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RADIOISOTOPE AGE: PART I

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Introduction

"Lucy, we can now confidently say, lived 3.18 million years ago, plus or minus 10,000 years." [*National Geographic*, Mar 1996, p 114 ("Face to Face with Lucy's Family," p 96-117).] On what basis can anyone affirm that humanoids existed on Earth 3.18±0.01 million years ago? Such claims are based on radioisotope dating. The assignment of Lucy's age was made from potassium-argon dating of the rock in which her skeleton was found. The conflicting testimony of the Bible concerning the amount of time since Creation Week requires a critical evaluation of radioisotope dating.

Figure 1. 1993 lava fountain, Kilauea Volcano, Hawaii. Photo courtesy of the U.S. Department of the Interior, U.S. Geological Survey.

What is a Radioisotope Age?

The radioisotope age of a specimen is obtained from a calculation of the time that would be required for unstable parent atoms [P] to spontaneously convert to daughter atoms [D] in sufficient amount to account for the present D/P ratio in the specimen. For the dating of Lucy, P was the unstable isotope 40 of potassium [^{40}K] and D was the stable isotope 40 of argon [^{40}Ar].

Conflicting Data

Lava from the AD 1901 eruption of Hualalei in Hawaii has potassium-argon (K-Ar) ages as great as 1.1 billion years. Historic eruptions of Mt. Kilauea in Hawaii (Fig. 1) have produced submarine lavas with K-Ar ages as great as 43 million years. Obviously these K-Ar ages do not represent the time of eruption, or the age of the lava flows. The ages must reflect other characteristics of the lava.

K-Ar ages from a volcanic deposit at Katmai, Alaska, suggest volcanic activity four million years ago. Historical records establish that the eruption which produced these deposits occurred in AD 1912.

A dominant feature of the topography in the Auckland, New Zealand, area is Mt. Rongitoto. During the time this volcano was active, a nearby forest was buried and fossilized in material having a K-Ar age of 485 thousand years. However, the carbon-14 (^{14}C) content of these fossil trees indicates burial less than 300 years ago! (The trees contain over 96% as much radioactive carbon-14 as found in living trees. The amount of ^{14}C in living material will diminish to 50% in 5715 years after death.)

These examples† adequately establish that a radioisotope age does not necessarily have a real-time significance. A relationship of a radioisotope age with real-time must be based on an interpretation. A discussion of rubidium-strontium ages in the Isotope Geoscience Section of the journal, *Chemical Geology*, specifically states that a radioisotope age determination "does not certainly define a valid age information for a geological

system" [Y.-F. Zheng, 1989, "Influences of the nature of the initial Rb-Sr system on isochron validity", *Chemical Geology* (Isotope Geoscience Section), 80:1-16]. Any interpretation will reflect the interpreters presuppositions (bias).

One Explanation

From a biblical perspective, radioisotope mineral ages associated with fossils are characteristics of the minerals in which the organic material was buried, and provide no information concerning the time of burial. The dates of human interment in cemeteries are determined from the historic information on the grave markers, not from radioisotope age data for the headstones, rock, and soil associated with the burial sites. Similarly, there is a reasonable and scientifically sound basis for estimating fossil ages on the basis of the chronological data in the Bible, rather than on the radioisotope ages of the minerals and rock layers now associated with these fossils.

History of the Radioisotope-based Geologic Time Scale

Before the discovery of radioactivity in the late nineteenth century, a geological time scale had been developed on the basis of estimates for the rates of geological processes such as erosion and sedimentation, with the assumption that these rates had been essentially uniform throughout all time. Early twentieth-century determinations of rock age from the ratio of daughter to radioactive parent were rejected by geologists on the basis of being unacceptably old (large). By 1925 increased confidence in radioisotope dating techniques and the demands of evolution theory for vast amounts of time led to the establishment of an expanded geological time scale. With the K-Ar dating techniques developed after World War II, this time scale was refined to the standard Geologic Time Scale adopted in 1964.

