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Kristen Mitchell was born in Worcester, Massachusetts on April 20, 1987. She received her bachelor's degree from Albion College in Michigan in May of 2009. She is currently attending the University of Nebraska — Lincoln to pursue her master's degree with expected graduation in May of 2011. When not researching, she enjoys boating and various water sports as well as playing guitar.

Prediscosphaera biostratigraphy and paleoecology of the late Albian to Cenomanian in the western North Atlantic and deep Gulf of Mexico

Project Overview

The purpose of this study is to examine *Prediscosphaera* as a paleoecologic and biostratigraphic indicator during the late Albian to Cenomanian. I plan to detail the evolutionary patterns of *Prediscosphaera* by its abundance and paleoecological response from the late Albian to Cenomanian. Detailing the evolutionary patterns of *Prediscosphaera* will allow for a better understanding of past paleoceanographic events and age determination of sediments in the two regions of study. Samples from the north central Atlantic (ODP Leg 171b) and Gulf of Mexico (DSDP Leg 77) have already been acquired for this study. Approximately $2500 is being requested to complete this research.

Background

Prediscosphaera is a premier biostratigraphic indicator for the late Albian to late Maastrichtian. The genus is divided into two lineages: *P. spinosa* and *P. cretacea.* These lineages are distinguished by whether the central structure is oriented in an "x" or cross fashion (Perch-Nielsen, 1985). In well preserved material, 12 additional species can be distinguished, besides *P. spinosa* and *P. cretacea*, based on shape, orientation or the central structure, and widths of the wall and distal shield (Perch-Nielsen, 1985).

It is generally accepted that calcareous nannofossils were reliable indicators of surface water temperatures in the past, but very little research has been done on *Prediscosphaera.* The distribution of modern coccoliths also indicates that the presence and relative abundance of species are related to temperature of surface waters (Okada and McIntyre, 1977).Wind (1979)

suggested that *Prediscosphaera cretacea* was an indicator of cooler surface water temperatures. However, Thierstein (1981) found no clear pattern of temperature distribution, citing high abundances of *P. cretacea* in temperate latitudes in the North Atlantic as well as equatorial regions in the Pacific. Examination of Southern Ocean assemblages from the Kerguelen Plateau by Watkins (1992), Falkland Plateau by Wise (1983), and Maud Rise by Pospichal and Wise (1990), suggested greater abundances at high southern latitudes.

Prior work has been performed on pinpointing the depth habitat for each nannofossil species in the water column (Watkins and Self-Trail, 2005). This depth habitat, or niche space, is related mostly to temperature. A particular species habitat, or loss of it, has can be tied to oceanic anoxic events (0AEs) as well as species extinction patterns (Herrle et al. 2003; Watkins et al. 2005). Watkins et al. (2005) argued that species' placement in the water column could affect abundance and extinction. In their study, 13 taxa went extinct during OAEld that had evolved in a well-stratified upper water column during the late Aptian-Albian. When the upper water column stratification disappeared during OAEld, the taxa lost their niche space and went extinct (Watkins et al. 2005).

Oceanic Anoxic Events

Planktic nannofossils, with skeletons of calcium carbonate, are generally abundant and well preserved in mid-Cretaceous marine sediments. Detailed studies of individual ocean anoxic events have demonstrated that calcareous nannoplankton and planktic foraminifera were influenced to varying degrees by the OAEs (Leckie, 1987; Huber et al., 2002; Watkins et al. 2005). Erbacher et al. (2001) examined planktic and benthic foraminiferal stable isotopic data at the base of the Albian in the sedimentary record of OAElb at ODP Site 1049 in the western tropical North Atlantic (Blake Nose). The data show a sharp increase in planktic-benthic $8^{18}0$ gradients across the event. These authors attribute the findings to increased stratification of the water column by surface water warming and/or increased runoff (Erbacher et al. 2001). Kuypers et al. (2001) concluded that severe oxygen depletion affected the water column during this event. *Prediscosphaera* has yet to be used as a paleoecological indicator for this event as well as other OAEs.

It is still unknown as to how *Prediscosphaera's* abundance, species diversity, and morphology changed with changing oceanic conditions. Documenting these changes will allow more detailed understanding of past ocean anoxic events and how calcareous nannofossil genera like *Prediscosphaera* responded to these periods of ocean anoxia. Better understanding *Prediscosphaera* will also aid in more precise age determination of sediments in these regions.

Field Site

An upper Aptian to Cenomanian succession containing unusually well-preserved planktonic foraminifers was documented during ODP Leg 171b, which concentrated on the study of the Blake Plateau off the eastern coast of Florida (Figure **1).** The Blake Plateau serves as an ideal location for this study because the good preservation at these sites will allow the microscopic detailing of the taxa.

