UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Seismic profiles of Lower Cook Inlet and Kodiak Shelf, R/V SEA SOUNDER, June-July 1976

by

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OPEN-FILE REPORT

76-848

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

Menlo Park, California

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INTRODUCTION

From June 18 until July 30, 1976, the Pacific-Arctic Branch of the U.S. Geological Survey conducted an environmental geologic cruise in lower Cook Inlet and on the Kodiak shelf (Fig. 1). Sparker, uniboom and 3.5 kHz seismic records were acquired along approximately 6500 kilometers of track line (Plates 1 and 2). In addition, side scan sonar surveys, bottom television observations and 154 sampling stations were made (Bouma and Hampton, 1976).

This report accompanies the seismic records that are publicly available on microfilm. It includes two track-line maps (Plates 1 and 2) at a scale 1:500,000 and two shot-point maps (Plates 3 and 4) at the same scale. This report also includes examples of the navigational data sheets as they were made during the survey and which are included on the microfilm, some remarks on the navigational accuracy, and an explanation of notations made on the seismic records. Details on the equipment, location and textural data of samples, shipboard interpretations of the sparker records, and some notations on the geology of both areas are given in Open-File Report 76-695 (Bouma and Hampton, 1976).

Microfilm prints of the seismic records and the shipboard logs are available from:

U.S. Geological Survey
Alaska Technical Data Unit
345 Middlefield Road
Menlo Park, California 94025
Telephone (415) 323-8111, ext. 2342

National Geophysical and Solar Terrestrial
Data Center
EDS/NOAA
Boulder, Colorado 80302

NAVIGATION

Two independent navigational systems were used by the scientific party. One system was a Magnavox integrated satellite-Loran C system that automatically recorded the data on magnetic tape, as well as typing it out on a keyboard printer. The other system was a Motorala Mini-Ranger unit that recorded the data on paper tape at 7-1/2 minute intervals.

Mini-Ranger positions were plotted manually on a 1:5000,000 scale chart at intervals of 15 minutes. In addition, all acceptable satellite positions were plotted. For easy reference a shot-point number was given to each 15-minute position. All satellite positions are shown on the enclosed position maps (Plates 3 and 4) as triangles with the time of fix. Mini-Ranger positions are presented as dots or as squares with shot-point numbers and occasionally with a time (GMT) indication. If a line started prior to an even 15-minute interval, shot-point number 0 was used to mark the position of the start of the line. In addition to the routine plots, the locations of major course changes were also plotted (see also trackline maps, Plates 1 and 2).

The Mini-Ranger was the primary navigational system, as the Loran C coverage in this region was inadequate. In most instances the Mini-Ranger locations were of high quality when the ship moved inside the range of the system's transponders. The maximum line-of-sight range for the Mini-Ranger was 80 nautical miles, but many stations on shore did not have sufficient elevation to obtain such a range. Consequently, some navigational weaknesses were encountered near the Kodiak shelf break. Technical problems occasionally occurred, forcing us to make use of direct bearings and radar.

SEISMIC SYSTEMS

A total of 2419 nm (4499 km) of sparker data, 2552 nm (4746 km) of uniboom data, and 3524 nm (6555 km) of 3.5 kHz high resolution data was recorded in Cook Inlet and on the Kodiak shelf. The combination of shallow water and sandy-gravelly bottom in many places resulted in little subbottom penetration and many strong multiples.

Examples and annotations, as can be found on the microfilm, are given in this report. Shot-point numbers are used throughout and occasionally the Julian Day and the time in GMT are listed. Stamps are given for beginning and end of line (see enclosed samples) as well as for beginning and end of roll of recording paper.

OTHER DATA

Open-file report 76-695 (Bouma and Hampton, 1976) lists the cruise itinerary, nannofossil ages of dart and gravity cores from Kodiak shelf and the position, lithology and some textural and color data from the samples collected at 154 stations. That report contains 9 maps (1:500,000) showing tracklines, shipboard analysis and interpretation of sparker data, location of faults, slumps and wavy bedforms, and shipboard microscopic analysis of surficial sediments. Besides containing information on instrumentation and procedures, some preliminary notes on both areas are given.

Background information on lower Cook Inlet with several references is given in open-file report 75-429 (Magoon and others), and on the Kodiak shelf in open-file report 76-325 (von Huene and others).

NOTES TO FIGURES

Attached are a number of figures displaying examples from the microfilms. Figure 2 shows the stamp used to indicate start or end of a roll of record paper, and a stamp employed to give the start or end of a trackline. The start/end of roll stamp gives archive information on the first four lines and a notation of start or end of roll. The four bottom lines show the type of data collected, Julian Day (JD), time in GMT, trackline number, and type of recorder employed. The lower stamp also gives the Julian Day, time in GMT, trackline number, the ship's course (CSE), speed (SPD) in knots, scale on the record in meters, type of data collected (values), and beginning or end of line.

Figures 3 and 4 give examples of 3.5 kHz high-resoltuion subbottom records, which commonly do show little more than bathymetry when dealing with shallow water depth and hard bottom (Fig. 3). Figure 4 shows good subbottom in reflectors in a 3.5 kHz record, in the area below the scarp. The main reason for penetration is the fine-grained nature of the overlying material.

