SHORT NOTES

Under the heading of "Short Notes" we will be soliciting brief descriptions of recent work, including preliminary results or summaries of work that you intend to eventually publish elsewhere.. These notes will generally be edited internally, and only sent out to reviewers if we feel out of our depth, or if the results appear contentious. We will, of course, ask contributors to consider submitting a full-length paper at a later date! But do not feel that you are committing yourself to *Helictite* for the final publication just because you have submitted a short note here. We will also consider theses abstracts.

Christmas Island Cave Studies

K. G. Grimes & W. F. Humphreys.

In March - April of 1998 a group of six karst scientists spent two and a half weeks on Christmas Island, in the Indian Ocean, doing a study of the Biology, Geological Hazards and General Management of the island's caves and karst. The team involved Bill Humphreys and Stefan Eberhard, who studied the cave biology, Ken Grimes and Dan O'Toole, who looked at the geological hazards, and Andy Spate and Rauleigh Webb who looked at other hazards and cave and karst management in general. This was done for Parks Australia North, so as to assist them in preparing a management plan for the National Park which now covers a large part of the island. Our job was made easier by a set of unpublished cave maps and reports prepared in the 1960s by local cavers, such as David Powell and Roy Bishop; and also by maps and reports from a later cave expedition from West Australia in 1987. Reports of these studies have been submitted to Parks Australia North.

The island is an old basaltic volcano with a limestone capping that is rising out of the Indian Ocean at a rate of 0.14mm per year and drifting north towards Indonesia at 8 cm per year. The interaction of uplift and a sequence of old sea-levels is a series of old shore-terraces cut into the steep and cliffy limestone sides of the island. The central plateau (about 200-250m ASL, with hills up to 360m ASL) has a partial phosphate cover over a pinnacle epi-karst limestone surface, with the crest of the volcanic surface about 30-40m down. The limestone is mostly a hard massive marine micritic calcarenite with scattered corals and partly recrystallised. It has little primary porosity.

Most of the big caves are at sea level and entered from the base of the coastal cliffs. Higher up one finds uplifted systems that formed at past sea levels, and on the plateau there are some horizontal stream passages. The coastal cliffs which circle most of the island have strong notches cut at sea-level, and well-developed hackly phytokarst sculpturing of the rocks. In one place spring-fed streams running across the Shore Terrace have cut narrow canyons, known locally as The Dales.

Coastal Caves

The coastal caves are horizontal and lie at present sea level. The longest has 2.5 km of mapped passage, and many unexplored leads. Most of these caves have strong outflows of fresh water and submarine springs have been reported from depths as great as 200m.

These caves are horizontal joint-controlled passages with irregular, sharp, spongework walls. At intervals they are punctuated by massive rockpile chambers; some caves are dominantly collapse with little of the original passage visible. Within the coastal caves a fresh water lens is floating on water, so salt/fresh-water mixing-corrosion will be active and responsible for the extensive spongework sculpturing. Tidal mixing and flushing may also assist in the solution of the limestone. The impermeable nature of the rock restricted the original passages to the joints, but spongework cavities are actively expanding from these.

The presence of drowned speleothems down to at least -6 m in the main flooded passages suggests that the original cave development predates the present Holocene high-stand of the sea, and might date back to an earlier sea-level; most likely the 101-104 ka high-stand if measured uplift rates are superimposed on sea-level curves.

Plateau Caves

The few known plateau caves are different. Smaller, muddy, horizontal stream passages run at or not far above the limestone-volcanic contact, and are entered via vertical shafts or collapse dolines. They show some joint-control, but this is partly obscured by a tendency to meander. These caves presumably feed water to the coastal caves (several kilometres away, and 200m down), some of which have impressive water-spouts coming out of small holes in their ceilings. However, no connections have been found so-far. We found foul air (3% carbon dioxide with 17% oxygen) in all the plateau caves. This had not been reported before so perhaps it is just a seasonal thing - we were there at the end of the "wet" season, although it had been an unusually dry one.

Other Caves

There are also a couple of fissure caves, behind and parallel to cliff faces, that seem to be at least partly the result of mass-movement. Most intriguing was a report by David Powell, held in the phosphate company records, that describes a sizable cave near the edge of the plateau that had a stream and was formed mainly in basalt beneath the limestone. Unfortunately, the entrance was filled in some years ago, and is currently lost.

Biology

The subterranean fauna was sampled via caves, boreholes and springs. The sampling was at the end of a relatively dry "wet" season - in which only half the usual rainfall was recorded. The effects of this was observed in the caves and it is likely that a much more extensive troglobitic fauna occurs than was recorded.

None-the-less, the results show that the island has a significant cave fauna in an international context. The fauna comprises swiftlets and a diverse assemblage of invertebrates, both terrestrial and aquatic. The latter include species from the relatively rare anchialine habitat - where freshwater floats over and mixes with sea water.

Identification of both the taxonomy and the troglomorphies of the specimens collected is far from complete, but at this stage there seems to be at least six troglomorphic and six stygomorphic species present along with others who's dependence on the caves is currently unknown. A least twelve of the species found underground are endemic to Christmas Island.

The coastal caves contain a number of terrestrial troglobitic species including the first blind scorpion known from Australia and only the second outside the Americas. These caves contain numerous amblypygids but these are not troglobitic. The plateau caves contain a new troglobitic gnaphosid spider related to one on the Togian Islands, off Sulawesi; possibly the first Australian cave adapted dipluran and a new genus of blind and troglobitic nocticolid cockroach.

The freshwater streams in plateau caves are sparsely populated by cyclopoid copepods and ostracods.

The anchialine waters contain the procaridid shrimp *Procaris sp. nov.* This genus is known elsewhere only from Hawaii in the Pacific and from Ascension Island in the South Atlantic. This primitive and highly aberrant family appears to be restricted to anchialine caves and has only one other known representative, a second genus from Bermuda. All species of Procarididae are sympatric with one or more species of atyid shrimps (Ascension I., Hawaiian archipelago, Bermuda and Christmas I.). These co-occurrences of these two primitive and presumably ancient caridean families support the contention that crevicular habitats have served as faunal refuges for long periods of time. This system is also notable for the presence of several taxa of alpheid shrimps and for ameirid copepods.

Overall, this anchialine system, as elsewhere, deserves intense study - in recent years numerous new species, new genera, at least 10 new families and even a new class of crustaceans (Remipedia) have been described from anchialine caves.

Mud Speleothems in a west Victorian cave.

K. G. Grimes.

An interesting follow-up to the paper on Sand Speleothems in this issue is the recent discovery of possible mud stalactites in a cave at Drik Drik in western Victoria. During exploration and mapping by Victorian cavers last Easter; small, brown, triangular stalactites were seen on the cave walls in several parts of the cave. They looked soft, but no-one liked to touch them to check as they seemed very fragile. The formations were up to 10cm long and a muddy-brown colour. Their form was a triangular ribbon, hanging vertically from a muddy wall, and ending below in a thin string only 1mm thick. The ribbon parts frequently had small holes and gaps which gave the impression that the mud might be coating filaments or cobwebs.

These need to be studied more closely.

The linear stream cave contains numerous soft mud banks and it appears that in the past breakdown has dammed up the stream so that there has been extensive mud deposition. Presumably when the lake drained the soft mud coatings on the walls ran off and in some places dripped to form the mud stalactites.