U.S. SCIENCE SUPPORT PROGRAM

UNAM

WORKSHOP REPORT: Developing Strategies for the Scientific Investigation of Sediment Drifts on Campeche Bank, Gulf of Mexico

August 16 to 18, 2023

Mexico City

Organizers:
Christopher Lowery, Ligia Pérez Cruz, Jaime Urrutia Fucugauchi, James Austin

IODP INTERNATIONAL OCEAN DISCOVERY PROGRAM

THE UNIVERSITY OF TEXAS AT AUSTIN

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Executive Summary

The Loop Current is a central component of the North Atlantic Western Boundary Current, and thus an important part of the Atlantic Meridional Overturning Circulation. It also directly impacts the hydrography and climate of the Gulf of Mexico. Understanding the mechanisms controlling Loop Current behavior is essential to predicting its response to ongoing climate change, and an important aspect of that is understanding how the Loop Current responded to past climate change. The Eastern Campeche Bank, in the southeastern Gulf of Mexico, is an ideal place to do this. Following the collection of new high-resolution multichannel seismic data on the Eastern Campeche Bank in July 2022, we planned this workshop to bring together multidisciplinary scientists from Mexico, the United States, and Europe to address the following questions: 1) what are the most compelling scientific questions that can be addressed by drilling on the Campeche Bank? 2) Where, exactly, should we propose to drill to best address those questions? 3) Given the changing landscape of scientific drilling, how should we move forward with proposing drilling?

Over three days at the Botanical Gardens of the National Autonomous University of Mexico we discussed these objectives and decided on a path forward. First, we had a series of talks covering a range of subjects on the Loop Current, the Gulf of Mexico, and the Campeche Bank. We then had discussions that led to the following hypotheses that fall under the Flagship Initiative "Ground Truthing Future Climate Change" from the 2050 Science Framework:

Hypothesis 1) Western Boundary Current Flow recorded by sediments on the Campeche Bank drives North Atlantic Circulation and thus the global climate system.

a) Disruptions to low latitude ocean circulation facilitate abrupt climate change.
b) Western Boundary Current Flow is sensitive to external forcing (e.g., gateway changes, changes in the intertropical convergence zone, freshwater input, pCO_2, sea level) at different timescales (tectonic, Milankovitch, millennial).
c) Unconformities in Campeche Bank drifts correlate with global circulation changes recorded in other drifts
d) The Loop Current exerts important control on the Gulf of Mexico and regional North American climate

Hypothesis 2) Changes in Western Boundary Current Flow impact marine ecosystems

a) Strengthening Western Boundary Current flow drives marine ecosystem distribution
b) Evolution of Western Boundary Current flow is coupled to North Atlantic nutrient cycling

To test these hypotheses, we selected five primary drilling sites which will allow us to both date key reflectors of the contourite drifts on the Campeche Bank and collect expanded sedimentary sections from which we can develop detailed paleoceanographic proxy records of hydrographic, climatic, and ecological change. We prioritized these sites for different Mission Specific Platform expedition lengths, with an entire expedition (90 days) occupying all five sites and developing the full potential of the Campeche Bank sedimentary archive and intermediate (60 days) and short (30 days) expeditions focusing on just higher priority time intervals. Finally, we agreed to produce a Full Proposal to submit to the Science Evaluation Panel by the October 2 deadline and began work on that document, making substantial progress on that document before the meeting adjourned

1. Workshop Rationale

The Loop Current (Figure 1) is a critically important component of the global thermohaline circulation and an important driver of North American climate. As one of the main feeder currents of the Gulf Steam, it is an important pathway for the movement of warm, salty water from the Caribbean northward. The Loop Current also controls the overall average oceanographic characteristics of surface waters in the Gulf of Mexico by aperiodically spinning off warm-core eddies which drift west (Thirumalai et al., 2021). Individual eddies can disrupt fisheries, strain offshore infrastructure, and provide a potent warm-water fuel source for hurricanes (e.g., Biggs, 1992, Bosart et al., 1999; Milkov and Sassen, 2000).

