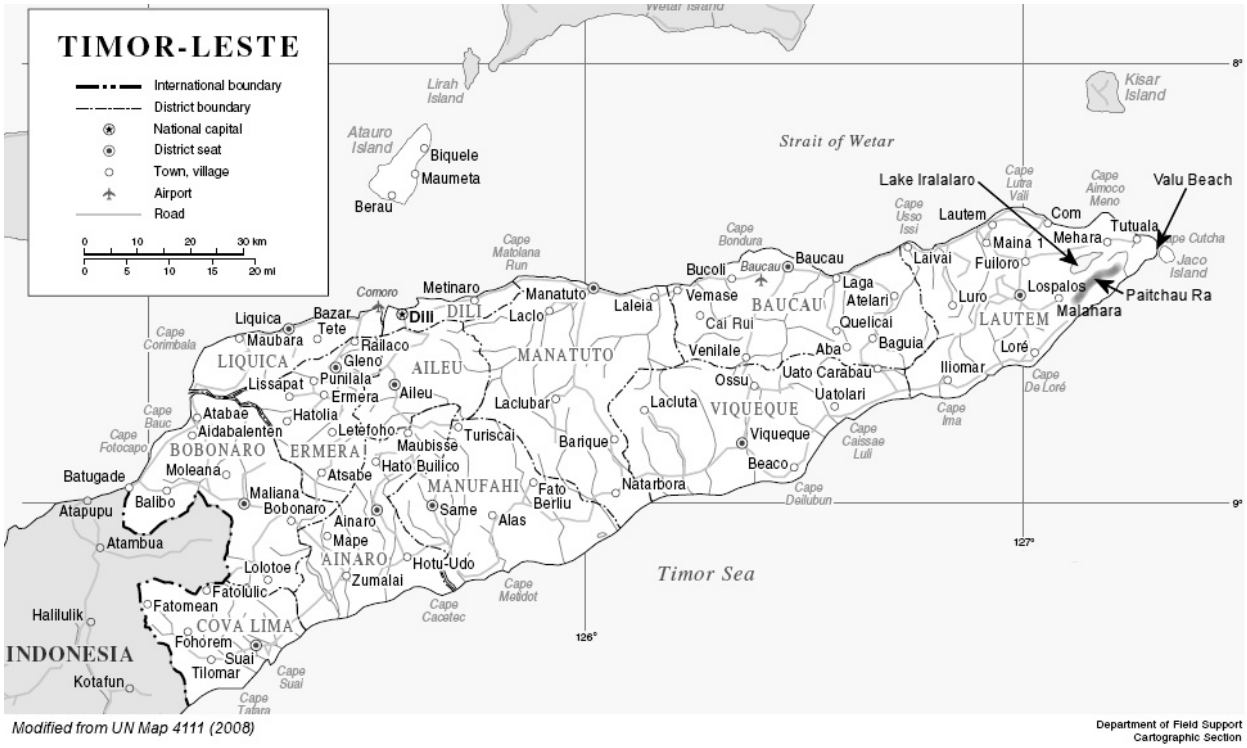
Map of Timor-Leste, showing major features referred to in the text



CAVE EXPLORATION IN TIMOR-LESTE

– John Brush

The Irasiqueiro River, which drains Lake Iralalaro and sinks at the foot of the Paitchau Range.

INTRODUCTION

In June this year I visited more than 30 limestone caves in Timor-Leste. All of them were in the new Nino Konis Santana National Park in Lautem District at the far eastern end of the country.

As Timor-Leste appears to have attracted little attention from speleos or from karst managers and researchers, I thought an outline of the trip might be of interest to ACKMA members.

The opportunity to visit Timor-Leste arose when Professor Sue O'Connor, Head of the Archaeology Department at the Australian National University (ANU), invited me to join an expedition she was leading in June 2009. Professor O'Connor has been undertaking research in Timor-Leste since 2000. Some of her work has involved digs in rock shelters and cave mouths where she has found evidence of human occupation extending back approximately 35,000 years.

