

MARVIN'S ICE SHELF JOURNEY, 1906

Vivian C. Bushnell*

THE extent of the ice shelf along the north coast of Ellesmere Island became of considerable interest in 1952 when Fletcher's Ice Island, T-3, was first occupied as a station for weather observations and geophysical studies by the United States Air Force. Aerial observations had shown the similarity between the surface features of the ice island and those of the ice shelf (Koenig et al., 1952). In order to make a thorough comparison of these large ice bodies and to obtain other geophysical data, a joint Canadian-United States expedition was made into the vicinity of Ward Hunt Island, near the centre of the ice shelf in the summer of 1954 (Hattersley-Smith, 1955). During this period Hattersley-Smith and Crary traversed the front of the present ice shelf between M'Clintock and Markham bays, collecting oceanographic data.

It was known from Peary's account of his 1905-06 expedition (Peary, 1907) that ocean soundings along the front of the Ellesmere ice shelf had been taken during the summer of 1906 by Ross G. Marvin, a member of the Peary party. A search of the literature produced no report by Marvin or by Peary on these soundings, although U.S. Navy Hydrographic Office Chart No. 2560 shows a few ocean depths in this area. In May 1954 a seventeen-page typed report written by Marvin was found in the Hydrographic Office files at the U.S. National Archives.

A limited amount of biographical material is available concerning Ross Marvin. According to Admiral Donald B. MacMillan (personal communication), who knew Marvin from the 1908-09 Peary expedition, Marvin had majored in civil engineering at Cornell University and had augmented his studies by spending some time on the New York state training ship, *Saint Mary's*. He had just graduated from Cornell in 1905 when he was chosen to go as a scientist with the Peary arctic expedition of that year (Stowell, 1954). Upon his return in December 1906, he accepted the post of instructor in the College of Civil Engineering at Cornell University. He held this position for the next two years, until he was granted leave of absence to join Peary again on his 1908-09 expedition. His untimely death on April 10, 1909, during the return of Peary's third supporting party, was most unfortunate. The photograph of Marvin shown in Fig. 1 has most generously been supplied by the Chemung County Historical Society of Elmira, New York.

Commander Peary, after his unsuccessful attempt to reach the pole in March and April 1906, travelled westward along the northwest coast of Ellesmere Island to the north end of Axel Heiberg Island, exploring the unknown area lying between the tracts visited by Aldrich in 1876 and by Sverdrup in

*Geophysics Research Directorate, Air Force Cambridge Research Center, Air Research and Development Command.



Fig. 1. Ross G. Marvin.

1902. As stated in his book, Peary (1907) instructed Marvin to "run a line of soundings as far north from Hecla as practicable". Because of much open water, Marvin was not able to go north as instructed, so decided to travel west, taking soundings. This journey of Marvin's was made between June 2 and July 16. His report of this trip, quoted below, was evidently submitted to Peary who later transmitted it to the Hydrographic Office. No title had been given to the copy obtained from the Archives. No attempt has been made to edit this manuscript other than to correct obvious typographical errors.

* * *

The following report of the trip and results obtained by the summer sounding party is respectfully submitted.

Making the trip from the Roosevelt at Cape Sheridan to the cache at

Cape Hecla in company with your own western party, June 2nd-4th, we left Cape Hecla at 10.30 p.m., June 4th, to follow the trail of Captain Bartlett's party to the north. At the end of three hours, we left the former trail leading to Point Moss and followed the more recent trail along the young ice of the lead which had detained one of the supporting parties in the earlier spring work. At the end of a nine hours' march of steady going over smooth ice, we reached the point where the two trails met once more, this more recent trail cutting down the time consumed by several hours.

Camp was pitched here at 6.30 and as no cracks were visible, no sounding was attempted. It had been a night of very pleasant weather, but soon after turning in a fresh southerly breeze sprung up, which maintained throughout the noonday sleeping hours.

