

DIE GLIEDERUNG DES WELTMEERES

(THE DIVISIONS OF THE OCEANS)

by

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1. ON THE QUESTION OF THE "NATURAL REGIONS" IN THE OPEN SEAS :

Are there any "natural regions" in the open seas of the world which can be recognised as such by the eye and which may be considered as "landscapes" of the ocean? This question must, in general, be answered in the negative. To the eye, the open sea presents an immense expanse, the mightiest and at the same time the most monotonous "landscape" on earth, but which, nevertheless, does exhibit certain finer features through the variations in the winds, waves and clouds. Only the ice-covered polar seas and the ice-carrying polar currents stand out in relief from this uniform picture as polar "landscapes".

For the geographical descriptions of the oceans of the world there first arises the necessity for a subdivision into *definite maritime regions, which are based upon phenomena hidden to the eye and are first disclosed indirectly through measurements. The geographer must insist that, for such divisions, the nomenclature employed be geographically well-founded and distinctive.*

"Climatic provinces" (Klimaprovinzen) or "wind regions" (Windregionen) (1) "primary biological regions" (biologischen Hauptgebiete) (2) or "maritime types" (Meerestypen) (3) and the "physical regions" (physischen Regionen) (4) are incapable of meeting these requirements, however much they may be of value in providing a deeper geographical insight into the climatic conditions, the biology and the oceanography of the high seas.

While, by means of these divisions, the primary emphasis is laid upon the climatic conditions, in other cases on the conditions of life in and on the surface of the ocean, and finally on the oceanographic relations, mostly on the surface, SCHOTT (5) recently undertook the remarkable task of combining all three of these natural complexes and thanks to his new concept of "natural regions" he achieved a combined presentation of all these phenomena in a new *Geography of the Indian and Pacific Oceans*. In this manner he succeeded in condensing into a sort of general summary a considerable mass of facts relative to climatic, oceanographic and biological conditions. But, with regard to the question posed above, these natural regions established by him are not applicable, in so far as pertains to their limits or their nomenclature. Since SCHOTT laid down the requirement that "in every natural region the properties and processes in the aqueous mass, including the biological facts, and the section of the corresponding properties and processes in the aerial mass, in so far as they mutually interact, must be unified into a comprehensive whole" he necessarily arrived at the variable nature of all such limits and at the impossibility of bringing the oceanographic, climatic and biological regions into mutual conformity — to use his own words: into a "definitely subjective" division and under more or less arbitrary denominations.

(1) W. KÖPPEN: *Die Klimate der Erde, Grundriss der Klimakunde*, Berlin, 1923.

(2) E. HENTSCHEL in G. SCHOTT: *Geographie des Indischen und Stillen Ozeans*, Hamburg 1935.

(3) E. MARKUS: *Meerestypen (Met. Zeitschur*, 1930).

(4) G. SCHOTT: *Geographie des Atlantischen Ozeans, 2 Aufl.*, Hamburg, 1926.

(5) G. SCHOTT: *Geographie des Indischen und Stillen Ozeans*, Hamburg, 1935.

But, by taking into consideration the oceanographic standpoint exclusively, the requirements for an unambiguous delimitation and nomenclature of the maritime areas cannot be met. The question arises immediately: To what depth is the "section of the properties and processes" in the body of water to be carried? If one restricts this to the upper surface layers, then one arrives at the masses of water comprising the great system of ocean currents, which are more or less sharply separated from each other by convergences and other diverse forms of aqueous boundaries. Without doubt, under such restrictions, for instance the Gulf Stream region, the Agulhas stream region, the Bengal current region and all other *current regions* might be designated as "*natural regions*" the boundaries of which are characterised by well-defined dynamic, physical, chemical and biological phenomena.

But even these limits are quite variable and frequently fade away. If we bring into consideration the deeper and more extended layers of the ocean, the so-called stratosphere, then it is found that with the ocean-wide diffusion of the kinds of water in the stratosphere, which comprises various layers drawn from quite different regions and from totally different directions, it becomes impossible to discover any principle of division which shall be valid for the entire column of water. *From the standpoint of the thermohaline structure of the total aqueous mass, i. e. the stratification and the circulation of the ocean, clearly defined "natural areas" cannot be distinguished.* There remains, therefore, as a final basis of division, the orographic-morphological, which on the one hand is determined by the marginal shores and on the other by the conformation of the ocean bottom, in particular by the structure of basins and rises in the deep sea. In so far as the more or less sharply delineated submarine ridges and rises form islands and often island groups, in this manner the limits of the individual areas may become visible on the surface of the ocean. *Therefore, it is only logical, if we attempt to project the morphologically determined — and therefore invariable — limits of the deep sea basins on the surface of the ocean and thus arrive at an unambiguous division of the three oceans and a system of nomenclature for their partial areas.*

To-day, numerous difficulties stand in our way in fulfilling these requirements; arising on the one hand from our faulty knowledge of the submarine relief, particularly in the Indian and Pacific Oceans and in the historical evolution of the nomenclature of the submarine formations: — a question which we must now investigate.

