of the original could probably have been achieved (my comment). Of course, a compressed system requires coding of data (this is achieved by use of a check-list form containing all the possible codes) and the data base cannot then be read by the casual user. For output the computer executes the reverse process, replacing the codes by the original terms. This results in a somewhat stylized form of English, at worst just a list of the terms; but by judicious use of conjunctions and keywords the result is perfectly legible. We may note that the output may be in a language other than English, for this only requires replacement of the codes by the foreign language terms, so that summaries in say, French, German, Spanish, Italian and Russian could be produced easily, given a printer with the required typefaces. But note that this is not an intelligent machine-translation system, only a keyword replacement system; any comments included in the data base in free English text remain in English in the foreign language output.

It is indeed sad that the doyen of Australian caving, Joe Jennings, did not live to see this finished work; his glossary of cave and karst terminology (first published in 1979) also appears in the book.

I found the section on naming caves and cave features pretentious. Obviously the Australian character has contributed more than the usual share of colloquial, humorous, obscure, eponymous or trivial names: perhaps there is reason to complain (examples are caves named after politicians, 'A Touch of Class', 'Beer Bottle Cave', 'Big Hole'. 'I'm Stuck', 'Sementite', 'Sharlands Organ' and the usual collection of Tolkien names), but I can imagine the reactions of the average group of Australian cavers over their tubes of Fosters to this pontificating.

The sections by Peter Matthews on the standards for the cave, karst feature, survey and map numbering codes are most instructive: such numbering schemes would be applicable to any geographical features requiring data base cataloguing, e.g. they could be adapted easily to archaeological, geological, hydrological, geomorphological and other scientific sites.

Finally, the section on the ASF cave survey and map standards is particularly worth while: we may note that there is a much wider range of symbols than the set recommended currently by BCRA, and there are some significant differences. I felt that other papers could have been included with advantage, perhaps syntheses of Australian cave flora and fauna, speleogenesis, hydrology, geology and geomorphology.

These comments are intended to be minor criticisms only. This is a remarkable achievement in documentation, one which British cavers would do well to copy. The standard of the written papers is high, the layout is attractive and the standard of printing is good. The *Australian Karst Index* is a credit to the thoroughness and persistence of its contributors, and particularly of Peter Matthews.

RUTTER, N. W. (ed.): *Dating methods of Pleistocene deposits and their problems*. Reprint Series of the Geological Association of Canada, no. 2, 1985, 96 pp. Obtainable from GAC Publications, 111 Peter Street, Suite 509, Toronto M5V 2H1, Canada. Price $15 + $3 postage & packing.
(reviewed by T. C. Atkinson)

One of the minor growth industries of the past 25 years has been the invention and development of new methods for measuring the age of archaeological and geological specimens. Radiocarbon dating was the first,

invented in the 1940s and exploited initially by archaeologists and later by geologists in the 1950s and 1970s. Most of the methods reviewed in this useful and modestly-priced book have originated since about 1960.

The book is divided into nine chapters, each by different authors and devoted to a different method, namely: thermoluminescence, uranium-series, radiocarbon by atom-counting, amino-acid racemisation, tephra and fission-track dating, palaeomagnetism, palaeosols and their characterization, weathering rinds, and electron-spin resonance. Of these, thermoluminescence (TL), uranium-series,amino-acids, palaeomagnetism and electron-spin resonance (ESR) are of the most interest to speleologists.

Thermoluminescence dating was first developed for use on archaeological materials which had been burnt or fired, such as pottery or burnt flint. The firing sets the TL (or luminescence on heating) of quartz grains in the pottery to zero, after which TL builds up again over time because of damage to quartz crystal lattices by natural radioactivity. The amount of TL that builds up depends on the age since firing and on the radiation dose rate which the sample has received. Workers in the U.S.S.R. first noticed that exposure to daylight had the same effect of removing the TL from natural quartz grains as firing did on quartz in pottery. This has recently become the basis for the dating of loess and other terrestrial and marine sediments. Thus, TL could potentially be used to date silts from caves, provided that they had been introduced from outside and their TL 'zeroed' by daylight. Calcite speleothems also exhibit TL, but small-scale variations in their uranium content, which is an important source of radiation, lead to technical problems in deriving accurate dates. Another method which has been used to date speleothems is ESR although this is also in the development stage. Like TL, it relies on measuring the effect of accumulated damage by natural radioactivity. It has potential for dating a wide range of materials including shell, bones and teeth.

