41. *On Bathymetrical Features of the Japan Sea.*

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(Read June 19, 1934.—Received Sept. 20, 1934.)

Recently, the bathymetrical data of the Japan Sea were remarkably enriched by the results of soundings carried out during the oceanographical expeditions of the Imperial Fisheries Institute, to which some new data have also been added due to the work of the Imperial Japanese Navy. Dr. M. Uda elaborated the compilation of the available data and constructed a number of charts for the different parts of the sea. These valuable charts were kindly placed at the disposal of the present author, who with the aid of Mr. Inomata, Assistant, constructed a synoptic chart shown in Fig. 1, putting together the above separate charts in one sheet. Fig. 1 will be regarded as representing the approximate features of the sea-bed according to the chief data available up to date.

In one of the previous papers, the present author[1] drew attention to a peculiar mode of arrangement of the islands along the Japan Sea coast and attempted some discussions regarding the origin of the Japan Sea basin, especially with reference to Wegener's land-drift theory. In another paper,[2] a model experiment was described to imitate the supposed process of separation of the Japan Arc from the continent and consequent formation of the Japan Sea. It seems indeed that the Japan Sea is the key-hole of the terrestrial casket storing numerous gems in form of the solutions of most interesting problems not only regarding the geological history of the Girland Islands, but also regarding the origin of continents and oceans at large.

With this point in view, an attempt is ventured in the following to see if the morphological features of the Japan Sea may serve in some way or others as a kind of touchstone for testing the validity or inadequacy of Wegener's theory as well as of its opponents.

1) T. TERADA, *Bull. Earthq. Res. Inst.*, 3 (1927), 67.
2) T. TERADA and N. MIYABE, *ibid.*, 4 (1928), 21.

