Deep Earth Academy
CONSORTIUM FOR OCEAN LEADERSHIP

Wanted: Dead and Well-Preserved... "*Mohawk Guy*" and his Band of Neogene Planktic Foraminifer Friends

Dr. Mark Leckie
Scientist

Introduction

Dr. Mark Leckie has a passion for science and education with a goal to "connect students to our planet." Who would have thought that his boyhood interest in fossils would one day lead him into the field of geology, to Antarctica, and to the Integrated Ocean Drilling Program (IODP)? Dr. Leckie has taught courses in oceanography, field geology, micropaleontology, paleoceanography, and paleoclimatology at the University of Massachusetts-Amherst since 1985. His research focus has been primarily with ancient (fossil) planktic and benthic foraminifera. He works with foraminifers to understand Earth history, the environment, and ancient climate change. Dr. Leckie has fun working with these one-celled protists because it is a lot like detective work, especially when integrating that information with his research on biostratigraphy, paleoceanography, tectonics and climate.

Biography

How did someone who grew up in the Midwest (Michigan, Indiana, and Illinois) end up sailing on expeditions to deep ocean sites around the world? Where did this journey begin? While pursuing an undergraduate and Master's degree in geology at Northern Illinois University, Dr. Leckie worked in the micropaleontology lab of Dr. Peter Webb. This led to his first trip to the ice in 1976 to do field work at McMurdo Sound in Antarctica to collect and map fossiliferous glacial erratics (rocks brought in by glaciers that contain fossils). He traveled back to Antarctica in 1977 as part of an international scientific party to work on the Ross Ice Shelf Project to collect sediment cores from the bottom of the Ross Sea. By this point he was doing active research with foraminifera. In 1979, he became engaged to his wife, and also spent over two months working on a drilling project in Antarctica. Dr. Leckie's experience in Antarctica enabled him to gain a better understanding of Deep Sea Drilling Project Site 270 in the Ross Sea. He went on to get his Ph.D. at the University of Colorado in 1984 before working on a post-doc at Woods Hole Oceanographic Institution for a year.

Dr. Mark Leckie examines forams by microscope on board the JOIDES Resolution.

Seagoing Experience

Dr. Leckie's first experience at sea was in 1981 when he had the opportunity to sail on the legendary *Glomar Challenger* with Deep Sea Drilling Project Leg 79 to recover sediment cores with mid-Cretaceous planktonic foraminifera off Central Morocco. He sailed on five Ocean Drilling Program (ODP) legs from 1985 to 2003 on board the *JOIDES Resolution*, including both the first and the last ODP Legs. In 1985, he sailed on Leg 101 to the Bahamas. He also joined Leg 130 for 63 days to drill deep ocean cores in the Western Equatorial Pacific. He was the co-chief scientist on Leg 165 to the Caribbean. In 2001, he sailed on Leg 198 to Shatsky Rise in the Northwest Pacific. His last ODP cruise was on Leg 210 in 2003 off the Grand Banks, south of Newfoundland. He joined the School of Rock expedition in 2005 and has continued to work with teachers since then.

Dr. Leckie with the JOIDES Resolution *in the background.*

Dr. Leckie at home in Massachusetts enjoying winter.

Noteworthy Things to Know about Dr. Mark Leckie

- **He plays hockey about nine months out of the year.**
- **He found and named two foraminifers from a sediment core taken from the bottom of the Ross Sea.**
- **He has had a foraminifer species and a nannofossil species named after him.**

