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Deep Freeze: The United States, the international Geophysical Year, and the origins of Antarctica's Age of Science

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Book Review

DEEP FREEZE: THE UNITED STATES, THE INTERNATIONAL GEOPHYSICAL YEAR, AND THE ORIGINS OF ANTARCTICA'S AGE OF SCIENCE. By Dian Olson Belanger. Boulder, Colorado: University Press of Colorado, 2006. 494 pp. $29.95. ISBN 9780870818301.

This account of the U.S. IGY Program in Antarctica, by a professional historian, takes its title from the U.S. Navy Operation Deep Freeze that constructed and supported the scientific stations involved. The IGY ran from 1 July 1957 to 31 December 1958. Deep Freeze I covered the Antarctic summer of 1955–1956, DF II that of 1956–1957 (then the first IGY winter), DF III that of 1957–1958 (then the second IGY winter), and DF IV that of 1958–1959. Belanger's book covers an enormous amount of planning, adventure, and science, which I will introduce by abbreviating her chapter headings.

Following a foreword, a preface, a very clear map, an introduction, and a prologue (a good history of U.S. expeditions from Wilkes's in 1838–1842 to Operation Windmill in 1948), chapter 1 concentrates on the idea of the IGY; 2 on logistics; 3 on gaining a foothold at McMurdo Sound; 4 on the establishment of Little America; 5 on the struggle to Byrd Station; 6 on the airlift to the South Pole; 7 on the relatively outlying Ellsworth, Hallett, and Wilkes Stations; 8 on the participants and politics at the start of the IGY; 9 on the meteorological; 10 on the atmospheric physics; 11 on the glaciological programs; and 12 on the experience of life on the ice. An epilogue summarizes the achievements and looks forward.

The introduction, prologue, and chapter 1 review some key steps in the making of the IGY and the U.S. program: the precedents of the International Polar Years of 1882–1883 and 1932–1933; scientific developments during World War II; the initiatives of Lloyd Berkner and Sydney Chapman ca.1950; the politics, especially the U.S.A.–U.S.S.R. rivalry; the avoidance of potentially divisive subjects such as mineral exploration and financial cooperation (!); the use of unifying mechanisms such as World Days and World Data Centers; the role of the National Academy of Sciences and then the National Science Foundation; and the indispensable logistical role of the Navy, especially its construction battalions (Seabees) and of Air Force cargo planes and Army Transportation Corps experts out of Greenland.

DF I began the awesome task of establishing seven new stations in a land where "every thing would have to be hauled in" and then delivered to the right place. The shopping list included food, clothing shelter, …generators, washing machines, medicines, liquor, and movie projectors. Three icebreakers and several cargo ships were assembled. Air Development Squadron 6 was formed, chiefly with Dakotas, Neptunes, Skymasters, and Globemasters. All the wintering men (one African American but no women yet) were volunteers, in large numbers. A reconnaissance in 1954 had confirmed that (Amundsen and) Byrd's Little America area could not provide a base for the wheeled Globemasters to airdrop the material for the Pole Station, so that Scott's and Shackleton's old departure point at McMurdo Sound (with its sea ice) became the logistical headquarters. From the edge of the sea ice to the new McMurdo base was 45 miles, and getting there was an epic effort that cost the crash of an Otter aircraft and the loss of a 35 ton D-8 tractor and its driver. But McMurdo was established by 9 March 1956, with 28 buildings and 93 inhabitants. The winter that followed was one of desperately hard work in temperatures of −60 °F and below, building a runway for the Globemasters that arrived in October, and packaging 500 tons of supplies for their airdrop at the Pole. Three aviators were lost at this stage.

Although Little America could not be the starting point for the airlift to the Pole, it did become both the main scientific base and the starting point for the oversnow advance eastward to establish Byrd Station in the interior of West Antarctica. Supplies were unloaded onto the sea ice (which later broke up) of Kainan Bay, then ferried via a fortuitous snow ramp to the surface (elevation ca. 30 m) of the floating Ross Ice Shelf, then taken south, 4 miles further "inland," to establish Little America. Hope that this would not be carried seaward on a bigger-than-4-mile iceberg was presumably encouraged by the still-visible remains of one of Byrd's previous Little America stations. While the new station was being built, an overland reconnaissance was launched, guided by an Otter overhead, toward the projected Byrd Station. The reconnaissance turned into an epic, but three D-8s began to move fuel towards Byrd. Again one was lost, with its driver, this time to one of many crevasses. Little America had been built, and 73 wintered over there (only 2 civilians at this stage); but there was real uncertainty about the prospects of reaching and building Byrd, 650 miles away, in time for the start of the IGY in July 1957.

