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The Age of the Earth: from 4004 BC to AD 2002

S. George Pemberton

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interested in one workable practical application of a "quick-and-dirty" methods approach, utilizing real examples from the real world, I would recommend Embry and Catuneanu (2002). However, I repeat my previous caveat, that taking the classroom short course itself likely provided much more "hands-on" experience.

Not surprising in a set of Short Course Notes, there are a number of minor spelling/grammatical/editing errors (eg. "Walter's Law" appears several times instead of Walther's Law), which will likely be rectified in later editions. Although the volume is well-illustrated and the photographs are of high quality, there is a preponderance of sedimentological photos that don't effectively demonstrate the principles of sequence stratigraphy, and of model-driven line drawings. The spiral-bound, soft-cover format is convenient, low-cost and appropriate for a publication that could receive daily use for a few years (particularly by students), later to be replaced by updated versions (already planned) as the content evolves.

The author states in his Preface "This volume should therefore be seen as work in progress, and comments from the readership will be most welcome". I encourage professionals and students alike to read carefully, sift, absorb, and analyse the contents, then take the author up on his offer for comments. Not only this book, but also sequence stratigraphy itself, is still a work in progress.

Barrell, J. 1917. Rhythms and the measurements of geological time. Geological Society of America Bulletin, v. 28, p. 745-904.

Embry, A.F. and Catuneanu, O. 2002. Practical Sequence Stratigraphy: Concepts and Applications. Canadian Society of Petroleum Geologists, Short Course Notes, 147p.

The Age of the Earth: from 4004 BC to AD 2002

by C.L.E. Lewis and S.J. Knell (Editors)
Geological Society Publishing House
Unit 7, Brassmill Lane
Bath, BA1 3JN, United Kingdom
Geological Society Special Publication No. 190, 2001, 288 p. Hardcover $US 117.00, GSL Members $US58.00, AAPG Members $US70.00

Reviewed by S. George Pemberton
Department of Earth and Atmospheric Sciences
University of Alberta,
Edmonton, AB T6G 2E3
george.pemberton@ualberta.ca

This volume resulted from the Geological Society's William Smith Millennium Meeting, convened on 28-29 June 2000 at Burlington House on behalf of the History of Geology Group. The book is dedicated to the memory of John Thackray, archivist at the Natural History Museum and the Geological Society who passed away in 1999.

A debate about the Age of the Earth has raged for centuries and absolute dates have been postulated and revised countless numbers of times. The discovery of the concept of deep geologic time was the cornerstone to the development of the modern concepts of geology and biology. It provided Hutton and Lyell with the mechanism to explain the history of the Earth and to formulate the modern principles of geology and Darwin with the time required to explain the transmutation of species. With apologies to plate tectonics it probably represents the most important concept to come out of geology. The volume contains 19 contributions from some of the best-known historians of geology and documents the development of the concept of determining the Age of the Earth over a span of some 350 years from 1650 to 2002. It provides valuable insights both on the techniques and the scientists involved in this enquiry. Although the author list is a bit top heavy with contributors from Great Britain (11 of the 21 contributors), the editors have tried to make it cosmopolitan with authors from Italy, the United States, Canada, Ireland, Australia, Sweden and Germany. This provides a more even handed treatment of the subject from a number of points of view.

The book opens with an introductory essay on "*Celebrating the age of the Earth*" by the editors Simon Knell and Cherry Lewis where they summarize the key developments for the quest of determining the Age of the Earth. The remaining 18 contributions are arranged in more or less chronological order, beginning with the work on biblical chronology in the 1660's and ending with the radiometric dating chronologies of the present day. Specific contributions on the role of fossils as geological clocks, time and life, dating humans, and the abstraction of cosmic time are also included.

I particularly enjoyed the contributions by Ken Taylor (on Buffon and Desmarest), Martin Rudwick (on Jean-André de Luc), Hugh Torrens (on William Smith), Patrick Wyse Jackson (on John Joly), and Cherry Lewis (on Arthur Holmes). The Torrens essay was brilliant and in spite of all of the recent work on Smith managed to cover new ground. On the other hand, I was disappointed with the essay by John Fuller on the early biblical chronologies especially the lack of discussion on the impact of the work by James Ussher and John Lightfoot. This is especially odd given that the title specifically mentions the 4004 BC date. This date became the rallying point from which geology began its dramatic separation from religious orthodoxy and established itself as a viable science. The contribution on the American perspective by Ellis Yochelson and Cherry Lewis was also disappointing as it was superficial. It could have used some of the verve given by Ezio Vaccari on his excellent treatment on the European views on the subject as exemplified by Descartes, Leibniz, Kirchner, Steno, Swedenborg, De Maillet and Scheuuchzer among others.

