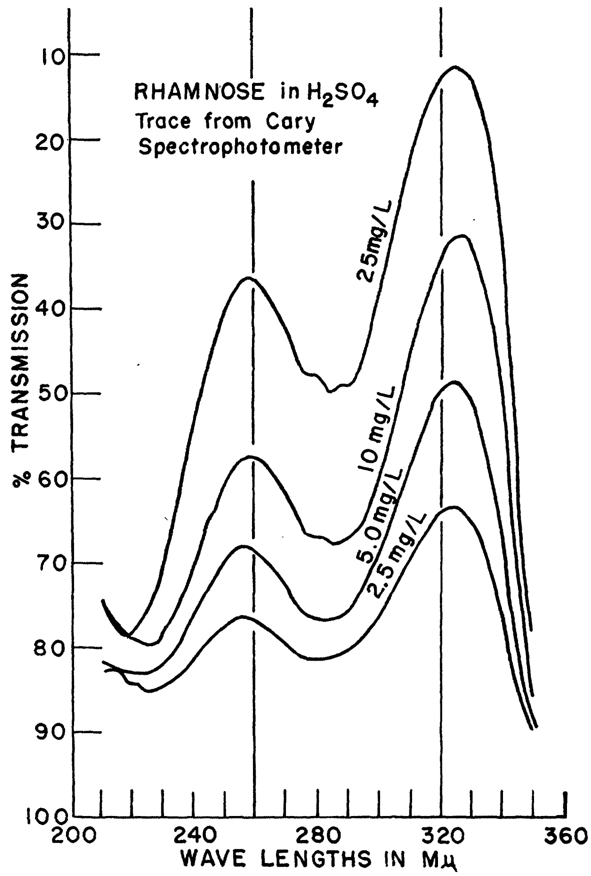

Fig. 2.

magnesium of this order may occur. The normal concentration of magnesium in sea water is about 1.3 g/liter. However, magnesium is picked up very readily by a great number of adsorbents and concentrated easily to 50 or 100 times its normal concentration. Exceedingly thorough dialysis is necessary to remove all traces of magnesium.

PETER J. WANGERSKY

U.S. Fish and Wildlife Service
Fort Crockett, Galveston, Texas

References

1. M. Ikawa and C. Niemann, *J. Biol. Chem.* **180**, 923 (1949).
2. M. Ikawa and C. Niemann, *Arch. Biochem. and Biophys.* **31**, 62 (1951).

Received January 18, 1954.

On Scientific Writing

Apropos of the Apr. 23 issue of *Science*, concerned largely with the problems of scientific writing, I find in my files the following quotation from a source unknown to me. Other readers may also find this of interest, and perhaps one of them can inform me of its authorship.

ADVICE TO YOUNG WRITERS

In promulgating esoteric cogitations and articulating superficial sentimentalities, philosophical and psychological observations, beware of platitudinous ponderosity, jejune babblement and asinine affectations. Let your extemporaneous discantings and unpremeditated expiations have intelligibility and vivacity without thrasonical bombast. Sedulously avoid all polysyllabic propensity, psittaceous vacuity and ventriloquial verbosity. Shun double-entendre, imprudent jocosity, and pestiferous polluting profanity either obscure or apparent. Don't call names or use big words, but talk plainly, sensibly and truthfully. All of which is remindful of Disraeli's philippic for Gladstone: He was a sophisticated rhetorician inebriated by the exuberance of his own verbosity.

ERNEST J. ROSCOE

Dugway Proving Ground
Dugway, Utah

Received May 17, 1954.

May I be permitted to give my impressions of Florence Moog's recent communication [*Science* **119**, 567 (Apr. 23, 1954)]. That it engages in rather broad generalizations to contend that scientists write poorly and that the censure should have limited itself logically to "some write poorly" is not to be gainsaid. However, when Dr. Moog, to buttress her critical position, brings in such works as Darwin's *Origin of Species,* and inquires whether they weren't highly effective in their own day, she misses the point involved in the problem. Certainly a work such as the *Origin* was most effective; in fact, it was epoch-making even in the early days of its inception; but, the fact remains that if it had been written in a more craftsmanship manner, it would have carried its message across with more simplicity to people who weren't possessed of the avid interest and curiosity of scientists.

Also, it is curious that the very issue in which Dr. Moog has her interesting letter carries an exceptionally valuable contribution by Eugene S. McCartney, titled "Does writing make an exact man?" [p. 525], in which the author points out some of the verbiage used in scientific articles, and so forth, which obfuscates the substance. That when one has things clearly in his mind, he can express them clearly may pertain to many instances; but, I seriously doubt whether this, too, isn't falling into the category of untenable generalization.

JACK BENJAMIN

55 Winthrop Street, Brooklyn 25, New York

Received April 26, 1954.