Both 3.5 kHz examples show the "white" zone above the bottom which is due to the use of the Raytheon Correlation Echo Signal Processor (CESP) unit. The notations along the margin of the record indicate time in GMT, occasionally the Julian Day and the water depth in meters, and the shotpoint number encircled at 15 minute intervals.

Figures 5 and 6 present a low and a high quality uniboom record, respectively. Notations on the records are similar to those on the 3.5 kHz records. Hard bottom material, shallow water and a profiling speed of about 6 knots often prevents good subbottom information (Fig. 5). However, when slowing down to 4 knots or less for side-scan sonar surveys, a considerable improvement in record quality can be obtained. For example, figure 6 shows good quality uniboom records over a field of sand waves in Cook Inlet, shot at a speed of 4 knots. Foreset bedding can be seen internally within the sand waves. A strong reflector occurs imme-

diately below the troughs of the sand waves, and an angular unconformity can be detected at about 0.15 sec below the water surface.

Sparker records are displayed in figures 7 and 8. Little, if any, subbottom information can be obtained in very shallow water due to the closely spaced multiples. As the multiples become separated, the subbottom reflectors can be distinguished, often even below the first and second multiples. Notations on the records are identical to the ones described above.

Figure 9 gives an example of the navigation log used on board the R/V Sea Sounder. The columns Julian Day, GMT time, Line Number (letter or number), and Station Number are self-explanatory. The column "Comments" uses several abbreviations: Sat 19 = satellite number 19, SP 9 = shotpoint 9, EOL = end of line, SOL = start of line, and MNR = Mini-Ranger. The "Fix Quality" column gives good (G), fair (F) or poor (P) for the quality of the navigational fix.

The column "Fix Type" uses abbreviations for: CCS = course change, S = satellite, DRC = dead reckoning course, MNR = Mini-Ranger. The other columns for New Course, New Speed, Longitude and Latitude follow known rules.

Very little use was made of the remaining columns except for writing down Mini-Ranger distances and shore-based transponder numbers.

Enclosed in a pocket in the back of this report are four maps on 1:500,000 scale. Plates 1 and 2 give the trackline positions and numbers for lower Cook Inlet and the Kodiak shelf, respectively. The numbering generally is not in any temporal or spatial sequence, as we deviated from the original preplots. In addition to using numbers for tracklines, some letters were used in the beginning of the cruise.

Plates 3 and 4 cover the same areas as Plates 1 and 2 and present the navigational plots. Solid dots or open circles are used for the 15-minute positions and the shotpoint number is given next to the fix. In a few cases the shotpoints have been connected to avoid confusion. Satellite positions are given by open

triangles together with the GMT time of the fix. The normal fixes often have a full-hour time notation to facilitate realizing the correspondence between satellite and other types of fixes.

REFERENCES

Bouma, A. H. and Hampton, M. A., 1976, Preliminary report on the surface and shallow subsurface geology of lower Cook Inlet and Kodiak Shelf, Alaska: U.S. Geol. Survey Open-File Report 76-695.

Magoon, L. B., Hampton, M. A., Sable, E. G., Smith, R. A. and Chmelik, F. B., 1975, Hydrocarbon-potential, geologic hazards, and the technology, time-frame and infrastructure for exploration and development of the lower Cook Inlet, Alaska, a preliminary assessment: U.S. Geol. Survey Open-file Report 75-549.

Von Huene, R., Bouma, A., Moore, G., Hampton, M., Smith, R. and Dolton, G., 1976, A summary of petroleum potential, environmental geology, and the technology, time frame, and infrastructure for exploration and development of the western Gulf of Alaska: U.S. Geol. Survey Open-File Report 76-325.

