6422
a & b

Diag'd. on Diag. Ch. No. 5602-3

Form 504

U. S. COAST AND GEODETIC SURVEY

DEPARTMENT OF COMMERCE

DESCRIPTIVE REPORT

Type of Survey Hydrographic

Field No. 121-A *Office No.* 6422 a & b

LOCALITY

State California

General locality Northern California Coast
-Offshore-

Locality (a)Point Delgada to Table Bluff

(b)Table Bluff to Redding Rock

1935-38

CHIEF OF PARTY
F. H. Hardy (1935 & 1938)
O. W. Swainson (June 1938)

LIBRARY & ARCHIVES

DATE Mar. 21, 1939

B-1870-1 (1)

6422
a & b

Form 537
Ed. Dec. 1930

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY

HYDROGRAPHIC TITLE SHEET

The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. 121 A

REGISTER NO. H 6422 a

State CALIFORNIA

General locality NORTHERN CALIFORNIA COAST

Locality ~~CAPE MENDOCINO~~ Point Delgada to Table Bluff

Scale 1:120,000 Date of survey Aug. 7, to Oct. 9, 1935
June 1 to Sept. 16, 1938

Vessel USC & GSS GUIDE

Chiefs of Party F.H.Hardy (1935) O.W.Swainson (June 1938)
F.H.Hardy (1938)

Surveyed by F. H. Hardy & O. W. Swainson

~~Protracted~~ Plotted by G. M. Marchand

Soundings penciled by G. M. Marchand

Soundings in fathoms ~~feet~~

Plane of reference M. L. L. W.

Subdivision of wire dragged areas by

Inked by R.H. Carstens

Verified by R.H. Carstens

Instructions dated May 2, 1935

Remarks: See contemporary Sheet Field No. 121-B for continuation of this work to northward.

U. S. GOVERNMENT PRINTING OFFICE

Form 537
Ed. Dec. 1930

REG. NO.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY

HYDROGRAPHIC TITLE SHEET

The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. 121-B

REGISTER NO. H 6422 b

State CALIFORNIA

General locality NORTHERN CALIFORNIA COAST

Locality ~~CAPE MENDOCINO~~ Table Bluff to Redding Rock

Scale 1:120,000 Date of survey July 27 to Aug. 28, 1938

Vessel U.S.C & G.S.S. GUIDE

Chief of Party F. H. Hardy

Surveyed by F. H. Hardy

~~Protracted~~ Plotted by W. F. Malnate

Soundings penciled by W. F. Malnate

Soundings in fathoms ~~feet~~

Plane of reference M. L. L. W.

Subdivision of wire dragged areas by

Inked by R. H. Carstens

Verified by R. H. Carstens

Instructions dated MAY 2, 1935

Remarks: See comtemporary Sheet Field No. 121-A for continuation of this work to southward.

U. S. GOVERNMENT PRINTING OFFICE

DESCRIPTIVE REPORT
to accompany H6422a (1935-1938) H6422b
HYDROGRAPHIC FIELD SHEETS NO. 121-A and 121-B
PROJECT H T-206
NORTHERN CALIFORNIA COAST
U.S.C. & G.S.S. GUIDE
1938

INSTRUCTIONS: The work on these sheets was undertaken in pursuance of the Director's Instructions for Project H. T. 206, dated May 2, 1935.

GENERAL DESCRIPTION: This survey embraces an area of approximately 6300 square miles in the vicinity of Cape Mendocino, California, between the parallels 40°00' and 41°20' north. Except for the areas of the submarine valleys, the survey was extended inshore to cover the 100 fathom curve. Offshore the survey extends to the meridian 125°40' west. The 1000 fathom curve was well developed, particular attention being given to the declination of this feature in Latitude 40°22' at which point the curve runs almost due east and west for a distance of approximately 47 nautical miles. Close development was attained also in the areas of the submarine valleys, particularly off Eel River and Punta Gorda.

An inspection of the depth curve on Boat Sheet No. H6422ab 161 will show the broken nature of the bottom over a large area of the Sheet No. H6422a 121-A. The deep valleys and steep slopes tended to dampen out the sounds produced by the bombs, hence in the offshore areas, the returns were not as consistant as they were inshore. Taken as a whole, however, the results obtained by R. A. R. were very satisfactory.

Referring to the valley off Eel River, attention is directed to the existance of a submerged knoll (depth, 384 fathoms) in Latitude 40°40', Longitude 124°43', between the longitudal axes of two valleys. This appears to be rather a unique feature in submarine topography.

SURVEY METHODS: Except for a few visual fix positions, these sheets are controlled by Radio Acoustic Ranging.

Work was first undertaken in the fall of 1935 when the inshore part of the south end of Sheet No. H6422a 121-A was completed. In 1938 the entire H6422ab (1935) project was completed. The work of 1935 is plotted on Boat Sheet No. 121 on scale 1:120,000, whereas the 1938 work is plotted on Boat Sheet No. H6422ab (1938) 161 on scale 1:160,000. For smooth sheet drafting the work was separated into two 120,000 scale sheets in order to comply with H6422a H6422b the original instructions. The smooth sheets are numbered 121-A and 121-B. The junction of these sheets are in approximate Latitude 40°40'.

Except for a few wire drag soundings taken in 1935, all soundings were obtained by fathometer, using the FAST RED LIGHT, the RED LIGHT XSIX, and the WHITE LIGHT methods. The latter method was used only in a few instances.

The control for the 1935 work consisted of three hydrophone shore stations located at SHELTER COVE, PUNTA GORDA and TRINIDAD HEAD, respectively. φ 40-01 λ 124-05 φ 40-15 λ 124-22 φ 41-03 λ 124-10

The 1938 R. A. R. control was three hydrophone shore stations at SHELTER COVE, TRINIDAD HEAD and CRESCENT CITY, supplemented by sono-radio buoys at PUNTA GORDA, MUSSEL ROCK, EEL RIVER, TABLE BLUFF, SHARP POINT and REDDING ROCK. (See Field Engineer's Bulletin for 1939 for description of sono-buoys used by the Ship GUIDE during the 1938 field season). These stations were not all in operation at one time but established or removed as the work progressed.

Regarding the sono-radio buoy station at Table Bluff, it should be mentioned that this station was picked up and relaid four times during the season, hence four positions are shown on the sheets. The time circles for this station were drawn using TABLE BLUFF$_2$ as a center since this station was used to the greatest extent. When plotting positions involving TABLE BLUFF 1, 3 or 4, the time arcs for TABLE BLUFF$_2$ were corrected for the distance and direction of the station being considered.

Mention should be made regarding the work on A-day (August 7, 1935). This is a short line detached from the subsequent work of 1935. This line crosses an area of well developed 1938 work and is in ~~fair~~ poor agreement. However, it should not be given full weight as a cross line because of the long interval of time between the two surveys necessitating different fathometer corrections and control stations. The soundings for this work are plotted on Overlay No. 1. It is recommended that the 1938 work be given preference for charting purposes. soundings on A-day were omitted RHC

Positions 26 to 35, E$_2$ day, (June 1,1938) have been omitted from the smooth sheet for the reason that the control of this portion of the work is weak and no satisfactory adjustment could be made by dead reckoning to fit the conditions recorded. This portion of the work is unimportant as the area was subsequently covered by additional lines. lines were omitted RHC

For the same reason Positions 1 to 11, V day, (July 28,1938) were not plotted on the smooth sheet.

TIDE REDUCERS: Tidal corrections were applied to soundings under 100 fathoms. For the 1935 work a gage at Shelter Cove was used. For data relating to this gage see the Tidal Report of Ship GUIDE for 1935.

The 1938 tidal reducers were obtained from data from a gage established at North Jetty, Humboldt Bay, California. A correction of minus 30 minutes was applied for the outside coast.

CORRECTION FOR RUN: The scaled times were corrected for the ship's run from the time of dropping the bomb until the explosion was heard in accordance with the equation.

$$\text{Correction for run} = \frac{0.513 \text{ meters per second} \times \text{Fuse time in sec.} \times \text{Knots}}{1480 \text{ meters per second}}$$

An additional constant correction was applied for the distance from the ship's hydrophone to the place where the bomb was dropped overboard. This correction is represented by the equation:

$$\text{Correction} = \frac{37.5 \text{ meters}}{1480} = 0.0253 \text{ seconds}$$

See Table of Corrections for Run attached to this report.

FATHOMETER CORRECTIONS:

For the year 1935:

See verifiers report for change in fathometer corrections for 1935 work. RHC.

The RED LIGHT X6 and WHITE LIGHT soundings were corrected in accordance with the Fathometer Corrections for Period I, 1936 (See Fathometer Corrections 1936, Ship GUIDE, in Washington Office) for the reason that no change was made in the fathometer from August 1935 to July 16, 1936. The 1935 fathometer corrections as computed for the RED LIGHT X6 and WHITE LIGHT did not take into account the index error of the instrument. The FAST RED LIGHT soundings were corrected according to the 1935 Fathometer Report.

For the year 1938:

The corrections for this year were made in accordance with the Report on Fathometer Corrections for 1938. This report has been submitted to the office under separate cover. No corrections for slope were applied.

COMPUTATIONS OF VELOCITIES: Three sets of velocity tests were made at scattered points at the inshore edge of the work, where good visual fixes were obtainable. These tests were made on May 26, August 11 and August 13, 1938 and are recorded in Volume 2 of the Hydrophone Records. The results are shown on a separate sheet attached to this report. The velocities were obtained by dividing the scaled distances to the various hydrophones by the respective elapsed times corrected for initial and run.