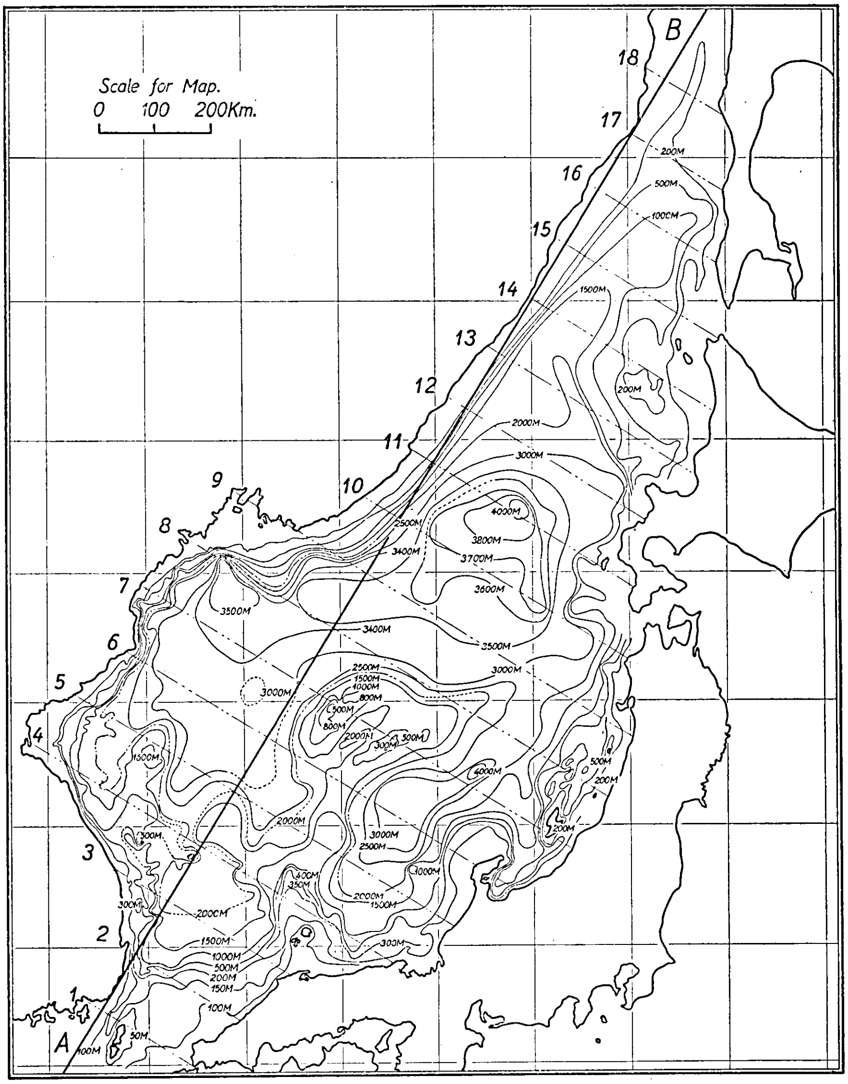

Fig. 1. A bathymetrical chart of the Japan Sea. *AB* is the assumed axial direction of the basin. The transverse lines numbered from 1 to 18 are perpendicular to *AB* and correspond to the profile curves shown in Fig. 2.

When we attempt to deform the present configuration of Japan versus continent in such a manner as to reconstruct the supposed original form in which the girland islands are to form a marginal strip of sial, lining the more or less smooth edge of the continent, it seems necessary at first to turn Corean Peninsula towards W, i. e. in clockwise sense, about a hinge placed somewhere at the neck of the peninsula. Even if such a deformation be allowed as plausible on account of the presence of the Yellow Sea, a difficulty is met with in the fact that the remarkable trapezoid-shaped engulfment of the continental coast line between Cape Kruilow and Cape Boltin, including numerous bays such as America, Ussuri, Amur, Possjet, Siwutsch, etc., remains as such and leaves open a wide gap when the Japanese Arc is pressed up to the continental coast. The difficulty is of essential nature especially because the gulf is of no small depth so that it can scarcely be reckoned as belonging to the domain of continental shelf.

On the other hand, a glance at the chart of Fig. 1 will show that there is a remarkable local elevation of the sea-bed in the middle of the Japan Sea. It may be suggested that the mass apparently lacking in the form of trapezoidal gulf above described might have been dragged behind the Japanese Arc during the process of separation of the latter from the continental margin and left under the mid-ocean in the same manner as supposed by Wegener with regard to the axial shallow ridge running under the Atlantic Ocean between the continents receding from each other. Though it is difficult to apply a direct crucial test to this conjecture, the following procedure may at least afford us with a hint as to the hopefulness or hope-

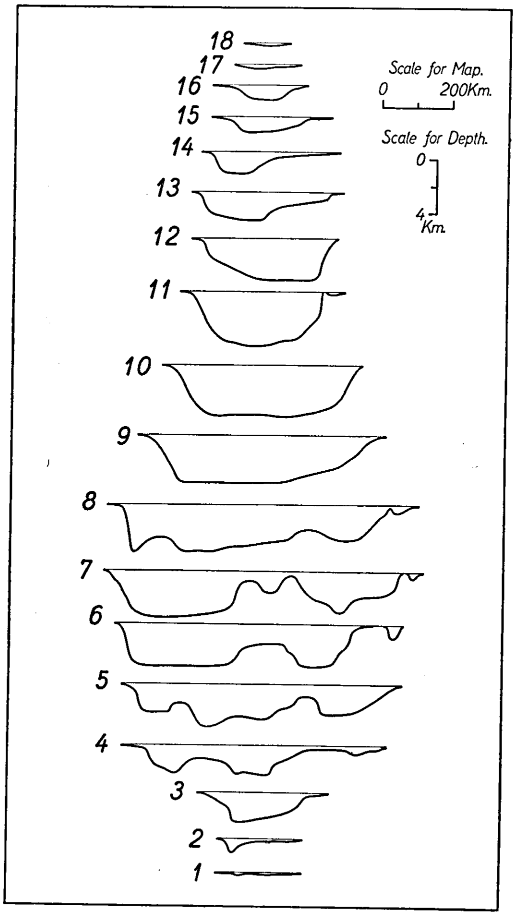

Fig. 2. Profile curves of the sea-bed corresponding to the vertical sections through the transverse lines 1~18 in Fig. 1.

lessness of a further investigation in the line here suggested.

