LIMESTONE CAVES IN THE SIGATOKA VALLEY VITI LEVU, FIJI

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SUMMARY

Visits to five caves in the Sigatoka Valley, Viti Levu, Fiji Islands were made during 1976. All the caves had been formed by water erosion and several contained fine examples of stalactite and stalagmite formations. Four of the caves contained evidence of human usage; two as burial caves; one as a fortified retreat and the other contained sherds. Two species of bat were encountered; *Emballonura semicaudata* and *Notopteris macdonaldi*. The Pacific swiftlet, *Collocalia spodiopygia* nested in two of the caves. A spider, *Loxosceles* sp. was found in one of the caves. This was a previously unrecorded species in Fiji; its presence in Fiji poses problems for zoogeographers.

INTRODUCTION

It would seem contrary to the expectations of most people to encounter caves on South Pacific islands, however many of the larger islands of the Fiji group and of Melanesia in general have had a continued history of volcanic and tectonic action, and have been subjected to periods of subsidence and uplift. Taveuni for instance, one of the smaller islands of the Fiji group apperas to have been formed as a result of a fissure eruption, and lava flow caves of the type described by Glover, *et al.* (1964) from Kenya are to be found there.

Since the islands are located in the tropical region, between latitudes 15 and 22 degrees South, one of the predominant features of their coastline is the presence of small barrier and fringing reefs formed by the action of aragonite secreting organisms such as corals and coralline algae. At various times during the geological history of the area the islands have been subjected to uplift, resulting in beds of reef formed limestone being pushed above sea level. Such limestone beds are found in various parts of Viti Levu, (the main island), Vanua Levu and other islands of the group (Figure 1).

In addition the islands are located in a belt of high rainfall (150-360 cm/year) which results in a high degree of erosion and a rugged, highly dissected landscape. An additional feature resulting from this rainfall is the formation of solution caves and cavern systems in the uplifted limestone. The present paper is a brief attempt to collate information gathered after a series of visits to caves in the Sigatoka Valley area of Viti Levu.

LOCATION OF THE CAVES

The Sigatoka River forms the main drainage system to the east of the Nausori highlands and from the western side of the Nadrau Plateau of central Viti Levu. The river reaches the coast as a broad, slowly moving river with a flood plain on either side varying in extent from half to one mile in width. On both sides of this meandering valley the land

