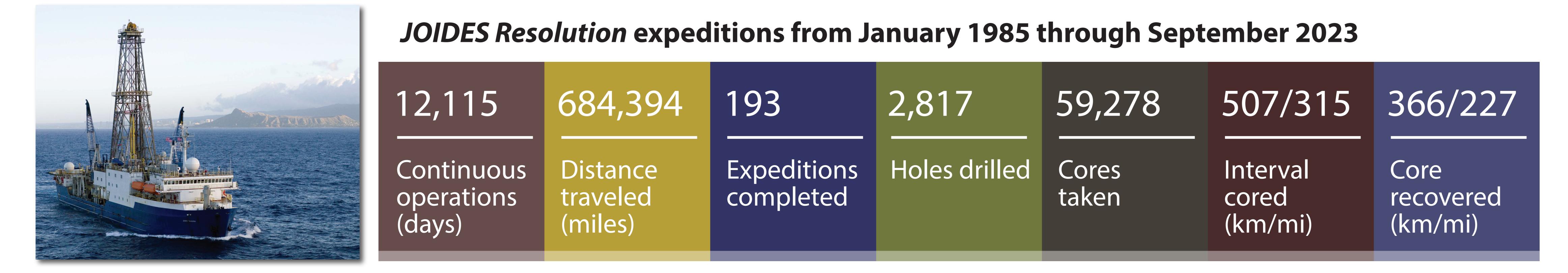
## JOIDES RESOLUTION AND SCIENTIFIC OCEAN DRILLING AT TEXAS A&M UNIVERSITY



SCIENTIFIC OCEAN DRILLING HISTORY PLATE TECTONICS, OCEAN CRUST, & SUBSEAFLOOR BIOSPHERE

OCEAN DYNAMICS & CLIMATE CHANGE HAZARDS, NATURAL RESOURCES, & OBSERVATORIES

## TECHNOLOGICAL ADVANCEMENTS

**1961: Dynamic positioning** is used for the first time to



## keep CUSS I drilling platform stationary.



1970

1980

1990

2000

2010



**1970:** reoccupied a previously drilled borehole by using a **re-entry cone** for the first time.

**1968:** the U.S. National Science

sail on the first leg of the **Deep** 

Foundation (NSF) authorizes

the Glomar Challenger to set

1969: Ocean drilling the South Atlantic confirms the unifying theory of plate tectonics.

> **1979: discovery of microorganisms living deep in marine sediments** in the Gulf of California, showing that life can survive under extreme conditions, similar to those in other planets.

**1974: correlation of Milankovitch climate cycles to periodicities in Earth's orbit**, illuminating some of the factors that control Earth's climate.

a desert 5–11 million years ago.

**1970:** proof that the

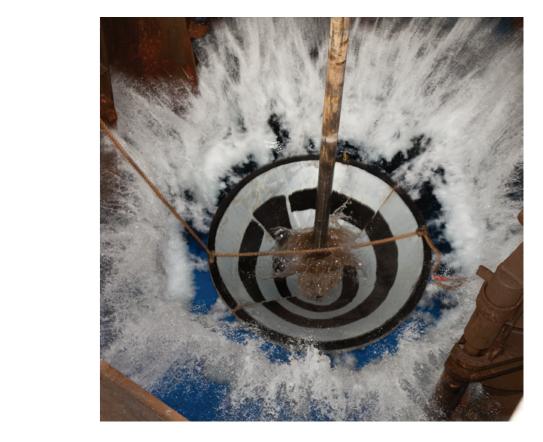
Mediterranean Sea was

**1982:** installs first ocean-bottom **seismometer** in the northwest Pacific to monitor earthquakes.

**1961: Dynamic Positioning**,

which allows a vessel to remain stationary over a point on the seafloor, is first used during Project Moho.

**1970:** the first use of a **reentry cone** makes it possible to reoccupy and deepen an existing borehole.



**1971:** the **Extended Core Barrel** is used for the first time to recover hard sediments and is developed into a routine coring tool.

 1979: development of the Hydraulic Piston Corer results in recovery of undisturbed sediments, which is important for climate change research.

1985: NSF chooses Texas A&M

University as the science operator for the Ocean Drilling Program (ODP), and JOIDES Resolution sails on the first expedition.

Canada and 12 European countries join ODP.

**1987 – 1997:** Australia, Korea, Chinese Taipei, and the People's Republic of China join ODP.

2003 – 2013: the NSF funds the Integrated Ocean Drilling Program (IODP) phase.

**2006:** South Korea joins IODP.

**1987:** confirmation of long-lived **hotspot tracks** in the Indian Ocean, demonstrating mantle convection and adding to our knowledge of plate tectonics.

**1989: recovery of the oldest ocean crust** (~170 million years) left on the planet in the northwest Pacific Ocean.

**2005: penetration of an** *in situ,* **ancient magma chamber** in the Guatemala Basin, clarifying models of ocean crust. **1986:** evidence of a dryer climate 2 million years ago off northwest Africa, providing a cause for the **human migration** from Africa to Europe.

**1987:** several expeditions establish the presence of a **permanent ice sheet in Antarctica 5-10 million years ago**, indicating a shift from warmer to colder climate.

The uplift of the Himalayas is linked to the evolution of the Asian Monsoon and climate cooling.

2000: dating the timing of the opening between Australia and Antarctica, critical to the formation of the Antarctic Circumpolar Current and the start of Earth's cooling 33 million years ago.

