DEEP-SEA SCIENTIST SPOTLIGHT

HIROSHI KITAZATO

DEEP-SEA ECOLOGIST & PALEOBIOLOGIST

Dr. Hiroshi Kitazato is a distinguished deep-sea scientist, currently a visiting professor at the Tokyo University of Marine Science and Technology and a senior research fellow at the Danish Center for Hadal Research. He earned his Bachelors, Masters, and Doctorate of Science from Tohoku University, in Sendai, Japan. He is a globally-renowned expert in benthic foraminifera and deep-sea habitats such as hadal trenches. He has published more than 275 scientific manuscripts and 24 books and been honored with multiple awards for his contributions to paleontology and biogeosciences.

In His Own Words: Dr. Kitazato's Journey in Science

I was born in Tokyo on 1948, just three years after the end of WWII. Where I lived, a lot of natural landscapes were developing, including forests, vegetable and wheat fields, and wet rice fields. **I grew together with nature and enjoyed playing outside**. This was the starting point of my understanding of nature, natural systems, and natural history. When I entered into the School of Science at Tohoku University, I studied traditional geology and paleontology. In my studies, I walked in the fields and described nature again and again. I think of understanding nature on Earth as a dialogue. Finally, **by the end of my undergraduate thesis, I could talk together with the nature and with fossil organisms well, like Dr. Doolittle of the English novel!** At the time my PhD studies, I chose the topic of deep-sea sedimentary rocks at Chiba Prefecture, near Tokyo. This site has thick piles of continental shelf and middle bathyal sedimentary rocks with well preserved smaller benthic foraminifer fossils. **In this fossil site world, I could walk the ancient seafloors (without a SCUBA system!).** I worked on deep-sea benthic foraminiferal fossils, using paleo-ecology. After three years, I finished my thesis and defended PhD from the Tohoku University (Kitazato, 1978).

I love studying geology and paleontology, but I wanted to also understand living organisms on the seafloor. When I finished my PhD, I began to cultivate living benthic foraminifera in the laboratory and to make ecological observations by submersibles (HOV Shinkai 2000 and Shinkai 6500), which are operated from research vessels. **Dialogue with sediment surfaces through the submersible window is a lot of fun for me!** In the field, I observe benthic foraminiferal behaviors and microhabitats in and on sediment (Kitazato, 1988, 1994). My exploration goals kept getting deeper and deeper, until I came to study hadal trenches.

To do this work, I changed my institution from the Teaching Collage (Shizuoka University) to a Research institution (JAMSTEC). At JAMSTEC, I coordinated deep-sea research cruises with submersible dives. Two of these projects I coordinated included studying Oxygen Minimum Zones of the Arabian Sea in 2008 and a series of big research cruises named Quest for Limit of Life in 2013 (QUELLE 2013). During the series of these cruises, I used approaches including habitat mappings and seascape analysis. Together with my colleagues from my institutions, I could understand living groups of benthic organisms as components of ecosystems.

What personal qualities helped you find your research field?

My research focuses on many aspects of the deep sea, including topographies, organisms such as foraminifera, and substrate. I learned a lots of basic natural sciences, social science and humanities during the undergraduates at Tohoku University, I prefer to think in a more generalist way than in a specialist way, **I like to think from multiple disciplinary points of view.** In addition to thinking about the big picture, I trust following proverb, "**God is in the details**" by a German philosopher. Because of this way of thinking, I was able to easily change my subject from pure geology to a hybrid between biology and geology at the end of PhD thesis. With my colleagues, we have established a new research field of "Biogeosciences" in Japan.

What was your first science experiment?

During my PhD, I tried to find living benthic foraminifera in sediments. I could not find any, and I had never seen any living foraminifers in nature. When I left a petri dish with sediment and seawater for a couple of days in a laboratory at the university marine stations, I found several meandering ant like trails on and in the surface of sediments. I watched the petri dish under the microscope, I found several specimens extruding their foot-like rhizopodia and forming the trails! I recognized these are living foraminifers, and I shouted, "**Eureka**!" No micropaleontological or marine biological textbook described living foraminifers. Only one protozoological book "Protozoology" by Prof. Karl Grell, described the living foraminifera. Soon, I could easily find living foraminifers after then. My first descriptive paper, written in Japanese, explained how foraminifers move through sediments.