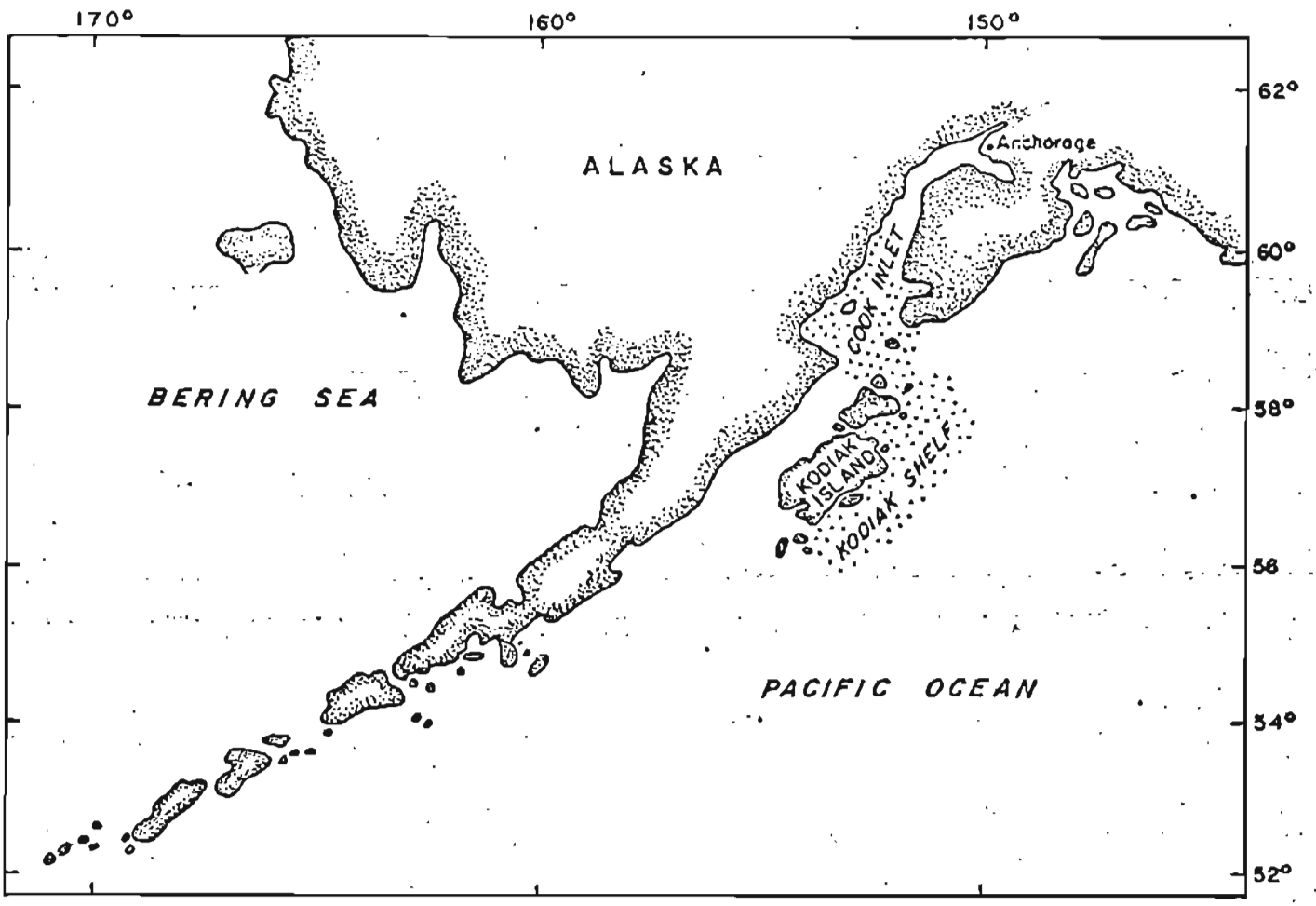

Figure 1.- Generalized location map of the study area

U.S.G.S. SHIP SEA SOUNDER START ROLL ☒
CHF. SCI. BOUMA/HAMPTON END ROLL ☐
LOCATOR SEA 2 (LD.) . 76 (YR.) . WG (AREA)
ARCHIVE # SCAR (DATA CODE) . 7 (ROLL #)
DATA TYPE 90 KJ SPARKER
START JD 191 TIME 0224 Z LINE 81
END JD 195 TIME 0148 Z LINE 92
RECORDER # & TYPE RAYTHEON

START/END OF ROLL

JD 202 TIME 2321 Z LINE 184
CSE 021 SPD 5.4 SCALE 0.187
VALUES UNIBOOM
☐ START LINE ☒ END LINE ☐ ROUTINE ☐ OTHER

START/END OF LINE

FIGURE 2. - EXAMPLES OF START/END OF ROLL AND START/ END OF LINE ANNOTATIONS AS USED ABOARD THE R/V SEA SOUNDER.

