KARST IN THE WEST KIMBERLEY – AN OVERVIEW AND UPDATE

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PHOTO: ROSS ANDERSON

Kimberley Panorama.

ABSTRACT

The Kimberley region in WA contains several significant karst systems. This area has been the focus of several intensive speleological expeditions. Since the mid 1900s several speleological groups have undertaken trips to this area. The expeditions have had the goal of documenting and recording the karst values of the area. The WA Speleological Group (WASG) is one such group that has undertaken speleological studies in the Kimberley.

It is essential, not only that speleological research is documented, but also that information is kept in a central area. It is also seen as important that the speleological groups in Western Australia are aware of trips occurring to the region, and of outcomes. This will assist in the co-ordination of information and ensure that valuable volunteer time is not wasted.

The main speleological expeditions/trips that are known to have occurred to this area are outlined. What is currently known about the karst in the Kimberley is discussed. Some recent discoveries and useful techniques of recording information are outlined. The potential for future visits and documentation of karst in the Kimberley are explored.

INTRODUCTION

In general, the limestone in the Kimberley occurs as a Devonian reef complex expressed as a series of ridges. The ridges run NW-SE for about 296 km along the northern side of the Fitzroy River Basin, fringing the Kimberley Plateau. Figure 1 shows the primary Limestone Ranges of the West Kimberley.

There have been numerous speleological expeditions to the Kimberley. From our research it appears that the 1960s and 1970s were a very busy time for cavers from all over Australia to visit the Kimberley. During this time the Illawarra Speleological Society (ISS) undertook six trips – mostly to the Laidlaw/Lawford Ranges karst area. References to these trips and more details will appear in *The Western Caver* (Anderson 2005, in prep. b). Robinson (2004, pers.comm.) stated that nearly all of the trips to the Kimberley were unrecorded. This is believed to be due to an agreement that ISS had with the landowner not to publicize or document the area. In total, ISS has undertaken 11 trips to the Kimberley, the majority of trips being to the Cave Springs/Mimbi area.

Western Australian cavers undertook numerous trips to the Kimberley karst areas. Speleologists like Jennings, Sweeting, Lowry, Davey, Jolly and Playford all visited the area numerous times. Many of these trips were not individually recorded – however the information gained was utilized in scientific papers and further documentation of the area. The authors are preparing a paper with more details to appear in *The Western Caver*. This will contain a list of the WA led expeditions that the authors are aware of from documented literature. It will also contain references to other non-WA speleological groups who have visited the Kimberley (Anderson in prep. b).

It has been known for some time that the limestone ranges of the west Kimberley are of considerable international significance both geologically and geomorphologically. Davey (1980) stated that *"the karst in the west Kimberley must be regarded as one of the most diverse and scientifically interesting – not to mention scenically impressive – of our scarce Australian karst resources"*. Davey also pointed out that unfortunately the remoteness of the limestone ranges from the main centres of the Australian population has significantly inhibited systematic exploration and documentation of the karst, and of caves in particular. The remoteness means that travel to the area takes at least 2-3 days driving from Perth and 4-5 days driving from the east coast. Visits to the karst areas in the north require consider-

able finances, planning, organization, time and of course "keen cavers"! The positive side is that the area has not had the same environmental impact by recreational cavers as karst areas located closer to places like Perth or Sydney.

Some of the caves in the west Kimberley have been recorded since the turn of the 19th Century. The Kimberley's three best known caves (The Tunnel, Old Napier Downs Cave and Cave Spring Cave System) have been fairly thoroughly investigated (Jennings 1962, Jennings and Sweeting 1963, Lowry 1967, Shannon 1970). In 1973 Bridge listed a total of 33 caves and karst features that were documented in the literature at the time. Other authors (Cox and Dohnt 1971, Nicoll 1977, Shannon 1970, Dicker 1978) describe previously unknown caves, which illustrate the potential for further discoveries in the region (Davey 1980). The WASG 1996 trip (Vine 1997) added about 70 "new" caves and karst features to the known caves of the Kimberley.

