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The topography of the Mid-Pacific mountains.

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THESIS

THE TOPOGRAPHY OF THE

MID-PACIFIC MOUNTAINS

by

Charles Keith Roberts

December 1968

THE TOPOGRAPHY OF THE MID-PACIFIC MOUNTAINS

by

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ABSTRACT

A recently contoured set of detailed bathymetric charts of the central Pacific Ocean were obtained from the Scripps Institution of Oceanography. The mean topography of the submerged Mid-Pacific Mountain chain was contoured from mean depths calculated for one-degree squares. The hypsometry of this area was determined. A study of the subsidence of the Mid-Pacific Mountains was made using the guyot information available on the charts and in the literature. The guyot data were examined and the dimensions of the 17 most reliable features were studied. The guyot tops are generally deeper in the eastern part of the area than to the west, with an apparent tilt of about 200 fathoms in 1200 nautical miles. The present topography closely resembles the old topography when the guyots were at the surface. It appears that the tops of the mountains have settled a bit relative to the deeper areas, although this is not proven.

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The writer gratefully acknowledges the assistance and advice of the following persons:

Dr. Henry W. Menard of the Scripps Institution of Oceanography who provided the bathymetric charts of the Mid-Pacific on which this study is based; Mr. Thomas E. Chase of the Scripps Institution of Oceanography who assisted the writer in obtaining copies of the Scripps charts and provided other information; Mr. Victor J. Strnad of the Navy Public Works Department in San Diego who arranged to have the charts duplicated; Dr. R. S. Andrews of the Naval Postgraduate School who critically read the manuscript; and my father Mr. John C. Roberts and my wife Mrs. Carol S. Roberts who provided both inspiration and assistance in completing this study.

The writer especially appreciates the assistance of Dr. Warren C. Thompson of the Naval Postgraduate School who interested the writer in the topographic study, provided considerable assistance, and who acted as advisor for this research.

CHAPTER I

INTRODUCTION

1.1 General Statement.

The Mid-Pacific Mountains (Figure 1) are a large submarine mountain range which extends from about 170° E longitude, just east of Wake Island, to near Necker Island of the Hawaiian Islands, about 400 nautical miles northwest of Oahu. These mountains are particularly interesting for several reasons:

(1) In this submarine mountain range are located a number of large guyots. These guyots are an ancient chain of islands which have sunk a mile deep relative to the sea surface in the middle of the Pacific Ocean [Hamilton, 1956].

(2) The Mid-Pacific Mountains "...remain today as the oldest uneroded mountains known on earth. They are fossil landforms preserved in the depths of the sea where they are disturbed only by light currents and the slow rain of pelagic material from the waters above" [Hamilton, 1956, p. 55].

(3) Good bathymetric charts of most of this area have only recently been produced.

1.2 Purpose.

In June 1968, this investigator obtained copies of a series of 11 charts of the central Pacific (Figure 1) through the courtesy of Dr. H. W. Menard of the Scripps Institution of Oceanography. These charts had recently been contoured by Jacqueline Winterer of Scripps. They cover an area of some 2,335,000 square nautical miles at a scale of

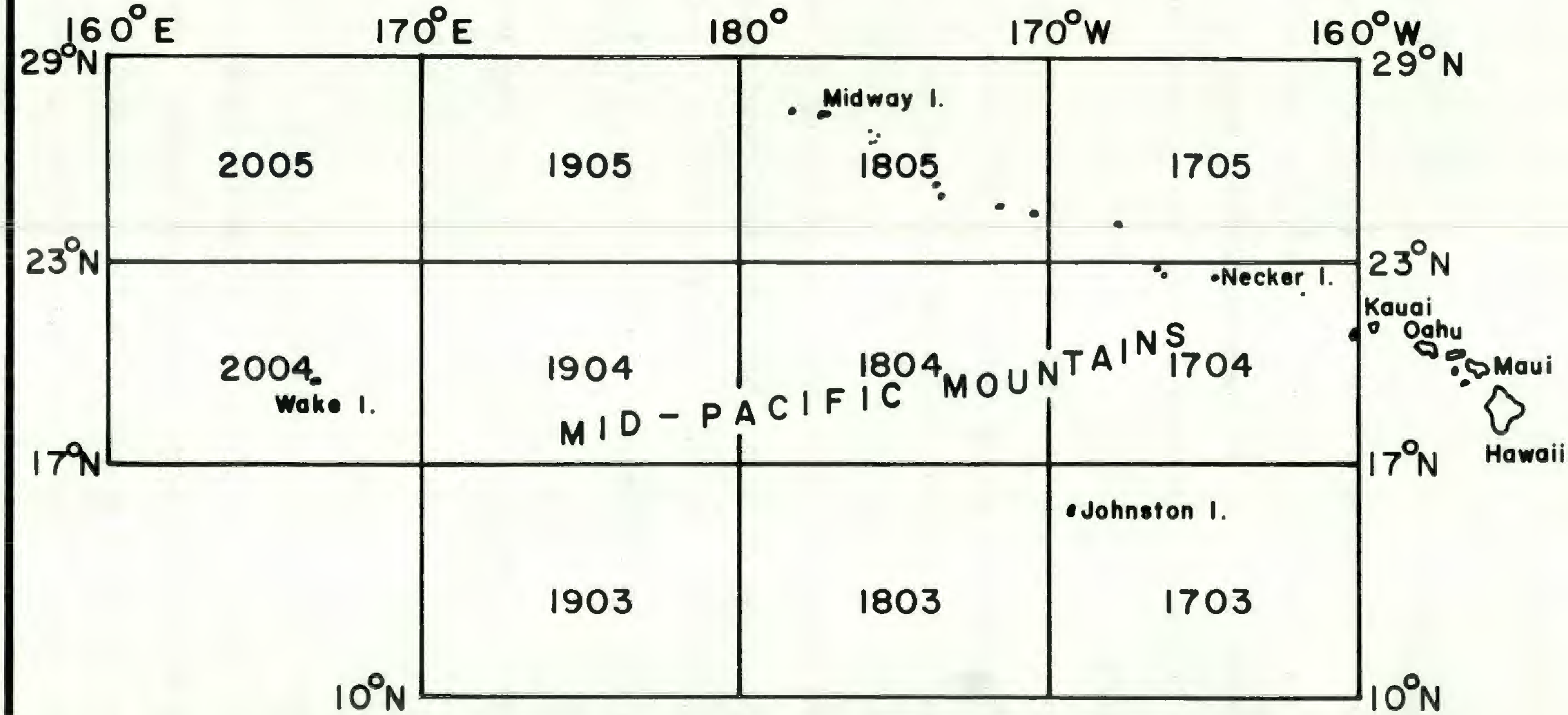

Figure 1. BATHYMETRIC CHART COVERAGE OF THE MID-PACIFIC MOUNTAINS

about 14 nautical miles per inch. When pieced together the charts occupied an area approximately 7 feet by 14 feet. The data used to prepare the charts was restricted to high-quality sounding information obtained by U. S. Navy, Scripps, and Russian vessels, using precision depth recorders.

The purpose of this study was to examine some of the gross aspects of the topography of the Mid-Pacific Mountain area that can be determined from these charts. This includes the calculation and contouring of the mean topography and a determination of the hypsometry of this region. Here, the mean topography refers to the topography resulting from a smoothing process described in detail in section 3.1. In addition, a study of the topographic subsidence of this area is made using the guyot information that is available in the literature and on these new charts. A brief review of the geologic history of the Mid-Pacific Mountains is also included to provide a background for this study.

1.3 <u>Physiography</u>.

The Mid-Pacific Mountains span about 1500 nautical miles from 170° E longitude to Necker Island (Figure 1). The mountain chain is only about 25 nautical miles wide near Necker Island. It reaches its maximum width of about 600 nautical miles between 175° E and 180° longitude. The main ridge is interrupted by gaps as deep as 2500 fathoms. The general trend of the mountains is east-west, which differs from the northwest-southeast orientation typical of much of the Pacific Basin. The mountains are located on a broad, low swell of the sea floor [Hamilton, 1956].

14. <u>History of Topographic Exploration</u>.

During World War II, Professor H. H. Hess of Princeton served two years as navigator and commanding officer of the USS CAPE JOHNSON in the western Pacific. There he discovered the flat-topped seamounts which he named "guyots" after the 19th century geography professor at Princeton, Arnold Guyot. Hess collected his echo-sounding information from random traverses by the CAPE JOHNSON, and supplemented this with soundings from the records of the U. S. Navy Hydrographic Office [Hess, 1946].

In his classic paper, "Drowned Ancient Islands of the Pacific Basin," Hess [1946] reported the existence of 20 guyots in the Pacific and inferred the existence of some 140 more. He included a chart showing the location of these guyots and a profile of what he called a "typical guyot" (Figure 2). Hess interpreted the guyots as drowned islands that had subsided 3000 to 6000 feet below sea level. His discovery provided a considerable stimulus to geologic exploration in the Pacific for the next several years [Menard, 1964].

In 1950, the Scripps Institution of Oceanography-U. S. Navy Electronics Laboratory Expedition to the Mid-Pacific explored five guyots in the Mid-Pacific Mountains, and the results were reported in E. L. Hamilton's [1956] paper "Sunken Islands of the Mid-Pacific Mountains." Included in the paper is a bathymetric chart of the Mid-Pacific Mountains, showing the locations of features which he believed to be guyots. Hamilton also reported the results of a detailed paleontological analysis of material cored and dredged from the guyots and presented an excellent discussion of the geologic history of the Mid-Pacific Mountain area. No detailed exploration of the topography of the Mid-Pacific Mountains is known to this writer to have been conducted since the Mid-Pacific Expedition of 1950.

