THE LOUISE A. BOYD SEVEN ARCTIC EXPEDITIONS

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INNATELY fond of geography from earliest childhood, from some unexplainable reason, my favorite readings took me into high northern latitudes. Therefore, it was little wonder that following the deaths of my father and mother, the summer of 1924 found me in Arctic waters having my first views of Spitsbergen and the pack ice to the northwest, as seen from a small Norwegian tourist steamer. My readings of the past made me mentally equipped for it, and on that trip were laid the foundations of my subsequent seven expeditions to the Arctic, all of them financed by myself and carried out under my leadership.

Compared to most Arctic expeditions, mine were small in size both as to personnel and ship. Being a firm believer that geography, certainly that of the Polar Regions, can best be studied by explorers and scientists equipped with the most precise and practical instruments that modern times have developed, and which would enable them to obtain the most thorough and detailed knowledge of areas not easy of access and where time plays an all important factor, I spared no efforts or expense in order to equip every branch of our work along those lines. This included my cameras as well as all other instruments.

Such equipment proved especially valuable in my case where all my expeditions were limited to the duration of the summer months, and where weather and pack ice were all important and governing factors in reaching our destinations; especially so with the coast of East Greenland; whether or not we would have a couple of months or our work curtailed into a few weeks between the seasonal opening and closing of the very heavy pack ice that guards the northeast coast of that country.

These expeditions were planned so that each member of the staff had his own special job, there being no duplication of work except for myself. I alone had the double role of leader and photographer. When in the field we worked as a unit with one major objective, all of which had been thoroughly planned prior to the sailing of the expedition. The work of each member of the staff was a detailed unit of an over-all plan.

Between the years 1926 and 1941 I organized and conducted seven expeditions to the Arctic. The first of these in the summer of 1926 took me to Franz Josef Land on the M/S *Hobby*, a Norwegian sealer chartered for that purpose. Interested in photography, I on that trip began the work of building up as complete a topographic record as I possibly could of Arctic topography, including sea and land ice; and this has been my own special field of work on all my subsequent expeditions.

The summer of 1928, while in the search for Amundsen and others lost in the Arctic I used my previous ship the M/S *Hobby*. I revisited Franz Josef Land and went north in the pack ice near there to Lat. N. 81°13′ in addition to visiting the coastal areas of a considerable part of Spitsbergen and well into the pack ice northwest of there.

NOTE: While Miss Boyd has been known as a Sustaining Member for many years, possibly only a small percentage of the Society Membership have known much of her Arctic Explorations and the mapping methods used. For a long time, a descriptive article in this journal has been desired. The Publications Committee and the Editor are greatly pleased that Miss Boyd consented to prepare this interesting and instructive article. It is their hope that the additional Arctic expeditions she desires will be carried out.

The experience of these two summers were in the nature of training for my subsequent expeditions, four of which have taken me to the east coast of Greenland, and the last, in 1941 in service of the United States Government, to the west coast of Greenland. On all of these seven expeditions I have set out to see as much as I possibly could and to record as much as possible with my cameras and detailed notes. Frequent landings have always been made; sometimes for brief close-at-hand investigations of features of particular interest, or for detailed studies and photographic record. We had several camping trips into the land, which varied in length of time from a few days to a couple of weeks.

Four of my expeditions were to the east coast of Greenland for which I chartered and used a wooden Norwegian sealing vessel, the S/S *Veslekari.* The first of these expeditions, that of 1931, was planned entirely as a reconnaissance expedition, my objective being to get a general over-all knowledge of the east Greenland coastal areas.

That year's expedition, as well as the following ones in the years 1933, 1937, and 1938 along the east and northeast coasts of Greenland, can be looked upon as integral parts of a program in which every fiord and passageway to which ice permitted entry with ship or small boat was examined from King Oscar Fiord north to Cape Monpensier at the northeast corner of Ile de France. In addition, one year we made three stops in Scoresby Sound and in fine weather photographs were obtained close along the Liverpool Coast.

On all my expeditions my photography of coastal features, in panorama and in detail, as well as of ice conditions, was an almost continuous process from either ship or motor dory; and while on shore I took every opportunity to take my cameras up on to high ground from which I could get wide and distant views that often afforded an understanding of the topography in no other way so easily obtained. My work took me long days and many miles into the land away from our base on the ship or from camp sites inland, in order to make as complete a photographic coverage of the regions as I possibly could; I sought not only general views over the land but detailed studies of the terrain, as well as of ice conditions, of glaciers and snow conditions and of pack ice along the coast and eastward in the Greenland sea.

