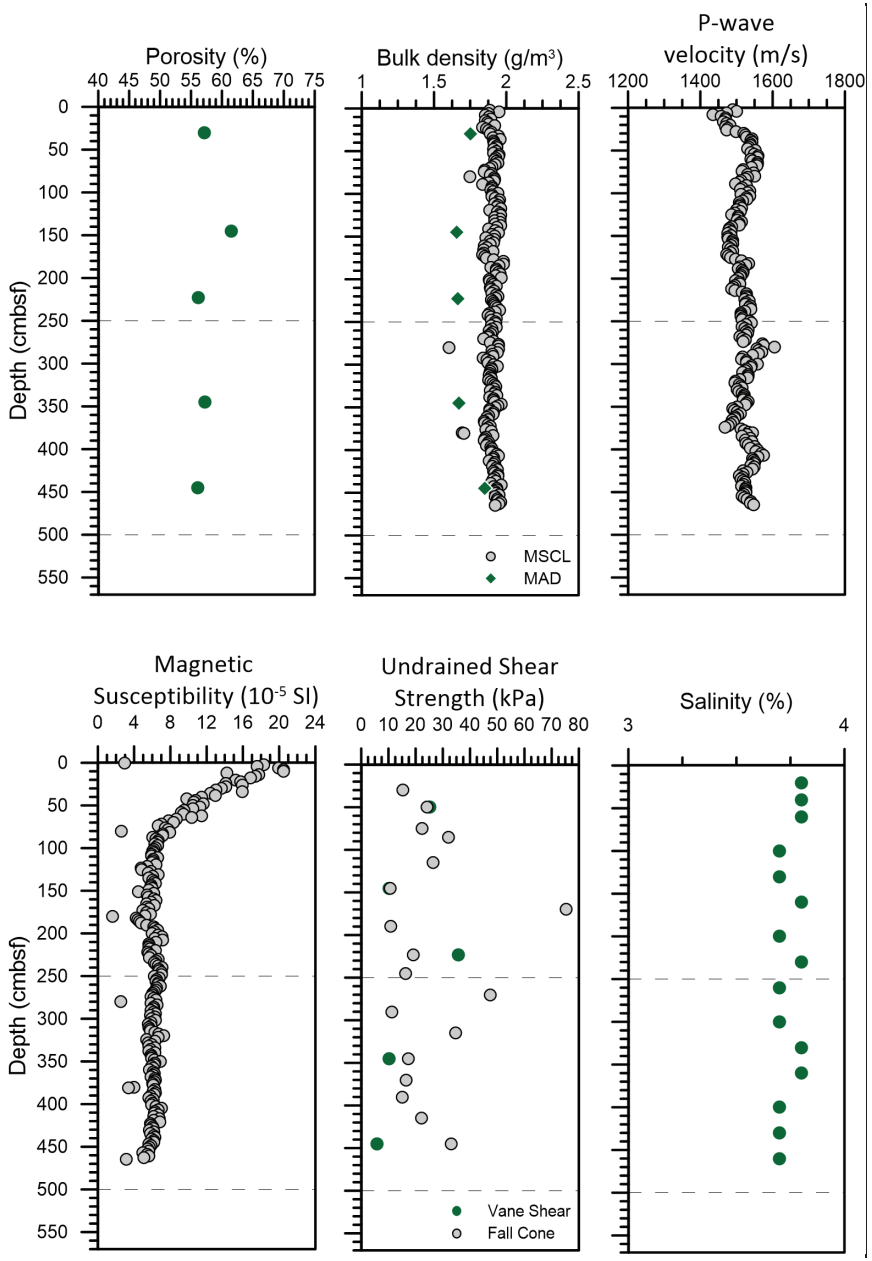
Latitude: 35°41.784´N
Longitude: 7°54.424´W
Water depth: 1481 m

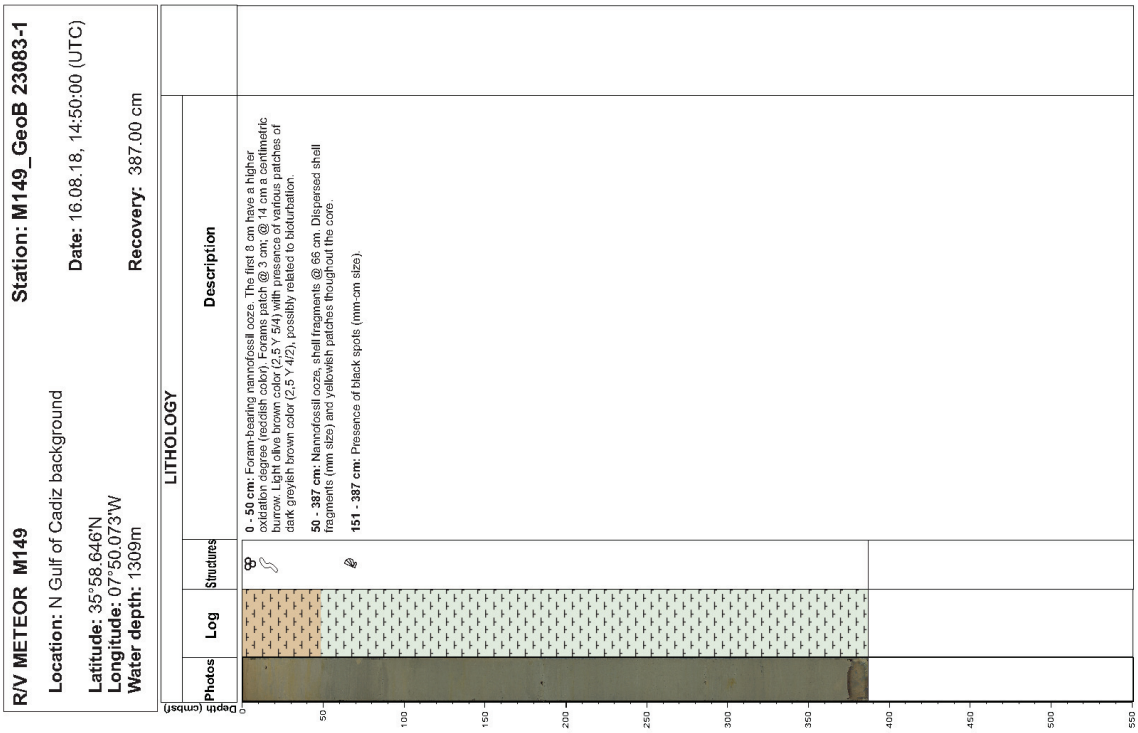
Date: 16.08.18 , 11:00:00 (UTC)

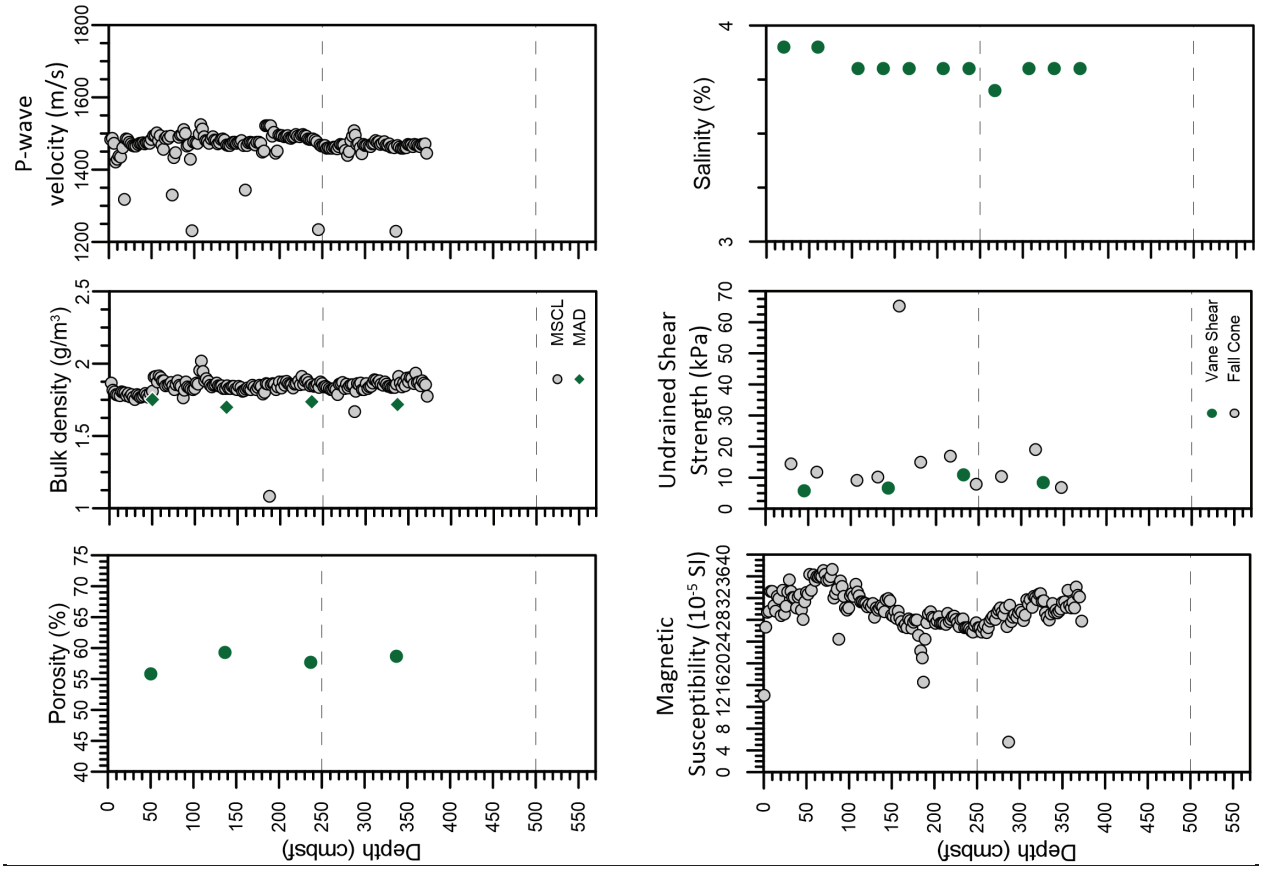
Recovery: 480.00 cm

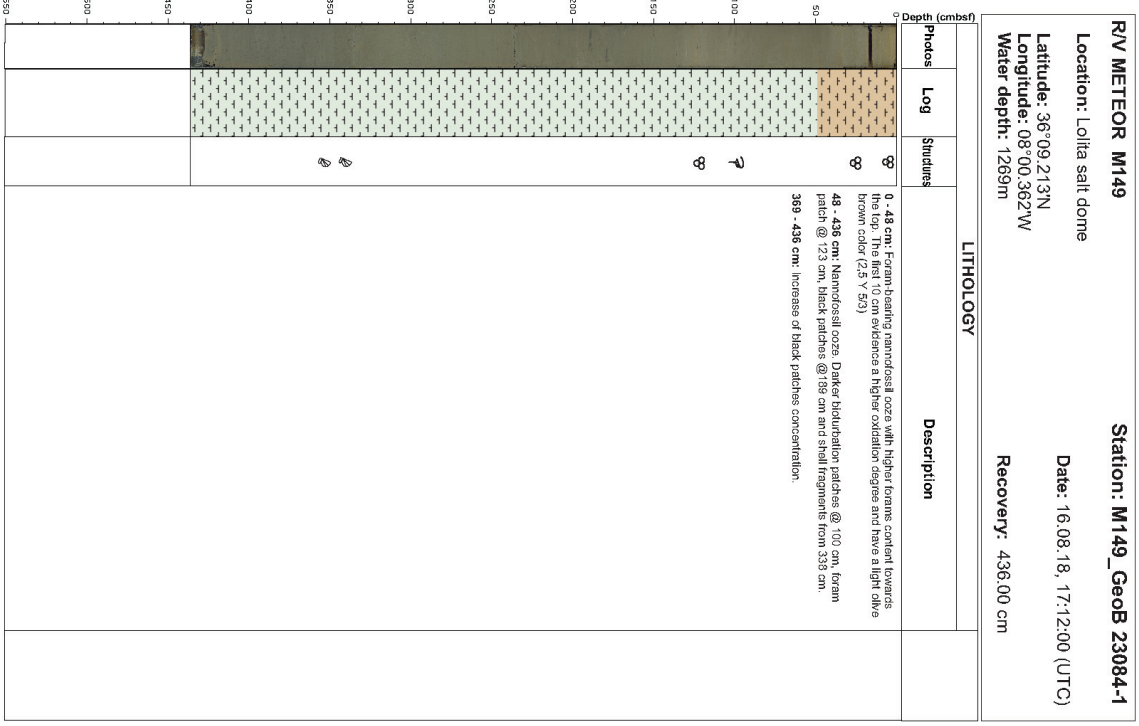
LITHOLOGY

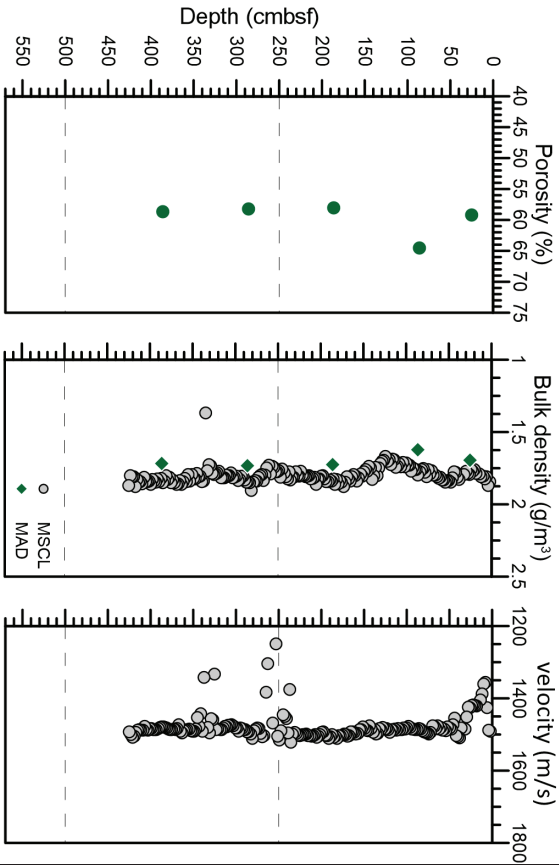
Depth (cmbsf)	Photos	Log	Structures	Description
0 – 550				**0 - 102 cm**: foraminiferal ooze; bioturbated to intense bioturbated; oxidation increasing to the top, colour gradually changing from yellowish brown (10 YR 5/4) @ 0 - 12 cm to gray (2.5 Y 5/) @ 102 cm; from 15 to 50 cm stain patches of yellowish brown colour; black patches from hallows on some borrow casts; some borrows are filled in with water saturated sediment; **102 - 480 cm**: foraminiferal ooze, with a very strong H_2S smell, very bioturbated; greenish gray colour (GLEY 7/) mixed of both colours by the borrowing texture; some of the textures resemble very much flow structures; (originated by coring or natural ?); patches of very water saturated material are found throughout this layer, such as @ 136 cm, 247 cm, 249 cm; patches of black stained sediment are found throughout this layer and large ones are found between 303 and 317 cm, where is possible to identify stained black forams, and most probably sulfide precipitates and pyrite.

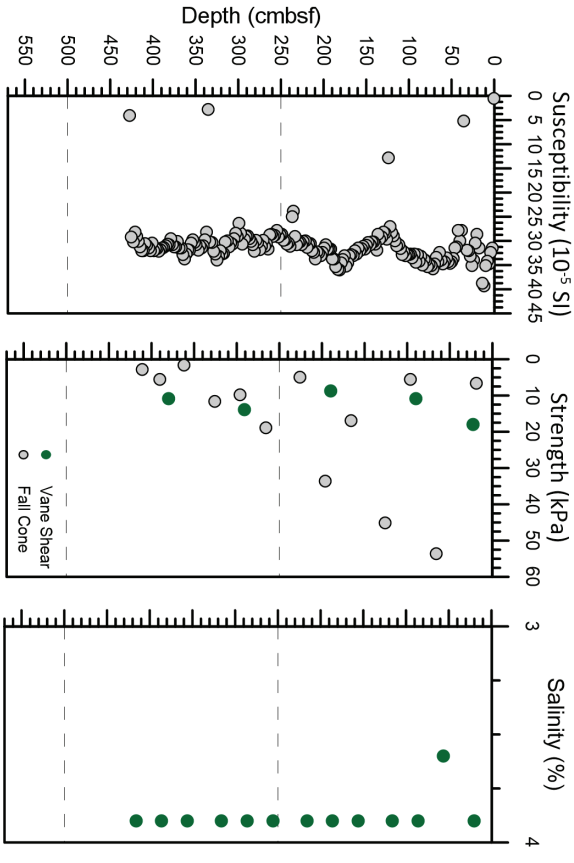


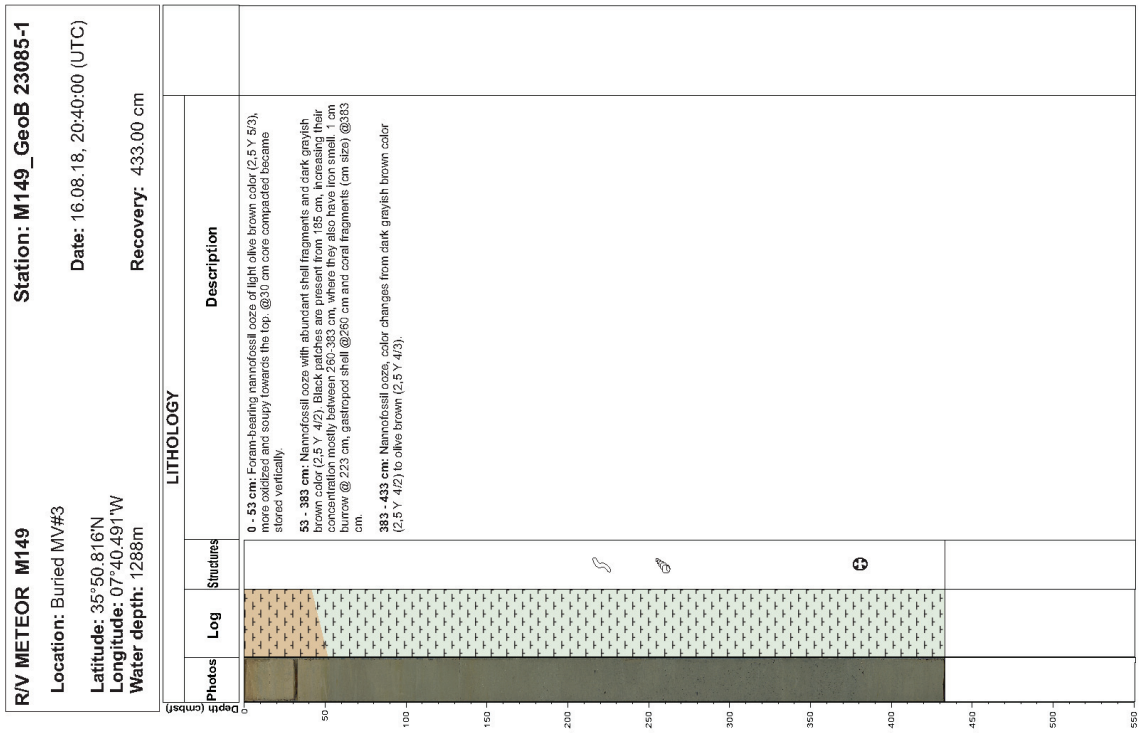

R/V METEOR M149
Station: M149_GeoB 23083-1
Location: N Gulf of Cadiz background
Date: 16.08.18, 14:50:00 (UTC)
Latitude: 35°58.646'N
Longitude: 07°50.073'W
Water depth: 1309m
Recovery: 387.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 50 cm: Foram-bearing nannofossil ooze. The first 8 cm have a higher oxidation degree (reddish color). Forams patch @ 3 cm; @ 14 cm a centimetric burrow. Light olive brown color (2,5 Y 5/4) with presence of various patches of dark greyish brown color (2,5 Y 4/2), possibly related to bioturbation.
50 - 387 cm: Nannofossil ooze, shell fragments @ 66 cm. Dispersed shell fragments (mm size) and yellowish patches throughout the core.
151 - 387 cm: Presence of black spots (mm-cm size).

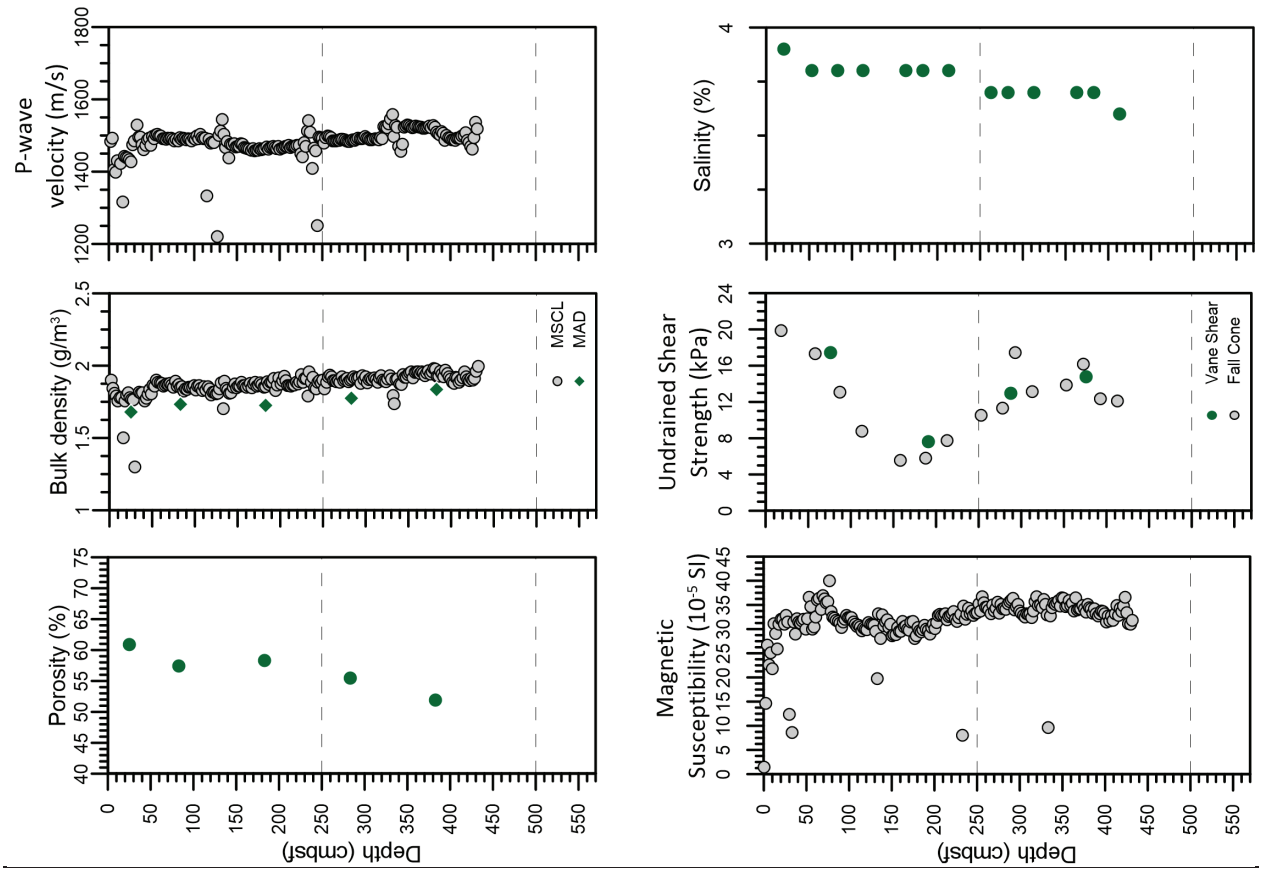

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

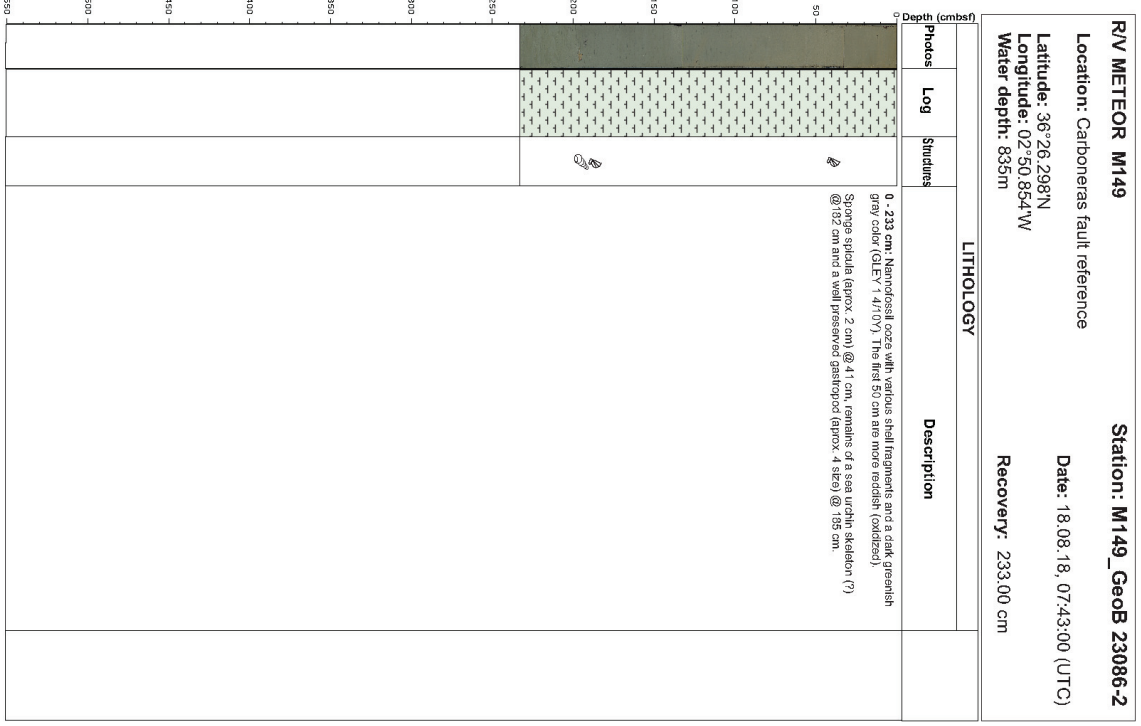

R/V METEOR M149
Station: M149_GeoB 23084-1
Location: Lolita salt dome
Date: 16.08.18, 17:12:00 (UTC)
Latitude: 36°09.213'N
Longitude: 08°00.362'W
Water depth: 1269m
Recovery: 436.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 48 cm: Foram-bearing nannofossil ooze with higher forams content towards the top. The first 10 cm evidence a higher oxidation degree and have a light olive brown color (2,5 Y 5/3)
48 - 436 cm: Nannofossil ooze. Darker bioturbation patches @ 100 cm, foram patch @ 123 cm, black patches @159 cm and shell fragments from 338 cm
369 - 436 cm: Increase of black patches concentration.

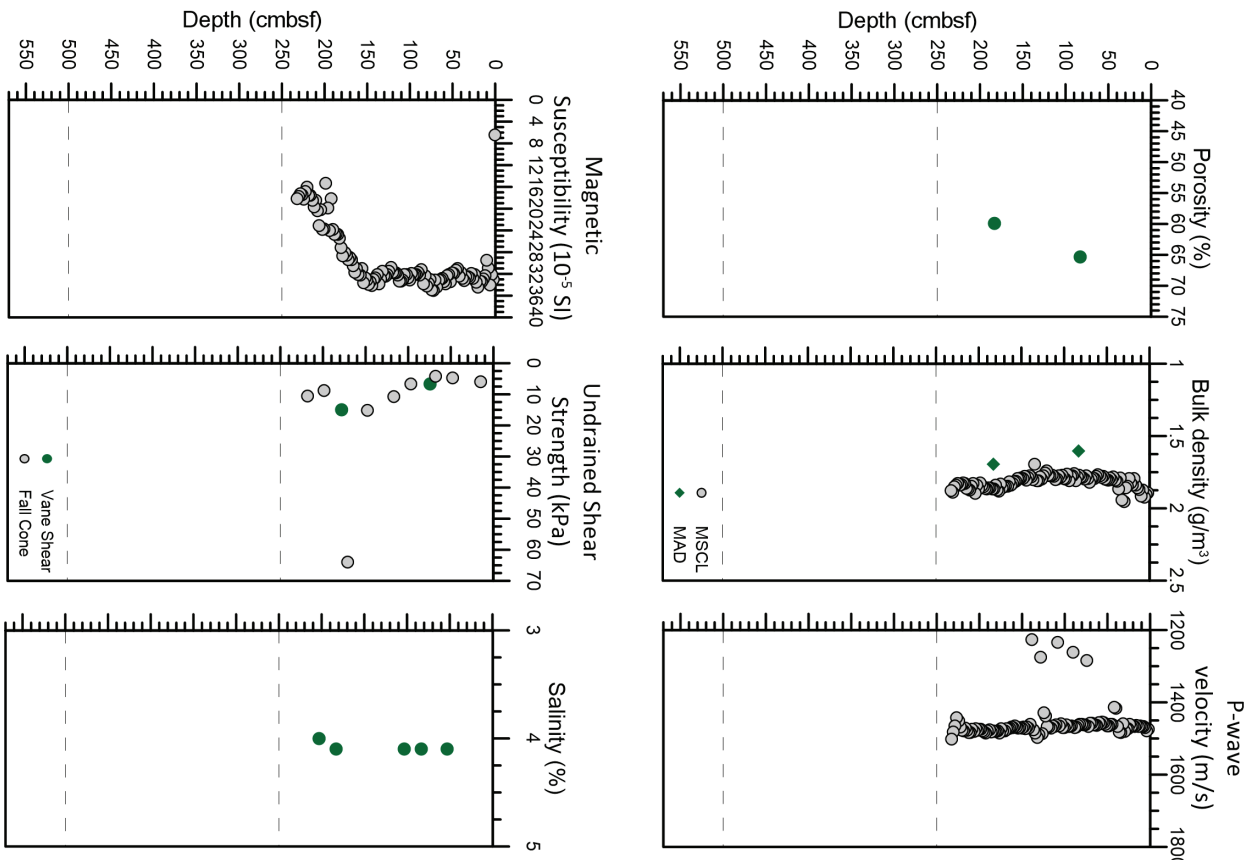

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)

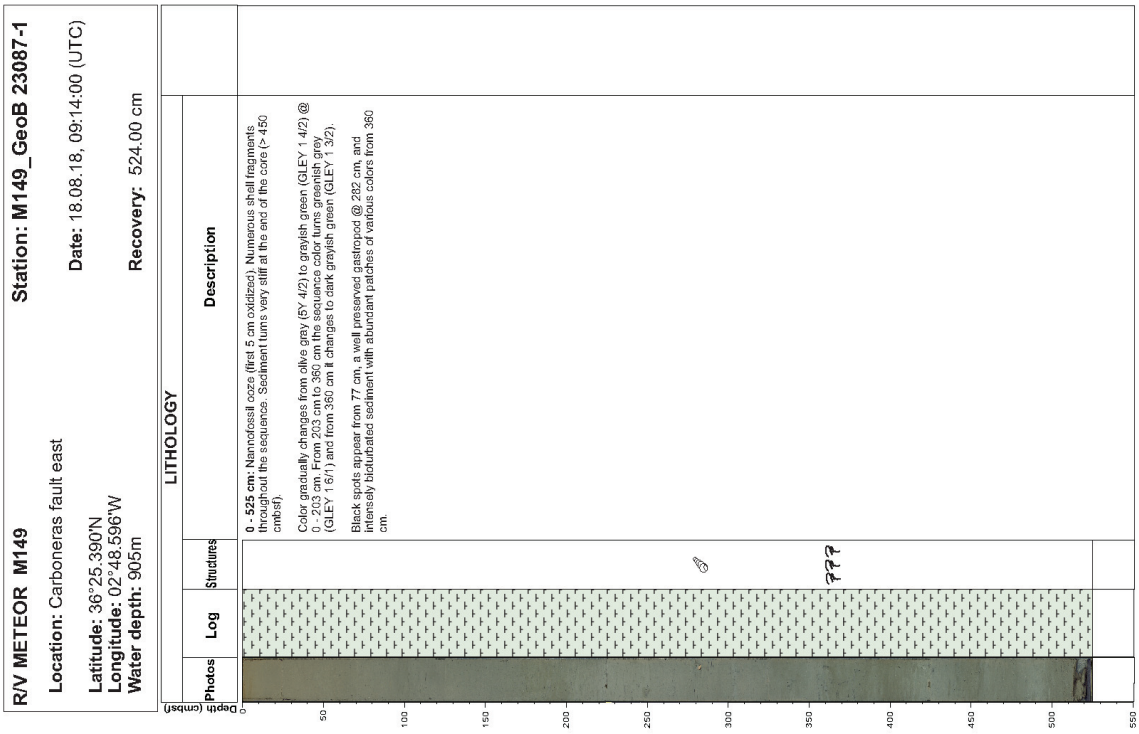

Depth (cmbsf)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)

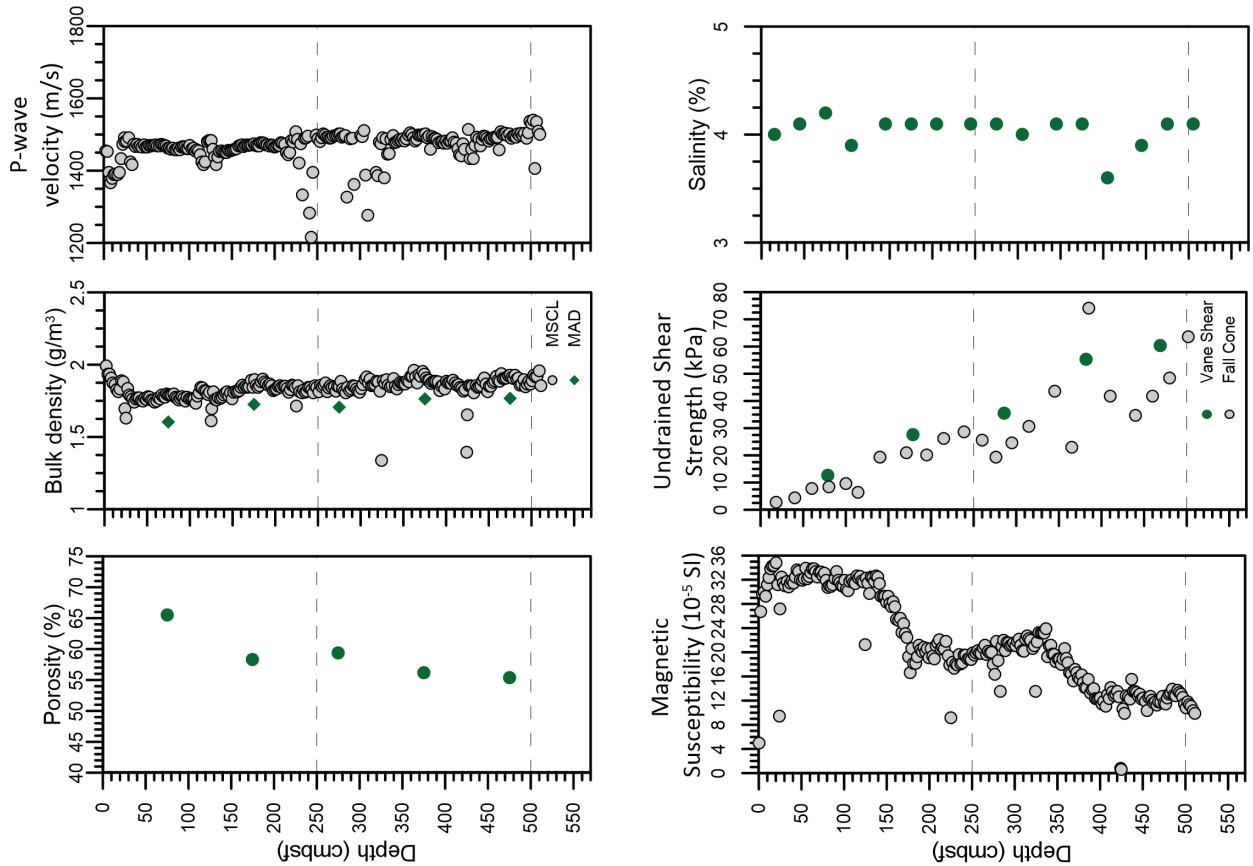

R/V METEOR M149
Station: M149_GeoB 23085-1
Location: Buried MV#3
Date: 16.08.18, 20:40:00 (UTC)
Latitude: 35°50.816'N
Longitude: 07°40.491'W
Water depth: 1288m
Recovery: 433.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 53 cm: Foram-bearing nannofossil ooze of light olive brown color (2.5 Y 5/3), more oxidized and soupy towards the top. @30 cm core compacted became stored vertically.
53 - 383 cm: Nannofossil ooze with abundant shell fragments and dark grayish brown color (2.5 Y 4/2). Black patches are present from 135 cm, increasing their concentration mostly between 260-383 cm, where they also have iron smell. 1 cm burrow @ 223 cm, gastropod shell @260 cm and coral fragments (cm size) @383 cm.
383 - 433 cm: Nannofossil ooze, color changes from dark grayish brown color (2.5 Y 4/2) to olive brown (2.5 Y 4/3).

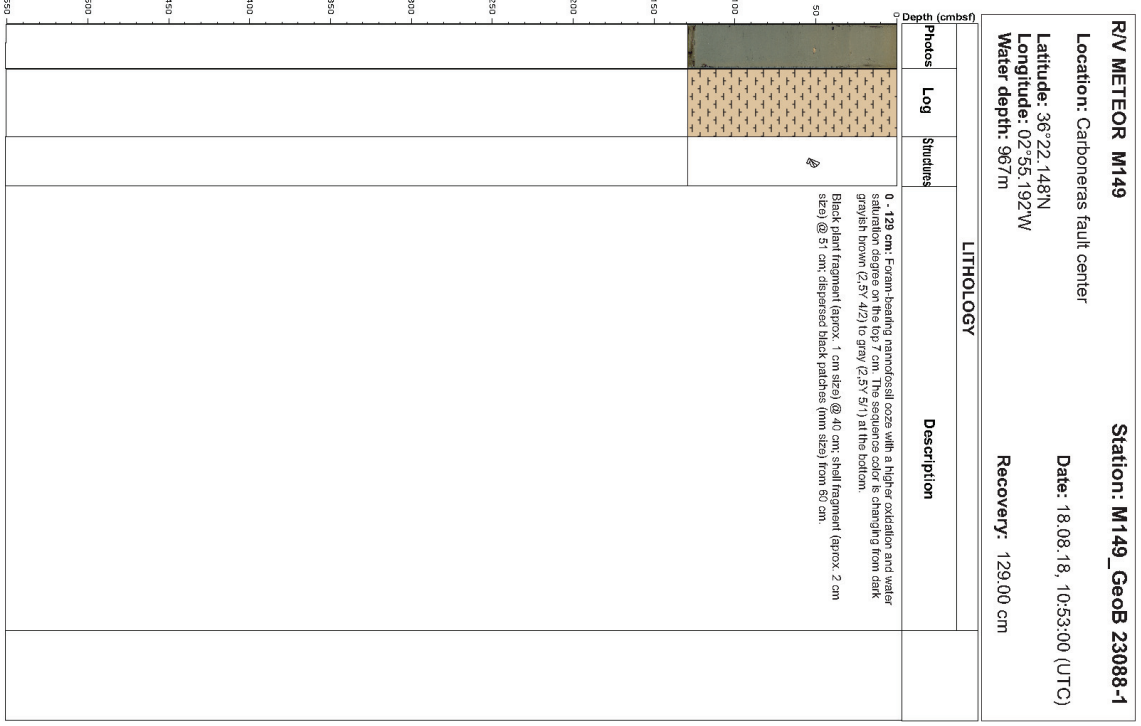

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

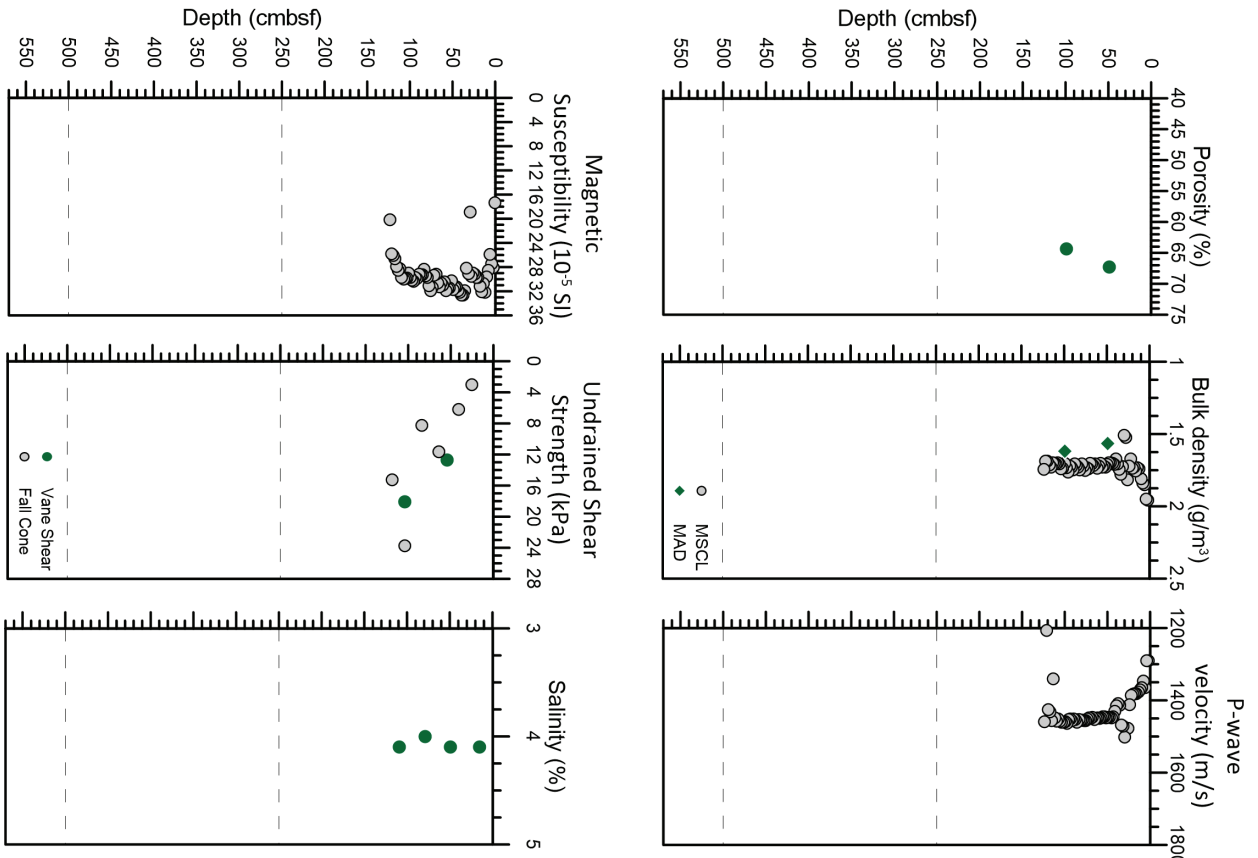

R/V METEOR M149
Station: M149_GeoB 23086-2
Location: Carboneras fault reference
Latitude: 36°26.298'N
Longitude: 02°50.854'W
Water depth: 835m
Date: 18.08.18, 07:43:00 (UTC)
Recovery: 233.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 233 cm: Nannofossil ooze with various shell fragments and a dark greenish gray color (GLEY 1 4/10Y). The first 50 cm are more reddish (oxidized).
Sponge spicula (aprox. 2 cm) @ 41 cm, remains of a sea urchin skeleton (?) @182 cm and a well preserved gastropod (aprox. 4 size) @ 185 cm.

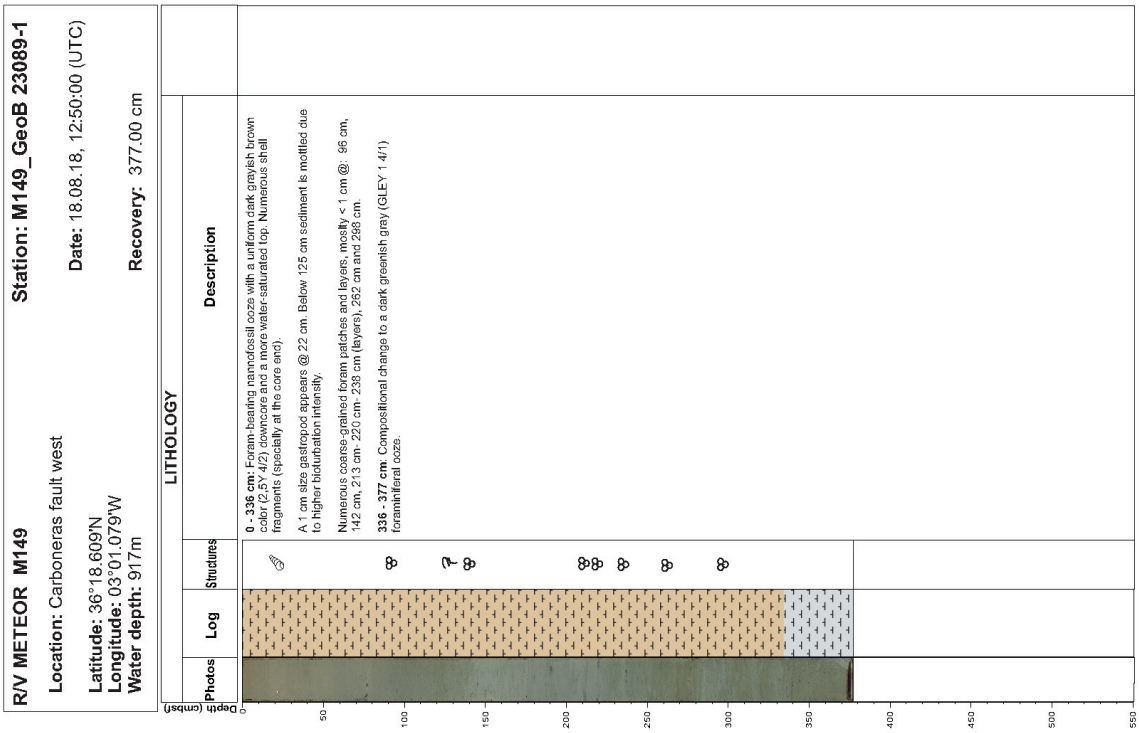

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)

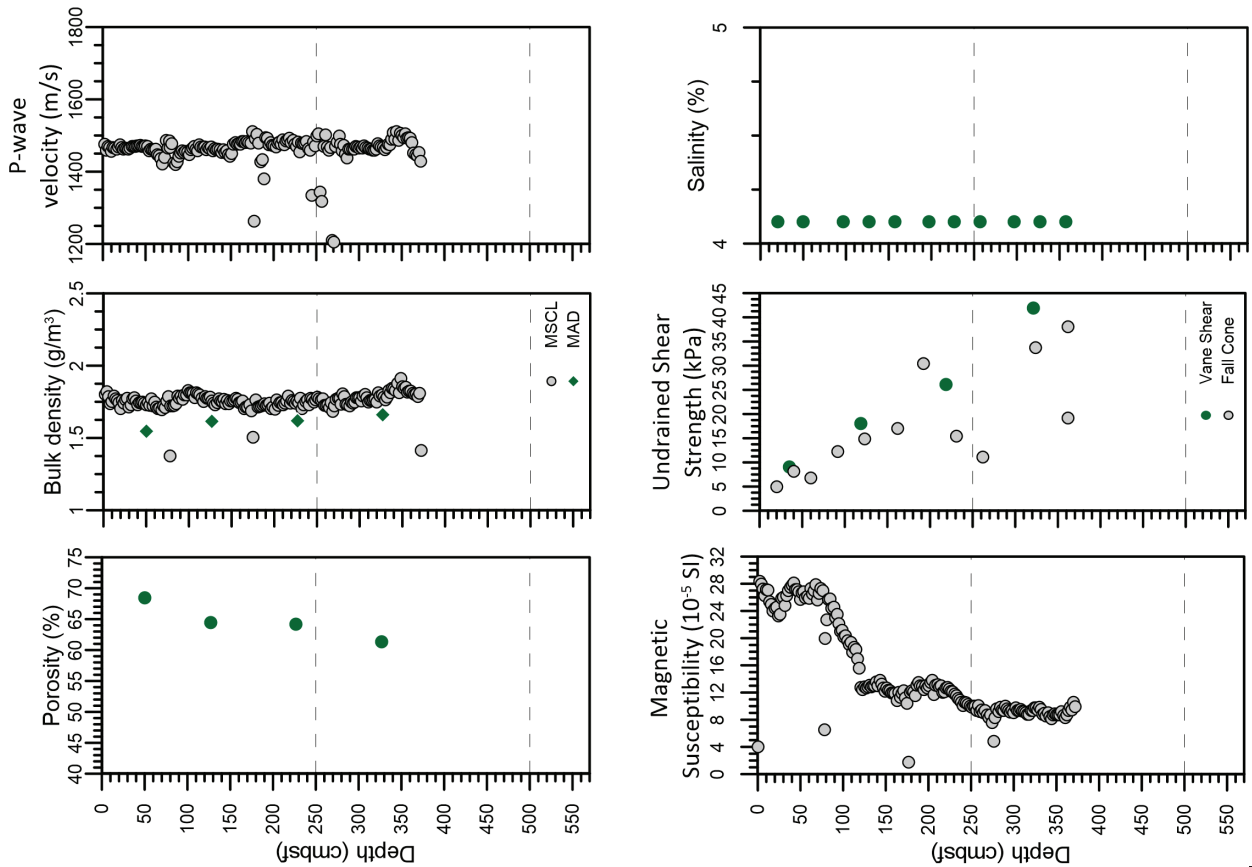

R/V METEOR M149
Station: M149_GeoB 23087-1
Location: Carboneras fault east
Date: 18.08.18, 09:14:00 (UTC)
Latitude: 36°25.390'N
Longitude: 02°48.596'W
Water depth: 905m
Recovery: 524.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 525 cm: Nannofossil ooze (first 5 cm oxidized). Numerous shell fragments throughout the sequence. Sediment turns very stiff at the end of the core (> 450 cmbsf).
Color gradually changes from olive grey (5Y 4/2) to grayish green (GLEY 1 4/2) @ 0 - 203 cm. From 203 cm to 360 cm the sequence color turns greenish grey (GLEY 1 6/1) and from 350 cm it changes to dark grayish green (GLEY 1 3/2).
Black spots appear from 77 cm, a well preserved gastropod @ 282 cm, and intensely bioturbated sediment with abundant patches of various colors from 360 cm.
???

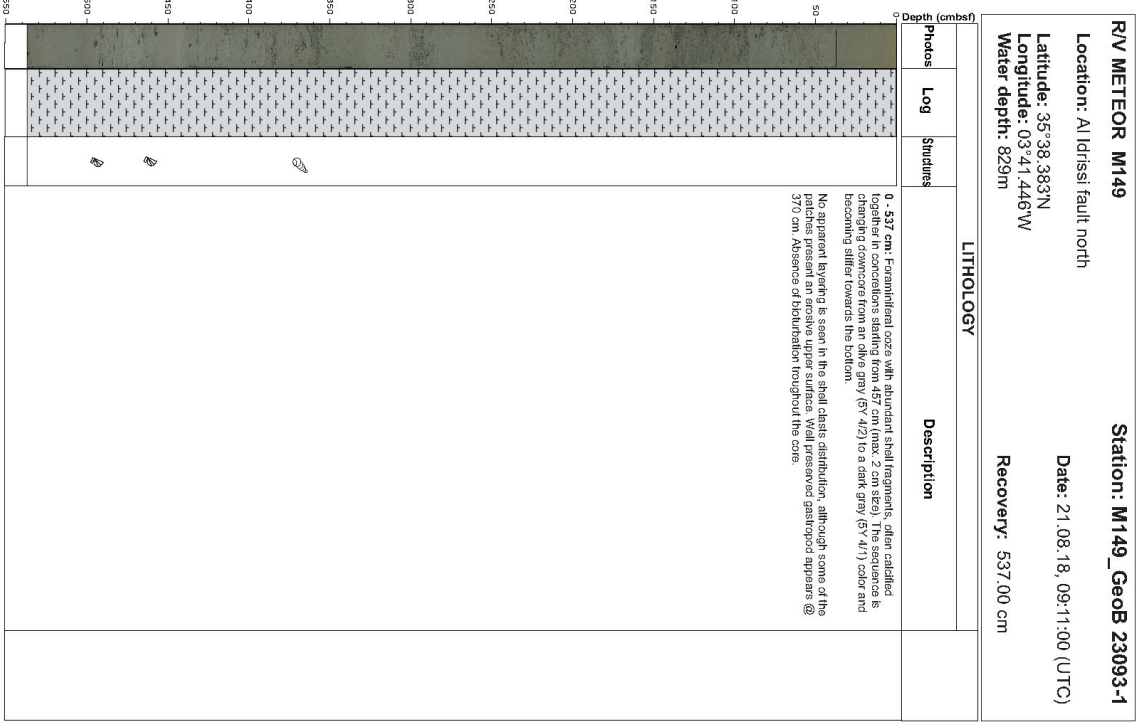

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

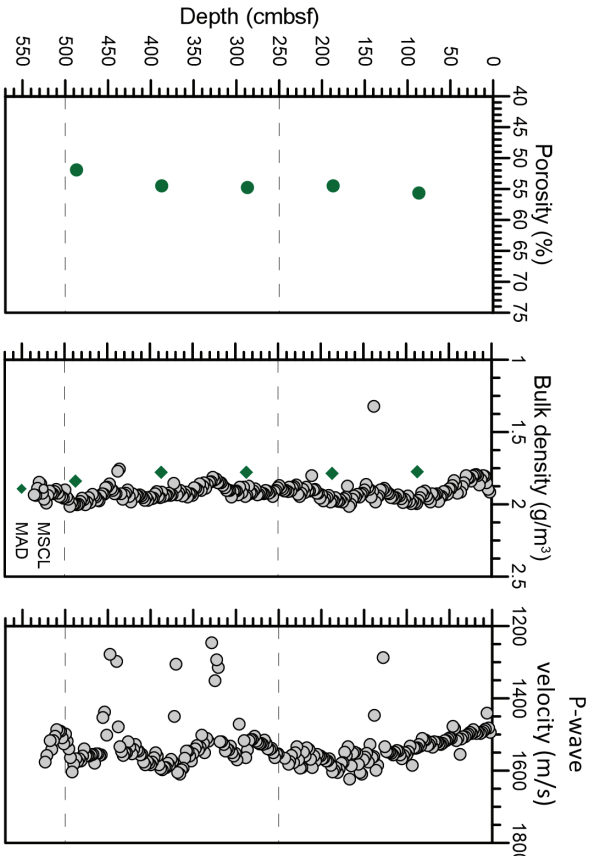

R/V METEOR M149
Station: M149_GeoB 23088-1
Location: Carboneras fault center
Latitude: 36°22.148'N
Longitude: 02°55.192'W
Water depth: 967 m
Date: 18.08.18, 10:53:00 (UTC)
Recovery: 129.00 cm
Depth (cmbsf)
Photos
Log
Structures
LITHOLOGY
Description
0 - 129 cm: Foram-bearing nannofossil ooze with a higher oxidation and water saturation degree on the top 7 cm. The sequence color is changing from dark grayish brown (2.5Y 4/2) to gray (2.5Y 5/1) at the bottom.
Black plant fragment (aprox. 1 cm size) @ 40 cm; shell fragment (aprox. 2 cm size) @ 51 cm; dispersed black patches (mm size) from 60 cm.

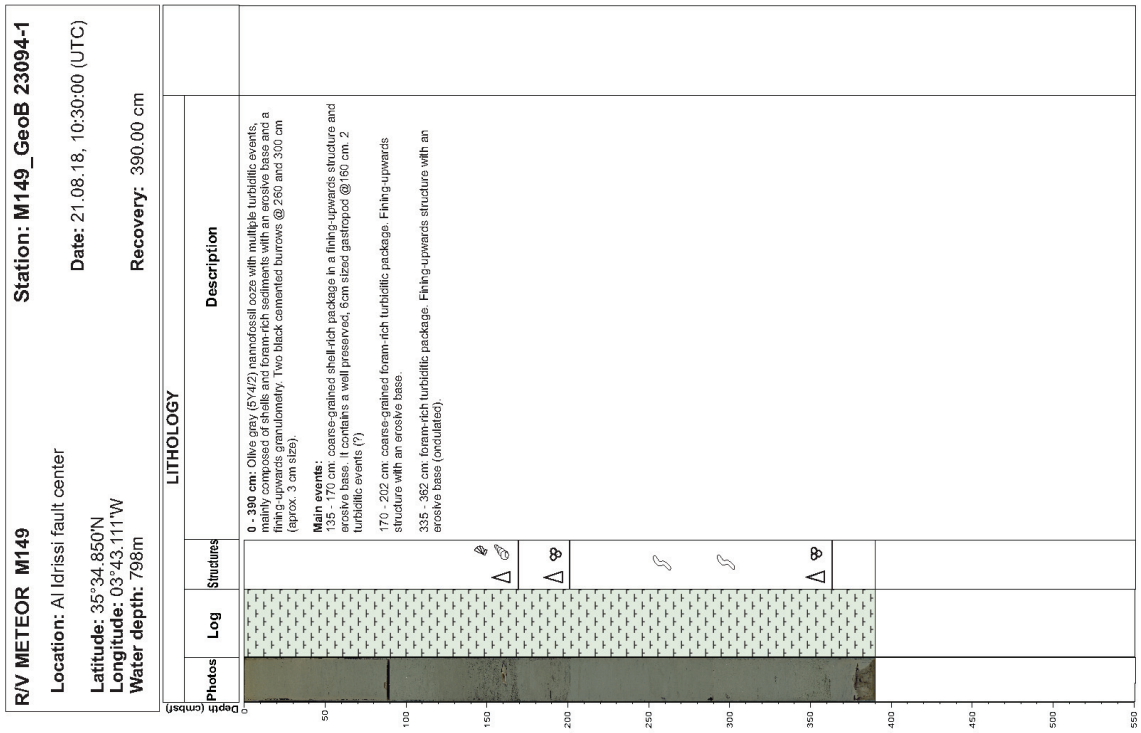

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)

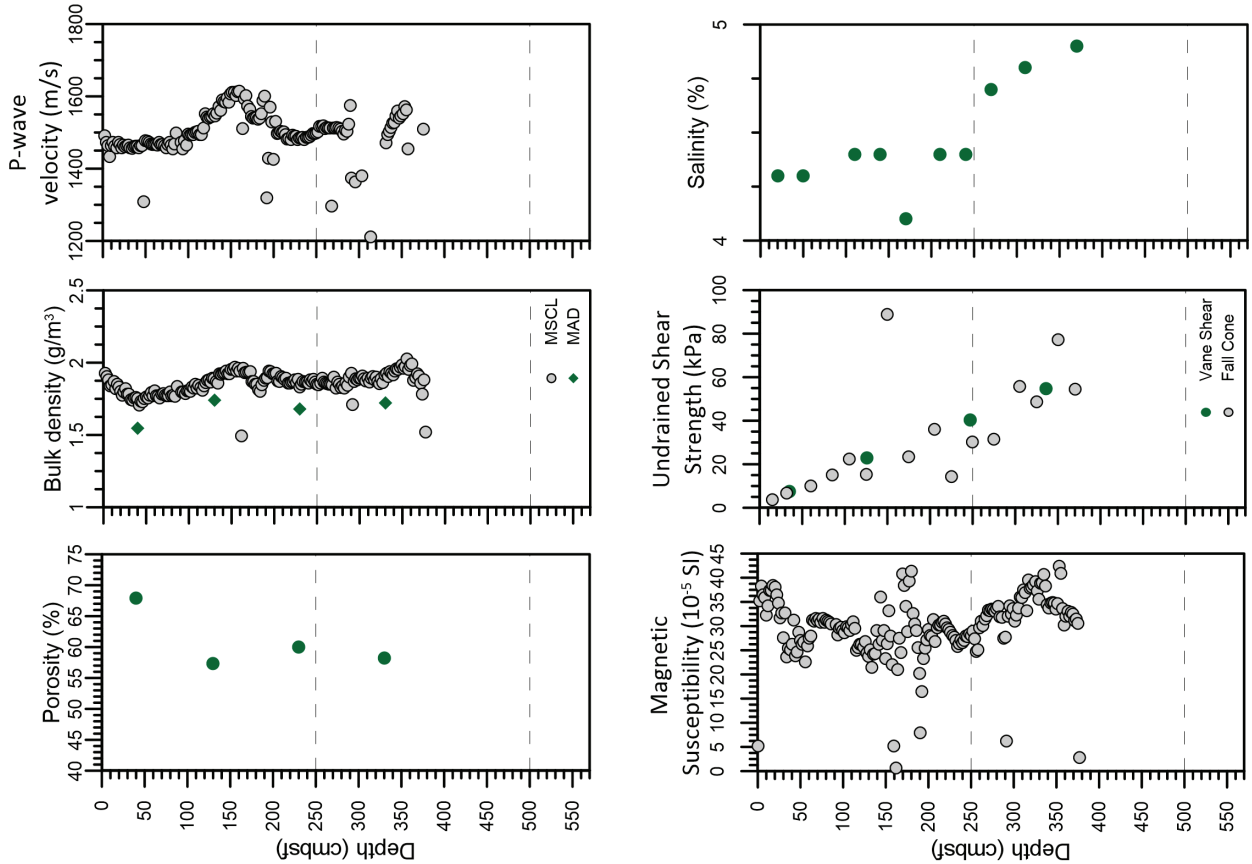

R/V METEOR M149
Station: M149_GeoB 23089-1
Location: Carboneras fault west
Date: 18.08.18, 12:50:00 (UTC)
Latitude: 36°18.609'N
Longitude: 03°01.079'W
Water depth: 917m
Recovery: 377.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 336 cm: Foram-bearing nannofossil ooze with a uniform dark greyish brown color (2.5Y 4/2), downcore and a more water-saturated top. Numerous shell fragments (specially at the core end).
A 1 cm size gastropod appears @ 22 cm. Below 125 cm sediment is mottled due to higher bioturbation intensity.
Numerous coarse-grained foram patches and layers, mostly < 1 cm @: 96 cm, 142 cm, 213 cm- 220 cm- 238 cm (layers), 262 cm and 288 cm.
336 - 377 cm: Compositional change to a dark greenish gray (GLEY 1 4/1) foraminiferal ooze.

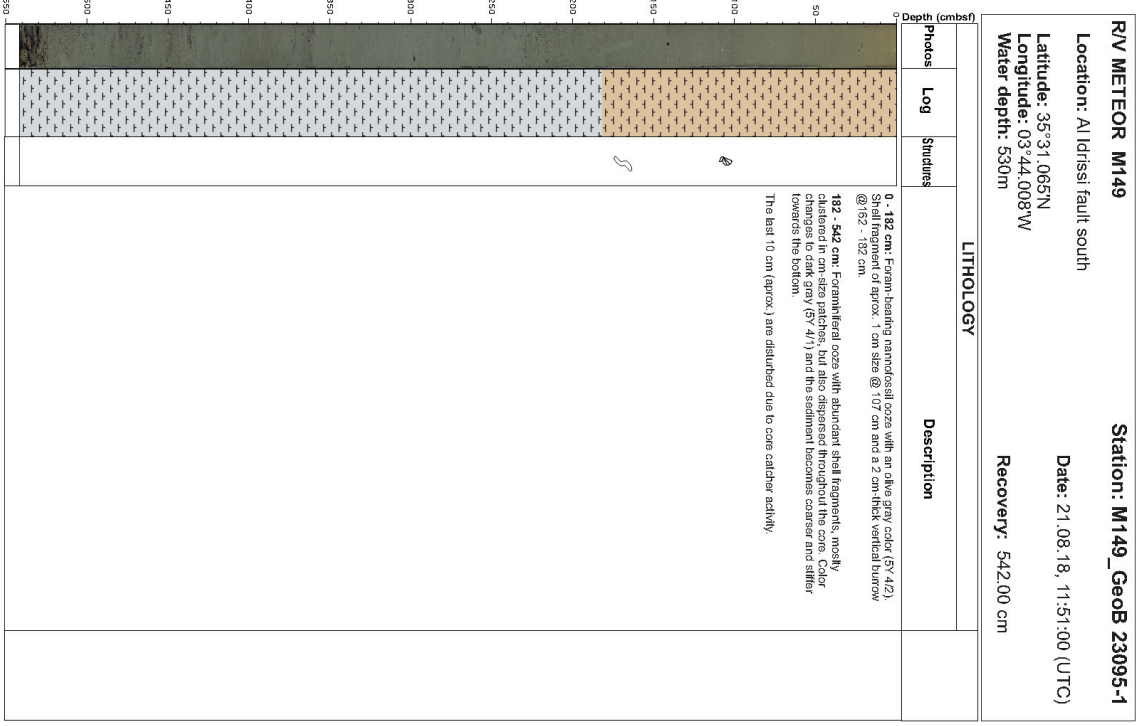

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

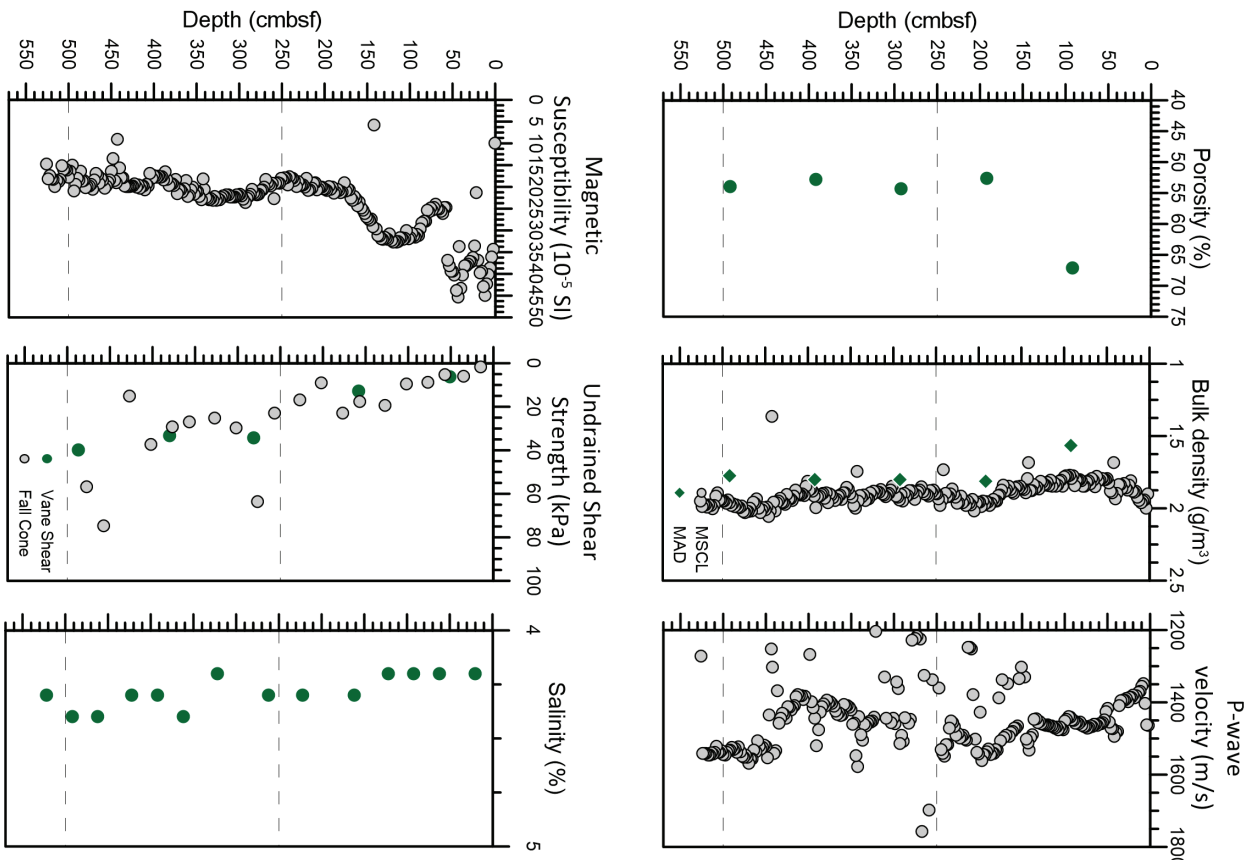

R/V METEOR M149
Station: M149_GeoB 23093-1
Location: Al Idrissi fault north
Date: 21.08.18, 09:11:00 (UTC)
Latitude: 35°38.383'N
Longitude: 03°41.446'W
Water depth: 829m
Recovery: 537.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 537 cm: Foraminiferal ooze with abundant shell fragments, often calcified together in concretions starting from 457 cm (max. 2 cm size). The sequence is changing downcore from an olive gray (5Y 4/2) to a dark gray (5Y 4/1) color and becoming stiffer towards the bottom.
No apparent layering is seen in the shell clasts distribution, although some of the patches present an erosive upper surface. Well preserved gastropod appears @ 370 cm. Absence of bioturbation throughout the core.

