Antarctic Science 1 (2): 165–166 (1989)

Short notes

Holocene ice fluctuations on Brabant Island, Antarctic Peninsula

J.D. HANSOM[1] and C.P. FLINT[2]

[1] *Department of Geography, University of Sheffield, Sheffield, S10 2TN, UK*
[2] *HMS* Cochrane, *Rosyth, Dunfermline, Fife KY11 2XT, UK*

Received 5 December 1988, accepted 14 January 1989

Introduction

Recent geomorphological research in the ice-free areas of West Antarctica and the subantarctic islands has begun to provide an outline glacial chronology that helps our understanding of the late Quaternary history of ice sheets. However, there is a need for detailed studies of the glacial history of the Antarctic Peninsula area and its offshore islands before a general chronology can be fully reliable. In particular, evidence of Neoglacial glacial fluctuations in the area are imperfectly known in spite of work by Sugden & Clapperton (1977) on island groups in the Scotia Sea, Clapperton *et al.* (1978) on South Georgia and Clapperton & Sugden (1982) on Alexander Island. The aim of this note is to present data relating to Holocene glacier fluctuations from the hitherto unstudied Brabant Island (64°15'S, 62°30'W).

Brabant Island is part of the Palmer Archipelago which is separated from the Antarctic Peninsula by the 30 km wide waters of Gerlache Strait. The island is 60 km long and 20 km wide, its mountainous (up to 2500 m) interior supporting an ice cap and numerous glaciers which discharge towards each coast. In some places the ice calves into deep-water inlets such as Chiriguano Bay in the south of the island, but for the most part it is grounded on rock at sea-level. In sheltered locations, debris derived from the melting of subglacial tills and from frost shattering of rock surfaces at sea-level has been worked by waves and floating ice into small beaches and boulder pavements. The geology of Brabant Island is dominated by basaltic lava flows and tuffs intruded by diorites.

Moraines and shelly tills

In spite of detailed searches of the limited ice-free area, only a few sites with glacial deposits were found. At least three low concentric moraines occur within 100 m of the present ice edge, at Claude and Metchnikoff points and at Cape Roux in the north-west of the island (Fig. 1), but in the absence of dateable materials the significance of these moraines is not clear. However, marine shells were found in basal till at 0.4 m above HWM at Welcome Point on the north side of Chiriguano Bay (Fig. 1). The shells are largely fresh and intact, occurring both as individuals and clusters within a layer of silty subglacial till, 0.6 m thick, beneath a 10–15 m high ice cliff presently undermined by the sea. The striated and subrounded clasts held within the finer till matrix are of purely local lithologies. Below HWM, however, the intertidal zone comprises an ice-smoothed boulder pavement which contains numerous granitic erratics, probably transported from the Antarctic Peninsula. The shells recovered from the till are of several species including the bivalves *Laternula elliptica* (King & Broderip), *Limatula pygmaea* (Philippi), *Mysella charcoti* (Lamy), the gastropods *Onoba turqueti* (Lamy), *Nacella concinna* (Strebel) and numerous echinoid spines. All of these species are now extant in shallow circum-Antarctic waters between 0 and 300 m depth. However, since the assemblage is characteristic of a coastal bay environment, it is likely to have been derived locally (A. Clarke, personal communication 1988) from the bed of Chiriguano Bay rather than from the floor of the 695-m deep Gerlache Strait.

Radiocarbon dating (SRR–3073) of *Laternula elliptica* yielded an age of 5610±80 yr BP. Allowing a correction factor of 750 yr for the ^{14}C deficiency of Antarctic waters (Harkness 1979), it appears that these marine shells were growing in the vicinity about 5000 yr ago. Amino acid analysis of two separate shells of *Laternula elliptica* from the same site yielded total D/L ratios of 0.012 and 0.014. This indicates that they are almost certainly Holocene in age (D.Q. Bowen, personal communication 1987).

Chronology and ice fluctuations

Given the present depth range and distribution of the shell species found, it seems likely that prior to 5000 yr BP the shells were growing locally under environmental conditions at least as warm as those at present. Supporting evidence for a more restricted glacier extent than now comes from both the nearby South Shetland Islands and from South Georgia where Sugden & John (1973), and Clapperton *et al.* (1978) respectively, have shown that glaciers had withdrawn earlier in the Holocene before re-advancing over raised beach deposits to their present extent. On Alexander Island, the presently ice-bound George VI Sound may have been ice free at about 6500 yr BP (Clapperton & Sugden 1982) and climatic conditions warmer than now between 8500–5500 yr BP are also suggested by pollen evidence from Patagonia

https://doi.org/10.1017/S0954102089000246 Published online by Cambridge University Press

