THE SCOTTISH GEOGRAPHICAL MAGAZINE

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
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VOLUME IV : 1888

EDINBURGH
PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HER MAJESTY
AT THE UNIVERSITY PRESS
1888

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ON THE HEIGHT OF THE LAND AND THE DEPTH OF THE OCEAN.

By JOHN MURRAY, of the *Challenger* Expedition.

Read before the Royal Society of Edinburgh, 19th December 1887.)

I.—THE AREA OF LAND AT DIFFERENT ALTITUDES ABOVE SEA-LEVEL.

AMONG the ancients, Aristotle, Posidonius, Pliny, and other philosophers speculated as to the height of the land and the depth of the sea, but their ideas on the subject were necessarily vague, and they had usually to confess themselves in a special manner ignorant of the depth of the sea. Posidonius stated that the Mediterranean, near Sardinia, had been sounded to 1000 fathoms, which he considered the greatest depth that had ever been attained.

Hu Khaldoun, who flourished in the fourteenth century, remarks that it is a providential arrangement that the highest mountains are situated near the sea, to resist the invasion of the ocean. In general, there is little orographical or bathymetrical information to be gleaned from the writings of the Arabian geographers.

Marsigli,[1] who lived in the latter part of the sixteenth century, combated the view of those who held that the sea had no bottom in some places, and argued that there was a symmetry between the heights of the land and the depths of the ocean, and views similar to his prevailed during last century.

Laplace, in his *Mécanique Céleste*,[2] arrived at the conclusion, from theoretical considerations, that the mean height of the dry land was 3280 feet (1000 mètres), and that the mean depth of the ocean was, likewise, 3280 feet.

The first systematic attempt to estimate the mean altitude of the land above sea-level is due to Humboldt. His method consisted in drawing across the continents a series of vertical sections in parallel planes, in estimating the surface of these planes comprised between the edge of the profile of the soil and a line representing the level of the surface of the

[1] *Physical History of the Sea*, Venice, 1711.

[2] Vol. v. p. 16.

sea. The arithmetical mean height of two successive sections multiplied by the area comprised between the two sections was considered as expressing the volume of the corresponding portion of the continent. All the elementary volumes thus obtained were added together, and the sum divided by the superficial area of the whole continent. In this way, Humboldt obtained for—

Europe	672 feet	(205 mètres)
Asia	1151 „	(351 „)
N. America	748 „	(228 „)
S. America	1132 „	(345 „)

He estimates, thus, the mean height of all continental lands at 1007 feet, or 307 mètres.[1]

In 1874, Leipoldt, after a detailed discussion of the different areas, estimated the mean height of Europe at 974 feet, or 297 mètres.[2]

Reclus[3] discusses the mean height of the various continents, but he does not seem to have made any independent measurements or estimations.

The most recent attempt to estimate the mean height of the land has been made by Lapparent in his *Traité de Géologie.*[4] He proceeded by calculating the area of the surfaces of each zone between contour lines, 0 to 200, 200 to 500, 500 to 1000, 1000 to 2000, and above 2000 mètres on the orographical map in Stieler's Atlas. This he did by laying squared transparent paper over the map, by counting the number of squares comprised between each of the contour lines, calculating the area of each, and then multiplying the areas thus obtained by heights selected for each zone. For the first zone (0 to 200 mètres) he used 100 mètres; for the second (200 to 500), 300 mètres; for the third (500 to 1000), 700 mètres; for the fourth (1000 to 2000), 1300 mètres; and for greater heights his numbers were 2000, 2500, or 3000 mètres according to circumstances. He then obtained the percentage which each zone contributed to each continent. His results were as follows :—

Europe	958 feet	(292 mètres)
Asia	2884 „	(879 „)
Africa	1975 „	(602 „)
N. America	1952 „	(595 „)
S. America	1762 „	(537 „)
Oceania	1188 „	(362 „)
Mean for all the Continents .	2120 „	(646 „)

He obtained a minimum result by taking the lower limit in each zone for the height except in the case of the first (0 to 200), where the height was taken at 100 mètres. His general conclusion is that the mean height of the continental land of the globe is above 1640 feet (500 mètres) and, more probably, near to 1968 feet (600 mètres), being the double of the number previously accepted.

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[1] Humboldt, *Asie Centrale*, Paris, 1843, vol. i. p. 165.

[2] Leipoldt, *Über die mittlere Höhe Europas*, Plauen, 1874, p. 183.

[3] *La Terre*, 4me edit., Paris, 1877, vol. i. pp. 81-83.

[4] 2me edit., Paris, 1885, p. 63.

In the present paper an attempt is made to give a numerical expression to the areas of land at different levels above, and of the ocean's floor at different depths below the surface of the sea, as well as to the bulk of the dry land, and the bulk of the waters of the ocean, with their mean height and depth.

It is at once evident that the data for any very accurate computation are not available, yet the records of travellers, of deep-sea expeditions, and the hydrographic surveys of various nations have of late years furnished much information for the construction of orographical maps and bathymetrical charts of the world. The following results, although only approximate, will, however, do much to render our ideas more definite; in consequence of these numerical statements, it will be all the more easy to point out those regions in which the estimates are most at fault, and the foundation may thus be laid for still more precise and accurate evaluations.

The available data as to the heights of the land and the depths of the sea have been placed on large maps constructed according to Lambert's Equivalent Surface Projection,[1] and from these contour lines have been drawn, as shown on the accompanying maps, which are reduced from those used in the investigations.[2]

The planimeter was used to ascertain the areas included within the contour lines; the results obtained were then calculated in square miles; the following tables give the general results.

[3] TABLE 1.—SUPERFICIAL AREA OF THE LAND OF THE GLOBE AT VARIOUS ELEVATIONS ABOVE THE SEA.

EUROPE.

(Including the British, Mediterranean, and Baltic Islands.)

Height in Feet.				Square Miles.
Below Sea-level				65,050
Between	0 and	600		1,975,550
,,	600 ,,	1,500		991,800
,,	1,500 ,,	3,000		362,000
,,	3,000 ,,	6,000		205,150
,,	6,000 ,,	12,000		62,800
,,	12,000 ,,	18,000		6,950
Over		18,000		800
				3,670,100

[1] *Scottish Geographical Magazine*, vol. ii. p. 549.

[2] In the collection of the latest information as to the heights of land, and in the construction of the maps themselves, I have been much indebted for assistance to Mr. J. G. Bartholomew. The depths are taken from the most recent hydrographic charts issued by our own Hydrographic Office, and those of other nations.

[3] These tables give the results of the first of three sets of measurements proposed to be made on four maps with different central points (see Drainage Areas, *Scot. Geog. Mag.*, vol. ii. p. 549). I will be obliged if any one interested in the subject will point out to me errors, or send suggestions as to estimates of areas, heights, or depths.

ASIA.

(Including Ceylon.)

Height in Feet.				Square Miles.
Below Sea-level				232,300
Between	0	and	600	3,817,200
,,	600	,,	1,500	2,603,700
,,	1,500	,,	3,000	3,551,950
,,	3,000	,,	6,000	3,558,200
,,	6,000	,,	12,000	1,635,300
,,	12,000	,,	18,000	826,550
,,	18,000	,,	24,000	135,500
Over			24,000	7,800
				16,368,500

AFRICA.

Height in Feet.				Square Miles.
Below Sea-level				16,300
Between	0	and	600	1,393,750
,,	600	,,	1,500	3,859,850
,,	1,500	,,	3,000	3,066,200
,,	3,000	,,	6,000	2,415,800
,,	6,000	,,	12,000	317,550
,,	12,000	,,	18,000	21,700
Over			18,000	1,600
				11,092,750

NORTH AMERICA.

(Including Newfoundland, the Aleutian Islands, the Arctic Islands, except Greenland, Iceland, Spitzbergen, and Nova Zembla.)

Height in Feet.				Square Miles.
Below Sea-level				3,900
Between	0	and	600	2,462,300
,,	600	,,	1,500	2,450,550
,,	1,500	,,	3,000	1,015,900
,,	3,000	,,	6,000	1,014,750
,,	6,000	,,	12,000	642,700
,,	12,000	,,	18,000	31,800
Over			18,000	1,150
				7,623,050

SOUTH AMERICA.

(Including Tierra del Fuego and Falkland Islands.)

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	2,725,550
,,	600 ,,	1,500	. . . .	1,842,850
,,	1,500 ,,	3,000	. . . .	1,151,000
,,	3,000 ,,	6,000	. . . .	483,700
,,	6,000 ,,	12,000	. . . .	346,950
,,	12,000 ,,	18,000	. . . .	280,350
Over		18,000	. . . .	31,000
				6,861,400

AUSTRALIA.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	896,300
,,	600 ,,	1,500	. . . .	1,935,700
,,	1,500 ,,	3,000	. . . .	123,900
,,	3,000 ,,	6,000	. . . .	46,500
Over		6,000	. . . .	11,650
				3,014,050

EAST INDIES.

(Including Sumatra, Java, Borneo, New Guinea, Philippines, Celebes, and smaller islands of Polynesia.)

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	305,850
,,	600 ,,	1,500	. . . .	185,650
,,	1,500 ,,	3,000	. . . .	282,450
,,	3,000 ,,	6,000	. . . .	255,550
,,	6,000 ,,	12,000	. . . .	59,300
,,	12,000 ,,	18,000	. . . .	2,700
Over		18,000	. . . .	800
				1,092,300

WEST INDIES.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	46,450
,,	600 ,,	1,500	. . . .	42,600
,,	1,500 ,,	3,000	. . . .	13,600
,,	3,000 ,,	6,000	. . . .	1,150
Over		6,000	. . . .	800
				104,600

MADAGASCAR.

Height in Feet.				Square Miles.
Between	0	and	600	73,600
,,	600	,,	1,500	27,100
,,	1,500	,,	3,000	42,600
,,	3,000	,,	6,000	60,000
Over			6,000	17,400
				220,700

NEW ZEALAND.