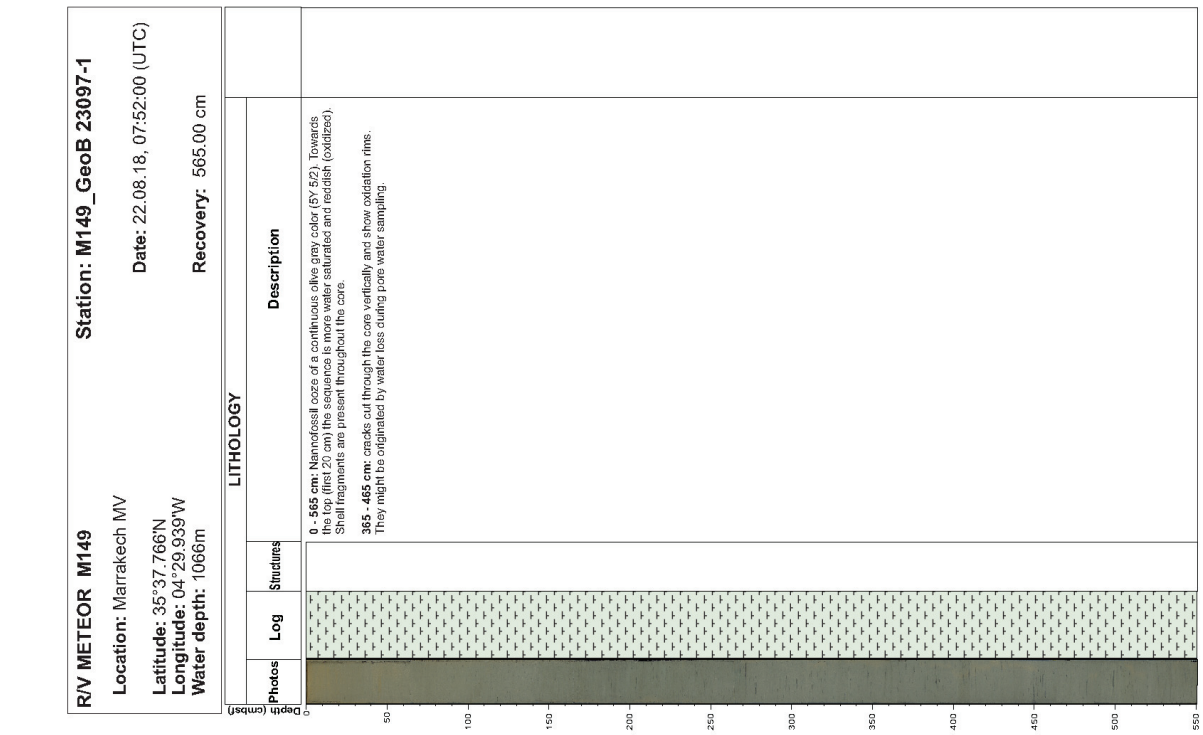

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)

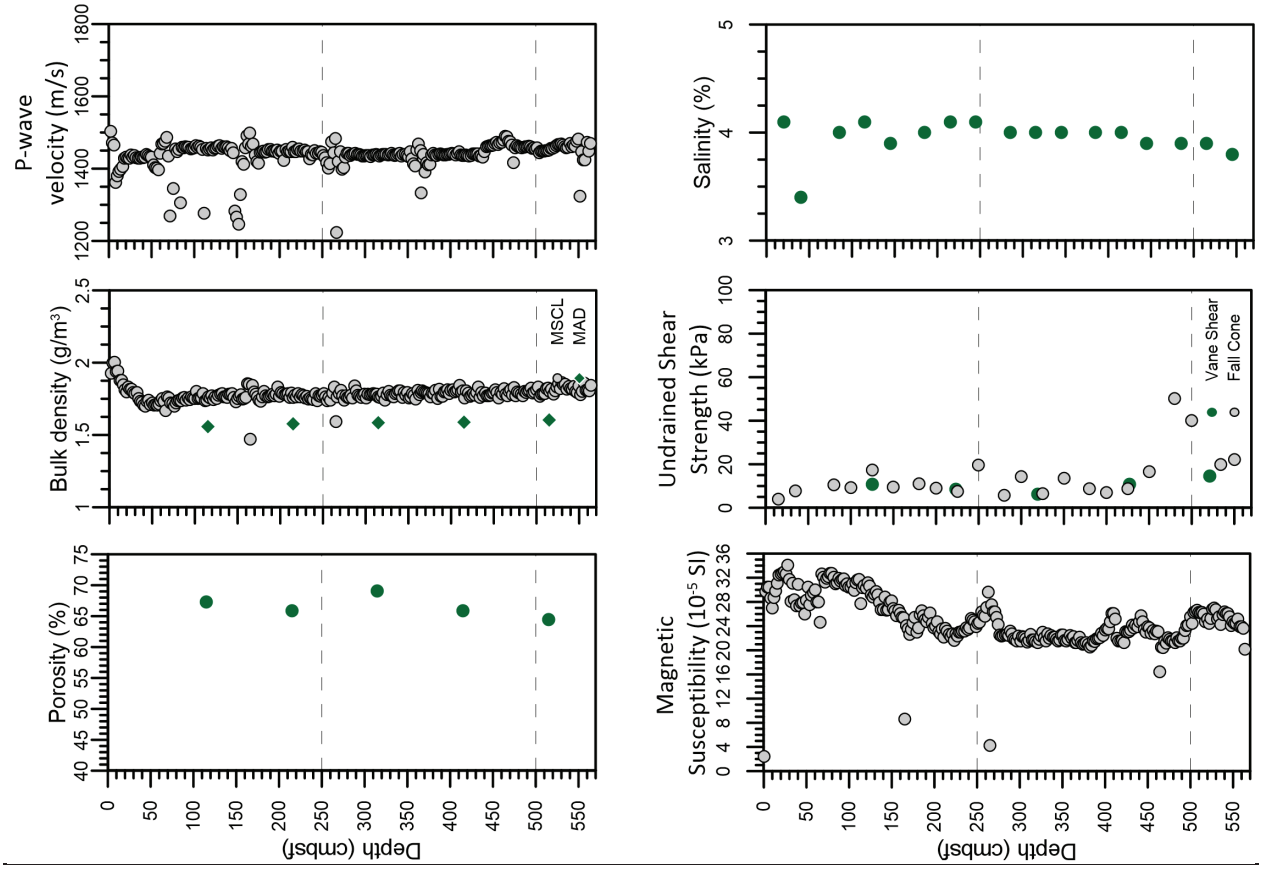

R/V METEOR M149
Station: M149_GeoB 23094-1
Location: Al Idrissi fault center
Date: 21.08.18, 10:30:00 (UTC)
Latitude: 35°34.850'N
Longitude: 03°43.111'W
Water depth: 798m
Recovery: 390.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
0 - 390 cm: Olive gray (5Y4/2) nannofossil ooze with multiple turbiditic events, mainly composed of shells and foram-rich sediments with an erosive base and a fining-upwards granulometry. Two black cemented burrows @ 260 and 300 cm (aprox. 3 cm size).
Main events:
135 - 170 cm: coarse-grained shell-rich package in a fining-upwards structure and erosive base. It contains a well preserved, 6cm sized gastropod @160 cm. 2 turbiditic events (?)
170 - 202 cm: coarse-grained foram-rich turbiditic package. Fining-upwards structure with an erosive base.
335 - 362 cm: foram-rich turbiditic package. Fining-upwards structure with an erosive base (undulated).


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_GeoB 23095-1
Location: Al Idrissi fault south
Latitude: 35°31.065'N
Longitude: 03°44.008'W
Water depth: 530m
Date: 21.08.18, 11:51:00 (UTC)
Recovery: 542.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
0 - 182 cm: Foram-bearing nannofossil ooze with an olive gray color (5Y 4/2). Shell fragment of aprox. 1 cm size @ 107 cm and a 2 cm-thick vertical burrow @152 - 182 cm.
182 - 542 cm: Foraminiferal ooze with abundant shell fragments, mostly clustered in cm-size patches, but also dispersed throughout the core. Color changes to dark grey (5Y 4/1) and the sediment becomes coarser and stiffer towards the bottom.
The last 10 cm (aprox.) are disturbed due to core catcher activity.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_GeoB 23097-1
Location: Marrakech MV
Date: 22.08.18, 07:52:00 (UTC)
Latitude: 35°37.766'N
Longitude: 04°29.939'W
Water depth: 1066m
Recovery: 565.00 cm
LITHOLOGY
Description
Photos
Log
Studures
Depth (cmbsf)
0 - 565 cm: Nannofossil ooze of a continuous olive gray color (5Y 5/2). Towards the top (first 20 cm) the sequence is more water saturated and reddish (oxidized). Shell fragments are present throughout the core.
365 - 465 cm: cracks cut through the core vertically and show oxidation rims. They might be originated by water loss during pore water sampling.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23024-2 (1P)**

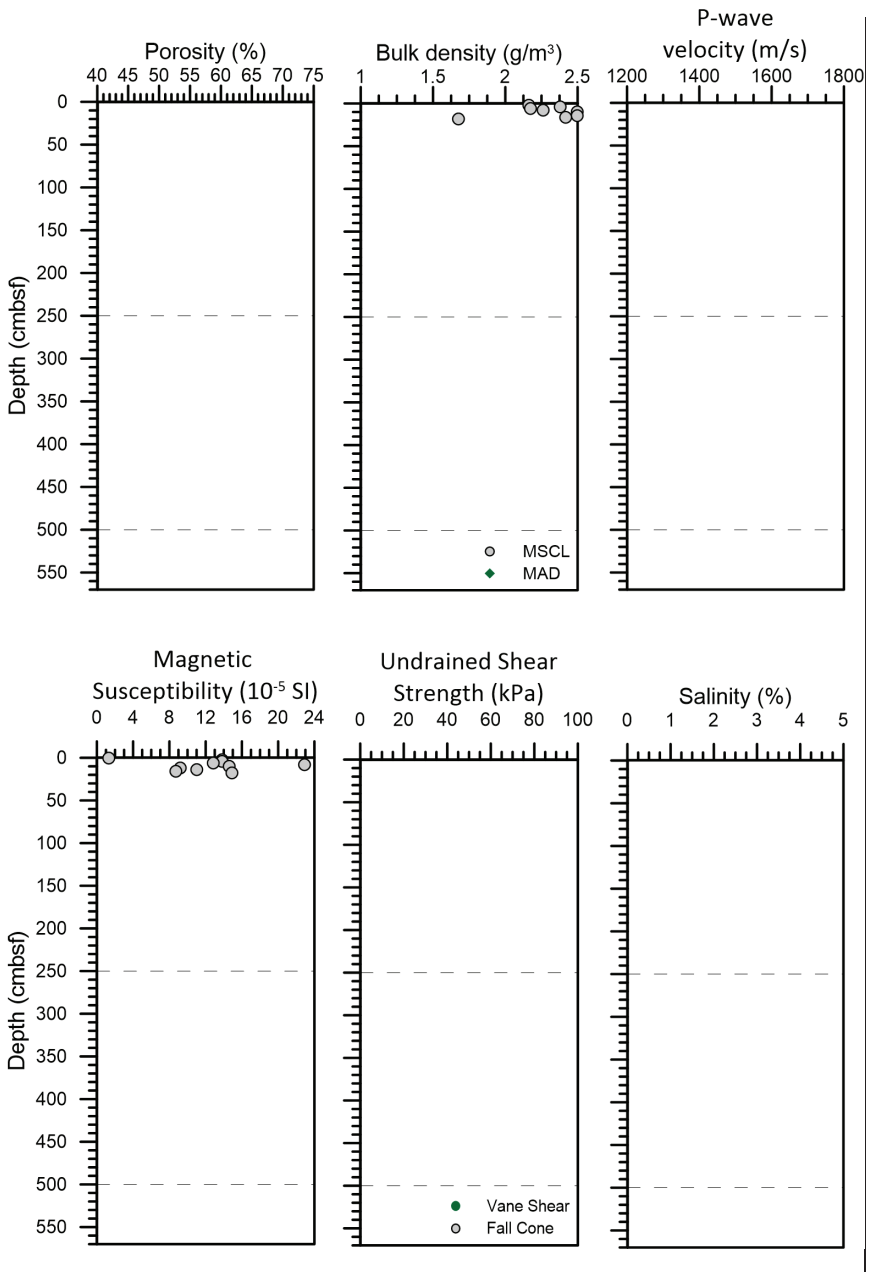
Location: Ginsburg MV Crest 3
Latitude: 35°22.356´N
Longitude: 7°5.295´W
Water depth: 906 m

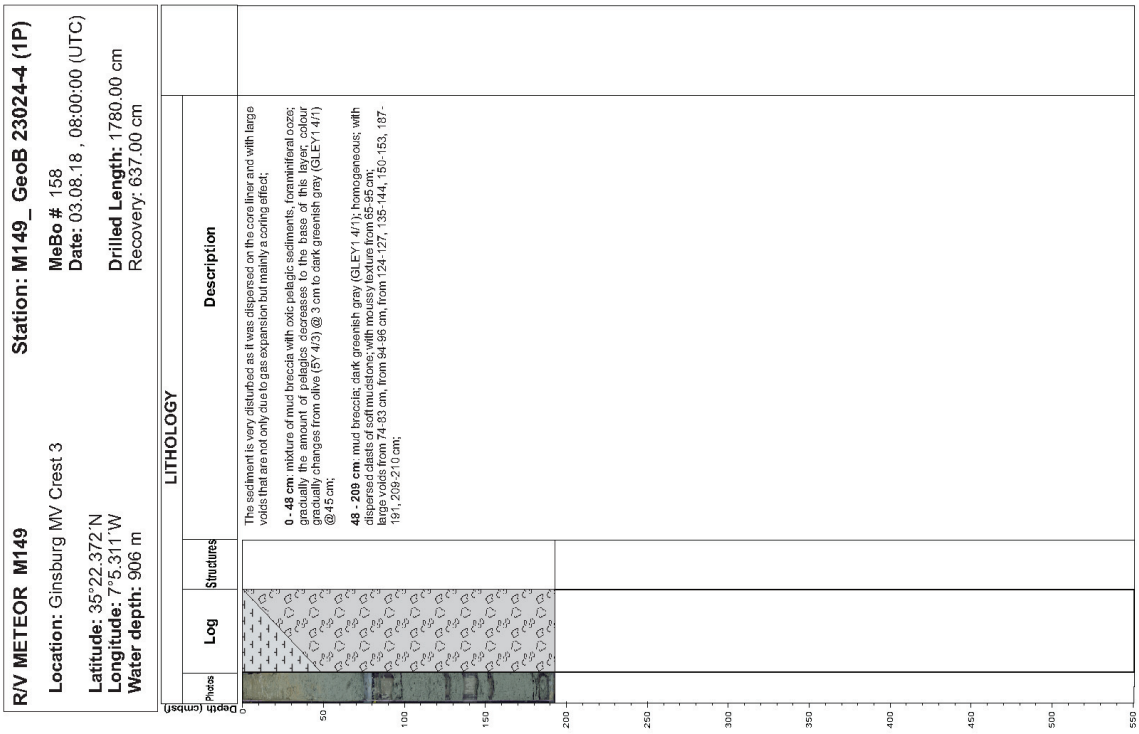
MeBo # 157
Date: 30.07.18 , 07:00:00 (UTC)

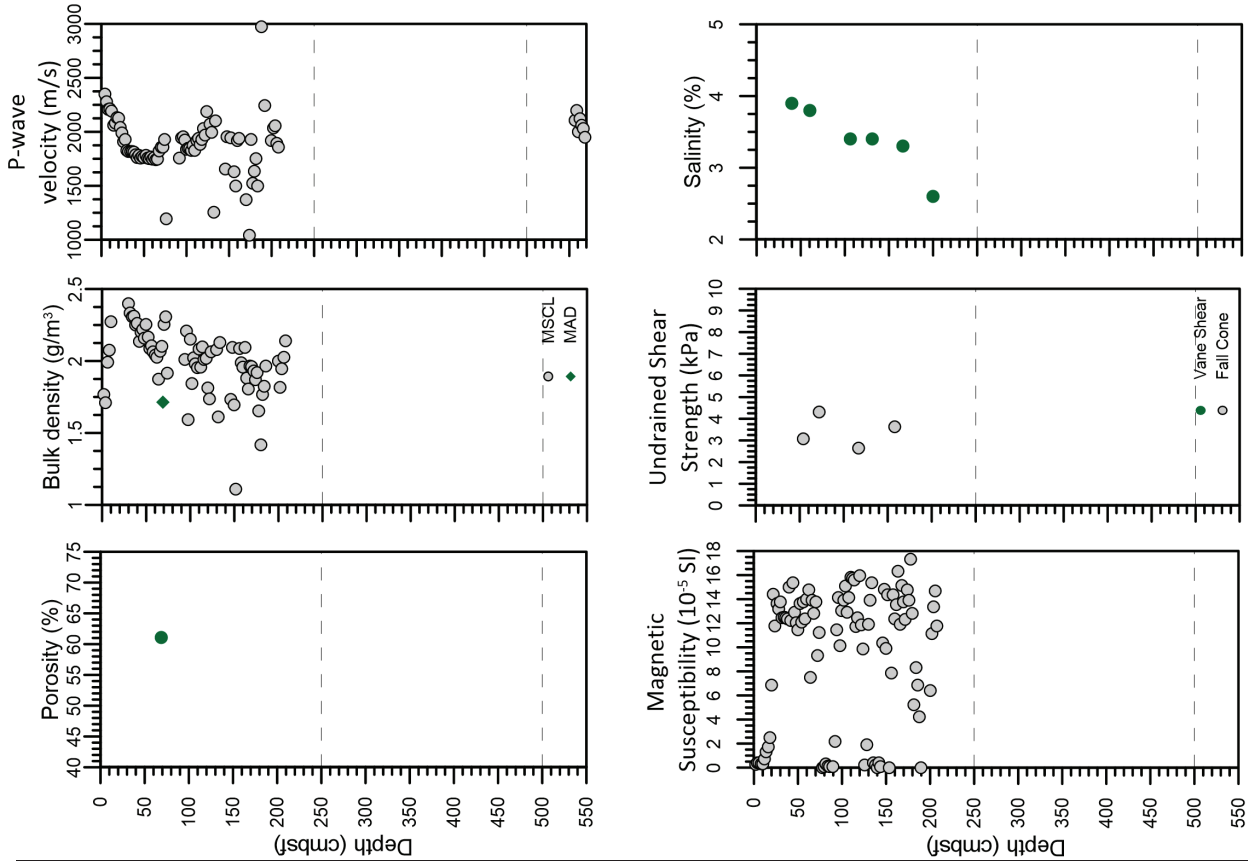
Drilled Length: .00 cm
Recovery: 19.00 cm

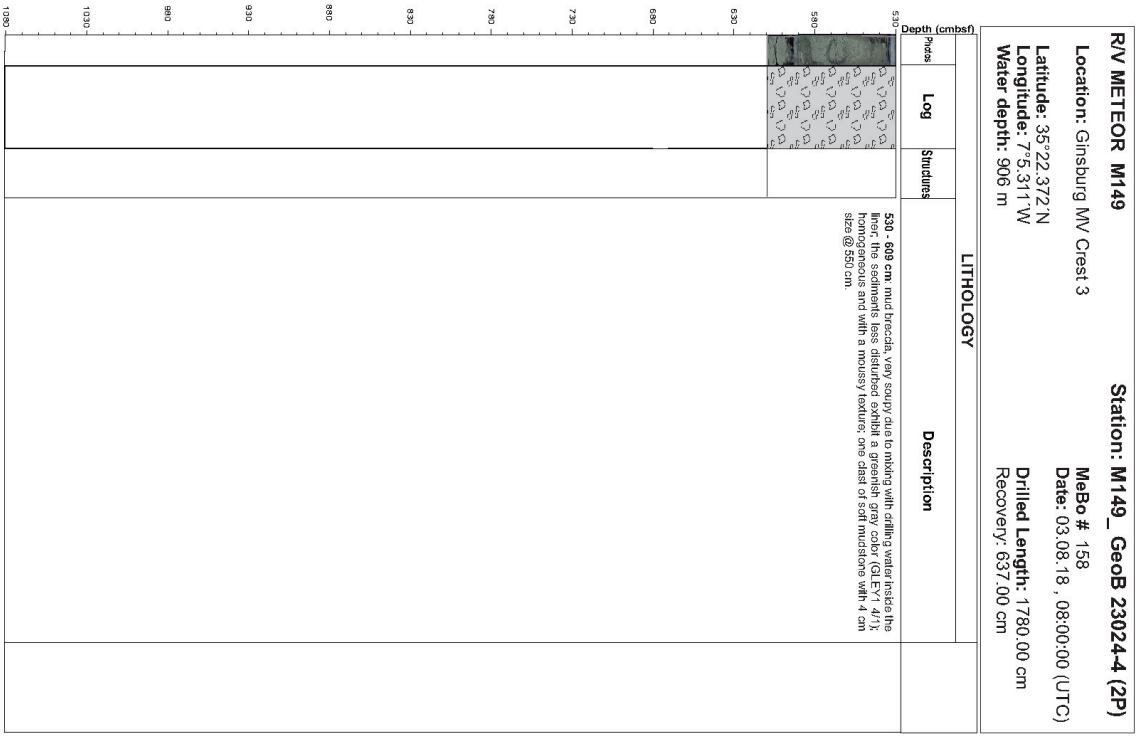
LITHOLOGY

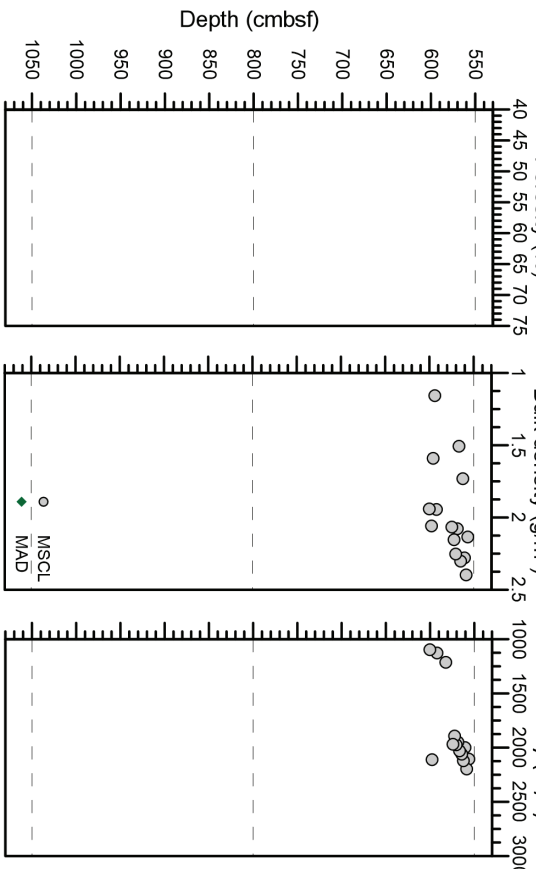
Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 19 cm**: Sediment admixture of the entire corer liner, very water saturated due to water fluxing during drilling; the sediment corresponds to a mixture of mud breccia with pelagic sediments and drill fluids; grayish brown (10YR 5/2) colour.

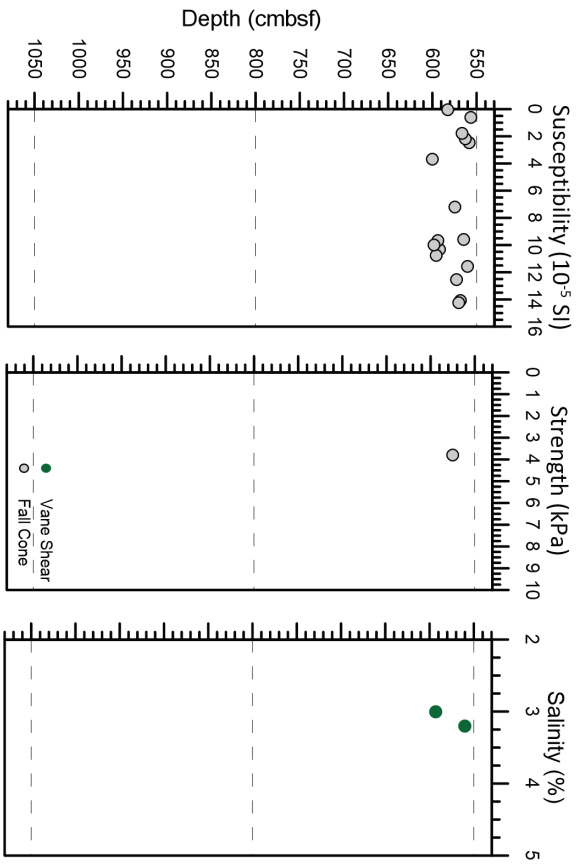


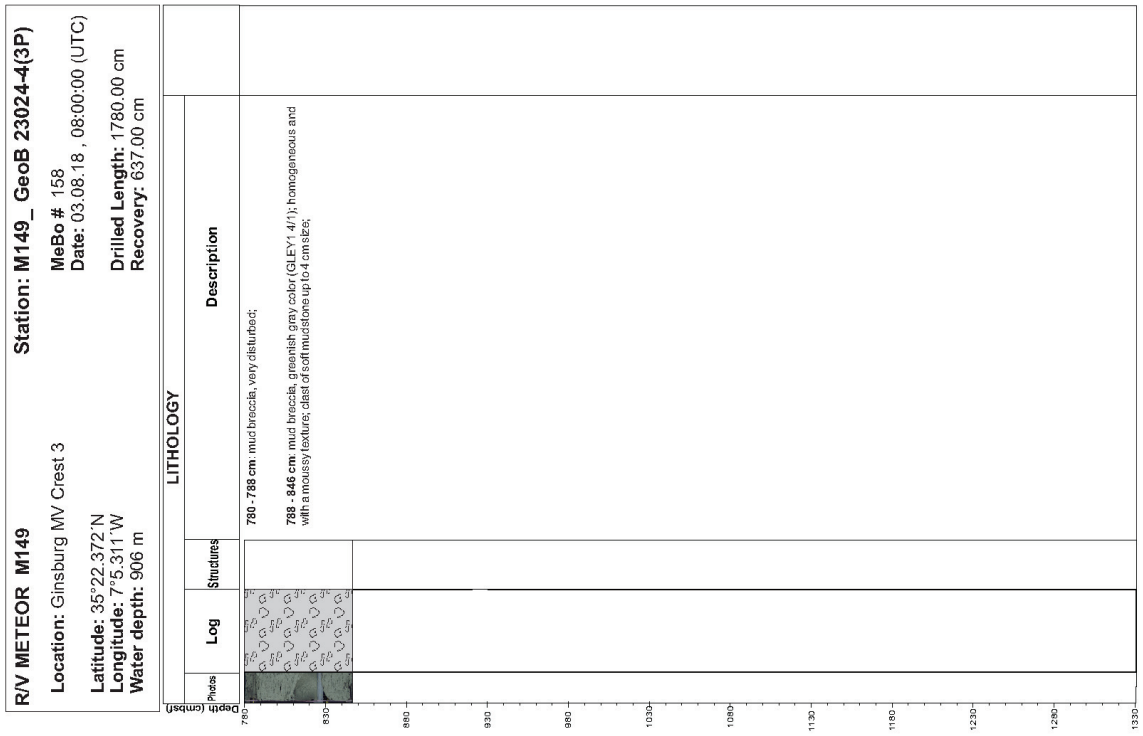

R/V METEOR M149
Station: M149_ GeoB 23024-4 (1P)
Location: Ginsburg MV Crest 3
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
This sediment is very disturbed as it was dispersed on the core liner and with large voids that are not only due to gas expansion but mainly a coring effect;
0 - 48 cm: mixture of mud breccia with oxic pelagic sediments, foraminiferal ooze; gradually the amount of pelagics decreases to the base of this layer, colour gradually changes from olive (5Y 4/3) @ 3 cm to dark greenish gray (GLEY1 4/1) @ 45 cm;
48 - 209 cm: mud breccia; dark greenish gray (GLEY1 4/1); homogeneous; with dispersed clasts of soft mudstone; with moussy texture from 65-95 cm; large voids from 74-83 cm, from 94-96 cm, from 124-127, 135-144, 150-153, 187-191, 209-210 cm;

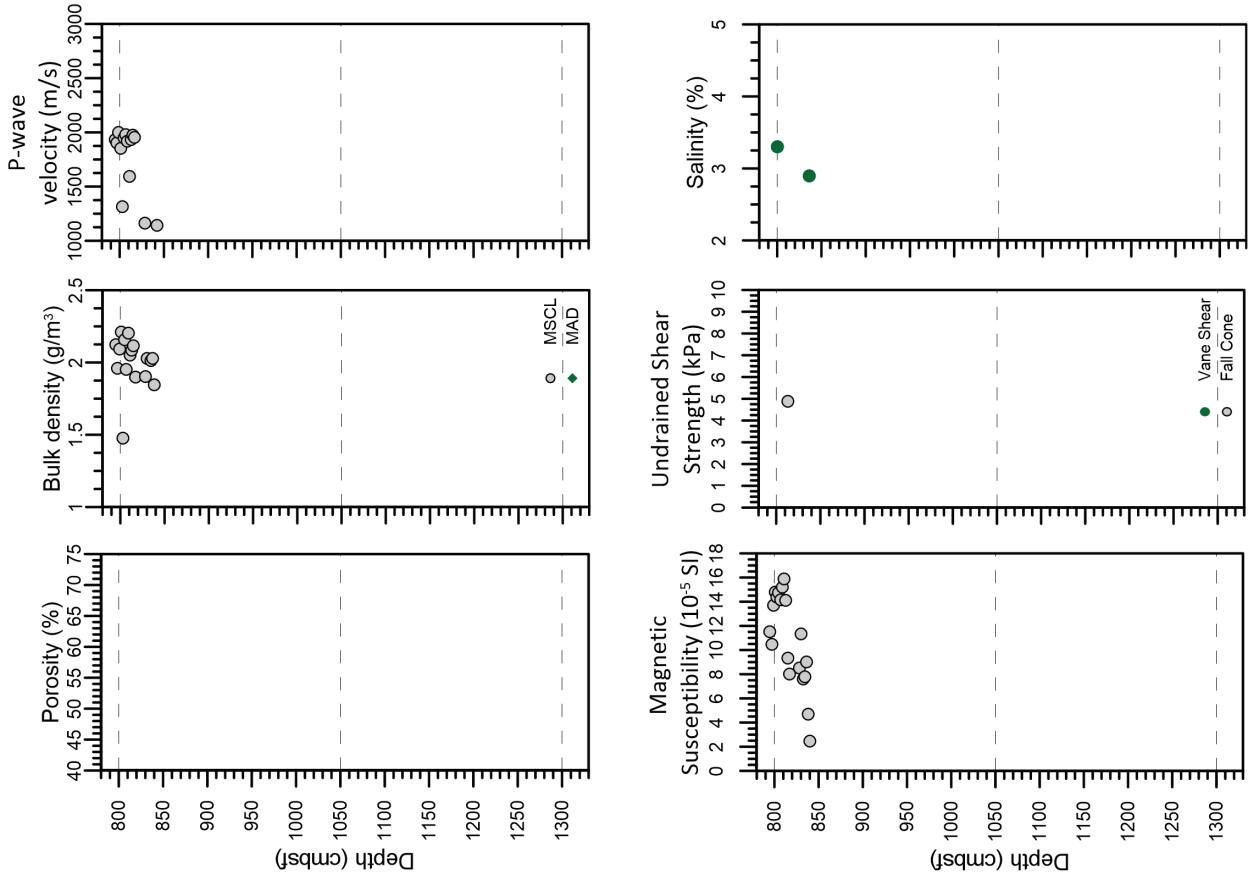

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23024-4 (2P)
Location: Ginsburg MV Crest 3
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
Depth (cmbsf)
Photo
Log
Structures
LITHOLOGY
Description
530 - 609 cm: mud breccia, very soupy due to mixing with drilling water inside the liner; the sediments less disturbed exhibit a greenish gray color (GLEY1 4/1); homogeneous and with a moussy texture; one clast of soft mudstone with 4 cm size @ 550 cm


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)


Depth (cmbsf)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23024-4(3P)
Location: Ginsburg MV Crest 3
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
780 - 788 cm: mud breccia, very disturbed;
788 - 846 cm: mud breccia, greenish gray color (GLEY1 4/1); homogeneous and with a moussy texture; clast of soft mudstone up to 4 cm size;


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23024-4 (4P)**

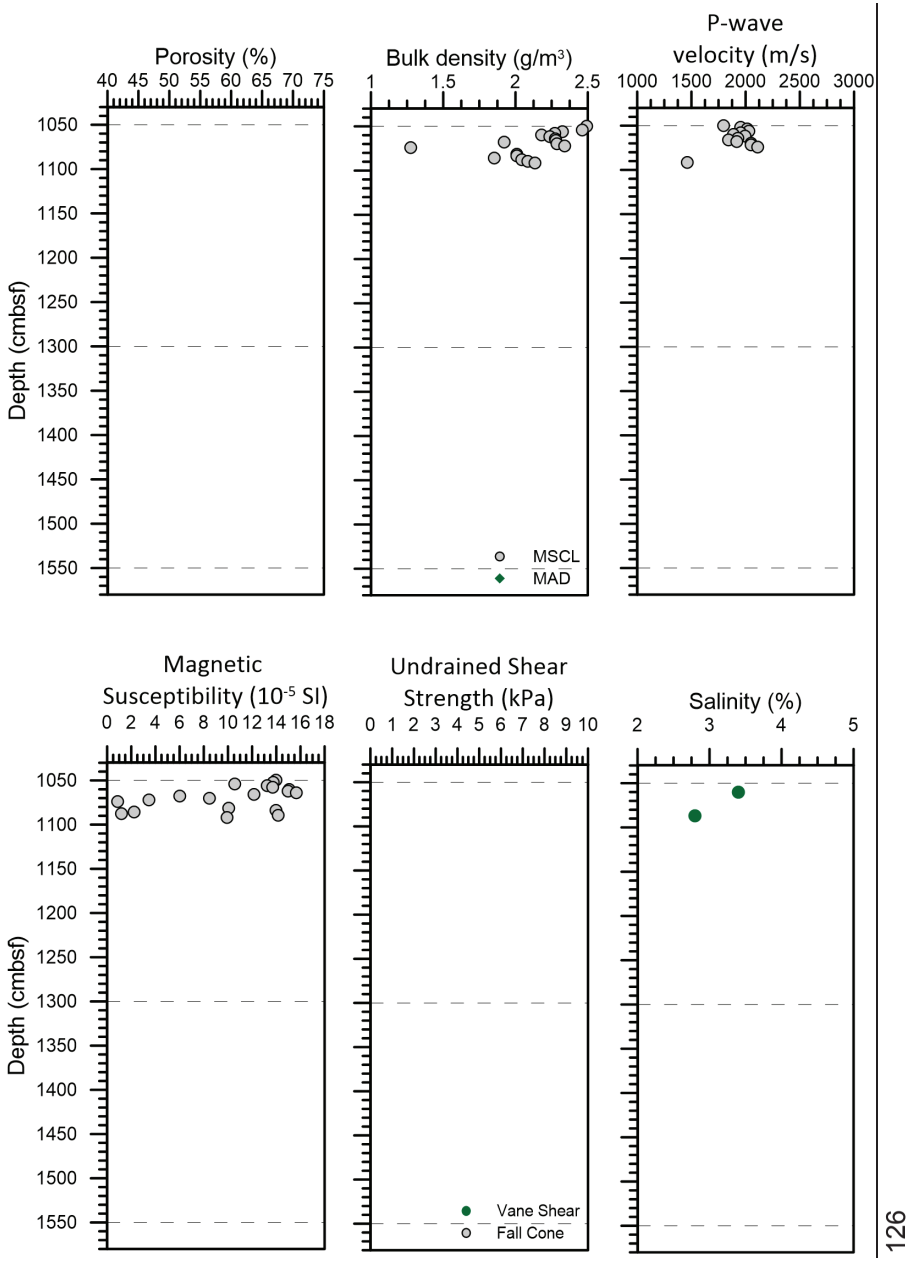
Location: Ginsburg MV Crest 3
Latitude: 35°22.372´N
Longitude: 7°5.311´W
Water depth: 906 m

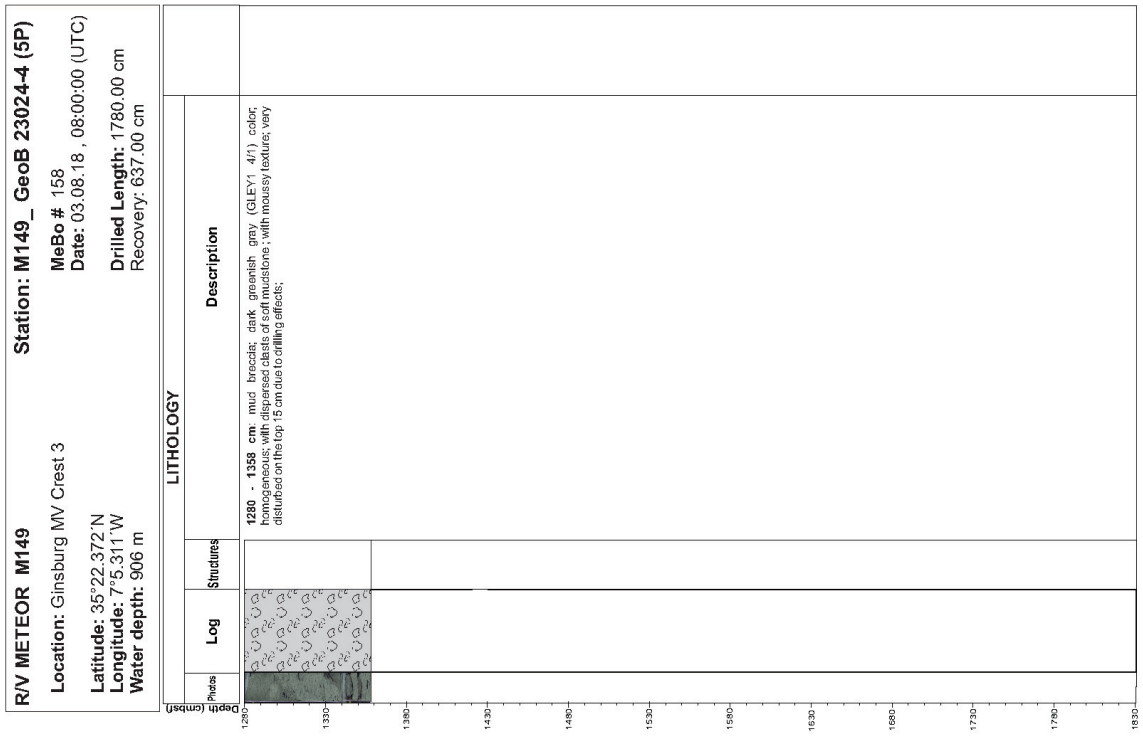
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)

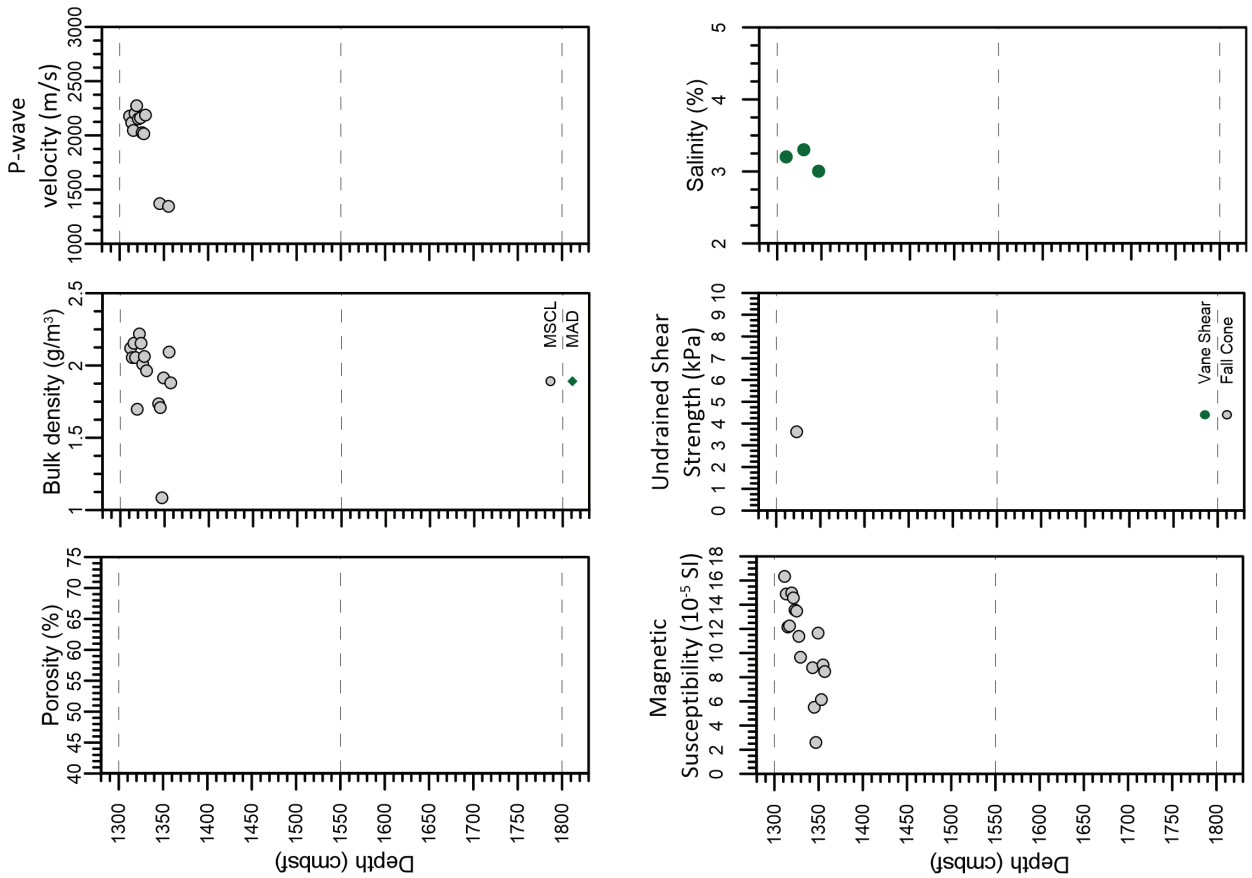
Drilled Length: 1780.00 cm
Recovery: 637.00 cm

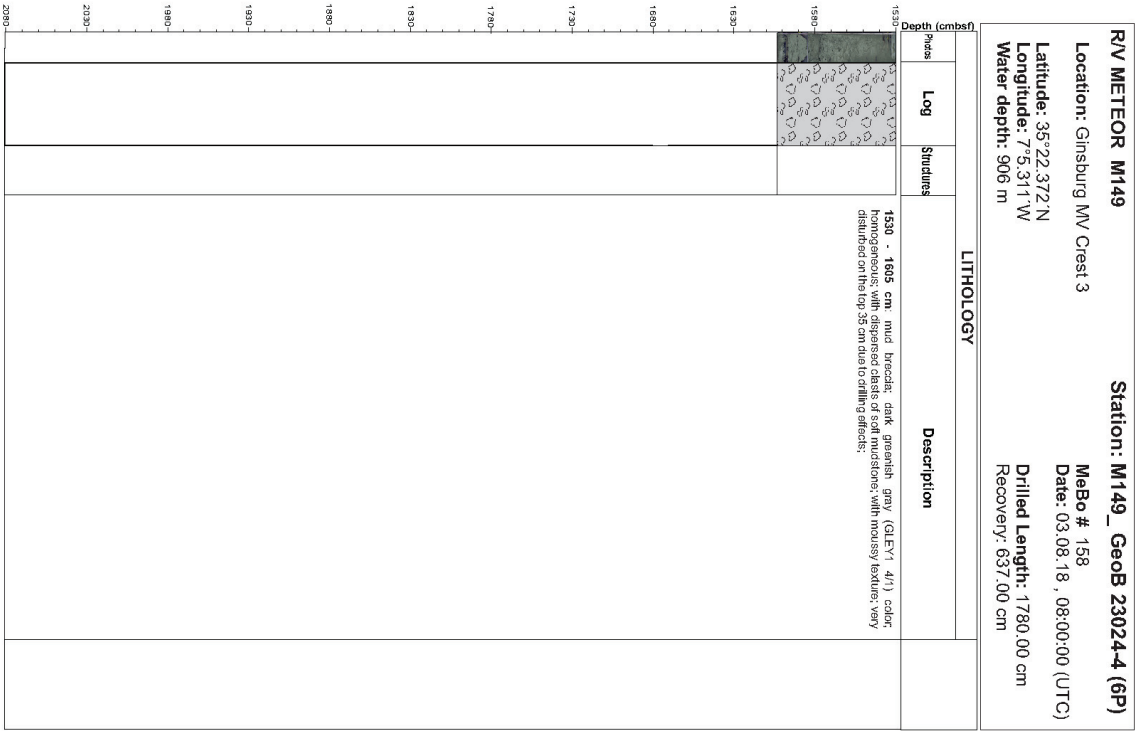
LITHOLOGY

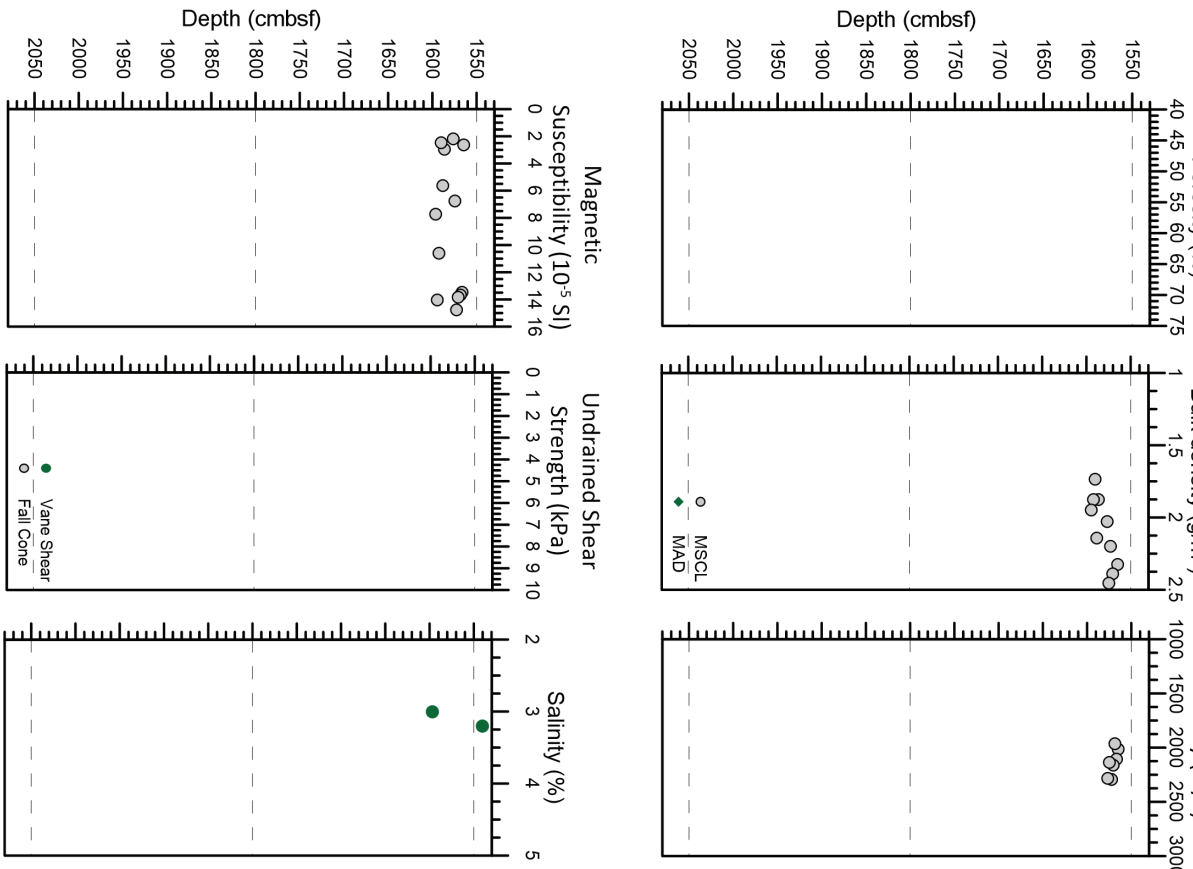
Depth (cmbsf)	Photos	Log	Structures	Description
1030				**1030 - 1095 cm**: mud breccia; dark greenish gray (GLEY1 4/1) color; homogeneous; with dispersed clasts of soft mudstone and a well consolidated clast of siltstone with 4 cm size; with moussy texture; very disturbed on the top 20 cm due to drilling effects;
1080				
1130				
1180				
1230				
1280				
1330				
1380				
1430				
1480				
1530				
1580				

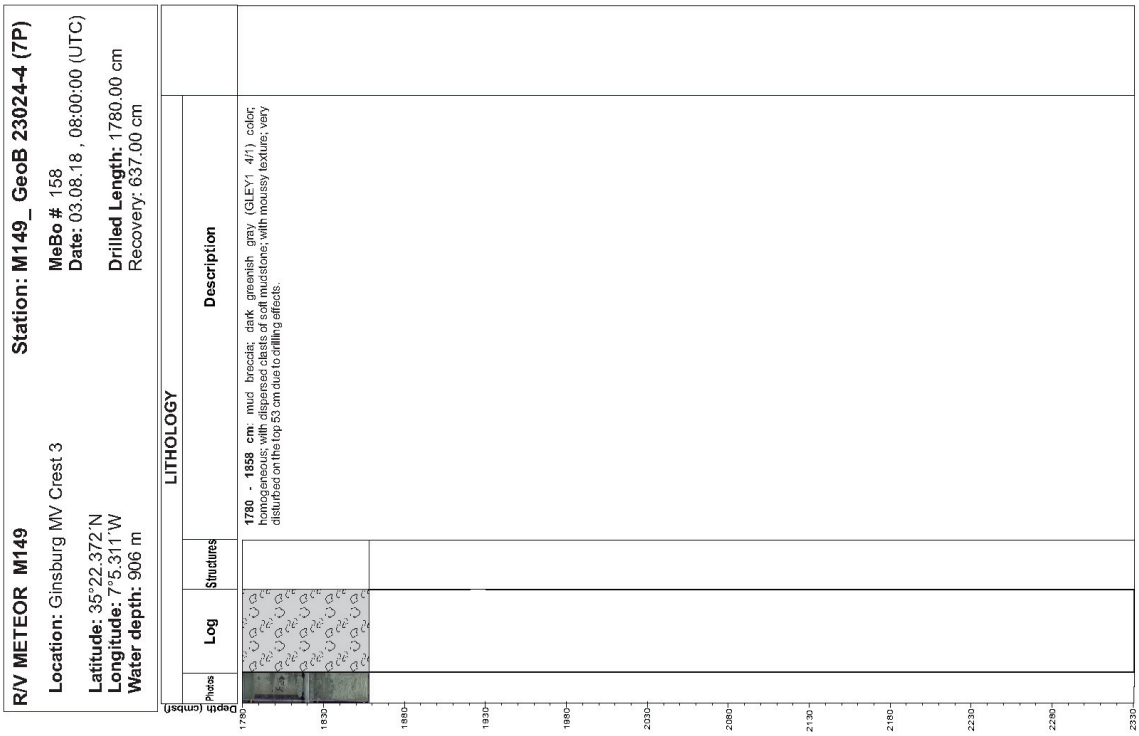


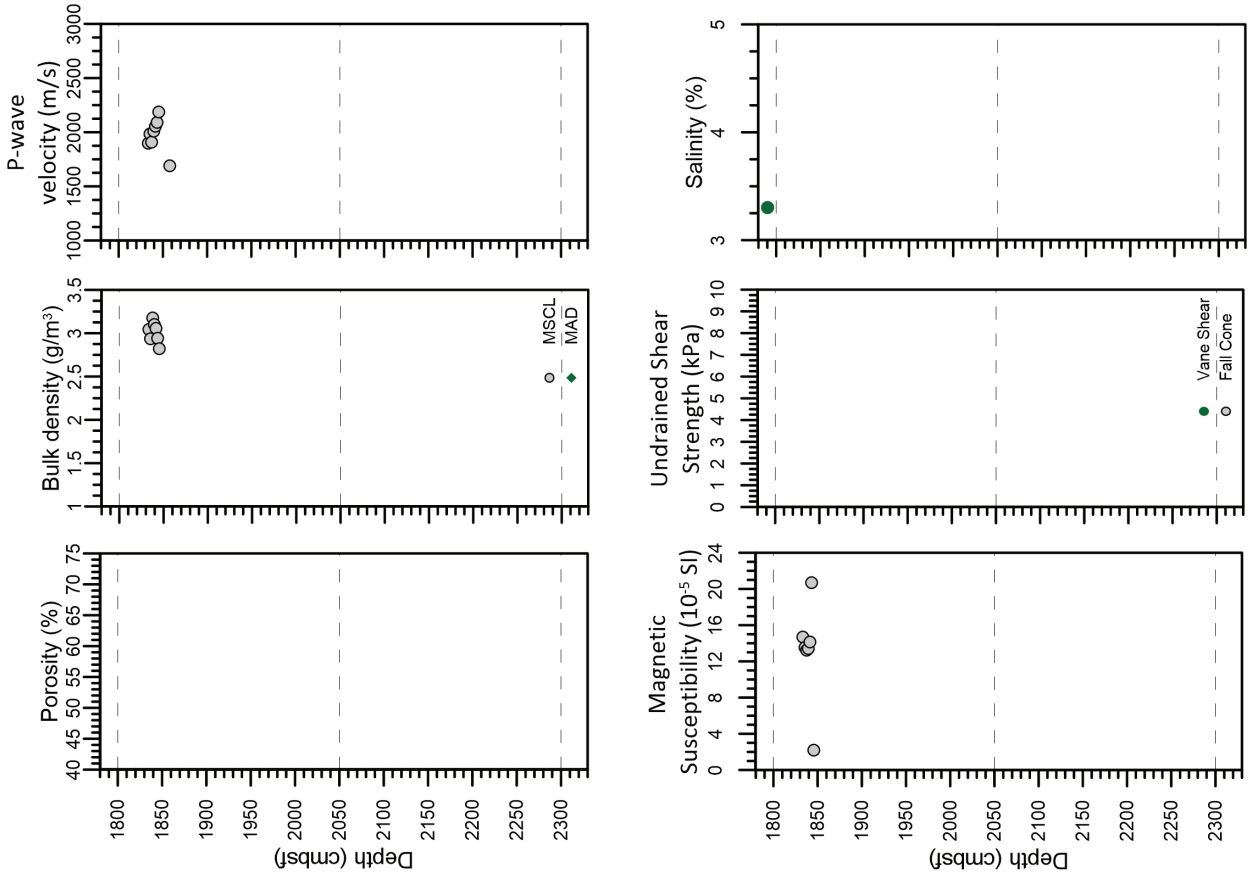

R/V METEOR M149
Station: M149_ GeoB 23024-4 (5P)
Location: Ginsburg MV Crest 3
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1280 - 1358 cm: mud breccias; dark greenish gray (GLEY1 4/1) color; homogeneous; with dispersed clasts of soft mudstone ; with moussy texture; very disturbed on the top ; 15 cm due to drilling effects;


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23024-4 (6P)
Location: Ginsburg MV Crest 3
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1530 - 1605 cm: mud breccia; dark greenish gray (GLEY1 4/1) color; homogeneous; with dispersed clasts of soft mudstones; with moussy texture; very disturbed on the top 35 cm due to drilling effects;


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
P-wave velocity (m/s)
MSCL
MAD
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23024-4 (7P)
Location: Ginsburg MV Crest 3
MeBo # 158
Date: 03.08.18 , 08:00:00 (UTC)
Latitude: 35°22.372'N
Longitude: 7°5.311'W
Water depth: 906 m
Drilled Length: 1780.00 cm
Recovery: 637.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1780 - 1858 cm: mud breccia; dark greenish gray (GLEY1 4/1) color; homogeneous; with dispersed clasts of soft mudstone; with moussy texture; very disturbed on the top 53 cm due to drilling effects.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23047-1 (1P)**

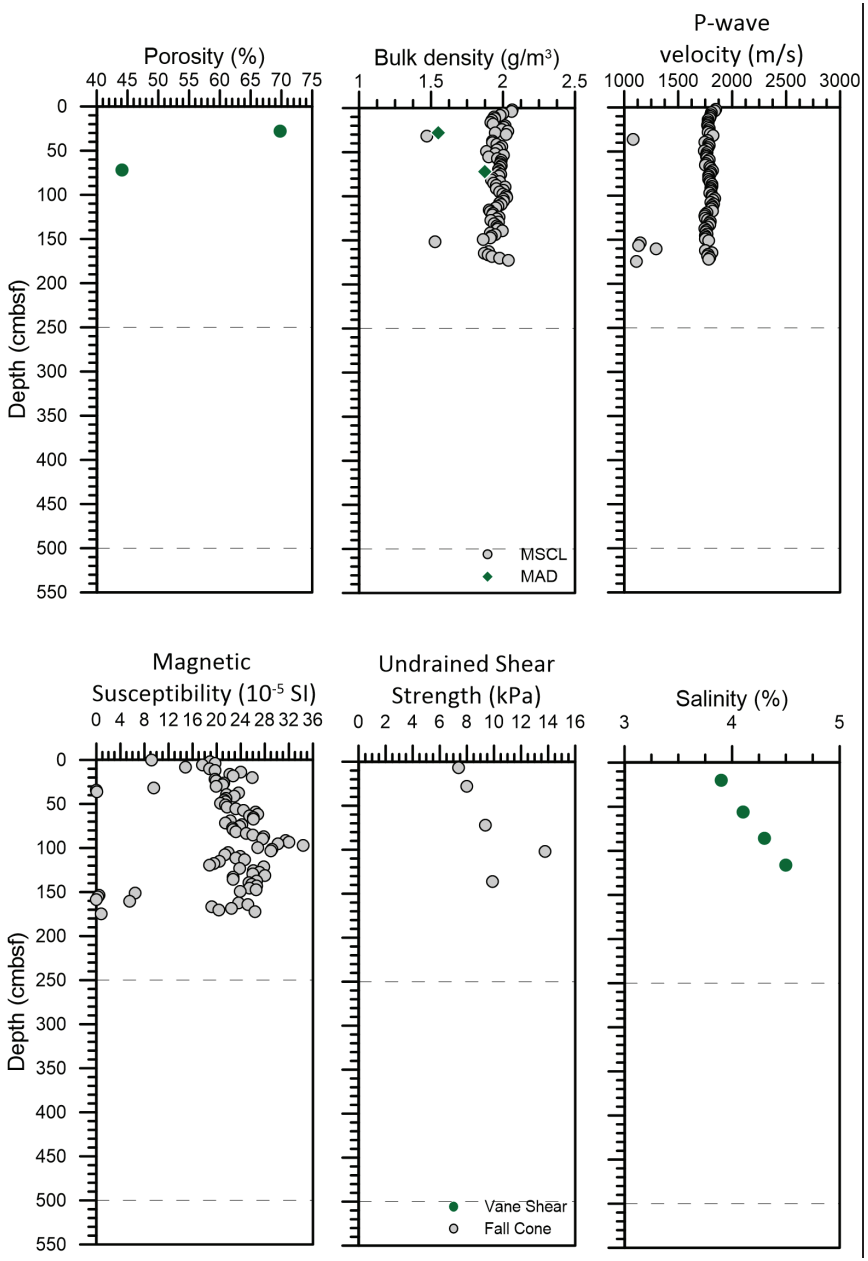
Location: Ginsburg eastern rim
Latitude: 35°22.871´N
Longitude: 7° 4.128´W
Water depth: 1116 m

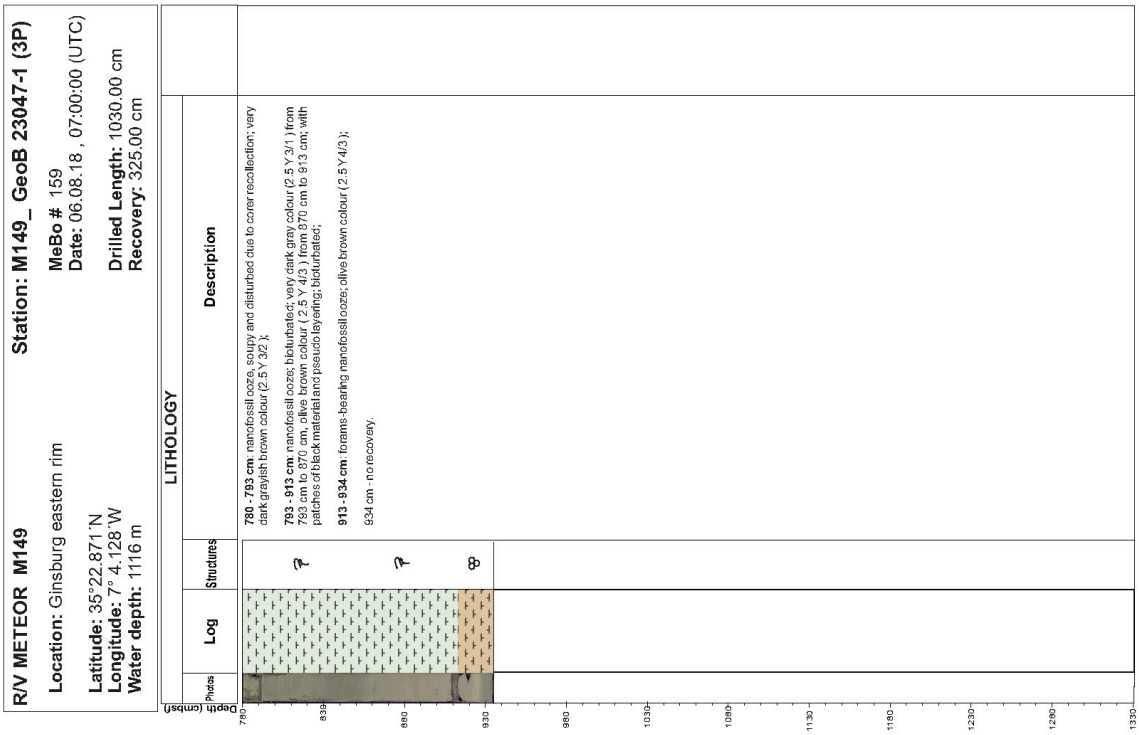
MeBo # 159
Date: 06.08.18 , 07:00:00 (UTC)

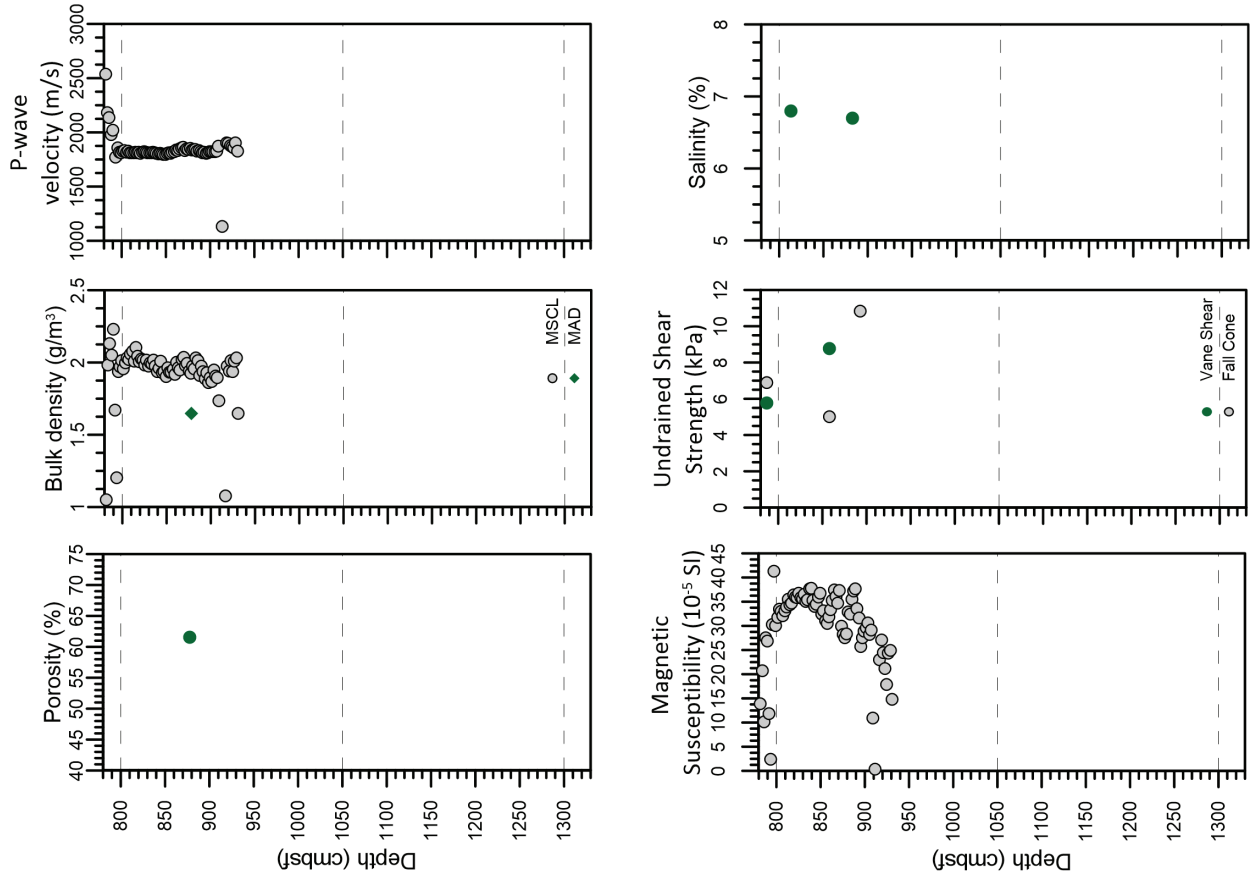
Drilled Length: 1030.00 cm
Recovery: 325.00 cm

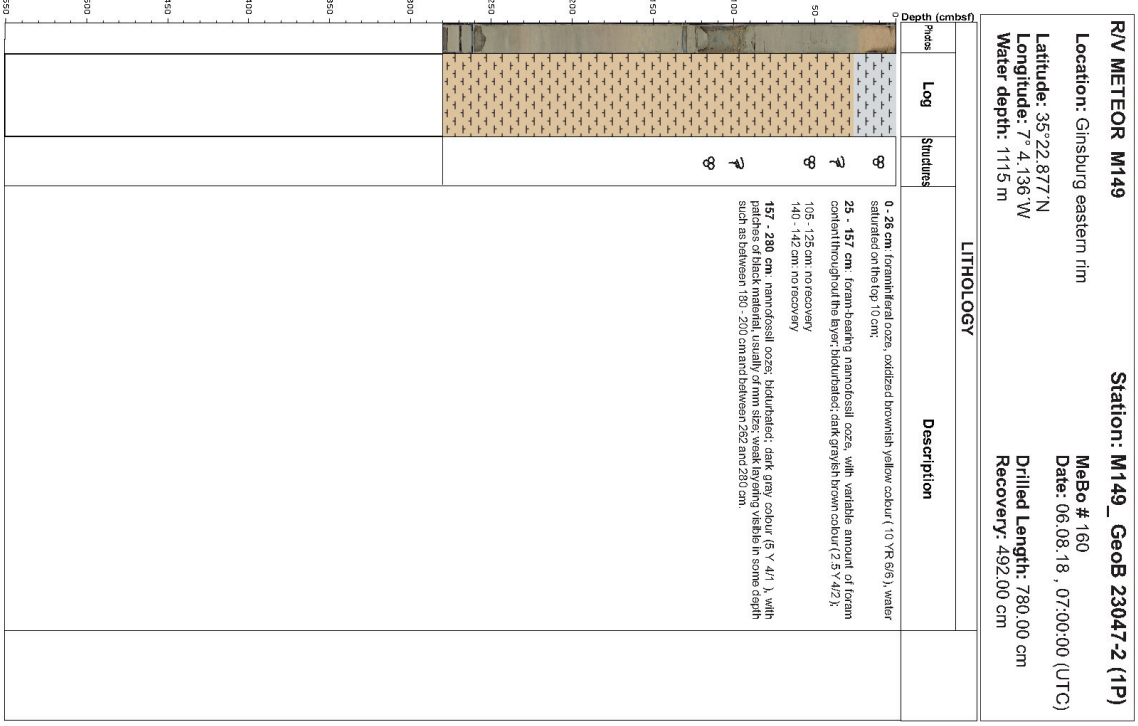
LITHOLOGY

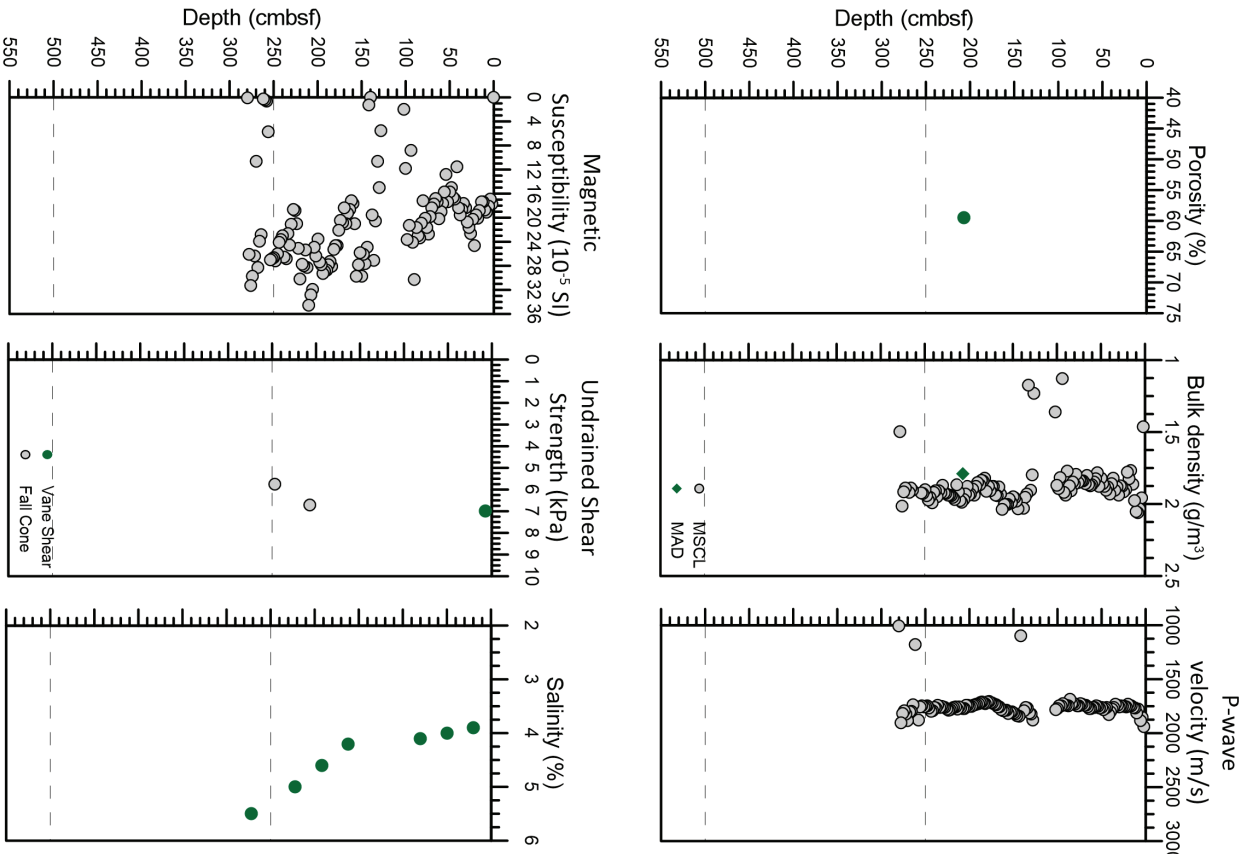
Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 20 cm**: foraminiferal ooze; oxidized; decreasing in foram content to the bottom; colour gradually changing from yellowish brown 10 YR 5/6 @ 1 cm to dark grayish brown (10 YR 4/2) @ 20 cm; a yellowish patch between 18 and 21 cm;
				20 - 100 cm: foram-bearing nannofossil ooze of gray colour (2.5 Y 5/1); mm to cm size patches of yellowish colour material; bioturbated; with some patches of higher forams content;
				100 - 122 cm: layer of foraminiferal ooze; olive brown colour (2.5 Y 4/3); bioturbated with upper and lower sharp contacts;
				122 - 156 cm: foram-bearing nannofossil ooze decreasing in foram content to the base of the layer and passing to a nannofossil ooze @ 140 cm; 153 - 156 cm: disturbed sediment;
				156 - 174 cm: nannofossil ooze, dark grayish brown colour (2.5Y 4/2);
				174 - 260 cm: no recovery.

