KARST AND PROBLEMATICAL FEATURES IN THE NORTHERN TERRITORY

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INTRODUCTION

The caving potential of the Northern Territory is relatively little known, with only the Katherine area commonly known to contain limestone caves. This is largely because the principal highway of the Territory passes through the area, but also because it is the optimum area for rainfall and quantity of limestone. It may well remain the only area where reasonably large caves will be found.

There is some published information on Cutta Cutta and Guy Caves (Spar) and Kintore Cave (Helictite), representing results from expeditions in the last ten years, and the brief period in the 1960s when there were resident caving groups. This paper will be more concerned with the situation in the remainder of the "Top End", for which there is virtually no published information, yet quite a number of caves.

THE PHYSICAL LIMITS ON CAVE DEVELOPMENT

The classic considerations for cave development are suitability of relief, climate and rock type. It is essential to recognise that the rules applicable in temperate climates do not apply directly to the Northern Territory.

CLIMATE

Central Australia is a low rainfall area in all seasons. The Top End is a desert for seven months of the year and awash for about two months. Evaporation rates are so high that a rainfall of 750 mm (30 inches) is considered the effective equivalent of 250 mm (10 inches) in Southern Australia and can be taken as the arid zone boundary.

Yet the climate is not quite as severe as the precipitation minus potential evapotranspiration formula would indicate. The intensity of the storm rains and the concentration into the short wet season mean that the country is, in effect, wet enough for cave development some of the time. Given a situation with optimum drainage concentration, karst caves exist in some areas with rainfall as low as 300 mm. Nevertheless, except in an area near Darwin which is flat and without limestone, the Northern Territory is rather too dry for cave development.

RELIEF

The Northern Territory can be divided into three main topographic regions.

1. South: Sandplains, with mountains up to 1500+ metres.
2. Central: Featureless low plateau extending to the coastal escarpment.

Caveconvict — Proceedings 13th A.S.F. Conference, 1980

3. North: Dissected country, isolated tablelands and coastal plains between the escarpment and the sea. This area is somewhat favourable for cave development.

ROCK TYPES

For conventional karst, limestone and dolomite are the necessary rocks. However, there are some unconventional karst rocks to be taken into consideration, since silica can undergo true solution in the Top End.

In part of the Cambrian period, there was a large area of carbonate sediment which survives as limestone in some areas and dolomitic limestone in others. Most of the surviving area of these essentially flat–lying rocks is covered by Cretaceous non–carbonate rocks, and also by dune sands further south.

The northern edge of the main area of Cretaceous cover occurs primarily as the coastal escarpment. The Cambrian carbonates occasionally outcrop from below the Cretaceous capping. These isolated carbonate exposures are given separate formation names. They are the Camooweal Dolomite (Qld.–NT border) Thorntonia Limestone (Qld.–NT border). Top Springs Limestone (McArthur River), Tindall Limestone (Katherine), Montiginnie Limestone (Victoria River), and Headley's Limestone (NT–WA border). The Precambrian contains several carbonate rock formations and some sandstones suitable for silica karst.

CAVES ETC. IN THE CAMBRIAN CARBONATES

Several caves have been documented for the Queensland section of the Camooweal Dolomite and Thorntonia Limestone. Although Danes (1910) describes some caves in the NT, no A.S.F. Societies have yet attempted to relocate them.

The Top Springs Limestone is dotted with dark patches obvious on air photos but these are more likely to be gilgai than sinkholes. Even so, this limestone apparently is a karst aquifer contributing to the Week Springs which in a good year keeps the McArthur River running all the way to the coast.

The Tindall Limestone belt is widest near Katherine but can be traced ESE for 150 km (mostly soil covered), NW for 150 km to Adelaide River and then SSE for another 200 km on the opposite side of the Daly River Basin. This belt is of mostly low relief and hence is poor in cave prospects, despite good karst aquifer development, responsible for a large permanent flow in the Daly River and some of its tributaries. There are almost no sites on the west limb of the Daly River Basin, but near the head of the Moon Boon Creek there is a major stream sink and two caves which are not fully explored.