Height in Feet.				Square Miles.
Between	0	and	600	15,550
,,	600	,,	1,500	34,850
,,	1,500	,,	3,000	34,900
,,	3,000	,,	6,000	18,600
,,	6,000	,,	12,000	4,700
Over			12,000	1,550
				110,150

JAPAN.

Height in Feet.				Square Miles.
Between	0	and	600	11,600
,,	600	,,	1,500	73,550
,,	1,500	,,	3,000	50,300
,,	3,000	,,	6,000	4,300
,,	6,000	,,	12,000	1,150
Over			12,000	400
				141,300

FORMOSA.

Height in Feet.				Square Miles.
Between	0	and	600	1,950
,,	600	,,	1,500	11,600
,,	1,500	,,	3,000	3,900
,,	3,000	,,	6,000	1,950
,,	6,000	,,	12,000	1,950
Over			12,000	800
				22,150

SAGHALIEN.

Height in Feet.				Square Miles.
Between	0	and	600	1,950
,,	600	,,	1,500	21,300
,,	1,500	,,	3,000	9,750
Over			3,000	9,600
				42,600

GREENLAND.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	143,300
,,	1,500 ,,	3,000	. . . .	147,150
,,	3,000 ,,	6,000	. . . .	619,400
Over		6,000	. . . .	4,700
				914,550

NOVA ZEMBLA.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	11,600
,,	1,500 ,,	3,000	. . . .	7,750
Over		3,000	. . . .	16,300
				35,650

SPITZBERGEN.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	27,100
,,	1,500 ,,	3,000	. . . .	3,500
Over		3,000	. . . .	400
				31,000

ICELAND.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	7,750
,,	600 ,,	1,500	. . . .	7,750
,,	1,500 ,,	3,000	. . . .	11,600
,,	3,000 ,,	6,000	. . . .	6,950
Over		6,000	. . . .	800
				34,850

TASMANIA.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	11,600
,,	600 ,,	1,500	. . . .	13,550
,,	1,500 ,,	3,000	. . . .	3,900
Over		3,000	. . . .	1,950
				31,000

SUMMARY.

Height in Feet.				Square Miles.
Between	0	and	600	13,746,950
,,	600	,,	1,500	14,284,400
,,	1,500	,,	3,000	9,882,350
,,	3,000	,,	6,000	8,720,250
,,	6,000	,,	12,000	3,107,750
,,	12,000	,,	18,000	1,172,800
,,	18,000	,,	24,000	170,850
Over			24,000	7,800
				51,093,150
Below Sea-level				317,550
				51,410,700

From the above tables we arrive at the following percentages for the areas of land in the different zones of height:—

Height in Feet.				Percentages.
Below Sea-level				0·618
Between	0	and	600	26·741
,,	600	,,	1,500	27·784
,,	1,500	,,	3,000	19·222
,,	3,000	,,	6,000	16·962
,,	6,000	,,	12,000	6·045
,,	12,000	,,	18,000	2·281
,,	18,000	,,	24,000	0·332
Over			24,000	0·015
				100·000

It thus appears that over 54 per cent. of the land lies between the sea-level and 1500 feet; over 36 per cent. between 1500 and 6000 feet; while over 6000 feet there is less than 9 per cent. This is without taking into consideration land which may exist in the Arctic and Antarctic regions. I have elsewhere given reasons for supposing that the Antarctic Continent should be estimated at about 3,500,000 square miles, while the unknown Arctic regions should be regarded as occupied by the waters of the ocean.[1]

The following Table (2.), showing the area and height of land in each ten degrees of latitude north and south of the Equator, brings out some

[1] *Scottish Geographical Magazine*, vol. ii. pp. 527 and 548.

interesting facts, especially with reference to the large amount of land at a high level between the Equator and 40° north latitude.

TABLE 2.—SUPERFICIAL AREA OF THE LAND OF THE GLOBE AT DIFFERENT ELEVATIONS AND BETWEEN EACH TEN DEGREES OF LATITUDE.

LATITUDES 80°—90° N.

Height in Feet.				Square Miles.
Between	0	and	600	.....
„	600	„	1,500	31,000
„	1,500	„	3,000	23,250
Over			3,000	58,050
				112,300

LATITUDES 70°—80° N.

Height in Feet.				Square Miles.
Between	0	and	600	535,400
„	600	„	1,500	314,350
„	1,500	„	3,000	82,900
„	3,000	„	6,000	441,750
Over			6,000	4,700
				1,379,100

LATITUDES 60°—70° N.

Height in Feet.				Square Miles.
Between	0	and	600	2,357,650
„	600	„	1,500	1,362,800
„	1,500	„	3,000	762,650
„	3,000	„	6,000	272,550
„	6,000	„	12,000	9,000
Over			12,000	1,950
				4,766,600

LATITUDES 50°—60° N.

Height in Feet.				Square Miles.
Below Sea-level				3,100
Between	0	and	600	1,974,400
„	600	„	1,500	1,583,400
„	1,500	„	3,000	774,250
„	3,000	„	6,000	754,900
„	6,000	„	12,000	205,950
Over			12,000	3,900
				5,299,900

LATITUDES 40°—50° N.

Height in Feet.				Square Miles.
Below Sea-level				220,700
Between	0	and	600	1,453,700
,,	600	,,	1,500	1,457,600
,,	1,500	,,	3,000	1,025,500
,,	3,000	,,	6,000	1,382,500
,,	6,000	,,	12,000	605,900
,,	12,000	,,	18,000	71,650
Over		,,	18,000	7,750
				6,225,300

LATITUDES 30°—40° N.

Height in Feet.				Square Miles.
Below Sea-level				85,200
Between	0	and	600	1,037,600
,,	600	,,	1,500	960,100
,,	1,500	,,	3,000	1,149,850
,,	3,000	,,	6,000	1,337,550
,,	6,000	,,	12,000	1,107,250
,,	12,000	,,	18,000	646,500
,,	18,000	,,	24,000	108,400
Over			24,000	3,900
				6,436,350

LATITUDES 20°—30° N.

Height in Feet.				Square Miles.
Below Sea-level				7,750
Between	0	and	600	1,078,200
,,	600	,,	1,500	1,757,600
,,	1,500	,,	3,000	1,409,250
,,	3,000	,,	6,000	979,550
,,	6,000	,,	12,000	379,450
,,	12,000	,,	18,000	138,250
,,	18,000	,,	24,000	19,350
Over			24,000	3,900
				5,773,300

LATITUDES 10°—20° N.

Height in Feet.				Square Miles.
Below Sea-level				800
Between	0	and	600	720,150
,,	600	,,	1,500	1,643,450
,,	1,500	,,	3,000	1,263,250
,,	3,000	,,	6,000	519,550
,,	6,000	,,	12,000	118,150
Over			12,000	12,750
				4,278,100

LATITUDES 0°—10° N.

Height in Feet.				Square Miles.
Between	0	and	600	747,250
,,	600	,,	1,500	1,134,150
,,	1,500	,,	3,000	1,062,550
,,	3,000	,,	6,000	667,900
,,	6,000	,,	12,000	208,400
,,	12,000	,,	18,000	10,850
Over			18,000	800
				3,831,900

LATITUDES 0°—10° S.

Height in Feet.				Square Miles.
Between	0	and	600	1,494,350
,,	600	,,	1,500	847,850
,,	1,500	,,	3,000	642,650
,,	3,000	,,	6,000	805,250
,,	6,000	,,	12,000	127,000
,,	12,000	,,	18,000	51,500
Over			18,000	4,700
				3,973,300

LATITUDES 10°—20° S.

Height in Feet.				Square Miles.
Between	0	and	600	729,900
,,	600	,,	1,500	979,550
,,	1,500	,,	3,000	855,600
,,	3,000	,,	6,000	778,200
,,	6,000	,,	12,000	133,950
,,	12,000	,,	18,000	140,950
Over			18,000	11,600
				3,629,750

LATITUDES 20°—30° S.

Height in Feet.				Square Miles.
Between	0	and	600	785,950
,,	600	,,	1,500	1,440,150
,,	1,500	,,	3,000	634,950
,,	3,000	,,	6,000	462,650
,,	6,000	,,	12,000	127,350
,,	12,000	,,	18,000	87,550
Over			18,000	11,600
				3,550,200

LATITUDES 30°—40° S.

Height in Feet.				Square Miles.
Between	0	and	600	720,100
,,	600	,,	1,500	561,400
,,	1,500	,,	3,000	123,950
,,	3,000	,,	6,000	189,000
,,	6,000	,,	12,000	53,150
,,	12,000	,,	18,000	7,750
Over			18,000	3,900
				1,659,250

LATITUDES 40°—50° S.

Height in Feet.				Square Miles.
Between	0	and	600	96,800
,,	600	,,	1,500	168,400
,,	1,500	,,	3,000	62,000
,,	3,000	,,	6,000	56,200
,,	6,000	,,	12,000	23,250
Over			12,000	1,550
				408,200

LATITUDES 50°—60° S.

Height in Feet.				Square Miles.
Between	0	and	600	15,500
,,	600	,,	1,500	42,600
,,	1,500	,,	3,000	19,350
,,	3,000	,,	6,000	6,600
Over			6,000	3,100
				87,150

LATITUDES 60°—90° S.

	Square Miles.
Antarctic Continent	3,565,550

II.—The Area of the Floor of the Ocean at Various Depths below the Level of the Sea.

In considering the extent of the various areas of the floor of the ocean at different levels beneath the surface of the sea, the same methods have been employed as in estimating the height and areas of the dry land.

In the following table, fathoms are used for indicating the contour lines, yet these are drawn at the same distances apart, as in the case of the land—100 fathoms being equal to 600 feet, 500 equal to 3000 feet, 1000 equal to 6000 feet; the line of 250 fathoms, corresponding to 1500 feet, is, however, omitted.

TABLE 3.

NORTH ATLANTIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	1,068,500
,,	100	,,	500	735,550
,,	500	,,	1,000	534,250
,,	1,000	,,	2,000	3,391,300
,,	2,000	,,	3,000	7,332,400
,,	3,000	,,	4,000	1,273,700
Over			4,000	7,750
				14,343,450

SOUTH ATLANTIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	402,600
,,	100	,,	500	278,700
,,	500	,,	1,000	178,100
,,	1,000	,,	2,000	1,366,600
,,	2,000	,,	3,000	6,883,300
Over			3,000	1,084,000
				10,193,300

GULF OF MEXICO.