Davey (1980, p 41) has stated that *"it must be stressed that many features of the limestone ranges are of considerable international significance, and that the area is an outstanding component of Australia's natural heritage"*. Of particular concern to the authors is that many of the ASF recommendations regarding the significance and protection of the Kimberley karst (when the ASF commented on the WA Dept of Conservation and Environment Report on the "Conservation through Reserves Committee" on System 7:The Kimberley") have not yet been resolved. Although important parts of the ranges are contained in National Parks (eg Windjana, Geiki Gorge, Tunnel Creek) there is little acknowledgement or management of the area's karst. The authors note that the WA Government primarily operates the National Parks as "surface" environments for tourism, and management of visitor impacts in tourism nodes. The IUCN outlines the need for Integrated Catchment Management. It is the IUCN Guidelines for karst management, which highlight the importance of what is referred to as a "total catchment regime" (Watson et al 1997). The Kimberley region requires an integrated management approach, such as integrated catchment management.

This paper does not describe or outline the significance of the karst in respect to its geology. This has been discussed in detail in numerous papers (Davey 1980, Jennings 1962, Jennings and Sweeting 1963, Playford 1960, Playford 1976, Playford and Lowry 1966, Teichert 1949, Playford 1976, Logan and Semeniuk 1976). Nor is this paper in any way attempting to describe the significance of the karst area's subterranean biota. The WASG web site (www.wasg.iinet.net.au/kimberley.html) notes that most cave fauna of the region has been collected by two expeditions – the WA Museum (WAM) and Bill Humphreys' 1994 (Humphreys 1995) and the WASG 1996 (Vine 1997) expeditions. The most recent WASG expedition (Anderson, in prep. a) has also undertaken cave fauna sampling.

Davey (1980) stated that there has not yet been any systematic study of the cave dwelling bats of the region. He also noted that Hamilton-Smith had claimed that many basic questions about the bats of the west Kimberley karst and caves remain unanswered (Hamilton-Smith 1966). As Davey noted however, this *"lack of information is indicative more of the rarity of visits to the area by interested and qualified researchers than any scarcity or impoverishment of the caves invertebrate fauna"* (1980:37). The authors point out that further study and documentation of the west Kimberley subterranean fauna is needed. Jennings (1962) stated that he considered *"the west Kimberley caves to be virgin ground for the bio-speleologist"* (1962:33). To date, the authors are only aware of three expeditions to the West Kimberley to collect subterranean fauna for the WA Museum (Vine 1996, Anderson in prep. a, Humphreys 1995).

Davey (1980) also stated that there is little published research on the palaeontological and archaeological aspects of the caves. He cites work done/undertaken by Nicoll (1977) and Gorter and Nicoll (1978) and Playford (1960). Even since that time, studies of the area have only been of a reconnaissance nature.

In the 1980s there were several expeditions to the Gogo and Mt Pierre Stations, East of Fitzroy Crossing. Significant fossils were found at several sites that are believed to be in the Devonian reefs of the Laidlaw/Lawford ranges and referred to as "Cave Springs". This area also contains the Mimbi Cave system.

McKenzie (2004, pers. comm.) has indicated that there was a recent Government expedition to the area – primarily concerned with live mammal trapping, but also examining caves and cliffs for subfossil deposits. O'Donnell (2004 pers. comm.) stated that the group of CALM scientists found a thylacine jawbone near the Cheddar Cliffs.

Davey's closing comments are that *"the limited features identified so far are of considerable interest and it is very likely that there will be significant discoveries in the future. As such, resource management must be sufficiently flexible to protect new sites as they are identified"* (1980:37). He also said that *"the impression remains that much of importance remains to be discovered, documented and protected"* (1980:37). It is now 25 years later and this statement is still true!!

Jennings (1962:30) stated that *"in the dissected limestone country, dark cave entrances invite the caver on every hand. Indeed, there is much first exploration to be done by visiting speleologists."* (He went on to say that *"unfortunately most will probably prove to be small caves"*). The authors note that the nature of the karst, with its dissected fissures has nevertheless provided some extensive cave systems. More recent exploration has found extensive network caves and extended the known sections of caves. For example, KN1 was surveyed in 1959 (Jennings 1962) and the cave was later extended on several occasions. It is the authors' opinion that there are still large caves to be found. Although it must be noted that the definition of "small" and "cave" are relatively subjective.

In 1995, Humphreys reported that *"few caves have previously been reported from the Devonian reef system, however… there is a large number of caves in the Devonian reef system. Some are substantial and contain extensive decoration. In addition there are significant caves in sandstone country"* (Humphreys 1995: xiii)

WHAT IS KNOWN ABOUT THE KIMBERLEY KARST?

Some early cave recordings include

- Wangahinnya Cave near Barnett Spring by Basedow (1918)
- The Tunnel in the Napier Ranges by Jack (1906).

