12. GERIATRIC CORE INVESTIGATION ON LEG 124E[1]

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INTRODUCTION

ODP spends considerable money and time preserving its core collection, some of which is now more than 20 yr old. Investigators sample cores in the collection, and may interpret the results of their work with an implicit assumption that the samples they take from the collection are as representative of the sediments from which the cores originally came as they were when they were first brought on deck. If this assumption is invalid, then their interpretations also may be invalid.

Over the years, many investigators have noted that properties and characteristics of the cores change with time, most strikingly those that we class as "ephemeral," and which we make a strong effort to measure immediately upon recovery. Recently we've begun to notice that properties that, at first blush, are thought to be stable may not be. For example, Schnitker et al. (1980) demonstrated that calcareous microfossil assemblages in nearshore (reduced sulfur-rich) sediments dissolve as the samples dry over a period of 2–3 months. Geyh et al. (1974) showed that bacterial activity in deep-sea cores severely affects ^{14}C measurements. Repository workers are continually fighting mold growth, evaporation, and other forms of physical degradation in the cores, so we are confident that our cores are not immune to the ravages of time.

Clearly, an understanding of the scientific importance of changes that occur in cores while they are stored in the DSDP/ODP repositories is vital to their analysis; however, no systematic study has been made.

About 3 yr ago, several of us at ODP/TAMU designed a study (the Geriatric Core Study) that would monitor changes in faunal assemblages and in chemical and physical properties over an indefinite period of time, beginning with initial core recovery. It was intended that we should acquire small amounts of core from a variety of sedimentary and igneous lithologies, which would be subjected to repeated subsampling and measurements in order to understand the changes that take place in a repository. Results would, of course, be made available to the scientific community. Additionally, we devised ways in which the existing core collection could be studied in order to recover data that might lend insight to the problem (R. B. Merrill, pers. comm., 1988).

METHODOLOGY

On Leg 124E, six cores from Holes 772A, 777A, and 777B were dedicated to this study. These consist of two mud-line (0-m) cores, three shallow (10-m) cores, and one deep (80-m) core. Care was taken to ensure that the cores were handled using routine shipboard procedures. Whole-round samples were taken on the catwalk from each core for interstitial-water (GIW, one per section), organic-geochemistry (GOG, one per core), and physical-properties (GPP, one per core) analyses. Whole-round sections were measured for *P*-wave and GRAPE properties. Holes 777A and 777B were additionally measured for magnetic susceptibility.

After the whole-round analyses were completed, the cores were split into working and archive halves. The archive halves were described, paleomagnetism was measured using the shipboard cryogenic magnetometer, and, last, the cores were photographed. The working halves were sampled and analyzed for physical and chemical properties and for paleontological content. Time-lines when the cores would be monitored were set: (1) initially after splitting (GER1), (2) the first 24 hr (GER2), (3) 1 week (GER3), and (4) 1 month (GER4) (Table 1). The interstitial waters resulting from the squeezed whole-round samples (GER1) were analyzed each time the sediment in the cores was resampled.

At each time-line, the samples were processed and analyzed by the marine technical staff. The original data were forwarded to the ODP Data Base Group. A Geriatric Core Study "cookbook" containing sampling guidelines (see Table 2) was written to aid in sampling on the ship and later in the repository.

The Hole 772A cores were recovered early in the cruise, giving us the opportunity to establish four time-lines. The time-lines GER1 and GER2 were established for Holes 777A and 777B (cored later in the leg) before heading for port.

Properties in the sediments will continue to change, even though they are physically removed from the core. Consequently, if a sample was not analyzed immediately, we found it necessary to process it in order to stop further alteration. Discrete samples were freeze-dried and analyzed by X-ray diffraction (GXRD) for inorganic carbon (GINO) and for organic carbon (GORG). The GIW samples were squeezed, and the waters analyzed. The paleontological samples (foraminifers, nannofossils, radiolarians, and diatoms) were washed by the curatorial staff following sample-preparation techniques recommended by specialists in the field and will be held for study by paleontologists.

STUDIES ADDED DURING CRUISE

The water chemistry in a core changes when exposed to the atmosphere. In order to test what changes occur, two GIW whole-round samples from Holes 777A and 777B were split and squeezed at 6-hr intervals. One half was squeezed and measured immediately, while the other half was allowed to sit exposed to the atmosphere for 6 hr and then squeezed. Preliminary results show differences in salinity, alkalinity, pH, and titration concentrations with time (Table 3).

X-ray-fluorescence (GXRF) analyses of seven samples of mineral growth, which were scraped from cores housed at the East Coast Repository, were completed. GXRD analyses of samples from Leg 119 GER cores were run.

The sediments from Hole 772A were measured for pH using a push-in pH electrode; however, neither the pH nor the EMF values would stabilize on the meter. Attempts to recalibrate the meter using buffers failed, so the pH measurements were discontinued.

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[1] Harding, B. W., Storms, M. A., et al., 1990. *Proc. ODP, Init. Repts.*, 124E: College Station, TX (Ocean Drilling Program).