Uranium-series dating of speleothems has been the most significant dating development for speleology, and the $^{230}Th/^{234}U$ technique has become almost routine for estimating ages within the last 350,000 years. This has opened up new possibilities for studying the age and development of whole cave systems, as well as dating the geomorphic development of the landscapes containing them. Schwarcz and Blackwell's chapter succinctly reviews these and other applications.

One of the frustrating aspects of speleological dating is that the scientist is chasing a moving target. In the days when only radiocarbon dating was available (with a range of 50,000 years), we thought in terms of a few hundred thousand years for cave development. To one in this frame of mind, a dating method which covered seven times as long as radiocarbon seemed like the 'Open Sesame' which would unlock the answers to all the speleogenetic questions he might care to pose. Ironic it was that the first U-series dates on speleothems from Britain should have shown that most of the major caves were formed before this time! Today the need is for dating methods which will reach back one or two million years. TL and ESR may eventually fill this role, but for the present the most useful technique in this time span is measuring the paleomagnetism of cave sediments and speleothems and comparing with the independently dated record of reversals of the earth's magnetic field. The principles and pitfalls of this type of geological correlation (it is only indirectly a dating technique) are outlined by Barendregt.

All of the chapters in the book outline the basic principles of each method, which will be useful for readers who merely wish to understand how they

work. To persons of a more critical disposition, the most valuable part of each chapter will be that concentrating on problems and pitfalls of interpretation and the suitabilities of different materials for dating. The chapters on palaeomagnetism, U-series and ESR are the most useful in this respect.

Although now collected together as a book, the chapters originally appeared separately as review articles in *Geoscience Canada* over the years 1978–82. Some have been completely revised (to 1984) for reprinting; others not at all. Despite this unevenness, the modest price should make this book an essential purchase for libraries and for individual archaeologists or speleologists who are not willing to take the dating experts entirely 'on trust' and want to find out more for themselves about how the different dating methods work.

International Journal of Speleology vol. **15** (1–4), 1986. Published by Società Speleologica Italiana. ISSN 0392 6672. Price US$20.
(reviewed by M. M. Sweeting)

This issue of the *International Journal of Speleology* contains four original articles and one short report. The coverage of the articles is world-wide—from China to Morocco—and many aspects of caves and karsts are discussed. The articles are well illustrated with clear diagrams and photographs.

Song Lin Hua reviews the origin of the stone forests in China. Stone forests are defined as groups of stone pillars over 5 m. high; when the pillars are less than about 5 m high they are usually called stone teeth. For stone forests to develop, thick-bedded and massive limestones are necessary; the rocks must also dip only slightly and the conditions must be such that soil water can enlarge fissures and separate the limestone blocks. Furthermore a thick soil cover or rock where water can penetrate is needed as solution is predominantly by sub-soil corrosion. The stone pillars are exposed by the removal of the soil or cover rocks and are later modified by rain-water corrosion. Many of the stone forests in China are developed in the Permian Mao-Kuo limestones. Song Lin Hua gives a diagram suggesting the evolutionary stages of the stone forests.

An article by F. Jaskolla and P. Volk illustrates the use of accurate cave surveys for tectonic analysis. Their supposition is that caves are controlled by tectonic lineaments—joints, faults and other features of deformation—and that mapped cave passages and tectonic (particularly micro-tectonic) elements show a very close relationship. Several well-known caves in S. Germany and the Alps are used as examples. In the Hölloch cave the directions of passages in the upper inactive part of the system are quite different from the directions of passages in the active lower levels—representing two different fabric patterns. The article illustrates the need for accurate cave surveys, for a fuller understanding of the fundamentals of micro-tectonics and for greater statistical data processing. It is to be hoped that this work will encourage more speleologists to give their time to preparing detailed cave surveys.

Two of the articles deal with speleogenetic role of air flow and condensation water. Arrigo Cigna and Paolo Forti look at the theoretical possibilities of corrosion in domes by condensation caused by convectional air movement. From their calculations based on parameters measured in the Grotta Giusti, the amount of $CaCO_3$ which could be dissolved in one day could be as high as 630 g/litre. Even though this figure is an upper limit, is it clear that the importance of convectional air-flow and condensation water have been underestimated in cave corrosion. Possible cave erosion forms resulting from condensation waters are illustrated.