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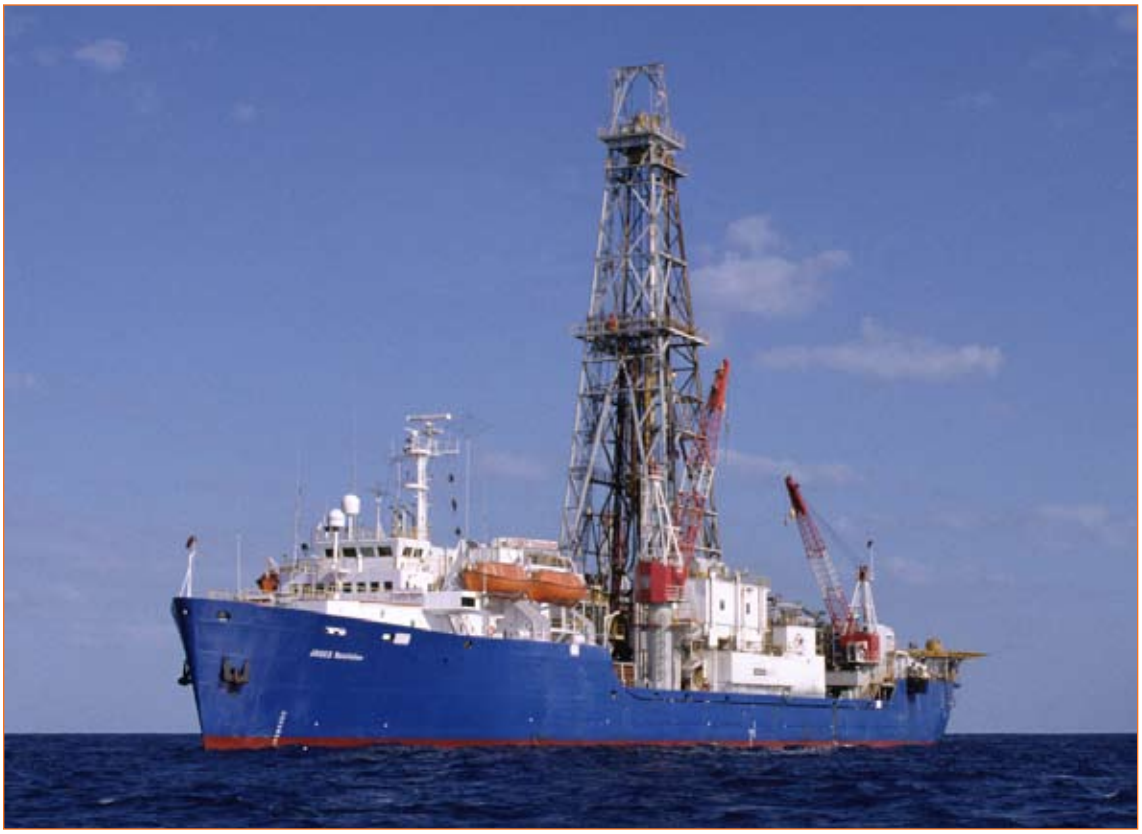
The *JOIDES Resolution* 1985 to Present

Scientific Drilling Vessel and Research Laboratory

The *JOIDES Resolution*:

- Originally was built as an oil exploration vessel in 1978 in Halifax, Nova Scotia.
- Was converted for scientific research in January 1985 for the Ocean Drilling Program (ODP).
- Served ODP from January 1985 until September 2003 (Legs 100 to 210). During this time it:
  - Operated for 6,591 days,
  - Traveled a total distance of 355,781 nautical miles
  - Visited 669 sites to drill 1,797 holes,
  - Recovered 35,772 cores, and
  - penetrated as deeply as 6,926 feet (1.31 miles) into the ocean floor.
- Was named for *Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES)* and for the scientific vessel, *HMS Resolution* that Captain James Cook sailed over 200 years ago to explore the Pacific Ocean, its islands, and the Antarctic region.
- Began drilling operations in September 2003 for a multi-platform research program, the Integrated Ocean Drilling Program (IODP).
- Currently is being converted as IODP's riserless vessel to resume operations in 2008.