2. ON THE HISTORY OF THE NOMENCLATURE OF THE DEEP SEA BASINS :

The first attempts to arrive at an uniform nomenclature for the deep sea basins of the oceans throughout the world were undertaken in the last two decades of the previous century, in the Atlases of the Deutsche Seewarte, in the bathymetric charts of the *Challenger* Expedition, after PETERMANN (1) in 1877 had already marked the thirteen deepest places in the Pacific Ocean with the names of ships, captains, Chiefs of Hydrographic Offices, etc., to whom knowledge of the regions concerned was due. While V. NEUMAYER (2) in 1882 in the Seewarte Atlas proceeded on the principle that "particular designations (localization) must derive solely from the location of the object in question and that its association with the names of ships or persons should be avoided" - John MURRAY in 1895, marked the bathymetric charts accompanying the *Challenger* Reports (3) throughout with the names of captains, hydrographers, oceanographers and ships, predominantly of British and American nationality, on which depressions of more than 2000 fathoms (3658 m.) were termed "basins" and those of more than 3000 fathoms (5486 m.) were called "deeps" (see tabulation, table 1). One may readily comprehend that these appellations should not be accepted in either scientific or nautical circles, first because it is impossible to associate with geographic presentations this great abundance of personal and ships' names which were known only in a few small technical circles and are mostly forgotten to-day; and secondly, for national reasons, because these names would stamp the entire oceans of the world as an Anglo-Saxon domain. Aside from the

(1) A. PETERMANN : Die Bodengestaltung des Grossen Ozeans (*Petermanns Mitteilungen* 1877, p. 125).

(2) G. v. NEUMAYER : Erläuterungen zur 1. Auflage des Atlas des Atlantischen Ozeans (*Deutsche Seewarte*, 1882).

(3) Summary of Results, *Chart IA - IC*, London, 1895.

"Gazelle Basins" and the "Monaco Deep" and two insignificant places in the Chilean trench, called the "Krümmel Deep" and the "Haeckel Deep", the rest of the depressions and partial areas in the deep sea — in all thirty — on the MURRAY charts were given names of British or American hydrographers or exploring vessels.

In 1899 the VIIth. International Congress of Geographers, convened in Berlin in special session, undertook a consideration of the question of a uniform international terminology for the submarine relief of the oceans, during which the German O. KRÜMMEL and the Englishman H. R. MILL, gave the principal discourses. (1). Both investigators held primarily to an appellation based fundamentally on geographic considerations, which was formulated by KRÜMMEL as follows:

"That the large irregular conformations in the ocean bottom be named exclusively in accordance with their geographical positions".

"That certain important individual points in the submarine relief, such as the soundings giving maximum depths and the shoal places on the rises, be designated by particular names; for such localities provision may be made eventually for the employment of ship and personal names."

In 1899, A. SUPAN arrived at very similar principles in his monograph on the "bottom conformations of the oceans" (2), in which he formulated the requirement that "for all primary parts in the divisions of the seas, geographical names should be employed which are derived either from the sea itself or from the marginal countries". In his bathymetric chart he made the deep-sea basins (of more than 4000 to 5000 metres depth) stand out clearly by means of colour differences and designated them "troughs" (Mulden) or "basins" (Becken) respectively with geographical names. The SUPAN nomenclature (see tabulation, table 1) was taken over in the French translation in the first edition of the *Carte Générale Bathymétrique des Océans* (published by the Prince of Monaco in 1904); on this we find the designations, "Bassin de l'Amérique du Nord, Bassin Brésilien, Bassin Argentin, Vallée de l'Afrique du Nord, Vallée de l'Afrique du Sud, Vallée du Cap, Vallée du Kerguelen, Golfe des Philippines, Bassin du Corail, Bassin des Hébrides, Bassin des Fidji, Golfe Australien Est". With this, important progress seemed to have been made towards the realization of a uniform international nomenclature for the submarine relief of the oceans. Evidently, however, no agreement was reached by the VIIth International Commission for sub-oceanic nomenclature with regard to the deep-sea basins, etc., and the names to be given them. But, with the second edition even of the *Carte Générale Bathymétrique des Océans* the geographical nomenclature was again abandoned and we find on it the personal names of the MURRAY charts with the appendage "fosse": the deepest area as distinguished from "fossé": (trench) and "bassin" (basin).

Since, in accordance with the indications of recent more accurate soundings, the areas of greater depth than 6000 m. to 5500 m. will tend to shrink more and more, the MURRAY designations will be applied more and more to the areas enclosed by the 5000 m isobath; thus for example, as in the first sheet A_1 of the North Atlantic, of the third edition (1935) of the *Carte Générale Bathymétrique*, which has just been published by the International Hydrographic Bureau of Monaco. Also, in the recent English publications such as, for instance, the MURRAY-HJORT: *The depths of the Ocean*, 1912, or the Times Atlas edited by J. P. BARTHOLOMEW which appeared in 1922, the "personal" nomenclature of the year 1895 has been retained for the deep sea basins. The German Bathymetric Charts by GROLL (1915) (3) and SCHOTT (4) (1926 and 1935) employ the geographic nomenclature, although there are slight differences in detail, in particular with reference to the designations of the basins, troughs, and sac (Becken, Mulden and Bucht). For these and other bottom conformations, SUPAN (5), in his exposition before the "Inter-

(1) Verhandlungen des VII Internationalen Geographen-Kongresses, 1899, I. pages 164-71, II. pages 370-92, Berlin, 1901.

(2) Peterm. Mitt., 1899, p. 177.

(3) M. GROLL: *Wandkarten: Der Atlantische, Indische und Stille Ozean, Tiefenkarten* 1:20 Millionen. Braunschweig (Westermann) 1915.

(4) G. SCHOTT: *Geographie des Atlantischen Ozeans, 2 Aufl., Hamburg* 1926. — G. SCHOTT: *Geographie des Indischen und Stillen Ozeans, Hamburg* 1935.

(5) A. SUPAN: Terminologie des wichtigsten unterseeischen Bodenformen. *Im Auftrag der Internationalen Kommission für unterseeische Nomenklatur* (Peterm. Mitt. 1903, p. 151).

national Commission for Sub-oceanic Nomenclature" had already worked out a well-founded terminology, in which the French terms emanate from THOULET and the English terms from H. R. MILL. Under these circumstances it would appear necessary, since the introduction of echo sounding devices, to clear up these by no means unimportant questions by a comparison of the different forms of nomenclature and the new systematic proposals, to bring about a clarification in the matter.