Some water entering the Katherine River comes from open holes; for example, behind the Katherine CSIRO Station there is a spring with a hole large enough for diving. The spring at the Springvale resort, however, is not in the Tindall Limestone and nor is it enterable.

At Daly Waters, there occurs a group of sinkholes which appear to be represent collapses through the Cretaceous cover into cavities in the Tindall Limestone.

The Montiginnie Limestone is relatively thin, but there are sinkholes marked on geological maps, usually in areas of Cretaceous cover.

PRE-CAMBRIAN DOLOMITES

(a) East from Katherine

Here there are cave-bearing Dolomites in the McArthur Group. Near the junction of Karns Creek and the Calvert River there is a place called Djudji-mudgi in the Gawrra language where there are gungula (= holes that go down, as opposed to jahrboon = holes that go in). The gungula vary from shaft type entrances to vast collapse sinks comparable with those on the Nullarbor.

On the Calvert River is a waterhole and spring emerging from a slot in the rock called Gwalina, and a spring feeding a small tributary creek called Cooginah.

The Karns Dolomite formation is quite extensive in the area between Borroloola and the Queensland border.

The biggest area of the McArthur Group rocks is in the McArthur River district. I have been able to explore fifteen or so caves rated as substantial in local terms and many other karst features, but only three would reach 100-160 metres total passage length, and 20 metres the maximum depth.

Typically they are hot and are likely to contain dangerous wildlife, particularly goannas and snakes.

Some caves, usually the hottest, contain the bat *Hipposiderus ater*. Many entrances are resting grounds for a small fly which causes impairment of vision on entering the zone most likely to contain reptiles.

The McArthur Group formations actually named as dolomites, notably the Reward Dolomite, all contain karst features. The mixed formations, which have non-carbonate interbedding, generally do not.

Another area of McArthur Group rocks which may have better cave potential lies mainly within the Arnhem Land Reserve, in the headwater areas of the Wilton River, Mainoru River and Guyuyu Creek. The base map for exploration licence tenure shows an abundance of "meteorite craters" in this area which are actually sinkholes. A problem with the area is that most of it is covered with sandplain deposits.

(b) West from Katherine

The Tolmer Group contains a unit termed the Hinde Dolomite which may contain caves. In the area of the Moon Boon (Bamboo) Creek there is another formation, at present included in the Waterbag Formation, which does contain at least two substantial caves.

In the Victoria River Basin there are several dolomite formations which do not seem to have caves in them. The Wickham Formation often has large sinkholes even though it is not generally thought to contain carbonate rocks. The lower portion of the Wickham formation is comprised of weathering debris derived from dolomites below it. The sinkholes appear to be modern collapse features developed over ancient caverns.

CAVES IN SANDSTONE

The Northern Territory has large areas of bare sandstone country, often with short stream caves which are may have been initiated by solutional action. The Cambrian Bukalara Sandstone in the McArthur River District covers a large area of this type of country.

One relocatable cave is at Glyde (262643) near Amelia Spring, on the east bank of the Glyde River. Others were found near the heads of Myrtle Creek and Amelia Creek. In this dissected plateau, there may be as much as one short through–passage stream per square kilometre.

One fascinating example of this type is at Paradise Pools (O.T. Downs 414390) where a short cave passage connects two parallel gorges and contains a stream which rises inside the cave before cascading along a ledge into another pool. The pool is reached by swimming across a large circular waterhole, along a gorge. then climbing through a rubble cave. The red sandstone cliffs are sixty metres high at this point.

"CAVES" IN THE CRETACEOUS ROCKS

There is a small blowhole entrance in Cretaceous rock on the plateau above Paradise Pools. At Yeuralba near Katherine, Cretaceous porcellanite is riddled with anastomosing tubes very similar to those in the Nullarbor Limestone. The blowing holes rumoured to exist in the northern part of the Barkly Tableland would appear to be in the Cretaceous rocks.

