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Oceanography and Women

Early Challenges

BY ENRICO BONATTI AND KATHLEEN CRANE



Figure 1. Early female marine scientists were largely confined to the laboratory, collecting their samples only in shallow waters just off the beach. This photo is from a Marine Biological Laboratory collecting trip from Woods Hole, MA, to Cuttyhunk Island around 1895. *Photo by Baldwin Coolidge, courtesy of The Marine Biological Laboratory Archives*

ABSTRACT. Today, oceanography is an active field of research that challenges hundreds of men and women. However, women scientists were not permitted to sail on oceanographic vessels up to the mid-1960s. This prohibition stems from ancient taboos reflected in myths and legends, starting with Homer's *Odyssey*. An isolated pioneer was Jeanne Baret, a botanist who managed to sail disguised as a man on the 1676–1679 French expedition of L.A. de Bougainville; she became the first woman to circumnavigate the globe. No women sailed on the 1872–1876 *Challenger* Expedition, the first major scientific exploration of the ocean. No women were allowed on research vessels of US oceanographic institutions during the post-World War II years. An attempt by graduate student Roberta Eike in 1956 resulted in her dismissal from Woods Hole Oceanographic Institution. The taboo against women at sea was broken at Scripps Institution of Oceanography in 1963, when two Russian scientists were invited to participate in a major expedition onboard R/V *Argo*. One turned out to be a woman—Elena Lubimova, a heat flow geophysicist. The taboo against women at sea prevailed also in Western Europe, but not in Russia. For instance, marine geologist Maria Klenova of Moscow's Institute of Oceanology led major expeditions in the Arctic and Atlantic as early as the 1930s. The taboo against women at sea subsided gradually, and today women oceanographers sail freely on research vessels, contributing greatly to the progress of our discipline.

INTRODUCTION

The scientific exploration of those two-thirds of our planet covered by the ocean made a quantum leap in the United States in the 1960s, particularly after Sputnik was launched into space by the Soviet Union in 1957. Research ships of the major US oceanographic Institutions (Woods Hole Oceanographic Institution [WHOI] and Columbia's Lamont Geological Observatory on the East Coast, Scripps Institution of Oceanography on the West Coast) began to navigate the high seas for months on end collecting data. Among the results of this effort was a major scientific revolution that led to the theory of plate tectonics.

Today, after about half a century, oceanography in its various aspects is an active field of research that challenges hundreds of dedicated men and women. We just wrote “men *and* women”—we would not have written the words *and women* 50 years ago, because US oceanographic expeditions were then off limits for women, no matter how talented they might have been (Figure 1). This situation was in part a fallout from ancient taboos widespread among sailors everywhere, whereby women at sea brought bad luck and disaster. No women are to be found on Captain Ahab's ship *Pequod* or in Captain Nemo's submarine *Nautilus*. In Coleridge's classic *The Rime of the Ancient Mariner*, the mariner's

Figure 2. Figurehead carved in the bow of an ancient ship.

wandering vessel has an all-male crew. The only female presence in the entire poem is a frightening “Life in Death” figure who, with her male companion “Death,” appears briefly close to the Mariner's ship on a ghostly mysterious vessel.

It is intriguing that, although real women were not allowed to navigate, feminine symbols permeated the act of navigation. Sailing ships often had alluring female bodies carved on their bows (Figure 2). Going back to the greatest myth of seafaring, Homer's *Odyssey*, we find female characters surrounding Ulysses' adventures: Penelope waiting for his return in the domestic peace of Ithaca, the seductive semi-goddesses Circe and Calypso keeping him bound for years in their islands, young virginal Nausicaa who discovers him shipwrecked on a beach of her father's island, his old nurse who first recognizes him in Ithaca. And, of course, the Sirens who with their chants entice sailors to their deaths. None of these female figures, although so important in Ulysses' adventures, ever set foot on his ship. His crew

