LITERATURE REVIEW

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TIME DEPENDENCY OF RADIOISOTOPE DECAY

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RADIOISOTOPES AND THE AGE OF THE EARTH. Larry Vardiman, Andrew A. Snelling, and Eugene Chaffin (eds.). 2000. Santee, CA: Institute for Creation Research; and St. Joseph, MO: Creation Research Society. 676 p. Cloth, $49.95.

This is an extraordinary book in many ways. It contains 47 pages of index, a 91-page glossary of specialized technical terms used in the book, and 56 pages of references to the professional scientific literature on the topics considered. A 66-page appendix outlines thirteen research projects for resolving critical questions raised in the text section The topics considered in the book are treated at a high level of technical sophistication by seven specialists, each of whom has a recognized doctorate in the area of his expertise. The authors have endeavored to provide thorough and accurate presentations of the various models that have been developed in the effort to understand the radiochemical features of planet Earth's crust, together with a listing of the major associated references in the scientific literature. Highest quality printing and 73 excellent illustrations[1] contribute to a book of extraordinary value to the community of scholars. I rate Chapter 8 as essential reading for anyone who desires to understand radiohalos, and for anyone who wishes to make a presentation on radiohalos for the general public. Similarly I can designate Chapter 4 as priority reading for anyone who wishes to understand radioisotope age data.

Although the primary motivation for the preparation of this book is to foster development of compatible understanding of radioisotope data and the chronological specifications in the Bible, the book is a valuable resource for individuals who do not share this concern.

On page 215 there is an example of the hazards faced by individuals with even the best reputation for effort to maintain high scientific standards. In a discussion on the Kambalda volcanics of Westem Australia, it is stated that "Although the whole suite yielded a good isochron 'age' of 2790 $\pm$ 30 Ma, the mafic and ultramafic samples alone gave an older best-fit 'age' of 2910 $\pm$ 170 Ma." Since the range 2760-2820 is entirely enclosed within the range 2740-3080, these age determinations are actually in agreement. This statement on age difference is an exception to the general character of the book.

A more serious example of the extent to which conclusions may be influenced by an investigator's initial bias is at the bottom of page 274: "... if there is one conclusive observation to be made, it is that the 'ages' derived from radioisotope systems can really only be regarded as maximum ages given the evidence of open-system behavior, mixing, inheritance, etc., ..." There are open-system processes that can reduce, as well as those that can increase a radioisotope 'age' characteristic. For example, heat could drive off argon, making the K-Ar 'age' younger than it was at the time of heating. Solution penetration could deposit potassium (or uranium), making the K-Ar (or the U-Pb) 'age' younger than it was at the time penetration occurred. A conviction regarding the age of the physical universe may prevent recognition of radioisotope age determinations that possibly have an unmodified relation to real time.

The reference to "dual ^{210}Po halos" in the third sentence on page 275 will cause confusion for some readers who are not acquainted with coalified-wood radiohalo phenomena. The ^{210}Po radiohalo has only one ring. The sentence would convey the author's intent better if it read "Furthermore, the presence of both elliptical and circular ^{210}Po halos indicates that U infiltrated these strata at the time of, and soon after, deposition and rapid compaction." This consideration is fully developed by the same author in a subsequent chapter (Chapter 8).

The data treated in RADIOISOTOPES fully indicate that Earth's crust contains concentrations of radiogenic isotopes many orders-of-magnitude greater than could have accumulated in 6000 years at present

rates of radioactivity. The authors are organized as the RATE (Radioisotopes and the Age of The Earth) Group for investigation of the possibility that at some time(s) in the past radioisotope decay rates could have been orders-of-magnitude (possibly about five orders, which is 100,000 fold) greater than given by determinations made over the past century.

In the process of transformation (decay) the nucleus of a radioactive isotope ejects a particle that has kinetic energy inversely proportional to the half-life of its parent. For example, the three daughters of uranium that produce most polonium radiohalos, ^{214}Po, ^{218}Po, and ^{210}Po, have ha1f-lives of 164 microseconds, 3.1 minutes, and 138.4 days, respectively; and emit alpha-particles (Helium-4 nuclei) with kinetic energy 7.69, 6.00, and 5.3 Mev, respectively. The air-equivalent distances traversed by these alpha-particles in dissipating their kinetic energy are 7.03, 4.67, and 3.87 cm, respectively.

To accommodate the observed abundances of fission-tracks and of radiohalos with postulated formation within a time-span in the order of 10,000 years, it must be presumed that radioisotope decay rates have been orders-of-magnitude greater than they are at present, without any significant difference in the energies of the particles ejected in the decay process. How can two isotopes of polonium be distinguished by related differences in their half-lives and the energies of the alpha-particles ejected in their decay, yet orders-of-magnitude changes in the half life of either of these isotopes be completely unrelated to the energy of its decay particle? This question is addressed in a theoretical chapter (Chapter 6). The author of this chapter concludes that reasonable changes may be postulated for energy relationships within the atomic nucleus that could produce orders-of-magnitude change in the decay probability (half-life) without significant change in the kinetic energy of the particles (fission products, or alpha particle) ejected in the decay. The appendix proposes research projects designed to seek for experimental confirmation of this speculation.

