EXTENDING THE VERSATILITY OF THE
BULLARD HEAT PROBE

BEN J. KORGEN

Department of Geology, University of North Carolina, Chapel Hill, N.C., U.S.A.

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Abstract. A versatile probe for simultaneous studies of heat flow and near-bottom water parameters has evolved through modifications of the Bullard heat probe frame. Suitable sensor arrays have been used with this instrument to study (1) heat flow through the ocean floor, (2) water column temperature structure, (3) near-bottom current speeds, and (4) the differential cooling of water-column temperature sensors placed in a current speed gradient.

Some of the advantages of such a modified Bullard probe are: (1) several parameters, including heat flow, can be measured across the sediment-water interface simultaneously, (2) the instrument frame is rigidly pinned to the ocean floor during measurement, permitting true Eulerian measurement in the water column with no effects of ship movement, swaying moorings or cable oscillation, and (3) the device is inexpensive and simple.

Extending the Versatility of the Bullard Heat Probe

The Bullard heat probe frame (Bullard, 1954) is well-known and can be fabricated \( \frac{1}{2} \) in (1.27 cm) diameter steel rod with associated fittings. Construction details for one form of the Bullard frame are given by Mesecar (1968). A long, plugged hollow shaft and a shorter coring tube are usually mounted on the probe frame baseplate. The hollow shaft contains transducers, typically thermistors, which are connected to an instrument case mounted in a frame on top of the probe shaft. The instrument case has a self-contained power supply and recording device. During a typical heat flow measurement at sea, the instrument is lowered from a ship and the probe shaft is planted into ocean floor sediments like an oversized dart. After a time interval which permits equilibration of the shaft transducers to the ambient sediment temperatures, the instrument is retrieved.

Each record obtained by a standard Bullard probe represents the vertical temperature gradient in the bottom sediments. Core length gives the extent of probe penetration into the bottom. Thermal conductivity of bottom sediment is determined in the laboratory from each core sample. The sediment thermal conductivity and vertical temperature gradient are combined in a simple equation to yield an approximation of terrestrial heat flow (Langseth, 1965).

Bodvarsson et al. (1967) and Mesecar et al. (1969) reported measurements of temperature structure across the water-sediment interface at various stations west of Oregon. These measurements, taken with a Bullard heat probe having additional water column thermistors mounted on an attached vertical rod led to the probe described in this paper.

With very simple and inexpensive modifications, the Bullard heat probe frame has
Fig. 1. A multi-purpose probe created by modifying a Bullard heat probe.