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NON-EXISTENT SEAMOUNTS
A CASE STUDY

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ABSTRACT

Attempts to pinpoint some of the shallow underwater features shown on nautical charts have failed. Some of these features appear to be non-existent. An evaluation of these indicates that many were found using shallow water echo sounders, which were run intermittently in deep water. The depths reported represent either a shallow scattering layer or a bottom of varying reflector character at greater depth. Difficulty in determining the phase in which the recorder was operating prevents an accurate determination of either the type or the depth of the reflector surface. The American Scout Seamount, reported 700 miles east of Newfoundland in the North Atlantic Ocean is presented as a feature typical of those that cannot be found. Data assembled to evaluate this feature also point up the need for an investigating technique of a reconnaissance nature if non-existent feature or features positioned more than 30 nautical miles in error are to be conclusively eliminated from hydrographic data. Removal of non-existent features from nautical charts is dependent on the international agreement of standards and procedures to be used in conducting the reconnaissance and detail surveys; and the publication of the results of these surveys in official international journals or through official "Notices to Mariners".

This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Manuscript.

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I. INTRODUCTION

Shallow areas of the ocean have always been of concern to the Mariner in the safe navigation of the oceans. The development of the submarine in this century has extended the depth to which features are considered a hazard to navigation. The U.S. Naval Oceanographic Office has a responsibility of providing charts which accurately show the depth and location of dangerous underwater features. Recent attempts by survey vessels to pinpoint some of the shallow features shown on these charts, for military and research purposes, have failed. These features are either non-existent or they are not located in the position originally reported.

Position discrepancies have always been a part of sounding data because of the limitations in celestial and dead reckoning navigation. Depth discrepancies have a similar long history particularly because of the limitations in sounding by lead line. Depth discrepancies associated with lead line sounding are usually discrepancies of reading excessive depths. Since the introduction of the echo sounder a new type of discrepancy has developed, the reporting of depths that are too shallow. This is generally caused by mistaking a reflection from organisms in the ocean for a reflection from true bottom. The discrepancy is undetected in many shallow water instruments by the inability of the operator to determine the multiple of scale depths in which the sounder is recording and the failure of the shallow water instrument to record true bottom.

This is illustrated in the reported sounding data upon which the American Scout Seamount is based. Numerous merchant ships have reported

this feature, yet Naval and Oceanographic vessels have failed to find it. A sounding history of this feature is presented here to show the nature of the evidence both for and against its existence. The search for this feature has indicated that it does not exist, at least in the area reported. The magnitude of the discrepancy necessary to place it beyond the limits of investigation suggests that it does not exist at all. The method of search and the reporting of results indicates some of the problems in developing conclusive evidence if such features are to be removed from the nautical charts.

II. EVIDENCE FOR THE AMERICAN SCOUT SEAMOUNT

The American Scout Seamount was first indicated in July 1948 from a 20 fathom (35m) depth taken by the SS AMERICAN SCOUT at 46° 20'N, 37° 21'W. The fathometer was placed in operation after personnel on the bridge had noted an unusual green color in the ocean. A depth of 20 fathoms (35m) was recorded immediately, and continued to register for ten minutes when the contact was completely lost. No lead line evaluation was made. The SS AMERICAN SCIENTIST reported the seamount again in August 1948 as a 20 fathom (35m) depth at 46° 23'N, 37° 20'W. The depth was checked simultaneously with lead line but no bottom was reached and no sample was obtained. (Fig 1)

The most extensive sounding of this feature occurred in August 1948. The SS SOUTHLAND obtained fathometer soundings of 29, 29, 32, 90, and 35 fathoms (53, 53, 58, 165, and 64m) between 46° 18'N, 37° 45'W and 46° 20'N, 37° 38'W. No soundings were recorded on the fathometer before or after the recording of the shallow depths. No lead line evaluation is reported.

In July 1964, the SS WACOSTA reported a 19 fathom (35m) depth at 46° 06'N, 38° 01'W. This depth was recorded for a period of one minute with no trace being registered before or after this time. No lead line evaluation is reported.

