AJIT KUMAR SAHA

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Meghnad Saha

AJIT KUMAR SAHA

(1925-1997)
Elected Fellow 1968

AJIT KUMAR SAHA was one of those rare personalities in the Earth Sciences community whose name became synonymous with total dedication to Science. A confirmed bachelor, he was referred to by his students as being wedded to geology. An eminent scientist and academician with a rare blend of scholarship and dedication, through sustained effort he contributed significantly in advancing the cause of earth sciences in India.

SCHOOL AND COLLEGE EDUCATION

Rajshahi town (now in Bangladesh) was the ancestral home of the Sahas—a distinguished family of educationists. Ajit was born in Patna (Bihar) on 25th May, 1925, at the place of his maternal grandfather who worked for the Railways. Ajit's father, Abinash Chandra Saha, served the Bengal Government in its Educational Service, and taught Physics with distinction in several Colleges of undivided Bengal. It was natural that the spirit of education and research was instilled in him from the early years. His childhood was spent in Chittagong, where his father was in the faculty of the Chittagong Government College. He read up to Class IX in the Chittagong Municipal School. In 1939, when his father was transferred to the Presidency College, Calcutta, Ajit moved with his father and was admitted to the Hindu School, the cradle of nineteenth century Bengal Renaissance, which nurtured many illustrious scholars of Bengal. This was the beginning of his 58-year association with the academic atmosphere of the College Street area of Calcutta. Nothing much is known about Ajit's school days except that he had the reputation of being a good student and loved to play cricket. He passed the Matriculation Examination of the Calcutta University in 1941 with Letter Marks (more than 80%) in several subjects and secured the highest marks among all the students passing out of Hindu School. Saha took admission to the Intermediate Science (I.Sc.) course at the Presidency College with Geology as one of the subjects. He secured the 13th position in the I.Sc. examination and was enrolled in the B.Sc. course with Honours in Geology. He passed the B.Sc. (Hons.) examination in 1945, securing the highest marks among all the Science students and was the recipient of the coveted Edwards Scholarship. He obtained the M.Sc. degree in Geology in 1947, again securing the highest marks among all the Science students. Any discussion of the development of Professor Ajit Kumar Saha as a geologist and as a researcher would be incomplete without considering the contribution of his mentor Professor Santoshkumar Ray. An

inspiring teacher, Professor Ray cast the teaching of Geology at the Presidency College into a new mould and raised the standard of teaching to an unprecedented height. A very original thinker, he encouraged the students to think independently and rationally. A student learnt from him that even the routine study of the thin section of a rock can be a creative exercise. He initiated high quality research in hard rock petrology and trained a horde of brilliant students. Professor Ray took Saha under his umbrella, and for the M.Sc. dissertation he advised Saha to address the problem of Kolhan-Iron Ore Series boundary near Chaibasa, Singhbhum District, Bihar (now in Jharkhand). Through careful mapping he delineated this contact and showed that there are Kolhan and pre-Kolhan (Nimdih Limestone) limestones in the area which have distinctive characters. He also undertook a critical study of the Newer Dolerite intrusives.

EARLY PROFESSIONAL CAREER

In those days, job opportunities in Geology were not many, but because of his brilliant academic record Saha was recruited as Geological Assistant by the Geological Survey of India. Here he worked with JB Auden, an association he treasured throughout his life. In addition to working in the emerging areas of engineering geology and hydrogeology he described the petrology of some interesting rock types, most notably the unusual saphirine bearing rocks from the Khasi Hills, probably the first report of saphirine from this area. The results of the investigations that he carried out were published in several issues of the Records of the Geological Survey of India.