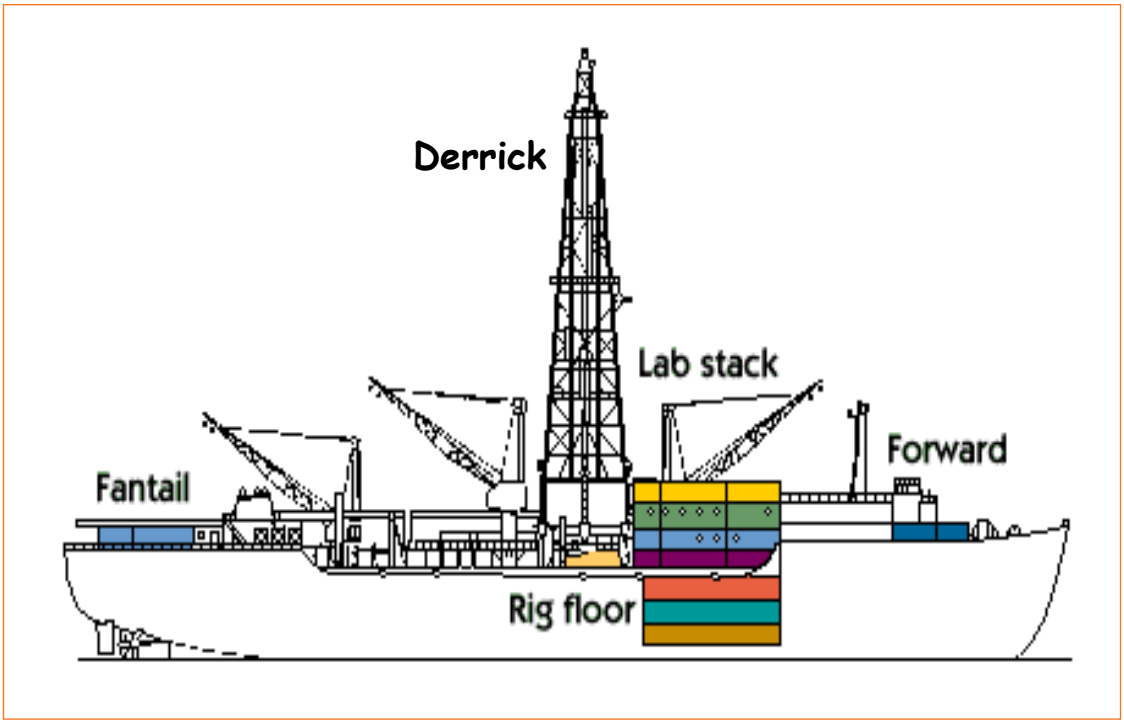
The scientific drilling vessel, JOIDES Resolution, *is a floating laboratory staffed with scientists from all over the world. It stays at sea for up to two months at a time recovering sediment and rock cores from the seafloor.*

Physical Dimensions of the *JOIDES Resolution*

Length of Ship: 143 m (469 ft)

Width of Ship: 21 m (68.9 ft)

Derrick: Stands 61.5 m (202 ft) above the water line



Did You Know?

- The *JOIDES Resolution* drills deep beneath the ocean to obtain deep ocean cores for scientific purposes.
- Drilling takes place in the center of the ship on the rig floor, a platform about four feet above the bridge deck.
- A mechanical device on the rig floor called an iron roughneck connects strands of pipe to make up the drill string. The entire string is rotated to drill through the seafloor.
- The rig can suspend as much as 9,150 m (30,020 ft) of drill pipe to an ocean depth as great as 8,235 m (27,018 ft).
- The length of each drill pipe measures 9.5 meters, the length of the cores.
- Assembled drill pipe goes through the bottom of the ship after it is lowered from the drill floor through the moon pool, an opening that measures 7 meters (23 ft) across.
- The crew positions the ship over a drill site using 12 computer-controlled thrusters as well as the main propulsion system.
- Seafloor drilling locations are marked with a retrievable acoustic beacon.With its computerized dynamic positioning system, the vessel can maintain position within 3% of water depth in up to 7.5 m (25 ft) waves, 60 knot (kt) winds, and 3.0 kt currents. The minimum water depth for drilling is 75 m (246 ft).
- The vessel typically houses 65 crew members and up to 50 scientists and technicians for each two-month leg, or expedition.
- Drilling and laboratories operate continuously 24 hours a day while on site.

The *Glomar Challenger* 1968 to 1983

Summary

- The ***Glomar Challenger*** was built by Levingston Shipbuilding Company in Orange, Texas before beginning operations with the Deep Sea Drilling Project (DSDP) on August 11, 1968.
- DSDP was the first of three international scientific drilling programs that have operated over the past 40 years with the support of the National Science Foundation (NSF).
- **1968 – 1972** (Phase 2) involved drilling and coring in the Atlantic, Pacific, and Indian Oceans, as well as the Mediterranean Sea and the Red Sea.
- **1972 - 1983** (Phase 3) included technological advances and international collaboration in 1975 with the Federal Republic of Germany, Japan, France, United Kingdom, and the Soviet Union.
- The *Glomar Challenger* was docked for the last time in November 1983 and was replaced with the *JOIDES Resolution*. The Smithsonian Institution in Washington, DC, stores parts of the ship: dynamic positioning system, engine telegraph, and thruster console.