One disappointing aspect of the volume is the lack of illustrative

materials. In total the 19 contributions have only 63 figures and 26 of them are graphic in nature. Geology is a visual science and I would have liked more illustrations. The history comes alive when it is depicted visually. Although the individual contributions stand alone, the editors have provided a common index that I found to be useful. As a bibliophile I enjoy perusing the bibliographies (references in the 19 contributions total 1,245) and I must say that this volume provides the reader with a concise over view of the literature on the subject.

On the whole I found the volume to be well written and tightly edited. Most of the contributions were informative and provided valuable insights on the techniques involved in determining the Age of the Earth. This book would serve well as a textbook for a graduate student seminar course because of its broad coverage of the topic. I think that this volume should be on the shelf of most geologists as it is only through a good understanding of the history of development of a concept that we truly understand it. I am sure that the final page on the quest for determining the age of the earth has not as yet been written and new methodologies will refine our understanding. The concept of deep geologic time will continue to excite future geologists and the quest to determine the Age of the Earth will continue.

Phosphates: Geochemical, Geobiological and Materials Importance

Edited by Matthew J. Kohn, John Rakovan, and John M. Hughes
Mineralogical Society of America and Geochemical Society
Reviews in Mineralogy and Geochemistry, volume 48
2002; paperback, 742 p.; ISBN 0-939950-60-X

Reviewed by Gerry Ross
Kupa'a Farm
Box 458
Kula HI 96790
U.S.A.

The Mineralogical Society of America has been publishing this series of reviews for nearly 30 years beginning with the initial volume in 1974 on sulfide minerals. They began publishing these reviews in conjunction with the Geochemical Society in 2001 and the series is now up to volume 53. The "phosphates" book was the text for a 2-day short course offered at the annual meeting of Geological Society of America in Denver 2002. The MSA/GS has set high standards with the publication of this series as they invariably offer an excellent snap shot of state-of-the-science in a particular area. This review is no different and offers an incredibly diverse and detailed overview of phosphate minerals.

The phosphates are an important group of minerals in that they have the greatest crossover between areas of traditional geology and mineralogy and nontraditional geoscience areas in such as medical science, materials research, and nuclear waste disposal. The phosphates are considered distinct in that they are able to incorporate more than half of the elements of the periodic table into their atomic structures. Enchanted by this and a myriad of interesting trivia encountered while reading this book, I anxiously await the day when Alex Trebeck (a good Canadian boy who has become "a true American icon" according to the Jeopardy website) and Jeopardy have "GEOLOGY" as a theme and I can say "I'll take Mineral Facts for $200".

The book is divided into 5 different sections: mineralogy and crystal chemistry, petrology, biomineralization, geochronology, and materials application. The first few chapters begin with the nuts and bolts of phosphate minerals chiefly the structure (Hughes and Rakovan) and composition (Pan and Fleet). Rakovan then provides a detailed look at the growth and surface properties of apatite followed by a chapter on synthesis by Boatner, who was one of the early researchers into the synthesis of phosphates as a means of using crystalline substances for radioactive waste disposal. Here I learned of a mineral detail for my day on Jeopardy, that being that the scandium phosphate mineral, pretulite is only the sixth mineral known to contain the element scandium as a principal component. I also learned that the mineral monazite, a personal favorite, is derived from the Greek *monazein* meaning "to be solitary"…I am unsure if there is a deeper psychological message here but geochronologists may want to take note. The nuts and bolts section of the book concludes with an exhaustive chapter by Huminicki and Hawthorne on the crystal chemistry of the phosphate minerals.

The section on petrology includes a diverse suite of articles that cover apatite in igneous systems (Piccoli and Candela), apatite, monazite, and xenotime in metamorphic systems (Spear and Pyle), electron microprobe analysis of the aforementioned (Pyle, Spear, Wark), and sedimentary phosphates (Knudesen and Gunter). The final chapter in this section covers the global phosphorous cycle (Filipelli), which I found to be particularly relevant to my current career as a farmer. The section on biomineralization included a chapter by Elliott on calcium phosphate biominerals. Elliot is from the Department of Dental Biophysics at University of London, a new (to me) but very interesting subdiscipline. His chapter is filled with lots of grist to enable you to become much more engaged at a technical level with your