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Technical Reports

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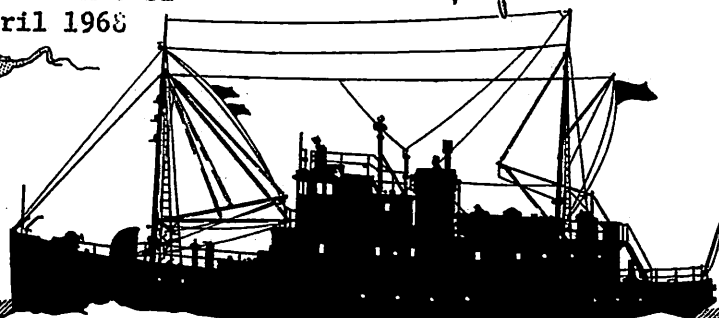
THE OFFICE OF NAVAL RESEARCH

U.S. Atomic Energy Commission  
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RICHARD H. FLEMING  
Chairman



CLIFFORD A. BARNES  
Principal Investigator

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Technical Report No. 214

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SINKING RATES OF RADIOACTIVE FALLOUT PARTICLES IN THE NORTH EAST PACIFIC  
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C. R. B. Lister  
John T. Whetten  
Bates McKee

Departments of Oceanography and Geology  
University of Washington  
Seattle, Washington

## Sonar Reflection Profiling on the Columbia River and in Lake Washington

The sedimentary history and stratigraphy of freshwater and nearshore sediments can often be efficiently investigated by a combination of continuous seismic profiling and scattered sampling. Most medium-penetration equipment uses a spark or an arc to generate the necessary sound, and is limited for satisfactory operation to water with some salt-induced conductivity. A new sound source has been designed which can be used equally successfully in saline water and in extremely salt-free water. The device operates on the principle of electromagnetic repulsion between moving coils in a towed transducer, and generates sound upon passage of a high-current pulse. The pressure wave output approximates a half-cycle at 1 kilohertz, and has a peak level of about +97 decibels referred to a microbar at one meter. The pulses have the optimum spectral bandwidth of an octave, which allows the use of simple receiving equipment, and are precisely repeatable. Changes in the appearance of the record are therefore due only to changes in the reflectivity or absorption of the sedimentary layers.

### Results from Bonneville Reservoir, Columbia River

Sample results from Bonneville Reservoir on the lower Columbia River (RV *Onar* cruise 81) are shown in Figure 1. Sand-size sediment (a) overlies relatively flat basalt bedrock (b); the top surface of the sediment shows large sandwaves similar to those described by Jordan (1962) from the Columbia River near Longview, Wash. Near the left-center of Figure 1, the sediment thins to a feather edge, and further to the left, the highly reflective basalt bedrock exposed at the surface has produced a strong secondary echo. We have profiled other reservoirs of the lower Columbia and Snake rivers, but the sediment is generally very thin and the distribution is patchy. The relatively thick sediment in some parts of Bonneville Reservoir may have been deposited in an ancient lake at the site of the present reservoir (Lawrence, 1958).

### Results from Lake Washington

A typical profile from Lake Washington (RV *Onar* cruise 82) is shown in Figure 2. The geologic interpretation is based in large part on a previous study by Gould and Budinger (1958), although our equipment provided deeper sediment penetration and a better knowledge of the topography buried beneath the lake sediment. Surface (c) is the ground surface scoured by the last (Vashon) advance of the Fraser glaciation in Puget Sound. On land this surface consists primarily of pre-Vashon sediments

