

BOOKS

Exploring the Depths of Scientific Patronage

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Naomi Oreskes's *Science on a Mission* is really three books in one. It's a history of the fruitful partnership between American oceanographers and the US Navy, focused on ocean research undertaken in the second half of the twentieth century. The second narrative told by Oreskes, a prominent historian of science, uses the case of oceanography to revisit perennial themes in the history of science, such as the distinction between basic and applied research. The third and most important story is a continuation of her long-standing interest in the effect of patronage—in a word, money—on scientific research.

Oreskes's best-known book, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Climate Change*, which she coauthored with Erik M. Conway, examines the links between corporate science funding and tobacco and climate disinformation. In *Merchants of Doubt*, the “production of ignorance” was a deliberate campaign to protect corporate interests. In *Science on a Mission* there is no malicious intent, but rather the more subtle influence of what Oreskes calls the “context of motivation,” the set of circumstances that shapes the intent and scope of scientific research. The overarching theme of this book is the effect of this context—the interplay between the priorities and

needs of researchers, their sponsors, and broader social and political structures—on the production of both knowledge and ignorance.

Oreskes is ideally qualified to tell this story. Her original training in geology, a close cousin of oceanography, is apparent in the fond homages to the generation of her forebears and mentors. The account of relations between oceanographers and the Navy draws on her expertise on scientific patronage. And her analysis of how oceanography developed both strengths and blind spots is informed by her prior work on the difficulties in forming a scientific consensus around initially controversial ideas about plate tectonics, continental drift, and climate change.

She gives precise and thorough explanations of deep-sea sedimentology, acoustic tomography, abyssal ecosystems, the discovery of climate change, and much more. If some of these terms seem technical, the general reader should indeed be cautioned: although Oreskes has a superb ability to weave together granular detail and broad themes, her love of the subject makes for some very deep dives into historical and technical details, going as far back as the early nineteenth century.

That being said, it's easy to enjoy *Science on a Mission* simply as a history of American oceanography from the 1930s to the turn of the century. Before the Second World War, oceanography in the United States was an obscure, underfunded branch of the sciences. American oceanographers were generally limited to small-scale research in shallow coastal waters, while the Norwegians, British, and Germans were the true leaders in the field. But with the advent of war, the

US Navy realized that the coming conflict would have a significant underwater component that would outstrip the abilities of Navy scientists. Thus began the military's partnership with academic oceanographers, united in the quest for better knowledge of currents, underwater acoustics, the configuration of the deep-sea floor, and other topics of relevance to both marine and submarine warfare. The Navy's generous support of ocean research continued through the Cold War, as mastery of the deep sea increased in strategic importance. In fact, for several decades, the Office of Naval Research was the sole patron of oceanographic research in the United States.

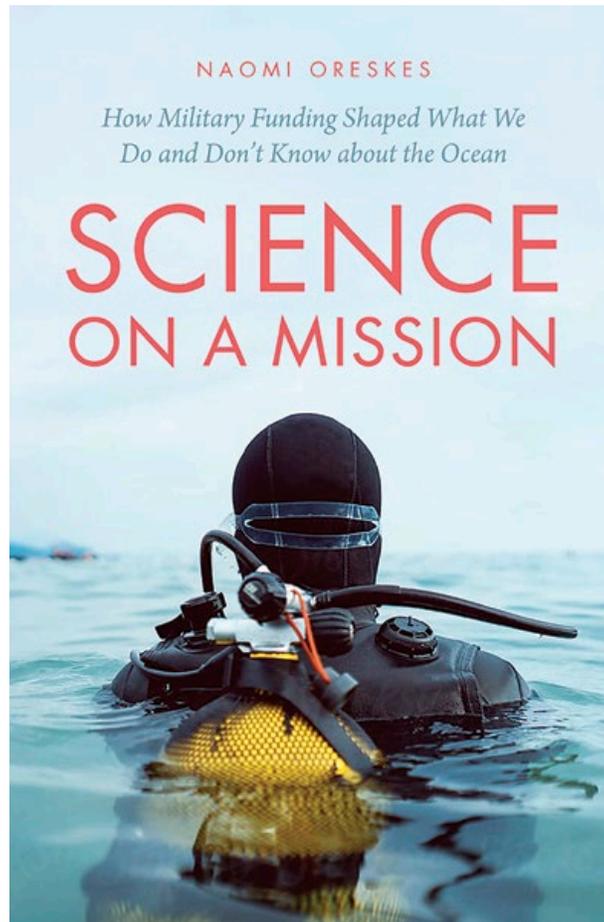
Oreskes draws on oral histories, interviews, and institutional records of the three main locales of American oceanographic research—indeed the *only* three in existence at the beginning of the story: the Woods Hole Oceanographic Institution in Massachusetts, Scripps Institution of Oceanography in San Diego, and Lamont Geological Observatory (now Lamont-Doherty Earth Observatory) at Columbia University. She describes thrilling discoveries made possible by generous funding, but at the same time she points to scientists' anxieties resulting from exclusive government patronage: the burden of loyalty, the effects of secrecy and classification, and the struggle to balance the Navy's mission with researchers' own search for knowledge.