3. NEW PROPOSAL FOR A UNIFORM GEOGRAPHICAL DENOMINATION OF THE DEEP SEA BASINS OF MORE THAN 4000 METRES DEPTH :

In the following we shall endeavour first, by employing the latest bathymetric charts and by following the principles laid down by SUPAN for the *division into deep-sea basins* (of more than 4000 metres depth), to arrive at a *uniform geographical nomenclature*. Our studies will therefore not be concerned with the deep-sea trenches. Further they will not touch on the question of soundings at maximum depths nor the shoalest places on the rises and banks. For such points the use of personal and ships' names is not only permissible but advisable. Thus we shall call the greatest depth measured in the Philippine Trench the "*Planet Deep*" (9788 m.), and the greatest ocean depth determined by echo sounding, also located in this trench, the "*Emden Deep*" (10790 m.); the greatest depth in the South Atlantic Ocean the "*Meteor Deep*" (8264 m.) near which is the somewhat lesser "*Discovery Deep*" (8102 m.).

For the relatively well-explored *Atlantic Ocean* (1), we have already treated the problem of the primary divisions of the ocean in two investigations of the "*Meteor Werke*", in which we used as a valuable criterion the distribution of temperature and saline content of the bottom water; and at the same time we worked out a proposal for the nomenclature of the abyssal basins (2). For the deficiently explored Indo-Pacific Ocean there is lacking a corresponding systematic analysis of echo-soundings which have so multiplied our knowledge of ocean depths in recent years.

Only in the *Indian Ocean* has such an attempt been made to arrive at a presentation of the bottom configuration, over and beyond that given by the present bathymetric charts, through a study of the distribution of the potential bottom temperature. In accordance with the above rather meagre measurements, which are still subject to confirmation and check, the author (3) reached the hypothesis that the Mascara ridge (in the north) and the Kerguelen ridge (in the south) should be connected by a central ridge and that the Indian Ocean is divided by the "*Indian Ridge*" into two parallel longitudinal troughs, which on the other hand are in free communication with the two south polar basins through the deeper saddle in the sub-antarctic rises. In the new bathymetric chart, which is based principally on compilations and not on a new systematic elaboration of the echo soundings, SCHOTT has made this concept of the Indian Ocean his own. Whereas otherwise the depth representations in SCHOTT'S (4) chart of this ocean coincide in general with those of GROLL, there are many marked differences in the Pacific Ocean which are occasioned by the consideration of new echo soundings on the part of SCHOTT. In the great immensity of the Pacific Ocean, even to-day the construction of many of the isobaths is a matter of pure hypothesis in many regions, and we must clearly understand that our new *effort to arrive at the divisions* of the Indo-Pacific expanse has much more the character of a *working hypothesis* than is the case in the Atlantic Ocean.

In the *Pacific Ocean* we distinguish two great meridional longitudinal rises, which stand out in bold relief on the SCHOTT chart and which we have designated as "*ridges*" (Rücken) although their morphological structure and their general orientation have not

(1) G. Wüst: Das Bodenwasser und die Gliederung der Atlantischen Tiefsee (*Scientific Results of the German Atlantic expedition on board the research vessel Meteor 1925-27, Vol. VI, Berlin 1933*). — Th. Stöcks & G. Wüst: Die Tiefenverhältnisse des offenen Atlantischen Ozeans (*Ebenda, Vol. III, Part. I, Berlin 1935*).

(2) *The nomenclature proposed in the works cited has been retained here throughout with the exception of the "Spanish Basin" which we should call the "Iberian Basin" in view of its proximity to Spain and Portugal.*

(3) G. Wüst: Anzeichen von Beziehungen zwischen Bodenstrom und Relief in der Tiefsee des Indischen Ozeans (*Die Naturwissenschaften 1934, pp. 241-44*).

(4) Loc. cit., 1935.

been determined in detail (1) : 1). - The "Eastern Pacific Ridge" which extends from the Gulf of California to the Antarctic and is called by SCHOTT the "Eastern Pacific Longitudinal Rise" and the "South Pacific Rise" respectively, and 2). — the "West Pacific Ridge" which in general forms the rim of the great Western Pacific Trough and is itself resolved into the individual basins it encloses — extends over New Zealand, the Kermadec and Tonga Ridges, the Fiji Islands, the New Hebrides, the Salomons, the Carolines, Mariana and Bonin Islands up to the main Japanese Island of Hondo.

The West Pacific Ridge, which forms to the eastward of Australia the outermost echelon in a series of almost parallel ridges, whose orientation is almost identical with that of the "Andesite Line" i. e. the boundary between the andesite and the basaltic magma; (2) — is conceived, as SCHOTT explains, "as the remainder of a former rim of the ocean, which to-day lies far out to sea" (3). With SUPAN we shall designate these principal depressions formed in the ocean by the ridges, as "troughs" (Mulden) and distinguish seven of them in all (see tabulation, table 1). The troughs are then subdivided into basins of more or less circular shape by the rises and ridges. Even in those cases, however, where the subdivisions are more elliptical in shape, we shall still retain the designation "basin" and thus associate them with the idea of a difference in magnitude as distinguished from the seven long-drawn-out troughs, although this does not conform strictly to the morphological terminology of SUPAN. (4)

In Table 1 there are compiled for inspection the *names of the deep-sea basins* (5) (of depths greater than 4000 m.) at which we have arrived by taking into consideration the principles enunciated by SUPAN and the application of the usual geographical denominations. Opposite these are listed the names which have been previously employed on the authoritative bathymetric charts, from which the confusion and the lack of uniformity in the submarine nomenclature becomes readily apparent.

From what precedes we see the proof of the necessity for our new nomenclature.