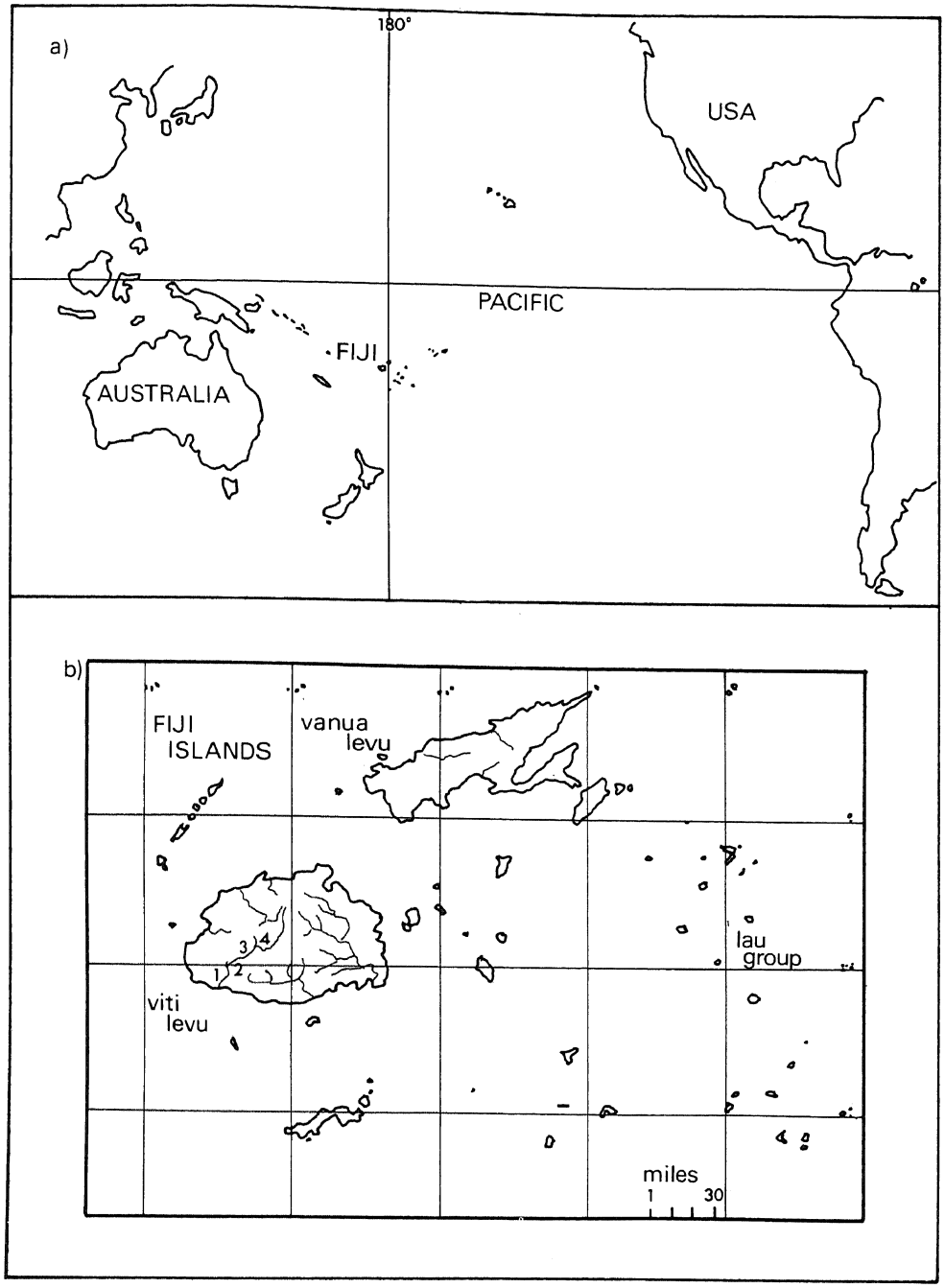

Figure 1

a) Map of the Pacific Ocean.
b) Map of the Fiji Islands showing the location of the caves visited.
1) Volivoli 2) Sautabu 3) Tuvu Caves 4) Saweni, Navosa.

is hilly with large numbers of subsidiary stream beds, many of which are waterless during the dry season (May to October). At various points along its forty mile course the river has cut through spurs of limestone leaving exposed bluffs of varying size from a few hundred yards in length to over a mile in some cases, and of heights from one to several hundred feet. No complete survey of the caves in this area has been undertaken. Figure 1 shows the location of the caves visited.

In that all the caves visited are the result of water erosion they have features typical of such caves; solution cracks in the roofs, smooth rounded cross section (Figure 2), fluvial deposits of clays and waterworn pebbles, and frequent evidence of collapse and subsequent erosion. Many of the caves contain fine examples of stalactite and stalagmite formations, such as 'poached eggs', 'cave pearls' straw stalactites, flow curtains and staircases, bosses and columns.

At the mouth of the Sigatoka River almost on the coast and directly behind the village of Volivoli lies a small limestone cliff with a pool of fresh water at its base. This may once have been on the coast since it is separated from the present beach by an area of recently formed sand dunes. In this limestone bluff is a cave system some half mile in extent, access to which is gained via a collapsed entrance on the upper surface of the bluff. In many sections this cave is small and narrow but widens into a series of chambers at least one of which has an alternative entrance to the surface now filled with boulders and slumped sediments. At points small side channels enter the roof and walls of the main passage and the whole system dips towards the base of the bluff. Extensive evidence of water erosion and sediment slumping can be seen throughout the cave.