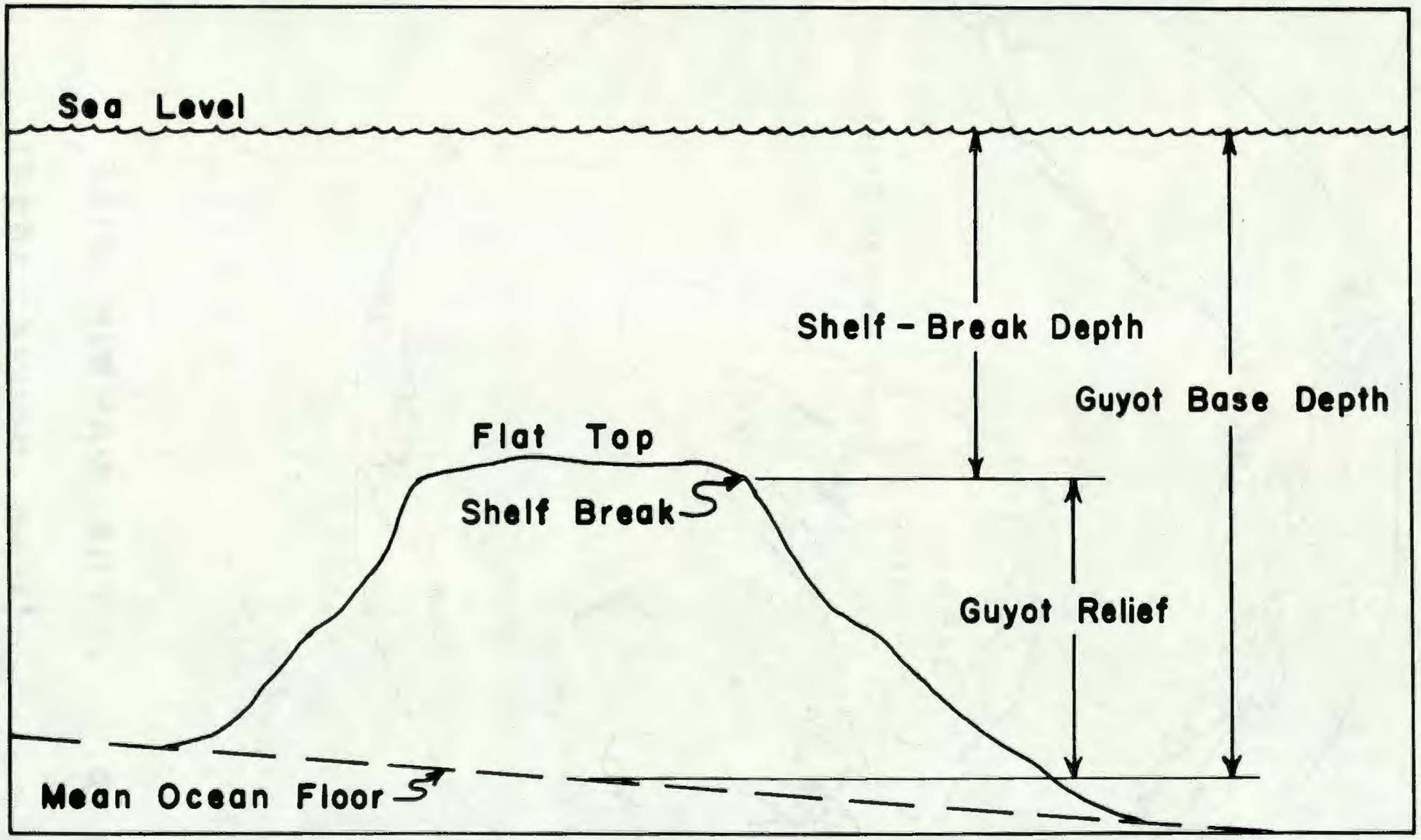

Figure 2. A TYPICAL GUYOT
(Adapted from Hess, 1946)

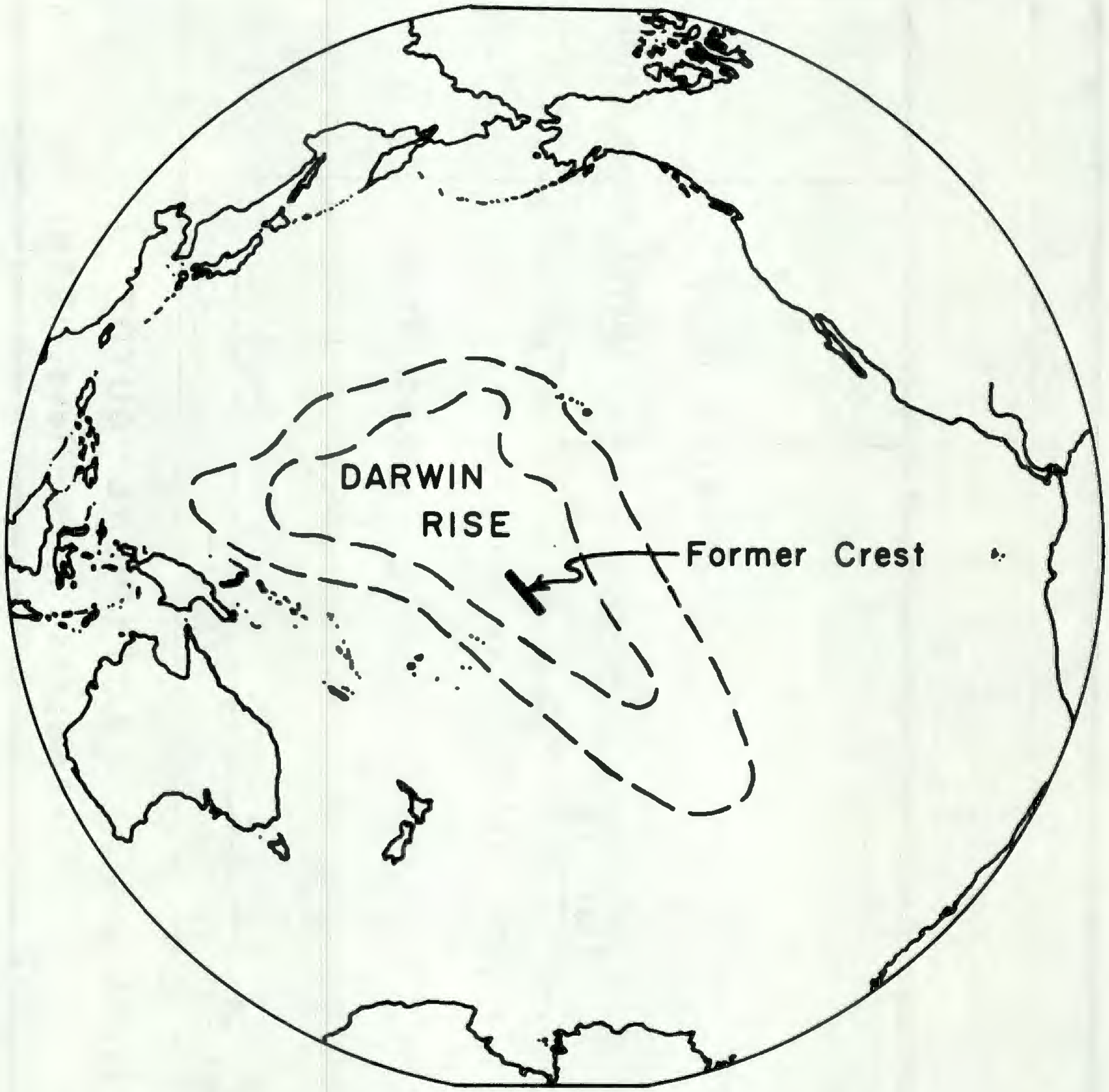

Figure 3. THE DARWIN RISE

(from Menard, 1964)

CHAPTER II

GEOLOGIC HISTORY OF THE MID-PACIFIC MOUNTAINS

2.1 General.

The intent here is to present a brief summary of the geologic history of the Mid-Pacific Mountain area as interpreted by H. W. Menard and E. L. Hamilton. Their conclusions are based on echo soundings, seismic-refraction records, heat-flow measurements, gravity anomaly measurements, and bottom samples obtained using corers and dredges.

2.2 Formation of the Darwin Rise.

Menard [1964] indicated that a vast rise once existed in the southwestern Pacific area (Figure 3), and he called this the "Darwin Rise." The rise was possibly 100 million years in forming and, in any event, had already developed as a large topographic bulge by late Mesozoic time. Menard stated that, although the hypothesis of convection currents in the mantle has not been proven, this presently offers the best explanation for the formation of an oceanic rise. Thus, a large mass of material in the mantle, heated by radioactive decay and contact with the hot core of the earth, rose upward and caused the mantle and crust to bulge outward. During its formation the bulge produced fractures in the crust resulting in longitudinal ridges and transverse faults. At about this time large-scale vulcanism occurred producing large volcanoes, mainly along the sides of the rise in two roughly parallel lines. The ridge of the Mid-Pacific Mountains was formed as the flows from adjacent, closely-spaced volcanoes overlapped [Menard, 1964].

