THE ALTAIR PEAK (KUPPE)

by

A. DEFANT.

(Translated from the " Bericht über die ozeanographischen Untersuchungen im zentralen und östlichen Teil des Nordatlantischen Ozeans im Frühsommer 1938 (Internationale Golfstrom-Expedition) ", page 40).

NOTE OF I.H.B. : Accompanying the extracts from an article by Dr. A. DEFANT on the Survey of Morphological Details of the sea bottom by means of Echo-Sounding, we gave in the Hydrographic Review, Vol. XVI, N° 2, November 1939, page 56, a reproduction of the very curious survey of the Altair peak (" Altair Kuppe "), discovered by the vessel of that name during the researches effected in the Gulf Stream in the year 1938.

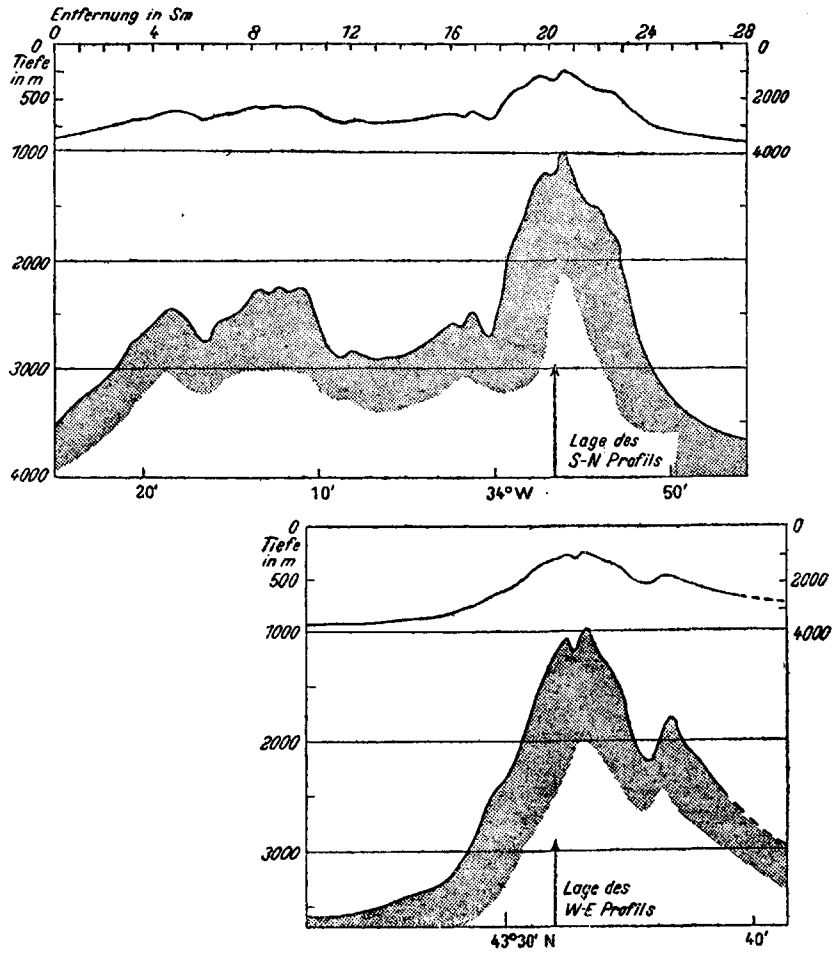
We give hereunder a more complete extract of Dr. Defant's remarks regarding the exploration of this sub-marine peak, in accordance with the report read in 1939 before the Berlin " *Akademie der Wissenschaften* ".

