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27th Polish Antarctic Expedition to *Arctowski* Station (King George Island, Antarctica), 2002/2003

Fig. 1. View of Ezcurra Inlet and Dufayel Island from Panorama Ridge. *Photograph by W. Majewski.*

King George Island is located in the middle of the South Shetlands arc. It is heavily glaciated. Its bedrock consists of several tectonic blocks bounded by longitudinal faults. Island-arc extrusive and intrusive volcanics of Cretaceous to Miocene age dominate; however, fossiliferous Oligocene–Miocene glacio-marine and terrestrial deposits also occur (see Birkenmajer 2001, 2003; Gaździcki 1987, 1996). The island's spectacular and diverse coastal and submarine morphology (Fig. 1) resulted from glacial erosion mainly during the Pleistocene (Birkenmajer and Marsz 1999).

Arctowski Station is located on western shore of fjord-like Admiralty Bay, which is the largest bay of King George Island (Fig. 2). From a biological and ecological researchers' perspective, this location is extremely convenient. It provides easy access to a wide variety of marine and terrestrial living resources within the bay and coastal glacier-free oases which surround the station (see Rakusa-Suszczewski 1993). This area's spectacular wild-life, climate, and geology has provided an unusual wealth of research

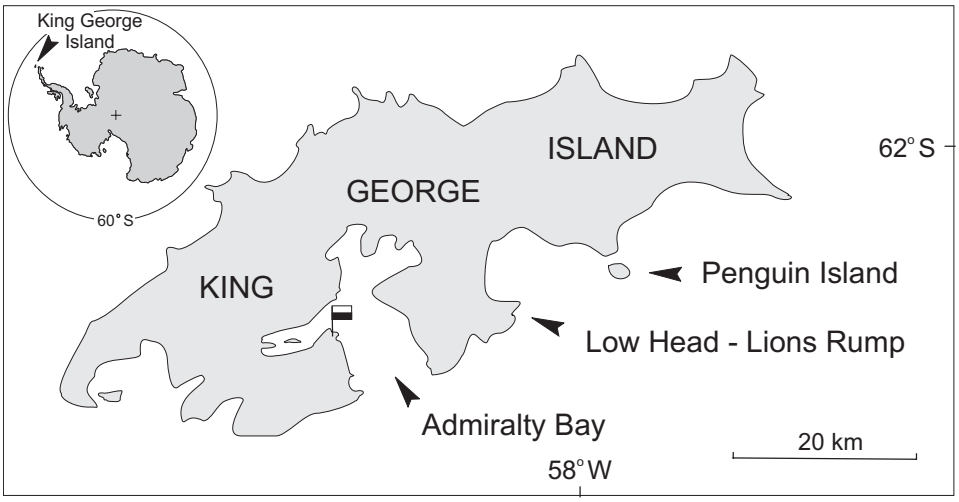

Fig. 2. Map showing location of research areas. Flag shows position of *Arctowski* Station.

problems for several generations of Polish Earth scientists since the austral summer of 1976/1977, when *Arctowski* Station was commissioned (Rakusa-Suszczewski 1993).

27th Expedition

The 27th Polish Antarctic Expedition was organized by the Department of Antarctic Biology, Polish Academy of Sciences. It departed from Gdynia onboard M/S *Polar Pioneer* on October 1st of 2002. The expedition reached *Arctowski* Station in Admiralty Bay via Buenos Aires on November 11th of 2002. The wintering party left Admiralty Bay on November 20th, and returned to Poland on November 30th of 2003. It included Dr Wojciech Majewski (expedition leader, geologist), Andrzej Przybycin M.Sc. (wintering technical coordinator, geologist), Anna Delimat M.Sc. (botanist), Dr Mikołaj Golachowski (zoologist), Ruslan Shabovych (physician, Ukraine), and 7 members of technical support group: Aleksander Karp, Tomasz Koterski, Krzysztof Pekowski, Józef Piwowar, Waldemar Roszczyk, Bohdan Sobiewski, and Andrzej Wyraz (Fig. 3). Summer party members were: Prof. Andrzej Gaździcki, Doc. Krzysztof Krajewski, Doc. Andrzej Solecki, and Doc. Andrzej Tatur (all geologists), as well as Jarosław Roszczyk (summer technical coordinator), and Antoni Skorupa (technical support).

Principal goals of our expedition were to carry out a variety of research projects and to sustain Polish presence in Admiralty Bay. Keeping in mind hardships of Antarctic environment these two were not always easy tasks to accomplish. One of the *Arctowski* Station priorities is providing an opportunity for contacts between scientists from different nations. During the austral season of 2002/2003, *Arctowski* Station hosted researchers from Bolivia, Brazil, Czech Republic, Germany, Hungary, Korea, Peru, Russia, and Ukraine. Our scientists were in daily contact with US ornithologists from *Pieter Lenie* Station. During the summer season, 12 tourist vessels anchored in

Fig. 3. Members of the wintering party. *Photograph by M. Golachowski.*

Arctowski Cove. They brought onshore a total of 1879 tourists, who could enjoy *Arctowski* Station hospitality and the scenic beauty of its surroundings.