Fathoms.				Square Miles.
Between	0	and	100	247,750
,,	100	,,	500	151,000
,,	500	,,	1,000	69,700
,,	1,000	,,	2,000	189,700
Over			2,000	58,050
				716,200

CARIBBEAN SEA.

Fathoms.				Square Miles.
Between	0	and	100	147,100
,,	100	,,	500	212,950
,,	500	,,	1,000	193,550
,,	1,000	,,	2,000	383,250
,,	2,000	,,	3,000	216,800
Over			3,000	7,750
				1,161,400

NORTH SEA.

Fathoms.				Square Miles.
Between	0	and	100	154,850
Over			100	7,750
				162,600

ENGLISH CHANNEL.

Fathoms.			Square Miles.
Between	0 and	100	30,950

BALTIC SEA.

Fathoms.			Square Miles.
Between	0 and	100	189,700
Over		100	5,800
			195,500

MEDITERRANEAN SEA.

Fathoms.			Square Miles
Between	0 and	100	201,300
,,	100 ,,	500	251,650
,,	500 ,,	1,000	81,300
,,	1,000 ,,	2,000	263,250
Over		2,000	15,500
			813,000

BLACK SEA and SEA OF AZOV.

Fathoms.			Square Miles.
Between	0 and	100	69,700
,,	100 ,,	500	23,200
,,	500 ,,	1,000	7,750
Over		1,000	38,700
			139,350

NORWEGIAN SEA.

Fathoms.			Square Miles.
Between	0 and	100	154,850
,,	100 ,,	500	332,950
,,	500 ,,	1,000	185,800
,,	1,000 ,,	2,000	437,450
Over		2,000	15,500
			1,126,550

ARCTIC OCEAN.[1]

(Excluding Norwegian Sea, and including Hudson's Bay.)

Fathoms.			Square Miles.
Between	0 and	100	1,195,300
,,	100 ,,	500	1,195,350
,,	500 ,,	1,000	1,195,250
Over		1,000	1,195,250
			4,781,150

[1] See note on p. 18.

INDIAN OCEAN.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	840,100
,,	100 ,,	500	. . . .	762,650
,,	500 ,,	1,000	. . . .	503,300
,,	1,000 ,,	2,000	. . . .	1,595,000
,,	2,000 ,,	3,000	. . . .	13,344,600
Over		3,000	. . . .	38,700
				17,084,350

RED SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	61,950
,,	100 ,,	500	. . . .	46,450
,,	500 ,,	1,000	. . . .	48,400
Over		1,000	. . . .	1,950
				158,750

PERSIAN GULF.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	77,450

NORTH PACIFIC OCEAN.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	437,450
,,	100 ,,	500	. . . .	286,500
,,	500 ,,	1,000	. . . .	309,700
,,	1,000 ,,	2,000	. . . .	1,792,450
,,	2,000 ,,	3,000	. . . .	22,364,900
,,	3,000 ,,	4,000	. . . .	1,420,800
Over		4,000	. . . .	92,900
				26,704,700

SOUTH PACIFIC OCEAN.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	232,300
,,	100 ,,	500	. . . .	518,750
,,	500 ,,	1,000	. . . .	731,700
,,	1,000 ,,	2,000	. . . .	4,262,350
,,	2,000 ,,	3,000	. . . .	17,119,200
Over		3,000	. . . .	739,450
				23,603,750

BEHRING SEA.

Fathoms.				Square Miles.
Between	0	and	100	383,250
,,	100	,,	500	77,450
,,	500	,,	1,000	54,200
Over			1,000	344,550
				859,450

SEA OF OKOTSK.

Fathoms.				Square Miles.
Between	0	and	100	181,950
,,	100	,,	500	189,700
Over			500	170,350
				542,000

SEA OF JAPAN.

Fathoms.				Square Miles.
Between	0	and	100	135,500
,,	100	,,	500	73,550
,,	500	,,	1,000	77,450
Over			1,000	89,050
				375,550

YELLOW SEA.

Fathoms.				Square Miles.
Between	0	and	100	371,650
,,	100	,,	500	92,950
Over			500	3,850
				468,450

CHINA SEA.

Fathoms.				Square Miles.
Between	0	and	100	669,750
,,	100	,,	500	205,200
,,	500	,,	1,000	228,400
,,	1,000	,,	2,000	240,000
Over			2,000	23,250
				1,366,600

CELEBES SEA.

Fathoms.				Square Miles.
Between	0	and	100	34,850
,,	100	,,	500	23,250
,,	500	,,	1,000	23,250
,,	1,000	,,	2,000	30,950
Over			2,000	69,650
				181,950

SULU SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	77,450
,,	100 ,,	500	. . . .	30,950
,,	500 ,,	1,000	. . . .	11,600
,,	1,000 ,,	2,000	. . . .	38,700
Over		2,000	. . . .	15,500
				174,200

BANDA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	58,050
,,	100 ,,	500	. . . .	162,600
,,	500 ,,	1,000	. . . .	73,550
,,	1,000 ,,	2,000	. . . .	92,900
,,	2,000 ,,	3,000	. . . .	29,050
,,	3,000 ,,	4,000	. . . .	3,900
Over		4,000	. . . .	1,950
				422,000

JAVA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	309,700
,,	100 ,,	500	. . . .	49,950
Over		500	. . . .	400
				360,050

ARAFURA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	487,800
,,	100 ,,	500	. . . .	42,600
,,	500 ,,	1,000	. . . .	23,000
Over		1,000	. . . .	11,600
				565,200

SOUTHERN OCEAN.[1]

(South of Pacific Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	143,250
,,	100 ,,	500	. . . .	178,100
,,	500 ,,	1,000	. . . .	197,450
,,	1,000 ,,	2,000	. . . .	5,017,300
,,	2,000 ,,	3,000	. . . .	4,405,600
Over		3,000	. . . .	336,800
				10,278,500

[1] See note on p. 18.

SOUTHERN OCEAN.[1]
(South of Indian Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	243,900
,,	100 ,,	500	. . . .	116,150
,,	500 ,,	1,000	. . . .	189,700
,,	1,000 ,,	2,000	. . . .	6,298,700
Over		2,000	. . . .	2,524,150
				9,372,600

SOUTHERN OCEAN.
(South of Atlantic Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	418,100
,,	100 ,,	500	. . . .	220,650
,,	500 ,,	1,000	. . . .	274,150
,,	1,000 ,,	2,000	. . . .	1,022,050
,,	2,000 ,,	3,000	. . . .	3,244,200
,,	3,000 ,,	4,000	. . . .	1,285,300
Over		4,000	. . . .	42,600
				6,507,750

ANTARCTIC OCEAN.[2]

Fathoms.				Square Miles.
Between	0 and	100	. . . .	1,108,200
,,	100 ,,	500	. . . .	1,108,200
,,	500 ,,	1,000	. . . .	1,108,150
Over		1,000	. . . .	1,108,150
				4,432,700

[1] The Southern Ocean as here defined is that belt of water extending from the Antarctic Circle to the latitude of 40° S., which latitude is looked upon as the southern boundary of the Pacific, Indian, and Atlantic Oceans.

[2] The figures for the Arctic and Antarctic Oceans are obtained by dividing the superficial area equally into the four zones of depth as shown.

SUMMARY.

Showing the Areas of the Chief Sub-divisions of the Ocean.

Ocean.	Square Miles.	Square Miles.
ATLANTIC OCEAN BASIN—		
North Atlantic,	14,343,450	
South Atlantic,	10,193,300	
Gulf of Mexico,	716,200	
Caribbean Sea,	1,161,400	
North Sea,	162,600	
English Channel,	30,950	
Baltic Sea,	195,500	
Mediterranean Sea,	813,000	
Black Sea,	139,350	
Norwegian Sea,	1,126,550	
Arctic Ocean,	4,781,150	
		33,633,450
PACIFIC OCEAN BASIN—		
North Pacific,	26,704,700	
South Pacific,	23,603,750	
Behring Sea,	859,450	
Sea of Okotsk,	542,000	
Sea of Japan,	375,550	
Yellow Sea,	468,450	
China Sea,	1,366,600	
Celebes Sea,	181,950	
Sulu Sea,	174,200	
Banda Sea,	422,000	
Java Sea,	360,050	
Arafura Sea,	565,200	
		55,623,900
INDIAN OCEAN BASIN—		
Indian Ocean,	17,084,350	
Red Sea,	158,750	
Persian Gulf,	77,450	
		17,320,550
SOUTHERN AND ANTARCTIC OCEANS BASIN—		
Southern Ocean (South of Pacific),	10,278,500	
Southern Ocean (South of Indian),	9,372,600	
Southern Ocean (South of Atlantic),	6,507,750	
Antarctic Ocean,	4,432,700	
		30,591,550
		137,199,450

SUMMARY.

Showing the extent of the Areas of the Ocean's Floor at different Levels in each of the Chief Sub-divisions of the Ocean.

Fathoms.	Atlantic Ocean Basin. Sq. Miles.	Pacific Ocean Basin. Sq. Miles.	Indian Ocean Basin. Sq. Miles.	Southern and Antarctic Oceans Basin. Sq. Miles.	Total. Sq. Miles.	Percentages.
Between 0 and 100	3,862,600	3,379,700	979,500	1,913,450	10,135,250	7·387
,, 100 ,, 500	3,194,900	1,753,450	809,100	1,623,100	7,380,550	5·379
,, 500 ,, 1,000	2,445,700	1,707,650	551,700	1,770,150	6,475,200	4·719
,, 1,000 ,, 2,000	7,265,500	6,902,550	1,596,950	13,446,200	29,211,200	21·292
,, 2,000 ,, 3,000	14,521,550	39,621,550	13,344,600	10,173,950	77,661,650	56·605
,, 3,000 ,, 4,000	2,365,150	2,164,150	38,700	1,622,100	6,190,400	4·512
Over 4,000	7,750	94,850		42,600	145,200	0·106
Total, . . .	33,663,450	55,623,900	17,320,550	30,591,550	137,199,450	100·000

The contrast between the percentages of the ocean's floor at different depths is interesting when compared with the percentages of the land above sea-level referred to on page 8. Only 17·4 per cent. of the sea-bed is found at depths less than 6000 feet (1000 fathoms), while over 90 per cent. of the land areas is at a less height than 6000 feet above the sea. Again 77·8 per cent. of the floor of the ocean lies between 6000 feet (1000 fathoms), and 18,000 feet (3000 fathoms), and 4·6 per cent. is deeper than 18,000 feet (3000 fathoms). The relatively rapid descent of the sea-bottom in depths between 100 and 1000 fathoms is thus clearly shown in the above tables, only about 10 per cent. of the ocean's bed being found between these depths.