The narrative continues through the 1980s and '90s, with the end of the Cold War, the precipitous drop in military funding, and the attempts of the field to adjust to this radical change in the context of motivation. As oceanographers searched for new funding and a new sense of purpose,

Oreskes describes their shift toward environmental issues, and their difficulties in engaging with a more complex world of stakeholders and priorities beyond the Navy.

Ironically, despite the length and depth of Oreskes's 744-page history, I found myself wanting more breadth. A brief account of the Navy's perspective on its relationship with science and scientists would have helped in understanding the tensions between patron and beneficiary. And examples of the invidious effects of private science sponsorship (covered so ably in her earlier work) would have given a more balanced perspective on military sponsorship. Although to be fair, this would have made the book unmanageably long.

The second way in which *Science on a Mission* can be read is as a scholarly guide to the history of science. It is a useful primer on the perennial issues of the field, as Oreskes engages with her colleagues both past and present, aligning, criticizing, or refining their interpretations. For example, Oreskes questions dogmas about the trajectory from one mode of science to another, in particular the so-called linear model, in which fundamental, pure, or basic science—driven exclusively by disciplinary curiosity without a practical goal in mind—precedes the applied science of practical uses. Although scholars have long seen the linear model as unhelpful in understanding how science works in practice, Oreskes cites examples of its tenacious grip on the public imagination. She is at pains to draw evidence from oceanography that the vector between basic and applied science can operate in either direction, citing several examples where fundamental knowledge flowed from



Science on a Mission: How Military Funding Shaped What We Do and Don't Know about the Ocean

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applied, mission-driven work, rather than the reverse.

The story of *Alvin*, the first successful deep-sea vehicle, is a compelling case of fundamental science following, rather than preceding, strategic problem-solving. Oreskes notes that most accounts assign a triumphal role to pure scientific curiosity, saying that *Alvin* was built to test the hypothesis that deep ocean ridges, where the Earth's crust is thinnest, must have hydrothermal vents. This quest led to one of oceanography's greatest discoveries: vibrant abyssal ecosystems based on

chemosynthesis rather than photosynthesis. Practical applications, such as the use of heat-resistant molecules for industrial purposes, then followed this discovery.

However, says Oreskes, the conventional wisdom has it backwards. The impetus to build *Alvin* was driven by Cold War military needs: better knowledge of the abyssal floor would improve underwater sound transmission and aid the salvage of sunken submarines, conferring a significant strategic advantage over the Soviet Union. Until the first three years of strategic missions were complete, oceanographers could not use *Alvin* for fundamental research. Indeed, they did not even show interest in using it. Scientifically speaking, Oreskes writes, "science did not lead the ... *Alvin* program; it followed.... *Alvin* was a solution in search of a problem."

Oreskes asks why, then, have those first three years of *Alvin*'s existence been "expunged" (to use her perhaps exaggerated term) from most historical accounts? Why did her interview subjects omit to mention—whether intentionally or not—the role played by strategic work in the development of their research?

