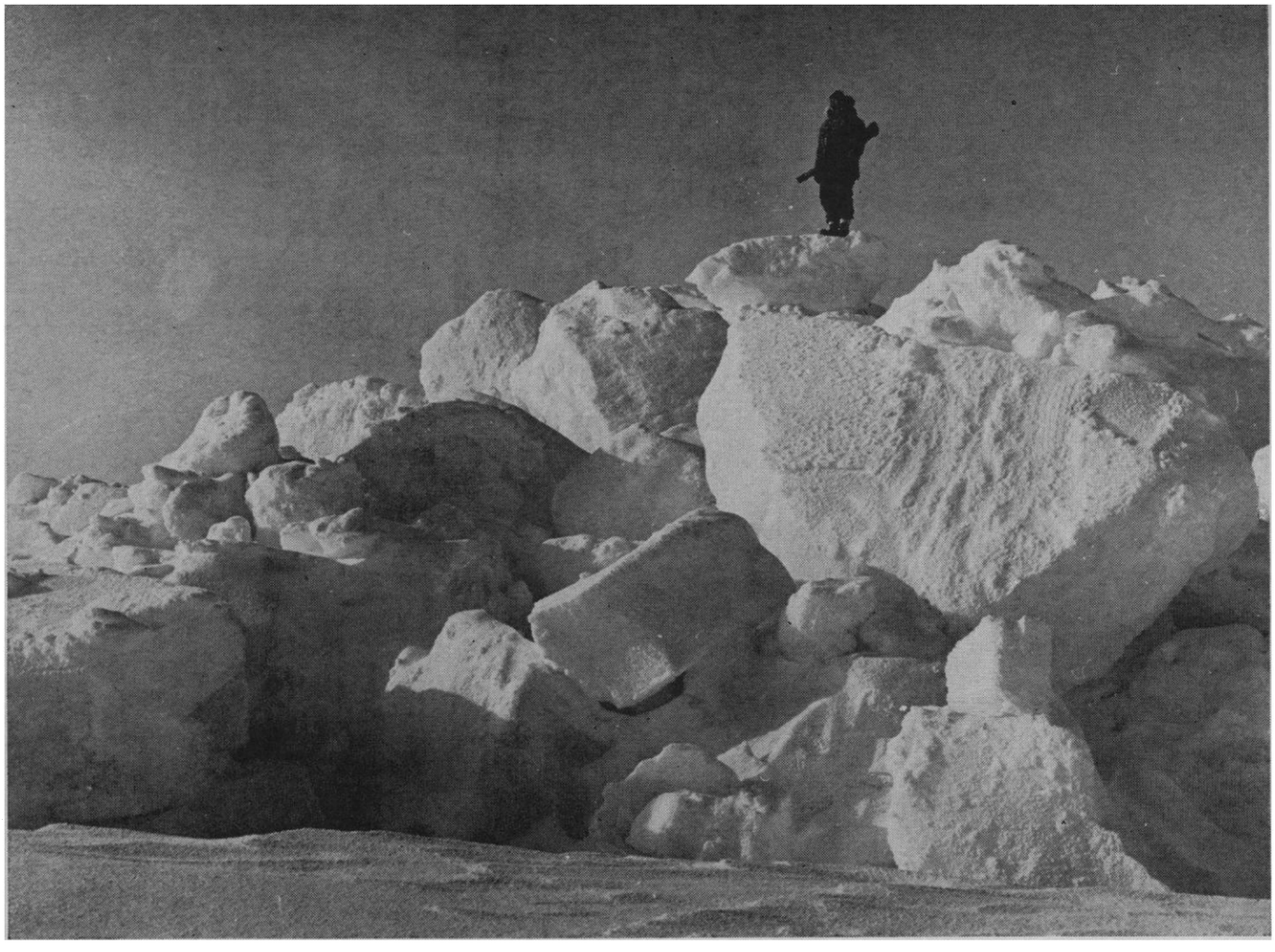


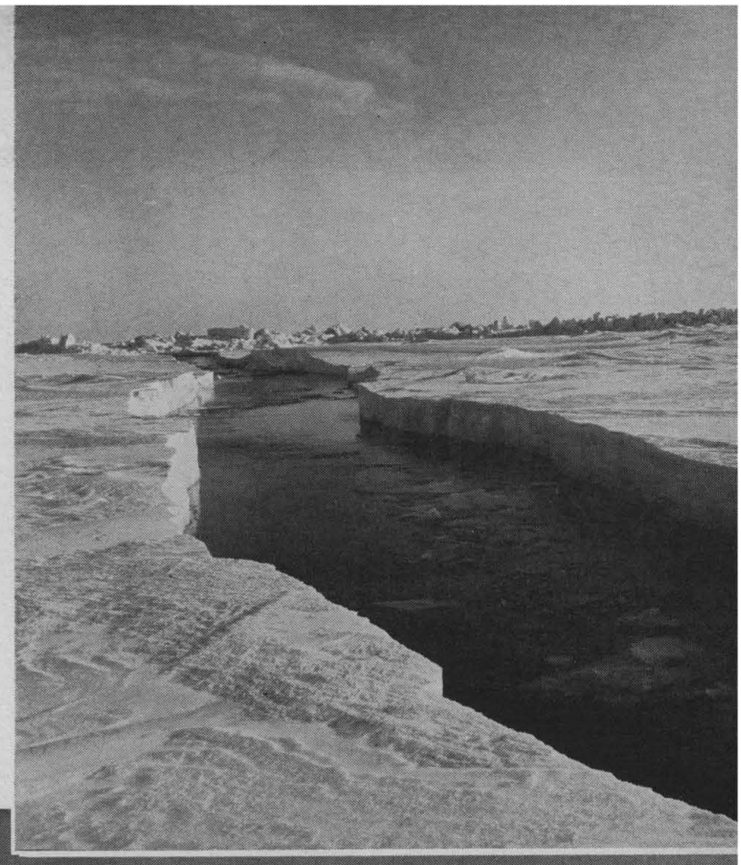
On a Floating Island

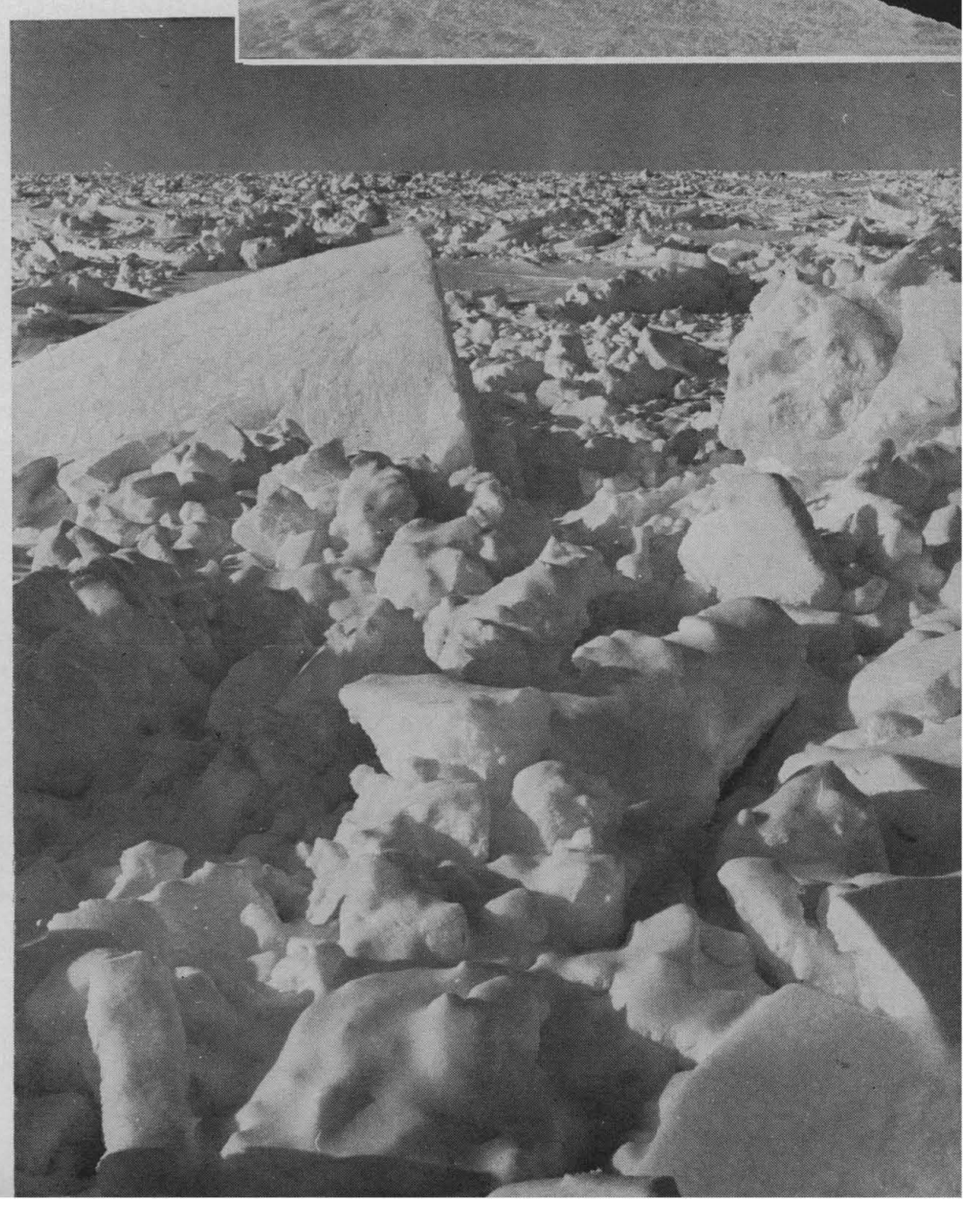
Seven U.S. Arctic drifting stations have been in operation for varying periods since the establishment of the IGY station, Alpha I, in 1957. Alpha I, a floe-based station, was established under Air Force logistic support. Station Charlie, the second U.S. floe-based station, was also operated with Air Force logistics but as a joint venture with the Office of Naval Research. T-3, also known as Fletcher's Ice Island, is a section of glacier ice (now about 100 feet thick) which has been occupied by U.S. groups almost continuously since about 1948. For many years it was occupied by the Air Force, but the camp is now maintained and supported by the Arctic Research Laboratory which is operated under contract by the University of Alaska for the Office of Naval Research. Since September 1960 the Arctic Research Laboratory has established four additional drifting stations, Arctic Research Laboratory Ice Stations (Arlis) I, II, III, and IV.