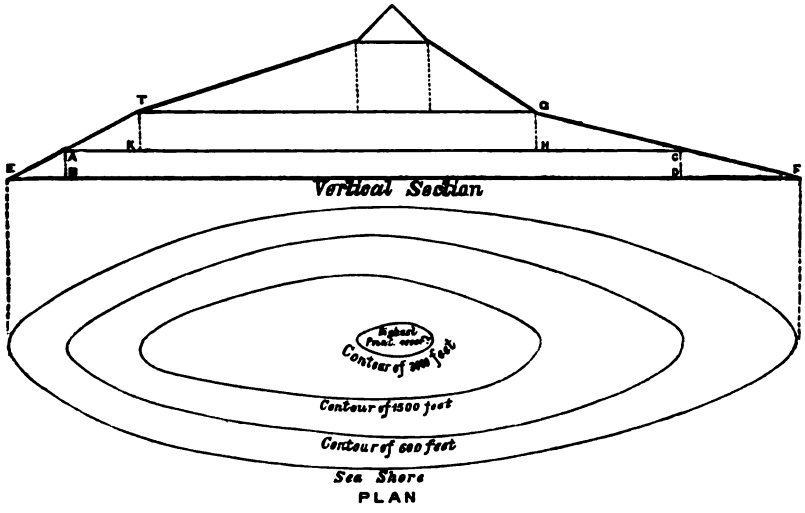
If we regard the abysmal regions as those at greater depths than 6000 feet (1000 fathoms), then according to these measurements they occupy about 113,000,000 square miles of the earth's surface, and the transitional area [1] occupies about 24,000,000 square miles; while the dry land occupies 55,000,000 square miles of the earth's surface.

III.—Bulk and Mean Height of the Land of the Globe.

From the data in the foregoing tables it is possible to estimate approximately the bulk of the lan and the volume of the ocean, and thence to calculate the mean height of the one and the mean depth of the other. Let us suppose the annexed diagram to represent a large island or continent. The area between the sea shore and the contour line of 600 feet being known, as also the areas between each of the higher contour lines, then by multiplying the total area within the 600 feet contour (*i.e.* the area of land higher than 600 feet), by 600 feet, we get the cubic contents of a

[1] See Great Ocean Basins, *Nature*, vol. xxxii., pp. 581, 611.

cylindrical mass reaching from a line representing the sea-level to a height of 600 feet, represented by A B D C in the section, and called cylinder in the following tables. In order to obtain the bulk of all the land between the sea-level and 600 feet above it in such an island,



there is still to be added to this cylinder the quoit-like mass surrounding the island, contained between the slope from sea-level to 600 feet, the line of sea-level and the edge of the cylinder—E A B and F C D in the section.

On the supposition that it is a portion of a cone, it is easy to show [1]

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[1] If A_1 and A_2 be the areas of the two ends of any conical frustum (not necessarily a frustum of a circular or other regular cone), and h the height of the frustum, *i.e.* the distance between the two parallel ends, then the volume is accurately given by the formula

$$\tfrac{1}{3}h\{A_1+\sqrt{(A_1A_2)}+A_2\}.$$

Hence, if V denote the volume of the quoit-shaped piece, left after removing the cylinder, whose ends are each A_2, and whose height is h, we have

$$\begin{aligned} V&=\tfrac{1}{3}h\{A_1+\sqrt{(A_1A_2)}-2A_2\},\\ &=k(A_1-A_2),\end{aligned}$$

where $$k=\tfrac{1}{3}h(A_1+\sqrt{(A_1A_2)}-2A_2)/(A_1-A_2).$$

Here k is the linear magnitude by which we must multiply the area of the base of the quoit to get its volume.

Now
$$\begin{aligned} k&=\tfrac{1}{3}h\{A_1-A_2+\sqrt{(A_1A_2)}-A_2\}/(A_1-A_2),\\ &=\tfrac{1}{3}h\{1+\sqrt{A_2}(\sqrt{A_1}-\sqrt{A_2})/(A_1-A_2)\},\\ &=\tfrac{1}{3}h\{1+\sqrt{A_2}/(\sqrt{A_1}+\sqrt{A_2})\},\\ &=\tfrac{1}{3}h\{1+c/(c+1)\},\end{aligned}$$

where $$c=\sqrt{A_2}/\sqrt{A_1}.$$

Hence
$$\begin{aligned} k&=h(1+2c)/3(1+c),\\ k/h&=(1+2c)/3(1+c).\end{aligned}$$

This last formula shows that, if c be very small—that is to say, if the aperture of the quoit be very small compared with the area of its outer (lower) rim, the ratio of k to h approaches 1/3. If, on the other hand, c be very nearly equal to unity—that is, if the aperture of the quoit be nearly equal to the area of its outer rim, the ratio k to h approaches 1/2.

that the volume of this quoit-like mass can be obtained by multiplying the area of its base by a number which will never be greater than a half, and never less than a third, of the height. The greater the area of the base the more nearly will one-third the height give a correct result, while the less the area between the two contour lines the more nearly will one-half the height into the area of the base represent the true volume. In other words, the height to be taken depends on the ratio between the total areas included within these upper and lower contour lines. Such a uniformity as we have above supposed in the slope of the land nowhere exists in nature, yet by taking one-third the height it is probable that we will not be far from the truth in estimating the volume of this region. The valleys and hills existing between contours render any exact estimate out of the question. It is probable that in the zones below 3000 feet one-third the height will give results near, but probably below, the truth, while above 3000 feet (where only about a quarter of the area of the land is found) it may not be too high a number. Lapparent uses one-half the height in estimating the region between sea-level and 600 feet, having regard in adopting this number to the many regions where the sea is faced by high cliffs. We might present the matter at present under consideration to ourselves thus:—Suppose a great many lines drawn from the sea-shore to a contour line of 600 feet surrounding an island or continent, these lines would pass through hills in some cases, and over valleys in other instances, and the question is, would the land cut off by or above these lines be sufficient to fill up the hollows beneath them?

On the whole, it is unlikely that, in using one-third the height in calculating the contents of the quoit-like segments, too high a number will be arrived at for the bulk of the land; it is probably less than the truth. In the following tables a second estimate is given, in which lower fractions of the height are taken in all the higher zones, and this product is added to the mass of the cylindrical section. The result thus obtained must certainly be regarded as, in all cases, much below the truth. The fractions used in calculating the slope contents are, in the tables, placed in brackets after the products. The cubic contents of the higher zones are found in the same way as described for that below 600 feet. For instance, the area above 1500 feet into 900 feet gives the volume of the cylinder for the zone between 600 feet and 1500 feet, and the area between the contours of 600 and 1500 feet into a third of 900 feet (300) gives the contents of the slope (H G T K + G H C and T K A in the section). The contents of the highest zone are ascertained by multiplying the area by one-third of the height of the highest mountain in that zone above the last contour line. The results for the various larger divisions of land are given in the following tables.

TABLE 4.—Cubic Contents of the Land of the Globe at different Altitudes above the Level of the Sea.

EUROPE. (Highest point, Mount Elbruz, 18,544 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	185,150	74,800 ($\frac{1}{3}$)	56,150 ($\frac{1}{4}$)	259,950	241,300
,, 600 ,, 1,500	108,700	56,350 ($\frac{1}{3}$)	33,800 ($\frac{1}{5}$)	165,050	142,500
,, 1,500 ,, 3,000	78,350	34,300 ($\frac{1}{3}$)	17,150 ($\frac{1}{6}$)	112,600	95,450
,, 3,000 ,, 6,000	40,100	38,850 ($\frac{1}{3}$)	16,700 ($\frac{1}{7}$)	78,950	56,800
,, 6,000 ,,12,000	8,800	23,750 ($\frac{1}{3}$)	8,900 ($\frac{1}{8}$)	32,600	17,750
,, 12,000 ,,18,000	900	2,650 ($\frac{1}{3}$)	900 ($\frac{1}{9}$)	3,550	1,800
Over 18,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{10}$)	50	10
	422,000	230,750	133,610	652,750	555,610

Mean height—First Estimate, 939 feet. Second Estimate, 799 feet.
Below sea-level—area, 65,050 square miles × 25 feet. Minus quantity, 308·00 cubic miles.

ASIA. (Highest point, Mount Everest, 29,002 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	1,399,850	182,000 ($\frac{1}{3}$)	108,450 ($\frac{1}{4}$)	1,581,850	1,508,300
,, 600 ,, 1,500	1,655,950	147,950 ($\frac{1}{3}$)	88,750 ($\frac{1}{5}$)	1,803,900	1,744,750
,, 1,500 ,, 3,000	1,750,900	336,350 ($\frac{1}{3}$)	168,150 ($\frac{1}{6}$)	2,087,250	1,919,050
,, 3,000 ,, 6,000	1,480,100	673,900 ($\frac{1}{3}$)	289,750 ($\frac{1}{7}$)	2,154,000	1,769,900
,, 6,000 ,,12,000	1,102,100	619,400 ($\frac{1}{3}$)	232,300 ($\frac{1}{8}$)	1,721,500	1,334,350
,, 12,000 ,,18,000	162,850	313,100 ($\frac{1}{3}$)	104,250 ($\frac{1}{9}$)	475,900	267,100
,, 18,000 ,,24,000	8,850	51,300 ($\frac{1}{3}$)	15,450 ($\frac{1}{10}$)	60,200	24,300
Over 24,000	.....	2,450 ($\frac{1}{3}$)	700 ($\frac{1}{11}$)	2,450	700
	7,560,600	2,326,450	1,007,800	9,887,050	8,568,450

Mean height—First Estimate, 3189 feet. Second Estimate, 2764 feet.
Below sea-level—area, 232,300 square miles × 25 feet. Minus quantity, 1099·87 cubic miles.