The experience gained in plotting the boat sheet using a constant assumed apparent velocity of 1480 meters per second indicated that a constant velocity could be used for the smooth plotting with a minimum of error, hence, the apparent velocity used for the smooth sheet plotting was a value of 1481.8 meters per second, the result of 51 velocity measurements. In arriving at this value the test involving scaled time of less than 14 seconds were arbitrarily omitted from the calculations, in as much as these tests gave somewhat erratic values. An inspection of the smooth sheets, particularly 121-B, show that the apparent velocity of 1481.8 meters per second gave very good intersections where returns from three or four stations were obtained. There is one area on the sheets, south of Latitude 40°55' and west of Longitude 124°35', where there is a lag of as much as 0.25 second in the returns from Station K V A (Crescent City). This is no doubt due to the broken nature of the bottom because from the returns from the same station inside the 200 fathom curve are consistent with the returns from other stations. In plotting the work in this area, the returns from the closer stations were given most weight for the reason that they were most consistent with the dead reckoning.

PLOTTING OF SMOOTH SHEET: The bomb returns were plotted in terms of time from the respective hydrophone stations, being referred to time circles drawn on the sheets. To allow for the distortion of the sheets, the time arcs were just translated into distance and computed points (usually 20 seconds apart) plotted on the sheet by D Ms and D Ps.

The time circles were drawn on the sheets at intervals of five seconds and a celluloid scale used for measuring intermediate times.

Where three or more returns were obtained the smooth plotting was very simple. However, in areas where the returns were scanty, it was necessary to plot the dead reckoning on tracing paper and fit this overlay to as many of the bomb returns as consistency allowed. Some tolerance was allowed for for changing log factors. For intermediate D. R. positions (i.e. between bomb positions) the log factor was computed from the adjoining fixed positions.

Where the question arose as to which of two bomb returns to use, most weight was usually given to the return having the greatest milliameter deflection and showing the clearest on the tape. Discrepancies between log readings and bomb positions were verified by checking the log against time and revolution counter.

A few visual fixes were plotted on the sheet but these were not always reliable on account of the poor visibility generally encountered in this area. In cases where one visual angle was obtained, the distance arc was shown on the sheet in black ink. Questionable bomb returns are indicated by dashed lines of the color proper to the station.

In the area of the junction of sheets 121-A and 121-B it was necessary to plot some of the work proper to 121-B on Sheet 121-A and vice versa. Hence it will be noted that Positions 1-U to 14-U, ~~49-V to 59-V and 68-V to 74-V~~ were plotted on Sheet 121-A and transferred to Sheet 121-B. In like manner Positions ~~12-W to 24-W and~~ 26-Z to ~~40~~-Z were plotted on Sheet 121-B and transferred to Sheet 121-A.

Some readjustments were made in the positions of parts of certain lines after the smooth plotting was completed in order to rectify errors at crossings. These readjustments were not made arbitrarily but were based on a different interpretation of the bomb returns and dead reckoning. The changes made involve Positions 23 to 29 K, 53 to 66 K, 44 to 55 T and 15 to 26 MM days. It is believed that the positions as readjusted are very close to the true positions inasmuch as the crossings were greatly improved.

Two overlays of soundings accompany Sheet 121-A.

Overlay No. 2 contains the soundings for Positions 41 to 45 D, while Overlay No. 1 contains the soundings for Positions 1 to 6 A.

DISCREPANCIES: The number of discrepancies on the two sheets is relatively small considering the broken nature of the bottom over a large area. Most differences at crossings are probably due to erratic behavior of the fathometer, steep slopes and rough bottom to say nothing of weak position control.

It should be noted that in areas where the 1935 and 1938 work overlap, the use of different fathometer corrections possibly contributed to introduce inconsistencies in depth. corrected by change in fathometer correction

SHEET NO. 121-A

List of crossing more than 3% in error and recommendations for charting purposes.

	POSITION	POSITION	DIFFERENCE	PERCENT OF ERROR
(1)	29-30-H	6 K-7 K 40-05 125-33	55 fms.	3.2

Discrepancies probably due to uneven bottom as soundings in area indicate this condition. Retain all soundings.

(2)	36D-38D	45-46H 40-03 124-43	47 fms.	8.6 crossing slightly improved by change in fath. corr

This crossing involves both 1935 and 1938 work. Recommend rejection of 1935 soundings for reason stated on Page 46, Volumn 1 of sounding records.

(3)	54-55L	18-19F 40-25 124-01	18 fms.	6.0

Discrepancies probably due to rapidly changing depth on line 54-55L. Retain all soundings.

(4)	46-47E_2	38-39L 40-15 124-43	25 fms.	8.3 crossing corrected by readjustment of line

Sounding on line 46-47E_2 probably correct as fast dial speed was used. Retain all soundings.

(5)	9-10C	2-3MM 40-13 124-37	23 fms.	7.5 crossing corrected by change in fath. corr.

This crossing involves 1935 and 1938 work in an area of rapidly changing bottom. Retain all soundings.

(6)	3-4MM	34-35L 40-14 124 124-36.5	13 fms.	4.4

Discrepancies probably due to rapidly changing depth on line 34-35L. Retain all soundings.

(7)	7-8R	31-32K 40-24 125-25	140 fms.	13.3 crossing corrected by adjustment of line

Discrepancy due to rapidly changing fathometer readings on steep slope. Retain all soundings.

(8)	2-3N	35-36K 40-23.5 125-09	45 fms.	4.1

Discrepancy due to steep slope. Retain all soundings.

H6422a

Sheet No. 121-A, continued:

	POSITION	POSITION	DIFFERENCE	PERCENT OF ERROR	
(9)	26-27T	2M-3M	70 fms.	11.8	crossing corrected by adjustment of line
		40-29 124-41			

Discrepancy probably due to combination of rapidly changing depth and small error in position of lines. Retain all soundings.

(10)	32T-33T	12-13KK	22 fms.	13.6	
		40-26.8 124-37			

Discrepancy due to small error in position of the lines. Retain all soundings.

40-41- 124-48

(11)	17-18W	25-26Z	30 fms.	5.5	crossings corrected by adjustment of line 17-22 W
	23-24W	6- 7U	29 fms.	5.8	
		40-41.7 124- 41			

adjusted

Discrepancies possibly due to error in position of line 12 W to 24W. Both discrepancies would be rectified by shifting line mentioned about 0.3 mile eastward.

H-6422 b

SHEET 121-B

This sheet covers an area of comparatively smooth bottom and there are practically no serious discrepancies at the crossings, except those noted above in the area of the overlap.

DANGERS, CHANNEL, ANCHORAGES: There are no dangers, channels or anchorages within the limits of this survey.

COMPARISON WITH PREVIOUS SURVEY: SHEET NO. 121-A H6422a

H-4095 extends over a small area of Sheet No. 121-A in the vicinity of the Eel River Submarine Valley. The agreement is excellent in the deep water areas considering the steepness of the slopes encountered. There is a small difference in the delineation of the 100 fathom curve but not sufficient to warrant rejection of the older survey. It is recommended that the soundings from H-4095 be used in conjunction with the new survey for charting purposes.

H-4991, except for a small area in Latitude 40°00', Longitude 125°10', the agreement between 121-A H6422a and H-4991 is very good. In this area the discrepancy in depth amounts to about 8%, whereas in the remaining area common to both surveys the discrepancies are generally under 6%. It is recommended that the new survey be given preference due to the use of the red light method of sounding.

H-4136 In general the agreement with H-4136 is good. In the area of the 200 fathom ridge extending off Punta Gorda it is observed that excellent agreement is obtained when the soundings of H-4136 are shifted about 0.2 mile south. It is recommended that the new survey be given preference for charting purposes due to the completeness of the development over the entire area common to the two surveys.

H-4185 This survey is in good agreement with Sheet 121-A H6422a see rep. for discrepancies

H-6138 (1935) No photostat of this work is available for comparison with Sheet No. 121-A. H6422a However, H-6138 was accomplished during 1935, the same season that the overlapping work of Sheet 121-A was done. Hence, it is very likely that the two surveys are in agreement.

See Rev. for add'l discrepancies and recommendations. H.W.M.

Comparison with previous survey, continued:

SHEET 121-B

H-4095 This survey is in excellent agreement with the 1938 survey.

H-4874 In general the agreement of this survey and the 1938 survey is excellent. However, in Longitude 124°49' and Longitude 124°53', the two north and south lines of H-4874 fail to agree with the new survey by as much as 50 fathoms in 800 fathom depths. By shifting these lines about 0.6 mile to westward, a good agreement is obtained. It is recommended that the new survey be given preference where discrepancies occur due to the fact it is better controlled than the old survey and the soundings were obtained by the RED LIGHT X6 method rather than the WHITE LIGHT METHOD used for the old survey. Where no discrepancies occur, the old survey should be used to fill the gaps in the new survey.

H-4185 In general this survey is in good agreement with 121-B. In the offshore area there are a few soundings on H-4185 as much as 100 fathoms deeper than those shown on 121-B, but it is believed that these discrepancies are due to small errors in position. It is recommended that the new survey be given preference due to the fact the depths where discrepancies occur are generally shoaler on the new survey.

See Rev. for addl discrepancies and recommendations. H.W.M.

GEOGRAPHIC NAMES: No new geographic names were determined.

STATISTICS: A statistical sheet is appended to this report.

MISCELLANEOUS NOTES: For the convenience of the verifier of these sheets, a log factor scale and a celluloid time plotting scale are submitted with this report.

The R. A. R. and dead reckoning abstract is being forwarded under separate cover with the sounding records, bomb records and hydrophone records.

The R. A. R. tapes for this work are being retained aboard the Ship GUIDE and will be destroyed after the lapse of a few months if they are not requested by the Washington Office.