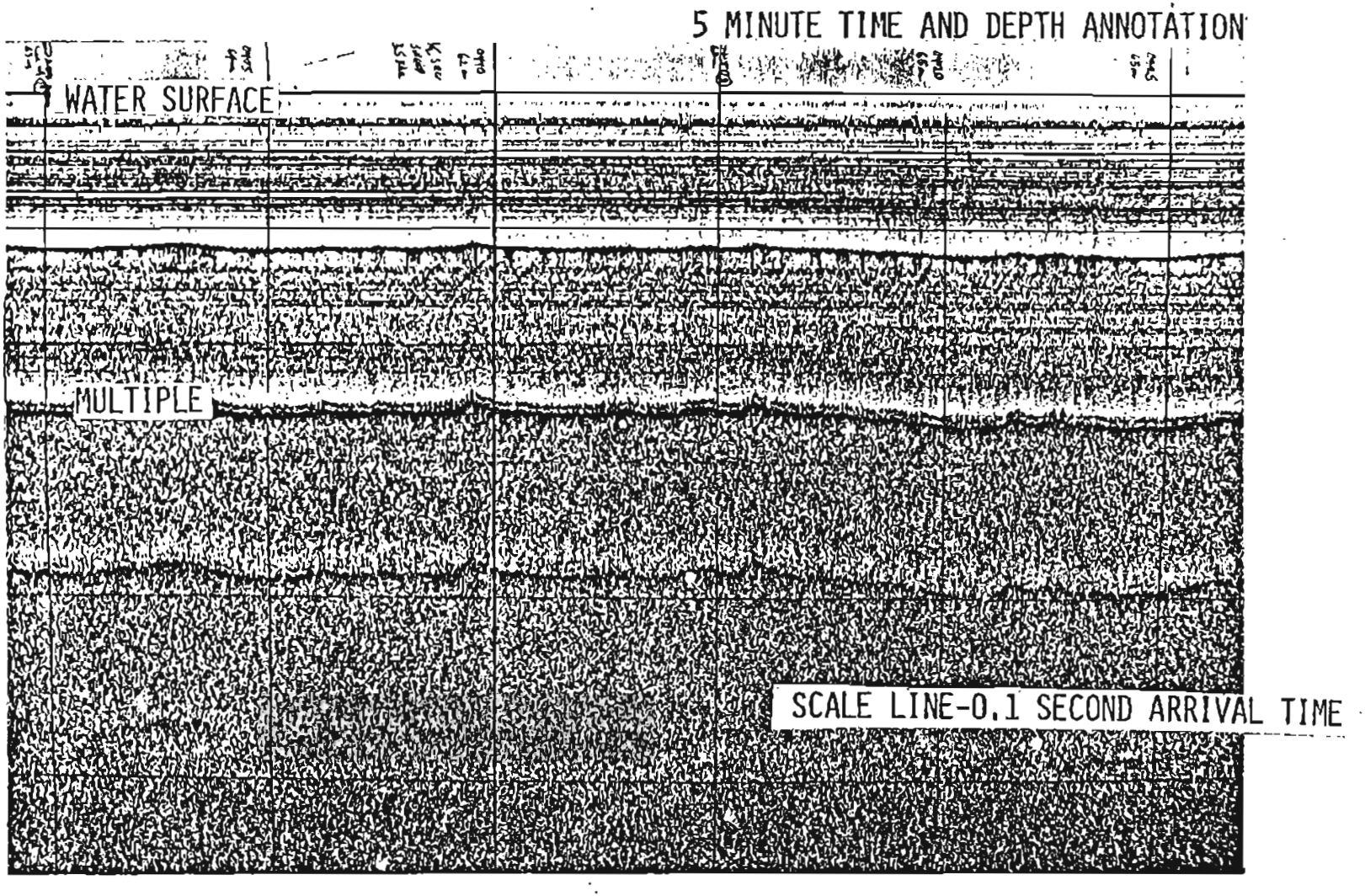

FIGURE 3. EXAMPLE OF 3.5 KILOHERTZ BATHYMETRY RECORD.

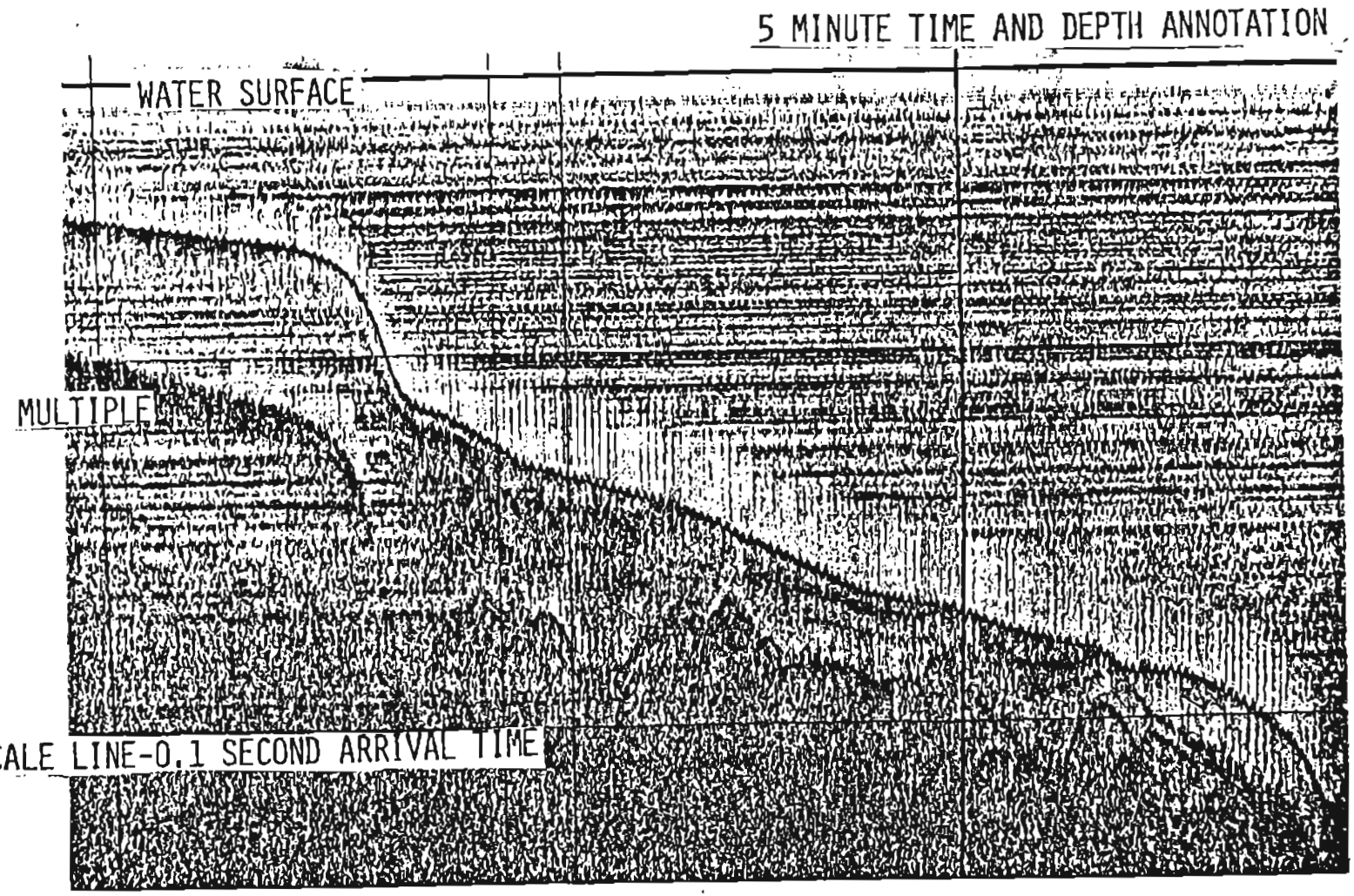

FIGURE 4. EXAMPLE OF 3.5 KILOHERTZ BATHYMETRY SYSTEM SHOWING SUBBOTTOM STRUCTURE.

