

## **MIMBI CAVES: GEOLOGY AND GEOMORPHOLOGY**

At the meeting of 4 December 2002, Dr Phillip Playford, a founding member of Kimberley Society, gave an informative talk about the Devonian reef belt and the processes which led to its present remnant form including the extensive and little known Mimbi Caves. He has visited and studied the reef every year since 1956 except for two years. He is working with CALM who are negotiating with Aboriginal interests in seeking to jointly manage the Mimbi Caves area, which is expected to become a major tourist attraction in the Kimberley, rivalling or surpassing Purnululu in interest. He has remapped the Devonian Reef with Roger Hocking, producing seven new maps, and is working on a bulletin for the Geological Survey of WA.

The remains of the reef belt, which was formed 350 million years ago, now forms a rugged belt of limestone ranges 350 km long known as the 'Devonian Great Barrier Reef'. This stretches from the Napier Range northeast of Derby to the most southerly outcrops on Mt Pierre Station, forming part of the Lennard Shelf, which separates the main part of the Canning Basin to the south from the mountainous Kimberley Block region in the north. In the past the reefs are believed to have encircled most of the Kimberley, for a smaller but similar formation occurs in the north Kimberley, at the Ningbing Range. During the Permo-Carboniferous era, when Australia was part of the Gwondana supercontinent in the south Polar region, a series of ice caps believed to have been more than 4 km thick in some areas, planed WA flat as the ice moved northwards. Polished pavement areas, typical of glaciation, with grooves and striations, are still in evidence on the top of the reefs and in other parts of WA today.

A feature of thick ice caps is the presence of areas of subglacial meltwater due to intense pressure and raised temperatures caused by heat from the rock below. The colder the water, the greater the solubility of limestone. The cold water under high pressure underneath the ice attacks limestone, forming dolines (large flat bottomed depressions), tower karst, karst corridors, caves and tunnels as the meltwater is forced towards the ocean beneath the ice cap. The karst features of the reef belt were formed some 290 million years ago. The Mimbi Caves system forms one of the most striking features of the subglacial karst.

Larger karst channels (or Nye channels) are evident in the reef limestones as gorges along which there is no stream to account for the channel formation, although some active gorges, such as Windjana Gorge through which the Lennard River flows, are also believed to have originated as Nye channels. More recent karst erosion of parts of the reef have given rise to karren which consist of sharp ridges separated by furrows forming a jagged tooth-like formation, parts of which are almost impossible to cross on foot.

Eroded faces in the limestone reveal fossil stromatoporides, corals, ammonoids (like pearly nautilus) and conodonts. These are used to distinguish strata. The famed Kimberley fossil fish were discovered in shales adjoining the reefs. The nature of the ancient reef edge is revealed in Windjana Gorge where horizontal strata of the reef platform are fronted by strata dipping at 30 to 40°, which formed as talus slopes in front of the reef. In other parts, masses of conglomerate were poured into the ocean adjoining the reef, as torrential rivers eroded the uplifted mountainous regions of the Kimberley Block.

Hydrothermal activity during past geologically active times formed valuable orebodies containing lead and zinc within the reef. Mining operations at one orebody exposed a magnificent glacial pavement on top of the reef.

Mimbi Caves are at the southern end of Lawford Range, where they form an interlocking maze of narrow caves and karst corridors several kilometres long, through which Mimbi Creek winds its way. Much of the cave system is under water during the wet season. The caves and corridors follow major joints in the limestone, forming one of the most remarkable cave systems known in the world. They were well known to Aboriginal people, but as far as more recent history is concerned, they were “discovered” by David Lowry of the WA Geological Survey in 1963.

Much of the system was mapped by the Illawarra Speleological Society during the 1980s. The caves and tunnels contain interesting stalactites, stalagmites, speleothems glinting with calcite crystals, rimstone rock pools, cave pearls etc. Many horizontal caves elsewhere in the limestone ranges were used by Aboriginal people for dwellings, paintings and tombs of the dead, though because of the darkness within, penetration was not great. Ghost bats live in some caves where deposits of bones of the animals they eat have accumulated.

The main area of the caves is not yet open to members of the public. The Gooniyandi people are the traditional owners of the area, and at present the area of Mimbi Caves is within Mt Pierre Station, an Aboriginal pastoral lease. Dual responsibility for management and development of the caves with CALM has been proposed. If agreement is reached with the Aboriginal interests a Ranger needs to be appointed and access controlled. Further exploration and research into matters such as subterranean fauna are needed.

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### **Postscript**

Prior to presenting this talk to the Kimberley Society in Perth, Dr Playford presented it to the sixth regional meeting of the Society, which was held in Derby in

July 2002. Dr Playford was in the Kimberley at that time leading a field excursion for the International Palaeontological Congress. An audience of some fifty people enjoyed the presentation and the event resulted in profit of \$100 over costs. The Derby members donated that money to the Kimberley Society's Old Halls Creek Post Office Appeal, which was responsible for generating much of the money used to put a protective roof over the ruins of the mud brick post office.