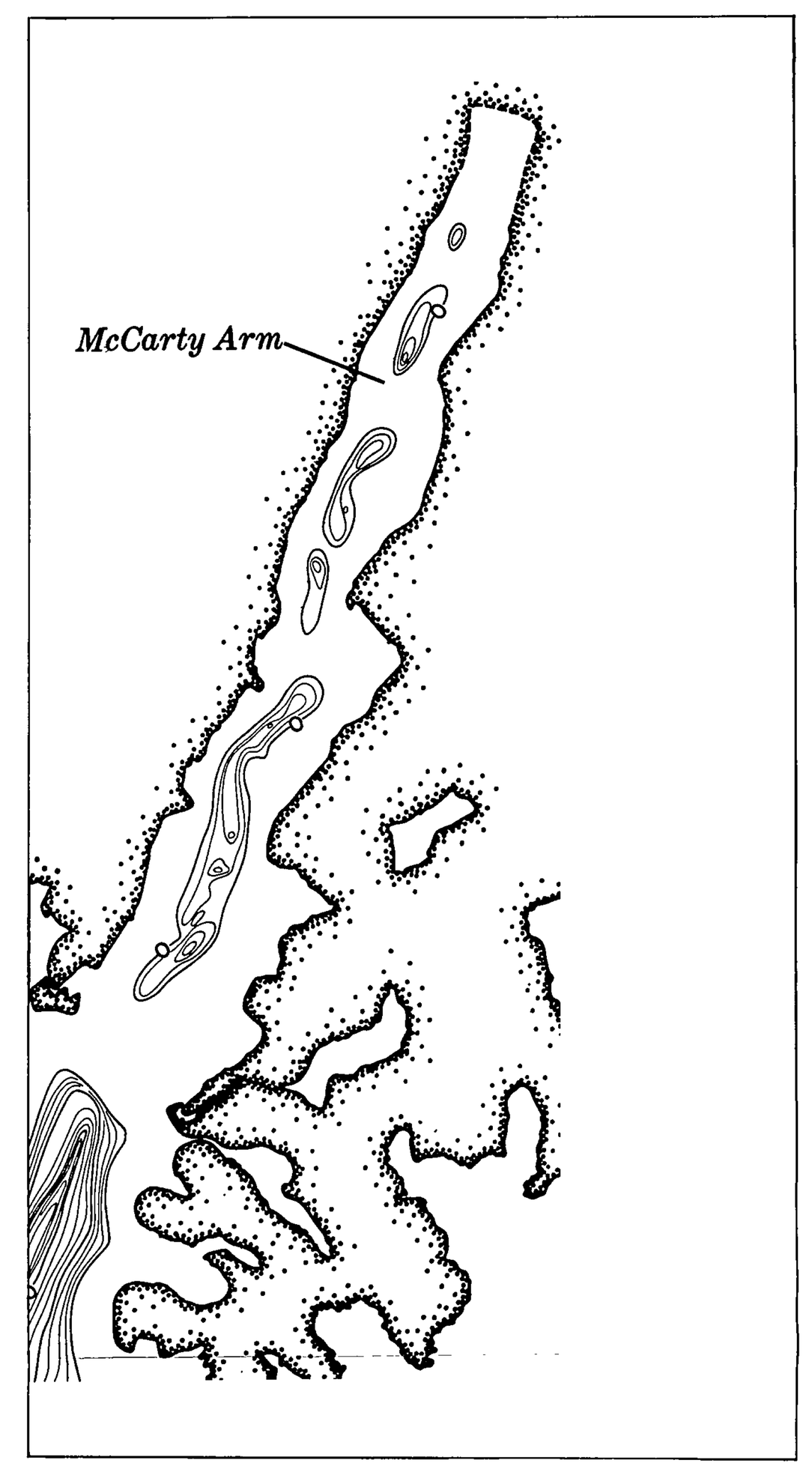
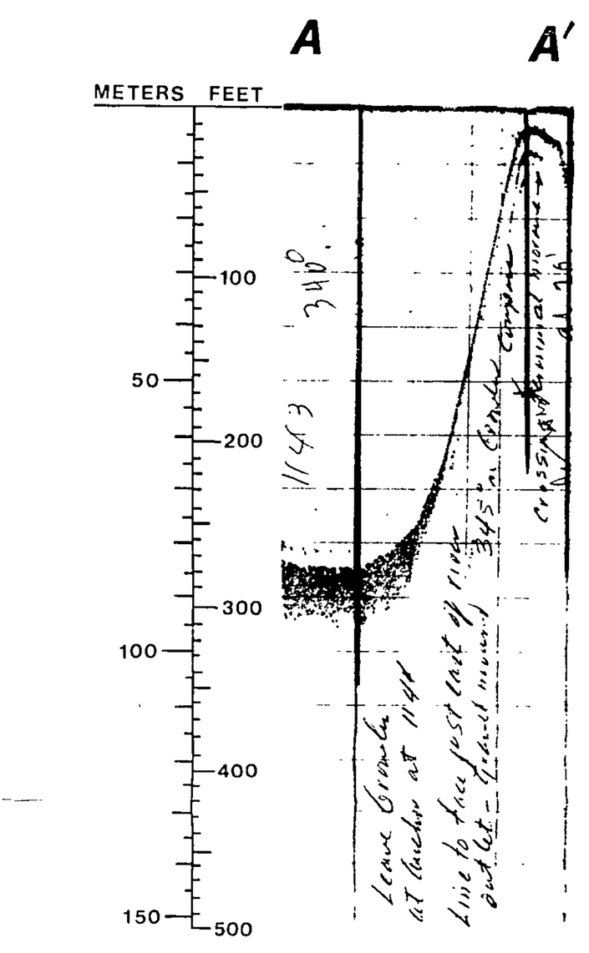
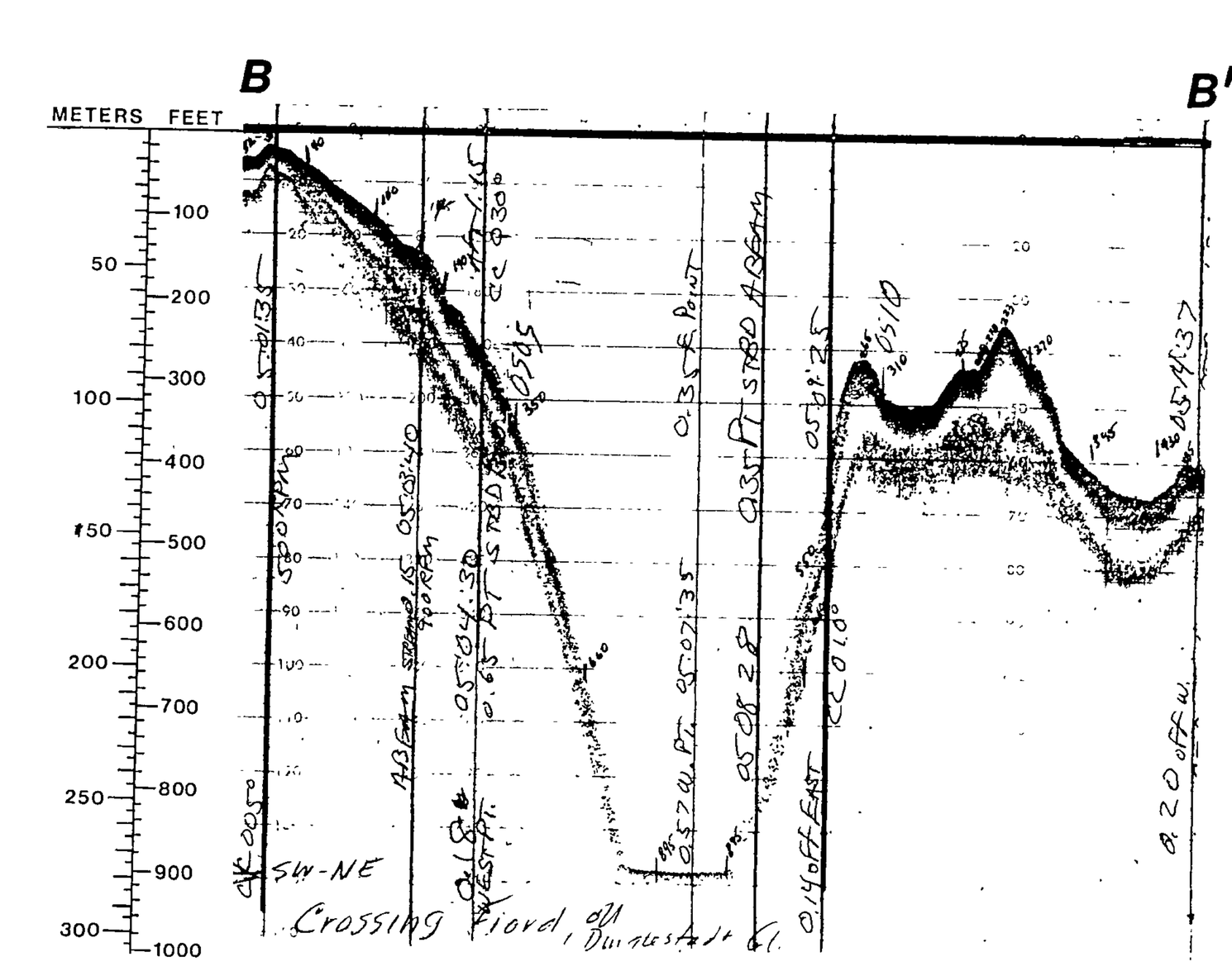
