UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

MINISPARKER PROFILES AND SEDIMENTOLOGIC DATA FROM R/V ACONA CRUISE (APRIL 1976) IN THE GULF OF ALASKA AND PRINCE WILLIAM SOUND

by

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OPEN FILE REPORT 78-381

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

Menlo Park, California

Illustrations

Introduction

In April 1976, the U.S. Geological Survey, Office of Marine Geology conducted a geophysical and sediment sampling cruise in the northern Gulf of Alaska between Seward and Kayak Island (Fig. 1) to obtain data on seafloor hazards pertinent to the OCS oil and gas lease sales. Stormy weather interrupted the planned data collection, during which time supplemental profiles and samples were collected in Prince William Sound including Montague Strait, Valdez Arm, Port Valdez, and Columbia Bay (Fig. 1). High resolution seismic profile records were made using a 600 Joule Del Norte Minisparker along 1151 km of track lines as shown on maps 1 and 2. Sediment samples collected with grab samplers (58) and gravity core (3) and bottom camera stations (14) are also shown on the track line maps and on figures 2 and 3.

This report indicates the seismic reflection records and shipboard logs that are publicly available and includes track line maps and a text that; (1) shows examples of characteristic seismic profiles, (2) describes geologic hazards observed on specific profiles, and (3) includes summary descriptions of sediment samples and bottom photographs.

Microfilm or paper prints of the seismic reflection records and shipboard logs are available for viewing:

(1) U.S. Geological Survey
Pacific-Arctic Branch of Marine Geology
Rm. 7169, Bldg. 7
345 Middlefield Road
Menlo Park, CA 94025
Phone 415-323-8111, ext. 2074

or for purchase:

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

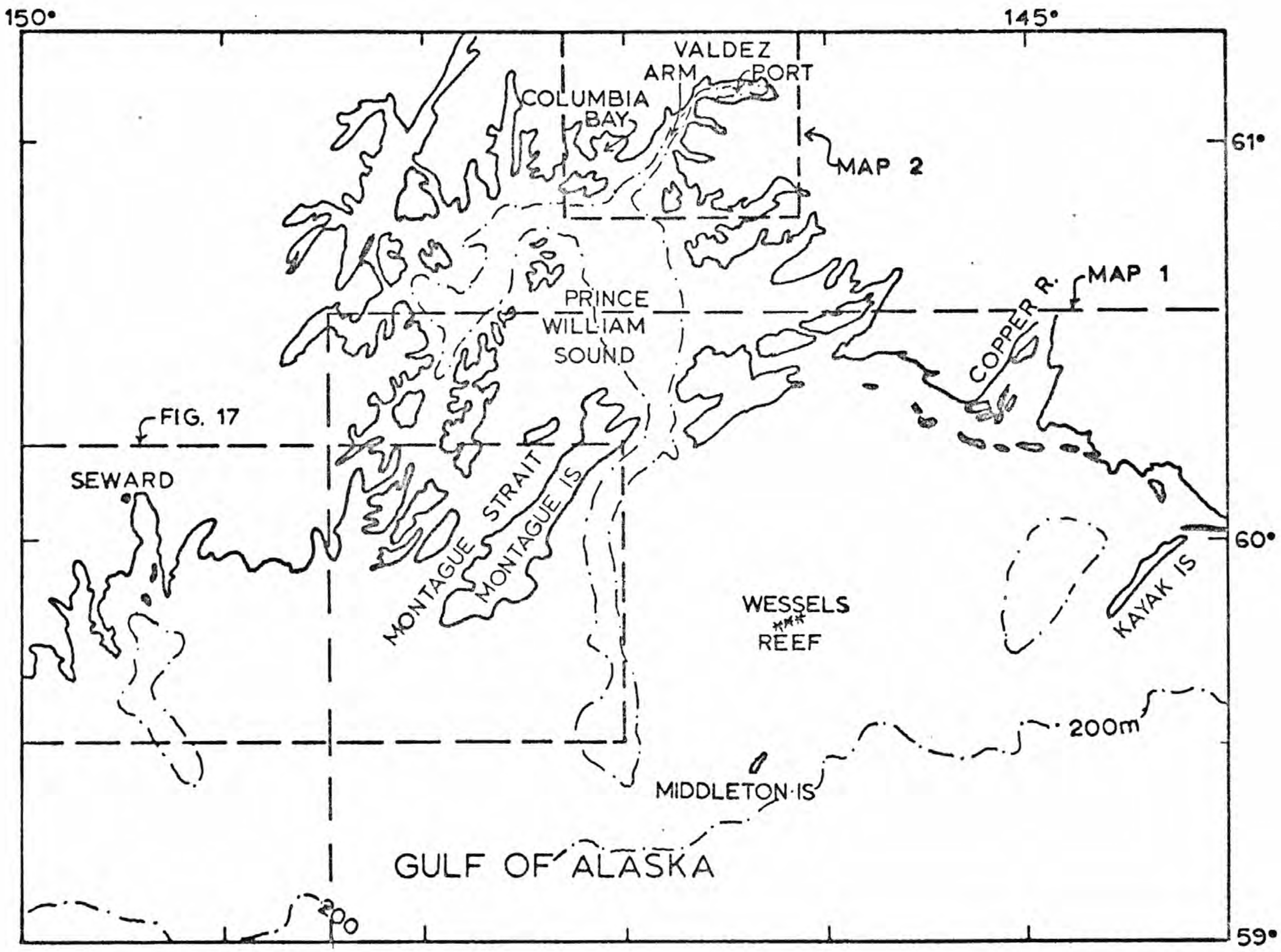

Figure 1. Location map of northern Gulf of Alaska and Prince William Sound. Areas of sample and trackline maps 1 and 2 and Figure 17 are outlined.

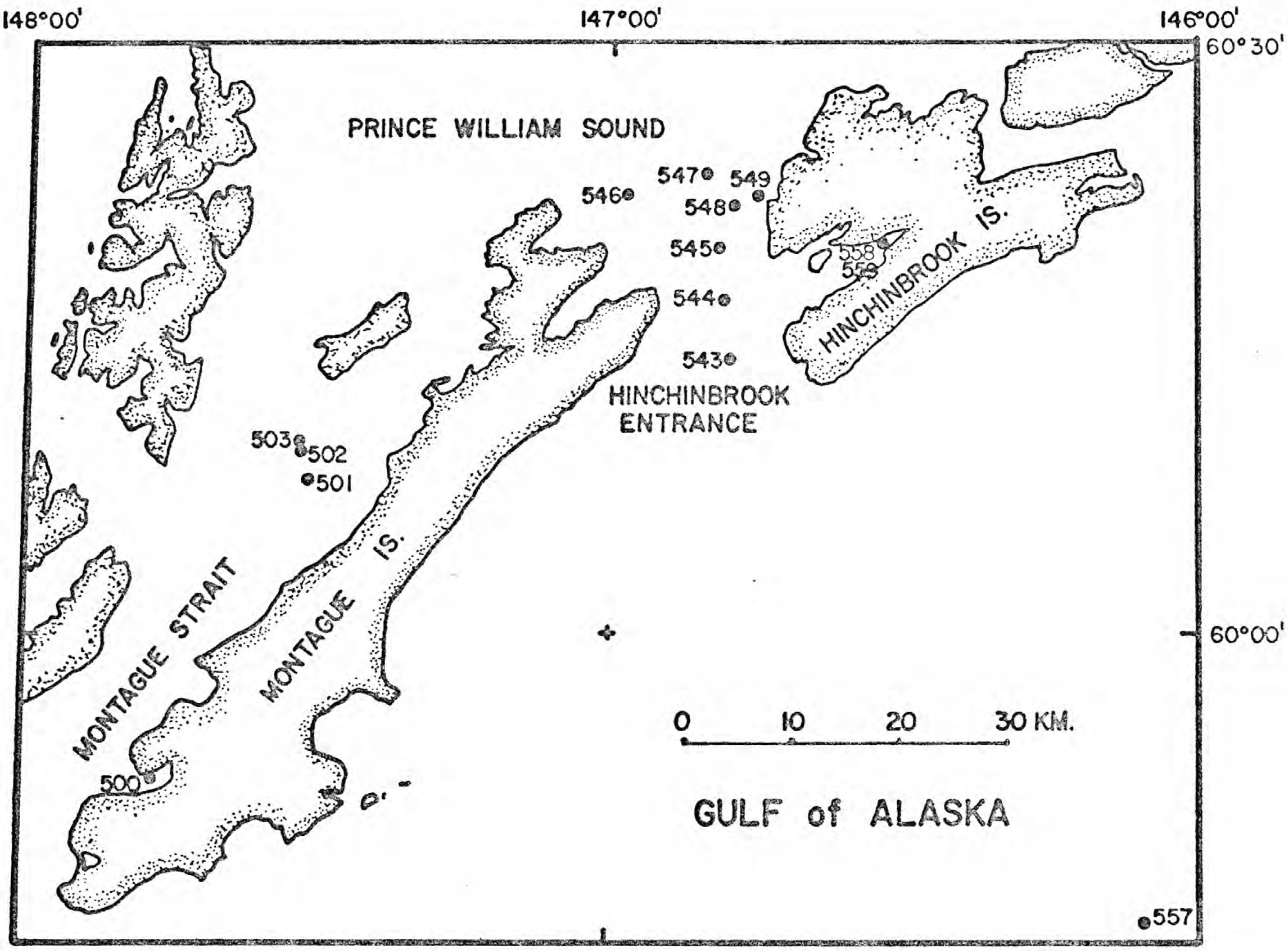

Figure 2. Sample location map - Montague Strait and Hinchinbrook Entrance.