Exegesis that includes the entire physical universe in the creation account of Genesis 1:1 - 2:4 (see Table 1, p 338) mandates the troublesome theoretical considerations addressed in Chapter 6. Exegesis on the basis of modern concepts associated with the Hebrew terms *shamayim* (heavens) and *'eretz* (earth) comes readily. Vastly greater freedom in seeking harmony with radioisotope and astrophysical data

that has become available in the last century is obtained if exegesis is restricted to the definitions God, the Creator, gave for these crucial terms, as recorded in Genesis 1:8-10.[2] Elaboration of this consideration is available at: http://www.grisda.org/resources/rb_bibch.htm.

A discussion in RADIOISOTOPES regarding the initial geochemical makeup of planet Earth is conditioned by "the unequivocal Biblical statements that the Earth was in fact created before the Sun" (p 278). The highest commendation should be given to recognition of the significance inspired testimony (specifically, the Bible) has in the achievement of understanding the physical universe. There is danger of an unbalanced emphasis in the interaction between conclusions from properly conducted experimental observation and exegesis to determine the intent of inspired testimony. Only inspired testimony can convey assured knowledge concerning ultimate origins; but a study of related physical evidence (the RATE Group's research programs, for example) may assist efforts to determine the intent of an inspired writer.

The first two chapters of Genesis have been accepted as a record of revelation received by an intermediary (probably Moses). Genesis 1: 1-2 provide an introduction to this record, and also a statement concerning the nature of planet Earth's surface at the beginning of Creation Week. A conclusion to the basic account is given in Genesis 2:4a. The intervening verses outline what an observer on the surface of the planet would have seen step by step during the creation process. On Day 4 the "Heaven" (vs 8, KJV) created on Day 2 cleared sufficiently to make celestial objects discernable from the "Earth" (vs 10, KJV) created on Day 3. Since the Hebrew language does not have a pluperfect tense, the statement in verse 16 may be taken to specify either that the celestial objects were created by God *on* Day 4, or that the celestial objects previously created by God became discernable from the surface of planet Earth on that day. A personal judgment is required as to which interpretation best accommodates the testimony throughout the Bible, together with the accumulated astrophysical and geochemical data.

Significant inferences regarding the geological past may be drawn from helium concentration and the $^{3}He/^{4}He$ ratio in Earth's atmosphere and crust, as discussed in Chapter 7. Individuals who are interested in helium considerations should also consult the article by R.H. Brown [1998. Unique enigmatic helium. ORIGINS 25(2):55-73; at: http://www.grisda.org/origins/25055.htm].

As I have already stated, this book provides a convenient survey of the radioisotope characteristics of planet Earth's crust, and ready access to their treatment in the scientific literature. I have a severe problem with the suggestion that these characteristics might be accounted for by a 100,000-fold increase in nuclear instability over a short time within the past 10,000 years. Changes in the energy relationships within atomic nuclei would be expected to occur in all matter, and not be confined merely to isotopes that are unstable at present.

Consequently, in addition to a 100,000-fold increase in the radiation and particle emission from the nuclei that are presently unstable, a corresponding release from many of the nuclei that are now stable would be expected. The cumulative increase would be many times 100,000 fold.

Organic life and the chemistry on which it is based would most likely be destroyed under such circumstances. Consequently the proposed increase in nuclear disintegration rates would be confined to the first two days of the Genesis 1 creation week (plus possibly a few hours of Day 3 before plant life was created). Therefore a postulation of higher decay rates over only the first two days is equivalent to a postulation that considers the radioisotope daughter features which presently characterize planet Earth to have been created in situ at the beginning, together with subsequent modifications of such. This alternative postulate does not involve either an increase in nuclear disintegration rates or development over long periods of time.[3]

ENDNOTES

1. The reader will need to consult the reference source in order to adequately understand some of the illustrations that are borrowed from the basic literature. Principal examples are Fig. 3, p 62; Fig. 8, p 81; and Fig. 10, p 164. The legends for these figures are incomplete.

2. The New International Version takes liberty to translate these terms differently in Gen. 1:1,2; 2:1,4 than in Gen. 1:8-10, imposing an interpretation that goes beyond straightforward exegesis.

   The reader who wishes a broader treatment of exegetical considerations should consult "The Age of the Universe: What Are the Biblical Limits?", a 200-page book by Gorman Gray (2001. $12 ppd. Morning Star Publications, 931 15th St., Washougal, WA 98671-1209. Telephone 1-888-667-6464).

3. If there is consideration of two creations, a primordial creation of the Solar System and a subsequent creation that fitted planet Earth with organic life, a development over long periods of time may intervene.