

# THE UNDARA LAVA TUBES - AN OVERVIEW OF THE “CAVE” SYSTEMS AND THEIR MANAGEMENT

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## LOCATION AND ACCESS

The Undara lava tubes are located in far north Queensland approximately 200km southwest of Cairns, 130km inland from the coast. In terms of driving distance/ time, the lava tubes are about three hours south from the Chillagoe limestone karst. Vehicular access is gained via a number of relatively rough, unmade pastoral property roads of the Yaramulla or Rosella Plains cattle stations, 40km east of Mt. Surprise. Both these adjoining cattle stations lie about 10-12km south of the Gulf Development Road; this road runs west from the Kennedy Highway approximately 50km south-southwest of Mt. Garnet. A tourism complex has now been developed on Rosella Plains station; this includes a small airstrip so visitors can also access the area by light aircraft.

## INTRODUCTION AND BACKGROUND

This paper has been “coerced” by Ian Houshold, the Tasmanian Parks & Wildlife Service’s Karst Officer and one of the ACKMA Conference organisers. On the Friday before this conference he suggested that I could knock-up a 10-20 minute address illustrated with some slides - all as a means to help promote the advance purchase sale (Pre-Publication discount offers to ACKMA members) of Anne and Vernon Atkinson’s new book: *Undara Volcano and its Lava Tubes*.

Anne Atkinson has been studying the geology of the Undara lava system since 1972 and is now recognised as being a world authority on lava tubes. In January 1989, following the ASF Tropicon Conference at Cairns and post-conference field trips in the tower karst of the Chillagoe and Mungana limestone areas, Mick Williams and I spent about a week at Undara with Vern and Anne Atkinson. We were both interested in photographing the sites and I was particularly interested in the unique invertebrate biology of the caves (lava tubes) as well as having a fascination with bats and the guanophile ecology associated with them. (Some of our photographs are included in the Atkinson’s new book.) Since our 1989 visit, I have maintained a correspondence with the Atkinsons and “persuaded” Anne to write an article on the geology of Undara which was published in *Journal No. 4* of the Tasmanian Cave and Karst Research Group. Similarly, I have followed with interest the discoveries of new invertebrate fauna species in many of the tubes as well as some of the conservation and management issues associated with the publicity and tourist development of Undara.

The sixty or so known “caves” and arches are essentially the remnant sections of lava tubes that formed along ancient river valleys, when basalt lava flows poured out from the Undara volcano spreading in a predominantly north-westerly direction to form a large planar region. The grassy woodlands over the Undara lava tubes

now form the pastureland of the Yaramulla and Rosella Plains cattle stations; apart from beef cattle, the vegetation also supports a range of native mammals including wallabies and koalas.

## GEOLOGY

The Undara lava tubes and their caves or arches form part of an extensive plain of basalt that lies in an elevated region of Cainozoic Era volcanic rock, which dates back approximately 66 million years. This elevated region of volcanic rock actually extends almost 4000km from Cape York to Tasmania and generally lies within 200-400km of Australia’s east coast, effectively forming a divide between eastern and western Australia.

The Undara volcano is the third youngest of one of 163 known volcanoes and their lava flows which constitute a predominantly Pleistocene age basalt in the geological zone known as the McBride Volcanic Province. The present 340m wide, 49m deep Undara crater lies slightly north of the centre of the McBride Volcanic Province and potassium-argon dating of the Undara basalts indicates that the Undara volcano erupted approximately 190,000 years ago. An estimated 23km<sup>3</sup> of lava erupted at 1200°C over a period of about three weeks and the sum total of all flows eventually blanketed an area of more than 1550km<sup>2</sup>.

## FORMATION OF THE LAVA TUBES AND CAVES:

Some of this Undara lava was channelled down old watercourses, mainly to the north and west-northwest, but also to the east. As the surface and former watercourse wall sides and floor of lava in these channelled flows cooled, it hardened to form a crust, effectively forming an insulated tube enabling the inner, uncooled molten lava to flow vast distances further on, eventually leaving a hollow tube. The three main flows or “tubelines” all extend westwards or northwards and include the 90km northern flow that followed the Lynd River and the 160km flow to the northwest, down the Einasleigh River valley and its tributaries. This northwestern flow is rated as the world’s longest lava flow from a single volcano and includes a 35-40km basaltic ridge section, known as The Wall, believed to be a relict form of accumulated lava flow levees.