2001: evidence of abrupt climate change to warmer temperatures during the Paleocene/Eocene Thermal Maximum, 55 million years ago.

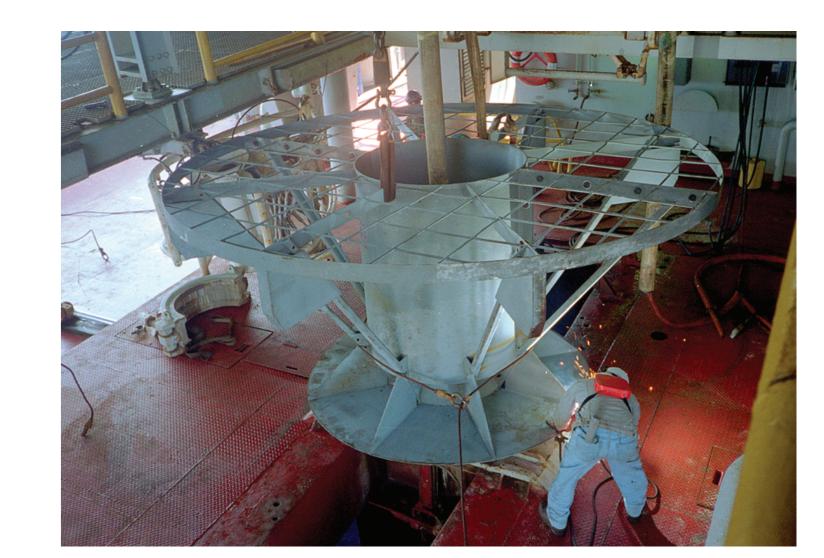
**1991:** discovers **hydrothermal metal deposits** on the Juan de
Fuca Ridge.

 1995: discovers large amounts of gas hydrates on the eastern margin of North America.

**1997:** evidence of the **meteorite impact** in the Gulf of Mexico
 that led to the **extinction of the dinosaurs** 65 million years ago.

 2001: timing of the Nuuanu landslide that removed ~40% of Koolau Volcano on the island of Oahu 2 million years ago. - 1980: development of the **Pressure Core Barrel** improves the recovery of methane gas hydrates, a potential energy source.

1991: installs the first long-term observatory (CORK).



Over the years, **automated instrument tracks** are developed to measure the physical properties of rocks, such as density, porosity, thermal conductivity, and magnetic susceptibility.

**2007 – 08: the NSF refits** *JOIDES Resolution* with improved science laboratories and drilling capabilities.

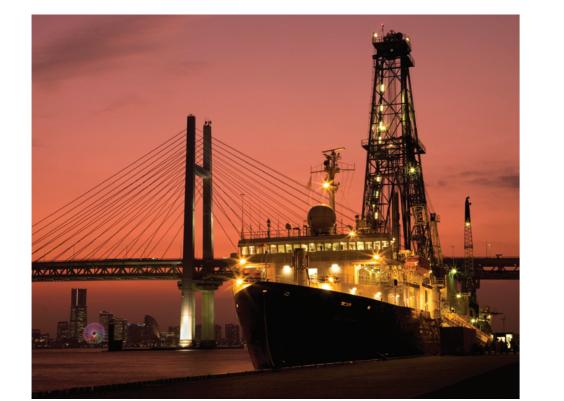
**2009:** the Australia/New Zealand Consortium and India join IODP.

**2011:** Poland joins the IODP European Consortium.

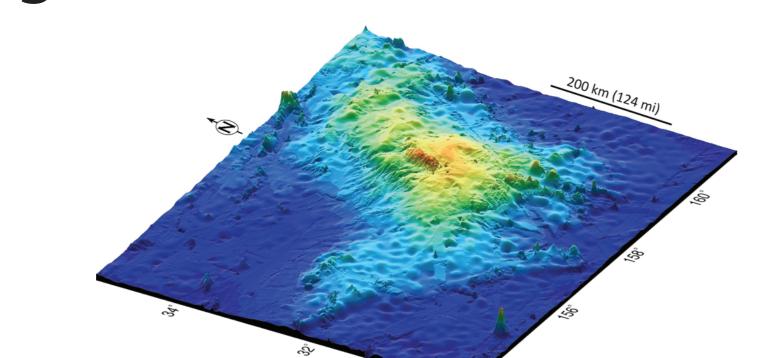
**2012:** Brazil joins IODP.

**2013:** Israel joins the IODP European Consortium.

2004 – 2022: NSF, etc. authorizes Texas A&M University to continue future operations for the International Ocean Discovery Program.



**2009:** Shatsky Rise in the western Pacific Ocean is identified as the **largest volcano on Earth**.



**2010:** investigation of **subsea-floor life in the low productivity environment** of the South Pacific Gyre.

2012–2013: investigates ocean dynamics and climate change off the coasts of Spain, Portugal, Newfoundland, Alaska, and Japan.

2007: the research vessel Chikyu starts the NanTroSEIZE project off the coast of Japan to investigate large earthquakes.

**2011:** timing of volcanism and landslides in the Lesser Antilles islands.

- **2012:** *Chikyu* drills into the plate boundary fault that caused the 2011 Tohoku mega-quake and tsunami.
- 2012: investigates the conditions that lead to large earthquakes in the Costa Rica subduction zone.

2008: in house development of Natural Gamma Ray detector.