Respectfully submitted,

W. F. Malnate,
Lieutenant, C. & G. S.

G. M. Marchand,
Lieutenant (j.g.)
C. & G. S.

Approved and forwarded:

E. W. Eickelberg,
Chief of Party, C. & G. S.,
Commanding Ship GUIDE from October 3, 1938;
Preceded by Captain F. H. Hardy from 6-15-38 to 10-3-38;
Preceded by Comdr. O. W. Swainson from 5-1-38 to 6-15-38;

LIST OF SIGNALS
to accompany
HYDROGRAPHIC FIELD SHEETS NO'S 121-A and 121-B
1938

Sheet 121-B

TRIANGULATION.

SALT RIVER, 1928
TABLE BLUFF, Highest Wireless Tower, 1928
SAMOA SMOKESTACK, 1928
MIDDLE, 1927
MAD RIVER$_2$, 1928, R.M. #2, DAM
GRUB, 1927
KNOLL, 1927
TRINIDAD HEAD LIGHTHOUSE, 1873-1928
TRINIDAD HEAD, 1870-1927
ROCK N.W. TRINIDAD HEAD,1928,BLANK RK.
INNERWOLF RK, 1928
SHARP POINT, 1874-1927
MUSSEL POINT$_2$, 1927
REDDING ROCK LIGHTHOUSE, 1919
SPLIT ROCK$_2$, 1927.

TOPOGRAPHIC

Topographic Station AQUA, 1937.

Sheet 121-A

TRIANGULATION

CHEMISE MT. 1872
SHUBRICK PEAK$_2$, 1930
KING PEAK, 1881
NORTH SLIDE PEAK, 1871
GORDA$_2$, 1930
CHAPARRAL PEAK$_2$, 1930
MUSSEL KNOLL$_2$, 1919
TAYLOR PEAK, 1871
JOEL FLAT, 1869
MT. PIERCE, 1919
STEAMBOAT ROCK, 1928
EAST TWIN, 1919
CAPE ROCK, 1869
CAPE MENDOCINO LIGHTHOUSE, 1869
BEAR RIDGE, 1869
FALSE CAPE ROCK, 1869
COON, 1928
POINT, 1928
SALT RIVER, 1928
TABLE BLUFF WIRELESS TOWER, 1928
BAYSIDE MILL CONCRETE CHIMNEY, 1919
SAMOA SMOKESTACK, 1928
ROCK N.W. TRINIDAD HEAD, BLANK, 1928
TRINIDAD HEAD, 1870
TRINIDAD HEAD LIGHTHOUSE, 1873

TOPOGRAPHIC

Topographic Station AQUA, 1937
" " FLIP, 1937
" " TOWER, 1937

TIME CORRECTION FOR SPEED OF SHIP AND FUSE TIME OF BOMB

FUSE TIME IN SECONDS.	1	2	3	4	5	6	7	8	9	10	11	12	13
8	.0028	.0056	.0084	.0110	.0139	.0166	.0194	.0224	.025	.028	.031	.033	.036
9	.0031	.0062	.0094	.0124	.016	.019	.022	.025	.028	.031	.034	.037	.041
10	.0035	.0069	.010	.014	.017	.021	.024	.028	.031	.035	.038	.042	.045
11	.0038	.0076	.011	.015	.019	.023	.027	.031	.034	.038	.042	.046	.050
12	.0042	.0083	.012	.017	.021	.025	.029	.033	.037	.042	.046	.050	.054
13	.0045	.0090	.014	.018	.023	.027	.032	.036	.041	.045	.050	.054	.059
14	.0049	.0097	.015	.019	.024	.029	.034	.039	.044	.049	.053	.058	.063
15	.0052	.010	.016	.021	.026	.031	.036	.042	.047	.052	.057	.062	.067
16	.0056	.011	.017	.022	.028	.033	.039	.044	.050	.056	.061	.067	.072
17	.0059	.012	.018	.024	.029	.035	.041	.047	.053	.059	.065	.071	.077
18	.0062	.012	.019	.025	.031	.037	.044	.050	.056	.062	.069	.075	.081
19	.0066	.013	.020	.026	.033	.040	.046	.053	.059	.066	.073	.079	.086
20	.0069	.014	.021	.028	.035	.042	.049	.056	.062	.069	.076	.083	.090
21	.0073	.015	.022	.029	.036	.044	.051	.058	.065	.073	.080	.088	.095

$$\text{Correction} = \frac{.513 \text{ meters per sec.} \times \text{Fuse time in sec.} \times \text{Knots}}{1480 \text{ meters per second.}}$$

Constant correction to be applied for distance from ship's hydrophone to place bomb was thrown over board = $\frac{37.5 \text{ meters}}{1480}$ = 0.0253 sec.

ABSTRACT OF VELOCITY TESTS, Continued:

POS.	DATE	STATION	SCALED TIME	SCALED DISTANCE	COMP. VELOCITY
12			23.41	34757.9	84.7
MEAN OF (9) EQUAL.					1483.7
			TABLE NO 2.		
1			34.71	51429.0	1481.7
2			34.07	50488.6	81.9
3			33.62	49785.3	80.8
4			33.24	49237.1	81.3
5			32.90	48740.5	81.5
6			32.55	48187.4	80.4
7			32.31	47692.0	(76.1)R
8			31.89	47245.9	81.5
9			31.58	46776.6	81.2
MEAN OF (8) EQUAL.					1481.3
1		KVA	----		
2		(120,000)	63.67	94312.2	1481.3
3		Crescent	62.77	93399.3	(88.0)R
4		City	---		
5			---		
6			59.79	88429.9	79.0
7			58.93	87159.1	79.0
8			---		
9			57.18	84626.9	80.0
10			56.49	83566.3	79.3
11			55.81	82572.9	79.5
12			---		
MEAN OF (6) EQUAL.					1479.7
1		KVA	43.78	65131.6	1487.7
2		(120,000)	44.58	66083.9	82.4
3			45.01	66819.7	84.6
4			45.40	67400.5	84.6
5			45.74	67906.7	84.6
6			46.12	68470.7	84.6
7			47.57	68998.5	(50.5)R
8			46.81	69454.2	83.7
9			47.15	69956.0	83.7
MEAN OF (8) EQUAL.					1484.5
1		RED	15.10	22417.5	1484.6
2		(120,000)	15.65	23200.3	82.4
3			16.01	23799.1	86.5
4			16.32	24262.0	86.6
5			16.61	24703.3	87.3
6			16.95	25196.3	86.5
7			17.35	25649.6	(78.4)R
8			17.53	25926.1	79.0
9			17.85	26493.7	84.2
MEAN OF (8) EQUAL.					1484.6

STATEMENT
to accompany
HYDROGRAPHIC FIELD SHEETS NO. 121-A and 121-B.
1938.

The smooth sheet and records have been inspected and are approved.

E. W. Eickelberg,
Chief of Party, C. & G. S.,
Commanding Ship GUIDE from October 3, 1938;
Preceded by Captain F. H. Hardy from 6-15-38 to 10-3-38;
Preceded by Comdr. O. W. Swainson from 5-1-38 to 6-15-38.

ABSTRACT OF VELOCITY TESTS

to accompany H-6422a H-6422b

HYDROGRAPHIC FIELD SHEETS NO. 121-A and 121-B

1938

POS.	DATE	STATION	SCALED TIME	SCALED DISTANCE	COMP. VELOCITY
1	May 26	KVH	40.66	60060.0	1477.1
2		(120,000)	39.52	58298.0	75.1
3		Trinidad	39.21	57847.0	74.3
4		Head	39.55	5843110	77.4
6			41.33	61142.0	79.3
7			43.31	61948.0	80.6
8			42.12	62284.0	78.7
9			42.33	62609.0	79.1
10			42.56	62910.0	78.1
15			45.58	67461.0	80.0
16			46.32	68525.0	79.4
17			46.94	69487.0	80.3
MEAN OF (12) EQUAL.					1478.3
1	Aug.11	KVH	--		
2		(120,000)	14.08	20858.8	1481.4
3			13.35	20313.5	(1521.6)R
4			12.86	19620.4	(1525.7)R
5			11.45	16932.1	1478.8
6			10.99	16219.8	75.9
7			10.41	15348.9	74.4
8			9.85	14534.5	75.6
9			9.39	13715.3	(60.6)R
10			8.86	13063.1	74.4
11			8.49	12502.1	72.6
12			8.16	12010.0	71.8
MEAN OF (8) EQUAL.					1475.6
1	Aug.13	KVH	9.30	13771.1	1480.8
2		(120,000)	8.62	12788.7	83.6
3			8.15	12052.8	78.9
4			7.76	11475.7	78.8
5			7.43	10973.5	76.9
6			6.89	10439.2	(1515.0)R
7			6.82	9928.2	(1455.7)R
8			6.40	9488.1	82.5
9			6.09	9015.5	80.4
MEAN OF (7) EQUAL.					1480.3
			TABLE NO. 2		
1	(Table Bluff)		14.26	21115.8	1480.8
2			14.93	22116.5	81.3
3			15.83	22997.0	(52.7)R
4			16.45	23905.1	(53.2)R
5			18.19	26993.4	84.0
6			18.80	27939.9	86.2
7			19.72	29221.6	81.8
8			---		
9			21.37	31751.3	85.8
10			22.10	32816.7	84.9
11			22.79	33816.2	83.8

ABSTRACT OF VELOCITY TESTS, Continued:

Omitting August 11 (KVH), Mean of (58) equal 1481.6

Mean of all (66) equal 1480.9

Omitting August 11 and 13 (KVH), Mean of (51) equal 1481.8
(This velocity used for smooth sheet plotting)

STATISTICS
to accompany
HYDROGRAPHIC FIELD SHEETS NO. 121-A and 121-B.
1938.

