

## BOOK REVIEWS

*The Quaternary of China*. Edited by Zhang Zonghu, Shao Shixiong, Tong Ghobang and Cao Jiadong. Institute of Hydrogeology and Engineering Geology, Zhengding, China. Beijing 1991 China Ocean Press, 575 pages. *Explanatory Notes of the Quaternary Geologic Map of the People's Republic of China and Adjacent Sea Area*. Edited by Zhang Zonghu, Shao Shixiong, Zhou Mulin and Fan Yi. Beijing 1990 China Cartographic Publishing House (9 maps and 78-page manual).

These book(s) and maps were produced in association with the 1991 INQUA XIII Congress in China. The primary work, *The Quaternary of China*, includes 16 chapters by various authors. The companion work, *Explanatory Notes of the Quaternary Geologic Map of the People's Republic of China and Adjacent Sea Area*, consists of nine 1:2,500,000 high-quality color maps (104 x 76 cm) of the Quaternary Geology of China, along with an explanatory 78-page volume.

*The Quaternary of China* bears many similarities to *Late Quaternary Environments of the Soviet Union*, edited by A. A. Velichko (1984). Zhang *et al.*'s work is more comprehensive and larger, and has the wonderful maps, but the format is the same. Following a general introduction by the Chief Editor (Zhang), there are chapters covering a wide range of topics, from tectonism to vertebrate paleontology. The design of the figures and correlation charts is even the same. Like the Soviet volume, *The Quaternary of China* provides a glimpse of prolific research in a region of great interest for Quaternary studies. Velichko's volume has photographs, Zhang *et al.*'s does not, and neither has an index.

As with Velichko's volume, *The Quaternary of China* provides a valuable counterpoint for Western Quaternary studies. Many conclusions seem familiar, but others are novel or exotic. The Quaternary time scale presented is entirely familiar. Major subdivisions are based on magnetostratigraphy and the marine oxygen isotope stages, and the Holocene subdivisions clearly are descended from the European Blytt-Syrrander sequence. Also familiar are the environmental reconstructions for the Last Glacial Maximum. In Tibet, lake basins dried *ca.* 18.9 ka BP, and trees were replaced by cold- and drought-resistant herbs. The periglacial limit was 800 m lower, and the snow line descended 350–1100 m, with many regional variations. In eastern coastal areas, sea level was 130–150 m lower.

Climatic events during the deglaciation are unclear. Whereas there are indications of climatic fluctuations between 18 and 10 ka BP, and some evidence for the Younger Dryas event (p. 232), I found no mention of whether lake levels were higher during deglaciation (like the northern Great Basin), or in the early Holocene (like southern Sahara). In fact, I found little information on the history of the Asian monsoon, beyond a general statement regarding its Neogene intensification due to uplift of the Tibetan plateau.

In contrast to recent claims of intensified monsoonal precipitation during the early Holocene (An *et al.* 1991), the climatic chronology presented in this book indicates greater aridity in the early Holocene (pp. 150–154). The middle Holocene, 5.5–2.5 ka BP, was warm and wet in most regions, and the late Holocene cold and dry. The mountainous regions of western China contain extensive deposits left by Holocene glacial advances dated 5500, 3900, 2800, 1700, 1100 and 400–70 yr BP. Many records of (relative) Holocene sea level from eastern China indicate water depths *ca.* 4 m greater than today during the middle Holocene (8–4 ka BP).

Several aspects of the book and maps warrant special mention. Chapter 6, titled "Quaternary Geology in Offshore Areas of China", is the most detailed and informative of the book. The errors

are minimal, and there are more figures, radiometric dates, and detailed diagrams of ostracods and pollen than in any other chapter. I also appreciated Chapter 15 by Zang Zonghu, Zhang Zhiyi and Wang Yunsheng on “Loess in China”. It includes a detailed history of loess research, regional descriptions of loess stratigraphy, summaries of fossils preserved in loess, discussions of soil-forming processes and implications of loess stratigraphy for the environmental chronology.

I recommend highly the chapters on fossil hominids in China, “The Other Cradle of Humanity”. Chapter 6 in *Explanatory Notes ...* lists the Ziaochangliang Culture, dated 2.5 Ma by paleomagnetism, as the oldest evidence (tools only) for humans in China. Chapter 10 in *The Quaternary of China* mentions, more conservatively, the earliest skeletal remains of *Homo erectus yuanmouensis*, dated 1.7 Ma by paleomagnetism. These are followed by many discussions of other human fossils throughout the Quaternary.