Referring to Fig. 1, a straight line AB was drawn to represent the approximate axial direction of the elongated Japan Sea basin. Lines perpendicular to this axis were next drawn with an equal interval and numbered from 1 to 18 as shown in the figure. The profile curve of the sea-bed was then drawn as shown in Fig. 2 for each of the vertical sections through the above transverse lines. The area S of each profile curve was calculated by Simpson's rule and plotted in Fig. 3 as ordinate along the axis AB as abscissa. On the other hand, the lengths L of the transverse lines were measured from the continental coast to the Japanese coast and similarly plotted as L-curve in Fig. 3. Similarly, the mean depth was plotted as D-curve.

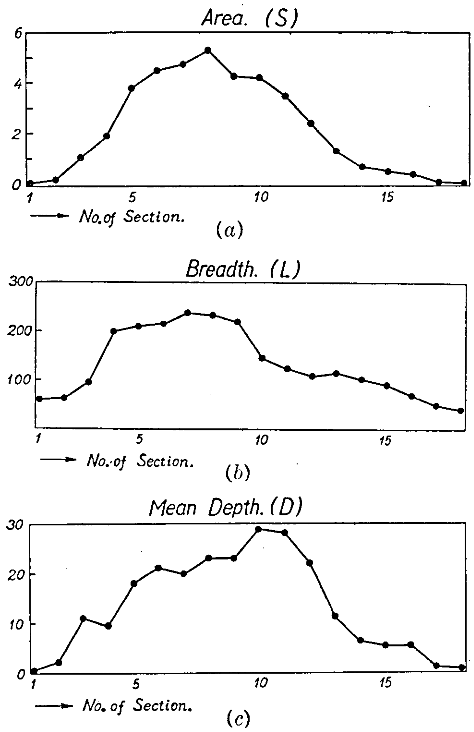

Fig. 3. Distributions of the sectional area of the profiles, S, the lengths of the transverse lines falling upon the sea area, L and the mean depths of the profiles, D. The axis of abscissa corresponds to the number of the transverse lines, increasing from S to N.

Comparing these curves, it may be noticed that S-curve is of a smoother trend than L-curve or D-curve. The word "smooth" is here used in the same sense as we say that the Japan Sea coast of Honsyû is smooth whereas the coast line on the continental side is not smooth.

We do not know of course what will be the form of S-curve in the case when the Japan Arc had really been torn off and dragged apart from the continental margin floating upon the surface of viscous sima substratum, but we may argue that the S-curve must in that case be more or less smooth in the sense above mentioned, i. e. not much disturbed by minor irregularities such as shown by L- or D-curve. On the other hand, L- or D-curve may take various forms according to accidental circumstances such as illustrated by the following examples.

A hypothetical model mechanism which may give rise to a configuration of sea-bed with the characteristics similar to those here pointed out with respect to Japan Sea, may be conceived in several manners, among which one of the probable modes consistent with our modern conception with regard to the general structure of the earth's crust will be such as schematically shown in Fig. 4: (I) and (II) represent two alternative cases. (*a*) is the profile of the crust before the separation of Japan from the continent on the left, while (*b*) represents the state after the separation. (*c*) shows the plan corresponding to (*b*).

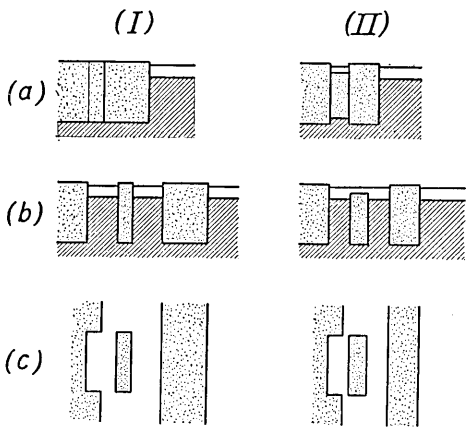

Fig. 4. Hypothetical mechanism for explaining the origin of the Japan Sea. (I) and (II) show the two alternatives. (*a*) and (*b*) show the vertical section of the earth's crust before and after the separation of the marginal piece of sial. (*c*) shows the plan corresponding to (*b*). Stippled area and shaded part correspond respectively to sial and sima, while the water is left blank.

If (I) was actually the case, it remains to be explained how the detached middle piece of sial was submerged below the sea level to form a shoal. Several possibilities are here conceivable in this respect: (i) The lower end of the sial piece might have been molten away on account of sima welling up from the hotter interior to fill up the gap produced as the result of separation. (ii) The upper structure of this detached piece of sial mass might have collapsed in the manner somewhat similar to landslide in mountain region; such an event may happen especially easily in the detached piece as it must have originally been subjected to most irregular stresses during the process of detachment.