The digs have also uncovered bones of a giant rat, now probably extinct. Other archaeological work posed questions about cultural adaptations over time. The objectives of the 2009 trip included searching for mammal bones, especially of the giant rat, and gathering palaeoclimate evidence that might shed more light on cultural adaptations and the reasons for changing habitation patterns. As the new work would be likely to require penetrating deeper into caves than had previously been necessary, I was invited along to provide some speleo expertise.

Valu Beach Resort.

Other members of the team included Dr Ken Aplin, a CSIRO mammal expert; Emma St Pierre a PhD student working on palaeoclimate and palaeoenvironment reconstructions; and Carmen Dos Santos Monteiro, our interpreter who was originally from Lautem District and is currently

studying at the ANU. In addition we engaged three or four local villagers as guides for each day in the bush. Most days we were also accompanied by staff from the Directorate of Forests, including a manager from head office in Dili, a ranger based in the Los Palos district office and a local ranger.

Cave exploration *per se* was not an objective of the trip. However, as we pursued the scientific objectives of the trip, we looked at innumerable shallow cliff foot caves (rock shelters) and solution pits and fissures and, as time permitted, I was able to explore more than 30 'real' caves. Although most of the caves were relatively short (typically 50-200m in length), many of them were spacious, several had vertical pitches, one contained a lake and another was an active stream cave.

The focus of our activities was around Tutuala, Valu Beach and Mehara. However, several team members spent two days looking at caves near Malahara on the south side of Lake Iralalara.

The imposing 50m wide entrance of Lene Hara.

Lene Hara entrance.

GEOLOGICAL SETTING

Carbonate rocks, ranging from Permian to Quaternary, cover much of the eastern end of Timor-Leste (Anon, 2003). Several formations have been described, but from a cave development point of view, it is the Baucau Limestone that appears to be the most important. Dating from the Pleistocene (less than 2 million years old), it is a massive coralline limestone that outcrops widely along the north coast and across the eastern end of the island. In the Tutuala area, it forms a series of marine terraces, some of which are now more than 200m above sea level as a result of very rapid geological uplift (as much as a metre every 2000 years has been suggested). There are many cave entrances in the cliff lines between the terraces and some caves appear to have formed as sea caves.

One of the carved faces discovered in Lene Hara.

The highest elevations in the area are along the Paitchau Range, which reach up to over 900m on Mt Paitchau. Much of the range is composed of Permian and Triassic calcareous shales and siltstones, not all of which are soluble. It is a dramatically rugged area that forms an effective barrier between the central plateau country of Lautem District and its remote and unpopulated southeast coast.

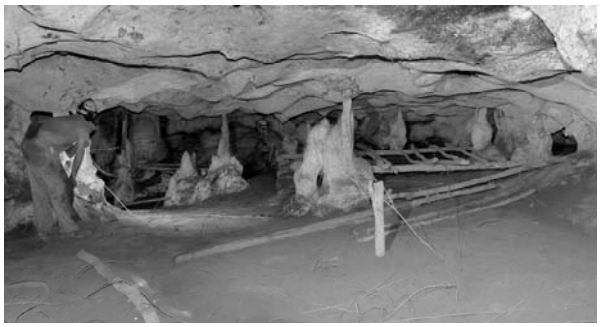
The central part of the plateau is a 100km^2 polje (Middleton, 2006) containing Lake Iralalaro, which varies markedly in size with the seasons and from one year to the next. The only known outlet of the lake is the Irasiquero River which flows to the southeast for several kilometres before sinking underground at the foot of the Paitchau Range. The water is thought to reappear as springs near the southeast coast along the lower reaches of the Vero River. The Irasiquero has been proposed for a hydropower development project (White *et al* 2006), but the current status of the proposal is not known.

