

of these, *Studies of Mineral-Forming Solutions*, by N. P. Yermakov, forms part I and fills nearly half the book. Parts II and III are translations of the journal *Research on Mineral-Forming Solutions*, volume 1, part 2, and volume 2, part 2, both edited by Yermakov.

After a discussion of mechanisms causing formation of inclusions, a classification scheme is presented to aid in the critical but often subjective discrimination between primary inclusions and those formed after the host mineral. Examples are given of inclusions, ranging in size from microns to 6 centimeters or more, in over 50 minerals. In most cases, inclusions contain two or more phases.

Fluid inclusions are useful only if they remain hermetically sealed throughout geologic time. The controversy found in our literature on this topic should be settled by the extensive evidence here presented, from both natural and synthetic inclusions, demonstrating that at least the predominant components of inclusion-fluids are retained nearly permanently. The interpretation of an inclusion is limited, however, because "only the temperature, but certainly not the composition of the captured droplet could have been the same as that of the mother liquor" (p. 49). In accord with this precept, compositions are largely neglected in favor of methods of evaluating the temperature of crystallization of the host mineral. Decrepitation is discredited, but the method of homogenization of phases (for transparent minerals) appears to give only slightly low temperatures, although corrections must be considered.

Descriptions of apparatus used in heating minerals while observing inclusions are slanted toward Soviet components and are of little value, particularly since commercial units are now available.

An interesting variant to these studies has been the measurement of volumetric phase ratios versus temperature. This technique offers easily acquired data directly related to "gross compositions"; such data are interpretable provided that sufficient volumetric data on pertinent solids and fluids become available. There is no discussion in the book of the utility of freezing-point determinations as used in this country.

The valuable information afforded fills only about half the volume; it is diluted by verbose and imprecise prose (apparently not the fault of the trans-

lation), by overly repetitive examples, by extraneous philosophizing, and in part I by frequent doses of propaganda. For example, errors are usually attributed to Americans, progress to Soviet geologists: "American geologists, whose concepts . . . tend towards simplification and emasculation . . ." (p. 293), ". . . creative daring of the young Soviet geologists . . ." (p. 297), and ". . . liberation from concepts alien to the Soviet school . . ." (p. 297).

The basic scientific method of the authors may be criticized on several counts. Few numerical data are given, and the derivation of values is often at least obscure. Quantitative evaluation of uncertainties is very rare indeed. The figures occasionally lack units for coordinates or on contours; graphs in parts II and III often present experimental curves without data points. My confidence was also shaken by such statements as "heating serves to reduce the volume of the vacuole wherein the inclusion is confined . . ." (p. 73).

Although the scientific quality of this book is only mediocre and the price seems excessive, purchase is warranted in the absence of another text on mineral inclusions.

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Mammoth in situ

No natural history museum worthy of the name lacks its display case of mammoth or mastodon teeth or its diorama of the "Great Ice Age" mammals. But to see the bones of such creatures exposed in the beds where they occur naturally, let alone to share the excitement of the "dig," one must be or travel with a paleontologist or amateur collector. To my knowledge there is no permanent public display of mammoth bones with artifacts of Early Man in a natural outcrop anywhere in the United States.

Domebo, named for its owner in southwestern Oklahoma, would not have been an easy fossil site to stabilize for such a purpose. The excavation team had its hands full mapping, jacketing, and removing mammoth bones before the spring thaws slumped over the site. **Domebo, a Paleo-Indian Mammoth Kill in the Prairie-Plains** (Contribution No. 1 of the Museum

of the Great Plains, Great Plains Historical Association, Lawton, Oklahoma, 1966. 63 pp., illus. Paper, \$2.50), edited by F. C. Leonhardy, treats the geology (Retallick and Albritton), paleontology (Slaughter and Mehl), archeology (Leonhardy and Anderson), malacology (Cheatum and Allen), and palynology (Wilson) of beds containing bones of a single subadult, probably female, Imperial Mammoth (*Mammuthus imperator*). Found with the bones were three projectile points, one of Clovis fluted type and one approaching the Plainview type. Carbon-14 dates on the organic fraction of the mammoth bone give its age as 11,200 years. Twelve species of small vertebrates and 30 species of molluscs were removed from associated beds. Part of the fauna cannot be regarded as contemporaneous, as it came from beds 1000 years younger than the mammoth itself. But the pollen diagram by Wilson indicates no major vegetation changes throughout this interval, and the environment 11,000 to 10,000 years ago may have been quite similar to the present one.

Although the information they contain bears directly on a leading controversy in paleoecology—the cause (or causes) of late Pleistocene megafaunal extinction—few single large mammal sites have received the careful attention devoted to the Domebo mammoth. Paleoecologists need many more case histories of this sort. And the public and the scientist both may hope that among future discoveries one showing bones, artifacts, stratigraphy, and ancillary evidence will prove suitable for a permanent exhibit *in situ*.