On the first reconnaissance profile in the Gulf Stream area, North-West of the Azores, undertaken for the determination of the bed of the Gulf Stream and the choice of an anchor station in the execution of the proposed repeat series and current measurements from the anchored ship, the exploring vessel *Altair* sounded, in approximately latitude 43°35' N., longitude 34° W., depths around 1500 m., depths hitherto not indicated on any chart. The Monaco Bathymetric Chart of the Atlantic Ocean shows very few soundings in this region; at this section of the West talus of the middle Atlantic ridge, two values in approximately latitude 43°41' N., longitude 34°10' W., and latitude 43°43' N., longitude 33°35' W., respectively, appear : 1772 m. and 1790 m. which are to be considered, perhaps, as an indication that, here, a somewhat uneven bottom configuration is to be expected. These relatively small depths of 1500 m. were decisive in the choice of this position as an anchor station for the above mentioned oceanographic research. During the search for this position, on the second cruise of the *Altair* northwestwards, somewhat more to the South than on the first cruise, after depths which held constant between 3300 m. and 3500 m., decreasing depths were sounded in quick succession, culminating in a value of 980 m. This spot was chosen as anchoring place, and the mooring was effected with a 7500 m. hawser, thereafter with a 5000 m. cable. The anchoring, which, in latitude 44°33' N., longitude 33°35' W., lasted from 16th to 20th June 1938, (90 hours), was good, and there were no indications that the ship had dragged in any way. After execution of the proposed repeat series and current measurements, it was decided to sound out in rapid sequence, on a zigzag course, the whole of the area around this bank, protruding steeply from a region of roughly 3500 m., in order to obtain a somewhat trustworthy picture of the morphological environment at the anchor station. There was no question of obtaining, through closely spaced sounding lines, a very accurate representation showing all the minor details of the bathymetric conditions of the whole region, as, for instance, that given by the U.S. Coast and Geodetic Survey for the surroundings of the Bogoslaf volcano (Bering Sea), (1) because for that, the time and necessary means would not have sufficed. It was rather with the idea of comprehending the primary forms of the submarine landscape, which might, anyhow, be assumed as capable of influencing the conditions of flow in, or on the edge, of the bed of the Gulf Stream. This investigation took place in the interval of 20th to 23rd June, on 20 different successive courses. In general, with slight depth variations, the soundings were effected every 5 minutes, with uneven bottom every 2 1/2 minutes, and at shallow depths continuously. In this way, for the area between latitude 44°25' to 44°48' N., longitude 34°40' to 34°25' W., 400 soundings were obtained altogether, which after reduction to true depths, were used for the

(1) *See in this connection:* A. DEFANT " *Über die Aufnahme morpphologischer Einzelheiten des Meeresbodens mittelst des Echolots* ". Geologische Rundschau, 1929, Vol. 30, Heft 1/2, p. 121 & seq.

construction of an isobath chart. For the joining up of the different lines of soundings, only two fixed points (astronomical fixes) were used, of which one was the anchor station, the other the noon position on the last day of the sounding work. No other adjustments within the system of soundings were effected than those which resulted from these fixed points. The chart of sounding points contains, therefore, no subjective elements, and the isobaths are lines of pure interpolations between the soundings. This bathymetric chart (2) reproduced herewith, in isobath representation 100 m. apart, shows also, as far as practicable, the sounding positions and the depths.

The submarine elevation which rises abruptly from fairly regular surroundings of roughly 3500 m., proves to be a rather extensive bank composed of three sugar loaves with gentle slopes, of which the two lower in the North and North-West, do not, most likely, greatly exceed 1600 m. and 1500 m., respectively, and thus overtop the environs by roughly 2000 m., whereas the third in the South-West, has revealed itself as an extremely steep-sided cone (Kegel), which rises to less than 1000 m. depth. It is on this summit that the *Altair* was previously anchored. No doubt we have to do here with a submarine volcano cone which, from North-East to South-West, via South-East, and from surroundings of



Morphological profiles through the *Altair* Cone.
Above : West-East profile in 43°32' N. *Below :* South-North profile in 33°56' W.
(hatched portions, fourfold exaggeration of height; above, without exaggeration).

(2) *See also Hydrographic Review, Vol. XVI, N° 2, page 56.*

3500 m., rise uniformly by 2500 m. in the shape of a sugar loaf. The run of the isobaths is generally simple, which. no doubt, is primarily traceable to the rather wide spacing of the lines of sounding. The discrepancy in latitude 44°37' N., longitude 33°57' W., could be made to disappear by shifting the East-West line of soundings, on which it is based, to the West, by about 1 1/4 nautical mile. The smooth run of the isobaths which then ensues, is, however, in itself no more probable than the irregularity itself. The figure shows two morphological profiles through this cone; the first, from West to East, passes just South of the summit of the volcano, the second is oriented perpendicularly to the first, from South to North, and passes exactly over it.

In the upper part of the figure, the profiles are drawn without exaggeration of height; in the lower part, with a quadruple exaggeration. The mean inclination between the 1000 m. and 3000 m. isobath, in the South, South-East and North-East slopes (here to 2500 m.) is 1 : 2.4; 1 : 3.2: 1 : 2.6, which corresponds to slope angles of 22 1/2°, 17° and 21°. Such values occur not only with submarine volcano cones, but with continental volcanoes as well. But places may be found which are much steeper. On the West side of the volcano cone, places occur with slope angles of 47° (3). The steepest place lies, most likely West. where with a distance of 0.4 nautical mile, a difference in sounding of 963 m. was found. This yields a slope angle of 52 1/2°, which, on the mainland, would appear as a wall of rock. The summit of the volcano seems to present a small hollow in the middle; should this be the crater of the volcano ? The two other elevations to the North and North-West are flatter in their upper part, more like a plateau, and only after 1600 m. to 1800 m. depths respectively, does the regular slope begin with inclinations of roughly 1 : 4. All three elevations, of which the Western is separated from the two Eastern by a saddleback of the sea bottom to about 2400 m., have, together, an expanse which corresponds approximately to that of the Grand Canaria.

