

Processes in Ice Caves and Their Significance for Palaeoenvironmental Reconstructions

Marc Luetscher, 2005. Swiss Institute for Speleology and Karst Studies, La Chaux-de-Fonds, Switzerland, 154 p. ISBN 3-908495-19-9, soft-bound, 7.8 × 10.8 inches, \$40 + \$4.90 shipping. Order on-line at www.speleobooks.com.

This book, which concerns perennial ice in caves, is the published version of a doctoral dissertation at the University of Zurich, Switzerland. Although it contains some fairly technical sections, most of the book can be easily understood by non-specialists. It is written in clear English, with short summaries in French and German, and is well illustrated with maps, diagrams, and black-and-white photos.

The author's study encompasses the low-altitude caves in the Jura Mountains, with special attention given to the Monlési Ice Cave, near Neuchâtel, Switzerland. In quantifying the ice-forming process in the caves, he strikes a nice balance between theory and field observation. He measured such variables as the temperatures of air, rock, and ice, as well as changes in ice volume and water flow entering the cave. On the basis of these measurements he modeled the energy balance of the system and compared it with physical theory, an approach that has rarely been applied to the subject.

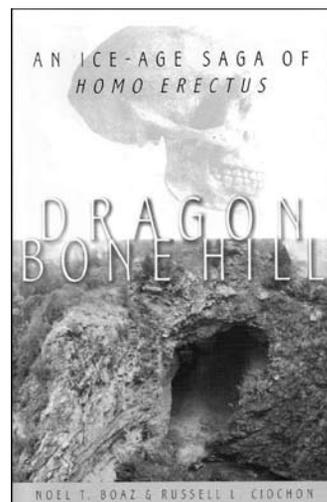
The book is divided into three parts: Part 1, which includes about half the book, concerns the ice-forming process in caves, and the significance of cave ice in paleoenvironmental studies. This section is fairly easy reading, with only a few brief excursions into heat transfer and the energy balance. It gives a thorough introduction to ice caves and their distribution, thermal characteristics of caves, types of cave ice, and processes of ice formation. Specific study sites are described with the aid of detailed cave maps. The heat flux is interpreted from the field data. The effect of climate is considered, and predictive models are devised. The modeling in Part I is mainly conceptual, rather than mathematical.

Part 2 consists of ten short papers on cave ice that have been published in scientific journals by Dr. Luetscher and his colleagues. All are in English except for two short papers in French and one in both French and German. Topics include classification of alpine ice caves based on ice-forming processes; effects of temperature and of air and water movement on cave ice; evidence for variations in winter climate in the study area; modeling heat transfer and energy flux; variations in ice volume with time; and ice dating procedures. Part 3 consists of a selected bibliography of the international literature on ice caves, which gives broad coverage to the subject and does not simply duplicate the more specific references cited in earlier sections.

The author calculates that about 79% of the heat transfer in the Monlési Ice Cave is caused by winter air circulation, and that nearly all of the remainder is caused by direct influx of snow. He concludes that circulating winter air can make the caves cold enough to support ice, even in climates where the mean-annual temperature is well above freezing. This makes them highly sensitive to changes in the surrounding climate. Ice in the Monlési Cave averages about 12 m thick, but measurements of ice strata and texture, in combination with isotopic evidence, show that the accessible ice in the cave averages only about 120 years old. Some caves elsewhere are known to contain ice more than 1000 years old. Ice caves in the mid- to low-altitude caves of the Jura Mountains lie near population centers and are very sensitive to airborne contaminants. They serve well as archives for changes in climate and air quality.

Although most of this book is focused on a single ice cave, it provides a broad background on cave ice. Anyone with an interest in the subject will find this to be one of the very few essential references.

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Dragon Bone Hill: An Ice-Age Saga of *Homo erectus*

Noel T. Boaz and Russell L. Ciochon, 2004. Oxford University Press, New York, 232 p. ISBN 0-19-515291-3, hard-cover, 6¼ × 9½", \$30.00.