We still grope in the dark, however, with regard to the central Pacific trough. In the isobaths drawn by SCHOTT we recognise the hypothetical guiding lines in the SE-NW direction on which GROLL based his presentation of the entire region. But these submarine elevations which radiate from the East Pacific Ridge are permitted by GROLL and SCHOTT to terminate in the Central trough, so that it remains purely a matter of personal conjecture as to how these should be subdivided. In Lat. 20-30° N. the submarine elevations may rather be considered as comprising the "Hawaii Rise", and those in Lat. 10-20° S. as the "Tahiti Rise". In this manner we arrive at a purely hypothetical dri-partition of the Central trough into a "North Pacific Basin", a "South Pacific Basin" and in the middle a "Central Pacific Basin" (6), from which one can, with some justification, separate the "Mariana Basin".

The new *presentation of the main Division of the Oceans* obtained in this manner is made apparent in Plate 2 (7). The trend of the submarine rises which are established with certainty and those which are still hypothetical, and which form the boundaries between the basins, is simply indicated by lines passing through the highest points of

(1) *In accordance with the results of the echo-soundings profiles obtained by the Meteor in the Atlantic Ocean, it is to be expected that in the Pacific and Indian Oceans these long drawn-out rises will also be characterized by steeper slopes when more soundings become available.*

(2) SCHOTT : Loc. cit., 1935, *Table III* or A. BORN : *Über Werden und Zerfall der Kontinentalschollen*, Berlin 1933, p. 386.

(3) SCHOTT : Loc. cit., 1935, p. 50.

(4) *The previous practice of designating the basin in the western Atlantic trough as a "basin" (Becken) (SUPAN, 1899 - SCHOTT, 1926), and that in the eastern Atlantic as a "trough" (Mulde), obviously for the purpose of associating them with their locations, has even less morphological foundation.*

(5) *The deep-sea trenches (Gräben) which SUPAN also includes amongst the major forms, are not taken into consideration : the deeps ("fosses") are not identical with these forms.*

(6) *These designations are purposely retained in general, since it is probable that further soundings systematically conducted will lead to a further subdivision into basins.*

(7) *The 4000 metre contour line in the Atlantic Ocean has been taken from the Bathymetric Chart by STOCKS-WÜST (1935); in the Indian Ocean from the Bathymetric Chart of GROLL (1911) together with the alterations proposed by the author (1934); and those in the Pacific Ocean from the Bathymetric Chart of G. SCHOTT (1935).*

the rises. In the present-day state of our knowledge, it is at present impossible — particularly in the Indo-Pacific expanse — to treat systematically the question of the morphological structure of the deep sea bottom, its oceanographic meaning (for the distribution of bottom temperatures, etc.) and its nomenclature.

4. AN ATTEMPT TO SUBDIVIDE THE OCEANS ON A MORPHOLOGICAL BASIS :

In geography it has been customary, in those cases in which submarine ridges and rises are surmounted by chains of islands, to employ the submarine relief as forming limits for the "seas" (Meeren) (either marginal or inland seas), thus, for instance in the, east Asiatic marginal seas, the seas of the Australasian region, and the American inland sea. This implies, therefore, rather a slight, not a fundamental difference when we employ the submarine relief in subdividing the "open" oceans into "seas", by projecting either the well-defined or the probable boundaries of the deep sea basins, the rises, on to the surface of the ocean. As opposed to previous attempts to subdivide the oceans into "physical regions" which, for the purpose of purely climatic considerations might be described as "climatic provinces" or "wind areas", and for purely oceanographic presentations as "natural regions" which in the sense of the geographical synthesis of SCHOTT, are all of much value, such a subdivision has the advantage that it is based upon invariable and (given sufficiently concentrated soundings) well-defined, natural boundaries, which in the final analysis are also important as regards the circulation of the masses of water and in the determination of the water columns.

If we include with this the marginal seas, we arrive at a division of the high seas and the nomenclature in three groups which, depending at the same time on magnitudes, are designated as: a) ocean; b) sea; c) gulf or sea (*See*).

a) Oceans.

We distinguish the three oceans, the Atlantic Ocean, the Indian Ocean and the Pacific Ocean and we repeat the injunction so frequently made — that the *un-German*, abbreviated designations of "Atlantik", "Indik", "Pacifik", which are employed at times not only in the common German language but also in scientific literature, should be studiously avoided. (1)

Their limits, as represented previously by PENCK (2) in 1894 and by KRÜMMEL (3) in 1907, cannot be derived from the submarine relief to the southward of the southern continents, but must be drawn in the conventional manner through the meridian of Cape Agulhas (20° E.), the south Cape of Tasmania (147° E.) and along the shortest line connecting the Cape of Good Hope and the South Shetland Islands (George Island). (4)

From fundamental considerations we are compelled to hold to these conventional limits for the oceans, since all efforts to locate the shortest possible and definitely defined connections between the South capes of the continents and the opposite portions of the Antarctic Continent must remain incomplete and subjective, in the present state of our knowledge. This applies also to the new proposal of SCHOTT, (5) to establish the limit between the Indian and Pacific Oceans (instead of along the meridian 147° E.), to choose a submarine connection (a submarine rise of less than 3000 m.) which is rather complicated in its delineation and not yet definitely established, namely, between Tasmania — Mill Bank — Macquarie Island — Balleny Island — Cape Adair (South Victoria Land).

It should be noted here that recently another attempt has been made to establish a fourth, independent ocean — the "Southern Ocean". In a publication which seeks very practical objectives (for the purpose of establishing uniformity in the Sailing Directions and the Light Lists) issued by the International Hydrographic Bureau entitled:

(1) In the *Institut für Meereskunde* and amongst the participants of the *Meteor Expedition*, Professor STAHLBERG has repeatedly made use of the abbreviated German expression "der Atlantische" (constructed similarly to the generally employed abbreviation "die Elektrische").