Passing up the valley some twenty miles to Raunitogo one sees an impressive pair of limestone cliffs on the opposite side of the river from the road, near the old Sautabu village site. A large cavern opens out at one end of the bluff through a low arched entrance from which flows a small stream. By wading through chest high water a large chamber 400 yeards long and 100 feet wide may be entered. The floor consists of fluvial clay and pebble deposits through which the small stream has cut a meandering channel. Evidence of periodic flooding in the form of branches and organic debris is abundant. At the top of this chamber a series of side caves lead in from the rest of the bluff suggesting that the cavern forms the major outlet for drainage from the bluff as a whole. Unfortunately the side chambers were not examined as access could only be gained by an 80 foot climb and the authors lacked rock climbing equipment at the time of the visit. A sink hole, now blocked, at the top of the ridge would appear to lead into the system and two other caves are known in the area.

At Tuvu a smaller limestone bluff is situated some distance from the course of the river and it would appear that a minor tributary of the main river is the cause of its exposure. This bluff has a more weathered appearance than the others, with a series of extremely large limestone blocks and boulders at its foot. Two large collapsed cavern systems are present, both with blocked subsidiary passages leading off them. In addition to these systems are a series of small caves at the foot of the bluff. Of these, two proved of interest, the first (Tuvu 1), with a false wall and small side passage was little more than a rock shelter, the other also quite short had a beautiful selection of calcite formations. Both caves had been used extensively for human burials.

Further up the valley near the village of Saweni, Navosa another small limestone exposure overlooks the main river on the opposite side from the present village site.