THE BOTTOM SAMPLE BROUGHT UP AT THE ANCHOR STATION OF THE "ALTAIR"

At the anchor station, on 19th June, during the 63rd oceanographic repeat series (leader Wüst) a solid piece of the sea bottom as large as two fists, which had got entangled in a kink of the wire strand, was brought to the surface from a depth of 1305 m. The depth figure is reliable, since it originates from the indications of a non-protected thermometer that had been secured to the lowest water bottle, which, on this series, came to rest on the floor. Temperature and salinity in this depth were 3.9° C and 34.94 o/oo. The bottom sample which, evidently, comes from the fracture of a coral growth, was handed over to several specialists for examination. The following is an extract from their reports:

"The coral sent me for examination is unfortunately a dead specimen, which, in most of its parts, is so badly preserved, that an exact determination is no longer possible. As concerns family, it belongs to the Oculinidae which are often met in great depths. The coral is so severely corroded that a determination beyond the above given family — which, besides, could be but doubtfully determined — is not possible. But, as the piece is dead, it cannot be stated whether it was alive at the place of finding. At any rate, it must have been lying there for some time, as it is covered with colonies of Bryozoera" (M.E. Thiel, Hamburg, Zoological State Museum).

"A closer study of this piece showed that it is a branch of coral dead very long ago, which presents already strong typical signs of decay. On being caught, the piece was probably detached from a large block, since one of the sides is pretty well preserved; whilst the other presents strong signs of rolling or grinding. Furthermore, most of the parts of the piece are eaten up by Silicispongiae, such as are never observed on living animals. The natural colour of this coral branch is well recognizable in a few places, where it is lodged, as a faint brownish colouring, in the upper layer of the lime. But its greater part, by far, is clearly coated with manganese crust, which is built in greater depths only, and requires a long lapse of time for its formation. The rolled or ground outer side indicates that, either for a long time a stream of water laden with much sand

(3) *This steep slope is conditioned, however, by the lie of the two lines of soundings which cross in latitude 44°30' N., longitude 34°00' W.; a slight displacement of the easterly towards East, would cancel out this irregularity in structure of the volcano. Only a closer-spaced net of sounding points could decide as to which concept is right.*

has acted upon it, or that the whole block was rolled or pushed on the bottom of the ocean. Anyhow, these durable changes must have occurred a long time ago, since the manganese crust had already covered all the worn down parts. The probability is, however, that this piece of coral grew in the location where it was found, but that the environment has undergone a change (through subsidence of the whole of the floor to greater depths). This last hypothesis seems the most plausible, as the region of the Azores seems very likely to have been subjected, in the earlier geological periods, to volcanic processes of that kind. Consequently, this specimen would be rather sub-fossile than recent, and the probability of capture from a secondary stratum bed does not seem precluded". (J.G. HELMCKE, Zoological Museum of the University of Berlin).

