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Distribution of Sediments on the Tops of Mid-Atlantic Ridge Mountains*

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During a recent cruise of the Department of Energy, Mines and Resources research vessel C. S. S. HUDSON, photographs of the bottom were obtained on nine mountain tops located along the crest of the Mid-Atlantic Ridge near latitude 45° North (Fig. 1). The camera was attached to a deep-sea drill (Brooke and Gilbert, 1968) that was being employed to collect rock cores from peaks situated on either side of the median valley. Preliminary comparison of bottom photographs and rock cores has provided information concerning the relationship between surface and shallow subsurface geology at these locations. The rock cores collected are composed primarily of coralline limestone and (or) basalt. Bottom photographs show areas of boulders, pebbles that appear well sorted, fine calcareous sediment (ooze), and coral colonies.

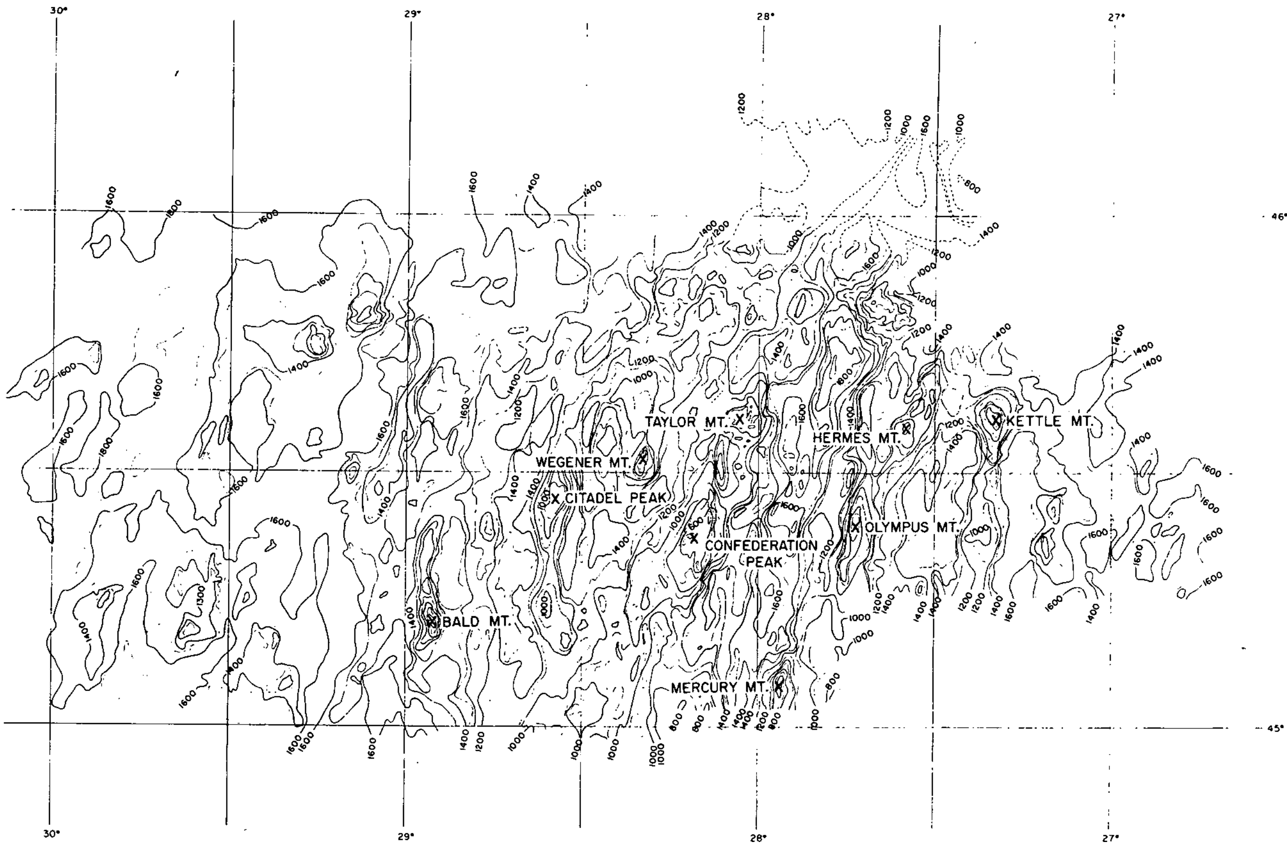

FIGURE 1 - Location of drilling sites over Mid-Atlantic Ridge.

