The expression "Mean Sea Level" is apparently free from ambiguity and carries an implication that can be determined readily and accurately. However, when it becomes necessary to determine this plane accurately, difficulties appear. For we find that sea-level at any point along the coast varies from day to day, from month to month, and from year to year.

For very rough values the average height of the sea at any place during a day may be taken as approximating sea-level. But for any one day sea-level so determined may differ from a precise determination of mean sea-level by several feet. When averaged over a period of a month, sea-level may differ from mean sea-level by as much as half a foot. Even when derived directly from a year of observations the value determined may differ from a precise value by as much as a tenth of a foot.

Sea-level derived from 19 years of observations is generally considered to constitute a primary determination of mean sea-level and as giving accurately the datum of mean sea-level. If observations covering this period were necessary for an accurate determination of mean sea-level at all points where such a datum is desired, the task would be a very formidable one. Fortunately it is possible to make secondary determinations of mean sea-level with considerable accuracy from observations covering a period of a year or even less, by comparison of simultaneous observations at the station for which mean sea-level is desired with observations at some suitable station at which a long series has been obtained. Thus, with a suitable spacing of a relatively small number of primary tide-stations along the various coasts at which continuous tide-observations are bieng made, it is possible to secure accurate determinations of mean sea-level for geophysical purposes at many other places by means of short series of observations.

The variations in sea-level from year to year are generally of much greater magnitude than the changes in relative elevation of land to sea during several years. It follows, therefore, that only by continuous observations covering a number of years can such relative changes in elevation be determined. But in this case, too, in connection with the relatively small number of primary tide-stations in continuous operation, short-period observations may be used to determine coastal stability at any desired place. For example, if at a given place it is desired to determine whether or not emergence or subsidence is taking place, a year of observations may be made and mean sea-level determined by comparison with some suitable nearby tide-station. A number of years later another year of observations may be taken at that place and again reduced to a mean sea-level value by comparison with a primary tide-station. The difference of the two mean sea-level values at the given place will then be a measure of the change in the relative elevation of land to sea at that place.

PUBLICATION SCIENTIFIQUE N° 1

(SCIENTIFIC PUBLICATION N° 1)

OF THE INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION

(ASSOCIATION OF PHYSICAL OCEANOGRAPHY):

I. — *HISTORICAL REVIEW OF DYNAMICAL EXPLANATIONS OF TIDES IN NON-ELONGATED SEAS AND LAKES.*

II. — *HISTORICAL REVIEW OF DYNAMICAL EXPLANATIONS OF THE TIDES OF THE MEDITERRANEAN, THE BALTIC SEA, THE GULF OF MEXICO AND THE ARCTIC OCEAN.*

by

S. F. GRACE, University of Liverpool.

(In 8vo, 26 pages - Helsingsfors, 1931).

Part I of this pamphlet on the tides in non-elongated enclosed basins relates to publications involving dynamical explanations of tidal motion either in actual seas and lakes or in geometrically simple basins.

It indicates the development of two modes of discussion. One concerns the theoretical explanation of actual tides in non-elongated enclosed basins, either by the equili-

brium theory or by application of narrow-sea methods, the other concerns the hydrodynamical theory of tidal motion in geometrically simple basins.

As regards the present state of the subject under review, it should be noted that the equilibrium theory, first used in the eighteenth century to account for actual tides in enclosed seas, provides a first approximation to these tides. In the case of certain geometrically simple basins hydrodynamical theory has progressed sufficiently within recent years to provide second approximations to the tidal motions in these basins ; the results indicate, however, that the error of the first approximation, provided by the equilibrium theory, is small.

The publications are listed according to dates using the same classifications as that adopted for the *Tidal Bibliography* published by the ASSOCIATION OF PHYSICAL OCEANOGRAPHY (*Publication Scientifique N° 2*).

Part II. is compiled on similar lines to the preceding part. These basins may be treated as though they were non-elongated and closed, though the more recent explanations of the tides of these basins depend mainly on narrow-sea methods.

INVESTIGATIONS OF SUBMARINE VALLEYS.

by

F. P. SHEPARD.

(Extract from *Transactions of the American Geophysical Union* Fourteenth Annual Meeting, April 27, 28, 29, 1933, Washington, D.C., page 170).

Prior to 1930 there was almost no suspicion of the presence of submarine valleys off the New England coast. The old charts showed an essentially straight 100-fathom curve along this area, yet within the last three years 27 true canyons have been found cutting into the outer edge of the continental shelf all having depths of more than 1,000 feet below their marginal zones and attaining depths below sea-level of over a mile. Three of these canyons discovered last summer have walls rising from 2,500 to 4,000 feet above their floors. Where these canyons have been charted in the greatest detail it becomes evident that they have the characteristics of the great river-cut canyons of western United States. They are also comparable with many of the larger submarine canyons which have been charted off the Pacific coast.

The recent surveys have indicated that at least many of the valleys are the product of river-erosion evidently at a time when the present submerged continental margins were well above sea-level. We should certainly consider most carefully every other possible mode of origin of the canyons, and evidence should be sought which would either reject or more firmly entrench the idea of fluvial origin.

To obtain new evidence concerning the origin of the submarine valleys, something besides the routine charting methods employed by governmental surveys is necessary. Research vessels or private yachts could be used to attack the problem by a variety of methods.

Current-meters. — In order to see whether waves and currents are important in excavating or maintaining the valleys, current-meters could be used.

Study of the topography. — The surveys of submarine valleys by echo-soundings are highly practical, particularly in deep water, but they are subject to the error of giving the distance to the nearest reflecting surface of the bottom rather than the true depths. These inaccuracies are important where there are steep slopes, and even with the application of slope-corrections the result is somewhat in doubt.

Bottom-samples. — Very few samples from submarine valleys have been studied, although notations of the bottom-character have been made by survey officers from a large number of these valleys.

Evidence concerning submarine landslides. — The evidence which suggests that submarine landslides periodically reopen the submarine valleys also needs verification.

Investigation of changes through landsliding is highly practical work. If it is found that these changes are quite common after earthquakes. it will be necessary to rechart the sea-floor in the area adjoining the epicenters of all great submarine earthquakes.
