

With the Soviets in Antarctica, 1972-1974

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The Soviet Union has supported an ever-growing antarctic program each year since the International Geophysical Year (1957-1958). About 430 persons participated in the 18th Soviet Antarctic Expedition (SAE) during 1972-1973, of which 240 spent the 1973 austral winter. Six stations are occupied year-round (figure 1). At Molodezhnaya, the largest of these, 94 persons wintered in 1973. A field camp at the edge of the Amery Ice Shelf on Sandefjord Bay

(69°42'S. 73°42'E.) was operated for three austral summers (1972 through 1974). Each summer about a hundred persons were involved in geological, geophysical, and geodetic projects in the Amery Ice Shelf region.

In the spirit of Article 3 of the Antarctic Treaty, the Soviet Union and the United States traditionally exchange scientists each year to winter at a station supported by the other country. The experiences of recent U.S. participants in this exchange are described in MacNamara (1969), Maish (1970), and Vane (1973). I was the 16th U.S. citizen to participate in this exchange, and the first U.S. geologist to join a Soviet field party in the Antarctic.

My program with the SAE was a petrologic study of Precambrian metamorphic rocks of the east antarctic shield. I hoped to visit as many areas as possi-

Dr. Grew was U.S. exchange scientist with the 18th Soviet Antarctic Expedition. The March/April 1975 issue of *Antarctic Journal* will include a report by meteorologist L. A. Zhdanov, U.S.S.R. exchange scientist at McMurdo Station during 1973-1974.

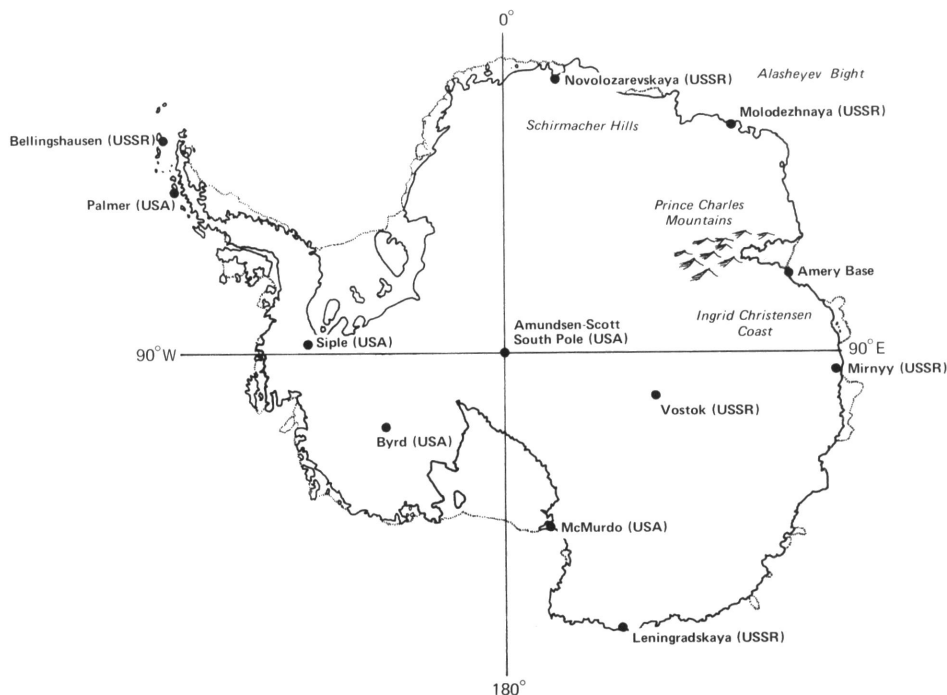


Figure 1. U.S. and U.S.S.R. antarctic stations, including field locations visited.



Figure 2. Professor Zubov moored to an iceberg near Molodezhnaya Station, December 1972.

ble to collect samples for later petrologic work and to obtain structural and stratigraphic information needed to interpret the metamorphism. The Soviets made every effort to help me realize these hopes; their efforts were successful. I was able to do large-scale mapping around Molodezhnaya, where I spent the winter, and around Novolazarevskaya, as well as spend two summers in the Amery Ice Shelf region.

Southward bound

The 18th SAE began in early November 1972 with the Leningrad departure of the scientific research vessel (NIS) *Professor Zubov*. The *Zubov*, designed for polar oceanographic work, is one of several ships leased to the SAE to supply antarctic stations and to transport antarctic personnel. Other ships leased for this purpose in 1972-1973 were two diesel-electric (d/e) ships of the icebreaker class, *Ob* and *Navarin*, both antarctic veterans; a tanker also called at Molodezhnaya to replenish fuel supplies.