Other early explorers visited caves. Woodward observed in 1907 (as cited by WASG 1973) that the Napier Range is *"riddled by numerous caves, some of which are of very considerable dimensions, but strange to say they are almost destitute of stalactites, and when these do occur, they are of a dull grey colour"* (1973:228). Hardman wrote in 1884 about the Oscar Ranges, whilst undertaking research on the Kimberley geology. It was recorded that he stated that *"fine clear crystals of Iceland spar (calcite) occur in cavities in the limestone, as also small deposits of gypsum.*

In the limestones of the Geikie Canyon calcspar is plentiful so also are stalactites and stalagmites, in caves or coating the exterior of the rocks". (1973:228). Hardman also wrote about the Mt Pierre area, saying *"large caverns with stalactites are found in the hills (of carboniferous limestone) near Alexander Creek, and at Mt Pierre".* (1973:228). He described several interesting caves, with large stalactites forming pillars and descending from the roof in icicle – like forms. The authors found that these early recordings of caves within the Kimberley region made interesting reading.

Table 1: The Karst areas of the Kimberley, as outlined by Bridge (1973) & Jolly & Lance (1980) and according to the ASF "Karst Index".

Area Prefix	Range Name	Location
KN	Napier Range	E Derby – 90 km – between Alexander Crk and 5km S of Carpenter's gap
KH	Horsespring Range Hull Range	E Fitzroy Crossing
KP	Pillara Range	East Fitzroy Crossing
KG	Geiki Range	E Fitzroy Crossing
KO	Oscar Range	NW Fitzroy Crossing
KL	Lawford & Laidlaw Range	SSW Fitzroy Crossing
KNI	Ningbing Range	N of Kununnurra
KJ	Jeremiah Range	N of Kununnurra

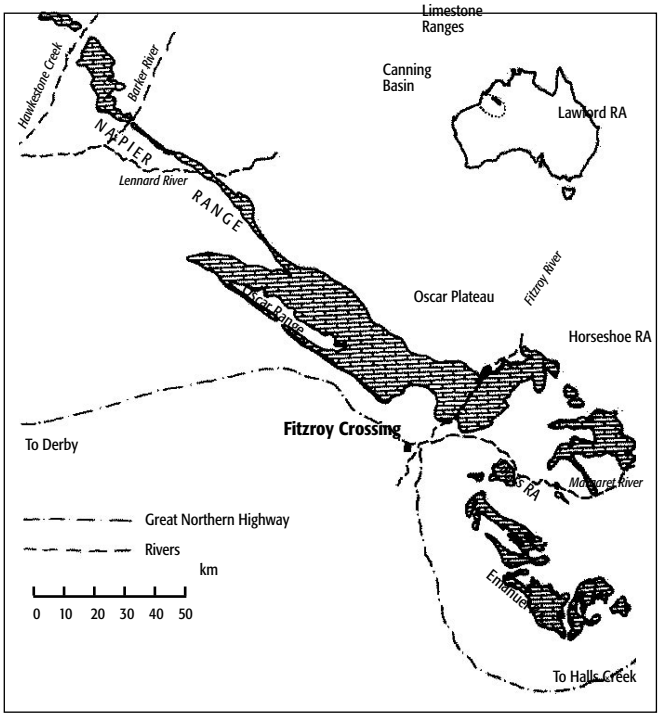

Figure 1: Map of Karst Areas in the Kimberley (after Nicoll 1977)

It is understood that Lex Bastian visited the area around 1973 (Bastian 1973).

In 1978, WASG published the "WA Nomenclature list No. 12" (Bridge 1973). This was the first documented speleological record of Kimberley karst features that the authors have found. At that time it was clearly stated that *"it is not intended to number the Kimberley caves until some years in the future when a great deal more is known about their distribution"* (1973:225). There was a list of about 35 karst features and references to their documentation. Table 1 lists the karst areas, their prefix and location. Cave area locations are shown in Figure 1.

EXPEDITION FIELD RECORDS

It is clear that the aim of speleological trips is to document karst features, particularly caves. How well this occurs depends on the particular skills and interests of those involved. It is clear from the reading of many volumes of speleological journals that the majority of documentation undertaken in the early years of speleo exploration was by speleologists whose profession was one of the sciences. It is appreciated that information may have been obtained from expeditions or field trips to the Kimberley under the auspices of groups other than speleological groups – the WA Geological Survey, State Government Departments or private individual trips.