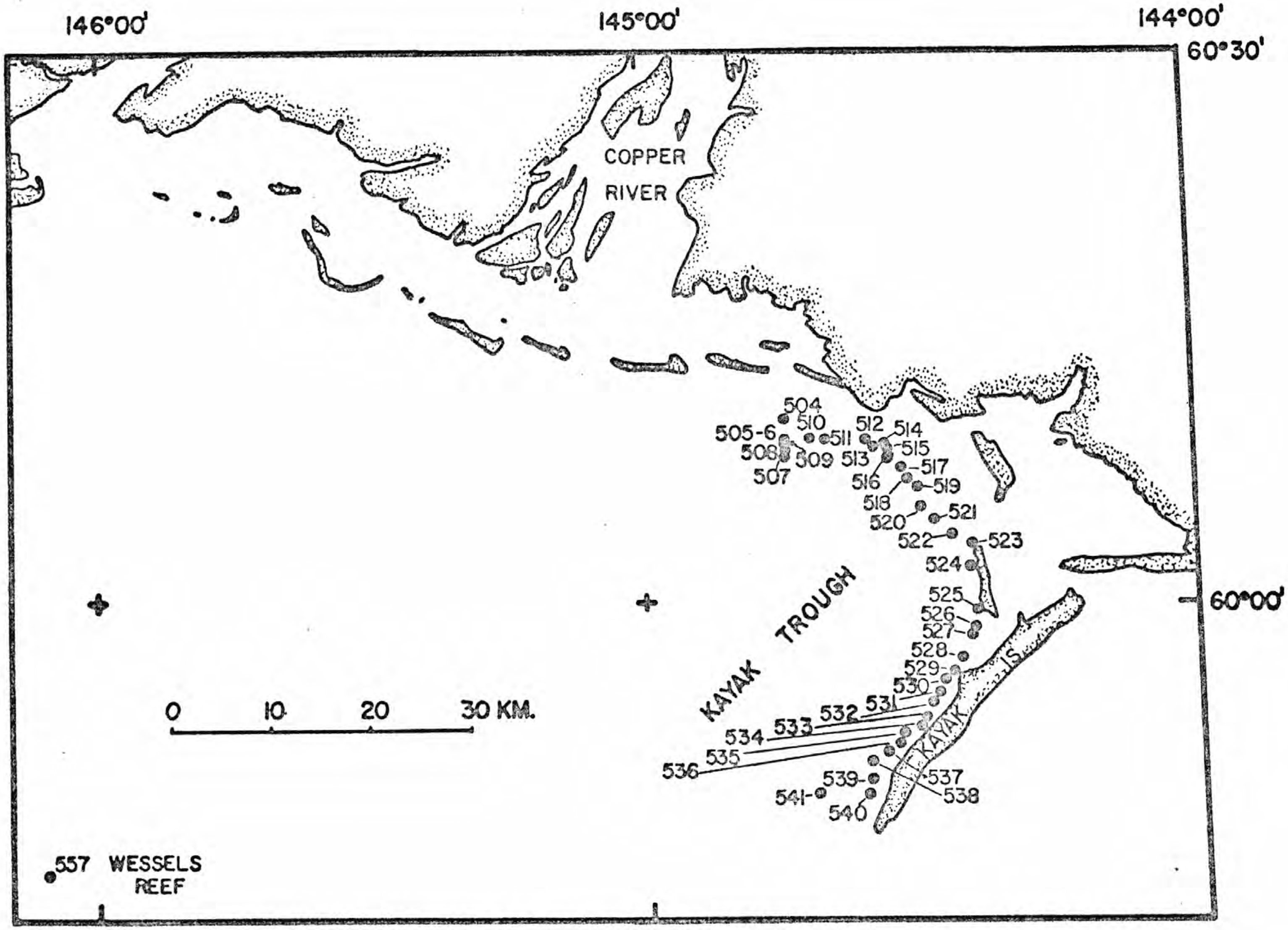

Figure 3. Sample location map - Kayak Trough and Wessels Reef.

Acknowledgements

The cruise was supported jointly by the U.S. Geological Survey and by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration.

We are appreciative of assistance on the cruise provided by the scientific personnel (Darlene Condra, John Cudnohufsky, John Hampson, Steven Kittleson, James McQuay, and Frances Wahl); the ship's Captain, K. Turner, and crew; and shorebase logistics by D. Dieter of the Institute of Marine Sciences, University of Alaska.

Discussion of Data

The cruise on the University of Alaska's R/V ACONA was round-trip from Seward April 9-19, 1976. The maps (1 and 2) show the progression of the cruise; both samples and track lines are numbered sequentially. Radar and Loran A were used for navigation. We estimate that our track lines and sample sites have location accuracies of about $\pm$ 0.5 km for the nearshore positions to $\pm$ 1-2 km for the offshore positions.

Examples of the high-resolution seismic records showing annotation of the lines are shown in figure 4. Figure 5 is an example of the shipboard log for the seismic system. The sequence of events on the cruise is summarized in Table 1, Table 2 lists descriptions and locations of the sediment samples, and Table 3 summarizes the results of the bottom camera stations.

A brief discussion of the major features observed with seismic, sediment sampling or photographic techniques follows for several geographic areas. The areas will be discussed in the approximate order sampled: Montague Strait, Hinchinbrook Entrance, Copper River pro-delta, Wessels Reef, Kayak Trough, Columbia Bay, Valdez Arm, Port Valdez, and Hinchinbrook Sea Valley.

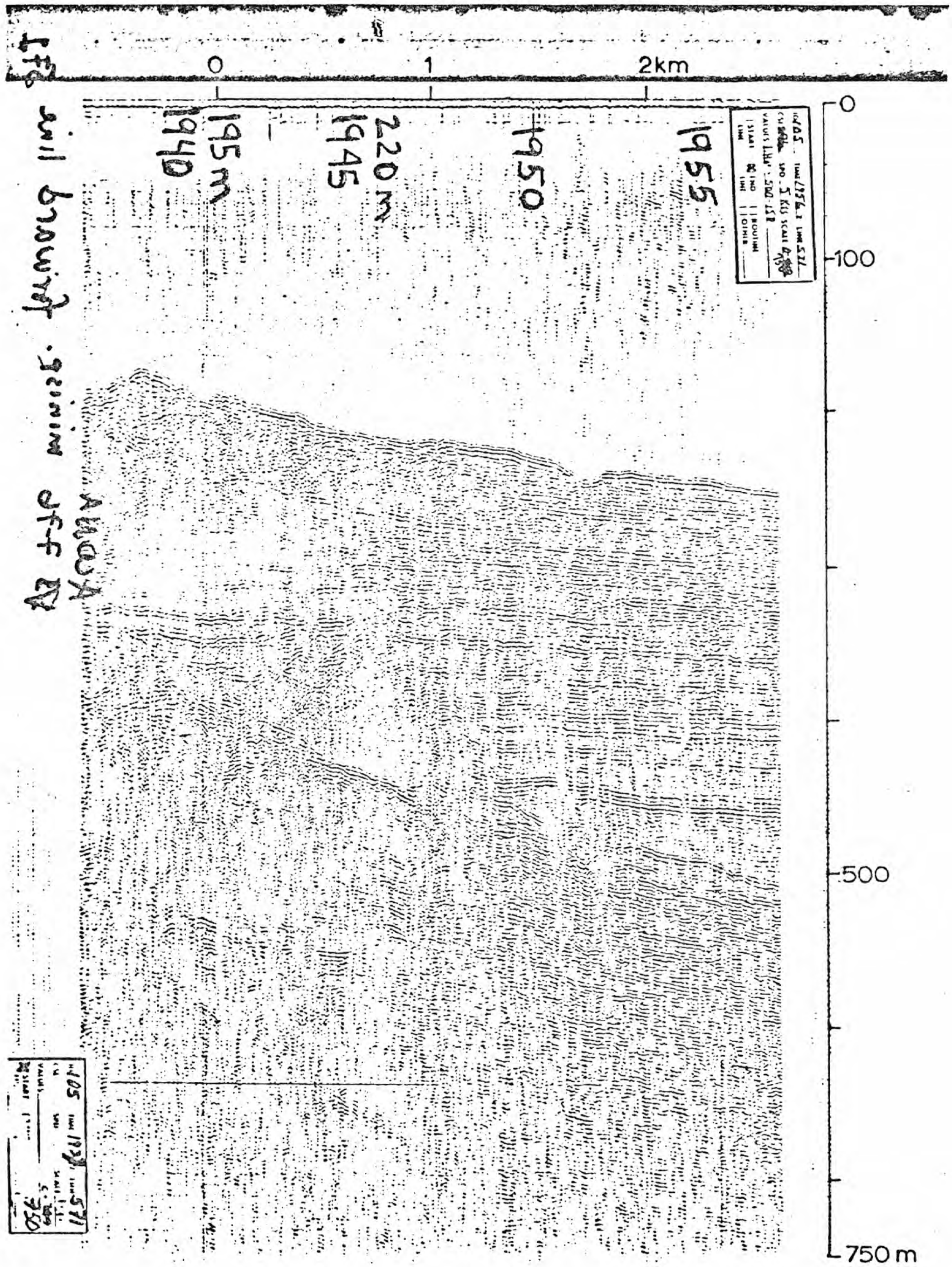

Figure 4. Example of annotations on high resolution seismic records. Minisparker profile collected from Columbia Bay (Line 571). Date is Julian Day and time is Greenwich. Record is one second sweep, 2-way travel, thus 0-750 m. Other records were obtained using 3/4, 1/2 and 1/4 second sweeps, depending on the water depths.

DAFE 1/76

U.S.G.S. ACOUSTIC EQUIPMENT LOG: LEG ______ EQUIP. TYPE Del Norte high resolution sparker PAGE 1 OF 4

LOCATOR ACO (I.D.) 1 - 76 (YR.) - EG (AREA) (COL. 73-80) TOW DIST./DEPTH: SOURCE 65m/1m RECEIVER 65m/1m SHIP Acona

RECORDER TYPE/NO. EPC 4100 CHIEF SCIENTIST Molnia/Carlson

PUNCH FLAG	TIME & POSITION * JULIAN DAY	GMT HR.-MIN.	GMT SEC.	LINE NO. **	SHOT POINT	MEDIA/SPEC. CODE 3 LETT'S.	ARCHIVE NO. DATA/EQUIP. CODE 4 LETTERS	ROLL OR REEL NO. 4 LET./No. *	PUT 'X' IN COR. BOX S/E OF ROLL, REEL STRT	END	DATA/SYST RECORDING ON	OFF	COMMENTS	COURSE	SPEED	WATER DEPTH meter	RECORDER SCALE	SWEEP	* SHOOT PPS	FILTERS HIGH	LOW	POWER Joules
✓	101	0352		550	—	PAP	DELN	1	X				start roll 1 ØD	043	5 kts	162	0-275m	1/2 s	2	500	200	7001
		0400											routine entry			172.5						
		0415											routine entry			175						
		0418											c/spd to 6 kts	043	6.0	183						
		0430											routine entry			195						
		0445											routine entry			215						
		0500											routine entry			215						
		0515											routine entry			195						
		0530											routine entry			162						
		0545											routine entry			160						
✓		0554										X	data loss, no time loss			154						
✓		0557									X		sys up			128						
		0600											routine entry			137						
		0606											c/cse to 028°	028	6.0	136						
		0615											routine entry			138						
	1-3	5-8	9,10	12-15	16-19	21-23	25-28	29-32	37	38	39	40										

* PLEASE RIGHT-JUSTIFY THESE ENTRIES ** DO NOT ENTER ST/END OF LINE ON THIS FORM (FOR KEYPUNCHING)

* PPS - Pops per second

GPO 895-825

Figure 5. Example of shipboard log for seismic system.