Broke camp here in the early evening and started on the march at 9.00 p.m., with all indications of making another good advance along the old trail. The igloos marking the end of the second day's advance on the spring trip were soon passed and by the end of four hours we had reached the point where the main party had been delayed by rafting ice and where the latter supporting party had been held up by open water, during the spring campaign. The southerly breeze had opened up the ice once more and a wide lead of open water extended indefinitely in both directions, the young ice having opened along a fairly straight line near its middle. This being the third party delayed right at the same point, it would seem to indicate a line of frequent fracture between the land locked ice and the outer area. A half hour of scouting made it evident that if we were to follow the former trail to the northward, it would be necessary to pitch camp here for the present.

The sounding machine was rigged on the sledge and a sounding taken on the edge of the lead. The wire belonging with the machine only half filled the barrel and upon trial, it was found to be too short. Some of the supply wire from the Roosevelt's sounding machine was spliced on and the barrel completely filled. On the second cast, a bottom of soft yellow mud was obtained at a depth of 158 fathoms. (The dry data of all soundings will be found tabulated at the end of this report.) A cloudy sky and a mist overhanging the land made it impossible to obtain either observations or land bearings.

Soon after midnight on Thursday, June 7th, the outside ice was setting to the northwest with the tide. Soon after 6.00 a.m., it had turned and was setting back again. This action of the ice continued with each turn of the tide. Obtained an a.m. time sight and a meridian altitude, also land bearings to fully determine our position.

Late in the evening of Thursday, we went to the westward along the edge of the lead with one sledge and the sounding machine in order to examine the lead and at the same time get another sounding. At the end of about four miles, the lead came right into the edge of rough rubble ice giving us no young ice to travel upon. As the lead extended as far as we could see, we halted here for our sounding. Paid out to the end of our line and got no bottom at 183 fathoms.

This showed us at once that we must devise some way of paying out the long coils of ship's wire if we hoped to obtain any results. We returned to our camp.

Before midnight of the 8th, after several hours work, we were able to give our new arrangements a trial at the edge of the lead and found several more changes necessary before it would be in working order. Before morning, it began to snow so we turned in once more to await developments of the lead and the weather.

On the evening of the 9th, we made a similar excursion to the eastward along the lead and at the end of six miles halted for a sounding. Similar bottom of soft mud at 151 fathoms. All the remaining soundings consisted of a similar bottom. A thick sky made bearings impossible. The whole northern horizon consisted of large patches of black water sky indicating other leads beyond the present one. No end visible to this lead in either direction. Returning to our camp, we made a few last changes in our newly arranged apparatus before turning in for our fifth and last sleep at this camp.

A small incident when breaking camp Sunday evening well illustrates the movement of the ice along the outer edge of this flaw. When first camped here, a pole which in March was about two miles to the eastward on the other side of this belt of unsteady ice, was not visible. On Friday, the loose pan from which we took our sounding to the westward, contained the sledge tracks which previously ran to the eastward of our camp. The pole was then close at hand, but in going to get it, the Eskimo found it to be still on the solid outside ice and so was unable to get it. On turning out this last morning, it was right alongside our tent, the pinnacle being jammed against the inner ice.

Got under way at 11.30 p.m., and travelled the young ice for only a short distance when we were forced to take to the old rafted ice, our trail of last Friday being broken by the constant running of the outside ice with every tide. This had widened the lead considerably but also filled it with loose floating fragments. This made our advance rather slow as we were forced to make a trail and the two pickaxes were in almost constant use.

At 3.30 a.m., we arrived at a suitable place for a cast. We halted intending to proceed again after the cast. While moving about along the edge of the lead, one of the men made a false step on soft snow and fell in the lead up to his hips. We then pitched camp and dried him before sounding. Later, we saw two seal in the lake outside and succeeded in shooting one of them, but having spilled his wind, he sank slowly to the bottom. Soft mud at 214 fathoms, bearings to also [sic] obtained.

As an advance along the spring trail had become impossible, we now decided to advance as far west as Cape Columbia, but to follow the edge of the lead and sound rather than cut into the smooth belt of ice-foot ice.