Photographs were taken on a far greater scale than mere recordings of local landscapes; they were taken to supplement the studies of the physiographer and geologist; for mapping purposes; and not to be overlooked without mention, was the flora which, though diminutive in size, showed the kind of ground terrain on which the plants grew and, in some cases, exposed root systems were tell-tales of wind direction, especially so in some of the passes where we encountered strong winds; this was also the case in some very sandy areas.

My first use of the camera as a mapping instrument was on the 1931 expedition and was the result of my concern with obtaining photographic records of everything that seemed worth recording. I discovered a previously unsuspected connection between Kjerulf Fiord at the head of Franz Josef Fiord and Dickson Fiord at the head of King Oscar Fiord. As we had no topographer with us that year, to make a map of this interesting area, I took upon myself the task of making a complete photographic record of it, taking over 200 photographs from 50 carefully selected stations. From these photographs the American Geographical Society was able to construct a topographical map of some 80 square miles. This map was published in the *Geographical Review* of October 1932, on the scale of 1:500,000 under the title "Map of the Heads of Kjerulf and Dickson Fiord."

I felt that this map had definitely demonstrated the value of cameras for

mapping in regions hard of access and where detailed surveys of representative features are greatly needed, but, where the time for doing them in any one season is all too brief. My next expedition, that of 1933, was planned to make mapping by photogrammetrical methods the major features of our work, partly to supplement the investigations of the physiographer of the expedition, and partly to try out new methods of field survey which had been developed by Mr. *O. M. Miller*, head of the American Geographical Society's Department of Mathematical Geography. The Society released Mr. Miller to take charge of the work and under his direction I purchased a Wild Phototheodolite. This was the first time, I believe, that any American expedition was equipped for ground photogrammetry. There was no equipment available in the United States at that time for plotting maps from stereoscopic ground photographs. This necessitated our having the plotting done in Zurich, Switzerland, after the return of the expedition. The work was ably done by Mr. *Walter A. Wood*, Assistant Topographer of the expedition, using a Wild autograph rented for the purpose. The resulting maps were published by the American Geographical Society with my reports on the work of the expedition under the title "*The Fiord Region of East Greenland.*"

My expeditions to that same coast in 1937 and 1938 were planned as a unit, and the scientific program for the two expeditions was in general a continuation of the 1933 expedition, with the exception that methods of surveys and equipment were different. Experience gained on the 1933 expedition had taught us the pros and cons of using photogrammetrical equipment in regions where the prime need is in the sense of exploratory surveys rather than where detailed information of topographical features is of real importance. Against its use was the fact that we worked in regions totally void of any roads or trails where the terrain was difficult of approach to most of our mapping objectives, and the objectives themselves, boulder-strewn moraines often slippery with ice close under the surface which had to be traversed; glaciers which had to be crossed and re-crossed and icy glacial streams forded. There were no natives in that part of Greenland from whom we could have obtained help in portaging the equipment, including the camp equipment, nor was it possible to take horses with us for some of the heavy portaging. On all the voyages it was necessary to add to the ship's personnel a special crew of men to carry the heavy camera equipment as well as that for the camp sites, and these men had to be recruited at the port of our departure in Norway prior to our departure and taken on the voyage for that purpose. These men were not trained or experienced in this capacity. It is therefore easy to understand the difficulties we encountered in transporting the photo-theodolite equipment with its total weight of $141\frac{1}{2}$ pounds, exclusive of that of the ruck-sacks used in the transporting. We used glass plates in the plate holders, the advantage being in their accuracy and facility for use in the plotting machine. But film certainly would have been far more preferable both as to weight and to chance breakage of such as glass plates. Also it would permit occupying more stations and working over a large area of terrain.

With the peak of glaciation throughout the world definitely on the wane, probably there is nowhere that one can see this ice recession in more varied and striking evidences than in Greenland, and in locations accessible for observations. We included studies of this phenonemon as one of the principal objectives of our 1933, 1937, and 1938 expeditions. In 1938 I had the opportunity of carrying this work north along the coast to and including our landing on the northeast corner of Ile de France, a part of the coast far north beyond the navigation

possibilities of any but the most extraordinary years, ours being one of only three on record to have successfully reached those destinations. Of these Dr. *Lauge Koch* and myself were the only two expeditions who got through the ice and made shore landings, so very heavy is the polar ice along this part of the coast, and so rarely passable with a ship. On these two expeditions further work was to be done on recessional glacier studies, and it was planned that if weather and ice conditions permitted we would carry our work progressively north as far as possible.