The Loop Current is broadly recognized as important, but its temporal evolution is still poorly understood. This has led the National Academies of Sciences, Engineering, and Medicine to write a 116-page report detailing major gaps in our understanding of the Loop Current (NASEM, 2018); this report was followed up with a decadal funding plan to fill these gaps, focused on observational data and modelling. Given this strong interest in the modern Loop Current, it is somewhat surprising that little attention has been paid to its history. **We do not know when the Loop Current first formed, nor do we have a clear understanding of whether it was stronger or weaker during the last ice age, let alone at other points in the Cenozoic**. Answering these questions will have direct implications for predictions of whether the Loop Current will weaken or strengthen as the climate warms in the coming decades, and allow us to define possible tipping points in the Loop Current system as future warming approaches past analog climate states, which may or may not have had a Loop Current in the modern sense.

Most studies of Loop Current history focus on the Florida Bank, where the current forms its namesake loop and bends back south to exit the Gulf through the Florida Straits. Existing results from this area that suggest the Loop Current was stronger during Last Glacial Maximum (LGM) are complicated by the fact that this area is also strongly affected by Mississippi River (fresh-water) discharge (e.g., Nürnberg et al., 2008). This makes it difficult to know whether proxy records indicate increased salinity, either because there was an increased flow of warm salty water north via the Loop Current or because there was a reduced flow of fresh water south from the Mississippi. Records from the Florida Straits themselves have the same issue. To get around this problem, we propose to study the Loop Current where it first enters the Gulf, north of the Yucatan Strait along the Campeche Bank.

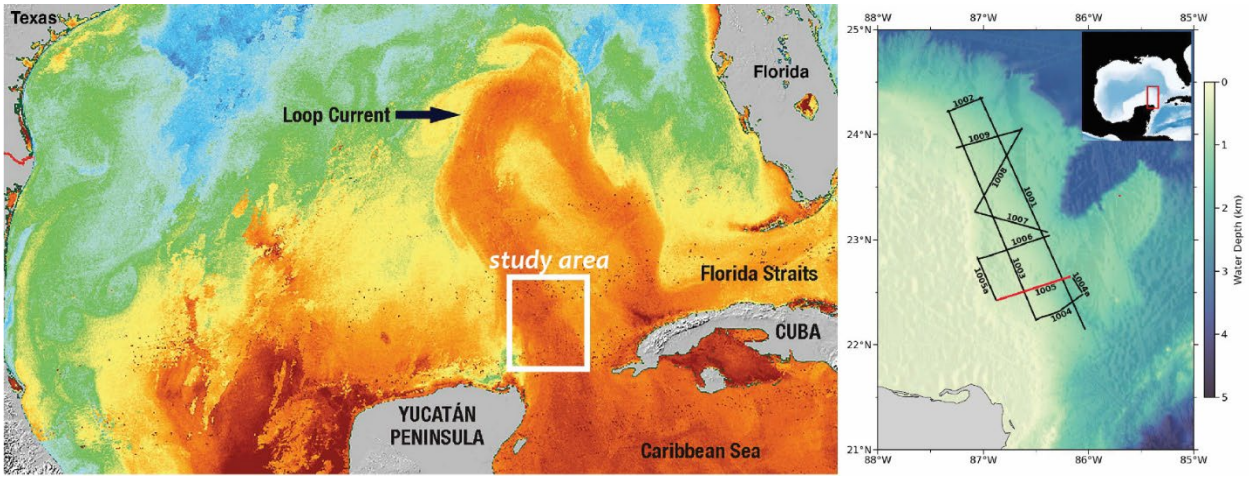

Figure 1. *L: Sea surface temperature map of the Gulf of Mexico showing the Loop Current and our study area. NOAA. R: bathymetric map of the Eastern Campeche Bank and seismic lines collected in summer 2022.*

The Eastern Campeche Bank (Figure 1) is an area of gently sloping sediment drifts atop a bench below the bathymetric high of the Yucatán carbonate platform and above the Campeche Escarpment, a cliff which drops into the deep Gulf of Mexico Basin. Active sediment drifts attributable to the Loop Current were discovered on the Campeche Bank by a cruise of the German ship *Meteor* in 2008 (Hübscher et al., 2010; Hübscher and Nurnberg, 2023; Hübscher et al., 2023). A subsequent reflection seismic survey funded by NSF and carried out on the Mexican research ship *R/V Justo Sierra* in summer 2022 by the team of American and Mexican scientists who organized this workshop (Lowery et al., 2023), identified identical features buried in the subsurface, indicating that these drifts contain a record of current flow into the Gulf of Mexico back to the onset of the Loop Current. These seismic profiles show a clear evolution of contourite deposits, with pre-drift early Cenozoic strata overlain by a package of large mounded sediment drifts (following the sediment drift nomenclature of Rebesco et al., 2014) with moats of impressive scale (100s of m deep and several km wide). These moats gradually reduce in size and abundance as the deposit transitions to younger plastered sediment drifts. With only a single Deep Sea Drilling Project site (Site 95) on the far eastern edge of this area, we have no sedimentary archives in these deposits with which to study the evolution of the current. However, with our new high resolution seismic data, it is now possible to plan a coring campaign to target specific seismic units to: 1) constrain the ages of key reflectors to develop an improved understanding of the timing of different stages of current development and 2) obtain develop high-resolution proxy records to reconstruct the development of the proto-Loop Current and Loop Current through time.