Broke camp and started our march again at 11.30 a.m. In addition to the rough going of yesterday, we were much delayed this day by soft deep snow which had to be traversed several times and packed before the sledges could advance. An overcast sky at the beginning of the march soon grew thicker and a fog began to settle down so that we were forced to pitch camp as we

could not see ahead of us to pick a trail over the rough rafted ice. Here we obtained sounding No. 4 with bottom at 232 fathoms.

On breaking camp in the evening, we were able to get our bearings and finally got under way at 11.00 p.m. The lead seemed to divide here, the two portions being separated by large pans which were adrift. The inner portion of the lead ran in more towards Cape Columbia. In the early morning, we were able to see ahead that the lead reached in nearly to the wide strip of smooth bay ice which stretches all along this coast. Our course was accordingly changed and set straight for the land in order to make better time to Columbia over this smooth ice. Just near the edge of the smooth ice, we found a narrow tide crack and so decided to camp here and take a sounding, nearly abreast Good Point, about 6 miles off-shore. A similar bottom at 162 fathoms.

We found a bed on the soft snow where a seal had been basking in the warm sunshine and so the two Eskimos set out in search of seal. Several hours later they returned with six eider duck which they obtained in a lake of open water a mile from camp. The eskimos say that the presence of these birds so early in the season indicates that the open water extends down through Robeson and Kennedy Channels. Upon leaving here, we cached a few articles of equipment and clothing which we had found superfluous.

With the better going on our next march, we were able to advance more rapidly at first but it soon became thick and foggy so that we were forced to follow the sinuous edge of the rough ice. Passed several places where the present lead ran into this edge, at other places all of this winter's cracks were a mile or so outside this edge. It finally became so thick that after seven hours of advance, we were forced to pitch camp for the day.

In the evening, the land was still overhung in places but Columbia appeared rather near, with a thick water sky to the northwest beyond Columbia. Began the march at 10.10 p.m., this being Thursday, June 14th. The same thick weather as yesterday forced us to make an irregular trail following the trends of the rough ice edge. About 3.00 a.m., a peak loomed up on the "Port Quarter". We kept on, however, to make sure of getting well out to the meridian of Columbia. At 6.30 it had cleared enough to show that we were well west of Columbia. We camped at once, hoping it might clear enough so that we could view the ice conditions outside and decide definitely our plan of work. While taking our sounding (88 fathoms), we obtained two black Guillomoy. The mud of this cast contained many short white hairs.

It had cleared when we turned out in the evening and we found ourselves nearer the land off the mouth of Clements Bay. The lead extended indefinitely to the westward and so after ten days of unsuccessful attempts, we were forced to give up all hope of getting out to the north to obtain any deep sea soundings. As the wide belt of bay ice along this coast seemed to extend indefinitely to the westward, to follow this seemed to be our only alternative left.

At the end of a nine hours march we camped off the mouth of Disraeli Bay. Bottom at 37 fathoms, with a few pebbles in the usual soft yellow mud.

Getting such a late start on our work as at present planned, it appeared

that it might be desirable to overstay the 30 days limit and so two men and one sledge were allowed to return to the ship from here. A four hours' march from here with the more heavily loaded sledge showed that a small cache would be desirable and so having reached a convenient point for a sounding, we camped once more, took our cast and made our cache before turning in for our rest. Also spent nearly an hour trying to get a shot at a seal in the open water. Bottom at 83 fathoms.

With clear weather this evening (Sunday, June 17th), we were able to set a straight course cutting across the large bights of smooth ice reaching far out and only touching at the successive inner points. At the end of a six hours advance, having seen no evidence of the lead we pitched camp at a place which seemed favorable for hunting the lead. A long scout, however, gave no signs of the lead and so we turned in.

Before turning out we heard a storm brewing and by evening a stiff breeze from the northwest was drifting the soft wet snow, forcing the party to remain in camp. The storm freshened during the night and by morning was blowing a light gale threatening the light tent at times.