The mechanisms for recording activities or documenting findings may be expected to be different from those of speleological groups.

Additionally, the motivation of individuals on recreational trips – say for a university group, would be different from those of a speleological group. It seems that many papers were written where extensive amounts of information were obtained, caves mapped etc, over a number of trips. In many situations, each individual trip is not specifically documented – but the outcomes of the trips are – for example a map is produced – but it has not been recorded who was on the trip, where they went, what exactly they found or looked at and on what dates they did it!

It would appear then, that there are no "official" WA trips, or organized speleological expeditions documented clearly in the literature.

The papers that have been written indicate that trips occurred during the time when a large amount of papers and articles were being written regarding the area. Clearly this is not an accurate reflection of WA speleological activity at the time.

Thus, it is the authors' belief that a systematic approach was not taken by the WA Speleological Group, and that a large amount of important information on the area rests with a number of individuals and groups.

It is obvious from a reading of Kimberley related documentation on these expeditions/field trips that there was a strong focus on the area's geology, geomorphology and speleogenesis.

There was some speleo interest in bats, as species were identified on a cave-by-cave basis, but there was little documentation of invertebrate fauna. So it appears that the main aims of a speleo expedition 35 years ago involved surveys and cave descriptions. However, for other groups, visits to the Kimberley were purely "tourist" trips and they visited caves already found by others.

The authors find that the main aims of recent WA speleo expeditions has been to document as much information as possible about the caves and karst system as a whole. For example, the following needs to be considered when documenting a karst area: the karst values, the area's significance, the karst features, biology, archaeology, palaeontology, hydrology, surveying and documenting caves as well as the collection of subterranean fauna for the WA Museum.

HISTORY OF DISCOVERIES

The early explorers found the *"caves are to be found in practically all areas where creeks run out of, or into, the range. Most entrances…characterized by trees or vines at the mouth"* (Cox and Dohnt 1971:78). Explorers marked the discovery of a cave

by an "x" cut into trees. It was noted that the walls of the gorge (Windjana Gorge) were honeycombed with caves and the limestone cliffs had numerous holes at all elevations. Some explorers left these areas alone, due to a lack of time or equipment, while other explorers noted what they saw. It is also interesting to note that when surveying a cave, some explorers examine every accessible hole and survey all of the cave passages, while others focus only on obvious passages. Lowry (1967) stated *"during surveying, any passages that required more than a yard or two of crawling or chimneying were abandoned in favour of passages where progress was faster"* (1967:68). The WASG discoveries of the Napier Range have involved explorers walking the range face and the surface of the range – techniques similar to those used by the early explorers – but a difficult task in grike country. With the introduction of GPS, the recording of locations of caves and karst features has become much more accurate.

Lowry visited the area in mid 1962 and 1963 (Lowry 1967). He spoke about the "cave springs" at Lawford Range – *"these accounts are inadequate as the authors did not record the existence of the extensive network of passages"* (1967:62). In regard to KL6, he stated that the cave is several hundred metres long but the unpublished survey conducted by the 1979 ISS trip shows only about 150 metres (Jolly & Lance 1980).[1]

Some of the authors' concerns in trying to gather information into one central place, to enable systematic karst study in the future, is the lack of information available on karst features that were documented in the 1960's and 1970's. For example, the WA Karst Index Database co-ordinator has a number of ISS maps, however as there was no location information provided, these maps have very little value. Particularly when the majority of caves have not been tagged for future reference. Thus, there is the potential situation where caves are re-discovered and re-surveyed without knowledge that a particular cave has been recorded already.

USEFUL TECHNIQUES

A common problem for cavers is how to relocate a cave that was found in the past. Thus, initial explorations and documents regarding karst areas need to detail cave locations in a way that makes their "re-location" possible. Otherwise – caves will be "found" several times and cavers spend countless hours documenting something that has already been discovered and documented. This information need not ALL be in a trip report – it could be with the description of the cave as specific cave identification or location information. It is however, important that trip reports document the activities of groups or individuals – not only with regard to what they found – but also where they were/went prior to and after finding it!

It is very useful for example, to know whether a ridge was searched by a party of four spread out individuals or whether one caver walked one side of the ridge. Another example is how far along a cliff face or range the group walked searching for caves. The situation we have in the west Kimberley is how much of the face of the Napier range has been examined – it may only be several kilometers, it may be the whole length. Has the northern side of the range been examined for karst features? What about from the top of the range – how much exploration has occurred and where has it occurred?