I boarded *Zubov* in Montevideo, Uruguay, on November 28, thereby becoming a full-fledged member of the 18th SAE. The *Zubov's* first port-of-call was Bellingshausen Station on King George (Waterloo) Island (figure 1), where it remained 3 days (December 10 to 12). I was shown volcanic rocks exposed near the station, samples of which have been given to N. E. LeMasurier, University of Colorado, Denver. Upon reaching heavy sea ice near Molodezhnaya, the second call, *Zubov* was moored to an iceberg on December 24 and 25 (figure 2). The winterers, including myself, were ferried by helicopter to the station 200 kilometers away. From there I was transferred to *Navarin*, moored to fast ice 80 kilometers from Molodezhnaya. *Navarin* departed for Sandefjord Bay on December 28, arriving January 2, 1973. Fast ice prevented the ship from approaching Amery Base closer than about 30 to 50 kilometers. Cargo was flown from the ship to the camp by helicopter and by small plane (figure 3). The ice, up to a meter thick, was rotten and, especially when a swell came in, tended to break up around the ship. The ship consequently was forced



Figure 3. Assembling an AN-2 on fast ice during unloading of *Navarin* near Amery Base, January 1973.

to move several times to a new location in order to resume unloading. The thousand or so metric tons of cargo for the field camp, including 800 metric tons of fuel, nonetheless was unloaded in 9 days.

Most of those planning to winter at Molodezhnaya sailed on either *Zubov* or *Ob*, the latter arriving in mid-January. A few were flown to Perth, Australia, and arrived in March when *Zubov* made a second call at the station. Much of the Molodezhnaya cargo was aboard *Navarin*, which returned to the station in late March. *Navarin*, leading the tanker, broke a channel through fast ice to a point a few hundred meters from the ice barrier and less than 2 kilometers from the station. While fuel was pumped from the tanker into storage tanks, *Navarin* was unloaded in a round-the-clock operation that involved many station personnel.

Summer activity in the Amery Ice Shelf region

Amery Base was located between two islands along the ice barrier in Sandefjord Bay. Field operations began in early January in both 1973 and 1974. The camp was temporarily closed for the season on March 4, 1973, and permanently on February 25, 1974, when all structures were dismantled and removed. One "РДКО" hut was left on the island just south of the camp for future emergency use. The ice in Sandefjord Bay went out both years before February 16th; therefore the ships could be moored and loaded at the ice barrier.

People at the base lived in РДКО huts and in KAPSh tents (figure 4); roughly 25 to 30 of these structures were erected. The huts were rapidly assembled by clamping together plywood panels containing

about 7 to 8 centimeters of styrofoam insulation. The tents come in two sizes: one a hemisphere with a radius of about 2 meters, the other oval in cross section and about 2 by 5 meters at the base. The tent is assembled by draping a windproof canvas exterior over an aluminum pole frame, then attaching a canvas floor and cloth liner inside the frame. KAPSh tents have been used in Soviet antarctic field operations for many years; the PDKO huts also are used at permanent stations.

Field operations, under the direction of D. S. Soloviev, involved the following parties (and numbers of persons): geology (5), geophysics (10 to 20), radar ice sounding (3), geodesy (13). These parties were supported by 30 to 33 aviators, two cooks, a meteorologist (1974 only), a doctor, and several mechanics-drivers and radio operators. Scientific personnel represented several organizations (mostly the Arctic and Antarctic Scientific Research Institute, Leningrad, and Sevmorgeo, a new organization that has absorbed the former Scientific Research Institute of the Geology of the Arctic, Leningrad). The 1974 geology party was joined by a specialist (German Democratic Republic) in structural and petrofabric analysis and by a biologist (Poland) collecting samples for micropaleontological work. Aircraft at Amery Base included two IL-14 two-engine airplanes, an AN-2 single-engine biplane, two of the large MI-8 helicopters, and, in 1973, one of the small MI-2 heli-

copters. Principal programs were deep seismic sounding across the Amery Ice Shelf, aerial photography and topographic mapping, magnetic and gravimetric surveys, airborne radar ice thickness measurements, and geology. The work was carried out in MacRobertson Land and along the Ingrid Christensen Coast. Some aeromagnetic and ice thickness work also was done along a coastal strip between Molodezhnaya and Mirnyy stations. Many of the programs required outlying field camps (supplied by the AN-2 and the MI-8) in the interior up to 600 kilometers from the camp.