Chapter 13, by Han Tonglin, includes a discussion of a unique aspect of Chinese Quaternary studies: the early Pleistocene “Great Ice Sheet”. This extensive ice cap formed before the uplift of the Tibetan Plateau had blocked monsoon moisture from the Indian Ocean. Its deposits include several continental-scale glacial features, such as bedrock drumlins and till-covered plains. The ice is estimated to have been 1000–2000 m thick, covering an area of 2–3 million km<sup>2</sup>.

Other topics include neotectonics, volcanism, stratigraphy, paleogeography, palynology and laterites. There are two regional syntheses: one for the Qinghai-Tibet Plateau, another for the Eastern China Plain. I was surprised by the absence of some topics, such as Quaternary faunal extinctions, and the minimal coverage given to the history of monsoon climate and pluvial lakes, but overall, the coverage is thorough.

Although *The Quaternary of China* compares favorably with Velichko’s Soviet volume, it would have benefitted from English-language editing. Wright and Barnosky (Velichko 1984) provided a conceptual interface for Western readers and revised the English. The errors in *The Quaternary of China* range from distracting to obscuring. Some sections must be read very carefully, and figure captions are particularly error-prone. For example, the axes of Figure 3.12 are labeled “Age (Ma BP)”, but the units are actually 10,000 yr. Most errors appear to result from the typesetters’ unfamiliarity with the English alphabet, but these mistakes should have been caught in proof. *Explanatory Notes ...* (Fan Yi, English Editor) is comparatively error-free.

The volumes are valuable sources of information on the Pleistocene of China, but they fall short as a resource for further study. The “big picture” is there, but without the specifics. Most references cited in the text are not included in the “Main References” at the end of the book. Even the radiocarbon dates are given without laboratory numbers. Despite these shortcomings, I strongly recommend these books and maps to any Quaternary scientist interested in Asia, in particular, or global change, in general. They provide a broad introduction over a wide array of topics for this fascinating region, and they have heightened my interest in more detailed studies.

## REFERENCES

- An, Z. Kukla, G. J., Porter, S. C. and Xiao, J. 1991 Magnetic susceptibility evidence of monsoon variation on the Loess Plateau of central China during the last 130,000 years. *Quaternary Research* 36: 29–38.  
 Velichko, A. A. 1984 *Late Quaternary Environments of the Soviet Union*. Wright, H. E., Jr. and Barnosky, C. W., (eds., English edition). Minneapolis, University of Minnesota Press: 327 p.

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*The Last Deglaciation: Absolute and Radiocarbon Chronologies*. Edited by Edouard Bard and Wallace S. Broecker. Nato ASI Series I: Global Environmental Change, Vol. 2. Proceedings of the NATO Advanced Research Workshop, Erice, Sicily (Italy), December 9–13, 1990. New York 1992 Springer-Verlag, 344 pages, \$159.00.

As with many topics in the Quaternary sciences, chronology limits our ability to understand the complicated relations among events that occurred during the termination of the most recent ice age. Although abrupt changes in oceans, atmosphere, biosphere and cryosphere are inextricably linked in ways that now appear to have global consequences, we are not yet able to resolve critical questions about the precise order in which the changes occurred. This useful book brings together a diverse but focused collection of papers in three sections dealing with (I) radiocarbon and absolute chronologies, (II) past changes in cosmogenic nuclide production, and (III) climate changes during the last deglaciation.

Section I contains papers by Kromer and Becker (tree-ring  $^{14}\text{C}$  calibration); Johnsen and Dansgaard (flow-model dating of ice cores); Björck *et al.* (Swedish varve chronology); Lotter *et al.* (annually laminated sediments from Switzerland); Rozanski *et al.* (annually laminated sediments from Poland); Zolitschka *et al.* (varve-dated records from Germany); and Bard *et al.* ( $^{230}\text{Th}/^{234}\text{U}$  and  $^{14}\text{C}$  dating of corals from Barbados, Galapagos and French Polynesia). Section II has papers by Lal (variations in global production rate of  $^{14}\text{C}$ ); Raisbeck *et al.* ( $^{10}\text{Be}$  variations in 50,000 years of the Vostok core); Beer *et al.* ( $^{10}\text{Be}$  peaks in polar ice cores); Salis and Bonhommet (geomagnetic field intensity from 8–60 ka); and Mazaud *et al.* (geomagnetic calibration of the  $^{14}\text{C}$  time scale). Section III includes Broecker (strength of the Nordic heat pump); Sarnthein *et al.* ( $^{18}\text{O}$  meltwater anomalies in the North Atlantic); Duplessy *et al.* (a new method to reconstruct sea-surface salinity); Southon *et al.* (past ocean-atmosphere  $^{14}\text{C}$  differences); Jouzel *et al.* (evidence of a “Younger Dryas” event in Antarctica); Fisher (ice-core evidence for an early Holocene freshwater cap in the Atlantic); Gasse and Fontes (climate changes in northwest Africa during the last deglaciation); and Peteet (palynological evidence for the Younger Dryas in Europe and North America). The chapters are unusually concise and to-the-point, with key conclusions supported well by data and figures. Because the papers were typeset camera-ready by authors, they vary in font and format; nevertheless, printing is of high quality and most chapters are easy to read.