We organized this workshop in Mexico City at the National Autonomous University of Mexican (UNAM, in Spanish) in order to bring together a diverse array of disciplines, especially including oceanographers from Mexico who have built an extensive observational dataset of modern ocean currents in the southeastern Gulf of Mexico, to prioritize scientific questions that can addressed by drilling on the Campeche Bank and then develop a plan to implement that drilling. Thirty-three scientists from Mexico, the United States, and Europe participated in this three-day workshop (see section 4, “List of Participants”). **Our goals for this workshop were:**

1. Prioritize key scientific questions that can be addressed by studying the newly mapped sediment drifts east of Campeche Bank in the Yucatan Channel.
2. Develop a list of sites at which sediments can be recovered to accomplish those priorities.
3. Envision a plan to drill those sites in light of the changing landscape of scientific ocean drilling.

2. Workshop Outcomes

The workshop began with a series of short talks by scientists who have studied the Loop Current system with a variety of techniques, including modern hydrographic observations, cold water coral ecosystems, paleoceanography, and geophysical surveys. We then began discussions of why and how to carry out a drilling campaign in this area.

2.1 Science Objectives

We formed breakout groups by broad scientific discipline to discuss high-priority science questions that could be addressed with drilling on the eastern Campeche Bank. Breakout groups then reported their findings in plenary session, followed by a productive group discussion of scientific priorities.

Following extensive discussion, we settled on two primary hypotheses with secondary hypotheses that represent specific tests of them:

2. **Western Boundary Current Flow recorded by sediments on the Campeche Bank drives North Atlantic Circulation and thus the Global Climate System.**
    a) Disruptions to low latitude ocean circulation facilitate abrupt climate change.
    b) Western Boundary Current Flow is sensitive to external forcing (e.g., gateway changes, changes in the intertropical convergence zone, freshwater input, pCO_2, sea level) at different timescales (tectonic, Milankovitch, millennial).
    c) Unconformities in Campeche Bank drifts correlate with global circulation changes recorded in other drifts
    d) The Loop Current exerts important control on Gulf of Mexico and regional North American climate
3. **Changes in Western Boundary Current Flow impacts marine ecosystems**
    a) Strengthening western boundary current flow drives marine ecosystem distribution
    b) Evolution of western boundary current flow is coupled to North Atlantic nutrient cycling

These hypotheses are strongly aligned with the 2050 Science Framework (Koppers and Coggan et al., 2021), particularly the Flagship Initiative **"Ground Truthing Future Climate Change."** Studying Campeche Bank drift deposits will "provide information about the ocean's [i.e., Loop Current's] response to past natural climate variability to help improve models that predict future change" and provide a new paleoclimate record to identify whether the Loop Current system is "susceptible to abrupt and irreversible change" (Koppers and Coggan et al., 2021). In so doing, this work will also address several Strategic Objectives:

- **Earth's Climate System**: What is the role of the Loop Current in the northward transport of heat throughout the Cenozoic?
- **Feedbacks in the Earth's System**: Is changing Loop Current strength associated with changes in Atlantic Meridional Overturning Circulation?
- **Tipping Points in Earth History** Was the development of the Loop Current driven by climate, and thus might be reversed? Or was it driven by gateway changes, and is thus likely to continue regardless of climate change?
- **Natural Hazards Impacting Society** Was the Loop Current stronger or weaker (or more or less stratified) during warm climate states, and thus more or less likely to shed warm core eddies as the Earth warms?

2.2 Primary Drilling Sites

To decide where to drill to achieve the consensus science objectives, new breakout groups were formed of a mix of disciplines to assess potential drilling sites. Breakout groups shared their sites selections in discussions in front of poster-size printouts of the 2022 seismic profiles, followed by plenary discussion and selection of primary sites to achieve drilling objectives.

