A BRIEF REVIEW OF THE LIMESTONE RANGES, WESTERN AUSTRALIA

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Abstract

A series of low limestone ranges extend for 275 km along the northern margin of the Canning Basin in northern Western Australia. To the north of the limestone ranges lie the mountains and plateaux of the Kimberley Block. The limestone ranges are exhumed reef complexes of Late Devonian age. They extend in a discontinuous belt, rarely over 15 km wide, from 175 km NW to 100 km SE of Fitzroy Crossing. In some areas the ranges may stand as much as 200 m above the surrounding plains. Karst features are abundant in the region but very few major caves have developed.

Introduction

The limestone ranges of Western Australia consist of a series of low limestone hills that are located along the southern margin of the King Leopold Range. The ranges extend for about 270 km with a northwest-southeast trend. About midway along, and just south of, the ranges is the small village of Fitzroy Crossing.

The ranges are traversed by a number of major streams including the Lennard, Fitzroy and Margaret Rivers. There are also a number of small rivers and creeks that cut through the ranges. In the wet season even small streams carry large volumes of water and have been important in the geomorphic development of the region.

In this paper the ranges have been divided into five areas (Fig. 1), running from the northwest they are:

1) the Napier Range.
2) the Oscar Range – Oscar Plateau – Geike Ranges area
3) the Horseshoe – Hull – Horse Spring Ranges, north of the Margaret River
4) The Pillara – Home Ranges; and
5) the Emanuel – Lawford – Laidlaw Ranges area.

The latter two are south of the Margaret River.

Environment

The climate is a semi-arid type with strongly seasonal rainfall amounting to 450 – 650 mm, 85% of which falls between December and March often very intensely. Temperatures are high exceeding 38° C for more than 100 days a year; evaporation is likewise high and is estimated to exceed 2500 mm. Soils vary from non-existent on the Ranges themselves to deep, heavy textured soils on the surrounding plains which carry Mitchell and other tussocky grasses. Some alluviated areas have an open eucalypt woodland community which becomes denser in the protected valleys. The dissected surface of the Limestone Ranges carries very little vegetation – scattered spinifex and other tussock grasses with some acacia scrub and an occasional baobab (*Adansonia gregorii*) and other trees.

Geology

The limestone ranges have been the subject of numerous geologic studies because the area has been considered as a classic example of an exhumed reef structure (Playford and Lowry 1966) and as a model for the study of potential oil accumulating strata in the subsurface to the south. The most popular geologic interpretation of the limestone ranges is that of Playford and Lowry (1966). They have put forward the hypothesis that the ranges are preserved reef structures of Devonian age (350

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million years old). Three types of limestone have been associated with the reef interpretation. They are a thin to a thick bedded, flat lying limestone representing the backreef facies; the massive interbedded limestone of the reef proper; and the steeply dipping interbedded limestones and clastics representing the forereef beds.

Logan and Semeniuk (1976) have recently proposed an alternative interpretation that depends on micro-solution to form the steeply dipping beds that have been assigned to the forereef; and they have dismissed the reef interpretation of Playford and Lowry. To date most workers have rejected the Logan-Semeniuk hypothesis and follow a modified Playford-Lowry hypothesis.

Caves in the ranges are usually developed in the steeply dipping forereef beds (eg. Old Napier Downs Cave, Tunnel Creek Cave) but the Cave Springs Cave system is developed in the backreef beds.

