Deep Sea Drilling

A global effort to collect data from the ocean-floor

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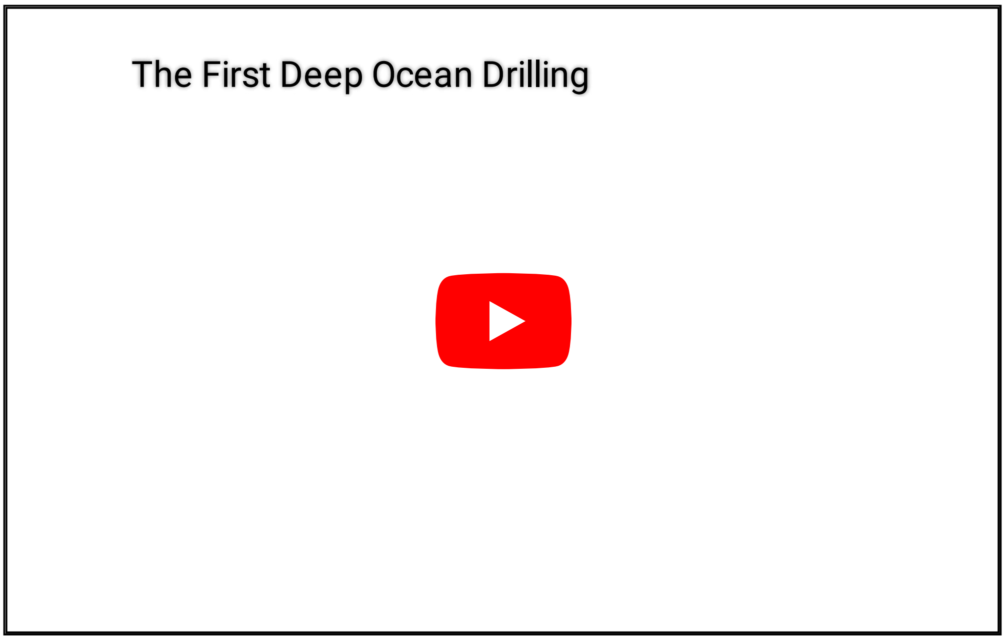
The drillship JOIDES Resolution departing Honolulu, Hawaii, at the beginning of IODP Expedition 321. (Image: William Crawford, IODP/TAMU.)

As I followed microfossils like Cycladophora davisiana through the collections of the Museum für Naturkunde Berlin, I came to realise they vastly outnumber all other specimens. One reason for this is that, as central tools in biostratigraphy, these fossilised microorganisms help researchers disentangle micropaleontological formations by providing useful, extensive, and easy to access fossil records. As such, microorganisms like Radiolaria and Foraminifera are entangled in a much larger apparatus of collection, which extends far beyond the walls of the museum. This socio-technical apparatus emerges from the ongoing transnational effort of deep sea drilling: the extraction of core samples from the sediments at the bottom of the ocean, and their use in the interpretation of the planet's history and dynamics. Thanks to the taxonomic expertise of its micropaleontologists and its data management infrastructure, over the last decades the Museum für Naturkunde Berlin has consolidated its position in managing this effort, and the collections and datasets it continuously hauls from the seafloor. But to better understand the role of the museum in this global technoscientific enterprise, it is useful to consider the long history of deep sea drilling.

Surprisingly, much of the momentum that inspired techniques and infrastructures for exploring the depths of the ocean floor came from outer space. In 1957 the Soviet Union successfully launched *Sputnik*, the first artificial satellite. This set in motion what came to be known as the Space Race, a technoscientific, political, and ideological contest that saw the Cold War superpowers compete to reach outer space. A similar race was launched to the seabed and profoundly shaped the history of technosciences. Early explorations of the ocean floor had already taken place in the 19th century, largely driven by developments in submarine telegraphy – which led, for instance, to finding Cycladophora. But the social and technical transformations brought about by the tight connection between technosciences and warfare during the two World Wars, together with the advent of 'big science', opened the seafloor to more ambitious dreams of exploration. Novel and expensive tools and techniques revealed the ocean floor as a living repository of both resources and data of great scientific and economic interest. Digging and extracting core samples from the ocean sediment and identifying and correlating their microfossil record, scientists could chart the inner workings of the planet. This was the goal that animated an important project that launched a series of deep sea drilling programmes that continue to this day – and that heralded the development of micropaleontology at sea. This was known as Project Mohole, a high-profile programme to drill into the Earth's crust and sample the Mohorovičić discontinuity, or Moho – the boundary between the Earth's crust and the mantle.[1]



Willard Bascom's original 1961 film was produced by the National Academy of Sciences. The film follows the first phase of Project Mohole, including the sea trials, experimental drilling, and major drilling tests off Guadalupe Island. (Source: NASEM/YouTube)

Importantly, Mohole demonstrated the feasibility of deep sea drilling, proving its scientific and economic value. Drilling from an untethered platform at sea represented a spectacular engineering feat and, together with the biostratigraphic data recovered, was instrumental to the nascent offshore fossil fuels industry – which tries to quench society's thirst for these resources looking in the depth of the open ocean.[2] Even if Mohole was discontinued in 1966 due to administrative, financial and political mismanagement, other projects soon followed in its footsteps. But their ambition was slightly different, as they focused, rather than on reaching extreme depths, on collecting large numbers of samples to chart as much as possible of the planet's subsurface. As a result, the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) organisation was founded in 1964 to coordinate the four main competing U.S. oceanographic institutions – Miami, Woods Hole, Scripps, and the Lamont-Doherty Earth Observatory.[3] With a newly built deep sea drilling research vessel, the "Glomar Challenger", JOIDES' Deep Sea Drilling Project (DSDP) began collecting samples and data in 1968. As the project's website puts it:

> "The success of the 'Glomar Challenger' was almost immediate. On Leg 1 Site 2 under a water depth of 1067 m (3500 ft), core samples revealed the existence of salt domes. Oil companies received samples after an agreement to publish their analyses. The potential of oil beneath deep ocean salt domes remains an important avenue for commercial development today. But the purpose of the 'Glomar Challenger' was scientific exploration. One of the most important discoveries was made during Leg 3. The crew drilled 17 holes at 10 different sites along an oceanic ridge between South America and Africa. The core samples retrieved provided definitive proof for continental drift and seafloor renewal at rift zones. This confirmation of Alfred Wegener's theory of continental drift strengthened the proposal of a single, ancient land mass, which is called Pangaea. The samples gave further evidence to support the plate tectonics theory, which at the time attempted to explain the formation of mountain ranges, earthquakes, and deep sea trenches."[4]

As JOIDES expanded over the course of the years, it attracted the participation of other countries, like the Federal Republic of Germany, Japan, the United Kingdom, the Soviet Union, and France, turning a US deep sea drilling project into a vast transnational effort. As a result, in the 1980s the DSDP was reorganised in the Ocean Drilling Program (ODP), which continued the sampling, mapping, and exploration of the seafloor with a new research vessel, the *JOIDES Resolution*.[5] Since then, the international collaboration has gone through two more reorganisations: first in 2003, with the Integrated Ocean Drilling Program (IODP), and again in 2013, with the International Ocean Discovery Program (also IODP). In the more than 50 years of deep sea drilling, the amount of samples and data gathered grew exponentially, transforming our understanding of planetary systems and generating a plethora of repositories, publications, archives, and datasets – as well as informing ideas of international technoscientific collaborations.

Spread among many different institutions and databases, the data and samples from this transnational effort also found their way to the collections of the Museum für Naturkunde Berlin. In fact, the museum's micropaleontology curator, David Lazarus, and his colleague Johan Renaudie[6] have been crucial to the development of one of the most important databases to emerge from these projects, the NSB Database. Together with the recently acquired Lamont-Doherty Collection of slides, the micropaleontology collections at the Museum für Naturkunde Berlin are not just the results of deep sea drilling; the microfossil record and the data they provide are an active part of the ongoing production of knowledge about micropaleontological formations and the Earth's biogeochemical cycles and dynamics. As great numbers of fossilised microorganisms are extracted from the ocean floor, identified, and inscribed in complex and growing networks of records, repositories, and datasets they are transformed by the work of micropaleontologists and many others, from once living organisms to scientific objects and data. But they also transform how nature can be understood, as microfossils become part of the historically situated apparatus of sense-making of technoscience, and in turn allow a specific view of planetary history and dynamics to shape our world. As other efforts in recording worlds, deep sea drilling and its knowledge making apparatus doesn't only collect specimens and samples: it actively transforms them, to make them part of how we relate to nature, bringing animals bodies to bear on our understanding of the planet.

For data to be mobilised to tell stories (of microbes and planets) – for instance by (using Cycladophora) to characterise glaciation dynamics – the vast socio-technical apparatus of deep sea drilling needs to be in place, with its drilling vessels, research institutions, transnational funding and collaborations, archives and datasets, as well as scientists, engineers, technicians, sailors, and many others. Centrally, this apparatus hinges on the transformations animals and other living organisms undergo as they become entangled in human (knowledge making practices): far from being merely old, specialised, technical repositories, then, natural history collections have an active role in shaping how society knows and relates to nature. As this brief history of deep sea drilling illustrates, *how* we know the world matters, as it also shapes *what* can be known: as the effort of characterizing planetary dynamics brought to the fore the dangers of climate change, it also continues to be instrumental to the chokehold extractive industries have on Earth's biogeochemical cycles. This should not discourage us from trying to understand nature and its workings, though. Instead, I want this story to remind us how critical a site for political intervention knowledge making is: paying attention to *how* we know the world, and to the concrete material and conceptual transformations involved in our projects of sense-making, we can ask better questions and continue learning how to better live together.

Footnotes

1. To learn more about Project Mohole's history, visit and listen to https://www.vox.com/unexplainable/22276597/project-mohole-deep-ocean-drilling-unexplainable-podcast or read Helen M. Rozwadowski and David K. van Keuren (eds.). *The Machine in Neptune's Garden: Historical Perspectives on Technology and the Marine Environment*. Canton, Mass.: Science History Publications, 2004. Also, for a broader historical take on oceanography, check out https://oceansciencehistory.com/page/2/.↩
2. Tellingly, the ship used for the first phase of Mohole was borrowed from a consortium of oil companies, as evident in its name: *CUSS I*, for Continental, Union, Superior, and Shell Oil.↩
3. The latter has been gathering a vast repository of core samples since 1949. It forms the basis for the micropaleontology slide collection described in Lamont-Doherty Collection.↩
4. From http://www.deepseadrilling.org/about.htm.↩
5. You can take a virtual tour of the vessel, which is still in use today, here: https://joidesresolution.org/about-the-jr/jr-vessel-tour/.↩
6. Here you can read Johan's report from his recent trip on board of *JOIDES Resolution* https://www.museumfuernaturkunde.berlin/en/about/news/scientist-mfn-board-iodp-expedition-379-amundsen-sea-west-antarctic-research-drill-ship.↩