III. EVIDENCE DISPROVING THE AMERICAN SCOUT SEAMOUNT

In 1958, the DISCOVERY II traversed the area 10 to 20 nautical miles south of the American Scout Seamount. A minimum depth of 2362 fathoms, (4320m) uncorrected, was sounded at 46° 03'N, 37° 05'W with an average depth of 2420 fathoms (4425m).

In 1961 the USS HARDER, crossed the area within three nautical miles of the position of the group of soundings reported by the SS SOUTHLAND. A minimum depth of 2450 fathoms, (4480m), was reported. The fathogram accompanying the report showed the bottom to be relatively flat. In 1962, the USS YAKUTAT crossed the area about 6 nautical miles south of the position of the SS AMERICAN SCOUT and SS WACOSTA soundings. The minimum depth of most of this line is 2300 fathoms (4210m). A sounding of 2200 fathoms (4030m) was recorded at the east end of the line in this area. The depth of this sounding line is at least 100 fathoms (183m) shallower than the other sounding lines in the area, indicating a consistent depth error in the record.

In 1964, the R/V ATLANTIS II traversed the area in search of the American Scout Seamount for the purpose of conducting a fishing experiment (Backus and Worthington 1965). A minimum depth of 2375 fathoms, (4340m) uncorrected was recorded between the positions of the SS AMERICAN SCOUT sounding and the SS SOUTHLAND soundings. The average depths in the area are 2420 fathoms (4425m).

In 1965, the USNS GILLISS under the technical control of the U.S. Naval Oceanographic Office conducted a sounding and magnetics survey in search of the American Scout Seamount. These soundings indicate a general depth of 2420 fathoms (4425m) in the center of the area. The magnetics survey failed to find an anomaly that would indicate the presence of a seamount (Fig. 2). Smoothness of the magnetic field indicates that the magnetic sources are relatively deep.

In June 1966, the USNS SILAS BENT surveyed the area and found no depths less than 2362 fathoms (4320 meters) (figure 3). Significantly, scattering layers were recorded at several places. One of these scattering layers (figure 4) could understandably be mistaken for true bottom on the trace of a small echo sounder.

IV. SOUNDING EVALUATION

Soundings from merchant vessels crossing the vicinity of the American Scout Seamount periodically report shallow depths which cannot be located by Naval and Oceanographic vessels. It seems unlikely that the feature could have been missed because it would be relatively large. A typical seamount is 10 to 12 times wider than it is high, as is evidenced by the contours of the New England Seamount Chain nearby (27°N, 59°W). Since the average depth of the bottom is 2400 fathoms (4390m) in the vicinity of the American Scout Seamount, the feature would have to be about 25 nautical miles wide across the base. The concentration of sounding data now available for the area makes it highly unlikely that a feature of this magnitude would not be detected. The failure of the magnetic survey of the USNS GILLISS to indicate a magnetic anomaly in the area is further indication that the feature probably does not exist. For example, a magnetics survey

conducted in the New England Seamount Chain area found the presence of these seamounts to be indicated by large anomalies with good correlation between the location of the anomaly and the posi ion of the seamounts as indicated by bathymetric contours (Walczak 1963).

V. NAVIGATION EVALUATION

Navigation errors in the American Scout Seamount area are apt to be large. The area is at the extreme edge of Loran "A" groundwave coverage, and positional accuracy within 5 miles can be obtained only under excellent receiving conditions. Most of the ships traversing this area are limited to celestial fixes in the morning and evening, and dead reckoning in between. Backus and Worthington (1965) indicate that their celestial fixes are accurate to within $\pm$ 0.5 mile, but interpolated to $\pm$ 3 miles, because of poor weather and missed fixes. The U.S. Naval Oceanographic Office considers celestial fixes for this study accurate only to $\pm$ 2 miles and when interpolated, for the reasons given, the positions were no better than $\pm$ 5 to 10 miles.

The fixes for the USNS GILLISS are considered to be within $\pm$ 10 miles, although accuracy of individual lines relative to each other is considered good. The fixes for the USNS SILAS BENT are considered to be $\pm$ 4 miles. The area of coverage by the surveys of the Atlantis II, the USNS GILLISS, and the USNS SILAS BENT should be sufficient evidence that a large seamount does not exist in this area, regardless of moderate discrepancies in position.