CHAPTER III

TOPOGRAPHY

3.1 Mean Topography.

The chart numbering system and coverage of the Mid-Pacific Mountains used in this study is shown in Figure 1. In order to determine the shape of the mean, or smoothed, topography, a procedure similar to that used by Menard and Smith [1966] was employed. First, the charts were divided into areas bounded by one degree of latitude and longitude, hereafter referred to as "one-degree squares." The charts had been contoured at 200-fathom intervals by Jacqueline Winterer, and the area contained above each contour was carefully measured using a polar planimeter (a Keuffel and Esser model 4236 which was read to the nearest unit on the vernier scale). When the area lying above each 200-fathom contour within a one-degree square had been determined, this information was punched onto a computer card, still in planimeter units. The computer was used to convert these values to square nautical miles and to percentage of the total area in the one-degree square. The area contained within a one-degree square at different latitudes was determined from the Handbook of Oceanographic Tables [1966]. These percentage data are on file with Professor Warren C. Thompson in the Department of Oceanography at the Naval Postgraduate School, Monterey, California.

In order to determine the mean depth of the topography within each one-degree square, the following procedure was used: A linear slope of the topography was assumed between adjacent 200-fathom depths. The volume contained within each 200-fathom increment was then calculated by averaging the upper and lower areas and multiplying this result by 200 fathoms, the height of the segment. The volume above the top contour in the square was determined by assuming that the peak, or zero area, was found exactly 200 fathoms above the uppermost contour. The volumes were then summed from the peak down to a depth of 3600 fathoms, just below the deepest area shown on the charts. This total volume was divided by the area of the one-degree square to obtain the mean height of the bottom topography above 3600 fathoms. The mean height was then subtracted from 3600 fathoms to determine the mean depth of the topography within the one-degree square. This is the depth which would result if the topography in each square were smoothed off with no change in volume.

When the mean depth had been calculated for all of the one-degree squares, these values were plotted (Figure 4) and the mean topography was contoured at 400-fathom intervals. The contoured topography is shown in Figure 5, along with the locations of the probable guyots described in section 4.1. As expected, the mean topography follows quite closely the topography shown on the bathymetric charts from which it was derived.

3.2 Hypsometry.

The hypsometry, or frequency distribution of sea floor area with depth, was determined for two regions (see Figure 5). Region No. 1, enclosed by the dashed line, contains the massive mountain-ridge area to the north. Region No. 2 includes all of Region No. 1 and, in addition, the area to the south enclosed by the dotted line. This additional area, which is somewhat deeper, extends down to the northern limit of the Line Islands or northwest Christmas Island Ridge.

The hypsometric calculations consisted simply of identifying the one-degree squares that were within the desired region, and then having the computer sum the areas above each 200-fathom level throughout the region

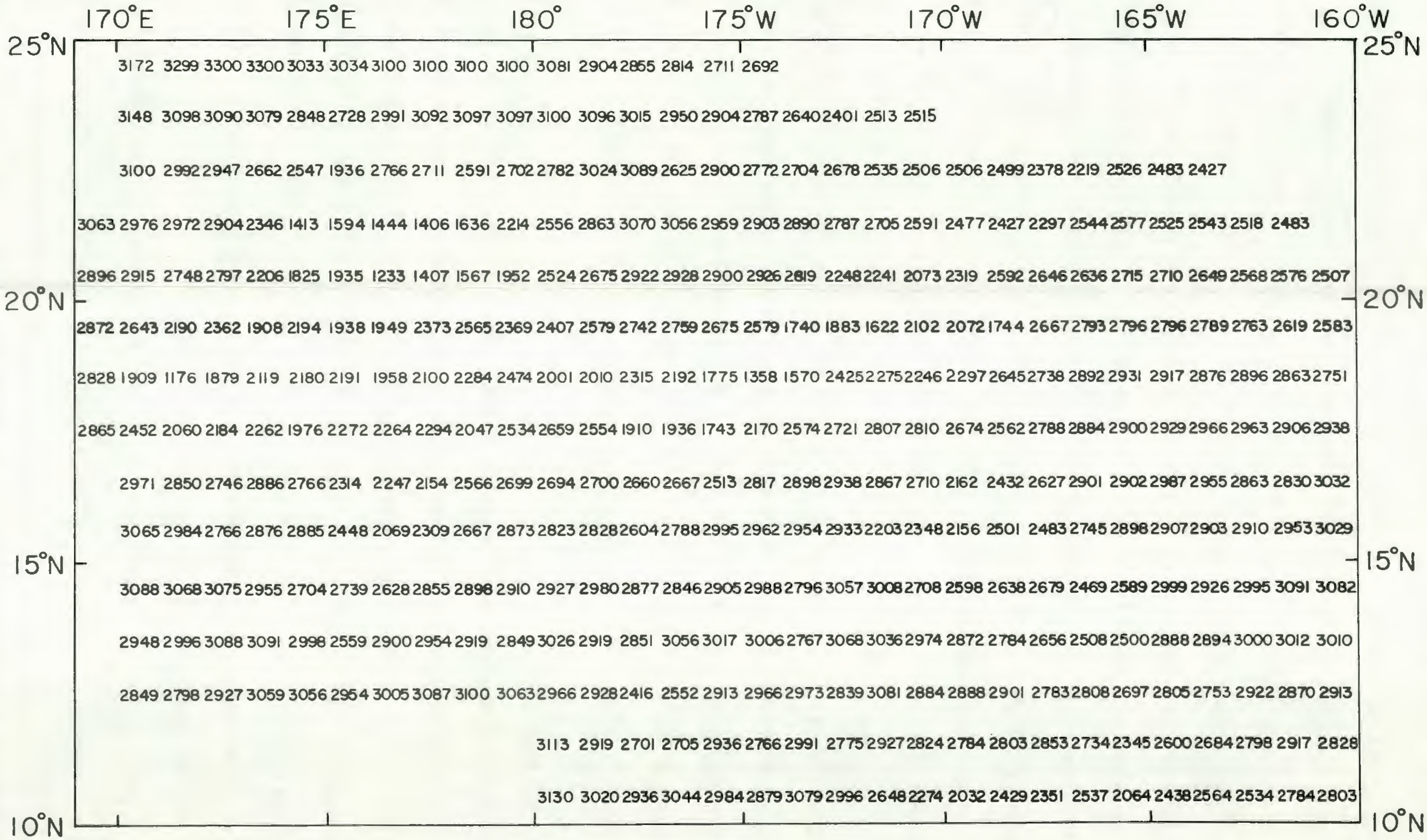

Figure 4. MEAN DEPTH OF THE TOPOGRAPHY IN ONE-DEGREE SQUARES (fathoms)

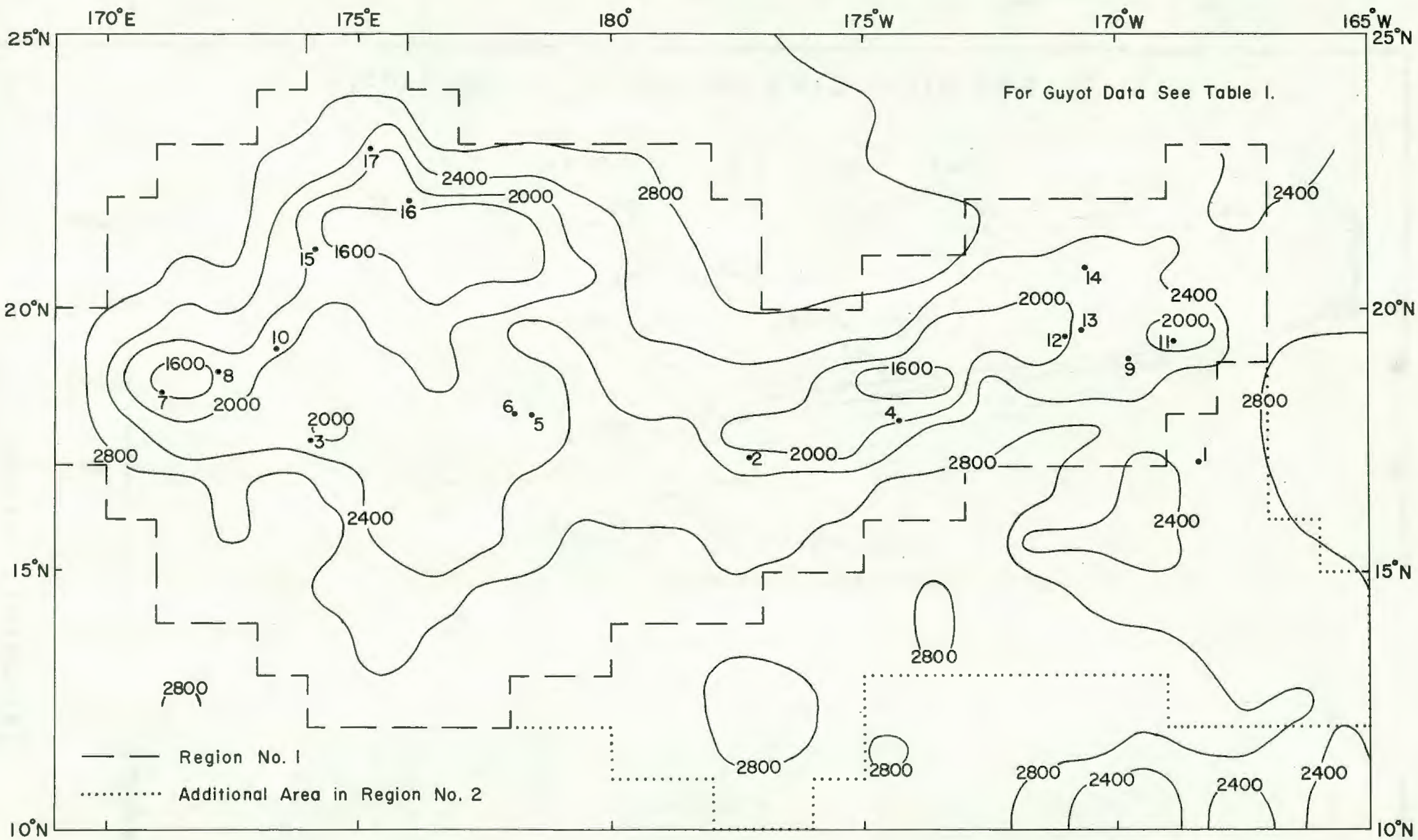

Figure 5. MEAN TOPOGRAPHY AND GUYOT LOCATIONS

(contour interval 400 fathoms)