There was nothing to be done except to await the end of the storm and this proved several days in coming. Thursday noon brought a temporary lull, but it immediately freshened again and it was Friday night, June 22nd, before we finally broke camp again.

At this late date, it seemed too late to attempt a trail to the north over the rough ice at a point so far to the westward, even if we were clear of the lead, which was by no means certain. And so we continued our westward advance with the even probability of meeting the lead once more.

At the end of a three hours advance, all the lashings on one side of the sledge gave away and we were forced to pitch camp and let the wood dry a bit before repairing it. The recent storm has made the going poorer. Spent several hours in scouting outside but no evidence of our former lead.

It was after midnight when we left this camp and after several hours marching, a point looming up ahead seemed to run in very close to the land just beyond McClintock Bay. We continued along the edge, however, and at the end of six hours were finally forced in to the shore just west of Cape Richards. The outlook from the top of the rafted ice showed that the smooth ice beyond here consisted merely of the usual narrow strip of ice-foot following the irregularities of the shore line.

Such further advance being unfitted for sounding purposes, we turned about at once and another hour put us to the outside edge of a large bight of smooth ice off the mouth of McClintock Bay, and a meridian altitude was obtained. The sun became overcast during the afternoon so that a p.m. sight was impossible, and we then turned in, expecting to spend the next day in getting a sounding, observations and bearings and resting the dogs a little before beginning the return march to the ship.

An a.m. sight for longitude was obtained, and then as several scouting trips showed no signs of open water, a hole was cut in a pan of this seasons ice and cast of 48 fathoms obtained. Bearings and other things completed,

we began our return march at 12.20 p.m. Monday, June 25th. Five and one half hours brought us to a strip of young ice at the edge of the smooth bay ice where we halted for a sounding, and it was destined to be a rather lengthy halt.

When the hole was finally completed through the thick young ice, the chisel fell out of the handle and sank to the bottom. The hole was still too small for the patent lead to go down through. As the temperature was about $+35^{\circ}\text{F}$ and water making on the ice surface, we left the lead suspended in the hole with the bare chance of its sinking its way down during our sleep. On turning out early next morning, we found the lead nearly a foot deeper but not entirely through the ice yet.

We succeeded in lashing the spade to the chisel handle and after some effort the hole made large enough for the lead. Lowered the lead as usual but found no bottom at the end of our coil, a little shy of 300 fathoms, instead of 500 as we had supposed the coil to hold.

Having had such shallow soundings all along, the spare coil had been left at the cache which was now nine hours to the eastward of our camp. Had another warm meal before undertaking this journey and then I set out at 1.15 p.m. with the empty sledge to go after our spare coil and ice chisel. A little misty upon starting and it steadily grew thicker so that I had difficulty in keeping the trail which the sun had already destroyed considerably. Soon found pools of water on the ice deeper than the sledge runners, which proved to be only a fore-taste of that to come further along on our return trip. Six and a half hours brought me to the cache. The return trip proved much worse as the dogs were thoroughly soaked and became cold and tired before the camp was reached at 3.30 a.m., Wednesday morning, having been over 14 hours on the road in making this trip.

As soon as we had our tea however, we proceeded to rig our coil which proved no easy task. After several trials, we finally got it in working order on the sledge upstanders and reached bottom at 10.25 a.m. Soft yellow mud at 429 fathoms and only five miles offshore.

Our rough rigging for the double coils made the work go slowly and it was 3.00 p.m. when we turned in once more, having been up since 5.00 a.m. of the morning before. Up to this time, it had been too thick for any bearings but being very anxious to obtain them for this deep cast we slept lightly keeping watch at times; and finally about 8.00 p.m. we obtained enough to fix the position of this our deepest sounding.