VI. DISCUSSION

Why do merchant ships report shallow depths when Naval and Oceanographic vessels do not? Perhaps the answer lies in the mode of operation

of sounding gear aboard the merchant ships. These ships are usually equipped with low-powered, short-range sounding equipment intended for use when the vessel is operating in shallow water, such as is encountered when entering or leaving port. The sounding gear is operated only occasionally when the ship is in transit in oceanic depths. This saves on the cost of paper, up-keep of the equipment, and the time spent in standing watches on the gear. The result is discontinuous unrelated data rather than a comprehensive sounding program. Under these conditions, positive depth interpretation of the information collected is extremely difficult for the equipment operator and virtually impossible for a person not present when the data was collected. The reason for the difficulty is that the operator cannot be certain in what phase the return echo is recording when the recordings are not continuous. For instance, if a recorder with a scale of 0-200 fathoms is being used in water 300 fathoms deep, the return trace will be recorded at 100 fathoms. Under good recording circumstances, water depths several phases deep will be recorded. If the equipment is turned on only occasionally, there is a chance that the depth, being some multiple of the scale, will be recorded incorrectly. The only means of assuring that the correct depth is determined is to have a continuous sounding profile or to count the time lag between an individual outgoing pulse and the return echo.

If a scattering layer is present when the sounding equipment is operated sporadically, it is possible that the return echo from this layer will be interpreted as the true bottom. This is especially true when the scattering layer is dense and the bottom is at great depth or a poor

reflector. Scattering layers have been noted in many oceans. Bates (1947) for example, pointed out the presence of a "phantom bottom" on an echogram taken in the North Pacific Ocean west of Hawaii, that the ship captain initially thought was shallow water. Bates attributed the phenomena to fish or other marine animals because the true bottom becomes evident when a tablemount also appeared on the echogram.

A scattering layer is indicated in the vicinity of the American Scout Seamount from several bits of evidence. The SS AMERICAN SCIENTIST could not find bottom with a lead line while recording shallow depths on the fathometer. The ATLANTIS II mentions the presence of a scattering layer when approaching the area (Backus and Worthington, 1965). Personnel of the SS AMERICAN SCOUT mention an odd green color to the water which subsequently does not appear to have been a true bottom. A scattering layer is most conclusively identified on the echo sounder record of the USNS SILAS BENT. The portion of the record shown, includes true bottom at about 2400 fathoms (4389 meters), a light trace from a scattering layer at about 140 fathoms (256 meters) and a strong return just below 30 fathoms (55 meters). This scattering layer was located in the southeast corner of the surveyed area. (Figure 3) A second strong scattering layer was identified 25 nautical miles to the northwest as noted on figure 3.

Thus, the American Scout Seamount does not exist in the location reported unless it is an unusually steep sided feature which does not possess significant magnetic character. Since this is unlikely, it is probable that the shallow soundings represent reflections from a shallow scattering layer or bottom of discontinuous character at 2420 fathoms (4425m). The U.S. Naval Oceanographic Office no longer contours a feature here, although the shallow soundings are retained on charts with an "existence doubtful".

VII. NEED FOR A RECONNAISSANCE TOOL

The majority of position errors in sounding data are less than 30 nautical miles. This permits existing features, which are reported in an erroneous position, to be located by a shoal investigation covering the area of a degree square. Obviously, such an investigation can be inconclusive when the position error exceeds 30 miles or where non-existent features are being sought. Extension of the area of investigation consumes an increasing amount of time and energies without additional results.