SUBJACENT COLLAPSE SINKS

These features are typically large collapse sinks in non-carbonate rocks. Debate still exists as to whether the original cavity into which the debris has deposited is of karst origin or is a fault related cavity. The best–known example of this feature is the Big Hole in New South Wales.

The best example in the McArthur district is Nhumbi Nhumbi, at Bing Bong (142333), a two–hundred–metre diameter lake almost surrounded by cliffs twelve metres high. The water is exceptionally clear, with a depth of fifty metres over most of the lake, except in one area where the depth is one hundred and three metres (J. Shaw pers. comm.).

The Stretton Sandstone outcrops in the surrounding cliffs. This formation is above the main dolomite formations of the McArthur Group. Another example is found adjacent to a fault near the Glyde River at Glyde 426209. It does not extend down to the water table.

Fossil equivalents of these features are a common and often confusing feature of the local geology. Those that breached the Cretaceous land surface are preserved as isolated bluffs of conglomerate.

One older example occurs in a shelter cave at Batten 929841. Inside the shelter the margin of a breccia pipe is exposed, but on top of the bluff there is Cretaceous cover with a slight basin over the breccia pipe. The cave was used as a camp by aboriginals and there are some paintings. The breccia pipe is the end product of upward stoping of the original cavity; pieces from the ceiling fall to the floor until the cavity is filled or

it breaks through to the surface. Sometimes whole blocks have subsided inside a ring fault.

CAVES AND TOPOGRAPHY

A striking difference between the dolomite caves in the Northern Territory and limestone caves in the temperate regions is in the topographic situation. Except in the sandstone country, there are no caves in which upland streams divert through caves to a major stream. Instead, the carbonate rocks are lowlands with some residual hills which, when of pure carbonate, form heaps of rubble rather than forming caves of the type found at Mt. Etna (Central Queensland).

A hydraulic head difference sufficient to induce caves develops because of the gradient difference between surface and underground routes for water moving towards the main rivers. For this process to work, the karst area needs to be quite large.

The entrances must be several kilometres away and are most often near the upstream ends of alluviated streams penetrating into the hills, though other entrances may occur marginal to the alluvium down the more substantial valleys. The seasonal lowering of the water table also helps to increase the head difference at the onset of each wet season.

Although all the caves show evidence of running water action, their entrances are not usually situated where they would directly capture the main surface drainage in the vicinity; creeks typically run past the entrance, not into it. It appears that the high sediment load in storm runoff produces choking of any "ambitious" entrance.

The caves are scarce relative to the temperate norm. There is frequent evidence that the cave is re–excavated out of old breccia fill.

This factor prompts the idea that conditions are unfavourable at present for the formation of caves, and that it is only well–situated fossil systems that are currently kept open, with few or no systems developing.

CAVE SUMMARY

McArthur River: Reward Dolomite

Greebly Hole (017835 Batten)

Located east of Berjaya Prospect, entrance in doline with native *Bauhinia*, shaft with infestation of flying insects. Rope needed for short free pitch from the shelf at the foot of the shaft, and also for steep slot leading to the bottom, where foul air may be encountered. Some shelves in the walls of the bottom chamber are useful in keeping the head higher, but the passage leading on has a pool of even worse foul air with a distinct layer below which a match will not light and an acetylene flame is extinguished. Vegetable debris hanging from muddy walls indicates a sump. Snakes have been observed in this cave.

Explored H. Shannon, R. St. George

Grade 3 sketch

T.P.L.: 35 metres. Depth: 20 metres

Trap Hole (025835 Batten)

Sharp edged doline and 3m crawlway with foul air. Approximately 500m west of Greebly Hole.

