Comments and Communications

Geologic Age from Metamict Minerals

Advances in the determination of the age of geological materials depend on the improvement of existing techniques and the development of new methods. The idea discussed below may be the basis of another absolute age method.

Studies of the isodesmic multiple oxides (i.e., those multiple oxides in which all cation-anion bonds have similar strength) of the type $A_mB_nO_{2(mn)}$, where A = U, Th, rare earths, Ca, Na, etc. and B = Nb, Ta, Ti, etc., have shown partial or complete absence of internal crystal structure while displaying macroscopic crystal faces. They may thus be said to be in the metamict state. (A metamict mineral is defined as a noncrystalline pseudomorph of the original mineral.) It has also been shown that in other cases the internal structure is preserved. Muegge (Centralblatt f. Mineralogie 1922, pp. 721–739 and pp. 753–765) has shown that heating metamict gadolinite—i.e., gadolinite which yields no x-ray pattern—converts the isotropic mass into an anisotropic material with a crystal structure identical with that of nonmetamict gadolinite. Similar behavior has been noted for other minerals of the group described above (Dana's System of Mineralogy, 7th Ed. Vol. I., John Wiley and Sons, 1944) and especially for the mineral microlite. Important minerals of the group which may occur in the metamict state also include pyrochlore, fergusonite, formanite, euxenite, polycrase, eschynite, priorite, samarskite, and betafite. It appears that zircon may also be metamict. If age determination by this method is practical it is of considerable importance, since zircon can be separated from most granites.

A recent survey of the isodesmic multiple oxide group by differential thermal analysis at Columbia University (unpublished) has shown that the return to the crystalline state proceeds at a definite temperature with a considerable evolution of heat. It seems plausible to assume with previous authors that these minerals were originally crystalline, and that destruction of the crystal lattice has taken place since their formation through alpha bombardment from the uranium and thorium in the lattice.

If this is the true mechanism, it follows that the amount of destruction of the lattice is affected by (1) the inherent stability of the given mineral structure, (2) the total alpha activity of the mineral, and (3) the time that has elapsed since the formation of the mineral. If the first two variables can be specified and if the degree of destruction of the lattice can be quantitatively measured, then the age is uniquely determined.

The amount of disorder created by alpha bombardment of the lattice can be measured by means of thermal analysis, since the area under the exothermic peak on the thermal record will be proportional to the amount of heat generated in the specimen upon returning to the crystalline state. For a particular mineral type the strength of the bonds, and hence the stability, will be essentially constant for all specimens. Some variation in the substituted cations should produce only a second order effect. The total alpha activity could be determined either by direct alpha counting or by uranium and thorium analyses. A knowledge of the damage done to the lattice and the alpha activity of the mineral should therefore permit estimation of the age of the particular specimen. It should be pointed out, however, that in a given specimen the rate of destruction of the lattice must decrease with time. Thus, for materials which are completely metamict, it would be possible to determine only a minimum age. In many geological applications, however, even information of this nature would be very useful.

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Correction

In our article "Mesons Produced by the Cyclotron" (Gardner, E. *et al.* *Science*, 1950, **111**, 191) there is a typographical error on page 196 in the table near the top of the page. The first entry in the right-hand column reads 28.8 and should read 26.8.

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A Modified Schiff's Solution

In connection with the article by J. Alexander, K. S. McCarty, and E. Alexander-Jackson (*Science*, 1950, **111**, 13), I should like to call attention to my paper "A Modified Schiff's Solution" (*J. Amer. chem. Soc.*, 1922, **44**, 1834).

There are some additional facts in this paper which might be of interest to the readers of *Science*.