Much of the geological research involved a detailed examination of exposures accessible by foot from outlying field camps (figure 5); exposures up to 15 kilometers across the regional strike were examined. Eight of these exposures were examined in 1973-1974 (seven by myself): six in the southern Prince Charles Mountains (figure 6) and two on the Ingrid Christensen Coast. The balance of the field work was done by reconnaissance from aboard one of the helicopters or the biplane, and generally in conjunction with geophysicists who took magnetic and gravity measurements at each stop. Fifty or more localities were reconnoitered by Soviet geologists in these two seasons; I visited or was given samples from 36 of these localities.

Soviet geologists invited an Australian team, also working in the southern Prince Charles Mountains,

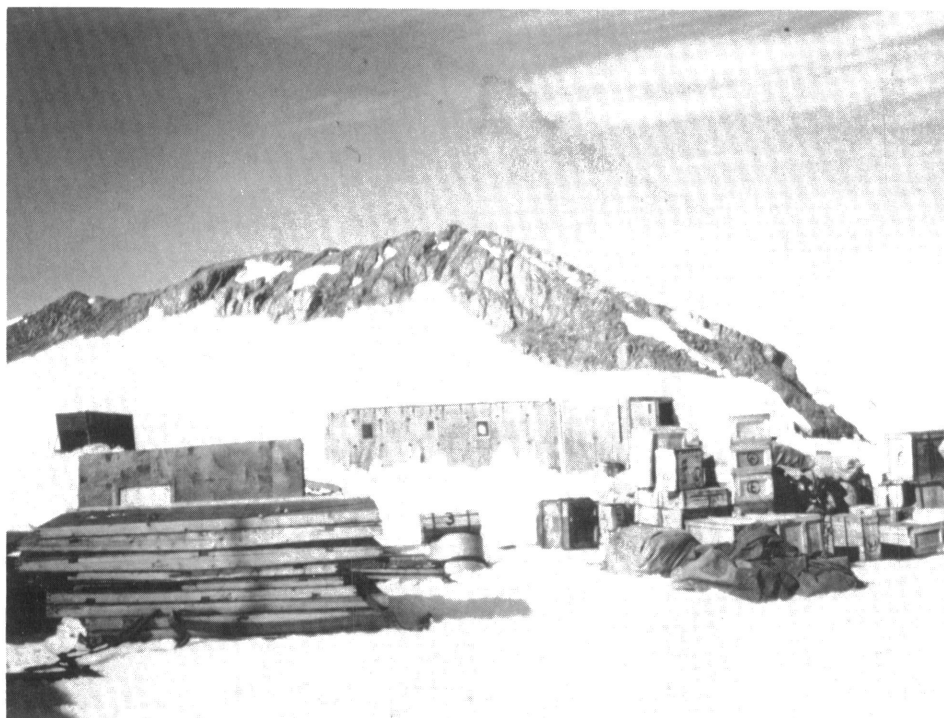


Figure 4. Two assembled "PDKO" huts and unassembled panel sections at Amery Base. Unnamed island and Sandefjord Bay are in background.

to compare results at the McCauley field camp (January 1973). Twelve guests arrived in three Jayrow helicopters. I also had the opportunity to spend a day on Mount Stinear with the Australian geologist R. J. Tingey.

The weather in southern Prince Charles Mountains in January and early February was suitable for field work and flying nearly every day. Coastal storms rarely penetrated the mountains at this time of the year, although storms hampered flights from the base to the interior. Temperatures in the mountains ranged from $+3.5^{\circ}$ to -17.5°C .; winds were from 0 to 10 meters per second, rarely exceeding 20 meters per second. The weather in mid-February deteriorated rapidly, however; the mountains were seized by plunging temperatures and increasing winds, while the coast was battered by storms of increasing frequency and severity.

Activities at Molodezhnaya

I returned to Molodezhnaya on February 26 aboard an IL-14 and remained there until December 14. The station, SAE headquarters, was named in honor of the young persons who were so active in its early construction (*molodezh* = young people). Molodezhnaya has grown remarkably in the last few years. The station consists of about 60 structures in an area exceeding a square kilometer. More than half

of the major structures were erected from the 14th SAE through the 17th SAE (1969 through 1972), including several dormitories, combination living and working quarters for geophysicists, computer center, polyclinic, warehouses, bath and laundry building (figure 7), garage, aerology pavilion, and living and working quarters for radio operators. Newer buildings are built of metal and are raised on stilts to reduce snow drifting.