YEARS AT THE PRESIDENCY COLLEGE, CALCUTTA

The work at the Geological Survey did not satisfy his intellectual curiosity and in 1951 at the call of his alma mater he joined the Presidency College as Assistant Professor of Geology. He immediately took up his doctoral work under the guidance of Professor Ray on the Bahalda Road granodiorite unit of the Singhbhum Granite Complex. JA Dunn and AK Dey of the Geological Survey of India described such rocks as diorites and commented on the gradation of diorite to granite. They noticed that "adjacent to the basic igneous rocks the Singhbhum granite is not uncommonly richer in hornblende and is more basic. Indeed the diorite may be an early stage in the assimilation of basic rocks". Saha started his research at a time when the 'granite controversy' was at its peak and petrologists were sharply divided into 'magmatic' and 'metasomatic' camps. Presidency College had a rich tradition of research on granites. As early as 1941 his teacher Professor Ray invoked the process of palingenesis to explain the evolution of the granitic gneisses of Deoghar and Santhal Parganas in Bihar. In the late forties, his other teacher Professor Saurindranath Sen of the Calcutta University started his pioneering work on the magmatectonics of the Adra-Anara pluton, elucidating the emplacement history from structural analysis.

Brought up and trained in this milieu, Saha immersed himself in research. Combining petrological with structural studies he came to the conclusion that the Bahalda Road granodiorite was of metasomatic origin. Saha's attraction for quantification of geological data was apparent in this early work. With the limited instrumentation available at the Presidency College he undertook systematic modal analysis of the samples, carried out with an awkward Dollar's Integrater, and depicted the areal compositional variations within the granodiorite body by drawing isopleths of modal proportions of different minerals. His contoured map for microcline content is internationally recognized as the first published mineralogical isopleth map. After submitting his D.Phil thesis to the Calcutta University in 1955 he left for Toronto University on a scholarship to work with Professor WW Moorhouse. There he pursued the study on granites, focusing his attention on the composition and structure of granite plutons in southeast Ontario. He analysed the significance of the modal and chemical composition of the rocks and their areal variability. He provided a new explanation for the so-called "basic fronts" around many granitic bodies. He suggested that these result from diffusion of silica and soda in aqueous solution from heated paragneiss into adjacent granitic magma at an early stage in the crystallization of the magma. The quantum of data that he generated within a short span of three years was really phenomenal. So meticulous was his documentation that EHT Whitten, a pioneer in the application of geostatistics in petrology, utilised his data to illustrate the method of trend surfaces for depicting areal compositional variability of granitic massifs.

By this time Saha had become a 'magmatist', and on his return from Canada he decided to take up systematic research on the Singhbhum Granite complex. It was a pink blob on the geological map of India, though Dunn's early work indicated that there was a lot of variation within. During the next two decades Saha and his students systematically mapped piece by piece a large area of the granitic complex and described their petrological and geochemical characters. A flourishing school of research developed at the Presidency College and a vast amount of information was generated. When Saha started his research, only rudimentary facilities were available at the Presidency College. Gradually, at the insistence of Saha, there came good petrological microscopes with automated point counters so necessary for his studies, an X-ray diffractometer, and a basic chemical laboratory for quick determination of major element composition of rock samples. For trace elements he had to depend on other laboratories. Lack of infrastructural facilities never deterred Professor Saha from his research; either he himself set up the laboratory or persuaded others to let him use their instruments.

Saha and his school demonstrated that the Singhbhum Granite is a composite batholith made up of 12 different plutons, each with its distinctive structural pattern and petrological characters. They were emplaced in three different phases. Geochemically they belonged to two groups, Group A containing the Phase I and

Phase II intrusions and Group B containing Phase III intrusions. Petrogenetic models were developed for the different groups. Saha's meticulous work combining field study, petrography and geochemistry will remain a model study for batholiths to the Indian geologists for many years to come.

Saha also undertook a study of the geochemistry and magmatectonics of the granite plutons and pegmatite bodies of the Bihar mica belt. He presented a model for the emplacement of the economically important pegmatite bodies and put forward a hypothesis based on the role of fluid pressure during crystallization of pegmatites for the genesis of muscovite books. He indicated several simple geochemical criteria for the exploration of muscovite bearing pegmatites. Thus he was a pioneer in concept oriented exploration of economic minerals.

