DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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PREPARED IN COLLABORATION WITH
UNITED STATES DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-677

HISTORIC ERUPTIONS AND FAULTING

Lava flows from three historic eruptions are present on the east cape above sea level within the map area. Many eruptive vents of the 1840 eruption broke out on the north side of the east rift zone; the easternmost vent, about 6 km west of Nanawale Bay, fed a large lava flow that poured into the sea at the bay.

The 1955 eruptive vents extend 14 km southwest from the map area. Much of the small northeastern flow just west of Kapoho Crater has been covered by 1960 lava (see Macdonald, 1959, fig. 12). In addition to the flows shown, three 1955 lava tongues flowed into the sea on the south coast just west of the map area.

The 1960 eruption occurred entirely within the map area. A new cone 50 m high was built at the eruptive vent, and a thick lava flow poured into the sea and extended the shoreline as indicated on the map. Contemporaneous with the eruption a graben subsided several meters as a result of displacement along its two bounding faults, and an eruptive fissure developed within the graben. Approximately the same graben subsided more than 4 m in 1924 during a period of magma withdrawal, subsidence, and phreatic explosions at the summit of Kilauea Volcano, 45 km to the west (Finch, 1925).

In 1884 a submarine eruption was reported off the east cape in approximately 20 meters of water (Stearns and Macdonald, 1946, p. 111).

BATHYMETRY

The crest of the submerged part of the rift zone ridge is directly on line with the subaerial part of the east rift zone of Kilauea Volcano. Submarine hills on the crest of the ridge are believed to be constructional volcanic cones at vents, and deep-sea photography shows that they are mantled with coherent pillows and pillow fragments. The submarine cones, like the subaerial cones and fissures, occur in a zone about 2 km wide. This fact and the possible presence of grabens like that on the east cape probably account for the broad, rather flat top of the rift zone ridge.

The bathymetric map clearly shows a variation in roughness along the flanks of the rift zone ridge. The ocean bottom downslope from the subaerial part of the east cape is smooth compared with the flanks of the submarine part of the rift zone ridge farther east. Dredging and ocean-bottom photography have shown that the smooth, even slopes are mantled by angular glass sand and scoria produced by explosive disintegration of subaerial lava flows when the hot flows enter the sea (Moore and Fiske, 1969). The irregular slopes of the summit and flanks of the submarine ridge to the east are mantled by pillow lavas, and both coherent and broken pillows are widely distributed. The origin of the many small lobes and benches on the flanks of the ridge is probably complex. Some could be the surfaces and toes of pillowed lava flows, others could be slump and slide lobes, and still others may be piles of pillows at vents fed by dikes extending outward from the core of the rift zone.

Some mapped scarps parallel to the ship traverses (see inset map) are clearly the result of errors in ship location or depth measurement.

The general regional slope of the flanks of the submarine part of the rift zone ridge is from 9°–12° and averages about 10°. However, parts of the north side of the ridge, especially near the ridge crest, have a regional slope of 18°–24°. The reason for this steep north slope is not known, but the fact that cones are better developed on the north side of the ridge crest than on the south side may indicate that recent eruptive vents are concentrated along the north side of the rift zone.

The smoother slopes mantled with glass sand downslope from the subaerial part of the east cape are steeper than the pillow-covered slopes farther east. These slopes are distinctly concave upward; they are about 26° near the island and about 12° halfway down to the flat ocean floor.

The crest of the rift zone ridge, despite the many cones surmounting it, plunges rather uniformly at about 3°.

