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Random Processes in Geology

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The text is very readable, but one does find the occasional slip in translation, e.g., the use of offtake in lieu of cumulative recovery, of petrostatic instead of lithostatic pressure. A profuse use of illustrative graphs, sketches and tables facilitates the understanding of a complex subject. The book can be recommended to anyone wishing a quick insight into methods of reservoir engineering, treated in an up-to-date fashion on a level addressed to the non-specialist.

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Random Processes in Geology

Edited by Daniel F. Merriam
Springer-Verlag, New York, 168 p. 1976.
$20.00

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Geologic processes are dynamic, evolutionary phenomena. At any geologic time, each observation is a function of both a strictly deterministic component and a random term ascribable to local components, measurement error, or sampling variation. The local components are usually assumed to be independent of one another for different observations. However, this assumption may not be valid if observations are made in a spatial pattern. In the case of no deterministic component, the model becomes a random model. The theory of random processes (synonymous with stochastic processes) is based on the concept that a process will develop in time and space in a manner controlled by probabilistic laws. This means that one cannot predict its future behaviours with certainty; the most that we can do is to attach probabilities to the various possible future states. The random process is a statistical technique useful in understanding how geologic process develops in time and space.

The book, *Random Processes in Geology*, consists of an introduction and 10 papers. These papers investigate various random processes in geologic phenomena. The introduction states that probabilistic methods are used by an increasing number of geoscientists. Communication between geologists and probabilists should increase, so that findings in the theory of random processes could be developed. Paper 1 summarizes the results of geometric probability theory that could be applied to tectonic features observable on earth and other planets. No example is given to demonstrate the applications of the theory. Based on the priniciple of topologic randomness, paper 2 summarizes properties of link magnitude that comprise channel networks and network channels. Due to the presence of probabilistic elements, paper 3 emphasizes the importance of a probabilistic model in geology. A generalized flowsheet of geologic modelling is also given. Paper 4 discusses how to use a random walk model to simulate an alluvial-fan deposition. The probability of water flow in any given direction is proportional to the gradient in that direction. Once a flow is established in a given direction, it will tend to continue in that same direction. Due to the complexity of grain-pore relationship, paper 5 regards the description of porous materials as a realization of a stochastic process in order to predict the average grain-pore geometry. Paper 6 analyzes a series of observations on volcanic earthquakes derived from the Japanese volcano Asamayama. It states that the past activity of Asamayama displays a trend. Prediction from the model is not discussed in the paper. Paper 7 adopts the renewal process (one of random processes) as a random sedimentation model. The concept and usefulness of a random sedimentation model are clearly discussed in this paper. It seems to me that the most valuable result obtained from a simulation model study is to know what kinds of field and experimental data are required, and also how to collect field data. Joint probability distribution function for link lengths and drainage areas is useful in the analysis of structures of drainage areas. Paper 8 reviews the properties of the function. Paper 9 states that spatial geologic patterns may be regarded as a realization of random processes. Thus, statistical correlation or dependence between sampling points should be considered in the case of reconstruction of the actual pattern of variation. Paper 10 uses Markov models for the repose-period pattern of volcanoes.

Justification of a random geologic model are: 1) The geologic phemonena are complex, no cause-effect relationship can be established, 2) The underlying mechanism is random in nature. This justification is based on geologic reasoning rather than on a statistical random test.

Geologic modelling is a young science, but it is a promising approach to understanding the complexity of geologic phenomena. However, one of its merits is to guide user in the collection of relevant information.

Written at a senior level in statistics, *Random Processes in Geology* consists of a cross-section of the random processes in use today. Geologists who already have a basic knowledge or random processes will find interesting applications in this book.

MS received September 2, 1976

Computers and Geosciences, Vol. 1, No. 1/2, 1975

Edited by D. R. Merriam
Pergamon Press Ltd. Quarterly Journal, multiple-reader institution.
$60 (U.S.)/year. Special rate to individuals $30 (U.S.)/year.

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This journal is to be published under the auspices of the International Association for Mathematical Geology. Papers are concerned with all aspects of computer applications (rather than computers), ranging from data management systems to problem-solving numerical techniques. In addition to formal articles, computer programs, short notes and book reviews of pertinent publications are also included. Contents of the journal should be beneficial to all earth scientists working with quantitative subjects.

The first issue of the journal has the following articles:

P1P1 and P1P2: FORTRAN IV programs to aid in the determination of important parameters in a classification scheme, by T. A. Jones and R. A. Baker.

An algorithm and FORTRAN IV programs for processing analytical emission-spectrography data, by Y. Frenkel, D. Gill and I. B. Brenner.

A monotone-sequences algorithm and FORTRAN IV program for calculation of equilibrium distribution of chemical species, L. J. Walters Jr. and T. J. Wolery.

Classification of glacial tills by computer using the CLUS program, B. S. Siegal and J. C. Griffiths.

FORTRAN IV program to compute Pearson's frequency curves by E. J. Schuegraf and E. L. Zodrow.

HYDROCHEM - a FORTRAN IV program for processing analytical hydrochemical data, by D. Gill and E. Rosenthal.

FOLKSS: a FORTRAN program for petrographic classification of sandstones, by A. F. Jacob.

Cyclic fluctuation of waterlevels in Lake Ontario, by B. P. Cohn and J. E. Robinson.

A computer similation and study of grain shape, D. F. Watson and F. G. Smith.

Prediction of wildcat well farmout success by use of the central limit theorem, by Z. C. Dahlberg.

The journal could be very meaningful to its readers if a card deck or a tape copy of each computer program published were available upon request. Test data and its ouput should also be provided.

The aim of *Computers and Geosciences* is to serve as a medium for stimulating as well as exchanging ideas among earth scientists from universities, research centres, and industry. It is similar in nature to its parent journal, but with more emphasis on computer programs. Geoscientists will find the journal of substantial value.

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Books Received

Exploration Geochemistry Bibliography, period Jan. 1972 to Dec. 1975, compiled by H. E. Hawkes. Spec. Vol. No. 5, Assoc. of Exploration Geochemists, 195 p., 1976. $10, soft cover. With classified index; available from the Secretary, AEG.

Global Geology by M. A. Khan. London, Wykeham Publ. Ltd. (Wykeham Science Series) 165 p., 1976. $8.60, soft cover (available from Springer-Verlag, N. Y.). Written at freshman level, the content is largely geophysical: "this is because geology today is based largely on the observations by geophysicists during the last twenty five years" (Preface). The author is, of course, a geophysicist (at the University of Leicester, England).