Early techniques included describing a feature and its location in relation to a nearby well-known feature. For example, the direction and number of miles from a spring or river was given.

A cave may be marked *"with an x facing west cut into a tree"* (Cox & Dohnt 1971:76). This then progressed to locating karst features on a topographical map. Depending on the scale of the map this may or may not be helpful to future visitors to that area. In this technique, a grid reference number was given and a specific topographic map referred to (Bastian 1973).

The introduction of the ASF cave and karst numbering and naming system gave explorers some guidance on field expeditions. Cave entrances could be tagged and descriptions of caves and karst features followed a standard set of criteria. The descriptions of locations of tags in a cave entrance enable accurate identification of caves and karst features.

The authors have found however, that locating a tag in an obvious and visible place is essential. On occasions the authors have only seen the tag on exiting the cave (it has been recommended that it should not be visible from the daylight/entry of the cave), which can be problematic if a group finds a cave – thinking it is new – surveys the cave and then discovers a tag later.

Robinson (2004, pers. comm.) has stated that techniques on their expeditions in the early years involved making a cairn in the cave and placing a stainless steel plate (club tag) on the cairn. The authors' concern is that these temporary structures may be eroded or washed away over time.

The introduction of the GPS and the removal of selective availability has meant that cave locations can be recorded much more accurately.

However, due to the nature of the terrain and limitations of accuracy, it is still extremely useful to have detailed descriptions of caves and cave locations clearly documented.

One useful technique is to have small area maps – if there are a number of caves in an area where it is hard to describe all of their locations. The researchers should draw a small diagram and specify where the caves are in relation to each other.

With the introduction of aerial photographs, these were also used in conjunction with topographical maps to locate areas of high cave potential. Recent WASG expeditions have utilized digital aerial images and electronic topographical maps. These allow more accurate positioning of karst features and the identification of parts of the range.

The current field techniques include the group/several individuals carrying a GPS so that it "tracks" the groups/individual's total route over an area. This is later downloaded into a computer and it can be documented where the karst area has been searched. This information is useful, in that explorers will know which areas have already been thoroughly examined.

Surveying techniques have moved from the simple compass and tape to the use of a compass, clino and tape. The instruments used will determine the grade of the survey. WASG expeditions have documented in great detail the interior of caves. This takes a large amount of time and means that there is a large amount of information on the maps/cave.

More recent trips have changed the focus of surveying from explicit detail to significant detail. It is acknowledged that the members of expeditions are in an area for a limited

1. A survey of KL:6 was published (see *ISS Newsletter* 2(1):13) and it shows about 1200 feet (approximately 360 m) of passage. A much improved map was then published in 1980 which shows 320 m of passage but the cave looks quite different. Much more significant was the work in Mimbi (Cave Spring) Cave where over 850 m of passage was surveyed. (*ISS Nl.*, 2(3):14) (Eds.).

time and there is a need to obtain as much information as possible without spending the whole trip focusing on only one cave. WASG expeditions now utilize an electronic measuring device called a "disto". This laser-measuring device removes the need for two people using a traditional "tape".

It is both time saving and has minimum impact on the cave. The surveying team can "point and shoot" and obtain highly accurate distances without having to physically explore the whole cave in detail.

FUTURE GOALS AND TECHNIQUES

Topographic maps can be printed (in colour or black/white) to allow groups to have small and detailed maps with them in the field. This is primarily to assist explorers in surface navigation – due to the fissured karst topography – traversing the karst area like Napier Range can be disorienting.

The authors would like to encourage the use of hand held "palm" or computer technology in cave surveying and recording. This would allow data to be recorded electronically on site, rather than manually recording and later entering data into a computer back at camp. This would then be entered into a Geographic information system (GIS). Currently, we are investigating the implementation of GIS.

Other goals include further documentation of the areas' biology, particularly, the bats of the area. Many different types of bats have been observed. There is an opportunity for further research in this area.

Additionally, the authors would like to document the caves in the area that were traditionally used by local Aboriginal groups. The WA Geological Survey has several maps that list significant caves sites in the area of which the ASF was not aware. These caves do not appear to be on the current Kimberley karst list.