When viewed from the air, these tubelines appear as sinuous, meandering tube flows, composed of long collapse sections where the thin roof crust has fallen in; these features have been favourably compared to many similar meandering channels on the surface of the Moon. The collapse sections of the Undara tubelines are often heavily vegetated depressions with vine thickets and fig trees and hence readily recognised from the air. In between these collapse sections, where the thin roof crust is largely intact, there are the various

tube sections that comprise the known caves and arches at Undara.

## **THE CAVES AND ARCHES AND THEIR CONTENTS**

Over 60 known caves and arches are known from two of the Undara tubelines. About 90% of the cave entrances are upslope from the tube cave (i.e., towards the volcano) and entry usually involves access down a rubble slope composed of roof collapse debris. Most of the caves and arches are broad, relatively low roofed features, formed where lava flowed down a relatively wide and shallow watercourse. Where the former watercourse was restricted to a deep and narrow valley, the tube shape changed from a horizontal oval to become a vertical oval, hence the 13.5m high passage in Barkers Cave, as shown on the front cover of the new book by Vern and Ann Atkinson.

The longest of the caves is Bayliss Cave: 1350 metres long, with 20m wide passages up to 11.5m high. Bayliss Cave has been the subject of extensive biospeleological studies and because of the rich diversity of troglobitic invertebrate species (26 known to date), it is regarded as one of the world's most biologically significant caves. Many of the troglobites in Bayliss Cave are found in the far (unventilated) end of the cave in the so-called stagnant air zone where CO<sub>2</sub> and humidity levels are high. Included amongst these invertebrate species is the large 7-10cm long scutigera centipede, believed to be one of the largest terrestrial troglobites in the world. The ecosystem of many of the Undara caves is based on the rich organic nutrient derived from bat guano, plant detritus, fungi or living tree roots, apart from the dead remains of other animals including vertebrates.

In addition to the diversity of invertebrate fauna in the lava caves at Undara, there are numerous vertebrates, including almost a dozen macropod species, many of which shelter in or around the tubes at sites which maybe up to 20°C cooler than outside. In several of the tube caves vertebrate species such as bats, frogs and snakes co-exist and compete for food resources. Around dusk, at the entrance of the 900m long Barkers Cave, snakes and frogs appear from "nowhere" to prey on emerging horsehoe bats. Nine species of bats, including a previously unrecorded species, are known from Undara and several of the caves including Barkers Cave have defined maternity sites and/ or wintering sites, with obvious implications in regard to conservation management. Cave visitors may also be affecting the biological status of some sites by virtue of inadvertently raising the CO<sub>2</sub> levels due to poor air circulation in many caves and Road Cave has already been considered to have been biologically sacrificed.

## **GEOLOGIC AND GEOMORPHIC FEATURES AND IMPLICATIONS FOR GEODIVERSITY MANAGEMENT**

The caves include a number of natural geologic and geomorphic features which present particular concerns in relation to protection of geodiversity

and geoconservation. Notable among the geologic features are the remnants of previous lava flows including: flow lines in many caves; the intact lava floor in Barkers Cave with a raised crust from the final flow; the final lava surge, preserved as a "wave" of lava in Pinwills Cave; and also theropy lava floors formed by the wrinkled surface of a stiffening skin in the still plastic crust of cooling lava. Similarly, many of the tube caves contain preserved lava drips, referred to as lavacicles, or lava dribbles on tube walls. The geomorphic features include the presence of the now perennial terminal lakes in Barkers Cave and Ewamin Cave and the presence of fragile calcite speleothems such as cave coral and helictites in several caves, some of which have been recently trampled or broken by cave visitors.