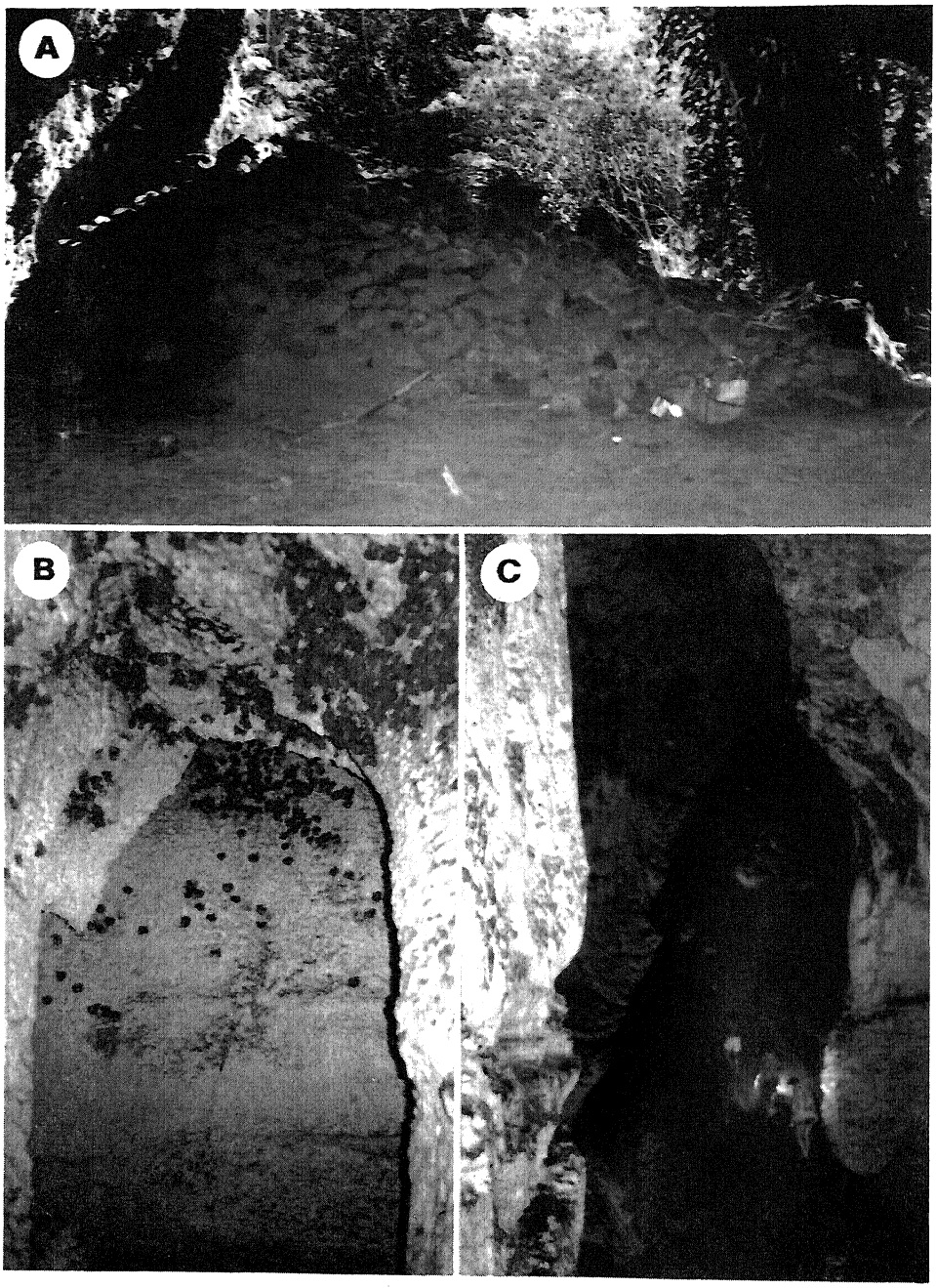

Figure 2

a) Fortified entrance at Saweni, Navosa.
b) Nests of the Pacific Swiftlet, *Collocalia spodiopygia* at Saweni, Navosa.
c) Inside the cave at Sawani, Navosa.

The cave more properly designated as a cavern has two large entrances in the rock face and a series of large chambers and passages connecting and leading to a common origin on the top of the ridge some ¾ mile away. A small stream runs through the lower level of the system.

HUMAN USAGE OF THE CAVES

The cave at Sautabu is the only one of the five visited which showed no evidence of human occupation or use as a burial site, although a party of archaeologists from the Fiji Museum is reported to have removed a quantity of pottery sherds. This cave was generally wetter (in addition to periodically being flooded), unlike the others the walls were running with water in many places.

At Volivoli pottery sherds were common around the entrance and throughout the cave system, whilst food refuse including bone material of pig and fish and the remains of a variety of marine molluscs were abundant. No evidence of fortification of the cave entrance was seen.

At Tuvu the two small caves visited had been used as burial sites (Figure 3), the last known burial occurring this century; some grandparents of the present villagers are buried there. In the first cave no systematic arrangement of the skeletons and no artifacts of any description were seen. The side passage in which the burials were located had at one time been sealed or partially sealed by a stone wall much of which appeared to have collapsed back into the chamber. The second cave (Tuvu 2) had again been used for burial but here some order is apparent. Small side passages or chambers had been used for the deposition of bodies singly or in groups, and then partially or completely sealed by artificial walls. Some collapses had occurred in the lower levels of the cave resulting in a disorganized placement of the remains. In addition rapid calcite deposition has completed the sealing of many of the side chambers of what could prove to be a very extensive burial site. Much of the stalactite and stalagmite is grey or black and large accumulations of charcoal at various points in the cave suggest the use of torches during the ceremonies associated with interment. Again the absence of artifacts is noteworthy although no attempt was made to examine the skeletons and none were moved, therefore the presence of small artifacts cannot be ruled out. The fresher appearance of the skeletons, their arrangement and greater completeness in Tuvu 1 suggest that this is the more recently used site of the two, a fact confirmed by the older villagers.

At Saweni the large cavern there has been used as a fortified retreat and habitation centre. The main entrance to the cave which leads into an extensive and level chamber is guarded by an 8' high wall (Figure 2). It can only be entered by passing along small walled paths close to the rock face. The lower smaller entrance has a stream running through it and connects with the upper system far back in the hillside by means of a small crawl. Access to both entrances is gained through an impressive series of stone wall defences and through an area of forest growing on an old enclosed village site; the raised house bases being obvious in the forest floor. The upper main sink entrance to the cave system has also been used for habitation, as evidence, by the abundant pottery sherds on the surface. Again the presence of extensive stone walls around the upper entrance, but some distance from it, point to the importance of this site as a defensive position. Food refuse was less obvious at this site than at Volivoli but a few fragements of pig were observed in the upper sink entrance. One further point of interest is the presence in this cave of

