



Life Cycle of a Deep-Sea Sample

Remotely operated vehicles (ROVs) and other technologies provide amazing, high-definition imagery of deep-sea environments, but there are some things scientists can only learn by examining actual specimens. For example, geologists need a physical rock sample to accurately determine what it is made of, how old it is, and where it originated. Species-level identification of unique organisms can usually only be made when a biological sample is collected and brought back to the lab. Carefully collecting and analyzing biological, geological, and water samples from deep-sea environments provides a valuable record of deep-sea ecosystems and their inhabitants, leading to the discovery of species new to science and novel environmental processes.

Learn more about the different types of [deep-sea sampling](#) and the tools used for collection.

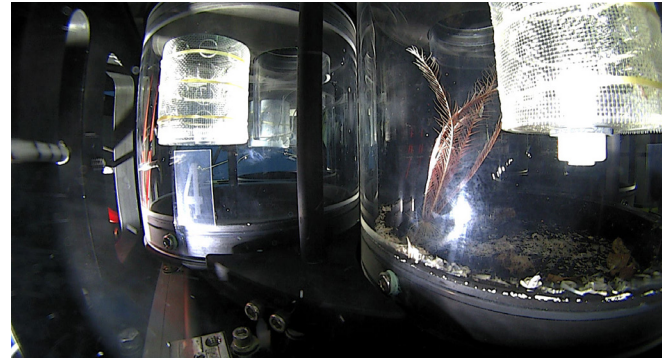
What happens with samples after they are collected at depth and how are they processed?

Once deep-sea samples are on board, science teams quickly and carefully gather the specimens into labeled bins and bring them to another deck space, cold room, or wet lab. Depending on the number and types of samples collected, ship-based sorting and processing can take over 24 hours!

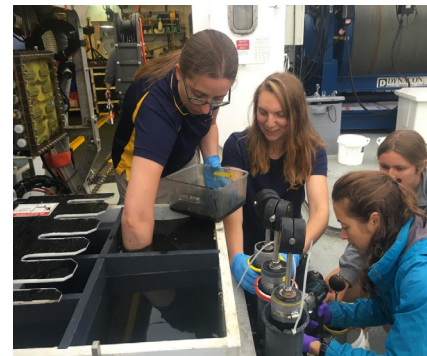
Biological samples are labeled and photographed. Labeling tags and rulers are included in each photograph for scale and reference, and features important for taxonomic classification are noted. Live specimens are kept cold to keep their tissues alive, ensuring better photographs and helping to preserve DNA for possible genetic studies. Organisms, or parts of organisms, may be preserved using formalin or ethanol, depending on which preservative is best for the type of animal. For larger biological specimens, the bulk of a sample may be dried to preserve its structure.

Both biological and geological samples may be collected using push cores and slurp hoses. After collection, sample containers are often placed in a refrigerator to keep cool until they can be worked on. Sediment from a push core may be removed from the tube and separated into subsampled layers, or the core may be preserved intact and shipped to a laboratory on land. Sediment collected in a slurp container is rinsed and filtered so scientists can look for, sort, and preserve any small and microscopic creatures.

Deep-sea rock and rubble samples are often dried, measured, photographed, and then placed into labeled bags. Sometimes, samples are broken open to take a closer look.



A crinoid, or feather star, sample collected in a biobox on a remotely operated vehicle. Image courtesy of NOAA Ocean Exploration.



Biological and geological samples are taken from bioboxes aboard the ROV *Hercules* and placed into plastic bins for future processing. Image courtesy of Ocean Exploration Trust.



Scientists aboard the R/V *Falkor* quickly transfer a rare hydroid sampled from 2,497 meters (8,192 feet) deep to the sample refrigerator for preservation. Image courtesy of Schmidt Ocean Institute.



Fossilized tooth of a megatooth shark, *Otodus megalodon*, found mostly covered in a ferromanganese crust. [Learn more about this surprise discovery!](#) Image courtesy of Ocean Exploration Trust.



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Water samples collected in what are called Niskin bottles, are taken to the ship's wet lab and placed into smaller bottles for processing or preservation. These samples can be taken to record basic water quality parameters, like temperature and dissolved oxygen levels, to collect [environmental DNA \(eDNA\) samples](#), or to provide information on things like deep-sea carbon levels, nutrient cycles, or the presence of microplastics.