Throughout this petrological research Saha kept alive his interest in quantitative analysis and in this his association with EHT Whitten acted as a catalytic factor. Whitten was one of the earliest proponents of the use of trend surface analysis to represent areal variation of composition in granite plutons. He appreciated the quantitative data generated by Saha and extensively used Saha's basic data to illustrate his methods. Saha did not have access to a computer, which in those days was a rarity in India. Trend surface analysis posed a logistic problem to him apart from some technical reservations that he had about this method. He devised a simple alternative technique of preparing grid deviation maps which objectively portray the areal variation in composition and his school extensively used this method for Singhbhum Granite. He used the critical studies on compositional variations in working out the crystallization and emplacement history of the magmatic body. He also showed how such areal variation studies can be utilised for mineral exploration.

He developed a general interest in the statistical analysis of observational data and consistently advocated the application of statistical tools in different branches of geological research. Some of the methods he used and advocated are: (a) analysis of variance for working out an optimum sampling plan, (b) discriminant functions for distinguishing the different components of the Singhbhum Granite, (c) use of correlation parameters between modal variables and use of statistics of trace elements distribution as clues to petrogenetic history of granitic bodies, (d) utilization of discriminant analysis and cluster analysis in classification of granites of the Bihar mica belt, (e) use of petrologic mixing equations in petrogenesis of migmatites, (f) use of multivariate analysis for studying copper mineralization, (g) application of geostatistical tools in mineral exploration. He became a member of the Editorial Board of the Journal of the International Association of Mathematical Geology and was instrumental in introducing Mathematical Geology in the M.Sc. curriculum of the Calcutta University, long before the subject was taught in other universities.

While working on the Singhbhum Granite Professor Saha became interested in the general problem of Precambrian stratigraphy and tectonics of Singhbhum. Thus began his life-long collaboration with Professor SN Sarkar. Together they proposed a major revision of the Precambrian stratigraphy of Singhbhum, and for the first time a major stratigraphic revision coming from academics who are outside the Geological Survey of India establishment gained wide acceptance nationally and internationally. They showed that the Singhbhum terrain is made up of an Archaean nucleus and a Proterozoic belt, and invoked plate tectonic processes for the evolution of the terrain. Four decades of Saha's sustained work in Singhbhum culminated in the publication of his monograph on "Crustal evolution of Singhbhum-North Orissa, Eastern India", brought out by the Geological Society of India in 1994.

The geochronological data that Saha and Sarkar needed to build up the model of Precambrain crustal evolution all came from foreign laboratories, and Professor Saha increasingly felt the need to set up a geochronological laboratory. Ultimately he succeeded in getting the funds for a Thermal Ionization Mass Spectrometer at the Presidency College. Unfortunately, by the time the instrument was installed Professor Saha was no longer at the helm of affairs at the Presidency College and the machine could not be made operational. One can only speculate what benefit would have accrued to Indian geology if Professor Saha got the machine while he was at the peak of his research career.

He also felt the need for a good Journal where peer-reviewed research articles of high standard by Indian geoscientists would be published. He was instrumental in founding the Indian Journal of Earth Sciences. It had a high quality of production and many fine articles on Indian geology were published in the Journal. It is sad that after Professor Saha's demise its tempo of publication slowed down. Professor Saha retired from the Presidency College in 1990, but till his last days he was associated with the Geology Department as Emeritus Professor.