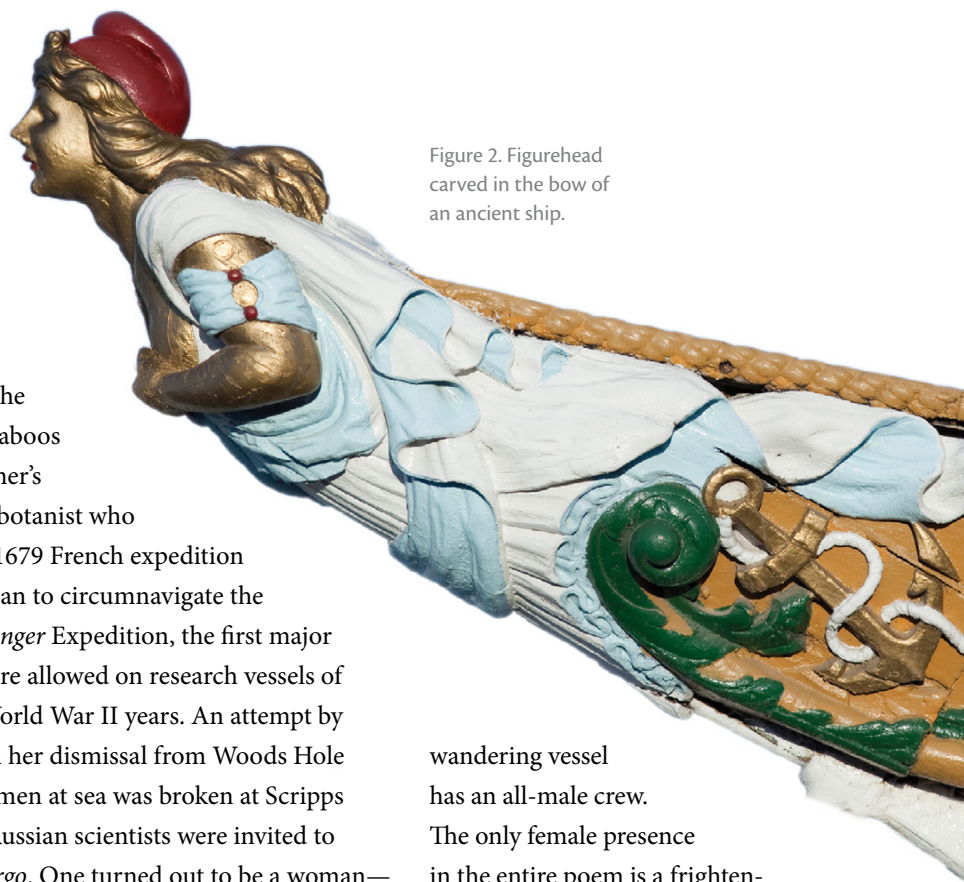




Figure 3. Marie Poland Fish, and her husband Charles Fish handle a plankton net on the 1925 *Arcturus* oceanographic expedition to the Sargasso Sea led by William Beebe. In addition to Marie Fish, who was listed as Assistant in Larval Fish Distribution, the *New York Zoological Society Bulletin* (28/4) reports that there were three other women involved in the expedition: Miss Isabel Cooper (Scientific Artist), L. Segal (Associate in Special Problems), and Miss Ruth Rose (Historian and Technician). *Zoological Society Bulletin* 28 (4):115, published in 1925, *New York Zoological Society*

is strictly male—not even Athena, the goddess who looks after him, ever sails with Ulysses. This ubiquitous feminine presence can be interpreted as representing the sailors' unconscious longings and fears. The infinite watery medium surrounding the sailors is considered in Jungian psychology an archetype of the maternal. The unconscious of sailors, saturated with the feminine, is unable to bear the presence of real women at sea.