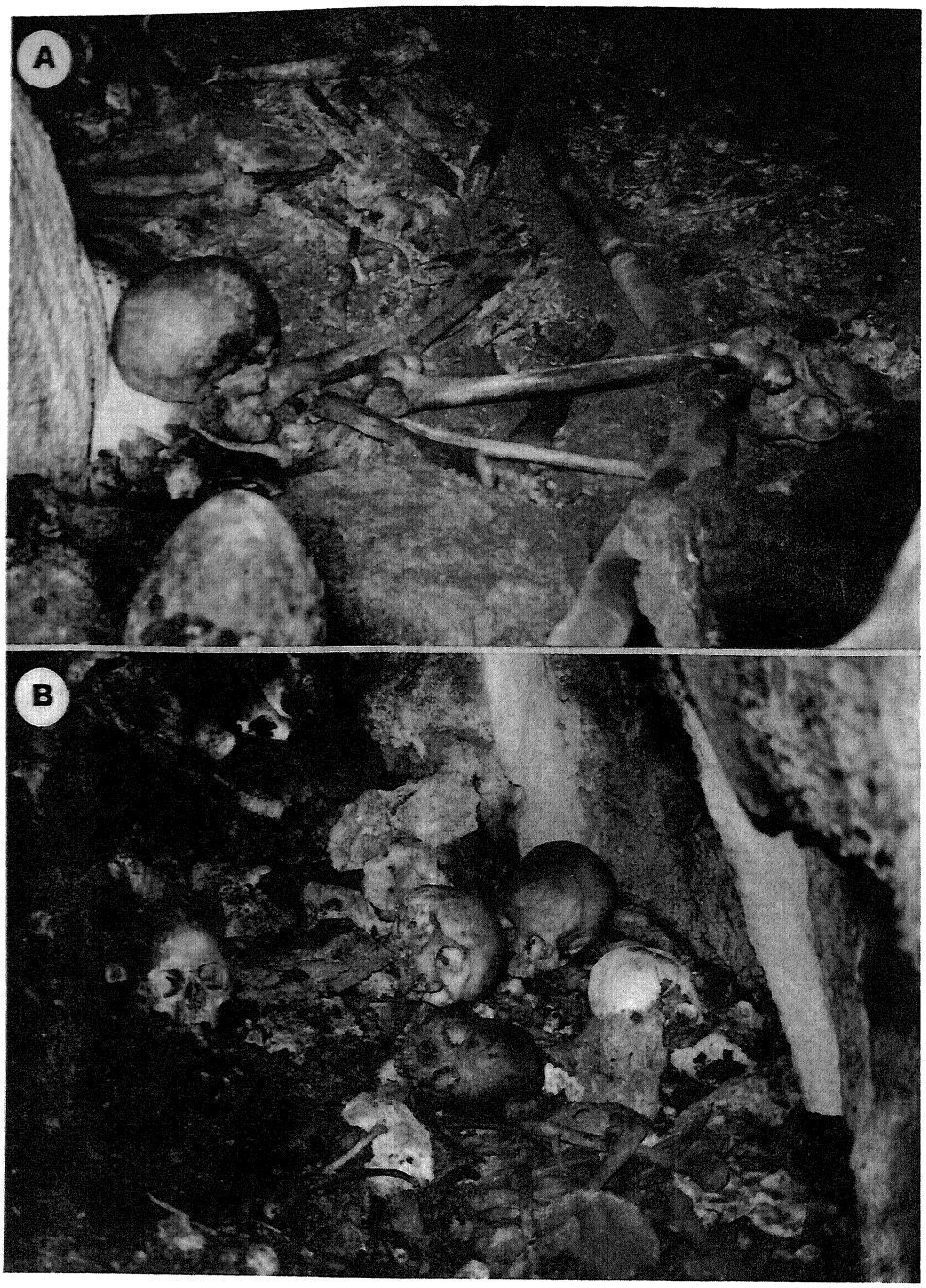

Figure 3
Human burials. a) Tuvu 2 b) Tuvu 1

numerous spherical or nearly spherical stones and boulders ranging from half to several pounds in weight. Whether these represent specially prepared sling shots or pottery anvils or are simply a random collection of stream worn material for use as throwing stones is difficult to say.