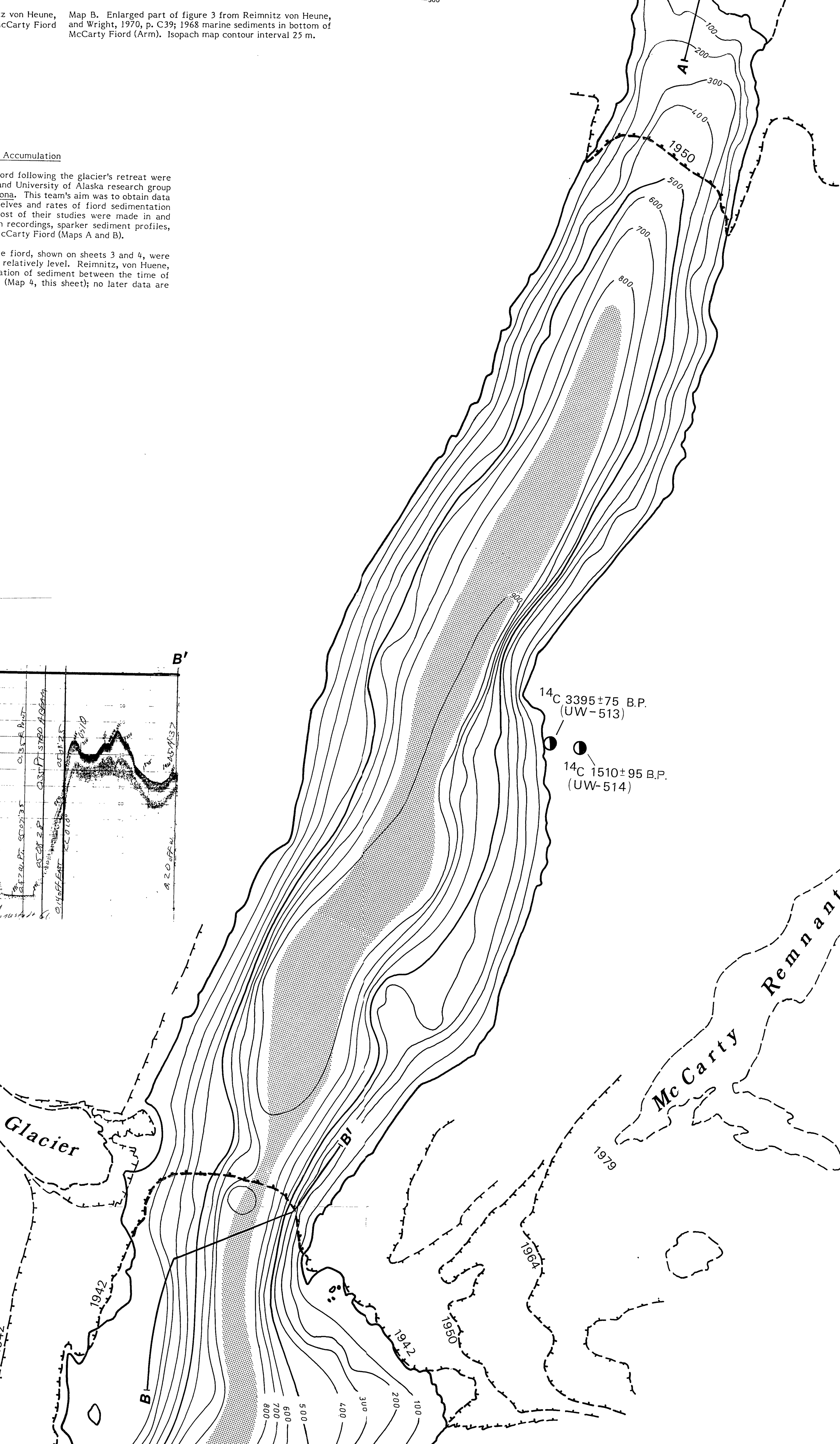
Map A. Enlarged part of figure 1 from Reimnitz von Heune, and Wright, 1970, p. C36; 1968 water depth in McCarty Fiord (Arm). Depth curves in meters.