A woman who dared break the taboo over three centuries ago was Jeanne

Baret; she sailed on the French ships *La Boudeuse* and *l'Étoile*, which circumnavigated the globe in a 1676–1679 expedition led by Louis Antoine de Bougainville (Goodrich, 1890; Ridley, 2010). Baret, a botanist, worked at sea for over a year disguised as a man until some natives recognized her as a woman during a stopover in Tahiti. Bougainville was dismayed but, according to Goodrich (1890), he let her be because she had behaved on board with the most scrupulous modesty and also because apparently he thought she was not attractive! Jeanne Baret, after the discovery of her true gender, underwent many tribulations, but she survived to become the first woman to circumnavigate the globe.

Taboos against women at sea did not apply to women as paying passengers, from such glamorous stars as Marlene Dietrich and Greta Garbo, who crossed the Atlantic early in the last century in the luxury class of transatlantic vessels, to thousands of women immigrants

stuck in third class of the same ships, or, much earlier, to women as forced passengers during the slave trade from Africa. And, of course, women must have participated in the sea migrations of historic and prehistoric populations, from Vikings to Polynesians. But no women are to be found among the over 240 persons, both crew and scientists, who sailed aboard R/V *Challenger* (Linklater, 1972) on the first oceanographic expedition of the modern era (1872–1876).

POST-WORLD WAR II WOMEN OCEANOGRAPHERS

Even though a few women scientists, such as Katherine Gehring from Scripps, sailed on day trips to carry out nearshore research, overnight voyages were generally not allowed. A few exceptions were made for women who sailed as wives of marine scientists. For instance, Helen Raitt sailed across the Pacific in 1952–1953 on Scripps vessels with her husband, geophysicist Russel Raitt. She then wrote a book (Raitt, 1956) inspired by this voyage. Another husband/wife team, Harvard biologists Barbara Lawrence and William Schevill, sailed around Bermuda on WHOI's R/V *Caryn* in 1952 to study whale sounds (Cullen, 2005). Marie Poland Fish, a distinguished researcher in bioacoustics (Figure 3), sailed with several expeditions, including William Beebe's *Arcturus* deep-sea expedition of 1925 (Brown, 1994; K. Wishner, University of Rhode Island, *pers. comm.*, 2012). However, she was always accompanied by her husband, biologist Charles Fish. Western European female oceanographers did not fare better. For instance, women did not sail on German oceanographic vessels before 1974 (Jörn Thiede,

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Alfred Wegener Institute, Bremerhaven, *pers. comm.*, November 2011).

The taboo on sailing the “ocean blue” for women scientists in the post-World War II years was probably also an aspect of the overt as well as subtle discrimination against women that prevailed then in the academic world (Rossiter, 1998) and that has not completely subsided even today (Crane, 2003; Rohn, 2010). In 1949, Carl Eckart, the director of Scripps at that time, formalized a rule forbidding women scientists at sea (Day, 1999). Earlier, Harald Sverdrup (director from 1936–1947) had discouraged taking women aboard ships. Roger Revelle, director from 1950 to 1964, wrote to the Scripps marine superintendent that it was not advisable to formally forbid women aboard ships, because they would turn up as stowaways if a formal rule was made. However, “the best thing,” said Revelle, “was to discourage them as much as possible” (Day, 1999; Elizabeth Shor, Scripps Institution of Oceanography historian, *pers. comm.*, 2010).

These attitudes prevailed not only at Scripps but also at the other oceanographic institutions, although there was a singular exception for Betty Bunce, a geophysicist who sailed on WHOI vessels as early as 1959 (Cullen, 2005). At Lamont under Director Maurice Ewing, women did not go to sea, although Captain Kohler, the master of Lamont’s R/V *Vema*, had his wife sail with him occasionally. Again, the idea was that women could go to sea as long as a husband was there to “look after” them. Marie Tharp (Figure 4), the great Lamont researcher who together with Bruce Heezen discovered in the late 1950s the rift valley along the crest of the Mid-Atlantic Ridge and whose maps of the

ocean floor are still used today, never set foot on a Lamont ship, although she sailed in 1968 on the Navy’s R/V *Kane*. In fact, the first Lamont woman to go at sea was geophysicist Ellen Herron in 1965 (Bell et al., 2005); however, she did not sail on a Lamont ship but rather on the National Science Foundation’s R/V *Eltanin*. About 10 years later, she was chief scientist on Lamont’s R/V *Conrad*. Lamont electron microscopist Dee Breger went to sea in 1968—however, again, not on R/V *Vema* but on the *Eltanin*.

