SEABED DISPOSAL PROGRAM: GEOCHEMICAL AND SEDIMENTOLOGICAL
STUDIES OF NORTH PACIFIC SEDIMENTS

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Abstract

Studies of sorption equilibria between end-member (illite-rich) and (smectite-rich) clays from the MPG-2 area (33°20'N, 151°00'W) and ThCl_4 and UO_2Cl_2 solutions in 0.7M NaCl, distilled water and artificial seawater have shown that partition coefficients vary with clay type, concentration of U or Th solution, temperature and presence of other ions.

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Introduction

As part of a multidisciplinary, multi-institutional study to evaluate the bed of the deep-sea as a repository for the permanent disposal of high-level radioactive waste, we are determining the barrier properties of the sediments and the long-term physical stability of two areas in the central North Pacific. Factors guiding the selection of test areas and the overall plan of attack for the Seabed Disposal Program are outlined in reports by Bishop and Hollister (1974) and Anderson et al. (1975).

Progress for 1975 and the first quarter of 1976 has been summarized in earlier reports (C00-2689-3 and C00-2689-4).

Progress January - March 1976

Our efforts this quarter have been concentrated in four areas: 1) Continued studies of the sorption properties of MPG clays; 2) Analysis of the magnetic properties of four MPG-1 cores; 3) Compilation of the 3.5 kHz acoustic records from MPG-2 (in cooperation with C. Hollister); and 4) Participation, as a member of the Advisory Group of the Seabed Disposal Program, in long-range planning for the Program and in various briefings of ERDA and other federal agency personnel on the scope and status of the Program.

The sorption studies have confirmed and extended the results reported previously (C00-2689-4). The Th experiments will be completed during the current quarter and will be documented in a technical report. The experiments involve 2 clay types (illite-rich surface material and smectite-rich material from 8-11m subsurface) from the MPG-2 area, 5 temperatures (50, 150, 250, 450, 850 C), 3 concentrations (14 mM,

1.4 mM and 0.14 mM) plus re-extractions, and 3 matrix solutions (0.7M NaCl, distilled water and artificial seawater). K_d values range from 4 ml/gm for illitic clay in 14 mM solution at 15°C to 4×10^7 ml/gm for smectite clay in 0.14 mM solution at 85°C. K_d values increase with increasing temperature and decreasing Th concentration. They also increase from distilled water to NaCl to artificial seawater (although only very low concentration experiments are possible in seawater because its alkalinity depresses the solubility of Th^{4+}). Preliminary results for UO_2Cl_2 solutions suggest that the pattern of behavior of oxidized UO_2^{2+} resembles Th^{4+} . K_d values for UO_2^{2+} are higher for smectite than illite clay and increase with increased temperature and decreased UO_2^{2+} concentration. Preliminary K_d values range from <2 ml/gm for illitic clay in 21mM solution at 15°C to 1400 for smectite clay in 2.1mM solution at 85°C. These experiments will continue this quarter.

The magnetic properties of MPG-1 cores are generally similar to those from MPG-2 (C00-2689-3). The classic paleomagnetic stratigraphy of the past 5 million years can be identified in three cores and indicates a roughly exponential decrease in accumulation rate from values close to 1 meter/million years today to less than $\frac{1}{2}$ meter/million years from 2.5-5 million years ago. Attempts to derive relative accumulation rates between cores by means of NRM correlations is underway.

B. van Dyk, working with C. Hollister, has worked up the 3.5 kHz records collected in the MPG-2 area by the contractor during cruise YALOC-74 (C00-2689-1). The surface sediment layer ranges in thickness from about 20m on topographic highs at the northern end of the area to more than 30m at the southern end of the area. The scale of variability is comparable to that observed in MPG-1.