Arlis I, a floe-based station, was established 10 September 1960 at 74.6°N and 141°W with the aid of the Navy icebreaker U.S.S. *Burton Island*. No icebreaker had previously penetrated so deeply into the Arctic pack ice. Arlis II, established in May 1961 at 73°10′N and 165°5′W, was evacuated at the Arctic Circle east of Greenland after 4 years of continuous occupation. Arlis III and Arlis IV were temporary small stations set up on the pack ice about 150 miles northeast of Point Barrow for the purpose of studying telluric currents, geomagnetic activity, and auroras. A floe-based station over deep water serves as an ideal post for telluric current studies because of the homogeneous half space of known conductivity provided for the electrode field. The stations were also used for oceanographic studies. The accompanying photographs were taken on Arlis IV during March and April 1965.

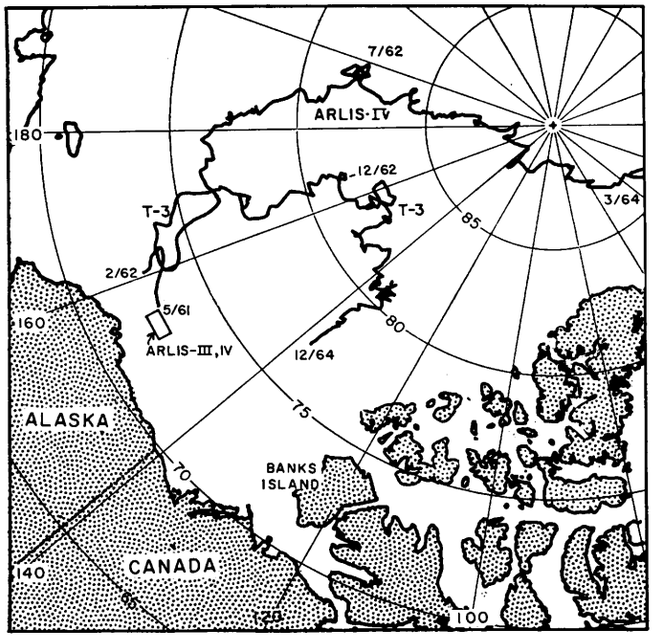
Pressure ridge (above) in the vicinity of Arctic drifting station Arlis IV. Such ridges are formed upon the reclosure of a lead. In case of minor ice activity only a line of the newly frozen thin ice may pile up. However, when the action continues, after the old ice on either side of the lead has come into contact, a major pressure ridge may be formed. A ridge will rarely exceed 20 feet in height in open sea, but it may exceed a height of 50 feet when the sea ice is thrusting against the shore line. Such activity in the open sea always tends to nibble at the edge of an old floe. When a large ridge is formed one edge tends to override the other, thus piling hundreds of tons of ice upon the overridden floe. Eventually the weight exceeds the strength of the ice and it cracks along a long line 10, 20, or 30 feet back from the ridge. During succeeding ice activity the new lead often opens at the crack, thus decreasing the area of the floe.

