

## Association News

### **Ninth William Christian Krumbein Medallist: Felix Chayes**

During the 1984 symposium entitled "Use and abuse of statistical methods in the earth sciences," jointly sponsored by the International Association for Mathematical Geology and held as part of the annual national meeting of the Geological Society of America in Reno, Nevada, Felix Chayes was presented his Krumbein Medal. This is the Association's premiere award; presenting the medal to Felix was an honor and, in a way, for me it was also something of a nostalgic trip.

Back in about 1953, I had written from England to Dr. Chayes with a request that he review what to me then was a major paper on the granites of northwest Donegal; the manuscript comprised a significant part of my recently completed Ph.D. thesis. Among numerous useful comments that I no longer remember, Felix offered the sound advice that the main body of a paper must deal only with facts, whereas the small amount of "moonshine" to which most papers are entitled must be left to the end. Over the years, I have oft recited this advice with profit to myself and to students.

Remembering this anecdote made me reflect that, Dr. Chayes internationally was considered an expert in mathematical applications in the earth sciences over 30 years ago; throughout the intervening years, he has been prolific in research, almost all of which truly has broken new ground and has caused geologists around the world to sit up and take notice—to go back to first principles and reexamine cherished ideas about modal analysis, the composition of granitoid, basaltic, and other igneous rocks, the significance of the ubiquitous percentage data of the earth sciences, and so forth.

To summarize the broad spectrum of his work, it could be said that it primarily deals with small-sample statistics and bases of petrographic inference. Much of his energy over the past decade or so has been devoted to refining a monumental file of data on volcanic rocks, although his paper at the 1984 Reno meeting was on "Efficacy of two-group discriminant functions and stability of their coefficients." By 1972, it was written that Chayes was developing an electronic equivalent of Henry S. Washington's famous tables (the 7,500 analyses listed in U.S.G.S. Professional Paper 99), a computerized Rock Infor-



mation System which then comprised some 10,000 analyses of Cenozoic volcanic rocks. According to the Carnegie Institution of Washington Year Book 83 (1984, p. 103):

The data explosion in descriptive petrography that began after World War II continues at an accelerating rate. Petrologists worldwide are collecting more and more information, including information of more and more different kinds, such that the accumulation defies effective organization by traditional scholarly procedures. Yet, little systematic advantage has been taken of the remarkable developments in electronic data storage and retrieval. In recent years, much of the work of Felix Chayes . . . has been in developing means whereby petrographers can systematically use modern computational techniques, not only for storage and retrieval but also for extracting and using pertinent chemical, petrographic, and mineralogical information.

The International Geological Correlation Project [163 (International Data Base for Igneous Petrology)], chaired by Chayes, is pioneering in the design and development of a world data base for igneous petrology. This year, the group made its first major deposit of information for public use at the world data center in Boulder, Colorado. Chayes, in order to strengthen the public's ability to exploit this large and heterogeneous data base, has been refining a method for improving the efficiency of matching operations used in data extraction.

It was most fitting that Felix Chayes be awarded the Krumbein Medal, because Chayes and Krumbein were good personal friends and scientific associates and collaborators over many years. Indeed, Bill Krumbein greatly admired and respected Chayes' abilities. Krumbein and I were both very pleased when Felix joined us as a temporary faculty colleague at Northwestern University in 1966. That occasion enabled me to discover Chayes to be a witty conversationalist and a cultured gentleman of the old school who carries his knowledge, experience, and wisdom with great modesty. Throughout the years, Chayes has consistently developed knowledge for its own sake and has tended to react negatively to programmed or directed science that fulfills ephemeral social needs. In short, he is a true scholar who has excelled in doing what he has enjoyed doing.

Born in New York City in 1916, it is said that Chayes initially registered at the New York University Law School, which may account for the precise and crisp manner in which he has viewed igneous-rock nomenclature and classification. However, after gaining the B.A. from NYU in 1936, he went on to earn M.A. and Ph.D. degrees from Columbia University in 1939 and 1941, respectively. At Columbia, he came under the influence of S. J. Shand, so well known for his book *Eruptive Rocks*; this undoubtedly accounts for his early preoccupation with problems that led to his first book, *Petrographic modal analysis* (1956), developed from lecture notes when a visiting professor at California Institute of Technology in 1955. The Shand influence also is undoubtedly reflected in his 64-page paper on the "Alkaline and carbonate intrusives near Bancroft, Ontario" (*Bulletin of the Geological Society of America*, 1942), and in his continuing high regard for the limestone-assimilation hypothesis for the generation of alkaline-igneous rocks (and consequently for the lively debates around the Geophysical Laboratory with former students of N. L. Bowen).

Leaving Columbia, Chayes began his professional employment in 1940 with Gillis and Pawel Metallurgical Company, Webster, North Carolina (U.S. War Production Board). From 1941 to 1945, with military leave, he worked for the U.S. Bureau of Mines Experiment Station, College Park, Maryland, and in 1946 and 1947 for the Manhattan Project, Metallurgy Department, Massachusetts Institute of Technology. Since, 1947, he has been at the Geophysical Laboratory of the Carnegie Institution of Washington, Washington, D.C., where he is currently titled 'Systematic Petrologist.'

Chayes is a Fellow of the Mineralogical Society of America, having served on their Council, as their Vice President, and finally as President in 1967. He is also a Fellow of the Geological Society of America and of the American Geophysical Union, having been secretary of the latter's volcanology section from 1953-56. Of course, he is also a charter member of IAMG, which was founded in Prague in 1968 during the International Geological Congress. Chayes is currently a member of COGEO DATA and of the International Union of Geological Sciences' Subcommittee on Systematics of Igneous Rocks.

Although only 99 pages long, Chayes' second book (which grew out of lectures developed at Northwestern University), *Ratio Correlation*, published in 1971 (and later translated into Russian) challenged one of the most important enigmas in petrology. Chayes and many others continue to battle with the difficult problems associated with drawing inferences from major- and trace-element analyses that are constant-sum percentage data. Actually, Felix Chayes has contributed to eight other texts and compendia, and has authored or coauthored well over 85 scientific articles and reviews. His productivity seems to be continuing unabated. It is invidious to select particular papers from those he's published, but "The finer-grained calcalkaline granites of New England" (J. Geol., 1952) particularly influenced me, although I learned only recently that sampling on grid nodes caused problems with the law in Ipswich, Massachusetts, where a statistically prescribed sample point proved to be a boss of granite supporting the statue of the founding father in the town square! The use of public property for noble scientific ends can sometimes be more than a scientific problem.

We hope that this award to one of the world's leading mathematical geologists will mark an interesting point in the course of the continuing flow of research and inspiration provided by Felix Chayes, Ninth Krumbein Medallist.

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*Past-President, I.A.M.G.*