Map B. Enlarged part of figure 3 from Reimnitz von Heune, and Wright, 1970, p. C39; 1968 marine sediments in bottom of McCarty Fiord (Arm). Isopach map contour interval 25 m.







Neoglacial Advance of McCarty Glacier

Because forests grew to maturity in various other Alaskan fiords during the hypsothermal period, about 7000 to 2000 years ago (as at Glacier Bay where forest debris have been uncovered by the retreating glaciers (Goldthwait, 1963)), it is likely that similar forests may have grown in McCarty Fiord. Vegetation is presently rapidly reclaiming the areas deglacierized during McCarty Glacier's drastic retreat; thus, searching for debris from former forests before most evidence of it had been obscured by new growth had a high priority, and during the 1977 bathymetry survey a close watch was kept for barren slopes, bluffs, and stream-eroded channels. Logs 1 foot (30 cm) or more in diameter were noted buried in glacial till and outwash on both sides of the fiord one to two miles south of Dinglestadt Glacier; a 3-inch (8–cm) diameter tree trunk, collected from till 20 ft (6 m) above sea level (sheet 4), had a carbon-14 date (UW-512) of 1500±90 years before present (B.P.). Evidence of former forest in the northern, extensively eroded portion of the fiord was seen in only one area about 3.5 mi (6 km) south of McCarty Glacier (this sheet). This wood, evidently a root from a fair-sized stump, was found 10 ft (3 m) above high tide on the outwash of a glacial stream along with several other fragments of the same tree. This had a carbon-14 date (UW-513) of 3395±75 years B.P.

A fragment of a broken branch was removed from bouldery till 250 ft (80 m) above sea level along the same stream channel. This wood had a carbon-14 date (UW-514) of 1510±95 years B.P. The 885±-year spread between the dates of these samples obtained from near the same point might be explained if the stump found near sea level had grown at low altitude and the small fragment dug from the till had been carried down by the ice from some point high on the mountain side. The 3395 B.P. date would date the terminal advance of McCarty Glacier down the fiord, whereas the other tree was killed at higher altitude some 8 centuries later by the thickening ice as the terminus continued its slow advance. As living trees thrive many miles up along the margins of present-day valley glaciers, such a situation is possible.

Although no evidence of former forests in place of growth was noted and all samples collected may have been transported some distance by the ice, the 3395 B.P. date provides a probable minimum age for the entry of McCarty Glacier into the fiord's head, and the 1500± B.P. dates may suggest the approximate time the glacier had advanced to within about 5 mi (8 km) of the present position of the terminal moraine.

Rate of Advance

The deeply eroded basin uncovered by the glacier, the extensive terminal-moraine shoal at the mouth of the fiord, and the time elapsed between the destruction of forest at points near the head and foot of the inlet all suggest that the glacier advanced by a relatively slow process of erosion and redeposit of a protective terminal moraine bar. Such an advance may continue in an otherwise deep channel until the glacier reaches an extended position from which even a small retreat will expose the deeply eroded basin behind the moraine. Evidently McCarty Glacier reached such a critical extension around 1860, having made an advance of 15 mi (24 km) over a period of around 1500 years, approximately 1 mile (1.6 km) per century. This rate of advance is roughly comparable to the present advances of Harvard, Meares, and Hubbard Glaciers.

Bottom Sediment Accumulation

The first scientific investigations in the fiord following the glacier's retreat were made in 1968 by a U.S. Geological Survey and University of Alaska research group aboard the university's Research Vessel Acona. This team's aim was to obtain data on gold placers on Alaskan continental shelves and rates of fiord sedimentation (Reimnitz and others, 1970). Although most of their studies were made in and around Nuka Bay, a number of water-depth recordings, sparker sediment profiles, and bottom samples were obtained within McCarty Fiord (Maps A and B).

Sediment-filled basins in the bottom of the fiord, shown on sheets 3 and 4, were interpreted from areas where the bottom is relatively level. Reimnitz, von Huene, and Wright's 1968 data show the accumulation of sediment between the time of glacier retreat and when measured in 1968 (Map 4, this sheet); no later data are available.