Although stone petroglyphs and cave paintings are reported from elsewhere in Fiji (Palmer and Clunie, 1970) no evidence of such artifacts was observed at the sites visited by the present authors.

The presence of pottery sherds at Saweni and Volivoli is of interest in view of the limited extent to which pottery is made at present in Fiji. In a number of villages in the Rewa and Sigatoka areas of Viti Levu, it is made without the use of a wheel, but by means of a paddle and anvil (Palmer, *et al.* 1965; 1966). In Sigatoka the main types of vessel are the Dari, Kuru and 'Finger bowl'; the first being used as a tanoa, (the bowl for mixing and serving the ceremonial drink, yanoona, made from the roots and stems of *Piper methysticum);* the second used for the storage of food or water and cooking and the latter for the presentation of food. Modern pottery is somewhat restricted in its design and decoration and many of the fragments examined by Birks (1973) from a Sigatoka sand dune site show a far greater range of incised, pinched and applied designs and vessel shapes. Although a collection of sherds was not made by the authors many of those examined showed designs and lip shapes identical to ones from this dune site. Dates for the pottery excavated by Birks (op. cit.) ranged from 510 BC to 230 AD on the basis of carbon dating.

THE CAVE FAUNA

Although the caves are not at present occupied by man they contain a rich and varied animal fauna. Two bat species are present, by far the most common of which is a small insectivorous sheath-tailed bat, *Emballonura semicaudata* (Figure 4). This species was found in all caves except that at Saweni. Although present in small colonies of between 10 and 20 individuals in the caves at Tuvu, large colonies of several hundred were seen at Volivoli and Sautabu. This small bat is widely distributed throughout the western Pacific but Fiji represents the easternmost limit of its distribution.

At Saweni one encounters an interesting fruit bat *Notopteris macdonaldi,* unusual for the lack of a claw on the first finger and the presence of a long free tail not enclosed in a membrane. Unlike most fruit bats which roost in colonies or singly in forest situations these bats hang during the day in caves like their smaller insectivorous relatives. In addition this species has a long protrusible tongue covered with small papillae and is presumed to feed on nectar, pollen and flowers. The species is restricted in its distribution to the islands of the South West Pacific and seems to be particularly abundant in Fiji.

Also present in the caves at Saweni and Sautabu is the white-rumped swiftlet *Collocalia spodiopygia* found in small numbers throughout the year but in many hundreds during the breeding season; November to February. This bird seems to prefer damper situations as its nests may also be found in scree shelters along stream beds. It nests in the twylight zone of the caves (Figure 2) but when flying in the darkness emits a high pitched twitter, used for echolocation (Medway, 1965; 1967).

The presence of these three vertebrates in the caves has resulted in extensive deposits of guano which, particularly in the dry sections of Saweni supports a large invertebrate fauna of small fungal gnats, centipedes and larger cockroaches. Also present at Saweni