To test the hypotheses laid out above fully, we need to cores that: 1) provide the best possible age constraints for key seismic reflectors which record the history of contourite deposition and 2) sample expanded sections that provide the best proxy archives of current flow and marine ecosystem changes. The five primary sites selected (CB1A-CB5A) balance those two objectives

and combine to represent a Full Mission Specific Platform (MSP) drilling plan (~90 days) to meet all scientific objectives to their full extent. Our intermediate plan (~60 days) would include primary sites CB1A and CB3A only to obtain a complete stratigraphic record of key Loop Current deposits without the depth transect. Our basic plan (~30 days) would involve only site CB1A to obtain the most complete record of the youngest contourite deposits and a short section at an alternate site to constrain the ages of the main seismic horizons in a relatively condensed sequence. Additional sites that were discussed but not selected as primary sites will be included as alternates.

2.3 Outline and Plan for Writing A Full Proposal

With science objectives agreed upon and sites selected, all that remained was to decide to whom we should propose a drilling expedition, given the ongoing changes in the scientific ocean drilling world with the planned retirement of the *JOIDES Resolution* and expiration of the International Ocean Discovery Program after 2024. Kevin Johnson of the National Science Foundation (NSF) gave a presentation via zoom that provided two crucial and timely updates that made this decision a simple one. First, NSF just released a Dear Colleague Letter calling for expressions of interest in hosting a new program office (the Scientific Ocean Drilling Coordinating Office, or SODCO) to manage the logistics of a mission specific platform (MSP) drilling program, and second, NSF will support US participation in the expeditions implemented by the new IODP^3 program being set up by ECORD and JAMSTEC. These two announcements were good news in themselves and also indicate NSF's willingness to join IODP^3 as a partner (although this is still pending an agreement between the parties involved as of this writing). Given all this, a brief discussion yielded the unanimous decision to submit a Full Proposal for a MSP expedition to the Science Evaluation Panel by the October 2 deadline.

This was followed by a discussion of IODP proposal guidelines, the development of an outline for our proposal, and the assignment of writing tasks to the workshop members. We then spent the final afternoon of the workshop beginning to write the proposal, and adjourned with >5000 words produced and a clear plan for completing the proposal and associated forms in the coming weeks.

2.4 Enhanced Collaboration Between the IODP Community and Mexico

A major goal of this workshop, and the reason we had it in Mexico City, was maintaining and strengthening the scientific collaboration between the IODP community and Mexico. International collaboration is of course good for its own sake, but is particularly essential for studies of the Loop Current, which directly affects Mexico, the United States and, through its connection to the Gulf Stream, northern Europe. Mexico is not presently a member of IODP, but its scientists have participated in IODP Expedition 364 (Chicxulub Impact Crater) and Expedition 385 (Guaymas Basin Tectonics and Biosphere).

Mexican scientists are at the forefront of modern Loop Current research, and many of those specialists attended this workshop, including Julio Sheinbaum, a professor at CICSE who has spent decades producing detailed hydrographic observations of the Loop Current as it flows through the Yucatán Strait and into the Gulf of Mexico; Jorge Zavala, former head of the Mexican National Weather Service and current director of the UNAM Institute of Atmospheric Sciences, who works on the physics of the Gulf of Mexico; and Elva Escobar of the UNAM Institute of Marine and Limnological Sciences and a member of the committee to advise the (US) National Academy of Sciences Gulf Research Program's Understanding Gulf Ocean Systems Initiative, which is focused on the Loop Current. These luminaries were enthusiastic participants in the meeting, and all expressed an eagerness to remain engaged with this project

and contribute to the Full Proposal as proponents. This is of course in addition to the invaluable support provided by our workshop co-organizers, Ligia Pérez Cruz and Jaime Urrutia Fucugauchi, who have been involved in this project from the start and without whom none of this would have happened. The value of their support cannot be overstated, and having this meeting at their home institution helped strengthen that support and clearly shows what a central role UNAM plays and will continue to play in this project.

This meeting was also attended by a number of UNAM graduate students, who are currently studying different aspects of Campeche Bank stratigraphy. These students were able to learn the basics of the IODP proposal process and took part in discussions planning key science questions, drilling sites, and contributed text to the Full Proposal.