[2] Shipboard engineering and scientific parties are as given in the listing of participants preceding the contents.

Table 1. Core time-lines set on Leg 124E.

Core	On deck (GER1)	24 hr (GER2)	1 week (GER3)	1 month (GER4)
124E-772A-1H	x	x	x	x
2H	x	x	x	x
11X	x	x	x	x
124E-777A-1H	x	x	—	—
124E-777B-1H	x	x	—	—
2H	x	x	—	—

Note: Dashes represent time-lines not attained by end of leg.

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REFERENCES

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Schnitker, D., Mayer, L. M., and Norton, S., 1980. Loss of calcareous microfossils from sediments through gypsum formation. *Mar. Geol.*, 36:M35–M44.

Table 2. Sampling guidelines for geriatric study.

Study	Code	Length or volume	Minimum frequency	Sample depth (0 mbsf)	Sample depth (10 and 100 mbsf)	Curatorial sample processing	Constituents analyzed
Whole-round sampling (shipboard only)							
Organic geochemistry	GOG	10 cm length	1 per lithology, Sec. 5	x	x	Freeze; no acetone; treat the same as routine organic geochemistry analysis	—
Interstitial water	GIW	10 cm length	1 per section 1 per core (Sec. 4)	x —	— x	Last WR sample in a section; never from same section as a PP sample; give to chemistry technician	Ca^{2+}, Cl, Mg^{2+}, SO_4, pH, alkalinity
Physical-properties consolidation	GPP	30 cm length	1 per lithology, Sec. 3	x	x	Seal in paraffin; refrigerate	—
Discrete sampling (shipboard and shore-based)							
Hydrogen-ion concentration	pH	—	3 in Sec. 1 1 per section all other sections	x x	— x	Test near the GORG and GINO samples	—
Index properties (bulk density, porosity, water content, grain density)	GDEX	10 cm^3 vol.	1 per lithology	x	x	Sample adjacent to GPP sample; seal in pop-top vial with moistened sponge in sample bag; shipboard: give to physical-properties scientist; shore-based: send to GCR	Bulk density, porosity, water content, grain density
Nannofossils, diatoms, radiolarians, foraminifers	GPAL	40 cm^3 vol.	1 per lithology	x	x	Process as soon as possible after sampling; ECR send to GCR for processing	Nannofossils, diatoms, radiolarians, foraminifers
Paleomagnetism	GPM	6–8 cm^3 vol.	1 per lithology	x	x	Shipboard: give to paleomagnetist; shore-based: give to loçal investigator	
X-ray diffraction; bulk and clay mineralogy	GXRD	5 cm^3 vol.	1 per lithology	x	x	Shipboard: give to XRD technician; shore-based: freeze-dry and send to GCR for processing	Bulk and clay mineralogy
X-ray fluorescence	GXRF	10 cm^3 vol.	1 per lithology	x	x	Shipboard: give to XRF technician; shore-based: freeze-dry and send to GCR for processing	Minor and major elements
Organic carbon (CHN analyzer)	GORG	5 cm^3 vol.	1 per lithology	x	x	Shipboard: give to chemistry technician; shore-based: freeze-dry and send to GCR	Total carbon, nitrogen, sulfur
Inorganic carbon (coulometrics)	GINO	5 cm^3 vol.	1 per lithology	x	x	Shipboard: give to chemistry technician; shore-based: freeze-dry and send to GCR	Inorganic carbon

Note: WR = whole round; PP = physical properties; GCR = Gulf Coast Repository; ECR = East Coast Repository.

Table 3. Comparison of analyses from two interstitial-water squeezes for the same interval.

Sample code	pH	Alkalinity (mM)	Salinity (g/kg)	Mg (mM)	Ca (mM)	Mg/Ca	Cl (mM)	SO_4 (mM)
Sample 124E-777A-1H-1, 140–150 cm; water analyzed 24 hr after squeeze								
GER1 SQ1	7.6	3.118	35.5	54.25	10.38	5.22	554.13	30.59
GER1 SQ2	7.6	2.318	37.0	54.09	10.78	5.02	585.29	33.97
Sample 124E-777A-1H-1, 140–150 cm; water analyzed 48 hr after squeeze								
GER1 SQ1	7.8	3.207	36.0	50.90	10.43	4.88	559.97	28.58
GER1 SQ2	7.5	3.340	36.8	52.90	10.78	4.91	589.19	35.24
Sample 124E-777B-1H-1, 140–150 cm; water analyzed 24 hr after squeeze								
GER2 SQ1	7.7	2.495	35.5	51.39	10.00	5.14	548.25	35.31
GER2 SQ2	7.4	2.304	35.5	51.84	10.34	5.01	560.95	37.85
Sample 124E-777B-1H-1, 140–150 cm; water analyzed 48 hr after squeeze								
GER2 SQ1	7.6	2.326	36.5	51.17	10.18	5.02	548.29	35.31
GER2 SQ2	7.5	2.362	36.8	52.19	10.36	5.04	558.03	37.85

Note: SQ1 = squeezed immediately following core recovery; SQ2 = split half was exposed to air and squeezed 6 hr later.