A practical method of shoal investigation would therefore start with a reconnaissance investigation to determine whether a feature of any magnitude was present in a general area. Where a feature was indicated, a shoal investigation covering a degree square (or less) would be undertaken to detail the feature. Where no feature was indicated the feature would be considered non-existent. To demonstrate how this would work, consider a reconnaissance investigation by topographic echo, a method of exploding small charges in positions calculated to produce echos from the feature under investigation. This method was employed in an operation conducted by Lamont Geological Observatory with the support of the U.S. Navy Bureau of Ships and the Office of Naval Research (Tirey and Ewing 1953). The R/V ATLANTIS II had searched unsuccessfully for Echo Bank (21-12E, 58-43W) in 1950. Investigation by topographic echo technique followed in 1953. During the investigation, echos were received from known topographic features elsewhere, but none were received from the vicinity of Echo Bank. A second phase of this investigation consisted of exploding small charges in positions in which the presence of Echo Bank could be expected to cause an "acoustical shadow" at the receiving station. The results of this phase were inconclusive because of several operational problems. On the basis of the first phase, Echo Bank was considered to

be non-existent in the magnitude reported.

Doubtless there are several tools of investigation at hand which would serve in a reconnaissance stage. An interesting tool under consideration is the space satellite. The U.S. Naval Oceanographic Office is participating in the NASA natural resources program. This program includes the use of space vehicles to reconnoiter large ocean areas. Color photography will locate and position the shoal features. Microwave, radar, and infrared sensing devices may detect those changes in the mass character and movements of ocean waters caused by the presence of the deeper features.

It is not anticipated that the results of reconnaissance surveys will be 100% conclusive in disproving suspect features. The primary goal should be a significant reduction in the number of suspect features that need to be investigated by detailed surveys. The total detailed survey investigation time is expected to increase since a considerable number of previously undetected features should be located.

VIII. ELIMINATION OF DOUBTFUL DATA FROM CHARTS

At present, the surveying of a doubtful feature does not necessarily lead to the elimination of the doubtful data from the nautical charts. Perhaps the primary reason for this is the lack of international standards for investigation and the lack of an official publication stating the significance of survey results. For example, the American Scout Seamount appears to be non-existent based on the data available through 1966. Yet some of these data were taken in the area by chance, other of these data indicated no consistent method of investigation. The cartographer or hydrographer faced with a potential maritime disaster on one hand or the price of ink necessary to print "existence doubtful" on the other hand,

takes the obvious choice on the basis of such evidence.

The International Hydrographic Bureau (IHB), has distributed an inquiry, Circular Letter 14, 1965 in an effort to bring together the requirements of member States and to assign areas of responsibility. The results of this inquiry are presented in Circular Letter 26, 1965. In brief, the majority of member States wish first to evaluate doubtful data which consitutes a danger to surface navigation. Preference is given to areas in which dangers are numerous or in which the volume of traffic is high. Ships having occasion to investigate doubtful dangers are encouraged to do so. The role of the IHB is mentioned as that of investigating, fostering and orienting investigations and the centralization of all information on doubtful data. Encouragement is given to the survey type investigation. Ultimately, as the search for the American Scout Seamount has shown, the elimination of doubtful features will require that the investigations of "Ships of Opportunity" or the standard survey vessels will have to be supplemented by reconnaissance investigations.

IX. CONCLUSION

The intermittent use of shallow water depth recorders in deep water results in discrepancies in reporting true depth. These discrepancies are caused by the difficulty in knowing in which phase the sounding gear is recording and the difficulty in distinguishing the true bottom from a scattering layer.

Investigations to disprove the existence of features, such as the American Scout Seamount, are expensive using present techniques. Failure to find the feature within a degree square does not prove that it does not exist outside the area investigated. The feature may also be an unusually steep, non-magnetic feature, capable of existing between

survey lines.

A reconnaissance tool such as the topographic echo technique is needed which will more simply evaluate suspect features. This tool will serve also to locate mispositioned or previously undetected features which can subsequently be surveyed in detail. Standards and procedures for conducting the reconnaissance and detail surveys for doubtful shoal soundings in the deep ocean should be established by the several international hydrographic organizations so that the results can be considered conclusive. Results of surveys conducted for this purpose when published would more likely receive official approval for the removal of doubtful features by the individuals charged with this task.

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Tirey, G. B., and Ewing, J. I., 1953, Investigation of Existence of Echo Bank by Topographic Echo Technique: Technical Report #3, Lamont Geological Observatory, July.