For thousands of years, Chinese pharmacists have made use of ground-up fossil bones and teeth (so-called dragon bones and dragon teeth) as ingredients in medicinal elixirs. These were claimed to cure a wide array of illnesses and fueled the long-standing fossil-mining industry among Chinese peasants. Such finds, coming from the many fossil-rich caves of China, have long been sold to big-city apothecaries. The practice survives to this day. Fossil teeth and bones of long-extinct creatures can be found among the wares of a well-stocked Chinese pharmacy. The local drugstore has often been the starting point for many anthropological and paleontological expeditions in this part of the world.

In *Dragon Bone Hill*, Boaz and Ciochon recount the remarkable tale of Zhoukoudian Cave. Located 30 miles southwest of Beijing, this is the most famous of China's dragon bone collecting sites. The discovery of fossilized hominid teeth at Zhoukoudian caused great excitement among anthropologists. On the strength of these meager finds, the Rockefeller Foundation funded a major excavation of the cave. The early remains

found at Zhoukoudian formed the basis of what was eventually regarded as a new genus and species of hominid. *Homo erectus*, or Peking Man as he became known to the world, pre-dated even the Neanderthals in human evolution.

This book describes (1) the impact of dragon bones on China's archaeology and anthropology, (2) the discovery of the Peking Man fossils, (3) loss of the Peking Man fossils, (4) the worldwide search for the fossils, (5) attempts to understand the habits and lifestyle of Peking Man, and (6) attempts to unravel the evolutionary significance of this hominid. The authors set their narrative against the political turmoil gripping China when Chiang Kai-shek and Mao Tse-tung were vying for power. Nevertheless, progress at the site was remarkable and, within a few years, the cave had achieved a worldwide reputation. By the late 1920s and early 1930s, fossil finds—including primitive stone tools, evidence of the use of fire, and, at long last, the elusive skull of Peking Man—were pouring in. The scientific validity of early tooth finds was confirmed. By the early 1930s, Zhoukoudian Cave had been transformed from simply a place where local peasants could dig up dragon bones to that of a world-renowned hominid fossil site.

Excavations at Zhoukoudian Cave continued until the beginning of the Sino-Japanese war in 1937. Franz Weidenreich from the University of Frankfurt was in charge of the dig, and worked tirelessly on the Zhoukoudian fossils until his research laboratory at the Medical College was shut down by the Japanese invasion of Beijing. Weidenreich was forced to flee to America, but managed to carry plaster casts of the entire Zhoukoudian fossil collection with him. For years, Weidenreich worked at the American Museum of Natural History in New York to get the original fossils shipped to the United States for safekeeping during the course of World War II. Finally, in 1941, they were carefully packed and crated for shipment. And then, these priceless relics of human history and a Chinese national treasure simply vanished and have not been seen since.

It is now known that the origin of *Homo erectus* was in Africa. This incredible species rode a wave of opportunity out of Africa and across Eurasia. Armed only with fire and sharp rocks, *Homo erectus* managed to survive for more than 1.5 million years. In China, he came to be known as Peking Man, which occupied the environs of Zhoukoudian Cave intermittently between 410,000 and 670,000 years ago.

Fossils from Zhoukoudian Cave have helped anthropologists develop a day-to-day picture of *Homo erectus*' struggle for survival. Life was far from idyllic. Evidence suggests that Zhoukoudian Cave was primarily used as a den by the giant cave hyena, which was the size of a modern African lion. The interaction between man and beast remains unknown. Indeed, many of the hominid remains found within the cave may represent individuals that fell prey to the animal predators.

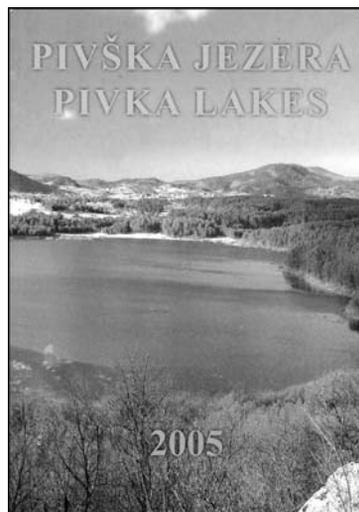
Primarily scavengers rather than hunters, the largely speechless hominids used primitive stone tools to strip the flesh from the bones of animals killed by local predators. Boaz and Ciochon theorize that the hominids living near Dragon Bone Hill made periodic commando-style raids on the cave. Temporarily driving the big carnivores off with fire afforded Peking Man the

opportunity to pilfer partially consumed kills, many of which were probably their own fallen comrades. Thus, the ability of Peking Man to tame fire must certainly have played a pivotal role in his survival. Moreover, the fossil evidence suggests that they were not averse to de-fleshing members of their own species for a good meal.