REFERENCES CITED

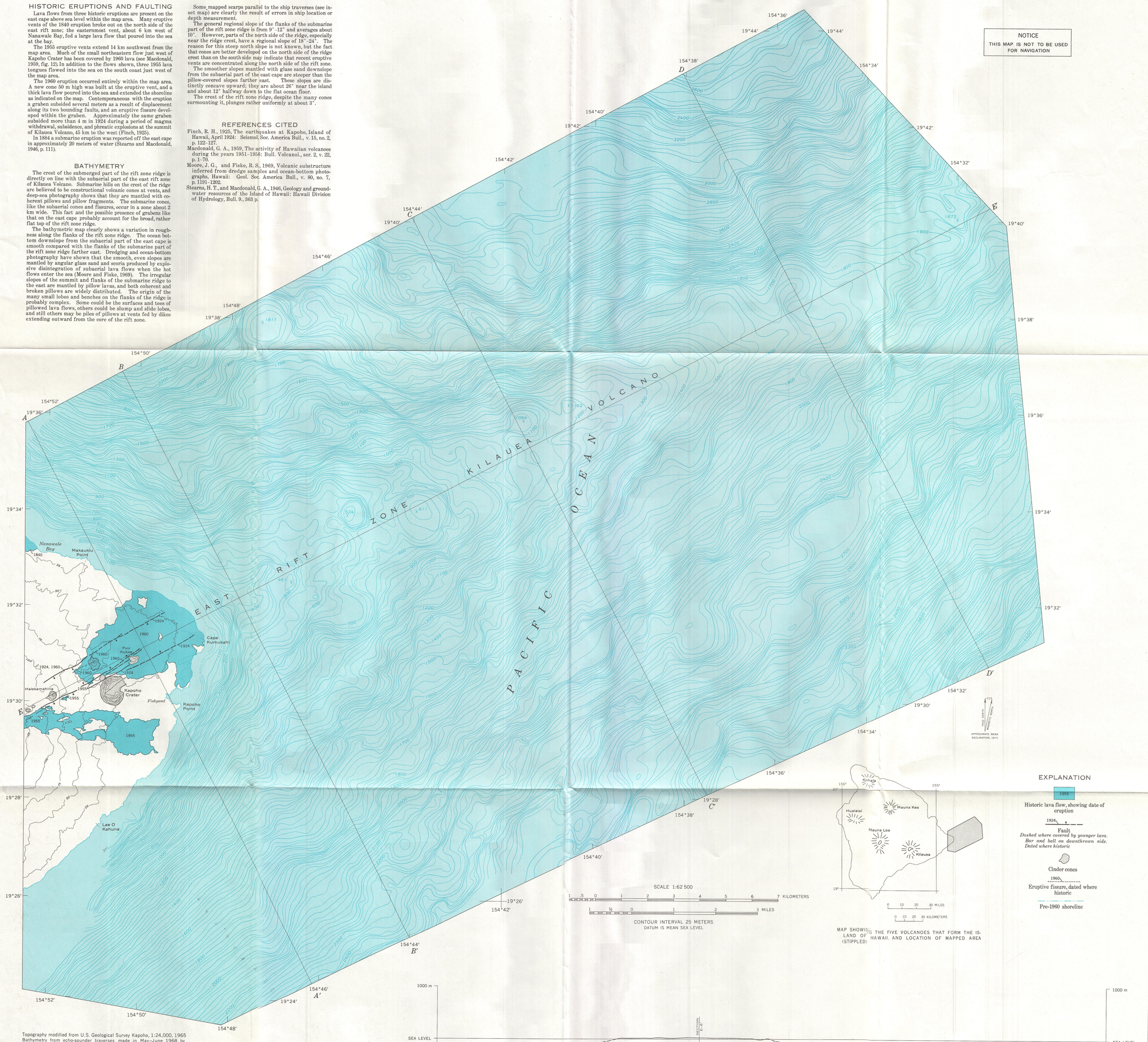
Finch, R. H., 1925, The earthquakes at Kapoho, Island of Hawaii, April 1924: Seismol. Soc. America Bull., v. 15, no. 2, p. 122–127.

Macdonald, G. A., 1959, The activity of Hawaiian volcanoes during the years 1951–1956: Bull. Volcanol., ser. 2, v. 22, p. 1–70.

Moore, J. G., and Fiske, R. S., 1969, Volcanic substructure inferred from dredge samples and ocean-bottom photographs, Hawaii: Geol. Soc America Bull., v. 80, no. 7, p. 1191–1202.

Stearns, H. T., and Macdonald, G. A., 1946, Geology and groundwater resources of the Island of Hawaii: Hawaii Division of Hydrology, Bull. 9., 363 p.

NOTICE
THIS MAP IS NOT TO BE USED FOR NAVIGATION



SCALE 1:62 500

1 5 0 1 2 3 4 5 6 7 KILOMETERS

1 ½ 0 1 2 3 MILES

CONTOUR INTERVAL 25 METERS
DATUM IS MEAN SEA LEVEL

MAP SHOWING THE FIVE VOLCANOES THAT FORM THE ISLAND OF HAWAII, AND LOCATION OF MAPPED AREA (STIPPLED)

EXPLANATION

1955 — Historic lava flow, showing date of eruption

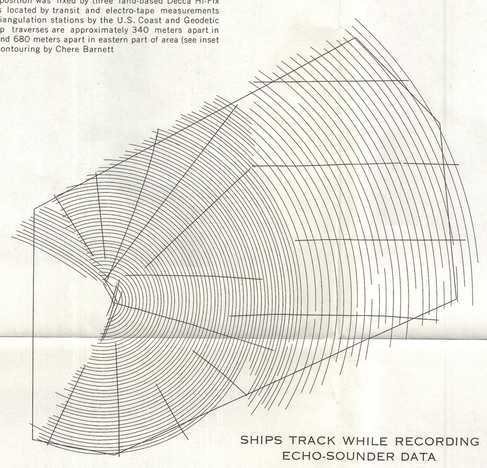
1924 — Fault
Dashed where covered by younger lava. Bar and ball on downthrown side. Dated where historic