The authors note that within the whole karst system there are numerous significant indigenous sites containing artifacts and rock art. Some of these sites are "fenced off' or protected in some other manner. Speleological expeditions document new caves and karst features that may be culturally significant but which either do not appear to be known to local communities or may not yet have been protected. In 2004, the WASG expedition located several new karst features with significant hand paintings. Thus there are significant cultural sites in the karst area.

KIMBERLEY KARST – MANAGEMENT AND PROTECTION

There are a number of discrete karst systems in the Kimberley Region (generally termed the West Kimberley or the East Kimberley) that have no formal karst management. In the east, the primary form of land tenure is pastoral leases and station land. In the West, there are some National Parks, and other areas of pastoral lease and private land. All of these areas need appropriate karst management, in particular a "total catchment management" focus (Watson et al. 1997). There have been a number of expeditions to this area over the last 45 years, however a lot more extensive work is required to document the fauna and the karst.

It has recently come to the authors' attention that there was a review of nature conservation reserves in the Kimberley in 1991. Humphreys (1995) outlines some of the recommendations that were made for the karst areas of the Kimberley, and refers to a submission made by the ASF in 1980. The caves and karst of the West Kimberley are considered to be of considerable international significance. The area's current land management regime does not adequately provide for the reservation and protection of important karst features, nor does it recognise outstanding opportunities to incorporate features into existing reserves that would considerably enhance their value. Point 1.8 of the ASF submission (Davey 1980) recommended that *"there be a thorough integrated survey of all the cave and karst features of the Limestone Ranges of the West Kimberley and that such a survey should examine geomorphological and biological attributes as well as aboriginal relicts"*. It is understood that it was recommended that the WA Museum be requested to make a survey of the caves and springs for the limestone ranges.

Humphreys (1995) indicates that this survey has never been conducted. It is our recommendation that the current status of the karst areas in the Kimberley needs upgrading and that the National Heritage List may be an appropriate mechanism for recognising the "outstanding" values of the area (Anderson, in prep. b).

CONCLUSION

As discussed in this paper, the karst of the Kimberley is extensive. This significant karst system needs to be accurately documented and recorded. This will allow future speleological expeditions to focus on exploring new areas and recording significant information. The Kimberley karst area also needs further protection. Currently a large proportion of the karst is in "rangelands" and pastoral leases. A reserve system would be more appropriate and is something that needs further consideration. The Kimberley karst needs to be acknowledged for its significant karst values and requires appropriate karst management. It would be excellent if the WA Government and speleological groups could work together in this regard. ■

REFERENCES

Anderson, J. in prep. a: The 2004 Kimberley Expedition Trip Report. *The Western Caver.*

Anderson, J. in prep. b: Summary of documentation regarding the Kimberley. *The Western Caver.*

Basedow, H. 1918: Narrative of an exploration in north Western Australia. *Trans. Roy. Geog. Soc. Aust. (S. Aust.)* 18: 105-239.

Bastian, L 1973: Kimberley Field Notes *The Western Caver* 13(6): 228.

Bridge, P. J. 1973: W.A. Cave Nomenclature List No: 12 - Kimberley Region. *The Western Caver* 13(6): 225-227.

Cox, J & Dohnt, C. 1971: Napier Range. *The Western Caver* 11(6): 76-78.

Davey, A. 1980: The Kimberley Karst. Excerpt from "The Conservation of the West Kimberley Karst" by Adrian Davey in *The Western Caver* 20(2): 35 – 48.

Dicker. D. 1978: Kimberley Trip Report Aug 77. *Illawarra Speleol. Soc. Newsletter* 1(12).

Gorter, J. D. & Nicoll, R. S. 1978: Reptilian fossils from Windjana Gorge, Western Australia. *J. Roy. Soc. W. Aust.* 60(4): 97-104.

Hamilton-Smith, E. 1966: The geographical distribution of Australian cave-dwelling Chiroptera. *Int. J. Speleol.* 2: 91-104.

Humphreys, W. F. 1995: *Limestone of the east Kimberley – Western Australia – karst and cave fauna.* WA Museum. Report prepared under the National Estate Grants Program.

Jack. 1906: Tunnel. *Bull. Geol. Soc. WA* 25.

Jennings, J. N. 1962: The Caves of the Limestone Ranges of the West Kimberley. *J. W. Aust. Speleol. Grp.:* 29-34.

Jennings, J. N. 1971: *Karst.* A.N.U., Press, Canberra. 252 pp.