3 Workshop Planning Suggestions

Scientific ocean drilling proposals are complex and benefit from a wide variety of perspectives. This workshop was designed to solicit the input of all participants and facilitate discussions to lead to consensus decisions. We found this plan to be very effective, and feel it would be worth describing it in some detail here for the benefit of future workshop conveners (who are also welcome to contact us for input and advice on workshop planning). We feel that ~30 participants was an ideal size for this type of meeting.

We had two major topics to decide: what are the most important scientific questions that can be addressed in our study area with drilling (i.e., how can we write the strongest proposal) and what sites would best allow us to answer those questions. For both of these topics, we structured discussions from individual brainstorming to group consensus. To develop science objectives, we split participants into breakout groups based on scientific discipline, assigned a group leader, and then gave them several hours to work on the following prompt:

> *Considering the background talks this morning and your own disciplinary background, what do you think are the most interesting and important scientific questions that could be addressed by drilling on the Eastern Campeche Bank? (The Scientific Framework 2050 will be useful in this regard.)*
>
> Part 1 – Spend ~10 minutes brainstorming ideas in the google Jam Board. Each participant should have a chance to express ideas.
>
> Part 2 – As a group, discuss initial ideas, identify areas of overlap, and come to a consensus of **top 2-3 priority science questions** (please also keep a list of secondary or tertiary priority questions!). Remember that a good scientific ocean drilling proposal is generally built around one or two central questions but will collect material that can be used to address many more.
>
> Things to consider when prioritizing:
>
> 1. What science questions can only be addressed on the **Eastern Campeche Bank**?
> 2. What science questions **require drilling** (as opposed to surficial sampling, like gravity or piston cores) to answer?

Once groups had decided on their own key science questions, we reconvened in plenary session and each group leader spent ~ 5 minutes going over their group's key questions, each time followed by broader discussion. Then we identified areas of overlap and discussed what the overarching questions should be, how to formulate them (typing them out and discussing the

wording on the projector), and what the sub-questions should be. This group discussion took another few hours and at the end we had a consensus on a set of priority science questions (hypotheses, actually, as we decided those were more compelling) that we all felt good about. These discussions strongly benefitted from a good moderator to keep the discussion on track and both solicit and synthesize ideas.

Once we had science objectives our other major task was to decide the best places to drill to address those objectives. For this, we once again split into breakout groups, this time with disciplines mixed together to ensure a variety of perspectives in site selection. We brought poster-size printouts of the 2022 seismic profiles in the study area and laid them out in a space where everyone could gather around them, which everyone agreed was very beneficial for the ensuing discussions. We then gave breakout groups several hours to work on the following prompt.

> *Where should we propose to drill to address the main science questions developed during the first breakout? Ideally, drilling location should be on seismic profiles, or even better, at the crossing points of profiles. Try to identify sites that can be used to address multiple science objectives. Don't forget that we have almost no age control, beyond "Early Cretaceous carbonate platform" "K/Pg Boundary Deposit" and "Mid Pleistocene Transition."*
>
> > As a group, discuss initial ideas for tying specific locations to the priority objectives listed in the first breakout group. Develop a series of sites that can drilled to address our main science questions. Remember, more sites are better than fewer sites (alternates form an important part of any successful drilling proposal).

When breakout groups had a chance to select their sites, we reconvened as a group and, starting with the first seismic profile, went through each profile in turn and discussed potential sites suggested for each before adjourning for the day. The moderator then spent some time in his hotel room synthesizing the discussion and coming up with a strawman list of primary sites that address all the science objectives, as a starting point for a plenary discussion the next morning. These suggested sites facilitated discussion of drilling philosophy, how to prioritize recovery of different horizons, and eventually led to a consensus on five primary sites to include in the proposal. Of these, only one was on the original strawman list, but that's ok, that's the point of setting up a strawman. Sites that were discussed but not included as primary sites comprise our list of alternates.

Once science objectives were defined and sites selected, the main remaining task was to write the proposal. This process benefitted immensely from developing the outline as a group, using a google doc projected on the screen which the moderator edited based on the discussion. This process: a) simplified the task of figuring out a proposal outline, and b) kept everyone on the same page as to writing goals, which made it very easier to ask people to assign themselves to a section and start writing. This allowed us to make a strong start to the proposal during the last afternoon of the workshop.