An examination of the rock cores and bottom photographs suggests that the mountain tops are characterized primarily by one, or a combination of seven, possible substrates (Table I). Parts of the bottom covered by pebbles (mostly basic igneous rocks) and boulders, with isolated growths of living coral, occur on Confederation Peak and Mercury Mountain (Fig. 2), both of which are located immediately on either side of the median valley. This coarse sediment substrate has persisted on Confederation Peak for a relatively longer period of time as evidenced by the thickness of basalt conglomerate core obtained at Station 140. Conversely, the rock core collected on Mercury Mountain is composed almost entirely of massive basalt with only minor amounts of fine calcareous sediment filling the narrow fractures in the basalt (Fig. 3).

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FIGURE 2 - Deep-sea drill begins boring into basalt conglomerate on Confederation Peak.

Dense growths of coral associated with pebbles or minor amounts of fine calcareous sediment are present on Citadel, Olympus and Bald Mountains (Fig. 4); the underlying rock is coralline limestone. At other stations (e. g. 156, Wegener Mountain) there are no coral colonies. Instead, pebbles that appear to have been concentrated by bottom currents are found mixed with fine calcareous sediment. Pebbles and coral skeletal fragments have been deposited over coralline limestone on Bald Mountain at Station 152 (Fig. 5). The absence of fine calcareous sediment at this locality may be due to the winnowing action of a relatively strong bottom current despite the greater water depth here (1682 metres), compared with other mountain tops in this area. Where currents are relatively slower, fine calcareous sediment is found in association with pebbles and coral fragments. This variety of sediment overlies coralline limestone on Confederation Peak, and Wegener and Olympus Mountains (Fig. 6). On Mercury Mountain a similar deposit overlies massive vesicular basalt (Schafer and Brooke, 1969).

At some mountain-top localities coarse sediment, composed of pebbles and coral skeletal debris, has accumulated in layers exceeding 166 centimetres in thickness. These relatively thick deposits occur on Hermes, Kettle, and Taylor Mountains (Fig. 7).

The formation of local, coarse sedimentary deposits on mountain tops of the Mid-Atlantic Ridge is probably most dependent on the winnowing action of local bottom currents and, to a lesser degree, on the proximity of high relief areas near the median valley. It appears that deposition of coarse sediments on mountain tops may have frequently resulted in the burial of coral colonies established on the hard basaltic substratum (Schafer and Brooke, 1969, in press). Similarly, the seemingly periodic nature of local bottom currents appears to have provided conditions for the deposition of fine calcareous sediment in areas formerly suitable for coral growth. This condition is in evidence at Station 15 (Fig. 8) on Wegener Mountain where approximately 149 centimetres of pebbles and fine calcareous sediments have been deposited over porous coralline limestone.

Table I - Occurrence of Substrates on Mountain Tops of Mid-Atlantic Ridge near Latitude 45° North

Substrate	Location	Depth Metres	Station
(1) Pebbles and boulders with small isolated patches of living coral.	Confederation Peak	914	140
	Mercury Mt.	987	176
(2) Dense growths of coral associated with pebbles or minor amounts of fine calcareous sediment and underlain by coralline limestone.	Olympus Mt.	715	169
	" "	827	160
	Citadel Peak	1243	145
	" "	1380	148
	Bald Mt.	1426	151
(3) Pebbles and coral skeletal fragments underlain by coralline limestone.	Bald Mt.	1682	152
(4) Associations of coral fragments, fine calcareous sediment and pebbles overlying coralline limestone.	Confederation Peak	1042	138
	Wegener Mt.	1360	157
	Olympus Mt.	1060	159
(5) Coarse sediment deposits thicker than 166 cm. and composed of pebbles and coral skeletal fragments.	Hermes Mt.	1154	164
	Kettle Mt.	1042	167
	Taylor Mt.	1390	158
(6) Pebbles and coral skeletal fragments overlying massive vesicular basalt.	Mercury Mt.	946	172
(7) Association of pebbles and fine calcareous sediment.	Wegener Mt.	1112	156