An accomplished WHOI oceanographer from the 1940s to 1970s was marine biologist Mary Sears (Cullen, 2005). During the war, she ran the Oceanographic Unit of the Navy’s Hydrographic office; later, she was for many years the editor of *Deep Sea Research*, and she organized the First International Oceanographic Congress, held in 1959 at the United Nations in New York. In spite of her talents and achievements, she could never go to sea on a WHOI vessel. Her only

participation in oceanographic expeditions took place on Peruvian fishing vessels, to collect plankton samples and study El Niño conditions in the eastern Pacific. The alleged reason for not letting her and other WHOI women oceanographers go to sea “was, of course, that there were ‘no proper facilities’ for a lady.” According to Cullen (2005), Sears commented, “But there were pails!” and added that, though there were no proper facilities on the Peruvian vessels, what made the difference was that there were proper gentlemen aboard!

A JEANNE D’ARC OF OCEANOGRAPHY

Another significant WHOI story took place in the 1950s and involved marine biology graduate student Roberta Eike. She published a *Woods Hole Diary* (Eike, 1956) that showed she was enthusiastic about her research at WHOI. However, she objected to the taboos that prevented WHOI women oceanographers from going to sea. In 1955, she circulated at



Figure 4. Marie Tharp (right), who did oceanography mostly from dry land, and Elena Lubimova (left), who did oceanography also at sea. Lubimova was visiting Lamont early in 1964 after the R/V *Argo* cruise. Photo courtesy of G. Udintsev

BOX 1 | WOMEN AND OCEANOGRAPHY

By Roberta Eike, Woods Hole Oceanographic Institution Summer Fellow, 1955 and 1956

The administration of this modern Institution need not be proud of the fact that policy to date regarding the subject of women going to sea has been governed by antiquated puritanical misconceptions as to their competence, a lack of foresight concerning utilization of one of the most apparent resources in the study of the oceans, and the ill tempered dictates of the crews.

The Woods Hole Oceanographic Institution was founded 25 years ago for the purpose of studying the oceans—of trying to unfathom the mysteries of this modern frontier. Today we are further mystified than when we started, if only for the simple reason that we now have a better inkling of the components of the vast interwoven fabric we are trying to unravel. In these years that the Institution has been lowering Nansen bottles, nets, cameras, and sonic devices into the seas, it has suffered many limitations, such as in funds and instrumental advances. I suggest that it has imposed upon itself yet another limitation, that of personnel; for during this same time economic and social conditions have been such that women have had the opportunity to contribute to almost all fields of scientific research. The one field, at least on Cape Cod, to which they have been denied full admission is Oceanography.

Many reasons have been given to account for this situation. Some scientists have said that it isn't necessary to go to sea in order to be an oceanographer. But I would prefer to collect my own data and to have the opportunity to make all the important personal observations that go with it. Furthermore, how can one even remain interested in the deep ocean if all he or she sees of it are pictures in *Life* or hears of it are reports of others?

It has been claimed as another excuse that there are not adequate facilities for women aboard the research vessels of this Institution. Sure this is true, and it will be true so long as the administration either wishes it that way or doesn't wish it otherwise. I have observed that man is capable of making things as involved or as uncomplicated as he desires. To some minds it might be a lot of trouble to install facilities for women aboard a ship. It's also a lot of trouble to study the seas in the first place, yet that isn't considered any proper impediment. If the effort can be made to construct and outfit a research vessel, why can't it be made to extend its facilities to women?

The following are the comments, in part, of some of the staff members concerning this issue.

"The advantages to be gained in the long run by the Institution in enabling women to go to sea greatly outweigh the disadvantages, which as usually expressed arise almost entirely from prejudice. In my mind practically no actual change is involved; the major change required is in the minds of people."