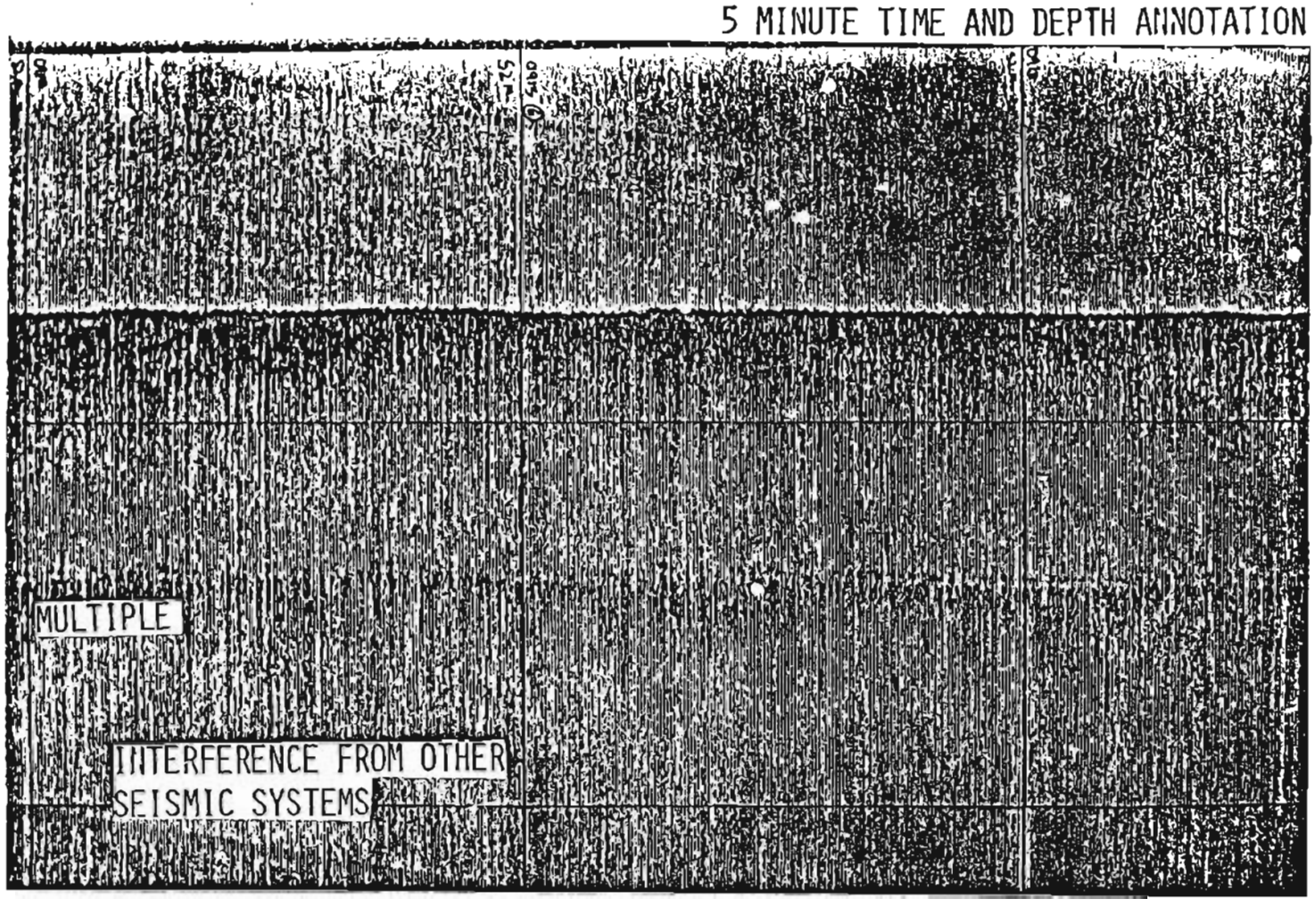

FIGURE 5. EXAMPLE OF LOW-QUALITY UNIBOOM RECORD SHOWING ONLY BATHYMETRY DUE TO EXTREMELY HARD BOTTOM CONDITIONS WHICH DO NOT ALLOW PENETRATION OF ENERGY.