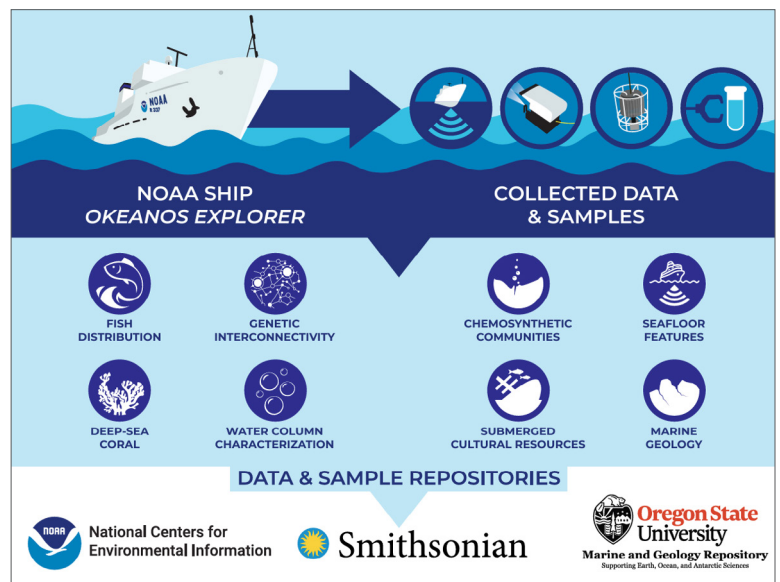
Where do deep-sea samples go?

Once samples have been properly cataloged and preserved on a vessel, they are shipped to a variety of shoreside labs and storage facilities ("repositories"). Different ships send their samples to different places. For NOAA Ship *Okeanos Explorer*:

- **Biological samples** are archived in the collections of the [Smithsonian Institution's National Museum of Natural History](#) (NMNH) in Washington, DC. There, they are preserved, taxonomically identified and sorted, computer cataloged, and made publicly accessible. For selected coral and sponge samples, a portion of a sample may also be sent to the [Bishop Museum](#) in Honolulu, Hawai'i.
- **Geological samples** are archived through the [Marine and Geology Repository at Oregon State University's NOAA Collection](#). There, the geological samples are described, cataloged, and made publicly accessible.
- **DNA samples** are archived in the NMNH's Biorepository, and are linked to the Museum's invertebrate or vertebrate collection catalog records. Some DNA samples are also archived at the [Ocean Genome Legacy Center](#) at Northeastern University in Boston, Massachusetts.
- **Images, video, and all descriptive data ("metadata")** are also carefully processed and archived through [NOAA's National Centers for Environmental Information \(NCEI\)](#). NOAA NCEI also ensures that scientists and the public have access to all sample-related information needed to fully understand the entire environment from which a sample was collected.



A tube is attached to each Niskin bottle on this [CTD rosette](#) to transfer water samples to plastic jugs for processing. Image courtesy of NOAA Ocean Exploration/BOEM/USGS.



The flow of data collected by NOAA Ocean Exploration from NOAA Ship *Okeanos Explorer*. These data provide baseline information about unexplored and underexplored areas, including the topics of study noted here. Illustration courtesy of NOAA Ocean Exploration.

Who can access the samples once on shore?

Anyone with appropriate credentials can request access to a repository sample for more detailed analysis. Once processed, NOAA Ocean Exploration data and samples collected during expeditions are not only available to researchers but may be requested by the public as well. Further study of these specimens may lead to new species identifications, new knowledge on the geographic range of organisms, medical advancements, publications, or could unlock secrets about how a seamount formed or where a tsunami originated. This information is incredibly valuable as, in most cases, the areas in which samples are collected have never before been explored.

LEARN MORE:

- [Accessing samples collected during expeditions on NOAA Ship *Okeanos Explorer*](#)
- [Sampling pathways for *E/V Nautilus*](#)
- [First-hand sampling experience aboard the *R/V Falkor \(Too\)*](#)