

Archaeology from the Ice: Excavation Methods in a Frozen Hut

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Recent excavations in the snow and ice that fills much of the interior of Mawson's Hut at Cape Denison in Antarctica, had to overcome unusual problems. Relatively little has been published on excavation methods appropriate to polar conditions and the author, who is based at the Tasmanian Museum and Art Gallery in Hobart, had to develop appropriate techniques to meet the special conditions of the site. She was able to demonstrate that stratigraphic excavation procedures were quite possible, in spite of the difficulties. In this paper, it is argued that mechanical methods of removing ice and snow are preferable to melting these deposits either in situ or after removal in large blocks. However, the use of an ice axe to break up solid ice does cause some damage to contained artefacts and it seems likely that some combination of digging and carefully controlled melting may eventually prove to be the best approach.

Every archaeological site presents its own logistical problems. The problems encountered doing fieldwork in Antarctica are sufficiently unusual to warrant special comment. The Mawson's Huts site at Cape Denison, Commonwealth Bay, was visited by Project Blizzard, a private expedition, in the summer of 1984-85 and again in 1985-86. The major aim of Project Blizzard was the conservation of the Mawson's Huts site. The logistical organisation, philosophy and achievements of the Project have been described by the expedition's photo-journalist, Jonathan Chester.¹

In 1984 archaeologist Estelle Lazer accompanied the first Project Blizzard expedition to the Mawson's Huts site, where she undertook a preliminary archaeological survey of the site including the Main Hut and collected data for a materials conservation assessment. In doing this, she became the first archaeologist to work in Antarctica and pioneered survey methods suitable for use there.²

In the summer of 1985-86 I was employed by Project Blizzard as the archaeologist on their second expedition to Cape Denison. The results of this archaeological work are reported elsewhere.³ It is the fieldwork techniques that are in particular discussed here.

Interest in the historic sites associated with the 'Heroic Age' of Antarctic exploration has attracted both the Australian and New Zealand Antarctic programmes. Clean-ups and structural work have been undertaken at several Ross Sea sites⁴ and at the Mawson's Huts site at Cape Denison.⁵ Apart from their most recent expeditions, the New Zealand restoration work was undertaken by official hut caretakers, without the involvement of archaeologists or other conservation professionals. As a result, artefacts were moved out of context with virtually no records being made⁶ and often artefacts were destroyed as rubbish.⁷ Recent New Zealand work has included structural studies and a consideration of the problems of artefact conservation.⁸ In 1977 Harrowfield became the first conservation professional to work on an historic site in Antarctica.⁹ He excavated a 2-metre square trench through frozen ground outside the Cape Evans hut, primarily in order to demonstrate the feasibility of using archaeological techniques in Antarctica. In 1986-87 both the Australian and New Zealand governments

employed historical archaeologists to work on historic sites in Antarctica.¹⁰

THE MAWSON'S HUTS SITE AND ITS SIGNIFICANCE

The Mawson's Huts site at Cape Denison was the place where the Australasian Antarctic Expedition (A.A.E.), led by Douglas Mawson (later Sir Douglas Mawson), established their base camp in 1911-12. This was the first Australian occupation in Antarctica and the scene of much important early scientific work. Because of this, the site has considerable historical and political importance. Figure 1 shows the location of Cape Denison and other 'Heroic Age' hut sites.

Cape Denison is a rocky promontory in the eastern sector of Australian Antarctic Territory, about 1700 metres by 900 metres, which is kept clear of permanent snow and ice cover by almost continuous strong katabatic gales. These gales are caused by cold air sinking down from the polar ice cap. It was these katabatic winds, sometimes exceeding 200 kilometres an hour, which inspired the title of Sir Douglas Mawson's book 'The home of the blizzard', in which he described the daily domestic life and activities of the A.A.E.¹¹

The A.A.E. lived here at Cape Denison for over two years from late 1911 to early 1914, using the site as a base for geographical exploration and their scientific work. They built four wooden huts and installed various other fixtures such as radio masts, meteorological equipment, survey stations, and a cross commemorating the deaths of two members of the expedition. Domestic, architectural and technical debris and faunal remains can be found scattered across the entire area, however concentrations of artefacts are found around the huts and major features and downwind of these various structures where the wind has blown them. Because of the site's location in the eastern sector of Australian Antarctic Territory, separated from the larger western sector, it is very remote from modern stations and has therefore received far less disturbance from human visitors than comparable sites elsewhere in Antarctica. For this reason it is considered to have good potential for an archaeological approach to the study of the site.