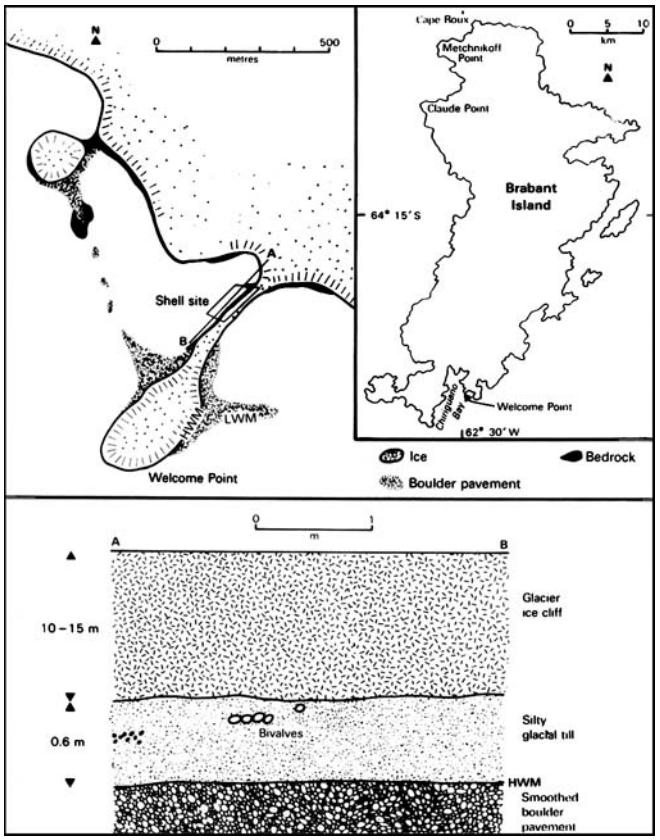


Fig. 1. Chiriguano Bay and Welcome Point. The shell-bearing tills are accessible only at low water. Since the ice cliff is actively being under-cut by the sea, future visits to the site may yield other ^{14}C material and hopefully a more detailed stratigraphy.

(Heusser 1974). Thus it appears that a more restricted Brabant Island ice cover in the early–mid Holocene was part of a more widespread warming felt beyond the immediate Antarctic Peninsula area.

The subsequent glacier advance that dredged up the marine shells and deposited them in till above HWM on Brabant Island probably related to extended glacier ice flowing seawards across Chiriguano Bay and overriding Welcome Point from the north and north-west (Fig. 1). North–south trending striations on adjacent scoured rock surfaces support this suggestion as does the occurrence of exclusively local lithologies as clasts in the subglacial till. The freshness and age of the shells strongly suggests incorporation soon after death and thus an early Neoglacial age for the readvance. Such expansion has been proposed on Alexander Island where Clapperton & Sugden (1982) suggest ice shelf re-growth and the construction of Neoglacial moraines some time after 6500 yr BP. Clapperton *et al.* (1978) noted the possibility of a Neoglacial readvance at 5000 yr BP on South Georgia and this may be supported in part by Gordon (1987) who showed that ice was more extensive in South Georgia prior to a warmer period between 2230–3330 yr BP. In Patagonia, Mercer (1978) considered an advance at 4500 BP to have been the largest of Neoglacial time. Glaciers on Brabant Island appear to have expanded in sympathy with these broad regional trends.

Conclusion

If the shell age assignments are correct then glacier fluctuations on Brabant Island correspond to those elsewhere in the Antarctic Peninsula area: restricted ice cover prior to 5000 yr BP closely followed by expanding glaciers. It is unfortunate that further geomorphological evidence is lacking. However, on small mountainous and heavily glacierized islands such as Brabant this may be the rule rather than the exception. Nevertheless, such data on glacier fluctuations in remote and previously unstudied areas provides an important input into emerging regional glacial chronologies.

Acknowledgements

The field work for this research was conducted by Ltnts Paul Flint and Simon Allen, as part of the Joint Services Expedition to Brabant Island 1983–85. JSE members, HMS *Endurance*, RRS *John Biscoe*, and British Antarctic Survey are warmly thanked for their support. Our thanks also to Dr J.D. Taylor (BM (NH)) for shell identification and Dr A. Clarke (BAS) for habitat information. The Natural Environment Research Council and the British Geomorphological Research Group provided support for dating.

References

Clapperton, C.M., Sugden, D.E., Birnie, R.V., Hansom, J.D. & Thom, G. 1978. Glacier fluctuations in South Georgia and comparison with other island groups in the Scotia Sea. *In* Van Zinderen Bakker, E.M., *ed. Antarctic glacial history and world palaeoenvironments*. Rotterdam: A.A. Balkema, 98–104.

Clapperton, C.M. & Sugden, D.E. 1982. Late Quaternary history of George VI Sound area, West Antarctica. *Quaternary Research*, **18**, 243-267.

Gordon, J.E. 1987. Radiocarbon dates from Nordenskjöld Glacier, South Georgia, and their implications for Late Holocene glacier chronology. *British Antarctic Survey Bulletin*, No. 76, 1–5.

Harkness, D.D. 1979. Radiocarbon dates from Antarctica. *British Antarctic Survey Bulletin*, No. 47, 43–59.

Heusser, C.J. 1974. Vegetation and climate of the Southern Chilean lake district during and since the last interglaciation. *Quaternary Research*, **4**, 290–315.

Mercer, J.H. 1978. Glacier development and temperature trends in the Antarctic and in South America. *In* Van Zinderen Bakker, E.M., *ed. Antarctic glacial history and world palaeoenvironments*. Rotterdam: A.A. Balkema, 73–94.

Sugden, D.E. & Clapperton, C.M. 1977. The maximum ice extent on island groups in the Scotia Sea, Antarctica. *Quaternary Research*, **7**, 268–282.

Sugden, D.E. & John, B.S. 1973. The ages of glacier fluctuations in the South Shetland Islands, Antarctica. *In* Van Zinderen Bakker, E.M., *ed. Palaeoecology of Africa, the surrounding islands and Antarctica*. Cape Town: A.A. Balkema, 141–159.

https://doi.org/10.1017/S0954102089000246 Published online by Cambridge University Press