Walczak, J. E., 1963, A Marine Magnetic Survey of the New England Sea mount Chain: U. S. Naval Oceanographic Office, Technical Report-159, October.

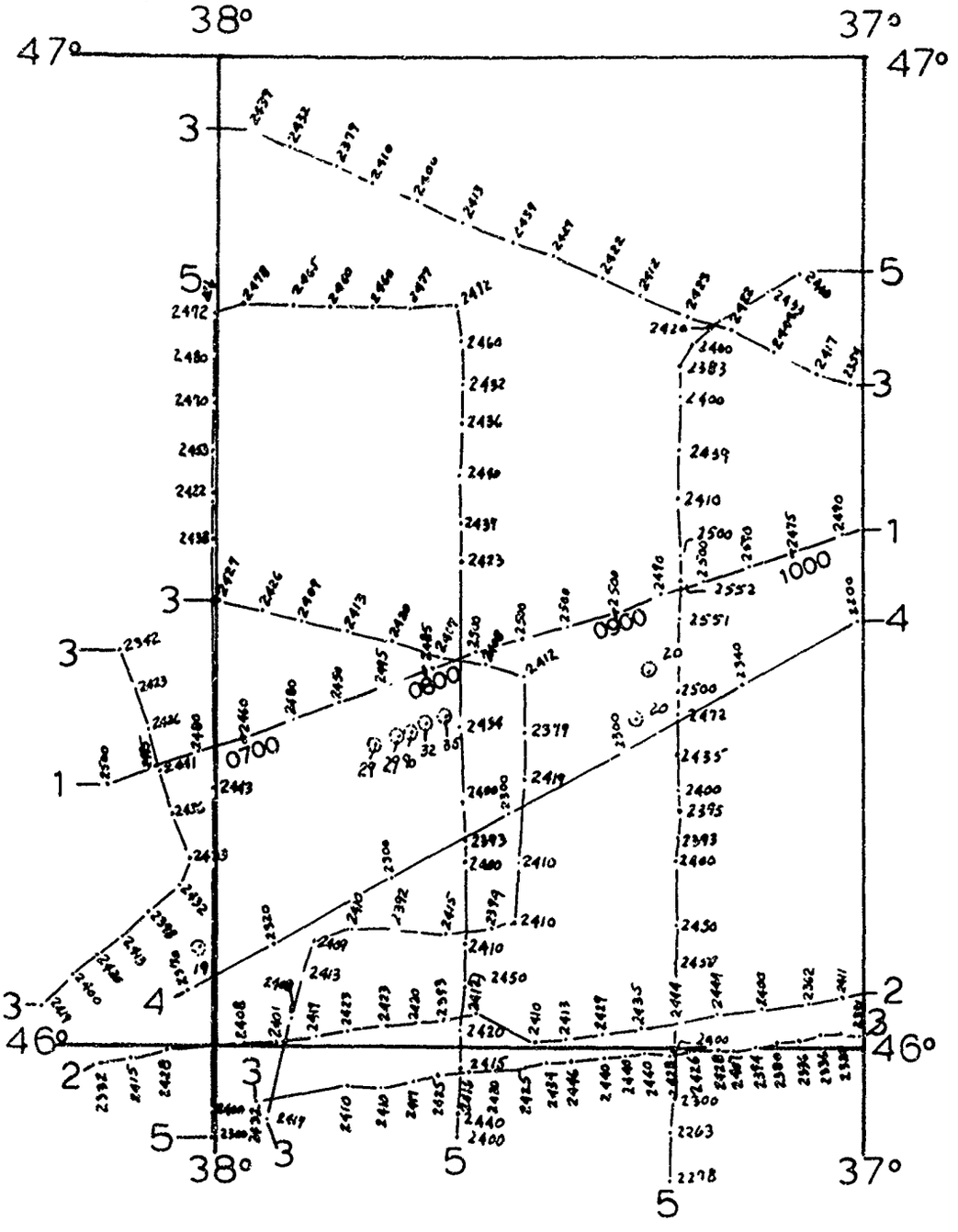