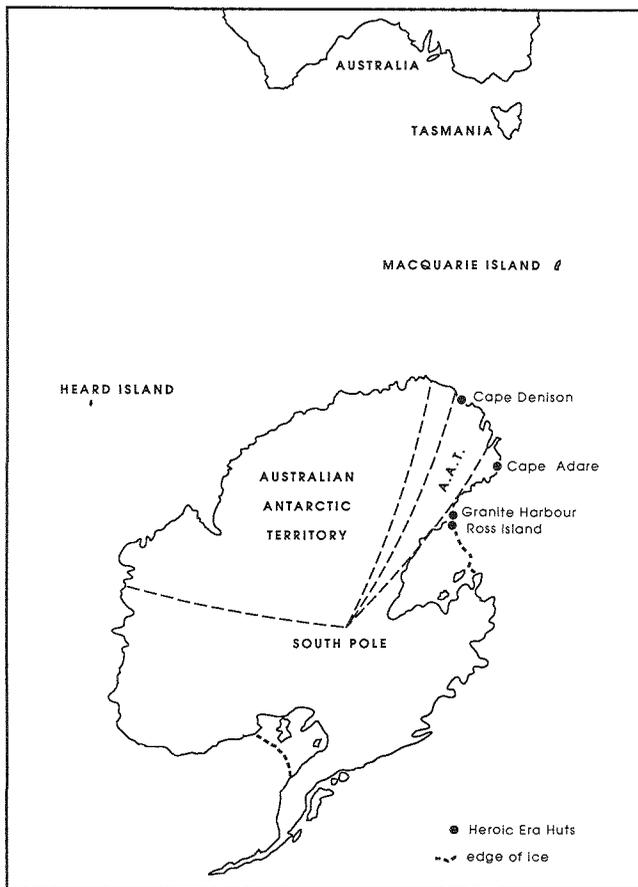


Fig. 1: Location of Cape Denison and other historic huts in Antarctica.

The cultural significance of the site is recognised both nationally and internationally. The buildings are listed on the Register of the National Estate and are protected as historic relics under the terms of the Antarctic Treaty.

The Hut

The largest and most important building at Cape Denison is the Main Hut, which was usually referred to by the A.A.E. as the 'Winter Quarters' and has been commonly known since as 'Mawson's Hut'. It is really two huts joined together to make a two-roomed hut for working and living (Fig. 2). Although entry into the Hut was fairly easy for visitors in the 1950s, since 1962 it has been full of snow and ice. This prevented visiting expeditions in the 1960s gaining access. However, in 1978 an Australian National Antarctic Research Expedition (ANARE) spent three weeks at the site, during which time they cleared the workshop room of snow and dug a tunnel into the living room which was found to have a large open space.¹² Subsequent expeditions have reopened this tunnel in order to inspect the interior. In 1985-86 this open space in the living room was found to have been greatly reduced by the influx of drift snow. The interior of the Hut is in total darkness and limited artificial lighting provided by generator or batteries allowed work to proceed. Summer temperatures inside the Hut are fairly constant, usually hovering around -4°C to -5°C .

Fig. 2: Mawson's Hut at Cape Denison.



THE ARCHAEOLOGICAL PROGRAMME IN 1985-86

The objectives of the second season's trip were to collect additional data for the condition report and site conservation plan and to undertake some maintenance work which had been identified the previous summer as urgent. This included inserting a prop beneath a cracked beam in the living room of the Main Hut, in order to support it.

Prior to departure, the aims of the archaeological programme were:

1. To define, describe and survey the archaeological site at Cape Denison.
2. To undertake salvage excavation to mitigate the impact of the building conservation programme on archaeologically significant deposits.