VOL.	DATE	DAY LETTER	STATUTE MILES	NO. SOUNDINGS	NO. POSITIONS
1	Aug. 7, 1935	A	10.0	74	6
	Sept.22,1935	B	105.2	406	46
	Sept.24,1935	C	103.5	334	58
	Oct. 8, 1935	C	76.6	331	50
	Oct. 9, 1935	E	51.8	149	28
	TOTAL		347.1	1294	188
2	June 1,1938	E_2	78.2	208	47
	June 16,1938	F	52.3	249	23
	June 17,1938	G	59.8	332	28
	June 18,1938	H	152.0	684	52
	June 20,1938	J	113.0	343	41
	TOTAL		455.3	1816	191
3	June 21,1938	K	145.0	671	62
	June 22,1938	L	109.0	591	60
	June 23,1938	M	95.6	270	38
	June 24,1938	N	147.0	418	59
	June 25,1938	P	17.0	76	13
	TOTAL		513.6	2026	232
4	June 25,1938	P	17.5	132	19
	July 21,1938	Q	64.5	400	27
	July 22,1938	R	63.1	252	32
	July 25,1938	S	48.0	176	22
4	July 26,1938	T	140.8	588	97
	TOTAL		333.9	1548	197
5	July 27,1938	U	108.7	408	47
	July 28,1938	V	84.1	527	74
	July 29,1938	W	111.5	512	66
4	July 30,1938	X	74.3	264	39
	TOTAL		378.6	1711	226
6	July 30,1938	X	26.3	104	10
	Aug. 10,1938	Y	99.5	369	49
	Aug. 11,1938	Z	119.5	623	74
	Aug. 12,1938	AA	95.0	472	45
	Aug. 13,1938	BB	49.0	215	27
	TOTAL		389.3	1783	205
	GRAND TOTAL		2417.8	10178	1239
	Vol. 7 & 8, Aug. 13 – Sept. 16 BB – MM days		779.8	3522	381
	GRAND TOTAL		3197.6	13,700	1,620

H.W.M.

Field Records Section (Charts)

HYDROGRAPHIC SHEET NO. H-6422ab

The following statistics will be submitted with the cartographer's report on the sheet:

Number of positions on sheet	~~1239~~ 1620
Number of positions checked	81
Number of positions revised	65
Number of soundings recorded	~~10178~~ 13,700
Number of soundings revised	1344 (1301 revised due to change in fath. corr.)
Number of soundings erroneously spaced	32
Number of signals erroneously plotted or transferred	0

Date: June 12, 1939

Verification by R.H. Carstens Time: 206 hr. (Two sheets)

Review by Harold W. Murray H-6422a Time: 17 hrs.

H-6422b 8 "

2629

HYDROGRAPHIC SURVEY NO. H-6422ab

Smooth Sheet Yes (one for H-6422a & One for H-6422b)

Boat Sheet Yes "

Records; Sounding 8 Vols., Hydrophone ~~Wire Drag~~ 2 Vols., Bomb 5 Vols.

Descriptive Report Yes

Title Sheet Yes (One for H-6422a & One for H-6422b)

List of Signals Page #8 of D.R.

Landmarks for Charts (Form 567) ---

Statistics Yes

Approved by Chief of Party Yes

Recoverable Station Cards (Form 524) ---

Special Chart for Lighthouse Service (Circular Nov.30, 1933) ---

Hydrography: Total Days 27 ; Last Date Aug. 13, 1938 (Combined)

Remarks

2776

	Remarks	Decisions
1		File No. 413 241
2		" 414 240
3		" 413 240
4		" 412 240
5	△ station is on Inner Turtle Rock	" 411 241
6		" 410 241
7		" 409 241
8		" 408 241
9		" 406 242
10		" 406 243
11	USGB decision	" 406 243
12		" 405 243
13		" 404 244
14		" 404 244
15	USGB decision	" 403 243
16		" 402 243
17	USGB decision	" 401 242
18	" "	" 401 241
19		" 400 240
20		" 400 240
21	Location of T.G.	" 407 242
22		
23		
24		
25		
26		
27		

M 234

GEOGRAPHIC NAMES

Survey No. H-6422a, b

Name on Survey	On Chart No. 5702, 5602 A,	On previous survey No. B,	On U. S. quadrangle Maps C,	From local information D	On local Maps E	P. O. Guide or Map F	Rand McNally Atlas G	U. S. Light List H	K	
Redding Rock (L.H.)	5702									1
Split Rock	5702									2
Mussel Point	5702									3
Sharp Point	5702									4
Inner Turtle Rock Inner Wolf Rock △	Turtle Rks. 5702									5
Trinidad Head	5702 5602									6
Mad River	5602									7
Samoa	5602									8
Table Bluff	5602									9
Salt River	5602									10
Eel Canyon										11
False Cape Rock	5602									12
Cape Mendocino	5602									13
Steamboat Rock	5602									14
Mendocino Canyon										15
Punta Gorda	5602									16
Spanish Canyon										17
Delgada Canyon										18
Point Delgada	5602									19
Shelter Cove	5602									20
Humboldt Bay	5602									21
										22
										23
										24
										25
										26
										27

Names underlined in red approved by [illegible] on 4/5/39

M 234 VR

FORM M-238

MEMORANDUM

IMMEDIATE ATTENTION

SURVEY
DESCRIPTIVE REPORT
~~PHOTOSTAT OF~~

No. H-6422ab
~~No. T~~

received Mar.2, 1939
registered Mar. 23, 1939
verified
reviewed
approved

This is forwarded in order that your attention may be directed to the matters as indicated below. Please initial in column 3 as an acknowledgement that your attention has been thus directed. The complete original records are available if desired. If you cannot give this your immediate attention, please initial, note, and forward to the next section marked, calling for the records at your convenience.

ROUTE		Initial	Attention called to
20			
22			
24			
25			
26			
30			
40			
62			
63			
82			
83			
88			
90			

RETURN TO

82	T. B. Reed

V JBOR

RAC

Form 712
DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY
Ed. Feb. 1935

TIDE NOTE FOR HYDROGRAPHIC SHEET

April 14, 1939.

Division of Hydrography and Topography:

✓ Division of Charts: Attention: Mr. E. P. Ellis

Plane of reference ~~Tide Reducers are~~ approved in
8 volumes of sounding records for

HYDROGRAPHIC SHEET 6422 a-b

Locality Point Delgada to Table Bluff; Table Bluff to Redding Rock,
North California Coast

Chief of Party: O. W. Swainson and F. H. Hardy, 1935-1938
Plane of reference is mean lower low water reading
3.4 ft. on tide staff at Shelter Cove
7.1 ft. below B.M. 1 A
2.0 ft. on tide staff at North Jetty, Humboldt Bay
11.5 ft. below B.M. 1

Height of mean high water above plane of reference is 5.6 feet at Shelter Cove; 5.8 feet at North Jetty.

Condition of records satisfactory except as noted below:

Chief, Division of Tides and Currents.

U. S. GOVERNMENT PRINTING OFFICE

Verifying Report for H-6422a and H6422b
(1935 - 1938)

1. The field records are neat and complete and conform to the requirements of the General Instructions except that all the proper information was not always entered at the beginning and ending of each day. The statement as to the correctness of the sounding clock was never entered at the end of the days work. It appears too that the checking of the reduction of the soundings was rather carelessly accomplished as 22 errors in the reduced soundings were found.* Noted OK at beginning of day.

2. The field plotting was completed to the extent prescribed in the Hydrographic Manual. As the bomb arc control on H6422a was rather weak in places a readjustment of a number of positions according to dead reckoning was made with a subsequent improvement in number of crossings. The drafting done over by the verifier is shown on the statistics sheet.

3. The usual depth curves can

IN REPLY ADDRESS THE DIRECTOR
U. S. COAST AND GEODETIC SURVEY
AND NOT THE SIGNER OF THIS LETTER

AND REFER TO No. 80-DRM

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

WASHINGTON

August 9, 1939

MEMORANDUM to Chief, Division of Terrestrial Magnetism and Seismology:

With reference to the Director's memorandum of April 7, 1939, attached to the descriptive report, hydrographic survey H-6422a is being forwarded to you for comment regarding the desirability of additional soundings on the submarine scarp off Cape Mendocino.

Chief, Section of Field Records.

be completely drawn. The depth curves on H6422a were left in pencil by the verifier for subsequent inking by the reviewer. left in pencil for the present

4. Satisfactory junctions were made with contemporary surveys H-6415 (1937-1938), H-6221 (1936-1937-1938) and H6138 (1935) on the east; and H4991 (1929) on the south. A butt junction was made with H-6138 a large portion of H6221, and H4991. On making the junction with H6138 it was found impossible to make a satisfactory junction with the line 44-46 B H6422a. As the control on this line is weak and as this area is completely covered on H6138 the line 44-46 B was left uninked.

5. On making a comparison between lines run in 1935 and those run in 1938 on H6422a, & between the overlapping work on H6221 (1936) and the work accomplished in 1935 on H6422a it was found that a nearly uniform discrepancy in soundings existed on cross lines and on adjacent lines. To correct this the fathometer correction for the

1935 work, positions 1A to 28E has been changed by the verifier.

On an examination of the Report on Fathometer Corrections for 1935 it was found that no comparison between the fast red light and the R.L. x 6 or the white light had been taken in 1935. Consequently no index correction had been determined for the 1935 work. Because of the fact that no adjustment of the fathometer had been made during the 1935 season's work on this sheet or during the first period of the 1936 work the field party assumed that the index correction for the 1935 work was the same as for the first period in 1936. The verifier assumed that this correction was different and made a change in the fathometer correction.