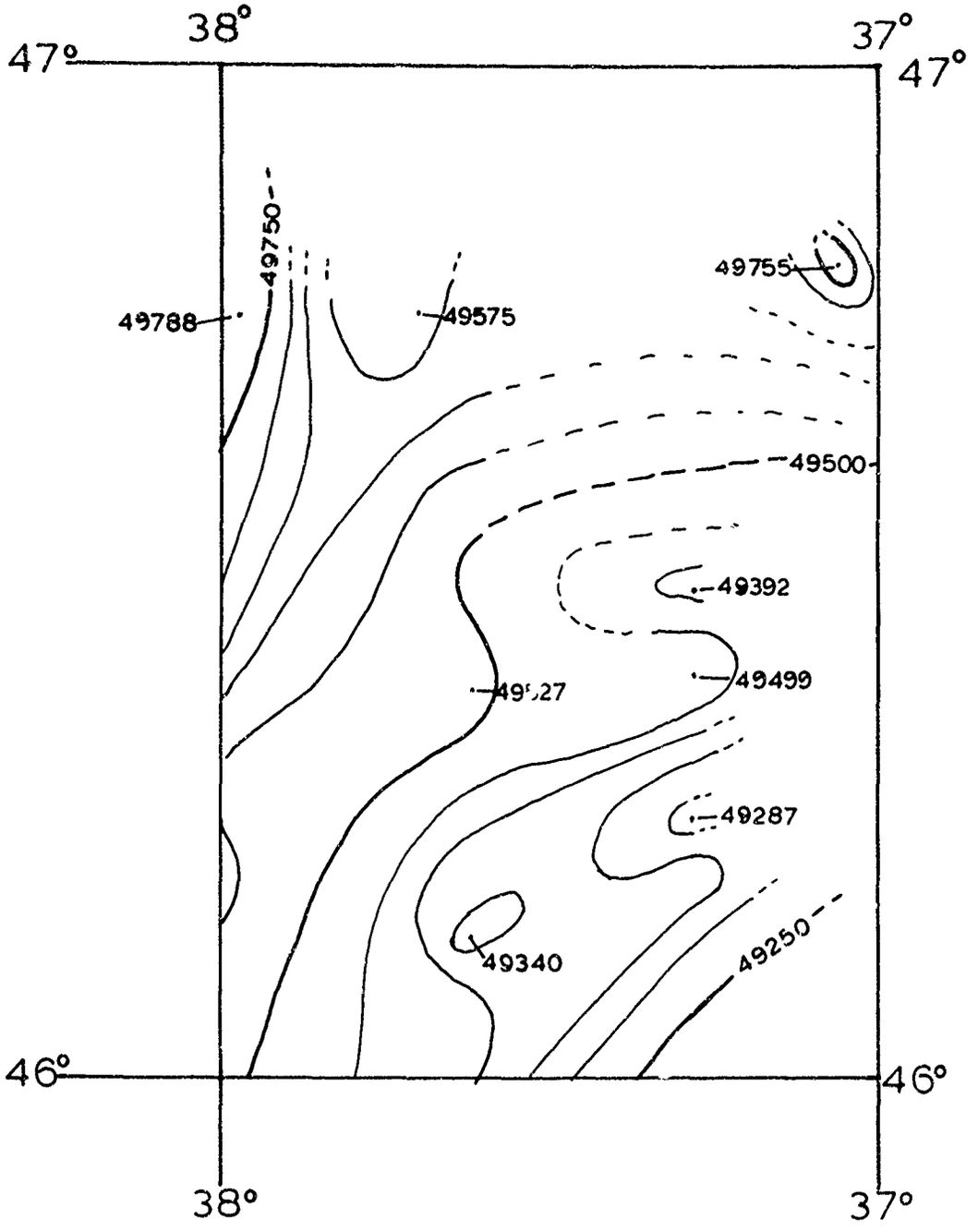
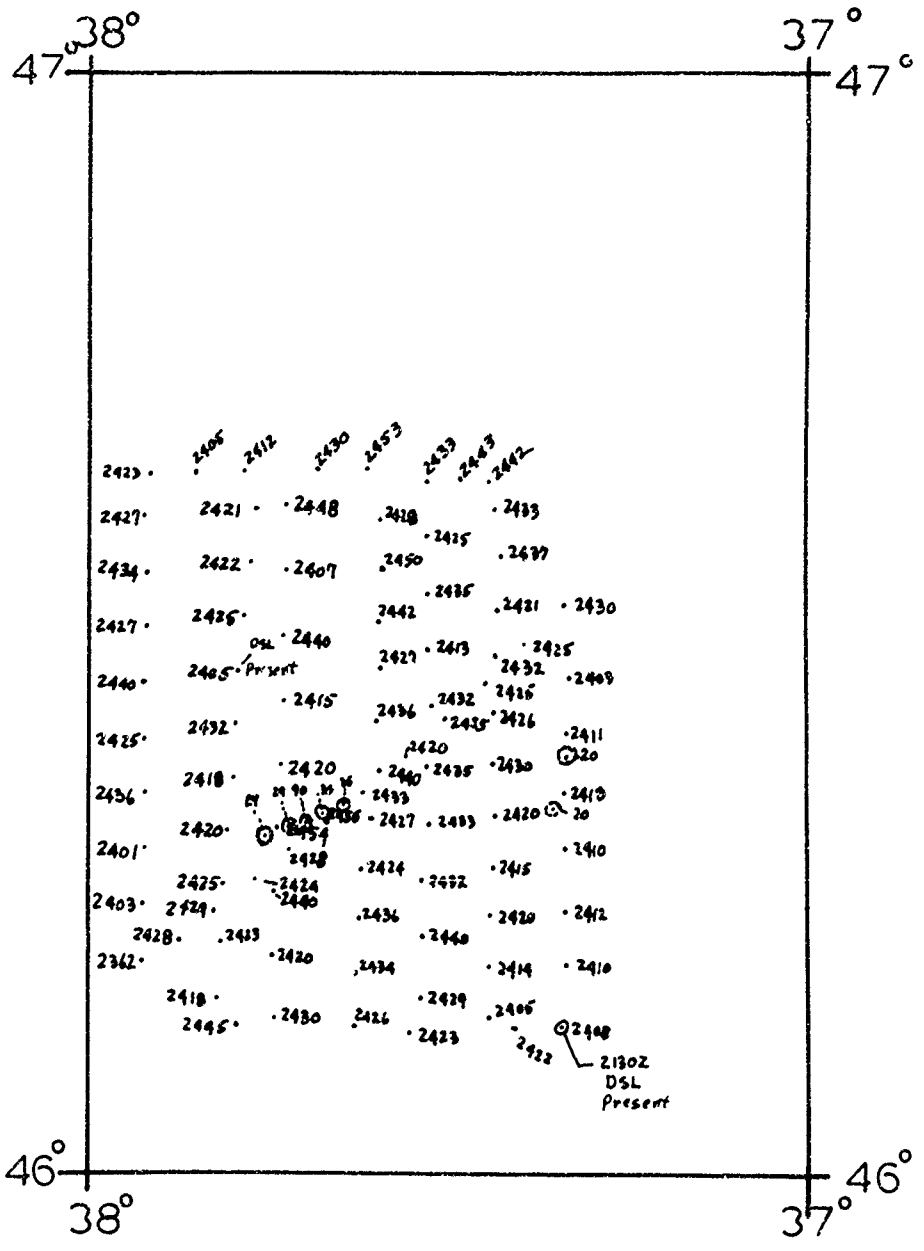