Finally left this place at 7.30 a.m. Thursday morning after a rather prolonged stay. Found more water than ever on the smooth ice. At the end of a five hours advance, we came upon a hole which seemed to indicate that our recent westerly winds had closed the former lead somewhat. As this was the only opening in sight, we camped here for a sounding. Soft yellow mud with a few white stones at only 33 fathoms. It is interesting to note that this the shallowest sounding of the trip is the one next east of the deepest cast; and they show a wide range from 33 to 429 fathoms.

Our next days march began at 8.00 a.m. in thick weather and after an hours advance it had become so thick it was very difficult to advance. We continued however and at the end of two hours, being at the lead once more we decided to halt for a sounding and await the clearing for fear of passing our cache in this thick weather. Sounding No. 12 gave 63 fathoms with a very soft yellow mud. It was necessary to lower the lead three times before the trap was sprung shut.

It cleared a little during the early morning and we obtained our bearings before leaving at 7.30 a.m. At the end of 1½ hours we reached our small cache. It has been utterly impossible to follow our outward trail for several days now as the warm sun has entirely destroyed it. Four hours to the eastward of the cache we found ourselves once more alongside the lead and so camped for the day.

Sounding No. 13 gave us 41 fathoms. The sample of the bottom contains many white hairs and a short bony like structure. When nearly ready to turn in the sun came out and we spent several hours in drying our clothes which had been constantly wet for several days.

The next morning, Sunday July 1st, we did not start the march until 9.00 a.m. After a few hours advance we came upon a stretch of young ice just outside and as this offered better going we followed it for some time. At the end of four and a half hours we came to the end and to a favorable place for a sounding. Being apparently well to the eastward of sounding No. 6 we halted for the day. The sample of this bottom at 90 fathoms contained a small piece of a white shell in the usual yellow mud.

On the next day's march we passed the lead at the end of the first hour but did not halt. At the end of four hours' advance we found another favorable place. We were only a little west of Cape Columbia and as it was nearing local noon, we decided to halt here and check our bearings with astronomical observations. Secured a meridian altitude and a p.m. sight for longitude.

This our fifteenth sounding gave us bottom at 87 fathoms. Spent the warm afternoon in drying our clothing and other gear and in overhauling the dog harnesses which were greatly in need of repair.

It thickened again during the night and soon after starting at 2.30 a.m. a fresh northwest breeze was blowing and a little snow was falling. At the end of two hours we halted and secured a cast of 88 fathoms, but no bearings. The entire halt here consumed an hour and a half. A little later we were again delayed a half hour in getting out of a large lake of water underlying soft wet snow. At the end of another two hours' advance we met the old lead once more. As it was still blowing and everything was wet we camped and turned in at once, hoping that the weather might clear.

For once our hopes were well founded, and it began clearing about 6.00 p.m. We turned out at once and after our usual breakfast found bottom at 64 fathoms with many fine white grains in the sample.

Just as we were hitching the dogs preparatory to starting at midnight,

we ushered in the Glorious Fourth by a single salute with our rifle fired toward Cape Columbia, whose twin peaks standing out like portals well justify the name "Columbia's Gates".

At the end of a four hours' advance we halted at the lead and secured another cast at 101 fathoms, which is a little deeper than the last ones have been. Thick and blowing so that no bearings were possible. Soon after starting again we were forced inshore by a wide point of rough ice but after rounding this we were led out once more on a strip of young ice which at the end of two hours brought us to another suitable point in the lead. We are now well to the eastward of Cape Columbia and so are getting deeper soundings once more. Soft mud at 224 fathoms.

It was after seven o'clock when we were finally ready to turn in. The only thing to mark the national holiday outside of our salute was the fact that we had put in a harder day's work than usual, having been on the go for over 24 hours, and having secured three soundings in that time.

We had not advanced far on our next day's march when we were delayed two hours in fixing the lashing of the sledge. During this delay the sky began to thicken rapidly. After another advance of 1½ hours we saw the lead open just outside and so stopped long enough to make a cast. Meanwhile, however, the Bos'n got into a lake of fresh water on the smooth ice and was wet to the skin up over his waist. This accident together with the thick weather which would easily lead us past our small cache, persuaded us to pitch our camp here. Bottom at 80 fathoms.