Recession of McCartly Glacier, 1942 - 1960

Since 1942, records of McCarty Glacier's recession have been obtained by air photography. U.S. Army Air Force trimetrogon photographs taken to compile 1:250,000 reconnaissance maps of Alaska in 1942 show the glacier terminating near the Dinglestadt Tributary Arm (toothed line dated 1942, this sheet) 5.5 mi (9 km) north of the terminal moraine. By 1950, when the photography for the published U.S. Geological Survey topographic quadrangles was taken, the glacier had retreated an additional 6.7 mi (11 km) (toothed line dated 1950). By 1960 an additional mile (1.6 km) of retreat had occurred and the glacier had reached its retracted stable position in shallow water at the head of the fiord.

The drastic retreat evidently began relatively slowly as the glacier broke back over the shoals of the terminal moraine (shown on sheets 1 and 4), taking about 65 years to retreat 1 mile. Once deep water was reached about 1925, the retreat became catastrophic, the glacier then averaging about 0.5 mi per year until 1950 when the terminus reached the shallower water at the head of the inlet. Since 1960 a very slight advance has occurred due to the glacier's moving ahead over moraine and outwash deposits recently discharged by the glacier--the beginning, presumably, of another slow but long-lived advance down McCarty Fiord.

Relative Rate of Ice Retreat and Thinning on Land and in Tidewater

The McCarty Glacier remnant, which became detached from McCarty Glacier shortly after 1942, is practically stagnant, with no accumulation area, and provides a useful reference point from which the rate of ice ablation on land can be determined. Since 1942 its terminus has retreated about 1.6 mi (2 km) from a steep calving front at the high-tide line of McCarty Fiord. Between 1950, when the topographic map was made, and 1977, approximately 600 ft (180 m) of thinning took place at the point where the remnant presently terminates; this averages approximately 20 ft (6 m) of ice melt per year. In contrast, the McCarty Glacier, terminating in water more than 800 ft (250 m) deep in 1942, by 1960 had retreated 6.5 mi (10 km) and the ice surface was lowered approximately 1500 ft (450 m) or 90 ft (27 m) per year where the glacier now terminates. In addition to this ice loss, at the same time, the reservoir at the head of the valley was drained down to near its present level, and substantial flow from a sizable accumulation area was also discharged. This demonstrates the instability created by iceberg calving in deep water, when iceberg discharge far exceeds snow and ice accumulation over the glacier.

Profiles

The profiles shown are photographic copies of original depth-recorder charts which are scaled in either meters (Ross SL 600C) or fathoms (Ross 400B). The scales for meters and feet shown at the left of each profile have been adjusted to correct for tidal effects when required. Hand-written notes on charts are generally navigation data.

Profile A-A'. Centerline longitudinal profile near head of McCarty Fiord to McCarty Glacier, obtained June 24, 1978, showing steep slope rising from the fiord bottom to a presumed terminal-moraine shoal about 600 ft (200 m) in front of McCarty Glacier. The end of the line at A' is about 20 ft (7 m) from the ice face. Note the abrupt deepening of the water in front of the glacier once the moraine crest is crossed. Typically, calving glaciers advance to near the crest of terminal moraines in winter and retreat in summer.

Profile B-B'. This line proceeds along the western edge of McCarty Fiord, crosses the channel east of Dinglestadt Glacier, then parallels the eastern wall. Very hard, rocky bottom is demonstrated by the heavy black multiple echoes along the fiord walls; these walls plunge steeply to the level floor of ponded sediments in the center of the fiord, which at this point on Map B (this sheet) are shown to be about 100 ft (25 m) deep. With this sediment removed, the fiord bottom would have the U-shaped profile of a typically glaciated valley (see also section C-C' on sheet 4).

Explanation

- Approximate position of dated glacier terminus position or trimline: heavy line where glacier terminated in water.
- Approximate areas of thick sediment deposits
- Exposure of preneoglacial forest debris
- ^{14}C (carbon-14) dated preneoglacial forest debris

PRELIMINARY BATHYMETRY OF MC CARTY FIORD AND NEOGLACIAL CHANGES OF MC CARTY GLACIER, ALASKA

Scale 1:20,000

MAP NOT FOR USE IN NAVIGATION

DEPTH CURVES IN FEET DATUM IS APPROXIMATE MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 8 FEET

By
Austin Post
1980