

DO PINE PLANTATIONS HAVE AN IMPACT ON THE DENSITY OF BRUSHTAIL POSSUMS IN KARST CAVES?

– Rolan Eberhard & Adrian Slee

During a survey of karst features on a property near Mole Creek, Tasmania, we located and entered five limestone caves of varying sizes. In all five caves we encountered living individuals or pairs of brushtail possums (*Trichosaurus vulpecula*). Abundant fur, scats, leaf-lined roosting niches and a pervasive possum aroma suggested that the possums had been living in these caves for some time and were not just occasional visitors. The density of cave-dwelling possums on this property is unprecedented in our experience.



Plate 1: Cave-dwelling possum, Mole Creek.

The property in question was developed as a pine plantation approximately 30 years ago. We surmise that a consequence of this was that the possums lost access to opportunities for roosting in tree hollows, which would be available in mature native forest but which are lacking in pines. We do not have any information on the vegetation that existed prior to the pine plantation, and whether the caves were inhabited by possums at this time. Nor have we attempted a broader systematic comparison of the density of possums in pine plantations versus other vegetation types. Nevertheless, we would suggest that the number of cave-dwelling possums on this property is unusual and plausibly linked to changes in land use.

A number of Tasmanian mammals are troglaxenes – habitual users of karst caves, but not dependent on caves to complete their life cycles (troglophiles) or unable to survive outside caves (troglobites). It is not unusual to find platypus, wombats, Tasmanian devils and also brushtail possums in karst caves. Each of these species is known to burrow or nest in caves, although caves do not appear to be their preferred habitat for this activity. Brushtail possums have been noted inhabiting sandstone caves and overhangs on the lower slopes of the Great Western Tiers (C. Spencer pers. comm.), and

have previously been noted in karst caves at Mole Creek. Typically, however, this species appears to prefer roosting in tree hollows.

Mammals occupying caves can have significant effects on the underground environments. Animals moving about and foraging or burrowing invariably disturb cave sediments, which may be compacted, mixed, displaced and otherwise altered. Wombats in particular can have quite intense effects due to their habit of digging holes, a practice which they engage in even when already underground inside a cave. Platypuses burrowing in riparian banks can be a source of obvious localised disturbance in stream caves. Mammals may displace other cave biota, such as invertebrates, or they may advantage them by bringing additional nutrients into otherwise nutrient poor cave environments. Under natural conditions, these are normal geomorphic and ecological processes.



Plate 2: Greasy slick across flowstone due to possums.

A range of impacts attributable to possums were observed in the caves on the property we surveyed. In all cases there was abundant evidence of earthy sediments becoming hardened and compacted along well-developed 'pads' leading to entrances or nesting hollows; however, localised puddling and mixing had occurred where higher moisture content

sediments were affected. Considerable sediment transfer had occurred, with stalagmites, flowstone and other substrates coated with dark greasy slicks over sizeable areas. The scale and intensity of the muddying was reminiscent of the squalid conditions that can result in poorly managed caves subject to excessive recreational pressure. Possum faeces and urine could be observed in many places, as well as nesting materials (sticks and leaves).

Broken stalagmites were also noted, although it is unclear whether possums were responsible for some or any of this damage. Possums are certainly capable of breaking off smaller stalactites. One of us had previously witnessed several straw stalactites broken off when a possum was startled

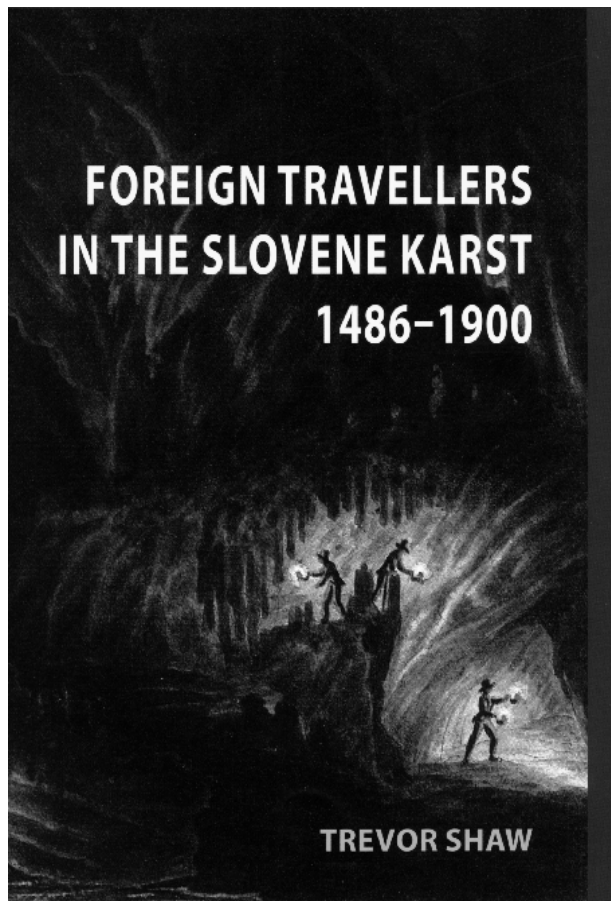
by an approaching caver on another Mole Creek property.

