IODP Proposal Cover Sheet

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Florida Straits Gateway Record

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Title	Revisiting the Mesozoic to Pleistocene in the Southeastern Gulf of Mexico: Plate Tectonics, Ocean Circulation, and Climatic Evolution
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Area	Florida Straits

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Abstract

The southeastern Gulf of Mexico (GoM) lies at an important gateway between the western North Atlantic/Tethys and the Caribbean/Pacific, and has the potential to provide a unique and potentially continuous geologic record of sedimentological, paleoecological, and geochemical signals of climate evolution and paleoceanography since the Late Jurassic. Despite the long history of scientific ocean drilling in the Gulf of Mexico (GoM), such a record has yet to be developed. This is likely because much of the GoM is characterized by thick (>10 km) sedimentary successions and/or extensive hydrocarbon reservoirs unsuitable for scientific drilling. However, the western approaches to the Florida Straits contain a relatively thin (<2 km) Mesozoic-Recent section that was cored by DSDP Legs 10 and 77. Although these sites were poorly recovered (average 42.5%), they indicate the safety and suitability of the strata there for modern paleoceanographic study. We propose to drill three sites (two new sites, near Sites 535 and 540, and redrill Site 95) to generate a composite section spanning the basement to the Pleistocene to address a number questions directly related to the IODP Science Plan, including Challenges 1, 2, 3, 4, 7, and 9. This is broadly focused around the role of the Florida Straits as an oceanographic gateway over the past 145+ my, and the GoM's relationship to and influence on the climatic evolution of that time interval.

The primary objective of this drilling is an investigation of the evolution of Mesozoic climate, including developing a deep sea record of Early Cretaceous climate change utilizing rhythmically-bedded pelagic limestones and marlstones (Challenges 1,2,4,7) , and investigating the roles sea level and circulation on the development of oceanic anoxic events (OAEs) (Challenges 1,2,4,7). Secondary objectives include determining the nature of the underlying crust (Challenge 9), the timing of rifting and the opening of the southeastern GoM gateway (Challenge 9), and the expression of a number of Cenozoic climate events, including the mid-Pleistocene Transition, Miocene Climate Transition, middle Miocene Climate Optimum, Eocene/Oligocene Boundary, middle and early Eocene Climate Optimums, and Paleocene-Eocene Thermal Maximum (PETM), and Cretaceous-Paleogene (K-Pg) Boundary. Particularly high impact questions from the Cenozoic interval include comparing the earliest Paleocene record to that recently recovered from the Chicxulub Crater (Challenges 4,7), determining whether the GoM was a sink for carbon during the recovery from the PETM and Eocene hyperthermals (Challenges 1,2,3,4,7), and investigating the timing of the onset of the modern Loop Current (Challenges 1,2,4,7).

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Scientific Objectives

1.How is Early Cretaceous climate evolution expressed in deep sea sediments (Challenges 1,2,4,7)?
2.How are Cretaceous OAEs expressed in the GoM, and what does this reveal about the evolution of Atlantic and Northern Hemisphere oceanographic circulation; what was the influence of the Western Interior Seaway (WIS) on Cretaceous climate and oceanography (Challenges 1,2,4,7)?
3.Was the GoM an important sink for carbon during the PETM and Eocene hyperthermals, (Challenges 1,2,3,4,7)?
4.Can changes in GoM circulation patterns be directly tied to Neogene gateway changes and Cenozoic cooling events, including the subsidence of the Nicaragua Rise, progressive closure of the Central American Seaway (CAS) (uplift of the Isthmus of Panama), and the evolution of Atlantic Meridional Overturning Circulation? Did changing sea level modulate circulation through the Straits of Florida gateway (Challenges 1,2,4,7)?
5.When did the southeastern GoM gateway form (Challenge 9)?
6.Finally, what is the nature of basement beneath the Florida Straits (beyond the isolated highs sampled on DSDP Leg 77), and what can this tell us about seafloor spreading history in the GoM (Challenge 9)?

Non-standard measurements technology needed to achieve the proposed scientific objectives

Proposed Sites (Total proposed sites: 3; pri: 3; alt: 0; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
FS-01A (Primary)	23.78915 -84.36011	2900	1300	0	1300	FS-01A targets Mesozoic-Cenozoic sediments spanning the MMCT, MCO, E-O Boundary, MECO, EECO, PETM, and K-Pg Boundary, which truncates most of the Late Cretaceous. By moving updip from Sites 97 and 540 we will take advantage of an apparently expanded section to recover the Cenomanian-Turonian Boundary and OAE2 at the top of a middle to Early Cretaceous section characterized by rhythmically-bedded limestone and organic-rich marlstone spanning OAE1b-OAE1d before reaching a target depth of ~1300 m below a prominent Aptian seismic reflector.
FS-02A (Primary)	23.76384 -84.54850	3400	1600	20	1620	Site FS-02A targets three important intervals: upper Cenozoic sediments, Early Cretaceous sediments and the transition from marine to syn-rift sediments, and basement. The site is offset from Site 535 to take advantage of a low that has filled with Cenozoic sediments that will faster APC coring and contain a record spanning the Recent to the E-O Boundary and possibly earlier. Below a lower Cenozoic unconformity, the site will penetrate Early Cretaceous sediments spanning the Aptian reflector targeted at Site FS-01A, thus continuing the composite section through the Early Cretaceous to possibly Jurassic or earlier sediments and then to basement.
FS-03A (Primary)	24.12000 -86.40694	1633	463	0	463	Site FS-03A is a redrill of DSDP Site 95, located on the Campeche Escarpment, and fills in the middle of our composite section. Site 95 was sport cored, but contains a mostly complete Cenozoic section, especially from the Oligocene to basal Paleocene, and as such will yield a unique record about the expression of Paleogene hyperthermals in the GoM. Additionally, this site contains the only Late Cretaceous interval in the area, spanning the late Campanian to Albian.