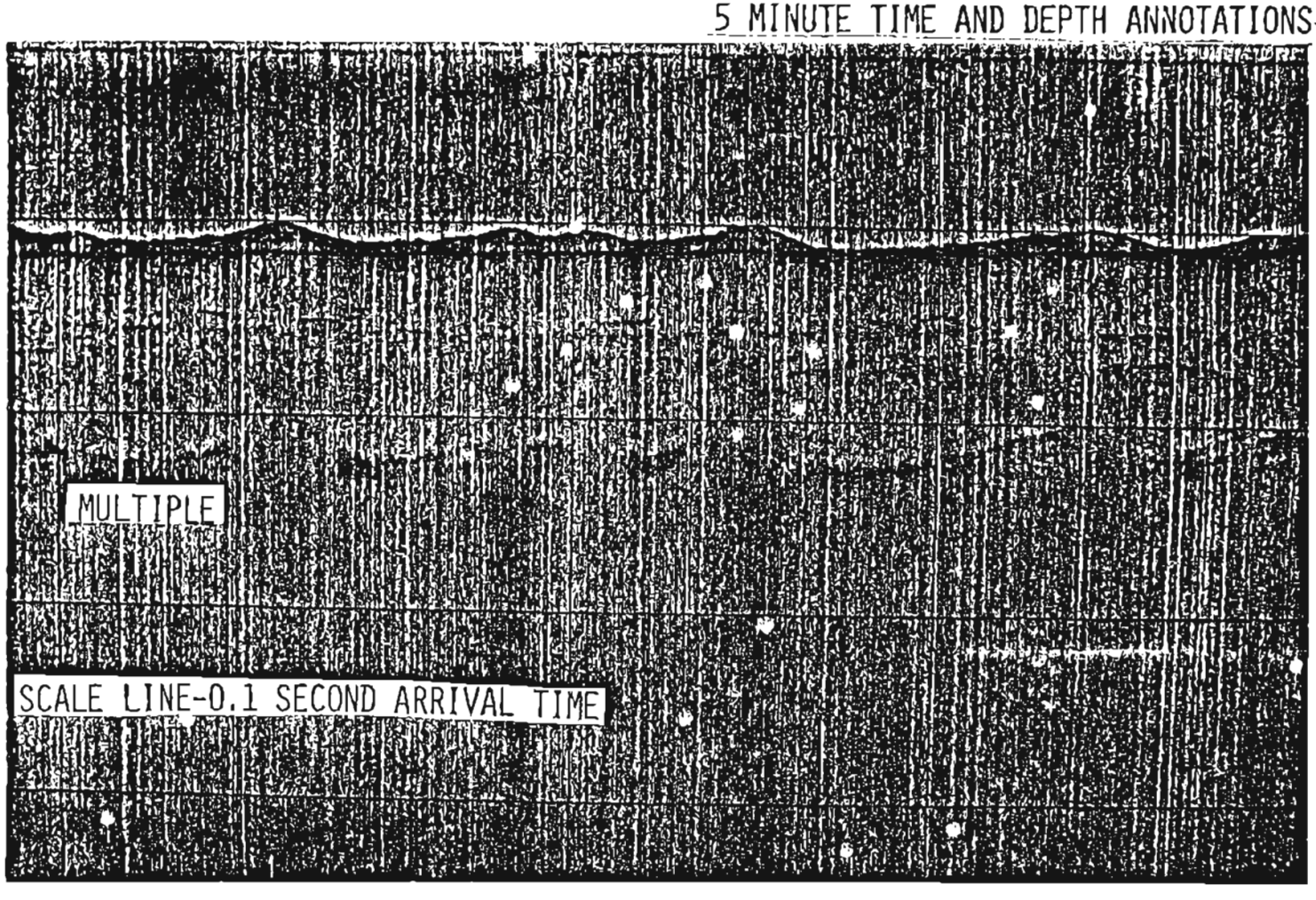

FIGURE 6. EXAMPLE OF HIGH-QUALITY UNIBOOM RECORD SHOWING SUBBOTTOM STRUCTURE.