Table 1. Cruise Summary April 1976

Date	JD	Time (Z)	TrackLines	Comments
April 9	100	1520		LV. Seward
	101	0352	550	SOL Montague Str.
	101	1447	552	EOL
	101	2107	553	SOL Hinchinbrook Is.
	102	0817	554	EOL to Kayak Trough
	102	0818	555	SOL) Kayak Trough
	102	1815	558	EOL)
	102	1900	(504-	SOS) Kayak Is.
	103	1046	540)	EOS) Platform
	103	1209	559	SOL Kayak Trough
	104	1430	568	EOL
	104	1350	(541-	SOS Kayak Trough
	104	1655	542)	EOS
	104	1740	569	SOL Kayak Trough to
	105	0603	569	EOL Hinchinbrook Is.
	105	0640	(543-	SOS) Hinchinbrook Entrance
	105	1300	549)	EOS)
	105	1803	550	SOL Columbia
	105	1955	571	EOL Bay
	105	2046	572	SOL Valdez Arm
	106	0405	575	EOL and Port
	106	0530		AR. Valdez
	106	0800		LV. Valdez
	106	0915	(550-	SOS Valdez Arm
	106	1350	556)	EOS
	106	2331	576	SOL) Wessels Reef
	107	0100	576	EOL)
	107	0200	(557)	SOS Wessels Reef
	107	0215		EOS LV Wessels Reef
	107	0700		Anchor Port Etches Stormy weather
	107	2110	(558)	SOS Port Etches
	108	1900		LV. Port Etches
	108	2335	577	SOL Hinchinbrook Sea Valley
	110	2042	584	EOL to Resurrection Bay
April 19	110	2100		AR. Seward End of Cruise

Abbreviations:

SOL - Start of line
EOL - End of line
SOS - Start of sampling
EOS - End of sampling
(504-540) - Sample no. 504-540

Table 2. Sample Summary R/V ACONA April 1976

Sta. No.	Lat.	Long.	Water Depth(M)	Equip. Type	Sample Description
500	59°52.9	147°46.3'	24	Spk	Muddy sand w/shells
01	60°08.1'	147°30.6'	118	GC'	1.3 m of olive gray mud
2	60°09.3'	147°31.6'	42	Spk	Mud, sand, gravel, shells
3	60°09.6'	147°31.5'	68	"	Pebbly mud
4	60°10.0'	144°44.6'	29	"	V. fine micaceous sand
5	60°09.3'	144°44.6'	32	"	"
6	60°09.3'	144°44.6'	30	"	"
7	60°08.0'	144°44.6'	47	"	"
8	60°08.5'	144°44.6'	40	"	"
9	60°08.9'	144°44.6'	34	"	"
10	60°09.0'	144°42.5'	30	"	"
11	60°09.0'	144°40.6'	29	"	"
12	60°09.0'	144°38.1'	25	"	"
13	60°09.0'	144°36.3	21	"	"
14	60°09.0'	144°34.8'	18	"	"
15	60°08.8'	144°33.6'	17	"	"
16	60°08.2'	144°33.6'	24	"	"
17	60°07.6'	144°32.0'	22	VV	"
18	60°06.8'	144°31.6'	21	"	"
19	60°06.3'	144°30.7'	20	"	"
20	60.05.1'	144°29.9'	20	"	"
21	60.04.6'	144°28.6'	18	"	"
22	60°03.8'	144°26.7'	21	VV	V. fine sand, mud
23	60°02.8'	144°24.5'	40	"	V. fine sand
24	60°01.8'	144°23.8'	23	"	Gravel, sand, shells
25	60°00.2'	144°24.0'	29	"	Gravel, sand, mud, shells
26	59°58.8'	144°24.4'	21	"	Mud, v. fine sand
27	59°58.1'	144°25.2'	21	"	Fine sand, mud
28	59°57.1'	144°26.2'	18	"	"
29	59°56.2'	144°27.1'	18	"	Fine sand, shells
30	59°55.7'	144°27.0'	41	"	Fine sand
31	59°55.2'	144°28.4	22	"	Fine sand
32	59°54.6'	144°29.2'	21	"	Fine sand, shells
33	59°53.9'	144°30.2'	9	"	Coarse sand, shells
34	59°53.5'	144°30.9'	8	"	Coarse sand, shells
35	59°53.0'	144°32.4'	18	"	"
36	59°52.5'	144°33.3'	18	"	Coarse sand, benthic organisms
37	59°52.0'	144°34.4'	15	VV, Spk	Gravel, benthic organisms
38	59°51.9'	144°36.0'	22	Spk	Bedrock, benthic organisms
39	59°50.5'	144°36.2'	18	Spk	Gravel, sand, shells
40	59°49.8'	144°36.4'	20	Spk	Small recovery, organisms
41	59°59.7'	144°42.6'	233	VV	Grey mud
42	60°03.9'	144°42.6'	186	Spk	V. fine sand, mud
543	60°14.1'	146°48.2'	212	VV	Sand, mud, benthic organisms

Table 2. (cont'd) Sample Summary R/V ACONA April 1976

Sta. No.	Lat.	Long.	Water Depth (M)	Equip. Type	Sample Description
544	60°17.1	146°48.4'	270	VV	Mud, sand
44A	"	"	276	GC	"
45	60°19.8'	146°49.0'	285	VV	Grey-green mud
46	60°22.5'	146°58.3'	210	"	"
47	60°23.3'	146°50.4'	285	Spk	"
48	60°22.3'	146°46.6'	310	Spk	"
49	60°22.3'	146°45.1'	251	Spk	"
50	61°05.1'	146°37.9'	230	"	"
51	61°03.2'	146°40.8'	155	"	Gravel, shells, benthic orgs.
52	61°02.3'	146°46.6'	102	"	Pebbly mud
53	61°00.3'	146°45.7'	393	"	Grey mud
54	60°59.9'	146°49.8	211	"	"
55	60°57.9'	146°51.8	140	"	Pebbly mud
56	60°55.9'	146°55.8	405	"	Grey mud
57	59°45.4'	146°05.9	82	"	Pebbly mud, shell, benthic org
58	60°21.0'	146°32.9'	18	"	Pebbly mud
559	"	"	18	GC	"

Abbreviations:

VV - Van Veen grab sampler
SpK - Shipek grab sampler
GC - Gravity corer

Table 3. Summary of bottom camera photographs obtained at each camera station.

(R/V ACONA, April 1976)

Camera (sediment) Sta. No.	Lat.	Long	Water Depth (m)	No. of frames	Photo Descriptions
1 (500)	59°52.9'	147°46.3'	24	8	All underexposed. Surface almost completely barren of flora and fauna. No primary surface structures. Numerous burrow holes.
2 (501)	60°08.1'	147°30.6	119	-	All extremely underexposed. Not usable.
3 (502)	60°09.3'	147°31.6'	42	24	Slightly underexposed. Bottom character varies from smooth surface with burrow holes to uneven surface with cobble cover, plant growth and moderate to dense brittle star encrustation.
4 (504)	60°10.0'	144°44.6	29	14	Mostly good exposures with good contrast. Low amplitude sinusoidal ripple marks-parallel crests. No benthos flora or fauna.
5 (506)	60°09.3'	144°44.6'	32	13	Slightly underexposed with low contrast. Low amplitude sinusoidal ripple marks. Longer wave length than 4, subparallel crests. No benthos flora or fauna.
6(523)	60°01.0	144°25.0	14	28	Underexposed. Minor surface undulations. No surface, no benthos flora or fauna.
7(529)	59°56.2'	144°27.1'	21	16	Slightly underexposed with moderate contrast. Low amplitude ripple marks. Many with discontinuous crests-subparallel with varying wave lengths. No benthos flora or fauna.

Table 3 (cont'd)

8(533)	59°53.9'	144°30.2'	9	4	Good exposure, moderate contrast. Low amplitude ripple marks. Crests most discontinuous. Subparallel with varying wave lengths.
9(541)	59°59.7'	144°42.6	233	2	Good exposure, moderate contrast. No surface sedimentary structures. Some burrow holes. No benthic organisms.
10(542)	60°03.9'	144°42.6'	184	13	Slightly overexposed with poor contrast. Mottled structure on surface with few benthic organisms.
11(551)	61°03.2'	146°40.8'	155	11	Good exposures with high contrast. Dense surface cover of encrusting organisms. Many large shells and shell fragments and cobbles also cover surface.
12(556)	60°55.9'	146°55.8'	380	4	Overexposed, low contrast. No surface sedimentary structures. Some burrow holes. No benthic organisms.
13(557)	59°45.4'	146°05.9'	82	22	Overexposed, moderate contrast. Mottled structure, cobbled surface. Many shell fragments and benthic organisms.

Montague Strait (lines 550-552; samples 500-503; camera stations 1-3). This connecting link between the Gulf of Alaska and Prince William Sound is 7-11 km wide and 65 km long and is floored by numerous small basins between very irregular bedrock knobs and crags (fig. 6). The basins contain from a few meters to nearly 100 m of relatively flat-lying Holocene sediment that varies from unconsolidated mud in the depressions to gravel, sand and shell debris which can be seen on photographs taken on the bedrock highs. The three dimensional aspect of these basins or depressions is impossible to delineate based on the few lines. However, one basin crossed by two nearly perpendicular lines (550 and 552, Map 1) measured 7 km by 3 km and contained a thickness of Holocene sediment up to 55 m deep, and an average thickness of about 25 m. Other basins are less than 0.5 km across and contain thicknesses of less than 10 m of unconsolidated sediment.

Hinchinbrook Entrance (line 553, samples 543-549). This eastern entrance to Prince William Sound which is about 9 km wide and >350 m deep, is located between two prominent islands (Hinchinbrook and Montague) that consist largely of very resistant, extremely well-indurated, flysch-like sedimentary rocks and tholeiitic basalt of Paleocene age (Winkler, 1976). These Orca group rocks form the acoustic basement in Hinchinbrook Entrance, Montague Strait and probably under much of Prince William Sound. The seismic reflections from this surface show a very rugged morphology (fig. 6) covered by varying thicknesses of unconsolidated clayey silt interspersed with thin layers of sandy silt.

The high-resolution seismic profile (line 553) shows a very thick (>200 m) wedge of Holocene sediment accumulating in the entrance (fig. 7). Most of this sediment originates from the Copper River and is transported westward by the counter-clockwise circulation pattern in the Gulf of Alaska (Carlson, Molnia and Reimnitz, 1976).