The verifier's assumption is based on the comparison of the 1935 season's work with the 1938 season's work on this sheet on the overlap of work on sheet H 6221 (1936), and on the vertical cast comparisons taken in 1935. The crossings between the 1938 work and

the 1935 work indicated that the 1935 work was between 10 and 15 fathoms deeper than the 1938 work. In a comparison between the 1935 work and H 6221 (1936) on which there was considerable overlap it was found that practically all crossings could be improved by the subtraction of 10 to 15 fathoms from the 1935 work. The vertical cast comparison on p. 15, vol 1, indicates that the fathometer correction as applied by the field party was 13 fathoms too large. The vertical cast comparison on p. 27, vol 1, indicates that the fath. corr. as applied by the field party was 22 fathoms too large. Inasmuch as a complete serial temperature was taken with the first comparison whereas only a top and bottom temperatures were taken with the second comparison, and, inasmuch as a difference of 13 fathoms between the vertical cast and the corrected fathometer soundings as found on the first comparison agrees closely with the differences in crossings as found on a comparison between the 1935 work and the 1938 work and the 1935 work and overlapping lines

on H6221, a correction of 13 fathoms was applied to the 1935 work by the verifier.

6. Only two bottom characteristics were recorded in the sounding records for the entire area covered by the two sheets.

7. The shoreline was transferred to H6422a from topographic sheets T4511(1929), T4514(1929, T6560 (1935-1936), T6559(1936) T6513(1936, T6512(1936), T6511(1936), T6516(1935), T6515(1935), T6514(1935) and T6486(1935) to facilitate a study of the fault lines in this area. No shoreline was transferred to H6422b.

Respectfully submitted
R.H. Carstens

6/12/39

Section of Field Records

REVIEW OF HYDROGRAPHIC SURVEY NO. 6422a & b (1935 and 38)
FIELD NO. 121A and B
Point Delgada to Redding Rock, Northern California Coast, Cal.
Surveyed in August-October, 1935 and June-August 1938,
Scale 1:120,000
Instructions dated May 2, 1935 (GUIDE)

Fathometer Soundings. RAR control.

Chief of Party - O. W. Swainson and F. H. Hardy.
Surveyed by - F. H. Hardy and G. M. Marchand.
Protracted and plotted by - G. M. Marchand and W. F. Malnate.
Verified and inked by - R. H. Carstens.

1. Shoreline and Signals.

a. This is an offshore survey and no shoreline is shown on H-6422b.

b. Because of the importance of the Submarine Scarp off Cape Mendocino on H-6422a, the shoreline has been added to facilitate identification of adjacent features. Surveys used were T-4511 and T-4514 of 1929, T-6486, T-6511 to T-6516, inclusive, T-6559 and T-6560 of 1935-36.

c. The control for this survey is furnished by R.A.R. the hydrophones having been located from triangulation stations.

2. Sounding Line Crossings.

Sounding line crossings are generally satisfactory. Mention is made, however, of the following:

a. Most of the larger discrepancies listed in the Descriptive Report, pages 5 and 6, were improved by adjustment of one or more of the affected lines.

b. The Descriptive Report, page 5, par. 2, stated that differences noted between the 1935 and '38 work could possibly be attributed to different fathometer corrections. Investigation of the fathometer corrections in the office disclosed that a deduction of 13 fathoms on the 1935 work improved the agreement. The records for pos. 1A to 28E (1294 soundings) were revised accordingly.

3. Depth Curves.

The usual depth curves may be satisfactorily drawn for general charting purposes.

Because of the importance of the submarine scarp off Cape Mendocino, H-6422a, the depth curves were drawn in pencil by the reviewer for every 25 fathoms, to test the adequacy of the survey for scientific purposes.

4. Junction with Surveys.

a. H-4991 (1929)

The present survey (H-6422a) joins this survey on the south. Agreement in the common area is generally satisfactory but differences of about 20 fathoms are noted in many instances. These differences may be partly due to weak control, being based mainly on dead reckoning and one R.A.R. arc. Only a fringe of soundings is shown at the present survey limits. For charting purposes, the present survey should be used to its limits and then continued from H-4991.

b. H-6138 (1935) and H-6221 (1936-38).

The present survey (H-6422a) joins these 1:40,000 scale surveys on the east. The overlap southward of lat. 40° 13' is extensive in that it covers about 80 square miles and also includes two prominent submarine valleys and several minor ones.

General agreement is varied and unsatisfactory. An anlysis of 37 crossings in rather smooth bottom shows 13 varying 3 to 22 fathoms shoaler, 11 varying 2 to 37 fathoms deeper, and 13 satisfactory in depths of about 70 to 400 fathoms on the larger scale inshore sheets. Other factors further complicate the problem such as; (1) The present survey depths show more irregularity in bottom; (2) The junction of an R.A.R. survey with three point fix work on a scale three times larger frequently results in discrepancies which can be smoothed out by a small shifting in position of the R.A.R. lines. The crossline disagreements noted above are not readily solved by shifting. (3) Crossline agreements on H-6221 in the submarine valley in lat. 40° 05', long. 124° 20' are none too good. Line 93-115R for example, maintains an average discrepancy of 30 fathoms in 14 crossings. (See par. 4, review H-6221). On the present survey, crossings with this line vary 17, 43 and 62 fathoms deeper.

While the latter disagreements also tentatively disprove this line, the present survey soundings do not agree sufficiently with other nearby soundings to adequately replace the R day depths.

In as much as these inshore sheets adequately cover the area for charting purposes, only a fringe of soundings were transferred from the present survey. For charting purposes, the inshore surveys (H-6138 and H-6221) should be used to their western limits and then continued from the present survey.

c. The junction on the east just north of Cape Mendocino with H-6415 (1937-38) is very good.

d. H-4874 (1928)

The present survey (6422b), joins this survey on the north. Agreement in the eastern portion is good. In the middle and western portions, the 1928 soundings generally vary 15 to 50 fathoms deeper. This is particularly noticeable on the west where the present survey depths are slightly less than 1700 fathoms and those on the 1928 survey are slightly greater.

Two soundings of 795 and 800 fathoms obtained on line in lat. 41° 09', long. 124° 53' are too shoal and should be disregarded. They show no indication of the submarine valley indicated here on the present survey with possible depths of 900 to 1000 fathoms. Several other soundings which help define the submarine canyon in this locality have been carried forward.

A fringe of soundings from H-4874 is shown at the present survey limits. For charting purposes the present survey including such soundings as have been transferred, should be used to its limits and then continued from the 1928 survey. In depths of 1600 fathoms, or deeper, where the spacing of lines on the present survey is about eight miles, additional selected soundings for compilation purposes may be taken from H-4874.

e. H-4216 (1921-22).

The junction on the northeast with this survey is satisfactory. Several soundings, however, varying one to five fathoms deeper on H-4216, have been omitted in the transfer in the overlapping area.

f. The junction with contemporary work in the vicinity of lat. 40° 47', long. 41° 08', will be considered when that work is received from the field.

g. There are no surveys to the westward of the present survey limits which need to be considered.

5. Comparison with Prior Surveys.

a. H-241 (1851), 1:1,000,000.

This sparsely covered sheet is a reconnaissance survey and contains no information not fully covered by the present survey. It should be superseded in future charting.

b. H-1299 (1872) 1:100,000.

Several soundings from this survey fall just within the eastern limits of the present survey in the vicinity of lat. 40° 55'. Some are in good agreement but others vary 20 to 25 fathoms deeper than the present survey in general depths of 200 to 250 fathoms. As this area is adequately covered by the present survey the soundings should be superseded by the present survey in future charting.

c. H-1681 (1886), H-1682 (1885-86) and H-1778 (1885-86), 1:20,000.

Portions of these surveys fall within the southeast limits of the present survey. The overlapping area, however, is common to the larger scale adjoining contemporary surveys, H-6138 (1935) and H-6221 (1936-38). They have been fully discussed in the reviews of those surveys and no further discussion in this review is necessary. (See also Par. 4b, this review).

d. H-1935 (1889), 1:20,000.

Several soundings from this sparsely covered survey fall just within the northeast limits of the present survey and are in good agreement. They are not needed for charting purposes and should be superseded in future charting.

e. H-4095 (1919) 1:120,000.

This survey covers a 6 mile strip of the present survey between lat. 40° 29' and 40° 55'. Agreement of the vertical cast soundings is excellent. Although small differences are noted in some cases, they are

mainly attributed to uneven bottom.

A 180 fathom sounding (not charted) in lat. 40°46' long. 124° 30' which varied 25 fathoms deeper than the surrounding depths was found to be incorrectly protracted. Correct protracting places the sounding 1/3 mile northwest where the agreement is good. In lat. 40° 36', long. 124° 38', several soundings on line 17 to 21F with depths of 83 to 104 fathoms are 20 to 30 fathoms shoaler than the present survey depths. The sounding records show the angles to be weak, less than 13 degrees. Careful reprotracting places them 240 to 720 m. eastward where the agreement is improved. An appropriate note was added to the old smooth sheet but no actual change in plotting was made because of the weak angles.

Several soundings which better defined the axis of the submarine cayons and other features found here were carried forward. With these additions, the present survey adequately covers the area for charting purposes and should supersede the old survey.

f. H-4136 (1919-21) 1:120,000.

This sparsely covered survey covers the present survey in the area south of lat. 40° 35'. Many soundings are in good agreement. Others on the old survey vary as much as 300 fathoms deeper in some cases and 260 fathoms shoaler in others. Two outstanding discrepancies are the 963 and 1162 (charted) fathom soundings obtained on line in lat. 40° 23', long. 125° 30' which vary 262 fathoms shoaler and 302 fathoms deeper respectively. The larger differences may be partly due to weak and distant angles. Because of the differences noted, the present survey should supersede this survey in future charting.

g. H-4184 (1921) and H-4185 (1921-22), 1:40,000 and 1:120,000.