(2) A. PENCK: *Morphologie der Erdoberfläche, Part I, Stuttgart 1894, p. 124.*

(3) O. KRÜMMEL: *Handbuch der Ozeanographie, Vol. I, Stuttgart 1907, p. 15.*

(4) The "Bransfield Meer" is considered as part of the Atlantic Ocean (see E. KOSSINNA: *Die Tiefen des Weltmeeres (Veörf. des Inst. für Meereskunde, H. 9, Berlin 1921, p. 9).*

(5) *Loc. cit.*, 1935, p. 35.

Limits of Oceans and Seas (1), and which is further not justified by the geographical requirements, the loxodromic connections between the south capes of the south continents (Cape Horn, Cape Agulhas, South Cape of Tasmania and New Zealand, Cape Horn) are proposed as the northern limits of the "Southern Ocean". VALLAUX (2), on the other hand permits his "Southern Ocean" (Ocean Austral) to extend as far north as 35° S, for climatological and oceanographic reasons, but to the southward only as far as the south polar circle, and calls it the "circumcontinental ocean" which is again subdivided into three "intra-continental oceans". All of these efforts may have been useful for the treatment of certain specific questions, but their orographic-morphological and oceanographic-climatic bases respectively will not suffice in general to win acceptance in geographical and nautical circles.

b) *Seas.*

A further subdivision of the oceans is given by the "seas", for whose limits the morphological points of view exclusively are decisive. In the open oceans the seas correspond to the deep-sea basins, their boundaries to the submarine rises and ridges. For their detailed designations we employ in Table 3 the geographical names of the deep-sea basins, except that instead of the word "basin" we replace it by the designation "sea". In the morphologically well-defined secondary seas — aside from the Gulf of Mexico, St. Lawrence Gulf, Persian Gulf, Baltic and several smaller partial areas called "See" (seas) in the Australasian inland sea — the designation "sea" is already in vogue. The exact nomenclature given in Plate II corresponds to that prevailing on the German charts. In general — aside from the Bering Sea, Baffin Sea and Hudson Sea (See) — they employ exclusively geographical names, which are derived from the marginal countries or else derive in general from the location or from some special property of the seas. (3). While in the case of the three exceptions noted above — in which the names of the world-renowned explorers and polar explorers of the 17th century have been retained by international usage — the same should not be made to apply to the "Scotia Sea" (4) so often mentioned in technical English literature, with all due respect to the high technical achievements of the "Scotia" Expedition. This morphologically well-defined intermediate sea between the Atlantic and Pacific Oceans which lies between the southern arc of the Antilles and the submarine rise in the Drake Straits, has been called by us the "South Antilles Sea" ever since the *Meteor* Expedition.

c) *Smaller subdivisions - Gulf, Sea (See).*

All of the smaller partial areas in the seas, which are not morphologically well bounded on all sides, we shall designate with the word "gulf" or "See" respectively. Thus in our chart we have marked without seaward limits: the Gulf (*sic*) of Biscay, the Gulf of Guinea, the Gulf of Aden, The Arabian Gulf, Gulf of Bengal, Gulf of California. Other less bay-shaped partial areas we have given the designation "See" (sea), such as for instance the Greenland Sea, the Kara Sea, the eastern Siberia Sea and finally the Sargossa Sea.

In the Polar areas it has long been the custom to associate certain regions with the names of great polar explorers of the past. In these cases we also join in the usual practice in regard to this personal terminology, and designate the peripheral parts of the north polar sea by the names: Barents Sea (See), Nordenskiöld Sea (See) and Beaufort Sea (See).

KOSSINNA has proposed the name "Nansen Sea" (Meer) for the central deep portions of the north polar sea, or in a narrower sense the north polar basin, in honour of its greatest explorer. Since there would be little purpose in aiding the general acceptance of this designation for the larger area — to displace the designation of the North Polar

(1) *Special Publication* N° 23, Monte-Carlo, 1928.

(2) C. VALLAUX: *Géographie Universelle des Mers*, Paris, 1933.

(3) In his article the "Benennung und Begrenzung der Meere" (*i. e.* the Secondary Seas), KOSSINNA, in 1921, in the publication of the Institut für Meereskunde (N. F. H. 9) has given full particulars with which we are, in general, in agreement.

(4) *Discovery Reports* — in particular Volume VI, pp. 205-36: H. F. P. HERDMAN: Report on Soundings taken during the Discovery investigations, 1926-32, Cambridge, 1932.

Sea (Meer) or Northern Ice Sea (Meer) — we would like to propose that the small area lying between Nova Zembla and Franz-Josef Land on the one hand and the North Land on the other, which has been called by BREITFUSS (1) the "West Siberian" or "Mangazea Sea" (Meer), should be called in future the "Nansen Sea" (See) and that the term "Kara Sea" (See) should be restricted to the bight between the peninsula of Samoeden and Nova Zembla. We should rather leave the question open as to whether the designation so often employed in the technical literature of "Irminger Sea" (See) (2) for the area between Cape Farvel (Greenland) and Iceland, for that part of the Labrador Sea (Meer), should be retained. In the south polar seas, the partial areas which are morphologically not fully delimited, have been designated by the names of three great polar explorers who carried on their explorations between the years 1820 and 1843. We concur in this usage and mark them: the Weddell Sea (See), Ross Sea (See), and Bellingshausen Sea (See) (3). On the other hand we do not concur in the further proposals to name other partial areas in the south polar sea after deserving men or the ships of recent polar expeditions, such as, for instance, a "Roald-Amundsen Sea" (Meer), "Belgica Sea" (See), "King-Hakon Sea" (Meer), etc. To-day, when unknown whaling fishers are active the year round in the southernmost latitudes, not far from the southern ice barrier, the era for the further extension of personal terminology in the south polar ocean seems definitely past.