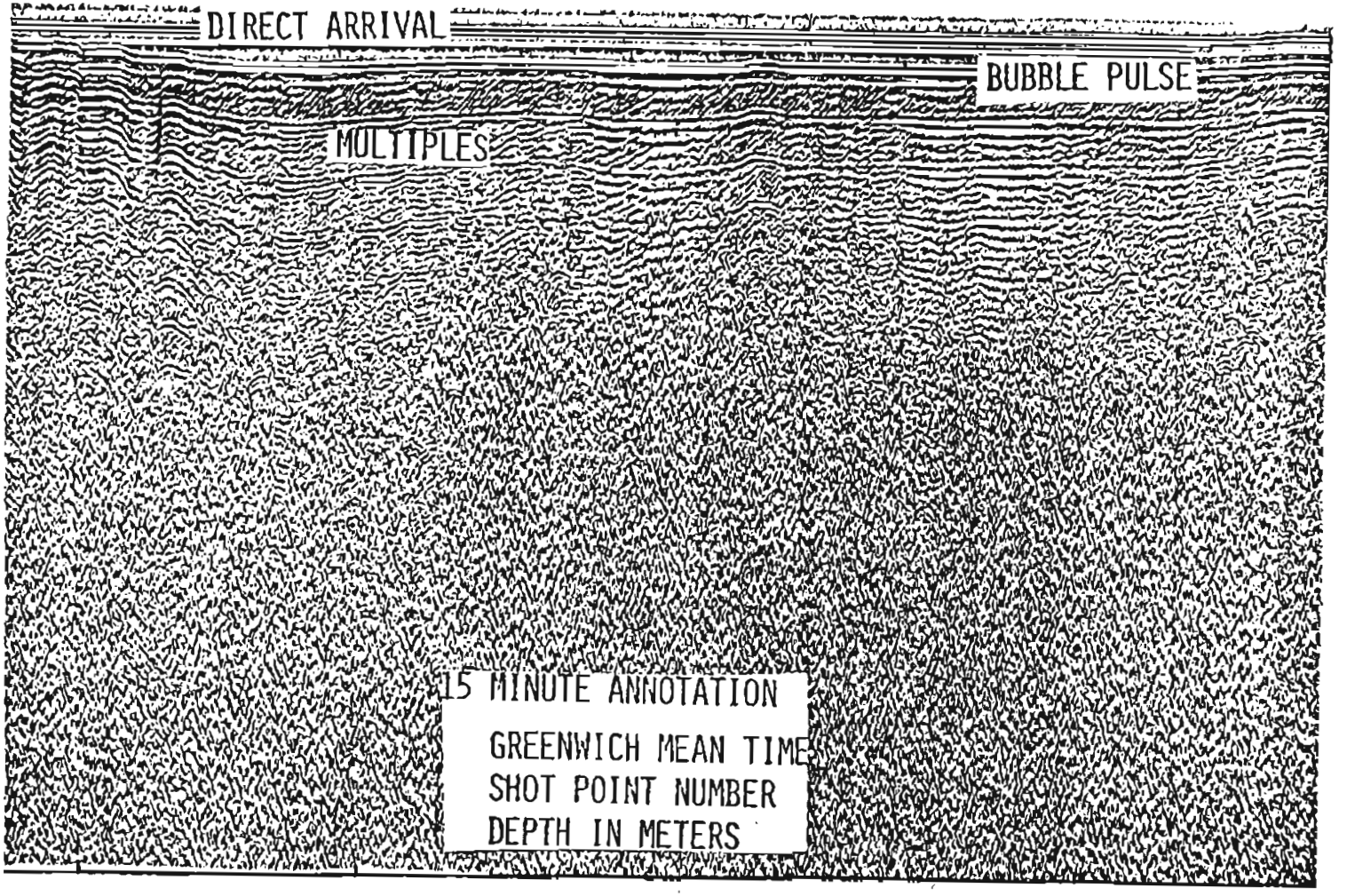

FIGURE 7. EXAMPLE OF LOW-QUALITY 30 KILOJOULE SPARKER RECORD. EXTREMELY SHALLOW WATER CAUSES MULTIPLE REFLECTIONS TO BE VERY CLOSELY SPACED, OBSCURING SUBBOTTOM STRUCTURE.