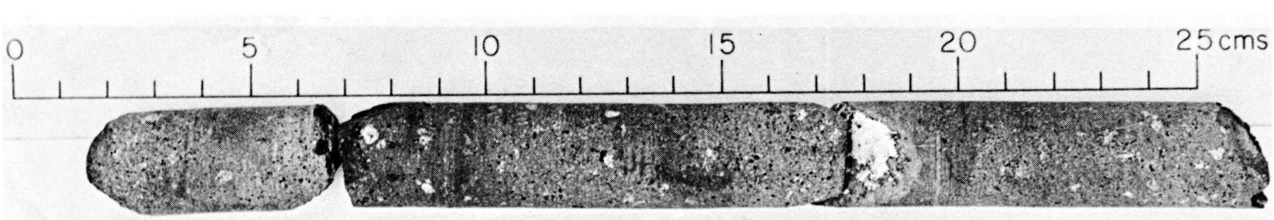

FIGURE 3 - Rock core of massive vesicular basalt collected on Mercury Mountain.

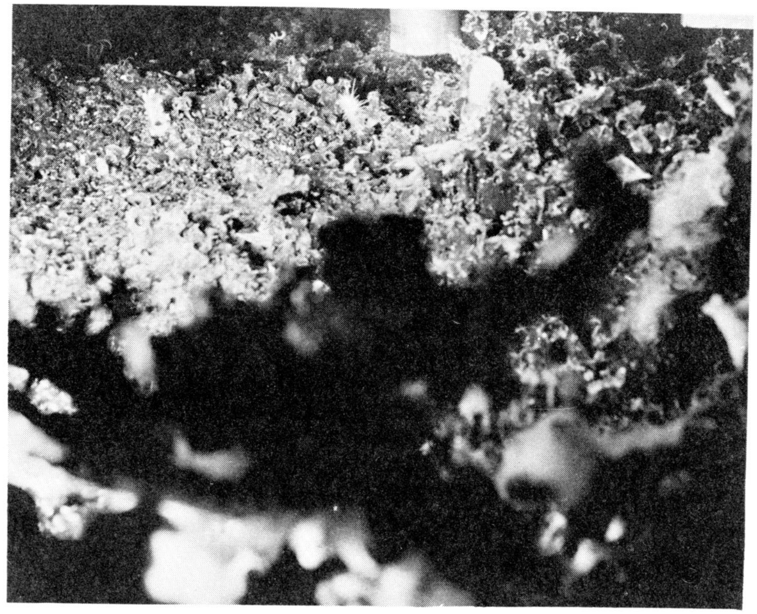

FIGURE 4 -
Coral growths on Citadel Peak.

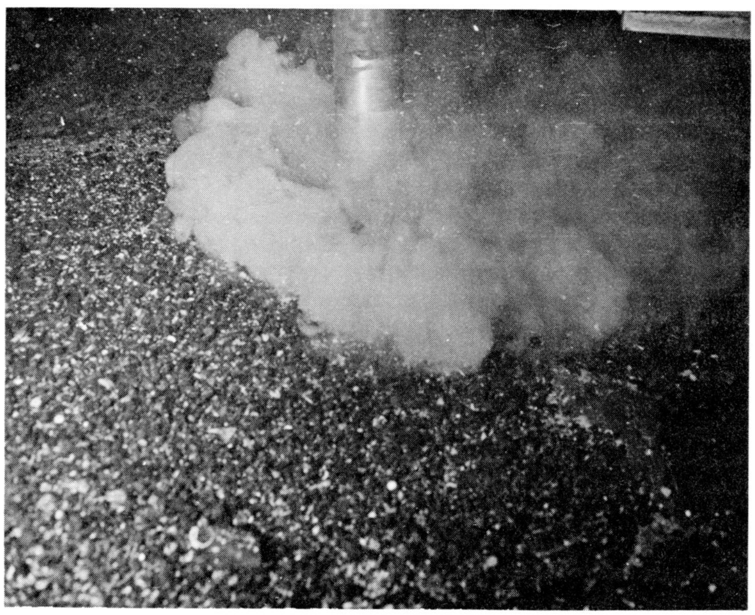

FIGURE 5 -
Pebble pavement at a depth of 1682 metres on Bald Mountain.

