

SPELEOTHEM SCIENCE: FROM PROCESSES to PAST ENVIRONMENTS by IAN J FAIRCHILD and ANDY BAKER

reviewed by Andy Spate

Ian Fairchild is Professor of Geosystems at the University of Birmingham. Andy Baker is an ACKMA member who arrived a few years back from a distinguished research background in the United Kingdom to head up the Australian National Centre for Groundwater Research and Training at the University of New South Wales. Ian and Andy have collaborated in much cave-related research and in the production of this excellent book.

Most ACKMA members have not had the privilege and pleasure of meeting Andy but we hope to see him at future ACKMA meetings - starting in Waitomo next year. I had the distinct honour of meeting Ian Fairchild at Yarrangobilly last December. They told me there about their forthcoming book – it sounded great! I was immediately intrigued and started salivating ...

In March this year I was at Margaret River assisting Pauline Treble in her researches in Golgotha Cave on past climates and environments as revealed in drip water chemistry and stalagmites. Andy was there and showed me one of the two extant copies of the book – I was hooked!

I have reviewed and or recommended a number of books over the years in the ACKMA Journal – this new book trumps all the others with the exception of Paulo Forti and Carol Hill's *Cave Minerals of the World* – they are companion volumes ...

Fairchild and Baker's book is different in that it is cave-oriented. Books such as Gillieson's *Caves: Processes Management and Development*, Ford and Williams' *Karst Hydrology and Geomorphology* and Palmer's *Cave Geology* which are largely karstic in approach. *Speleothem Science* builds significantly beyond those texts.

I am tempted – as I usually do – to quote at length from the authors. But it would be better for you – and for me – to examine things more closely.

Chapter 1 goes straight to the chase asking why speleothems are useful for understanding past climates. This sets the scene for the whole book and how it is organized. It also looks at how speleothems can answer our questions about the past

Chapter 2 is more like the conventional texts mentioned above – carbonate rocks, their diagenesis and the development of karst systems.

Chapter 3 relates karst to climate, soils and vegetation. Very importantly it firmly places the role of climate – and climate change – in karst processes.

Part II, Chapters 4, 5 and 6 may be more hard-going for lay readers – but worth persevering with. They deal with the processes operating within caves – many of them we don't ordinarily think about such as heat fluxes from the bedrock – and inorganic water chemistry. Chapter 6 goes on to discuss biogeochemistry of karst environments - again a subject we tend to skate over.

It goes on! Part 3 gets to the bit that so excited me! I have felt for a long time that the standard texts – including Hill and Forti – have not told me enough about what Fairchild and Baker term 'Speleothem Architecture'. Speleothem architecture and mineralogy dominate Chapter 7 leading onto Chapter 8 on the geochemistry of speleothems. This leads inevitably to the dating of speleothems in Chapter 9 – a difficult subject for cave managers – we want to understand all we can about our caves but are we getting value from stalagmite harvesting? Interestingly, and importantly, the book includes an appendix on archiving speleothems and speleothem data.

This is an important issue and one that we must address in Australia (and internationally) given the numbers of speleothems that are being sampled by many different researchers – often without resultant publications. We need to account for research projects that didn't work as well as the ones that do, so as to avoid further harvesting in sites where, for one reason or another, dating or palaeoclimate techniques and analysis have not worked.

Back to the book. In Section 4, Palaeoenvironments, we get to the guts of this book. What do speleothems tell us about the past? Chapter 10 reviews methodologies and case studies on what speleothems can tell us and asks the questions that previous studies have addressed – or not.

Chapters 11 and 12 discuss happenings in the Holocene (the last 12,000 years to today) and the Pleistocene (2.6 million to 11,700 years ago) respectively. These chapters are preceded by a review of approaches and methodologies for deriving environmental relationships. As with the rest of the book, these final three chapters have plenty of case studies and examples of environmental proxies such as the timing of 'ice ages', changes in the patterns of monsoon, sea level changes and so on.

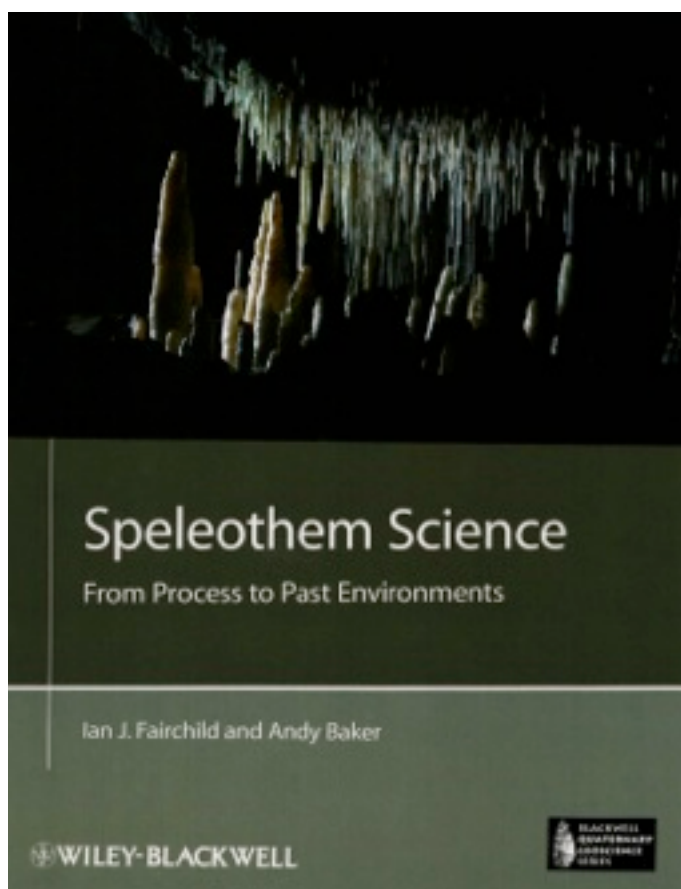
The book concludes with the short, but important, appendix titled "Archiving speleothems and speleothem data". This is followed by a very extensive reference list of an estimated 1,400 citations and a comprehensive index.

A further wonderful asset is that the book has a companion website: www.wiley.com/go/fairchild/speleothem. On this site you will find the Figures and Tables from the book as PowerPoint slides and PDFs, respectively, for downloading. Wiley states that you are free to download the material on this site for your own use and teaching purposes.

This is an excellent book – some readers, me included, will find some parts heavy going – but for the most part it is written in simple English – sometimes very expressive phrases such as “One view of geological history, emphasizing the chemical changes, is that of a great titration experiment between rocks and acidic volcanic gases” (30).

The authors invite readers to alert the authors to errors that can be corrected online or in future editions. When I was spruiking the book at the ACKMA AGM at Wee Jasper someone spotted a minor error in the index and I have spotted another very minor typo in the web address

for the companion site. But these do not detract from the book’s immense contribution to cave and karst science. As we know from discussions on the ACKMA email list, the book can be obtained at substantially less than the RRP quoted above. At whatever price it is very well worthwhile having on your shelves.



Speleothem Science: From Processes to Past Environments, Ian J Fairchild and Andy Baker, 2012, Wiley-Blackwell, 432 pp. RRP \$87.95.

Pauline Treble’s speleothem research in Alexandra Cave (top) and Victoria Fossil Cave (middle and bottom), Naracoorte.
Photos: Steve Bourne