The emphasis was to have been on documenting parts of the site not surveyed the previous year by Lazer, then moving on to collect additional data from areas already surveyed, which was a major recommendation of Lazer.¹³ It was hoped to complete the hut stabilisation work and associated salvage excavation in the first week, whilst the materials conservator, Janet Hughes, was on site to deal with excavated material. Her time at the site was limited because she was returning to Australia with our transport vessel, the *Southern Quest*.

On our arrival at Cape Denison, this plan had to be radically revised. In addition to the cracked beam, several joists in the Main Hut were found to be cracked, necessitating considerably more propping than had been planned. This meant that the priority of the archaeological programme was shifted to the archaeological excavation of prop pits inside the Main Hut. The documentation and surveying of the remainder of the site now became a subsidiary aim. In addition to this change in emphasis, heavy pack ice had delayed our arrival, cutting into the time available on site for the materials conservator. In fact, it was

not possible to commence excavation until after the materials conservator had departed. Therefore, the provision of initial conservation treatment and storage for the excavated artefacts also became part of the archaeological programme. Altogether twenty-five working days were spent at the site.

As a result of the changed circumstances, the major maintenance work of the 1985-86 season involved the installation of four timber props inside the living room of the Main Hut, in order to support the cracking beams and joists of a loft platform. It was important that these props were seated directly on the wooden floorboards, rather than on the solid ice which covered the floor. This was in order to avoid the ice melting under the pressure, as this would cause the props to become loose. It was my task to excavate the four holes for these props, through the snow and ice which covered the floor and partially filled the interior of the Hut.

EXCAVATING THROUGH SNOW AND ICE

The usual texts on archaeological field methods, for example Barker, Connah or Joukowsky,¹⁴ do not offer any advice on suitable techniques or procedures for excavating through snow and ice. However, workers from both Canada and New Zealand have undertaken historical archaeological work in polar latitudes, in the far north of Canada¹⁵ and at Cape Evans on Ross Island, Antarctica,¹⁶ respectively. I was able to draw on their experience to a limited extent, although in neither case were their techniques directly applicable at Cape Denison. In general, appropriate techniques had to be developed on the spot to meet the special conditions of the site.

Fig. 3: Paper and wood in partly excavated solid ice. Scale of 20 cm.



I decided not to attempt any excavation method which involved melting the ice, such as the use of blow torches or the application of hot water, both of which have been used in the Canadian Arctic.¹⁷ Janes considers these techniques to be experimental and requiring the specialist advice of a conservator on site. Without our materials conservator available, I did not feel qualified to deal with the conservation problems likely to be raised by the sudden changes in temperature. I also felt that by melting the ice I would lose too much control over the excavation, as any discrete layers in the deposit would coalesce. This belief was subsequently borne out by the discovery of artefacts made of ice (explained below), which would have been lost if the ice layers in the prop pits had been thawed. Harrowfield recommends the use of solar radiation to melt permafrost slowly and reports having used black plastic successfully outside the stables' wall at Cape Evans on Ross Island. Once the top few centimetres of frozen ground had thawed, the deposit could then be excavated with a trowel in the usual way.¹⁸ Of course this method would only be feasible outside. Therefore, only mechanical methods of removing ice and snow from the interior of the Hut were used.

I also decided against cutting out large blocks of ice for thawing after removal from the trench. This method was used by Quartermain, to whom it had apparently been recommended by an unnamed 'eminent archaeologist with Arctic experience' in 1960.¹⁹ However, Barker's advice is that 'only in the last resort should a miniature trench be cut round the find in order to release it from the ground. Doing this destroys its relationship with unseen layers and may well obscure its real function, origin or derivation'.²⁰ This philosophy is equally applicable to ice-bound finds and it would therefore be a very dangerous policy to use this method for the wholesale removal of all finds.



Fig. 4: Excavations in progress inside Mawson's Hut.