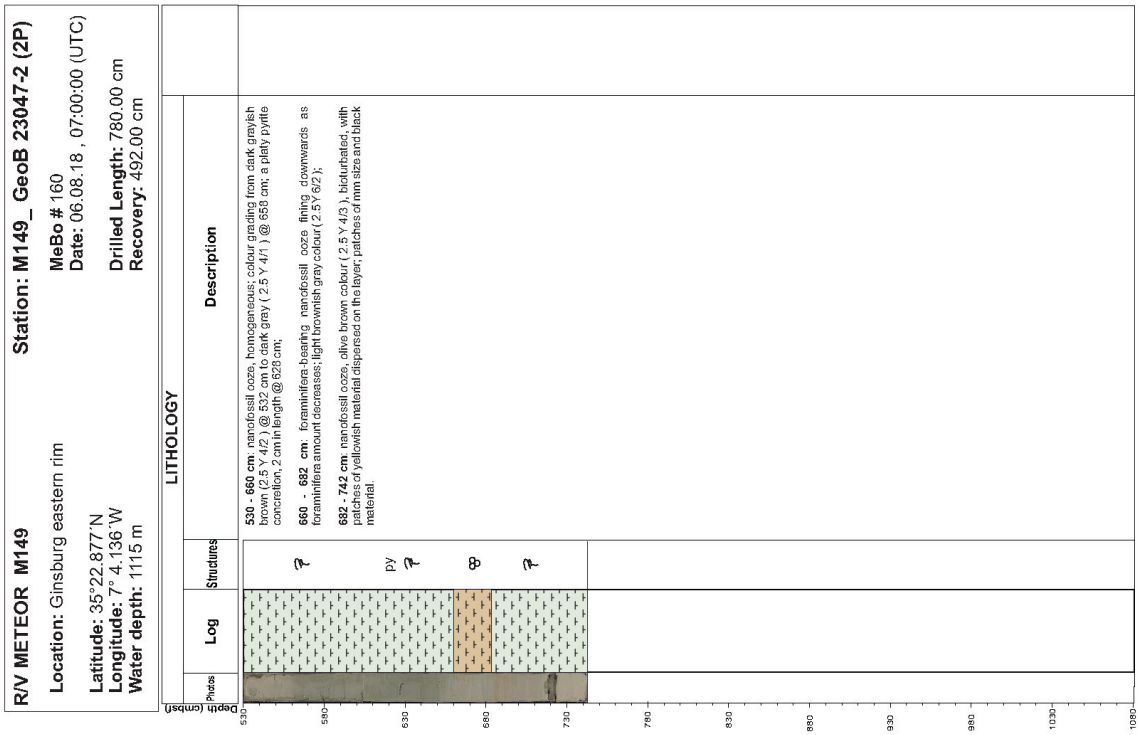


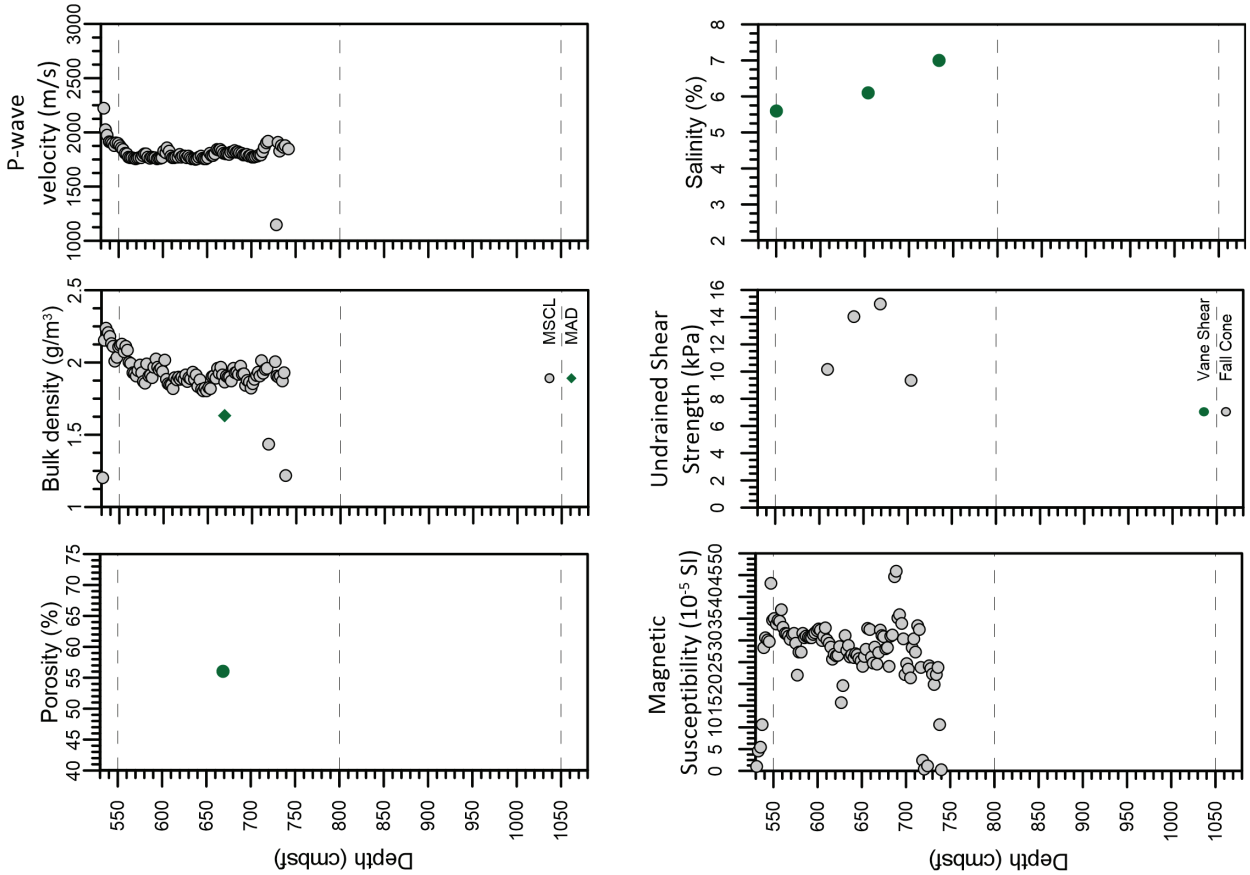

R/V METEOR M149
Station: M149_ GeoB 23047-1 (3P)
Location: Ginsburg eastern rim
MeBo # 159
Date: 06.08.18 , 07:00:00 (UTC)
Latitude: 35°22.871'N
Longitude: 7° 4.128'W
Water depth: 1116 m
Drilled Length: 1030.00 cm
Recovery: 325.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
780 - 793 cm: nannofossil ooze, soupy and disturbed due to corer recollection; vary dark greyish brown colour (2.5 Y 3/2);
793 - 913 cm: nannofossil ooze; bioturbated; vary dark gray colour (2.5 Y 3/1) from 793 cm to 870 cm, olive brown colour (2.5 Y 4/3) from 870 cm to 913 cm; with patches of black material and pseudo layering; bioturbated;
913 - 934 cm: forams-bearing nannofossil ooze; olive brown colour (2.5 Y 4/3);
934 cm - no recovery.
780
830
880
930
980
1030
1080
1130
1180
1230
1280
1330


P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Salinity (%)
5 6 7 8
Undrained Shear Strength (kPa)
0 2 4 6 8 10 12
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 5 10 15 20 25 30 35 40 45
Depth (cmbsf)
800 850 900 950 1000 1050 1100 1150 1200 1250 1300


R/V METEOR M149
Station: M149_ GeoB 23047-2 (1P)
Location: Ginsburg eastern rim
Latitude: 35°22.877'N
Longitude: 7° 4.136'W
Water depth: 1115 m
MeBo # 160
Date: 06.08.18 , 07:00:00 (UTC)
Drilled Length: 780.00 cm
Recovery: 492.00 cm
LITHOLOGY
Photo
Log
Structures
Description
Depth (cmbsf)
0 - 26 cm: foraminiferal ooze, oxidized brownish yellow colour (10 YR 6/6), water saturated on the top 10 cm;
25 - 157 cm: foram-bearing nannofossil ooze, with variable amount of foram content throughout the layer; bioturbated; dark grayish brown colour (2.5 Y 4/2);
105 - 125 cm: no recovery
140 - 142 cm: no recovery
157 - 280 cm: nannofossil ooze; bioturbated; dark grey colour (5 Y 4/1), with patches of black material, usually of mm size; weak layering visible in some depth such as between 190 - 200 cm and between 262 and 280 cm


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23047-2 (2P)
Location: Ginsburg eastern rim
MeBo # 160
Date: 06.08.18 , 07:00:00 (UTC)
Latitude: 35°22.877'N
Longitude: 7° 4.136'W
Water depth: 1115 m
Drilled Length: 780.00 cm
Recovery: 492.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
530 - 660 cm: nannofossil ooze, homogeneous; colour grading from dark grayish brown (2.5 Y 4/2) @ 532 cm to dark gray (2.5 Y 4/1) @ 658 cm; a platy pyrite concretion, 2 cm in length @ 626 cm;
660 - 682 cm: foraminifera-bearing nannofossil ooze fining downwards as foraminifera amount decreases; light brownish gray colour (2.5 Y 6/2);
682 - 742 cm: nannofossil ooze, olive brown colour (2.5 Y 4/3), bioturbated, with patches of yellowish material dispersed on the layer; patches of mm size and black material.
py

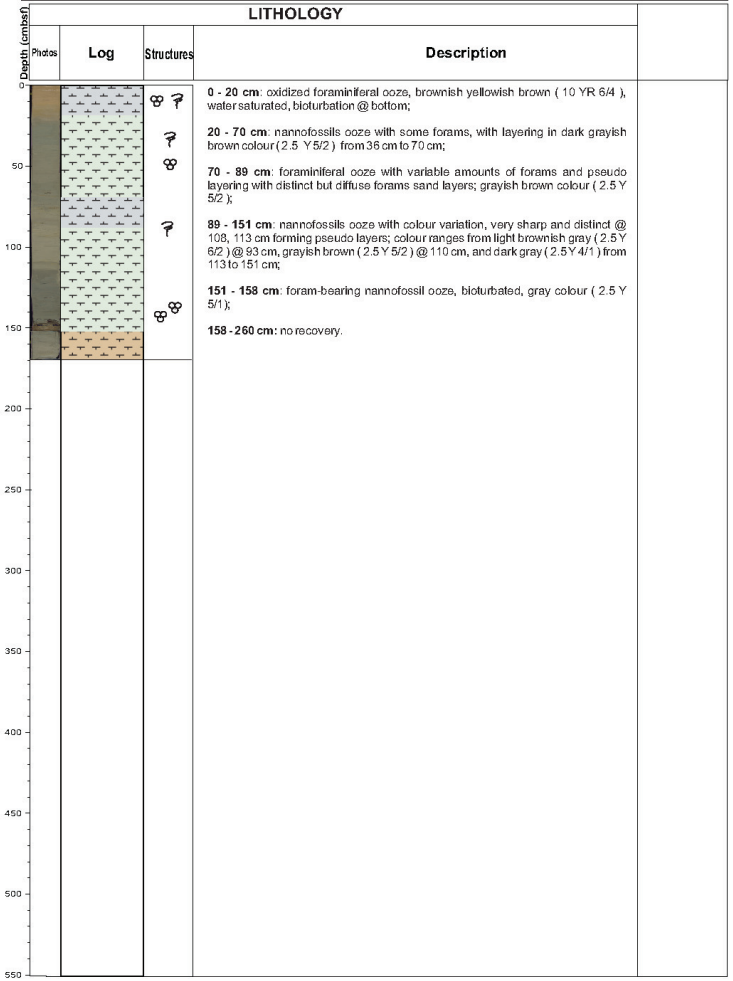

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

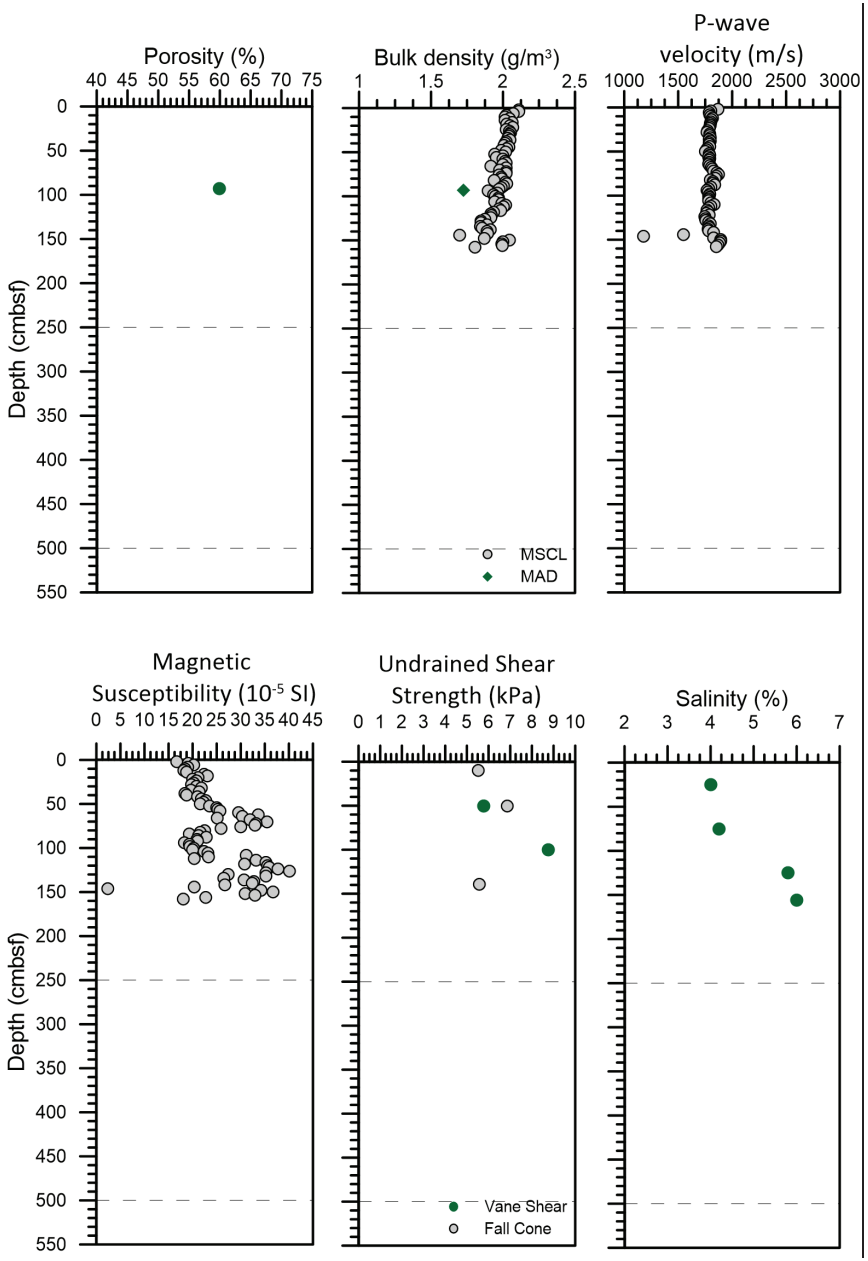
R/V METEOR M149 **Station: M149_ GeoB 23047-3 (1P)**

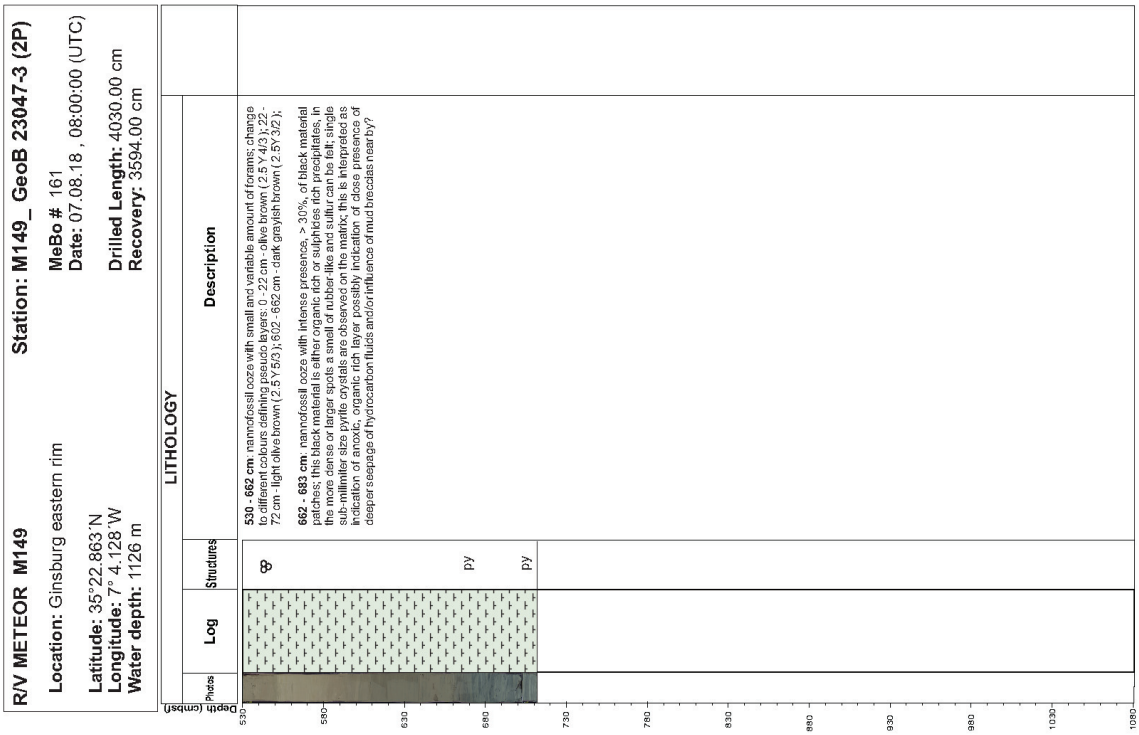
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)

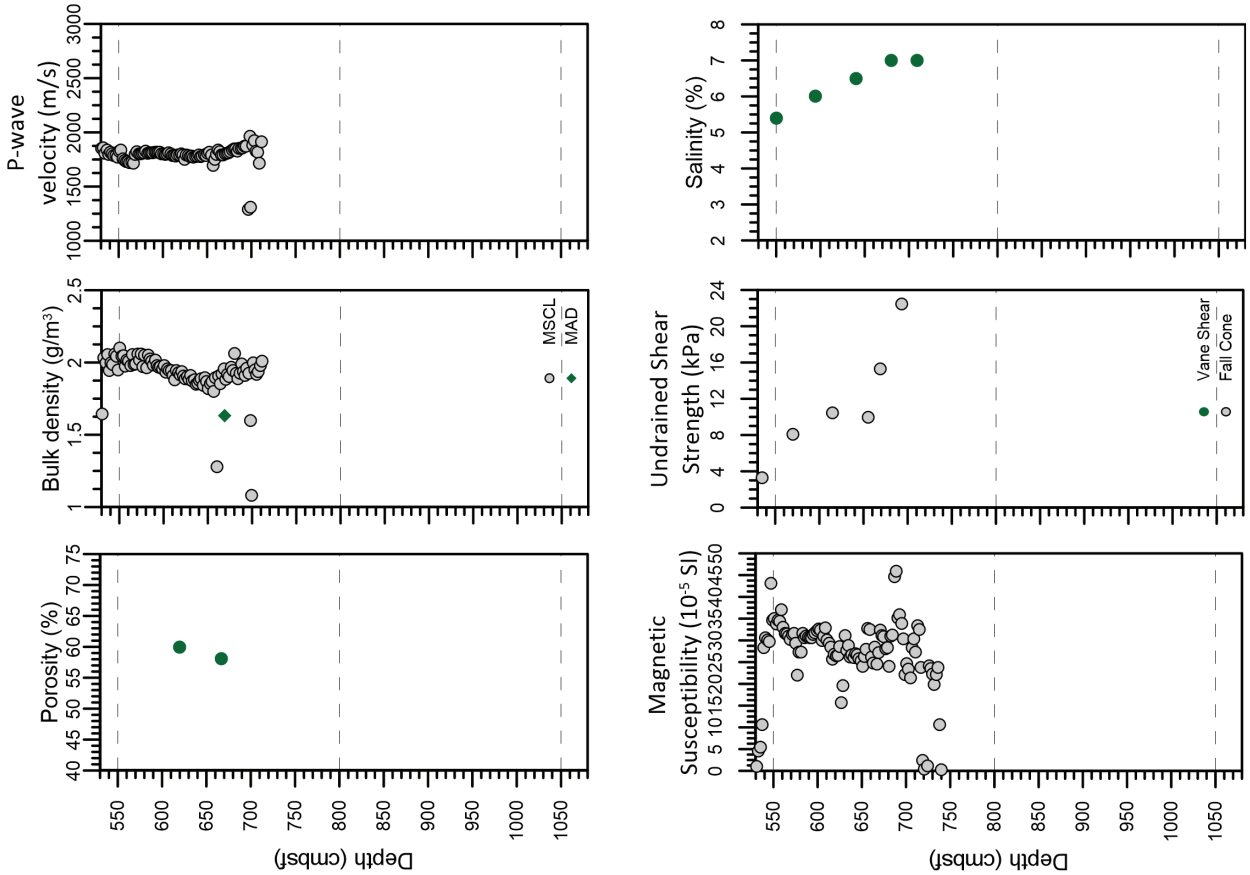
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

Drilled Length: 4030.00 cm
Recovery: 3594.00 cm






R/V METEOR M149
Station: M149_ GeoB 23047-3 (2P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
530 - 662 cm: nannofossil ooze with small and variable amount of forams; change to different colours defining pseudo layers: 0 -22 cm - olive brown (2.5 Y 4/3); 22 - 72 cm - light olive brown (2.5 Y 5/3); 602 - 662 cm - dark greyish brown (2.5Y 3/2);
662 - 683 cm: nannofossil ooze with intense presence, > 30%, of black material patches; this black material is either organic rich or sulphides rich precipitates, in the more dense or larger spots a small of rubber like and sulfur can be felt; single sub-millimiter size pyrite crystals are observed on the matrix; this is interpreted as indication of anoxic, organic rich layer possibly indication of close presence of deeper seepage of hydrocarbon fluids and/or influence of mud breccias nearby?
py
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

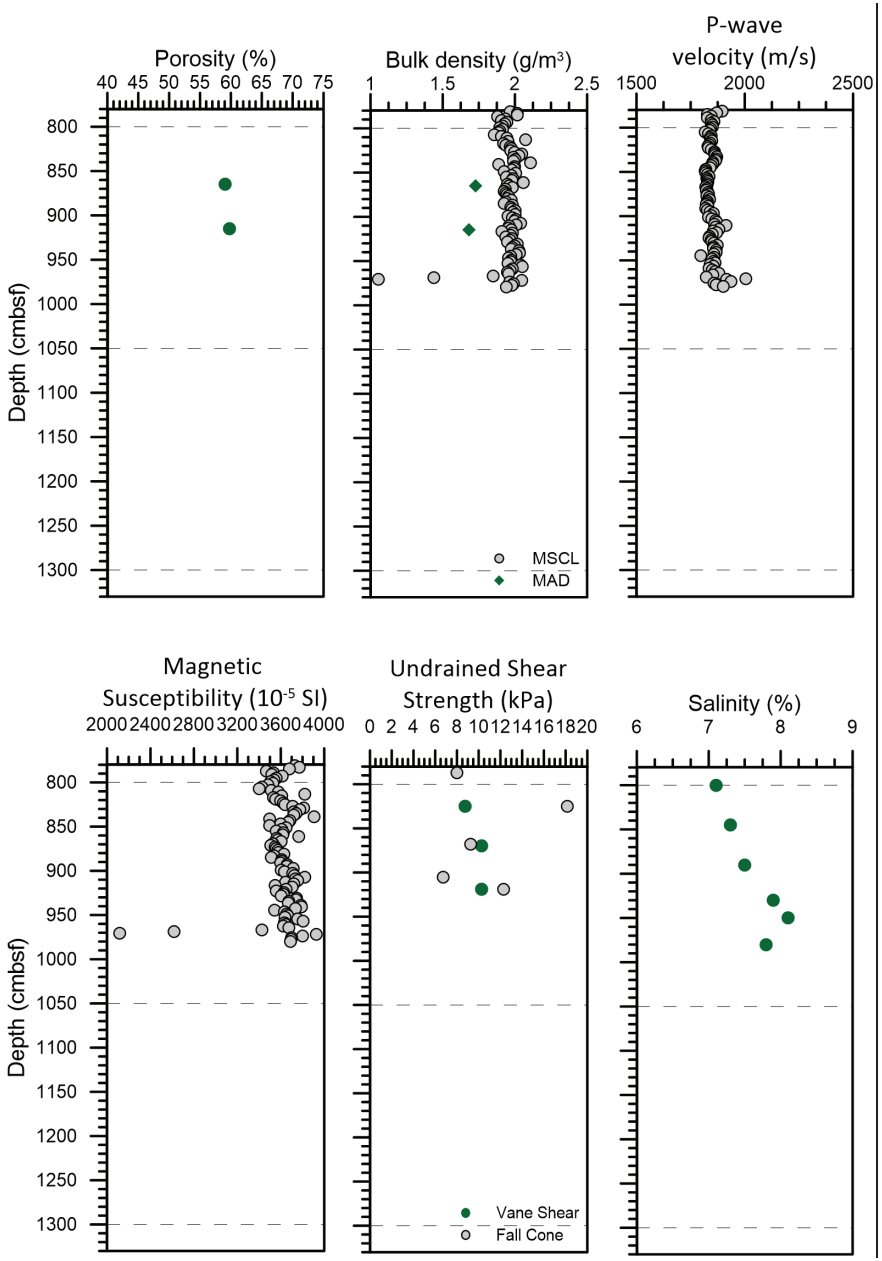
R/V METEOR M149 — **Station: M149_ GeoB 23047-3 (3P)**

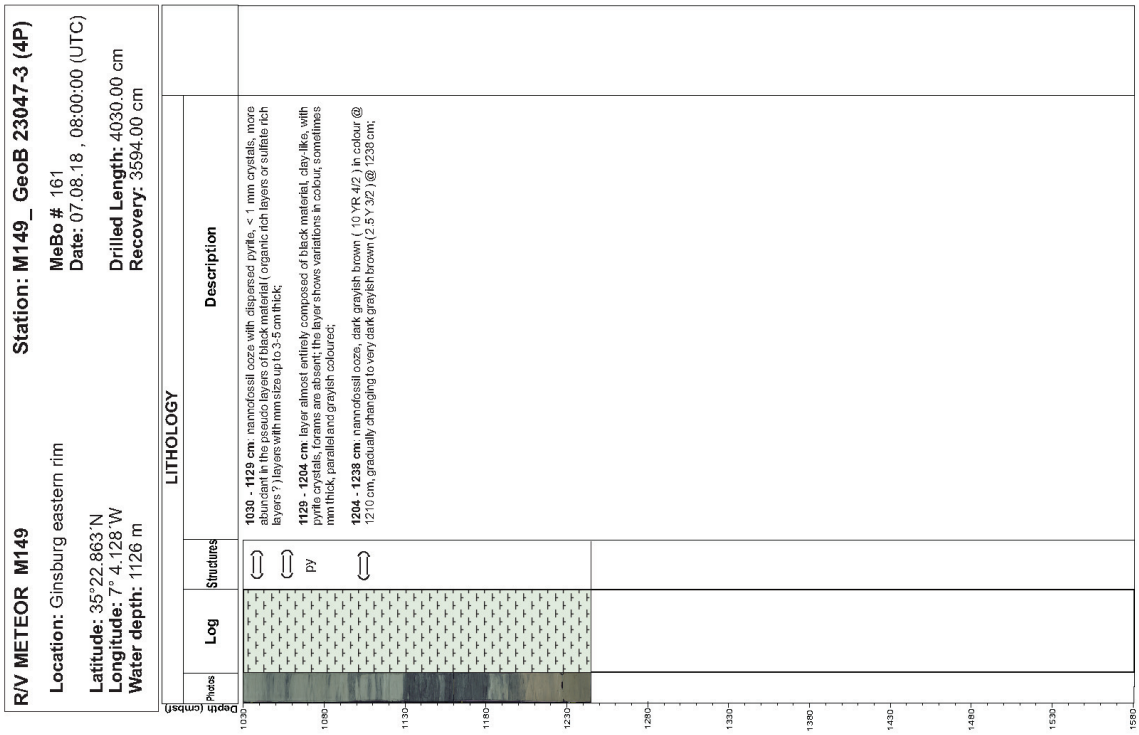
Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

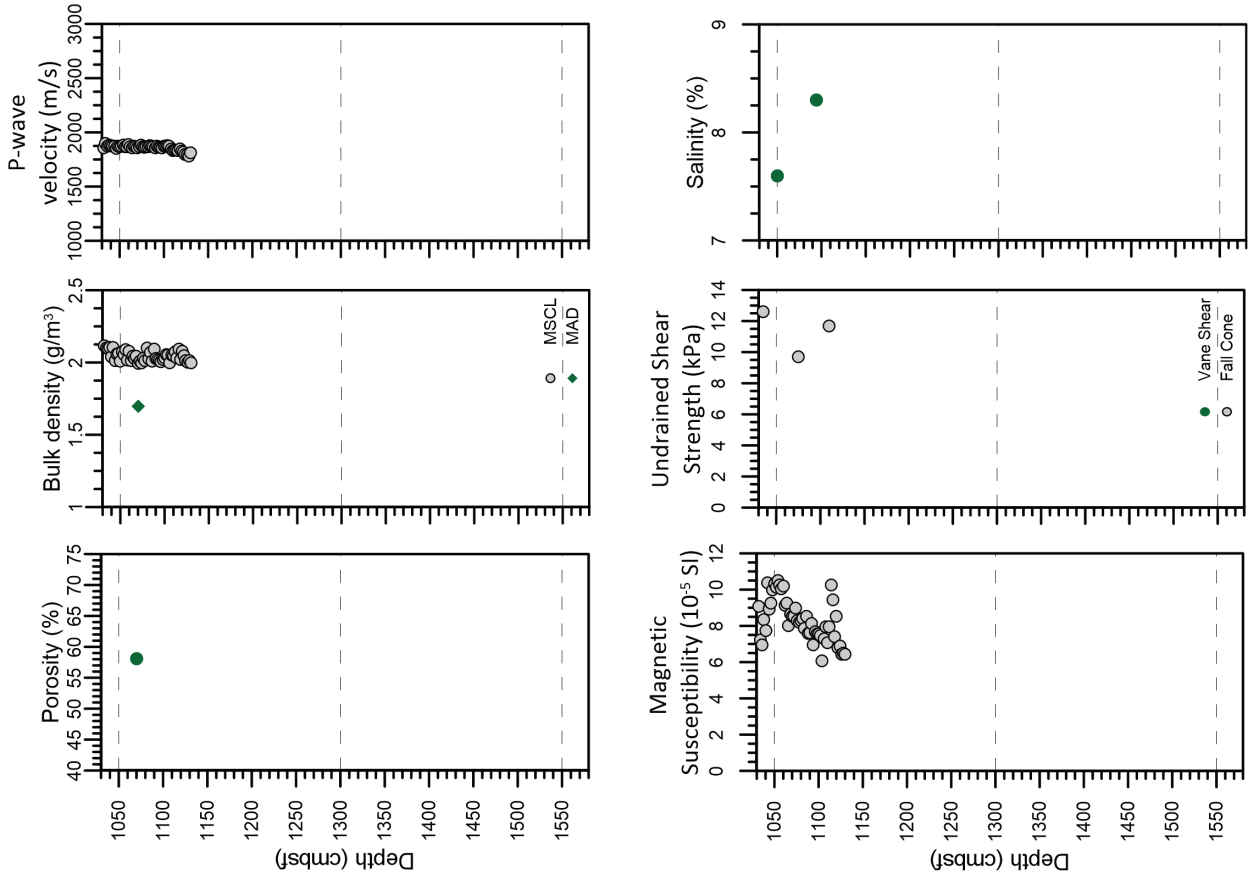
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
780			py	**780 - 834 cm**: nanofossils ooze with some forams ranging in colour from dark gray (GLEY 4/) @ 780 cm to gray (GLEY 1 5/); with black material patches ranging in size from mm to areas of more than 5 cm; dispersed crystals of pyrite;
830			py	**834 - 850 cm**: foram-bearing nannofossil ooze with higher density of dispersed crystals of pyrite and with a concretion of pyrite of 5 cm @ 835 cm; a large patch of black material forming a pseudo layer between 841 and 849 cm;
880			py cc	**850 - 896 cm**: nannofossil ooze with some forams, gray colour (GLEY 1 5/) with dispersed py crystals and disperse patches of black material, foram pseudo layers;
930			py	**896 - 981 cm**: nannofossil ooze, greenish gray in colour (GLEY 1 5/1) with 5 mm layers defined by black material; these layers are parallel and horizontal;
980				Between **947 and 980 cm** a fracture crosscut the core and it is in filled by a slimy material of dark brown (10 YR 3/3) colour, most probably of bacterial mat.
1030				
1080				
1130				
1180				
1230				
1280				
1330				




R/V METEOR M149
Station: M149_ GeoB 23047-3 (4P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
1030 - 1129 cm: nannofossil ooze with dispersed pyrite, < 1 mm crystals, more abundant in the pseudo layers of black material (organic rich layers or sulfate rich layers ?) layers with mm size up to 3-5 cm thick;
1129 - 1204 cm: layer almost entirely composed of black material, clay-like, with pyrite crystals, foram assemblage; this layer shows variations in colour, sometimes mm thick, parallel and greyish coloured;
1204 - 1238 cm: nannofossil ooze, dark grayish brown (10 YR 4/2) in colour @ 1210 cm, gradually changing to very dark grayish brown (2.5 Y 3/2)@ 1238 cm;
py
1030
1080
1130
1180
1230
1280
1330
1380
1430
1480
1530
1580


P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Salinity (‰)
7 8 9
Undrained Shear Strength (kPa)
0 2 4 6 8 10 12 14
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 2 4 6 8 10 12
Depth (cmbsf)
1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550

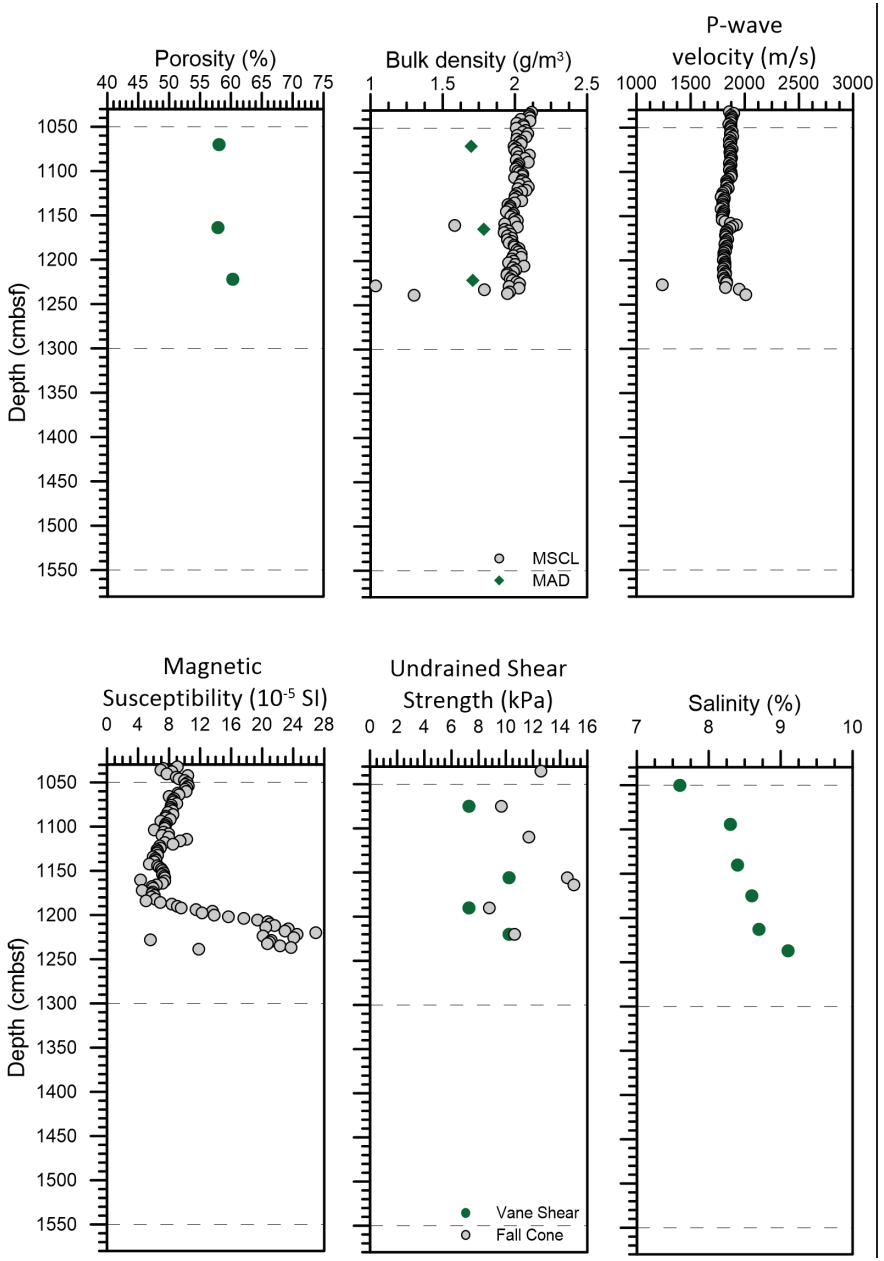
R/V METEOR M149 — **Station: M149_ GeoB 23047-3 (5P)**

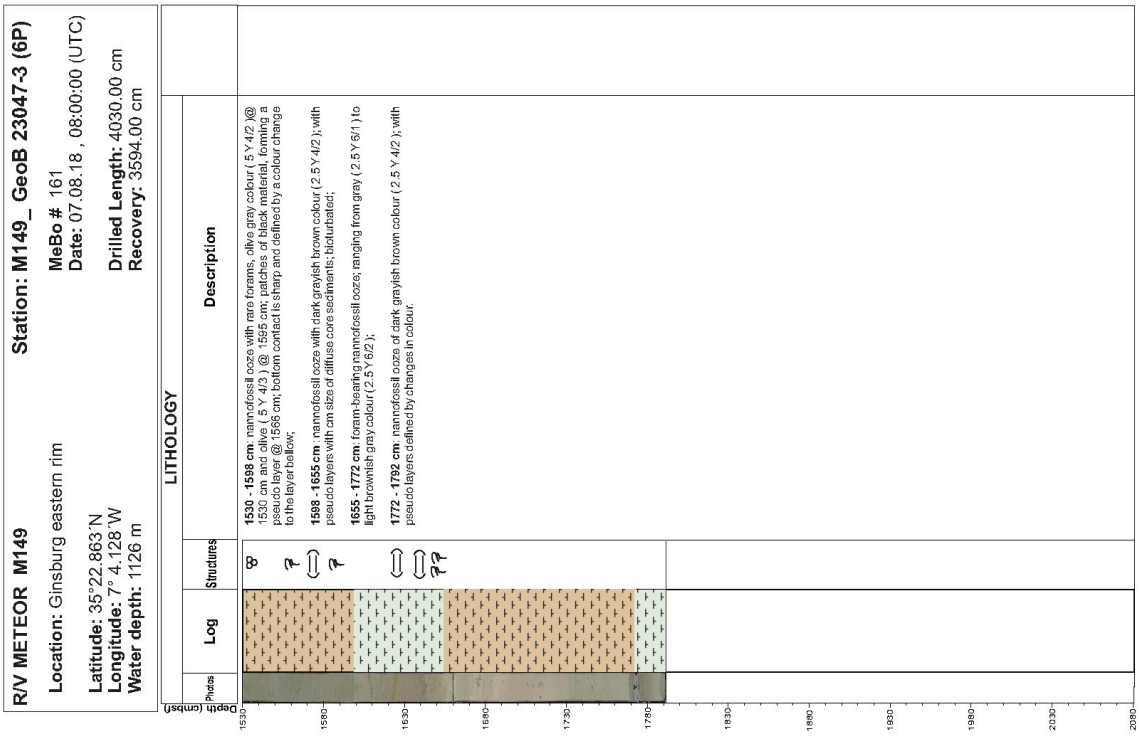
Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

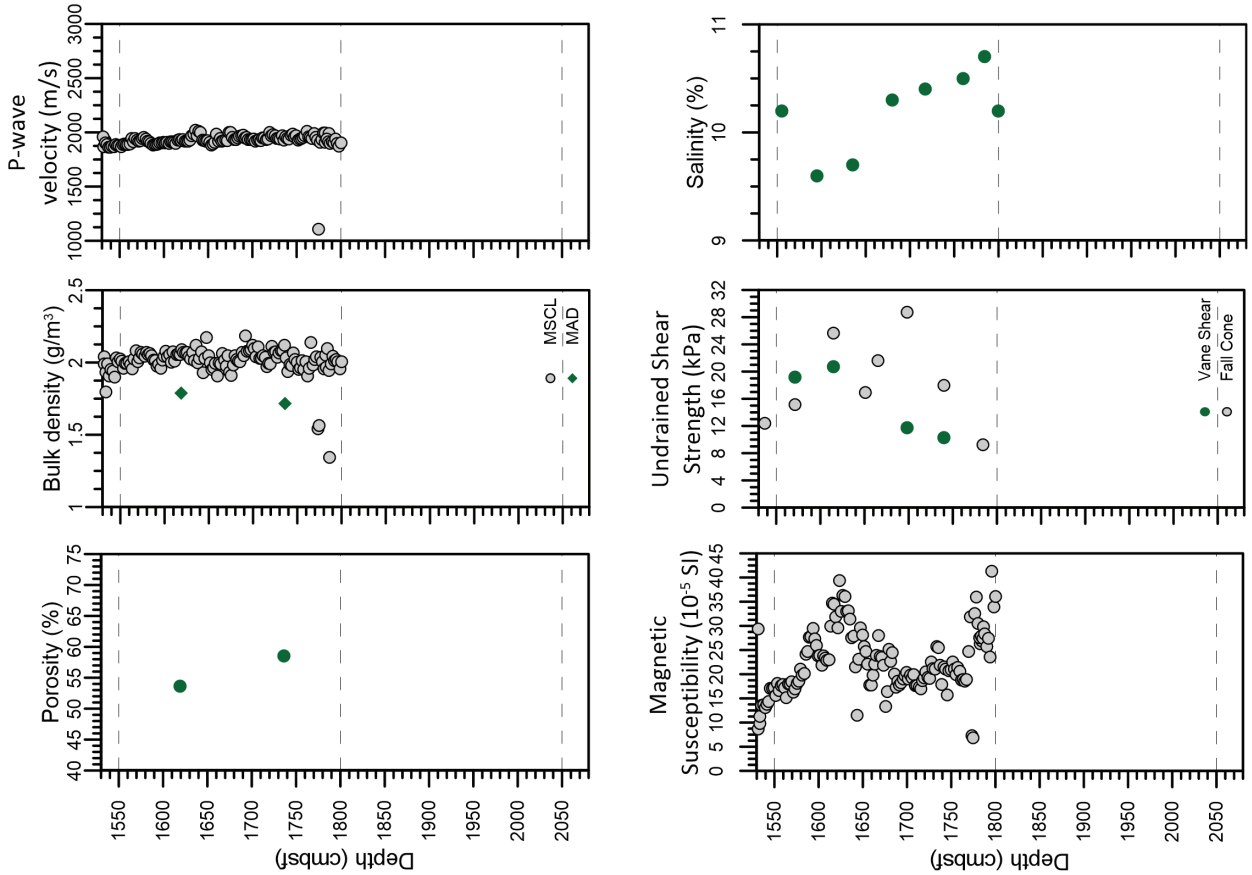
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1280				**1280 - 1337 cm**: foram-bearing nannofossil ooze, dark gray colour(2.5 Y 4/1), with patches of black material dispersed throughout the package; sharp and well defined bottom layer;
1330				**1337 - 1355 cm**: foraminiferal ooze grading upwards, with sharp top contact and gradual bottom contact; colour dark grayish brown (2.5 Y 4/2);
1380				**1355 - 1539 cm**: nannofossil ooze; bioturbated @ 1370 - 1380 cm; @ 1457 cm; with pseudo layers defined by patches of yellowish colour; colour ranging from grayish brown (2.5 Y 5/2) to olive brown (2.5 Y 4/4);
1430				
1480				
1530				
1580				
1630				
1680				
1730				
1780				
1830				




R/V METEOR M149
Station: M149_ GeoB 23047-3 (6P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1530 - 1598 cm: nannofossil ooze with rare forams, olive gray colour (5 Y 4/2)(@ 1530 cm and olive (5 Y 4/3) @ 1565 cm; patches of black material, forming a pseudo layer @ 1566 cm; bottom contact is sharp and defined by a colour change to the layer bellow;
1598 - 1655 cm: nannofossil ooze with dark grayish brown colour (2.5 Y 4/2); with pseudo layers with cm size of diffuse core sediments; bioturbated;
1655 - 1772 cm: foram-bearing nannofossil ooze; ranging from gray (2.5 Y 6/1) to light brownish gray colour (2.5 Y 6/2);
1772 - 1792 cm: nannofossil ooze of dark grayish brown colour (2.5 Y 4/2); with pseudo layers defined by changes in colour.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23047-3 (7P)**

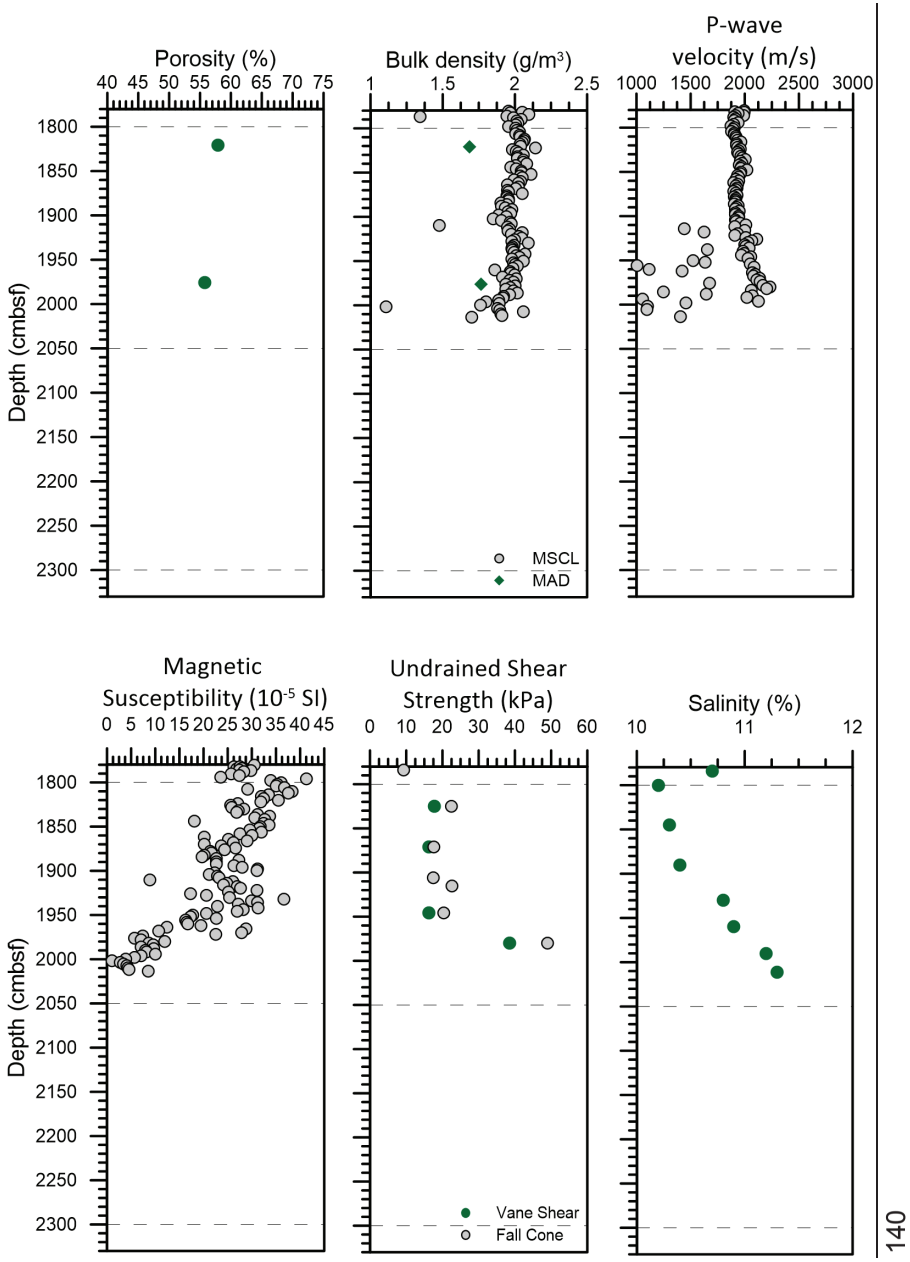
Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

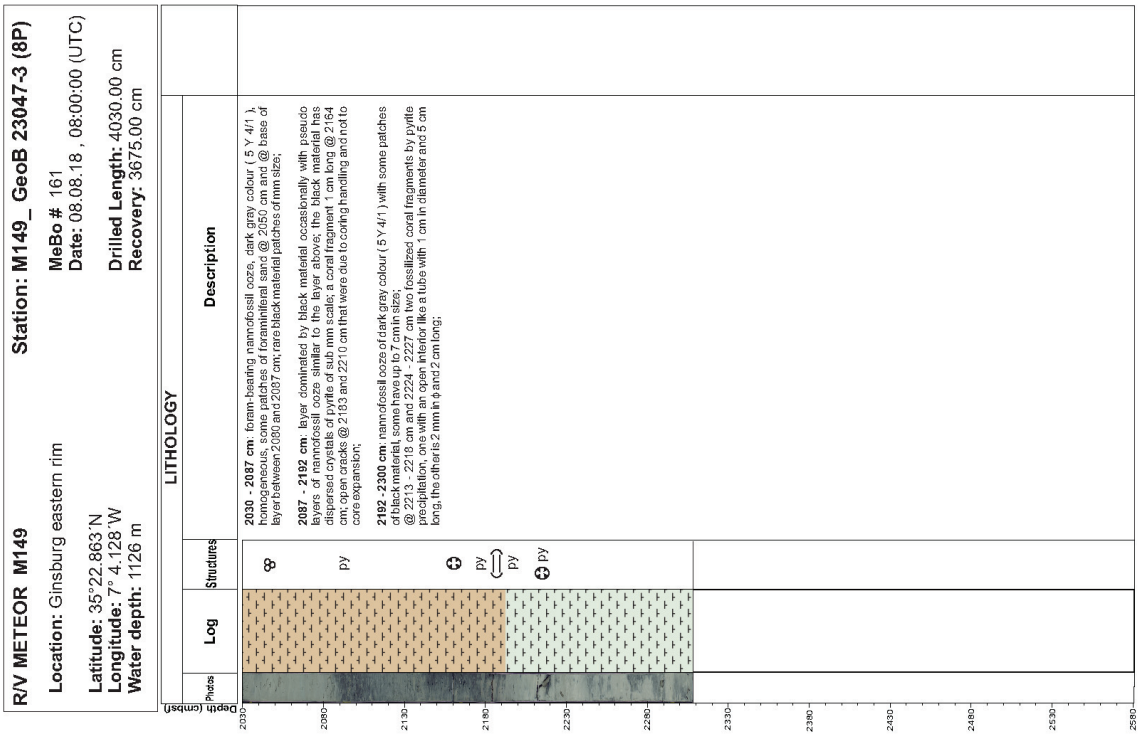
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)

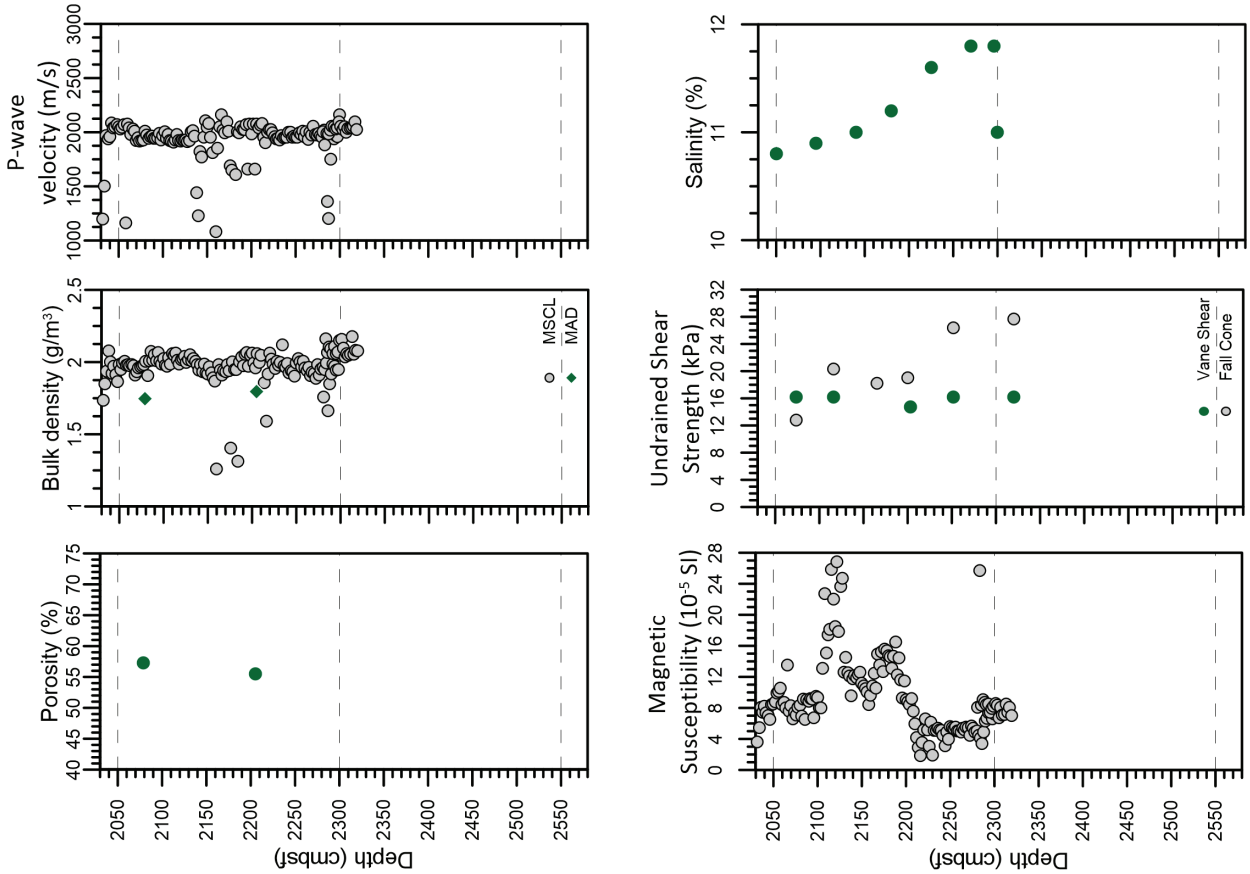
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1780				**1780 - 1950 cm**: foram-bearing nannofossil ooze; variable in colour with layering defined by changes in colour; colours ranging from dark gray (5 Y 4/1) to olive gray (5 Y 4/2) and to light olive brown (2.5 Y 5/3); all over this package layering defined by strong and sharp changes in colour are common; the layering range from 2-3 mm up tp 4-5 cm thick; the laminations are parallel and in general horizontal; between 1800-1890 cm branched veins with 2-3 mm thick, cross-cut vertically the lamination for 6-7 cm, similar branching veins are also observed between 1840-1857 cm; these veins are interpreted as result of fluids migration through the sedimentary column; some patches of mm size of black colour are observed dispersed on the package;
1830				
1880				**1950 - 2013 cm**: foraminiferal ooze mixture with large % of black material; bioturbated; in some parts the black material totally predominates, pyrite crystals are found dispersed on the black material that as a S smell; @ 1960 cm two pyritized gastropod shells with 1 cm size;
1930			py	
1980				
2030				
2080				
2130				
2180				
2230				
2280				
2330				




R/V METEOR M149
Station: M149_ GeoB 23047-3 (8P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 08.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3675.00 cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
2030 - 2087 cm: foram-bearing nannofossil ooze, dark gray colour (5 Y 4/1), homogeneous, some patches of foraminiferal sand @ 2050 cm and @ base of layer between 2080 and 2087 cm; rare black material patches of mm size;
2087 - 2192 cm: layer dominated by black material occasionally with pseudo layers of nannofossil ooze similar to the layer above; the black material has dispersed crystals of pyrite of sub mm scale; a coral fragment 1 cm long @ 2164 cm; open cracks @ 2183 and 2210 cm that were due to coring handling and not to core expansion;
2192 - 2300 cm: nannofossil ooze of dark gray colour (5 Y 4/1) with some patches of black material, some have up to 7 cm in size;
@ 2213 - 2218 cm and 2224 - 2227 cm two fossilized coral fragments by pyrite precipitation, one with an open interior like a tube with 1 cm in diameter and 5 cm long, the other is 2 mm in ø and 2 cm long;
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23047-3 (9P)**

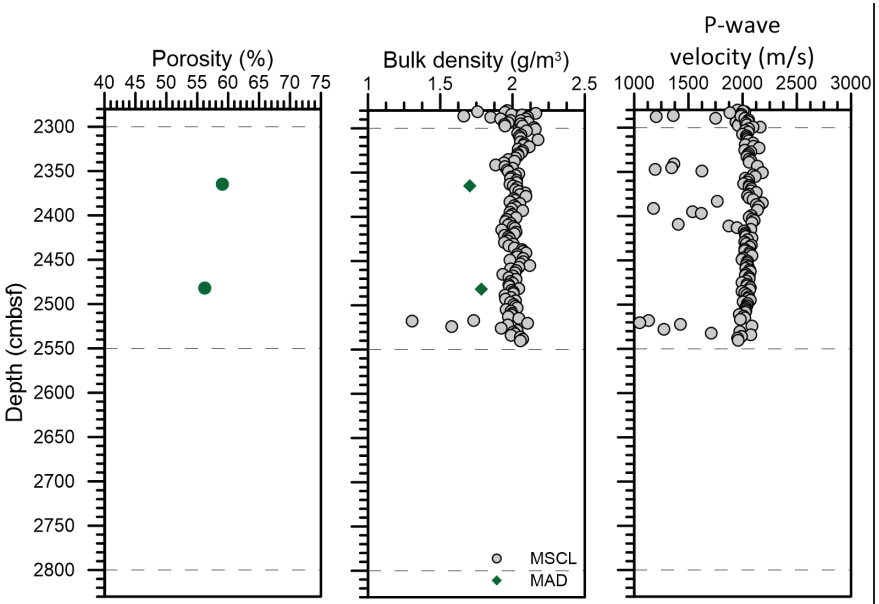
Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

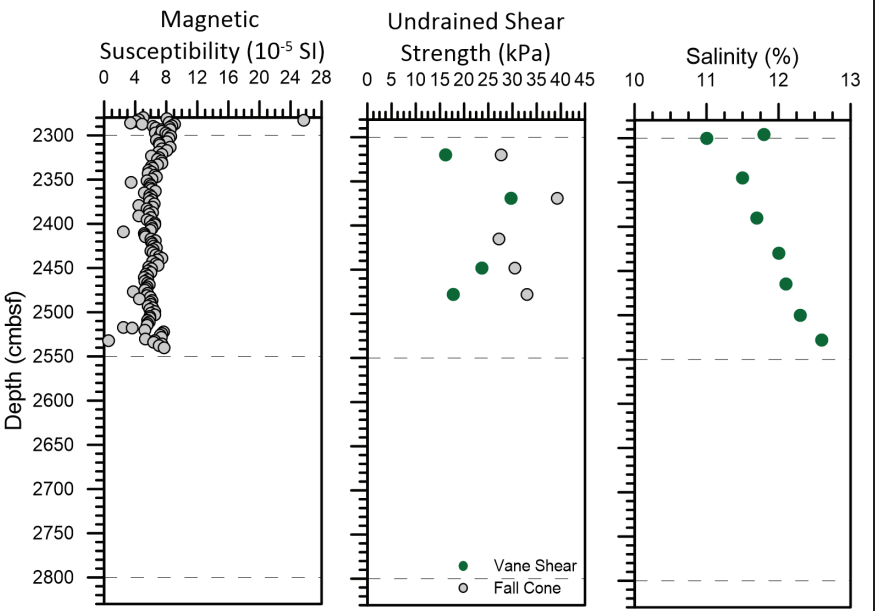
MeBo # 161
Date: 08.08.18 , 08:00:00 (UTC)

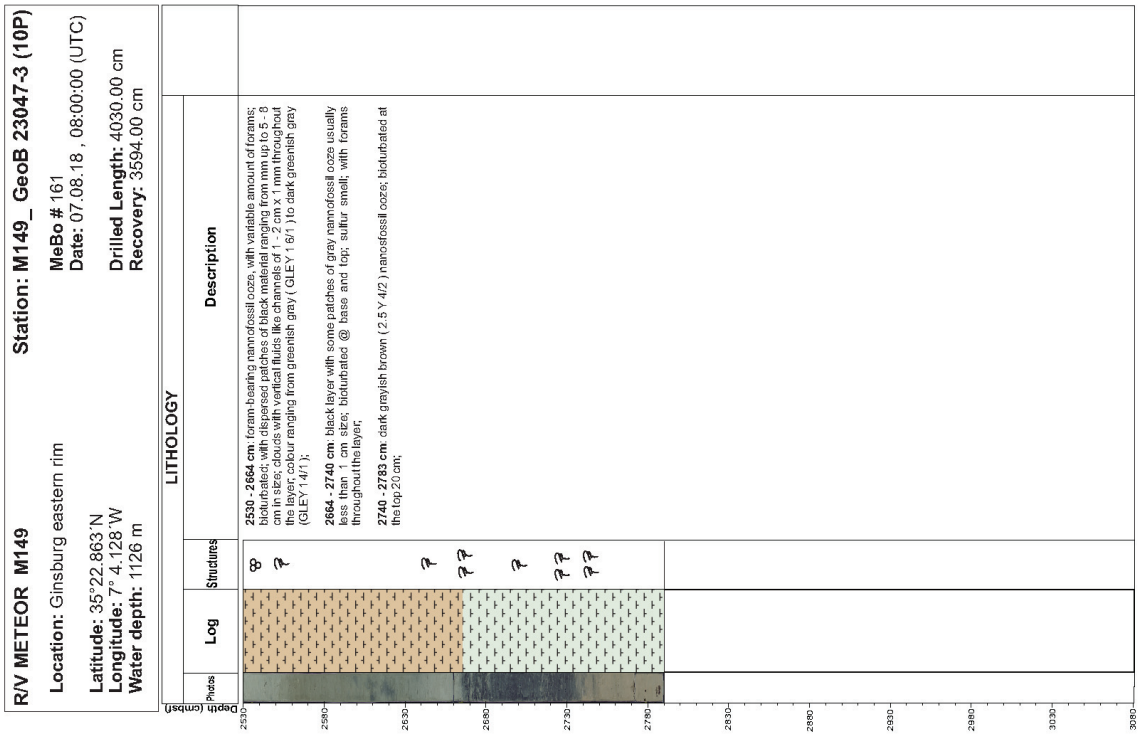
Drilled Length: 4030.00 cm
Recovery: 3675.00 cm

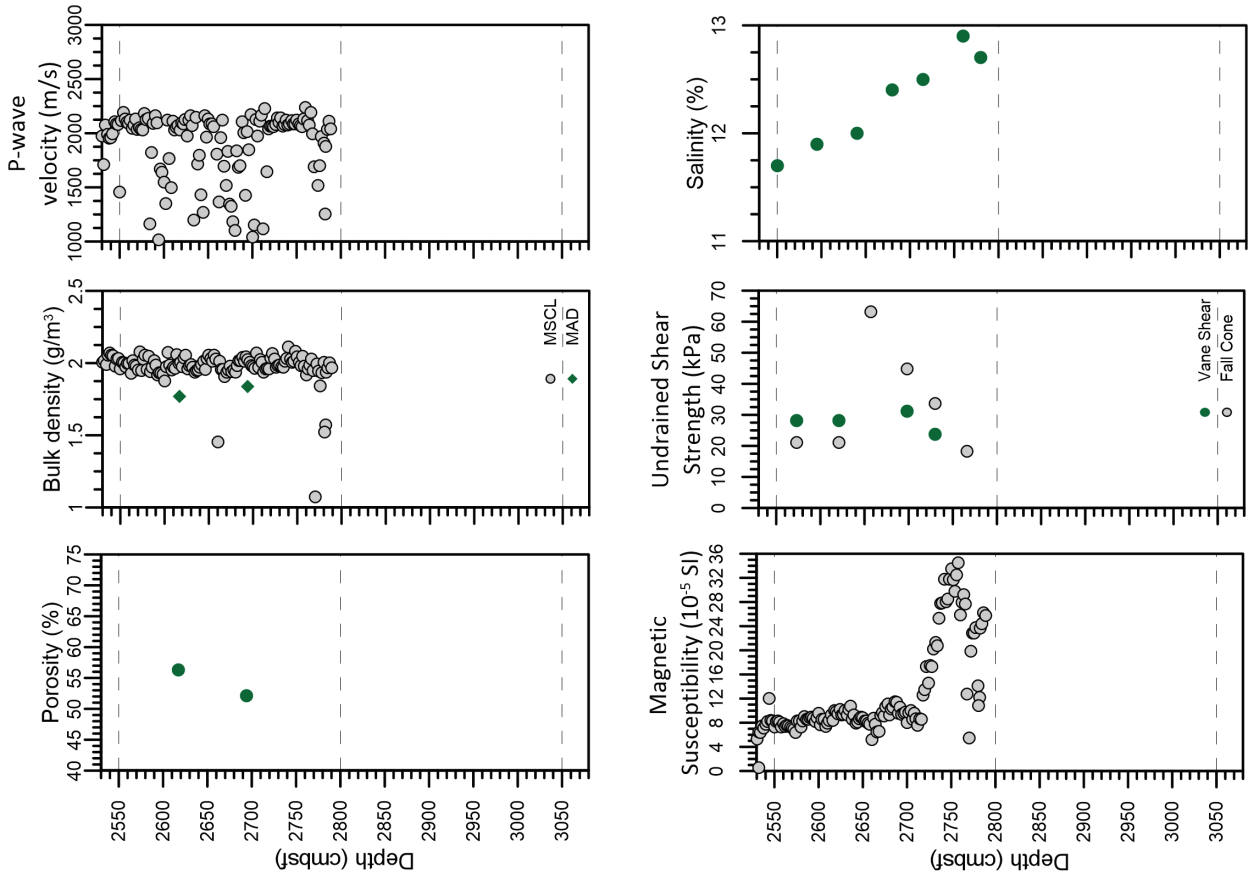
LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
2280				**2280 - 2532 cm**: foram-bearing nannofossil ooze, with variable % of forams; with pseudo layers of 1 - 2 cm thick; rare black patches; bioturbated; greenish gray colour (GLEY 1 6/1); a 5 mm fragment of tubular pyritized coral or borrow @ 2442 cm; a 3 cm long spicule fragment @ 2521 cm;