Caves have limited or negligible capacity to recover from many forms of disturbance, including most of the impacts described above. If our interpretation is correct that the abnormally high density of cave-dwelling possums on this property is attributable to its conversion to a pine plantation, then the environmental effects of the plantation include the impact of increased numbers of possums in the caves. While our observations are of a preliminary nature, we suggest that they raise questions concerning the use of caves by mammals under different land use regimes and are worthy of further investigation.

BOOK REVIEWS

FOREIGN TRAVELLERS IN THE SLOVENE KARST 1486-1900

Trevor Shaw (2008) Published by ZRC Publishing, Ljubljana, and Karst Research Institute, Postojna, Slovenia. ISBN 978-961-254-065-4. 338 pp. 200 x 270 mm. 31 colour + 194 b&w illus., copious notes & refs, index, soft cover. Available from ZRC Publishing, PO Box 306, Ljubljana 1001, Slovenia – for 25 Euro (about A\$52). **Reviewed by Greg Middleton.**



This is a revised and much enlarged version of an earlier book that began with the year 1537. It was reviewed by this reviewer in 2000 (see JSSS 44(12): 429-430) but has been out of print for some years. Whereas the earlier book recorded 92 visits, the new edition records 138, by 128 different travellers. Of the 225 illustrations in the book, 91 are new.

Dr Shaw has carefully documented and annotated the reports left by visitors to the Classical Karst over 400 years. Of these, 61 were British, 22 were from USA, 20 from Germany, 7 from Italy, 5 from France, 3 from Austria, 2 each from Russia and Switzerland and one each from what are now the Czech Republic, Slovakia, Croatia, Hungary, Sweden and Denmark.

By way of introduction Shaw describes the travellers, their sources of information (there was a tourist guidebook as early as 1771), the routes and roads they travelled, dangers they faced, language problems, accommodation available, early guides and how visitors behaved (they wrote their names on cave walls, removed speleothems and took specimens of *Proteus*, the endemic cave salamander). We are then given an introduction to the Karst and its features – the karst surface with its lack of streams and its dolines, the seasonal lake Cerknjško Jezero and some 15 caves (principal amongst them being Postojnska Jama (Postojna or Adelsberg Cave)).

The bulk of the book is comprised of the 138 original accounts, reproduced verbatim (with some editing and translated into English where necessary) and in many cases in facsimile. For each account, Shaw gives background details on the writer (including, where possible, a portrait) and the reasons for his (or, in just five cases, her) visit. In many instances, Shaw describes the route taken and any known consequences of the visit. The signatures of many visitors after about 1820 are reproduced from the Postojna visitors books.

The new 'first traveller' (1486 and 1487) was Paolo Santonino, though Shaw tells us that, as a travelling priest, he was not interested in the caves or the landscape so he left no description of

features or scenery. The importance of his diaries, which were unpublished until 1943, lies in the fact that they encourage one to hope that other obscure reports will turn up.

Among the better known later travellers to the Karst were Sir Humphry Davy, English chemist and geologist (in 1818 and 1828); Sir Roderick Murchison, English geologist (after whom Tasmania's Mt Murchison is named) (1829); Charles Latrobe, later Governor of Victoria (1830); King Frederick Augustus II of Saxony (1838); George Spottiswoode (1860) who, as head of the London publishing firm Eyre & Spottiswoode in 1889, was to publish the first book containing printed cave photographs, on Jenolan Caves; Thomas Cook, originator of the 'Cook's tour', who organised many later excursions to Postojna (1868), Sir Richard Burton, explorer of Africa and the Middle East, translator of the *Kama Sutra* and British diplomat (5 visits between 1873 and 1889), the Prince of Wales (later George V) (1887), and Dr Sigmund Freud, psychoanalyst (1898).