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Dramamine

The use of Dramamine in the prevention and therapy of motion sickness (Gay, Leslie N. and Carliner, Paul E. *Science*, 1949, **109**, 359; Strickland, Benjamin A. and Hahn, George L. *Science*, 1949, **109**, 359) and in the treatment of the nausea and vomiting of pregnancy (Carliner, Paul E., Radman, H. Melvin, and Gay, Leslie N. *Science*, 1949, **110**, 215) has attracted widespread attention. Although some of the procedures employed in these studies have been criticized (Tyler, David B. *Science*, 1949, **110**, 170), the results provide at least preliminary evidence of the efficacy of this treatment. However, it has come to the writer's attention that these papers have

left many readers with the impression that Dramamine is a basically new agent with unique pharmacological and therapeutic properties. All the articles cited failed to mention the fact that Dramamine is simply an organic salt of a compound, the hydrochloride of which has been recognized by the Council on Pharmacy and Chemistry for several years under the official name of *diphenhydramine* and which has been widely marketed and prescribed under the trade name *Benadryl.*

An additional note on Dramamine (Cusic, John W. *Science*, 1949, **109**, 574) has suggested that formation of the 8-chlorotheophylline salt might reduce the sedative effect that is not uncommonly observed with diphenhydramine. However, absolutely no pharmacological or clinical evidence was presented to substantiate this contention. Available pharmacological data point to the conclusion that 8-chlorotheophylline, in the amount administered (45 mg orally), would have little or no detectable pharmacological action. This dosage of theophylline is essentially inactive in man and the 8-halogen substitution appears to reduce all pharmacological properties of the parent compound (Green, D. M., *et al. Fed. Proc.*, 1949, 8, 296). From these considerations, it appears highly improbable that the therapeutic properties of Dramamine and diphenhydramine differ significantly except inasfar as the heavy anion in Dramamine may reduce the percentage of active substance.

Science is a publication designed primarily for the broad dissemination of scientific information and not as an organ for the purpose of launching proprietary pharmaceutical preparations. It may be hoped that in the future the constituents of proprietary salts or mixtures may be more clearly identified for those readers who fail to stop and translate chemical descriptions into terminology commonly applied to the active principles involved.

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Book Reviews

Atomic Medicine. Charles F. Behrens, Ed. New York: Thomas Nelson, 1949. 416 pp. $7.50.

This timely volume dealing with medical aspects of nuclear science represents an attempt by a group in the Navy to provide a source of basic information primarily regarding radiation derived from radioactive isotopes. The book is written in simple language and can readily be understood by anyone with scientific training. The terminology peculiar to radiologists has been carefully avoided except when it adds clarity to the discussion. There are chapters dealing with the pathology of total body irradiation, the physical background for radioactivity, ionizing radiations and their biological effects, methods of detection and measurement of radiation, tracer methods in the biological application of radioisotopes, the atomic bomb in action in Japan and the planning necessary to deal with an atomic bomb explosion in the future.

In any field that suddenly becomes of great and widespread interest, a newcomer needs information that is hard to find in scattered papers in the literature. By meeting some of his needs it is inevitable that those demands not met should stand out in glaring relief. Although Cronkite, Geschickter, and Copeland in particular have provided numerous references to the literature in the fields covered by the chapters they contributed, it is to be regretted that more specific references were not provided for readers who want to go to original sources. The greatest omission was a thorough discussion of dosimetry of radioactive isotopes. An understanding of the principles and methods of calculation of radiation delivered by the administered isotopes is a prerequisite to their intelligent use by the physician.

More ruthless editing would have eliminated duplications in the historical background supplied by the various contributors. This would have removed an unnecessary sense of repetitiveness that the reader now gets from the book. The styles of the various authors, although showing individual differences, are sufficiently similar to give a homogeneity to the book not always found in joint efforts.

The chapter on the design and operation of laboratories employing radioactive isotopes in medical research will be most helpful to those not yet acquainted with many of the specific requirements of such installations. The hazards are pointed out without alarm and means for combating them described.

The book is pleasing in format, the figures and illustrations are clear, and typographical errors are at the absolute minimum.

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Medical Etymology: The History and Derivation of Medical Terms for Students of Medicine, Dentistry, and Nursing. O. H. Perry Pepper. Philadelphia: W. B. Saunders, 1949. 263 pp. $5.00.

This little volume of less than 4,000 words makes no pretense of being a dictionary; it is a history of medical terms for students of medicine, dentistry, and nursing. The author, an eminent internist, has observed the change in premedical education from emphasis on Greek and Latin in days gone by to the current deletion of the classic and more rigid requirements in the biological and physical sciences. The impact on the present-day student entering medicine, dentistry, or nursing of a new and bewildering terminology creates confusion and unquestionably contributes to the high attrition in the freshman year. Not only must he master the discipline but he must learn simultaneously a new language—a task for