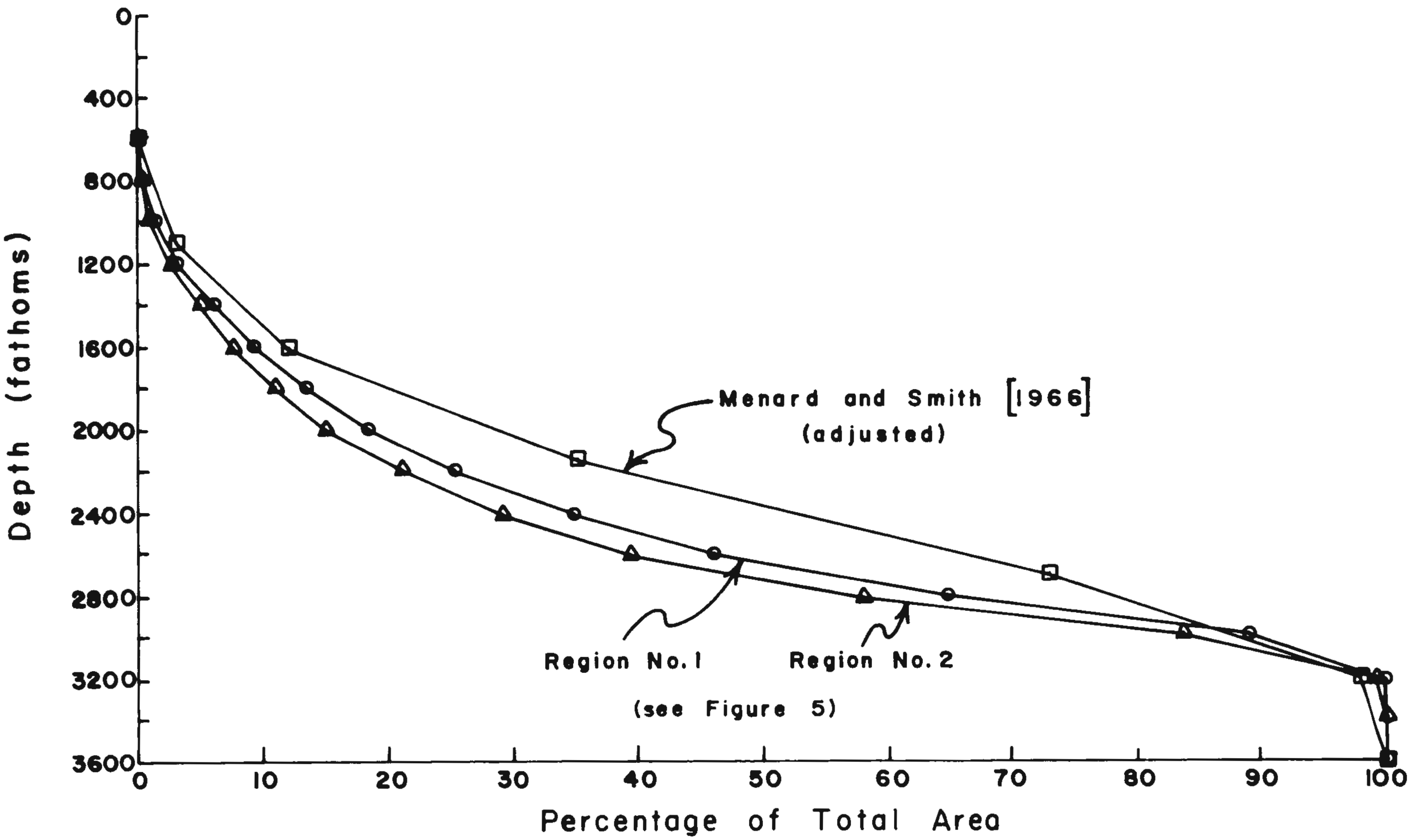

Figure 6. HYPSOMETRIC CURVES

from the surface down to 3600 fathoms. The summation was done after the planimeter units had been converted to square nautical miles. The numerical results are tabulated in Appendix A. Plots of the area distribution with depth were then constructed and are shown in Figure 6.

It should be noted that the hypsometric curve of Region No. 1 represents an essentially uneroded mountain range, except for the truncation of the guyots. Both curves are exceptionally smooth, with no obvious breaks or steps. For comparison, Menard and Smith's [1966, p. 4320, Figure 12] curve for a composite volcanic ridge is also shown. The portion of the curve below 600 fathoms has been converted from square nautical miles to percent in order to permit comparison with the curves of the Mid-Pacific Mountains. It agrees quite closely with the hypsometric curves for the Mid-Pacific Mountain area.

CHAPTER IV

GUYOTS

4.1 Procedure.

The final and most interesting portion of this study was an effort to determine if anything new could be learned about the geologic history of the Mid-Pacific Mountains using the contoured topography described above and, in addition, information about the guyots in this mountain range. First, it was necessary to establish the geographic positions of the guyots and to determine how far they had sunk below sea level. Small-scale charts showing the locations of features believed to be guyots are available in the literature, but the geographic coordinates have been published for only a few of the well-known guyots. The depth of the break-in-slope, or shelf break, was selected as the measure of their subsidence. It represents the elevation of sea level when truncation of the guyots began.

The location and shelf-break depth determinations were carried out as follows: Hess [1946, p. 774, Figure 1], Hamilton [1956, pl. 10], and Menard [1964, p. 139, Figure 6.14] each included charts which show the positions of features believed to be guyots. Hess indicated next to some of his guyot locations the depth to the top surface; Hamilton indicated the depth to the top of his features; and Menard showed the depth to the shelf break of his guyots. In order to accurately measure the locations, each of these charts was enlarged using an opaque projector, and the latitude, longitude, and depth of each feature was recorded. This information was replotted to a common scale on Mercator projections (Figures 7, 8, and 9). Another source of information used was a list of bathymetric

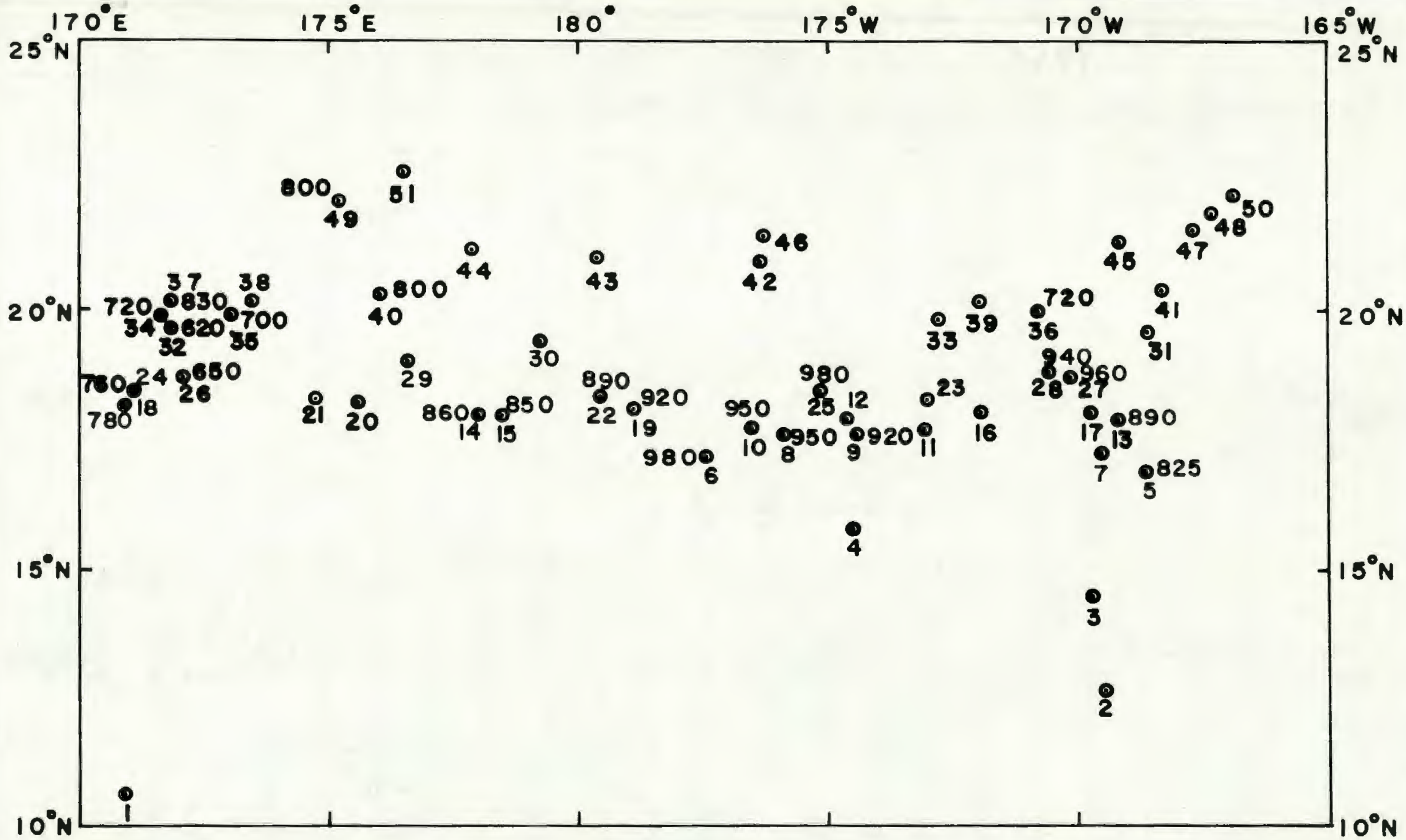

Figure 7. GUYOT LOCATIONS AND DEPTHS TO TOP (Fathoms) from HESS [1946]