R/V METEOR M149
Station: M149_ GeoB 23047-3 (10P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
2530 - 2664 cm: foram-bearing nannofossil ooze, with variable amount of forams; bioturbated; with dispersed patches of black material ranging from mm up to 5 - 8 cm in size; clouds with vertical fluids like channels of 1 - 2 cm x 1 mm throughout the layer; colour ranging from greenish gray (GLEY 1 6/1) to dark greenish gray (GLEY 1 4/1);
2664 - 2740 cm: black layer with some patches of gray nannofossil ooze usually less than 1 cm size; bioturbated @ base and top; sulfur smell; with forams throughout the layer;
2740 - 2783 cm: dark greyish brown (2.5 Y 4/2) nannofossil ooze; bioturbated at the top 20 cm;
2530
2580
2630
2680
2730
2780
2830
2880
2930
2980
3030


P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Salinity (‰)
11 12 13
Undrained Shear Strength (kPa)
0 10 20 30 40 50 60 70
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 4 8 12 16 20 24 28 32 36
Depth (cmbsf)
2550 2600 2650 2700 2750 2800 2850 2900 2950 3000 3050

R/V METEOR M149 — **Station: M149_ GeoB 23047-3 (11P)**

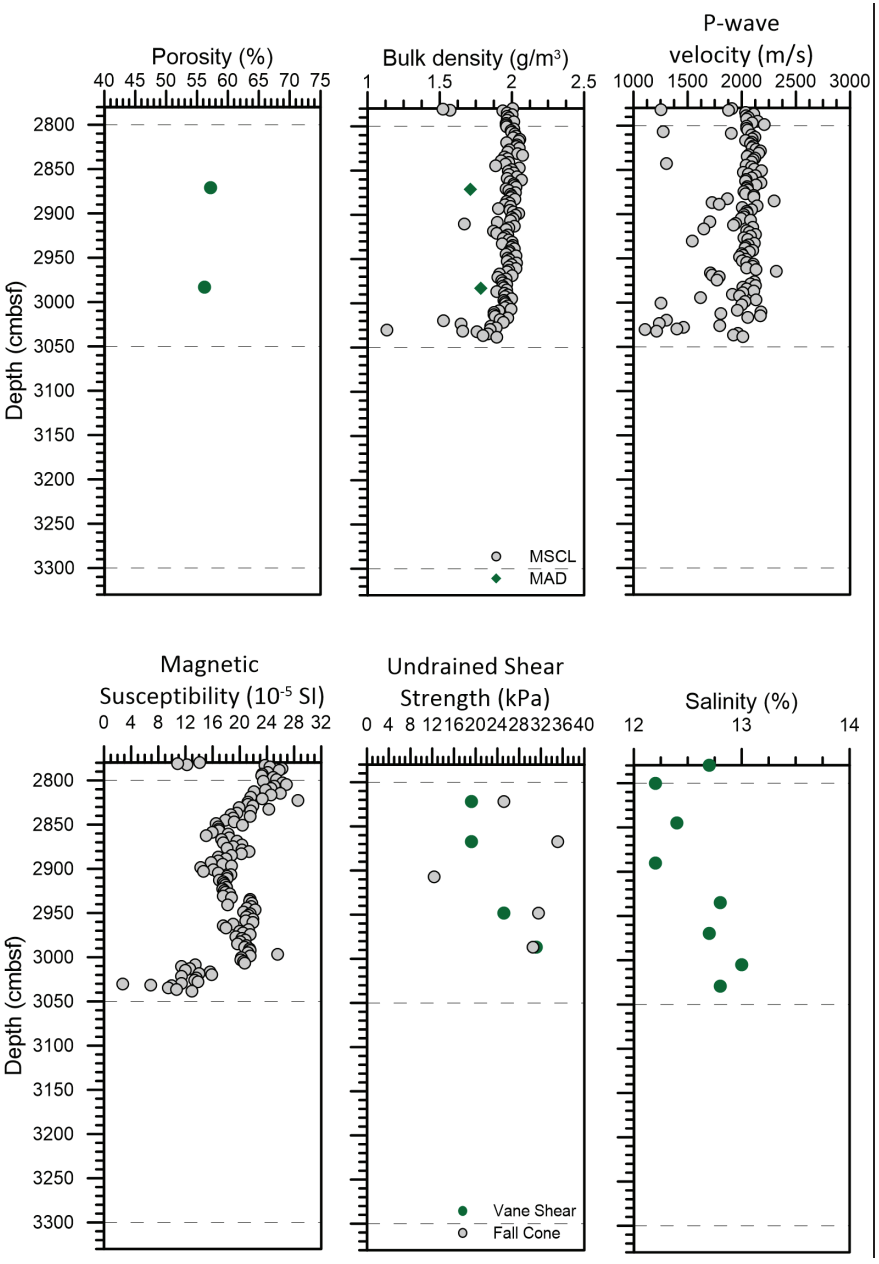
Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

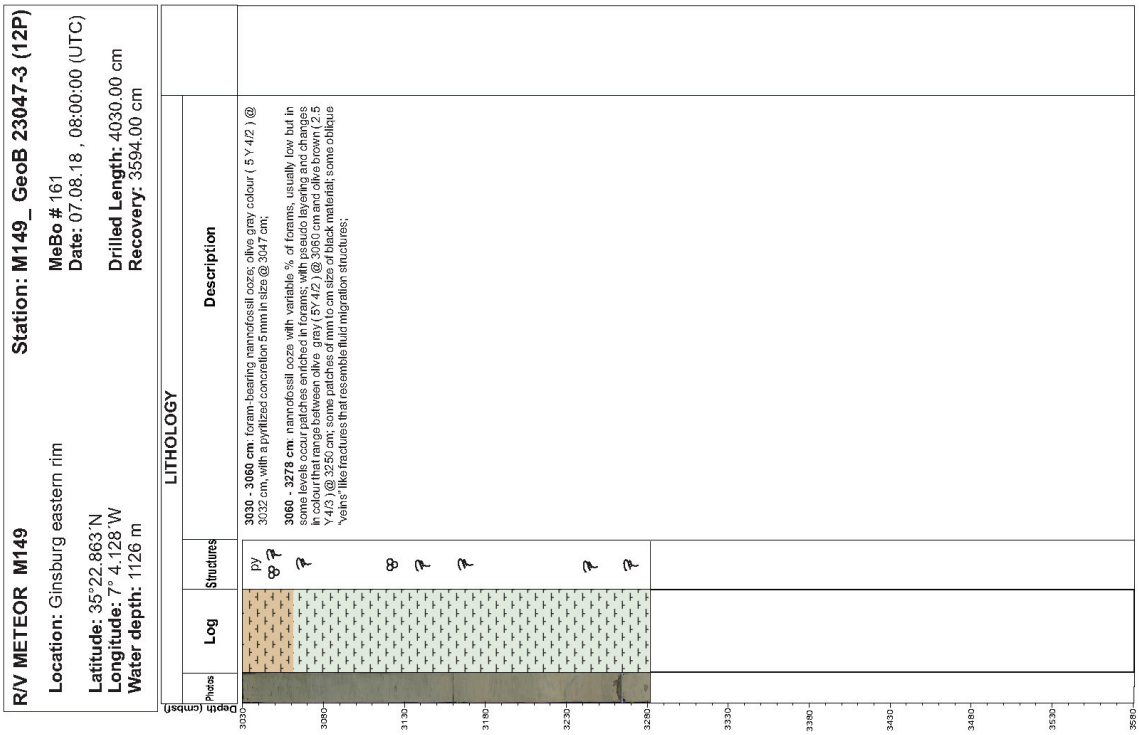
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)

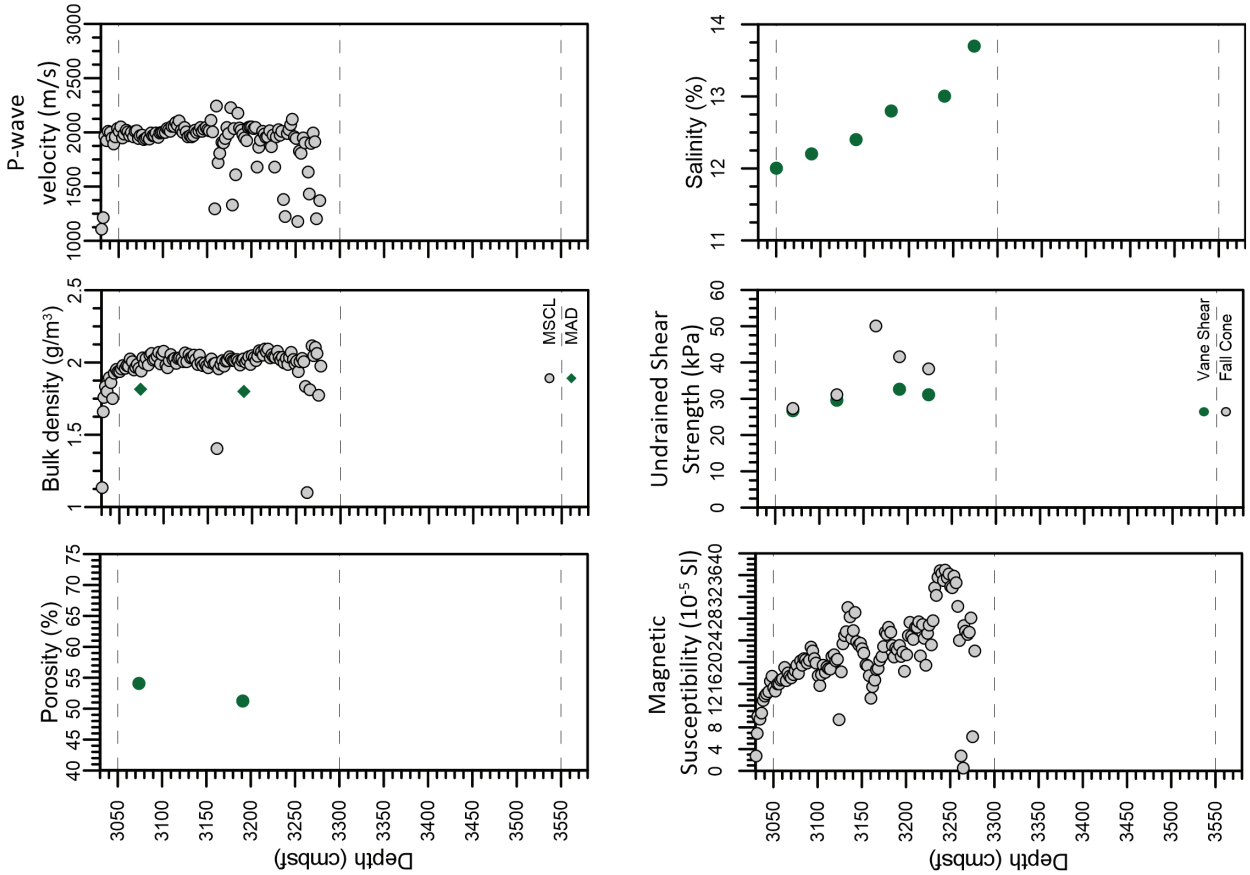
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm

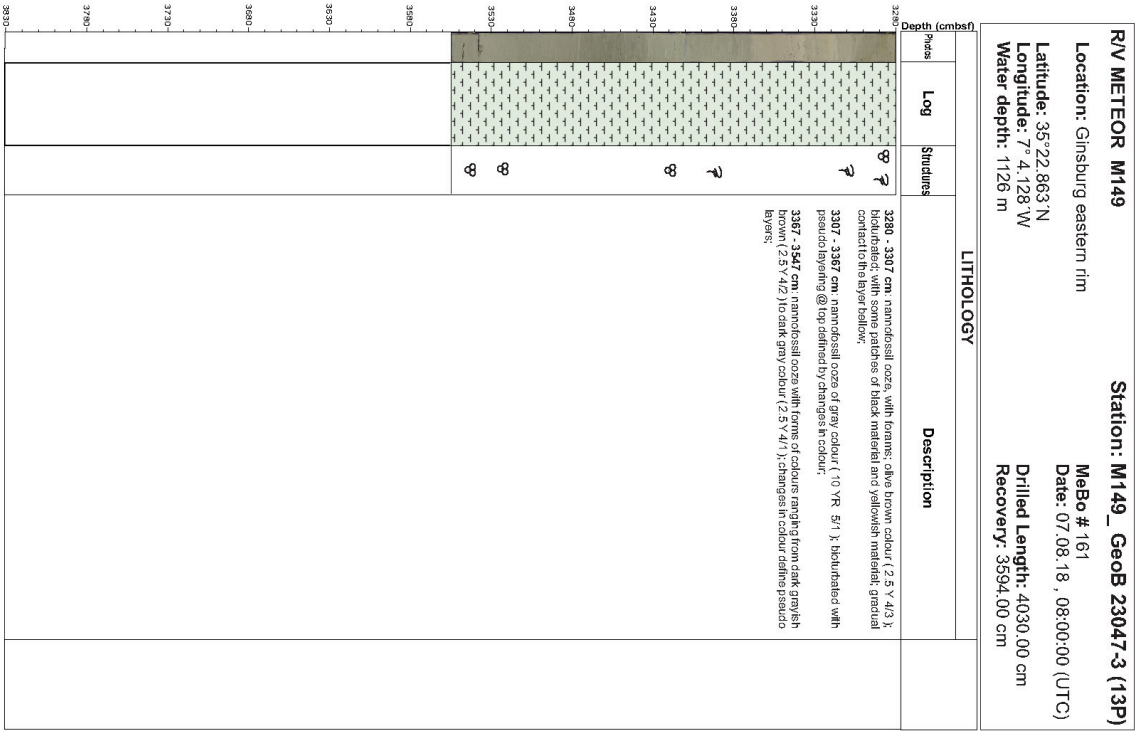
LITHOLOGY

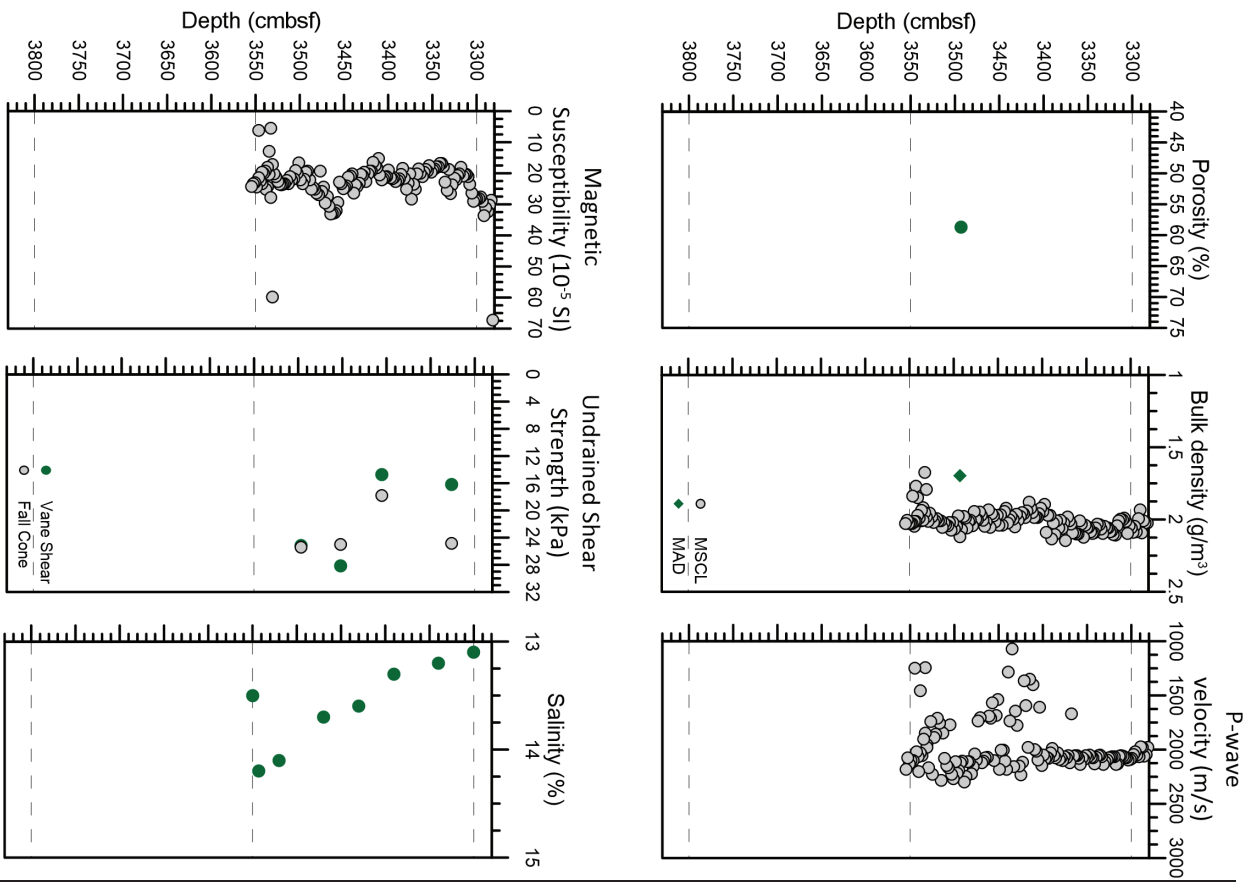
Depth (cmbsf)	Photos	Log	Structures	Description
2780				**2780 - 3032 cm**: nannofossil ooze with variable % of forams, low % in the top of section and high % of forams between 3000 and 3032 cm; colour ranging from grayish brown (2.5 Y 5/2) @ 2781 cm and very dark grayish brown (2.5 Y 3/2) @ 3270 cm; rare patches of black material but occurring as 1 mm up to 1 cm size;

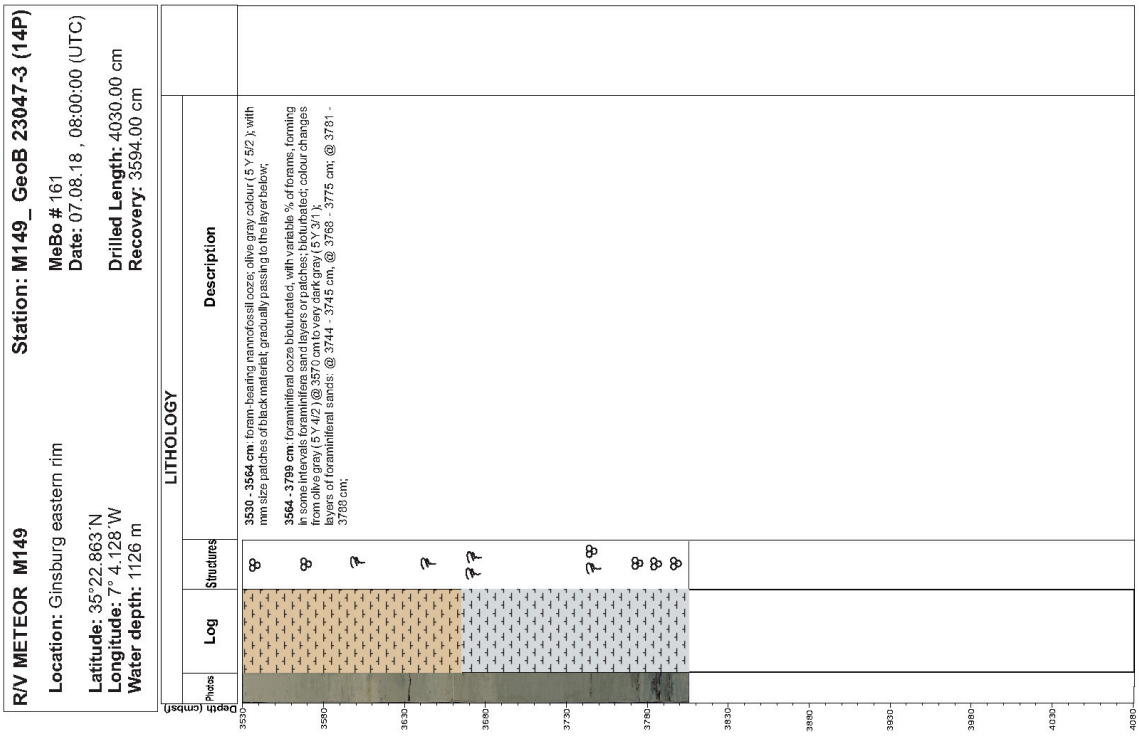


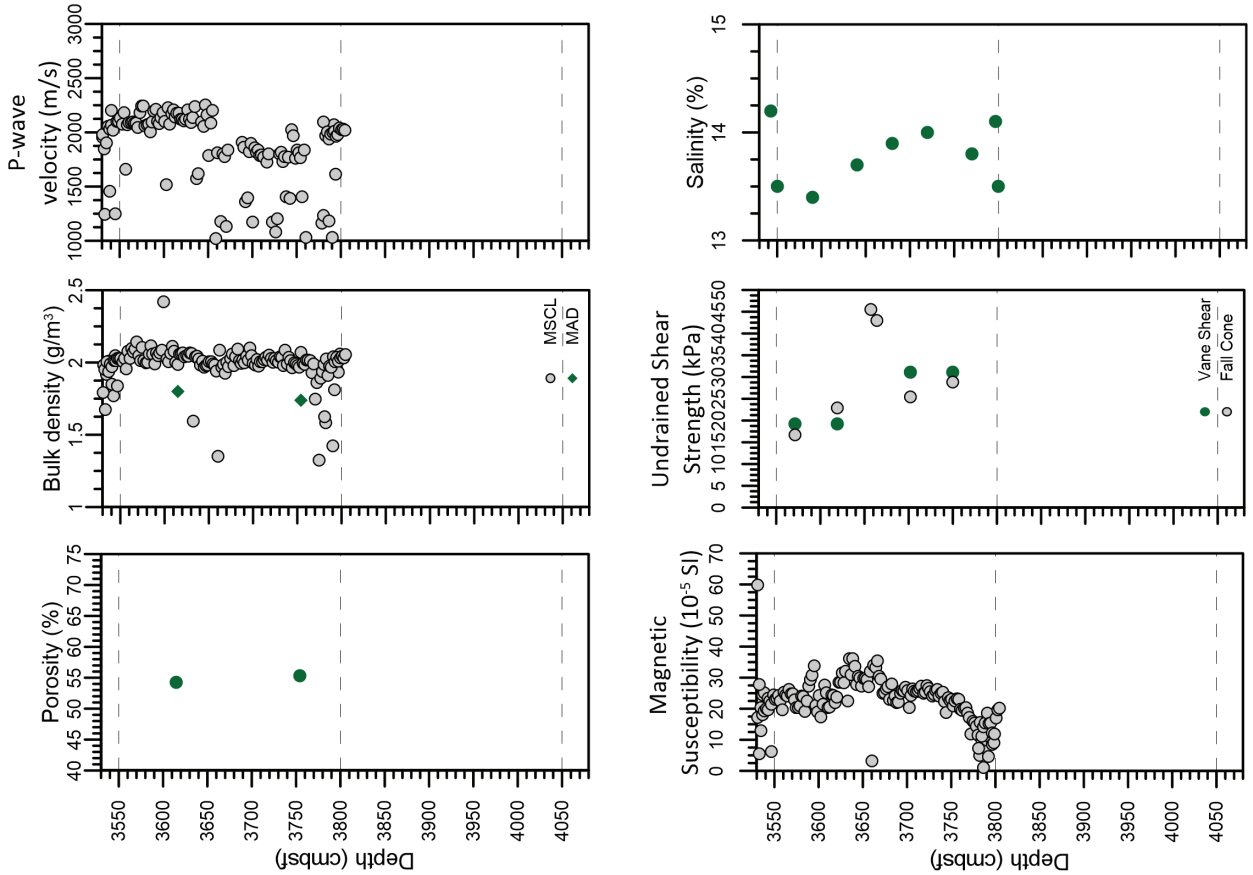

R/V METEOR M149
Station: M149_ GeoB 23047-3 (12P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3030 - 3060 cm: foram-bearing nannofossil ooze; olive grey colour (5 Y 4/2) @ 3032 cm, with a pyritized concretion 5 mm in size @ 3047 cm;
3060 - 3278 cm: nannofossil ooze with variable % of forams, usually low but in some levels occur patches enriched in forams; with pseudo layering and changes in colour that range between olive grey (5Y 4/2) @ 3060 cm and olive brown (2.5 Y 4/3) @ 3250 cm; some patches of mm to cm size of black material; some oblique "veins" like fractures that resemble fluid migration structures;
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23047-3 (13P)
Location: Ginsburg eastern rim
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3280 - 3307 cm: nannofossil ooze with forams; olive brown colour (2.5 Y 4/3); bioturbated; with some patches of black material and yellowish material; gradual contact to the layer bellow;
3307 - 3367 cm: nannofossil ooze of gray colour (10 YR 5/1); bioturbated with pseudo layering @ top defined by changes in colour;
3367 - 3547 cm: nannofossil ooze with forms of colours ranging from dark grayish brown (2.5 Y 4/2) to dark gray colour (2.5 Y 4/1); changes in colour define pseudo layers;


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23047-3 (14P)
Location: Ginsburg eastern rim
MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Latitude: 35°22.863'N
Longitude: 7° 4.128'W
Water depth: 1126 m
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3530 - 3564 cm: foram-bearing nannofossil ooze; olive gray colour (5 Y 5/2); with mm size patches of black meterial; gradually passing to the layer below;
3564 - 3799 cm: foraminiferal ooze bioturbated, with variable % of forams, forming in some intervals foraminifera sand layers or patches; bioturbated; colour changes from olive gray (5 Y 4/2) @ 3570 cm to very dark gray (5 Y 3/1);
layers of foraminiferal sands: @ 3744 - 3745 cm, @ 3768 - 3775 cm; @ 3781 - 3788 cm;


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

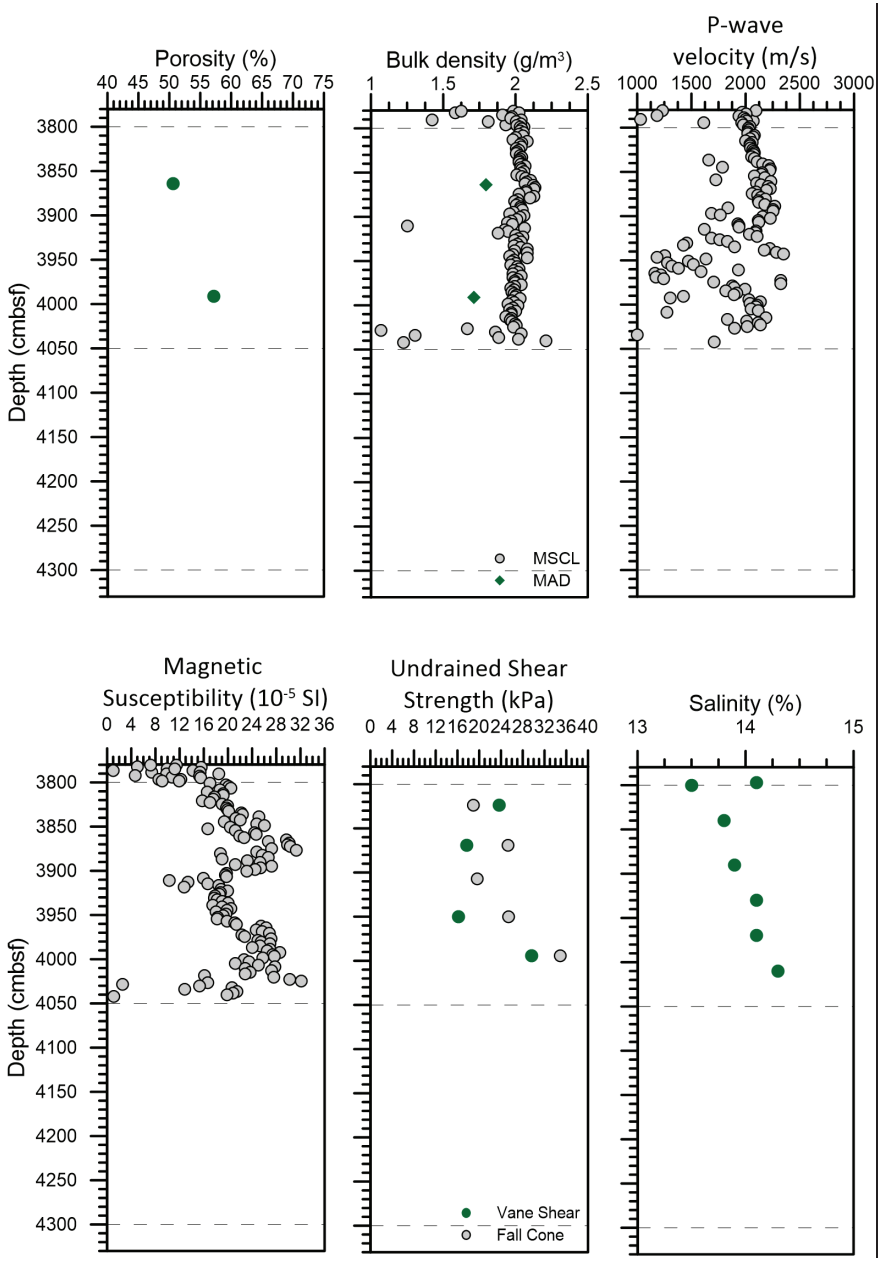
R/V METEOR M149 — **Station: M149_ GeoB 23047-3 (15P)**

Location: Ginsburg eastern rim
Latitude: 35°22.863´N
Longitude: 7° 4.128´W
Water depth: 1126 m

MeBo # 161
Date: 07.08.18 , 08:00:00 (UTC)
Drilled Length: 4030.00 cm
Recovery: 3594.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
3780				**3780 -4042 cm**: foram-bearing nannofossil ooze, with variable % of forams; bioturbated; olive gray in colour (5Y 5/2) from 3700 cm gradually changing to dark grayish brown (10 YR 4/2) from 3840 up 3961 cm; from 3961 cm to 4042 cm the colour is olive gray (5 Y 4/2) to dark olive gray (5 Y 3/2); a shell fragment with < 1 cm size @ 4010 cm.
3830				
3880				
3930				
3980				
4030				
4080				
4130				
4180				
4230				
4280				
4330				



R/V METEOR M149 **Station: M149_ GeoB 23060-1 (1P)**

Location: Lineament center

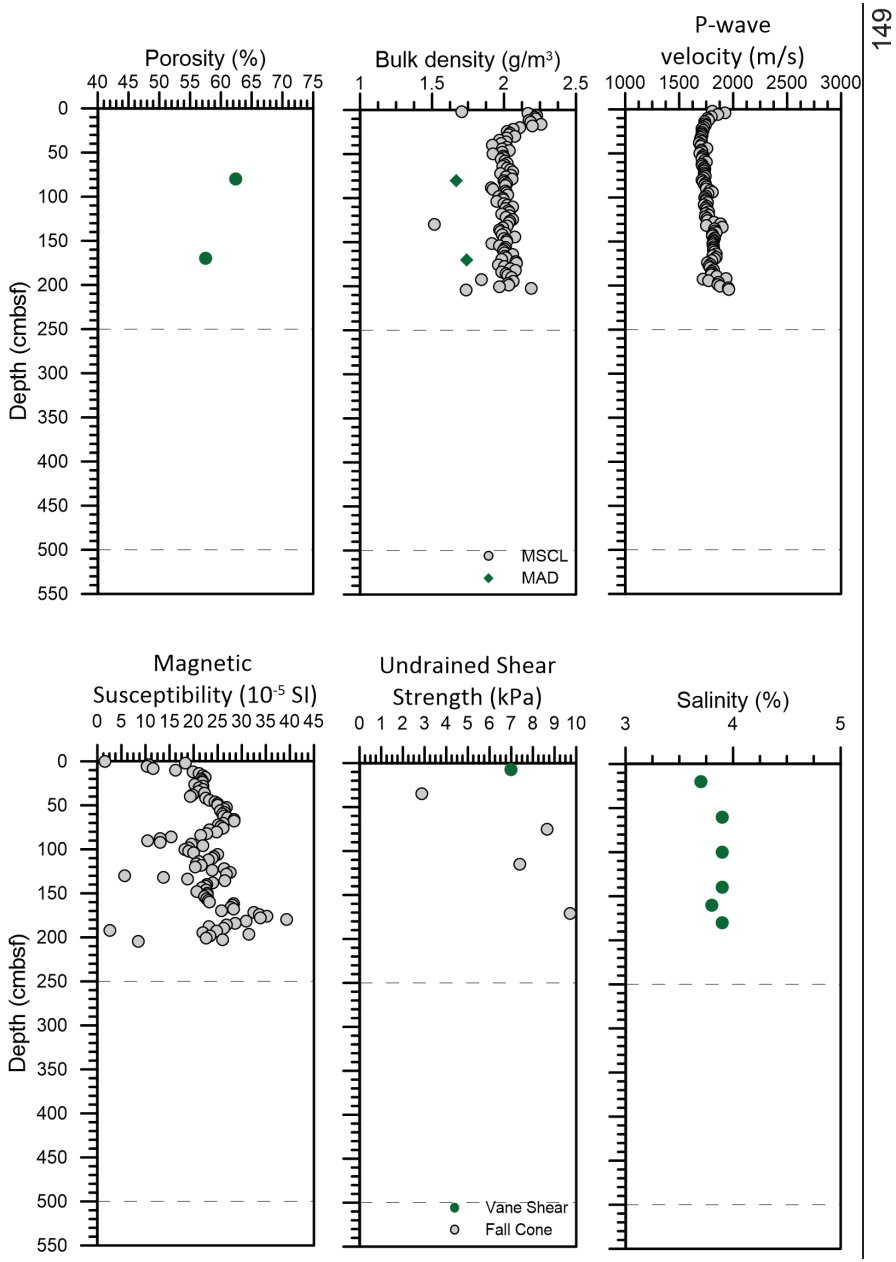
Latitude: 35°15.347´N
Longitude: 7°5.155´W
Water depth: 1013 m

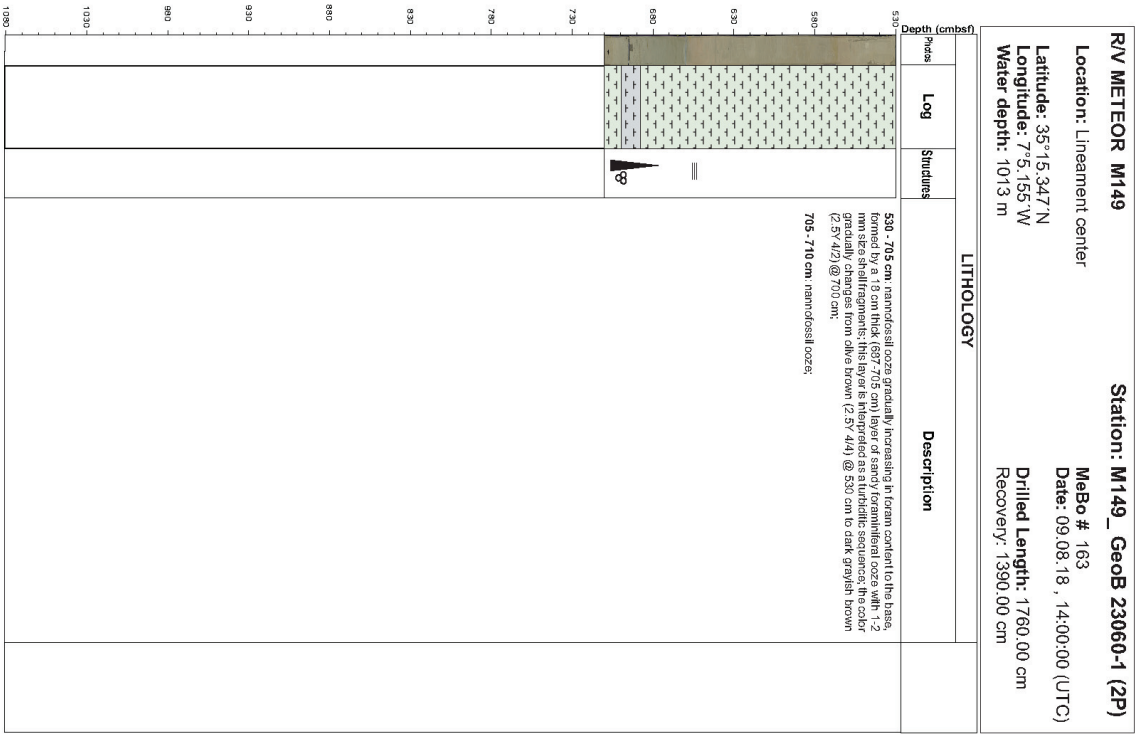
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)

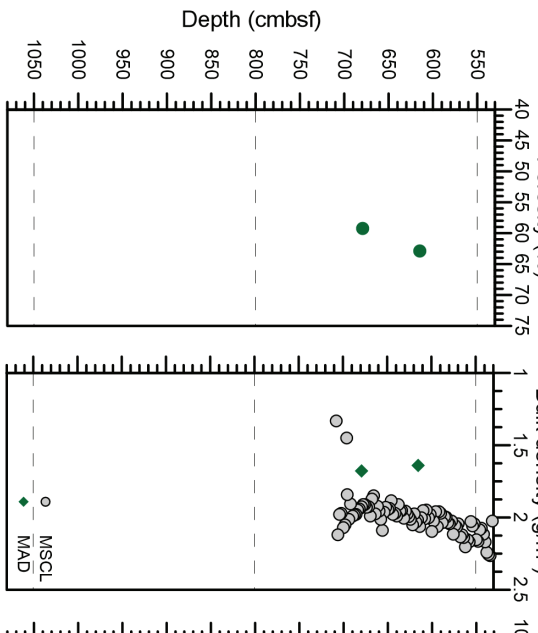
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm

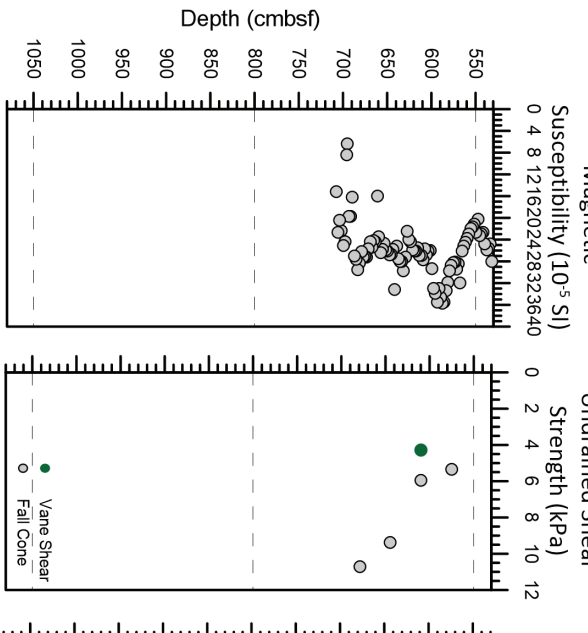
LITHOLOGY

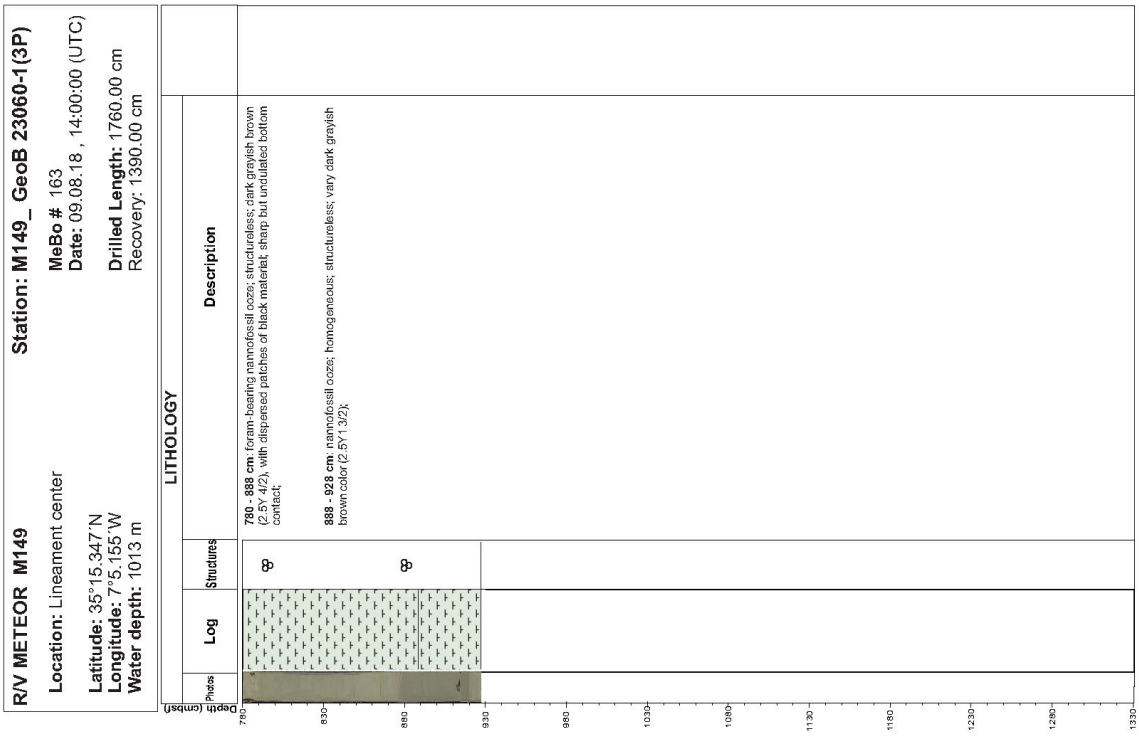
Depth (cmbsf)	Photos	Log	Structures	Description
0				**0 - 69 cm**: silt/bearing foraminiferal ooze with nannofossils; oxidized, water saturated on the top 17 cm; color gradually changes from yellowish brown (10YR 5/6) @ 5 cm to brown (10YR 5/3) @ 69 cm; with patches of yellowish brown stains dispersed throughout the layer; **69 - 93 cm**: fining-upward layer, a distal mass wasting or turbiditic package, of dark grayish brown (2.5 Y 4/2) color defined at the base by a 11 cm thick (82-93 cm) layer of foraminiferal sand fining-upwards, with 2/3 mm size shell fragments; the base of this sandy layer is undulated, with a mud clast within the sandy layer; above this sandy layer the sediment is a foram-bearing nannofossil ooze with decreasing % of forams upwards; **93 - 120 cm**: another turbiditic layer, with a basal 8 cm thick layer of sandy foraminiferal ooze fining-upwards and with incipient lamination upwards; **120 - 135 cm**: turbiditic layer with similar characteristics of the above; **135 - 200 cm**: turbiditic layer with similar characteristics of the above; **200 - 205 cm**: nannofossil ooze with rare forams, laminated;
50				
100				
150				
200				
250				
300				
350				
400				
450				
500				
550				

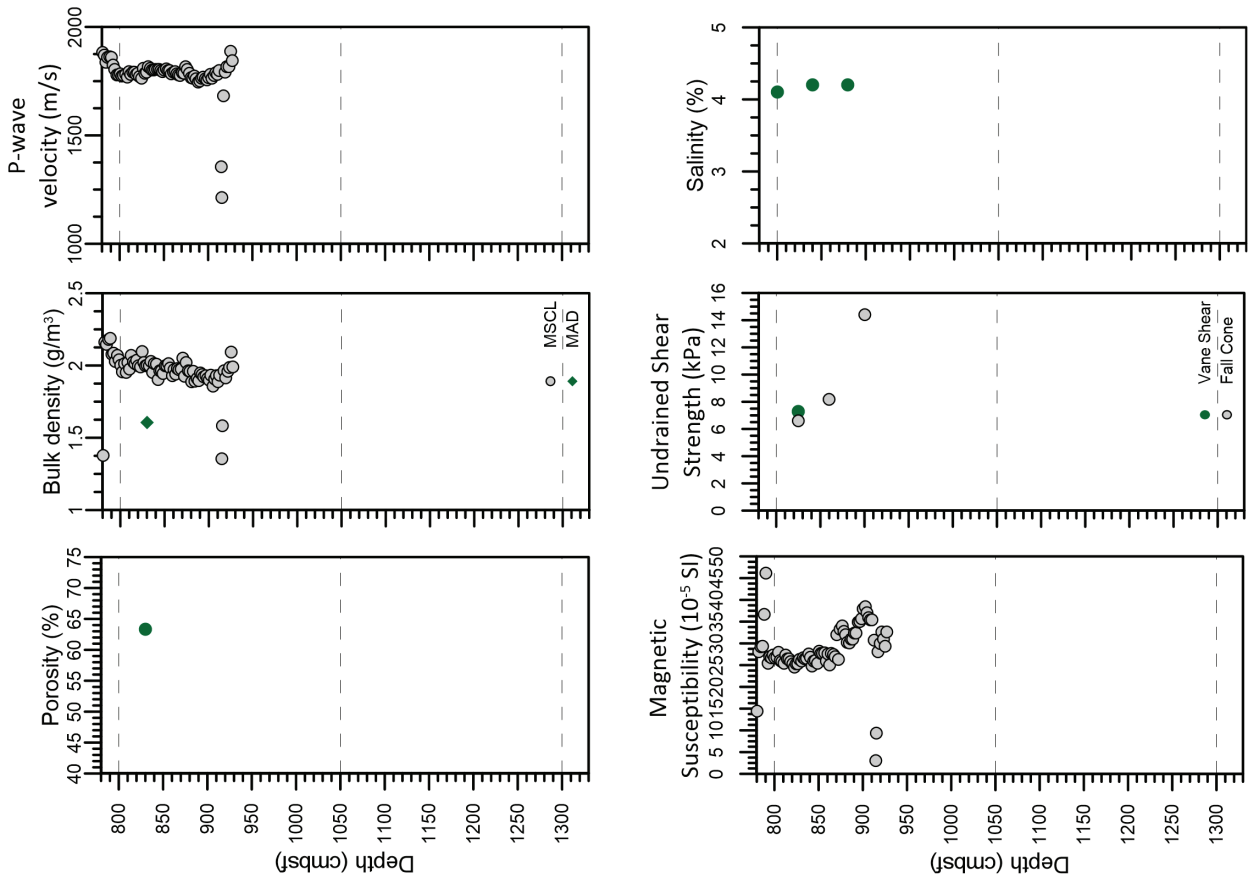



R/V METEOR M149
Station: M149_ GeoB 23060-1 (2P)
Location: Lineament center
Latitude: 35°15.347'N
Longitude: 7°5.155'W
Water depth: 1013 m
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm
LITHOLOGY
Photo
Log
Structures
Description
Depth (cmbsf)
530 - 705 cm: nannofossil ooze gradually increasing in foram content to the base, formed by a 18 cm thick (687-705 cm) layer of sandy foraminiferal ooze with 1-2 mm size shellfragments; this layer is interpreted as a turbiditic sequence; the color gradually changes from olive brown (2.5Y 4/4) @ 530 cm to dark grayish brown (2.5Y 4/2) @ 700 cm;
705 - 710 cm: nannofossil ooze;


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)


Depth (cmbsf)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23060-1(3P)
Location: Lineament center
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)
Latitude: 35°15.347'N
Longitude: 7°5.155'W
Water depth: 1013 m
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
780 - 888 cm: foram-bearing nannofossil ooze; structureless; dark grayish brown (2.5Y 4/2), with dispersed patches of black material; sharp but undulated bottom contact;
888 - 928 cm: nannofossil ooze; homogeneous; structureless; very dark grayish brown color (2.5Y 3/2);


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23060-1 (4P)**

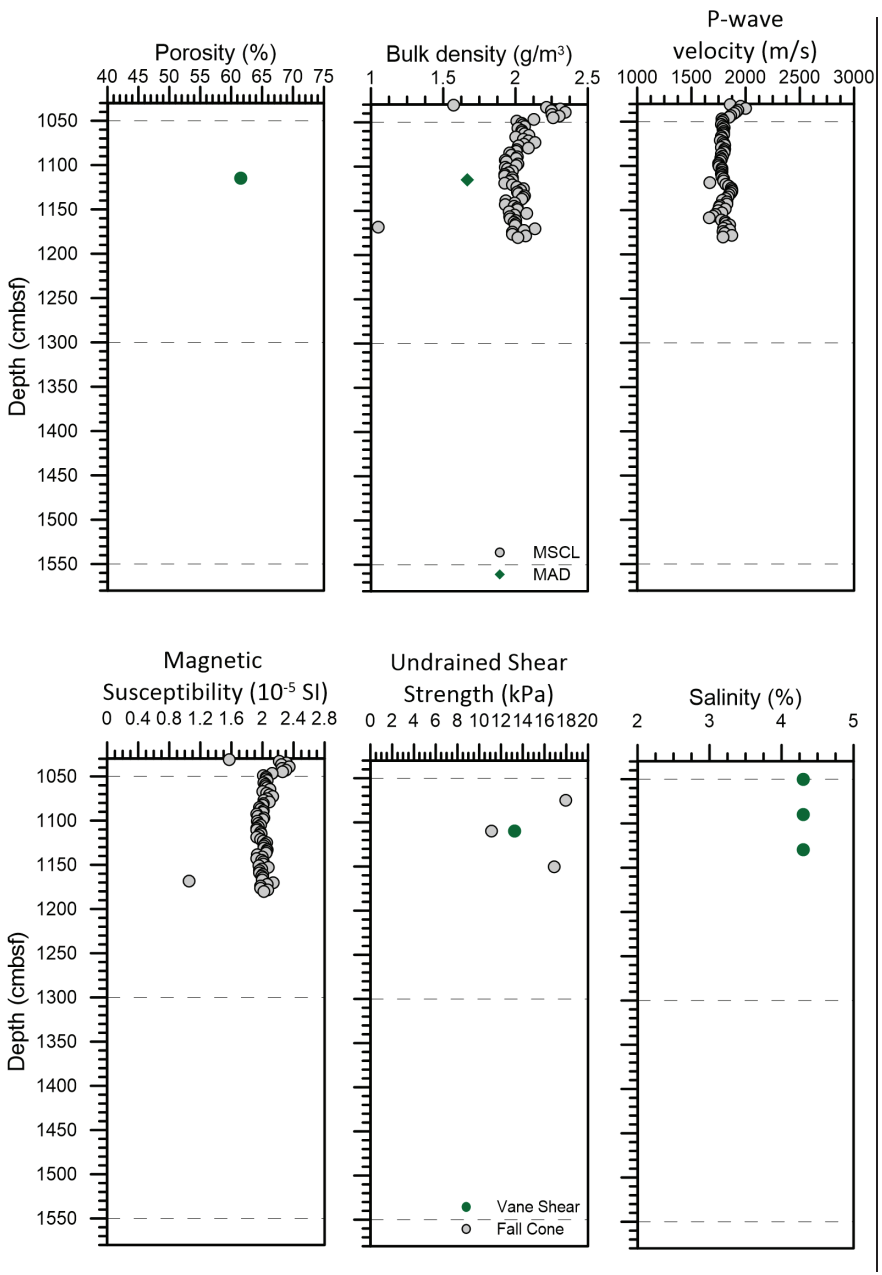
Location: Lineament center
Latitude: 35°15.347´N
Longitude: 7°5.155´W
Water depth: 1013 m

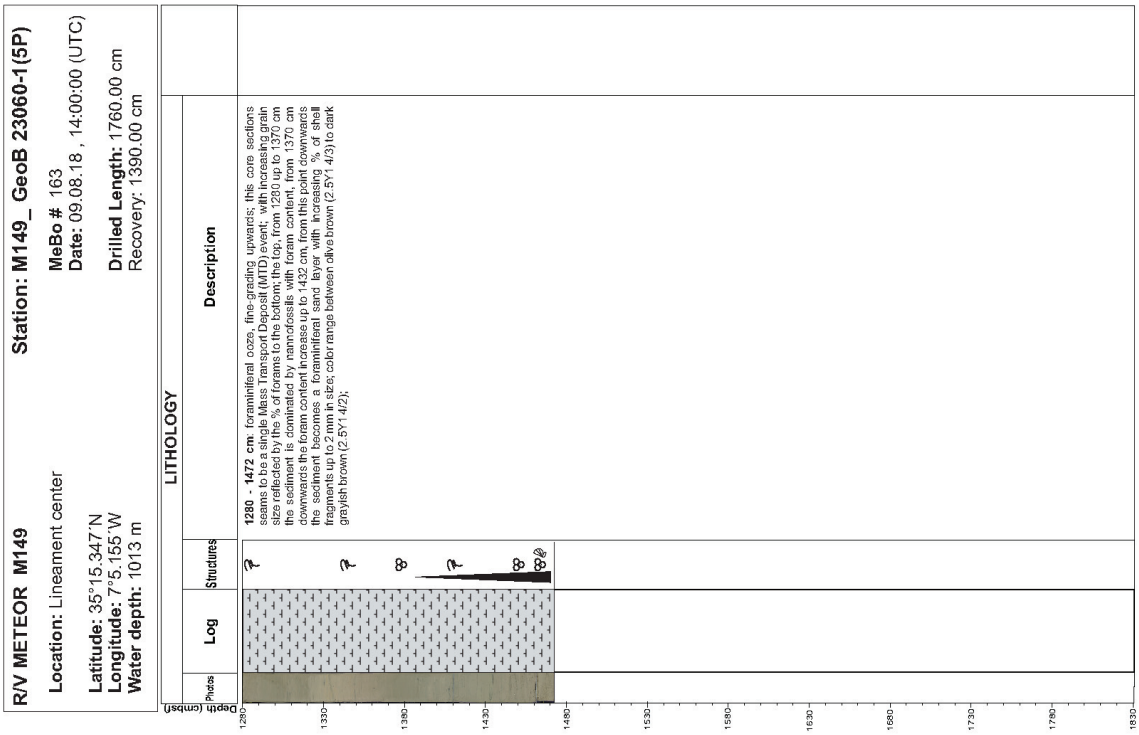
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)

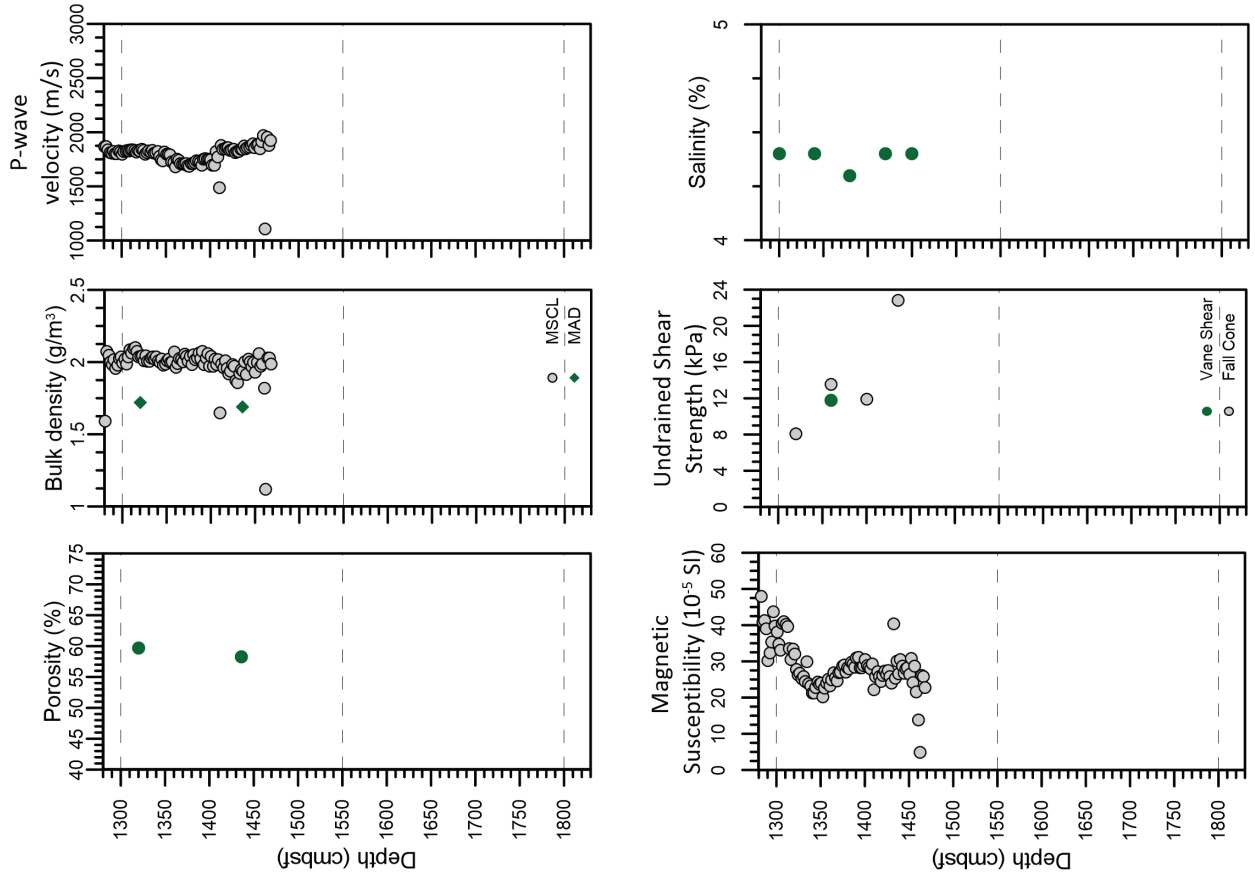
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm

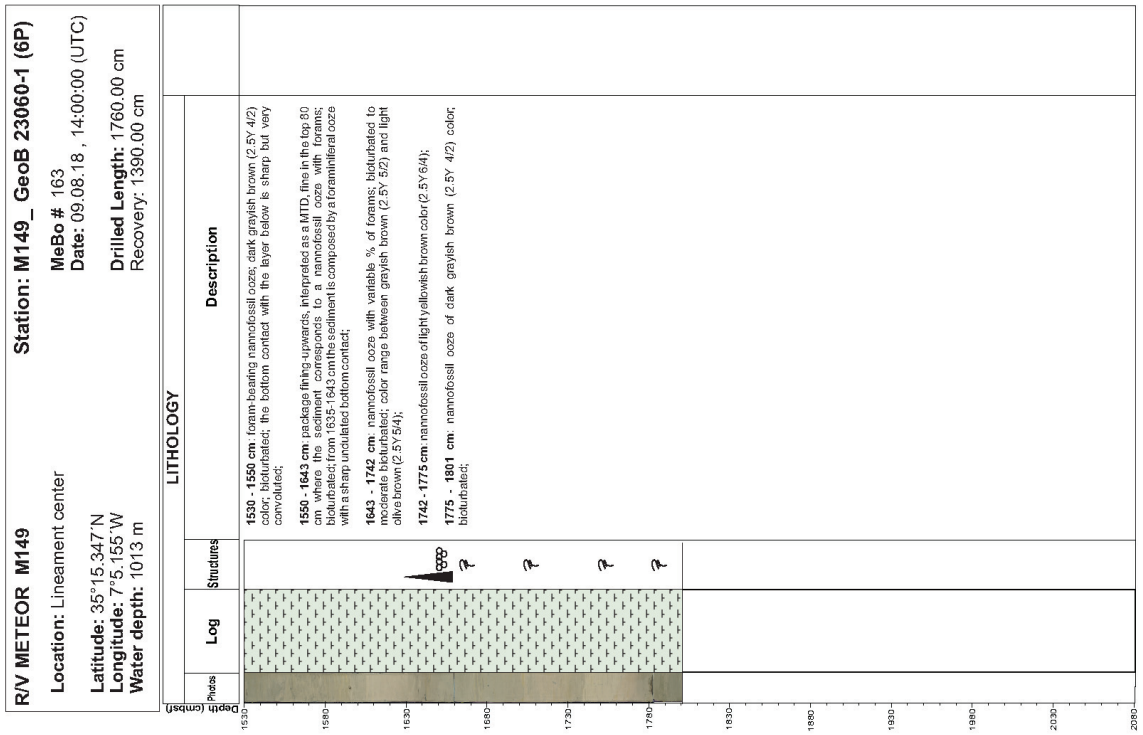
LITHOLOGY

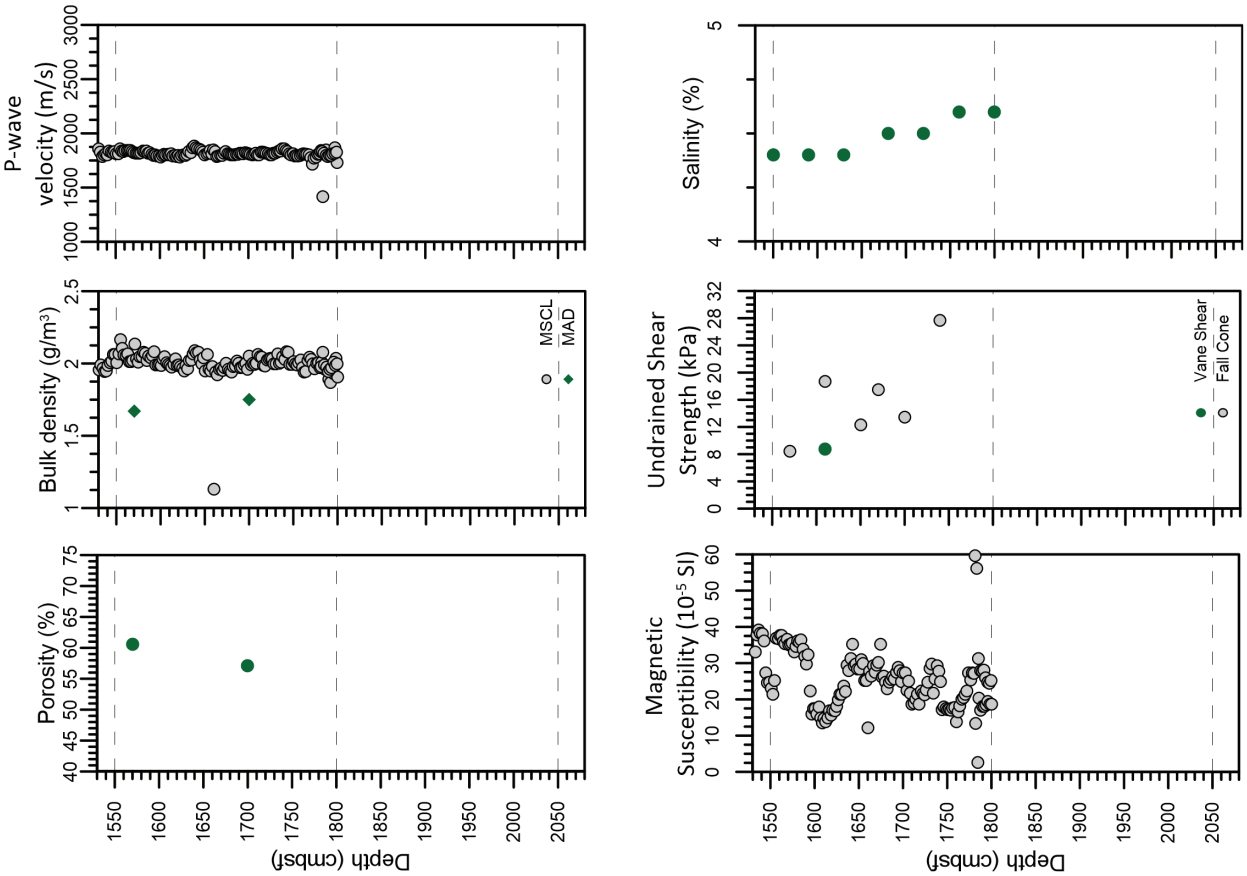
Depth (cmbsf)	Photos	Log	Structures	Description
1030				**1030 - 1070 cm**: silty foraminiferal ooze; structureless; diffuse bottom transition to the layer below; dark grayish brown color (2.5Y 4/2);
1080				**1070 - 1030 cm**: foram-bearing nannofossil ooze with a bottom layer of foraminiferal ooze from 1108 - 1130 cm, fining-upwards; this package corresponds to a turbiditic layer; the base is sharp and undulated; color ranging from grayish brown (10YR 5/2) @1090 cm to dark grayish brown (2.5Y 4/2) @ 1130 cm; a shell fragment @ 1085 cm;
1130				**1130 - 1182 cm**: nannofossil ooze; with variable % of forams; dark grayish brown color (2.5Y 3/2);
1180				
1230				
1280				
1330				
1380				
1430				
1480				
1530				
1580				

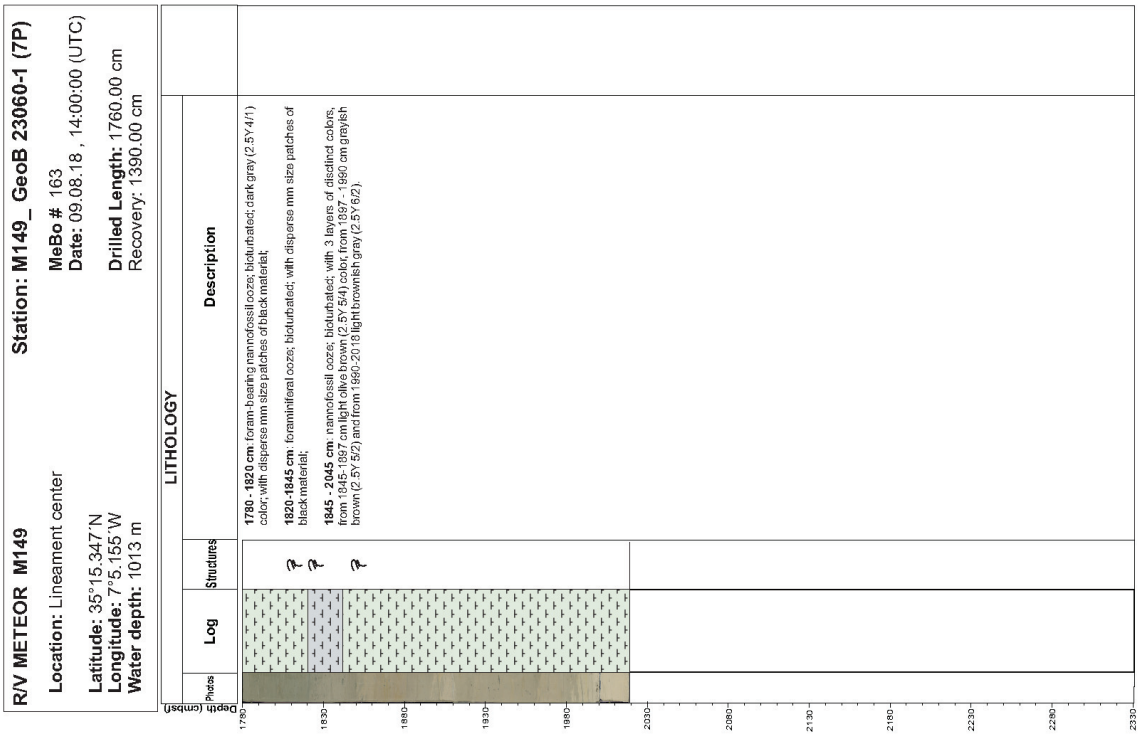


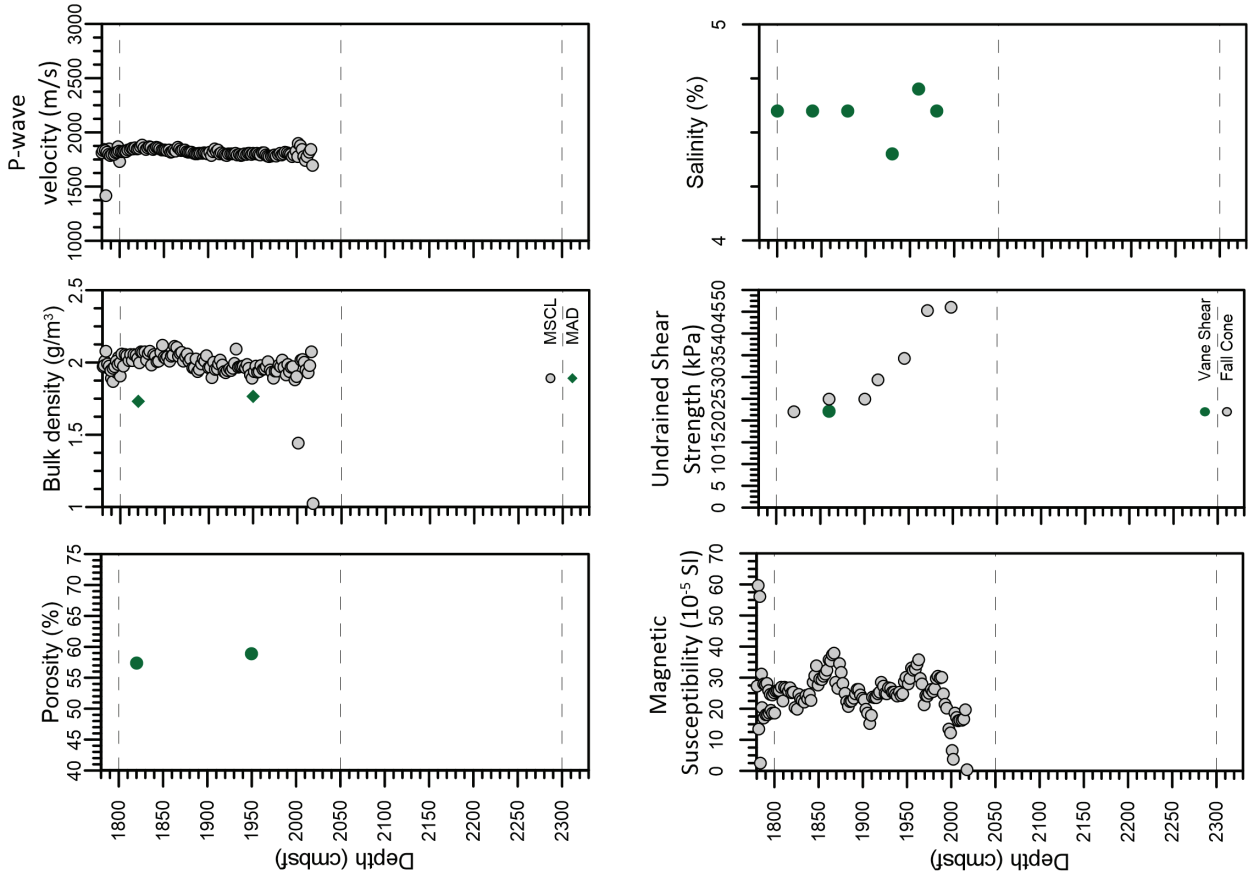

R/V METEOR M149
Station: M149_ GeoB 23060-1(5P)
Location: Lineament center
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)
Latitude: 35°15.347'N
Longitude: 7°5.155'W
Water depth: 1013 m
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1280 - 1472 cm: foraminiferal ooze, fine-grading upwards; this core sections seems to be a single Mass Transport Deposit (MTD) event; with increasing grain size reflected by the % of forams to the bottom; the top, from 1280 up to 1370 cm the sediment is dominated by nannofossils with foram content, from 1370 cm downwards the foram content increase up to 1432 cm, from this point downwards the sediment becomes a foraminiferal sand layer with increasing % of shell fragments up to 2 mm in size; color range between olive brown (2.5Y1 4/3) to dark greyish brown (2.5Y1 4/2);