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Motion of Fluids

Basic Developments in Fluid Dynamics, volume 1 (Maurice Holt, Ed. Academic Press, New York, 1965. 459 pp., illus. \$17.50), consists of five articles on topics of current interest. "The numerical solution of problems in gas dynamics," by O. M. Belotserkovskii and P. I. Chushkin of the Computing Center of the Academy of Sciences of the U.S.S.R., describes three numerical methods of solving nonlinear partial differential equations used mostly in gas dynamics, namely the method of finite

differences, the method of integral relations, and the method of characteristics. "Bluntness effects in hypersonic small perturbation theory," by J. P. Guiraud, D. Vallee, and R. Zolver, is concerned with the analogy between hypersonic flow and blast wave. "The stability of parallel flow," by W. H. Reid, includes a discussion of the adjoint Orr-Sommerfeld equation. In actual calculation of the inviscid part of the characteristic equation two methods are suggested. One is direct numerical integration of the inviscid equation, and the other is based on transforming it into a first-order Riccati equation and then expanding the solution in powers of wave-number. "Blast wave theory," by Akira Sakurai, is concerned with perturbation of similarity solutions and its application to explosions, magnetohydrodynamics, and other unsteady phenomena. "Laminar boundary layers on cambered walls," by F. Schultz-Grunow and W. Breuer, is devoted to the effect of curvature on boundary-layer theory. The skin friction and heat transfer, the velocity, vorticity, and shear distributions, and boundary-layer thicknesses are given as functions of curvature and Reynolds number.

Each article contains extensive references. The present volume is recommended as a reference for graduate students and research workers in fluid dynamics. A second volume on cavitation and reacting gases is planned.

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Biochemical Reactions

A carefully composed text on the kinetics of enzyme reactions would be of considerable value to both scientists and students in the biosciences. Unfortunately, Charles Walter's **Enzyme Kinetics: Open and Closed Systems** (Ronald, New York, 1966. 108 pp., illus. \$7) is not the text.

A very brief chapter on the concept of a stationary state for open systems and the associated thermodynamics of irreversible processes (after Prigogine) is followed by a chapter on "Stationarity in closed systems" which refers to the steady-state approximations. The author places a great deal of emphasis on the approximate nature of the steady-state equations and warns

that the habit of using such approximations may be hazardous to the interpretation of kinetic data. Unfortunately, he offers no prescription for "kicking the habit" and gives no clear indication of how serious the hazard is in practical cases. Indeed, a later and somewhat confusing chapter discusses the steady-state equations for a few mechanisms without further ado.

Other chapters include "Kinetics of the early stages of enzyme reactions," "Labeled reactant distribution," and "Relaxation methods." In all these chapters some rather complicated kinetic expressions are presented, but there is virtually no discussion of the experimental and practical limitations of the techniques and equations. The difficulties which arise with such complicated equations are emphasized by a cumbersome notation and an insufficiency of graphs. Is it not remarkable that a text on enzyme kinetics does not include even one complete graph on the kinetics of an enzyme reaction?

The final chapter, on chemical oscillations, appears to have been added as an afterthought. In contrast with the other chapters, it is not concerned with the kinetics of a single enzyme reaction and there are a lack of equations and an abundance of pretty but largely irrelevant graphs.

The author's paraphrasing of the papers he cites frequently results in cumbersome, misleading, or even incorrect statements. The selection of material—the good as well as the bad—demonstrates neither a critical eye, a comprehensive understanding of the literature, nor any serious attempt to integrate and digest such information. Those interested in understanding enzyme kinetics would do best to spend their money on postage stamps and xerox copies of the original papers.

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Origins of Behavior

Ethology is a method of studying animal behavior that has developed in Europe principally during the last 30 years, although it certainly has its roots in investigations that were carried out around the turn of the century by an American zoologist, Charles Whitman, and by a European zoologist, Oskar Heinroth. During the 1930's and '40's

studies of animal behavior in Europe and in the United States were markedly divergent and proceeded with practically no communication between investigators on the two continents. While the European ethologists emphasized the biological bases of behavior, the comparative psychologists in the United States stressed the importance of learning processes, and essentially rejected the notion of genetically based differences in behavior. Thus, upon being introduced to the notions of ethology, the behavioristic psychologists of this country felt that these presented a challenge to their own position, and for a time there were heated polemics on the question of whether unlearned behavior existed. In the last few years, however, there have been many meetings between American psychologists and European ethologists, and many of the original misunderstandings of each other's positions have been resolved. In fact, the relationships between the two disciplines have evolved to the point where there is now developing an extremely useful dialogue.

Animal Behaviour (McGraw-Hill, New York, 1966. 544 pp., illus. \$10.50), by the English ethologist Robert A. Hinde, represents an ambitious attempt to integrate the methods and findings of ethologists with those of comparative psychologists, particularly with respect to the question of causation and development of behavior in the individual, a common area of interest of psychology, physiology, and ethology. Hinde's book is of value in pointing out ways in which comparative psychologists may profitably apply biological concepts to their investigations. It is also a good reference source for much ethological work which is not generally known in this country. Many chapters provide good reviews of certain research areas and problems, particularly chapter 7, on orientation, chapter 16, on conflict, chapter 24, on developmental aspects of learning, chapter 27, on evolution and behavior, and chapter 28, on the adaptedness of behavior and its role in speciation.

While Hinde rightly asserts that ethology has an especially important contribution to make to the analysis of learning processes, and fully discusses the aspects of learning investigations to which ethological concepts are relevant, it must be said that, because of his own theoretical biases, he does not present a complete exposition of important ethological concepts. Especial-