A final important point is that these discussions did not fit neatly in the schedule laid out, and in fact we were quite off schedule by the end of the first day. That was expected, and contingency time was built into Day 3 in the form of extended discussion of drilling strategy and writing time. Letting key conversations have space to play out was key to the successful outcomes listed above. They simply can't be rushed.

4 List of Participants

Chris Lowery, University of Texas (Convener)

Ligia Pérez Cruz, UNAM Institute for Geophysics (Convener)

Jaime Urrutia Fucugauchi, UNAM Institute for Geophysics (Convener)

James Austin, University of Texas (Convener)

Patricia Standring, University of Texas

Jessica Labonté, Texas A&M Galveston

Gregor Eberli, University of Miami

Jordan Todes, University of Chicago

Amy Weislogel, West Virginia University

Bryce Mitsunaga, Brown University

Hong Yang, Stanford University

James Wright, Rutgers

José Isola, Rutgers

Lélia Matos, Marine Science Center of Algarve

Uisdean Nicholson, Heriot Watt University

William Lee, Vice Chancellor of Science, UNAM

Guillermo Pérez-Drago, Beicip-Franlab IFPEN

Juilo Sheinbaum Prado, CICSE

Jorge Zavala, IACC, UNAM Institute of Atmospheric Sciences

Edgar Garcia Garnica, UNAM

Luz Adriana Arredondo, Coordinación de Plataformas Ocenaográficas

Monica Aparicio Estrada, Coordinación de Plataformas Ocenaográficas

Axel Xavier Lara Omaña, UNAM

Julián Zapotitla Román, UNAM

Hugo Gilberto Martínez Vázquez, UNAM

Carlos Alfonso Rosales Armendáriz, UNAM

Elva Escobar, ICML, UNAM

5 Workshop Schedule

This is the planned workshop schedule; the actual timing varied but we did all the things listed here.

Day 0 (arrival day) – August 15, 2023

18:00 - 20:00 h. informal icebreaker in the Radisson Paraíso lounge

Day 1 – August 16

Breakfast in hotel

8:00-8:30 h. Transportation to Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM

8:30-8:55 h. **Welcoming Remarks** – William Lee Alardín, Ligia Pérez Cruz, Jaime Urrutia Fucugauchi, Chris Lowery.

8:55-9:25 h. **Introductions** each participant will prepare 1 slide to share who they are, where they're from, and why they're interested in the Campeche Bank.

BACKGROUND TALKS

> So that we're all on the same page, the workshop will begin with a series of talks about the hydrography and geologic history of the southeastern Gulf of Mexico, a summary of IODP Proposal 915-PRE, and the results of the site survey cruise carried out last summer on the *Justo Sierra*.

9:25-9:45 h. **Modern Loop Current Flow through the Yucatán Strait** – Julio Sheinbaum (CICESE)

9:45-10:05 h. **Holocene Hydrography of the Broader Gulf of Mexico –** Kaustubh Thirumalai (University of Arizona)

***10:05-10:30 h* COFFEE BREAK**

10:30-10:50 h. **Drilling Programs with Continuous Core Recovery in Yucatan**- Jaime Urrutia Fucugauchi (UNAM)

10:50-11:10 h. **Circulation in the Gulf of Mexico***.* Jorge Zavala Hidalgo (UNAM).

11:10-11:30 h. **Seismo-Stratigraphic Insights into Cenozoic Contourites Deposits offshore Newfounland-Labrador, Northwestern Atlantic margin.** Guillermo Pérez-Drago (Bacip-Franlab independent Petroleum Consultancy Firm).

11:30-11:50 h. **Coldwater Corals of the Campeche Bank** Lélia Matos (CCMAR)

11:50-12:20 h. **IODP Proposal 915-PRE** – Amy Weislogel (West Virginia University)

12:20-13:00 h **LUNCH @ Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM** (breakout groups assigned before lunch so they can sit together and chat)

13:00-13:20 h. **July 2022 Seismic Survey Results and Key Science Questions** – Chris Lowery (UT Austin)

13:20-14:30 h. **Breakout Groups 1 – Science Objectives**

Attendees will be assigned small groups by their discipline/research interest. Each group will discuss the key science questions that could be addressed by drilling on the Campeche Bank. They will produce a prioritized list of objectives to share with the workshop.

14:30-15:00 h **COFFEE BREAK**

15:00-16:30 h. **Breakout Groups report back**

Each breakout group will spend 5-10 minutes sharing their prioritized list of science objectives.