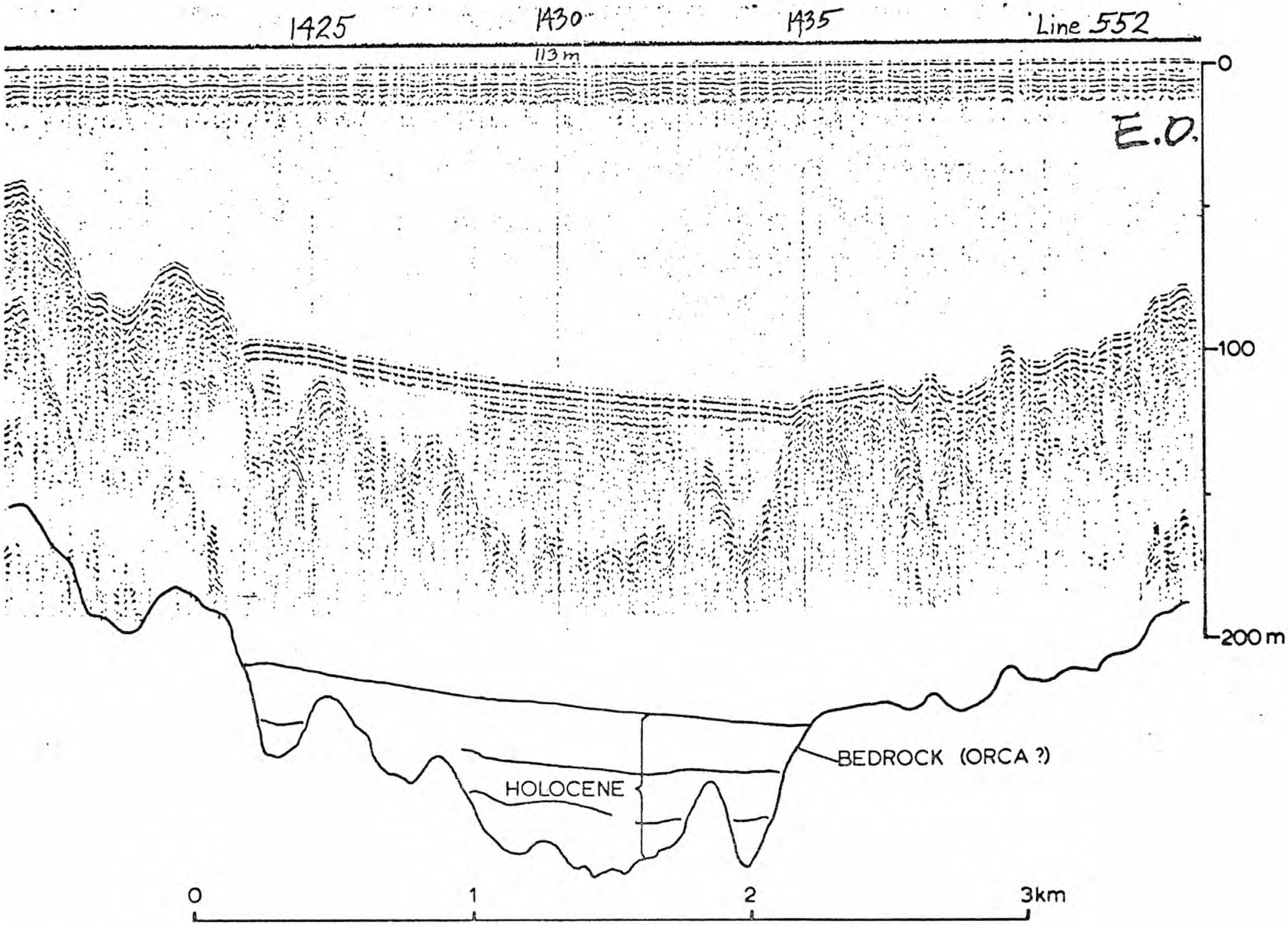

Figure 6. Minisparker profile in Montague Strait showing irregular bedrock surface and Holocene sediment that is filling in the depressions. Line 552 (V.E. ~ 10x).

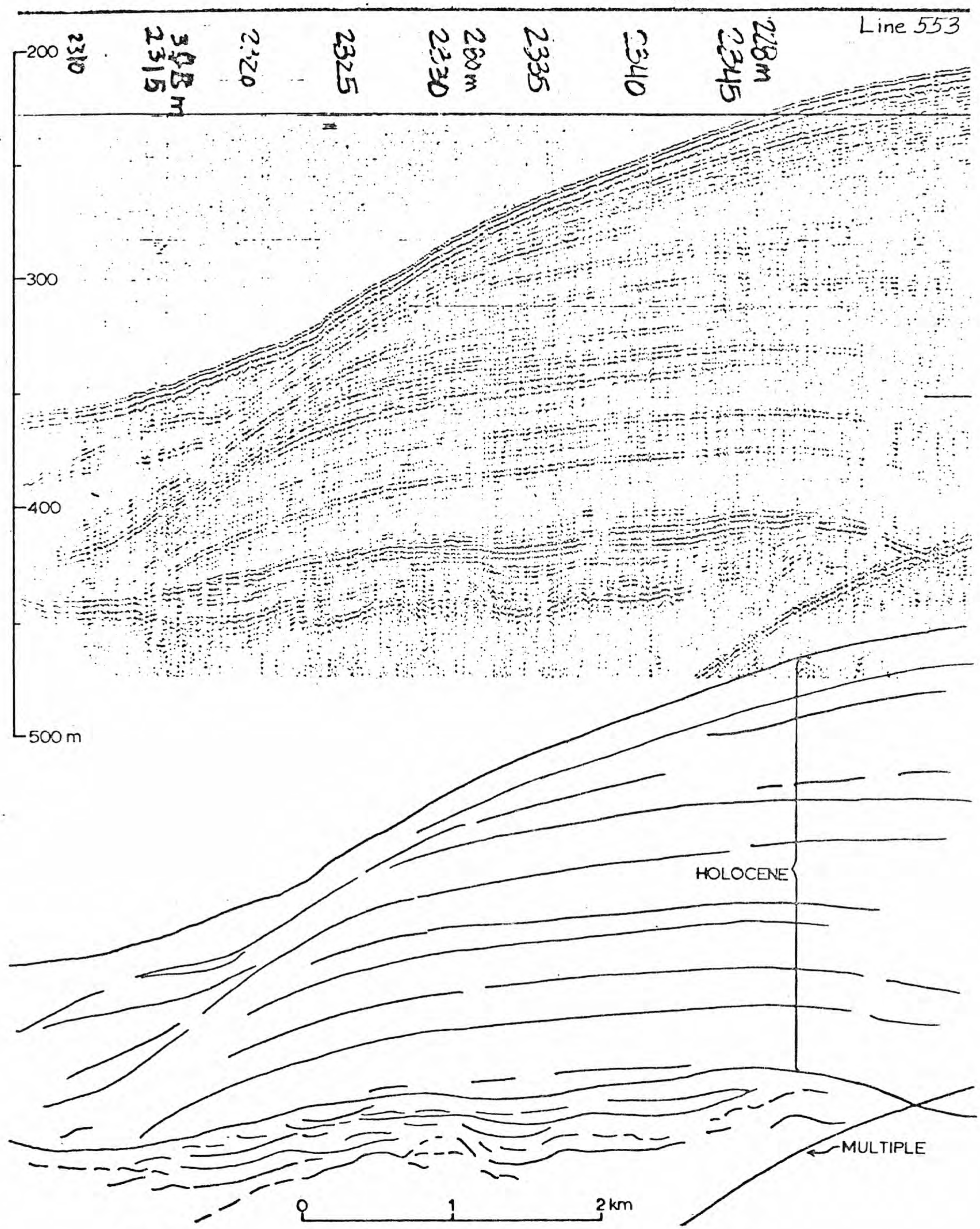

Figure 7. Minisparker profile of thick wedge of Holocene sediment in Hinchinbrook Entrance. Line 553 (V.E. $\simeq$ 10x).

Copper River Pro-Delta (lines 554, 555 and 569) and Tarr Bank (line 576; sample 557; camera station 13). Two minisparker lines were run across the Copper River pro-delta between Hinchinbrook Entrance and Kayak Trough, a distance of approximately 100 km (Map 1). The nearshore line (554 and 555) in water depths of 50-100 m shows a series of cut and filled channels at depths in the sediment of 100-180 m. These channels are up to 1-2 km in width and vary in relief from 10 to 80 m (fig. 8). This highly eroded, truncated and channelled unit is overlain by Holocene sediment that averages about 100 m in thickness. This agrees closely with a Holocene sediment thickness isopach map by Carlson and Molnia (1975). The Holocene sediment has continuous, parallel flat-lying reflectors (fig. 8) in this region of rapid sediment accumulation (9-15 m/1,000 years, according to Pb-210 dating by C. Holmes, USGS and C. Nittrouer, U. of Wash., personal comm. 1977). Surface sediments in this water depth are primarily clayey silt transported into the Gulf of Alaska by the Copper River.

The offshore line (569) crosses the northern edge of Tarr Bank, a bedrock high that is largely devoid of Holocene sediment (Molnia and Carlson, 1975). At the edges of the bank, the seismic reflections suggest foreset bedding (fig. 9) These phenomena may have been formed by the deposition of sediment eroded from the bank by the frequent, powerful storm waves that sweep through the Gulf of Alaska--especially during the winter seasons.

The short north-south line (576) near Wessels Reef, which is located on Tarr Bank, also indicates the scoured nature of Tarr Bank. This minisparker line depicts inclined, truncated units cropping out at the seafloor. Molnia and Carlson (1975) concluded that these bedded units are Tertiary in age. A sediment sample (557) and camera station (13) along this line showed pebbly mud as the sediment type with scattered large cobbles and boulders (up to 50 cm

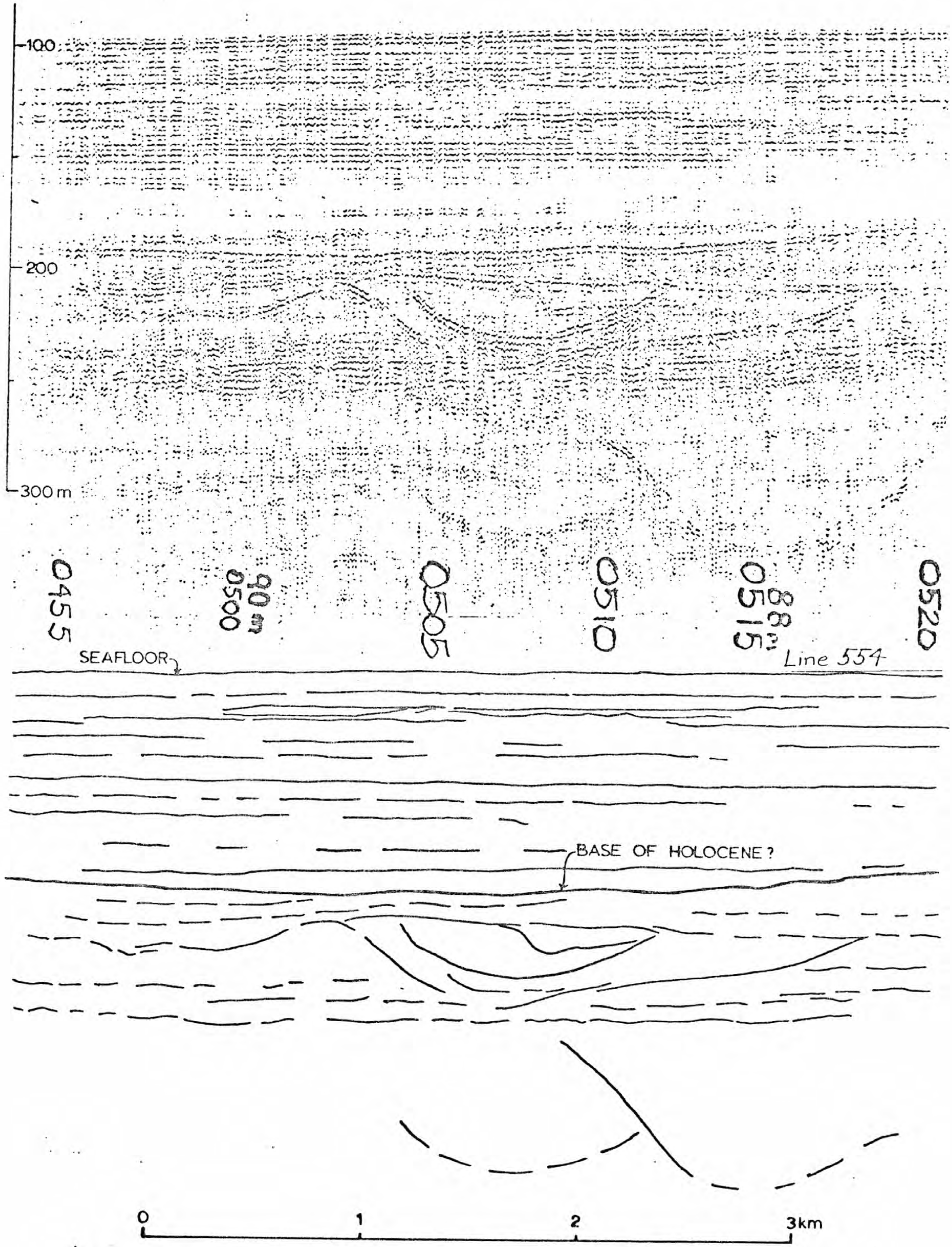

Figure 8. Minisparker profile across the Copper River prodelta showing the buried channels and cut and fill features. Line 554 (V.E. $\simeq$ 10x).