The present-day standpoint can only be: the employment of geographical names as a fundamental basis for all terminology of the partial areas of the oceans, aside from the few exceptions which derive from the times of the earliest explorations. It will depend upon the geographers and the hydrographers to what extent the above attempt to divide the oceans on a basis of morphological considerations finds acceptance in the atlases and the idea of a geographical terminology for the maritime expanses of the globe is taken up. It should be emphasized again, however, that the limits of the open oceans at present are in many cases hypothetical only and that these may be altered when further soundings become available. (4)



(1) L. BREITFLUSS: *Der Sibirische Seeweg und seine physikalischen Verhältnisse (Arktis, 4th Year, Gotha 1931, Justus Perthes, p. 77).*

(2) IRMINGER was a Danish naval officer who was renowned for his oceanographic research in this part of the ocean (about 1850).

(3) In accordance with our principle of non-personal terminology for the seas, we cannot concur in the proposal of SCHOTT to designate the whole Pacific south-polar basin as the "Bellingshausen Mulde" (Bellingshausen trough) particularly because on the English charts only that portion of the south Polar seas which borders on the shores of Graham-Land, is called the "Bellingshausen Sea" (See *Discovery Reports*). Further, the name of this German-Russian explorer and naval officer in the Russian service is Fabian Gottlieb v. BELLINGSHAUSEN (not Bellingshausen as erroneously appears on some charts).

(4) In this article, for the French and English translation of the submarine relief terminology the International Hydrographic Bureau has used the Table published in *Hydrographic Review*, Vol. V, No 2, November 1928.

TRANSLATION OF TABLE HEADINGS AND FOOTNOTES.

TABLE I

Table : The nomenclature of Deepsea Basins (more than 4,000 m.) in the open Sea.

<p><i>New Proposals</i> (from N to S) B = Basin. M = "Mulde" (trough)</p>	<p><i>Atlases of Deutsche Seewarte</i> 1891-1902 Atlantic 1902 Ind. O. 1891 Pac. O. 1896</p>	<p><i>Murray 1895</i> Bathymetric Chart 1:40 Mill. Challenger Reports Summary of Results Chart I, A-C</p>	<p><i>Suðann 1899</i> Bathymetric Chart 1:80 Mill. Peterm. Mitt. 1899 Table 12</p>	<p><i>Groll 1915</i> Atlas of the 3 Oceans 1:20 Mill. Braunschweig (Westermann)</p>	<p>General Bathymetric Chart of the Oceans 1912-1935 2 edit. Sheet A₁ 3 edit. 1:10 Mill. Monaco.</p>	<p><i>Schott 1926 & 193</i> Geography of Atlantic Ocean. Bathymetric Chart 1:30 Mill. 1926 Ind. and Pac. Oceans Bathymetric Chart 1:60 Mill.</p>
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1) Greater than 4000 m. only a small area. — 2) o.N. = No name. — 3) Partial designation for depths greater than 3000 fathoms (5486 m.). — 4) Partial designation of greater than 6000 m. — 5) Is probably divided into a north and south basin by the Trinidad Rise. — 6) Partial designation for more than 3000 fathoms. — 7) Partial designation for more than 3000 fathoms or 6000 m. — 8) Partial designation for more than 3000 fathoms. — 9) Same for more than 5000 m. — 10) Partial designation for more than 3000 fathoms. — 11) The same for more than 5000 m. — 12) Same. — 13) Atlantic portion. — 14) Indian portion. — 15) Partial designation for more than 3000 fathoms. — 16) Partial designation for more than 6000 m. — 17) Partial designation for more than 3000 fathoms. — 18) Same for more than 5000 m. — 19) Partial areas of more than 6000 m. — 20) All partial areas of more than 3000 fathoms. — 21) Partial designation for more than 3000 fathoms. — 22) With the Milne Edwards Deep, Krümmel Deep, Richards Deep, Haeckel Deep. — 23) The southern boundary cannot as yet be morphologically determined.

TABLE I

DIE GLIEDERUNG DES WELTMEERES

Von G. WÜST

Tabelle: Benennungen der Tiefseebecken (von mehr als 4000 m Tiefe) im offenen Weltmeer