Reward Mine Complex (038839 Batten)

This is the largest group of caves known in the area, related to capture of floodwaters from the edge of an alluvial flat which lacks a surface channel. All caves show evidence of excavation from old cave fill. It includes the following four caves:

Slot Tomo

The entrance lies just outside a doline with a conspicuous fig tree visible from the Reward Mine road, not to be confused with a small doline with overhanging sides used by dingoes, or the unenterable hole under another fig tree about 500 m west. A narrow, vertical slot gives access to a rudimentary maze of cool passages.

T.P.L.: 25 metres. Depth: 10 metres

Overflow Cave

This is situated two hundred metres away from Slot Tomo, under a large clump of figs not visible from the road. A short rocky gorge leads to a sheltered entrance. On the left is an open side passage. Ahead, a smallish hole (possibly blocked by fuel drum) gives access to two chambers. In 1977 there was a shallow pool at the outlet, which had disappeared by 1978. Crawlway to left becomes too tight. The cave is cool for this area.

Explored H. Shannon, R. Curtis, R. Playle et al.

Grade 3.4 traverse and sketch R. Curtis, H. Shannon.

T.P.L.: 100 metres. Depth: 10 metres

U Tube Cave

Two shafts and a short connection.

T.P.L.: 15 metres. Depth: 6 metres

Dull Cave

Winding cave with smooth arched ceiling, excavated in old fill, rubble floor.

T.P.L.: 10 metres. Depth: 4 metres

Teena Complex (064815 Batten)

This is similar to the Reward Complex, located about three kilometres further down the same dry valley, and also in the Reward Dolomite. It includes the following two caves plus minor holes:

Gollum Cave

Perhaps the most interesting cave in the area. At the high water level seen in the original exploration, the water is barely six metres below the surface. The accessible cave is then sixty metres long, consisting mostly of lake. At the low level seen three years later (1980), the water was three metres lower and a further sixty metres of cave was accessible beyond the former upstream sump.

At this level the downstream lake continues round a corner, but was not explored. Most of the cave is developed along the crest of a sharp anticline. The new section includes a U tube squeeze and ends in a rockpile probably quite near the surface water inlet.

Map: 1977 by H. Shannon and R. Curtis.

Fright Cave

Three metre entrance climb, then earth floored chamber fifteen metres long.

Isolated Caves

Gasworks Cave (022784 Batten)

This occurs in Teena Dolomite. It is a short gully sink going to water about twelve metres down. The entrance is often blocked by flood debris. A terminal lake generates methane bubbles.

Ripplemark Cave (022822 Batten)

This occurs in the Mara Dolomite. There is a fifteen metre pitch leading to a substantial chamber. Ripplemarks are conspicuous in a slab half way down. When visited, the cave contained a large goanna.

Berjaya Caves (002822 Batten)

Two nearby entrances on top of a creek bank in Mara Dolomite, with good draught in winter. The lower cave is perhaps fifteen metres long, a knobbly, stooping, crawling cave with muddy flood debris in it. The upper cave starts as a dusty rock shelter with a floor hole towards the back. Snakes have been observed in this location.

Pink Slabs Cave (920668 Mallapunyah)

In the topmost Teena Dolomite, this cave is the most decorated in the area. Much of the hanging wall above the lower level is excavated in coarsely crystalline travertine. The entrance area is sometimes occupied by goannas. The lower level is a very hot maze. Access is through a flattener and over a cliff. Passages total about thirty metres.

Hat Hole (128630 Glyde)

This is in Reward Dolomite, near the base of a hill in a complex saddle area. There is a ten–metre shaft to a bone–strewn chamber, exiting through a canyon to a talus–filled chamber. A hot, dry side passage with bats occurs at this level, with big fallen slabs. A squeeze at the base of the talus gives access to a round chamber. The main stream bed follows the wall of this chamber to a sump with its water covered by grass trash, while across the sump is another streamway passage. Passages total about one hundred metres, depth about eighteen metres.

Bauhinia Turnoff Cave (765954 Batten)

Visible from the Bauhinia Road, one kilometre from the old Borroloola Road, on the right. A typical doline with vine scrub gives access to a daylight chamber.