NEWLY COMPLETED STUDY ON THE JEWEL CAVE SYSYEM – WESTERN AUSTRALIA

- Kent Henderson, with Stefan Eberhard

As many will be aware, Stefan Eberhard has been contracted to the Augusta – Margaret River Tourist Association (AMRTA) for the last three years to carry out a full hydrogeology and stygofauna study and assessment of the Jewel Cave Karst System.

The study is now complete, and the resultant detailed report is expected to be published, at worst, in the New Year. A summary of the Report is below, kindly supplied by the author. The results of the study are interesting, if not surprising, to say the least, as are some of the recommendations. I will arrange for a Review of the Report, and other comments as appropriate, in the next ACKMA journal, together with purchase details for those interested in obtaining a copy.

As Stefan's contract with the AMRTA has now finished, he will spend next year completing his PhD in environmental science, which involves further research into the hydrology and ecology of the Jewel Cave and other karst systems in the Leeuwin-Naturaliste region. He will also be looking for consultancy work.

EBERHARD, S.M. (2002) JEWEL CAVE KARST SYSTEM, WESTERN AUSTRALIA - ENVIRONMENTAL HYDROGEOLOGY AND STYGOFAUNA. Report prepared for the Augusta Margaret River Tourism Association Inc., Western Australia. 120 pp.

New perspex covering and railing in Jewel Cave

SUMMARY

When Jewel Cave was developed for tourism in 1959 it contained a spectacular lake. The walls and ceiling of the lake chamber were profusely decorated with speleothems and the reflection of these formations in the lake waters formed a stunning display.

The lake and its reflections became a major attraction on the cave tour, however by 1988 the groundwater table had dropped by more than one metre, the lake and its famous reflections had all but disappeared.

The watertable has continued to decline and in 2002 was at the lowest level recorded since 1958. Two other nearby caves, Easter Cave and Labyrinth Cave, have experienced a similar watertable decline.

During 1993, a lake in Easter Cave was found to contain species of aquatic subterranean fauna (stygofauna) associated with submerged tree roots. Because of the watertable decline, this aquatic root mat community, together with root mat communities in three other caves on the Leeuwin-Naturaliste Ridge, were listed as critically endangered under the Environmental Protection and Biodiversity Conservation Act (1999). The reasons for the watertable decline remained uncertain, although lower rainfall, groundwater pumping and increased groundwater usage by tree plantations were speculated causes.

In 1999 the Augusta-Margaret River Tourism Association, through CaveWorks, initiated a three year research project to investigate:

(a) Cause of the watertable decline in the Jewel Cave karst system, and;

Hydrology experiment in Jewel Cave

Interpretation Sign at Lake Cave,
Margaret River

(b) Distribution and ecological/conservation requirements of stygofauna, including root mat communities.

This research report provides the hydrogeological and ecological framework for dealing with current environmental management issues associated with groundwater and subterranean fauna within the Jewel Cave karst system.

The research report also has broad relevance and significant implications for research, monitoring and management of other cave systems on the Leeuwin-Naturaliste Ridge, and elsewhere in Western Australia.

This research further contributes, in part, toward realizing the original vision and aims of CaveWorks (Caves World of Research Karst Science) - that of contributing to better understanding and protection of caves and karst throughout the Leeuwin-Naturaliste region.

The research report also contributes to realising the other major aims of CaveWorks, - sustainable tourism development, and provision of a high quality, ecologically-based, visitor experience.

Southwest Australia is a region notable for a prolonged and significant decrease (21 %) in winter rainfall over the period since 1968. Rainfall patterns in the study area have not followed the regional trend however - Cape Leeuwin recorded a decline in winter rainfall of only 1 % over the same period.

Mean groundwater recharge rates to the karst system decreased by 29 % after 1979-80. The reduction in recharge rates corresponds with a significant change in fire regime – fire frequency within the karst catchment changed from an average 4.3 fires per decade over the period 1958 to 1977, to less than 0.5 fires per decade between the period 1978 – 2002. Groundwater pumping and tree plantations have not contributed to the watertable decline.

The absence of fire during the previous 15 years (and possibly 25 years) has allowed a dense growth of understorey vegetation and accumulation of ground litter.

Through interception of rainfall, it is hypothesised that this has been a major contributing factor to the watertable decline in the Jewel Cave karst system.

Groundwater recharge may be promoted by prescribed burning to reduce the density of understorey vegetation and ground litter.

The conservation status and ecological requirements of root mat communities are reassessed. The known distribution range of the Easter Cave root mat community, recorded previously from one small pool, has been extended to > 2 km^2 area, throughout Jewel, Easter and Labyrinth Caves.

The distribution of stygofauna is not restricted to root mat habitats, and tree roots are not critical for the survival of species that dwell within root mat communities.

The Easter Cave root mat community may not presently meet the criteria for classification as critically endangered, because it has survived lower water levels in the past. All stygofauna remains vulnerable to watertable lowering, however the threshold at which watertable lowering becomes critical to the survival of stygofauna remains to be determined.

Strategies for the conservation of subterranean biodiversity within the Jewel Cave karst system will be most effective if:

(a) They encompass all stygofauna communities, and not solely root mat communities;

(b) They are integrated with karst system processes, especially hydrogeologic and geomorphic processes;

(c) They are applied at an appropriate spatial and temporal scale, viz. karst catchment / karst geo-ecosystem.

The principal management issue relating to stygofauna concerns the need for revision of the Interim Recovery Plan (IRP) prepared by the Department of Conservation and Land Management (CALM).

Threatening processes, recovery actions, fauna monitoring methods, and future research directions in the IRP need to be reviewed and reset.

Mammoth Cave Guides Office, Margaret River

In view of the wider distribution of stygofauna and root mat communities on the Leeuwin-Naturaliste Ridge, combined with increasing pressure from regional developments and associated threatening processes, a regional-scale survey and mapping of all karst catchments, karst drainage systems, and stygofauna needs to be undertaken.

Audio-prompting sign in Mammoth Cave

New Perspex Interpretation Sign – Mammoth Cave

The survey needs to be initiated as a matter of high priority, by the government departments responsible for water resources (Water and Rivers Commission) and wildlife (CALM).

The Jewel Cave aquifer is very sensitive to contamination. A localized area of contamination occurs in the vicinity of the Organ Pipes in Jewel Cave, where groundwaters show concentrations of both chemical and biological species that are significantly higher than background levels.

Elevated levels of metals, nitrate, bacteria and protozoa, are linked to a number of potential sources located both inside and outside the cave.

Key recommendations:

1. To promote the recovery of groundwater levels:

(a) Support prescribed burning of the Jewel Cave precinct and the Cliff Spackman Reserve, and;

(b) Monitor and evaluate the effects of fire treatment.

2. Revise the Interim Recovery Plan for aquatic root mat communities in caves.

3. WA government to instigate a regional-scale survey and mapping of all karst catchments, karst drainage systems, and stygofauna on the Leeuwin-Naturaliste Ridge.

4. To characterise and control the contamination in Jewel Cave, AMRTA to undertake:

(a) Further testing of water quality;

(b) Water-tracing test to determine if there is a link between the septic system and cave waters;

(c) Appropriate remedial actions.

Calgardup and Giant's Cave Manager, Anne Wood, at the entrance to Calgardup Cave, Margaret River