Antarctic Science (2025), 1–4
doi:10.1017/S095410202400049X

CAMBRIDGE UNIVERSITY PRESS

Perspective

Rock cairn and items from 'Operation Windmill' (January 1948) rediscovered in Bunger Hills, East Antarctica

Damian B. Gore[1], Sonja Berg[2], Amber E. Howard[3] and Marie Weber[4]

[1]School of Natural Sciences, Macquarie University, Sydney, NSW, Australia; [2]Institute of Geology and Mineralogy, University of Cologne, Cologne, Germany; [3]Centre for Applied Water Science, University of Canberra, Canberra, ACT, Australia and [4]Faculty of Environmental Sciences, Institute of Planetary Geodesy, Technische Universität Dresden, Dresden, Germany

Abstract

A rock cairn, with two matchbooks buried beneath, was found on the summit of the highest hill on Thomas Island, Bunger Hills, East Antarctica. The matchbooks are most likely from United States World War II-era ration packs, which were distributed to various military and civilian expeditions from the mid-1940s into the 1950s. Bunger Hills was first visited by United States Navy 'Operation Highjump' in February 1947, when a seaplane most likely landed on a marine inlet, rather than a lake as reported previously. Thomas Island was first visited by United States Navy 'Operation Windmill' in January 1948, when a survey point was established, and it is probably this location that is marked by the rock cairn. The matchbooks were replaced beneath the cairn and the rocks replaced. Just over 76 years had elapsed between burial of the matchbooks, construction of the cairn and their rediscovery.

Key words: historical site, matchbook, United States Navy

(Received 12 April 2024; accepted 4 November 2024)

Introduction

Sometimes, to be in Antarctica is to discover the unexpected. A rock cairn with artefacts has been found on Thomas Island, Bunger Hills, East Antarctica (Fig. 1). Our knowledge of exploratory and scientific visitation to Thomas Island is scant (Table I). The region was first visited and photographed by aircraft from United States Navy 'Operation Highjump' in February 1947, with a Martin PBM Mariner seaplane landing on an 'unfrozen colored lake' (Byrd 1947, p. 437; colour plate VIII, p. 452; p. 475; p. 516; Apfel 1948). The location of this lake landing is unknown, and field observations are consistent with the landing instead taking place on one of the large marine inlets that are confined from the open ocean by Shackleton Ice Shelf. Byrd (1947) commented that there are 'three open-water lakes' - each large enough to provide a 'smooth three-mile take-off' (Byrd 1947, p. 498), and that the water was two-thirds as salty as sea water (p. 499). An image of the aircraft on the water also shows icebergs (p. 499). These descriptions are inconsistent with any of the southern Bunger Hills lakes, so the aircraft and crew most probably landed on Cacapon Inlet or Edisto Channel, located either side of Thomas Island (Fig. 1). The region was subsequently named Bunger Hills after Lieutenant Commander David E. Bunger, commander of this first aircraft to have landed there.

The following summer, United States Navy 'Operation Windmill' was conducted to provide ground truthing and astronomical control for the 1947 aerial photography. Surveyors Merritt and Krause from the United States Navy Hydrographic Office were dropped at Bunger Hills via helicopter (probably from USS *Edisto*) on 12 January 1948 and were retrieved on the morning of 15 January 1948 (Alberts & Blodgett 1956, Anon 2024). It is unclear whether or not Lieutenant (junior grade) Randolph G. Thomas, hydrographic officer with United States Navy 'Operation Windmill', who served as surveyor with the astronomical control parties and for whom the island was named (USGS 2015), was present at the January 1948 field camp.[1] Subsequently, surveyors with the Soviet Antarctic Expeditions (SAE) worked on Thomas Island and measured a spot height of 109 m, reported in the *Atlas Antarktiki* (SAE *et al.* 1966), at the hilltop discussed in this manuscript.

These largely exploratory visits to Thomas Island were followed by short scientific visits consisting of lake water and biological sampling (Table I). The first systematic research on Thomas Island was possibly an Australian effort in 1985/1986 on glacial geology and emergent marine shorelines (Adamson & Colhoun 1992, Colhoun & Adamson 1992). Surveyors were present on the 1985/1986 Australian expedition, but it is unclear where they worked, or even if they visited Thomas Island. Subsequent research visits are unlikely to have travelled to the hilltop location of interest, as their activities were conducted elsewhere on the island (Table I).