The construction of this time scale was based on about 380 radioisotope ages that were selected because of their agreement with the presumed fossil and geological sequences found in the rocks. Radioisotope ages that did not meet these requirements were rejected on the basis of presumed chemical and/or physical modification that made the "ages" unreliable indicators of real time. About 85% of the selections were K-Ar dates, 8% rubidium-strontium dates, and 4% uranium-lead dates. [See Chapter 8, *The Earth's Age and Geochronology*, D. York and R.M. Farquhar, Pergamon Press, 1972.] The crucial determinors are volcanic (extrusive igneous) rocks that are interbedded with sediments, and intrusive igneous rocks that penetrate sediments — igneous rock that is particularly suited to K-Ar dating.

Processes Affecting K-Ar Ages

Since the geologic time scale (Table 1) is largely based on K-Ar ages for selected samples of igneous material, consideration must be given to the possibility that any K-Ar age may merely reflect a characteristic of the material, rather than indicate real time. The examples of anomalous K-Ar ages previously cited in this article strongly support this possibility and justify further examination of those characteristics, and of the processes affecting K-Ar ages.

K-Ar ages for successive flows or ash deposits on the flanks of volcanoes generally increase (as expected) with reverse order of flow, i.e., with depth, even when the real time lapse between eruptions is not equal to the K-Ar age difference. This feature has been identified as indicative of two factors: zonation in the supporting magma (molten rock) chamber, and progressive heating of the magma conduit.

Since argon is an inert gas, it is readily understandable that the argon concentration may increase from the lower to the upper portions of a magma chamber within Earth's crust. In a series of eruptions to the surface, or intrusions below the surface, the argon concentration may decrease progressively. Since K-Ar age is proportional to the ratio of [daughter] ^{40}Ar to [parent] ^{40}K, successive eruptions or intrusions may have decreasing K-Ar ages, none of which specifies the real time at which the event occurred.

As magma forces passage through surface rock, the passage conduit is heated, with corresponding cooling of the magma; and some magma is diluted by melting of the conduit walls. Consequently, in a volcanic event or closely-spaced sequence of events, the ejecta is progressively hotter. The higher the eruption temperature, the more dissolved argon will escape as the ejecta cools, and the lower

Table 1. The Geologic Column

ERA	SYSTEM OR PERIOD	SERIES OR EPOCH	STANDARD TIME SCALE*
Cenozoic	Quaternary	Holocene (Recent)	0.01
		Pleistocene	2.5
	Tertiary		
	Neogene	Pliocene	7
		Miocene	26
	Paleogene	Oligocene	38
		Eocene	54
		Paleocene	65
Mesozoic	Cretaceous	Upper, Lower	136
	Jurassic	Upper, Middle, Lower	190
	Triassic	Upper, Middle, Lower	225
Paleozoic	Permian		280
	Carboniferous		
	Pennsylvanian	Upper, Middle, Lower	325
	Mississippian	Upper, Lower	345
	Devonian	Upper, Middle, Lower	395
	Silurian	Upper, Middle, Lower	430
	Ordovician	Upper, Middle, Lower	500
	Cambrian	Upper, Middle, Lower	570
Precambrian		Upper, Middle, Lower	4800

or younger the K-Ar "age" will be with respect to that which characterizes the eruption source. Accordingly, there are two factors which produce K-Ar ages that increase with depth, yet do not necessarily indicate real time intervals.

Conclusion

From a creationist's perspective, the geological evidence indicates that, associated with the Flood, there was massive volcanic and intrusive activity throughout the world. The expression "fountains of the deep" (Gen. 7:11) might indicate magma as well as water. Due to 1) the variation of argon concentration and other elements with depth in the magma chambers of Earth's curst, and 2) the nature of the magmatic activity associated with the Flood, sequential geologic formations world-wide may be expected to be often marked by sequential radioisotope ages from "older" to "younger" upward.

† References to the professional literature on which this essay is based may be found in PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON CREATIONISM, II:31-57 (Creation Science Fellowship, 362 Ashland Ave., Pittsburgh, PA 15228), and Chapter 8 of the Dalrymple and Lanphere reference on p 51 of that volume.