Those spending the 1973 winter at Molodezhnaya included: chief of the station and of the 18th SAE, P. K. Senko; three administrators, three cooks, and bath and laundry attendant; two doctors; 30 (including a Mongolian exchange scientist) in meteorology and related activities; 11 in geophysics; 12 in aviation; 18 in radio; six at the diesel-electric station; six mechanics-drivers. Year-round meteorology programs included standard weather observations every 3 hours, aerological balloon launches twice daily with data reception on a Meteorit-2 station installed in 1973, actinometry, radar tracking of meteor trails, preparation of synoptic maps twice daily using satellite photographs, and rocket sounding of the atmosphere. About 60 rocket launches were made in 1973; 70 or more are scheduled for 1974. In addition to standard temperature, pressure, chemistry, and wind speed (determined by capsule drift and by drift of an artificial cloud) measurements, corpuscular flux intensities were measured with a Geiger counter in the head capsule of the M-100 rocket (1973 only). A Minsk-32 computer was put into operation in 1973



Figure 5. "KAPSh" tent at the geology field camp in southern Prince Charles Mountains.



Figure 6. View of Cumpston Massif from Mount Maguire, southern Prince Charles Mountains.

and meteorological data from all Soviet stations were processed; processing of actinometric and aerologic data was scheduled for 1974. Satellite photographs also were used to map sea ice conditions as a ship navigational aid. A study of radioactive elements in the atmosphere was being made in cooperation with French researchers. Year-round geophysics programs included studies of radio wave propagation, inclined and vertical sounding of the ionosphere, riometry, geomagnetism, short-period fluctuations of the magnetic field (1973 only), and aurora studies, both with radar and visual (all-sky photography and intensity). A 60-meter antenna mast for inclined sounding was erected in 1973. A study of crevasse detection by radar sounding and polarization of radio waves in ice was made in 1973. The doctors periodically examined all station personnel, planned the menus, inspected the food, and collected sputum samples for immunization studies. During the 1974 summer, Polish biologists collected marine fauna in Alasheyev Bight for protein studies.

Geological field work around the station was possible from September through April. Most of the exposures along Alasheyev Bight were accessible by foot. More distant outcrops were reached in day trips using a cross-country vehicle, by staying for a week

in a PDKO hut 13 kilometers from the station, and by joining other groups who were working on or near outcrops. About 20 square kilometers of ice-free area were mapped along the coast between $45^{\circ} 25' \text{E}$. and $46^{\circ} 20' \text{E}$. Three Soviet topographic maps were available: 1:10,000 (1967), 1:50,000 (1972), and 1:200,000 (1967). The winter months (May through August) were spent preparing and examining thin sections; I succeeded in making 35. The German Democratic Republic's pavilion, where E. E. Mac-Namara lived in 1967, served as my laboratory. Equipment needed for this work was brought from the United States: a petrographic microscope, Buehler trim saw and polisher/grinder, transparent epoxy cement, and many accessories.

The winter at Molodezhnaya

Life at Molodezhnaya has all the comforts of a modern antarctic facility. Each of the major buildings has running water (from a storage tank) and decent toilet facilities. Water is pumped directly from Lagernoe Lake to the bath and laundry building and is distributed to storage tanks by truck. Indoor areas were maintained at comfortable temperatures

(around 20°C.) by electric radiators. The station is equipped with a telephone network and public address system, the latter used for music and news broadcasts and for announcements. Saturday is a special day at the station: the sauna is in full operation (a tub bath or shower with hot water could be taken on any day). Bundles of leafy birch twigs are brought to Antarctica especially for body swat massages while steaming in the sauna.

Meals at the station were wholesome, well prepared, and hearty. Ingredients generally were natural: potatoes, onions, and cereal grains were kept for the entire year. Fresh bread, *kasha* (porridge), *tvorog* (pot cheese), marinated herring, caviar, bliny, *kholodets* (meat with aspic), and soups were among my favorites. A wide variety of soups, all made from scratch, were served at the midday meal: *shchi* (cabbage), *borshch*, chicken, mushroom, pea, fish, *rassolnik* (meat, pickle, and vegetable). As the chief cook was a pastry specialist, we were occasionally treated to cookies, cakes, and other pastries.

Expedition members were expected to do their fair share of the chores: setting tables, washing dishes, washing the mess hall and game room floors, cleaning common areas in dormitories, seeing that water tanks were full and sewage disposed of, transferring food from the warehouses to the mess hall, and unloading cargo from ships.

For diversion there were movies every evening, a game room with billiards, ping-pong, dominoes, *nardy*, and *shish-bess* (games of Caucasian or Central Asian origin), and a reading room, which also serves as a quiet place for chess and checker games. Each expedition brings a fresh supply of journals and newspapers for the reading room. A small library is in a separate room. Scientists occasionally gave talks on their research programs.