Portions of these surveys taken together cover the present survey in the area northeast of a point at lat. 40° 30', long. 125° 00'. Agreement of H-4184 is good. Agreement of soundings on H-4185 varies from being slightly deeper at the inshore limit to as much as 350 fathoms deeper at the offshore limits. An outstanding discrepancy is line 4-11E continuing on line 1-6F (charted) in lat. 40° 57', long. 124° 51' which consistently varies 50 to 347 fathoms deeper. The discrepancies noted are probably due to dead reckoning control

frequently used offshoreward of the 300 fathom curve. The present survey adequately covers the area and should supersede these surveys in future charting.

h. H-4186 (1921), 1:40,000.

A fringe of pressure tube soundings from this survey falls within the present survey limits in the vicinity of lat. 41° 03', long. 124° 19'. Agreement of soundings is generally within 5 fathoms or less in depths of 54 to 80 fathoms. A 51 fathom (charted) and a 55 fathom sounding in lat. 41° 05.5', long. 124° 18.5', are both 14 fathoms shoaler than the surrounding depths of 64 to 69 fathoms. Although these pressure tube soundings are marked OK in the sounding records (statement based on amount of wire out), it is noted that several tube soundings on this survey varying 12 to 18 fathoms less than the surrounding depths of 50 to 65 fathoms were rejected. In as much as the new adjacent contemporary inshore survey (authorized by the Instructions) will probably overlap this area, these soundings will be disposed of when that sheet is received from the field. For the time being, however, the 51 fathoms should be retained on the chart. Except as noted above, the present survey should supersede this survey in future charting.

i. H-4187 (1921), 1:288,000.

Nine scattered soundings from this survey fall within the limits of the present survey in the vicinity of lat. 41° 00', long. 124° 45'. Agreement is poor, the old survey depths varying 15 to 60 fathoms shoaler in some cases and 50 to 100 fathoms deeper in others. The differences are attributed to dead reckoning and astronomical control obtained under "fair" weather conditions in a rough sea. The present survey should supersede this survey in future chartings.

j. H-4873 (1928) 1:240,000.

A single line of dead reckoning and astronomically controlled soundings from this survey crosses the present survey in a westerly direction in the vicinity of lat. 41° 00'. The older soundings are progressively deeper by 30 to 400 fathoms out to depths of 1630 fathoms. Westward of this depth, agreement is within 10 fathoms or less principally because the bottom is very uniform

and has only a perceptible slope. A westward shift of 2 miles or less will materially improve agreement. Because of the differences noted, the present survey should supersede this survey in future charting.

6. Comparison with Charts 5052 (New Print dated June 9, 1938)
5602 (New Print dated Nov. 5, 1938)
5702 (New Print dated Aug. 6, 1938)

Within the area of the present survey the charts contain no additional information that needs consideration in this review.

7. Condition of Survey.

a. The sounding records are neat and legible.

b. The descriptive report is satisfactory. On the statistics sheet, however, 779.8 miles of sounding data recorded in Volumes 7 and 8, were inadvertently omitted.

c. The field plotting is satisfactory.

d. The bottom characteristics on the present survey may be supplemented by consulting the more recent previous surveys discussed in Par. 5, this review.

8. Compliance with Instructions for the Project.

Satisfactory.

9. Additional Field Work Recommended.

Such additional field work as is deemed necessary on H-6422a for scientific purposes will be considered as a separate report. (See letter dated April 7, 1939 by the Director attached to the descriptive report).

Mention is also made of the fact that a tracing of the submarine scarp to the westward of the limits of H-6422a, by a zig-zag dead reckoning sounding line, would be of value for navigation and for scientific purposes.

10. Superseded Surveys.

H-241 (1851)	In part	H-4136 (1919-21)	In part
H-1299 (1872)	" "	H-4184 (1921)	" "
H-1681 (1886)	" "	H-4185 (1921-22)	" "
H-1682 (1885-86)	" "	H-4186 (1921)	" "
H-1778 (1885-86)	" "	H-4187 (1921)	" "
H-1935 (1889)	" "	H-4873 (1928)	" "
H-4095 (1919)	" "		

11. Reviewed by - Harold W. Murray, July 15, 1939.

Inspected by - H. R. Edmonston, July 24, 1939.

Examined and approved:

T. B. Reed,
Chief, Section of Field Records.

K. T. Adams
Chief, Division of Charts.

Fred. L. Lacock
Chief, Section of Field Work.

G. Rude
Chief, Division of H. & T.

DEPARTMENT OF COMMERCE

OFFICE OF THE DIRECTOR

U. S. COAST AND GEODETIC SURVEY

WASHINGTON

80 KTB
82 WSR
Smith PAS

April 7, 1939

Chief, Division of Charts
Chief, Division of Terrestrial Magnetism & Seismology
Chief, Division of Hydrography & Topography

Subject: Study of submarine configuration of earthquake fault off Cape Mendocino.

The following is quoted from the report of the Chief, Division of Hydrography and Topography, dated April 6, 1939, in connection with the field examination of the work of the Steamer GUIDE.

"The Chief of the Division was not entirely satisfied with Captain Hardy's development with the GUIDE of the fault extending directly offshore from Cape Mendocino. The work was done on field sheet No. 121 a, which has not yet been received at this office. While the work done is satisfactory for the construction of a small scale chart for the purpose of navigation, it does not appear a satisfactory development for a submarine configuration of its peculiar character and its undoubted interest in connection with seismology. In view of the extreme slope of this apparent fault, it was not possible to obtain accurate fathometer soundings, and it would appear desirable when work on project No. 206 is again taken up either by the GUIDE or by the new EXPLORER on a shake-down cruise. It would be desirable that upright casts be taken on a system of lines normal to the fault and extending well offshore. Upon receipt at this office of sheet 121 a, this matter will be taken up by the Division of Terrestrial Magnetism and Seismology as to the desirability of additional work along this fault."

It is desired that a study of this area be made when field sheet 121 a, GUIDE, is received in the office and has passed the stage of preliminary examination and review for charting purposes.

The Division of Charts will make note to initiate this study at the proper time and after conference with the other divisions involved.

L. O. Colbert

Director

~~IN REPLY ADDRESS THE DIRECTOR~~
U. S. COAST AND GEODETIC SURVEY
AND NOT THE SIGNER OF THIS LETTER

DEPARTMENT OF COMMERCE

AND REFER TO No. 41-GMT

U. S. COAST AND GEODETIC SURVEY

WASHINGTON

August 23, 1939.

Memorandum to Chief, Section of Field Records:

With reference to your memorandum of August 9, 1939, this Division would like to have the following additional work done on Hydrographic Sheet 121-A, Survey H-6422a if a vessel is again sent to that vicinity:

1. A system of short lines of vertical casts crossing the submarine scarp approximately normal to the depth curves from longitude 124° 40' to longitude 125° 40'.

2. Lines to be spaced 5 miles.

3. Distance between soundings on steepest portion of slope not to exceed 100 meters, in order to determine degree of slope.

4. Any evidence of cliffs should be checked by additional soundings.

5. An effort should be made to determine how far offshore the scarp extends by running a zigzag echo sounding line.

6. Vertical soundings should be taken across the axis of the branches of the canyons between longitude 124° 36' and 124° 40' with sufficient frequency to definitely determine the character and degree of slope.

7. No less than 5 good bottom samples should be obtained on each side of the scarp between longitudes specified in "1".

8. Control should be by any means possible. Good astronomical fixes will be satisfactory as the good development of the scarp slope is more important than the exact position of the lines.

N. H. Heck

N. H. Heck
Chief, Division of Terrestrial
Magnetism and Seismology.

80-DRM

August 9, 1939

MEMORANDUM to Chief, Division of Terrestrial Magnetism and Seismology:

With reference to the Director's memorandum of April 7, 1939, attached to the descriptive report, hydrographic survey H-6422a is being forwarded to you for comment regarding the desirability of additional soundings on the submarine scarp off Cape Mendocino.

Chief, Section of Field Records.

Submarine Scarp off Mendocino, California

By HAROLD W. MURRY
CHIEF, HYDROGRAPHIC SURVEYS SECTION, NAUTICAL CHART BRANCH
U. S. COAST AND GEODETIC SURVEY

Reprinted from FIELD ENGINEERS BULLETIN, December 1939, No. 13, pages 27-33

SUBMARINE SCARP OFF CAPE MENDOCINO, CALIFORNIA

Harold W. Murray, Associate Cartographic Engineer
U. S. Coast and Geodetic Survey

The significance of Cape Mendocino and the nearby area to navigators using these waters is a classic example of the use of submarine and shore configuration in position determination. The Pacific Coast Pilot describes the cape as a "mountainous headland" and "famous landmark of the old Spanish navigators". The cape is a turning point for nearly all vessels bound north or south and, in view of the dangers in this vicinity, must be approached with great caution in thick weather because the currents and irregular bottom tend to make the ordinary methods of navigation uncertain. It is also in a region of great climatic change, and the meteorological conditions northward of the cape are quite different from those to the southward. Fog, for example, is more prevalent to the southward, whereas rainfall is heavier and the northwesterly winds of summer are more violent to the northward. The combined influence of these factors on navigation is emphasized by the number of wrecks which occurred during the earlier years of the present century when the then existing hydrographic surveys were so woefully inadequate.