Various types of snow and ice are found inside the Main Hut and these form recognisable stratigraphic units: wind-drifted snow which had entered the Hut within the last year; corn snow, a harder icy snow more than a year old; and solid ice. Because of the penetrating quality of drift snow, the tendency for water vapour to form icicles and for melt water to refreeze as icicles, the archaeological stratigraphy can become complicated inside a frozen hut. The main points of ingress of snow into the living quarters of the Main Hut are the damaged skylights. Large icicles of clear ice hang from the ceiling and skylights or project in unlikely configurations from the side bunks or other surfaces, where gradual melting and refreezing of snow has allowed the growth of an ice block. Snow has drifted beneath and alongside this ice as well as around the interior shelves and along the old access tunnel. Artefacts, particularly paper, wood and iron, were found in all layers. The solid ice also contained 'ice artefacts', that is lenses of coloured or pungent ice which are thought to be the frozen spilt contents of broken bottles or jars.

Wind-drifted snow and the older corn snow were excavated fairly easily with a snow shovel and archaeologist's trowel. The solid water ice presented more of a challenge. Although small in volume compared to the amount of snow that was excavated, proportionally far more time and energy was needed. Water ice is rock hard and has to be shattered using considerable force with an ice axe. The ice shatters around the point of impact and the small chips can then be swept up with a stiff hearth brush and hand shovel. Eye protection should be worn while digging as small glass-like slivers of hard ice can fly upwards. Occasionally a small chisel was also found to be useful. Both ice axe and chisel had been recommended by the 1978 ANARE party.²¹ Because of the force required to dig through the ice, minor damage was suffered by some artefacts, especially the paper. Ice does not behave like soil or clay, which tends to peel away from buried objects. Rather it tends to fracture like glass. Removing objects from the ice caused considerable problems, and most pieces of paper and wood bear small nicks from the ice axe. The excavated snow and loose ice chips were carted away in a small snow sled, which was pushed along the access tunnel, and then dumped in a spoil heap outside the Hut entrance. Figure 3 shows paper and wood artefacts in a partially excavated layer of solid ice.

The actual area dimensions and locations of the pits were decided by the Project Blizzard architect, in order to accommodate the wide prop bases and to position the props beneath the broken beams. Each of the four pits was treated as an archaeological excavation trench and traditional excavation procedures were followed with each layer of snow or ice being removed separately. However, laying out the trenches and erecting datum lines above or across the sections proved a problem, as it was not possible to construct a grid inside the Hut. The major difficulty was ablation, the direct evaporation of snow, which made it impossible to anchor wooden stakes in the snow with any confidence that they would stay in place. Strings could be tied around some posts and beams but usually the other end could not be tied in the desired position. It was considered undesirable to damage the Hut by driving nails into the timbers or to excavate quantities of snow in order to anchor our strings. Indeed, the Antarctic Division had particularly asked us not to excavate more snow than necessary. Therefore, the four trenches were laid out and excavated without reference to an overall grid. Their positions were then related to various internal features of the Hut. For this purpose, the two northern queen-posts and the dining area partition were used as reference points and have been assumed to be square. The datum lines had to be erected in any convenient position and these were also related to the internal features. The depths of artefacts were measured and sections were drawn relative to

one of the datum lines, by the deft use of a carpenter's level and a plumb bob. Figure 4 shows excavations in progress.

CONCLUSIONS

Snow and ice have quite different physical properties from soil and clay, and therefore archaeological excavation of these matrices poses some difficulties. The rapid rate of snow ablation caused by the very dry atmosphere means that stakes and pegs cannot be anchored securely, posing problems for the establishment of datum lines and grids. Whilst snow presents no particular problems for excavation, the physical removal of ice is a different matter as it requires considerable force to break up, which puts the embedded artefacts at some risk.

Both snow and ice could be melted, although this would cause irreparable loss of trench sections and stratigraphic control. One would then be faced with the problem of pumping the water away before it refroze and also of dealing with exacerbated artefact conservation problems. For these reasons, wholesale melting of the ice layers is not recommended. However, mechanical excavation techniques do not provide a 100 per cent satisfactory result because of the potential hazard to artefacts. Therefore, for optimum results in the future some combination of digging and carefully controlled melting techniques probably needs to be developed. Melting should only be chosen after the ice layer has been examined and the method assessed as necessary. Use of the technique should be strictly localised and only used on a limited scale.

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