Corresponding author: Damian B. Gore; Email: damian.gore@mq.edu.au

Cite this article: Gore DB, Berg S, Howard AE, Weber M (2025). Rock cairn and items from 'Operation Windmill' (January 1948) rediscovered in Bunger Hills, East Antarctica. *Antarctic Science* 1–4. https://doi.org/10.1017/S095410202400049X

[1]Thomas was subsequently promoted to the permanent grade of Lieutenant on 6 April 1949 (File number 314361; p. 198, https://play.google.com/books/reader?id=dv2-1uNKfeEC&pg=GBS.PP5&hl=en).

© The Author(s), 2025. Published by Cambridge University Press on behalf of Antarctic Science Ltd. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

https://doi.org/10.1017/S095410202400049X Published online by Cambridge University Press

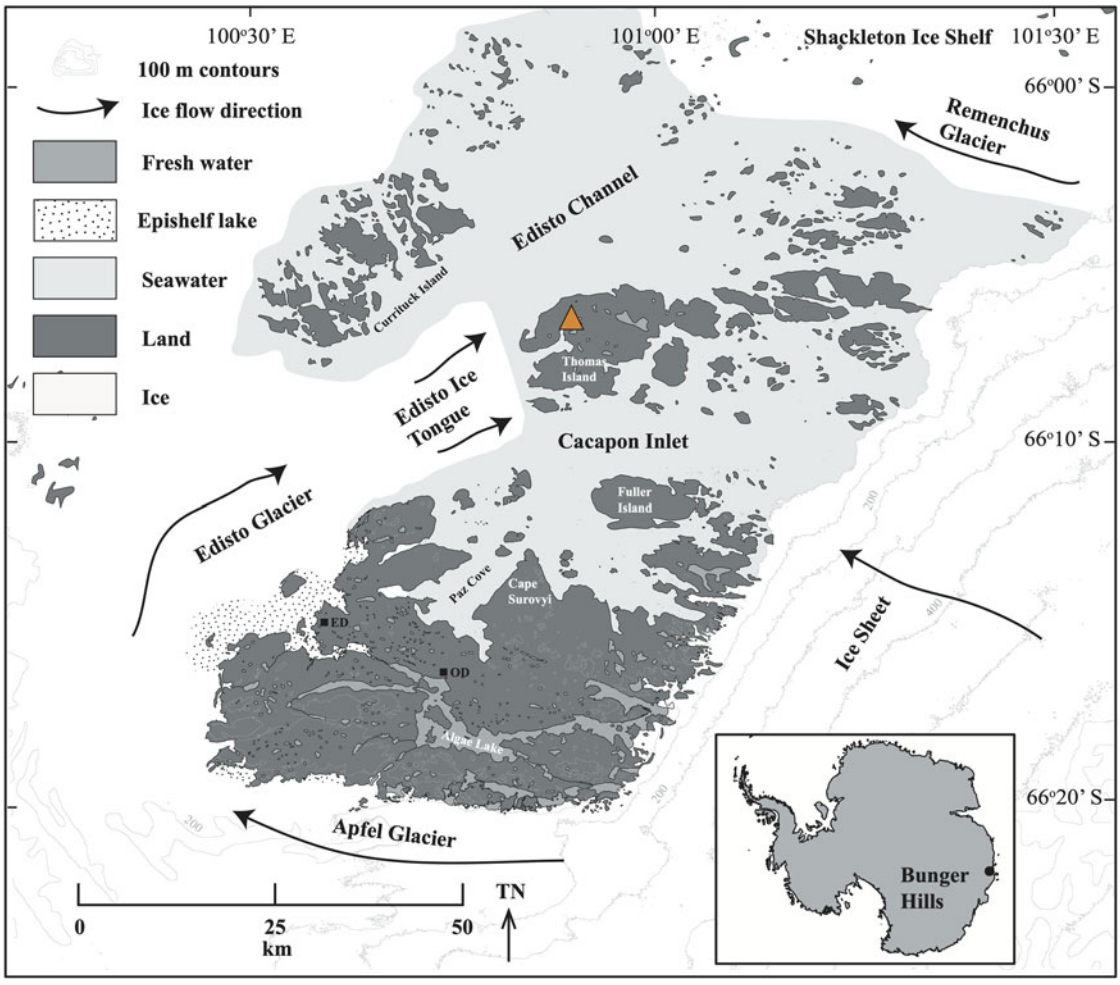

Fig. 1. Location of the field area showing the relationship of the rock cairn (marked by a yellow triangle) on Thomas Island to the unrelated Oasis-Dobrowolski Station (OD; 20 km south-south-west) and Edgeworth David Base (ED; 20 km south-west). TN = true north.

Table I. Known visits to Thomas Island. Further details of visits to Bunger Hills, without reference to specific location, are in Gore *et al.* (2020). This list carries the caveat that there may have been other visits, particularly by the SAE, which were not found in our literature search.

Year	Agency; purpose of visit to Thomas Island	Publications arising
1948	United States Navy 'Operation Windmill'; surveying	-
1955–1966	SAE; surveying	SAE *et al.* (1966)
1977	ANARE; sampling water and algae (Site 14, just north of Elliptica Lake; see their fig. 1)	Barker (1977)
1985/1986	ANARE; geoscience, surveying around the island (mainly on the shorelines), geological sampling in the north-east - the role of the surveyors is unknown	Adamson & Colhoun (1992), Colhoun & Adamson (1992), Sheraton *et al.* (1992, 1993)
1989	SAE; limnology, sampling 'Small Lake' in the far east and 'Lake 13' in the east	Kaup *et al.* (1993)
1995/1996	ANARE; geoscience, glacial geology (mainly in the west)	Augustinus *et al.* (1997), Augustinus (2002)
January 2024	AAP; environmental science, lake and soil sampling (mainly in the east, including 'Small Lake')	-
February 2024	AWI; geo/environmental science, coring 'Lake 13' and an unnamed lake in the west, soil/sediment sampling (mainly in the east)	-

ANARE = Australian National Antarctic Research Program, now AAP (Australian Antarctic Program); AWI = Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research; SAE = Soviet Antarctic Expeditions, now RAE (Russian Antarctic Expeditions).

