

# SURVEY OF THE MORPHOLOGICAL DETAILS OF THE OCEAN BOTTOM BY MEANS OF ECHO SOUNDING

by

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(Translated from the German)

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The invention of echo-sounding, its rapid adoption on practically all vessels as an aid to navigation, the possibility of obtaining by this means a series of soundings while the ship is underway, and even recording the depths continuously, has already brought about, in the short space of the last ten years, a considerable increase in our knowledge of the submarine relief, which very greatly exceeds the state of knowledge we should have had, had we been restricted to the older method of wire soundings.

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In addition to the oceanic survey of the larger expanse of the ocean or in the greater basins, which is being undertaken gradually, there is becoming manifest an increasing desire for more accurate bathymetric surveys of the smaller regions where special morphological configurations exist. This wish has been expressed on the part of the navigators for more detailed bathymetric charts in the vicinity of the land ; and it is certain that in the scientific realm (geophysics and geology) there is also an increasing interest in a better knowledge of the « secondary forms », in so far as their structure and configuration are concerned. The edges of the continental shelves, the transverse ridges and rises, the banks, shoals and peaks constitute these « secondary forms » (Kleinformen), which need to be investigated by means of echo-sounding if we are to obtain a better knowledge of their morphological structure. In order to achieve this result, we are in need of much denser soundings and more accurate determinations of their position. It is surprising how little we know of these interesting features. Dr. Stocks has taken the pains to collate all the available soundings known in the vicinity of numerous banks, located in the eastern part of the North Atlantic Ocean, to the North of the Cape Verde Islands, to analyse them and then in the light of these soundings, to draw bathymetric charts (1) of these banks in order to obtain a representation of their bottom configuration. A large number of such charts give a representation which is so highly improbable as to cast doubt upon their reality. This point of view has been reinforced by the echo-soundings on the Josephine Bank (39° 39' N and 14° 17' W) taken by the *Meteor* in the short space of six hours in February 1937 ; soundings which give this bank quite a different aspect from any that might have been obtained from the earlier soundings.

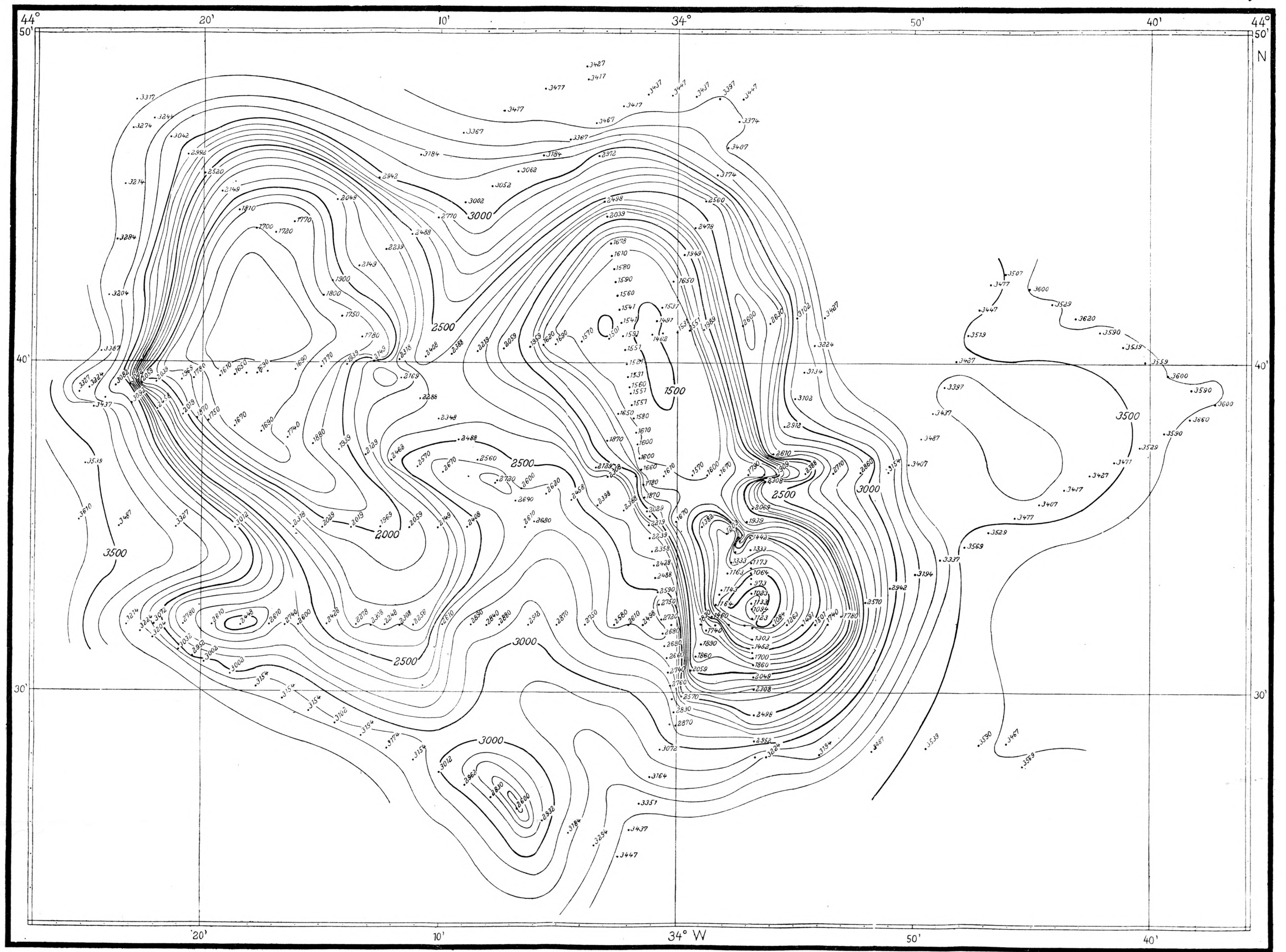
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Further, it cannot be expected that results obtained by different vessels from soundings at different times, and where the positions of one with respect to the other might, taken in conjunction, be in error by as much as 3 to 5 miles, should yield an accurate chart of objects which are not very extensive. The entire bank is not much larger than the uncertainty of position of the different soundings.