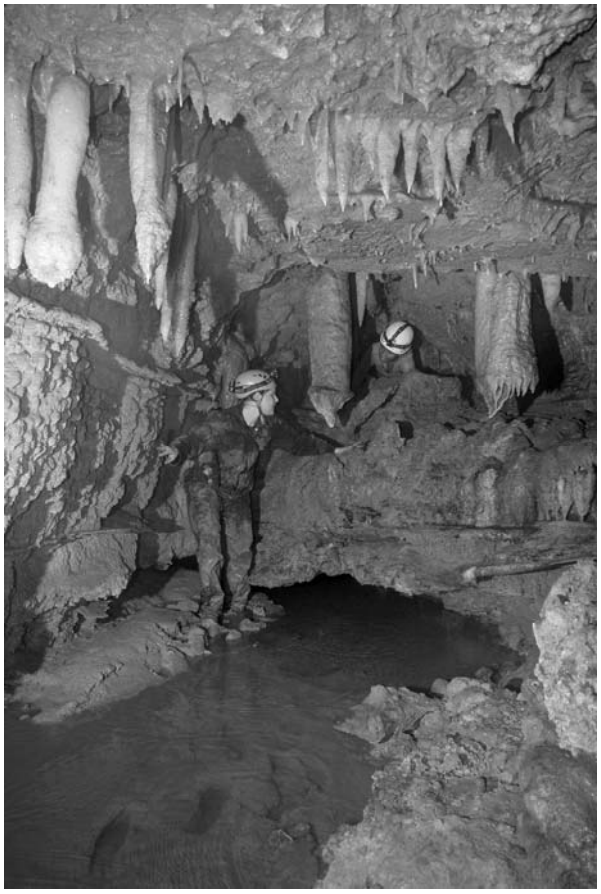
VALU BEACH

We stayed at Valu Beach 'Resort' at the far eastern end of the island. By road, it is about 200km, a good five hour's drive, from Dili. At first, the bitumen roads are generally of good quality but the condition deteriorates towards the east. In remote parts of Lautem District some of the roads are more potholes than bitumen and the final 8km descent from Tutuala to Valu Beach is a rough 4WD track.

Another of the carved faces discovered in Lene Hara.

Remains of sleeping platforms in Lene Lutu dating from 'Indonesian Times'.





Kamu Cave – the only active stream cave visited by the team.

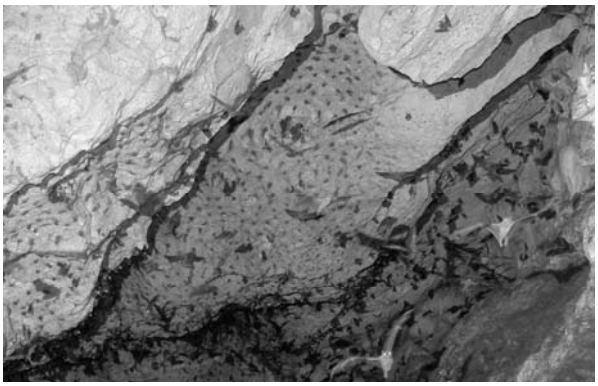
The resort is a collection of simple but reasonably comfortable bamboo and thatch huts set amongst trees adjacent to the beach. The setting is idyllic with views through shady trees to a white coralline beach and across to nearby Jaco Island and the more distant Leti Island in Indonesia.

Tutuala villagers staff the resort and stay onsite on weekly rotations. The operation is bringing much-needed cash into the local economy, but from what we observed, business is fairly slow during the week. At weekends, however, the place bulges to capacity as UN staff and other foreign workers flee Dili for a weekend of relaxing, drinking, and swimming before setting off on the long trip back to the capital.

Meals at the resort were fine, but with no refrigeration and limited opportunities for restocking, the range was somewhat limited. Breakfast, for example usually comprised banana fritters, dried banana slices and boiled banana and, if we were unlucky, a chunk or two of cassava root. All washed down with tea or coffee that had a distinctive and yet somehow undefinable aftertaste.

A big problem for the resort is water supply. Essentially, it doesn't have one apart from the nearby ocean. This is fine for (bucket) flushing the toilet and for swimming – although we were a bit wary of salt water crocodiles (*crocodylus porosus*) that are known to frequent the area. At first, the source of the fresh water used for cooking and the coffee perplexed us. There are no nearby surface streams and the closest spring is 5km distant. Too far, we suspected, to explain the quick return trip times by those rostered for water duty with their string of plastic containers on a bamboo pole. The mystery was solved several days later when we visited Lene Tulu. This is a cave located about 1.5 km from the resort and which has a small crystal-clear lake about 150m from the entrance. Perfect – except for the colony of messy fruit bats roosting above. Could this explain that certain *je ne sais quoi* quality of the tea and coffee? A huge coil of black poly pipe near the entrance and lengths of it snaking down to the lake suggests plans are (or were?) afoot to have 'fresh' water on tap at the resort.

