Cruise Report
Regional Monitoring Program
Sediment Sampling Cruise #12
July 31–August 6, 12, 1996

1.0 INTRODUCTION

This report describes activities associated with the 1996 dry-season sediment sampling cruise of the Regional Monitoring Program (RMP) for Toxic Contaminants in the San Francisco Estuary. Sediment sampling is one component of this program that is designed to provide long-term data on concentrations of trace metals and organic compounds, as well as toxicity, throughout the estuary. Also being measured are water concentrations of trace metals and organic compounds, and bioaccumulation and condition in transplanted bivalves.

Sediment samples were collected and distributed to five laboratories for analysis under regular RMP protocols. Samples for the analysis of arsenic, mercury, and selenium were sent to Brooks-Rand, Ltd. in Seattle, Washington. Samples for the analysis of other trace metals (i.e., aluminum, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, and zinc) and ancillary measurements (i.e., TOC, total nitrogen, and grain size) were delivered to Dr. Russ Flegal's laboratory at University of California, Santa Cruz. Samples for analysis of trace organic compounds were shipped to Dr. Terry Wade of Texas A&M University Geochemical and Environmental Research Group. Samples for the measurement of sediment toxicity and porewater sulfides were delivered to personnel of Mr. John Hunt's laboratory at the California Department of Fish and Game's Granite Canyon facility. Samples for the analysis of benthic biota were retained by Mr. Michael Kellogg of the City and County of San Francisco. Measurements of porewater pH and ammonia were made in the field and profiles of water-column characteristics were obtained at each site (except Standish Dam) using a Sea-Bird SBE 19 profiler.

In addition to the regular RMP samples, several other types of samples were collected. Split sediment samples from three RMP sites were taken and delivered to four participating POTW's as part of the 1996 intercalibration exercise. The POTW's and their lead personnel participating in the intercalibration exercise were: City and County of San Francisco (Jim Salerno), Contra Costa Central Sanitation District (Bhupinder Dhaliwal), San Jose Wastewater Treatment Plant (Dave Tucker), and East Bay Municipal Utilities District (Patti TenBrook). Samples were also taken from three RMP sites for sediment toxicity TIE studies (Toxicity Identification Evaluation), and samples were taken from 25 sites for studies of foraminifera by USGS (Mary McGann). All sampling was conducted from the R/V David Johnston using a 0.1-m$^2$ Van Veen grab coated with Dykor® for chemistry samples and a 0.05-m$^2$ Ponar grab for benthic samples.

2.0 CRUISE REPORT

2.1 Objectives

The objectives of this cruise were:
1) Collect samples from 25 sites for analysis of trace elements; percent sand, silt, and clay; temperature; total organic carbon; total nitrogen; and pore water pH, ammonia, and total sulfides.

2) Collect samples from 24 sites for analysis of organic contaminants.

3) Collect samples from 13 sites for analysis of sediment toxicity.

4) Collect samples from nine sites for analysis of benthic organisms.

5) Collect profiles of water-column temperature, conductivity, salinity, dissolved oxygen, and optical backscatterance at 24 sites.

6) Collect samples from three sites for the POTW intercalibration exercise.

7) Collect samples from three sites for sediment TIE investigation.

8) Collect samples from 25 sites for analysis of sediment foraminifera.

2.2 Personnel

The personnel and work assignments for this cruise were as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Duties</th>
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</thead>
<tbody>
<tr>
<td>David Bell (7/31–8/2, 5–6)</td>
<td>AMS</td>
<td>Cruise Co–Manager, Sediment Chemistry, pH, CTD</td>
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<tr>
<td>Jonathan Crick (8/12, 16)</td>
<td>UCSC</td>
<td>Sediment Sampling</td>
</tr>
<tr>
<td>Ted Daum (8/6)</td>
<td>SFEI</td>
<td>Sediment Sampling, Foraminifera Sampling</td>
</tr>
<tr>
<td>Jordan Gold (7/31–8/2)</td>
<td>AMS</td>
<td>Sediment Sampling, Cruise Co-Manager</td>
</tr>
<tr>
<td>Dane Hardin (8/12, 16)</td>
<td>AMS</td>
<td>Sediment Sampling, Sediment Chemistry</td>
</tr>
<tr>
<td>Mike Kellogg (8/1–2, 5)</td>
<td>CCSF</td>
<td>Benthic Samples</td>
</tr>
<tr>
<td>Sarah Lowe (8/5)</td>
<td>SFEI</td>
<td>Sediment Sampling, Foraminifera Sampling</td>
</tr>
<tr>
<td>Michael May (7/31–8/1)</td>
<td>SFEI</td>
<td>Sediment Sampling, Foraminifera sampling</td>
</tr>
<tr>
<td>Mary McGann (8/5)</td>
<td>USGS</td>
<td>Foraminifera Sampling</td>
</tr>
<tr>
<td>Bryn Phillips (8/6)</td>
<td>UCSC</td>
<td>Sediment Toxicity Sampling</td>
</tr>
<tr>
<td>Karen Salamy (8/2, 5–6)</td>
<td>AMS</td>
<td>Sediment Sampling</td>
</tr>
<tr>
<td>Gordon Smith (7/31–8/2, 5–6)</td>
<td>UCSC</td>
<td>Vessel Skipper</td>
</tr>
<tr>
<td>Jung Yoon (8/2)</td>
<td>SFEI</td>
<td>Sediment Sampling, Foraminifera Sampling</td>
</tr>
</tbody>
</table>

2.3 Activities
0700–0740  Mobilized gear at R/V *David Johnston*, Berkeley Marina, departed for Dumbarton Bridge site (BA30).

1025–1120  Sampled at Dumbarton Bridge, departed for San Jose site (C–3–0).