— A.H. Woodcock, Meteorologist



R/V Atlantis—"no proper facilities for a lady." Photo by Jan Hahn © Woods Hole Oceanographic Institution

"Part of the issue is an emotional one. For many men going to sea represents a temporary reversion to boyhood, and they don't want their glorious chance to get away from it all endangered. I should think W.H.O.I. might be realistic about it and take a couple of week-long trips to see how it works. If the institution could make a ship go out of here that was fit for women to be aboard it would probably be a better research vessel for all concerned, even if no women ever went out on it!"

— H. Stommel, Mathematician

"There are many thoughts against the employment of women on vessels, ranging from superstition, which may be overcome by gradual adjustment to practical reasons. It would be in the interests of science to let women go to sea, but with the present ships I am against it. On one-day trips or even overnight the lack of privacy wouldn't present too serious a problem, but to throw women in with men on two to three-week cruises would be unwise. If in the future we get larger or more properly built vessels so that living quarters can be separated I think it would be worth a try to see how they work out."

— J. Pike, Port Captain

"I feel we're in the Dark Ages about it around here. If they are competent to do the work and have a reason to go there's no reason in the sun why women can't go to sea. The fact that they can't go is one reason there aren't more women oceanographers around here."

— F.C. Fuglister, Oceanographer

"In other nations and in other laboratories in this country women go to sea, although not very extensively. If we had a properly built vessel I would have no objection."

— J.B. Hersey, Oceanographer

"I don't believe in any hard and fast rule against women going to sea. When the time comes that there is a woman oceanographer who wants and needs to go to sea then the taboo will be broken. I only hope that time doesn't come until we have a larger and more commodious ship than the Atlantis or the Caryn."

— L.V. Worthington, Oceanographer

The final question to my mind is, "Does the administration of W.H.O.I. believe that the extra effort (both real and imagined) involved in making it possible for women to investigate the ocean would be outweighed by the value of their contributions?" I think that it would, and conclude that any Institution cannot be serious in its aims if it refuses to submit the solution of its problems to the ingenuity and understanding of women as well as men.

WHOI a statement, including comments she solicited from several WHOI staff members, that is worth reproducing here (see Box 1).

However, the WHOI administration (Rear Admiral E.H. Smith was the Director) did not modify the rules preventing women at sea. After about a year, in July 1956, Roberta Eike stowed away in the bilge of R/V *Caryn* when the ship left for a marine biology expedition led by her supervisor George Clarke. When she was discovered, she was locked in the captain's cabin. The ship returned early, and the event made the front page of the local newspaper, the *Falmouth Enterprise* (Figure 5). Eike's fellowship was cancelled and she was dismissed from WHOI, in spite of a written protest by some WHOI staff members. We could not find out what happened to her after her dismissal. A true Jeanne d'Arc of oceanography!

THE TABOO IS BROKEN AT SCRIPPS

What broke the taboo? Here is a recollection of how it happened at Scripps. The year was 1963. Roger Revelle was the director; he had attracted to Scripps an outstanding group of scientists, among them Harold Urey, Walter Munk, Bill Menard, Teddy Bullard, Harmon Craig, Gustav Arrhenius, Hans Suess, and Russel Raitt. Scripps operated a fleet of oceanographic vessels “manned” (this word is significant!) by all-male scientific teams.

In the fall of 1963, Scripps was preparing a major expedition with its best vessel, R/V *Argo*. Dick Von Herzen, a geophysicist who had pioneered measuring heat flow from the ocean floor, was to lead the first leg, from San Diego to Tahiti. One of us (E.B.) was part of the



Figure 5. Portion of the front page of the *Falmouth Enterprise*, July 20, 1956, with an account of the stowaway story of Roberta Eike.