The first two sections include discussions of such topics as 1) the plateaus in  $^{14}\text{C}$  ages that occur at 10,000, 9600 and 8800 BP, according to dendrochronologic data, and at 12,700, 10,000 and 9500 BP, according to data from annually laminated Swiss lake sediments; 2) the duration of the Younger Dryas, which is measured as 260–400 yr (Swedish varves), 450 yr (Greenland ice-core chronology), 680 yr (annually laminated lake sediments from Switzerland), and at least 1200 yr (annually laminated lake sediments from Poland); 3) estimates for the absolute age of the Younger Dryas/Holocene transition, which vary from 10,630 cal BP to  $\geq 11,090$  cal BP; 4) support for the accuracy and precision of  $^{230}\text{Th}/^{234}\text{U}$  age determinations (dating of corals); and 5) stratigraphic markers that may be reliably used to date ice cores.

Chapters in the third section are interesting and provocative. All in all, this book provides first-hand insights that are both fascinating and useful – to this reader, at least. Despite its \$159.00 cost, many Quaternary scientists will be pleased to have this book readily available.

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*Isotopic Techniques in Water Resources Development 1991*. Edited by G. V. Ramesh. Proceedings of a Symposium, Vienna, 11–15 March 1991. Vienna, Austria, International Atomic Energy Agency, 1992, 789 pages. (757 text pages) Paperbound, \$240.

This volume consists of 84 papers presented (37 oral, 47 poster) at the symposium of the same name. The topics for the oral presentation are: Interface Processes between the Atmosphere and the Hydrosphere (2 papers); Surface Water and Sediments (6 papers); Groundwater Dating: Problems and New Approaches (9 papers); Groundwater Dating: Problems and New Approaches – Methodological Aspects and Models (3 papers); Groundwater (6 papers); Environmental Problems and Water Pollution (5 papers); and Paleohydrology and Paleoclimatology (6 papers). The poster presentations are listed in their separate categories, and are more concise than the papers from the oral presentations. Seven papers are in French, 2 in Spanish and 2 in Russian. Only the three non-English papers from the oral presentations have English-language abstracts.

This volume will be valuable reading for those who utilize environmental isotopes, and need to learn about the latest isotopic tools and new applications of the traditionally applied isotopes. Topics range from applications of the well-studied  $^{14}\text{C}$ ,  $^3\text{H}$ ,  $^2\text{H}/^1\text{H}$ , and  $^{18}\text{O}/^{16}\text{O}$ , to  $^{36}\text{Cl}$ , U-series isotopes and noble gases. The papers contain a few examples of the use of artificial tracers in water-tracer experiments; one illustrates the propitious use of Chernobyl-generated isotopes as large-scale “artificial” tracers. At least three papers deal with *in-situ* production of environmental isotopes.

Recent years have seen the evolution of the hydrological applications of environmental isotopes from strict isotopic considerations to more integrated studies that include not only all available geochemical parameters, but also the geological and hydrological context. Environmental isotopes have assumed their proper role in testing hypotheses based on all available data. This volume continues this trend.

A particularly vexing aspect of groundwater isotope data is the interpretation of the results in terms of real uncertainties. Several previous groundwater investigations have pointed out possible sources of errors, but until recently, few efforts have dealt with uncertainties quantitatively. The article by Brian Payne shows how statistical methods can be applied to stable oxygen and hydrogen isotope data. The techniques are transferrable to other isotopes. This chapter should be required reading for users of environmental isotopes.

The section on environmental problems includes studies of saline mine discharge, artificial radionuclide migration, and public water supply degradation. The Paleoclimatology section has particular relevance to global change research, as papers in this section illustrate that aquifers and groundwater-deposited travertine and permafrost can be archives of paleoclimatic information.

This volume will be a valuable addition to libraries of universities and research institutions in two senses of the word. First, it illustrates the current state of acceptance of the use of environmental isotopes in practical situations involving questions of water quality and quantity. Second, the price all but precludes this volume’s occupancy on personal library shelves. At \$240 (US), even university libraries, many of which are currently trimming budgets, will be circumspect about its purchase. Current and potential users of environmental isotopes in water resources, including hydrology students and environmental consultants, should take note of the variety of ground and surface water studies illustrated in this volume.