Neuer Vorschlag (von N nach S) B = Becken	Atlanten der Deutschen Seewarte 1891-1902 Atl. Ozean 2. Aufl. 1902 Ind. Ozean 1891 Stiller Ozean 1896	Murray 1895 Tiefenkarten 1:40 Mill. Challenger Reports Summary of Results Chart 1 A-C	Supan 1899 Tiefenkarte 1:80 Mill. Peterm. Mitt. 1899 Taf. 12	Groll 1915 Wandkarten der 3 Ozeane 1:20 Mill. Braunschweig (Westermann)	Carte générale bathy- métrique 1912-30 (1935) 2. Ausgabe (Blatt A, der 3. Ausgabe) 1:10 Mill. (Aquatour) Monaco	Schott 1926 u. 1935 Geogr. des Atl. Ozeans Tiefenk. 1:30 Mill. 1926 Geogr. des Indischen u. Stillen Ozeans Tiefenk. 1:60 Mill. 1935
I. Westatlantische Mulde						
(Labrador-Becken) ¹⁾	o. N. ²⁾	o. N.	o. N.	Labrador-Bucht	o. N.	o. N.
Neufundland-B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Nordamerikanisches B.	Nordamerikan. B.	Suhm deep ³⁾ , Nares deep ³⁾	Nordamerikan. B.	Nordamerik. Mulde	Fosse de Suhm ⁴⁾ Fosse de Nares ⁴⁾	Nordamerikan. B.
Guyana-B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Brasilisches B. ⁵⁾	Brasilian. B.	Tizard deep ⁶⁾ Havergal deep ⁶⁾	Brasilianisches B.	Brasilian. Mulde	o. N.	Brasilianisches B.
Argentinisches B.	Argentinisches B.	Ross deep ⁶⁾	Argentinisches B.	Argentin. Mulde	o. N.	Argentinisches B.
Atlantisches Südpolar-B.	o. N.	Ross deep ⁶⁾	fehlt	o. N. (Weddell- Meer)	o. N. (Mer de Weddell)	Südpolarbecken
II. Ostatlantische Mulde						
Westeuropäisches B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Iberisches B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Nördl. Kanaren-B.	Kap-Verden-Mulde	Monaco deep ⁷⁾ Moseley deep ⁷⁾	Nordafrikan. Mulde	Kapverden-Mulde	Fosse de Monaco ⁸⁾ Fosse de Moseley ⁸⁾	Kapverdesche Mulde
Südl. Kanaren-B.	" " "	" " "	" " "	" " "	" " "	" " "
Kapverden-B.	" " "	" " "	" " "	" " "	" " "	" " "
Sierra Leone-B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Guinea-B.	Westafrikan. Mulde	o. N.	Südafrikan. Mulde	o. N.	o. N.	o. N.
Angola-B.	" " "	Buchanan deep ¹⁰⁾	" " "	Südafrikan. Mulde	F. de Buchanan ¹¹⁾	Westafrikan. Mulde
Kap-B.	Südafrikan. Mulde	o. N.	Kap-Mulde	Kap-Mulde	Fosse du Cap ¹²⁾	Kap-Mulde
Agulhas-B. ¹³⁾	" " "	o. N.	" " "	" " "	" " "	" " "
Atlant. Südpolar-B.	o. N.	o. N.	" " "	o. N.	Océan Antarctique	Südpolarbecken
III. Westindische Mulde						
Arabisches B.	o. N.	o. N.	o. N.	(Arab. Meerbusen)	(Mer d'Oman)	Arabische Mulde
Somali-B.	o. N.	o. N.	o. N.	Somal-Mulde	o. N.	Somali-Mulde
Maskarenen-B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
Madagaskar-B.	o. N.	o. N.	o. N.	o. N.	o. N.	Madagaskar-B.
Agulhas-B. ¹⁴⁾	o. N.	o. N.	(Kap-Mulde)	o. N.	o. N.	Agulhas-Becken
Westl. Ind. Südpolar-B.	o. N.	o. N.	im Norden: Kerguelen-Mulde	o. N.	im Norden: Dépression des Kerguelen	Indisches Südpolar- becken
IV. Ostindische Mulde						
Indisch-Australisches B.	Austral-Indische Tiefe	Maclear deep ¹⁵⁾ , Wharton deep ¹⁵⁾	o. N.	Indisch-austral. Becken	Fosse de Wharton ¹⁶⁾	Indisch-austral. Becken
Südaustralisches B.	Austral-Ind. Tiefe	Jeffreys deep ¹⁷⁾	o. N.	Südaustral-B.	Fosse de Jeffreys ¹⁸⁾	Südaustral. Mulde
Östl. Ind. Südpolar-B.	o. N.	o. N.	o. N.	o. N.	o. N.	o. N.
V. Westpazifische Mulde						
Philippinen-B.	Philippinen-Tiefe	Philippine basin	Philippinen-Bucht	Philippinen-Becken	Bassin des Philipp.	Philippinen-Becken
Karolinen-B.	Karolinen-Tiefe	o. N.	o. N.	Karolinen-Mulde	o. N.	Karolinen-Mulde
Sulomonen-B.	Korallen-Meer	o. N.	o. N.	(Salom.-Graben)	o. N.	(Bougainville- Neupommern-R.)
Korallen-B.	" " "	Carpenter basin	Korallen-Becken	Korallen-Meer	Mer du Corail	Korallen-Meer
Neuhebriden-B.	o. N.	Agassiz basin	Hebriden-Becken	(Neue Hebrid.-Gr.)	o. N.	(Hebriden-Rinne)
Fidschi-B.	o. N.	Gazelle basin	Fidschi-Becken	Fidschi-Becken	o. N.	Fiji-Becken
Tasman. (Ostaustral.) B.	Ostaustral. Tiefe	Thomson basin	Ostaustral. Bucht	Ostaustral. Bucht	Bassin de Thomson	Tasman-Becken
VI. Zentralpazifische Mulde						
Nordpazifisches B.	Nordwestpazi- sches Meer ¹⁹⁾	Tuscarora deep, Murray deep, Maury deep, Wy- mann deep, Clover deep, Tanner deep ²⁰⁾	o. N.	o. N.	o. N.	o. N.
Marianen-B.	Marianen-Tiefe ¹⁹⁾	Brooke deep ²⁰⁾	o. N.	o. N.	Fosse de Brooke ¹⁹⁾	o. N.
Zentralpazifisches B.	o. N.	Belknap deep, Grey deep, Hilgard deep, Campbell deep, Miller deep ²¹⁾	o. N.	o. N.	o. N.	o. N.
Südpazifisches B.	Südpazifische Tiefe	Aldrich deep, Oldham deep ²²⁾	o. N.	o. N.	o. N.	Antipoden-Mulde (südl. Teil)
VII. Ostpazifische Mulde						
Guatemala-B.	o. N.	o. N.	o. N.	Guatemala-B.	o. N.	o. N.
Peruanisches B.	(Peru-, Chile-Tiefe)	Buchan basin ²³⁾	Chilen.-Peruan. B.	Peruan.-Chilen. B.	o. N.	Peru-Chile-Becken
Südschinesisches B. ²⁴⁾	o. N.	Barker basin	Pazif.-antarkt. B.	o. N.	o. N.	Bellinghausen-M.
Pazifisches Südpolar-B.	o. N.			o. N.	o. N.	