The presence of salt water crocodiles at Valu Beach is hardly surprising. However, they also inhabit Lake Iralalaro which lies at an elevation of more than 300m and is located well away from the coast. Apparently, they do not cause many problems for villagers. Carmen told us this is because the locals believe the spirit of their ancestors is embodied in the crocodiles and that they do not harm 'good' people. This was not very comforting for those of us who have no local ancestry and have never claimed to be good.



A thousand ever-watchful eyes of fruit bats in Machu Kuru 1 (Bat Cave).

CAVES

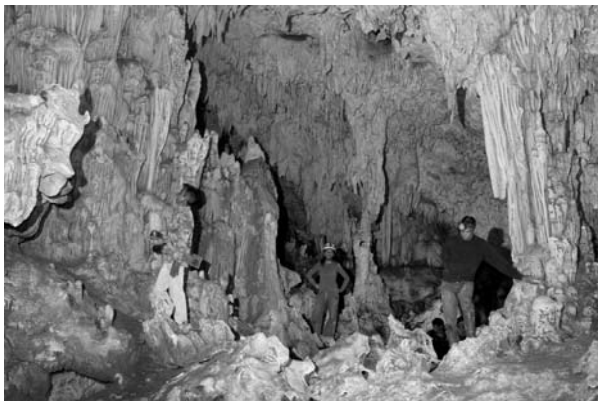
We came across many cave entrances in the densely forested areas that we visited with our local guides. Some cliffs are honeycombed with entrances. However, on closer inspection, many entrances proved to be just shallow overhangs or had passages that quickly pinched down to narrow fissures or small solution tubes. It was not uncommon for a passage to turn and run parallel to the cliff and then pop out to another entrance without penetrating any distance into the hillside. That said, we did examine many interesting caves.

The 20m deep entrance pitch into Hera Mou Chou.

Most caves appeared to be phreatic in origin and sponge work and fret work were common. Only one active stream cave (Kamu Cave) was found and as noted above, one cave (Lene Tulu) contained a small lake. A couple of caves had been partly infilled with cemented gravel and coral fragments that appear to date from when the caves were at sea level.

The caves were generally horizontal, or nearly so. However, exploration of a collapse pit and two vertical fissure systems 20-30m deep required the use of SRT gear. We also looked into the entrance of a very deep fissure, estimated depth in excess of 100m, but did not have sufficient rope to bottom it. Only one cave (Lene Huchu) had an internal pitch that needed rigging.

Speleothems were common in many caves and we saw some fine displays of stalactites and stalagmites, flowstone cascades, microgours and oolites. A few speleothems were active and it appeared that many more would be seasonally active. However, the larger speleothems were often corroded, desiccated or simply falling apart. In some caves, there was remnant decoration that had been redissolved and taken on the form of surrounding phreatic sponge work, indicating considerable periods of immersion subsequent to their formation.



Avacate Cave.

Bats (including *Miniopterus sp*, two *Rhinolophus* species, and at least two species of cave-dwelling fruit bat) were very common. There were few caves that did not have at least one or two bats in residence and we encountered sizeable colonies in three caves near Mehara (Machu Kuru, Oca Kuru and Pere Kuru), in one cave near Malahara (Avacate Cave) and in several caves in the Tutuala area (including Lene Tulu, Lene Hara, Lene Huchu and the Kurus fissure). We also came across cave swiftlets, rats, snakes, geckos, giant cockroaches, termites, colourless millipedes, land crabs (or were they cave crabs?) and evidence of monkeys, civet cats and cuscus.

There were signs of human activity in many caves. Much of it appeared to date from what is now euphemistically referred to as 'Indonesian times' – the period of Indonesian occupation between 1975 and 1999 when many members of the Timorese resistance movement took refuge in caves. The impact of this on the local way of life was brought home to us when Carmen led us to the small cave that she was born in while her parents were members of the resistance. Some caves still contain the remains of wooden and bamboo sleeping platforms. Stone barricades, walls and pottery sherds are common and there is the occasional unbroken pot, enamel plate and cartridge casing.