Another alternative shown as (II) in Fig. 4 is also possible, in which case the detached middle piece is deformed before detachment from its neighbours. Such a deformation has often been assumed by Wegener.

Again, if the detached middle piece in such a state as shown in (II) (*a*) be covered with a marine deposit, say Tertiary, and afterward separated from the continent without losing its junction with the drifting piece on its right side, we could expect a geological structure not unlike that found in NE part of Honsyû, i. e. Pacific side with Palæozoic and Japan Sea side with Tertiary, provided that the detached pieces were subsequently upheaved due to some or other causes.

The above is merely a kind of working hypothesis which must be subjected to many crucial tests from various sides based on material evidences.

On the other hand, the famous "Staffelbruch" theory attributed to Richthofen seems to be quite at a loss to explain the characteristic bathymetrical features of the sea as are here pointed out, firstly because the profile curves shown in Fig. 2 do not show any systematic tilting of the sea-bed as implied by this theory and secondly because the deepest part of the sea is of a depth which is genuinely oceanic, i. e., above 3000 m., so that such a remarkable depression of a piece of continental mass is difficult to explain as long as we base our consideration on the principle of isostasy and on the assumption of a fundamental qualitative differences between the materials constituting continent and ocean bed.

Regarding the latter point, another fact may be quoted as a crucial evidence. From Fig. 1, the lengths of the segments of the transverse lines belong to the different depth-intervals were measured, in arbitrary scale, and summed up for the different intervals respectively. The sum $\sum$ for each interval is shown in the following Table.

It will be seen that a decided frequency-maximum exists at the depth 3000～3500 m. This result is positively in favour of the assumption here made as to the truely oceanic character of the Japan Sea as well as to the structure of the earth's crust at large.

For a further researches regarding the geophysical significance of the Japan Sea, it is highly desirable to carry out a thorough survey of this sea area with regard to the distribution of gravity and terrestrial magnetic elements.

Table I.

Depth-Internal	Σ*
0～ 500	642
500～1000	238
1000～1500	238
1500～2000	235
2000～2500	233
2500～3000	198
3000～3500	400
3500～4000	141

* Σ in arbitrary unit.

41. 日本海々底の形態

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日本嶋弧がもしも往昔大陸の東緣から分離したものであるといふヴェーゲナーの考が正しいと假定すると，現在の日本を逆に大陸の方に押し付ければ，或程度迄はうまく間隙なく接合されなければならない．さういふ復舊變形をするには先づ朝鮮半島をその根元近い或點を廻轉軸として時計の針の方向に廻轉させなければならない．これは黄海といふものゝ存在によつて假りに許容されるとしても，殘る一つの困難は，朝鮮の舞水端から雄基灣を經て，アムール灣，ウスリー灣，アメリカ灣迄を包括する梯形の海岸線凹入が一つの充塡し難い空隙となるといふ事實である．ところが，日本海の中央部には從來著いし淺瀨或は「堆」のあることが知られて居り，近頃その全貌が稍明かにされて來てゐるので，この堆を作る物質が或は上記の空隙に相當するものではないかといふ想像が起こし得られる．それで，此の考が如何なる程度迄都合よく行くかを見る爲に，試に，日本海の各横斷面の面積を其縱軸上に排列して見た．もし，その分布が平滑な曲線で示されるならば，上の想像が幾分有利になる筈である．さういふ吟味を行つた結果は上記の假說に好都合と見られるやうなものであつた．即，海の横幅や各斷面の平均の深さが海の軸に沿ふて不規則な分布を示すに反して斷面々積は同じ軸に沿ふて極めて平滑な分布を示すのである．

尤もこれだけではウェーゲナー流の考が正しいといふ證據にならないこと勿論であるが，併し此學說を吟味する際の一つの有力な與件にはなるであらう．

序に，リヒトホーフェンの段階的陷沒說や，その他一般の陷沒說では現在の日本海々底の形態を說明するのに根本的な困難があると思はれるので，それ等の要點を指摘しておいた．