AFRICA. (Highest point, Kilima-njaro, 18,800 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	1,100,300	52,800 ($\frac{1}{3}$)	39,600 ($\frac{1}{4}$)	1,153,050	1,139,850
,, 600 ,, 1,500	992,500	219,300 ($\frac{1}{3}$)	131,600 ($\frac{1}{5}$)	1,211,800	1,124,050
,, 1,500 ,, 3,000	783,100	290,350 ($\frac{1}{3}$)	145,150 ($\frac{1}{6}$)	1,073,450	928,300
,, 3,000 ,, 6,000	193,650	457,500 ($\frac{1}{3}$)	196,750 ($\frac{1}{7}$)	651,200	390,400
,, 6,000 ,,12,000	26,500	120,300 ($\frac{1}{3}$)	45,100 ($\frac{1}{8}$)	146,750	71,600
,, 12,000 ,,18,000	1,800	8,200 ($\frac{1}{3}$)	2,700 ($\frac{1}{9}$)	10,000	4,550
Over 18,000	.....	100 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	100	50
	3,097,850	1,148,550	560,950	4,246,350	3,658,800

Mean height—First Estimate, 2021 feet. Second Estimate, 1741 feet.
Below sea-level—area, 16,300 square miles × 33 feet. Minus quantity, 101·87 cubic miles.

NORTH AMERICA. (Highest point, Mount Wrangel, 20,000 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	585,900	93,300 ($\frac{1}{3}$)	69,950 ($\frac{1}{4}$)	679,150	655,850
„ 600 „ 1,500	461,100	139,250 ($\frac{1}{3}$)	83,550 ($\frac{1}{5}$)	600,350	544,650
„ 1,500 „ 3,000	479,950	96,200 ($\frac{1}{5}$)	48,100 ($\frac{1}{10}$)	576,100	528,000
„ 3,000 „ 6,000	383,300	192,150 ($\frac{1}{3}$)	82,650 ($\frac{1}{5}$)	575,500	465,950
„ 6,000 „ 12,000	37,450	243,450 ($\frac{1}{3}$)	91,300 ($\frac{1}{5}$)	280,900	128,750
„ 12,000 „ 18,000	1,300	12,050 ($\frac{1}{3}$)	4,000 ($\frac{1}{5}$)	13,350	5,300
Over 18,000	.....	150 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	150	50
	1,949,000	776,550	379,600	2,725,500	2,328,550

Mean height—First Estimate, 1888 feet.
Second Estimate, 1613 feet.
Below sea-level—area, 3900 square miles × 100 feet. Minus quantity.
73·86 cubic miles.

SOUTH AMERICA. (Highest point, Mount Aconcagua, 22,415 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	469,950	103,250 ($\frac{1}{3}$)	77,400 ($\frac{1}{4}$)	573,200	547,400
„ 600 „ 1,500	390,850	104,700 ($\frac{1}{3}$)	62,800 ($\frac{1}{5}$)	495,550	453,650
„ 1,500 „ 3,000	324,400	109,000 ($\frac{1}{3}$)	54,500 ($\frac{1}{6}$)	433,400	378,900
„ 3,000 „ 6,000	470,850	91,600 ($\frac{1}{5}$)	39,400 ($\frac{1}{7}$)	562,500	510,250
„ 6,000 „ 12,000	353,800	131,400 ($\frac{1}{3}$)	49,300 ($\frac{1}{8}$)	485,200	403,100
„ 12,000 „ 18,000	35,250	106,200 ($\frac{1}{3}$)	35,350 ($\frac{1}{9}$)	141,400	70,600
Over 18,000	.....	8,650 ($\frac{1}{3}$)	2,600 ($\frac{1}{10}$)	8,650	2,600
	2,045,100	654,800	321,350	2,699,900	2,366,500

Mean height—First Estimate, 2078 feet.
Second Estimate, 1821 feet.

AUSTRALIA. (Highest point, Mount Kosciusko, 7176 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	240,650	33,200 ($\frac{1}{3}$)	25,450 ($\frac{1}{4}$)	273,800	266,100
„ 600 „ 1,500	31,050	110,000 ($\frac{1}{3}$)	66,000 ($\frac{1}{5}$)	141,000	97,000
„ 1,500 „ 3,000	16,500	11,700 ($\frac{1}{3}$)	5,850 ($\frac{1}{6}$)	28,250	22,400
„ 3,000 „ 6,000	6,600	8,800 ($\frac{1}{3}$)	3,800 ($\frac{1}{7}$)	15,450	10,400
Over 6,000	.....	850 ($\frac{1}{3}$)	350 ($\frac{1}{8}$)	850	350
	294,800	164,550	101,450	459,350	396,250

Mean height—First Estimate, 805 feet.
Second Estimate, 694 feet.

EAST INDIES. (Highest point, Mount Schopenhauer, New Guinea, 20,073 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	89,350	11,600 ($\frac{1}{3}$)	8,700 ($\frac{1}{4}$)	100,950	98,050
„ 600 „ 1,500	102,400	10,550 ($\frac{1}{3}$)	6,350 ($\frac{1}{5}$)	112,950	108,700
„ 1,500 „ 3,000	90,450	26,750 ($\frac{1}{3}$)	13,350 ($\frac{1}{6}$)	117,200	103,800
„ 3,000 „ 6,000	35,650	48,400 ($\frac{1}{3}$)	20,800 ($\frac{1}{4}$)	84,050	56,500
„ 6,000 „ 12,000	4,000	22,450 ($\frac{1}{3}$)	8,400 ($\frac{1}{8}$)	26,450	12,400
„ 12,000 „ 18,000	900	1,000 ($\frac{1}{3}$)	350 ($\frac{1}{5}$)	1,950	1,250
Over 18,000	.....	100 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	100	50
	322,750	120,850	58,000	443,650	380,750

Mean height—First Estimate, 2144 feet.
Second Estimate, 1841 feet.

WEST INDIES. (Highest point, La Tina, 10,300 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	6,600	1,750 ($\frac{1}{3}$)	1,300 ($\frac{1}{4}$)	8,350	7,950
„ 600 „ 1,500	2,650	2,450 ($\frac{1}{3}$)	1,450 ($\frac{1}{5}$)	5,050	4,100
„ 1,500 „ 3,000	550	1,300 ($\frac{1}{3}$)	650 ($\frac{1}{6}$)	1,850	1,200
„ 3,000 „ 6,000	450	200 ($\frac{1}{3}$)	100 ($\frac{1}{4}$)	700	550
Over 6,000	...	200 ($\frac{1}{3}$)	100 ($\frac{1}{8}$)	200	100
	10,250	5,900	3,600	16,150	13,900

Mean height—First Estimate, 816 feet.
Second Estimate, 700 feet.

MADAGASCAR. (Highest point, Mount Ankaratra, 8887 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	16,700	2,800 ($\frac{1}{3}$)	2,100 ($\frac{1}{4}$)	19,500	18,800
„ 600 „ 1,500	20,450	1,550 ($\frac{1}{3}$)	900 ($\frac{1}{5}$)	22,000	21,400
„ 1,500 „ 3,000	22,000	4,050 ($\frac{1}{3}$)	2,000 ($\frac{1}{6}$)	26,050	24,000
„ 3,000 „ 6,000	9,900	11,350 ($\frac{1}{3}$)	4,900 ($\frac{1}{4}$)	21,250	14,750
Over 6,000	.....	3,150 ($\frac{1}{3}$)	1,200 ($\frac{1}{8}$)	3,150	1,200
	69,050	22,900	11,100	91,950	80,150

Mean height—First Estimate, 2199 feet.
Second Estimate, 1917 feet.

NEW ZEALAND. (Highest point, Mount Cook, 12,400 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	10,750	600 ($\frac{1}{3}$)	450 ($\frac{1}{4}$)	11,350	11,200
„ 600 „ 1,500	10,200	1,950 ($\frac{1}{3}$)	1,200 ($\frac{1}{5}$)	12,150	11,350
„ 1,500 „ 3,000	7,050	3,300 ($\frac{1}{3}$)	1,650 ($\frac{1}{5}$)	10,350	8,700
„ 3,000 „ 6,000	3,550	3,500 ($\frac{1}{3}$)	1,500 ($\frac{1}{4}$)	7,100	5,050
„ 6,000 „12,000	1,750	1,800 ($\frac{1}{3}$)	650 ($\frac{1}{3}$)	3,550	2,450
Over 12,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{5}$)	50	10
	33,300	11,200	5,460	44,500	38,760

Mean height—First Estimate, 2134 feet.
Second Estimate, 1859 feet.

JAPAN. (Highest point, Fuzi-Yama, 14,180 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	14,750	450 ($\frac{1}{3}$)	350 ($\frac{1}{4}$)	15,200	15,050
„ 600 „ 1,500	9,550	4,200 ($\frac{1}{3}$)	2,500 ($\frac{1}{5}$)	13,750	12,050
„ 1,500 „ 3,000	1,650	4,750 ($\frac{1}{3}$)	2,350 ($\frac{1}{6}$)	6,400	4,050
„ 3,000 „ 6,000	900	800 ($\frac{1}{3}$)	350 ($\frac{1}{3}$)	1,700	1,250
„ 6,000 „12,000	450	450 ($\frac{1}{3}$)	150 ($\frac{1}{3}$)	900	600
Over 12,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{5}$)	50	10
	27,300	10,700	5,710	38,000	33,010

Mean height—First Estimate, 1420 feet.
Second Estimate, 1235 feet.