A vessel running the courses commonly used in this locality would approach Cape Mendocino from the north on a course of 176° and would expect to pass about six miles off the cape to clear safely the known dangers. When the cape is abeam and bearing about East, the course would be changed to 160°, a 16° change to the East. That is, to exaggerate, one might say that a vessel has to run out and around the cape, keeping six miles off. It is evident that if one did not run far enough or, in other words, changed course too soon, the vessel would run onto the shoals or onto the cape itself. The currents in this locality are strong and variable, some wind effects are little known, and fog is more prevalent than in most places on the coasts of the United States, there usually being approximately 1,300 hours of fog per year. A vessel passing the cape may well have been running for many hours in fog without sight of any fixed object and be entirely dependent on dead reckoning and soundings for an approximate position.

It was during a period of foggy weather in the year 1916 that the master of the Steamer BEAR, "when his reckoning put him about 15 miles northward of Cape Mendocino, began to take soundings to locate his position" and feel his way to the lightship anchored off the cape. The soundings immediately indicated that the vessel was proceeding over deep water of 100 fathoms or more. When the depths began to shoal from 80 fathoms to 34 fathoms and subsequent soundings showed substantially deeper water, it appeared from the published chart then in use that the vessel had safely passed the cape and the course was changed as usual. About an hour later the vessel stranded two miles north of the cape with a loss of six lives. The contributing factor in the disaster was that the misleading soundings had been obtained in a reported but unsurveyed and, consequently, inadequately charted submarine depression (Eel Canyon) several miles northward of Cape Mendocino.*

* See Coast and Geodetic Survey Special Publication No. 48 (1918), "The Neglected Waters of the Pacific Coast", for details of this and other accidents.

Between the years 1899 and 1917, 15 wrecks or strandings occurred in this area and an additional 50 occurred at other points along the California coast. Accidents off the coasts of Oregon and Washington in this period totaled 26 and 15 respectively. In each case the lack of hydrographic surveys, insufficient knowledge of currents, and inadequate charts were the contributing though not necessarily the sole factors involved.

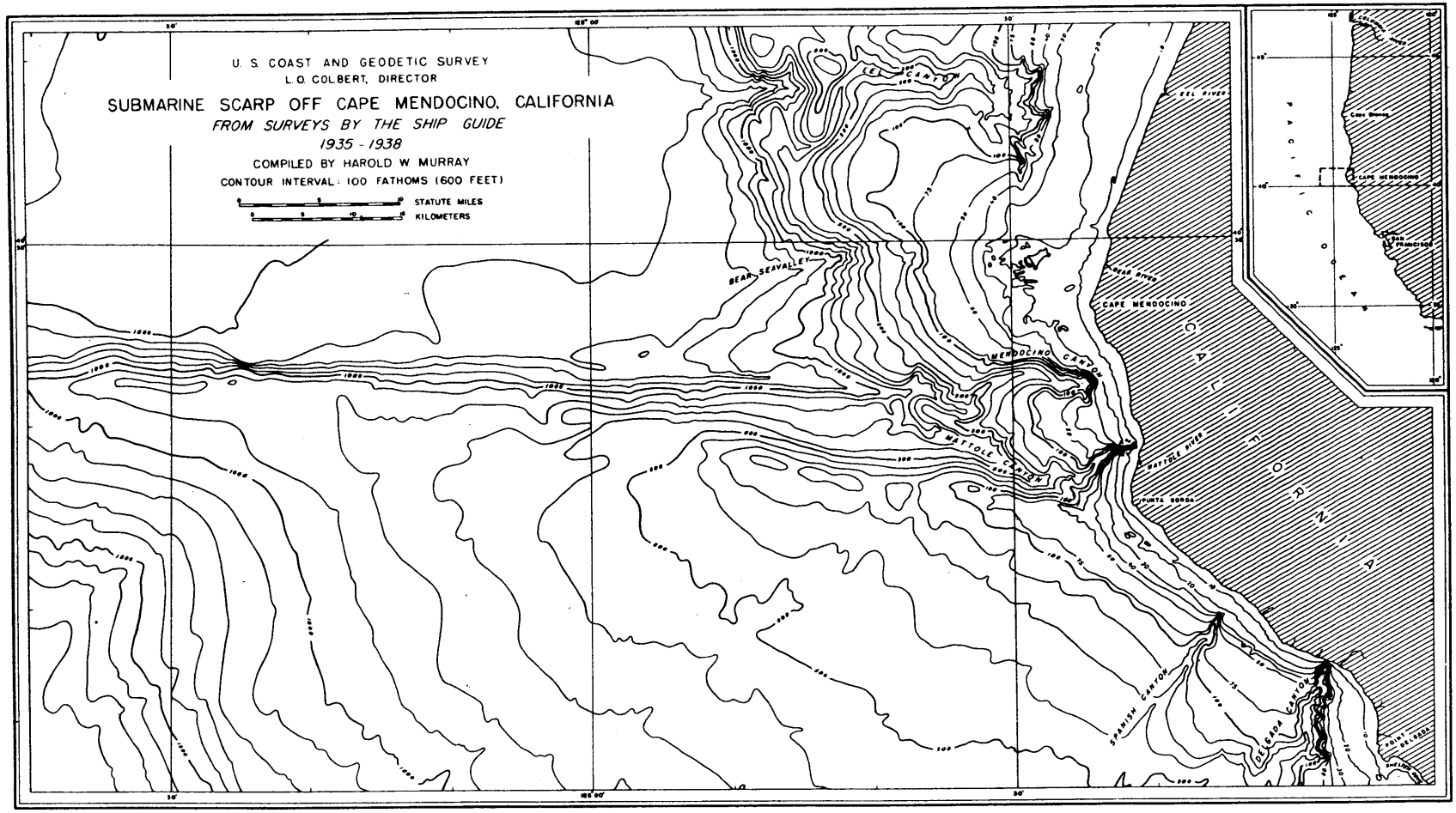
Hydrography previously executed by the Coast and Geodetic Survey in the vicinity of Cape Mendocino, aside from earlier reconnaissance surveys, consisted principally of 1:10,000 and 1:20,000 scale surveys accomplished between the years 1872 and 1886. These surveys, generally speaking, extended from six to eight miles offshore and included the heads of all submarine depressions terminating within the above mentioned limits. All soundings were vertical casts and probably did not exceed 20,000 in number.

It was not until the years 1919 to 1921 that the Coast and Geodetic Survey Ships WENONAH and LYDONIA, R. R. Lukens and E. H. Pagenhart commanding, surveyed the offshore area of Cape Mendocino and exposed the rather complex submarine topography existing offshore for a distance of at least 67 statute miles. The deeper offshore soundings, totaling about 6,500, were obtained by the laborious and time-consuming vertical cast method, horizontally controlled in part by dead reckoning and by three-point fixes on shore objects. The intensity of hydrography was naturally limited by the methods used, by the length of time available, and by the funds allotted to the vessels, but was accepted as adequate for the needs of navigation and the heretofore reported but mysterious Eel Canyon was now definitely surveyed and firmly secured within the confines of a geographic projection.

In 1935 the Coast and Geodetic Survey's plan of making modern and more intensely developed surveys, a project begun in 1932 at the southern limit of the State of California, had progressed northward to the vicinity of Cape Mendocino. The submarine topography revealed in the waters contiguous to the cape is shown by the submarine contours in the accompanying illustration.

The hydrography represented in the illustration was obtained at selected intervals during the period from 1935 to 1938 by the Coast and Geodetic Survey Ship GUIDE, F. H. Hardy, O. W. Swainson, and E. W. Eickelberg commanding. These surveys consisted of three series. One series of nine 1:10,000 and one 1:20,000 scale surveys embracing the area between the shore line and the 20-fathom curve consisted of 48,000 soundings. The second series was composed of one 1:20,000 and three 1:40,000 scale surveys extending from the 20-fathom curve to distances of three to seven statute miles offshore and consisting of about 25,000 soundings. The last series consisted of one 1:120,000 scale survey with about 7,000 soundings extending from the last mentioned limits to more than 66 miles offshore. In all, a total of more than 80,000 soundings have been taken within the area of the illustration. The soundings obtained are principally echo soundings supplemented by vertical cast and hand lead soundings in the waters adjacent to the shore line. Horizontal control consisted of three-point fix angles on shore objects in the inshore area and radio acoustic ranging in the offshore area.

The contour interval shown on the illustration is 100 fathoms (600 feet) for depths of 100 to 1,800 fathoms. In depths less than 100 fathoms the 10-, 20-, 30-, 40-, 50-, and 75-fathom contours are


U. S. COAST AND GEODETIC SURVEY
L. O. COLBERT, DIRECTOR
SUBMARINE SCARP OFF CAPE MENDOCINO, CALIFORNIA
FROM SURVEYS BY THE SHIP GUIDE
1935 - 1938
COMPILED BY HAROLD W. MURRAY
CONTOUR INTERVAL: 100 FATHOMS (600 FEET)
STATUTE MILES
KILOMETERS
EEL CANYON
EEL RIVER
BEAR VALLEY
MENDOCINO CANYON
CAPE MENDOCINO
MATTOLE CANYON
MATTOLE RIVER
PUNTA GORDA
SPANISH CANYON
DELGADA CANYON
POINT DELGADA
CALIFORNIA
PACIFIC OCEAN
SAN FRANCISCO

shown. The contour interval used in the 1:120,000 scale survey previously mentioned was 25 fathoms, or four times greater. This insured a more accurate contour delineation in areas where echo soundings were practically continuous on rather widely-spaced sounding lines.

The diversity of submarine topography expressed in the illustration is self-evident. Heading the list is the long submarine scarp one-half to one mile in height extending more than 66 statute miles from shore. The western extremity of this feature has not as yet been ascertained. Portions of the face of the scarp plunge downward to the north with a steepness of from 24 to as much as 100 per cent. The downward slope of the top of this scarp, measured from the closed 200-fathom contour to the closed 800-fathom contour, is 1.7 per cent. However, from the western extremity of the 800-fathom contour to the western limit of the 1,000-fathom contour (outside the limit of the illustration), the rate of descent has increased to 3.9 per cent. The ocean bottom to the north and northeast of the scarp is quite flat and about one and three-fourths miles below the surface of the ocean, whereas the bottom to the south of the scarp slopes gently southwestward at a rate of 3.8 to 7.6 per cent accompanied by a depth change of from one-fifth to two miles. This scarp with the three types of contrasting topography constitutes a submarine feature too unusual to possess a known rival on the entire West Coast.

