

SPOTLIGHT

on Geostatistics — Professor D. G. Krige

by A. N. BROWN*

Professor D. G. Krige, of the Department of Mining Engineering of the University of the Witwatersrand, received the degree of Doctor of Engineering (*honoris causa*) from the University of Pretoria at the Autumn Graduation Ceremony in April 1981. He was honoured as an outstanding engineer for his world-renowned pioneering work in the field of statistical methods of ore valuation, or geostatistics as it has become known.

Early Life

Daniel Gerhardus Krige was born at Bothaville in the Orange Free State on 26th August, 1919. He completed his schooling at the Monument Hoërskool at Krugersdorp, the town at which his father, ds. J. J. Krige, was a well-known minister of the Nederduits Gereformeerde Kerk. He graduated as a mining engineer at the University of the Witwatersrand in 1939 at the age of 19.

Mining Experience

Through the next five years he received training and practical experience on various gold mines on the Witwatersrand, and in 1944 took up a post in the office of the Government Mining Engineer. One of his important duties during the eight years he spent in the Mines Department was to provide direct assistance to the Government Mining Engineer in preliminary and subsequent negotiations with the American and British authorities concerning the production of uranium. He was responsible for the design of the original uranium-pricing formula and other provisions incorporated in the uranium supply contracts negotiated in the period 1945 to 1951 between the South African government and the mining industry on the one hand, and the governments of purchasing countries on the other. Another important aspect of his work during the same period was the processing of various post-war applications for mining leases in the Orange Free State and Klerksdorp gold fields.

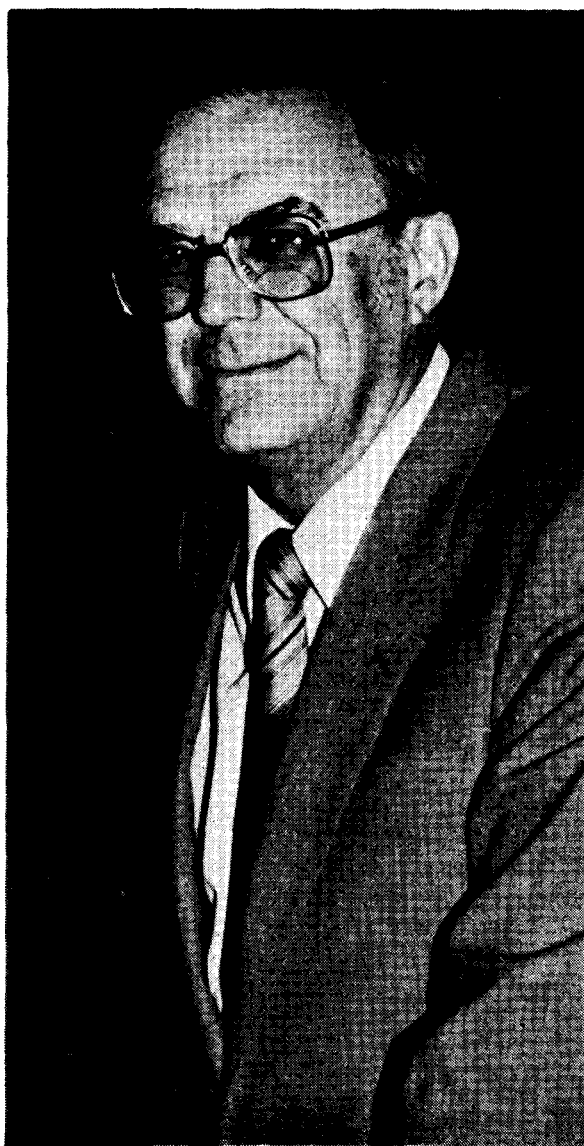
Ore Valuation

Professor Krige was stimulated to start doing basic research in the field of ore valuation because so many decisions concerning new gold mines, which were of vital importance to the State and the private sector, had to be taken in connection with ore values without a sound scientific analysis to indicate the chances of success. His approach was based on the application of mathematical statistics to mine valuation, which had, at that stage, not received recognition abroad. The degree M.Sc. (Eng.) was conferred on him in 1951 by the University of the

Witwatersrand for his pioneering work in this field.

In 1952 he took up an appointment with the Anglovaal mining group and progressed rapidly to the position of Group Financial Engineer. His research in the application of mathematical statistics to ore valuation continued unabated, as is evidenced by the forty or more scientific publications that stand to his credit over the years. These publications and papers have had a number of important consequences.