DF II, in the summer of 1956–1957, was the biggest logistically, with 12 ships and 3400 men. With McMurdo and Little America as bases, DF II's chief job was to complete the Byrd mission and to establish the other scientific stations of South Pole, Ellsworth, Hallett, and Wilkes. On Byrd, following reconnaissances in Dakotas, Otters, and helicopters, 6 Army and 5 Navy men with 2 D-8s, 2 Weasels, 1 Sno-cat, crevasse detectors, and some 2 or 3 tons of explosives threaded and blasted a more southerly route from Little America to the Rockefeller Plateau. Beyond a horrifying, 7 mile "Crevasse Junction," where the tractors were steered by reins, the going was rapid, and the Byrd locality reached on 18 December. A following "swing" by 18 Seabees and 6 D-8s, each with two 25 ton sleds, made up to 63 miles in 1 day. After a second swing, and 17 Globemaster flights, but with much equipment still missing, 11 Navy support personnel and 12 scientists settled in for the first winter of the IGY. At the Pole, the first landing there (by a Dakota) was made on 31 October (temperature −58 °F). Globemasters air-dropped 760 tons of supplies, and the station was constructed in only 45 days. The last three stations were on the coast, and penetrating the guarding sea ice was a race against time for the icebreakers and their cargo charges. Establishing Ellsworth involved even harder problems than had Little America: finding and reaching an accessible site, and the same slight worry that it might float out to sea. Hallett Station was the most scenic; built on a penguin rookery below such peaks as Mount Herschel. Wilkes was the only station built onto bedrock, but gave easy access to the East Antarctic ice sheet behind it. By early 1957, all was ready for the IGY.

Of the scientific programs, the meteorological was the biggest, and important for logistics, also. In 1958 there were 14 meteorologists at Little America "Weather Central." At other stations Navy aerologists were important. Cold, wind, and blowing snow made data difficult to gather, and radio blackouts

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at the different stations hindered its synthesis into maps. Atmospheric physics subjects included cosmic rays, the ionosphere and the aurora, all affected and linked by solar activity. The IGY had been timed to coincide with an 11 year sunspot maximum, but the Antarctic effort was perhaps overshadowed by the launch of the first satellites and the discovery of the Van Allen radiation belts. The glaciological (*sensu lato*) programs continued the physical challenge of the construction efforts: the digging of pits as deep as 36 m, then hand-augering to similar depths below that. The "traverses", with their seismic, gravity, and magnetic observations, were truly exploratory, reaching unknown mountains in the interior, and showing that the ice sheet was thousands of meters thick. Page 290 includes a very clear map of them.

I was enabled by DF III to spend the 1958 winter at Wilkes Station; as Belanger says, it was a relatively sunny locality. Her book has shown me how, with the station already established, we had a generally easier time of it than did the 1957 teams. However, occasional fires, and crevasses on our 400 mile traverse (missing on the p. 290 map but correct on, e.g., the American Geographical Society map of 1970) maintained the excitement. Small errors in the book are (1) the misspelling of our geomagnetician Sebastian Borrello and (2) the movement of the Vanderford Glacier was triangulated from the nearby Haupt Nunatak, not Site 1, which was a minor meteorological post some 8 km inland from Wilkes, on the 80 km route to Site 2, our inland station. All these localities are positioned and illustrated in the summary paper by Hollin and Cameron in the 1961 *Journal of Glaciology* (v. 3, p. 833–843). Detailed scientific results such as this are beyond the scope of Belanger's book, but many conceal much history.

In the summer of 1958–1959, with our aurora observer reduced or promoted to counting penguins (I recollect that he scored 200,000 Adélies), DF IV came to take us home. Compared with that of the "heroic age" of Scott and others, our food, clothing, and shelter had been excellent. Ham radio contacts, movies, alcohol, and religion had lightened the isolation, which was hardly worse than that of wars, jails, or boarding schools. Escaping bad situations "stateside," saving money, and interest in the job had all made for cheerfulness. Only one station in 1957 had suffered severe "personality" problems. Fascinating is how much younger our scientists and sailors were than many of the much more experienced (in the Arctic) U.S.S.R. workers. Important in this youthful world were the chief petty officers who kept the generators and radios running. Some star players who deserve a special mention were Admiral George Dufek, Chief Scientist Bert Crary, Crevasse Junction's Lt. Phil Smith, and stateside radio ham Jules Madey.

In her epilogue, Belanger describes the involved negotiations that led from the IGY to the Antarctic Treaty of 1959, with science largely evading or outflanking politics: "the IGY in Antarctica never ended." With the treaty came visiting "inspectors" (welcome stimuli!), women, environmental concerns, tourism, snowmobiles ("tin dogs"), and the Hercules and other aircraft that changed logistics. The book closes with a formidable 50 pages of "notes" or references for each chapter, with a wide range that compels admiration: many of them to governmental records would take an amateur days, weeks, or forever to track down. Similarly, 20 pages of "notes on sources" cover the almost innumerable books and monographs on individual parts of our subject. Belanger's lively book is the best that I have encountered on the whole subject of its title. It is not an adventure book for everybody but, as one who was involved, I found it enormously educational and fascinating, and am recommending it to the diminishing band of survivors that I know. And the book should retain its interest for new international expeditions, in particular for the International Polar Year just beginning, 50 years after the IGY.

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