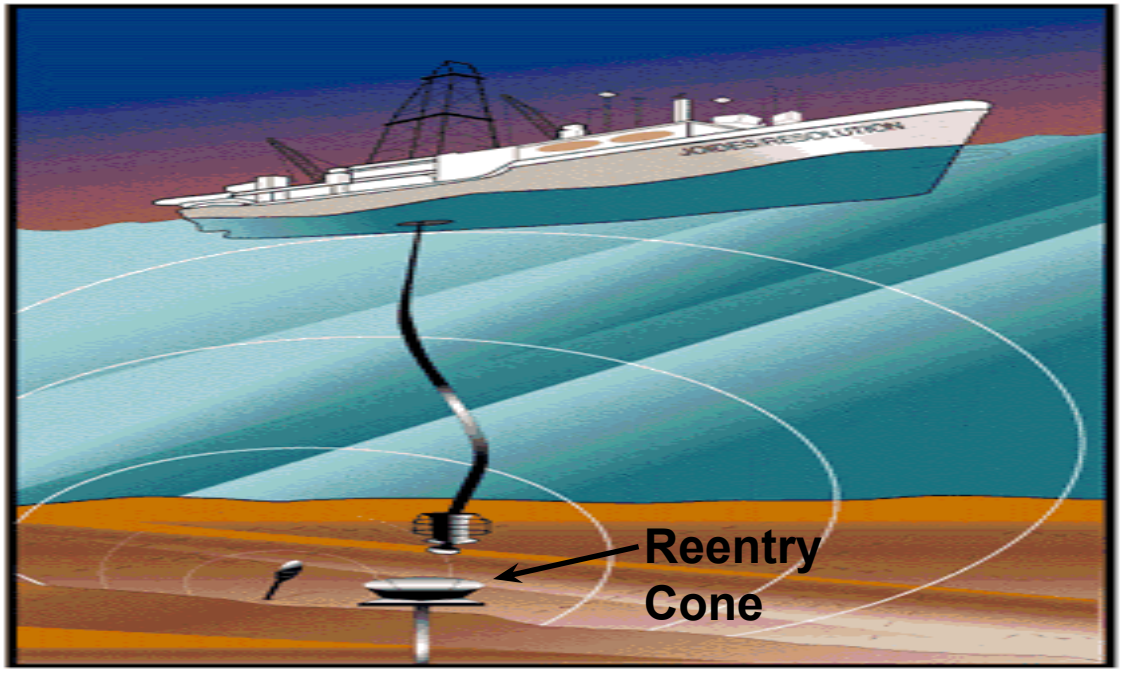
The Glomar Challenger was a legendary deep sea drilling vessel for scientific exploration

Glomar Challenger's Drilling Accomplishments August 11, 1968 to November 11, 1983 (Legs 1 – 96):

- Cores recovered: 19,119
- Sites investigated: 624
- Expeditions completed: 96
- Deepest core beneath the ocean: 1741 m (5710 ft.)
- Maximum coring into basaltic crust: 1080 m (3542 ft.)
- Deepest water (Leg 60, Site 461 A): 7044 m (23,104 ft.)
- Total Distance Traveled: 375,632 nautical miles

Core Information (on-line database)

- Core samples retrieved in 30-foot-long cores with a diameter of 2.5 inches
- Cores currently refrigerated and stored in the USA, Germany, and Japan
- One-half core (archived half) preserved for future scientists
- Working half of core available to scientists for ongoing scientific research



Glomar Challenger was the site of many technological advances in deep ocean drilling.

Technological Accomplishments

- June 14, 1970: Sonar scanning equipment and a reentry cone accomplished the task of replacing a worn drill bit in 3048 m (10,000 ft.) of water in the Atlantic Ocean off the coast of New York. The reentry cone had a diameter of 4.88 m (16 ft.) with a height of 4.27 m (14 ft.).
- Hydraulic piston corer introduced in 1979, which enabled undisturbed sediment cores to be recovered for scientists to study the ancient ocean environment.
- Extended use of the holes for further analysis during and after the drilling and occasionally including installing long-term seismic monitoring devices in the holes.