The same is true of the soundings on the Gettysburg Bank (36° 30' N and 11° 37' W), taken by the *Altair* on the tenth of last May. Now, according to the chart of Dr. Stocks, it should comprise three elevations rising to about 40 m. below the surface of the water with distances of 20 and 30 nautical miles, respec-

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(1) Manuscript chart kept at the Institut für Meereskunde, Berlin.



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Echolotaufnahme der „Altair“-Kuppe im Nordatlantischen Ozean (44,5° N und 34,0° W). Isobathen von 100 : 100 m  
Maßstab 1:87 500

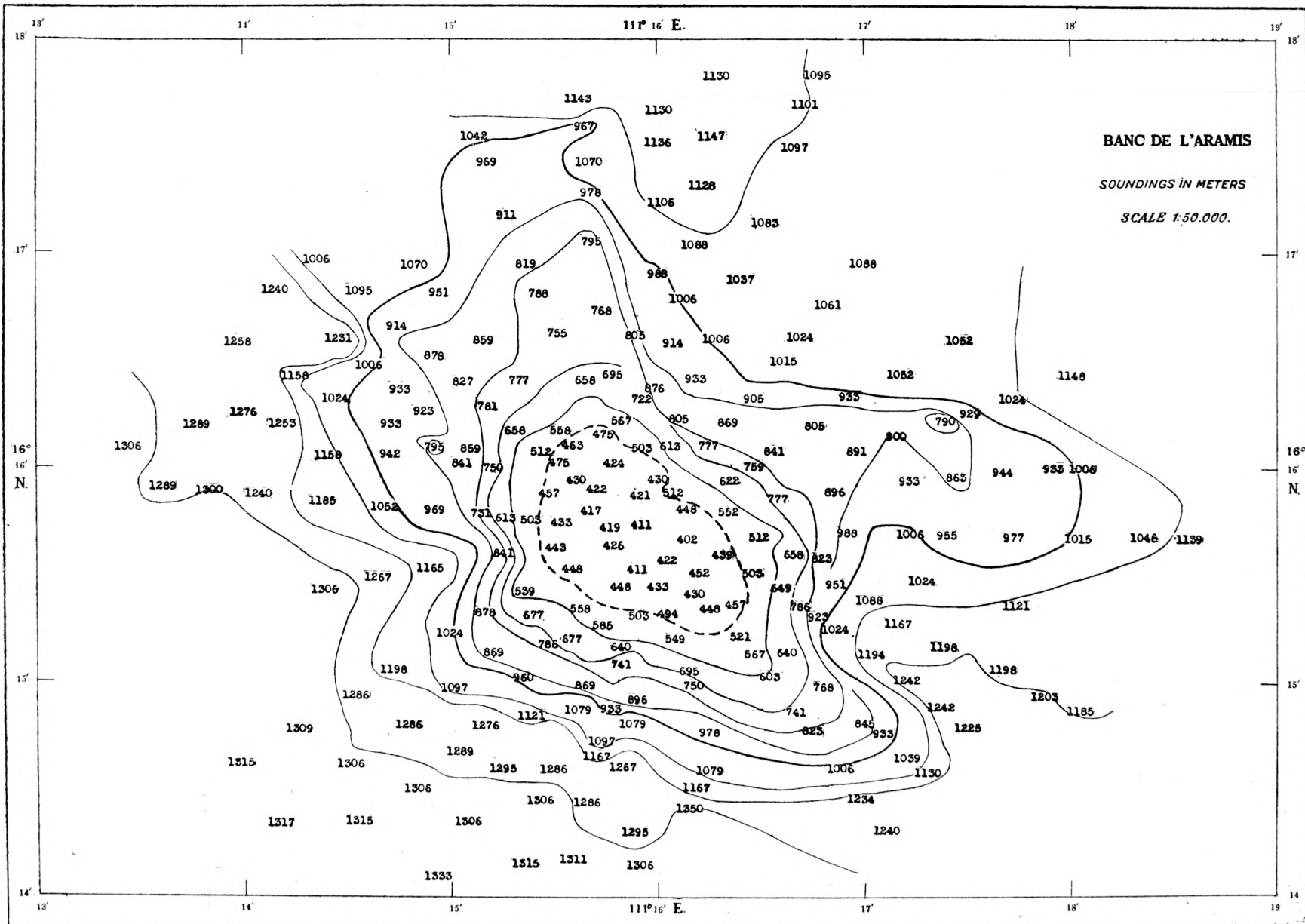


Fig. 2. — Aramis Bank

tively, between them. The western elevation could not be found by the *Altair* nor was there any indication thereof. The positions of the previous soundings were certainly in error.

Only surveying vessels which are capable of surveying the entire area in one operation, in as short a time as possible, of accurately determining the geographical position and of increasing this accuracy on occasion by setting out numerous buoys, are in a position to determine the true shape of such small submarine conformations.

The fact that, in this manner, rather detailed charts may be obtained which are further very instructive, has been proven by the survey of the *Altair* peak, effected by the *Altair* in the North Atlantic Ocean (44° 5' N, 34° 00' W) in the course of its research in the Gulf Stream. The peak was « star » sounded systematically in one day and a half by means of the echo sounder, while lying at anchor for 3 1/2 days over its highest point at a depth of 980 m. with a 4000 m. hawser metres over this peak, doubtless a submarine volcano, having approximately the same dimensions as the Grand Canary Island. What a wealth of material can be gathered from such a chart and how interesting the configuration of such a region !

*Note by Director P. de Vanssay :*

The opinions expressed by Dr. A. Defant on the interest offered by accurate surveys of certain submarine formations are in complete agreement with the efforts of the International Hydrographic Bureau to publish all the results of surveys of this nature. That is why we have reproduced the very interesting survey of the *Altair* Peak.