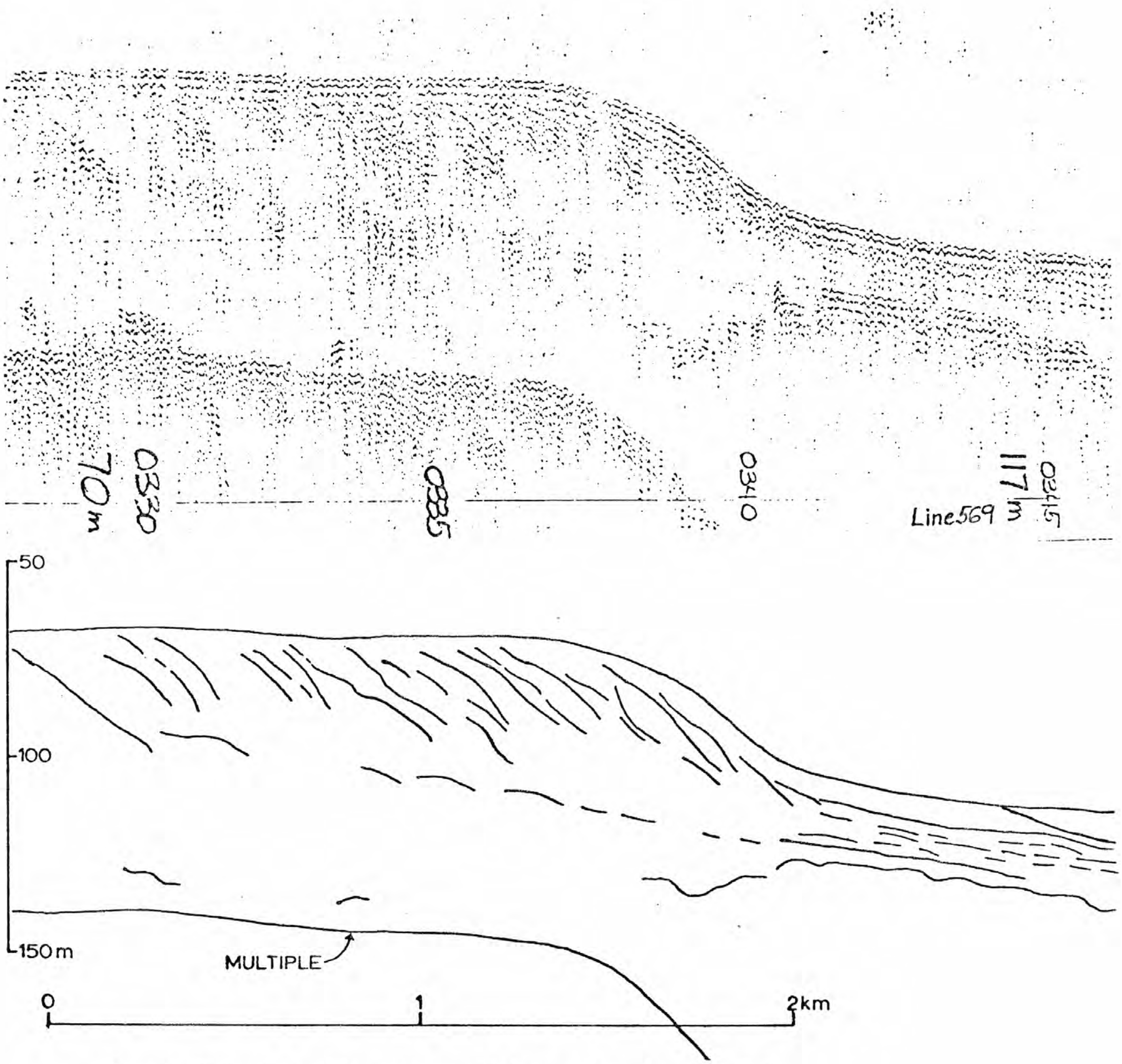

Figure 9. Minisparker profile across foreset beds on northern edge of Tarr Bank. Line 569 (V.E. ~ 10x).

in length) present on this storm scoured bank. Some of the pebbles collected in the grab sampler were encrusted with bryozoans, indicating lack of sediment cover.

Kayak Trough (lines 556-568; samples 504-542; camera stations 4-10). This oval shaped trough of probable glacial origin is the site of a large submarine slide (volume of 5.9 km^3), first described by Carlson and Molnia (1975a). On the 1976 cruise of the R/V ACONA this slide was carefully delineated with twelve minisparker lines (Map 1). These profiles have been described in considerable detail by Molnia, Carlson and Bruns (1977) and therefore will not be further analyzed in this report. In addition to the seismic lines, thirty-eight grab samples were collected from the shelf adjacent to Kayak Trough on both the north and east sides(Fig. 3). Grain-size data from these samples were incorporated in a map of the distribution of bottom sediments of the northeastern Gulf of Alaska (Carlson and others, 1977). Shipboard descriptions of these samples are included in table 2. Six bottom camera stations were taken in this area; these results are summarized in table 3.

Columbia Bay, Valdez Arm and Port Valdez (lines 570-575; samples 550-556 and camera stations 11 &12). These fjords, located at the northern end of Prince William Sound, consist of a series of deep basins of varying widths and depths separated by sills that probably vary from glacial moraines to glacially scoured well-lithified bedrock of the Valdez Group. The late Cretaceous rocks of the Valdez Group are primarily interbedded slates and metagraywackes (Moffit, 1954). The sediment fill, as measured from our minisparker records (assuming a sound speed of 1,500 m/sec) is up to 300 m thick in Columbia Bay between Flent Pt. and Elf Pt. (fig. 10), 185 m thick in upper Valdez Arm south of Sawmill Bay (fig. 11) and 330 m thick along the south side of Port Valdez northwest of Sawmill Creek (fig. 12).

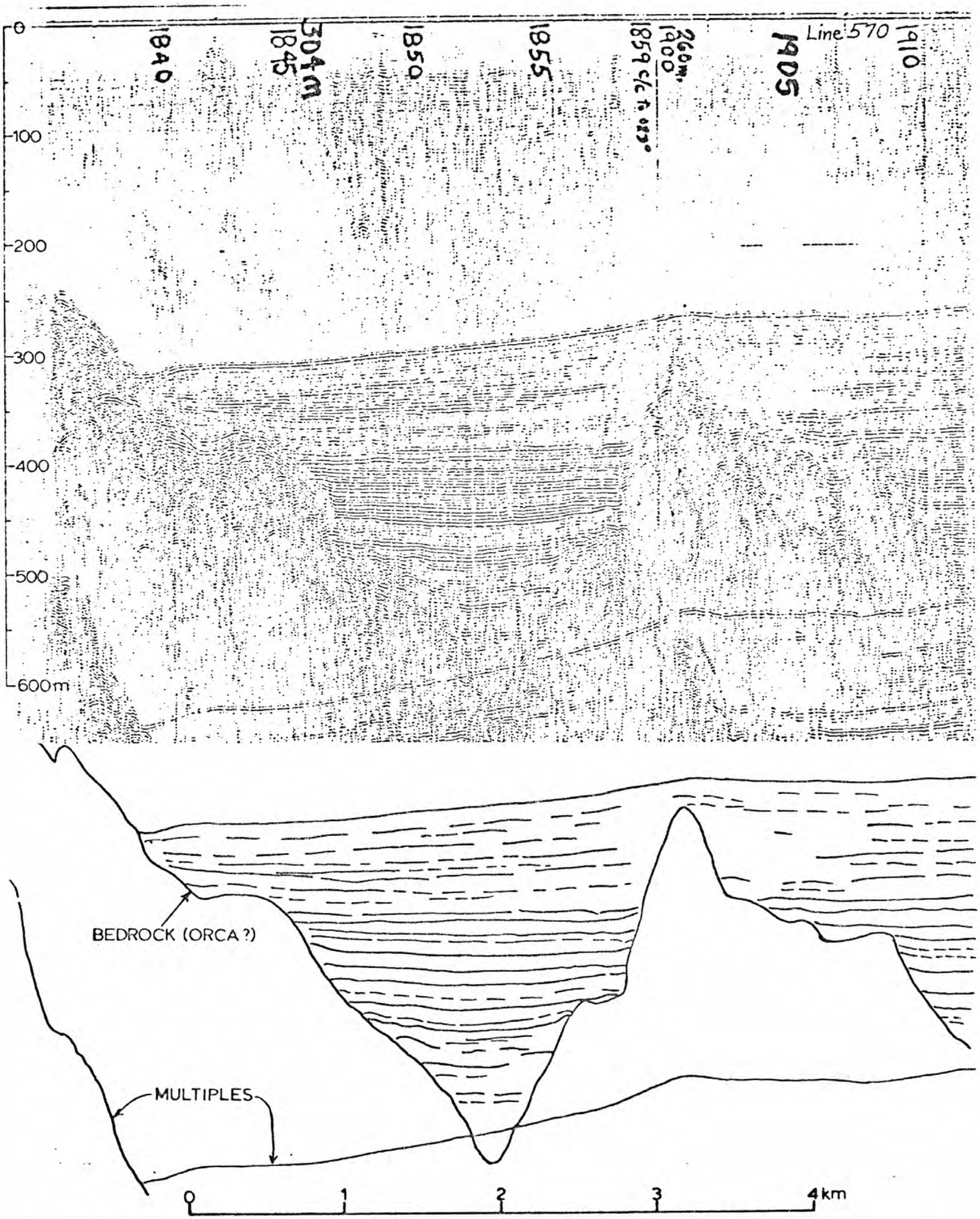

Figure 10. Minisparker profile in Columbia Bay showing deep sediment filled basins cut in rocks of the Orca Group. Line 570 (V.E. ~ 10x).