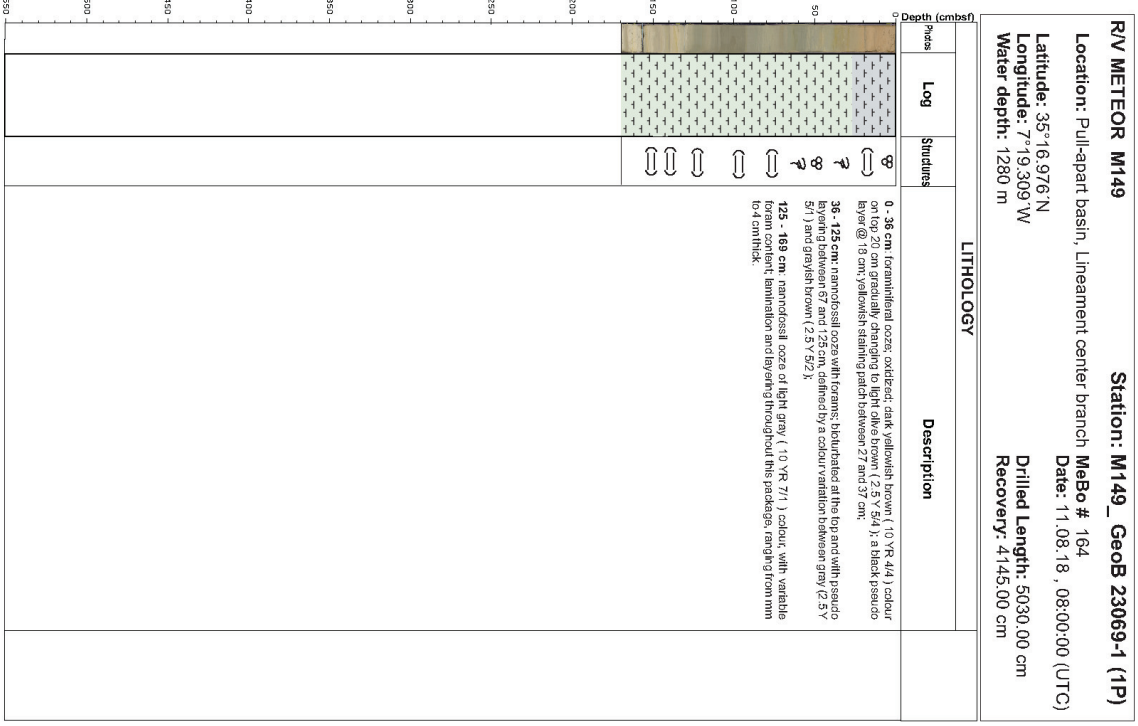

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

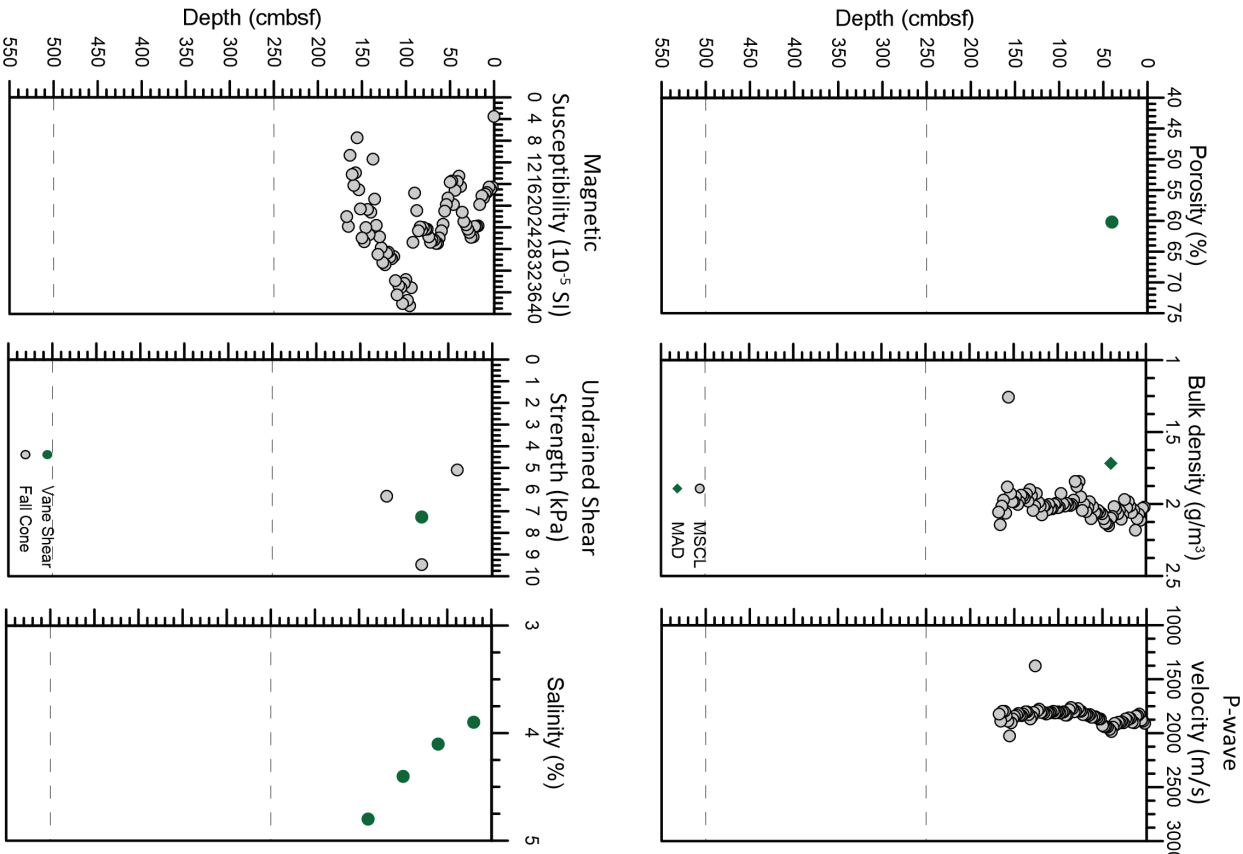

R/V METEOR M149
Station: M149_ GeoB 23060-1 (6P)
Location: Lineament center
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)
Latitude: 35°15.347'N
Longitude: 7°5.155'W
Water depth: 1013 m
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1530 - 1550 cm: foram-bearing nannofossil ooze; dark grayish brown (2.5Y 4/2) color; bioturbated; the bottom contact with the layer below is sharp but very convoluted;
1550 - 1643 cm: package fining-upwards, interpreted as a MTD, fine in the top 80 cm where the sediment corresponds to a nannofossil ooze with forams; bioturbated; from 1635-1643 cm the sediment is composed by a foraminiferal ooze with a sharp undulated bottom contact;
1643 - 1742 cm: nannofossil ooze with variable % of forams; bioturbated to moderate bioturbated; color range between grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4);
1742 - 1775 cm: nannofossil ooze of light yellowish brown color (2.5Y 6/4);
1775 - 1801 cm: nannofossil ooze of dark grayish brown (2.5Y 4/2) color; bioturbated;

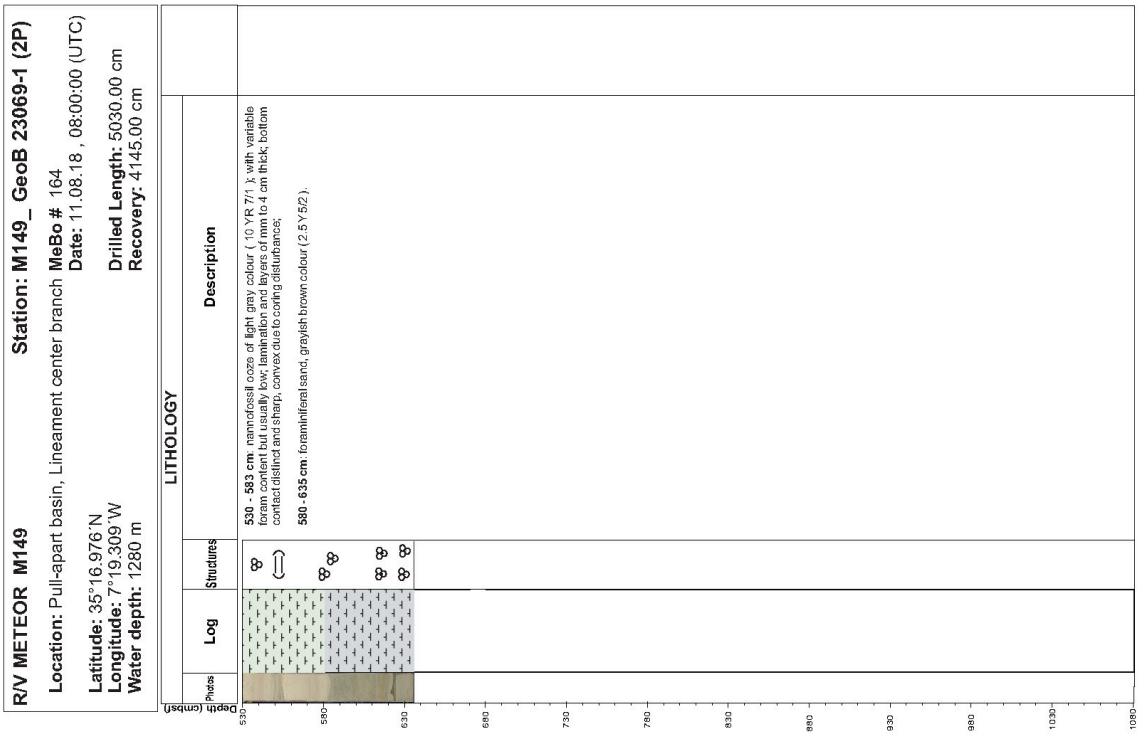

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

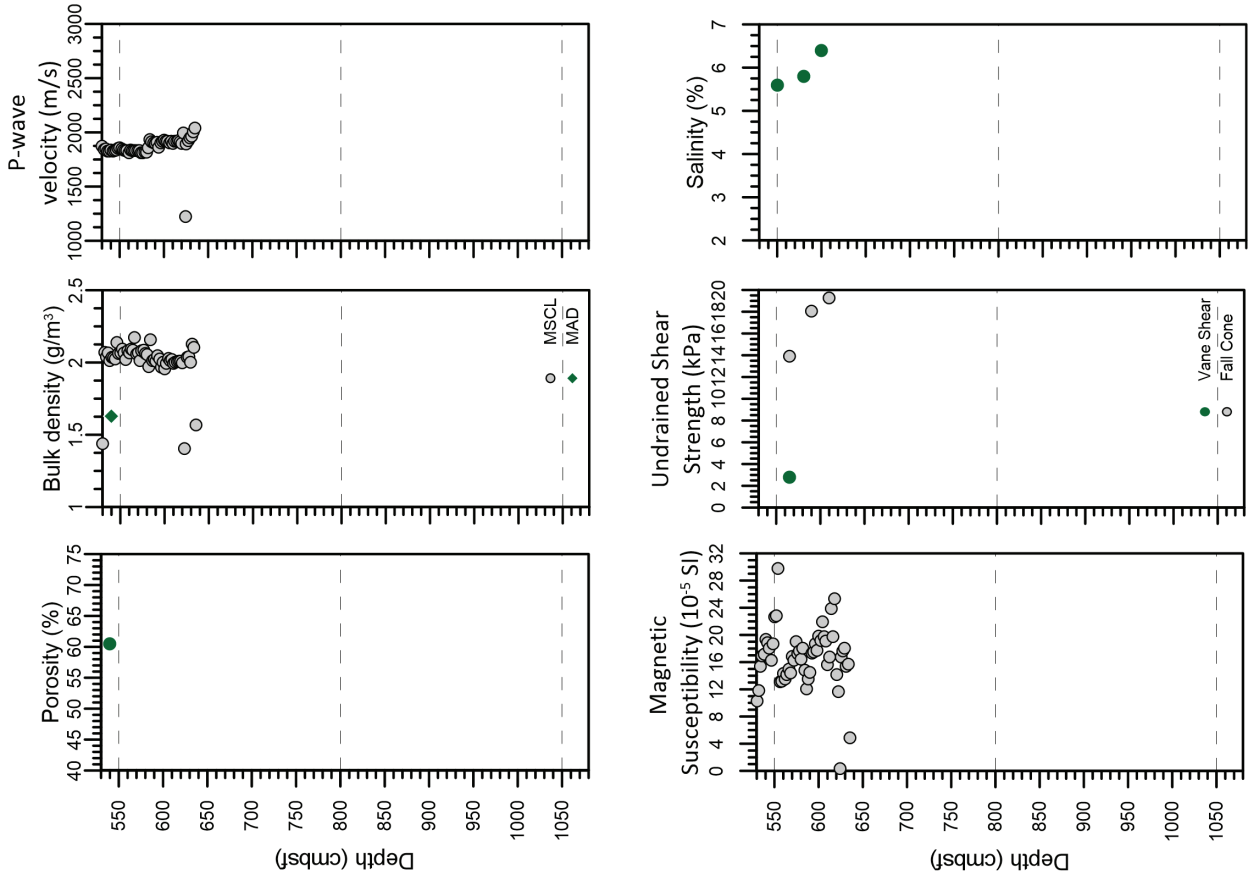

R/V METEOR M149
Station: M149_ GeoB 23060-1 (7P)
Location: Lineament center
MeBo # 163
Date: 09.08.18 , 14:00:00 (UTC)
Latitude: 35°15.347'N
Longitude: 7°5.155'W
Water depth: 1013 m
Drilled Length: 1760.00 cm
Recovery: 1390.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1780 - 1820 cm: foram-bearing nannofossil ooze; bioturbated; dark gray (2.5Y 4/1) color; with disperse mm size patches of black material;
1820-1845 cm: foraminiferal ooze; bioturbated; with disperse mm size patches of black material;
1845 - 2045 cm: nannofossil ooze; bioturbated; with 3 layers of disctinct colors, from 1845-1897 cm light olive brown (2.5Y 5/4) color, from 1897 - 1990 cm grayish brown (2.5Y 5/2) and from 1990-2018 light brownish gray (2.5Y 6/2).

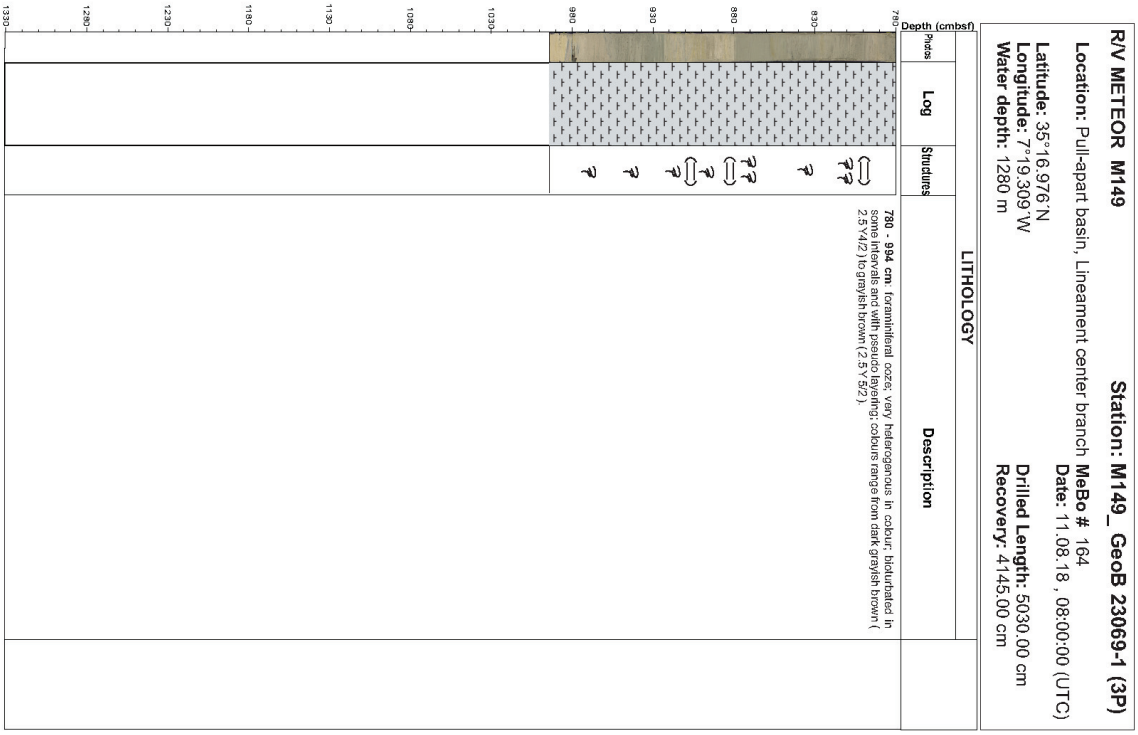

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

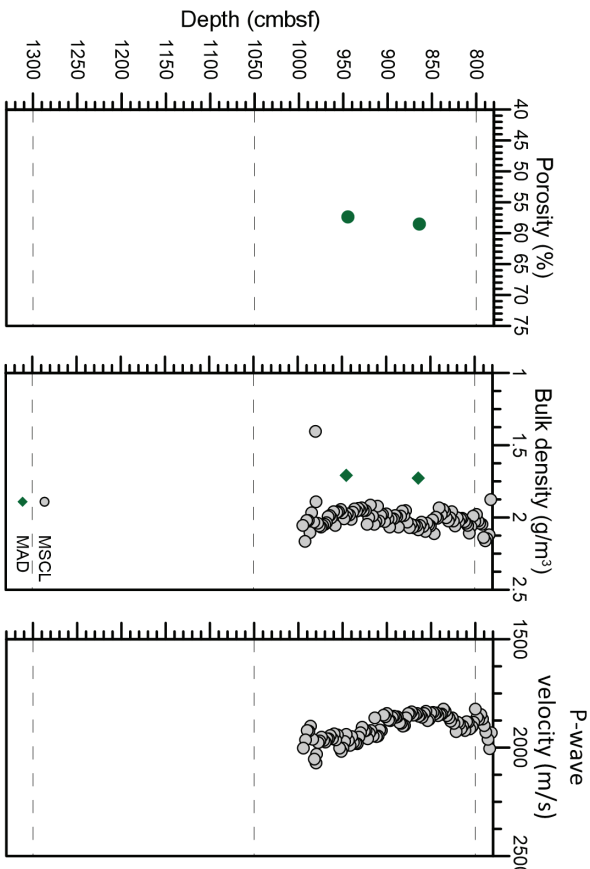

R/V METEOR M149
Station: M149_ GeoB 23069-1 (1P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
0 - 36 cm: foraminiferal ooze; oxidized; dark yellowish brown (10 YR 4/4) colour on top 20 cm gradually changing to light olive brown (2.5 Y 5/4); a black pseudo layer @ 18 cm; yellowish staining patch between 27 and 37 cm;
36 - 125 cm: nannofossil ooze with forams; bioturbated at the top and with pseudo layering between 67 and 125 cm, defined by a colour variation between gray (2.5 Y 5/1) and grayish brown (2.5 Y 5/2);
125 - 169 cm: nannofossil ooze of light gray (10 YR 7/1) colour, with variable foram content; lamination and layering throughout this package, ranging from mm to 4 cm thick.

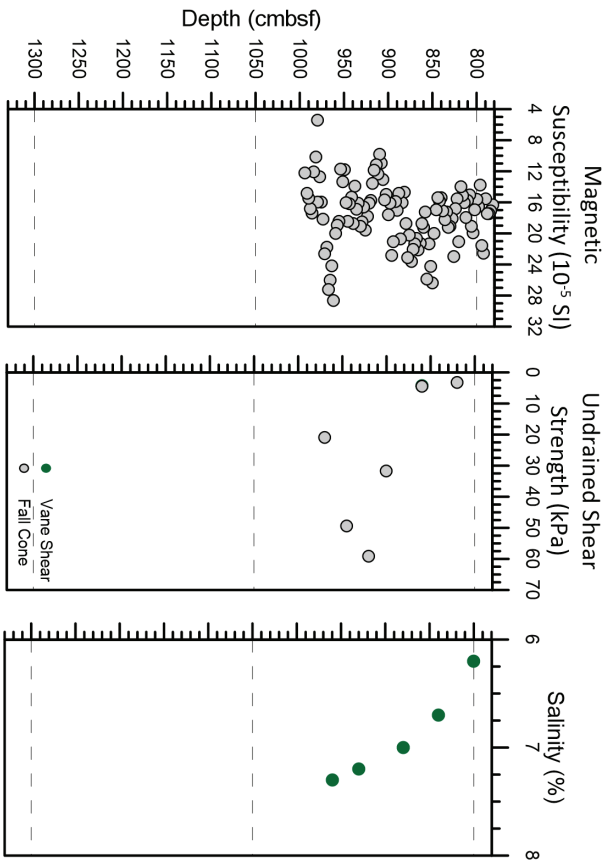

Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)

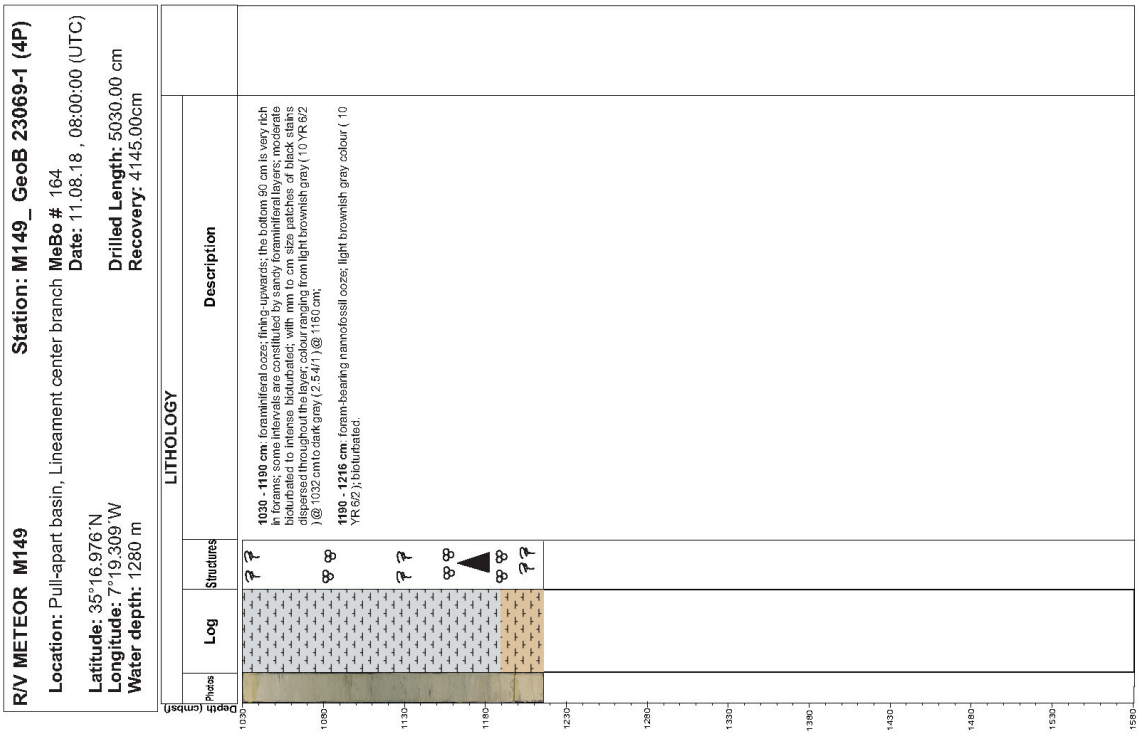

R/V METEOR M149
Station: M149_ GeoB 23069-1 (2P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
530 - 583 cm: nannofossil ooze of light gray colour (10 YR 7/1); with variable foram content but usually low; lamination and layers of mm to 4 cm thick; bottom contact distinct and sharp, convex due to coring disturbance;
580 - 635 cm: foraminiferal sand, grayish brown colour (2.5 Y 5/2).

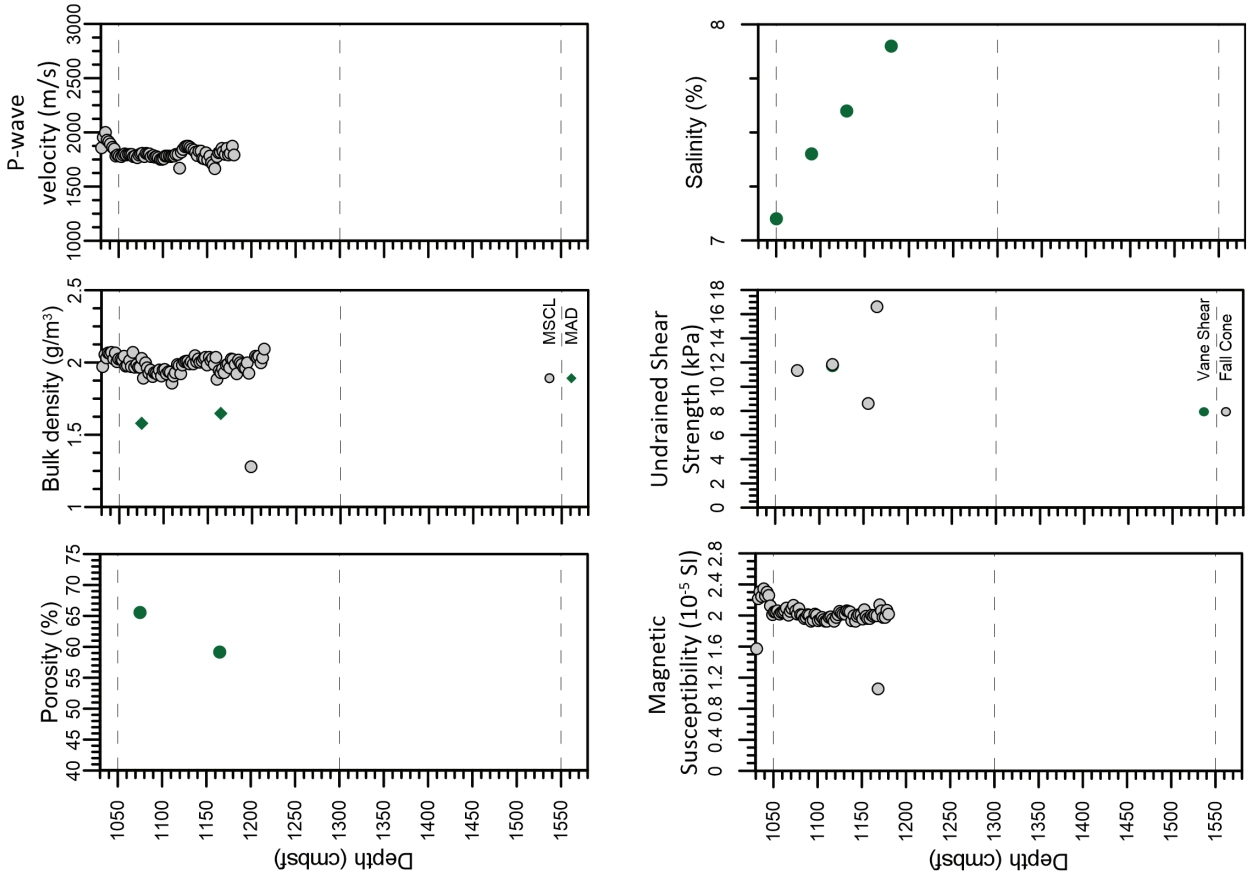

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23069-1 (3P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
780 - 984 cm: foraminiferal ooze; very heterogeneous in colour; bioturbated in some intervals and with pseudo layering; colours range from dark grayish brown (2.5Y4/2) to grayish brown (2.5Y 5/2).


Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Depth (cmbsf)


Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23069-1 (4P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1030 - 1190 cm: foraminiferal ooze; fining-upwards; the bottom 90 cm is very rich in forams; some intervals are constituted by sandy foraminiferal layers; moderate bioturbated to intense, bioturbated; with mm to cm size patches of black stains dispersed throughout the layer; colour ranging from light brownish gray (10 YR 6/2) @ 1032 cm to dark gray (2.5 4/1) @ 1160 cm;
1190 - 1216 cm: foram-bearing nannofossil ooze; light brownish gray colour (10 YR 6/2); bioturbated.

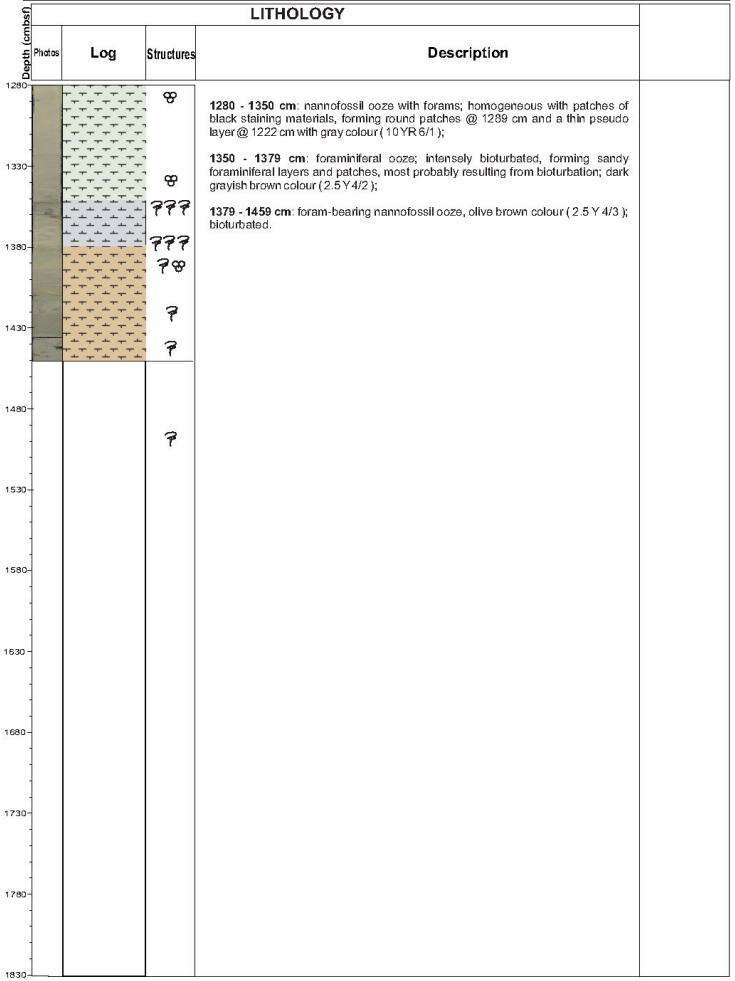

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23069-1 (5P)**

Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

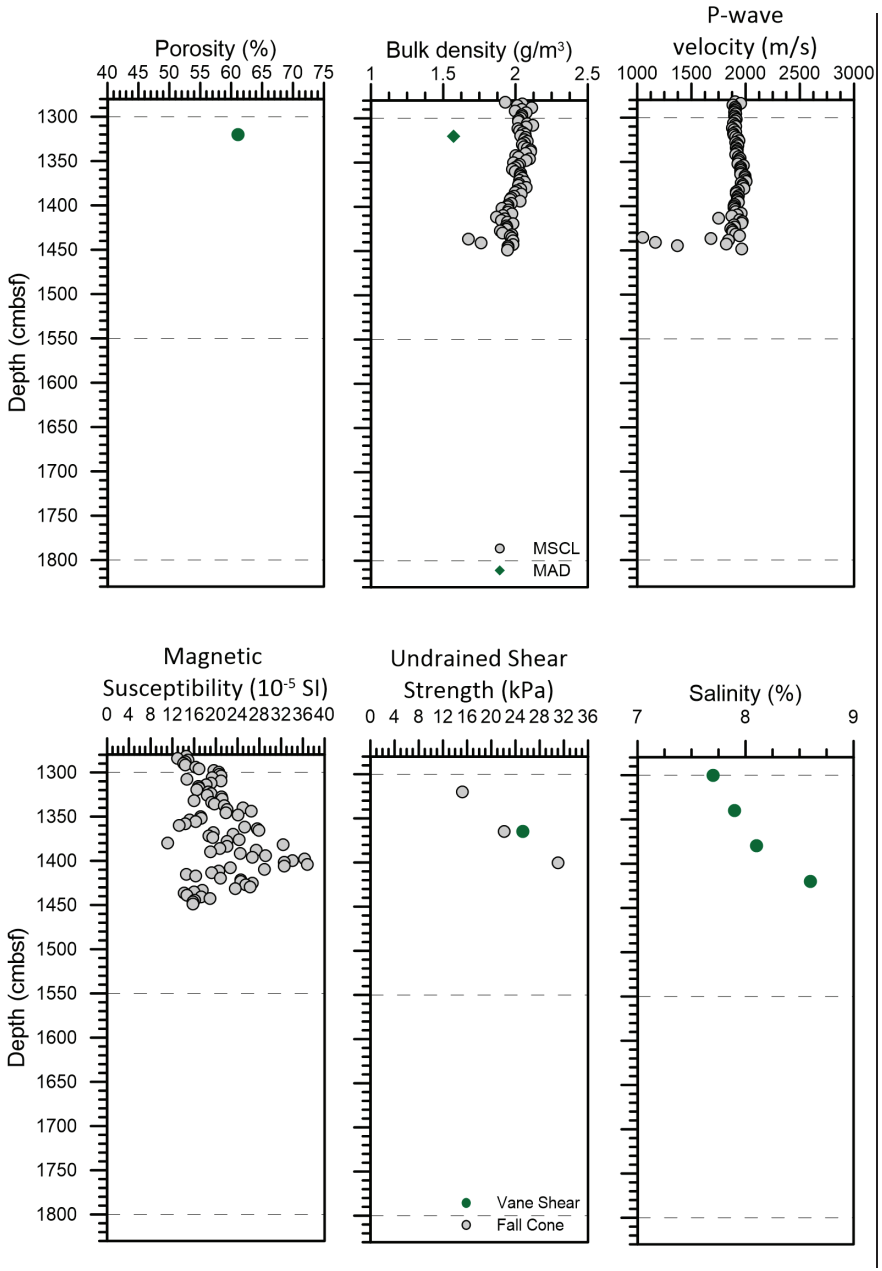
Drilled Length: 5030.00 cm
Recovery: 4145.00cm

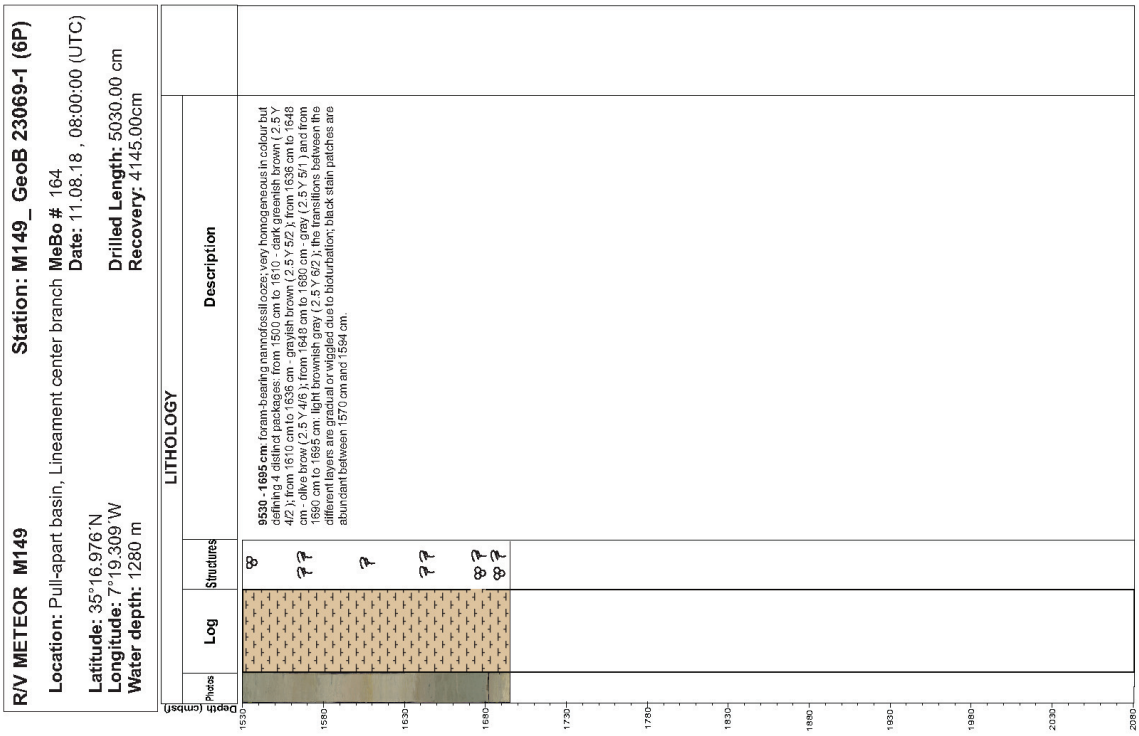


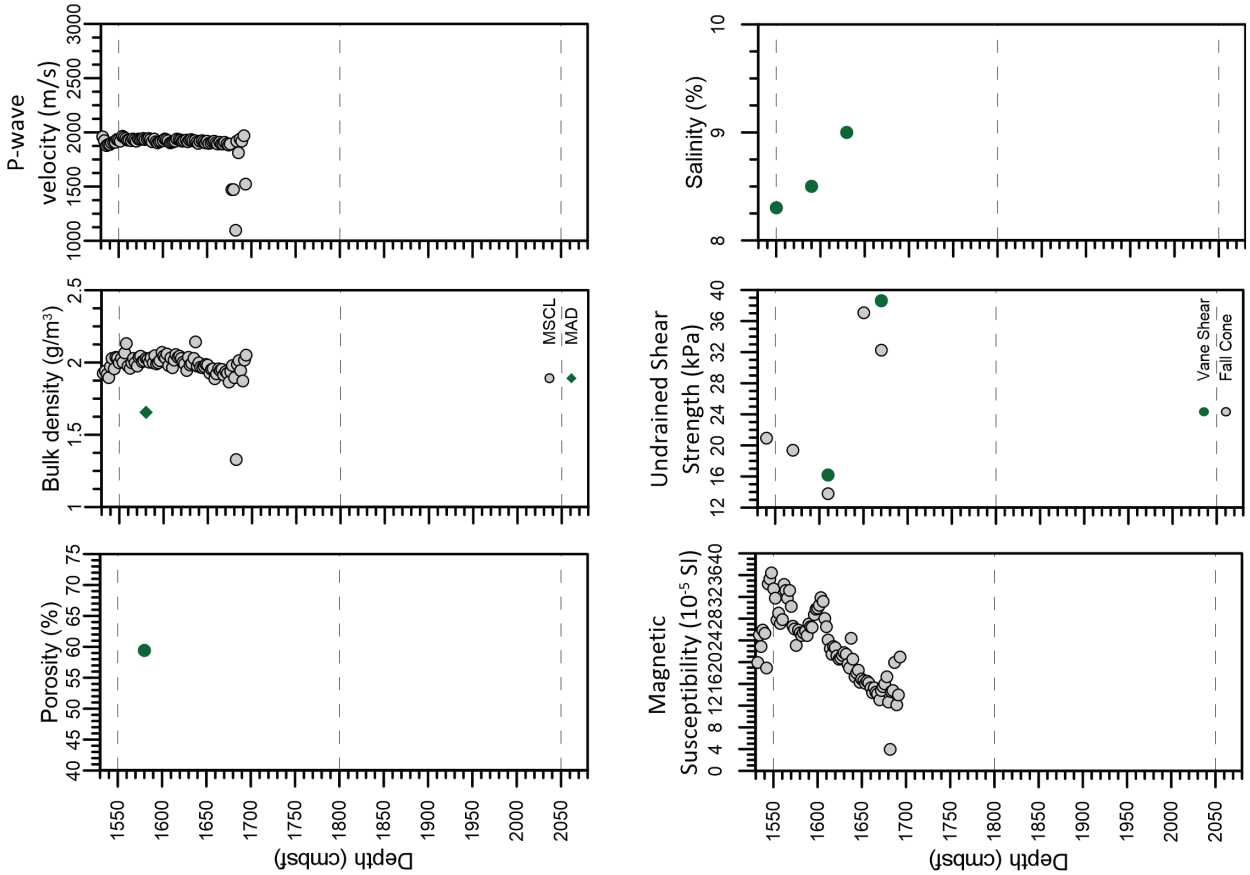
1280 - 1350 cm: nannofossil ooze with forams; homogeneous with patches of black staining materials, forming round patches @ 1289 cm and a thin pseudo layer @ 1222 cm with gray colour (10 YR 6/1);

1350 - 1379 cm: foraminiferal ooze; intensely bioturbated, forming sandy foraminiferal layers and patches, most probably resulting from bioturbation; dark grayish brown colour (2.5 Y 4/2);

1379 - 1459 cm: foram-bearing nannofossil ooze, olive brown colour (2.5 Y 4/3); bioturbated.




R/V METEOR M149
Station: M149_ GeoB 23069-1 (6P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
9530 - 1695 cm: foram-bearing nannofossil ooze; very homogeneous in colour but defining 4 distinct packages: from 1500 cm to 1610 - dark greenish brown (2.5 Y 4/2); from 1610 cm to 1636 cm - grayish brown (2.5 Y 5/2); from 1636 cm to 1648 cm - olive brow (2.5 Y 4/6); from 1648 cm to 1680 cm - gray (2.5 Y 5/1) and from 1690 cm to 1695 cm: light brownish gray (2.5 Y 6/2); the transitions between the different layers are gradual or wiggled due to bioturbation; black stain patches are abundant between 1570 cm and 1594 cm.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23069-1 (7P)**

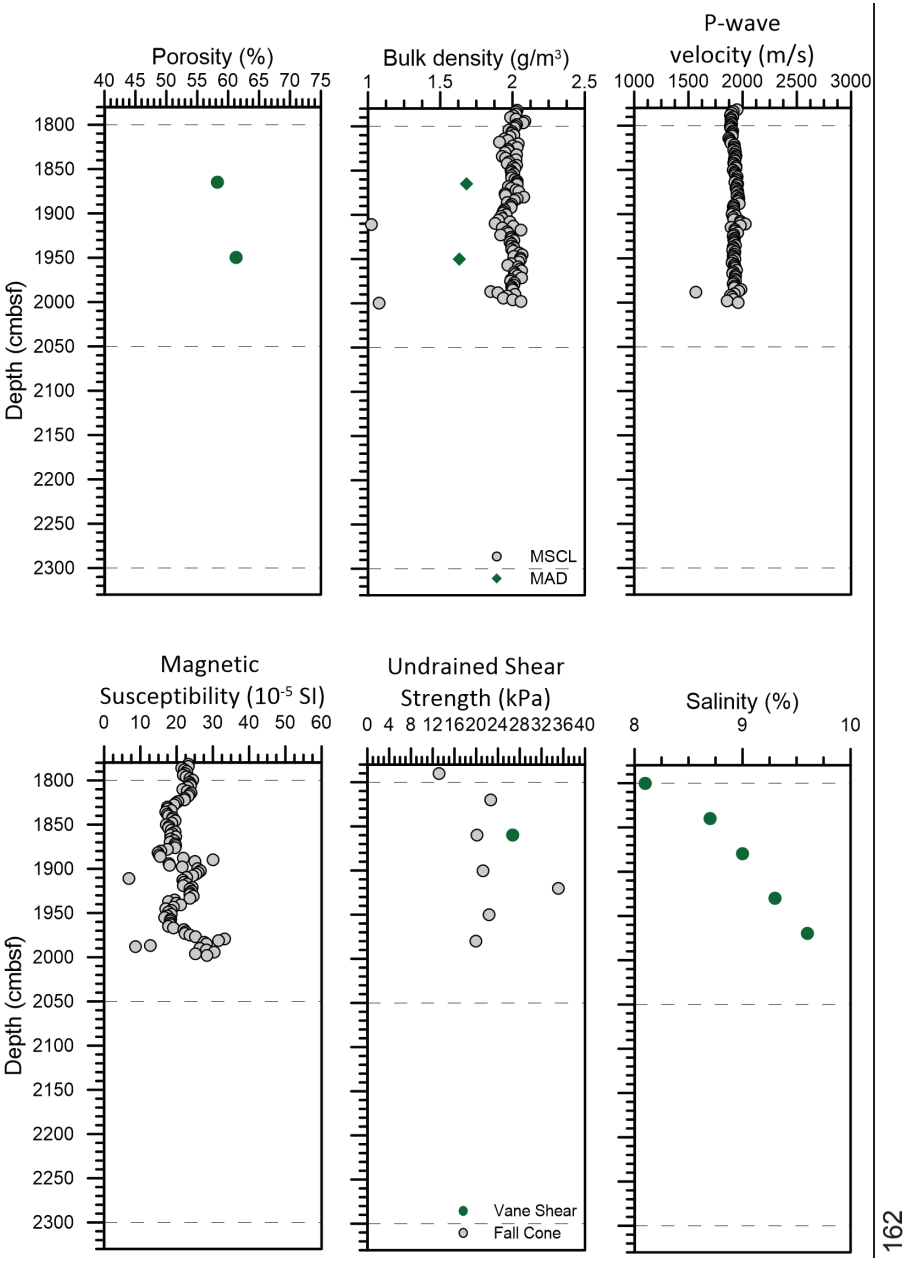
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

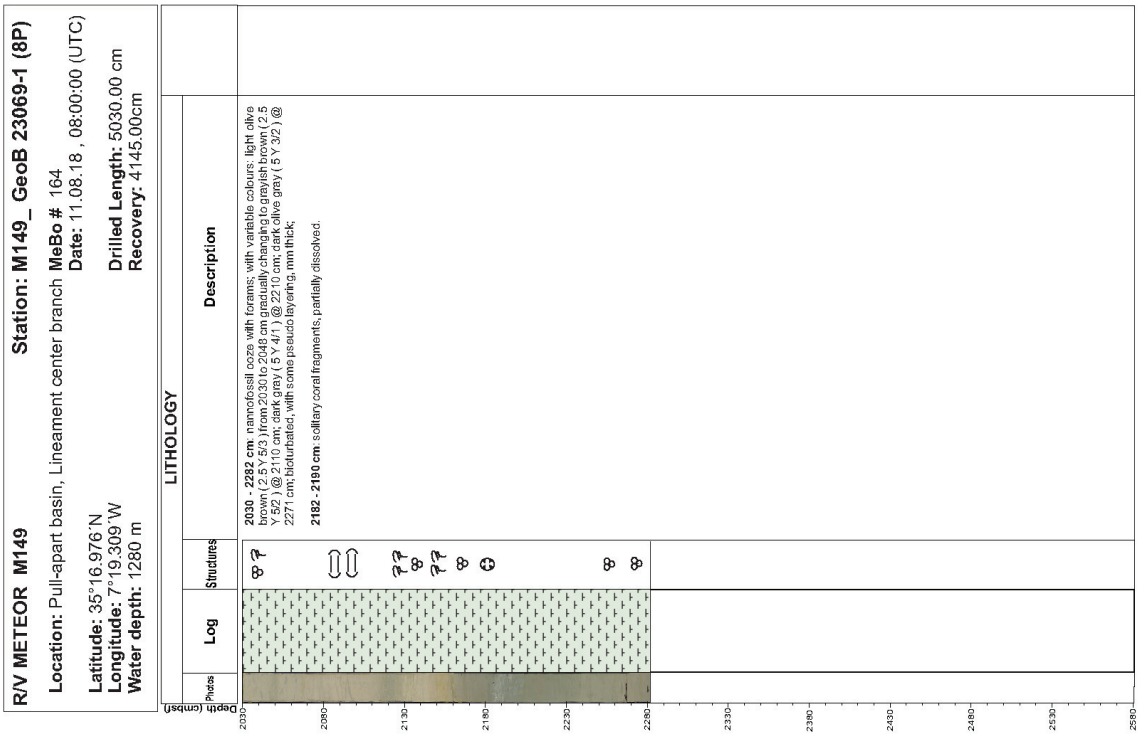
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

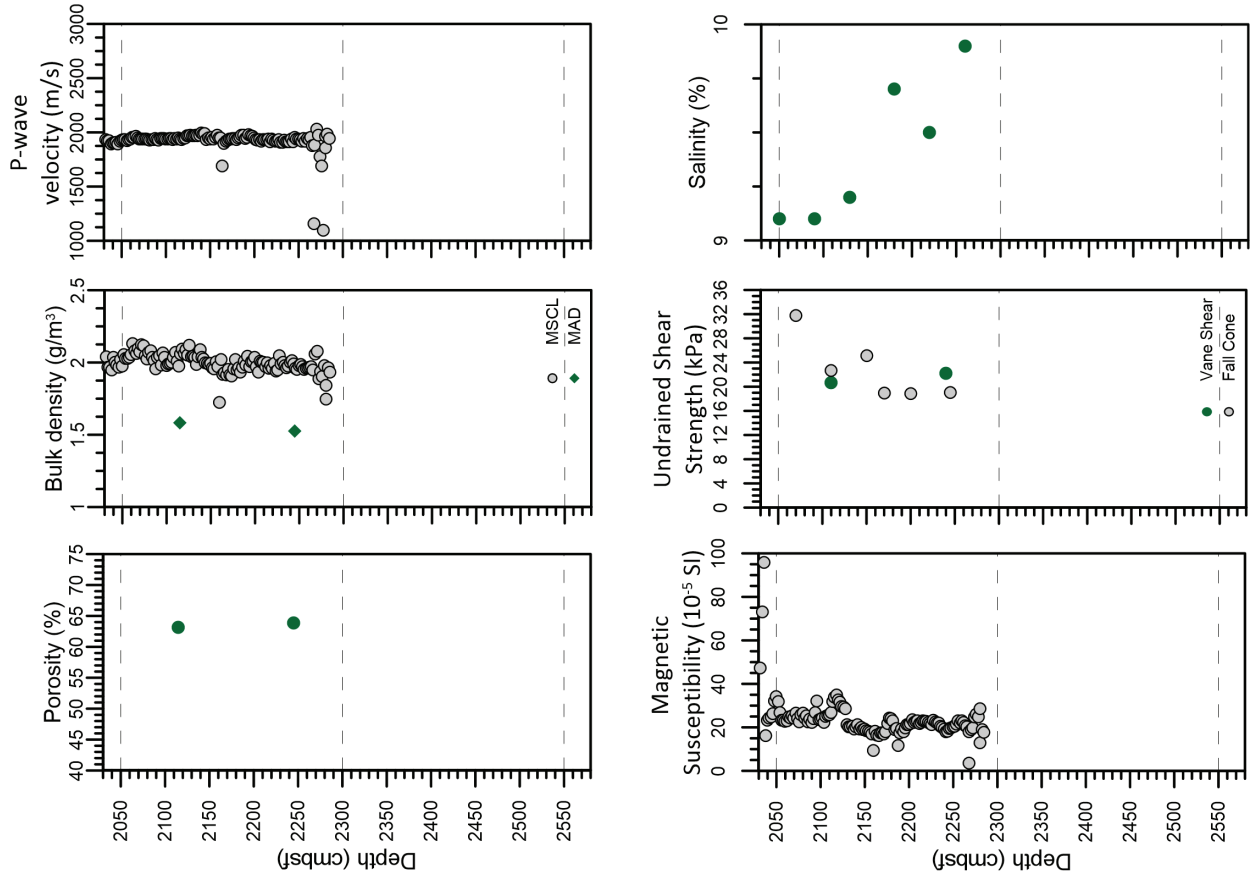
Drilled Length: 5030.00 cm
Recovery: 4145.00cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1780				**1780 - 1879 cm**: foraminiferal ooze; very heterogeneous in colour, with light yellowish brown colour @ 1782 cm changing to light olive brown (2.5 Y 5/6) @ 1820 cm; from 1810 - 1823 cm the sediment is stained with very undulated contours; **1823 - 1880 cm**: dark gray colour (2.5 Y 4/1), in this interval several oblique to sub vertical pseudo layers or veins are observed, resembling flux-like structures; **1880 - 1992 cm**: foram-bearing nannofossil ooze; with a pseudo layer of 5 cm thick at the base, that seems to be cross-cutted by inverse fault from which sub-vertical fluid -like structure is root in; **1992 - 2000 cm** : nannofossil ooze with forams; grayish brown colour (2.5 Y 5/2); heterogeneous with sub vertical flux - like veins or structures between 1908 cm and 1938 cm; bioturbated.
1830				
1880				
1930				
1980				
2030				
2080				
2130				
2180				
2230				
2280				
2330				




R/V METEOR M149
Station: M149_ GeoB 23069-1 (8P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Photos
Log
Structures
Description
Depth (cmbsf)
2030 - 2282 cm: nannofossil ooze with foramns; with variable colours: light olive brown (2.5 Y 5/3),from 2030 to 2048 cm gradually changing to grayish brown (2.5 Y 5/2) @ 2110 cm; dark gray (5 Y 4/1) @ 2210 cm; dark olive gray (5 Y 3/2) @ 2271 cm;bioturbated, with some pseudo layering, mm thick;
2182 - 2190 cm: solitary coral fragments, partially dissolved.

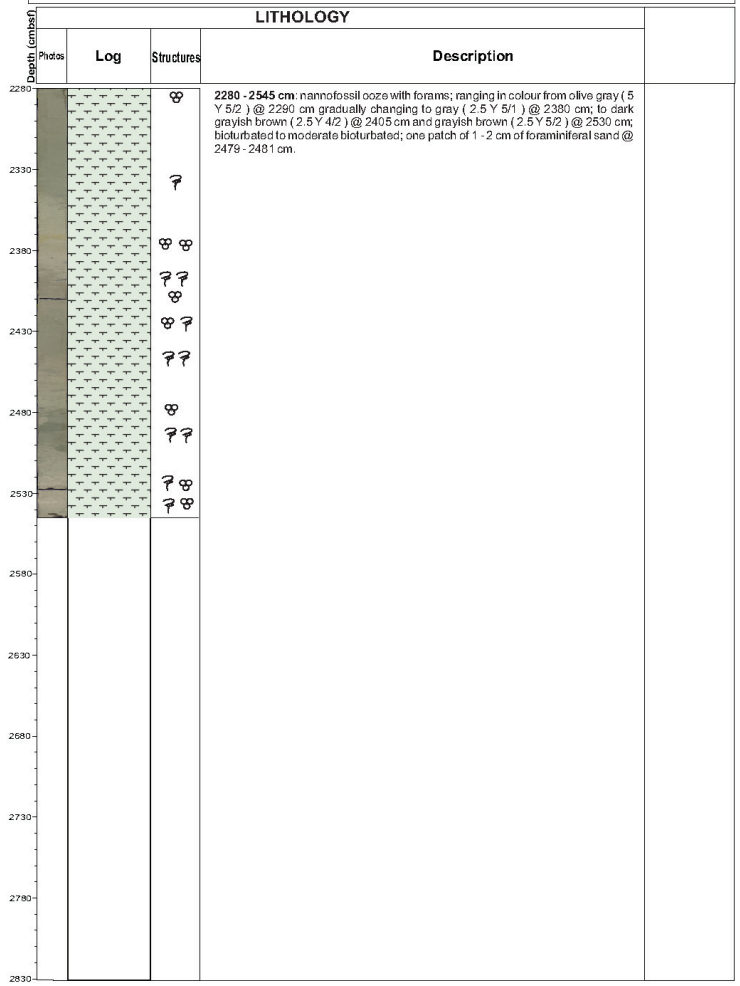

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

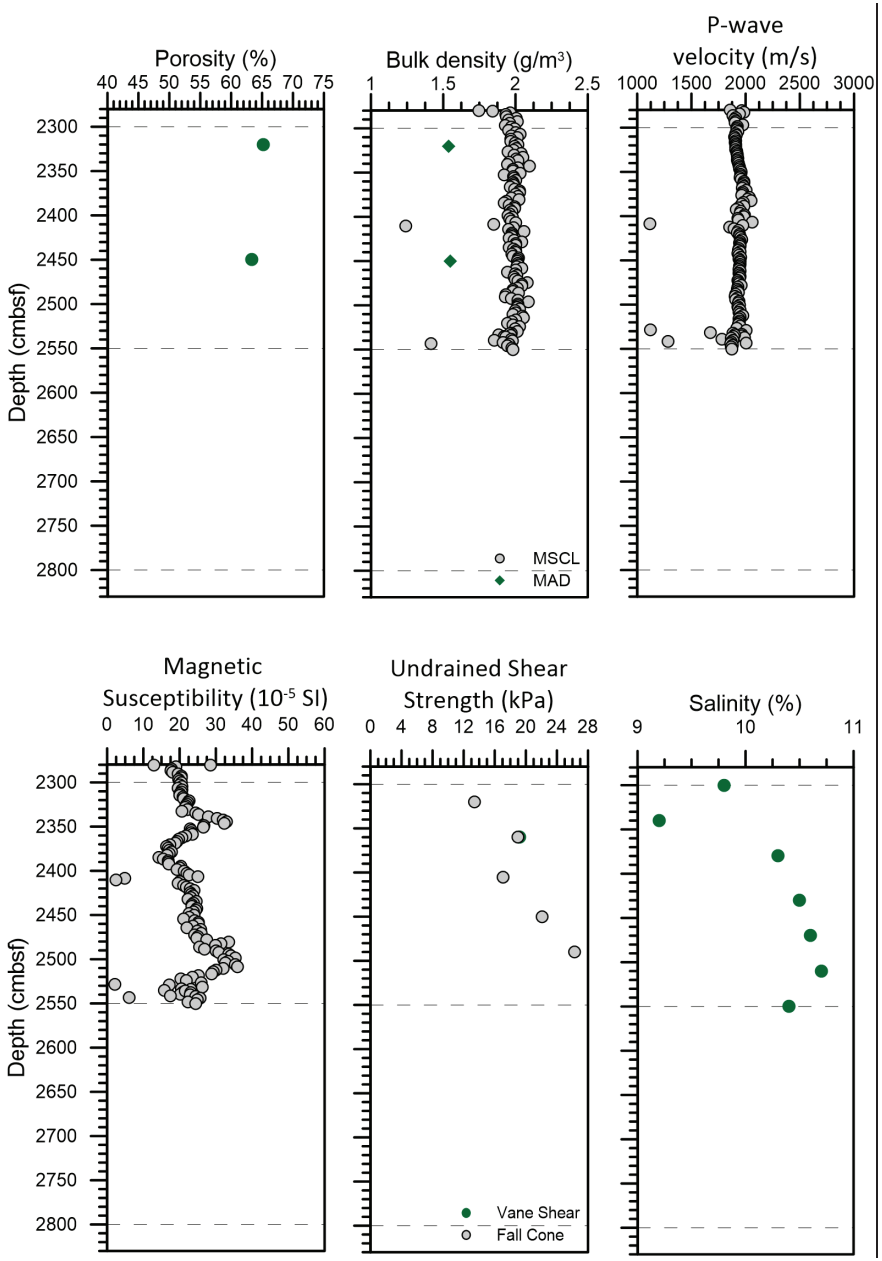
R/V METEOR M149 **Station: M149_ GeoB 23069-1 (9P)**

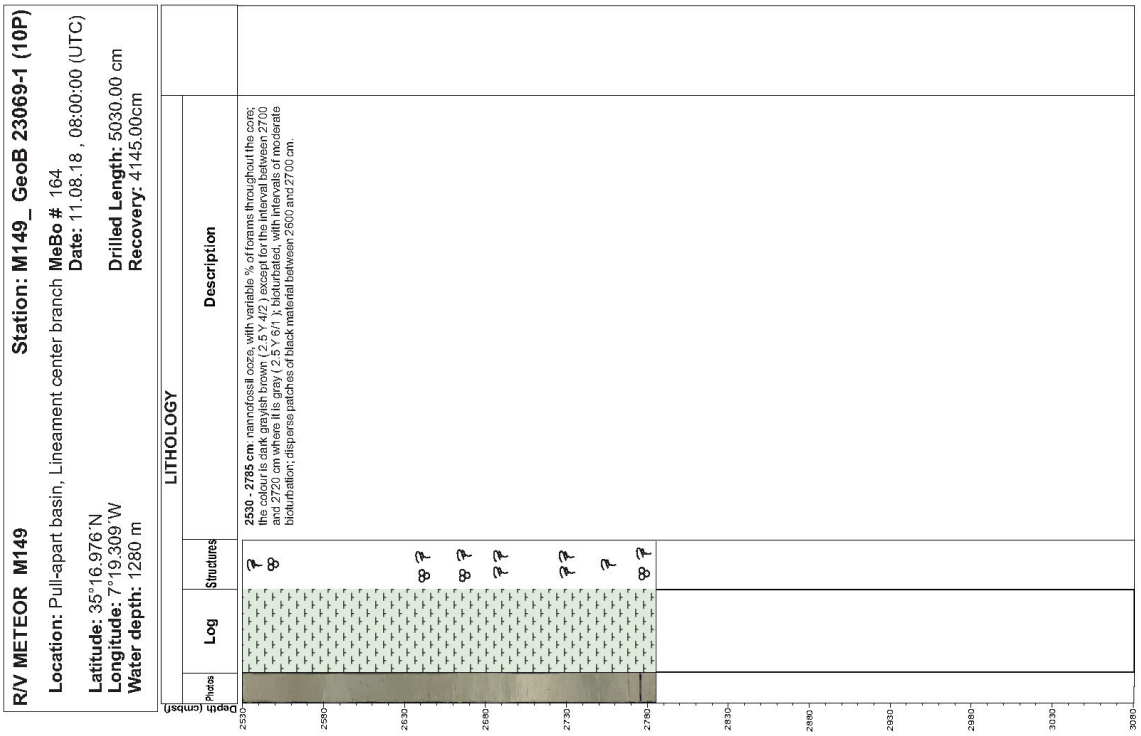
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

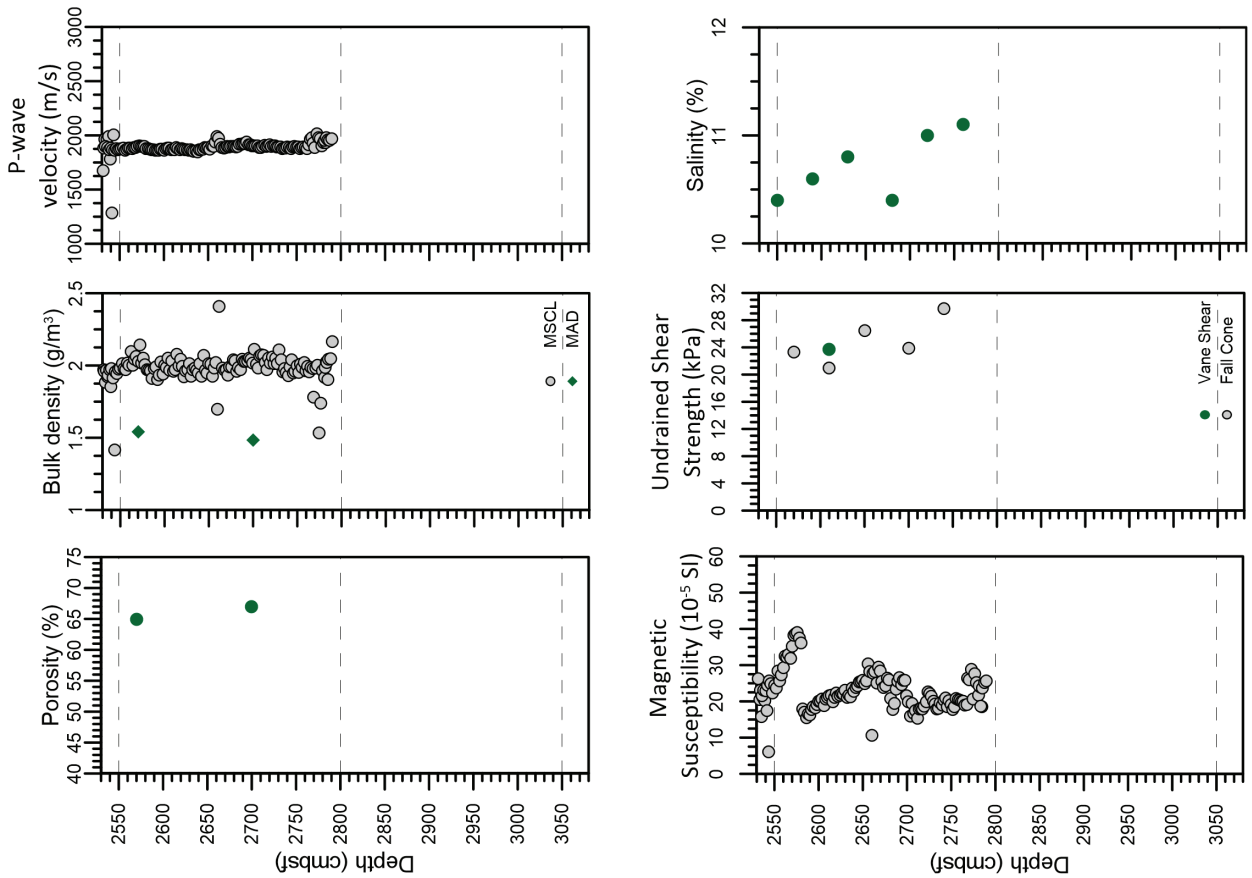
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

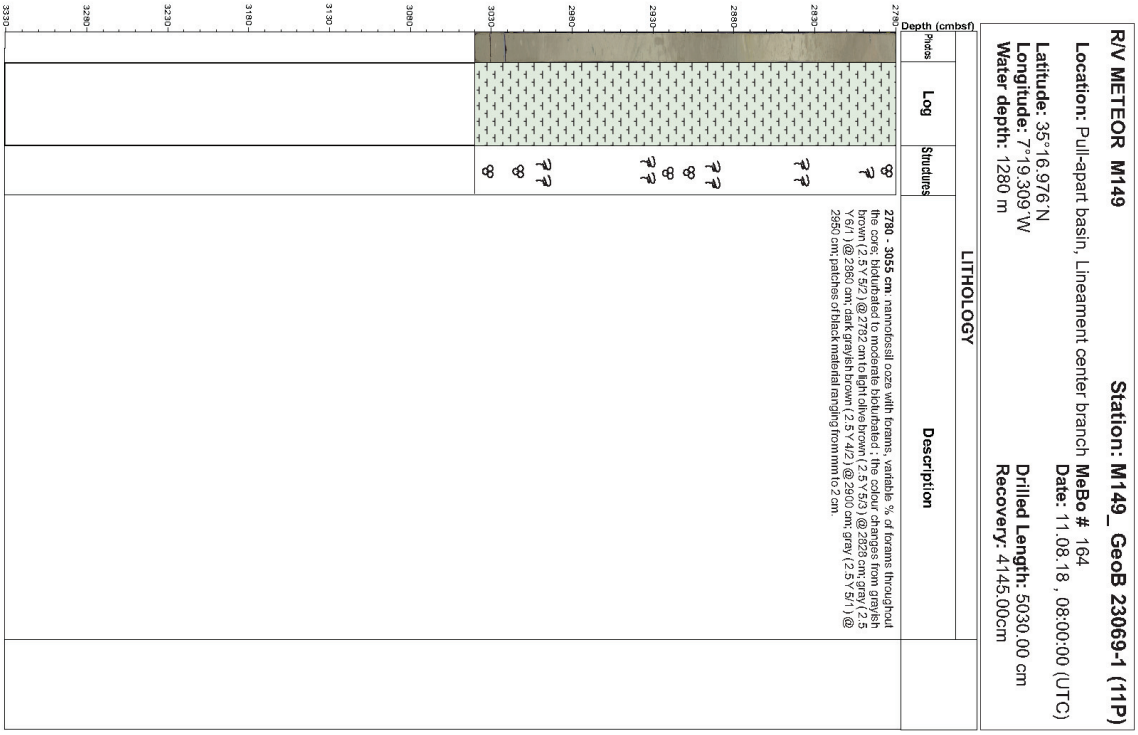
Drilled Length: 5030.00 cm
Recovery: 4145.00cm

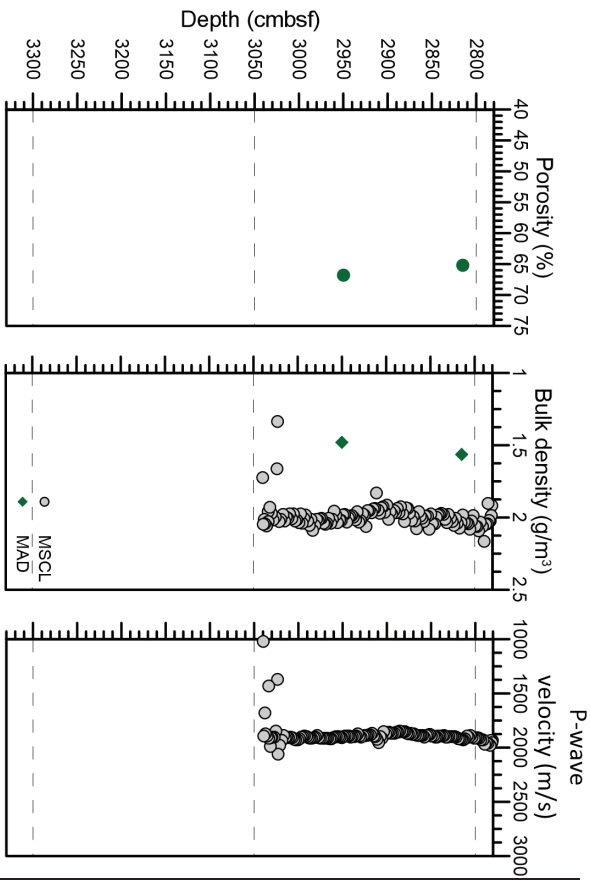


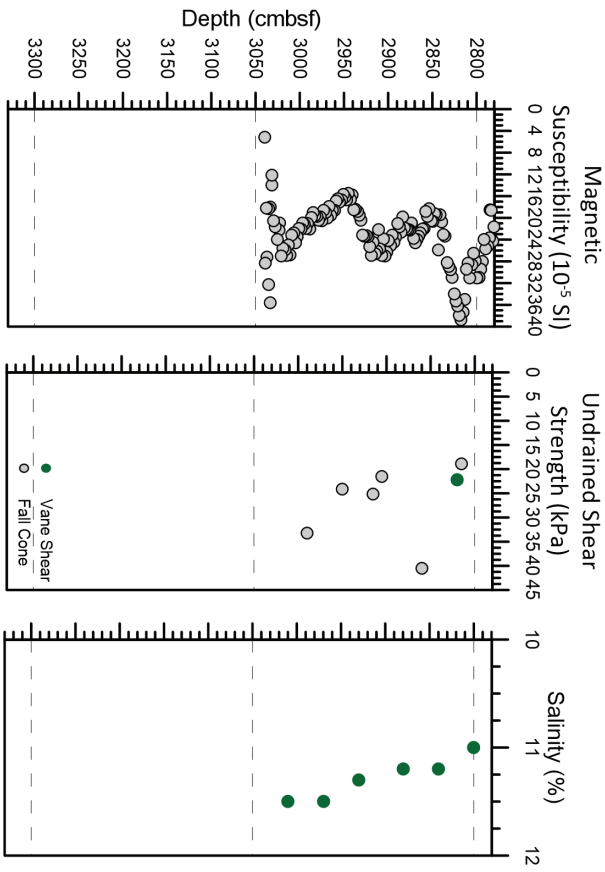


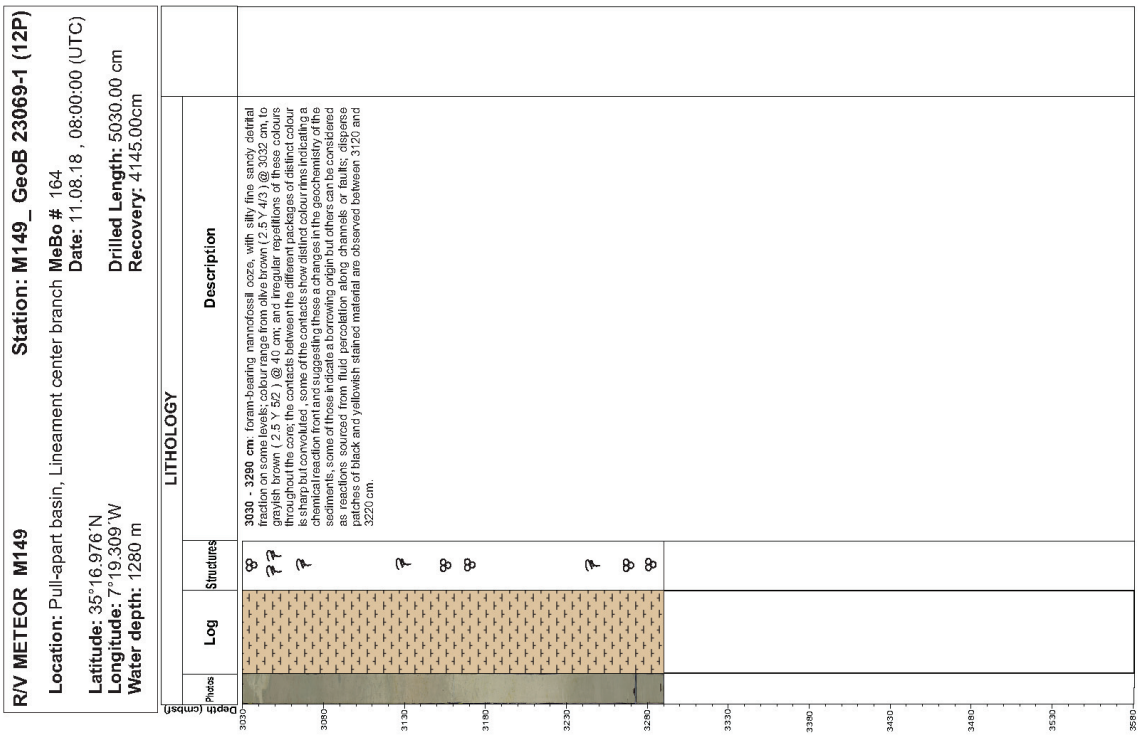

R/V METEOR M149
Station: M149_ GeoB 23069-1 (10P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
2530 - 2785 cm: nannofossil ooze, with variable % of forams throughout the core; the colour is dark greyish brown (2.5 Y 4/2) except for the interval between 2700 and 2720 cm where it is grey (2.5 Y 6/1), bioturbated, with intervals of moderate bioturbation; disperse patches of black material between 2600 and 2700 cm.

