RESTORATION, STABILISATION AND GATING OF THE CHRISTMAS STAR EXTENSION OF CRYSTAL CAVE (WI-62), WITCHCLIFFE W.A.

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Abstract

Crystal Cave (WI-62) is located in the Witchcliffe region of the Leeuwin-Naturaliste ridge some 290 km south of Perth, W.A.

The Christmas Star Extension was first entered in 1968 and by 1972 considerable sand-staining damage had occurred to the flowstone floor throughout the Extension despite the use of plastic pathway. Most damage was around the clothes-changing area where a sand bank had been spread across the floor and into a dry crystal pool.

During 1973, S.R.G.W.A. undertook a major restoration program in the Extension consisting of scrubbing the floor, laying new pathways and the construction of several walls.

Time out was taken through the program to stabilise the entrance area where a strategic rock, if dislodged. threatened to initiate a major rockslide.

At a later date a gate was installed over the entrance to the Extension.

This paper will describe the restoration methods, design and construction of various walls as well as the design and construction of the gate.

INTRODUCTION

Crystal Cave is a small cave of 610 m passage length (see Fig. 1 for map), formed in coastal limestone, located in the Witchcliffe region of the Leeuwin-Naturaliste ridge some 290 km south of Perth. The cave is in the form of several chambers connected by passages of varying dimensions, a small stream is present. The average ceiling height of the chambers is 20 m while the average chamber roof thickness is 7 m. The Christmas Star Extension leads off from the Helium Chamber and is low roofed for the first third of its area, persons being unable to stand up along the pathway. The remaining tracked area presents little difficulty except that the pathway, by necessity, passes within close range of delicate decoration.

A report by the Chief Inspector of Lands, published in the 1900 Parliamentary Papers attributed extensive damage in the entrance chamber and stream passage to "marauders" and timber felling before the turn of the century (Shoosmith, 1975). Chief Inspector C. Erskine May recommended that Crystal be closed so that ".. it may, in the course of 20-30 years, restore itself from the hacking about it has received with a timber 'jack' which I found in the cave."

GENERAL

The Christmas Star Extension was first entered during Christmas 1968. Access was apparently gained by breaking some decoration thus creating the First Squeeze

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which led into a small decorated chamber. At the other end of this chamber, the Second Squeeze led into the main section of the Extension. Once through the Second Squeeze, visitors came out onto a sandbank, the source of future decoration damage. The passage that led off from this sandbank over a white flowstone floor is heavily decorated with straw stalactites, helictites, crystals and an outstanding crystal pool. A gate was installed near the Entrance Chamber shortly after.

Despite the laying of a plastic pathway throughout the Extension and a policy of removing boots and overalls at the Second Squeeze sandbank, by August 1972, the pathway was broken in several places and footprints had soiled the flowstone in numerous places. Most damage that occurred during this four year period was at the clothes-changing area beyond the Second Squeeze where the sandbank, under pressure of use, moved across the flowstone and into a dry crystal pool. The damage to this Extension can only be attributed to cavers' indifference and lack of foresight.

Following the formation of S.R.G.W.A. in December 1972, a restoration program based, but later expanding upon, Poulter's recommendations of August 1972 (Poulter, 1972) was started in March 1973 continuing through until October of the same year. Minor additions were added during 1974.

Part of the restoration program entailed removing the original pathway, scrubbing the floor with water and laying new pathways using slightly stiffer plastic. The outcome of this exercise was not as successful as expected. The deeply ingrained footprint stains could only be made less obvious by "blending in" so to speak. In places the new pathway was widened to cover possible sources of soil contamination. A disadvantage with plastic sheeting as pathway is that it is quite slippery and with use across slopes, crimples (reducing its width) or breaks up altogether. It is hoped to replace "problem areas" of pathway with heavier gauge non-slip clear plastic "carpet protector" type pathway in the near future.

The "Crystal Walls" as they became known presented a different problem. Soon after work began it became obvious that one low wall, as originally suggested, would not be enough. Another, larger retaining wall to completely isolate the sandbank from the chamber was necessary. This presented a logistical problem as all building materials used had to be transported through the two squeezes.