scientific team. Among the objectives was to measure bathymetry, magnetics, and heat flow, and carry out rock sampling along the East Pacific Rise. Note that the seafloor spreading/plate tectonics debate was then just starting; mid-ocean ridges were the target of intense exploration, but their significance was not yet clear. In fact, most of the papers defining the significance of mid-ocean ridges within the framework of the new ideas had not yet appeared when we were preparing the expedition. Vine and Matthews (1963) explained ridge magnetic anomalies; Engel and Engel (1964) first defined the composition of mid-ocean ridge basalts; that basalts outcrop continuously along the crest of the East Pacific Rise was established in 1968 (Bonatti, 1968a); in the same year, mantle ultramafics were sampled along the Mid-Atlantic Ridge (Bonatti, 1968b). J. Tuzo Wilson explained ridge-axis offsets in 1965 (Wilson, 1965), and he introduced the concept of transform faults; Lynn Sykes clarified the



Figure 6. Amphitrite, Goddess of the Sea, wife of Poseidon.

significance of ridge seismicity in 1965 (Sykes, 1965); Dick Von Herzen and John Sclater, among others, defined trends in ridge heat flow during those years (Von Herzen and Uyeda, 1963); ridge hydrothermal activity was first reported in 1979 (Corliss et al., 1979).

Thus, the 1963 *Argo* cruise was mounted in an atmosphere of excitement because of the turmoil of the new ideas. At Scripps, all major expeditions were identified with a name: Monsoon, Capricorn, and so on. This one had been named “Amphitrite”: in Greek mythology she was the Goddess of the Sea, wife of Poseidon (Figure 6). Again, an all-male ship sponsored by a female deity. But, as yet unknown to us, this was not going to be an all-male venture.

A few weeks before the departure of R/V *Argo*, the news came that two Soviet scientists were to join the cruise. Given the political climate at that time, this was quite some news! The Cold War was in full swing. Kennedy was president. The reverberations of the Cuban missile crisis had not yet subsided. Contacts among Russian and American oceanographers were minimal: the Iron Curtain extended its grip even under water! A small crack had opened early in 1963 during an International Union of Geodesy and

Geophysics (IUGG) meeting in Berkeley attended by Soviet oceanographers. This meeting led to the possibility of two of them participating in a US expedition (G. Udintsev, Vernadsky Institute of Geochemistry of the Russian Academy of Sciences, Moscow, *pers. comm.*, 2010). Both Soviet and US authorities approved this participation.

After several days, the Scripps community had another surprise: one of the two Soviet scientists would be a woman! Of course, there was no way a visiting foreign scientist sponsored by the US Department of State could be denied a berth on the ship because of her gender. So, it turned out that the first woman oceanographer to sail on a Scripps research vessel was Russian. Her name was Elena Lubimova, a geophysicist from the Institute of Physics of the Earth of the Russian Academy of Sciences in Moscow (Figure 4). She was known in the west because of a synthesis on the thermal state of the Earth published in English (Lubimova, 1958). The other Russian scientist was Gleb Udintsev, one of Russia's foremost marine geologists.

From the Soviets' viewpoint, sending a woman oceanographer was nothing unusual. Oceanography was quantitatively strong in the Soviet Union, particularly due to a number of institutes of the Academy of Sciences, and to a large fleet of research vessels. However, Soviet research in ocean geology did not lead in those years to the new "mobilistic" ideas that in the West produced the theory of plate tectonics. Under the influence of V.V. Belousov, a prominent geologist who favored vertical rather than horizontal lithospheric motions to explain global processes, Soviet geologists resisted plate tectonics (Belousov, 1970) up to the late 1970s. The style of doing fieldwork was

different in the two countries. The United States used small (generally 60 to 80 m long) vessels; expeditions had specific objectives, and the US sailed relatively small scientific teams. Soviet oceanography used large (> 100 m long) vessels hosting 50 or more scientists in long expeditions dedicated to gathering data in a variety of disciplines. There had been no restrictions on the presence of women scientists on Soviet oceanographic ships since even before the Second World War. Women even led major expeditions. For instance, Maria Klenova, of Moscow's Institute of Oceanology, became a pioneer in Russian geological oceanography (Figure 7). Starting in the 1930s, she led expeditions in the northern seas and in the Atlantic and Southern Oceans. She authored a major book on marine geology in 1948 (Klenova, 1948), the earliest book on that subject. Other prominent sea-going Russian oceanographers before and after World War II include sedimentologist Tatiana Gorshkova, geophysicist Raissa Demenitskaya, and biologist Zinaida Filatova (G. Agapova, Geology Institute of the Russian Academy of Sciences, Moscow, *pers. comm.*, 2010).