By 2000, scientists studying the sediments in Zhoukoudian Cave were able to correlate specific strata with climatic conditions of the time. It is now known that Peking Man lived in and around the cave during relatively warm spells, when food and rain were plentiful. However, during periods of glacial cold, Peking Man is believed to have sought refuge farther south, where glacial winds were blocked by the Qinling Mountains.

More hominid fossils have been retrieved from Zhoukoudian Cave than from almost any other site yet excavated. They include fully 1/3 of all known fossils of *Homo erectus*. In 1987, Dragon Bone Hill was designated a United Nations World Heritage site. The treasure trove, despite its loss, that the cave yielded has helped to revolutionize our understanding of human evolution. For non-scientists interested in the evolution of man and the study of caves and cave men, most of this book is highly readable, despite technical discussions of population genetics and terminology.

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Pivka Lakes

Janez Mulec, editor, 2005. Acta Carsologica, Ljubljana, Slovenia, vol. 34, no. 3, 291 p. ISBN 0583-6050, softbound, 6.5 × 8.8 inches, 11.68 euros. Order on-line at www.zrc-sazu.si/zalozba.

This special issue of the karst journal *Acta Carsologica* provides an interdisciplinary description of the Pivka Lakes, which are located in the heart of the classical Karst area of Slovenia. *Pivka* is pronounced,

roughly, “*pewka*.” The Pivka River occupies a large closed karst basin south of Postojna, home of the Slovenian Karst Institute, and at least half of the contributing authors in the book are scientists at the Karst Institute. The book draws together all the scientific and cultural aspects of this important drainage basin. The text is in both Slovene and English, which occupy adjacent columns.

The Pivka River heads on insoluble rocks but drains onto limestone, where it eventually sinks into Postojnska jama, one

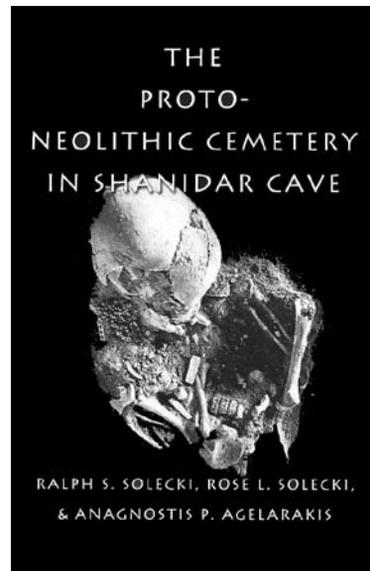
of the world's most popular show caves. (Note: the Slovene *j* is pronounced *y*.) During high discharge, water in the low-relief middle parts of the basin fills fault-aligned depressions to form intermittent lakes. The river is connected to the lakes by underground conduits, although known caves in the lake area are small. These caves show the effects of severe flooding and act alternately as both springs and inlets as the water level varies. Between floods the fertile lake bottoms are farmed and also serve as the home of many cleverly adapted animals and plants. Environmental problems in the area include flooding during wet periods and a shortage of water during dry periods. People, plants, and animals all must adapt to the varied conditions.

The area is a natural corridor between central Europe and the Mediterranean. It was once inhabited by Stone Age humans. It also contains the remnants of a Roman road and medieval fortifications, and experienced much damage and hardship during the world wars. During the 20th century the land changed hands from Austria to France and then to Italy. Persecution and economic crises led to mass emigration.