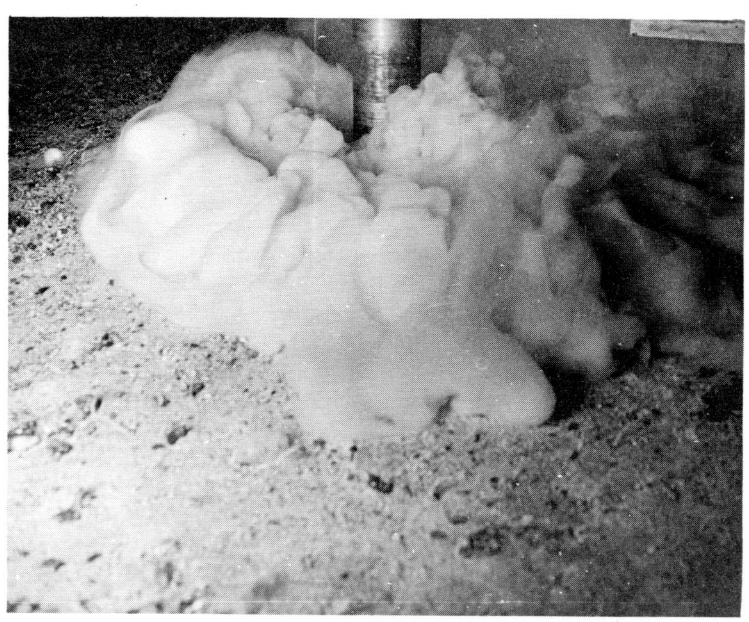

FIGURE 6 -
Plume of fine calcareous sediment forms as deep-sea drill flushes cuttings and loose sediment from the face of the drill bit.