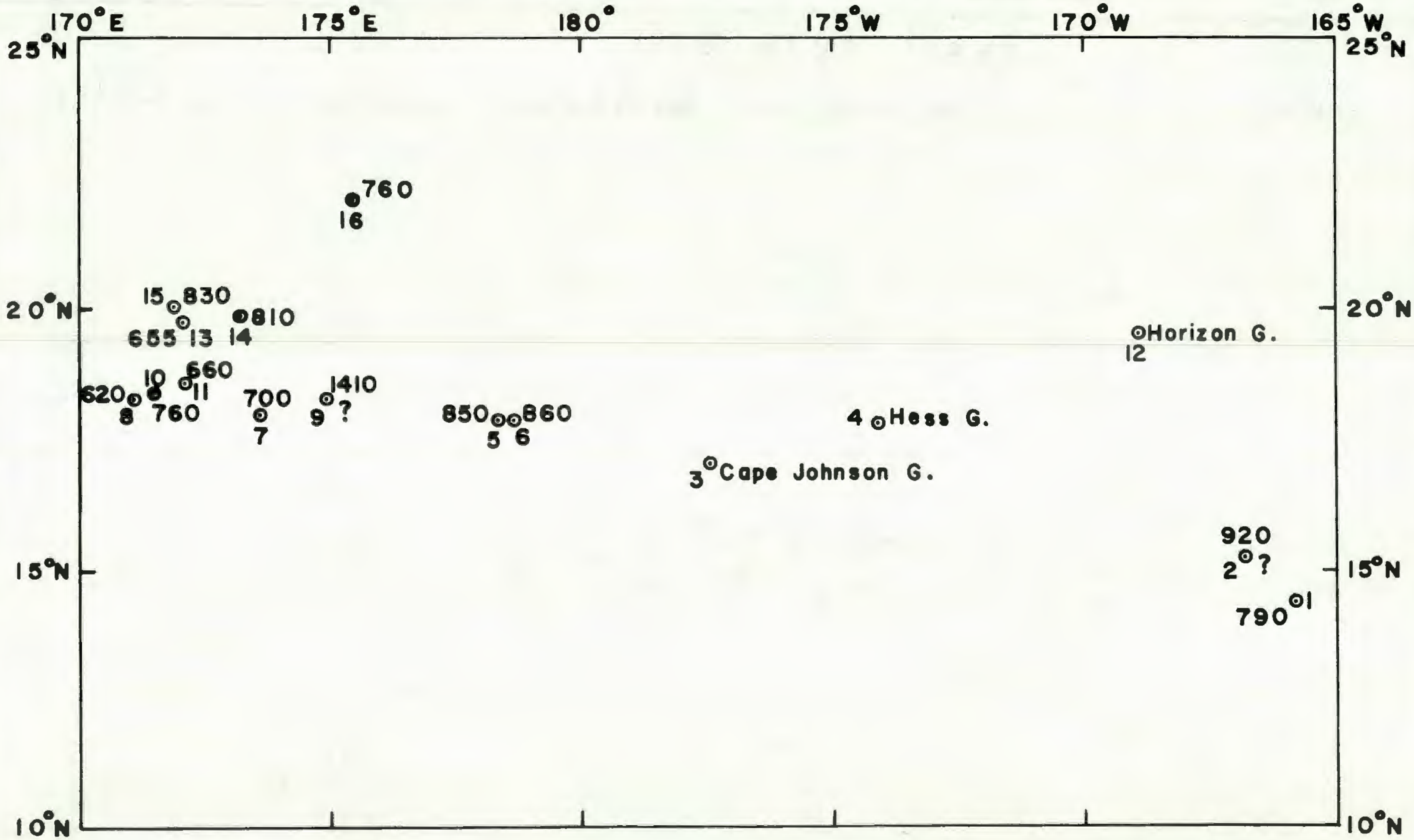

Figure 8. GUYOT LOCATIONS AND DEPTHS TO TOP (Fathoms) from HAMILTON [1956]

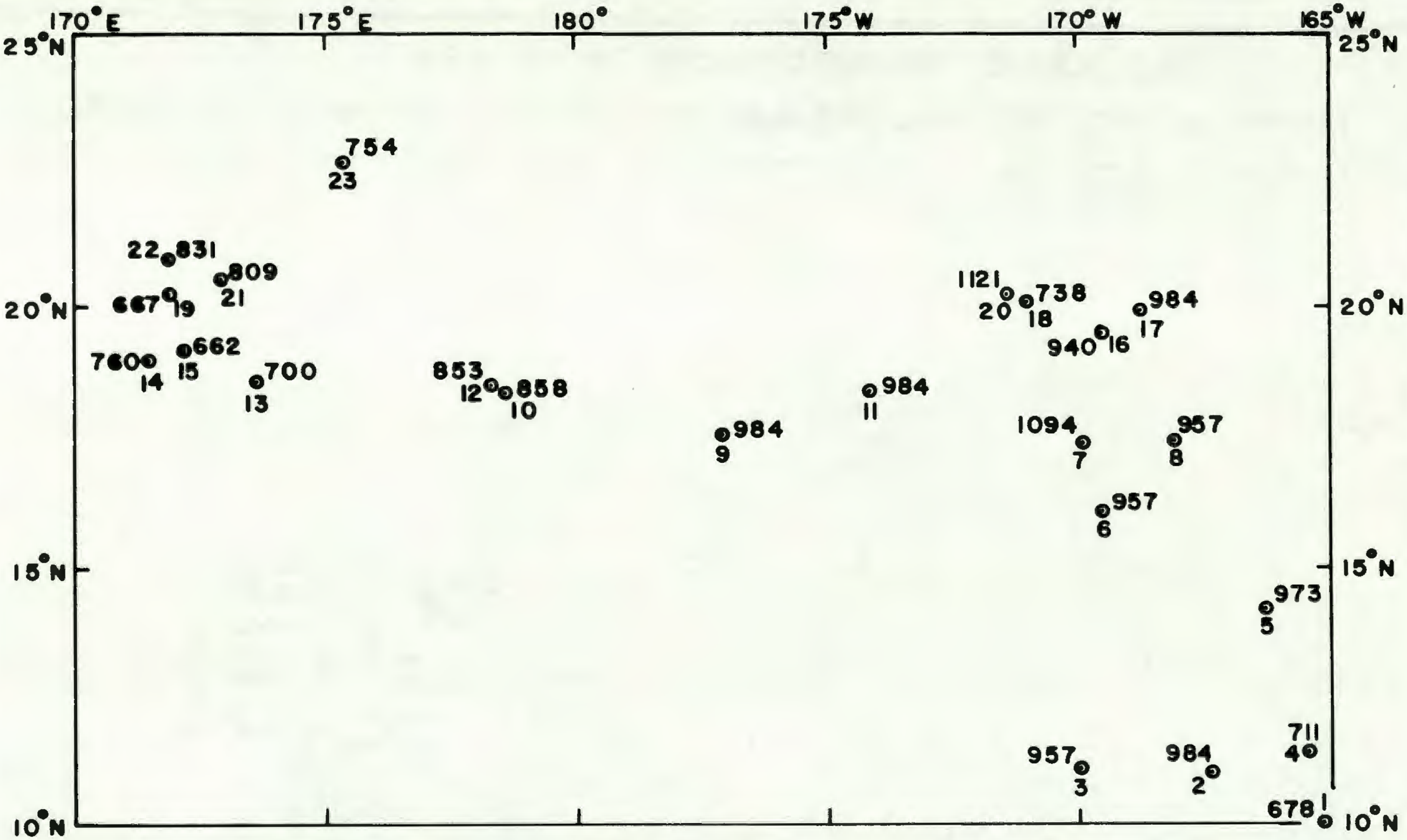

Figure 9. GUYOT LOCATIONS AND SHELF-BREAK DEPTHS (Fathoms) from MENARD [1964]

