Curating and Maintenance of the Sediment Library and Dredge Collection

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LONG-TERM GOALS

The Lamont-Doherty Deep-Sea Sample Repository houses a collection of the most diversified as well as the largest number of different sites of deep-sea sediment cores in the world (Figure 1). For over 53 years, the collection has continuously grown. Researchers from all over the world use the material for work as diversified as searching for evidence of cosmic impacts on the ocean floor, mapping routes of ice bergs and sea ice, reconstructing past climate, and environmental studies. A large percentage of the cores and dredges were collected through ONR programs and support.

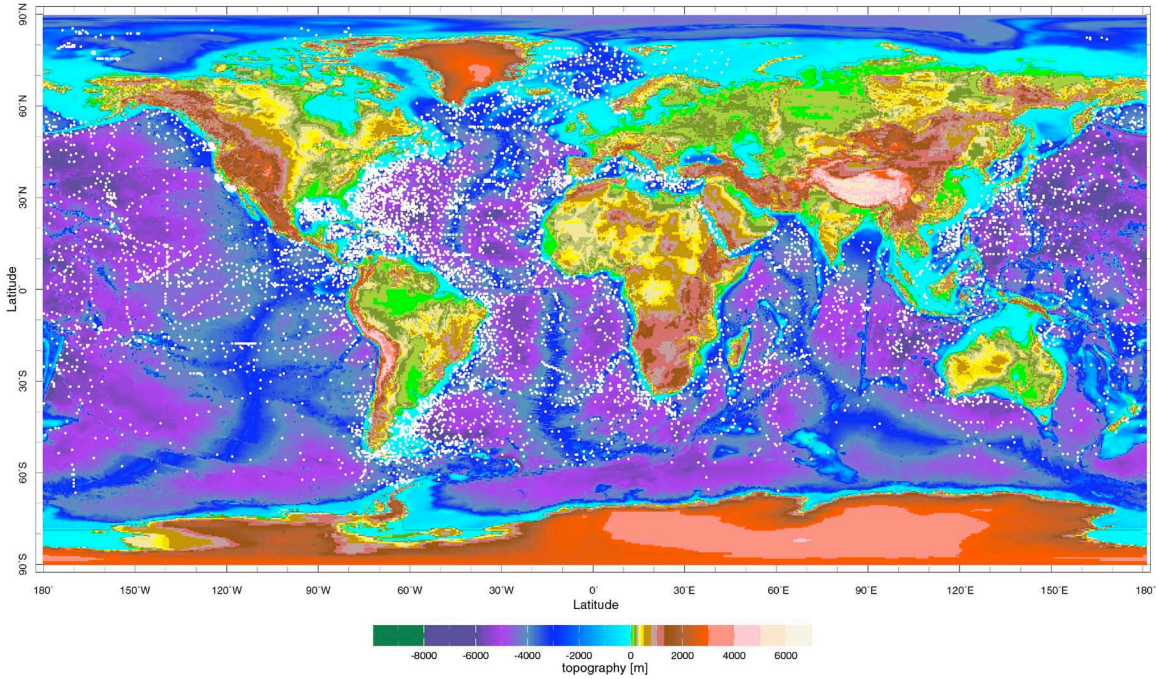

Figure 1. Core Location Map
[Each white dot represents one of the nearly 13,000 sites where a core was taken and is archived at Lamont's Deep-Sea Sample Repository.]

The sustained value and use of the Lamont collection is directly linked to the careful archive of each core since inception of the Core Repository along with preservation of the cores and their metadata. Each core is split open, photographed, and megascopically described. Metadata on all the cores keyed to micropaleontology and mineralogical content of the sediment has been on a database and kept current since the early 1970's and is constantly upgraded. The history of samples taken from the sediment over the past 53 years is now being entered into the database, linked to the core metadata. The next linkage to the core metadata will be to the vast list of publications resulting from work on LDEO cores. This electronic archive is an invaluable tool for scientists.

Long-term goals for the repository are all focused on material and data. Curation of newly acquired deep-sea sediments and preservation of the collection and archive data for future research is an obvious, visible aspect. Another of equal importance is provision of an environment for researchers to interact and develop their ideas by the availability of marine sediments, continued expansion of the content of the database, and provision of accessibility to all data on the web.

