production, but much more careful investigation must be carried out before the mechanism of their action is fully understood.

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Thermoluminescence of Geological Materials

Investigations of the thermoluminescence of geological materials have been carried on by geologists and others for several decades. Detailed studies of the phenomenon were only begun about 20 years ago by Farrington Daniels and his associates at the University of Wisconsin. Since that time, several widely separated groups of investigators have continued research on the subject. In order to allow North American, European, and Asian researchers to meet and exchange information on current developments in the field, the 1st International Symposium on Applications of Thermoluminescence to Geological Problems, was held in Spoleto, Italy, 5–6 September 1966. Participants included geologists, archeologists, physicists, chemists, and astronomers from Austria, Belgium, Canada, Denmark, England, France, Germany, Greece, India, Italy, Japan, Malaysia, Mexico, Switzerland, Thailand, the United States, and Venezuela. Sixty-five papers were presented covering all aspects of thermoluminescence investigations as well as such related phenomena as electron spin resonance and exoelectron emission.

Farrington Daniels opened the technical program with a review of the pioneering work of such investigators as Lind, Wick, Urbach, Randall, and Wilkins, and the studies carried out at the University of Wisconsin between 1946 and 1959.

Thermoluminescence radiation dosimetry is a recently developed medical technique by which the thermoluminescent response of irradiated crystalline materials, such as LiF, can be utilized as a means of measuring the amount of radiation received by the crystals. The application of the principles of thermoluminescence radiation dosimetry to determine the radiation conditions of a sedimentary environment, the measurement of very low radioactivity of geological and archeological samples, geothermometry, paleoclimates, and sedimentary transport was the subject of several papers.

One of the earliest applications of thermoluminescence to geological problems has been the attempt to determine the age of carbonate rocks by using either radiation damage or dosimetry methods. This subject received considerable attention, both from the theoretical and applied points of view. Attempts to apply similar techniques to the dating of ancient pottery, meteorites, recent lava flows, and orogenic events were described.

In addition to radioactivity, several factors may influence the thermoluminescent response of geological materials; such factors include: pressure, mineralogy, trace element content, temperature of formation, polymorphic phase transitions, and adsorbed gases. These were considered, both from the point of view of "spurious" thermoluminescence, which may cause problems in investigations of age determination, and as direct applications in investigations of rock mechanics and the search for mineral deposits.

With the objectives of maintaining the exchange of information between laboratories and promoting further research in thermoluminescence of geological materials, several committees were appointed: International Symposium on Thermoluminescence of Geological Material (1969), E. Tongiorgi (Laboratorio di Geologia Nucleare, Pisa, Italy) and D. J. McDougall (Loyola College, Montreal, Canada); Committee on Thermoluminescence Standards, D. R. Lewis (Shell Development Co., Houston, Texas) and J. Kaufhold (Universität zü Koln, Koln, Germany); Bibliography, Norbert Grögler (Universität Bern, Bern, Switzerland); Liaison between Laboratories, Edward Zeller (University of Kansas, Lawrence).

Laboratories or individuals who would like to be kept advised of the work of these committees should contact E. Tongiorgi or D. J. McDougall. Support for the meeting was provided by NATO; the U.S. Air Force; the National Research Council of Canada; the United States National Science Foundation; Loyola College, Montreal, Canada; and the Laboratorio di Geologia Nucleare, University of Pisa, Italy. Proceedings of the meeting will be published by Academic Press, London, probably in mid-1967.

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Stereology

"Universities have departments of various disciplines. But nature knows of no departments. It is one indivisible whole." This statement made by Buckminster Fuller in the opening session of the Second International Congress for Stereology (8–13 April 1967, Chicago, Illinois) characterizes the spirit and work of the Congress.

Scientists from various disciplines and countries discussed problems which they all have in common. Problems of structure common to astronomy, ceramics, geology, metallurgy, anatomy, botany, cytology embryology, neurology, pathology and zoology were attacked with the methods of conventional geometry, integral geometry, and topology. Aspects of instrumentation formed an integral part of the program.

Stereology in the strict sense is defined as three-dimensional interpretation of flat images. These images may be sections or projections. The internal structure of complex solids can be studied, without disturbing the dimensions and mutual relationship of parts, by sectioning. The flat images with which metallurgists are confronted are planes of polish. These are true mathematical planes without any thickness. In the life and earth sciences, we deal with translucent slices of finite thickness. In astronomy and cosmology we are confronted with images which in essence are projections of objects on a sphere circumscribed around the observer.

In all these cases, direct access to the objects to be studied is impossible, be they metallic or mineral particles, components of living tissues or galaxies. Their visible images do not give direct information on many aspects of their three-dimensional structure, orientation, or mutual relation. We are dealing in these cases with uniaxial viewing.

In order to obtain the desired information we must extrapolate from two- to three- dimensional space. The procedures involve measurements of lines as well as counts of points or profiles in grids superimposed on the plane of observation. In most cases the algebraic formulas, often found independently with much labor by several investigators who did not know of each other's work, are astonishingly simple.

For example, the total length of a system of lines per unit volume is represented by $L_V = 2\bar{P}_A$, where $\bar{P}_A$ is the average number of intersections of those lines with the test area A in the sections. The equation for the total