CHANNEL, CALIFORNIA, COMPILED FROM SIDE-SCANNING SONAR RECORDS

Side-scanning sonar surveys of parts of the floor of the Santa Barbara Channel, California, carried out in March 1969 in connection with the U.S. Geological Survey's study of the oil-spill area, provide the basis for an acoustic-geologic map of the area. Navigation during the field work was controlled closely and continuously by means of aircraft-tracking radar onshore that communicated with the ship by 2-way radio.

The side-scanning-sonar equipment consisted of a towed transducer housing a dual array of piezoelectric-crystal hydrophones, each 4 ft long, one operating at 27.5 khz and the other at 30 khz. These were triggered alternately with 0.5-m sec pulses at 1-sec intervals and scanned the bottom to ranges of 375 m on both sides of the track or in a single-channel mode to ranges of 750 m on one side or the other. The shipboard equipment included the electronic systems, power supply, and recorder, which displayed returns on linear sweeps of an intensity-modulated Alden helix recorder, 45 cm wide, printing 45 lines/cm of length on wet paper.

Features mapped include smooth bottom, rippled sand bottom, ledges of folded bedrock, drilling towers, pipelines, and features of unknown origin. Sonar records delineate changes in strike of the north-dipping strata on the flanks of the east-west-trending Rincon anticline, and identify a structural depression along the anticlinal crest at long. 119°40′W.

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SEDIMENTOLOGY AND SHALLOW STRATIGRAPHY OF MID-ATLANTIC RIDGE MOUNTAIN TOPS

Bottom photographs and drilled rock cores, obtained from several mountain tops along the crest of the Mid-Atlantic Ridge near 45°N, show a patchy distribution of basic igneous rock outcrops and localized mixed deposits of basaltic boulders, cobbles and pebbles, ahermatypic-coral skeletal fragments, and calcareous mud. Coralline limestones repeatedly have been observed underlying unconsolidated pebble and mud deposits.

Between 900 and 1,200 m water depth on the south slope of Confederation Peak (45°23′N, 28°10′W), outcrops of fractured igneous rock are surrounded by deposits of angular cobbles and pebbles in a calcareous-mud matrix. Downslope, exposed, igneous rock outcrops are surrounded by pebble deposits with about a 60% calcareous-mud matrix. A basalt conglomerate core drilled near the top of this mountain (914 m) is composed of manganese-coated pebble and cobble-sized basaltic fragments cemented by a calcareous matrix that may have lithified, in part, during subsequent vertical uplift of this deposit to its present elevation. At 1,042 m water depth, porous coralline limestone was encountered by the drill after 143 cm of penetration through unconsolidated sediments. The surface of the north side of Bald Mountain (45°13′N, 28°56′W) between 1,555 and 2,380 m is composed of outcrops of basic igneous rock alternating with angular cobble and gravel deposits, probably of similar composition. An intermittent cover of calcareous mud is evident starting at about 1,900 m water depth. Slightly porous and friable, coralline limestone, covered by 81 and 155 cm of coral skeletal material, basaltic pebbles, and calcareous mud has been drilled at 1,426 and 1,682, respectively. Generally, limestones covered by a relatively thin layer of unconsolidated sediment and those situated at relatively shallow water depths show a greater degree of induration. Five whole-sample radiocarbon dates determined for the upper parts of several limestone cores range approximately between 31,000 and 39,000 years, suggesting that deposition and (or) lithification may have been associated with a moderately warm interval following the early Wisconsin glaciation (Emiliani's Stage 3).

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DEPOSITION OF COCCOLITHS IN CALCIUM CARBONATE COMPENSATION REALM OF ATLANTIC OCEAN

Recent coccoliths deposited in the Atlantic Ocean undergo selective dissolution in the calcium carbonate compensation realm, resulting in an increase in the relative proportion of solution-resistant placoliths in the assemblage. Solution of the coccoliths proceeds through gradual selective removal of ultrastructural elements in a sequence characteristic for each taxonomic group.

Selective dissolution of coccoliths permits recognition of 3 zones. (1) A basal dissolution zone about 500 m thick immediately overlies the calcium carbonate compensation depth. Sediments in this zone lack planktonic Foraminifera, have a low $CaCO_3$ content, and contain a coccolith assemblage of low diversity composed of solution resistant species, chiefly placoliths. In the southern and equatorial Atlantic, these sediments are bathed by Antarctic bottom waters. (2) A middle zone in the region from 500 to 1,500 m above the calcium carbonate-compensation depth contains corroded and fragmental tests of planktonic Foraminifera and a coccolith assemblage, with abundant resistant species and some corroded, less resistant forms. (3) An upper dissolution zone extends from about 1,500 m above the calcium carbonate compensation depth to the calcium carbonate saturation depth. Sediments contain normal planktonic foraminiferal assemblages and diverse, well- to moderately well-preserved coccoliths, with only a few species showing obvious signs of corrosion.

Selective dissolution with depth removes tropical species, so that assemblages deposited at greater depths resemble living assemblages from higher latitudes.

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ABYSSAL BENTHONIC FORAMINIFERA AS INDICATORS OF PRESENT AND PAST DEEP-SEA CIRCULATION IN NORTH ATLANTIC OCEAN

Analysis of surface-sediment samples from 5 transects across the western North Atlantic Ocean shows the existence of 2 distinct populations of benthonic Foraminifera. The distribution of these populations correlates well with the distribution of the cold North Atlantic deep water (*Epistominella exigua* assemblage) and the very cold Arctic/Antarctic bottom-water masses (*Epistominella umbonifera* assemblage). Slight, but detectable, faunal differentiation is associated with the Arctic and Antarctic deep-water masses respectively. Abyssal, benthonic Foraminifera thus can be utilized to trace the thermohaline circulation of the deep ocean.

Analyses of core samples, dating from the last full-glacial period, indicate a shifting of faunal boundaries. First information points to an areal diminution of the fauna associated with the very cold bottom water, indicating a general warming of the bottom water during the last ice age, that possibly was due to the pack-ice cover over ocean areas that now provides the very cold bottom waters.

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DIAGENESIS OF UPPER CRETACEOUS CHALKS FROM NORTH SEA, ENGLAND AND NORTHERN IRELAND

Cores of chalks from the Ekofisk field in the North Sea have been compared with outcrop samples of the "Upper Chalk" in southern England, Yorkshire, and Northern Ireland. Techniques used included petrography, scanning electron microscopy, and isotope and trace-element geochemistry. Although all of the chalks appear to have shared a similar initial composition,