Learn more about Dr. Kitazato's work!

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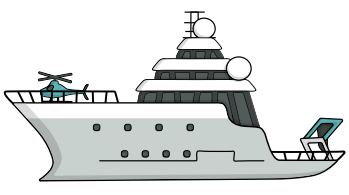
Why is it important to study the deep seas? What motivates you?

Hadal Trenches beyond 6,000 m deep are frontier regions on the Earth where a lot of unknown and unexplored habitats exist and many unsolved questions remain. Why not go and explore unknown hadal seas on our own planet prior to exploring space?

Is there a research project that you're most proud of?



I am always challenging myself with difficult scientific research topics, so several expeditions come to mind. During 1993-1998, I coordinated a series of research expeditions monitoring sinking organic fluxes from the sea surface to the deep-sea sediments at 1500 m in Sagami Bay. In 2008, we carried out a series of human occupied vehicle (HOV) dives along the Oxygen Minimum Zone of the Indian Ocean with HOV Shinkai 6500. We carried out cruise campaigns around the world with RV Yokosuka/ HOV Shinkai 6500 of JAMSTEC in 2013. Recently, we carried out to have joint submersible dive project with Caladan Oceanic LLC and global colleagues at the Japanese hadal trenches under the project name of Ring of Fire 2022 Japan Cruise by RV Pressure Drop and HOV Limiting Factor in 2022. I am very much pleased to coordinate and to take part in such big cruises with global colleagues in the past, present, and near future.

How do you share your love for the deep oceans with others, outside of science?

I also try to share hadal depths with citizens outside science **through coffee**! I asked my colleagues around the world who work with the organisms that live in hadal environments, "What do you imagine when you think of hadal depths? Please let me know with a couple of key words." Many of colleagues kindly answered. For example, one shared, "To the people who study and who love these trenches, these are places of quiet, of depth, complexities, peace, slow paces, curiosities, and full of possibilities." I and my colleagues around the world compiled the keywords into a couple of related words and asked SARUTAHIKO Coffee in Tokyo to **blend a special coffee inspired by the hadal zone**. We succeeded, producing a Hadal Blend Coffee in 2023. We shared the coffee by partnering with an exhibition of the deep-sea submersible, Shinkai at the National Museum for Nature and Science, selling the coffee at the museum shops. Audiences saw the deep-sea exhibition, and then at home they smelled the hadal blend coffee and thought of the deep seas. The Hadal Blend Coffee is helping to share the experience and feelings of the hadal zone!

ADVICE & LESSONS FROM DR. KITAZATO

Other than your studies in Marine Biology, what experiences have helped you build skills that you use to study the deep oceans? What skills do you find especially important for deep-sea science?

Practicing observing the nature around me in comprehensive detail has helped, as has frequently talking with other scientists about living creatures and goals. Observing and discussing are important skills across deep-sea science, from geological surveys to submersible dives.

Clarifying Misconceptions

Are there any misconceptions you often see about the work scientists do that you would like to clarify?

There is no answer in any of the textbooks, **we should find the truth hidden in nature.**

My Advice to Future Scientists

Deep-sea habitats are far beyond the land where you live and also invisible under the sea, but we can and should study them. First of all, y**ou should learn how to think about ecosystems in detail, both over space and over time.** When you study nature closely and pay attention, you can talk with nature reciprocally. If possible, visit the deep sea with a submersible or picture the full environment. Finally, be open to seeing miraculous things in the deep sea, even in the trenches. Because the deep sea is difficult to access, you can find many things there that are new to science. Please try to observe the organisms in detail and **pay attention to how the organisms connect to the rest of the ecosystem.** Life exists in closely-intertwined networks. Robust science relies on understanding these close connections.

Read about Dr. Kitazato's Hadal-Inspired Coffee Project

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