Many of these features are relatively unique and require specific geoconservation techniques in order to maintain and manage these features as significant examples of geologic geodiversity in an environment with ever increasing demands of tourism. Very few caves have a natural lava surface floor and repeated trampling and walking in the tube caves introduces further rubble, sandy dust or silt layers over the natural surface. The floor in Barkers Cave is reportedly losing its natural "ring" due to the introduction of outside dirt and mud and has been suggested that to maintain the natural floors of caves such as Barkers and Pinwills, cave visitors should wear velvet slippers or avoid the sites altogether, unless especially constructed walkways can be emplaced!

## **SITE MANAGEMENT AND TOURIST DEVELOPMENT**

The Collins family who own Rosella Plains station under which many of the lava tubes lie, have been grazing cattle in this area of Queensland since the 1860's. Recognising that the tourist potential of the Undara lava tubes could a greater income source than cattle farming, the Collins family offered the land that the tubes are on to the Queensland National Parks and Wildlife Service on condition that they lease it back in order to properly "manage" the tubes. The Undara Volcanic National Park was gazetted late in 1992 and officially opened by the Premier of Queensland, the Honourable Wayne Goss. Gerry Collins manages the site and is currently setting up a \$750,000 tourist village complex which includes a recently bulldozed airstrip and the Undara Lava Lodge, presently composed of some tastefully restored antique railway carriages which have been converted to provide a modern interpretive centre, dining facilities and comfortable accommodation facilities for up to 40 people. Caravan and tent sites are also available. On site Savannah Guides provide a tour service to some of the caves and arches and give tourists additional interpretive information on the local flora and fauna.

There are currently three tariffs: a 2 hour budget special at \$18.00 a head designed to also cater for cavers; a Half Day tariff at \$65.00 and a Full Day tariff of \$85-\$90.00. The half-day and full-day tariffs both include a first class meal with wine/ champagne and chicken under a shade cloth.

The site currently employs 38 staff during the peak season and 24 staff in the off-peak season. Current estimates of visitor numbers vary: from 10,000 a year (Anne Atkinson) to 20,000 a year (Brian Clarke), though Gerry Collins states that marketing surveys he has commissioned, indicate that visitor numbers will reach 40,000 per year within a 2-5 year period.

#### **CONSERVATION PRIORITIES AND WORLD HERITAGE AREA NOMINATION**

Despite the current National Park tenure, there is considerable concern that the biologic and geologic heritage of many of the sites will be severely compromised if conservation and management priorities are not enforced. It is suggested that a number of sites should either be off limits or only have very restricted access: Arches, Barkers Cave, Bayliss Cave, Pinwills Cave, Road Cave and the Wind Tunnel. The national park and some of the surrounding area have been nominated for World Heritage Area listing and conservation bodies are hoping that if accepted, this added status will assist in the establishment of geoconservation and biodiversity strategies to ensure more appropriate management of the lava tubes and their fauna.

#### **THE NEW ATKINSON BOOK - UNDARA VOLCANO AND ITS LAVA TUBES:**

The new book by Anne and Vernon Atkinson is sub-titled: "A geological wonder of Australia in Undara Volcanic National Park, North Queensland". This 86 page, A4 size format with colour plates will be available in hardback or soft cover editions. It incorporates the efforts of 61 contributors, including ACKMA members and cavers (particularly members of the Chillagoe Caving Club), who have supplied artwork, photographs, maps and surveys and diagrams. The text and plates include geological comparisons with similar features on the lunar surface of the Moon and analogies to modern day processes in active volcanic regions such as Hawaii. It includes a foreword from Dick Smith and preface by Prof. Ron Greerly a former NASA space scientist and accolades from the National Parks Association of Queensland and from the Honourable Pat Comben, while the Queensland Minister for the Dept. of Environment and Heritage (1900-1993).

The book includes numerous colour plates of many of the better known tube caves and arches, plus a brief glossary and a number of appendices related to volcanic activity within the Earth, chemical composition of lava flows, early maps of the Undara Lava Tube system, a tabulation of the world's long lava tubes and a list of recorded mammals in the Undara Volcanic National Park. I recommend the book to all ACKMA members.

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