A Gravity Survey of the Island of Hawaii[1]

W. T. KINOSHITA

A BOUGUER ANOMALY CONTOUR MAP, based on a gravity survey made on the island of Hawaii during parts of 1961 and 1962 (Kinoshita et al., 1963), is presented as Figure 1. The table of principal facts is reported elsewhere (Hawaii Inst. Geoph., 1965, Table 1). Measurements along the main roads and trails provided generally good coverage at elevations below 6000 ft, but at higher elevations large areas are inaccessible, and the gravity map is necessarily generalized.

About two-thirds of the stations were located at bench marks or spot elevations published on standard 1:24,000 scale U. S. Geological Survey topographic quadrangle maps. The rest were located at similar points on 1:62,500 scale maps. All of the gravity measurements were made with a LaCoste Romberg gravimeter relative to a base station at the Hawaiian Volcano Observatory, which has an observed gravity value of 978,664.42 mgal. Topographic and Bouguer corrections were made in the same manner as those on Maui (Kinoshita and Okamura, pp. 000 in this issue) with the exception that topographic corrections were made at about 50% of the stations instead of at 15% as on Maui. In the table the complete Bouguer anomaly is given to 0.1 mgal at those stations where the topographic correction was calculated, and to the even mgal where they were estimated.

The gravimeter was read at the base station several times during the course of approximately 30 days of field work and the maximum variation in the readings was 0.7 mgal. Corrections for instrumental drift and tidal effects were neglected in the calculations; their combined effects could be as large as 1 mgal. Although the maximum variation in base readings was as much as 0.7 mgal, about 90% of the readings were within 0.2 mgal. Thus, any one observed gravity value could be in error by as much as 1 mgal, but is probably correct to within 0.5 mgal. Most of the published elevations are accurate to within 5 ft of their true elevations, but for the parts of the island where only the smaller scale topographic maps were available, the elevations could be in error by 15 ft. In terms of a combined free-air Bouguer correction, these elevation uncertainties would correspond to errors of about 0.3 mgal and 1 mgal, respectively. Topographic corrections are probably correct to within 10%. Hence the largest topographic corrections, such as the 50- to 60-mgal values obtained at the summits of Mauna Loa and Mauna Kea, can introduce errors up to 6 mgal. However, most of the stations had topographic corrections of less than 20 mgal, so the complete Bouguer anomaly value at any one station is probably accurate to at least 3 mgal.

[1] Publication authorized by the Director, U. S. Geological Survey.

REFERENCES

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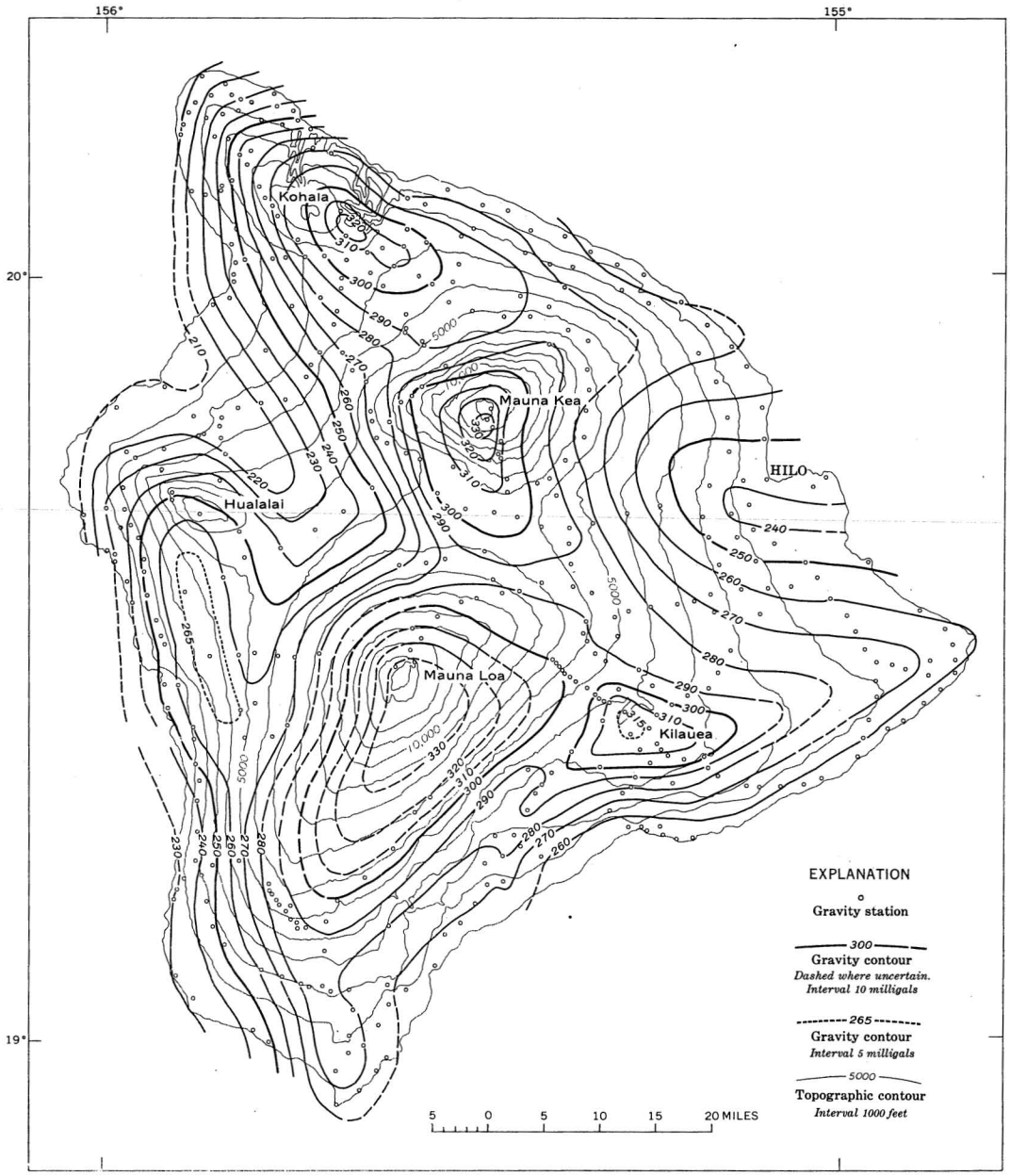

FIG. 1. Bouguer gravity-anomaly map of the island of Hawaii.