Jennings, J. N. 1975: How well off is Australia for caves and karst? a brief geomorphic estimate. *Proc. 10th Biennial Conf. Aust. Speleol. Fedn.*: 82-90.

Jennings, J. N. & Sweeting, M. N. 1961: Caliche pseudo-anticlines in the Fitzroy Basin, Western Australia. *Amer. J. Sci.* 259: 635-639.

Jennings, J. N. & Sweeting, M. M. 1963a: The Limestone Ranges of the Fitzroy Basin, Western Australia: A tropical semi-arid karst. *Bonn. Geogr. Abh.* 32: 60pp.

Jennings, J. N. & Sweeting, M. M. 1963b: The Tunnel, a cave in the Napier Range, Fitzroy Basin, Western Australia. *Trans. Cave Res. Grp. Gt. Br.* 6(2): 53-68.

Jennings, J. N. & Sweeting, M. M. 1966: Old Napier Downs Cave, West Kimberley, Western Australia. *Helictite* 4(2): 23-31.

Jolly, S & Lance K. 1980: An Index of Limestone Caves and Other Karst Features of the West Kimberley. *The Western Caver.* 20(2): 29-33.

Lance, K. 1980: Kimberley Trip Report. *The Western Caver* 20(2).

Logan, B. S. & Semeniuk, V. 1976: Dynamic metamorphism; Processes and products in Devonian carbonate rocks, Canning Basin, Western Australia. *Geol. Soc. Aust. Spec. Publ.* 6.

Lowry, D. C. 1967: The Cave Spring Cave systems, Kimberley Division of Western Australia. *Helictite* 5(3): 62-68.

McKenzie. 2004 Personal communication. Discussion of fauna in the Kimberley, particularly bats. Employee - Dept. of Conservation and Land Management (CALM).

Nicoll, R. S. 1977: A brief review of the Limestone Ranges, Western Australia. *Proc. 11th Biennial Conf. Aust. Speleol. Fedn.* : 135-139.

O'Donnell, R. 2004: Personal communication. Discussion of recent visits to the Kimberley, in planning for the 2004 WASG Kimberley Expedition.

Playford, P. E. 1960: Aboriginal rock paintings of the West Kimberley region, Western Australia. *J. Roy. Soc. W. Aust.* 43: 111-122.

Playford, P. E. 1976: Devonian reef complexes of the Canning Basin, Western Australia. *25th Int. Geol. Congr., Sydney;* Excursion Guide No: 38a.

Playford, P. E. & Lowry, D. C. 1966: Devonian reef complexes of the Canning Basin, Western Australia. *Geol. Surv. W. Aust. Bull.* 118: 150pp.

Robinson, L. 2004: Personal communication. Discussion of I.S.S. trips to the Kimberley.

Shannon, H. 1969: Linadell (sic) Station, West (sic) Kimberley, W.A. *Down Under* 8(4): 19.

Shannon, H. 1970: Old Napier Downs Cave, Napier Range, W.A. *Down Under* 9(2): 56-58.

Teichert, 0. 1949: Stratigraphy and Palaeontology of Devonian portion of Kimberley division, Western Australia. *Aust. Bur. Min. Res. Rept.* 2: 55pp.

Vine, B. 1997: WASG Kimberley Trip '96. *The Western Caver* 37: 48-54.

Watson, J., Hamilton-Smith, E., Gillieson, D. and Kiernan, K. (eds). 1997: *Guidelines for Cave and Karst Protection.* IUCN, Gland, Switzerland and Cambridge, UK

WASG 1973: Extract from 'Simpsons Minerals of WA.'. Vol 1: 331. *The Western Caver.* 13(6): 228.

POSTER

AN UPDATE ON THE EXPLORATION OF THE NULLARBOR KARST

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ABSTRACT

A detailed description was given at the last Conference of exploration up to and including the collecting of megafauna bones from three caves in May 2002. The W.A. Museum continues to work on these.

Two post-Easter trips in 2003 and 2004 have yielded a further 194 and 603 features respectively. Many features located from the air remain to be documented on the ground.

Those visited so far include several respectable caves, one of which is a smaller version of Thampanna doline and entrance named 'Whispering Cavern'. Features are seen to be somewhat clustered, and other areas are all but devoid of any. The significance of the data remains to be understood. The documentation process is outlined.

Exploration is ongoing, typically some 1500 sq. km per year. The focus continues to be on all karst related features rather than just caves.