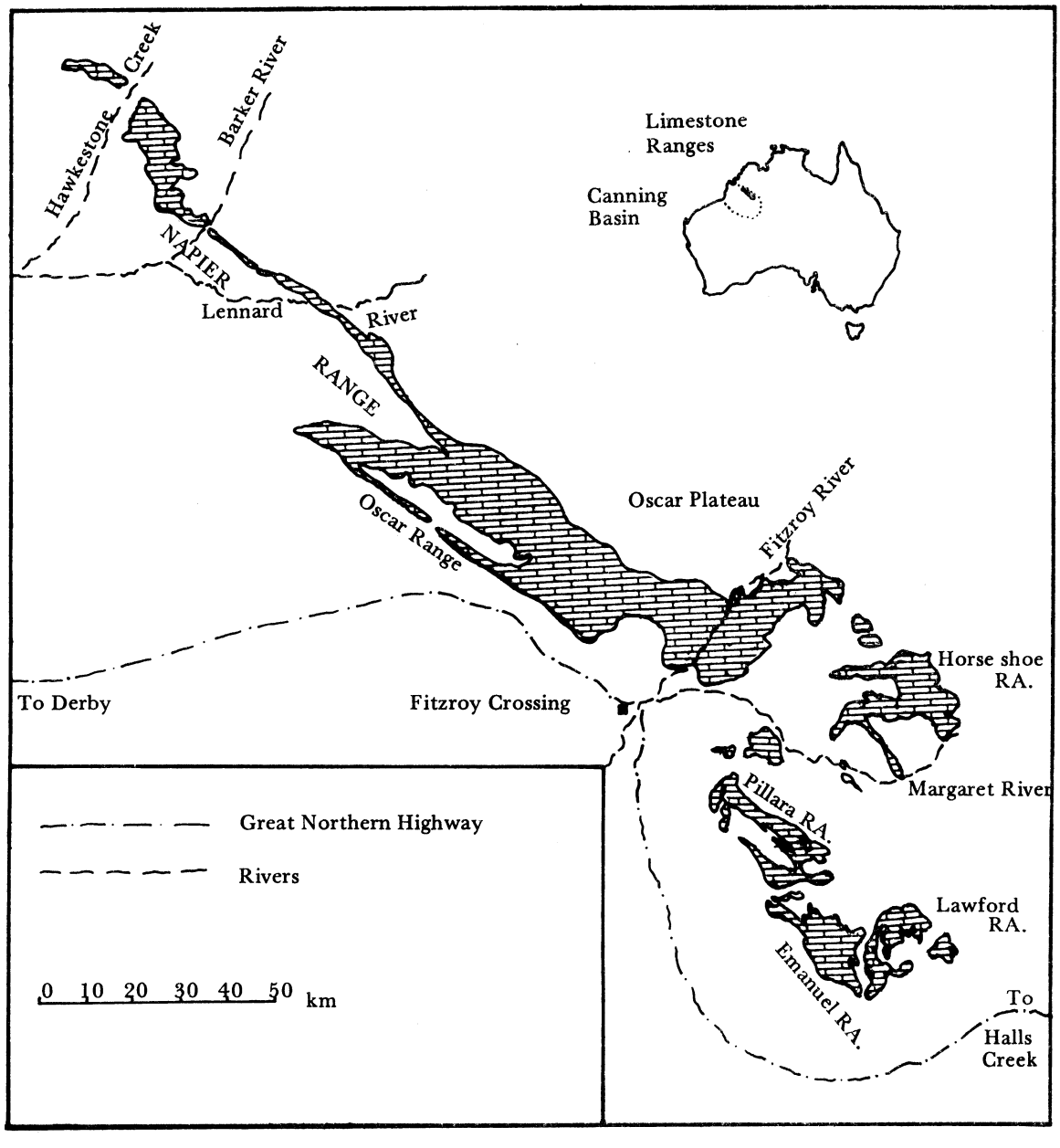

Fig. 1. The Limestone Ranges of Western Australia.

Karst Features

A wide range of karst features is found in the Limestone Ranges. These range from rain pits and rillenkarren to caves and marginal amphitheatres. These features have been enumerated by Jennings and Sweeting (1963a) and will not be discussed here.

Only a few large caves have been developed in the region. This may, in part, be related to the lack of concentration of water into confined channels in the limestone, as would occur in a sinkhole. The thin to non-existent soil cover means that most of the rainwater falling on the rock surface enters the nearest joint or bedding plane. This does, however, mean that a great number of minor caves have developed some of which are geologically very interesting.

Aboriginal Sites

Many of the caves and rock shelters of the Limestone Ranges contain material associated with aboriginal culture. These include burials, paintings and artifacts. Extreme care should be taken so that no damage occurs to any of these sites. If possible a photographic record should be made of all sites. The burials consist of the skull and some other bones, usually limb bones, that were originally wrapped in bark and placed on a ledge in the cave. The paintings may be simple monochromes or very complex works in three or four colours. Artifacts include points and tools.

Napier Range

The Napier Range is the best studied of all the Limestone Ranges (Basedow 1918; Jennings and Sweeting 1963a, 1963b, 1966). The major caves, such as Old Napier Downs Cave and The Tunnel, have been mapped, as has one of the larger cliff-foot caves near Barnett Spring. There are, in addition, a number of caves known to the author that have not been discussed in the literature. All the caves will be briefly discussed by following the trend of the range from north-west to south-east.

The westernmost cave of the Napier Range is located in the gorge where Alexander Creek cuts through the range near Limestone Spring. A small entrance passage, a few metres in length, in the south wall of the gorge intersects a large transverse passage. This passage is blocked at either end and contains relatively abundant speleothems. When entered in July of 1972 the larger passage contained a bat population, species undetermined, estimated at between 50 and 100 specimens. There is an aboriginal burial in an alcove near the cave entrance.

Barnett Spring is located near the end of a spur that juts out about 3 km from the trend of the range. Jennings and Sweeting (1963b) have described a major cliff-foot cave located on the north-west side of the spur. There are also a number of caves located on the west side of the gorge that runs up the centre of the spur. These caves are solution passages that run for short distances parallel to the trend of the gorge. There are additional small caves around the margin of the spur on the south and east sides.

Old Napier Downs Cave (Jennings and Sweeting 1966) is located near the eastern end of Chedda Cliffs. The cave is small, about 110 m long, but interesting as it has the best decoration of any of the caves in the area. The cave has exploration potential as it was not fully mapped by Jennings and Sweeting.

There are a number of caves in the immediate vicinity of Windjana Gorge. Most are small but exploration has not been thorough. About 2 km west of the gorge there is a complex of small cave entrances associated with a travertine deposit at the base of the cliff. A large sinkhole is located on top of the range above these caves and there may be a connection.