FORMOSA. (Highest point, Mount Morrison, 12,847 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	2,300	100 ($\frac{1}{3}$)	50 ($\frac{1}{4}$)	2,400	2,350
„ 600 „ 1,500	1,450	650 ($\frac{1}{3}$)	400 ($\frac{1}{5}$)	2,100	1,850
„ 1,500 „ 3,000	1,350	350 ($\frac{1}{3}$)	200 ($\frac{1}{5}$)	1,700	1,500
„ 3,000 „ 6,000	1,550	350 ($\frac{1}{3}$)	150 ($\frac{1}{4}$)	1,950	1,700
„ 6,000 „12,000	900	750 ($\frac{1}{3}$)	300 ($\frac{1}{3}$)	1,650	1,200
Over 12,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{5}$)	50	10
	7,550	2,250	1,110	9,850	8,610

Mean height—First Estimate, 2341 feet.
Second Estimate, 2063 feet.

SAGHALIEN. (Highest point, say 4,000 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	4,600	100 ($\frac{1}{3}$)	50 ($\frac{1}{4}$)	4,700	4,650
,, 600 ,, 1,500	3,300	1,200 ($\frac{1}{3}$)	750 ($\frac{1}{2}$)	4,500	4,000
,, 1,500 ,, 3,000	2,750	900 ($\frac{1}{3}$)	450 ($\frac{1}{6}$)	3,650	3,200
Over 3,000	.....	600 ($\frac{1}{3}$)	250 ($\frac{1}{7}$)	600	250
	10,650	2,800	1,500	13,450	12,100

Mean height—First Estimate, 1667 feet.
Second Estimate, 1505 feet.

GREENLAND. (Highest point, Mount Petermann, 11,400 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	103,950	.....	.....	103,950	103,950
,, 600 ,, 1,500	131,450	8,150 ($\frac{1}{3}$)	4,900 ($\frac{1}{5}$)	139,600	136,350
,, 1,500 ,, 3,000	177,300	13,950 ($\frac{1}{3}$)	6,950 ($\frac{1}{6}$)	191,200	184,250
,, 3,000 ,, 6,000	2,650	117,300 ($\frac{1}{3}$)	50,450 ($\frac{1}{2}$)	120,000	53,100
Over 6,000	.....	1,600 ($\frac{1}{3}$)	700 ($\frac{1}{8}$)	1,600	700
	415,350	141,000	63,000	556,350	478,350

Mean height—First Estimate, 3212 feet.
Second Estimate, 2762 feet.

NOVA ZEMBLA. (Highest point, 3204 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	4,050	.....	.....	4,050	4,050
,, 600 ,, 1,500	4,100	650 ($\frac{1}{3}$)	400 ($\frac{1}{2}$)	4,750	4,500
,, 1,500 ,, 3,000	4,650	750 ($\frac{1}{3}$)	350 ($\frac{1}{7}$)	5,400	5,000
Over 3,	...	200 ($\frac{1}{3}$)	100 ($\frac{1}{7}$)	200	100
	12,800	1,600	850	14,400	13,650

Mean height—First Estimate, 2130 feet.
Second Estimate, 2019 feet.

SPITZBERGEN. (Highest point, Schwartz-Spitz, 4399 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	3,500	.....	.....	3,500	3,500
„ 600 „ 1,500	650	1,550 ($\frac{1}{3}$)	950 ($\frac{1}{2}$)	2,200	1,600
„ 1,500 „ 3,000	150	300 ($\frac{1}{3}$)	150 ($\frac{1}{7}$)	450	300
Over 3,000	.. ...	50 ($\frac{1}{3}$)	10 ($\frac{1}{7}$)	50	10
	4,300	1,900	1,110	6,200	5,410

Mean height—First Estimate, 1057 feet
Second Estimate, 921 feet.

ICELAND. (Highest point, Oraefa Jokul, 6408 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	3,100	300 ($\frac{1}{3}$)	250 ($\frac{1}{2}$)	3,350	3,300
„ 600 „ 1,500	3,300	400 ($\frac{1}{3}$)	250 ($\frac{1}{2}$)	3,750	3,550
„ 1,500 „ 3,000	2,200	1,100 ($\frac{1}{3}$)	550 ($\frac{1}{2}$)	3,300	2,750
„ 3,000 „ 6,000	450	1,300 ($\frac{1}{3}$)	550 ($\frac{1}{7}$)	1,750	1,000
Over 6,000	...	50 ($\frac{1}{3}$)	10 ($\frac{1}{7}$)	50	10
	9,050	3,150	1,610	12,200	10,610

Mean height—First Estimate, 1849 feet.
Second Estimate, 1612 feet.

TASMANIA. (Highest point, Cradle Mountain, 5069 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	2,200	450 ($\frac{1}{3}$)	350 ($\frac{1}{2}$)	2,650	2,550
„ 600 „ 1,500	1,000	800 ($\frac{1}{3}$)	450 ($\frac{1}{2}$)	1,750	1,450
„ 1,500 „ 3,000	550	350 ($\frac{1}{3}$)	200 ($\frac{1}{2}$)	950	750
Over 3,000	.....	250 ($\frac{1}{3}$)	100 ($\frac{1}{7}$)	250	100
	3,750	1,850	1,100	5,600	4,850

Mean height—First Estimate, 1068 feet.
Second Estimate, 925 feet.

SUMMARY.

Continent.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Mean Height. (By First Estimate.)
Europe,	652,750	555,610	939 feet
Asia,	9,887,050	8,568,450	3189 ,,
Africa,	4,246,350	3,658,800	2021 ,,
North America,	2,725,500	2,328,550	1888 ,,
South America,	2,699,900	2,366,500	2078 ,,
Australia,	459,350	396,250	805 ,,
East Indies,	443,650	380,750	2144 ,,
West Indies,	16,150	13,900	816 ,,
Madagascar,	91,950	80,150	2199 ,,
New Zealand,	44,500	38,760	2134 ,,
Japan,	38,000	33,010	1420 ,,
Formosa,	9,850	8,610	2341 ,,
Saghalien,	13,450	12,100	1667 ,,
Greenland,	556,350	478,350	3212 ,,
Nova Zembla,	14,400	13,650	2130 ,,
Spitzbergen,	6,200	5,410	1057 ,,
Iceland,	12,200	10,610	1849 ,,
Tasmania,	5,600	4,850	1068 ,,
	21,923,200	18,954,310	

Mean height—First Estimate, 2252 feet.
Second Estimate, 1947 feet.

SUMMARY.

Height in Feet.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Percentage. (By First Estimate.)
0— 600	4,801,000	4,634,200	21·900
600— 1,500	4,742,250	4,417,650	21·631
1,500— 3,000	4,679,550	4,211,650	21·345
3,000— 6,000	4,277,050	3,338,150	19·509
6,000—12,000	2,705,300	1,974,410	12·340
12,000—18,000	646,350	350,600	2·948
18,000—24,000	69,200	21,000	0·316
Over 24,000	2,450	650	0·011
	21,923,150	18,954,310	100·000
Antarctic Continent,[1]	1,520,700	1,314,750	
	23,443,850	20,269,060	

From the above we find that 84 per cent. of the bulk of the land of the globe lies between the sea-level and a height of 6000 feet, while about 16 per cent. is met with above that height.

[1] These figures are obtained from the estimated area of the Antarctic Continent and the estimated mean height of the land of the Globe, but the Antarctic land is probably higher from the accumulation of snow and ice.

IV.—The Volume of the Ocean at Different Depths beneath the Surface.

The volume of the waters of the ocean has been calculated in the same way as the volume of the dry land at different levels. In the case of the sea, however, in calculating the volume of the slope (quoit-like segments) one-half the depth has been taken in the zones 0 to 100 fathoms (0 to 600 feet), and 100 to 500 fathoms (600 to 3,000 feet), and two-thirds of the depth for all the other zones. The reason for this is obvious, for just as the slope of the land increases as we approach mountains, so does the slope in general decrease as we get into deeper water.

TABLE 5.

NORTH ATLANTIC OCEAN. (Greatest depth, 4561 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,508,500	60,700 ($\frac{1}{2}$)	1,569,200
„ 100 „ 500	5,699,400	167,150 ($\frac{1}{2}$)	5,866,550
„ 500 „ 1000	6,820,850	202,350 ($\frac{2}{3}$)	7,023,200
„ 1000 „ 2000	9,788,100	2,569,100 ($\frac{2}{3}$)	12,357,200
„ 2000 „ 3000	1,456,100	5,554,700 ($\frac{2}{3}$)	7,010,800
„ 3000 „ 4000	8,800	964,900 ($\frac{2}{3}$)	973,700
Over 4000	...	3,300 ($\frac{2}{3}$)	3,300
	25,281,750	9,522,200	34,803,950

Mean depth—2135 fathoms.

SOUTH ATLANTIC OCEAN. (Greatest depth, 3100 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,112,550	22,900 ($\frac{1}{2}$)	1,135,450
„ 100 „ 500	4,323,500	63,350 ($\frac{1}{2}$)	4,386,850
„ 500 „ 1000	5,303,200	67,450 ($\frac{2}{3}$)	5,370,650
„ 1000 „ 2000	9,053,500	1,035,250 ($\frac{2}{3}$)	10,088,750
„ 2000 „ 3000	1,231,800	5,214,450 ($\frac{2}{3}$)	6,446,250
Over 3000	...	82,150 ($\frac{2}{3}$)	82,150
	21,024,550	6,485,550	27,510,100

Mean depth—2375 fathoms.

GULF OF MEXICO. (Greatest depth, 2119 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	53,250	14,100 ($\frac{1}{2}$)	67,300
„ 100 „ 500	144,300	34,300 ($\frac{1}{2}$)	178,600
„ 500 „ 1000	140,750	26,400 ($\frac{2}{3}$)	167,150
„ 1000 „ 2000	65,950	143,700 ($\frac{4}{5}$)	209,700
Over 2000	...	5,250 ($\frac{4}{5}$)	5,250
	404,250	223,750	628,000

Mean depth—772 fathoms.