We also give, to the same scale, a representation of the Josephine Bank in accordance with the soundings taken by the *Meteor* in February 1937 and by the *Schlesien* in October of the same year. We have deliberately neglected all soundings taken in the preceding years for the excellent reasons given by Dr. Defant. Further, in order to utilise the soundings of the *Schlesien*, we have had to allow for a systematic displacement of about 1.9 miles in the soundings of the two vessels with respect to each other, a displacement which presupposes a perfectly admissible error of position, in the inverse sense, of about 1 mile for each vessel. Further, for a single vessel sounding for several hours, the relative error of position between the first and the last sounding might easily amount to one mile, even in the absence of any wind or current. This shows the impossibility, when all landmarks are lacking, of obtaining detailed surveys, and of being able to provide an image of the bottom which may be represented to a scale at which the length of one mile cannot be neglected. That is why it has appeared to us illusory, or even inopportune, to represent the bottom configuration far from the coasts, on the charts of certain areas, to a scale greater than 1 : 1,000,000 (scale at which 1 M. = 1.85 mm.).

This, however, is not the case when the positions of the soundings can be connected up to the coast either by direct measurements, by chains of buoys or by radio-acoustic methods. Further, it is also not the case when one or more buoys may be moored on the ground relief under investigation, so that the relative positions of the soundings are assured with a probable uncertainty of much less than one nautical mile. It is thus that H.M.S. *Herald* was able to obtain « starred » lines of soundings with great accuracy in March 1939, on a bank in the vicinity of the Paracels Islands which was discovered in 1937 by the steamer *Aramis* (see International Hydrographic Bulletin N° V, 1937, page 138). With the aid of the original document published in the International Hydrographic Bulletin N° III, 1939, it was possible for us to establish the adjoining chart to a scale of 1 : 50,000, with depth contour lines every 100 metres, which reveal a well-rounded summit of very regular shape. We were also enabled to reproduce to the scale of about 1 : 95,000 a very accurate chart from the soundings taken in the vicinity of the Gettysburg Bank in October 1933 by H.M.S. *Ormonde* (see International Hydrographic Bulletin N° 1, 1934, page 11).

P.V.

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