U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
U.S. GEOLOGICAL SURVEY—NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
JOINT OFFICE FOR MAPPING AND RESEARCH

MISCELLANEOUS FIELD STUDIES
MAP MF-2269

Mercator projection

NOTE: THIS MAP IS NOT INTENDED FOR NAVIGATION

SCALE 1:150 000

5 4 3 2 1 0 5 MILES

5 4 3 2 1 0 5 10 KILOMETERS

CONTOUR INTERVAL 10 METERS

Edited By Jan Zigler; prepared by Lori Moore Ghequiere

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INTRODUCTION

This map shows the topography of a small part of the subaerial western part of the Island of Hawaii as well as modern multibeam bathymetry of the west submarine flank, which covers a total area of about 8,500 km^2 (see index map). The map area includes part of the submerged flanks of the active Mauna Loa and Hualalai Volcanoes, which last erupted in 1984 and 1801, respectively. The steep and irregular submarine slope is shaped by several giant submarine landslides. They were first identified during surveys from the U.S. Geological Survey research vessel *S.P. Lee* in 1976 and 1978 (Normark and others, 1979) and later mapped in more detail during a swath-sonar survey (GLORIA) of the United States Hawaiian Exclusive Economic Zone in 1986 to 1991 (Lipman and others, 1988; Moore and others, 1989) as part of a cooperative venture of the U.S. Geological Survey and the British Institute of Oceanographic Sciences.

TOPOGRAPHY

Elevation data were gridded at 200-m spacing and contoured by computer on a Mercator map projection at a scale of 1:150,000. Both the subaerial and submarine topographic data were contoured at an interval of 10 m; every tenth (100 m) contour is heavier and marked with ticks on the downslope side. Subaerial topography (fig. 1, area 1) is indicated by a faint brown tone on the main map and is based on recent digital elevation data from 7.5' quadrangles of the U.S. Geological Survey. The data were generated from parallel scan lines across stereoscopic models projected from aerial photographs.

BATHYMETRY

Nearshore bathymetric mapping (fig. 1, area 2), conducted by single-beam sonar surveys, is from the NOAA National Ocean Service Hydrographic Database, National Geophysical Data Center. Multibeam bathymetry in most of the map area (fig. 1, area 3) was collected from the National Oceanic and Atmospheric Administration (NOAA) ship *Surveyor*, R.V. Forster commanding, during November 1986 and April 1987 (Fox and others, 1992). Multibeam surveys of a small area offshore (fig. 1, area 4) were made from the U.S. Navy vessel *Laney Chouest*, Victor Gisclair commanding, in October 1992 as part of a joint program of NOAA, National Undersea Research Program, and the U.S. Navy, R.E. Young, Chief Scientist. Multibeam depth contours are based on an uncorrected oceanic sound speed of 1,500 m/s; reported depths may deviate slightly from true ocean depths. This map is not intended for navigational purposes.

GEOLOGIC INTERPRETATION

The bathymetry shows several large landslides (Lipman and others, 1988; Moore and others, 1989; Normark and others, 1993) that are named and outlined in figure 2. The north Kona slump is a complex feature rooted in three volcanoes: Mahukona (a submerged volcano north of the map area), Hualalai, and Mauna Loa. The slump is marked by arcuate scarps and benches, and it has apparently moved in a complex fashion over a considerable time. It is older than and has not affected the uppermost reef (fig. 2), which drowned about 15,000 years ago. The upper part of the north Kona slump is apparently stabilized by the presumed intrusive core of the northwest rift zone of Hualalai Volcano.

Catastrophic failure of the southern part of the north Kona slump occurred in two phases and produced the Alika 1 and Alika 2 debris avalanches (fig. 2), each of which is believed to have moved rapidly in a single episode (Lipman and others, 1988). The earlier Alika 1 debris avalanche moved 80 km directly west down the steep west flank of Mauna Loa and produced a broad, distal, hummocky apron of fragmented volcanic rock on the flat sea floor at the base of the Hawaiian Ridge. The younger Alika 2 debris avalanche originated near the same place on the Mauna Loa slope, moved west in its upper reaches, but turned north 60° in its middle course and followed the base of the west slope of the volcano for a total length of about 100 km. The middle course of the avalanche deposit has a 40-km-long flat-floored channel, which is 10 km wide and flanked by natural levees up to 100 m high (Moore and others, 1992). The broad lobe at the lower part of the Alika 2 debris avalanche deposit is 35 km across and studded by more than 100 mapped hummocks that are 200 m to 1 km in diameter. The Alika 2 avalanche occurred more than a few thousand years ago because its upper, subaerial headwall is mantled by lavas of that age. The combined volume of both Alika landslides is 200 to 800 km^3.

A series of five drowned coral reefs are evident in the northeastern part of the map area (Moore and Clague, 1992). The reefs drowned from 15,000 to about 500,000 years ago; the deepest reef is the oldest. The presence of these reefs indicates that the volcanic flanks have undergone only loading-induced regional subsidence and have been free of landslides since their formation.

The Indianapolis Seamount is probably Cretaceous in age and predates the growth of the Hawaiian Ridge volcanoes. The unnamed seamount in the middle of the map area between the two Alika debris avalanche deposits may be a large detached block from the north Kona slump or may also be a pre-Hawaiian Cretaceous seamount.

ACKNOWLEDGMENTS

NOAA multibeam data from area 3 was processed by D.H. Herlihy of NOAA's National Ocean Service. This map was compiled at the NOAA Pacific Marine Environmental Laboratory, Newport, Oregon.

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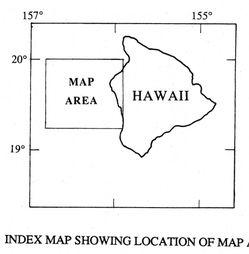

INDEX MAP SHOWING LOCATION OF MAP AREA

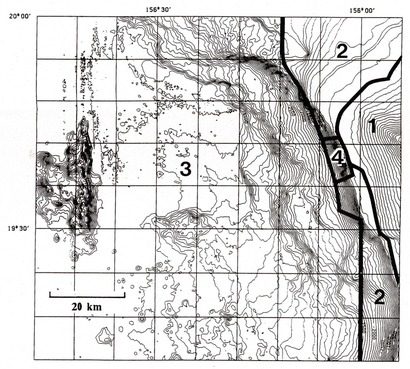

Figure 1. Map showing sources of data (see text).

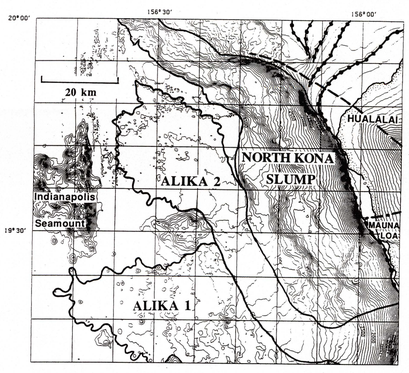

Figure 2. Map showing geologic features. Major landslides are bounded by heavy solid lines; drowned reefs shown by beaded lines; northwest rift zone of Hualalai Volcano shown by dashed line; and approximate boundary between lavas of Hualalai and Mauna Loa Volcanoes shown by dash-dot line.

BATHYMETRY OF THE WEST-CENTRAL SLOPE OF THE ISLAND OF HAWAII

By

William W. Chadwick, Jr.[1], James G. Moore[2], and Christopher G. Fox[3]

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[1]Oregon State University, [2]U.S. Geological Survey,
[3]National Oceanic and Atmospheric Administration

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