OBJECTIVES

The megascopic descriptions and core photos are essential tools for selecting an appropriate core for a particular research purpose. Until recently, the descriptions were in analog format, bound in almost 100 ringbinders along with other information associated with the cores. Scientists would frequently make a special visit to the Repository for the purpose of reading through the volumes to aid in selection of cores for work. Recent ONR funding supported the project of scanning and character-reading every single Megascopic Description. They are incorporated into the database and can be searched by all words instead of restricted to the keyed elements. They can be downloaded off the web, a tremendous convenience to the researchers.

Sediment color and texture reflects chemical composition and, to some extent, physical properties of the sediment (Figure 2). Color scanning, color reflectance and color spectometry have become important tools for researchers. Changing colors in cores from the Cariaco Trench were used to

Figure 2. Digital Color Image of Newly Acquired Core
[Core taken off the Research Vessel KNORR in 1993. The color variations are evidence of changes in chemical composition and, to some extent, physical properties in the cores. These color changes can be research tools in themselves, or used as a guide for sampling the sediment.]

produce a "greyscale" that indicate the dark sediment bands are evidence of low bottom oxygen, high surface productivity, and high runoff from South America. It can be used as a proxy for paleoceanographic studies, and thus a monitor of regional and (or) global climate change. Dark banding can indicate the presence of ice rafting debris, evidence of passing icebergs or sea ice. Especially dark color can be evidence of an "anoxic" condition at one time. The color is used most frequently in selection of sampling intervals in the sediment core.

Many of these uses of color change can be applied to the black and white glossy photos of the older cores, especially in the selection of sample intervals and grey scale (Figure 3). Having all of these core photos scanned and digitally available for researchers is our most recent objective.

Figure 3. A Scanned Image of an Earlier, Black and White Photographed Core [Core taken off the Research Vessel VEMA in 1954. Note the sharp "color" variations clearly visible even in this black and white image.]

APPROACH

New cores are currently digitally imaged as they are opened, and are database-ready. The older black and white photos are in the process of being scanned and prepared for entry into the database. The work can mostly be carried out using computers, scanners, and software presently in the Repository. The preparation of the images for scanning, and final entry into the database is carried out by Ramona Lotti. Technical staff supported by other sources do the actual scanning. Images are backed up in a mass storage unit for digital archive while other copies are prepared for on-line use.

WORK COMPLETED

The project to scan the LDEO core image collection is tremendous. Thanks to previous ONR funding, many of the older photos have already been scanned. The work continued on schedule this FY. Other sources have provided funding for a scanner, computer, software and mass storage of the digital images, and to set up the database for inclusion of the photo images.

RESULTS

A computer programmer funded by other sources is finalizing the adjustments in the database to accept the core photos into the website. The Repository website showing our operations and core database including the digitized megascopic descriptions, a project generously supported by ONR, can be found at: http://www.ldeo.columbia.edu/CORE_REPOSITORY/RHP1.html.

IMPACT/APPLICATIONS

The Lamont Repository has set standards for curation over the years. Cores in the collection taken over fifty years ago are currently being sampled for research. The fact that the cores were photographed at the time of their collection, megascopically described, and preserved and maintained impeccably over those years makes this possible. We continue to develop new methods for preservation. Digitization of the core photos is a most recent endeavor in preservation and upgrading. The ready availability of the images along with the digitized Megascopic Descriptions are a great aid to researchers seeking information on the cores.

TRANSITIONS

The Repository website is instructional as well as informational and receives a tremendous number of visitors. Many educational institutions from lower grade levels through graduate, and many environmental organizations link to it. The site goes into great detail to explain what we are doing and most importantly, why. There are pages explaining what we find in sediments and the significance of the findings. Pages describe techniques for studying the sediment and links to many other sites offer explanations of procedures, how we use the information from the cores to explain climate, to explore the earth's atmosphere, search for extraterrestrial events, and much more. There are links to data provided to us by researchers, publications resulting from work on cores. A page threads through a full research cruise from beginning to end including details of retrieving cores.

RELATED PROJECTS

All metadata on cores is sent to the National Geophysical Data Center for inclusion in the National Geoophysical Database at: http://www.ngdc.noaa.gov:80/mgg/curator/curator.html.

HONORS/AWARDS/PRIZES

Gerard C. Bond, a Principal Investigator of this project, is the 2003 recipient of the Maurice Ewing Medal. The American Geophysical Union presents this medal to geoscientists who make significant original contributions to the understanding of physical, geophysical, and geological processes in the ocean; to those who advance oceanographic engineering, technology, and instrumentation; and to those who perform outstanding service to the marine sciences.