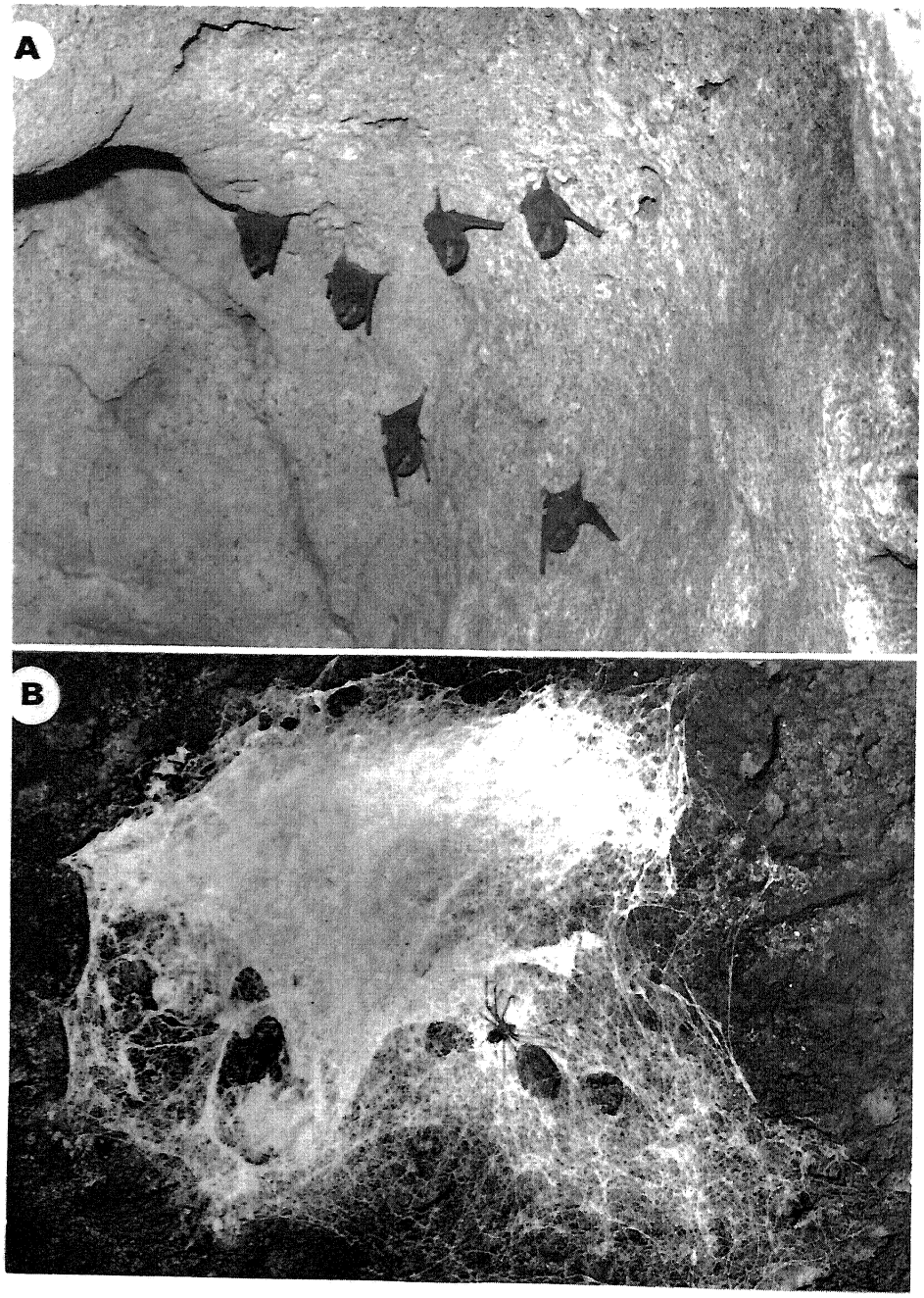

Figure 4
a) Short-tailed bats, *Emballonura semicaudata* at Volivoli.
b) Spider webs, *Loxosceles* sp., Saweni, Navosa.

some 250 feet from the entrance are numerous spiders (Figure 4) which judging from the remains observed in their nests prey on small nymphal cockroaches and flies. According to Dr. Gray of the Australian Museum (pers. comm.) these spiders are members of the genus *Loxosceles* which was previously known to occur in the African and American tropics, although some species are more widespread as a result of accidental transport by man. Such an explanation for their presence at Saweni is unlikely due to the isolation of the cave site, thus their presence in Fiji poses problems for the zoogeographers.

In conclusion it might be stated that opportunities in Fiji for speleological work in the biological fields are extensive.

It is perhaps also important to point out that these caves represent an important and perhaps little recognized part of the cultural history of the Fijians of Nadroga district and as such should be conserved as an important part of their heritage.

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