

# Journal of Sedimentary Research

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***Studies of Cave Sediments: Physical and Chemical Records of Paleoclimate***, edited by Ira D. Sasowsky & John Mylroie, 2004. Kluwer Academic / Plenum Publishers; 329 pp., hardbound; price EUR 140.00, USD 155.00, GBP 96.00. ISBN 0-306-47827-7.

'Studies of Cave Sediments' is a collection of scientific papers on several caves from different parts of the world and from a range of latitudes and altitudes. To my knowledge, this is the first book to be devoted entirely to cave sediments. Thus this book is important in its own right as the first in its field and should prove useful for scientists and students alike.

Surface landforms are broken down by weathering and removed by erosion, whereas in caves such processes are typically reduced as caves provide an environment predisposed to preservation. In addition, caves act as sediment traps for physical (e.g. clastics), chemical (e.g. speleothems) and biological (e.g. guano) deposits that may contain valuable information on the paleoclimate. The paleoclimatic record held in cave deposits forms a major theme of the book, as alluded to in the title. The main focus of the book is on the basic quality of caves as data repositories, and an attempt has been made by the editors to provide a comprehensive treatment of cave deposits.

The book is made up of seventeen chapters. Chapters 1–8 deal with clastic sediments, whereas chapters 9–16 deal with chemical precipitates, or speleothems. Chapter 17 involves the study of clastic deposits, speleothems and bones.

The preface (Mylroie & Sasowsky) gives a useful background to the development of cave science and to what is contained in the book. The first chapter (Bosch & White) proposes a facies classification system for clastic sediments in karstic aquifers—important since such classifications for cave clastic deposits are rare. Examples are given from caves in Pennsylvania and Virginia, USA. In chapter 2, Mahler et al. examine clastic sediments in terms of their water-quality implications in Texas, USA; their results show that sediments act as vectors for contaminant transport. Paleomagnetic analysis can sometimes be the only direct method of dating clastic cave deposits and is discussed in detail by Musgrave & Webb (chapter 3) with application to sediments in caves of Southeastern Australia. Sasowsky et al. (chapter 4) also attempt to date cave deposits using paleomagnetic analyses in Pennsylvania, USA, and note the potential rapidity that cave sediments can accumulate. In chapter 5, Lynch et al. present a case study from Texas, USA, that shows how sediment provenance can be determined from X-ray diffraction; their results show that suspended sediment discharged from a karst aquifer can be derived from eroded soils tens of kilometers from the recharge zone of the aquifer - with implications for surface contaminant transfer. Knapp et al. employ geochemical and sedimentological techniques to clastic cave sediments to infer the paleoclimatic record of Virginia, USA, for the oxygen isotope stage (OIS) 6/5e boundary (chapter 6). Mapping of cave sediments in Colorado, USA, was undertaken by Burger (chapter 7) to understand sediment cycles controlled by the advances and retreats of Pleistocene glaciers. Mapping was also utilized by Šušteršič in the Slovenian karst (chapter 8) to look at the phenomenon of denuded ("roofless") caves and their deposits.

The 'second part' of the book examines chemical precipitates, or speleothems, as both geochronological tools and paleoclimatic indicators. Chapters 9–11 form a comprehensive resource for scientists interested in using speleothems for these indicators. Chapter 9 (White) provides a useful review of calcite speleothem formation and chemistry. Chapter 10 (Dorale et

al.) presents an in-depth review of uranium-series dating - the most commonly used technique to date speleothems. Chapter 11 (Harmon et al.) provides an excellent overview of oxygen and carbon isotope analyses of speleothems.

A series of case history studies from a variety of sites follow in chapters 12-16. Kolesar & Riggs present a petrographical/morphological study of the famous Devils Hole (Nevada, USA) calcite for understanding its depositional history (chapter 12). Spötl et al. describe results from the first studies of speleothems in the high-altitude Spannagel Cave, Austrian Alps (chapter 13). Chapter 14 (Lauritzen & Lundberg) shows how a speleothem from a Norwegian cave at the Arctic circle reveals the duration and conditions of OIS 11. In chapter 15, Turgeon & Lundberg examine the isotope chemistry and geochronology of speleothems from a cave in Oregon, USA, using growth-rate determinations to carry the speleothem record beyond the dating range. Polyak & Güven (chapter 16) provide results of mineralogical analyses of carbonate speleothems from caves in New Mexico, USA, where silicate authigenesis is occurring as a function of time and temperature conditions. The final chapter (McFarlane & Lundberg, chapter 17) presents interesting results from several caves in the tropical West Indies with the identification of 'hyper-flood' sedimentary facies associated with the Last Interglacial.

This is the first book to deal specifically with cave sediments and so is an important resource for people conducting research in caves, e.g. geoscientists, speleologists and archaeologists. The book includes a range of cave sites, applicable techniques with in-depth reviews and several case studies to provide an excellent tool for those already involved in cave research and those interested in venturing into cave-sediment studies.

I feel that the organization and clarity of the book could be improved, however, by the inclusion of a more definite structure e.g. 'PART 1' and 'PART 2' for the clastic and speleothem chapters, respectively. The final chapter (17) is largely concerned with the interpretation of flood-debris facies and so may be better placed alongside the other clastic sediment chapters. Further weaknesses are that chapters 2 and 5 diverge from the book's "dominant theme" of paleoclimate and have greater implications for sediment transfer of contaminants. These papers do, however, provide useful information on the transport of sediment through karst (and how it can be measured) and so their inclusion is acceptable in this respect.

Most of the illustrations are in black and white although the few color photographs, cave plans and photomicrographs are nice additions. Some of the black and white illustrations are of poor quality though. It is also unfortunate that the book is flawed by a few typographical errors and not every chapter has the same format: for example, some have abstracts, some do not.

Most of the papers derive from studies in the USA although there is a nice sprinkling of research presented from Central Europe, Norway, SE Australia and the West Indies. It is a pity, however, that no research from Asia was included. For example, the large caves of Malaysia that, in some cases, contain amazingly deep guano deposits, and form an important repository for Quaternary paleoclimate in the region (Gilbertson et al., 2005). This would also further the book's aim to provide a comprehensive treatment of cave deposits, as guano is only mentioned briefly in chapter 17.

Guano is important in cave sediments for driving chemical processes through the addition of organic matter that breaks down into phosphates which readily react with carbonates, setting off a chain reaction. Such diagenetic evolution of minerals can be traced towards the reconstruction of ancient chemical environments (e.g. Karkanis et al., 2000). A recent development is the direct analysis of guano using carbon isotopes to derive a paleoclimatic record (Bird, 2004). Such research could be considered for possible future editions of the book.

### *References*

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