Among the newcomers in this edition are Johann Kohl (1850) who wrote about commercial transport across the Karst and the dangers to karst of deforestation, the entomologist Gustav Joseph who listed the 41 caves he collected from between 1853 and 1881 and Anton Lang (1900) who visited parts of Zelške jame at Rakov Škojan that Prince Hugo Windisch-Graetz had made accessible for visitors.

As previously, the index is thorough and there are useful lists of equivalent place names and old units of measurement. The references are presented as endnotes – the only element of the presentation with which I would differ (preferring the alphabetical Harvard system). However the citations are meticulous and all the necessary information is provided. The book is extremely well presented and bound.

DISCOVERING CAVES OF WESTERN AUSTRALIA

Samille Mitchell and Anne Wood. Department of Environment and Conservation (2009). 72 pages. Full colour, with numerous maps and images. \$6.50. Available at most bookshops and newsagents in Western Australia, DEC offices and visitor centres, and various cave visitor centres. **Reviewed by Kent Henderson.**

This new book is aimed squarely at the tourist market, and maps out the caves of Western Australia for the uninitiated, in a readable and useful fashion. It is profusely illustrated with maps and photographs, all of a high quality.

The introduction is entitled *Cave Formation*. It is a useful introduction, only one page in length, and succinctly covers the topic. The language is simplistic, but accurate.

The next section, *Windows to the Past*, deals with Ancient Animals, first Human Occupation and Past Climate. Again, the information is to the point. Three pages on *Cave Life* follows, covering Troglobites, Stygofauna and Cave Life 'Hotspots'. *Nature's Crystal Wonderland* is next – with a

As a result of his continuing scholarship, Shaw has enhanced this fine work which I have already described as a classic in the annals of cave history and an essential reference on the history of the Karst.

Mention should also be made of an earlier work by Shaw, *Names from the past in Postojnska Jama (Postojna Cave)* (2006, 151 pp). This is not about the names of many famous, and not-so-famous, visitors to the cave written on the walls, but concerns the names of various parts and features of the cave – totalling 371 (often in 3 languages – Austrian/German, Italian and Slovene plus, in some cases, English) – used over the centuries. Shaw has collected these from plans, guidebooks, travellers' reports, postcards, unpublished archives and contemporary drawings and photos.

The purpose of the book is to provide the locations of all the places and objects in the Postojna system that have (or had) names and to group together the names by which each has been known at various times. Thus each name is associated with the date when it was first used (or, at least, first written or published). Shaw explains why name changes occurred and observes that the number in use has tended to decrease since 1910, a fact which he correlates with increasing party size and lower guide to visitor ratios.

The main body of the work is a tabulated list, arranged in a sequence following a journey through the cave, including parts not on the present tourist route. Sources are listed (some 138) and the work is thoroughly referenced. There is also an alphabetical list, keyed back to the tabulated list. The work is rounded off with a collection of 34 historical illustrations of named parts or features of the cave, many in colour, and a set of nine plans ranging from 1821 to the present. A remarkable piece of work, no doubt reflecting years of careful recording and cross-checking.

general introduction, and several pages enumerating and explaining the main forms of cave decoration. Let's have a quote:

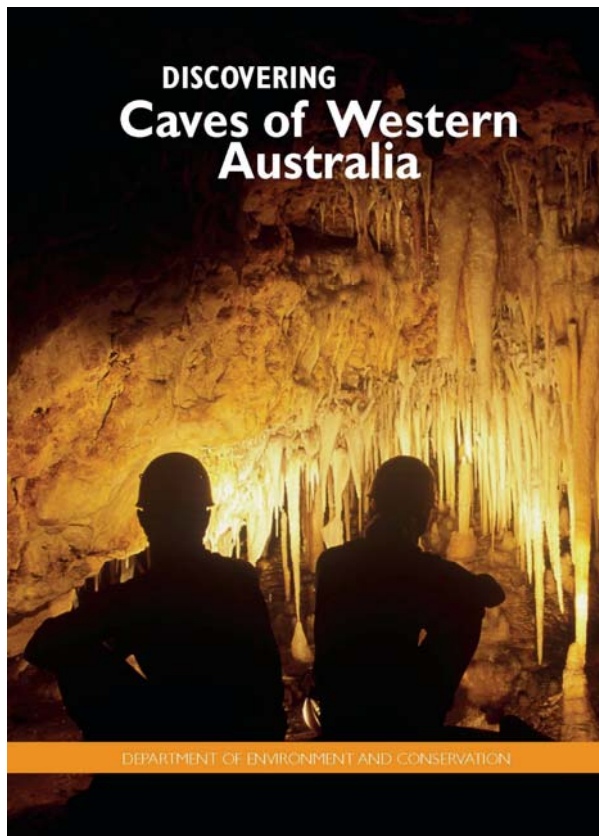
Speleothems are created when slightly acidic water seeps down through the limestone bedrock and dissolves calcium carbonate. When the solution reaches an air-filled cave, a discharge of carbon dioxide may alter the water's ability to hold these minerals in solution, causing its solutes to precipitate. Over time, which may span tens of thousands of years, the accumulation of these precipitates may form speleothems. The rate of speleothem growth depends on the amount of carbon dioxide held in solution, rainfall, surface vegetation, density of the limestone,

temperature, and other factors. Different combinations of factors create different speleothems such as those on the following pages.

This is hardly deep science, but is it accurate (more so than the spiel of some cave guides...) and clearly explains the matter to the layman.

The book now turns to specific areas, starting with an introduction to *Coastal Limestone of the South-East*. Again, accurately and simplified language:

The coastal dune limestone of the south-west was formed during the Pleistocene era (during the past two million years) from fragmented shells, calcareous algae and other material. The shells and skeletons were broken up by wave action, washed ashore, then blown into dunes. Water, rich in carbon dioxide, dissolved and redeposited calcium carbonate as it seeped through the dunes, cementing the material together. This type of limestone is very porous and much softer than the older, crystalline limestones more commonly encountered through the rest of the world...



After the introduction, each cave area is presented (comprising the bulk of the book) with a brief Introduction, Description, History, Exploring, and Where is it? This section covers Ngilgi Cave, Calgardup Cave, Mammoth Cave, Giants Cave, Lake Cave, Jewel Cave, Meekadarabee Falls, Yanchep caves, Crystal Cave, Other Yanchep caves, and Stockyard Gully. Let's look at an example:

Crystal Cave is the main tourist cave at Yanchep and is open for guided tours all year.

DESCRIPTION: *The cave is home to exquisitely beautiful formations that sparkle like treasures harboured in a secret underground hideaway. Active stalactites, stalagmites, helictites, flowstones, shawls and other formations adorn the caverns. Two artificial pools mirror the enchanting forms all around them. Crystal Cave is a 'stream cave' and has a horizontal, tubular shape caused by groundwater flowing through the earth and removing the calcium carbonate.*

The park also has some 'solution tube' caves which formed through erosion and solution seeping downwards through cracks in the rock or along tree roots. This type of cave development results in the formation of almost vertical pipes. You can see some examples of this in the cave's entrance chamber. You can also make out the root of a tuart tree about 13 metres below the surface.

HISTORY: *Crystal Cave was recorded by Yanchep's first settler, Henry White. White became honorary care taker of the caves in the area and guided visitors from an old stone hut named Caves House. The building had been used by cattlemen who summered their cattle on the coast from as early as 1880s.*

White would guide visitors through caves using a magnesium flare, crawling along muddy streams to reach the best chambers. Just imagine these people in their old-fashioned attire, crawling through the mud and watching the jewel-like cave formations in the flicker of the flare's light.

EXPLORING: *This cave is lit with discreet man-made lighting, bathing the 'jewelled city' in enchanting and ever-changing hues. You can explore it on a guided tour. Entry fees apply.*

WHERE IS IT? *Yanchep National Park is 51 kilometres north of Perth, on Wanneroo Road.*

The book then covers the Nullarbor Limestone and Caves, Cape Range Limestone and Caves, Tunnel Creek, and Windjana and Geike Gorges, using the same format. Finally, there is a section entitled *If you want to go caving*, setting out the expected do's and don'ts, and who to contact. The book concludes with a brief index.

I must say I am most impressed with this little book. It succeeds admirably in its obvious goal in bringing Western Australia Caves to public attention in a straightforward manner, giving accurate information with no padding.

This book is a real winner, and could be very usefully emulated in other states. Indeed, better still, an expanded version to cover all of Australia (and New Zealand) would be wonderful!