A floe may be diminished in size by attrition at the edges or subdivided by a lead running completely across its area. No prediction of either the cleavage line or the time of probable occurrence is possible. During one 3-day blow on Arlis I the station drifted 50 miles with no relative ice activity occurring anywhere within sight of camp. Then, during the lull which followed, a 15-foot ridge formed just to the west of the station. Arlis IV was established on a 1- by 2-mile floe. Six weeks later it was no more than 500 feet in any direction. The lead was located about 300 feet from camp, intersected the runway, and opened while the planes were at the station. After this occurrence, cargo had to be hauled more than a mile over sastrugi and pressure ridges to another runway area. Should such a lead go through camp it could result in the loss of a hut and possibly its contents. The situation warrants alertness, but not apprehension.



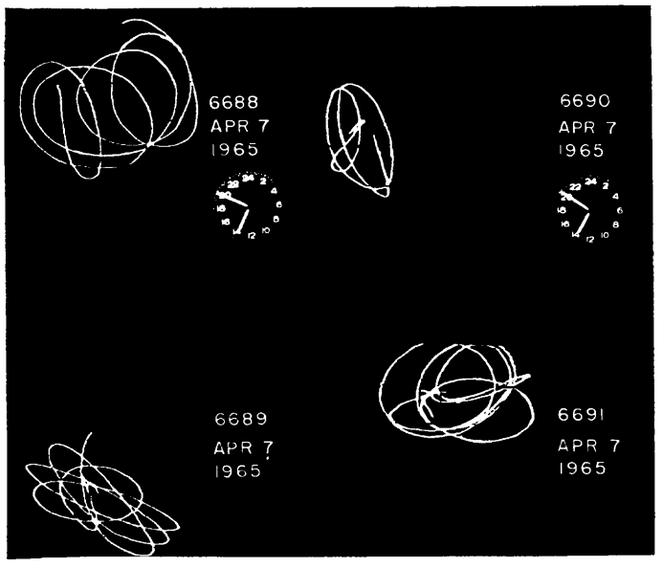


This area about 500 feet west of the station was the site of the R4D runway during camp construction. Shortly after all heavy equipment and supplies had been delivered, the ice became active in this area, with the resulting devastation. The site requirements for a drifting station such as Arlis IV are a 2- or 3-year-old floe, a square mile or more in area, with no recent ice activity and adjacent to a runway lead. The lead must have formed several months previously and remained quiescent in the interim. Such a lead will be completely free of sastrugi and serves as an excellent runway. Hopefully, there will be no ice activity in the floe at least through the camp site. The extent of contiguous ice activity noted here is unusual at this distance from shore. In the vicinity of the shore-fast ice, say less than 50 miles at sea, large areas may be completely fractured, but farther out such areas are generally limited to a few acres.



After nearly 18 months aground during which time considerable melting of the top surface occurred, T-3 floated free in early 1962 and continued its clockwise drift. This time it traveled in a much tighter pattern than it did during the previous circuit. T-3 is occupied by scientific groups from many disciplines. The drift of ice island Arlis II from its discovery in May 1961 through March 1964 followed the characteristic pattern from a point near Point Barrow northwestward and then northward beyond the pole. For several months it hovered subject to the Arctic winds and ocean currents in this region of instability. Finally, under the influence of the east Greenland current, it drifted rapidly southward and was evacuated in May 1965. It then drifted around the tip of Greenland and broke up because of thermal stresses in the warmer waters of the North Atlantic. Arlis III and IV were located within the rectangular area shown on the map about 150 miles northeast of Point Barrow. Because of their temporary nature and limited staff, no navigational data were recorded.

The author making observations. The all-sky camera, telluric current electrode pairs, and induction loops were all aligned at installation with respect to the magnetic meridian and then allowed to rotate with the floe. The orientation was checked every 24 hours with a Brunton compass. The amount of rotation varies considerably, depending upon the amount of local ice activity and the size of the floe. On Arlis III the maximum deviation from the original orientation over a period of 2 months was less than 10 degrees. On Arlis IV the total rotation amounted to 40 degrees and was 30 degrees in one 24-hour period. This rapid rotation occurred only after the floe had been reduced to a 1000-foot-square, when a nudge on one corner could produce a large shift with respect to the surrounding pack.



According to the hydromagnetic theory of geomagnetic micropulsations a single frequency pulsation at the geomagnetic latitude of Arlis IV should display near-circular counterclockwise polarization. The polarizations actually recorded varied from nearly circular to linear and were of both clockwise and counterclockwise rotation. Each of the four traces shown constitutes about 15 seconds of data.

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Note

The auroral and geomagnetic studies conducted on Arlis III and IV are part of ONR and the University of Alaska Geophysical Institute's contribution to the general IQSY scientific program. The author is currently engaged in geophysical studies in Antarctica.