This book gives a well-rounded introduction to the area that goes well beyond mere geographic description. There are chapters on geology, hydrology, water-tracing studies, detailed observations during a flood, aquatic and terrestrial fauna, archaeology, the strategic position of the region during World War I, and suggestions for protecting the environmental heritage.

Illustrations are clear and well prepared. They may seem sparse because of the double-length text. Most photographs are in attractive color but are a bit low in contrast. Despite the formatting difficulties inherent in a dual-language book, and the fact that the area is not an obvious target for tourists, this is an attractive volume that invites browsing. Prospective visitors will appreciate the holistic approach to the subject. In addition, this book gives insight into strategies of land management that can be of benefit in similar karst areas.

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The Proto-Neolithic Cemetery in Shanidar Cave

Ralph S. Solecki, Rose L. Solecki, and Anagnostis Agelarakis, 2004. Texas A&M University Press, College Station, Texas, 234 p. ISBN 1-58544-272-0, hardcover, 6¼" × 9½", \$50.00.

Shanidar Cave is located about 250 miles north of Baghdad, in the Zagros Mountains of Iraq. Its known history of human habitation extends from the time of Neanderthal

Man (about 100,000 years ago) up to the present. Even in recent times it has been a seasonally used refuge, sheltering local Kurdish tribesmen during the winter. Similarly, a community of Proto-Neolithic people living in the 9th millennium BCE are also known to have spent their winters in the cave. During warmer months, they likely lived in open villages, such as the nearby Proto-Neolithic village of Zawi Chemi Shanidar. Between 1951 and 1960, Ralph Solecki and his team of archaeologists and anthropologists excavated in Shanidar Cave and at the Zawi Chemi Shanidar site. The deteriorating political climate in the country prevented further fieldwork.

During these excavations, four major cultural layers were uncovered in Shanidar Cave. From top to bottom these can be distinguished chronologically: 1) from present day until about 6,000 years ago, 2) about 10,000–13,000 years ago, 3) about 8,000–40,000 years ago, and 4) about 80,000–100,000 or more years ago. The 2nd layer from the top, located at a depth of one meter below present ground surface in the cave, is referred to as the Proto-Neolithic layer. It contained the remains of anatomically modern humans (*i.e.*, people just like us). The significance of the Proto-Neolithic culture is that it represents transition between the older Paleolithic and the younger Neolithic cultures—a transitional period between an earlier hunting-and-gathering culture and a later one that primarily depended on the domestication of plants and animals. The 4th (oldest) layer, referred to as the Middle Paleolithic or Mousterian layer, contained the remains of Neanderthals. Skeletons unearthed by Solecki from this layer are among the most important Neanderthal finds ever made. His interpretation of these finds revolutionized our appreciation of the Neanderthal culture and contributed greatly to our understanding of their innate humanity.*

During the initial years of excavation, the rear section of the cave had been blocked off by the presence of a corral and a stone wall. However, by the end of the 1960 field season, these impediments had been removed by local tribesmen, allowing the archaeologists access to portions of the cave that had previously been off-limits to them. At that time an ancient cemetery, attrib-

uted to a once-thriving Proto-Neolithic culture, was discovered near the back of the cave. Excavation of this cemetery uncovered the skeletal remains of 35 people, including 20 infants and children, five adolescents, and 10 adults. These were contained in 26 distinct graves and dated to approximately 11,000 years ago. In addition, various grave offerings, consisting mainly of bone tools and stone beads, were associated with many of the remains. Because of time constraints at the end of the 1960 field season, none of the cemetery was excavated.

Excavation revealed the cemetery to be surrounded by a series of stone pavements. These were fashioned from hundreds of carefully placed, fist-sized limestone fragments. The authors believe these pavements to have been components of mortuary hearths (*i.e.*, fire pits) used in ritual interment ceremonies. These pavements and an adjoining curved wall of stone separated the burial sites from the remaining (habitable) regions of the cave.

The most commonly found grave offerings were ornaments of personal adornment, primarily strings of beads. These were fashioned from perforated gastropod shells, crab-claw tips (both locally available), or colorful stones. Moreover, many of the stone beads were formed from materials not found in the vicinity of the cave. This suggests that the Proto-Neolithic people of Shanidar Cave had established extensive trading networks with more distant locales, although it is unknown if this involved trade in raw materials or in fully finished products.