CARIBBEAN SEA. (Greatest depth, 3169 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	115,250	8,350 ($\frac{1}{2}$)	123,600
„ 100 „ 500	364,250	48,400 ($\frac{1}{2}$)	412,650
„ 500 „ 1000	345,350	73,300 ($\frac{2}{3}$)	418,650
„ 1000 „ 2000	255,150	290,350 ($\frac{4}{5}$)	545,500
„ 2000 „ 3000	8,800	164,600 ($\frac{4}{5}$)	173,400
Over 3000	...	1,000 ($\frac{4}{5}$)	1,000
	1,088,800	586,000	1,674,800

Mean depth—1269 fathoms.

NORTH SEA. (Greatest depth, 360 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	900	8,800 ($\frac{1}{2}$)	9,700
Over 100	...	1,500 ($\frac{1}{2}$)	1,500
	900	10,300	11,200

Mean depth—61 fathoms.

ENGLISH CHANNEL. (Greatest depth, 86 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	...	1,500 ($\frac{1}{2}$)	1,500

Mean depth—43 fathoms.

BALTIC SEA. (Greatest depth, 430 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	700	10,750 ($\frac{1}{2}$)	11,450
Over 100	...	1,100 ($\frac{1}{2}$)	1,100
	700	11,850	12,550

Mean depth—57 fathoms.

MEDITERRANEAN SEA. (Greatest depth, 2150 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	69,500	11,450 ($\frac{1}{6}$)	80,950
„ 100 „ 500	163,650	57,200 ($\frac{1}{3}$)	220,850
„ 500 „ 1000	158,400	30,800 ($\frac{2}{9}$)	189,200
„ 1000 „ 2000	17,600	199,450 ($\frac{2}{3}$)	217,050
Over 2000	...	1,750 ($\frac{4}{5}$)	1,750
	409,150	300,650	709,800

Mean depth—768 fathoms.

BLACK SEA. (Greatest depth, 1070 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	7,900	3,950 ($\frac{1}{2}$)	11,850
„ 100 „ 500	21,100	5,300 ($\frac{1}{4}$)	26,400
„ 500 „ 1000	22,000	2,950 ($\frac{2}{9}$)	24,950
Over 1000	...	2,000 ($\frac{2}{3}$)	2,000
	51,000	14,200	65,200

Mean depth—412 fathoms.

NORWEGIAN SEA. (Greatest depth, 2005 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	110,400	8,800 ($\frac{1}{6}$)	119,200
„ 100 „ 500	290,350	75,650 ($\frac{1}{3}$)	366,000
„ 500 „ 1000	257,350	70,400 ($\frac{2}{9}$)	327,750
„ 1000 „ 2000	17,600	331,400 ($\frac{2}{3}$)	349,000
Over 2000	...	50 ($\frac{4}{5}$)	50
	675,700	486,300	1,162,000

Mean depth—908 fathoms.

ARCTIC OCEAN. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	407,450	67,900 ($\frac{1}{2}$)	475,350
,, 100 ,, 500	1,086,550	271,650 ($\frac{1}{4}$)	1,358,200
,, 500 ,, 1000	679,100	452,700 ($\frac{2}{3}$)	1,131,800
Over 1000	...	452,700 ($\frac{2}{3}$)	452,700
	2,173,100	1,244,950	3,418,050

Mean depth—630 fathoms.

INDIAN OCEAN. (Greatest depth, 3097 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,845,850	47,750 ($\frac{1}{2}$)	1,893,600
,, 100 ,, 500	7,037,050	173,300 ($\frac{1}{2}$)	7,210,350
,, 500 ,, 1000	8,510,000	190,650 ($\frac{2}{3}$)	8,700,650
,, 1000 ,, 2000	15,207,500	1,208,300 ($\frac{2}{3}$)	16,415,800
,, 2000 ,, 3000	44,000	10,109,550 ($\frac{2}{3}$)	10,153,550
Over 3000	...	2,850 ($\frac{2}{3}$)	2,850
	32,644,400	11,732,400	44,376,800

Mean depth—2286 fathoms.

RED SEA. (Greatest depth, 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	3,500 ($\frac{1}{2}$)	14,500
,, 100 ,, 500	22,900	10,550 ($\frac{1}{2}$)	33,450
,, 500 ,, 1000	1,100	18,350 ($\frac{2}{3}$)	19,450
Over 1000	...	300 ($\frac{2}{3}$)	300
	35,000	32,700	67,700

Mean depth—375 fathoms.

PERSIAN GULF. (Greatest depth, say 50 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	...	2,200 ($\frac{1}{2}$)	2,200

Mean depth—25 fathoms.

NORTH PACIFIC OCEAN. (Greatest depth, 5000 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	2,984,800	24,850 ($\frac{1}{2}$)	3,009,650
„ 100 „ 500	11,809,200	65,100 ($\frac{1}{5}$)	11,874,300
„ 500 „ 1000	14,585,400	117,300 ($\frac{1}{9}$)	14,702,700
„ 1000 „ 2000	27,134,450	1,357,850 ($\frac{1}{20}$)	28,492,300
„ 2000 „ 3000	1,720,050	16,942,700 ($\frac{9}{10}$)	18,662,750
„ 3000 „ 4000	105,550	1,076,350 ($\frac{9}{10}$)	1,181,900
Over 4000	...	70,300 ($\frac{1}{1}$)	70,300
	58,339,450	19,654,450	77,993,900

Mean depth—2570 fathoms.

SOUTH PACIFIC OCEAN. (Greatest depth, 3305 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	2,655,700	13,200 ($\frac{1}{2}$)	2,668,900
„ 100 „ 500	10,387,450	117,900 ($\frac{1}{3}$)	10,505,350
„ 500 „ 1000	12,568,400	277,150 ($\frac{2}{3}$)	12,845,550
„ 1000 „ 2000	20,293,750	3,228,950 ($\frac{7}{8}$)	23,522,700
„ 2000 „ 3000	840,250	12,968,550 ($\frac{9}{10}$)	13,808,800
Over 3000	...	170,850 ($\frac{1}{1}$)	170,850
	46,745,550	16,776,600	63,522,150

Mean depth—2368 fathoms.

BEHRING SEA. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	54,100	21,750 ($\frac{1}{2}$)	75,850
„ 100 „ 500	181,250	17,600 ($\frac{1}{5}$)	198,850
„ 500 „ 1000	195,750	20,550 ($\frac{2}{3}$)	216,300
Over 1000	...	130,500 ($\frac{1}{1}$)	130,500
	431,100	190,400	621,500

Mean depth—636 fathoms.

SEA OF OKOTSK. (Greatest depth, say 700 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	40,900	10,350 ($\frac{1}{2}$)	51,250
„ 100 „ 500	77,450	43,100 ($\frac{1}{3}$)	120,550
Over 500	...	25,800 ($\frac{2}{3}$)	25,800
	118,350	79,250	197,600

Mean depth—292 fathoms.

SEA OF JAPAN. (Greatest depth, say 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	27,250	7,700 ($\frac{1}{2}$)	34,950
„ 100 „ 500	75,700	16,700 ($\frac{1}{3}$)	92,400
„ 500 „ 1000	50,600	29,350 ($\frac{2}{3}$)	79,950
Over 1000	...	13,500 ($\frac{2}{3}$)	13,500
	153,550	67,250	220,800

Mean depth—517 fathoms.

YELLOW SEA. (Greatest depth, say 600 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	21,100 ($\frac{1}{2}$)	32,100
„ 100 „ 500	1,500	21,150 ($\frac{1}{3}$)	22,650
Over 500	...	300 ($\frac{2}{3}$)	300
	12,500	42,550	55,050

Mean depth—103 fathoms.

CHINA SEA. (Greatest depth, say 2200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	79,200	38,050 ($\frac{1}{2}$)	117,250
„ 100 „ 500	223,500	46,650 ($\frac{1}{3}$)	270,150
„ 500 „ 1000	149,550	86,500 ($\frac{2}{3}$)	236,050
„ 1000 „ 2000	26,400	181,800 ($\frac{2}{3}$)	208,200
Over 2000	...	3,550 ($\frac{2}{3}$)	3,550
	478,650	356,550	835,200

Mean depth—538 fathoms.

CELEBES SEA. (Greatest depth, 2745 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	16,700	2,000 ($\frac{1}{2}$)	18,700
,, 100 ,, 500	56,300	5,300 ($\frac{1}{2}$)	61,600
,, 500 ,, 1000	57,150	8,800 ($\frac{2}{3}$)	65,950
,, 1000 ,, 2000	79,150	23,450 ($\frac{2}{3}$)	102,600
Over 2000	...	39,300 ($\frac{2}{3}$)	39,300
	209,300	78,850	288,150

Mean depth—1394 fathoms.

SULU SEA. (Greatest depth, say 2200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	4,400 ($\frac{1}{2}$)	15,400
,, 100 ,, 500	29,900	7,050 ($\frac{1}{2}$)	36,950
,, 500 ,, 1000	30,800	4,400 ($\frac{2}{3}$)	35,200
,, 1000 ,, 2000	17,600	29,300 ($\frac{2}{3}$)	46,900
Over 2000	...	2,350 ($\frac{2}{3}$)	2,350
	89,300	47,500	136,800

Mean depth—691 fathoms.

BANDA SEA. (Greatest depth, say 4200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	41,350	3,300 ($\frac{1}{2}$)	44,650
,, 100 ,, 500	91,550	36,950 ($\frac{1}{2}$)	128,500
,, 500 ,, 1000	72,600	27,850 ($\frac{2}{3}$)	100,450
,, 1000 ,, 2000	39,650	70,400 ($\frac{2}{3}$)	110,050
,, 2000 ,, 3000	6,650	22,000 ($\frac{2}{3}$)	28,650
,, 3000 ,, 4000	2,200	2,950 ($\frac{2}{3}$)	5,150
Over 4000	...	300 ($\frac{2}{3}$)	300
	254,000	163,750	417,750

Mean depth—871 fathoms.

JAVA SEA. (Greatest depth, say 550 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	5,700	17,600 ($\frac{1}{2}$)	23,300
,, 100 ,, 500	200	11,350 ($\frac{1}{2}$)	11,550
Over 500	...	50 ($\frac{2}{3}$)	50
	5,900	29,000	34,900

Mean depth—85 fathoms.