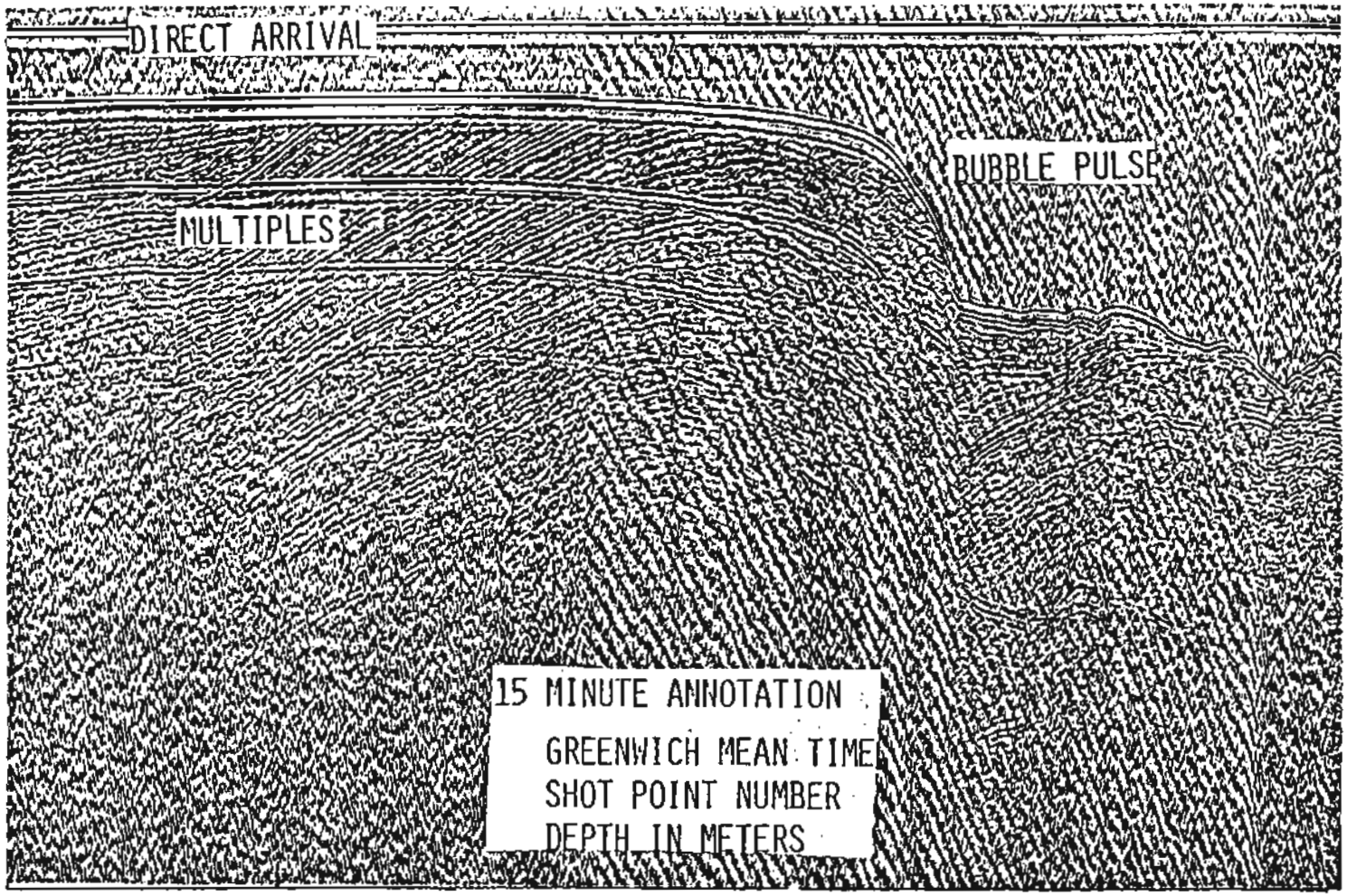

FIGURE 8. HIGH-QUALITY 30 KILOJOULE SPARKER RECORD SHOWING APPROXIMATELY TWO SECOND PENETRATION.

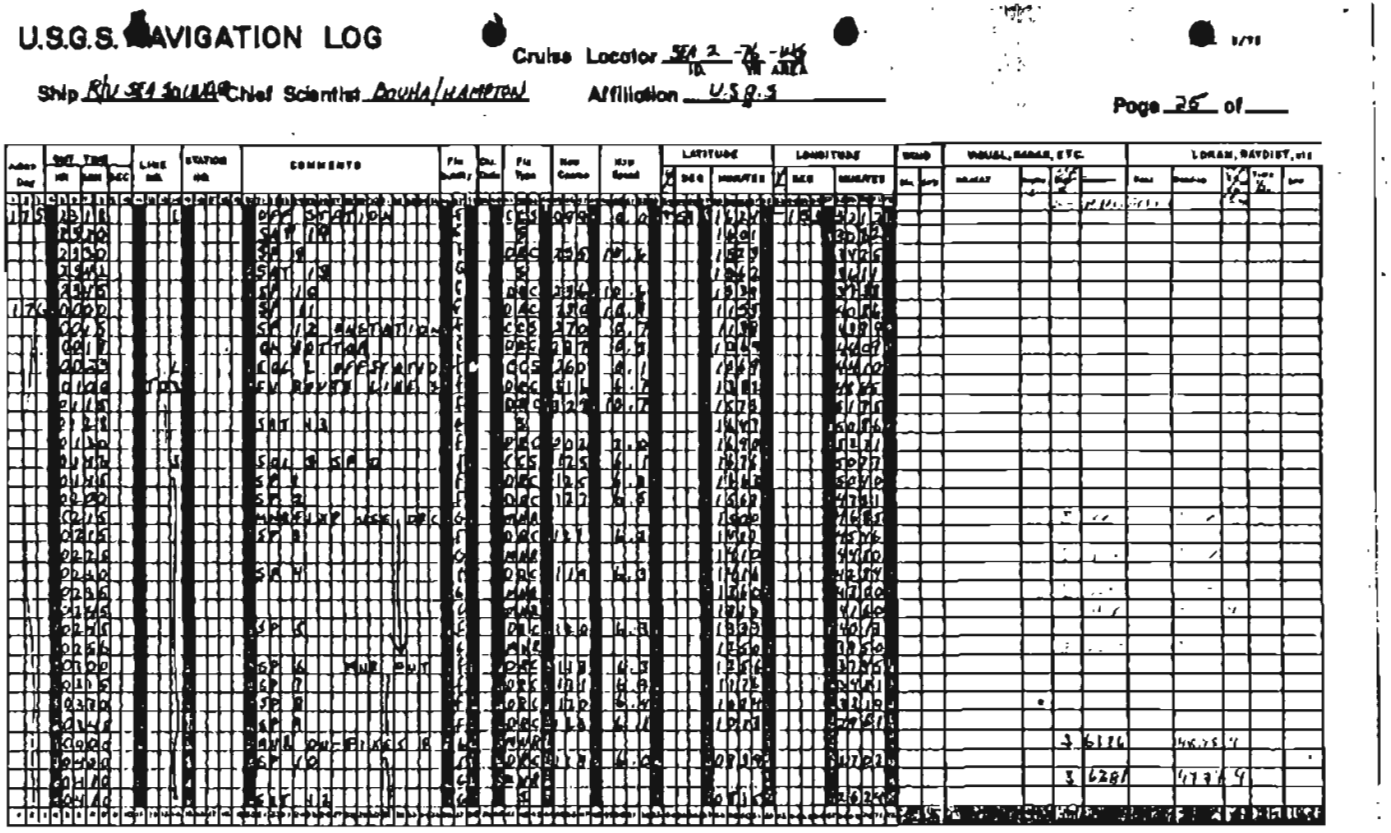

FIGURE 9. EXAMPLE OF U.S.G.S. NAVIGATION LOG AS USED ON BOARD R/V SEA SOUNDER.