¹⁾ > 4000 m nur kleines Areal. — ²⁾ o. N. = ohne Namen. — ³⁾ Teilbezeichnungen für Tiefen > 3000 Faden (5486 m). — ⁴⁾ Teilbezeichnungen für mehr als 6000 m. — ⁵⁾ Wird durch Trinidad-Schwelle wahrscheinlich in ein nördliches und südliches Becken geteilt. — ⁶⁾ Teilbezeichnungen für mehr als 3000 Faden. — ⁷⁾ Teilbezeichnung für mehr als 3000 Faden bzw. 6000 m. — ⁸⁾ Teilbezeichnung für mehr als 3000 Faden. — ⁹⁾ Dgl. für mehr als 5000(1) m. — ¹⁰⁾ Teilbezeichnung für mehr als 3000 Faden. — ¹¹⁾ Dgl. für mehr als 5000 m (1). — ¹²⁾ Dgl. für mehr als 5000 m. — ¹³⁾ Atlantischer Teil. — ¹⁴⁾ Indischer Teil. — ¹⁵⁾ Teilbezeichnungen für mehr als 3000 Faden. — ¹⁶⁾ Teilbezeichnung für mehr als 6000 m. — ¹⁷⁾ Teilbezeichnung für mehr als 3000 Faden. — ¹⁸⁾ Dgl. für mehr als 5000 (1) m. — ¹⁹⁾ Teilgebiete von mehr als 6000 m. — ²⁰⁾ Sämtlich Teilgebiete von mehr als 3000 Faden. — ²¹⁾ Teilbezeichnungen für mehr als 3000 Faden. — ²²⁾ Mit Milne Edwards deep, Krümmel deep, Richards deep, Haeckel deep. — ²³⁾ Südl. Begrenzung ist bisher morphologisch nicht zu begründen.

DIVISION OF THE OCEANS IN BASINS

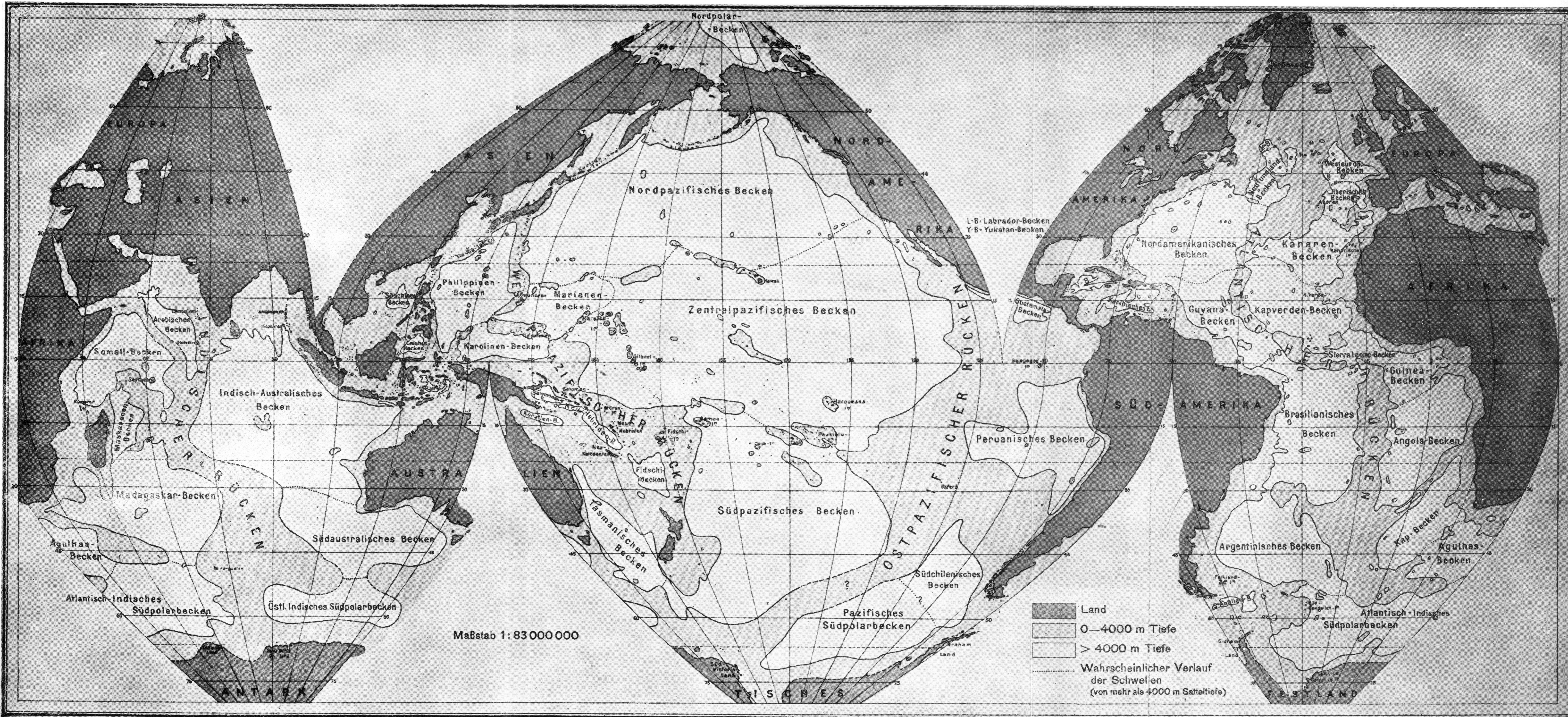


PLATE II
DIVISION OF THE OCEANS IN SEAS