CENTRE FOR STUDY ON MAN AND ENVIRONMENT

From the late 70s he became interested in environmental issues and his first venture in this field was the study of air pollution in urban, industrial and rural settings in southern Bengal. This was a new field for him and he plunged into it with his characteristic thoroughness, zeal and dedication. Along with an eminent geographer Professor NR Kar, he founded the Centre for Study on Man and Environment (CSME) which was initially housed at the Geology Department, Presidency College. After the sudden demise of Professor Kar the entire responsibility of the Centre came on Professor Saha and he was the Honorary Secretary of the organization till his last days. In the last decade of his life he became more and more involved with the research activities of the Centre. The Centre did not receive any grant-in-aid from the

Government and its expenses were entirely met from projects sponsored by governmental and non-governmental agencies. How the fledgling organization grew to be a highly respected institution and was able to move to its own building in the Salt Lake township speaks volumes for Professor Saha's organizational efficiency and scientific integrity. He had a sense of quiet pride that the Centre thrived and could build its own home without taking any aid from anybody. Under his guidance the Centre produced valuable Project Reports on air pollution, water pollution including arsenic pollution, groundwater potential and groundwater management in several areas, including Calcutta Metropolitan area, wasteland management and on several other topical themes. Baseline studies on air quality in parts of southern Bengal have yielded valuable information on the nature and magnitude of air pollution, particularly over rural areas. A novel aspect of the study was the use of the technique of factor analysis in identification of the natural processes determining the distribution and migration of the pollutants. Ingenious use of multivariate statistical techniques in the analysis of water pollution parameters has helped evolve an optimum plan for monitoring water pollution of the Ganga. Along with his colleagues at the Centre he demonstrated the beginning of land subsidence in parts of Calcutta, caused by continued subsidence of piezometric surface of the confined groundwater because of overdrawal. He dreamed that the Centre would grow as the premier institute for environmental studies and he personally met many of his ex-students to persuade them to take an active interest in the affairs of the Centre.

THE MAN AND THE TEACHER

In spite of being totally involved with research, Professor Saha never neglected teaching. He would teach with equal seriousness a course of "Introduction to Geology" to the freshers and "Mathematical Geology" to the advanced postgraduate students. He was not an eloquent speaker but each of his lecture was thoroughly prepared. They were rich in content, outlining the basics but also incorporating the results of most up-to-date research. His students treasured his lecture notes and many continued to refer to them throughout their professional life. One of his students wrote that what they appreciated most in Professor Saha's teaching was his 'ability to simplify complex facts in order to be able to focus on the truth at the centre of a question'. His students learnt from him the importance of hard work, meticulous observation, systematic approach and rational analysis. A simple unassuming but straightforward man of strict principles, he set his rules, abided by them himself and expected others to follow them also. He was uncompromisingly critical of slip-shod work and negligence. But behind his stern exterior was a very kind-hearted man, and no student in need of help, academic or otherwise, was turned back by him, no matter how preoccupied he might have been with other duties. He quietly helped many students in financial distress. He was a bachelor but

was deeply attached to his family and affectionate to his younger brothers and sisters and a loving uncle to his nephews.

Professor Saha was elected Fellow of the Indian National Science Academy in 1968. He was also elected Fellow of the Indian Academy of Sciences and of the National Academy of Sciences, India. He was UGC National Lecturer in 1970 and was a recipient of the National Mineral Award in 1969.

Professor Saha enjoyed a robust health, but years of hard work and particularly the onerous responsibility of running the CSME, looking after its financial and administrative affairs in addition to the scientific programme, finally took its toll. He suffered a cerebral stroke in 1996. He recovered after prolonged treatment, but his doctors advised him to take it easy and not to exert very much. However, as soon as he felt slightly better he plunged into all his activities with the same vigour as before. His health could not bear the strain and he again collapsed with another stroke and died within 24 hours on April 27, 1997. The tradition of scholarship, single minded pursuit of excellence, devotion to duty combined with humanity will always remain a beacon to his countless students and admirers.

D MUKHOPADHYAY, FNA
Department of Geology, University of Calcutta
35 Ballygunge Circular Road
Calcutta-700 019 (WB)
Res: G-7, MIG Hsg Estate
25/3 Raja Manindra Road
Kolkata-700 037 (WB)
E-mail: elfim@vsnl.net

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