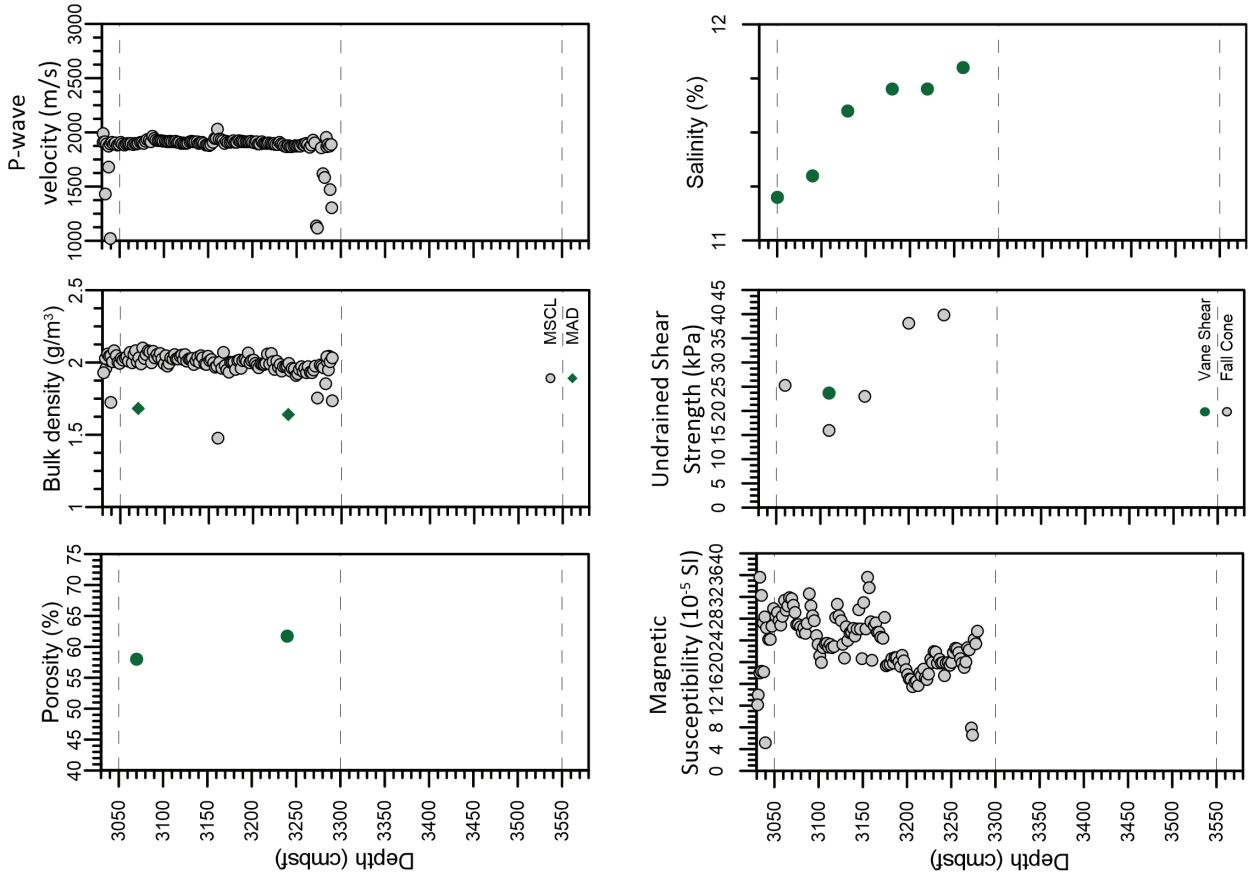

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23069-1 (11P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
2780 - 3055 cm: nannofossil ooze with foram, variable % of forams throughout the core; bioturbated to moderate bioturbated ; the colour changes from grayish brown (2.5 Y 5/2) @ 2782 cm to light olive brown (2.5 Y 5/3) @ 2828 cm; gray (2.5 Y 6/1) @ 2880 cm; dark grayish brown (2.5 Y 4/2) @ 2900 cm; gray (2.5 Y 5/1) @ 2950 cm; patches of black material ranging from mm to 2 cm


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)


Depth (cmbsf)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23069-1 (12P)
Location: Pull-apart basin, Lineament center branch
MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3030 - 3290 cm: foram-bearing nannofossil ooze, with silty fine sandy detrital fraction on some levels; colour range from olive brown (2.5 Y 4/3) @ 3032 cm, to grayish brown (2.5 Y 5/2) @ 40 cm; and irregular repetitions of these colours throughout the core; the contacts between the different packages of distinct colour is sharp but convoluted , some of the contacts show distinct colour rims indicating a chemical reaction front and suggesting these a changes in the geochemistry of the sediments; some of those indicate a borrowing origin but others can be considered as reactions sourced from fluid percolation along channels or faults; disperse patches of black and yellowish stained material are observed between 3120 and 3220 cm.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23069-1 (13P)**

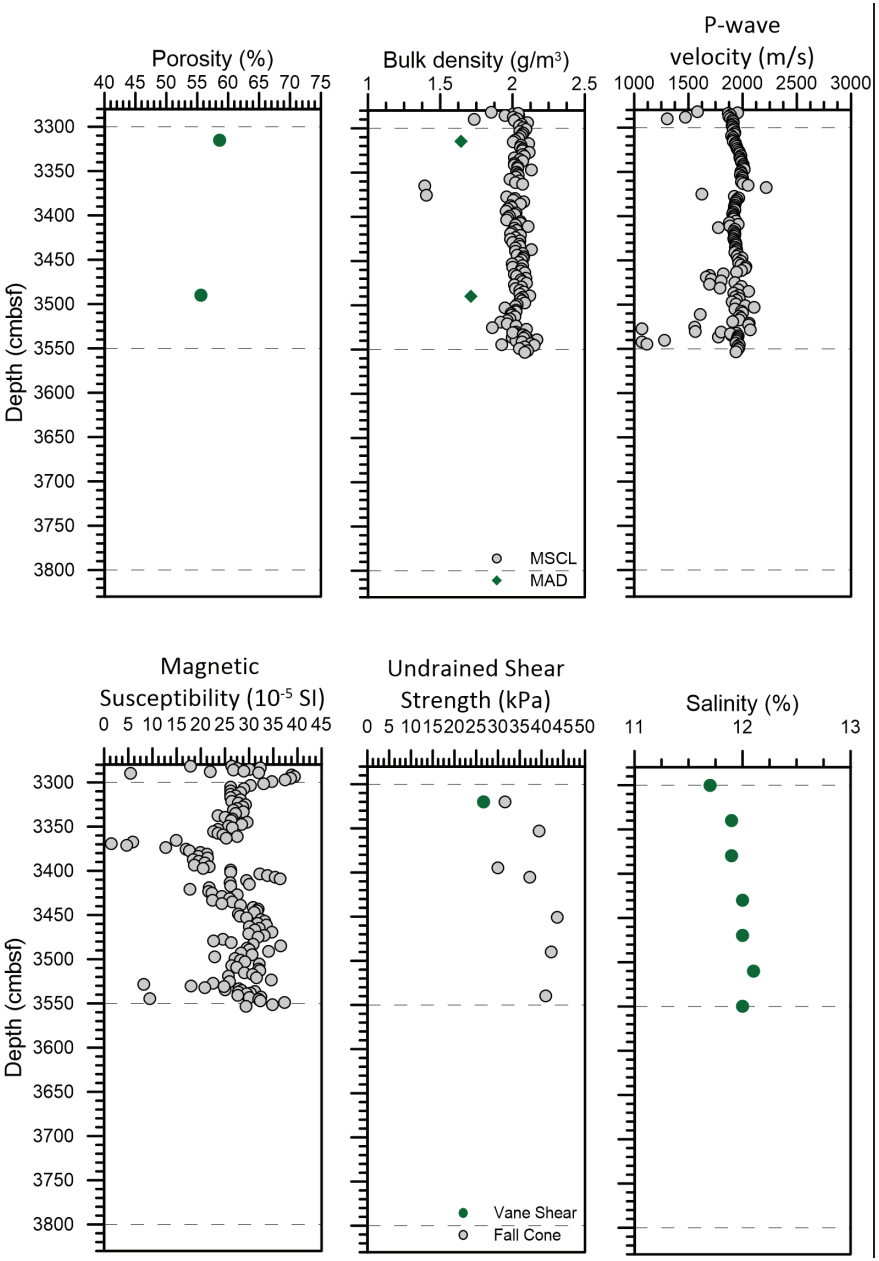
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

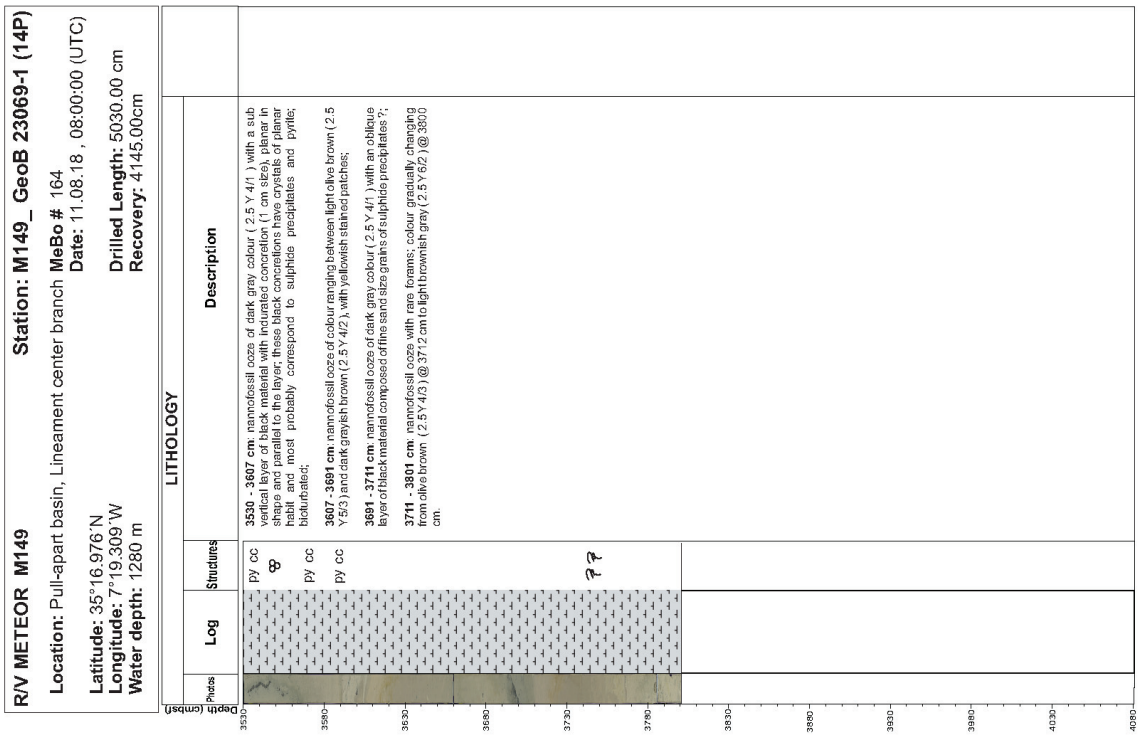
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

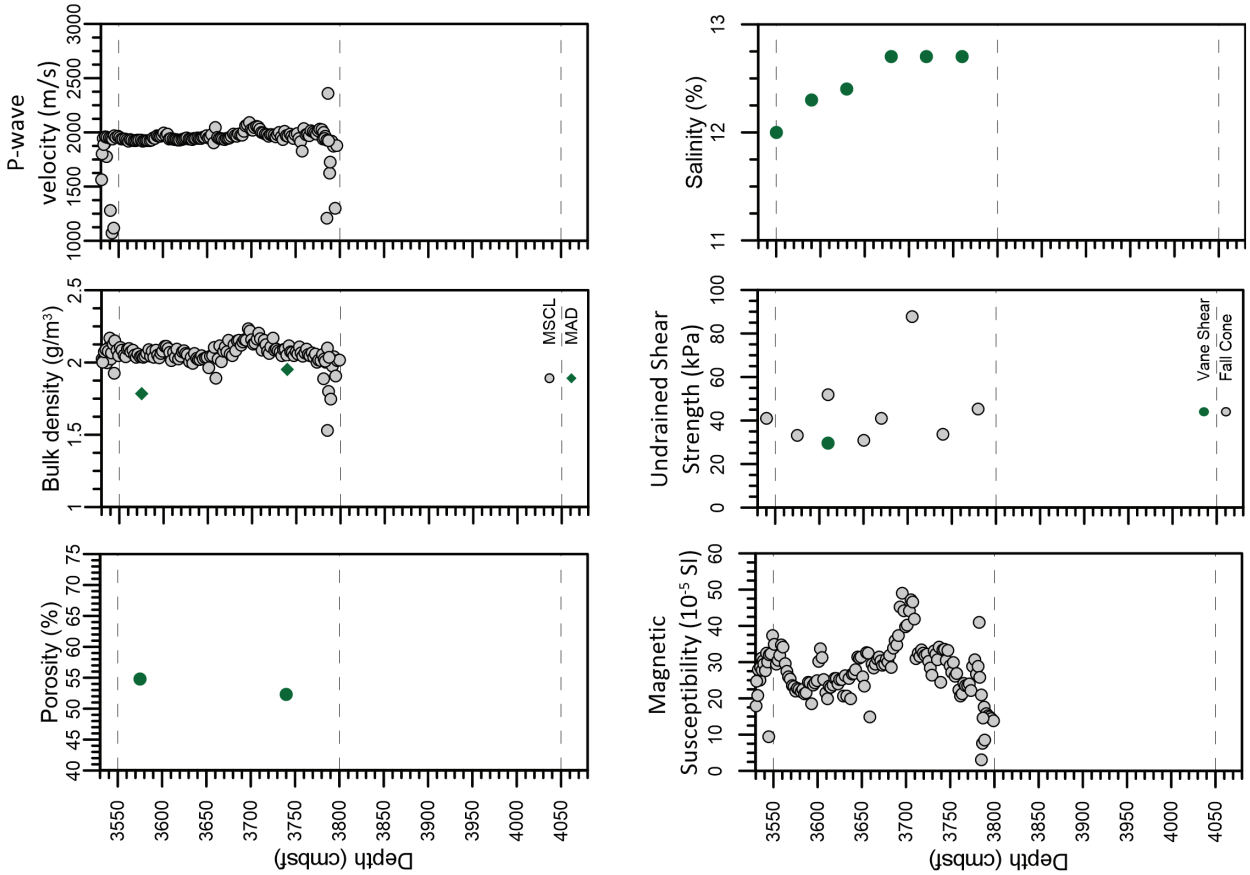
Drilled Length: 5030.00 cm
Recovery: 4145.00cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
3280				**3280 - 3580 cm**: nannofossil ooze with forams and variable fraction of silty to very fine sandy detritals; very heterogeneous in colour, ranging from grayish brown (2.5 Y 5/2) to dark grayish brown (2.5 Y 4/2) to gray (2.5 Y 5/1); the colour variations are sharp but with a complex structure/ texture, sometimes chaotic and sometimes defining sharp bottom and top contacts, often defining pseudo layers; between 3360 and 3378 cm an open void, with 2 clear straight and very well defined planes, oblique to the core liner and the 2 planes are perpendicular to each other, this void is interpreted as result of coring effect that rotated 90° the section above or below this depth and displaced it by ~ 10 cm; the "fault" plane along which this rotation occurred could have been previously existent;
3330				
3380				**3519 - 3545 cm**: nannofossil ooze of dark gray colour (2.5 Y 4/1) with a oblique layer or plane-like layer of black material, with an indurated platy shaped concretion of 2 cm of authigenic sulfide minerals including pyrite.
3430				
3480				
3530			py	
3580				
3630				
3680				
3730				
3780				
3830				




R/V METEOR M149
Station: M149_ GeoB 23069-1 (14P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photos
Log
Structures
Description
3530 - 3607 cm: nannofossil ooze of dark gray colour (2.5 Y 4/1) with a sub vertical layer of black material with indurated concretion (1 cm size), planar in shape and parallel to the layer; these black concretions have crystals of planar habit and most probably correspond to sulphide precipitates and pyrite; bioturbated;
3607 - 3691 cm: nannofossil ooze of colour ranging between light olive brown (2.5 Y 5/3) and dark grayish brown (2.5 Y 4/2), with yellowish stained patches;
3691 - 3711 cm: nannofossil ooze of dark gray colour (2.5 Y 4/1) with an oblique layer of black material composed of fine sand size grains of sulphide precipitates ?;
3711 - 3801 cm: nannofossil ooze with rare forams; colour gradually changing from olive brown (2.5 Y 4/3) @ 3712 cm to light brownish gray (2.5 Y 6/2) @ 3800 cm.
py cc
py cc
py cc
??
3530
3580
3630
3680
3730
3780
3830
3880
3930
3980
4030
4080

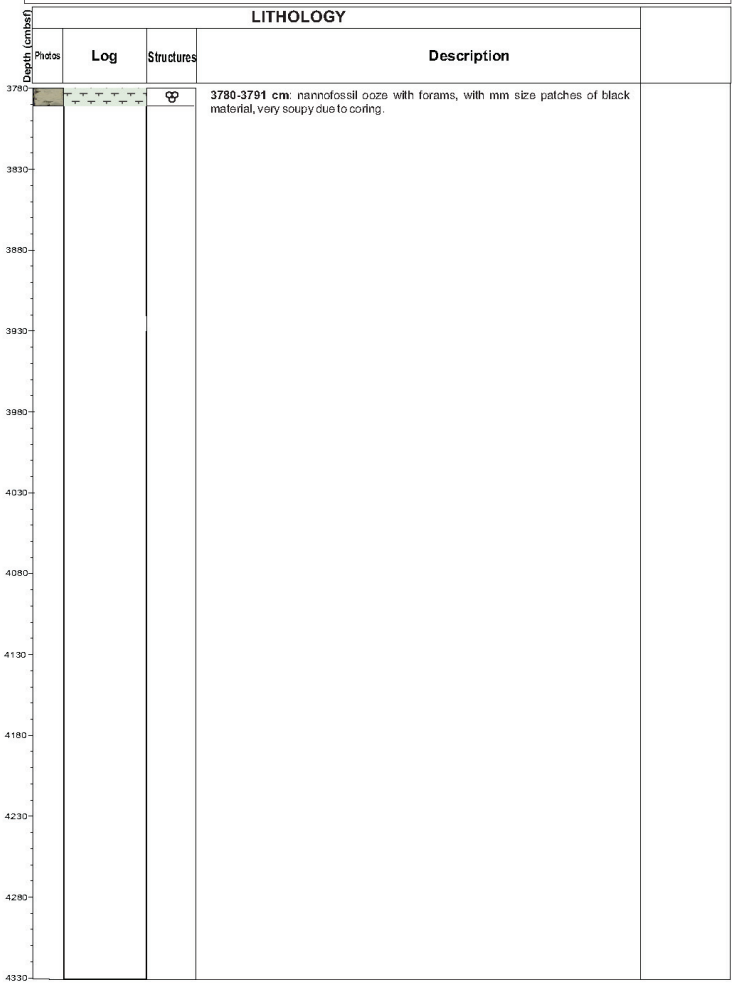

P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Depth (cmbsf)
3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050
Salinity (%)
11 12 13
Undrained Shear Strength (kPa)
0 20 40 60 80 100
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 10 20 30 40 50 60
Depth (cmbsf)
3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050

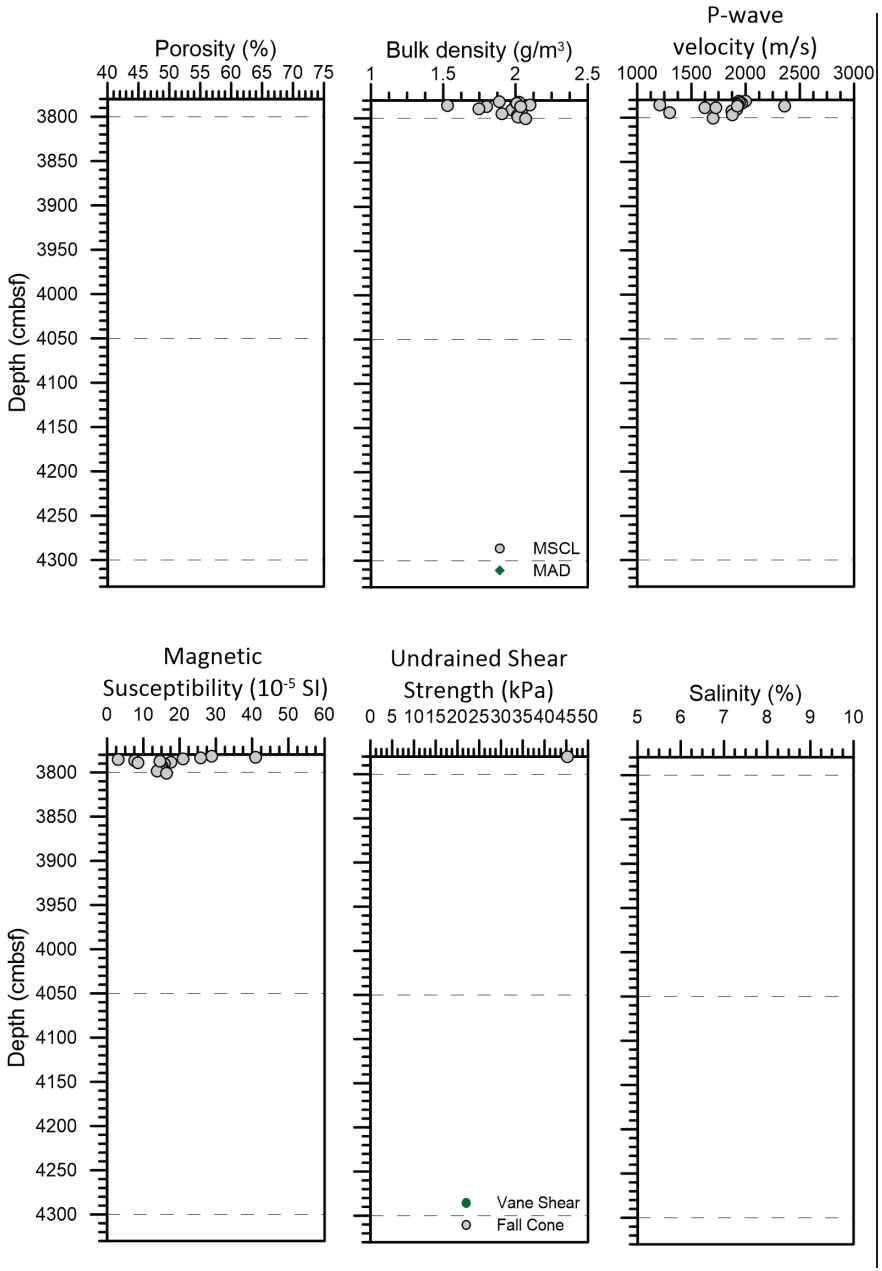
R/V METEOR M149 **Station: M149_ GeoB 23069-1 (15P)**

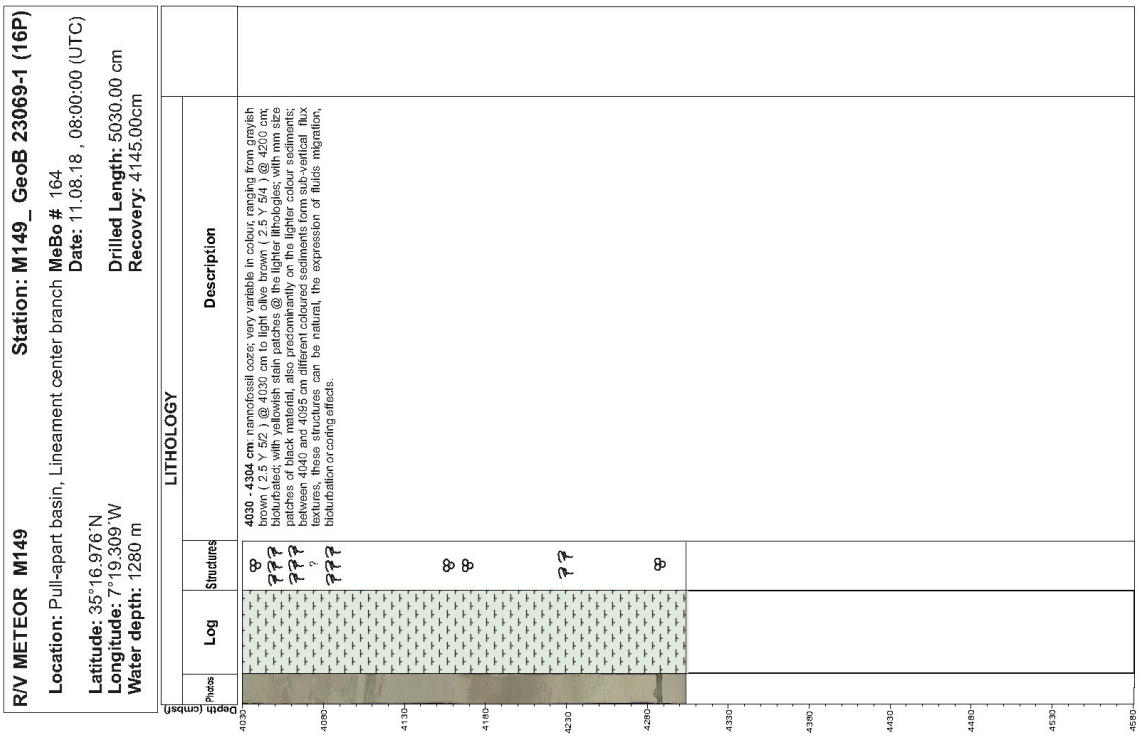
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

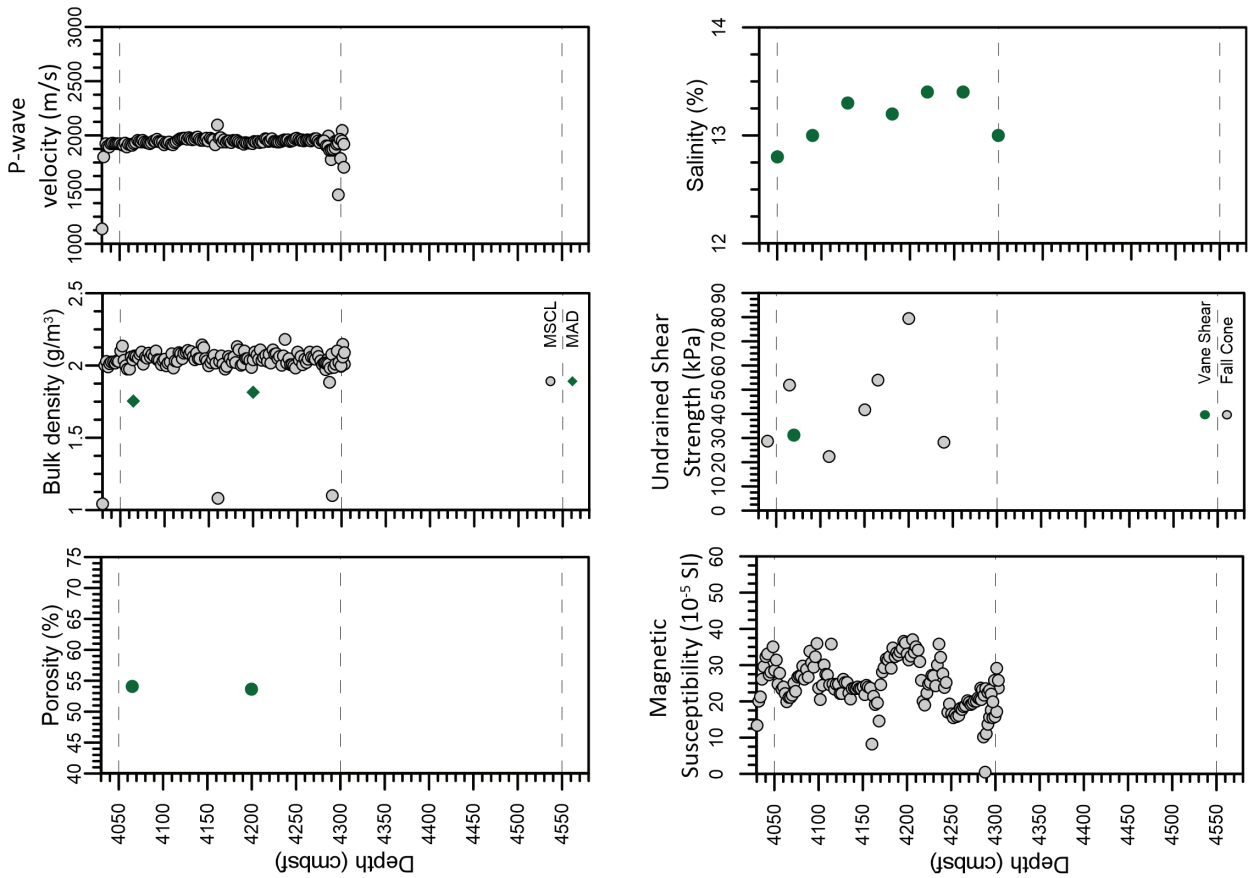
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

Drilled Length: 5030.00 cm
Recovery: 4145.00cm






R/V METEOR M149
Station: M149_ GeoB 23069-1 (16P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
4030 - 4304 cm: nannofossil ooze; very variable in colour, ranging from greyish brown (2.5 Y 5/2) @ 4030 cm to light olive brown (2.5 Y 5/4) @ 4200 cm; bioturbated; with yellowish stain patches @ the lighter lithologies; with mm size patches of black material, also predominantly on the lighter colour sediments; between 4040 and 4045 cm different coloured sediments form sub-vertical flux textures, these structures can be natural, the expression of fluids migration, bioturbation or coring effects.

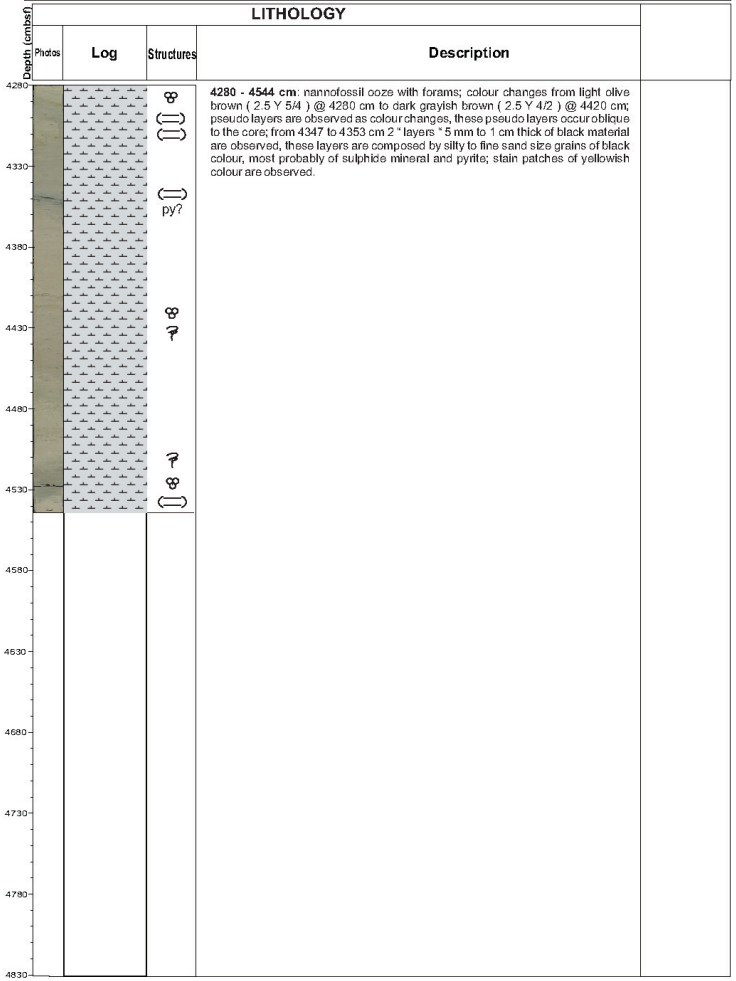

P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

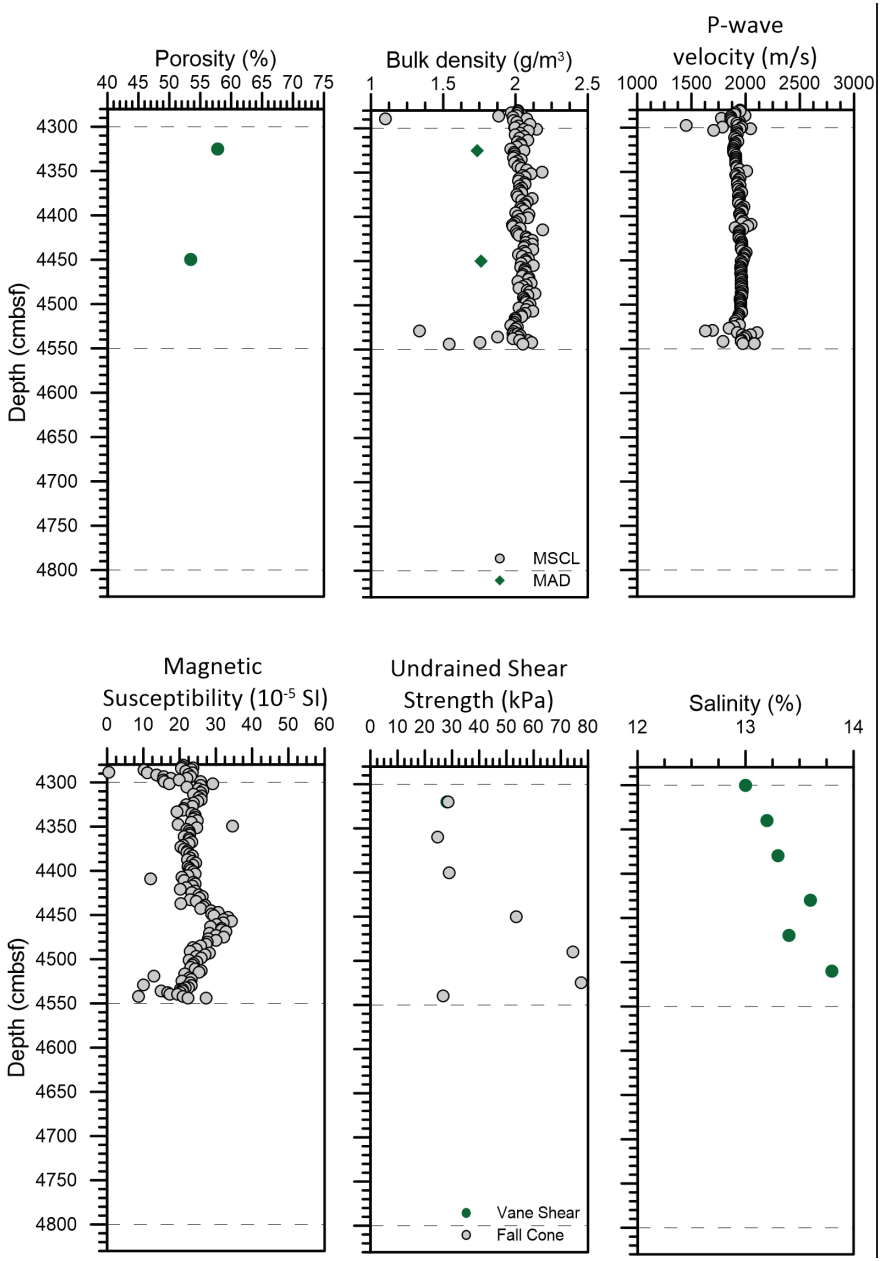
R/V METEOR M149 **Station: M149_ GeoB 23069-1 (17P)**

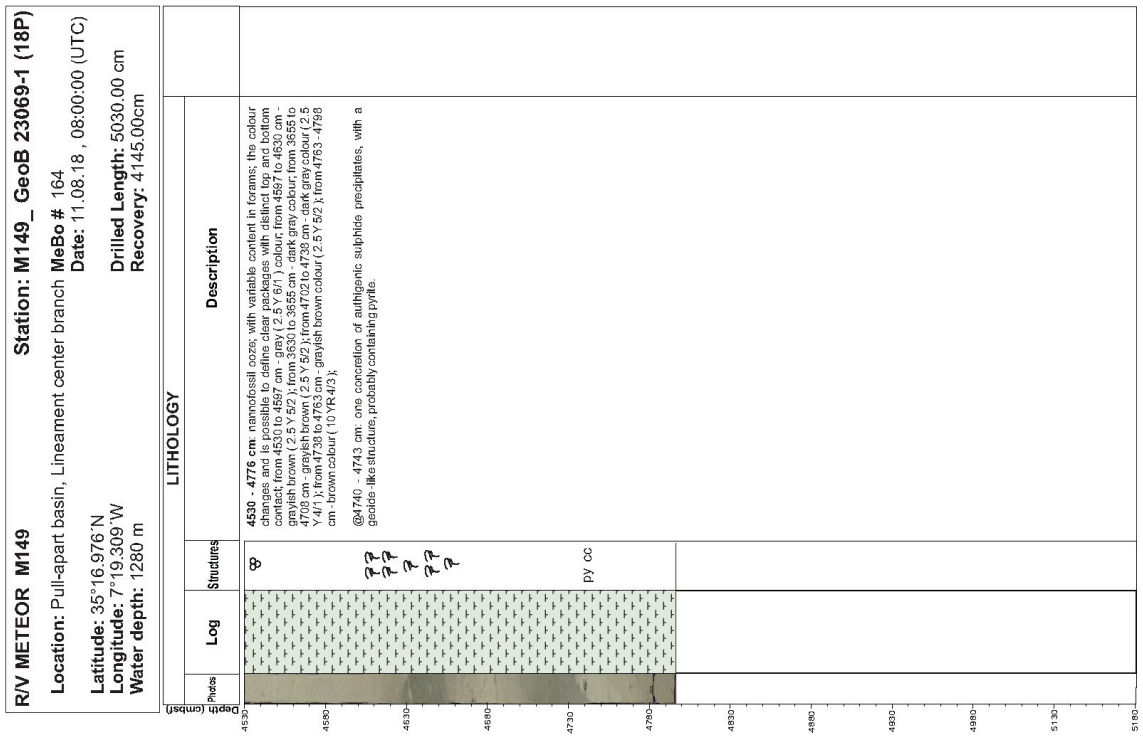
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

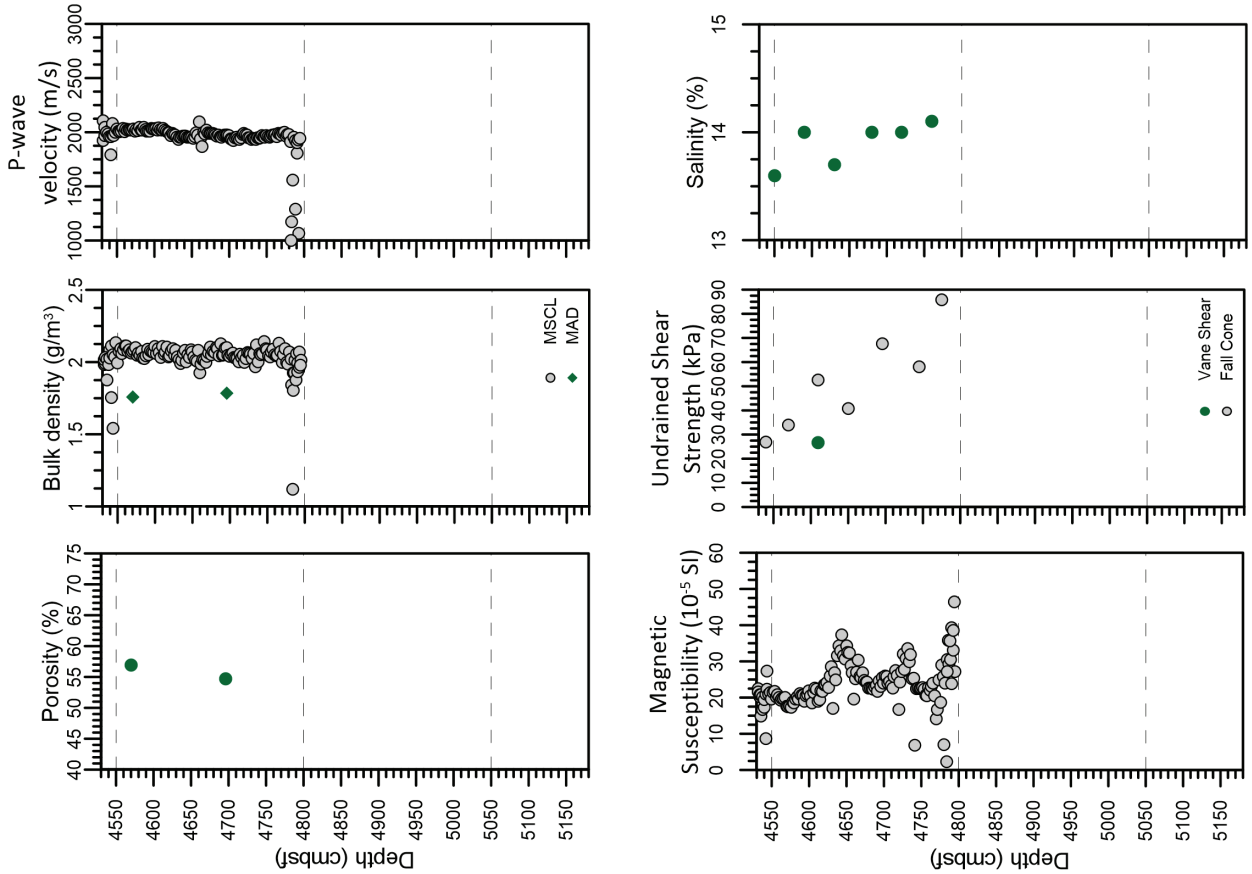
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

Drilled Length: 5030.00 cm
Recovery: 4145.00cm






R/V METEOR M149
Station: M149_ GeoB 23069-1 (18P)
Location: Pull-apart basin, Lineament center branch MeBo # 164
Date: 11.08.18 , 08:00:00 (UTC)
Latitude: 35°16.976'N
Longitude: 7°19.309'W
Water depth: 1280 m
Drilled Length: 5030.00 cm
Recovery: 4145.00cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
4530 - 4776 cm: nannofossil ooze; with variable content in forams; the colour changes and is possible to define clear packages with distinct top and bottom contact: from 4530 to 4597 cm - grey (2.5 Y 6/1) colour; from 4597 to 4630 cm - grayish brown (2.5 Y 5/2); from 3630 to 3655 cm - dark gray colour; from 3655 to 4708 cm - grayish brown (2.5 Y 5/2); from 47021o 4738 cm - dark gray colour (2.5 Y 4/1); from 4738 to 4763 cm - greyish brown colour (2.5 Y 5/2); from 4763 - 4798 cm - brown colour (10 YR 4/3);
@4740 - 4743 cm: one concretion of authigenic sulphide precipitates, with a geode- like structure, probably containing pyrite.
py
cc
4530
4580
4630
4680
4730
4780
4830
4880
4930
4980
5130
5180


P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Salinity (‰)
13 14 15
Undrained Shear Strength (kPa)
0 10 20 30 40 50 60 70 80 90
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 10 20 30 40 50 60
Depth (cmbsf)
4550 4600 4650 4700 4750 4800 4850 4900 4950 5000 5050 5100 5150

R/V METEOR M149 **Station: M149_ GeoB 23069-1 (19P)**

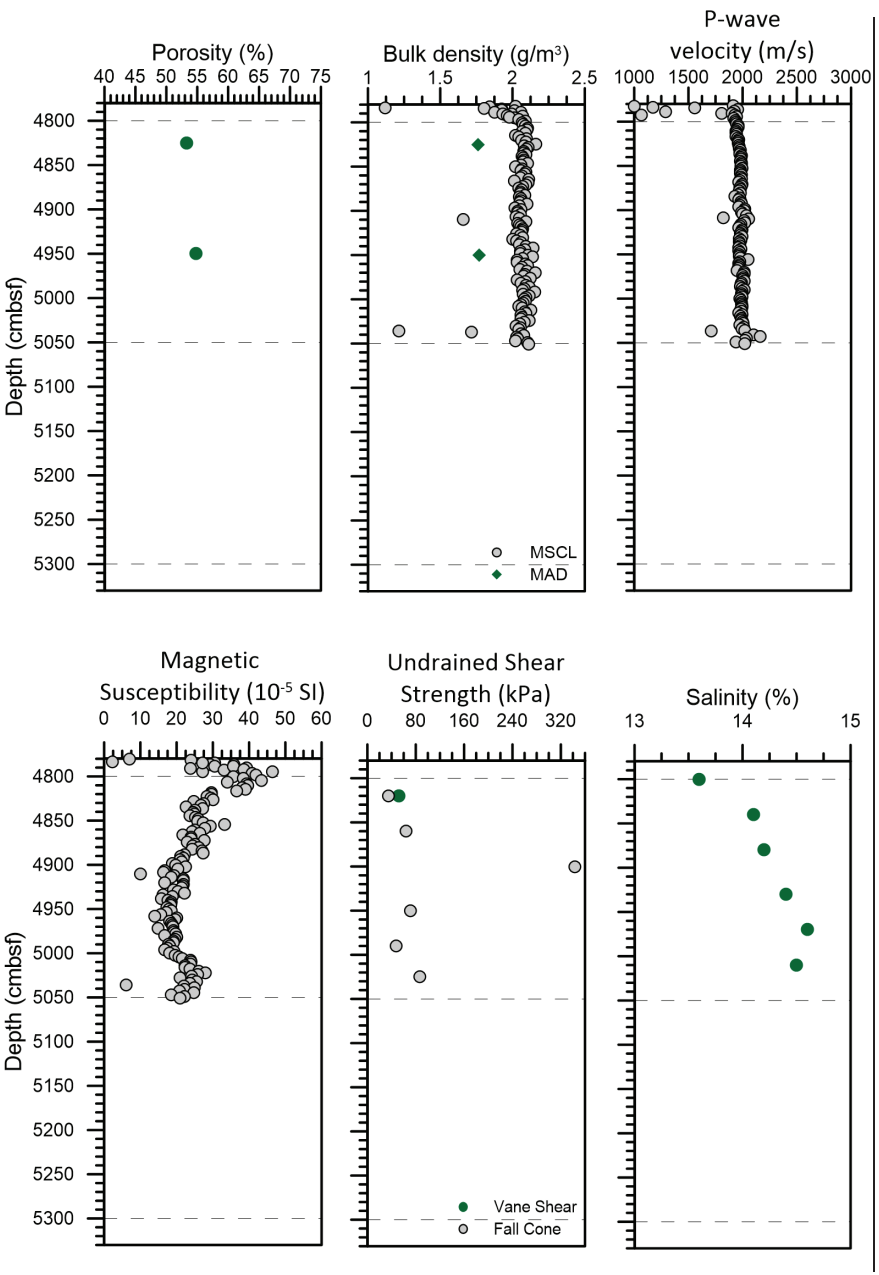
Location: Pull-apart basin, Lineament center branch **MeBo #** 164
Date: 11.08.18 , 08:00:00 (UTC)

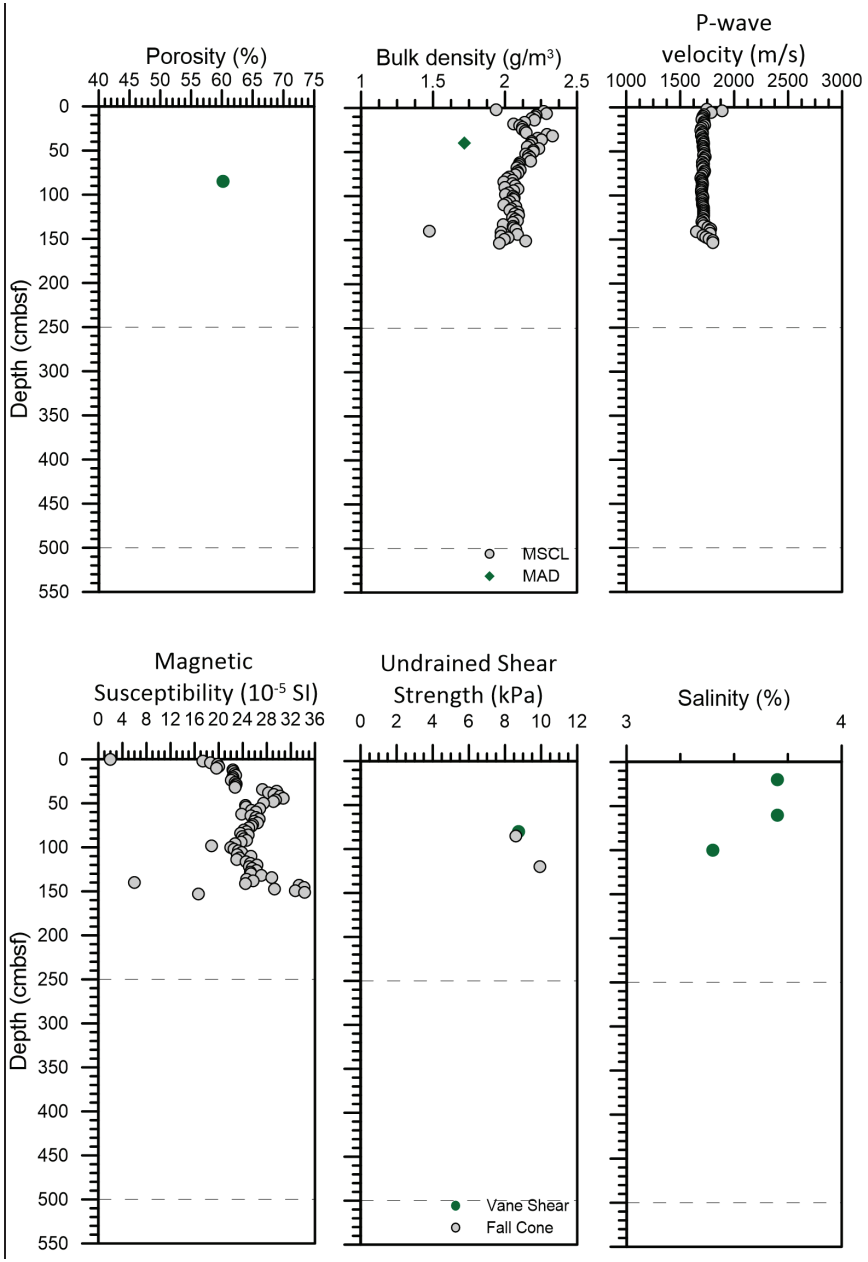
Latitude: 35°16.976´N
Longitude: 7°19.309´W
Water depth: 1280 m

Drilled Length: 5030.00 cm
Recovery: 4145.00cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
4780				**4780 - 4790 cm**: foraminiferal ooze, disturbed by coring with cracks; dark gray colour (2.5 Y 4/1);
4830				**4790 - 5052 cm**: nannofossil ooze; with variable % of forams; bioturbated on the top 50 cm; colour gradually changing from dark grayish brown (2.5 Y 4/2) @ 4795 cm to light brownish gray (2.5 Y 6/2) @ 4950 cm and to grayish brown (2.5 Y 5/2) @ 5052 cm;
4880				@ 4998 cm: one patch of 1 cm size of foraminiferal sand with forams being stained by black material on a mud of black matrix, probably of sulphide minerals.
4930				
4980				
5130				
5180				
5230				
5280				
5330				
5380				
5430				



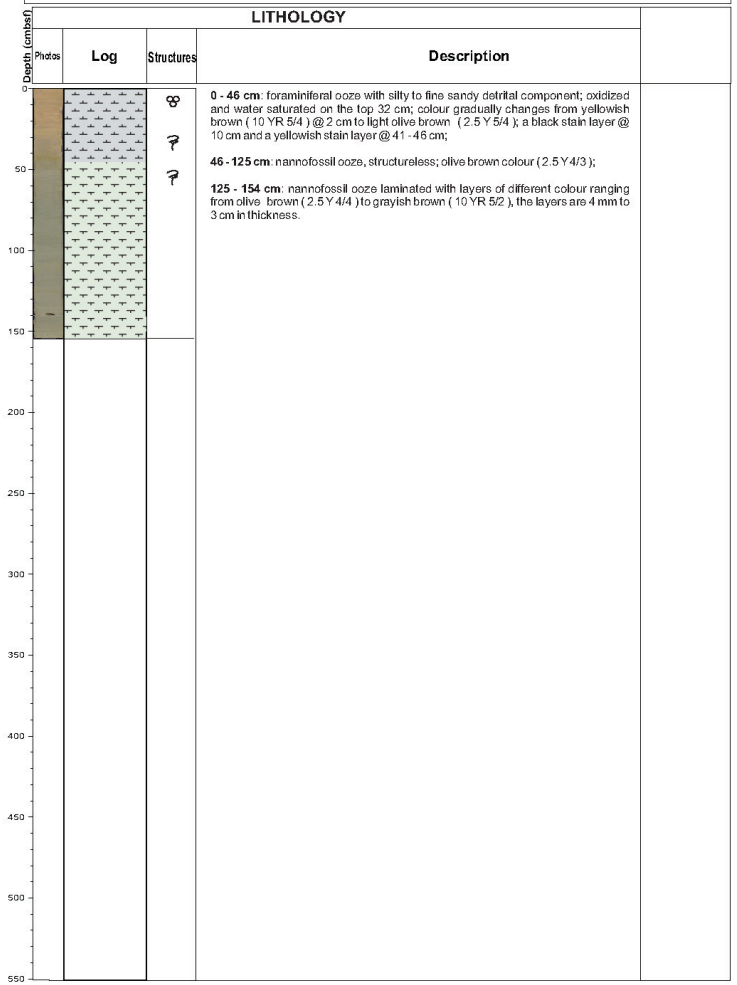


R/V METEOR M149 **Station: M149_ GeoB 23073-1 (1P)**

Location: Pull-apart basin lineament south

Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm



0 - 46 cm: foraminiferal ooze with silty to fine sandy detrital component; oxidized and water saturated on the top 32 cm; colour gradually changes from yellowish brown (10 YR 5/4) @ 2 cm to light olive brown (2.5 Y 5/4); a black stain layer @ 10 cm and a yellowish stain layer @ 41 - 46 cm;

46 - 125 cm: nannofossil ooze, structureless; olive brown colour (2.5 Y 4/3);

125 - 154 cm: nannofossil ooze laminated with layers of different colour ranging from olive brown (2.5 Y 4/4) to grayish brown (10 YR 5/2), the layers are 4 mm to 3 cm in thickness.