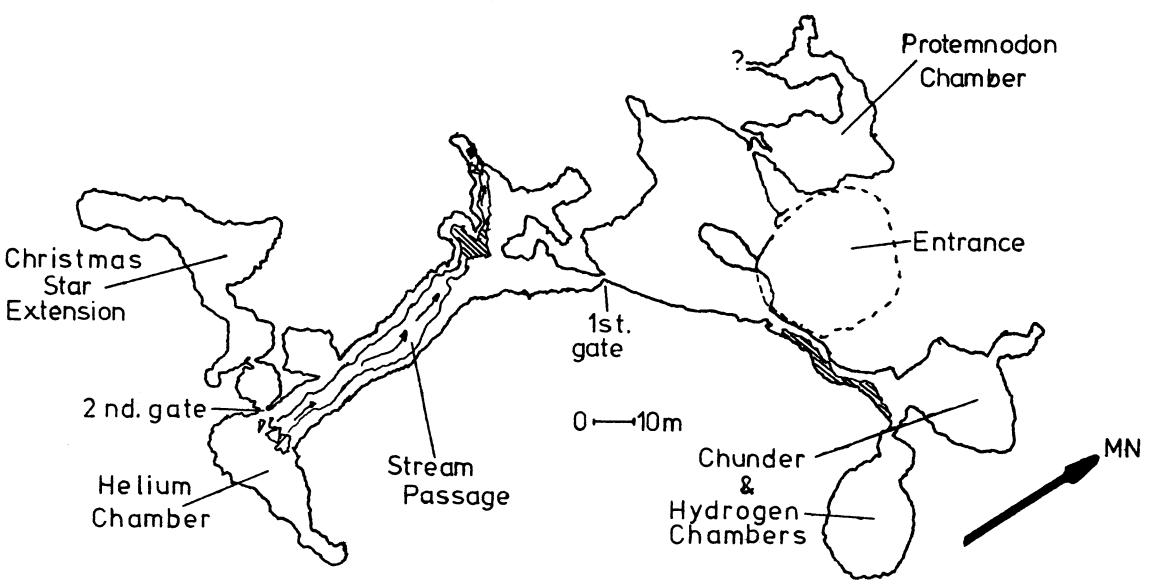


Fig. 1 Reduced outline of the Loveday (WASG) map of Crystal Cave Wi 62

During the course of the program, to make maximum use of available time and increase overall efficiency, a camp was established in the Entrance Chamber of the cave, close to the First Gate. People confined their camp activities on large groundsheets with no observable effect to the cave environment.

A typical work weekend on the "Walls" was preceeded by removing suitable rocks from the adjacent Helium Chamber and moving them in batch lots through the squeezes to the work site. Watercarriers then started a relay to bring water in 4.5 L containers from the streamway to the cement mixing site. The mixing of cement took place on a steel sheet in the area between the two squeezes (Fig. 2). Mixture used was three measures of sand (taken from an adjacent sandbank) to two of lime to one of cement. The lime and cement powders were premixed in Perth and transported into the cave in small double polyester bags. The mixed cement, usually of a soupy consistency was moved to the work site in 2.25 L buckets; the only size capable of fitting through the Second Squeeze upright.