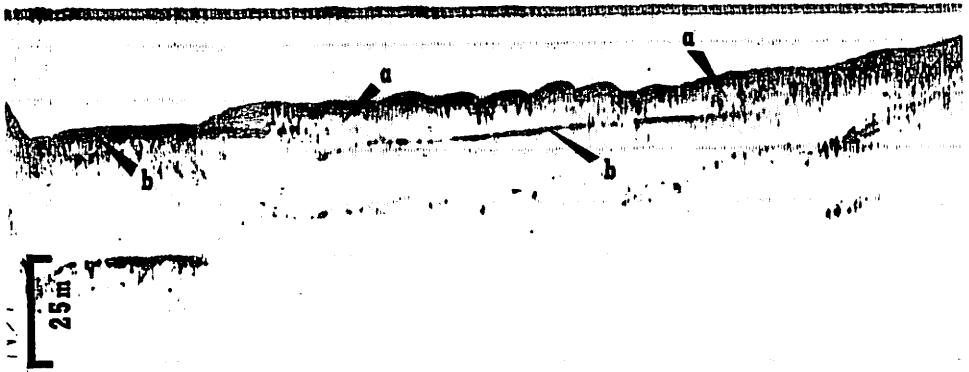


Figure 1. Sonar profiler record from Bonneville Reservoir, Columbia River. Length of profile is 1.3 km. Symbols explained in text.

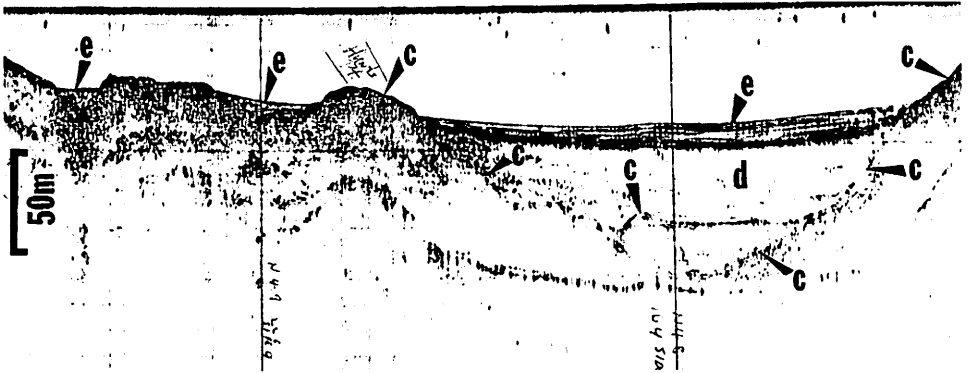


Figure 2. Sonar profiler record from Lake Washington, Sand Point (right) to Houghton. Length of profile is 3.4 km. Symbols explained in text.

and Vashon till (Waldron *et al.*, 1962). The profile indicates that the steep slope of the trough at the edge of the lake continues down below the present lake bottom to considerable depths—128 meters below lake level on this profile—and has substantial relief. This surface was buried by a thick section of blue clay (unit d) consisting of glacial rock flour of meltwater origin. Gould and Budinger (1958) reported from core data a local thickness in excess of 30 meters, and this is confirmed by sonar profiling (60 meters maximum here).

Some even layering is apparent from the record, including a particularly strong reflecting layer low in the section, which could be an outwash sand or silt bed.

The blue clay layer is overlain by a layer of limnic peat (unit e) ranging from less than 2 to more than 17 meters thick, and consisting mainly of diatoms and decomposable organic matter. The clay-peat contact has been radiocarbon dated at 13,650 years, and the peat contains a 5-centimeter ash layer dated at 6700 years (Gould and Budinger, 1958). The latter was identified by Gould and Budinger as Glacier Peak ash, but the date establishes it as Mazama. A 1.5-meter-long gravity core was taken during the present survey from the buried ridge extending out from Hunts Point, and reveals the ash in a very thin (0.7 meter) peat section resting on blue clay.

### **Acknowledgments**

This research was supported by National Science Foundation grants GP-4894 and GP-3591, Atomic Energy Commission contract AT(45-1)-1725 (RLO-1725-64), and also in part by Office of Naval Research contract Nonr-477(37), project NR 083 012. Contribution no. 397, Department of Oceanography, University of Washington.

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### **Association News**

Plans are well underway for the 41st annual meeting in Ellensburg, Washington, on March 22 and 23, 1968. All members should have received forms for submitting titles of papers to be presented. Additional forms may be obtained from the secretary-treasurer. Titles must be received by December 18, 1967, to be included in the program.

Applications are being accepted for several research grants in the range of \$100-\$250 to cover laboratory supplies and services or field costs. Send a concise resumé of the proposed research and a statement of costs to be covered by the grant to Mark F. Adams, Engineering Research Division, W.S.U., Pullman, Washington 99163. The grants will be awarded in March, 1968.