Geochronological Significance of Extinct Natural Radioactivity*

An extinct natural radionuclide is defined as an unstable nuclide whose half-life is sufficiently short to have resulted in complete decay since the presumed origin of the elements, yet sufficiently long for its disintegration to have produced effects in nature that can

* This work and the experimental program mentioned herein are being supported by the U.S. Atomic Energy Commission.

be identified. If the universe and the chemical elements are of the order of 4 to 8×10^9 yr old, the half-life would have to be less than 2 or 3×10^8 yr in order for it not to have survived to the present time. If chemical fractionations of elements yielding products that are now accessible took place no earlier than 3×10^8 yr after the formation of the elements, a minimum half-life of about 3×10^7 yr would be required in order that traces of the decay product might be detected unambiguously at the present time. No nuclides are known with half-lives definitely between 2.4×10^7 yr (U^{236}) and 7.1×10^8 yr (U^{235}).

Although helium production (*1*) and heat evolution (*2*) by now-extinct nuclides may have been important early in the history of the earth, such nonspecific effects would be difficult to identify and assign. It has been postulated that certain pleochroic haloes were formed by alpha emitters which have subsequently vanished (*3*), but the evidence is hardly convincing. The clearest manifestation of an extinct radioactivity would be the occurrence of its decay product in abnormal abundance in a portion of matter such as a meteorite (*4, 5*), geochemical phase (*6, 7, 8*), planet (*6*), or terrestrial mineral (*9*) that had once contained the unstable nuclide. It has been pointed out (*4*) that the presence or absence of such effects can give information about the interval between the formation of the elements and the formation of the phase in question, and several applications of this principle have been made (*5, 6, 7, 8*). A principal objective has been to arrive at an estimate of the age of the elements and possibly of the universe.

It is the purpose of this note to indicate that extinct natural radioactivity, if it should exist and be detectable, should be useful for determining the times of ancient geologic events associated with the formation of appropriate minerals or geochemical phases. There would exist a functional relationship between the age of a mineral that once contained an extinct natural radionuclide and the quantity of the radiogenic product: the ratio of the radiogenic product (corrected in the usual way for the nonradiogenic portion originally incorporated into the mineral) to the amount of a stable (or long-lived) isotope of the extinct activity would decay exponentially. From this relationship, a relative chronology for such minerals could be established, allowing determination of relative times for geologic events in widely separated parts of the earth. It might be possible to derive the "cosmic decay curve" for the extinct activity from independently determined ages of the minerals. Alternatively, the slope of the semilogarithmic curve could be established by a laboratory determination of the half-life. With one fixed time point, the absolute age of any such analyzed mineral could be read off of the curve.

This method would be particularly useful for studying the earliest part of the history of the earth. It would be increasingly precise for increasingly aged minerals and, therefore, would nicely complement the existing methods based on long-lived natural radioactivity, which yield dates of low precision for early events. Since the time scale could be fixed relative to the present, it would not depend on any assumption regarding the primordial abundance of the extinct nuclide, or on any postulate regarding the origin of the elements of the universe at large.

A statistical examination of the lifetimes of known β-labile nuclides near stability (*10*) and considerations of the probable or possible nuclear properties of those that are unknown suggest that there may well be a few having half-lives within a factor of ~ 3 of 10^8 yr. To be useful for geochronometry, such a nuclide and its daughter must each have a stable or long-lived isotope. They must, furthermore, belong to elements that are geochemically fractionated to an appreciable extent. The latter requirement would probably render Sm^{146}, whose lifetime has been reported to be $\sim 5 \times 10^7$ yr (*11*), of little value in this connection.

An experimental search for extinct natural radionuclides is under way in our laboratories, involving artificial production of nuclides suspected of being long-lived and isolation from selected minerals and meteorites of the hypothetical daughter elements for mass-spectroscopic analysis.

These ideas were discussed at an AEC Raw Materials Research Information meeting at the University of Arkansas in Nov. 1951, at the AAAS Gordon Research Conference on Nuclear Chemistry in June 1952, and at the NRC-NSF Conference on Nuclear Processes in Geologic Settings at Williams Bay, Wis., in Sept. 1953. A detailed discussion of the possibilities of occurrence and of the potential significance of extinct natural radioactivity will be published in the *Annals of the New York Academy of Sciences.*

TRUMAN P. KOHMAN

Department of Chemistry,
Carnegie Institute of Technology
Pittsburgh, Pennsylvania.

References

1. R. J. Strutt (Lord Rayleigh), *Proc. Roy. Soc. (London)* **A80**, 572 (1908) ; *Nature* **123**, 607 (1929).
2. D. B. Rosenblatt, *Phys. Rev.* **91**, 1474 (1953).
3. J. Joly, *Nature* **109**, 517 (1922) ; **114**, 160 (1924).
4. H. Brown, *Phys. Rev.* **72**, 348 (1947).
5. H. Brown and M. G. Inghram, *Phys. Rev.* **72**, 347 (1947).
6. H. E. Suess, *Z. Physik* **125**, 386 (1948) ; *Experientia* **5**, 278 (1949).
7. S. Katcoff, O. A. Schaeffer, and J. M. Hastings, *Phys. Rev.* **82**, 688 (1951).
8. H. E. Suess and H. Brown, *Phys. Rev.* **83**, 1254 (1951).
9. M. G. Inghram and J. H. Reynolds, *Phys. Rev.* **78**, 822 (1950).
10. J. W. Jones, R. A. Brightsen, and T. P. Kohman, unpublished work.
11. D. C. Dunlavey and G. T. Seaborg, *Phys. Rev.* **92**, 206 (1953).

Received March 19, 1954.