

FRENCH CONTRIBUTION TO THE STUDY OF MEAN SEA LEVEL

by

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We find in the *Rapports et Procès-Verbaux des Réunions de la Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée* (Report of Proceedings of the International Commission for the Scientific Exploration of the Mediterranean), Vol. XI, Paris, September 1938, pages 167 to 198, an interesting study by M. LEGRAND, presented by Ingénieur Hydrographe Général COT, concerning the differences between the mean sea-level in the Mediterranean and the adjacent basins. We reproduce below the preamble giving the general conclusions of the author.

The article of M. LEGRAND collates and analyses the data of French origin concerning the differences between the mean sea-level in the Mediterranean and the Red Sea on the one hand, and the Atlantic Ocean on the other.

He shows that these differences exist between the mean sea-level in the ports bathed by the Mediterranean which are connected by precise levellings.

He explains that these are the result of the differences of order in the respective curves of mean annual level (M.A.L.) of these various ports.

The above mentioned curves show concordant changes which demonstrate the systematic character of the oscillations of the mean annual sea-level.

These oscillations reveal periodic elements which M. LEGRAND attempts to separate out by the application to the curves of the Mediterranean M.A.L., of the maximum and minimum waves which he found in the other Oceans. These waves appear in trains of two to four waves of the same period, depending upon the conditions; those showing a maximum are independent of those showing a minimum. From the composition of the two rhythms corresponding to them, there may arise a long period or even a secular period, which does not imply either the direct intervention of any physical phenomenon or an astronomic conjunction occurring at long intervals.

When the two curves M.A.L., follow slightly different rhythms, we observe a concordance during a successive period of years which suddenly gives way to an opposition of phases. This phenomenon does not imply a discontinuity in the physical causes which produce the oscillations of the mean annual sea level.

The mean monthly sea levels in the western Mediterranean oscillate much more as a result of the influence of general causes than local conditions, contrary to what has been assumed heretofore. These synoptic curves show this concordance, and a detailed analysis will bring out for each port the particulars of the annual waves (or meteorological), which only action at a distance or the displacements of masses of different density can explain.

All of the preceding applies to the mean monthly sea level of the eastern Mediterranean, in which the annual waves for the different ports have the same speed, which, in summer, differs essentially from the speed curves obtained simultaneously for the ports of the western Mediterranean.

Without touching for the present on a tentative detailed explanation of this contrast of regimes in the summer, M. J. LEGRAND remarks that one of the basins is subjected to the influx on the surface of the less saline waters of the Atlantic through the Straits of Gibraltar, and that the other finally receives the relatively fresh waters of the Black Sea passing through the Dardanelles. The modulation imposed by the annual wave on the common

basic wave, disclosed by the concordance of the curves of the M.A.L. in the two basins, may therefore differ from one basin to the other.

It is understood, of course, that local phenomena, the configuration of the coasts and interferences, may, in certain localities, mask more or less the general influence mentioned above.

A more thorough study of the transgression of the oceanic masses characterised by their temperature and salinity, i.e. basically by their density, might undoubtedly throw much light on the production of periodic oscillations of the mean level of the seas.

The birth and evolution of these oceanic masses evidently depends upon circumstances intimately related to the climate of the globe which intensifies, either simultaneously or later, depending upon circumstances, the production of fusion waters near the polar caps and the production of warm waters in the tropical regions. The phase lag resulting from the respective routes followed by these affluents of opposing character, due to their geographic position, before their anomalies make themselves felt in the basins in question, explains, according to Mr. J. LEGRAND, why the phenomena of climate and also of the oscillations of the mean sea level at one place, can rarely, if ever, be consistently correlated to the solar activity characterized by the sun-spot statistics.

These proposals of a general order can be verified more readily in the Mediterranean, dotted with closely spaced observation posts, where the balance is more easily determined than in the greater part of the oceans of the world.

After having stated his thesis and shown the road, M. J. LEGRAND invites us to follow it to where it has led him.

His point of departure was the study of the oscillations on the two coasts of the Isthmus of Panama, which permitted him to discover in the eastern Pacific a train of seven-year waves explaining the maxima and minima of the M.A.L. over a sequence of thirty six years.

By analogy, in the Mediterranean, he will start with a study of the oscillations on the two coasts of the Isthmus of Suez.