Local villagers continue to visit caves on a regular basis for gathering food (especially cuscus and bats), collecting swiftlet nests (for the birds nest soup trade) and for spiritual purposes.

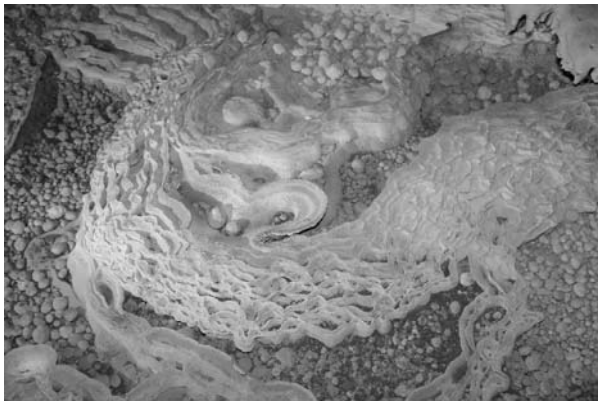
Descriptions of individual caves is beyond the scope of this article (more detailed information will be published elsewhere), but two caves are worthy of additional comment here.

Ken sifting through bone material recovered from Machu Kuru 2.

Lene Hara is probably one of the most widely known caves and archaeological sites in Timor-Leste. While the cave is only about 70m long, it has a 50m wide entrance and a vast expanse of flat (or nearly so) earth floor, it is an impressive site. There have been several archaeological digs near the entrance and in one of these Sue O'Connor found evidence of human occupation dating back 35,000 years (O'Connor *et al*, 2002).

Today, the most obvious sign of use is a low stone wall, but its age is unknown. There is also some art work in red ochre and charcoal along the southern wall. In addition, Ken discovered several faces carved into degraded stalagmites near the entrance. They are not very obvious without side lighting and had not previously been noticed by the locals, including the traditional owners, or by archaeologists.

Microgours and oolites in Latu Kuru 3.



Kamu Cave was the only active stream cave visited on the trip. The entrance is in a shallow collapse doline near the former site of Muapitine village on the lower slopes of the Paitchau Range. The stream is encountered about 50m from the entrance and steps cut into the cave floor and some rubbish suggest that it may have served as a water source for the village.

We explored up the streamway for about 100m to a low, wet crawl. Due to a lack of time, this was not pushed and we also did not attempt to see where the stream went below where we first encountered it. There is a considerable volume of mud and gravel fill in the cave and its composition suggests that some of the catchment is on non-soluble rocks of the Paitchau Range.

NINO KONIS SANTANA NATIONAL PARK

The Government of Timor-Leste formally set aside 123,600 hectares for the nation's first National Park in August 2007. The park covers the entire eastern end of the island as well as 55,600 hectares of surrounding marine areas. It is named in honour of Nino Konis Santana, a national hero and former leader of the resistance movement – FALANTIL (Forcas Armadas da Libertacao Nacional de Timor-Leste) – who died tragically in 1998. Santana was born in the District and lived for a time in the Tutuala area.

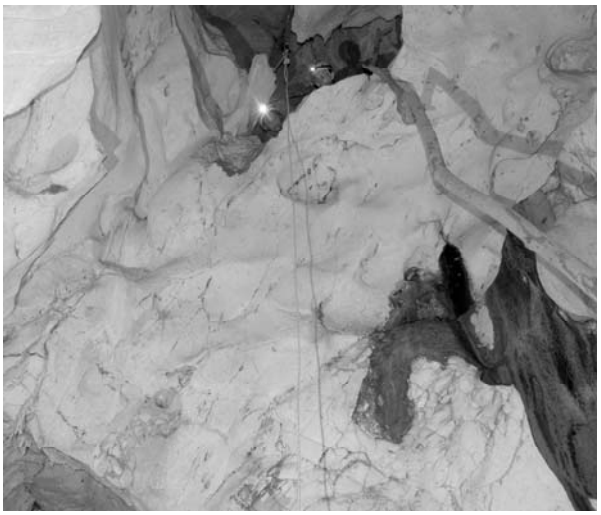
The Park is managed by the Directorate of Forests that sits within the Ministry of Agriculture and Fisheries (formerly the Department of Agriculture, Forests and Fisheries).