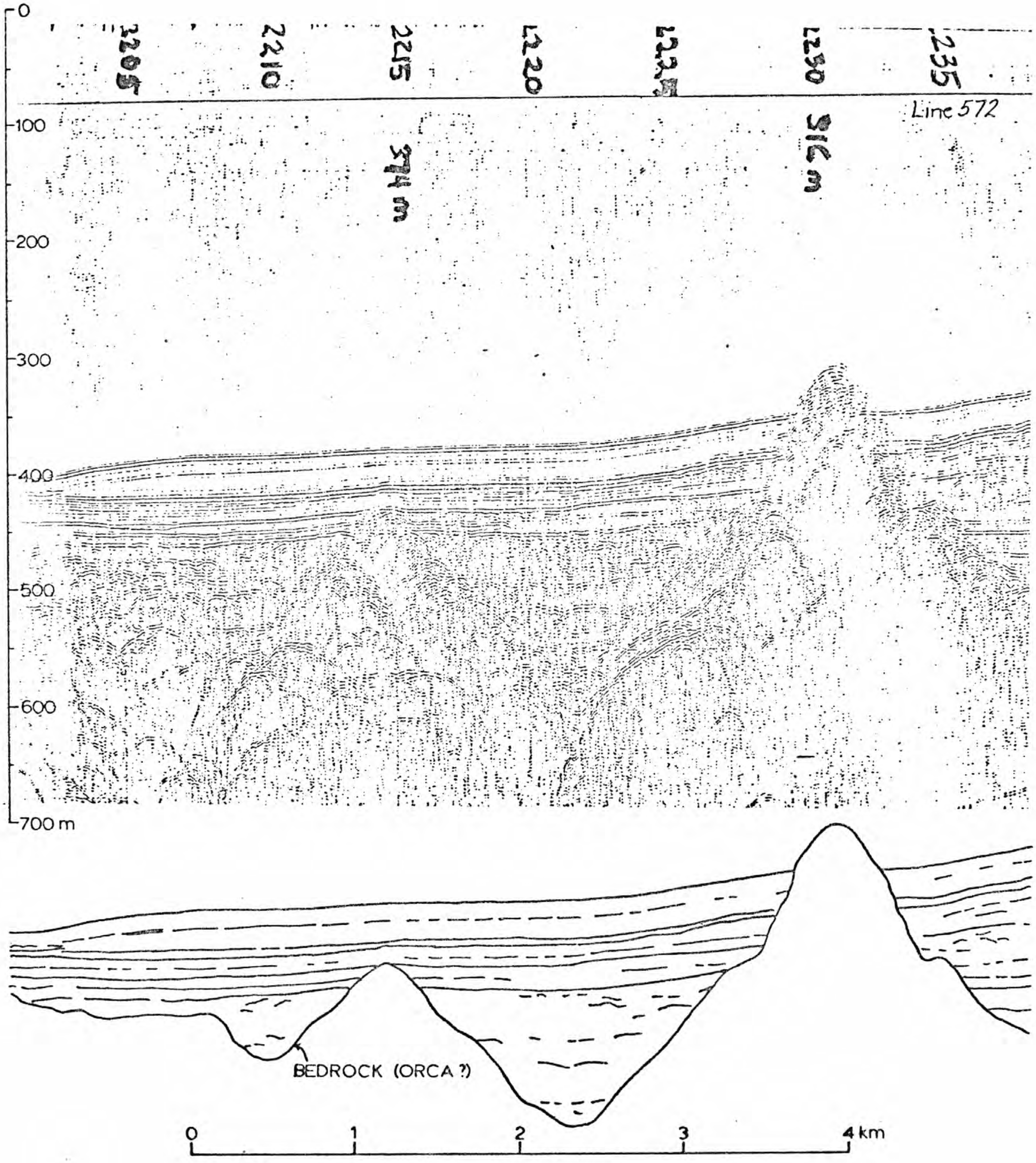

Figure 11. Minisparker profile in Valdez Arm showing irregular acoustic basement (Orca Group?) and thick sediment fill. Line 572 (V.E. ~ 10x).

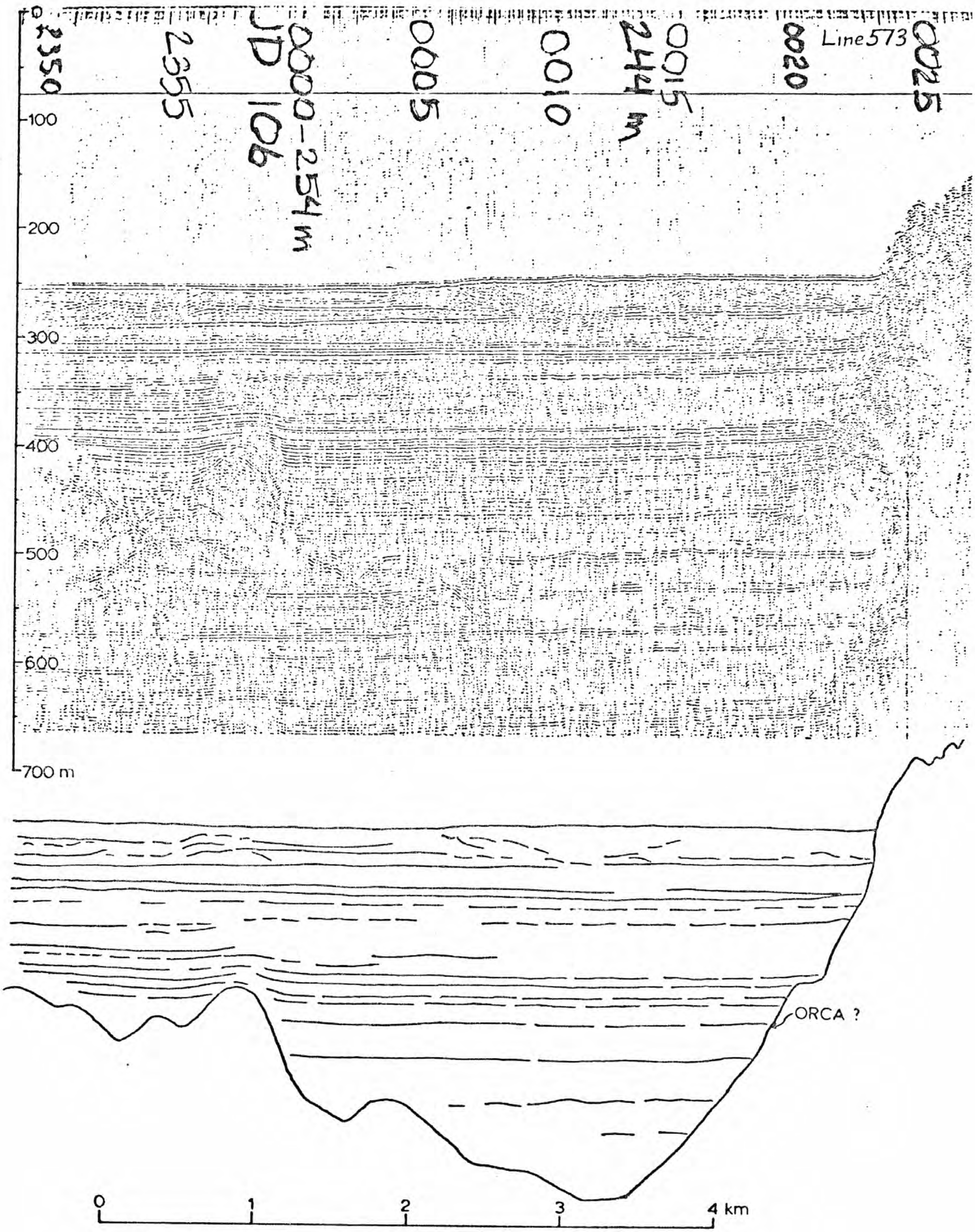

Figure 12. Minisparker profile in Port Valdez showing sediment fill up to 330 m thick in glacially scoured trough. Line 573 (V.E. $\simeq$ 10x).

Post (1975) has shown that the terminus of Columbia Glacier has been very near its present position for more than 70 years. Tarr and Martin (1914) give evidence that Columbia Glacier was once a tributary to the great Prince William Sound glacier. They further suggest that Columbia Glacier was at that time thick enough to completely cover Heather Island (> 300 m) and perhaps to have glaciated some of the surrounding ridges to a height of about 1,200 m. Maximum scour depth below sea level in Columbia Bay (water depth plus unconsolidated sediment thickness calculated at sound velocity of 1,500 m/sec) reaches 480 m in the middle part and 580 m at the outer part of the bay. Seafloor irregularity at the upper end of the bay suggests that slumping of the most recent sediments may have occurred.

At the time of maximum glaciation, Valdez Glacier occuppied Port Valdez and Valdez Arm and covered the surrounding mountain slopes to elevations of nearly 1,000 m (Tarr and Martin, 1914). Maximum depths of scour in these fjords are 520 m near the middle of Valdez Arm and 570 m near the middle of Port Valdez.

Bottom samples collected in Valdez Arm (Map 2) consist of gray mud and pebbly mud with scattered shell fragments and benthic organisms. The pebbles are sub-angular to angular slates and meta-graywackes up to 15 cm in largest dimension. Between Valdez Arm and Port Valdez is a very restricted channel, Valdez Narrows, that appears to be principally irregular, glacially-scoured bedrock knobs and walls with little or no sediment cover except in the depressions (fig. 13).

Port Valdez, tanker loading spot for Prudhoe Bay oil, is a narrow steep-walled fjord whose east-west trend is controlled by the steeply dipping foliation of the metasedimentary rocks of the Valdez Group (Coulter and Migliaccio, 1966). The Valdez Glacier at one time occuppied this fjord, but has since retreated about 8 km from the eastern end of the fjord. An extensive outwash fan and delta extends from the glacier to the fjord.