Methods

The rock cairn and items were found opportunistically on 28 February 2024 while conducting geoscientific research on Thomas Island. The rock cairn was examined and two matchbooks were found buried in the frozen soil beneath the cairn. The site location was recorded using a handheld Garmin Etrex 22x GPS device using the WGS84 geoid, with a locational uncertainty of ±3 m. Some of the frozen soil could not be removed from the relatively fragile matchbooks due to the

https://doi.org/10.1017/S095410202400049X Published online by Cambridge University Press

Fig. 2. a. Marie Weber (left) and Amber Howard (right) stand beside a cairn four rocks tall, under which two matchbooks were buried. The cairn (circled) lies between the people and the dark boulder at the right. The view is to the south across the broad hill summit (image: 20240228_185134.jpg). **b.** Detail of the front of the red matchbook. The sand obscuring the top of the book was frozen on and could not be removed without damaging the artefact (image: 20240228_184623.jpg).

potential for damage. The matchbooks were photographed and returned to the soil and the cairn reconstructed. Web searches, particularly of scientific literature and images of matchbooks, were conducted to help determine further history of the artefacts and of visits to Thomas Island.

Results and discussion

The rock cairn was on the broad, glacial debris-mantled summit of one of the highest hills on Thomas Island (Fig. 2a), at ~114 m above sea level as recorded by handheld GPS (similar to the 109 m noted in SAE *et al.* 1966). There was no exposed bedrock or other form of formal survey marker there. The location at 66.10597 S, 100.90063 E is not presently in a Historic Sites and Monuments, Antarctic Specially Protected Area or Antarctic Specially Managed Area. The cairn is nearly 21 km north-east of the Australian Edgeworth David summer base and 20 km north-north-east of the Russian Oasis-Polish Dobrowolski

Fig. 3. a. Front side of the grey matchbook found on Thomas Island (image: 20240228_184637.jpg) compared with the front side of a World War II-era 10-in-one United States Army ration pack matchbook (source: https://www.kration.info/cigarettes-and-matches.html). **b.** Rear side of the grey matchbook from Thomas Island (image: 20240228_184612.jpg) compared with the rear side of a World War II-era 10-in-one United States Army ration pack matchbook (source: https://www.kration.info/cigarettes-and-matches.html).