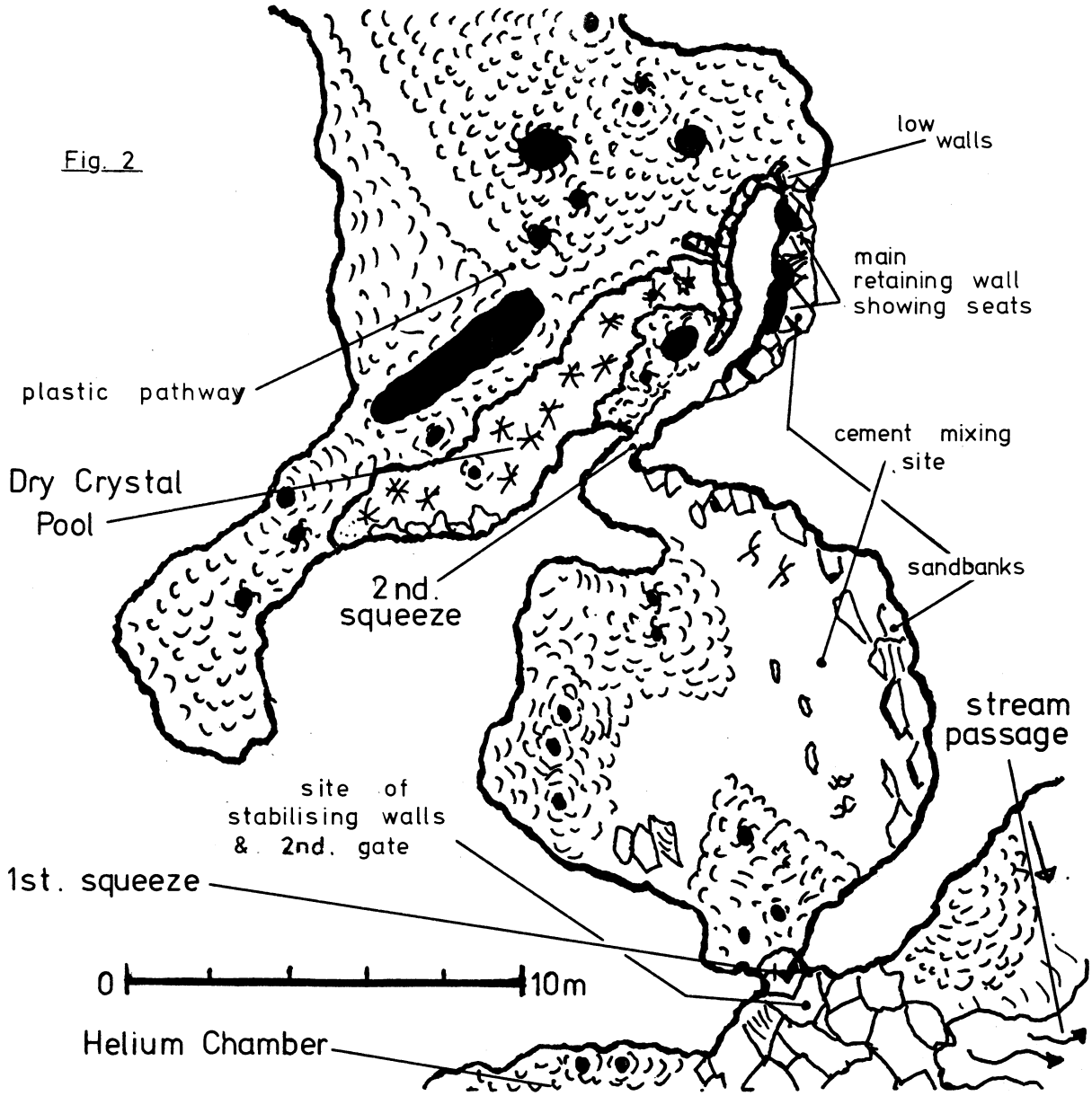
An unfortunate aspect of the wall construction was that initially, traditional grey cement was used which, due to its colour was not very compatible to the decidedly yellow colour of the native rock. Shortly afterwards, the colour advantage of the more expensive white cement was observed and all subsequent construction used this cement; in some situations it is difficult to see the joints.

Altogether, 200 hours were spent constructing some 10 m of walls. The low wall is approximately 4.2 m long and 0.2 m high whilst the larger retaining wall, incorporating seats to accommodate five to six persons is approximately 3.6 m long and 0.6 m high (Plate 1) with loose rocks sloping back to the chamber's wall to completely isolate the sand, allowing clothes and equipment to be placed on top without fear of becoming contaminated with sand again. In its roughest sections part of the intervening floor was covered with cement to facilitate cleaning. A bend was placed in the low wall after the discovery, during site cleaning, of a steady drip of water from the ceiling near the Second Squeeze. The runoff from this seepage flows over badly stained flowstone and into the dry crystal pool. It is hoped that in time nature will heal at least some of the damage.

The entrance to the Christmas Star Extension, immediately above the First Squeeze has always been in a dangerous condition, due in part to the frailty of the ceiling rock and the unstable nature of the rockpile forming the actual entrance; some of the rocks on the downslope side being flowstone cemented together. At least one ceiling collapse has been recorded in recent years (Willock, 1976). The main danger of the entrance lay in one strategic rock, in a natural hand-hold position that, during restoration work, was noted to be in danger of falling if dislodged from its precarious position. If it had been dislodged then a chain reaction rockslide would have resulted.

Work on the restoration project was halted while stablisation of the entrance area took place (Fig. 3). Cement mixing, using the same techniques described above, took place in the Stream Passage, with the 2.25 L buckets again being the best way to transport the mixed cement. The main retaining wall is approximately 1.5 m long and ranges, with backfilling, from 0.6-1.5 m high and utilises a 5 inch R.S.J. beam. On the other side of the entrance, a pier has been built on another 5 inch R.S.J. to support a cluster of rocks above it. One hundred hours were spent stabilising this section.