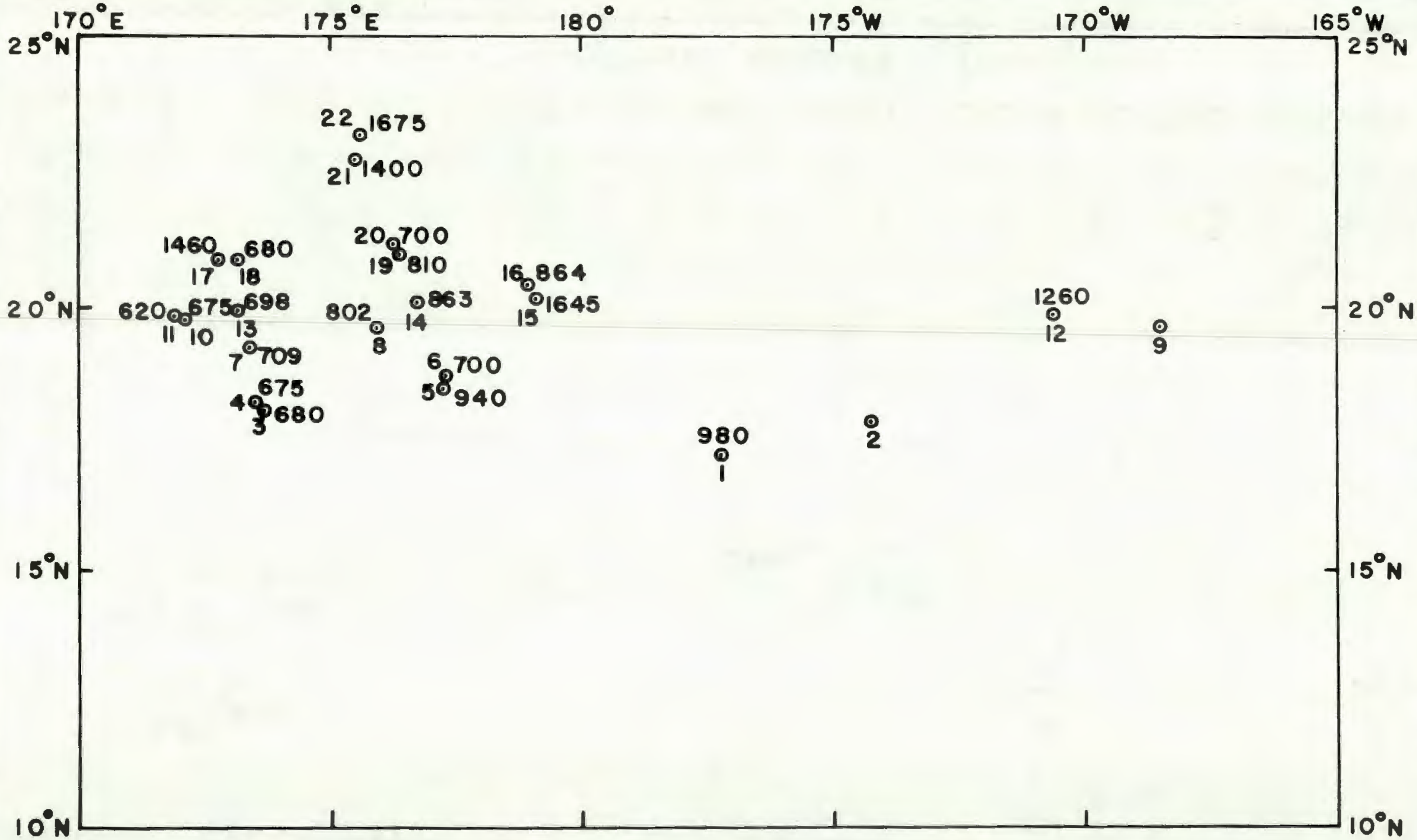

Figure 10. GUYOT LOCATIONS AND DEPTHS TO TOP (Fathoms) from NAVAL OCEANOGRAPHIC OFFICE FILES

features obtained from the Naval Oceanographic Office. Each guyot location and depth in the Mid-Pacific Mountain area contained in this list was also plotted (Figure 10). Finally, the bathymetric charts obtained from the Scripps Institution were examined in detail. The location and the depth of the top contour of each feature that had the visual appearance of a guyot were recorded and this information was plotted. The Scripps charts were considered to contain the most accurate topographic information available and, therefore, were used as the position reference for features classified here as guyots. For each of the above five sources of information, the guyot locations were assigned numbers in order of increasing latitude, and from west to east where more than one was at exactly the same latitude.

The shelf-break depth of each of the five guyots surveyed during the Mid-Pacific Expedition of 1950 is accurately known and these values were accepted here. For the remainder of the guyots, the depth of the shelf break was obtained or estimated from the best available source. In most cases Menard's [1964, p. 139, Figure 6.14] depths were used. When Menard or the other authors did not show a guyot where the Scripps charts indicated the possible existence of one, the position of the feature was recorded and it was assigned a guyot classification, discussed below, based on a careful evaluation of the information available. In these cases the shelf-break depth was taken as 100 fathoms above the top contour shown on the chart, disregarding small, anomalous peaks.

By a comparison of the above sources of information, those features which this investigator believed, with a high degree of confidence, to be guyots were classified as "probable guyots." Those in which this writer had less confidence were called "possible guyots." The remaining features which could still, although with even less confidence, be considered guyots, were called "questionable guyots." A list of the features considered to fall in each of the three categories is presented in Appendix B. The five guyots which were surveyed during the Mid-Pacific Expedition are included by name in the list of probable guyots. Only the probable guyots are dealt with in the remainder of this study.

4.2 Guyot Dimensions.

A summary of the dimensions of the probable guyots is given in Table 1. The guyot shelf-break depths vary from 662 to 1135 fathoms with a mean depth of 830 fathoms. The guyot base depth (see Figure 2) is the mean depth of the topography below the surface at each guyot location, estimated from the contoured mean topography chart (Figure 5). These values represent the depth of the present topography. The guyot base depths range from 1600 to 2500 fathoms with an average depth of 2010 fathoms. The guyot relief is the difference between the guyot base depth and the shelf-break depth for each guyot. The relief represents the depth of the old topography when the guyot was at the surface. The reliefs vary from 840 to 1543 fathoms with a mean value of 1180 fathoms.

4.3 Guyot Provinces.

A visual inspection of Figure 5 reveals that the guyots lie in regional groups on the basis of both proximity and shelf-break depth. Accordingly, the guyots were visually subdivided into western, central, and eastern provinces (see Figure 11). An examination was then made of the distribution of shelf-break depth and guyot relief within each province.

As may be seen in Figure 11, the guyots within the western and central areas have a narrow range of shelf-break depths, although in the

TABLE 1

DIMENSIONS OF PROBABLE GUYOTS

	Depths (Fathoms)		
Guyot No.	Shelf Break	Base[1]	Relief[2]
1	957	2500	1543
2	974	2050	1076
3	700	2100	1400
4	930	1950	1020
5	858	2150	1292
6	853	2200	1347
7	760	1600	840
8	662	1700	1038
9	938	2100	1162
10	700	1950	1250
11	985	1850	865
12	725	1950	1225
13	770	2050	1280
14	1135	2200	1065
15	700	1800	1100
16	700	1800	1100
17	754	2250	1496

[1]Depth of the guyot base is taken as the depth of the contoured mean topography at the guyot location.

[2]Guyot relief, or height of the shelf break above the guyot base, is the difference between columns 2 and 3.

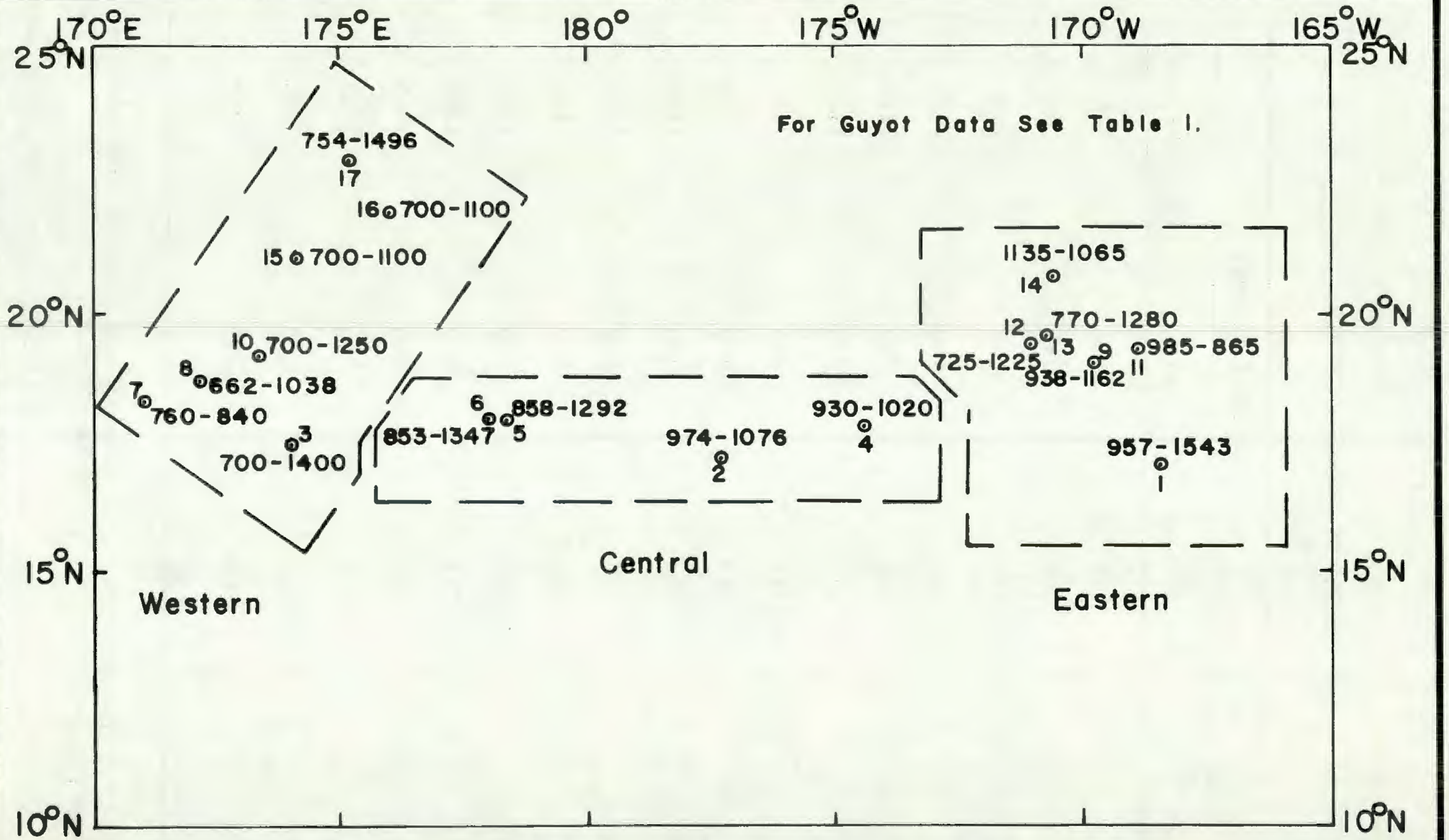

Figure II. SHELF-BREAK DEPTH AND RELIEF WITHIN GUYOT PROVINCES (Depths in Fathoms)