Station. The cairn was four cobbles high and wide, with the long axes of the rocks being flat-lying, giving dimensions of ~40 cm height and 70 cm width at the base.

Beneath the cairn were buried two 'books' of matches. With adhering sand and showing evidence of decay, the matchbooks were obviously not modern. One had a red cover with a prominent 'United States Army' text and logo (Fig. 2b), while the other carried printed warnings about mosquitoes and malaria (Fig. 3).

The matchbooks are similar to those provided in United States World War II-era ration packs, which were distributed to military and civilian expeditions from the mid-1940s into the 1950s (van den Bogert 2024b, personal communication 2024). The matchbooks, along with cigarettes, were supplied in the dinner units of the K-ration and 10-in-one ration packs (Streeter 2007, Wikipedia 2024). The warnings about malaria were noted in the Type IIIb and Type IVa K-ration packs, produced from February 1944 for the former and from May 1944 for the latter (van den Bogert 2024a). The front sides of a matchbook found on Thomas Island and a World War II-vintage 10-in-one United States Army ration pack matchbook are shown for comparison in Fig. 3a. The text 'Mosquito Bites Cause Malaria' and an arrow across the bottom of the matchbook and leading up the right-hand side are the same in each case. The rear of the matchbook from Thomas Island contains the same text as a World War II-era matchbook, albeit in a slightly different design (Fig. 3b). The text on the Thomas Island matchbook reads '… shirt on and your sleeves rolled down. Use mosquito repellent

https://doi.org/10.1017/S095410202400049X Published online by Cambridge University Press

when out-of-doors between sunset & sunrise.' Note the difference in the use of hyphens in 'out-of-doors' and of the ampersand in 'sunset & sunrise' compared with the example known to be from a ration pack. These subtle differences may help to further constrain the timing and origins of these Thomas Island matchbooks.

Thomas Island was visited by United States Navy 'Operation Windmill' in January 1948. During this visit, a survey point was established by United States surveyors on what is now named Thomas Island, and it is probably this location that is marked by the rock cairn. An alternative is that SAE surveyors built the cairn, but the matchbooks make a United States origin more probable. The motivation for leaving the matchbooks buried in the soil there are lost to time. The matchbooks were replaced beneath the cairn and the rocks replaced. Just over 76 years had elapsed between burial of the matchbooks, construction of the cairn and their rediscovery.

Conclusions

A rock cairn, with two matchbooks buried beneath, has been found on Thomas Island, Bunger Hills, East Antarctica. The cairn marks the summit of a glacial debris-covered hilltop, which is probably the highest hill on Thomas Island. The rarity of visits to the island plus the origins of the matchbooks in World War II-era ration packs identify the United States Navy Hydrographic Office surveyors from 1948 as the probable creators of the rock cairn. A year earlier, an 'Operation Highjump' aircraft probably landed on the marine inlet near Thomas Island, rather than a lake elsewhere in southern Bunger Hills as reported previously.

Author contributions. DBG, AH and MW jointly found the cairn and artefacts. SB contributed the cartography, and all authors contributed to researching the literature and writing the manuscript.

Acknowledgements. We thank the crew, aircrew and other expeditioners from RV *Polarstern*, who made our fieldwork possible. We thank H. van den Bogert, who assisted with identification of the matchbooks, and two reviewers for their helpful comments.

Financial support. This research was not supported by a specific grant from any funding agency, commercial or not-for-profit sectors. Fieldwork was supported by RV *Polarstern* (Grant No. AWI_PS141_04, Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel POLARSTERN Operated by the Alfred-Wegener-Institute. *Journal of Large-Scale Research Facilities*, **3**, A119, http://dx.doi.org/10.17815/jlsrf-3-163).

Competing interests. DBG is on the editorial advisory board of *Antarctic Science* but had no part in the review or acceptance of this research. We declare no other known competing interests.