Scientific activities

Scientific interest of the summer party centered on geological problems. Their activities were a continuation and diversification of intense geological and paleontological exploration of King George Island, which started with the beginning of Polish presence at *Arctowski* Station (Birkenmajer 2001; Gaździcki 1987, 1996). On the other hand, wintering scientists focused mainly on biological topics. In part, the two fields of research were brought together by late Quaternary climatic investigations led by A. Tatur.

Tertiary geology and paleontology of King George Island

A. Gaździcki and K. Krajewski explored Oligocene fossiliferous deposits at two locations. They investigated glacio-marine Oligocene sediments of the Polonez Cove Formation at Low Head – Lions Rump (Fig. 4), where previous lithological descriptions were verified and facies analysis was conducted. Large collections of brachio-

Fig. 4. Polonez Cove and Chopin Ridge as seen from Low Head. Prominent cliffs in the lower part of slope are formed by the Oligocene Polonez Cove Formation. *Photograph by A. Gaździcki.*

pods and other invertebrates, as well as stromatolithic structures were made. Special attention was given to early-diagenetic processes. At Point Hennequin, late Oligocene interglacial fresh-water deposits of the Mount Wawel Formation revealed well preserved algal structures and meadow-ore horizons.

A. Gaździcki, K. Krajewski, A. Przybycin, A. Solecki, and A. Tatur documented fossil moraine within the volcanic Point Thomas Formation, which with its postulated Early Oligocene age, belongs to one of the oldest terrestrial records of West Antarctic glacial history.

Quaternary climatic history of Penguin Island and Admiralty Bay

A. Tatur's team took several bottom-sediment cores for paleolimnological, geochemical, and lithological studies from Petrel Lake crater on Penguin Island offshore from King George Island. Physicochemical parameters of lake-water were recorded. Geological and geomorphological studies of the surrounding area were conducted in order to unravel the lake's history and evolution. Field counts of sediment lamination suggest an age for the Petrel Lake of 450 to 600 years.

Seventeen short sea-floor sediment cores were taken throughout Admiralty Bay to assess modern deglaciation rates. Special emphasis was concentrated on areas of recent glacier retreat, when good records of biotic colonization are present. All cores are currently undergoing micropaleontological and geochemical investigations. Prelimi-

nary studies suggest the presence of cyclic variation in foraminiferal and ostracode abundances and diversities.

Isotope geochemistry of the Admiralty Bay area

A. Solecki conducted a series of GR-320 gamma-specrometer measurements in the vicinity of the station, Herve Cove, Cytadela, Dufayel Island, Barrel Point, and Keller Peninsula. It was possible to determine concentrations of K, U, and Th in the upper 30 cm layer of rocks. Apparently, most of the investigated material contains low amounts of radio-nuclides, which is characteristic for oceanic-crust rocks. Proportions of radio-nuclides investigated were similar throughout with exception of Dufayel Island (K-enrichment) and Keller Peninsula (eTh-enrichment), which is probably due to chemical migrations through tectonically-fractured zones. In the surroundings of major penguin rookeries, no ornithogenic K-enrichment was detected.

Benthic foraminiferal ecology, Admiralty Bay

W. Majewski collected short (15 cm) undisturbed sediment cores at 38 locations, distributed throughout Admiralty Bay. Their water-depths ranged from 8 to 520 m. At each location, sediment-surface chlorophyll content was measured and standard granulometric analysis of sediment was conducted. The goal was to document modern distribution of living (Rose Bengal stained) foraminifera throughout Admiralty Bay and their vertical distribution within sediment. Only 12 out of 379 sub-samples revealed no specimens. So far, more than 80 species of foraminifera are recognized; however, number of species described at particular locations seldom exceeds 20. This large spatial variability gives promise for the use of benthic foraminifera as paleoenvironmental indicators in local and regional shallow- to intermediate-water Quaternary marine research. Moreover, almost 70 specimens of living foraminifera were fixed for future DNA taxonomic studies.

Behavioral ecology of pinnipeds, Admiralty Bay

In the Admiralty Bay area and Penguin Island, M. Golachowski collected hair samples of 52 sea elephant pups born in the 2002/2003 season for DNA analyses. These will address parental relations within sea elephant populations. In addition, fur seal excrements were collected for diet studies.

Greenhouse experiments on plant physiology

During the expedition, A. Delimat conducted greenhouse vegetable cultivation on local soils. She used guano-rich soil from abandoned penguin rookery mixed in various proportions with mineral soil. It was apparent that during winter plant growth-rates depend on natural-light intensity. Thanks to this experiment success, all members of

our expedition could enjoy fresh tomato, cucumbers, and radish, so precious during Antarctic winter isolation.

Moreover, 93 samples of soil, plants, and fresh water were collected for biodiversity assessment of sub-Antarctic ice-free coastal oases. Sea-water samples were collected for comparative seasonal studies of marine phyto- and zoo-plankton. Similar sampling was previously conducted between February 1990 and January 1991 (Wasik and Mikołajczyk, 1994).

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