A westerly breeze soon veered to the northwest and began to freshen so we took a good rest and sleep here, and did not get under way until the next morning at 5.00 a.m., Friday, July 6th. A three hours' advance brought us to the small cache and after another advance of four hours we halted to camp, as we were near a crack in the young ice outside. Sounding No. 21 gave us bottom at 150 fathoms.

Leaving here Saturday p.m. a long march landed us at Cape Hecla, after a break down which kept us over 24 hours on the road.

No further soundings were attempted and from Cape Hecla the return to the ship, then at Lincoln Bay, was made without incident except constant delays by the thick snowy weather and the great amount of fresh water covering the ice. Our sledge and most of the outfit had to be abandoned near Cape Rawson and the ship was finally reached on foot about midnight of Monday, July 16.

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In addition to the journal presented above, a seven-page data table was included with the Marvin report. This table listed dates, ocean depths, horizontal angles to various capes and mountain peaks, and magnetic bearings to the same points. The few sun observations noted in the journal have not been found.

The 1954 expedition (Hattersley-Smith, 1955) also measured horizontal angles to mountain peaks as a means of determining positions along the front of the ice shelf. Determination of accurate locations by sun lines was

considered impractical. Therefore, locations for both the 1906 and the 1954 expeditions were determined from horizontal angle difference between mountain peaks or features which were visible or by interpolation between these for times when clouds obscured the peaks. Through the cooperation of the Canada Defence Research Board and the Canada Department of Mines and Technical Surveys, Aeronautical Chart Section, a map was obtained that was sufficiently accurate to make use of these observations. Much credit is due to their Photogrammetry Section for the fine map that they produced. Surface photographs taken by Hattersley-Smith in 1954 and aerial photographs of the same localities were used to identify specific mountain peaks that were then located on the map. The sites of the oceanographic stations in 1906 and 1954 are shown in Fig. 2.

One discrepancy is noted in the Marvin locations. This concerns the cache mentioned at site 8. Station 12 of the return trip falls east of this site, though from the wording of the journal it appears to have been west of it. These conflicting statements are reconciled when we assume that Marvin also established a cache at site 7, from where one sledge returned to the Roosevelt. A further cache, including the sounding wire, was left at site 8, the wire being obtained later in order to find the depth of water at site 10. Thus, the cache to which he refers as being past site 12 would be the one located at site 7.

Some interesting comparisons can be made between Marvin's observations and those of Hattersley-Smith and Crary. The first of these concerns the extent of the ice shelf. Marvin makes it clear that, beginning with his fifth sounding, he followed the ice front as it existed at that time. As the line soundings could be made most easily in areas of open water that were usually available immediately off the ice shelf, the logical path of travel would be along the ice front. He mentions the "smooth belt of ice-foot ice", the "wide strip of smooth bay ice which stretches all along this coast", etc. Therefore, by locating Marvin's soundings, beginning with the fifth, to his farthest west and back, we are actually tracing the extent of the ice shelf in 1906. This is also true of the sounding stations in 1954.

The ice shelf which was present in 1906 to the west and to the east of that found in 1954 has undoubtedly been the source of ice islands at some time during the intervening period. In 1947 one such island was photographed just north of Good Point. The close proximity of the site where it was found to its rather obvious place of origin at the eastern end of the ice shelf, leads to the conclusion that it had broken away only a short time before it was photographed in the summer of 1947. When the outline of this island is drawn on the map in the area from which it originated, its northern extremity coincides with the ice front as it had been found by Marvin in 1906. It will be seen in Fig. 2 that the extent of the ice shelf between longitudes 73° and 78° W was the same in 1954 as it was in 1906.