38°
37°
47°
47°
46°
46°
38°
37°
0700
0800
0900
1000
1. USS HARDER 1961
2. DISCOVERY II 1958
3. ATLANTIS II 1964
4. USS YAKUTAT 1962
5. USNS GILLISS 1965
SHALLOW BOTTOM SOUNDING.
SOUNDINGS IN UNCORRECTED FATHOMS.
naut. miles
0 5 10

FIG. 1



USNS GILLISS MAGNETICS
SURVEY JUNE 1965
Total magnetic intensity
in gammas.
Contour Interval. 50gammas.
FIG. 2



USNS SILAS BENT

11–12 JUNE 1966

20 merchant ship sounding

FIG. 3

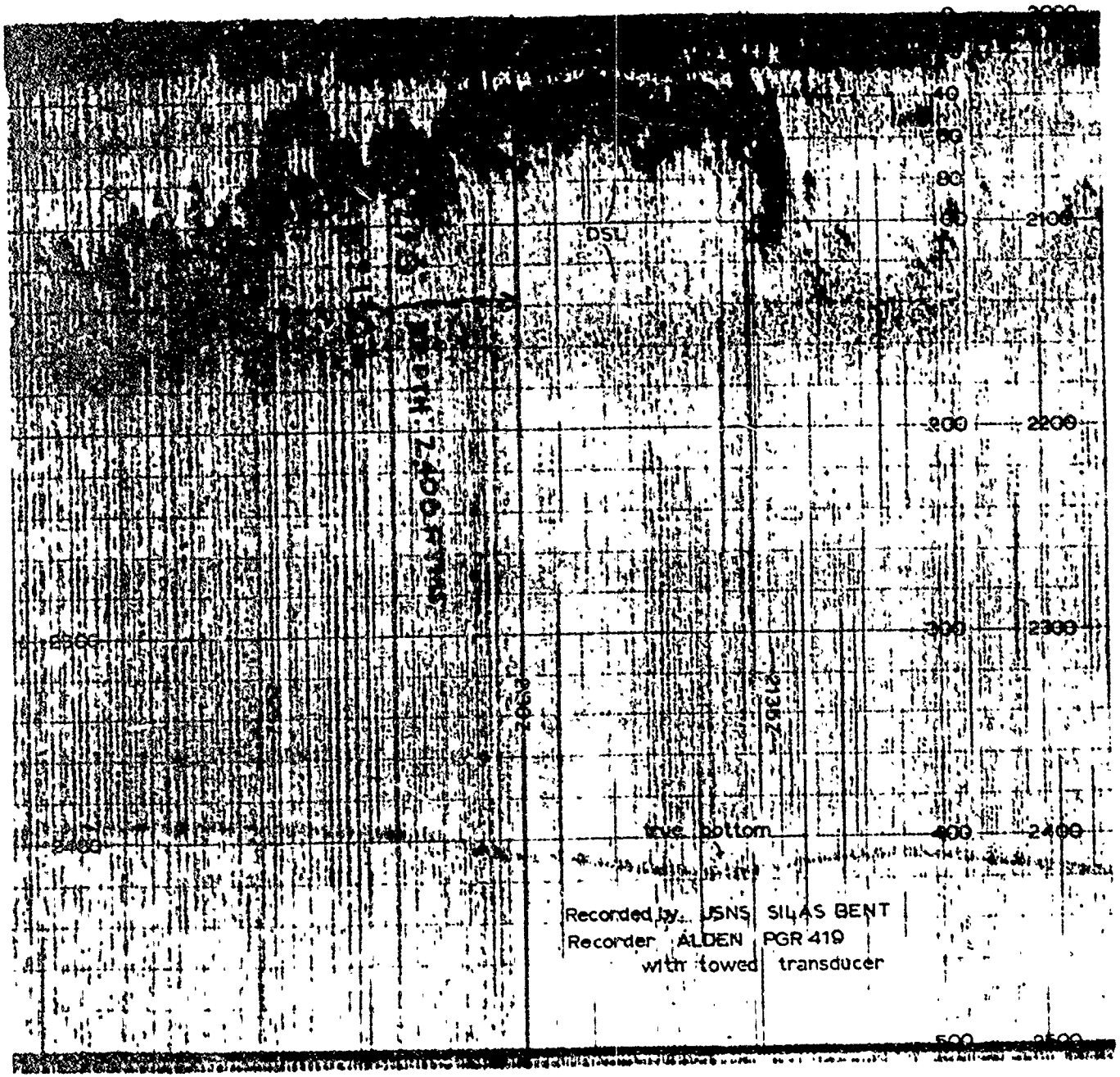

DSL
2100
2200
2300
2400
true bottom
Recorded by USNS SILAS BENT
Recorder ALDEN PGR 419
with towed transducer

Fig. 4

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