THE ARGO CRUISE

Scripps ships would normally sail from the pier of the Naval Electronics Laboratory located in a sensitive military area of San Diego harbor. This time, however, R/V *Argo* was moved to a remote area of the harbor before the scheduled departure so that the two Soviet guests would be spared the sight of the more important military installations. As it turns out, when we all came out on deck several hours out of San Diego, we found ourselves with several warships in sight, a missile shooting out of the water, and



Figure 7. Maria Klenova, foremost Russian marine geologist.

helicopters hovering above us, signalling that we should get out of the way—the entire scene taking place under the amused eyes of Elena and Gleb, and to the embarrassment of everybody else. The *Argo* must have mistakenly sailed into an area where the Navy was conducting exercises.

Elena Lubimova worked with Von Herzen on the heat flow program. She was a soft-spoken, gentle person, but it took a while for a few hardcore red-necks in the crew to get over the double shock of having on the ship somebody who was not only a Soviet Communist but also a woman. But then, gradually, the hearts of those sailors softened, in part perhaps because of what happened on Christmas Eve far out in the South Pacific. No special celebrations were planned. In the galley, the crew sat down for dinner as usual, in normal, torn work clothes. Throughout the cruise, like everybody else, Elena had worn simple work clothes, but not tonight: she appeared for dinner wearing a magnificent evening dress, necklace, earrings, and even a little make up in a Felliniesque scene that left us gasping with admiration and Elena with embarrassment. Perhaps she naively felt that

in the West, Christmas was a serious religious holy day, solemnly celebrated even at sea...


It was actually a very good cruise. We obtained valuable geophysical data, and we dredged up lots of basalts from the East Pacific Rise. Notwithstanding the presence of a woman on board, we encountered no major storms...we hit no iceberg...we were not assaulted by pirates...the ship did not sink... At Scripps, they realized that women oceanographers were not a threat. The ice was broken. Although issues with women going to sea did not subside completely (Atwater, 2001; Crane, 2003), scores of young women oceanographers came along at Scripps: Tanya Atwater, Linda Holmes, Cindy Lee, Sharon Stonecipher, Rachel Haymon, Karen Wishner, Kathy Crane, Marcia McNutt, Kim Kastens, Miriam Kastner, Lisa Levin, Donna Blackman, Lisa Tauxe, and many others.

A few years after Elena Lubimova's first "solo" voyage, Scripps geophysicist Tanya Atwater led an expedition with an all-women scientific team on a research vessel with a woman's name, R/V *Ellen B. Scripps* (T. Atwater, University of California, Santa Barbara, *pers. comm.*, 2011). Also, beginning in the late 1960s, the other oceanographic institutions and even the US Navy started allowing women scientists to intermittently to work on their vessels. The first women to sail on the *Kane* in 1968 were Linda Glover and Yvonne Jones from the Naval Oceanographic Office, followed by Marie Tharp later in that same year (Linda Glover, *pers. comm.*, 2012). In 1989, marine biologist Cindy Lee Van Dover became a pilot of the *Alvin* submersible; in one dive she even led an all-women scientific team (Van Dover, 1996). The importance of

these changes is demonstrated by the quantity and quality of science produced since then by women oceanographers.

Elena Lubimova died in Moscow April 22, 1985. Today, almost 60 years after Roberta Eike's dismissal from WHOI, and nearly 50 years after Elena Lubimova's trip, research vessels from the US institutions sail Earth's oceans, manned and "womaned" by scores of equally competent and passionate oceanographers.

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