Another point of similarity between Marvin's observations and those of Hattersley-Smith and Crary concerns the pack ice conditions north of Cape Discovery. In both cases the pack ice found immediately to the north of the ice shelf was of a permanent nature and badly hummocked. In fact, Marvin

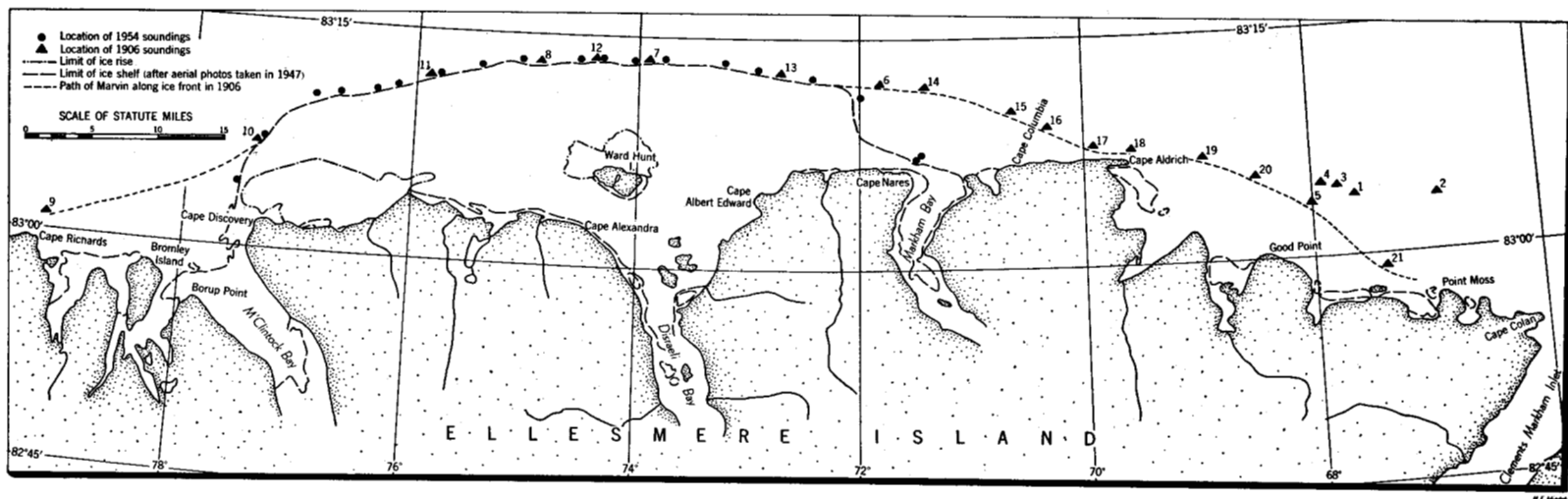


Fig. 2. Map showing locations of 1906 and 1954 soundings. Probable extent of ice shelf in 1906 is indicated.

found no open water at all, and the 1954 party succeeded only by sledging over the rough pack for approximately one mile.

It must also be pointed out that Marvin does not mention the "rolls" or ridge and trough systems that are generally characteristic of this ice formation. In the survey taken in 1954, the rolls were absent in the last mile of shelf width nearest the pack ice, and elevations of this outer strip were only about five to ten feet above sea level. It is presumed that it was much the same in 1906.

All comments made above in regard to conditions in 1954 are based on information furnished by A. P. Crary. The finding of the Marvin report is due largely to the efforts of personnel at the U.S. National Archives, whose assistance is gratefully acknowledged. Biographical information on Marvin obtained from Admiral D. B. MacMillan and J. V. Stowell was most interesting and helpful.

References

- Hattersley-Smith, G., et al. 1955. "Northern Ellesmere Island, 1953 and 1954". *Arctic*, Vol. 8, pp. 3-36.
- Koenig, L. S., et al. 1952. "Arctic ice islands". *Arctic*, Vol. 5, pp. 67-103.
- Peary, R. E. 1907. 'Nearest the Pole'. New York: Doubleday, Page and Co. 411 pp.
- Stowell, James Vinton. 1954. "Ross Gilmore Marvin, scientist, teacher, explorer". Elmira, N.Y.: Chemung County Historical Society, Inc. 21 pp.