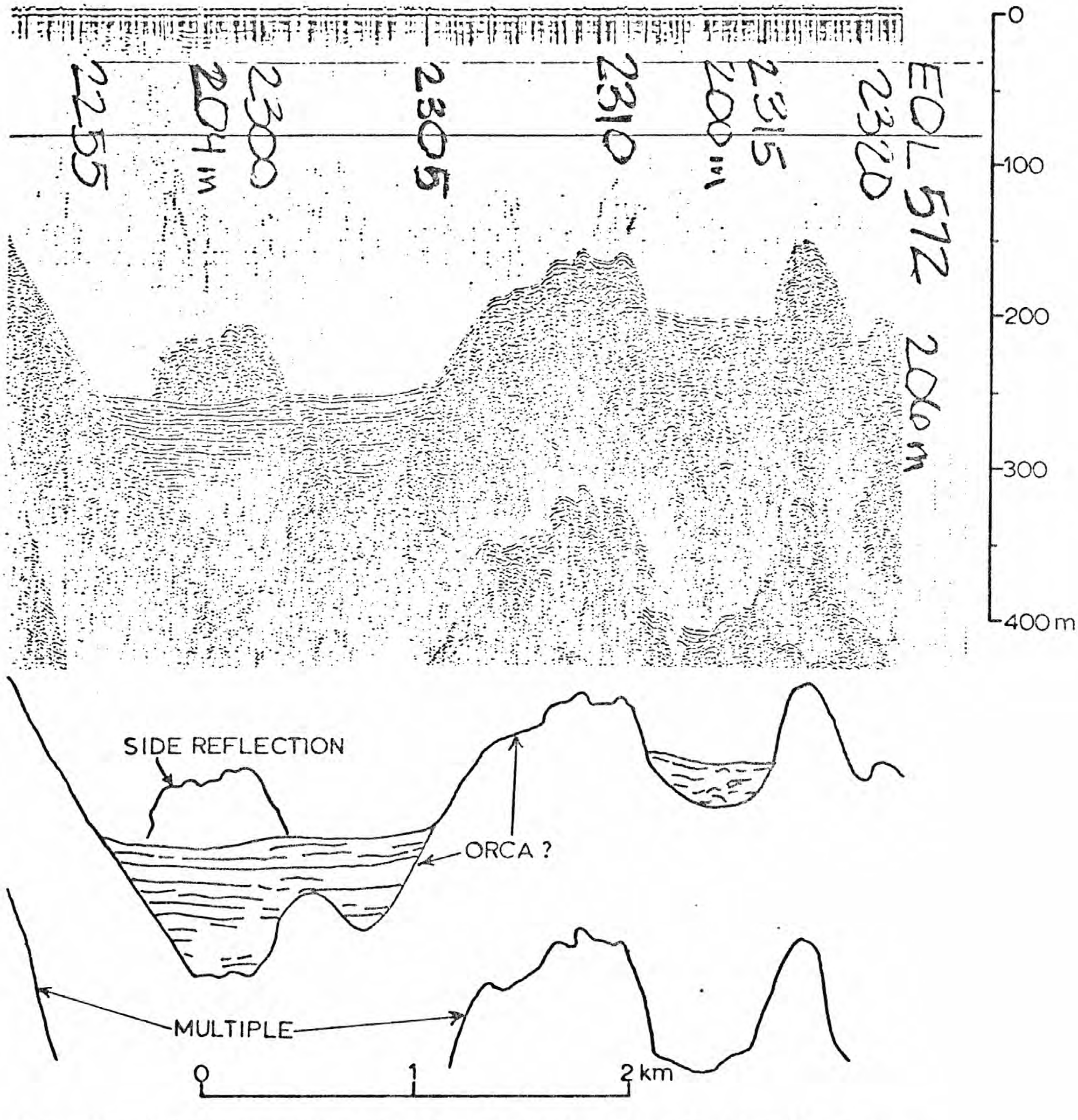

Figure 13. Minisparker profile of irregular bedrock (Orca) morphology in Valley Narrows. Line 572 (V.E. $\simeq$ 10x).

The delta is composed of a thick section of poorly consolidated gravels with thin beds of silt and sand disseminated throughout. The town of Valdez was located on this delta until a catastrophic submarine slide, triggered by the 1964 Alaska earthquake, moved an estimated 9.8 x 10^7 yd^3 (7.5 x 10^7 m^3) of the delta face and overlying dock area into the fjord (Coulter and Migliaccio, 1966). The eastern 0.7 km of minisparker line 573 crossed the hummocky irregular morphology that marks the surface of this submarine slide (fig. 14). The toe of the slide mass has a relief of about 5 m and rests in water depth of 230 m. The gradient of the slide surface, therefore, is approximately 18°, if we use the existing shoreline as our datum. Two prominent secondary scarps and associated depressions can be seen on the slide surface. The first has a relief of 10 m and is 0.2 km from the toe and the second with a relief of 20 m is 0.5 km east of the toe. It is not possible to determine with certainty from our limited coverage if these scarps represent secondary slides subsequent to the main failure or if they are merely ruptures or separations that occurred as part of a single episode of mass movement.

Hinchinbrook Sea Valley (lines 577-583). The principal purpose of lines 577 and 579 were to cross the continental shelf-slope break along the path of Hinchinbrook Sea Valley to see if a terminal moraine could be detected. Carlson and others (1977) have suggested that this sea valley was carved or at least modified by Pleistocene glaciers that may have covered much of the shelf. Although the results of this profiling are equivical, some evidence for glacial deposition at the shelf edge can be seen on these profiles (fig. 15). The wedge of Holocene sediment that blankets the inner shelf (Carlson and Molnia, 1975; Molnia and Carlson, in press) pinches out about 20 km from the shelf break. At this point, the character of the recorded acoustic signal changes from the well-bedded reflectors typical of the Holocene to the irregular, discontinuous reflectors more typical of pebbly glacial sediments, possibly morainal. Sediment samples and underwater

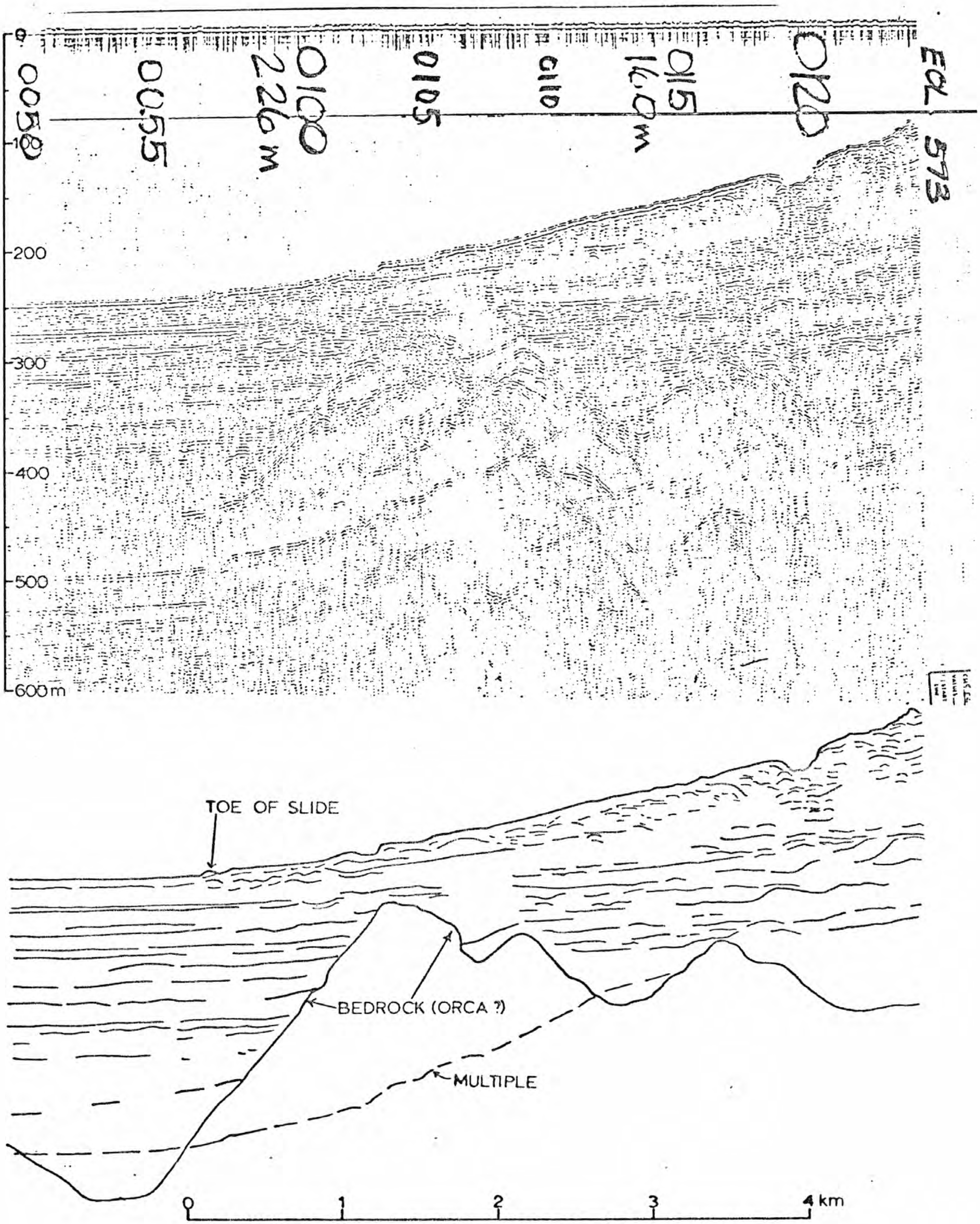

Figure 14. Minisparker profile across the 1964 submarine slide at east end of Port Valdez. Line 573 (V.E. ~ 10x).

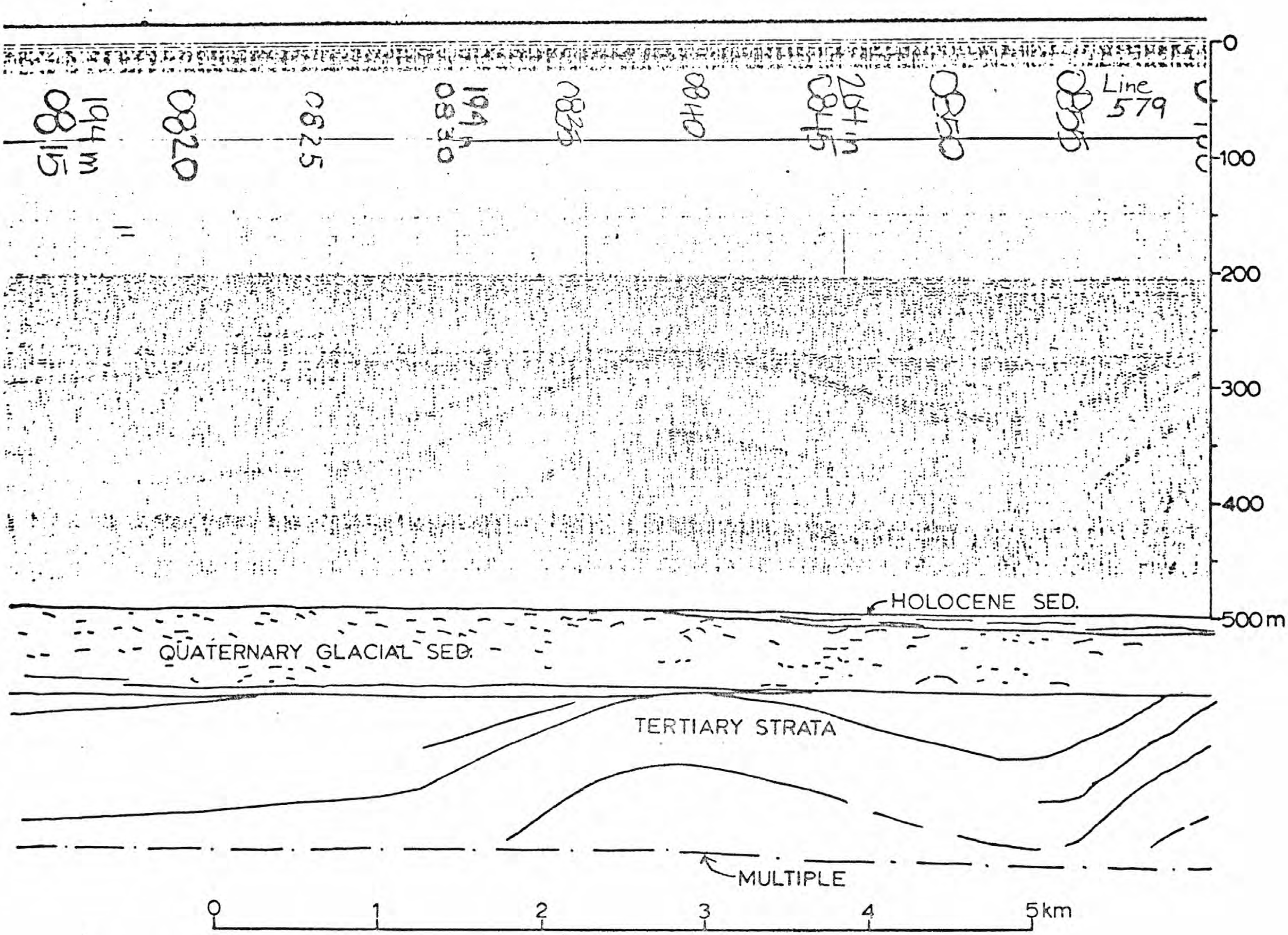

Figure 15. Minisparker profile showing pinch-out of Holocene sediment and cropping out of Quarternary glacial sediment near shelf edge along floor of Hinchinbrook Sea Valley. Note folded nature of underlying Tertiary sedimentary units. Line 579 (V.E. $\simeq$ 10x).