ARAFURA SEA. (Greatest depth, 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	8,800	27,700 ($\frac{1}{2}$)	36,500
,, 100 ,, 500	15,800	9,700 ($\frac{1}{2}$)	25,500
,, 500 ,, 1000	6,600	8,800 ($\frac{2}{3}$)	15,400
Over 1000	...	1,750 ($\frac{2}{3}$)	1,750
	31,200	47,950	79,150

Mean depth—123 fathoms.

SOUTHERN OCEAN (South of Pacific). (Greatest depth, say 3200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,151,650	8,150 ($\frac{1}{2}$)	1,159,800
,, 100 ,, 500	4,525,850	40,450 ($\frac{1}{2}$)	4,566,300
,, 500 ,, 1000	5,545,150	747,900 ($\frac{2}{3}$)	6,293,050
,, 1000 ,, 2000	5,388,950	3,800,850 ($\frac{2}{3}$)	9,189,800
,, 2000 ,, 3000	382,700	3,337,500 ($\frac{2}{3}$)	3,720,200
Over 3000	...	51,050 ($\frac{2}{3}$)	51,050
	16,994,300	7,985,900	24,980,200

Mean depth—2139 fathoms.

SOUTHERN OCEAN (South of Indian Ocean). (Greatest depth, 2600 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,037,350	13,850 ($\frac{1}{2}$)	1,051,200
„ 100 „ 500	4,096,450	26,400 ($\frac{1}{2}$)	4,122,850
„ 500 „ 1000	5,012,800	71,500 ($\frac{2}{3}$)	5,084,300
„ 1000 „ 2000	2,868,200	4,771,600 ($\frac{2}{3}$)	7,639,800
Over 2000	...	1,147,300 ($\frac{2}{3}$)	1,147,300
	13,014,800	6,030,650	19,045,450

Mean depth—1788 fathoms.

SOUTHERN OCEAN (South of Atlantic). (Greatest depth, say 4200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	692,000	23,750 ($\frac{1}{2}$)	715,750
„ 100 „ 500	2,667,650	50,150 ($\frac{1}{2}$)	2,717,800
„ 500 „ 1000	3,178,400	104,100 ($\frac{2}{3}$)	3,282,500
„ 1000 „ 2000	5,195,400	774,200 ($\frac{2}{3}$)	5,969,600
„ 2000 „ 3000	1,508,950	2,457,650 ($\frac{2}{3}$)	3,966,600
„ 3000 „ 4000	48,400	973,700 ($\frac{2}{3}$)	1,022,100
Over 4000	...	6,450 ($\frac{2}{3}$)	6,450
	13,290,800	4,390,000	17,680,800

Mean depth—2391 fathoms.

ANTARCTIC OCEAN. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	377,750	62,950 ($\frac{1}{2}$)	440,700
„ 100 „ 500	1,007,400	251,850 ($\frac{1}{2}$)	1,259,250
„ 500 „ 1000	629,600	419,700 ($\frac{2}{3}$)	1,049,300
Over 1000	...	419,750 ($\frac{2}{3}$)	419,750
	2,014,750	1,154,250	3,169,000

Mean depth—629 fathoms.

SUMMARY.

Showing the Volume of Water in each of the Main Divisions of the Ocean.

Ocean.	Cubic Miles.	Cubic Miles.
ATLANTIC OCEAN BASIN—		
North Atlantic,	34,803,950	
South Atlantic,	27,510,100	
Gulf of Mexico,	628,000	
Caribbean Sea,	1,674,800	
North Sea,	11,200	
English Channel,	1,500	
Baltic Sea,	12,550	
Mediterranean Sea,	709,800	
Black Sea,	65,200	
Norwegian Sea,	1,162,000	
Arctic Ocean,	3,418,050	
		69,997,150
PACIFIC OCEAN BASIN—		
North Pacific,	77,993,900	
South Pacific,	63,522,150	
Behring Sea,	621,500	
Sea of Okotsk,	197,600	
Sea of Japan,	220,800	
Yellow Sea,	55,050	
China Sea,	835,200	
Celebes Sea,	288,150	
Sulu Sea,	136,800	
Banda Sea,	417,750	
Java Sea,	34,900	
Arafura Sea,	79,150	
		144,402,950
INDIAN OCEAN BASIN—		
Indian Ocean,	44,376,800	
Red Sea,	67,700	
Persian Gulf,	2,200	
		44,446,700
SOUTHERN AND ANTARCTIC OCEANS BASIN—		
Southern Ocean (South of Pacific),	24,980,200	
Southern Ocean (South of Indian),	19,045,450	
Southern Ocean (South of Atlantic),	17,680,800	
Antarctic Ocean,	3,169,000	
		64,875,450
Grand Total,		323,722,150

SUMMARY.

Showing the Volume of Water at Different Levels in each of the Main Divisions of the Ocean.

Fathoms.	Atlantic Ocean Basin. Cub. Miles.	Pacific Ocean Basin. Cub. Miles.	Indian Ocean Basin. Cub. Miles.	Southern and Antarctic Oceans Basin. Cub. Miles.	Total. Cub. Miles.	Percentages.
Between 0 and 100	3,605,550	6,128,500	1,910,300	3,367,450	15,011,800	4·637
,, 100 ,, 500	12,818,700	23,348,350	7,243,800	12,666,200	56,076,950	17·324
,, 500 ,, 1000	14,653,350	28,323,700	8,720,100	15,709,150	67,406,300	20·822
,, 1000 ,, 2000	24,221,900	52,628,500	16,416,100	23,218,950	116,485,450	35·982
,, 2000 ,, 3000	13,637,500	32,545,400	10,153,550	8,834,100	65,170,550	20·132
,, 3000 ,, 4000	1,056,850	1,357,900	2,850	1,073,150	3,490,750	1·078
Over 4000	3,300	70,600	...	6,450	80,350	0·025
Total, . .	69,997,150	144,402,950	44,446,700	64,875,450	323,722,150	100·000

Mean depth—2076 fathoms.

The above summary shows that 42 per cent. of the waters of the ocean lie between the surface and a depth of 1000 fathoms (6000 feet), while 84 per cent. of the volume of the dry land lies within the same height above the sea-level. Again, 56 per cent. of the ocean's waters is situated between depths of 6000 and 18,000 feet (1000 and 3000 fathoms); beyond the latter depth there is only about 1 per cent. of the bulk of the ocean.

From the foregoing investigation, then, the area of the dry land is estimated at 55,000,000 square miles, the area of the ocean at 137,200,000 square miles. The bulk of the dry land above the level of the sea is 23,450,000 cubic miles, and the volume of the waters of the ocean is 323,800,000 cubic miles. The mean height of the land is 2250 feet; the mean depth of the whole ocean is 12,480 feet (2080 fathoms).

If now we regard the ocean as divided into two areas by the 1000 fathom line, it will be found that the mean depth of the regions within 1000 fathoms is 2030 feet (338 fathoms), or somewhat less than the mean height of the dry land above the sea. On the other hand, the regions beyond 1000 fathoms in the ocean have a mean depth of 14,640 feet (2440 fathoms).

In a previous paper[1] I have called the former regions the *transitional area* of the earth's surface, and it occupies about 24,000,000 square miles. The latter regions are called the *abysmal area*, and cover 113,000,000 square miles, or more than one-half of the earth's surface, while the general level of this area is fully three miles below the general level of the

[1] *Nature*, vol. xxxii. pp. 581, 611.

dry land. In the transitional area of the ocean there is a great variety of conditions in regard to light, heat, currents, changes of level, the character and variety of the deposits there forming, and the animals and plants inhabiting the various parts of the region. The deposits are in most respects quite similar to those which make up a very large part of the sedimentary formations of the dry land. In the abysmal area there is a very uniform set of conditions—the temperature is near the freezing-point, and the annual range does not exceed 5° F., there is no sunlight, no plant life. While there is a great abundance of animal life, the forms from various parts of the area are very similar, and unlike those of shallower waters; the deposits, which there accumulate slowly, are not similar to the sedimentary deposits of the dry land.

The annual discharge of nineteen rivers[1] in different parts of the world is estimated at 865 cubic miles of water, and it is further estimated that these carry into the ocean 0·332 of a cubic mile of matter in suspension within the same time. The total annual discharge of rivers from the land of the globe is estimated at 6524 cubic miles, which at the above rate would give 2·5 cubic miles of sediment carried into the ocean each year. To this must be added the matter carried to the sea in solution, which is estimated at 1·183 cubic miles of matter.[2] Together, then, the amount of matter carried from the land each year in suspension and solution is 3·7 cubic miles. It would thus, according to this calculation and rate of degradation, take 6,340,000 years to transport the whole of the solid land down to the sea.

From the above investigation it also appears that if the land of the globe were reduced to the sea level by being removed to and piled up in the shallower waters of the ocean, its extent would then be nearly 80,000,000 square miles, and the rest of the surface of the earth would be covered by an ocean over three miles in depth, extending to about 113,000,000 square miles. Again, should the whole of the solid land be reduced to one level under the ocean, then the surface of the earth would be covered by an ocean with a uniform depth of about two miles.

The volume of the whole sphere is estimated at 259,850,117,778 cubic miles; hence it follows from the foregoing tables that the volume of the ocean is to the volume of the whole sphere as 1 to 800. Regarding the globe as covered by an ocean of a uniform depth of two miles, the ocean would be roughly 1/666 of the whole sphere.

I have been indebted to Professor Chrystal for many suggestions during the preparation of this paper. I desire also to acknowledge the care with which my assistants, Mr. James Chumley and Mr. John Gunn, have checked all the measurements and calculations.

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[1] Ganges, Yangtse-kiang, Yellow River, Pei-ho, Irrawaddi, Hooghley, Tay, Thames, Forth, Clyde, Boyne, Po, Danube, Rhine, Brentna, Durance, Plate, Mississippi, and Amazon.

[2] *Scottish Geographical Magazine*, vol. iii. pp. 76, 77.