1215–1247  Sampled at San Jose, departed for Sunnyvale site (C-1-3).

1350–1420  Sampled at Sunnyvale, departed for Coyote Creek site (BA10).

1503–1531  Sampled at Coyote Creek, departed for Port of Redwood City (MARFAC).

1645–1715  Arrived at Port of Redwood City, demobilized gear.

0700–0735  Mobilized gear at R/V *David Johnston*, Redwood City, departed for South Bay site (BA20).

0845–0920  Sampled at South Bay, departed for Redwood Creek site (BA10).

1020–1052  Sampled at Redwood Creek, departed for San Bruno Shoal site (BB15).

1150–1235  Sampled at San Bruno Shoal, departed for Oyster Point site (BB30).

1313–1350  Sampled at Oyster Point, departed for Alameda site (BB70).

1430–1505  Sampled Red Rock, departed for Point Isabel site (BC41).

1549–1628  Arrived at Berkeley Marina, demobilized gear. Vessel transits to Vallejo Marina.
8/5/96 0700–0815 Mobilized gear at R/V David Johnston, Vallejo Marina, departed for Davis Point site (BD41).

0908–1003 Sampled at Davis Point, departed for Pinole Point site (BD31).

1037–1112 Sampled at Pinole Point, departed for Petaluma River site (BD15).

1217–1318 Sampled at Petaluma River, departed for San Pablo Bay site (BD20).

1407–1507 Sampled at San Pablo Bay, departed for Napa River site (BD50).

1552–1621 Sampled at Napa River, departed for Vallejo Marina.

1630–1730 Arrived at Vallejo Marina, demobilized gear. Vessel transits to Martinez Marina.

8/6/96 0700–0732 Mobilized gear on vessel, departed for Grizzly Bay site (BF20).

0820–0906 Sampled at Grizzly Bay, departed for Honker Bay site (BF40).

0945–1013 Sampled at Honker Bay, departed for Sacramento River site (BG20).

1106–1150 Sampled at Sacramento River, departed for San Joaquin River site (BG30).

1225–1300 Sampled at San Joaquin River, departed for Pacheco Creek site (BF10).

1420–1450 Sampled at Pacheco Creek, departed for Martinez Marina.

1502–1602 Arrived at Martinez Marina, demobilized gear.

8/12/96 0945–1015 Sampled at Standish Dam.

2.4 Discussion

Sample Collection and Handling Procedures

Prior to sampling, all equipment was thoroughly cleaned. The cleaning process began with a thorough washing with Alconox® detergent. Following the detergent wash, the grab and compositing bucket were rinsed with tap water, followed by three rinses with deionized water, a rinse with 10% HCL, and a rinse with petroleum ether. The utensils were rinsed three times with deionized water, soaked three days with 10% HCL, and rinsed with petroleum ether. Cleaned utensils were sealed in Ziploc® bags until used in the field. To avoid cross-contamination
between sites, all utensils and the grab were washed between sites with a seawater rinse, scrubbed with Alconox® followed by another seawater rinse, a 1% HCL rinse, and a methanol rinse.

Sampling procedures ensured that samples were collected from a localized area at each site to reduce uncontrolled temporal and spatial variation. In the field, the vessel was anchored as close as possible to the target coordinates listed in Cruise Plan. The coordinates were checked throughout the sampling activities to ensure that the anchor had not dragged. If the vessel was swinging on its anchor, coordinates were recorded for each sample, as presented in Table 1.

The first sampling operation at each site was the collection of the benthic sample with the Ponar grab (benthic samples were not taken at all sites). After the required benthic samples were collected, the Ponar grab was replaced with the Van Veen grab for collection of chemistry samples. After being sieved, benthic samples were preserved in 10% neutral buffered formalin in seawater.

When the Van Veen grab was brought on deck, and any overlying water had been siphoned off, samples were collected (from selected sites) to document foraminifera abundances, and cores were removed for extraction of porewater for measurement of pH, ammonia, and sulfides. The remaining top 5-cm of sediment was then scooped from each of two replicate grabs and mixed in the bucket to provide a single composite sample for each site. Portions of the composited sample were placed into sample containers provided by each laboratory, and duplicate samples were collected from this composite for archival.

All chemistry samples were placed on ice immediately after collection and delivered to the appropriate laboratories as soon as possible after the cruise. Samples for organics and arsenic, mercury, and selenium analyses were frozen at the end of the cruise, prior to shipment to Texas A&M and Brooks-Rand on August 7. Samples for analysis of aluminum, cadmium, chromium, copper, iron, lead, nickel, manganese, silver, zinc, grain size, and total organic carbon were shipped to Russ Flegal’s laboratory on August 8. Samples for analysis of sediment toxicity, pore water sulfides, and Sediment cores for TIE analysis were taken off the boat by Bryn Phillips at the end of the cruise. The POTW intercalibration samples were frozen after the cruise, and shipped on August 14. Foraminifera samples were taken from the boat by SFEI personnel at the end of the cruise.

The quality of grab samples was ensured by requiring each sample to satisfy a set of criteria concerning the depth of penetration and disturbance of the sediment within the grab. Samples were rejected for the following conditions:

- There was a rock or shell fragment wedged between the jaws of the grab allowing the sample to wash out.
- The surface of the sample was significantly disturbed.
- The sample was uneven from side to side, indicating that the grab was tilted when it penetrated the sediment.
• The surface of the sample was in contact with the top doors of the grab, indicating over penetration of the grab and possible loss of material around the doors.

Samples were collected from each site and placed into containers, as indicated in Table 2. Single containers were filled for each replicate for each sample type, except that three 1-liter jars were filled for each toxicity sample.

**General Comments**

All cruise objectives were achieved and the cruise was completed on schedule.