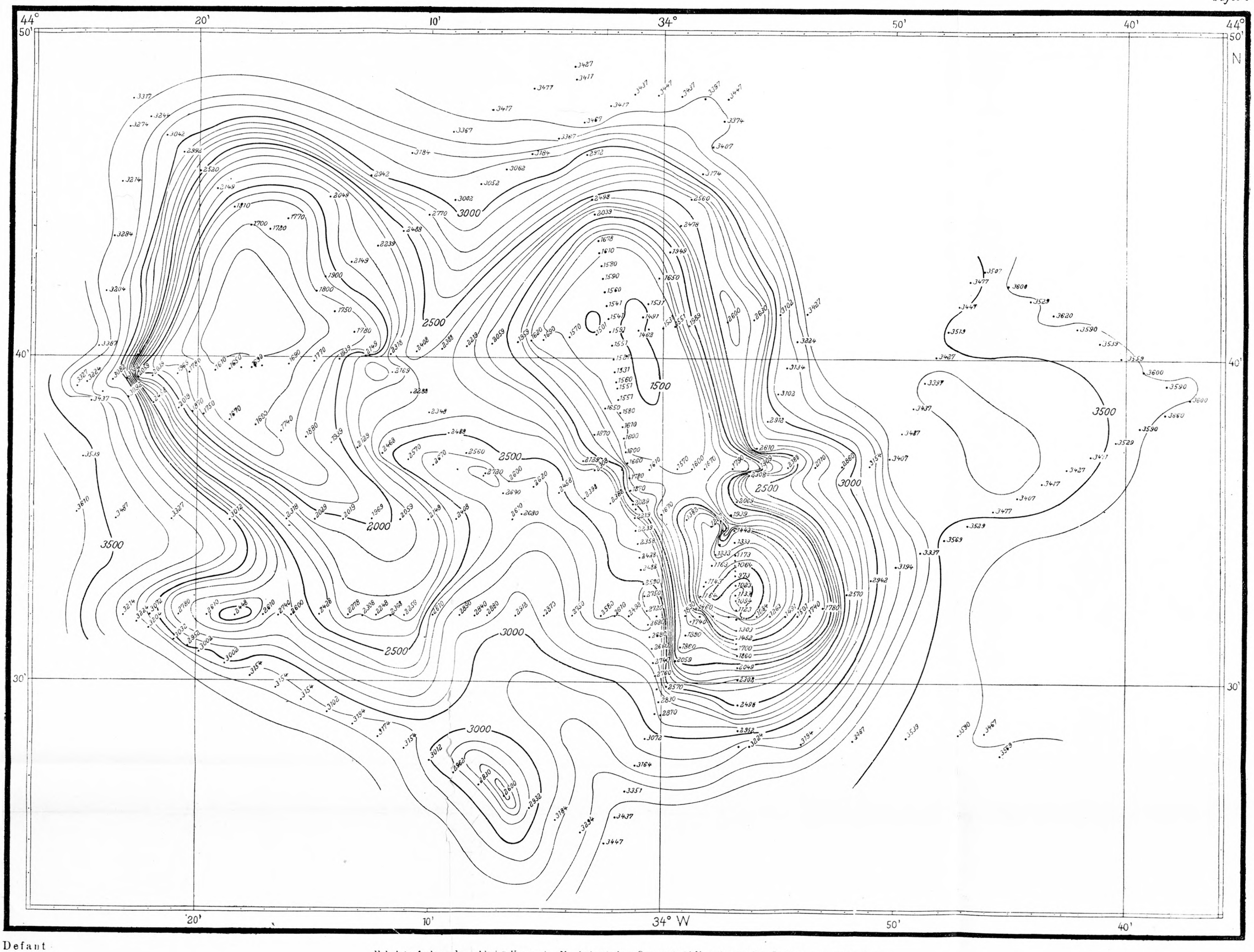
"The sample brought up accidently belongs almost exclusively to a recent abyssal form. The Brachiopode species Eucalathis tuberata Jeffreys, unsuccessfully searched for near the Azores, is ascertained at last, and for the first time, in the sample in question, by which the area of distribution of this species is also adapted to the picture of the oceanographic conditions". (J.G. HELMCKE).

"The examination of a sponge showed that the sample is in effect a piece — at any rate of respectable size — of the recent Silicispungea Macandrevia azorica Gray 1859; it is a species found in the northern Atlantic Ocean, from the region between the Feroes and Scotland, right down to the Azores, in depths ranging from 454 m. to 1550 m., of which most of the finds emanate from the region of the Azores. The sponge crusts and sponge bits on the sample of coral and sample of bottom, belong, most likely, to 5 species at least (partly of the Cornacuspongides, Halicnemia and Gallious genera, partly of tetraxone genera) which are already known in the Porifera fauna of the adjacent region, in the same, and even greater, depths." (W. ARNDT, Zoological Museum of the University of Berlin).

"On the coral colony were two isolated chalices of corals, which, maybe, are something else. It might be that they are young isolated chalices of colony-building coral, but it might also be that they are solitary abyssal forms." (M.E. THIEL).

"The biggest piece of the two ophiudirea is: Ophiolitrella clavigera (Ljungman), a species occurring in the deep water of Ireland and West Greenland, down to the Azores. The second animal is still too young to permit its determination with certainty; it is most likely an Amphiura sp. juv." (A. PANNING, Hamburg, Zoological State Museum). Still undetermined are the Globigerina shells, which point to an embedding of the piece of coral in the Globigerina ooze of great depths, as well as the mostly broken Serpulide tubes, which are already coated with a manganese crust and of which only one contained the soft body of an animal.

APPENDIX: Altair-Cone, in 43°33' N., 33°58' W. (Isobaths 100 m. apart, scale 1: 250,000).



Defant

Echolotaufnahme der „Altair"-Kuppe im Nordatlantischen Ozean (44,5° N und 34,0° W). Isobathen von 100 : 100 m
Maßstab 187500