The 100-fathom contour closely approximates the limit of the continental shelf which is broader on the north than on the south. The continental slope beginning at the 100-fathom contour slopes away in the broader areas at a rate of about 4.3 per cent just above Spanish Canyon and is as great as 11 to 19 per cent on either side of Bear Seavalley where it is considerably shorter in length. Here again contrasting topography is presented in that the rate of slope on the north is about three to four times greater than that to the southward.

Submarine canyons are well entrenched on either side of the scarp and protrude several miles into the continental shelf. Mattole and Delgada canyons to the southward of the cape are remarkable in that they extend so close to shore. Eel Canyon on the north has a broad head about five miles wide with five pronounced tributaries. It traverses a distance of 32 statute miles between the 30- and 1,400-fathom contours. The bottom gradient between the 75- and 900-fathom contours, a distance of about 25 miles, is from 5.0 to 3.0 per cent. At the 900-fathom contour the bottom slopes steeply to a depth of 1,300 fathoms with gradients as great as 30.3 per cent after which it lessens to about 2.4 per cent. The submarine knoll existing near the mouth of the canyon, around which the stream channel has had to travel 11 miles, is a phenomenon in deflection of submarine canyon courses. This knoll will evoke an interesting discussion as to whether it is younger or older than the canyon, or contemporary with a portion of the canyon's history. The fact that the mouth of the canyon including that portion of the canyon just eastward of the knoll approaches a straight line would imply, for example, that the canyon was fault-controlled and that the knoll was a subsequent intrusion occurring at some time after the canyon was well established.

Bear Seavalley is about 18 miles long between the 75- and 1,400-fathom contours. Its gradient is about 14 per cent down to the 500-fathom contour, thence 30 per cent to a depth of 1,000 fathoms after which it levels out from 11 to as low as 2.9 per cent. The name of

this feature was supplied by the writer, all other names shown on the illustration being in use on the later editions of the Coast and Geodetic Survey charts of this area. The term "seavalley", however, is a recent decision of the United States Board on Geographical Names and is applied to submarine depressions that are of valley form but unaccompanied by steep adjacent parallel walls such as are found in canyons.

Although outside the scope of this article, it is nevertheless of practical interest to note that another recent decision is "seamount". This new term is being applied more frequently off the West Coast and is used to denote a submarine elevation of mountain form. As a specific example, the first feature to receive this designation was a submarine mountain discovered by the Coast and Geodetic Survey Ship GUIDE in 1933 about 75 miles west of Point Piedras Blancas, California. This feature rises from a depth of 1,900 fathoms to 729 fathoms and has a net elevation above the ocean floor of 1,171 fathoms or 7,026 feet. It was named "Davidson Seamount" in honor of George Davidson (1825-1911) of the U. S. Coast and Geodetic Survey.

Mendocino and Mattole canyons join at a depth of around 900 fathoms. Their lengths inshoreward from this point are 14 miles to the 40-fathom contour and 18 miles to the 10-fathom contour respectively. Two alternate outlets into the broad region of the 1,400-fathom contour are possible: one where Bear Seavalley enters, and the other about nine miles farther westward. The total lengths, in the case of the longer Mattole Canyon, to the two outlets are about 39 and 48 miles. Mendocino Canyon is more direct and has a gradient of about 6.4 per cent from a depth of 200 to 1,100 fathoms after which it levels out to about 2.2 per cent. The gradient along the major portion of Mattole Canyon is about 5.4 per cent or slightly less. Portions of the side walls of these two canyons are similar and yet contrasting. Near the apex of the 400-fathom contour, Mendocino Canyon has a steep wall slope of about 49 per cent on the north side, whereas Mattole Canyon has its steeper side slope of about 52 per cent of the south side where the face of the scarp serves as a side wall. In the same vicinities the opposing walls of each canyon are also similar in that they have lesser slopes of 21 and 16 per cent respectively.

Spanish and Delgada canyons are only partially shown on the illustration. Spanish Canyon is fairly straight and has a gradient of about 7.2 per cent from the 30- to the 300-fathom contour after which it lessens to about 2.4 per cent. Delgada's gradient is about 15 per cent from the 10- to the 100-fathom contour, thence 11 per cent to the 200-fathom contour after which it changes to about 2.7 per cent.

The contouring of several features represented in the illustration has revealed the desirability of additional development for further geological and seismological researches. Such additional development will necessarily be more comprehensive than that needed for purposes of navigation and will be accomplished by the Coast and Geodetic Survey Ship GUIDE, E. W. Eickelberg commanding.

The new development will consist briefly of:

1. A zigzag echo sounding line extending along the fault scarp to ascertain its present unknown western extremity.

2. A system of short, closely-spaced, vertical cast sounding lines crossing the submarine scarp approximately normal to the depth curves between the junction of Mattole and Mendocino canyons and the western limit of the illustration. These lines will be spaced about five nautical miles apart. The sounding interval will be as close as 100 meters on the steepest portion of the scarp. Bottom specimens will also be obtained at each vertical cast sounding. This development will permit a more exact determination of the face of the scarp and will, of course, be intensified if any unusual features, such as cliffs or terraces, are discovered.

3. Spanish Canyon will be further developed by a system of lines running approximately at an angle of 45° with the depth curves. Other areas to the northeastward, including the longest tributary of Eel Canyon will also receive further development.

While the careful development of these features and the intimate knowledge obtained from them are of considerable scientific value, probably the greatest present value is to the navigator. Previously in this article a short description was given of the stranding of the Steamer BEAR near Cape Mendocino. If the master of that vessel had been provided with a modern chart of this locality, he would not have made the assumption that the cape had been safely passed and the disaster probably would have been averted.

At that period, of course, soundings were obtained by vertical casts or pressure tubes. Nowadays, sounding is much simplified by the use of an echo sounding device with which more and more commercial vessels are being equipped. With such a device and a modern chart, a ship rounding Cape Mendocino in fog can determine its position almost as accurately as though the weather were clear, simply by adjusting the profile of this unique bottom as given by a continuous line of soundings, to the chart.

It is pleasant to think that Nature, while making Cape Mendocino one of the most dangerous points on our coasts, with its reefs, fogs, and generally unfavorable weather, has so patterned the submarine topography that the very peculiarities of its features increase the safety of navigation in this locality.

Following are some remarks by Captain N. H. Heck concerning the seismological aspects of the submarine scarp.

COMMENT

N. H. Heck, Hydrographic and Geodetic Engineer
Chief, Division of Terrestrial Magnetism and Seismology
U. S. Coast and Geodetic Survey

Recent confirmation of early surveys which indicated a vertical scarp running west from Cape Mendocino in about latitude 40°18' raises the interesting question as to whether or not this is an ex-

tension of the San Andreas Fault. Since this means a sharp change in direction of the fault as it leaves the coast, it is important to introduce the seismic evidence. It is to be understood that the San Andreas Fault is a major earth feature extending from the vicinity of Cape Mendocino through California into Mexico and possibly even farther. The only similar formation on land, comparable in extent, is the great fault which begins in northern Syria, extends through Palestine and across the Red Sea into Africa. It is possible, however, that the great submarine troughs are similar phenomena.

It is necessary first to appraise the accuracy of the locations of the known earthquakes of the region. Several elements are essential. The instrument should be suited for recording the earthquakes that occur, there should be a proper distribution of stations, the time scale on the records should be open so that the time of arrival of an earthquake phase is accurately known, and the velocities of the earth waves of the region should be known. If we were discussing the problem in the vicinity of San Francisco or southern California, these conditions would be met, but they are far from being met in the Cape Mendocino region.

During recent years there have been seismographs at Ferndale and Ukiah, and it is probable that the earthquake epicenters are reasonably well recorded off Cape Mendocino, but these are not enough stations for best results; and, since we are dealing with a geological phenomena, the history should be as long as possible. Prior to the installation of the two stations mentioned, only approximations of the epicenter could be made. A number of vessels reported feeling shocks in the vicinity, but the difficulty is that no matter what the relation of the vessel to the epicenter may be, if it feels the shock, it appears to come directly from beneath the vessel. It is probable that the recent determinations of epicenters are 10 or 15 miles in error and the earlier ones in still greater error, so that the direct association of earthquakes with the well-defined scarp cannot be made. However, the definition of the scarp is very important in connection with future more precise determinations. While the evidence is incomplete there is reason to think that there is not the same degree of earthquake activity to the northward of Cape Mendocino, either on land or sea, as there is just south of that vicinity.

Professor Perry Byerly of the University of California, in a paper presented at the Richmond meeting in 1938 of the American Association for the Advancement of Science, made the interesting suggestion that the fault continues only until it meets the region where there is a transfer from continental to oceanic crustal conditions (i.e., from 40 km. thickness to practically zero). This is a very interesting speculation, and it is in part supported by the westerly trend of the scarp.

In any case this is an excellent example of the need for accurate depiction of submarine features in connection with geological and seismological problems.

		Applied to chart		5002	11/17/39	P.B.C.
		"	" "	5602	1/18/40	J.F.W.
		"	" "	9000	June 1940	O.K.P.S.
		"	" "	5052	Sept. 1940	P.B.C.
		"	" "	5702	June 6/42	G.R.
		Partially "	" "	5021	Mar./47	G.R.