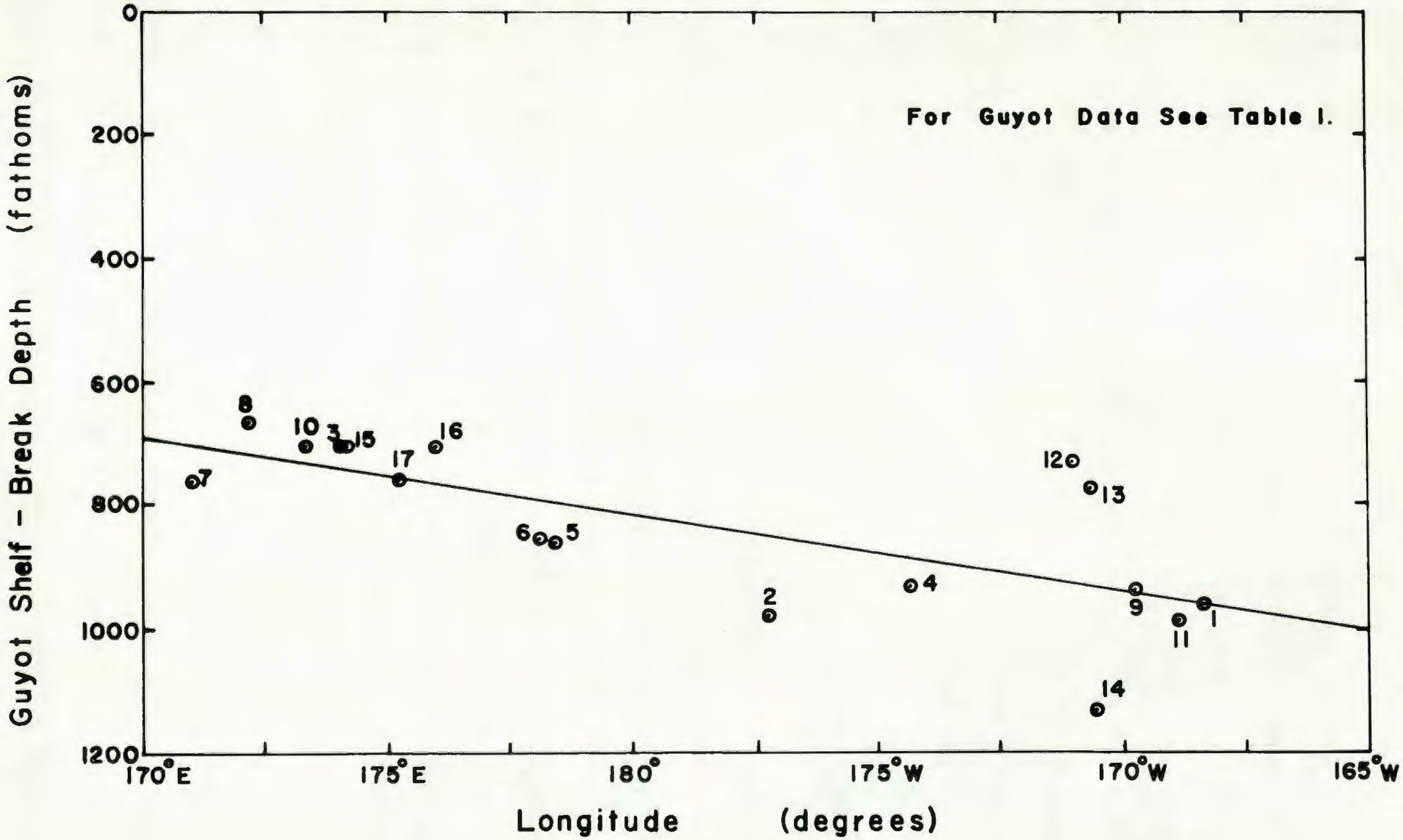

Figure 12. SHELF-BREAK DEPTH VS. LONGITUDE

eastern area they show a large spread. On the other hand, guyot reliefs were found to be irregular within each province. These results do not agree with the general observation of Menard [1964, p. 138] that "Guyot tops are not exactly concordant, and there are wide variations within a region, but most of the guyots in a region have about the same relief above the sea floor."

The possibility was also investigated that the guyot dimensions might have a relationship to fracture zones that can be seen on the Scripps charts to pass through the Mid-Pacific Mountain area and which are also documented in the literature [Menard, 1967]. This was done by comparing the guyot shelf-break depths and guyot reliefs on either side of the fracture zones, but no pattern could be found.

4.4 Regional Tilt of Guyot Tops.

From an examination of Figure 11, it appears that the shelf-break depths in the eastern part of the region are generally deeper than those to the west; accordingly, a graph of shelf-break depth versus longitude for the probable guyots was constructed and is shown in Figure 12. On this graph and on Figure 13 where straight lines are shown fitted to the plotted points, the lines represent least squares fits obtained from computer processing of the data.

Figure 12 shows that the shelf-break depths in the eastern part of the Mid-Pacific Mountains are generally deeper than those to the west. Because of the principally east-west geographical distribution of the guyots, only the east-west component of the depth variation was examined here. This apparent general tilt of the guyot tops amounts to a depth difference of about 200 fathoms over a distance of 1200 nautical miles.

Assuming that the guyot data are accurate, there are two possible explanations for the apparent increase of guyot shelf-break depth from west to east. The first possibility is that the vulcanism may have progressed from east to west so that the guyots to the east are older and have been subsiding for a longer period of time than those to the west. This situation would certainly explain the observed depths and, in fact, does agree with the migration of vulcanism known to have taken place within several island groups in the Pacific, including the Hawaiian Islands [Menard, 1964, p. 79]. It is interesting to note, however, that while the migration of vulcanism in the Hawaiian Islands advanced from northwest to southeast, the pattern for the nearby Mid-Pacific Mountains would have been from east to west.

The second possible explanation for the apparent tilt of the shelf-break depths is that the guyots were all truncated at the surface at roughly the same time, and that the eastern portion of the area has subsided more rapidly than the area to the west due to regional tilting. This explanation would require that vulcanism occur throughout the region more or less simultaneously and that it last only for a geologically brief period. Menard [1964, p. 92] defends the latter assumption. No attempt is made here to explain the possible geologic situation that could have caused the tilt.

This investigator believes that the first possibility, that of migration of the vulcanism from east to west in the Mid-Pacific Mountains, is the more probable explanation of the observed situation. In any event, the overall distribution with longitude will hereafter be referred to as a "regional tilt" of guyot shelf-break depths.

4.5 A Comparison of the Old and New Topography.

In order to compare the present seafloor topography with the topography that existed when the guyots were at the surface, Figure 13 was constructed which includes the three quantities, shelf-break depth, guyot relief, and guyot base depth. The guyot relief represents the depth to the original topography when the guyot was truncated, and the guyot base depth represents the present topography after the subsidence has occurred. The guyot shelf-break depth represents the amount of subsidence of the guyot top. The values in the graph were arranged in order of increasing guyot relief to facilitate comparison between the old and the new topography. This procedure also resulted in a geographically random arrangement of the guyots, which served to average out the effect of the regional tilt of the shelf-break depths.

Figure 13 shows that, on the average, the new topography closely reflects the original topography. It may be noticed, however, that the lower two lines are slightly farther apart at the shallow (left) end of the graph than they are at the deep end. This may indicate that the higher areas of the Mid-Pacific Mountains, where the guyot relief is less, have subsided a bit more than the lower areas, so that the net effect has been to slightly reduce the overall relief of the mountains, although the data here are insufficient to prove this. This conclusion is reasonable since it is likely that high mountain masses tend to settle under their own weight. The scatter of the points about the upper and lower curves may be due partly to differential settling of individual guyots or the local sea floor, partly due to the possibility that the regional tilt has not been completely averaged out, and partly due to inaccuracies in the data.