References

Adamson, D.A. & Colhoun, E.A. 1992. Late Quaternary glaciation and deglaciation of the Bunger Hills, Antarctica. *Antarctic Science*, **4**, 10.1017/S0954102092000658.

Alberts, F. & Blodgett, G. 1956. The Bunger Hills area of Antarctica. *The Professional Geographer*, **8**, 10.1111/j.0033-0124.1956.83_13.x.

Anon. 2024. U.S. Navy Second Antarctic Developments Project 1947-48. Operation Windmill. Retrieved from https://www.south-pole.com/windmill.htm (accessed 9 March 2024).

Apfel, E.T. 1948. Bungers 'Oasis', Antarctica. *Bulletin of the Geological Society of America*, **59**, 1308–1309.

Augustinus, P.C. 2002. Weathering characteristics of the glacial drifts, Bunger Hills, East Antarctica. *Arctic, Antarctic, and Alpine Research*, **34**, 10.1080/15230430.2002.12003470.

Augustinus, P.C., Gore, D.B., Leishman, M.R., Zwartz, D. & Colhoun, E.A. 1997. Reconstruction of ice flow across the Bunger Hills, East Antarctica. *Antarctic Science*, **9**, 10.1017/S0954102097000424.

Barker, R.J. 1977. A biological reconnaissance of the Bunger Hills, (March 1977). Australian Antarctic Division. Retrieved from https://doi.org/10.4225/15/5767462D3FD1D (accessed 7 April 2024).

Byrd, R.E. 1947. Our navy explores Antarctica. *National Geographic*, **92**, 429–522. Retrieved from https://www.cuttersguide.com/pdf/National-Geographic/1947-10.pdf (accessed 6 April 2024).

Colhoun, E.A. & Adamson, D.A. 1992. Raised beaches of the Bunger Hills, Antarctica. ANARE Reports 136, 52 pp. Retrieved from https://www.antarctica.gov.au/site/assets/files/64898/ar_136.pdf

Gore, D.B., Gibson, J.A.E. & Leishman, M.R. 2020. Human occupation, impacts and environmental management of Bunger Hills. *Antarctic Science*, **32**, 10.1017/S0954102019000348.

Kaup, E., Haendel, D. & Vaikmäe, R. 1993. Limnological features of the saline lakes of the Bunger Hills (Wilkes Land, Antarctica). *Antarctic Science*, **5**, 10.1017/S0954102093000070.

SAE (1955–), Tolstikov, E.I. & Soviet Union Glavnoe Upravlenie Geodezii i Kartografii. 1966. *Atlas Antarktiki* [*Atlas of Antarctica*]. Glavnoe upravlenie geodezii i kartografii MG SSSR. Retrieved from https://nla.gov.au/nla.cat-vn1099045

Sheraton, J.W., Black, L.P. & Tindle, A.G. 1992. Petrogenesis of plutonic rocks in a Proterozoic granulite-facies terrane - the Bunger Hills, East Antarctica. *Chemical Geology*, **97**, 10.1016/0009-2541(92)90075-G.

Sheraton, J.W., Tingey, R.J., Black, L.P. & Oliver, R.L. 1993. Geology of the Bunger Hills area, Antarctica: implications for Gondwana correlations. *Antarctic Science*, **5**, 10.1017/S0954102093000112.

Streeter, T.S. 2007. U.S. Army Field Rations. The K Ration. Retrieved from http://www.usarmymodels.com/ARTICLES/Rations/krations.html (accessed 8 April 2024).

USGS. 2015. Antarctica ID 15197. Thomas Island. Retrieved from https://web.archive.org/web/20210602223257/https://geonames.usgs.gov/apex/f?p=gnispq:5:::NO::P5_ANTAR_ID:15197 (accessed 7 April 2024).

van den Bogert, H. 2024a. K Ration. Retrieved from https://www.kration.info/original-k-rations.html (accessed 8 April 2024).

van den Bogert, H. 2024b. K Ration: Cigarettes and Matches. Retrieved from https://www.kration.info/cigarettes-and-matches.html (accessed 28 February 2024).

Wikipedia. 2024. K-ration. Retrieved from https://en.wikipedia.org/wiki/K-ration (accessed 12 March 2024).