television are needed to verify this hypothesis. Folding and truncation of the underlying Tertiary sedimentary rock can also be seen on these outer shelf lines. These structures have been mapped by Bruns and Plafker (1975). Lines 580-583 cross Hinchinbrook Sea Valley at different angles providing additional information about sediment thickness and morphology of this strath. Line 581 crosses normal to the axis east of Patton Bay where the strath is 20 km wide and contains a layer of Holocene sediment confined to the eastern half of the valley. This layer reaches a maximum thickness of 50 m. On profile 583, southeast of Patton Bay, the Holocene sediment also reaches a thickness of about 50 m, but covers the entire strath floor that is about 15 km wide at this crossing.

West of Hinchinbrook Sea Valley, line 583 crosses the southern end of Montague Island platform. Three prominent scarps and minor surface irregularities are visible on this profile. The largest scarp has a relief of 40 m (fig. 16) and separates the well-indurated bedrock platform from shelf sediment. Whether this shelf sediment is Holocene mud or till-like glacial debris must be determined by sampling and underwater television observations. Two scarps 10 meters high create the highest bedrock bench on the Montague platform, 12 km SSW of Cape Cleare. This bench shoals to less than 50 m of water. We have no direct evidence that these are fault scarps; however, vertical offsets of about 7 m and 5 m were measured on the Patton Bay and Hanning Bay faults after the 1964 Alaska earthquake (Plafker, 1967). In addition, Malloy (1965) has compared detailed bottom soundings taken southwest of Montague Island in 1927 with soundings taken after the 1964 earthquake and concluded that prominent 6 to 30 meter scarps may represent the 1964 movement.

West of the Montague Island platform, line 583 crosses Montague Sea Valley, a probable glacial strath about 8 km wide in water depth of 175 m. Although the bottom of the strath can not be identified with certainty on the minisparker profile, a thickness of >100 m of sediment is present.

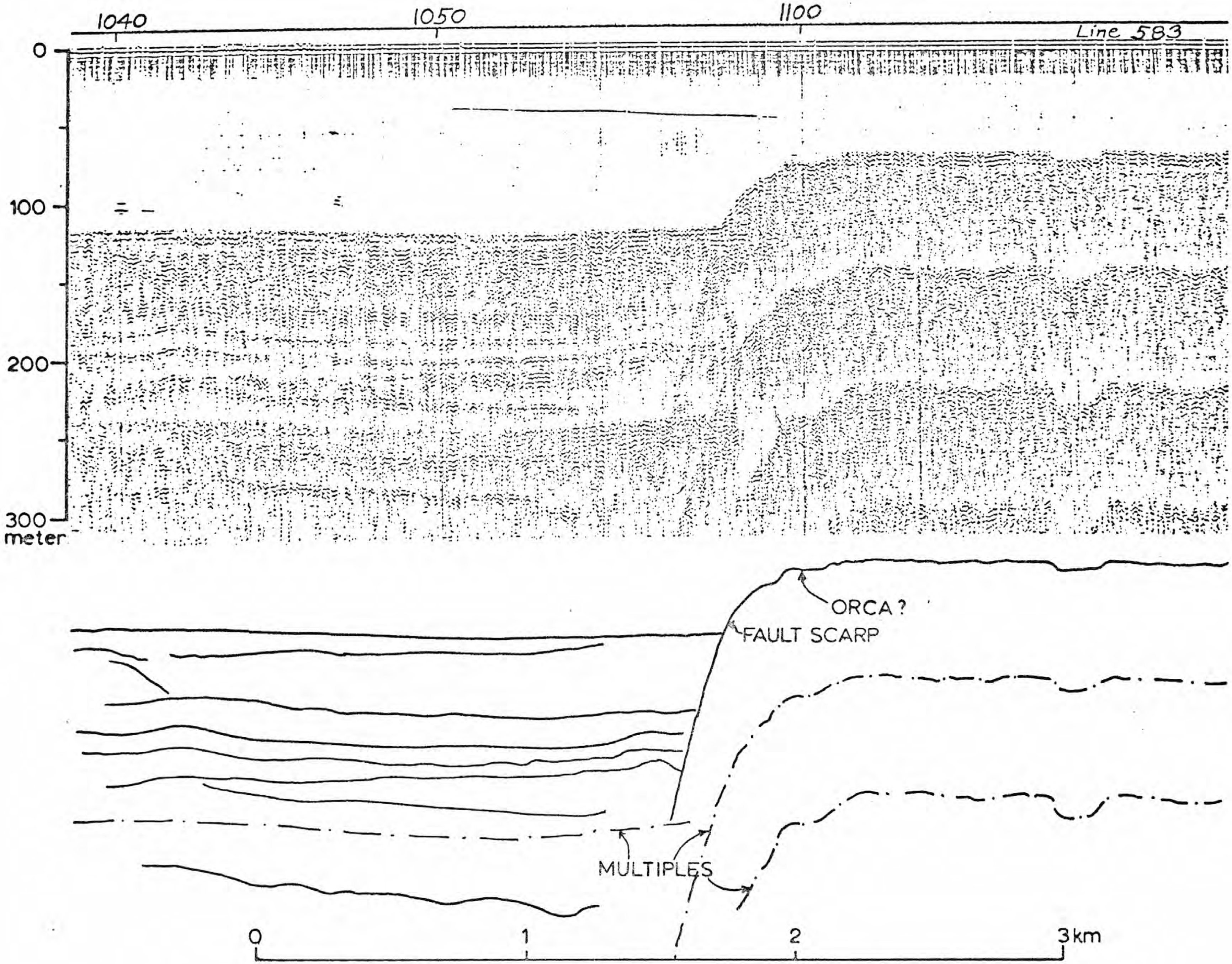

Figure 16. Minisparker profile across the south end of the faulted Montague Island platform. Line 583 (V.E. $\simeq$ 10x).

Line 583 continues westward to the mouth of Resurrection Bay (Fig. 17); line 584 continues up the bay to Seward where the cruise ended. Resurrection Bay is a fjord with deep basins between morainal and bedrock highs. Line 584 crosses a basin in mid-bay where the water is 300 m deep and the sediment fill about 150 m thick.

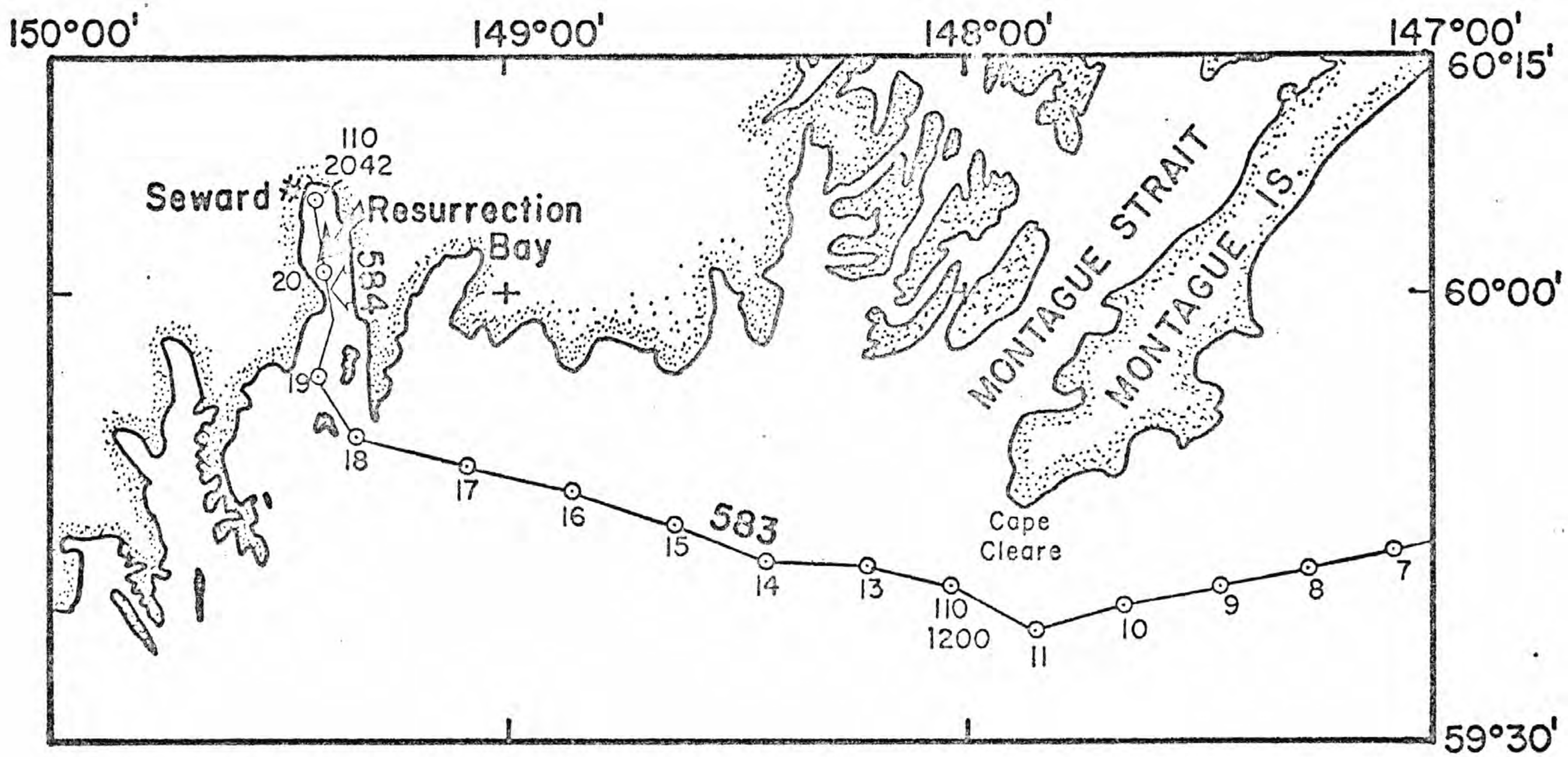

Figure 17. Map of Resurrection Bay and part of the Gulf of Alaska showing tracklines 584 and part of 583.

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