He is internationally known and acknowledged in mining circles throughout the world as one of the leading



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pioneers in the field of geostatistics. The term *kriging* couples his name with one of the more important geostatistical techniques that is applied world-wide. Geostatistics, or technical mine valuation, has become established as a subject in the mining-engineering courses at universities in France, Italy, Britain, Canada, the U.S.A., Australia, and South Africa, and has even found acceptance in countries behind the Iron Curtain. Many of his publications have been translated into Russian and French.

Honours and Awards

In 1963 the degree of D.Sc. (Eng.) was conferred on him by the University of the Witwatersrand in recognition of his work in the field of statistical ore valuation. The South African Institute of Mining and Metallurgy also acknowledged his work by awarding him the Certificate of Merit on four occasions, and the Institute's Silver Medal and Gold Medal in 1966 and 1979 respectively. The first volume issued by the Institute in its monograph series was written by Professor Krige and concerns the application of geostatistics in the South African mining industry. Over the years he has delivered lectures, read papers, and conducted courses on geostatistics, both locally and abroad, particularly at the Universities of the Witwatersrand, Pretoria, California, Oregon, Minnesota, Arizona, Penn State, and Brisbane, and at the Colorado School of Mines. He has also served over the years as external examiner at undergraduate level and for the degrees of M.Sc. and Ph.D. in the departments of mining engineering at the Universities of the Witwatersrand and Pretoria. Recently he was appointed an external examiner for the M.Com. degree at the Rand Afrikaans University. He has participated in international mining congresses in South Africa, the U.S.A., Canada, West Germany, Italy, and Australia — at the last-mentioned as main speaker in 1977.

Mining Finance

Professor Krige's distinguished career has not been restricted to the development of ore-valuation techniques. He has made noteworthy contributions to the science of investment, financial mine valuation, and mining taxation, as is evidenced by local and overseas publications. Among them is one that appeared in 1955, possibly the first in the world dealing with a subject that is known today as risk analysis of new mining ventures. In the same field, he served on a sub-committee of the

Economic Advisory Council, which investigated State aid for gold mines. He was responsible for the design of the State aid formula for marginal gold mines enacted in 1968, which enabled a number of mines to survive the critical period of low gold prices. The application of State aid made a significant contribution towards stabilizing the gold-mining industry, and therefore the country's economy as a whole, over a difficult period.

Committee Work

Professor Krige has served on various committees of the Chamber of Mines of South Africa over the years, where he has made, and continues to make, valuable contributions. In 1974 he was chosen by the government and the Chamber of Mines to participate in a trade mission to investigate a closer working relationship with Iran in the field of mining.

In his capacity as a professional mining engineer, he serves on several committees including that of the Professional Advisory Committee (Mining) of the South African Council for Professional Engineers, the Council of the South African Institute of Mining and Metallurgy (where he has held the important portfolio of Honorary Treasurer for the past two years), the Advisory Committee of the National Research Institute for Mathematical Sciences of the C S I R, the Income Tax Special Appeal Court, where he serves as the mining engineer member, and the Mining Chamber of the Afrikaanse Handelsinstituut. He is also a founder member and fellow of the South African Statistical Association and an Honorary Life member of the Institute of Mine Surveyors of South Africa.

University Career

Professor Krige was first appointed a part-time lecturer in the Department of Mining Engineering at the University of the Witwatersrand in 1961. Since his retirement from Anglovaal at the beginning of 1981, he has held the newly created Chair of Mineral Economics at the same university.

Latest Award

By conferring the honorary degree of Doctor of Engineering on Professor Krige, the University of Pretoria has honoured an outstanding engineer who has placed South Africa prominently on the mining map of the world through his efforts during a distinguished career.

Metalliferous Ore Deposits

A short course on the 'Evolution of Metalliferous Ore Deposits' will be held at Rhodes University, Grahamstown, from 8th to 13th February, 1982.

The course will be based on an up-to-date review of ore environments and ore-forming systems, and will highlight the geological factors influencing the exploration for, and evaluation of various types of ore deposits.

An outline of the major topics to be covered is given below:

- Tectonic setting of mineralized environments
- Magmatic ore deposits

- Volcanogenic sulphide deposits
- Archaean vein-type gold deposits
- Tin-tungsten deposits
- Carbonate lead-zinc deposits
- Sedimentary copper deposits

The course will be presented by Professor R. Mason, Professor R. E. Jacob, and Dr I. P. Reynolds of the Geology Department at Rhodes University.

Enquiries should be directed to Miss D. V. Turner, Geology Department, Rhodes University, P.O. Box 94, Grahamstown 6140.