For the 1937 expedition it was planned that the mapping would be exclusively by plane table methods, inasmuch as it was to be limited to the mapping of glacial marginal features in connection with glacier recessional studies. Unusually difficult ice conditions delayed us a full two weeks in getting through the coastal ice barrier. The result was that the whole program had to be greatly speeded up, and it was decided again to resort to the camera for the recording of map detail. Mr. *Fred A. Buhler* was the surveyor in charge of the mapping and I did all the photography in connection with this mapping, working with him and under his direction. The plane table alone was used only for a rough sketch map of South Glacier on Jan Mayen Island and for mapping a small area of glacier fill remnants in Agassiz Valley at the head of Franz Josef Fiord. Two other surveys were made in connection with glacier recession for studies carried out by the geologists of the expedition, Professor *Richard Foster Flint* of Yale University and Dr. *A. Lincoln Washburn*, now Executive Director of the Arctic Institute of North America. There were surveys of Tyroler Valley at the head of Tyroler Fiord and including Cope and Glacier and that of Narwhal Glacier on the north shore of Lyell Land. For these the camera was not only used for topographic detail, but also to a greater or lesser degree for providing control of subsequent construction.

In the Tyroler Valley it was particularly desirable to map the largest possible area in the available time, and the camera was used almost exclusively, the location of only a few camera stations (8 out of 20 occupied) being obtained by plane table, and those were near the head of the fiord. Positions of the other camera stations were established by re-section methods in the process of constructing the map. The elevations of all the camera stations were obtained by altimeter. These of course could be regarded only as approximate, but were an aid in determining the true elevations. Because most of the features we were interested in were either on, or near the floor of the valley, we did not attempt to go to the higher elevations or to the rim of the valley, and confined our work to areas of not over an elevation of 500 meters.

For the Narhwal Glacier area, on the other hand, rigid control for the map construction was provided by locating all the camera stations and determining their elevations by plane table methods.

For the Tyroler Valley survey I used an Aero K-10 Fulmer Graflex camera with focal length of 254 mm. For the Narhwal Glacier survey I used the Aero K-6 Fairchild camera with focal length of 50 mm. for most of the work, supplementing it to some extent with the Eastman 5×7 View Camera for certain close detail to be sketched in during the map construction process.

The Fairchild K-6 aerial camera had never before been used for ground work, having been manufactured for aeroplane use only. Due to its size and weight, its use for ground work had previously not been considered. Knowing the camera well, I felt that it would be most valuable for my work photographing on the ground and from the ship, if a way could be found to make this possible. I therefore, on my own initiative, devised, and had made for me by the Fair-

child Camera Corporation, a special mounting by means of which the camera, complete with magazine, could easily be mounted on an Akeley Searchlight tripod. This tripod has a revolving head which I had scaled to degrees so that with the camera mounted on it, it was possible to take photographs at any desired angle and in any direction from a single setting.

The level tubes on the tripod also provided a means by which excessive swing could be eliminated and the graduated arc on the camera made it possible to record the approximate tilt of the camera at the moment of exposure, and which was of great assistance in making the final set-ups of the photographs during the map construction.

In addition, the large rolls of film in the magazine of the K-6 enabled taking many photographs without changing of roll, and more than one loaded magazine taken in the field of operation made possible the longest requirements of any day on shore.

Construction of the maps of the Tyroler Valley and of the Narwhal Glacier area on return of the expedition was done by Mr. *Fred A. Buhler*, our topographer, with the assistance of Mr. *James LeRoy* our hydrographer, at the American Geographical Society, and later published by them in 1948 with a volume on my 1937 and 1938 expeditions, entitled "*The Coast of Northeast Greenland*" *by Louise A. Boyd.* The delay in publishing was due to the fact that the areas visited by my expeditions of 1937 and 1938 became part of the War Zone from the time of the invasion of Denmark and Norway, Greenland being territory of the former and Spitsbergen and Jan Mayen Island of the latter; our reports were considered so valuable, possibly to the enemy, that I immediately made them available to our government where the material remained restricted to their use for the duration of the war.

On the 1938 expedition no mapping of land areas was done except for the geological map of one of the Orientering Islands in Dove Bay. However, after return of the expedition, I noted what appeared to be certain discrepancies on the map of the Orientering Islands constructed from surveys of the Denmark Expeditions of 1906 and 1908. My photographs had been taken to show the topography of the Islands in detail, and their relation to the surrounding part of the northern end of Dove Bay. Their coverage proved to be so nearly complete that a map was compiled and published on the scale of 1:200,000 with 50 meter contours and a text in the volume "*The Coast of Northeast Greenland.*" This further demonstrated the value of the camera as a mapping instrument.