Visit to Novolazarevskaya

I had an opportunity to spend 2 weeks (December 14 to 28, 1973) at Novolazarevskaya Station, flying there and back aboard an IL-14. At Novolazarevskaya I stayed in Gregg Vane's seismology pavilion. Using the newly published 1:25,000 topographic sheet (1972), I mapped roughly 6 square kilometers of the eastern tip of Schirmacher Hills. I also was driven to a nunatak 15 kilometers southwest of the station. In contrast to the Molodezhnaya area, where snow cover still was considerable and most lakes remained frozen both summers, at Novolazarevskaya relatively little snow remained and several lakes were ice-free in December.



Figure 7. Molodezhnaya Station. The bath and laundry building and aerology pavilion (with cupola for antenna) are in the foreground.

Geology of areas visited

I studied four areas while in Antarctica: Alasheyev Bight, Schirmacher Hills (70°45'S. 11°50'E.), Ingrid Christensen Coast (72°30'E. to 78°30'E.), and the southern Prince Charles Mountains (73° to 74°30'S., 60° to 70°E.). The three coastal areas are underlain by granulite facies metamorphic rocks, including charnockitic granite gneiss, pyroxene and amphibole gneisses, and subordinate marble, calciphyre, ultramafic rocks, and rocks with cordierite and sillimanite. The metamorphic rocks are cut by pegmatite, granite, mylonite, and dolerite. Rocks exposed along Alasheyev Bight and in the Schirmacher Hills have been affected by later metamorphic events of lower grade. The southern Prince Charles Mountains, by contrast, are underlain by at least two distinct series of metamorphic rocks: (1) a basement complex consisting of pink granite gneiss and subordinate quartzofeldspathic gneisses, and (2) younger sedimentary and volcanic rocks metamorphosed under conditions of the amphibolite and greenschist facies. Included are quartzite, marble, calciphyre, conglomerate, mica schist, amphibole schist, and iron formation. Binary granite and pegmatite, hypabyssal mafic rocks, and amphibolite intrude the younger rocks; the last also intrudes the basement complex.

I collected samples for petrologic study and for radiometric age work, and for a chemical study of metamorphosed igneous rocks by Fred Barker, U.S. Geological Survey, Denver. Samples of greenschist facies metasedimentary rocks were submitted to L. R. Wilson, University of Oklahoma, Norman, to search for microfossils.

Transition between the 18th and 19th SAEs

The Leningrad departure of NIS *Professor Vize*, on October 11, 1973, heralded the end of the 18th SAE's long winter sojourn. This event soon was followed by the departures of d/e *Olenek*, *Vasily Fedoseyev*, and refrigerated vessel *Nina Sagaydak*. Winter isolation at Molodezhnaya ended December 7, 1973, with the arrival—hailed by rocket flares—of an MI-8 from *Olenek* (moored 60 kilometers distant). Finishing at Molodezhnaya, *Olenek* proceeded to Sandefjord Bay, where unloading for Amery Base was completed before the New Year.

I flew to Amery Base from Molodezhnaya on January 3, 1974, aboard an MI-8, returning by IL-14 on February 20. Alasheyev Bight was ice-free by this time; the fast ice had gone out completely on February 6, the first time in 3 years. This was fortunate since the ships could moor at the ice barrier 1.5 kilometers from the mess hall. In the meantime, most of the 19th SAE winterers were southbound aboard the passenger motorship *Bashkiria*, which normally plies the Black and Mediterranean seas. *Bashkiria* called at Mirnyy, Amery Base, and Molodezhnaya, taking on most of the 18th SAE wintering personnel. After getting freshwater at a lake near Molodezhnaya, *Bashkiria* left Antarctica on March 7, arriving in Las Palmas, Canary Islands, March 31.

My participation in the SAE ended on April 2 with a touching farewell on the pier as *Bashkiria* departed from Las Palmas. It was a fitting tribute to the mutual friendship and goodwill that existed during my stay with the Soviets in Antarctica. I am grateful to expedition members who so generously helped me carry out my program, both in the field and at Molodezhnaya, and without whose help my work would have been impossible to complete. Especial thanks are due to Yu. M. Zusman, chief of Novolazarevskaya Station, to D. S. Soloviev and P. K. Senko, who provided logistics support for my field work, and to B. G. Lopatin and L. V. Fedorov, chiefs of the geological parties, for their cooperation and assistance. The hospitality and generosity of the Soviet *polyarniki* ("polar men") made my stay in Antarctica memorable, enjoyable, and fruitful.

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