Cinder cones

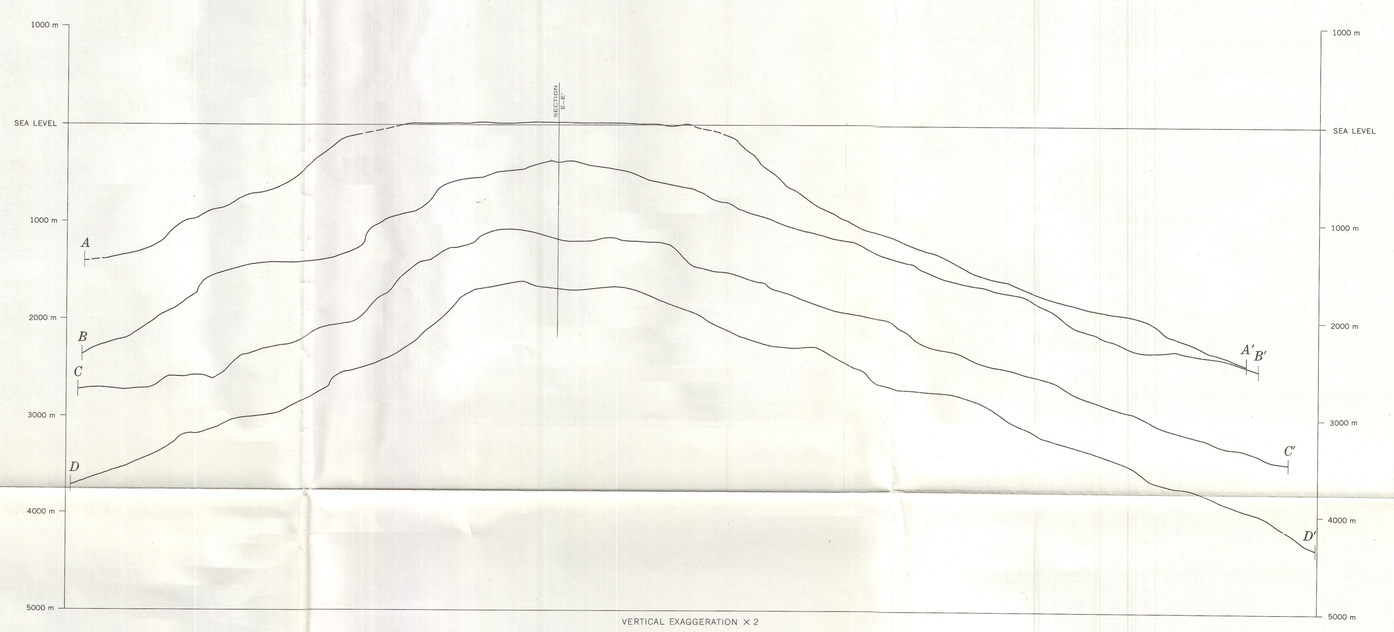
1960 — Eruptive fissure, dated where historic

Pre-1960 shoreline

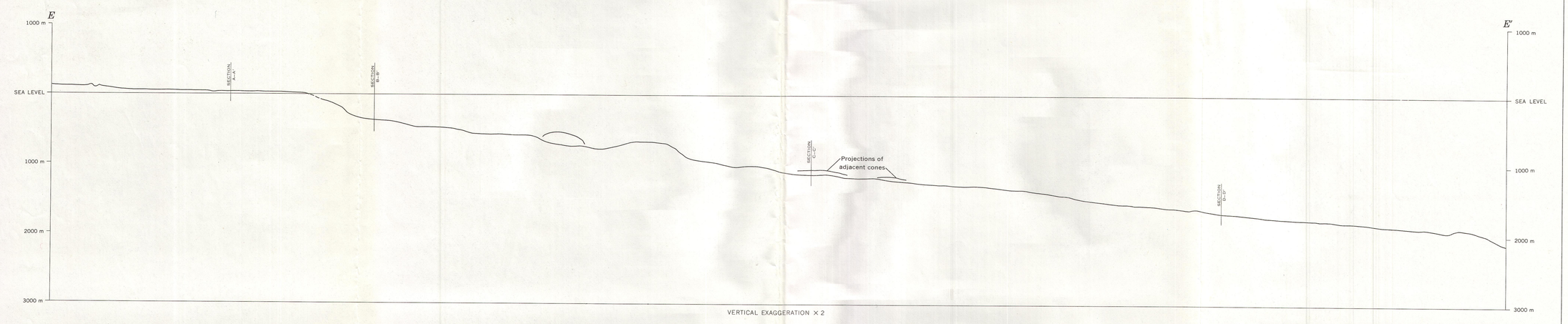
Topography modified from U.S. Geological Survey Kapoho, 1:24,000, 1965
Bathymetry from echo-sounder traverses made in May–June 1968 by ESSA, U.S. Coast and Geodetic Survey Ship *McArthur* , Ronald L. Newsom commanding. Ship position was fixed by three land-based Decca Hi-Fix transmitting stations located by transit and electro-tape measurements relative to existing triangulation stations by the U.S. Coast and Geodetic Survey. Arcuate ship traverses are approximately 340 meters apart in western part of area and 680 meters apart in eastern part of area (see inset map). Bathymetric contouring by Chere Barnett



SHIPS TRACK WHILE RECORDING ECHO-SOUNDER DATA



VERTICAL EXAGGERATION × 2



VERTICAL EXAGGERATION × 2

BATHYMETRY AND GEOLOGY—EAST CAPE OF THE ISLAND OF HAWAII

By
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For sale by U. S. Geological Survey, price $1.00