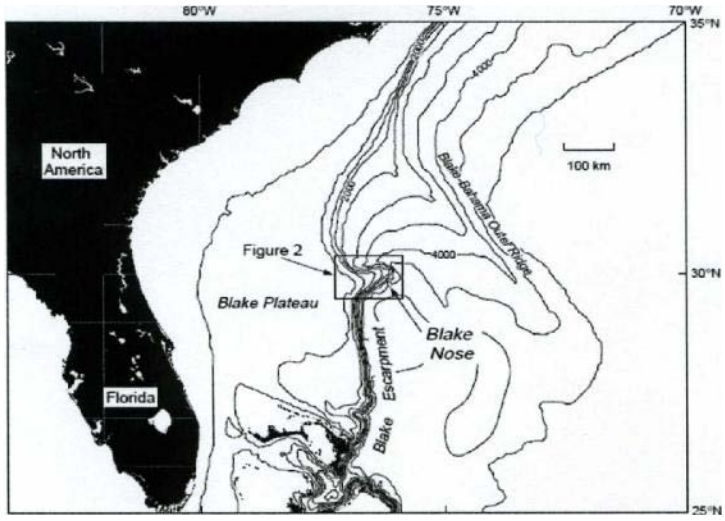

Figure 1. Location of ODP Leg 171b Blake Nose drilling transect (Norris et al. 1998).

Five sites were drilled on ODP Leg 171b (Figure 2). With the exception of two zones in the Albian, a nearly continuous section of sediment permits an in depth investigation of the evolution of the foraminiferal assemblages (Bellier and Moullade, 2002). Well-preserved planktonic foraminiferal calcite in this section has allowed detailed stable isotope investigation of foraminiferal paleoecology and paleoceanographic changes in the upper water column in the late Albian to earliest Cenomanian (Norris and Wilson, 1998; Wilson et al. 2002).

The other location for this study is in the deep Gulf of Mexico, where DSDP Leg 77 (Figure 2). sought to investigate the history of sedimentary basin fill in the deep Gulf. Two basin sites (535 and 540) were drilled on an erosional slope at the western end of the Straits of Florida. One hole (535) was near the stratigraphic level where the other hole (540) reached total depth. Because of this arrangement, the sediments recovered from both sites yield a fairly complete composite section spanning the late Berriasian through the middle Cenomanian (Watkins & Bowdler, 1983). I plan to use these holes in tandem with ODP leg 171b sites to compare and contrast paleoceanographic events and evolution of *Prediscosphaera* in these two localities.

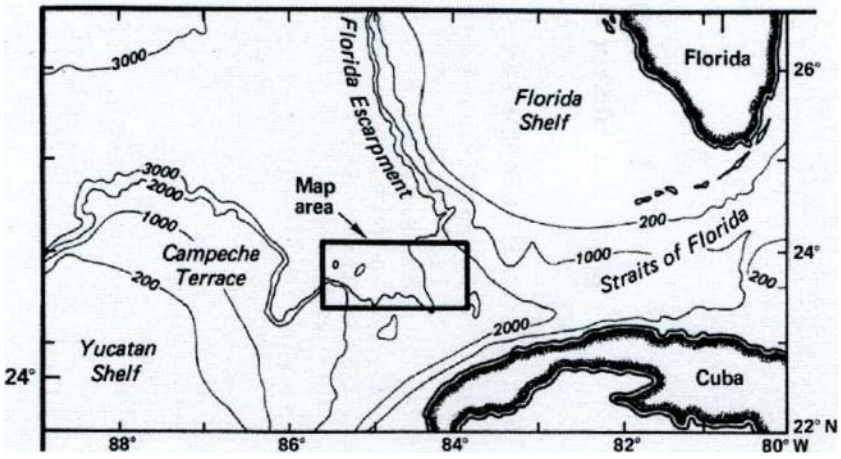

Figure 2. Map of DSDP Leg 77, located in the deep Guff of Mexico (modified from Watkins & Bowdier 1983).

Methods

Samples will be taken from holes 1050C and 1052E of ODP Leg 171b and holes 535 and 540 of DSDP leg 77. Samples will be prepared as smear slides and examined to determine biostratigraphic ranges, species abundances, and preservation (Watkins et al. 2005). The stratigraphic section will be correlated to the geochronologic timescale through cyclostratigraphy as outlined by Watkins et al. (2005). From the examined samples, the best preserved from each stratigraphic section will be chosen for SEM analysis to document how *Prediscosphaera* species are changing in response to paleoceanographic events as well as for documenting new taxa. Paleontological and sedimentological counts will be performed from the smear slides prepared using a double slurry method shown to yield reproducible data at the 99.99% confidence level (Watkins and Bergen, 2003).

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