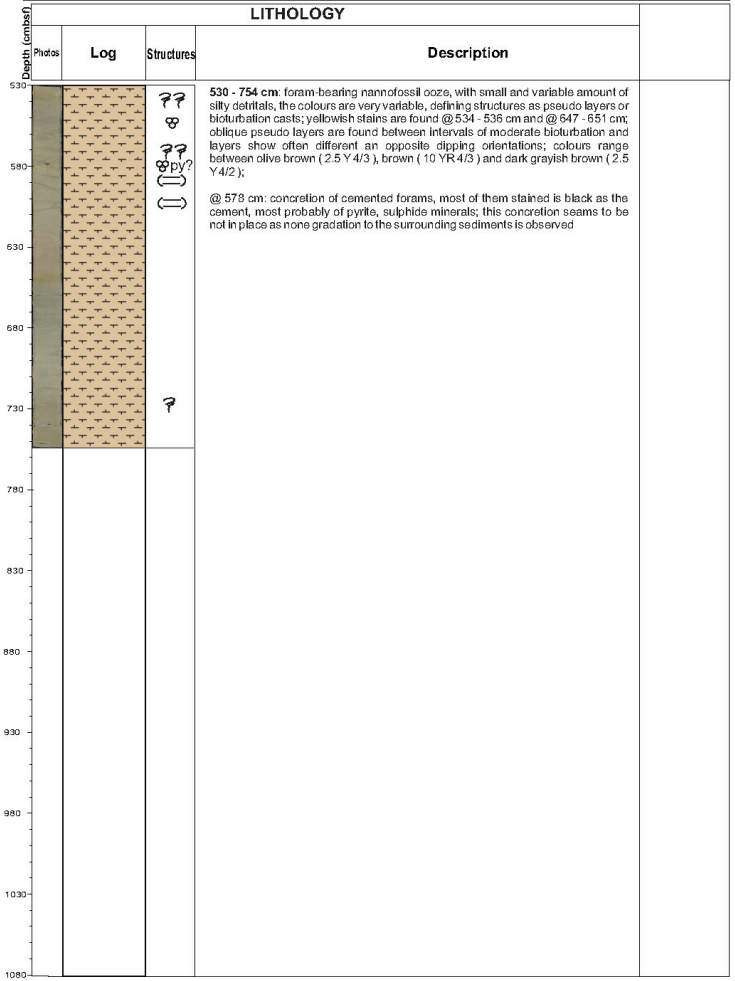
R/V METEOR M149 **Station: M149_ GeoB 23073-1 (2P)**

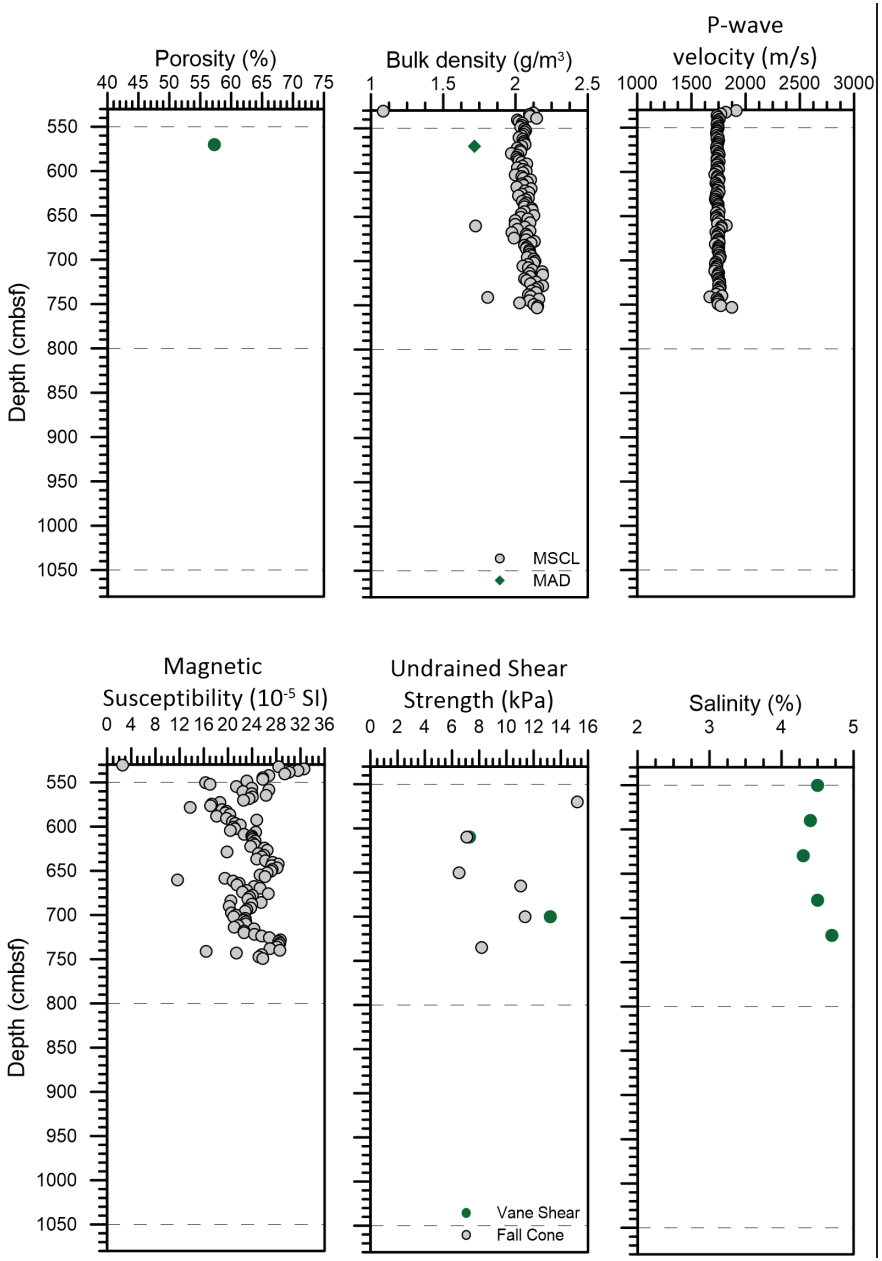
Location: Pull-apart basin lineament south

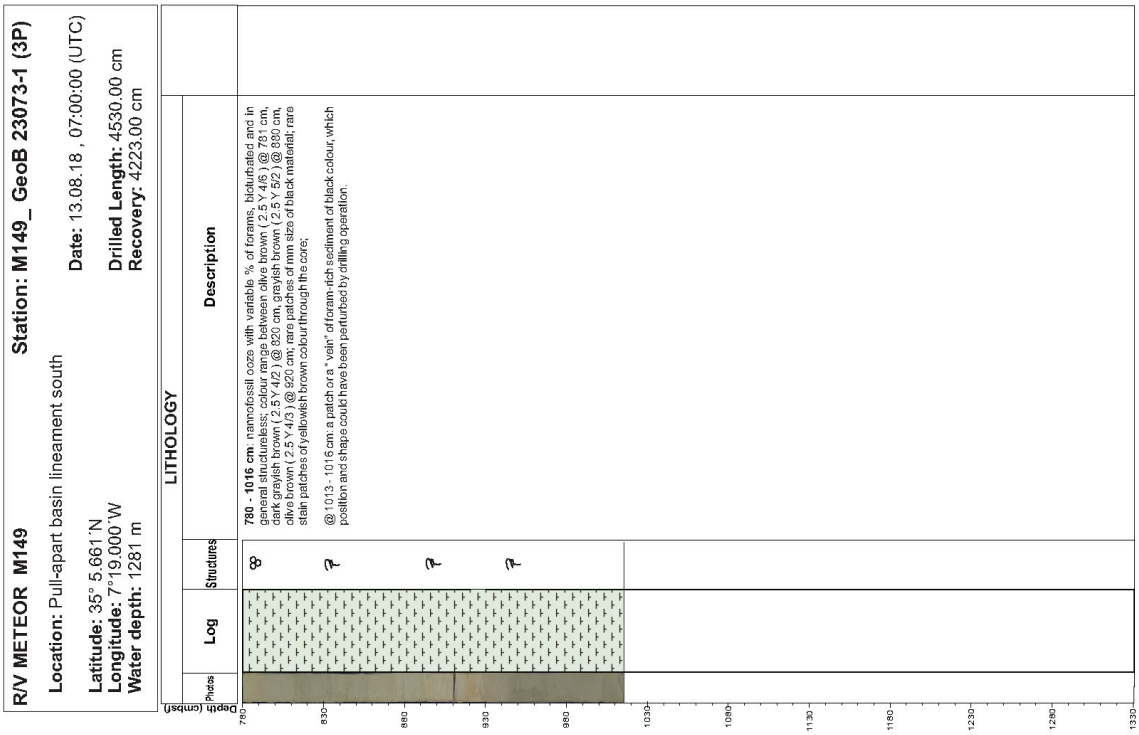
Date: 13.08.18 , 07:00:00 (UTC)

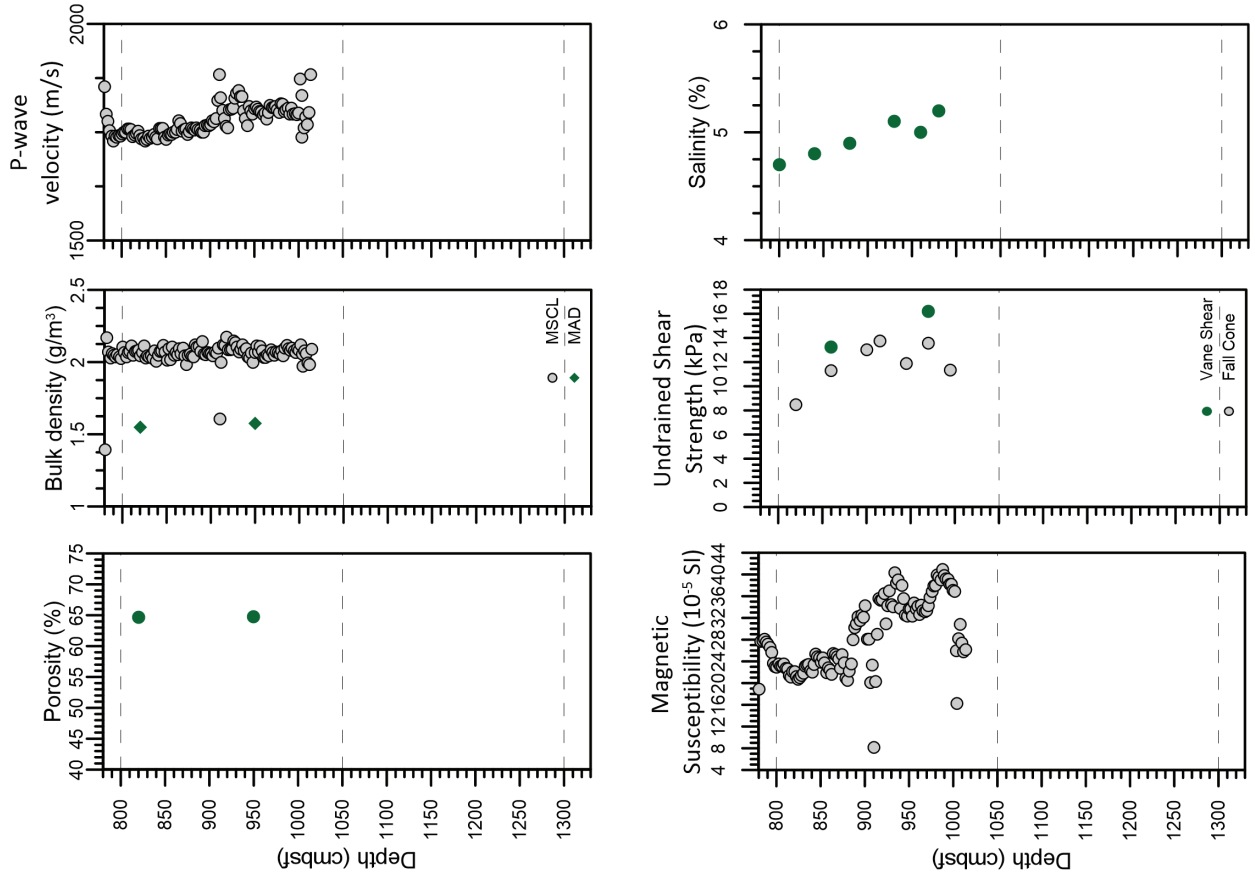
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Drilled Length: 4530.00 cm
Recovery: 4223.00 cm






R/V METEOR M149
Station: M149_ GeoB 23073-1 (3P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
780 - 1016 cm: nannofossil ooze with variable % of forams, bioturbated and in general structureless; colour range between olive brown (2.5 Y 4/6) @ 781 cm, dark grayish brown (2.5 Y 4/2) @ 920 cm, grayish brown (2.5 Y 5/2) @ 880 cm, olive brown (2.5 Y 4/3) @ 920 cm; rare patches of mm size of black material; rare stain patches of yellowish brown colour through the core;
@ 1013 - 1016 cm: a patch or a "vein" of foram-rich sediment of black colour, which position and shape could have been perturbed by drilling operation.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

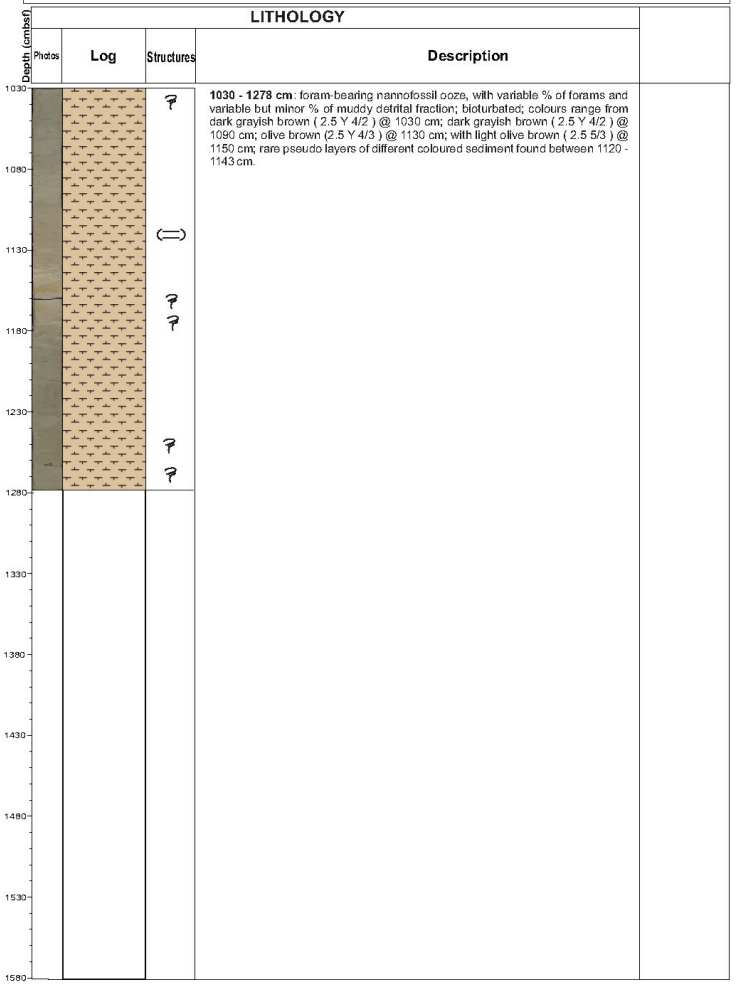
R/V METEOR M149 **Station: M149_ GeoB 23073-1 (4P)**

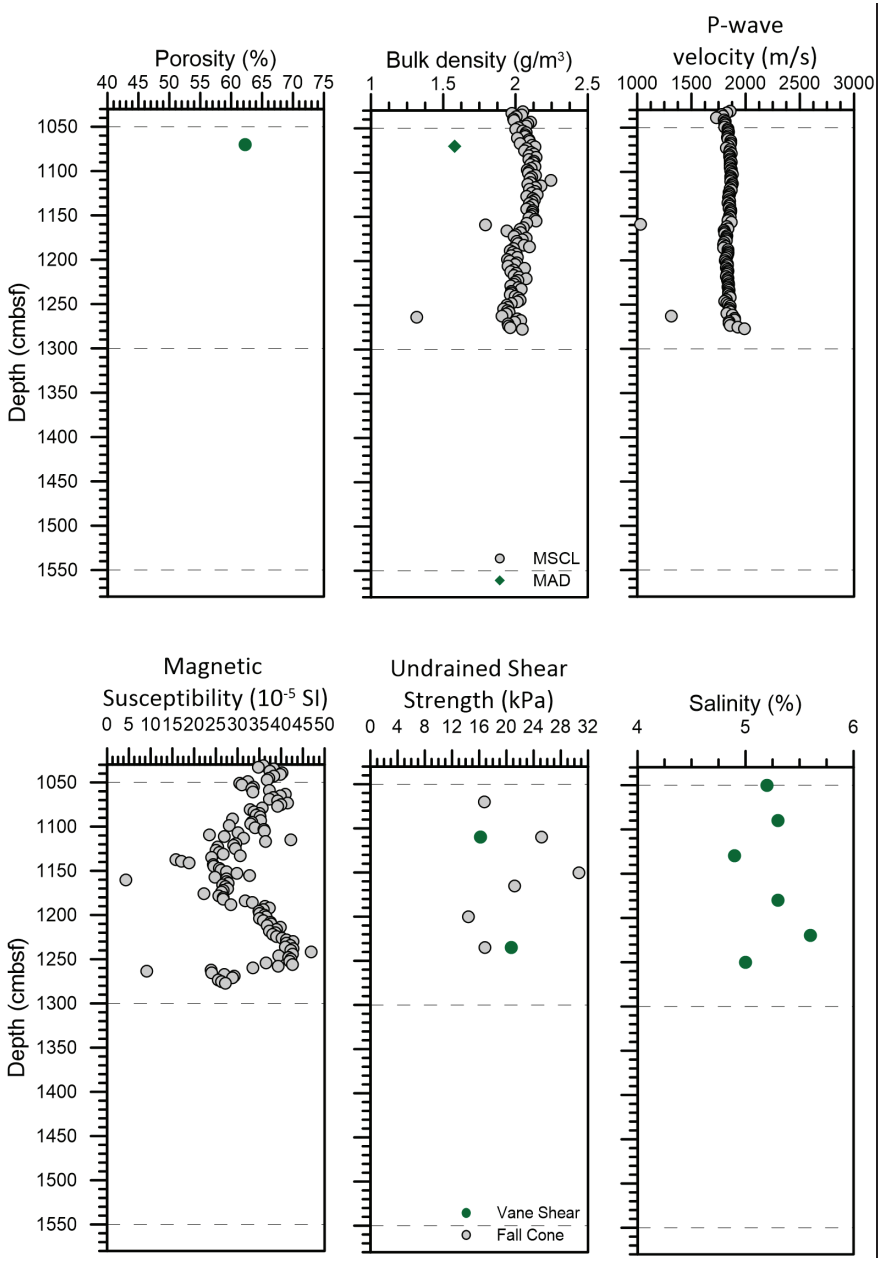
Location: Pull-apart basin lineament south

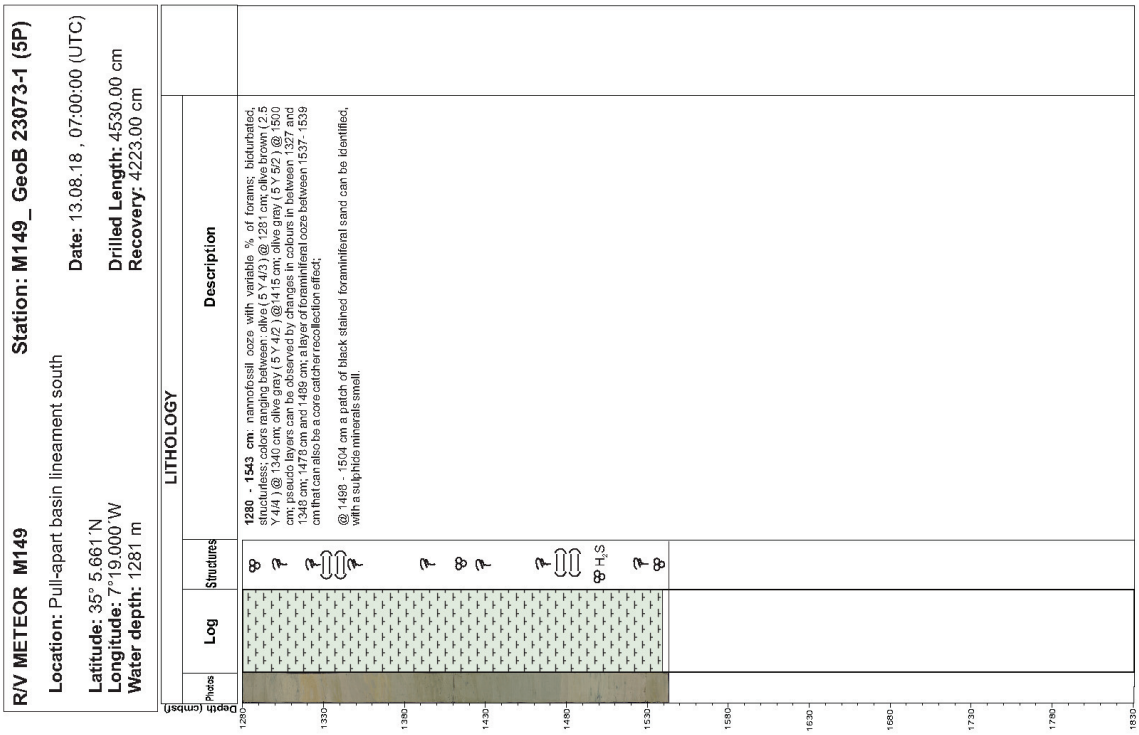
Date: 13.08.18 , 07:00:00 (UTC)

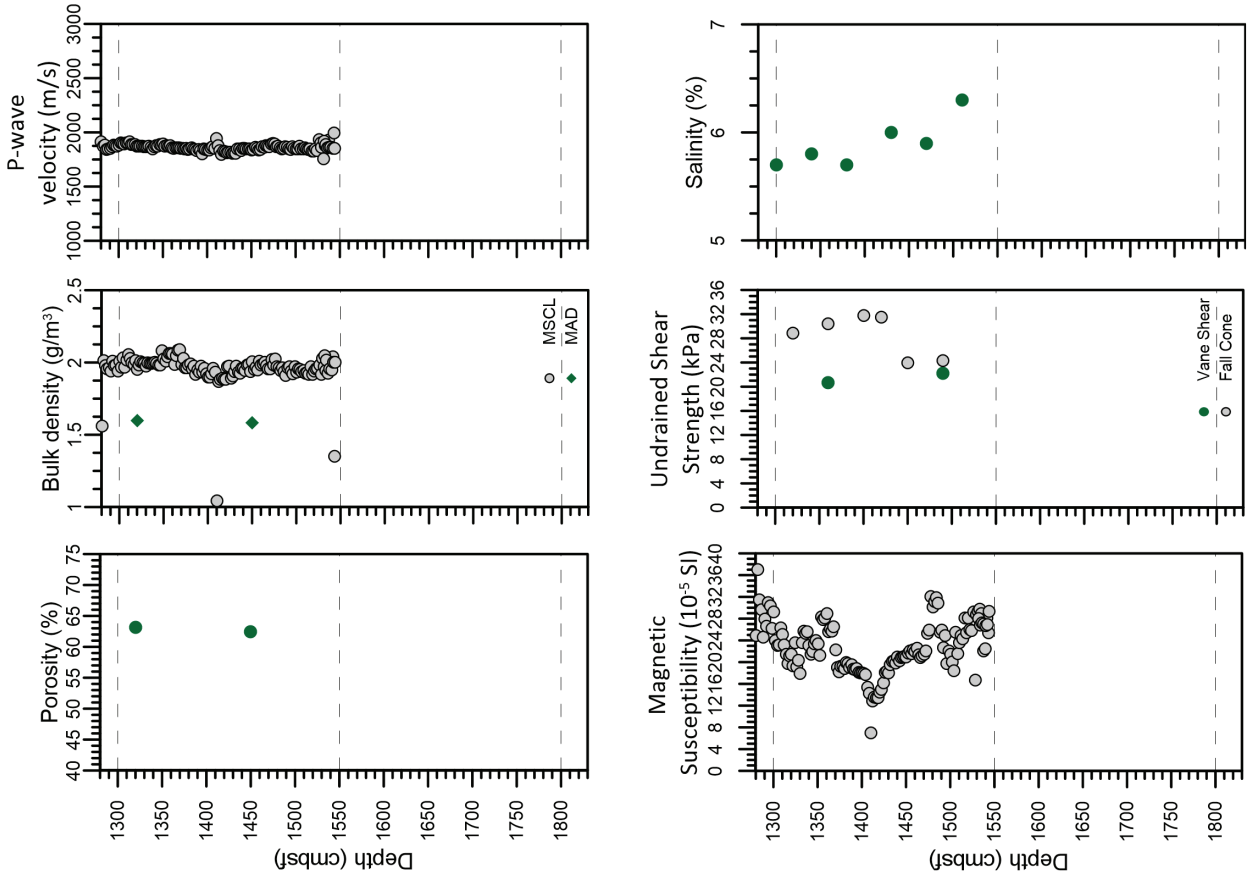
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Drilled Length: 4530.00 cm
Recovery: 4223.00 cm






R/V METEOR M149
Station: M149_ GeoB 23073-1 (5P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1280 - 1543 cm: nannofossil ooze with variable % of forams; bioturbated, structureless; colors ranging between: olive (5 Y 4/3) @ 1281 cm; olive brown (2.5 Y 4/4) @ 1340 cm; olive gray (5 Y 4/2) @ 1415 cm; olive gray (5 Y 5/2) @ 1500 cm; pseudo layers can be observed by changes in colours in between 1327 and 1348 cm; 1478 cm and 1489 cm; a layer of foraminiferal ooze between 1537 - 1539 cm that can also be a core catcher recollection effect;
@ 1498 - 1504 cm a patch of black stained foraminiferal sand can be identified, with a sulphide minerals smell
H2S


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23073-1 (6P)**

Location: Pull-apart basin lineament south

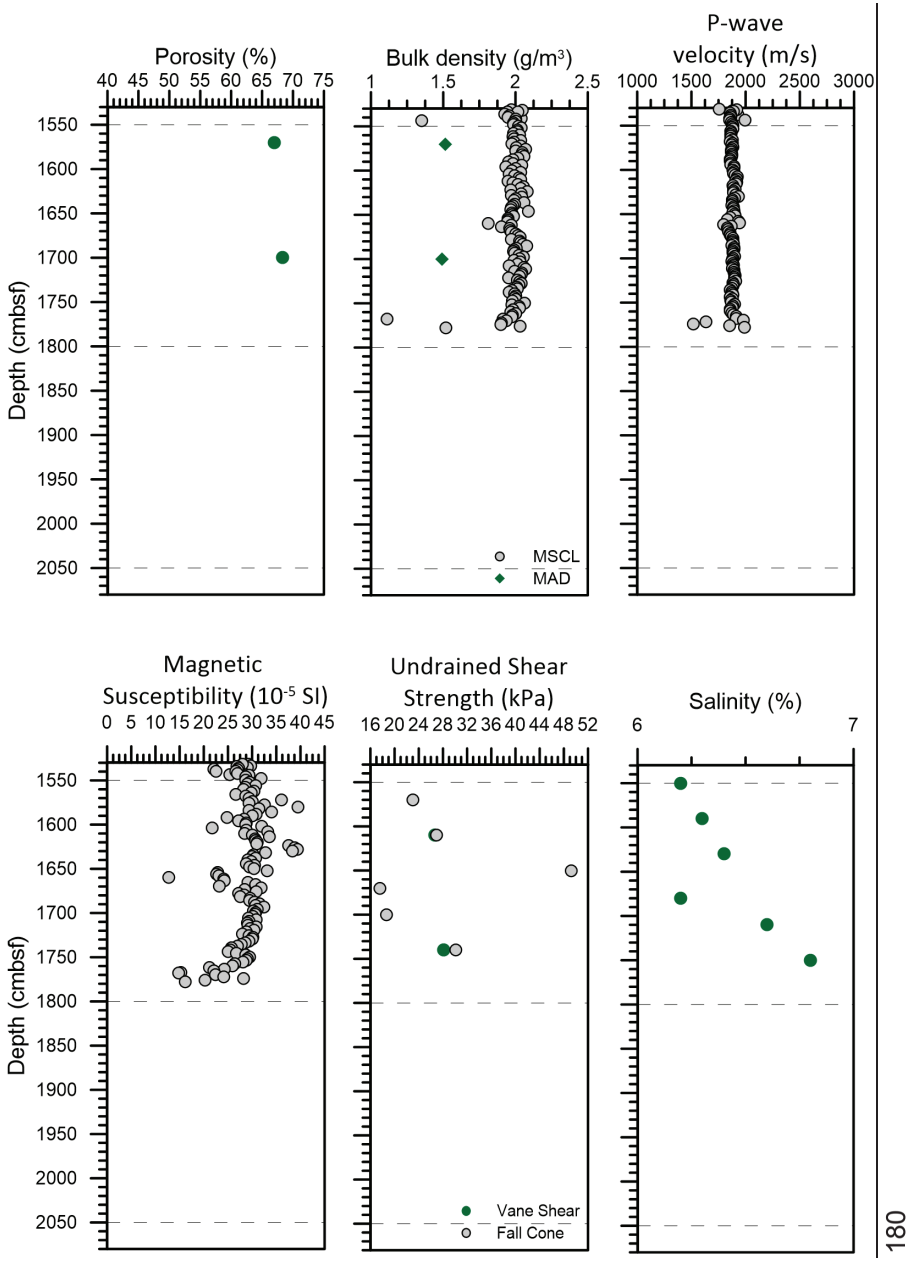
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Date: 13.08.18 , 07:00:00 (UTC)

Drilled Length: 4530.00 cm
Recovery: 4223.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1530				**1580 - 1538 cm**: foraminiferal ooze, olive brown colour (2.5 Y 4/4);
1580				**1533 - 1778 cm**: foram-bearing nannofossil ooze with variable % of forams; colour changing between olive brown (2.5 Y 4/3) @ 1540 cm and dark grayish brown (2.5 Y 4/2) and very dark grayish brown (2.5 Y 3/2); concentric colour zonation of different scales, from 5 cm packages up to 30 cm are identified throughout the core, creating pseudo layering effects and in some areas indicating flow patterns; bioturbation is present throughout almost all the core.
1630				
1680				
1730				
1780				
1830				
1880				
1930				
1980				
2030				
2080				



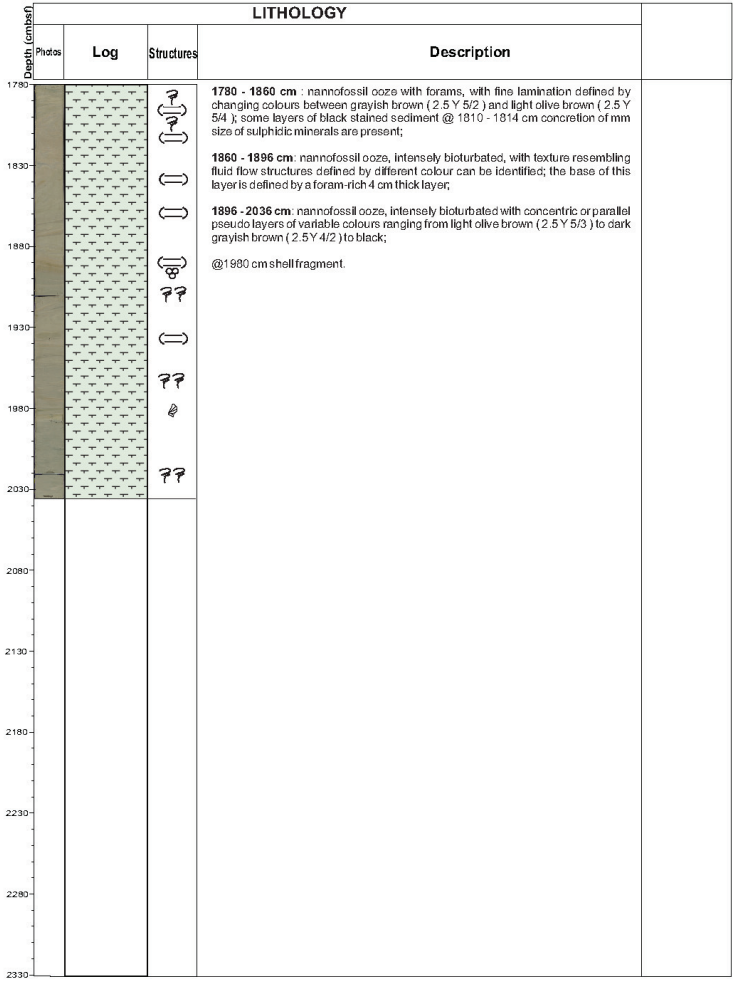
R/V METEOR M149 **Station: M149_ GeoB 23073-1 (7P)**

Location: Pull-apart basin lineament south

Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Date: 13.08.18 , 07:00:00 (UTC)

Drilled Length: 4530.00 cm
Recovery: 4223.00 cm

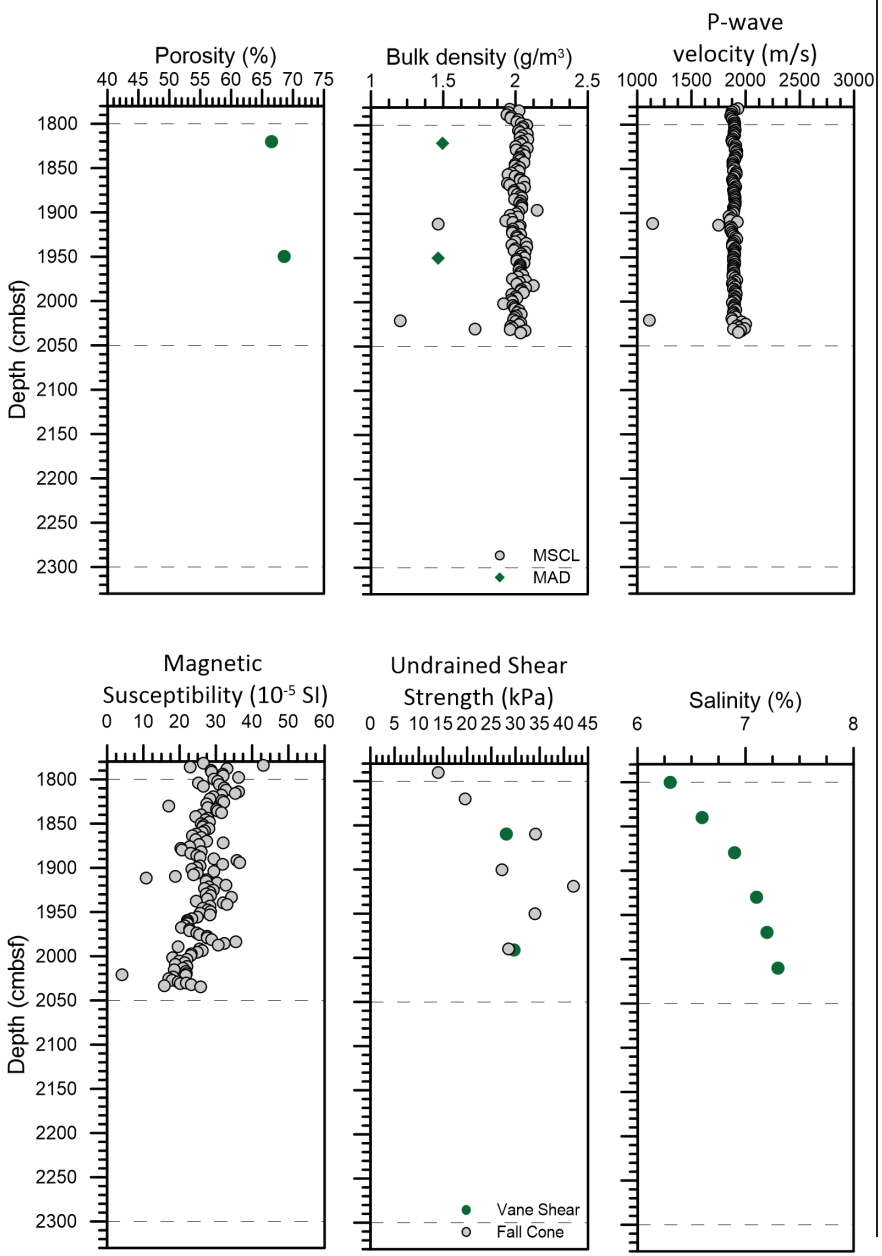


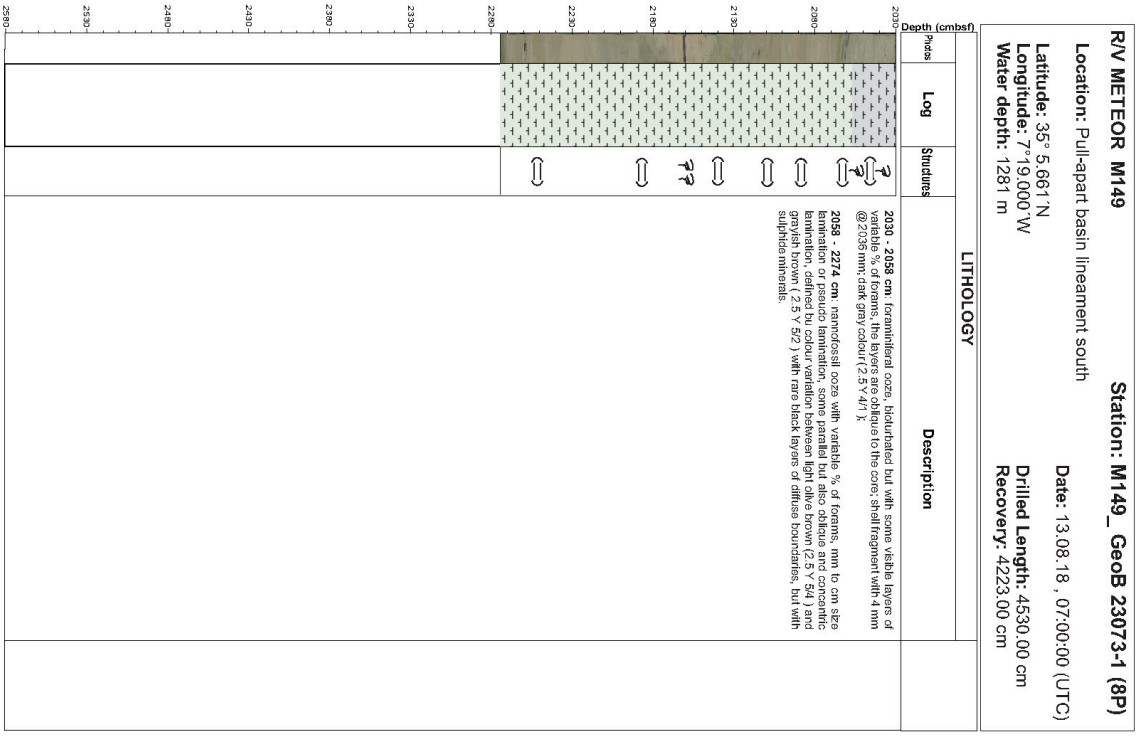
1780 - 1860 cm : nannofossil ooze with forams, with fine lamination defined by changing colours between grayish brown (2.5 Y 5/2) and light olive brown (2.5 Y 5/4); some layers of black stained sediment @ 1810 - 1814 cm concretion of mm size of sulphidic minerals are present;

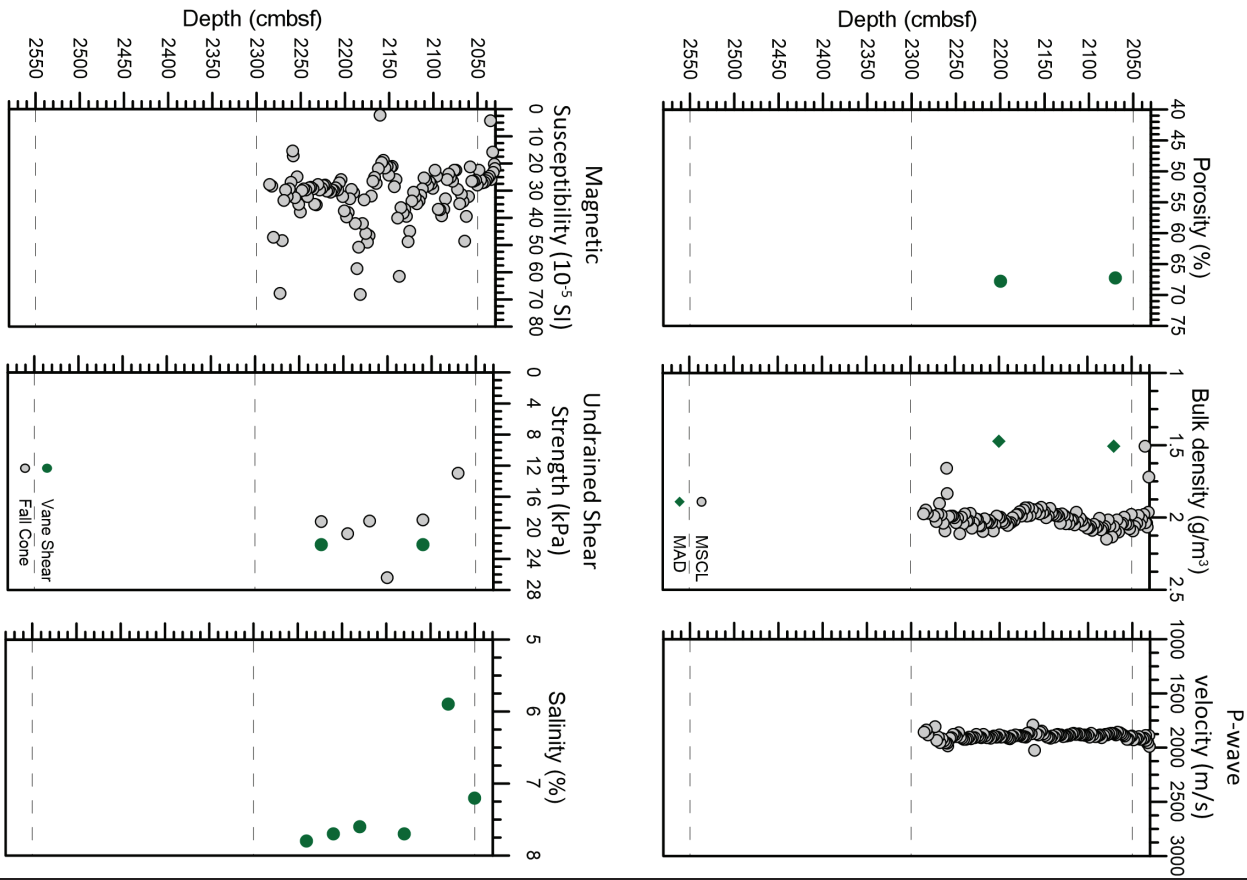
1860 - 1896 cm: nannofossil ooze, intensely bioturbated, with texture resembling fluid flow structures defined by different colour can be identified; the base of this layer is defined by a foram-rich 4 cm thick layer;

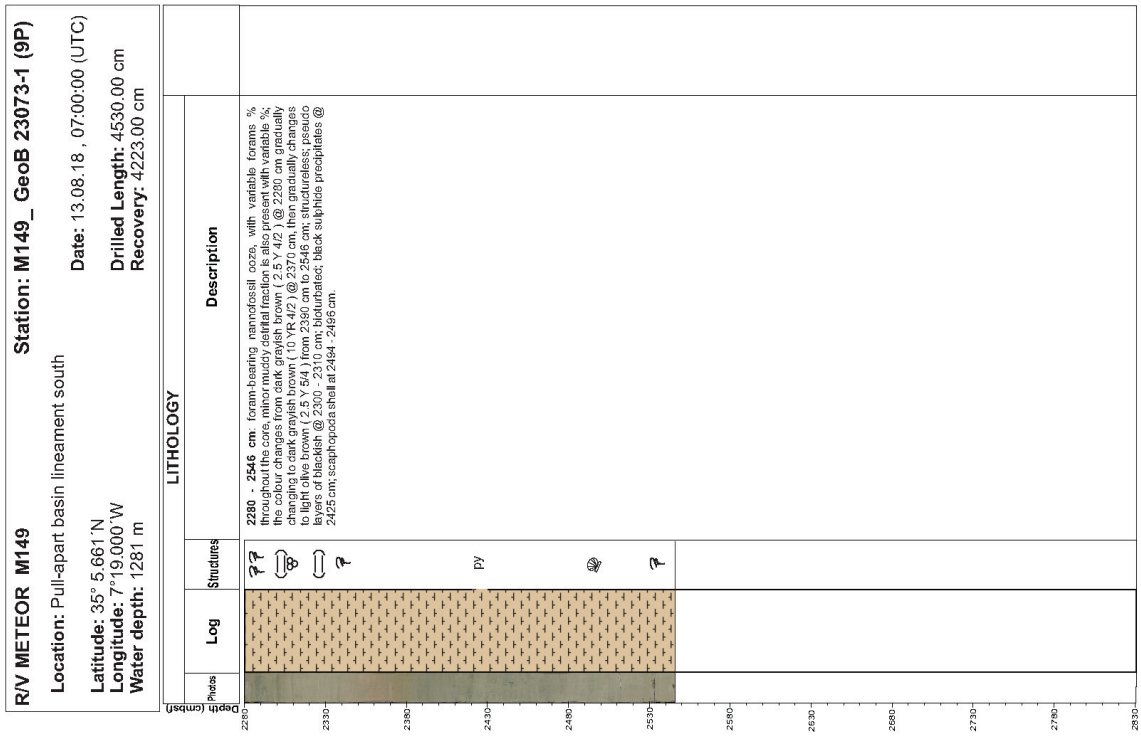
1896 - 2036 cm: nannofossil ooze, intensely bioturbated with concentric or parallel pseudo layers of variable colours ranging from light olive brown (2.5 Y 5/3) to dark grayish brown (2.5 Y 4/2) to black;

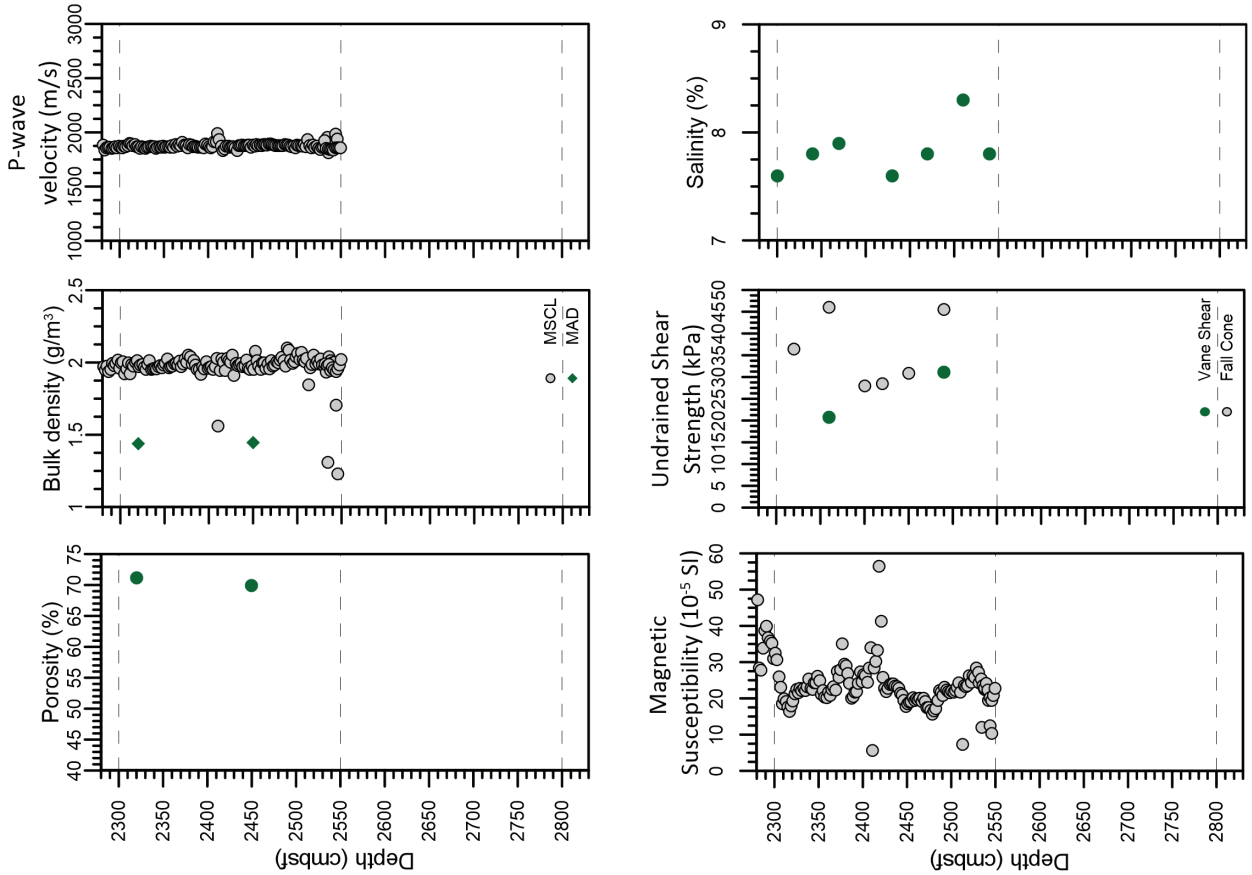
@1980 cm shell fragment.




R/V METEOR M149
Station: M149_ GeoB 23073-1 (8P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661'N
Longitude: 7°19.000'W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
2030 - 2058 cm: foraminiferal ooze, bioturbated but with some visible layers of variable % of forams, the layers are oblique to the core; shell fragment with 4 mm @ 2036 mm; dark gray colour (2.5 Y 4/1);
2058 - 2274 cm: nannofossil ooze with variable % of forams, mm to cm size lamination or pseudo lamination, some parallel but also oblique and concentric lamination, defined bu colour variation between light olive brown (2.5 Y 5/4) and grayish brown (2.5 Y 5/2) with rare black layers of diffuse boundaries, but with sulphide minerals.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (%)


R/V METEOR M149
Station: M149_ GeoB 23073-1 (9P)
Location: Pull-apart basin lineament south
Date: 13.08.18 , 07:00:00 (UTC)
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
2280 - 2546 cm: foram-bearing nannofossil ooze, with variable forams % throughout the core, minor muddy detrital fraction is also present with variable %; the colour changes from dark grayish brown (2.5 Y 4/2) @ 2280 cm gradually changing to dark grayish brown (10 YR 4/2) @ 2370 cm, then gradually changes to light olive brown (2.5 Y 5/4) from 2390 cm to 2546 cm; structureless; pseudo layers of blackish @ 2300 - 2310 cm; bioturbated; black sulphide precipitates @ 2425 cm; scaphopoda shell at 2464 - 2496 cm
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

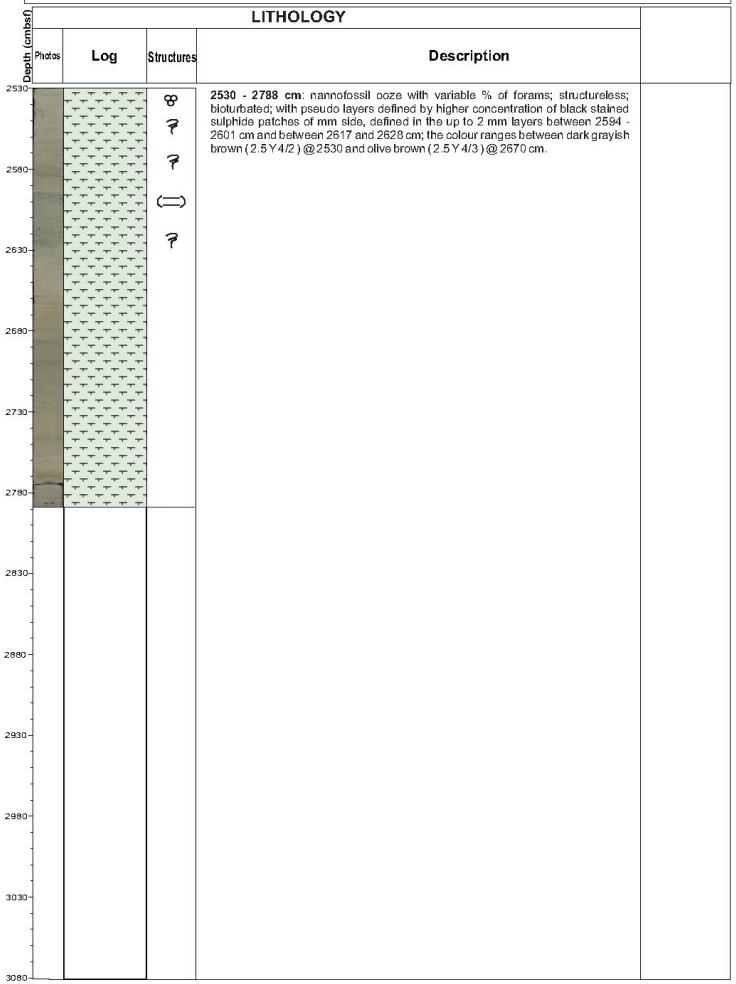
R/V METEOR M149 **Station: M149_ GeoB 23073-1 (10P)**

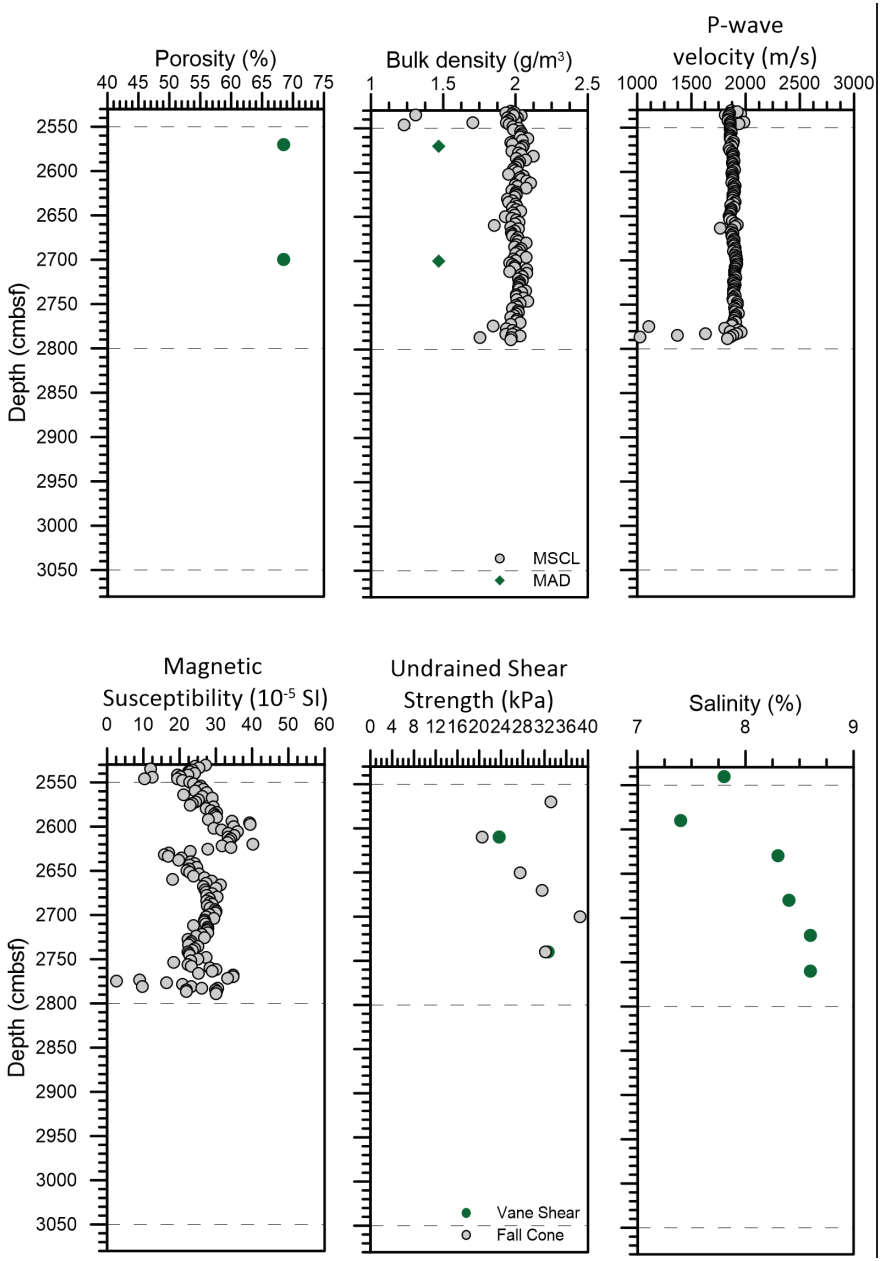
Location: Pull-apart basin lineament south

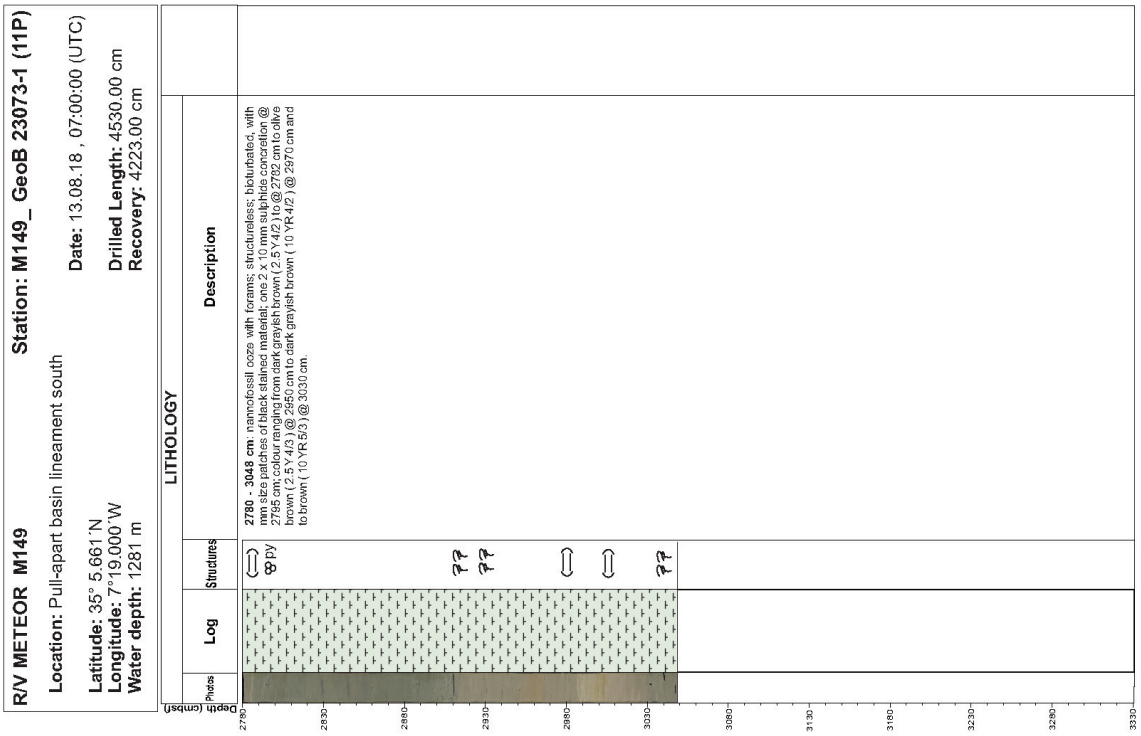
Date: 13.08.18 , 07:00:00 (UTC)

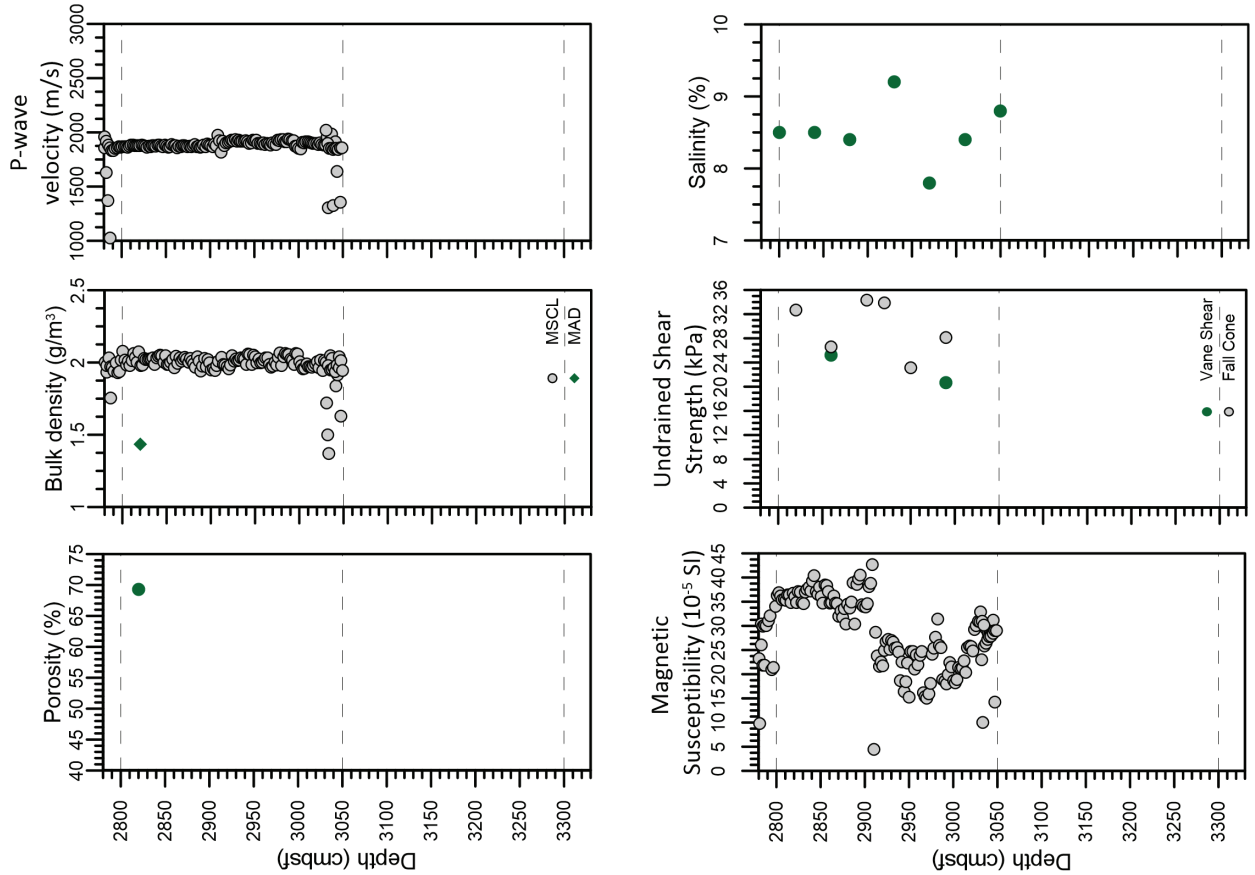
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

Drilled Length: 4530.00 cm
Recovery: 4223.00 cm






R/V METEOR M149
Station: M149_ GeoB 23073-1 (11P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
2780 - 3048 cm: nannofossil oozes with forams; structureless; bioturbated, with mm size patches of black stained material; one 2 x 10 mm sulphide concretion @ 2795 cm; colour ranging from dark grayish brown (2.5 Y 4/2) to @ 2792 cm to olive brown (2.5 Y 4/3) @ 2950 cm to dark grayish brown (10 YR 4/2) @ 2970 cm and to brown (10 YR 5/3) @ 3030 cm.
2780
2830
2880
2930
2980
3030
3080
3130
3180
3230
3280
3330


P-wave velocity (m/s)
1000 1500 2000 2500 3000
Bulk density (g/m³)
1 1.5 2 2.5
MSCL
MAD
Porosity (%)
40 45 50 55 60 65 70 75
Depth (cmbsf)
2800 2850 2900 2950 3000 3050 3100 3150 3200 3250 3300
Salinity (‰)
7 8 9 10
Undrained Shear Strength (kPa)
0 4 8 12 16 20 24 28 32 36
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
0 5 10 15 20 25 30 35 40 45
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23073-1 (12P)**

Location: Pull-apart basin lineament south

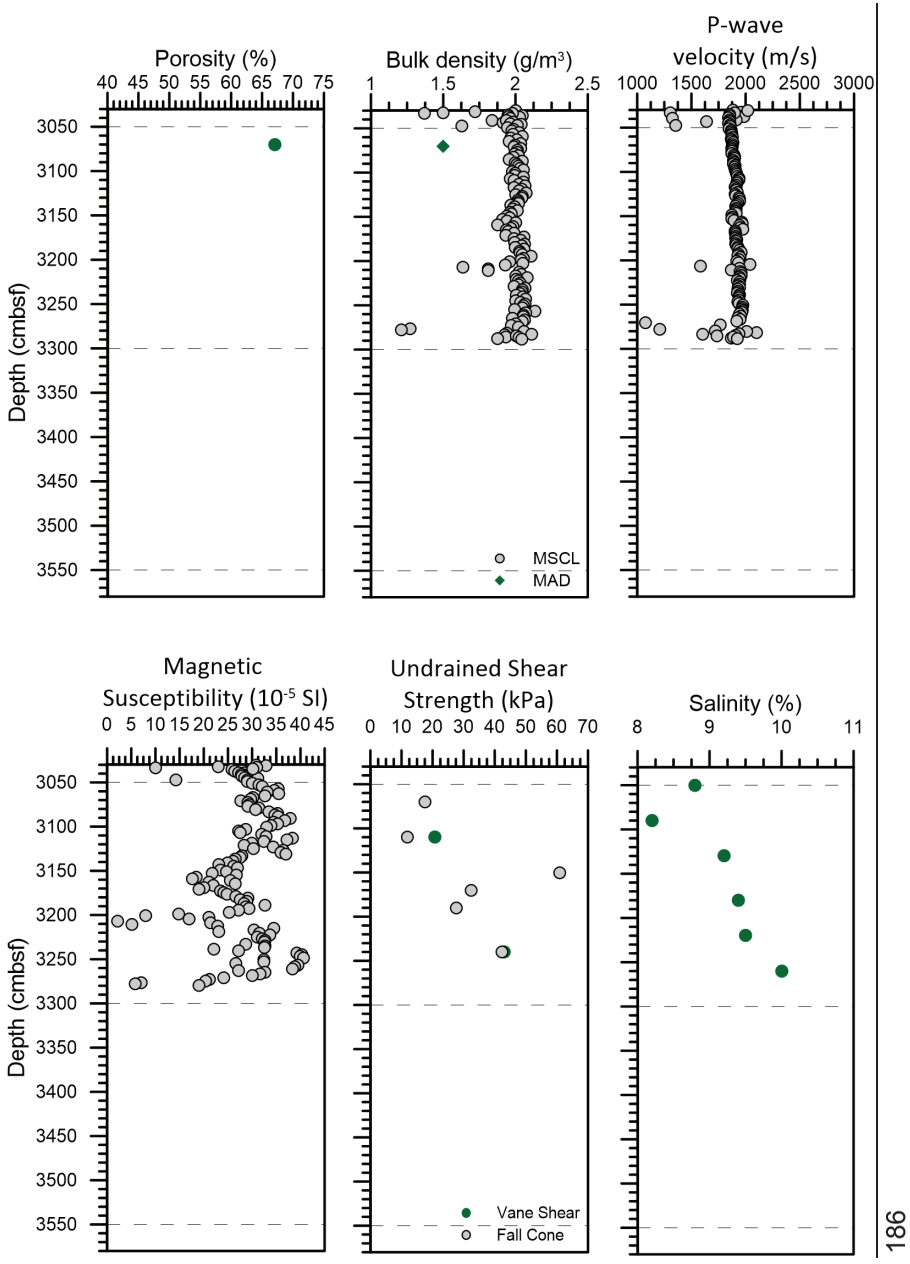
Date: 13.08.18 , 07:00:00 (UTC)

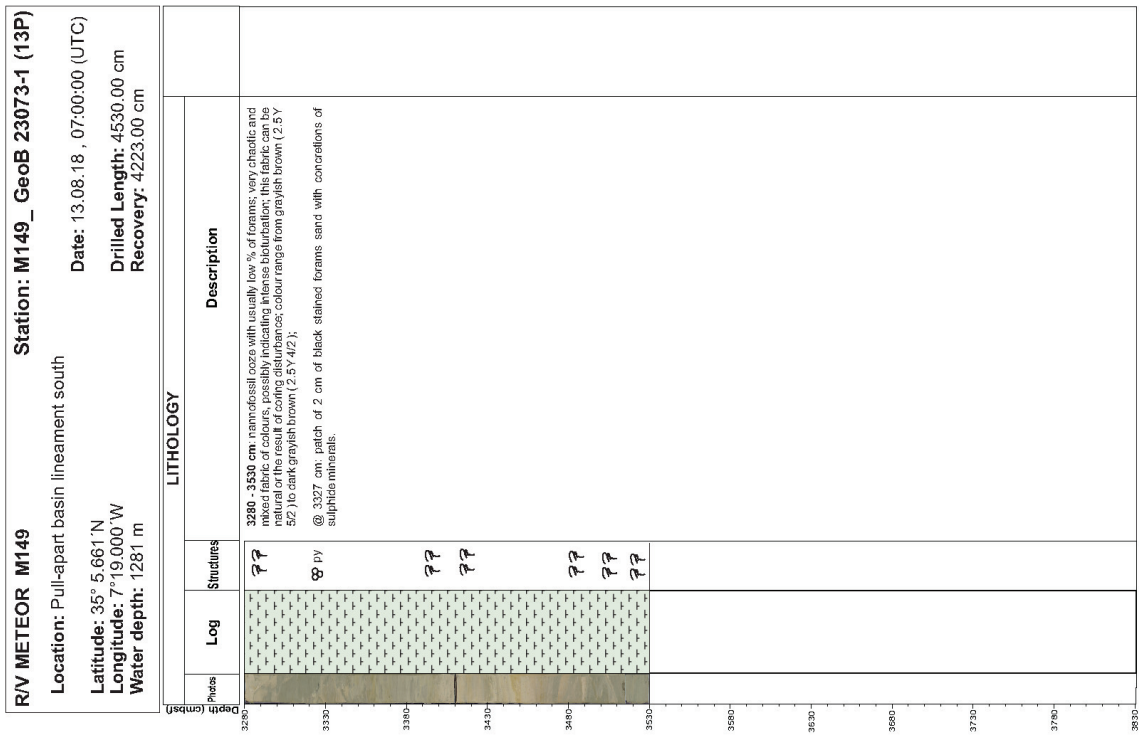
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

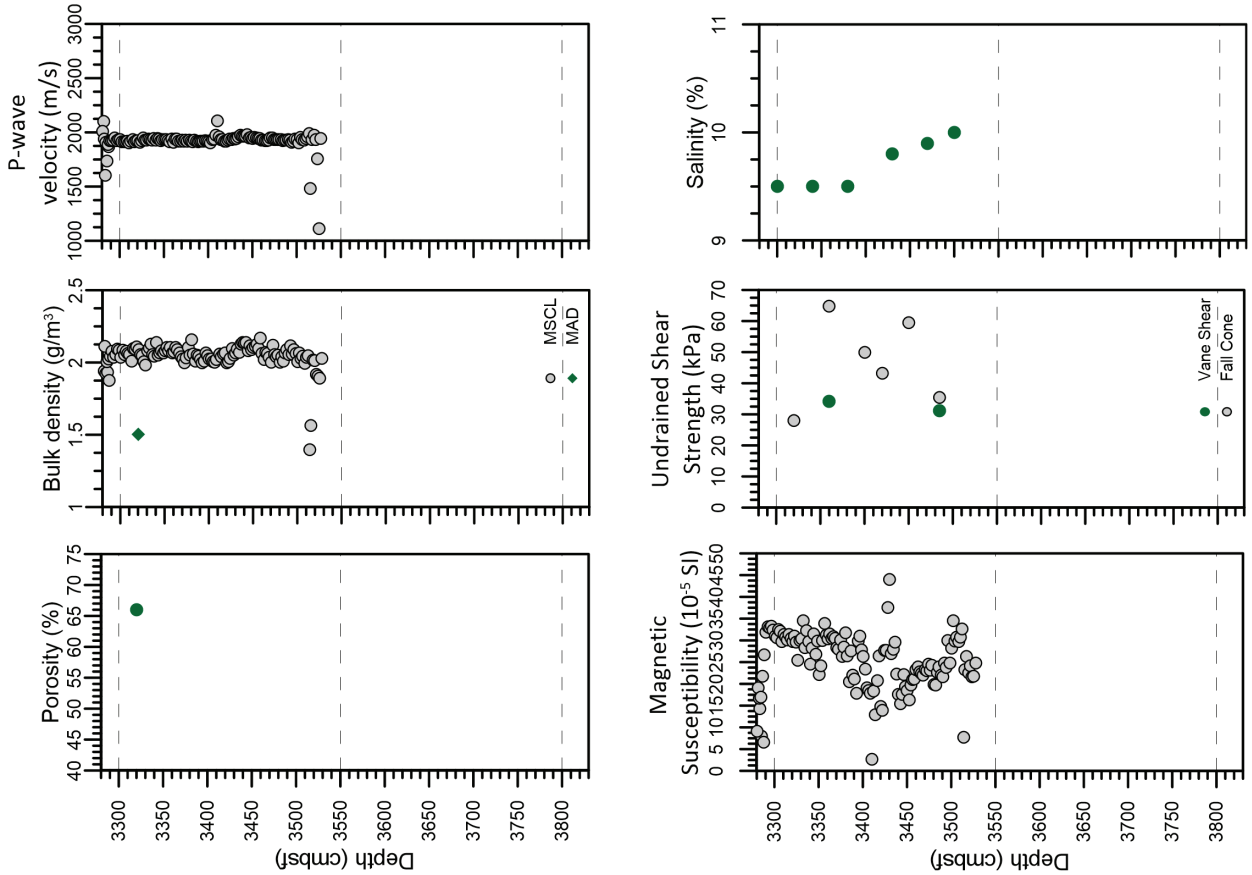
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm