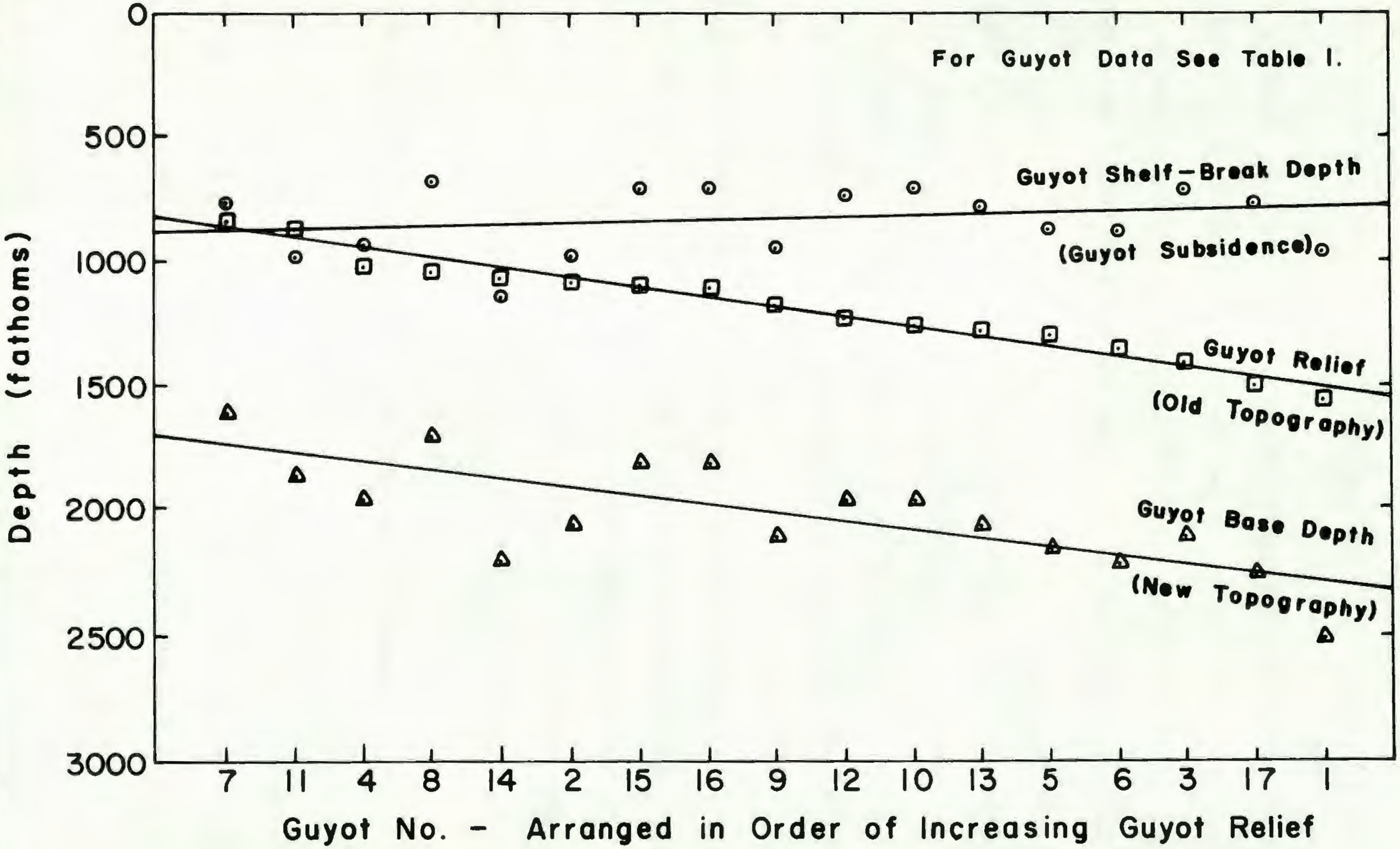

Figure 13. ORDERED GUYOT DIMENSIONS

CHAPTER V

CONCLUSIONS

The contoured mean topography looks, as expected, quite similar to the regular bathymetric charts of the Mid-Pacific Mountain area. The hypsometric curves are exceptionally smooth with no unusual steps or breaks. They are quite similar to Menard and Smith's [1966] curve for a submarine ridge.

The guyot locations and depths found in this study are summarized in Appendix B. Seventeen features were selected as probable guyots, ten as possible guyots, and two as questionable guyots. Only the probable guyots, the dimensions of which are shown in Table 1, are dealt with in this study.

In the Mid-Pacific Mountains, the guyot tops are generally deeper in the eastern part of the area than they are to the west. This apparent regional tilt amounts to about 200 fathoms in 1200 nautical miles. The apparent tilt could be due to progressive vulcanism from east to west in the Mid-Pacific Mountains, or to a higher rate of subsidence toward the east.

The present topography of the Mid-Pacific Mountains resembles quite closely the shape of the old topography when the guyots were at the surface. The data indicate that possibly the tops of the mountains have subsided a bit more than the deeper areas, with a resulting slight decrease in the relief of the mountains, although this is not proven.

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APPENDIX A

HYPSOMETRIC DATA

Depth (Fathoms)	Region No. 1		Region No. 2	
	Area[1]	Percent[2]	Area[1]	Percent[2]
200	0.0	0.00	0.0	0.00
400	10.5	0.00	10.5	0.00
600	92.2	0.01	103.0	0.01
800	3,206.6	0.39	3,530.8	0.32
1000	10,526.2	1.28	11,795.1	1.06
1200	24,989.9	3.04	27,826.6	2.50
1400	49,475.2	6.03	54,625.1	4.92
1600	75,508.4	9.20	83,934.9	7.55
1800	111,121.2	13.54	123,369.9	11.10
2000	150,165.2	18.30	167,084.2	15.04
2200	208,167.2	25.36	234,086.7	21.06
2400	284,463.8	34.66	322,966.2	29.06
2600	377,920.8	46.05	436,069.9	39.24
2800	531,142.3	64.71	641,498.3	57.73
3000	731,386.6	89.11	929,905.1	83.68
3200	820,475.9	99.97	1,102,309.0	99.19
3400	820,748.3	100.00	1,110,540.0	99.93
3600	820,748.3	100.00	1,111,291.0	100.00

[1]Area in square nautical miles.

[2]Percentage of the total area.

APPENDIX B

SUMMARY OF GUYOT DATA

[1]Guyot Number.

[2]From Hess [1946].

[3]From Hamilton [1956].

[4]From Menard [1964, p. 139, Figure 6.14].

[5]Depth of guyot top. In this and the next two columns, the letter following the depth indicates the source of the information: He, H, and M refer to 1, 2, and 3 above; L indicates information from the Naval Oceanographic Office file; T indicates a depth 100 fathoms above the top contour on the Scripps charts; C indicates a depth marked on the Scripps charts; and * is a shelf-break depth estimated from C.

[6]Guyot shelf-break depth.

[7]Depth of the top contour on the Scripps Charts.

							Depths (Fathoms)			
G[1]	He[2]	H[3]	M[4]	Chart	Latitude	Longitude	GT[5]	SB[6]	TC[7]	Remarks
1	6		9	1704	17°04'N	168°24'W	825He	957M	1000	Probable Guyot
2	7	3	10	1804	17°09'N	177°17'W	925H	974H	1000	Cape Johnson Guyot
3				1904	17°28'N	174°01'E	680L?	700T	800	Probable Guyot
4	12	4	12	1804	17°52'N	174°19'W	902H	930H	1000	Hess Guyot
5	9	6	11	1904	17°58'N	178°24'E	860H	858M	1000	Probable Guyot
6	11	5	13	1904	17°59'N	178°04'E	850H	853M	1000	Probable Guyot
7	19?	10	15	1904	18°21'N	171°02'E	760H	760M	800	Probable Guyot
8		11	16	1904	18°45'N	172°10'E	660H	662M	800	Probable Guyot
9				1704	19°02'N	169°46'W	900H	938H	1000	Horizon Guyot (SW Peak)
10	27			1904	19°12'N	173°20'E	650He	700T	800	Probable Guyot
11	31	12	18	1704	19°22'N	168°52'W	774H	985H	1000	Horizon Guyot
12			19	1804	19°28'N	171°01'W	668H	725H	800	Guyot 19171
13				1804	19°35'N	170°42'W	766C	770*	800	Probable Guyot
14			21	1804	20°44'N	170°38'W	1075H	1135H	1200	Guyot 20171

15				1904	21°02'N	174°06'E		700T	800	Probable Guyot
16				1904	21°55'N	175°58'E		700T	800	Probable Guyot
17			24	1904	22°53'N	175°11'E	675L?	754M	800	Probable Guyot
18			1	1703	10°03'N	165°18'W		678M	800	Possible Guyot
19			3	1703	10°24'N	167°09'W		984M	1000	Possible Guyot
20			5	1703	10°52'N	165°30'W		711M	800	Possible Guyot
21		1	6	1703	14°22'N	165°50'W	540He	590He	1000	Possible Guyot
22				1803	15°09'N	170°59'W		700T	800	Possible Guyot
23	16?			1804	18°34'N	175°06'W		500T	600	Possible Guyot
24				1904	19°41'N	176°02'E	802L?	1100T	1200	Possible Guyot
25				1904	19°57'N	176°38'E	863L	900T	1000	Possible Guyot
26				1904	20°00'N	177°11'E		900T	1000	Possible Guyot
27				1904	21°42'N	176°24'E		700T	800	Possible Guyot
28	37	15	20	1904	20°19'N	171°57'E	830H?	1500T	1600	Questionable Guyot
29				1904	22°27'N	176°18'E		1900T	2000	Questionable Guyot

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13. ABSTRACT

A recently contoured set of detailed bathymetric charts of the central Pacific Ocean were obtained from the Scripps Institution of Oceanography. The mean topography of the submerged Mid-Pacific Mountain chain was contoured from mean depths calculated for one-degree squares. The hypsometry of this area was determined. A study of the subsidence of the Mid-Pacific Mountains was made using the guyot information available on the charts and in the literature. The guyot data were examined and the dimensions of the 17 most reliable features were studied. The guyot tops are generally deeper in the eastern part of the area than to the west, with an apparent tilt of about 200 fathoms in 1200 nautical miles. The present topography closely resembles the old topography when the guyots were at the surface. It appears that the tops of the mountains have settled a bit relative to the deeper areas, although this is not proven.

14 KEY WORDS	LINK A		LINK B		LINK C	
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