In Windjana Gorge there is a prominent cave entrance close to the top of the downstream end of the west wall. The entrance is at least 5 m in diameter and extends for more than 10 m. Observation of this cave has only been from the ground and from a helicopter as it is at least 40 m above the floor of the gorge. There is also a rock shelter with an unexplored lead just east of the upstream entrance to the gorge.

Three kilometres east of Windjana Gorge, behind the ruins of Lillimilura Police Station, there is a small cave at the base of the cliff. In July, 1972, a small stream was flowing from the cave which is about 2 m high, 2 – 3 m wide and extending 5 – 7 m into the cliff, the water enters from the ceiling. Above the cave, on top of the range, are two major sinkholes one of which was investigated and a shaft located but not explored.

The Tunnel is the largest (but not the longest) cave in the Limestone Ranges, it has been described in detail by Jennings and Sweeting (1963b). The Tunnel is 675 m long, up to 15 m high, averages 20 m wide and carries the waters of Tunnel Creek through the range. There is a major collapse doline (karst window) about halfway through the cave. Speleothems are present but most are dry.

Jennings (1962) reported a cave in a spur in Dingo Gap, no description or exact location is recorded but it contained a bat colony.

Oscar Range

The Oscar Range has not been examined as thoroughly as the Napier Range has been; caves have been investigated in three areas – Morown Cliff, near Stumpy Soak and at Brooking Yard.

Morown Cliff extends for about 8 km along the NW tip of the Oscar Range. The cliff is up to 60 m high rising abruptly from the adjacent plain. There are numerous cliff-foot caves as well as several large entrances part way up the cliff. One of these caves in the cliff-face was entered; a steep upward climb over talus, bedrock and clay fill, possibly old guano, to a large chamber at the top. Speleothems are present although scarce but the abundant small vertebrate material on the floor is of interest and the cave is potentially an important study site.

There are numerous small caves in an area about 3 km southwest of Stumpy Soak. These include some cliff-foot types but some multi-level solution caves with multiple entrances also occur. One small cave is an anastomosing passage developed within a steeply dipping bed of the forereef beds. The largest of the caves has large angular passages 2 – 3 m in diameter plus a couple of larger chambers. One of a number of smaller crawl size passages leads up to an upper level entrance. The cave also contains a short side passage that has been used as a multiple burial site by aborigines. The passage only goes a few metres and should not be disturbed.

Brooking Yard is a large marginal amphitheatre located adjacent to Brooking Creek at the south eastern end of the Oscar Range. There are a number of cliff foot caves in the yard. A larger cave is located in a spur at the southern side of the entrance to the yard.

Pillara Range

The author visited the Pillara Range only briefly. The only cave observed was a small shelter cave in Menyous Gap that contains some poorly preserved aboriginal paintings.

Horsespring – Hull – Horseshoe Ranges

These ranges, located in the relatively inaccessible northeastern part of the Limestone Ranges, were not visited by the author and the extent of karst features in the area is not known.

Emanuel – Lawford – Laidlaw Ranges

These ranges represent the southeastern end of the Limestone Ranges; the only described cave in this area is the Cave Spring Cave system located in the Lawford Range (Lowry 1967). There are a number of shelter caves throughout the area especially around the north end of Paddys Valley between the Laidlaw and Emanuel Ranges.

The Cave Spring system consists of three separate caves located on Mimbi Creek as it flows through the southern end of the Lawford Range. The Lower Cave is about 60 m long and contains a large pool even during the dry season. Middle Cave is about 150 m long with pools of water in the main passage. The Upper Cave has over 2000 m of passage, again with pools. Speleothems are relatively abundant in the three caves. The Middle and Upper Caves are the only caves described from the Limestone Ranges that are developed in the flat lying backreef limestone. The development of these caves was controlled by prominent joint sets that are developed in this limestone. The result is a maze type plan with most passages intersecting at right angles. The tendency is toward rectangular cross sections usually about 1 m wide and 3 – 4 m high but some passages are up to 12 m high. The main passage is about 4 m wide. Most of the system is subject to flooding during the wet season.

Conclusion

The Limestone Ranges represent one of the largest karst areas in Australia and has not been examined in detail for caves. It is probable that most of the major caves have been located but numerous caves and cave systems with lengths between 10 and 100 m may be expected during systematic exploration. Aerial photo interpretation and field observations indicates that the smaller cliff-foot caves tend to be located beneath shallow depressions on the tops of the ranges.

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MEASUREMENT OF RELATIVE AND ABSOLUTE WATER TABLE LEVELS IN NULLARBOR CAVES

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Abstract

Several specially conducted trips to the Nullarbor Plain have been made over the period December 1968 to January 1970 with the aim of measuring the differences in height between the water table levels in a number of major caves. In addition, by connecting the surveys to the national levelling network, the water table heights with respect to mean sea level at Esperance and Eucla have been determined. The water table level was assumed to be indicated by the free standing surface of the lakes which occur in some caves. Minor diurnal and longer period fluctuations in these levels are also reported. Special surveying techniques, devised to cope with the difficult condition in the caves, are explained and results are presented for Mullamullang (Oasis Valley), Cocklebiddy, Weebubbie (Weebubby), and Murra-el-elevyn Caves.

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