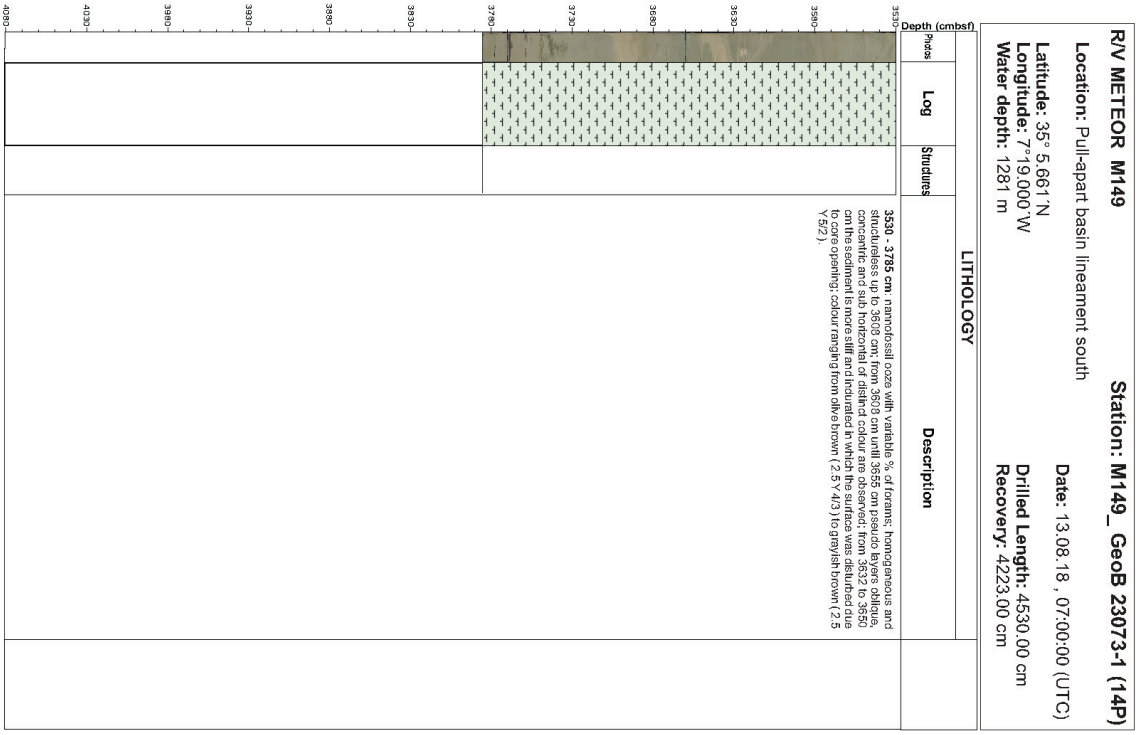
LITHOLOGY

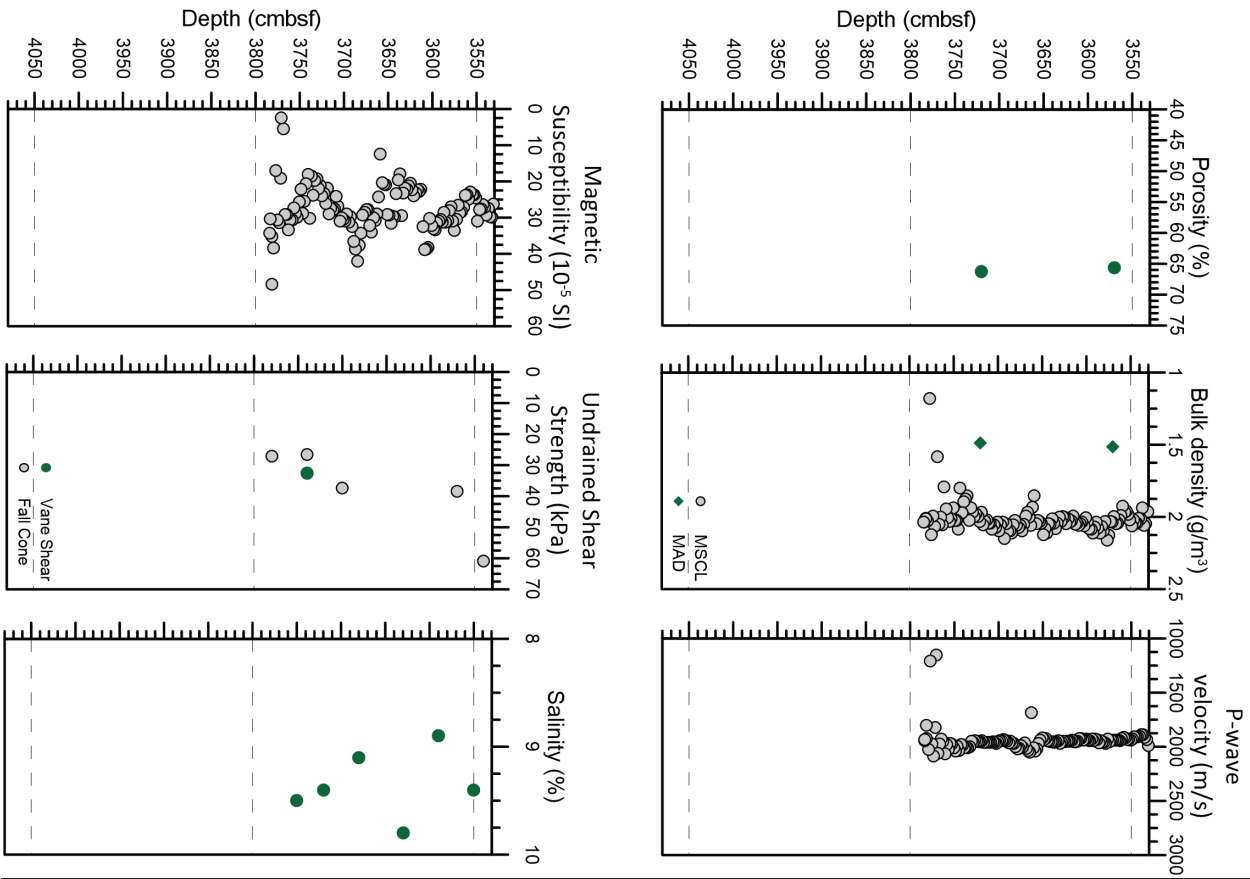
Depth (cmbsf)	Photos	Log	Structures	Description
3030				**3030 - 3139 cm**: nannofossil ooze of dark grayish brown colour (2.5 Y 4/2) with mm size; black stained patches; with rare pseudo layers of up to 1 cm defined by slightly different colours; **3139 - 3198 cm**: package of 5 - 6 cm layers of nannofossil ooze, with distinct colours: grayish brown (10 YR 5/2) from: 3139 - 3146 cm, 3148 - 3155 cm and from 3145 to 3164 cm; intercalating with layers of olive brown colour (2.5 Y 4/3); **3198 - 3219 cm**: nannofossil ooze, with no forams, dark grayish brown colour (10 YR 4/2), very stiff; this layer is disturbed by drilling; at this layer the barrel core catcher was found stuck and during his removal the sediment was disturbed; **3219 - 3288 cm**: nannofossil ooze, bioturbated to intense bioturbated; olive brown colour (2.5 Y 4/3).
3080				
3130				
3180				
3230				
3280				
3330				
3380				
3430				
3480				
3530				
3580				

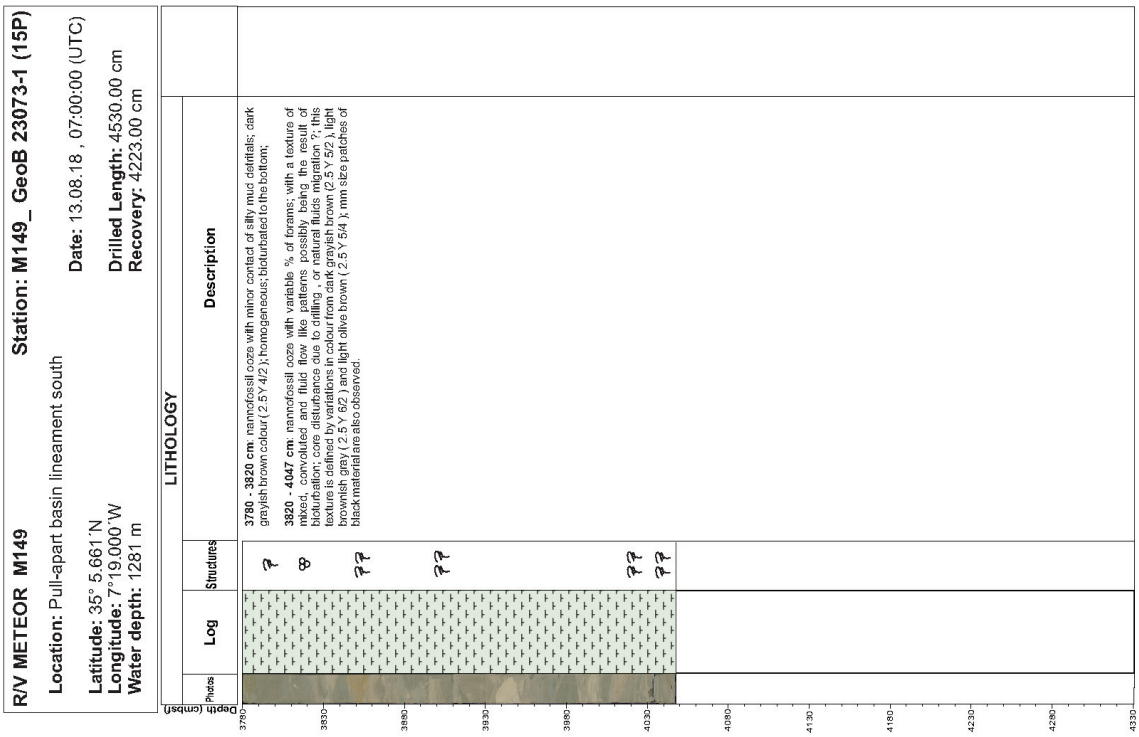


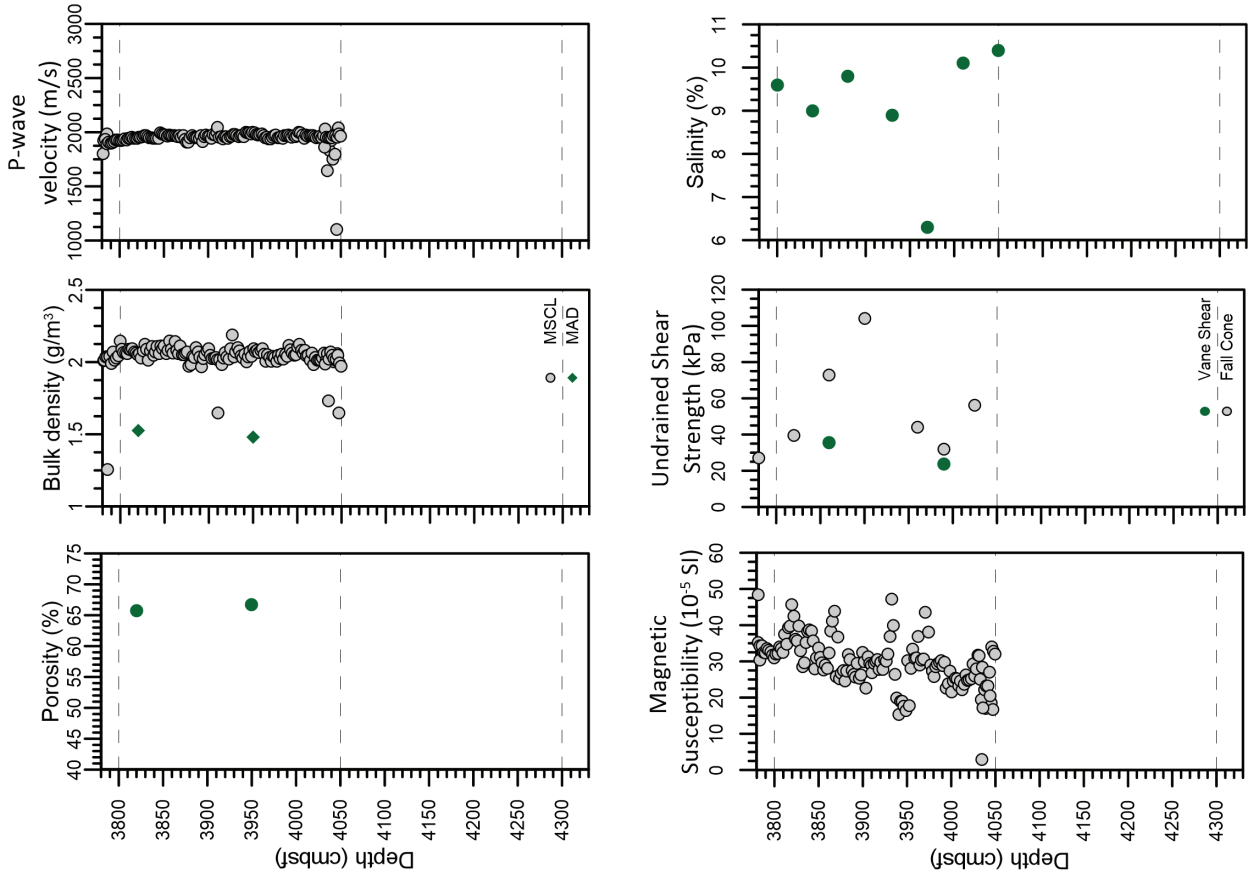

R/V METEOR M149
Station: M149_ GeoB 23073-1 (13P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3280 - 3530 cm: nannofossil ooze with usually low % of forams; very chaotic and mixed fabric of colours, possibly indicating intense bioturbation; this fabric can be natural or the result of coring disturbances; colour range from grayish brown (2.5Y 5/2)to dark grayish brown (2.5Y 4/2);
@ 3327 cm: patch of 2 cm of black stained forams sand with concretions of sulphide minerals.
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23073-1 (14P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661'N
Longitude: 7°19.000'W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
Depth (cmbsf)
Photo
Log
Structures
LITHOLOGY
Description
3530 - 3785 cm: nannofossil ooze with variable % of forams; homogeneous and structureless up to 3608 cm; from 3608 cm until 3655 cm pseudo layers oblique, concentric and sub horizontal of distinct colour are observed; from 3632 to 3650 cm the sediment is more stiff and indurated in which the surface was disturbed due to core opening; colour ranging from olive brown (2.5Y 4/3) to grayish brown (2.5 Y 5/2).


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_ GeoB 23073-1 (15P)
Location: Pull-apart basin lineament south
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Date: 13.08.18 , 07:00:00 (UTC)
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
3780 - 3820 cm: nannofossil ooze with minor contact of silty mud detritals; dark grayish brown colour (2.5Y 4/2); homogeneous; bioturbated to the bottom;
3820 - 4047 cm: nannofossil ooze with variable % of forams; with a texture of mixed, convoluted and fluid flow like patterns possibly being the result of bioturbation; core disturbance due to drilling , or natural fluids migration ?; this texture is defined by variations in colour from dark grayish brown (2.5 Y 5/2), light brownish gray (2.5 Y 6/2) and light olive brown (2.5 Y 5/4); mm size patches of black material are also observed.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 **Station: M149_ GeoB 23073-1 (16P)**

Location: Pull-apart basin lineament south

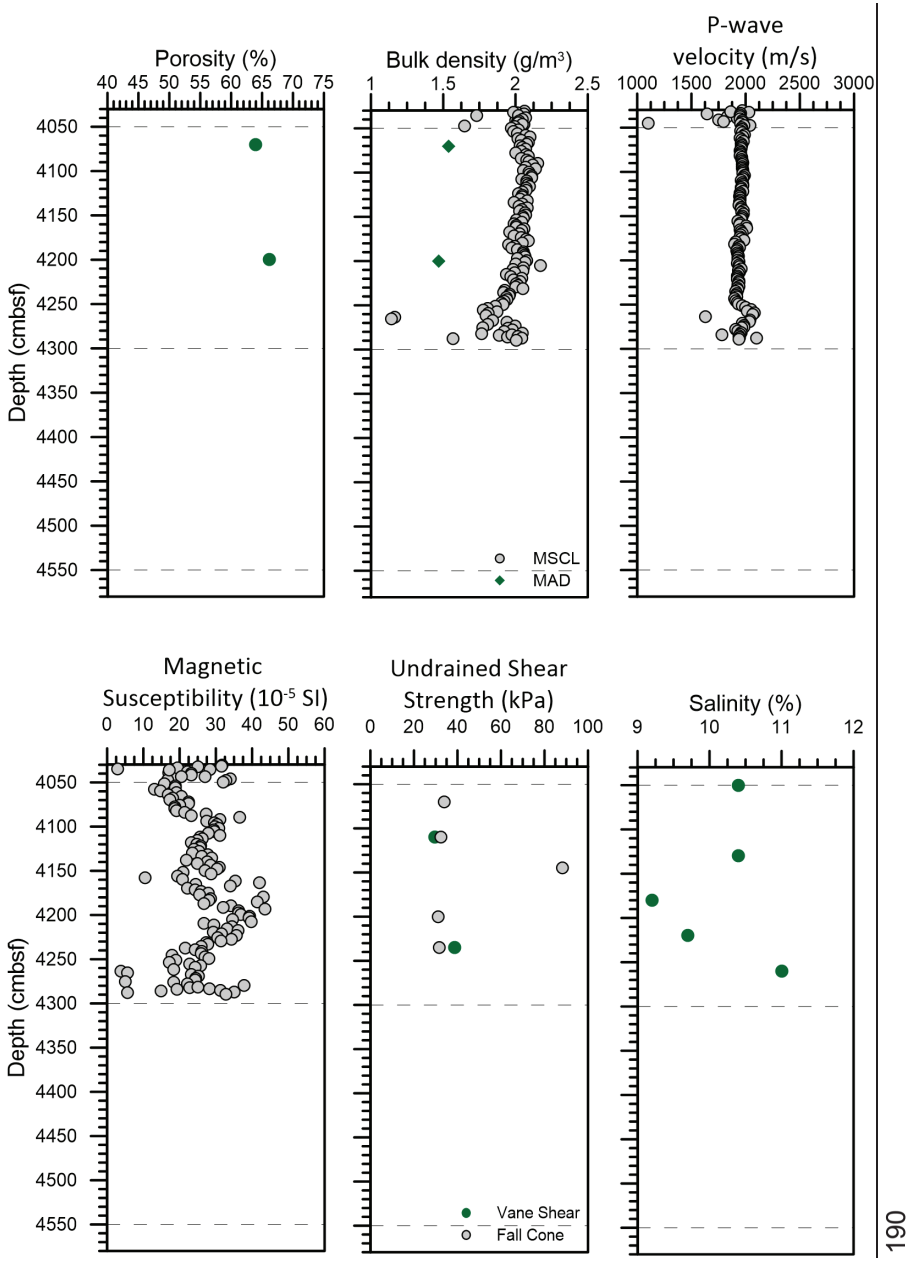
Latitude: 35° 5.661´N
Longitude: 7°19.000´W
Water depth: 1281 m

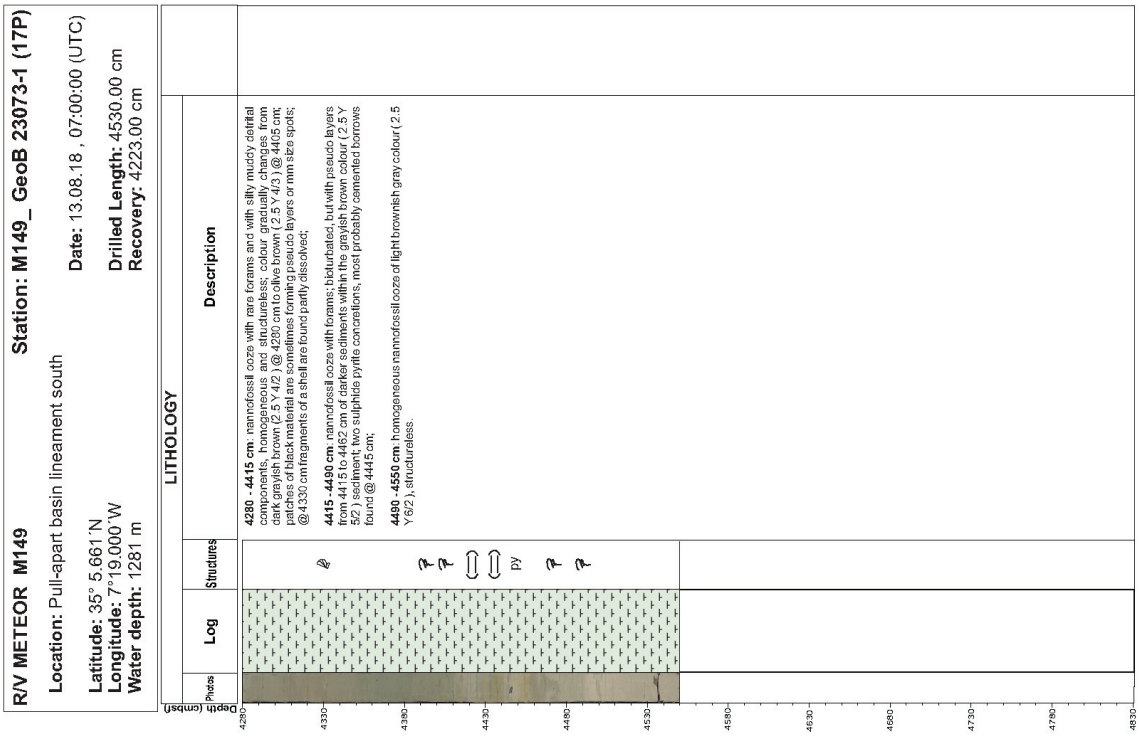
Date: 13.08.18 , 07:00:00 (UTC)

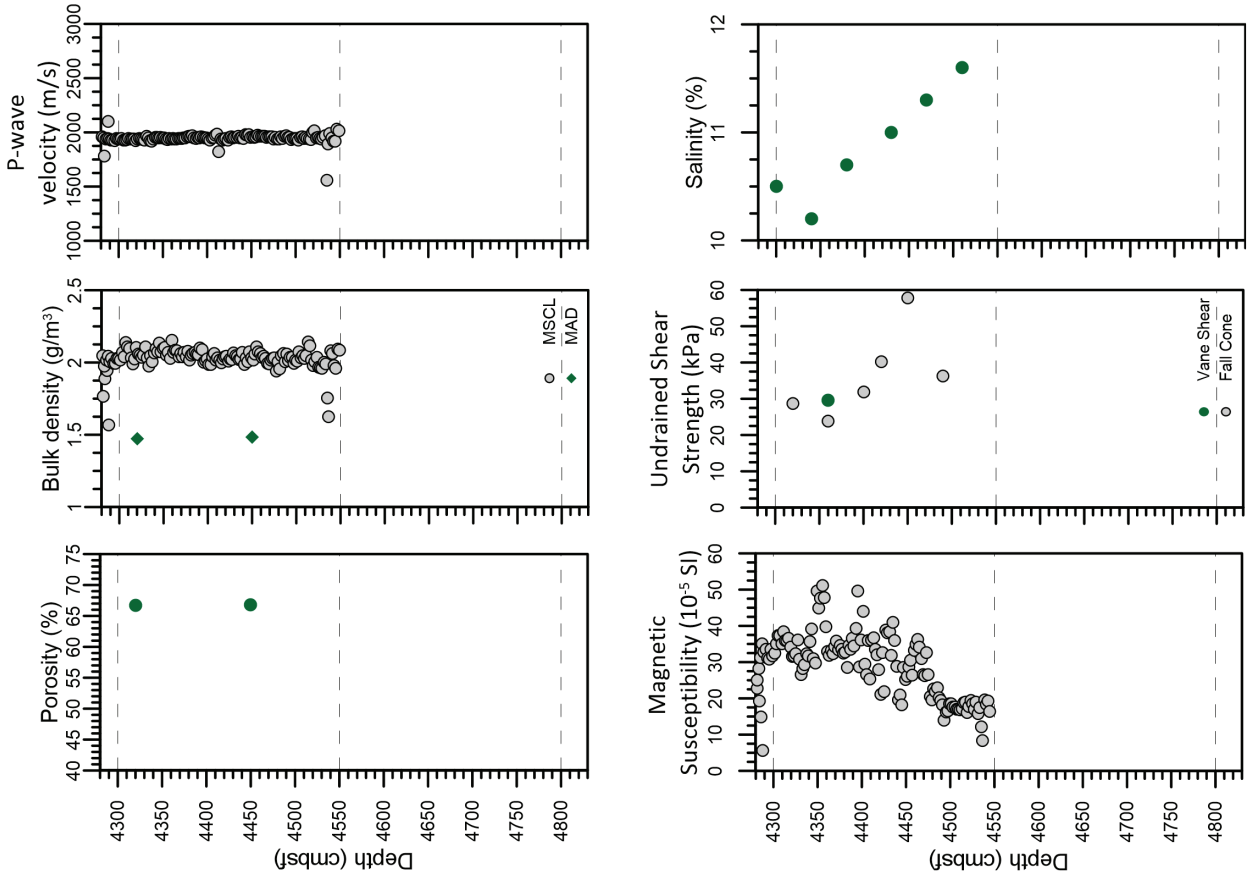
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm

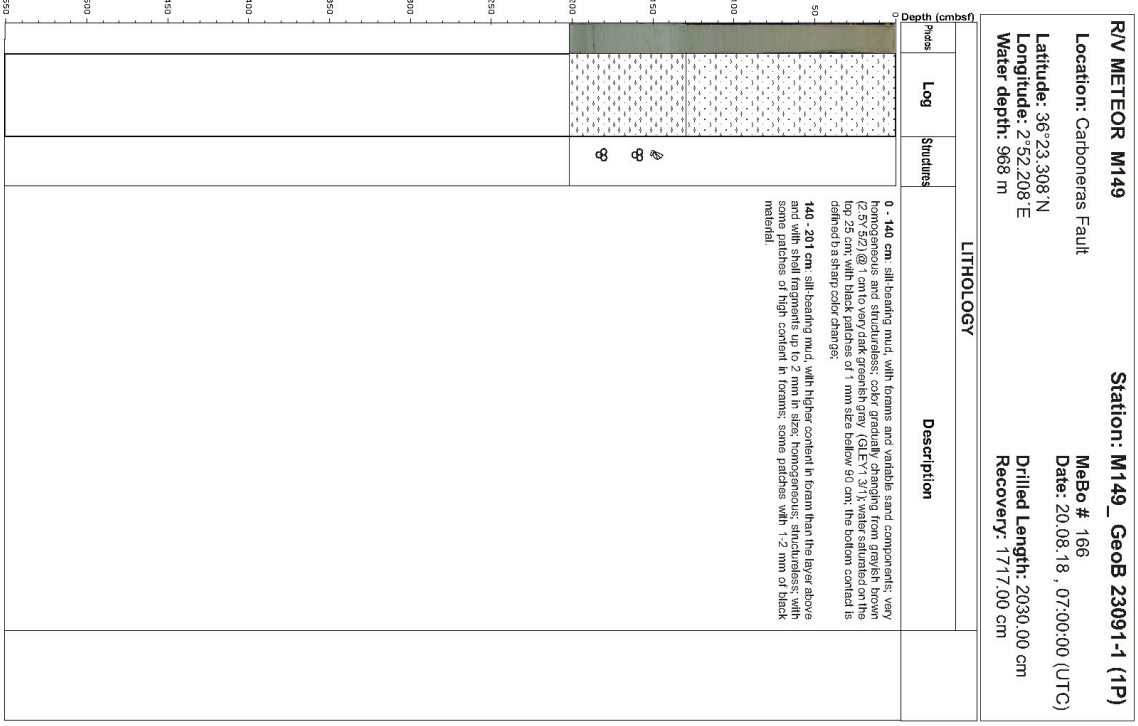
LITHOLOGY

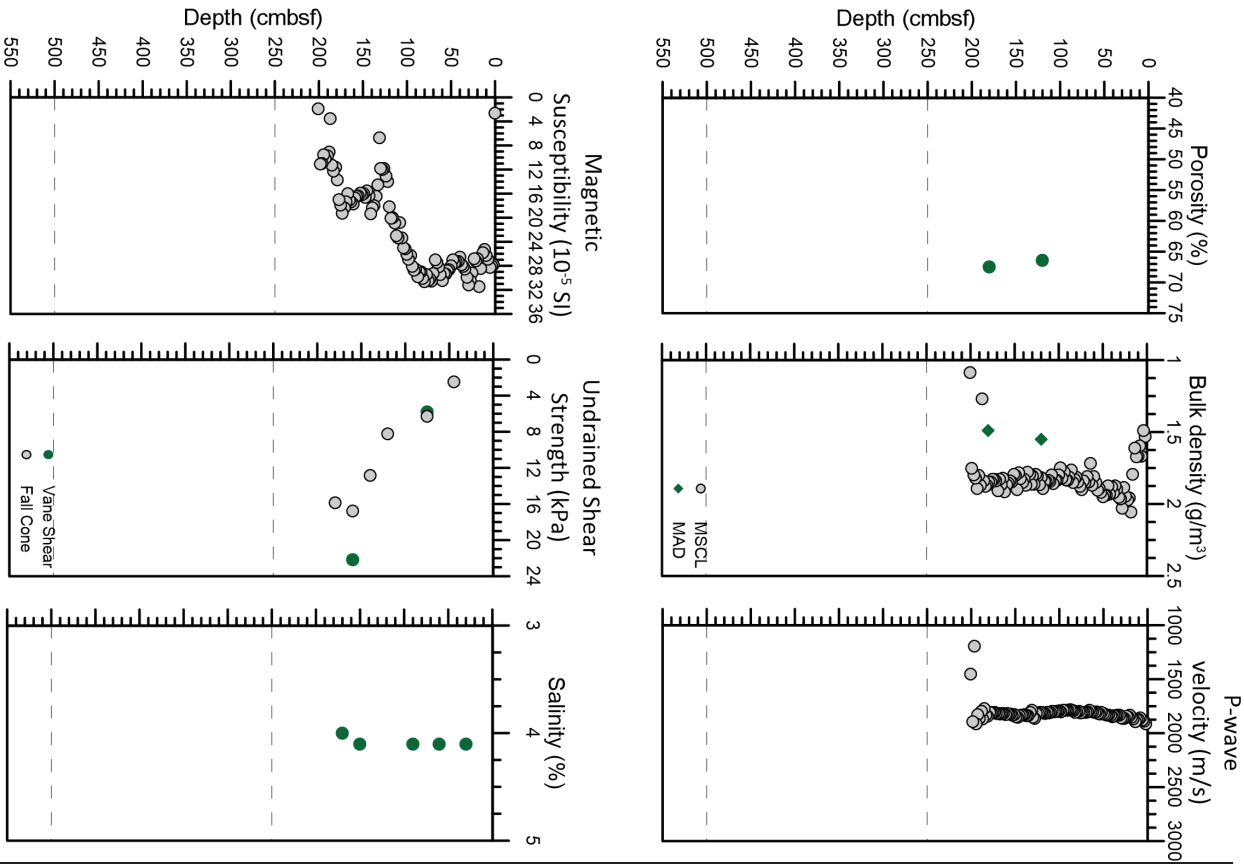
Depth (cmbsf)	Photos	Log	Structures	Description
4030				**4030 - 4250 cm**: nannofossil ooze with low content forams and minor silty-muddy content; this interval presents a mixed, convoluted texture from 4030 cm up to 4075 cm; bioturbated from 4075 to 4116 cm; from 4116 cm to 4175 cm pseudo layers pattern with parallel layers with 5 mm up to 4 cm thick of different colours; from 4175 cm to 4250 cm the sediment is homogeneous and structureless; dark gray colour (2.5 Y 4/1) with patches of black sulphide rich sediments; **4250 - 4288 cm**: nannofossil ooze very stiff, cohesive, disturbed between 4250 and 4270 cm due to core cutting; dark grayish brown (2.5 Y 4.2).
4080				
4130				
4180				
4230				
4280				
4330				
4380				
4430				
4480				
4530				
4580				

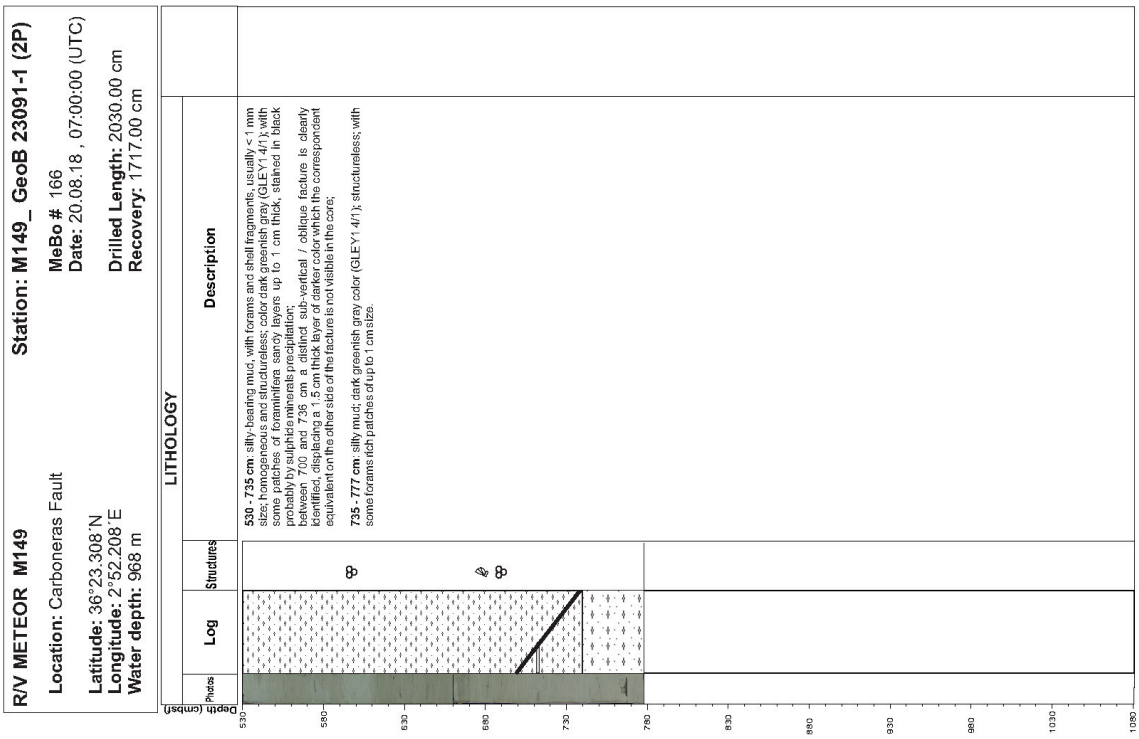


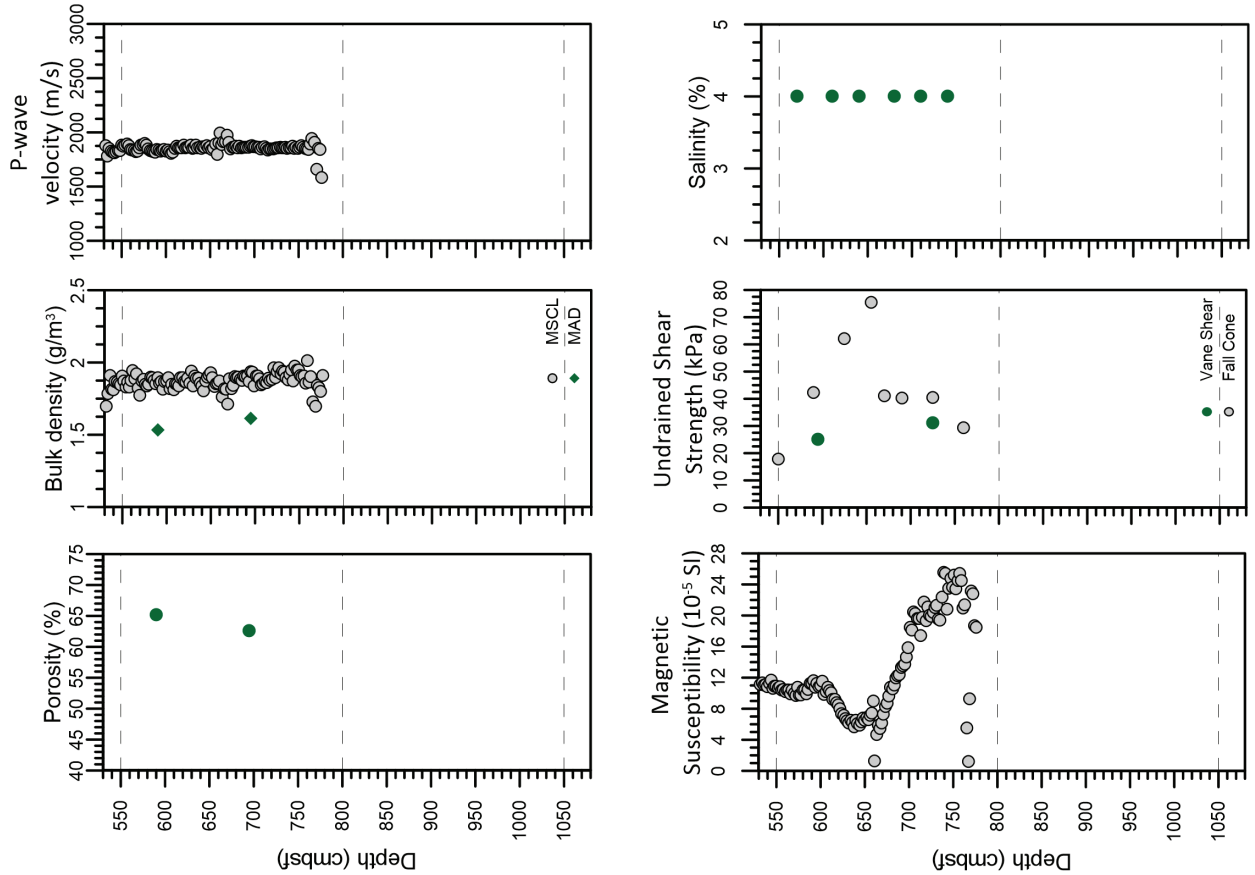

R/V METEOR M149
Station: M149_ GeoB 23073-1 (17P)
Location: Pull-apart basin lineament south
Date: 13.08.18 , 07:00:00 (UTC)
Latitude: 35° 5.661' N
Longitude: 7°19.000' W
Water depth: 1281 m
Drilled Length: 4530.00 cm
Recovery: 4223.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
4280 - 4415 cm: nannofossil ooze with rare forams and with silty muddy detrital components, homogeneous and structureless; colour gradually changes from dark grayish brown (2.5 Y 4/2) @ 4280 cm to olive brown (2.5 Y 4/3) @ 4405 cm; patches of black material are sometimes forming pseudo layers or mm size spots; @ 4330 cm fragments of a shell are found partly dissolved;
4415 - 4490 cm: nannofossil ooze with forams; bioturbated, but with pseudo layers from 4415 to 4462 cm of darker sediments within the grayish brown colour (2.5 Y 5/2) sediment; two sulphide pyrite concretions, most probably cemented borrows found @ 4445 cm;
4490 - 4550 cm: homogeneous nannofossil ooze of light brownish gray colour (2.5 Y 6/2), structureless.
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)


R/V METEOR M149
Station: M149_ GeoB 23091-1 (1P)
Location: Carboneras Fault
Latitude: 36°23.308´N
Longitude: 2°52.208´E
Water depth: 968 m
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm
LITHOLOGY
Photo
Log
Structures
Description
Depth (cmbsf)
0 - 140 cm: silt-bearing mud, with forams and variable sand components; very homogeneous and structureless; color gradually changing from grayish brown (2.5Y 5/2) @ 1 cm to very dark greenish gray (GLEY1 3/1); water saturated on the top; 25 cm; with black patches of 1 mm size bellow 90 cm; the bottom contact is defined by a sharp color change;
140 - 201 cm: silt-bearing mud, with higher content in foram than the layer above and with shell fragments up to 2 mm in size; homogeneous; structureless; with some patches of high content in forams; some patches with 1-2 mm of black material.


Depth (cmbsf)
Porosity (%)
Bulk density (g/m³)
MSCL
MAD
P-wave velocity (m/s)
Magnetic Susceptibility (10⁻⁵ SI)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Salinity (‰)


R/V METEOR M149
Station: M149_ GeoB 23091-1 (2P)
Location: Carboneras Fault
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)
Latitude: 36°23.308'N
Longitude: 2°52.208'E
Water depth: 968 m
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
530 - 735 cm: silty-bearing mud, with forams and shell fragments, usually < 1 mm size; homogeneous and structureless; color dark greenish gray (GLEY1 4/1); with some patches of foraminifera sandy layers up to 1 cm thick, stained in black probably by sulphide minerals precipitation;
between 700 and 736 cm a distinct sub-vertical / oblique facture is clearly identified, displacing a 1.5 cm thick layer of darker color which the correspondent equivalent on the other side of the facture is not visible in the core;
735 - 777 cm: silty mud; dark greenish gray color (GLEY1 4/1); structureless; with some forams rich patches of up to 1 cm size.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (‰)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

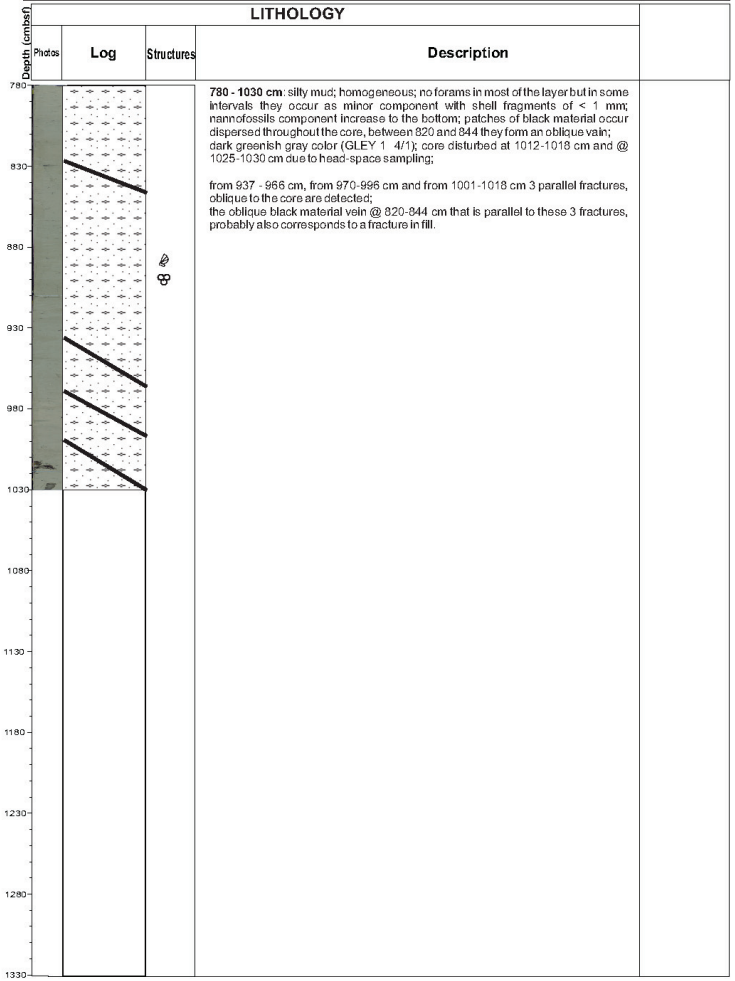
R/V METEOR M149 — **Station: M149_ GeoB 23091-1 (3P)**

Location: Carboneras Fault

Latitude: 36°23.308´N
Longitude: 2°52.208´E
Water depth: 968 m

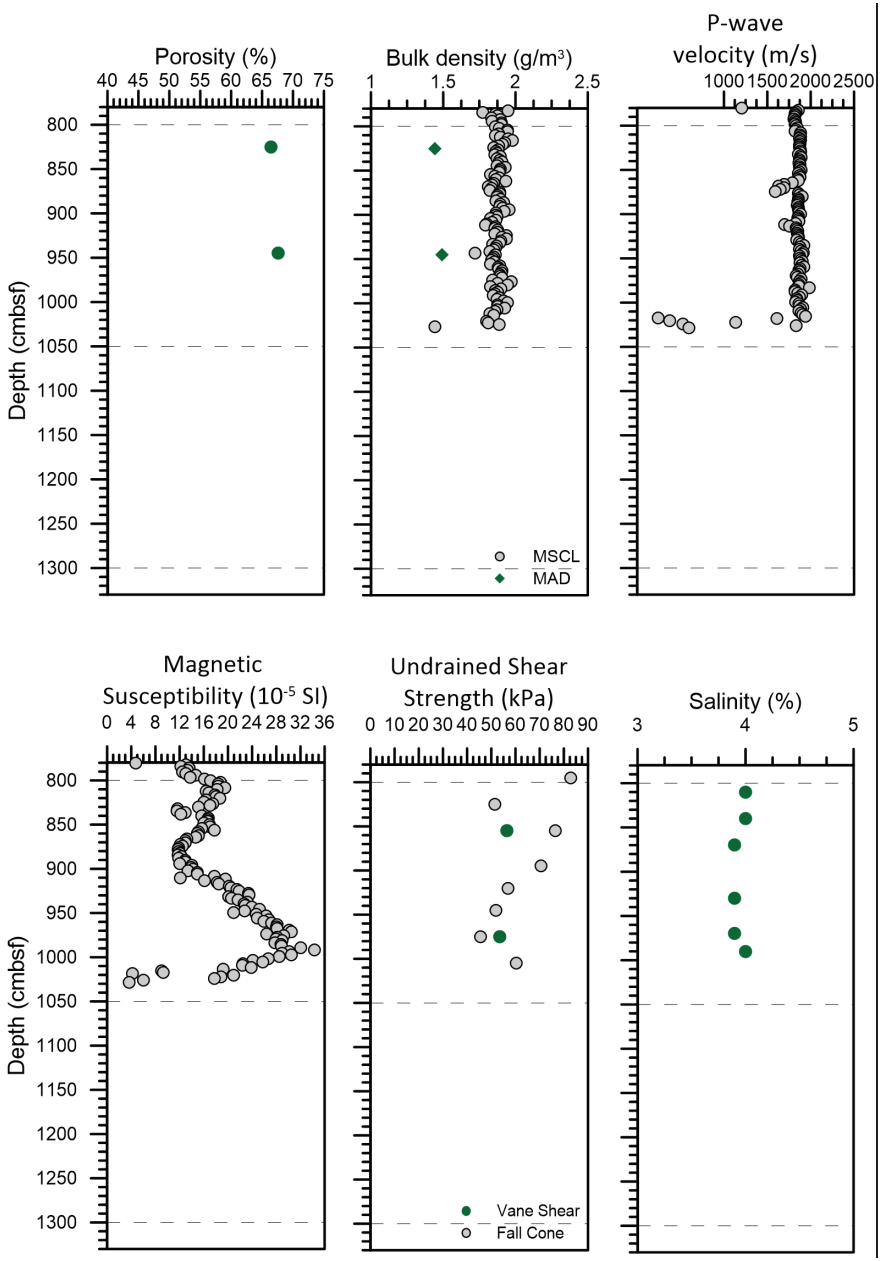
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)

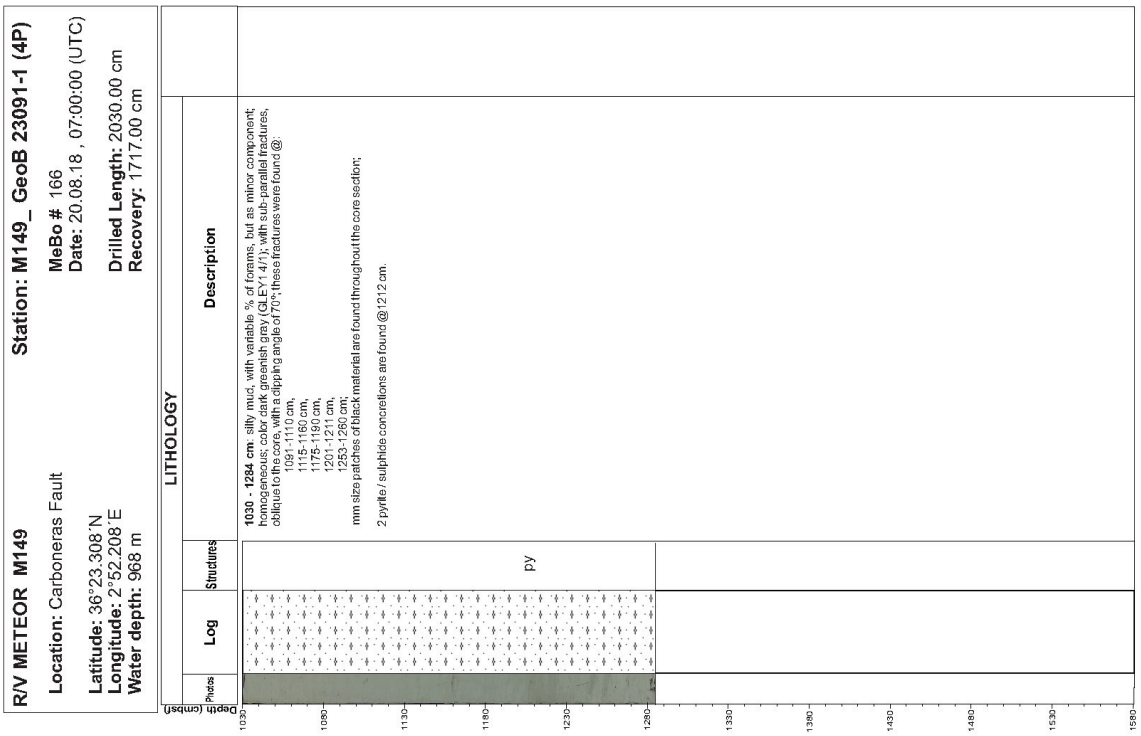
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm

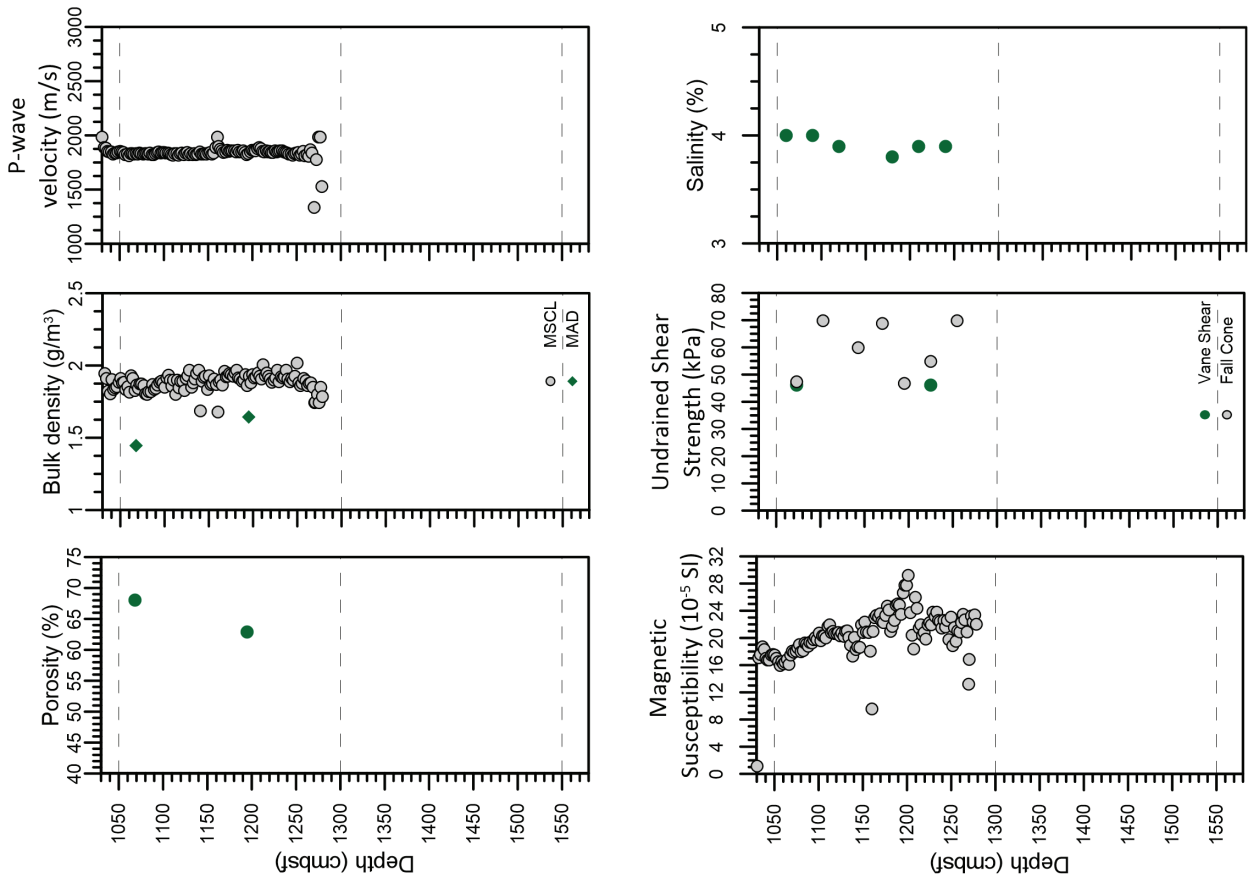


780 - 1030 cm: silty mud; homogeneous; no forams in most of the layer but in some intervals they occur as minor component with shell fragments of < 1 mm; nannofossils component increase to the bottom; patches of black material occur dispersed throughout the core, between 820 and 844 they form an oblique vein; dark greenish gray color (GLEY 1 4/1); core disturbed at 1012-1018 cm and @ 1025-1030 cm due to head-space sampling;

from 937 - 966 cm, from 970-996 cm and from 1001-1018 cm 3 parallel fractures, oblique to the core are detected;
the oblique black material vein @ 820-844 cm that is parallel to these 3 fractures, probably also corresponds to a fracture in fill.




R/V METEOR M149
Station: M149_ GeoB 23091-1 (4P)
Location: Carboneras Fault
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)
Latitude: 36°23.308' N
Longitude: 2°52.208' E
Water depth: 968 m
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1030 - 1284 cm: silty mud, with variable % of forams, but as minor component; homogeneous; color dark greenish grey (GLEY1 4/1); with sub-parallel fractures, oblique to the core, with a dipping angle of 70°; these fractures were found @:
1091-1110 cm,
1115-1160 cm,
1175-1190 cm,
1201-1211 cm,
1253-1260 cm;
mm size patches of black material are found throughout the core section;
2 pyrite / sulphide concretions are found @1212 cm.
py


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

R/V METEOR M149 — **Station: M149_ GeoB 23091-1 (5P)**

Location: Carboneras Fault

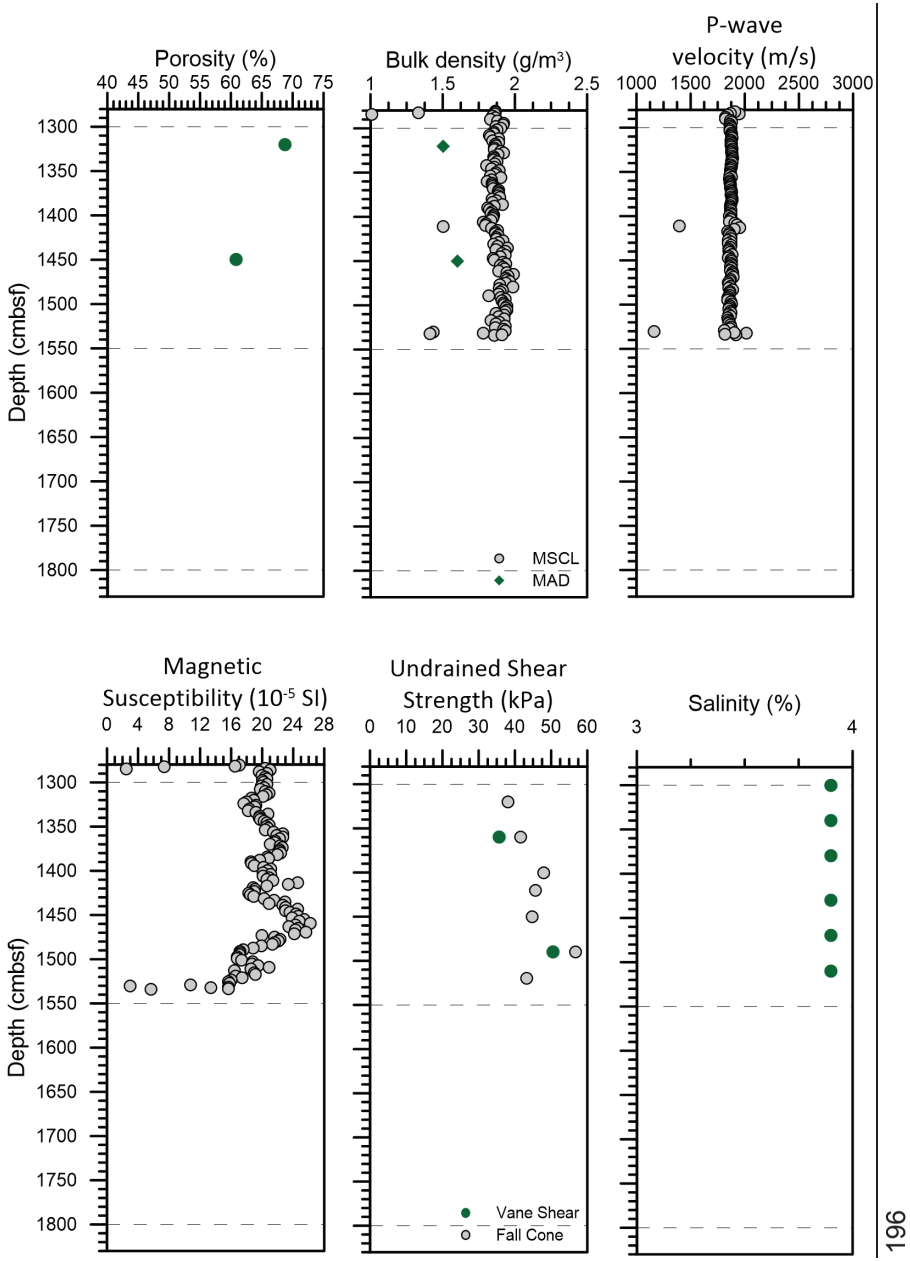
Latitude: 36°23.308´N
Longitude: 2°52.208´E
Water depth: 968 m

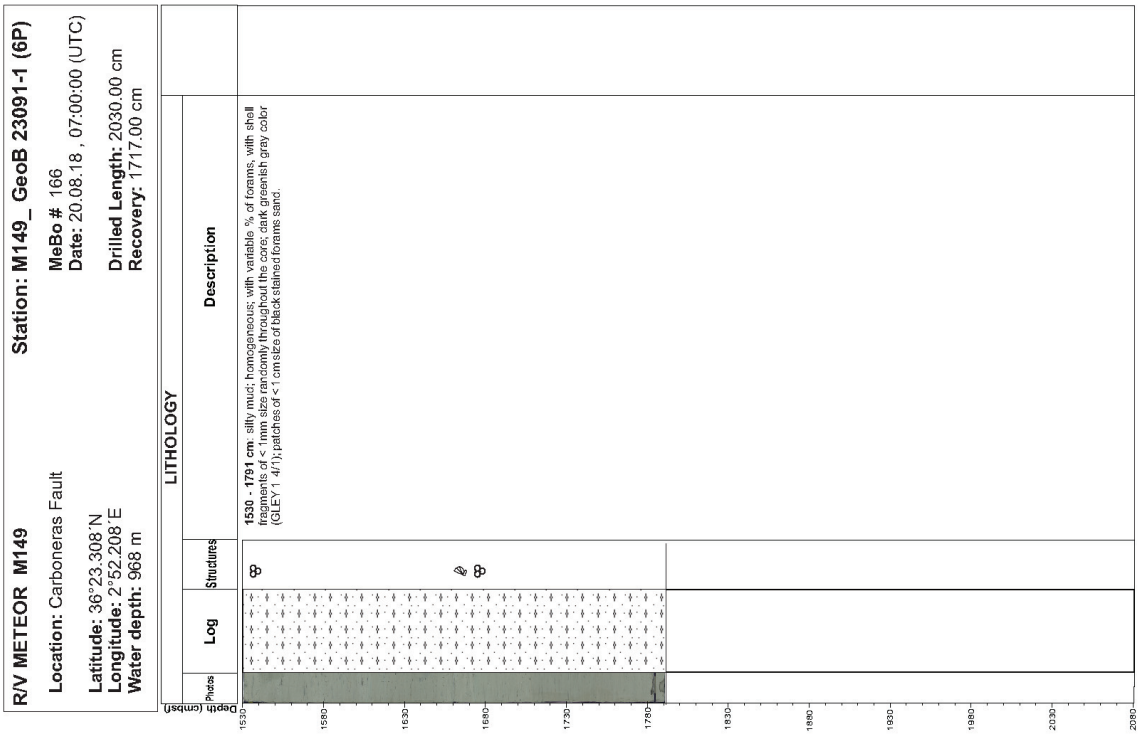
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)

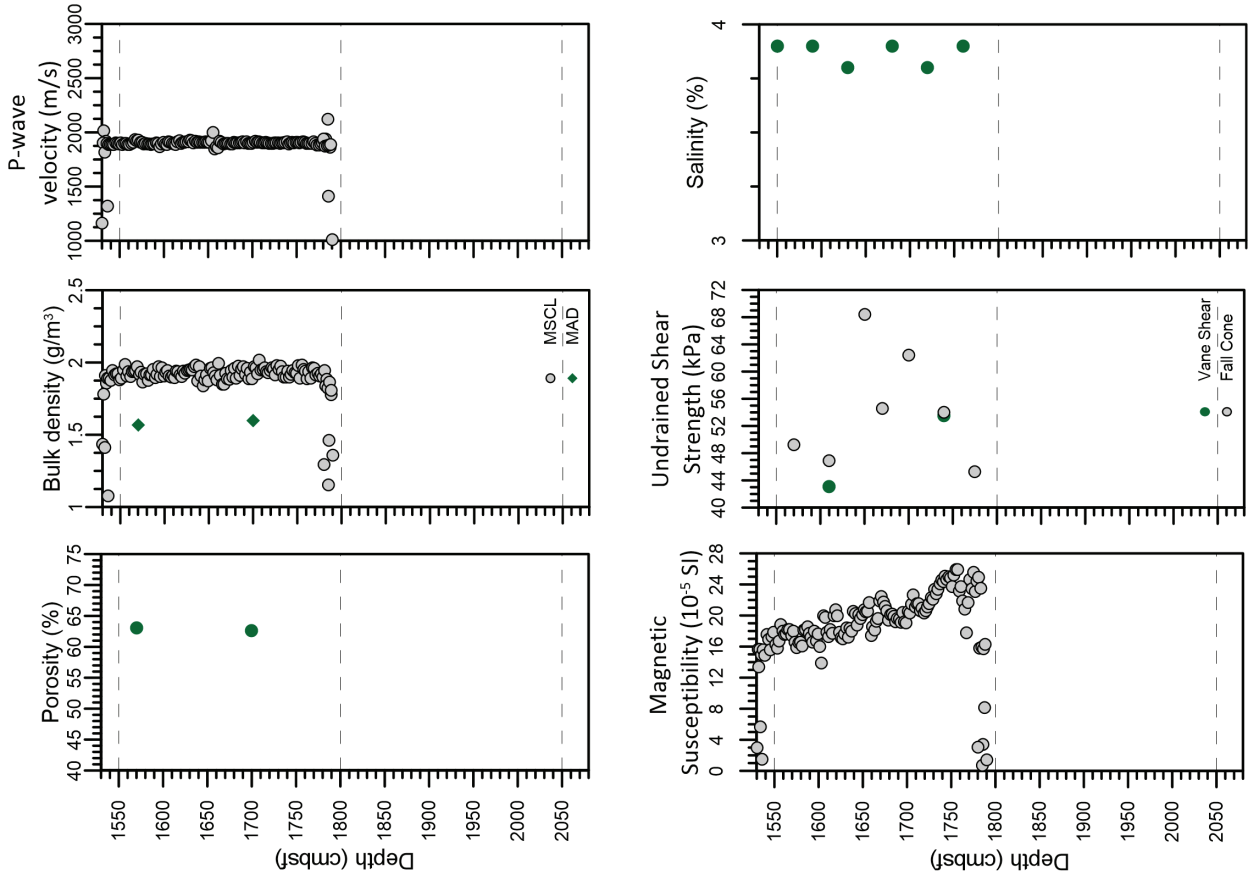
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1280				**1280 - 1510 cm**: silty mud, homogeneous, structureless; dark greenish gray (GLEY1 4/1) color; mm size patches of black material dispersed throughout the core; pseudo-layers between 1320 and 1330 cm defined by 2/5 mm thick color variations; the bottom of this layer is defined by a sharp color change to the layers below of lighter color; **1510 - 1536 cm**: silty mud, homogeneous, structureless; greenish gray color (GLEY1 5/1) with black stained patches usually with 1-2 mm size and one patch of 2x4 cm at the top pf this layer.
1330				
1380				
1430				
1480				
1530				
1580				
1630				
1680				
1730				
1780				
1830				




R/V METEOR M149
Station: M149_ GeoB 23091-1 (6P)
Location: Carboneras Fault
MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)
Latitude: 36°23.308'N
Longitude: 2°52.208'E
Water depth: 968 m
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm
LITHOLOGY
Depth (cmbsf)
Photo
Log
Structures
Description
1530 - 1791 cm: silty mud; homogeneous; with variable % of forams, with shell fragments of < 1mm size randomly throughout the core; dark greenish gray color (GLEY1 4/1); patches of <1 cm size of black stained forams sand.


P-wave velocity (m/s)
Bulk density (g/m³)
MSCL
MAD
Porosity (%)
Salinity (%)
Undrained Shear Strength (kPa)
Vane Shear
Fall Cone
Magnetic Susceptibility (10⁻⁵ SI)
Depth (cmbsf)

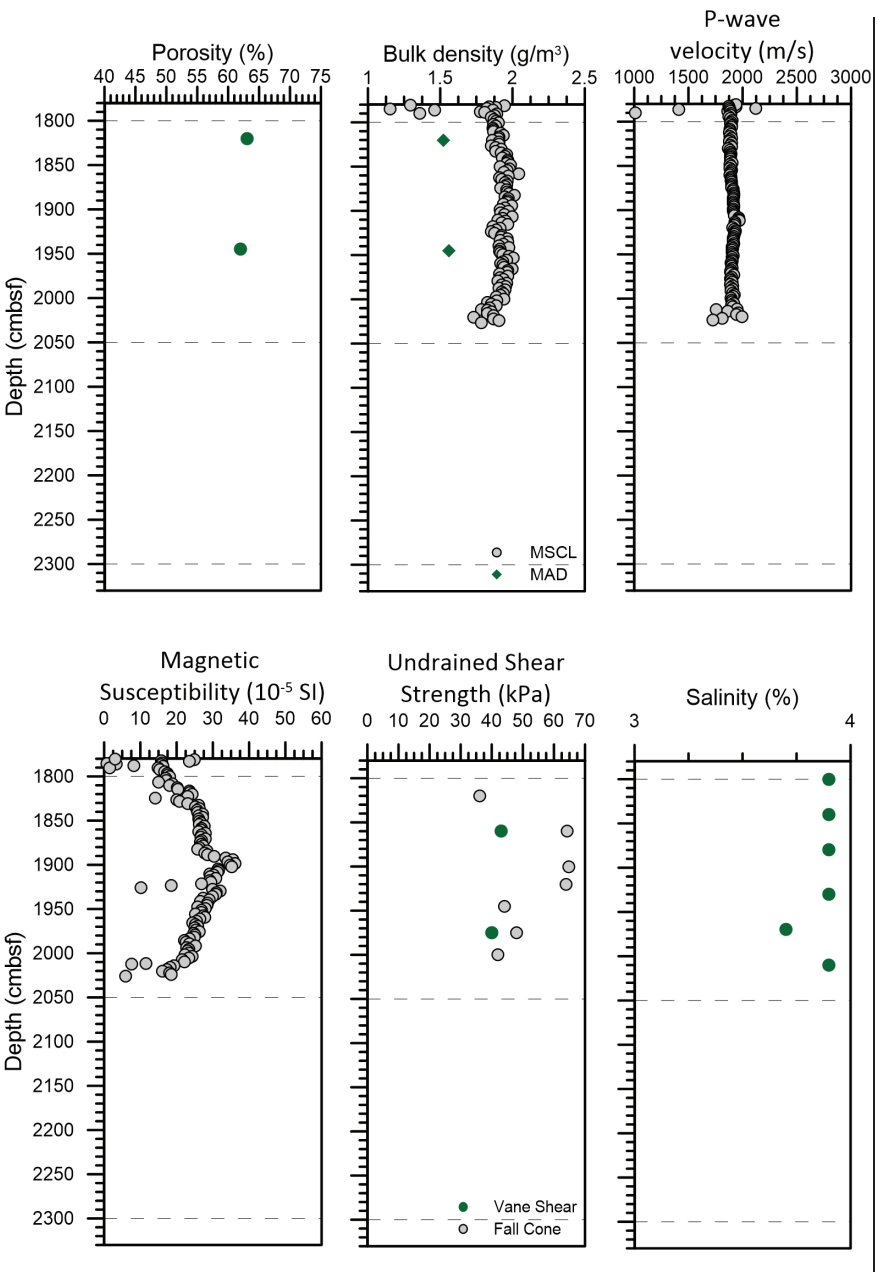
R/V METEOR M149 — **Station: M149_ GeoB 23091-1 (7P)**

Location: Carboneras Fault
Latitude: 36°23.308´N
Longitude: 2°52.208´E
Water depth: 968 m

MeBo # 166
Date: 20.08.18 , 07:00:00 (UTC)
Drilled Length: 2030.00 cm
Recovery: 1717.00 cm

LITHOLOGY

Depth (cmbsf)	Photos	Log	Structures	Description
1780			py	**1780 - 2028 cm**: silty mud with forams and nannofossils; homogeneous, structureless; with mm size black patches dispersed throughout the layer; pyrite /sulphide concretions of up to 1 cm in size @ 1823 cm, 1879 cm, 1923 cm and 1977 cm; dark greenish gray color (GLEY1 4/1).
1830			py	
1880			py	
1930			py	
1980			py	
2030				
2080				
2130				
2180				
2230				
2280				
2330				



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