16:30-16:50 h. **Plenary discussion – What are the most important objectives we can address?**

As a group, we will discuss the objectives presented by the groups. Are there overlapping or complementary objectives? What are the most compelling or scientifically relevant objectives we can address? What are the key objectives a proposal should focus on? How can we ensure that the maximum number of secondary objectives are addressed?

16:50-17:00 h. **Wrap-up for the day**

17:00 h. Back to hotel

Dinner in hotel or in town

DAY 2 - AUGUST 17

8:00-8:30 h. Transportation to Transportation to Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM

8:30 – 9:00 h. **Summary of previous day's discussions**

The previous day ended with a list of key objectives. We will review them (so that they're fresh in mind for subsequent discussions) and give a last call for any other ideas that may have come up over dinner, etc.

9:00-10:00 h.– **Breakout Groups 2** – **Drilling Sites**

Attendees will be assigned different small groups, this time aiming to balance disciplines (again aiming for 6-8 people/group). All groups will have copies of all the available seismic data on Campeche Bank, and will discuss the best places to drill to achieve the objectives laid out in the previous exercise. Groups will *not* get bogged down in discussion of what specific drilling platforms can achieve, but rather where, under ideal circumstances, they would propose the sites. Discussion of what platforms to use and how to deal with other real-world constraints will follow from this discussion.

10:00-10:30 h. **COFFEE BREAK**

10:30-11:00 h. **Breakout groups report**

Breakout groups spend a 5-10 minutes reporting on their proposed drill sites.

11:00-12:00 h. **Plenary discussion on drilling sites**

As a group, we will discuss the planned sites. Is there a clear consensus among the breakout groups or do we need to sort out differences of opinion? Can we optimize the sites to achieve our secondary objectives?

12:00-13:00 h. **LUNCH @ Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM**

13:00-13:20 h. **Summary of Current US Post-IODP Plans –** Kevin Johnson (NSF, *via Zoom*)

13:20-13:40 h. **Summary of ECORD workshop on Deep Ocean Circulation** – Uisdean Nicholson, (Heriot Watt University)

13:40-14:30 h. **Breakout Groups 2** – **Drilling Strategy**

In the same breakout groups as the morning, we will discuss how to go about proposing this drilling. What platform should we target to drill the sites we've picked and achieve the science objectives we've defined? Can we work through SEP to propose a MSP? What are the funding options from NSF? What should we do? We will invite representatives of SEP, USSSP, and NSF to provide feedback on these discussions to the extent they can (certainly, there will be a lot of specific questions about "can we do that?").

14:30-15:00 h. **COFFEE BREAK**

15:00-16:45 h. **Plenary Discussion of Drilling Strategy**

Groups will report on their ideas for drilling strategy, and then we will discuss them. We will not come to a decision in this time block but rather let the discussions bleed over into dinner, and then resume in the morning

16:45-16:55 h. **Wrap-up for the day**

16:55-17:10 h. **Group Photo in the Garden**

17:10 h. Transportation to Biodiveristy Pavilion.

***17:30-20:00 h* PLENARY GALA DINNER AT BIODIVERSITY PAVILION (Pabellón de la Biodiversidad)**

20:00 h. Back to hotel

DAY 3 – AUGUST 18

8:00-8:30 h. Transportation to Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM

8:30-10:00 h. **Plenary Discussion of Drilling Strategy**

> We will resume discussions from the previous evening and come to a decision on the best strategy to move forward.

***10:00-10:30 h.* COFFEE BREAK**

10:30-12:00 h. **Assignment of writing groups, writing groups begin work on white paper/proposal**

> The outcome of this workshop will be either a proposal of some sort or a white paper which can be used as the basis for a proposal. Either way, we will split into groups to work on different parts of the whole, and begin this work at the workshop. Scheduled writing time also represents contingency time for the workshop, so that if some discussions wind up taking longer than planned that's ok, we'll just reduce the writing time. Under ideal circumstances, we'll have a head start on the proposal/white paper.

***12:00-13:00 h.* LUNCH @ Unidad de Seminarios "Dr. Ignacio Chávez," Jardín Botánico, UNAM**

13:00-14:30 h. **Writing groups continue to meet**

***14:30-15:00 h.* COFFEE BREAK**

15:00-16:50 h. **Writing groups continue to meet**

16:50 – 17:00 h. Adjourn

17:00 h. Back to hotel

2.3 Outline and Plan for Writing A Full Proposal

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