Through the Directorate, the Government of Timor-Leste aims to conserve the rich and extensive natural, cultural and historical heritage of the area. The reserve area is recognised internationally as an important area for birds – 25 species are endemic (Trainor *et al*, 2007). In addition, there are large areas of mixed tropical forest, the surrounding seas have diverse range of corals and reef fish and there is evidence of a rich tapestry of human occupation extending over many, many thousands of years.

The Park has been designated as an IUCN Category 5 Reserve, meaning that conservation of natural values will be integrated with activities of local residents and current cultural practices. Balancing these conflicting goals will be a real challenge. Within the boundaries of the new park there are large areas of traditionally owned land, there are extensive grazing and cropping areas (mainly on the flat lands surrounding Lake Iralalara) and there are more than a dozen villages. There are well in excess of 10,000 inhabitants in these villages (Simpson and Sun, 2002) and most of them are subsistence farmers who derive their livelihoods through working their gardens and hunting and fishing in areas now covered by the park.

Villagers have apparently been told not to hunt and some are being discouraged from working their gardens, but in the absence of alternative food sources, edicts from far away Dili are, through necessity, likely to fall on deaf ears.

Tourism is still in its infancy in Timor-Leste and relatively few travellers make it as far from Dili as the east coast. However, local anecdotal evidence suggests that creation of the National Park has stimulated interest the area and it is likely that visitor pressures will increase. Discussions in Dili indicate the Directorate of Forests is thinking in terms of a boom gate across the access road and a substantial entrance fee to address the pressures. Such measures will undoubtedly help the budget but are unlikely, by themselves, to ameliorate visitor impacts.



7m pitch in Lene Huchu. Note the wooden pole, supposedly in place for 30 years, used by locals to access the lower level.

Of the travellers who do make it into the Park, many engage local villagers to act as guides for forest walks, for fishing and snorkelling trips and for visits to Lene Hara and other well known archaeological sites. This gives an important boost to village economies, but at present the activities are totally unregulated and, through ignorance, could be causing irreparable damage to some sensitive sites. In fact, there are already signs of damage at Lene Hara.

Many of the villages within the park now have a resident ranger – a local engaged by Forestry to protect the National Park. However, their precise roles are still evolving and it is likely to take some time to gain the necessary training and experience to deal with likely management issues. Several issues that caused grief (for them or us) during our time in the park were:

- some plants in the Park are not endemic and in fact are highly invasive weeds (eg *Lantana camara* and *Chromolaena odorata*);

- sambal deer are not an endangered endemic species, but were introduced about 100 years ago;

- torching palm trees in the hope of smoking out a cuscus is not the most environmentally benign way for a patrolling ranger to obtain his dinner;

- the sweep of a ranger's arm is a very effective means of clearing a route through a forest of straw stalactites, but is not good for the cave.

Flowstone cascade in the lower level of Lene Huchu.

Creation of the National Park recognises the significant natural and cultural values of the area and is an important milestone for East-Timor. It is to be hoped that the values will be protected with an appropriate and effective management.

Over a two week period in Timor-Leste we covered many kilometres of surface terrain in the Nino Konis Santana National Park as we pursued the scientific objectives of the trip. In doing so we looked at more than 30 caves. But cave exploration-wise, we barely scratched the surface. There was insufficient time to adequately document and map most of the caves we visited and there are vast areas of limestone in the Paitchau Mountains and along the north coast that we did not have time to cover at all.

Searching for caves near Tutuala.

Many more caves undoubtedly remain to be found, but it may not be easy as some areas are remote and rugged, most areas are heavily forested and few karst features are apparent on maps and satellite imagery.

In terms of future access approvals, the Directorate of Forests is still working on a range of access and management issues and it is unclear what its final position might be.

I thoroughly enjoyed my time in Timor-Leste. I am very grateful to Professor Sue O'Connor for inviting me to participate and for the opportunity of exploring caves as we pursued the major objectives of the trip.

Importantly, our cave exploration activities would not have been possible without approval from the Directorate of Forests. Thanks are also extended to our local guides (especially Custodio, Pedro, Alberto and Rafaelo from Tutuala) and the various Forestry staff who assisted with exploration activities.

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