In connection with photography, I used the Fairchild Aero K-6 camera as well as their F-8 and the Folmer Graflex K-10. These aero cameras proved most useful and satisfactory cameras for all general photography in the Arctic. For work requiring close-up detail I used the Eastman View Camera and the Folmer Graflex Speed Graphic Camera. An assortment of filters and lenses were included in my equipment. Eastman Super Sensitive film was used altogether, and gave excellent results in those high latitudes.

When time is short, the combination of the surveyor with his plane table and myself, the photographer with my cameras, working as a unit proved a fast and reliable method of recording material that could be worked upon into desired maps by the surveyor on return of the expedition to the United States. As I have often said: it produces a maximum of cartographic results in the minimum of time, and in our case proved well worth while, and one that I certainly would recommend for similar work; but it must be considered only in the case of a means to an end; not the best method of survey. In my opinion, for precise recordings where possible, I still would recommend and use for spe-

cific purposes the photogrammetrical method, and second to that, that of the standard plane table methods so generally understood and used in many latitudes and conditions. When those methods are not feasible or practical, then the one we resorted to was a combination of plane table and photography, or just photographing from well chosen sites, and in my opinion these should be included in methods suitable for Arctic surveys.

No matter how long my days had been, constantly photographing from the shore or from the ship; no matter how fatigued I was at the time one usually calls bed time, I never terminated my day's work until I had thoroughly cleaned all used photographic equipment and packed all exposed film. My hours often were not those of round the clock, but it was a case of boots on till boots off that constituted my day, and hours that often took me well into those of the following morning.

My keen interest in everything that I was seeing and doing in the Arctic regions, and my indefatigable energy and ambition to obtain the finest results for my expeditions minimized all efforts. Work under these conditions was the greatest pleasure and of unending interest. Each expedition opened new interests and possibilities for future work. Fate was more than kind to me in the splendid staffs of scientists whose results prove their outstanding abilities and qualifications. The same high caliber, I am proud to say, existed with my skippers and crew. To all of them I give the greatest credit.

Our expeditions took us into many uncharted waters, both along the coast of Greenland and in the Fiord Regions with their ramifications of many fiords, sounds and inlets. As we were making intensive studies of the physiographical features of the land, our interest grew as to how the land extended under the fiord and coastal waters. This led to including hydrography in 1933, and as a major unit of our work on the expeditions of 1937 and 1938. For this purpose I had installed on our ship the S/S *Veslekari* an echo sounder, one of which later became a permanent part of my Arctic equipment. A Hydrographer was added to the staff, his assignment also including studies of currents, tide gauge recordings, and to a much lesser degree, magnetic observations, the instruments all having been loaned us by the U. S. Coast and Geodetic Survey. Included in our soundings were the following discoveries:

In 1933 while having our first test with the newly installed echo sounder off the northwest coast of Norway in vicinity of the Lofoten Islands, we had recordings that proved those of coming from off the massed bodies of the great schools of fish that frequent those waters, and led to the manufacturers of the instrument designating that type of sounder as "The Veslekari Model" and to the extensive use of the instrument on trawlers off the Norwegian coast. Another discovery with the instrument was in June 1937 when we located a hitherto unknown Bank in Lat. N. 72°41′, on a line between Bear Island and Jan Mayen Island. The Bank was recrossed by us again in July 1938 and further information gained.

Veslekari's radio equipment had been for use only for short distance transmittance in connection with her sealing voyages and available gear for our needs never had been satisfactory. Our results, however, were such as to warrant further investigations, and for the 1938 expedition I had equipment made in the U.S.A. and installed on *Veslekari* and took as member of our staff, Mr. *A. F. Hilferty*, who had had a great deal of experience, and very ably fulfilled his position.

With advent of World War II, plans for continuing my work in the Arctic came to a stop. At request of the National Bureau of Standards in Washington,

D. C., I again returned to Greenland in 1941, and spent four months on the west coast of Greenland and parts of eastern Arctic Canada. We journeyed from Cape Farewell, the southernmost tip of Greenland north into Smith Sound. This was the habitable coast of Greenland and far different from the rugged, spell-binding grandeur I had come to know so well on the east and northeast coasts where, north of Scoresby Sound, the sole inhabitants in those years had been limited to the few men who operated three wireless stations, and here and there hunters who more often than not, lived alone in their small wooden huts.

Will I again go north far into the Arctic? Definitely "Yes" if it is possible under conditions where I can be of service! Aviation has played such a major roll in the Polar Regions since World War II, and land as well as air operations are now on such a vast scale of personnel and equipment, that I am fully cognizant that small expeditions such as mine have been would be but a dot among the others and of very questionable good. We pioneered where others now carry on. I am happy to record that considerable of my Arctic equipment continues to function in the Arctic in my behalf through the Arctic Institute of North America.