The fact that these people buried their dead in a localized cemetery, accompanied by valuable goods, and perhaps associated with a ritualized interment ceremony, provides insight into their religious and spiritual lives. They may have believed in an afterlife. Because no obvious symbols of rank or status were found among the grave offerings, the authors suggest that these people lived in a socially classless society.

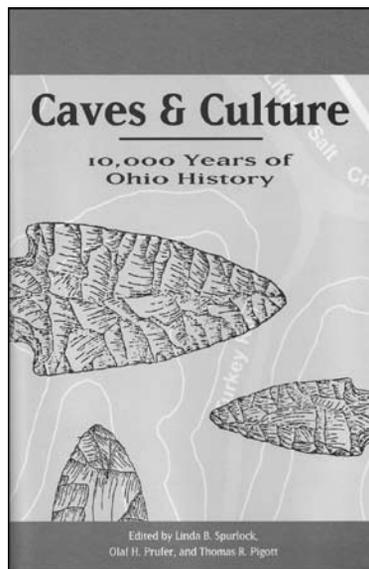
All of the skeletal remains and most of the grave goods excavated from Shanidar Cave were ultimately delivered to the Iraq Antiquities Museum in Baghdad. Over a 30-year period following the excavations of Shanidar's burial site, these artifacts have been studied and re-studied in attempts to further define the culture, technology, and even common medical afflictions of our distant human ancestors.

In *The Proto-Neolithic Cemetery in Shanidar Cave*, the authors provide a complete and carefully cataloged documentation of the 11,000-year-old human skeletal remains and grave goods found in Shanidar Cave. The book is well illustrated with black-and-white photographs and ink drawings and is very readable. It provides an exemplary account of the diversity and wealth of information that can be derived from the study of caves. Moreover, it is an excellent showcase for explaining what cave archaeology can tell us from a systematic study of prehistoric artifacts. The more we learn about our distant ancestors, the more we ultimately know about ourselves.

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* Solecki, Ralph S. (1971). *Shanidar: The Humanity of Neanderthal Man*. Allen Lane/Penguin, London. Readers interested in Solecki's earlier excavations might also be interested to know that several of his finds at Shanidar served as

the foundation for Neanderthal society in Jean Auel's best-selling novel, *The Clan of the Cave Bear*. The discovery of a very old and deformed Neanderthal male—who couldn't have possibly survived on his own—was the basis for the character of Kreb, the clan's holy man or Mogur. Although controversial, the finding of a Neanderthal grave filled with pollen was interpreted as a ritualized burial, similar to the one depicted in the book and movie.



Caves and Culture: 10,000 Years of Ohio History

Linda B. Spurlock, Olaf H. Prufer, and Thomas R. Pigott (eds.), 2006, Kent State University Press, 463 p. ISBN 0-87338-865-8, hardcover, 6½" × 9½", \$45.00.

Primarily intended for professional and serious avocational archaeologists, *Caves and Culture* presents an in-depth discussion of archaeological finds in the various caves

and rock shelters that dot the state of Ohio. Continued surveys of these sites reveal their repeated use by humans and provide evidence for prehistoric habitation over three millennia in the region. While archaeological investigations of Ohio's caves and rock shelters have been ongoing for almost half a century, early discovery and interpretations of unearthened artifacts were hampered by many problems, including theft, poorly organized field notes and collecting techniques, accidental loss or deliberate disposal of valuable material, outright fraud, and disturbance of sites by modern human activity. These and other issues are considered in the detailed description of various sites.

Each chapter is devoted to a separate study site and typically includes a discussion of the physical setting of the cave or rock shelter; historical aspects of research at the site, including both local politics and personalities of those involved; and archaeological finds and interpretations. The book concludes with a brief discussion of the historic use of local caves over the past few hundred years.

Although largely free of complicated jargon, this work is not a popularized account of archaeology written for the lay reader. Serious students of archaeology or human prehistory will find much to interest them.

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