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The Postglacial Lakes in the Admiralty Bay Catchment (King George Island, West Antarctica) – Morphometric and Physicochemical Characteristics

Joanna PLENZLER✉ and Kornelia WÓJCIK-DŁUGOBORSKA

Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Warszawa, Poland

✉ joannapl@ibb.waw.pl

The objective of the presented research was to gather reliable data on the bathymetry and physicochemical properties of water of lakes situated on King George Island in West Antarctica. The area that was examined in particular was the unglaciated portion of the Admiralty Bay catchment, which is situated in the central region of the island.

Since the 1950s, the climate of this region of Antarctica has been deliberately warmed (Bello et al. 2022; Dalaiden et al. 2022). For example, the annual mean surface air temperature at H. Arctowski Polish Antarctic Station for the period 1977–1999 was –1.7 °C, while for the period 2013–2021 it was –1.2 °C (Marsz and Styszyńska 2000; Plenzler et al. 2023). One consequence of the warming trend is the retreat of glaciers, with some glaciers retreating up to 1000 metres (Dziembowski and Bialik 2022). As glaciers retreat, they create new lagoons and terrain. For instance, between 1979 and 2018, land-terminating glaciers at the western shore of Admiralty Bay resulted in the formation of 2.7 km² of new terrain (Pudełko et al. 2018). The formation of lakes is a characteristic feature of the post-glacial landscape. Using satellite data, Petsch et al. (2022) found that the number of lakes at King George Island increased from 90 in 1986 to 169 in 2020. In geological terms, the glacial forefield landscape is relatively young and dynamic, meaning that the lakes may undergo changes in shape or depth, therefore it is imperative to conduct comprehensive documentation of the current state, that in the future will allow to examine the speed of environmental changes.

During the 2025 Antarctic summer, bathymetric surveys and measurements of surface water temperature, pH and specific conductivity were carried out at 46 lakes located in the Admiralty Bay catchment. The measurements were conducted using a sonic depth finder equipped with a global positioning system (GPS), installed on a small inflatable boat propelled by an oar. Water temperature, pH and specific conductivity were measured with the use of YSI 1030 probe.

The lakes that were measured during fieldworks represent variability in terms of age, water supply source, dimensions, location, and geological composition of the bedrock. The youngest,

like lakes at the forefields of Baranowski, Dobrowolski, and Windy glaciers were formed during the last decade (Pudełko et al. 2018; Petsch et al. 2022; personal observation). They are situated at the terrain close to the sea level up to 220 m a.s.l. They are relatively small, with the largest being Ginger Lake and the lake in the front of Vieville glacier – according to preliminary calculations they both have an area of approx. 4.5 ha. The smallest lakes were approx. 0.01 ha. The Ginger Lake is also the deepest one – with maximum measured depth of 10 m. The range of surface water temperature was in the range from 0.3 °C to 10.2 °C. Surface water conductivity was from 17.6 to17434 μS/cm and pH was from 5.3 to 11.1. The majority of the lakes are supplied by glacial and snow meltwater, either directly or via streams that flow from the glacier. However, some are supplied only by melting snow or streams that originate from non-glaciated areas or by sea water intrusions.

The results of the research will be used to develop a scientific study aimed at analysing the variability of the hydrochemical and morphological characteristics of the lakes in Antarctica using both in situ and remote sensing methods. Moreover they may be also useful for various geomorphological and ecological studies as they provide insight into the habitat conditions within the lakes.

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