Her search for answers opens the door to another important issue for historians of science: the balance of power between scientists and the state. In the case of oceanography, to put it baldly, who was using whom? Oreskes's response is that it depends: the relationship between scientists and state varied over time and within the community of scientists. The distortion of *Alvin*'s history is a telling clue. At the time, there was a running joke among military-funded scientists about "bluewashing" their proposals—that is, cloaking them in strategic relevance in the hope of better funding. The

omission of *Alvin's* original purpose is the exact reverse, she argues: disguising a sword as a plowshare to maintain scientists' sense of agency and autonomy vis-à-vis their patrons. The idea of science subservient to the state was an unacceptable self-image for gifted scientists, and uncomfortably reminiscent of Soviet practices during the Cold War.

In the later chapters of the book, covering the years of waning military support for oceanography, Oreskes shifts her focus from science and the state to science and society. Oceanographers' search for new funding and renewed purpose raises questions about what President Obama memorably called the "rightful place" of science in a complex modern democracy. How should scientists participate in current affairs? Are they simply advisers, invited to contribute their expertise but not allowed to set priorities? Or is it permissible for them to advocate for particular policies or solutions? As she tries to delineate the ethical boundaries for scientific participation in society, Oreskes draws on sociologist Robert Merton's criterion of "disinterestedness" as the "core norm" of the scientific community. According to this principle, the demarcation of appropriate behavior is whether a scientist's advice is colored by the benefits the scientist stands to gain.

In the real world, however, discerning disinterested from biased behavior is not easy, and it seems to me that Oreskes is aiming for a more precise distinction than is possible. One of her key examples to illustrate the nuances of the issue is oceanographers' efforts to reinvent themselves as environmental scientists. Although this reinvention made sense in many ways, it also demonstrates how oceanographers were often ill-suited to environmental issues, which are by

definition not only scientific but also social and political.

Oceanographers proposed to add to the evidence of climate change by taking ocean temperatures. Their idea was to use their knowledge of underwater acoustics by sending large pulses of sound through the ocean and studying changes in transmission time, which is affected by temperature. Their proposal met with vigorous opposition from marine biologists and citizens concerned about damage to marine mammal populations. Climate scientists and policy experts also contended that the experiment was superfluous because evidence of climate change was already overwhelming. Even assuming the proposal was disinterested and wasn't driven by potential new sources of funding, the idea of "fixing" a social and political stalemate with more scientific fact was misguided. Here Oreskes draws on ocean scientist Rodney Fujita and policy scholar Daniel Sarewitz—as well as her own work—in stressing that in cases of contentious issues, a solution must flow from political negotiation, not from more facts.

The ocean acoustic tomography episode is part of the third and most important aspect of Oreskes's book: the study of epistemology and agnotology, or the construction of knowledge and ignorance. How did oceanographers' close ties to the Navy, their "context of motivation," lead to a lack of knowledge that caused them to fumble the transition to a new era?

Oceanographers' surprise at the opposition to their acoustics proposal—and, once challenged, their failure to marshal credible evidence in their defense—stemmed from unfamiliarity with marine biology. The weak professional ties to their colleagues in that field seems strange until one considers that for many decades they were encouraged to focus on the purely geophysical aspects of the ocean, in alignment with the

Navy's interests. Similarly, the Navy's bias toward secrecy and classification meant that oceanographers were discouraged from sharing research, not only with other disciplines but with colleagues in their own field. And finally, their unfamiliarity with the complexities of a multi-stakeholder policy environment was the result of their long-term reliance on a single generous sponsor.

As with many books nowadays, *Science on a Mission* ends by contemplating how humans got to this current juncture of potentially catastrophic climate change. The salient question in the case of oceanography is whether the "context of motivation" delayed the appreciation of the problem. Oreskes argues that it did: apart from a few exceptional visionaries, oceanographers were late arrivals to the scene. Navy patronage made possible many advances in knowledge, but it also created what she calls "domains of ignorance." How much future damage will result from other domains of ignorance?

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