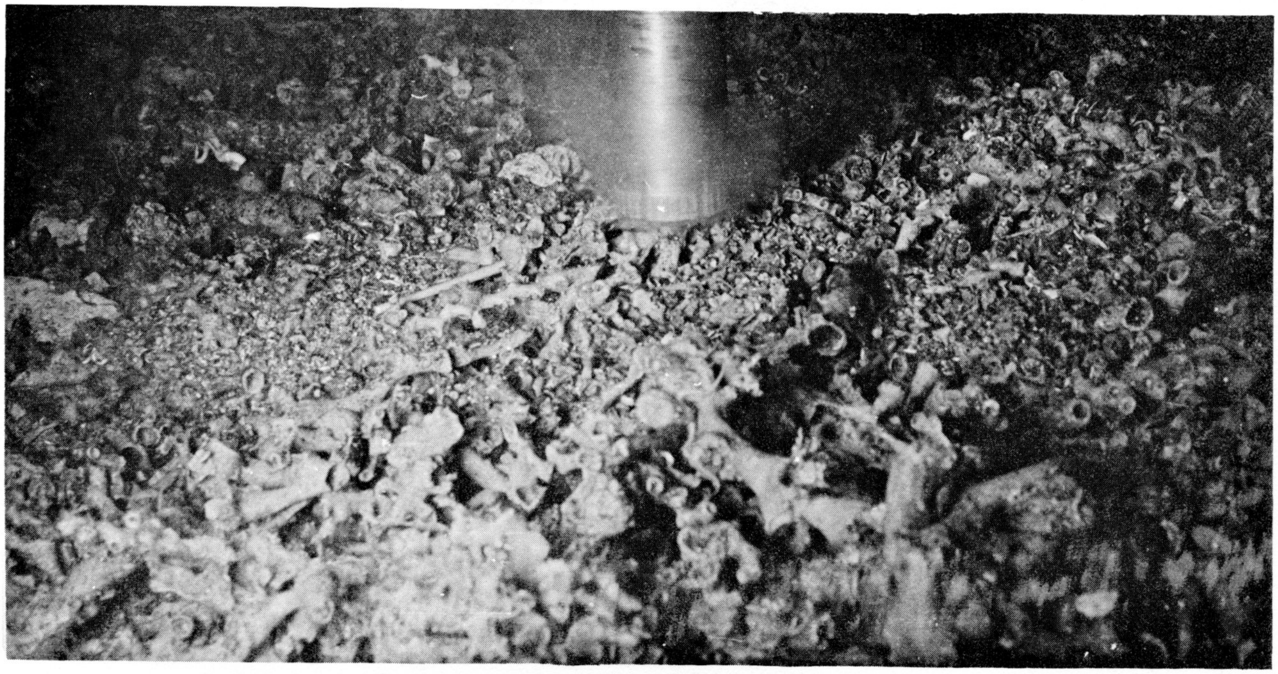

FIGURE 7 - Accumulation of coral skeletal debris. At some localities this exceeds the penetration depth of the drill.

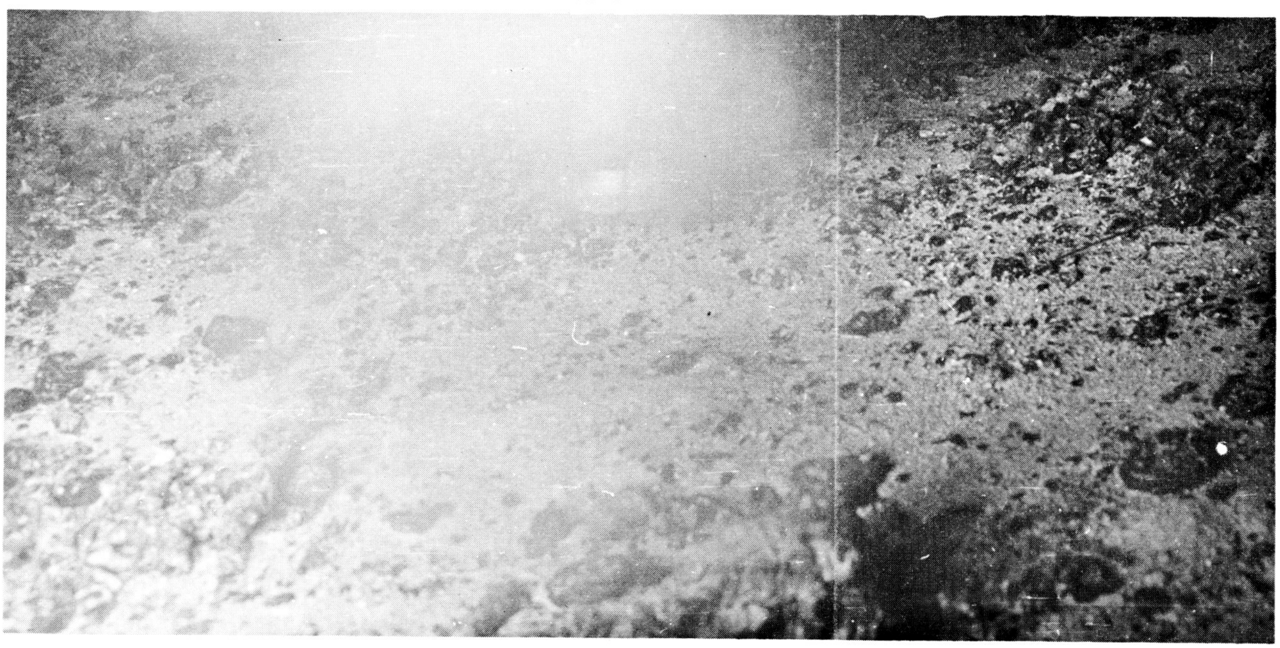

FIGURE 8 - Fine calcareous sediment, pebbles, and boulders overlie coralline limestone on Wegener Mountain

References cited

BROOKE, J. and GILBERT, R. F., 1968, The development of the Bedford Institute Deep Sea Drill. Deep-Sea Res., v. 15, pp. 483-490.

SCHAFER, C. T. and BROOKE, J., 1969, Drilled hard rock cores from the crest of the Mid-Atlantic Ridge at 45° North (in press).