NOTES ON THE FAUNA OF THE CHIPOLA FORMATION – XI
HELIUM–URANIUM DATING STUDIES OF CORALS

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Fanale and Schaeffer (1965) first recognized that the helium–uranium method might be a way to reliably date fossil corals. The method is based on the fact that when uranium and its radioactive daughters decay, they produce helium atoms at a known rate. From measured helium and uranium concentrations one can calculate an "age." This "age" will be reliable provided that diagenetic processes have not leached or contaminated the fossil and that the gaseous helium has not leaked out.

Fanale and Schaeffer (1965) and later Bender (1970, 1972) extensively tested the reliability of the method by determining He/U ages on a total of about fifty fossil corals from five different localities. Only in the case of samples from Eniwetok drill holes were ages of various samples internally inconsistent (nonconcordance between radiometric and relative stratigraphic ages). These anomalous results were traced to diagenetic addition of uranium or one of its daughters. Analyses of samples from other areas showed that this addition was absent or very slight elsewhere.

Samples from the Caloosahatchee and Pinecrest formations were analyzed and gave results that were internally consistent and in agreement with the loosely constrained stratigraphic ages–1.8 to 2.5 myr for the Caloosahatchee and 3.7 myr for the Pinecrest (see Bender 1970, 1972 for results and discussion). Samples from the upper Pleistocene of Barbados gave ages in agreement with those determined by another radiometric method, after a small empirical correction for "inherited helium" (that present in living corals) was made.

Nine corals from the Chipola formation were dated by the helium–uranium method. The ages are shown in Table I. The average

Table I. Helium – uranium dates of Chipola corals.

Tulane Locality Number	He/U Age (million years)
655 A	15.8
821 A	16.2
821 B	16.2
821 C	17.8
458 A	16.5
458 B	15.6
546 A	17.2
547 A	14.1
547 B	15.6

Locality numbers are arranged in stratigraphic sequence (youngest at top), as nearly as can be determined.

age is 16.1 million years (myr); the uncertainty is comparable to the standard deviation of ± 1 myr.

The ages of the different samples agree well with one another, and this is evidence that the results are reliable. However, it does not completely rule out the possibility that some process has raised or lowered all ages by about the same amount. For example, if all corals had lost half of their uranium continuously during diagenesis, radiometric ages would be uniformly higher than the true ages by about one-third. Such an error is unlikely but not impossible.

The helium–uranium age is in good agreement with the absolute age estimated from the planktonic foraminiferal assemblage studied by Akers (1972) and correlated with standard zonations. This agreement of two lines of evidence lets us place more confidence in the result.

LITERATURE CITED

AKERS, W. H., 1972, Planktonic foraminifera and biostratigraphy of some Neogene formations, northern Florida and Atlantic Coastal Plain: Tulane Stud. Geol. Paleont., v. 8, p. 1-139, pls. 1-60, 4 figures, 1 map.

BENDER, M. L., 1970, Helium–uranium dating of corals: Columbia U., Ph.D. Thesis, 149 p.

BENDER, M. L., 1972, Helium–uranium dating of corals: Geochim. et Cosmochim. Acta, in press.

FANALE, F. P., and SCHAEFFER, O. A., 1965, Helium–uranium ratios for Pleistocene and Tertiary fossil aragonites: Science, v. 149, p. 312-317.

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REVIEW

PAST AND PRESENT CAUSES IN GEOLOGY, by Lucien Cayeux. Translated (from French) and edited by Albert V. Carozzi. xxiv + 161 pp. (1941), reprint (1971) by Hafner Publ. Co., New York, $13.95

THE NOMENCLATURE OF PETROLOGY, by Arthur Holmes. v + 284 pp. (1920, 1928), reprint (1971) by Hafner Publ. Co., New York, $9.95

This publishing company is continuing a most valuable service to the geological fraternity, *i.e.*, bringing back into print some of the "mid-period" classics of our science. And, as in the case of the Cayeux volume, by presenting them in the English language with copious comments and expanded footnotes by the translator and editor, this edition is certainly far more useful to us than was the original. The Holmes work is a facsimile of the 1920 edition but, having been long out-of-print and really quite scarce (and thus expensive, when found), this edition is also very welcome.

Little needs to be said concerning books which have been well known to scholars for the many decades represented by these two. Holmes' book, being a thorough glossary of the petrographic terms used in English publications in that era, plus language dictionaries for many French and German petrographic terms, also Latin and Greek words and prefixes used in constructing the nomenclature, obviously leads to a better understanding of the AGI Glossary in common use today. The Cayeux book has been a controversial one, with some authorities saying that it refutes the principal of uniformity; the editor says that, in his opinion, it does not. A generation of new readers will now have the opportunity to determine this for themselves.

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