Fig. 2



Section of Christmas Star Extension

Reproduced from the Loveday's (WASG) map of Crystal Cave Wi 62

Plate 1. Christmas Star Extension seat and retaining walls.

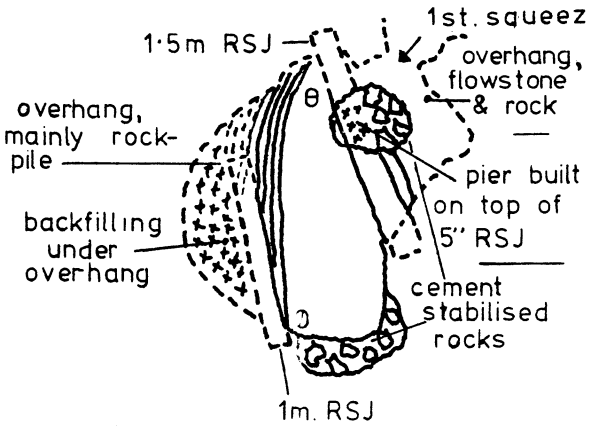


Fig. 3

Stabilising Wall detail

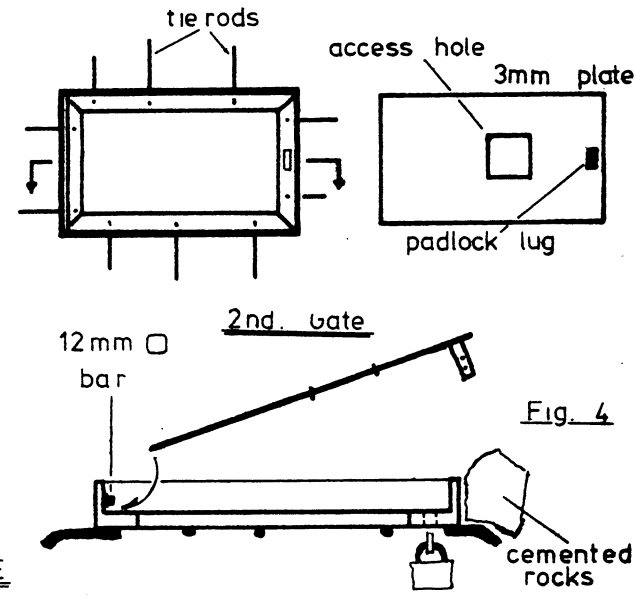


Fig. 4

NOT TO SCALE

During 1974 an access dispute arose over Crystal Cave. The Christmas Star Extension is generally regarded as being for cavers only while the main cave has been used to show speleological features to scout and youth groups. These "tourist trips" of youth groups etc. increased during 1973/74 although they have since subsided. In order to remove the temptation to take such groups into the Extension, a second Gate, covering the Extension only was proposed and accepted.

The gate, (Fig. 4) consists of an angle iron frame with welded tie rods of various lengths to fit the aperture of the stabilising wall section of the Extension entrance. A rectangular slot was cut in one of the short side bases to allow a padlock lug to pass through. A 12 mm square rod was welded to the opposite end, slightly above the base to allow the lid to slip into the slot created. The actual gate-lid is a sheet of 3 mm plate with a padlock lug welded on one side and a square hole cut in the middle of the plate to allow two arms to pass through to get at the lock. The lid is then lifted clear of the entrance.

The gate, installed during September 1975, could be considered to be almost tamperproof as the lid itself is recessed well below the level of the angle iron and the padlock is underneath the gate and therefore is not exposed to open attack by "intruders". Close proximity of rock around the padlock and the closeness and fragility of the ceiling above the gate combine to make unauthorised entry to the Extension a difficult and hazardous proposition.

The cost of materials for the gate and stabilising wall were jointly funded by the Western Australian Speleological Group and the Speleological Research Group Western Australia while all work on the restoration, gating and stabilising of the Christmas Star Extension was carried out by members of S.R.G.W.A. and staff and PhD students of the Physics Department of the University of W.A.

REFERENCES

Poulter, N. (1972). Trip Report. *The Western Caver* 12(4):93-94.

Shoosmith, R. (1975). History of Crystal Cave, Boranup, W.A. *The Western Caver* 15(3):61-62.

Willock, C. (1976). Trip Report. *The Caver's Chronicle* 4(4):2-3.