

# ASOKE MOOKHERJEE

(23 May 1931 – 15 February 2006)

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(1931-2006)

Elected Fellow 1981

## EARLY LIFE

**A**SOKE MOOKHERJEE was born on May 23, 1931, at Jamtara (now in Jharkhand) to the Late Shri Pyari Mohan Mookherjee and the Late Shrimati Abha Mookherjee. He was the eldest son with a younger brother Shri Alope Mookherjee (formerly Managing Director, Flakt India Ltd and at present the Honorary Swedish Consul at Kolkata) and a sister Shrimati Alpana Maitra (formerly Lecturer, Dakshineswar College, Kolkata). Born and brought up in a typical Bengali middle class family of limited means, reasonable dreams and a strong ethical sense, Asoke inculcated all qualities of a responsible citizen from an early age. The lessons he drew early in life from his family can be illustrated by an incident that Asoke related to the writer. His father, an employee in the Department of Tribal Welfare, the then Government of undivided Bengal, had dismissed a freshly recruited household help on the suspicion that he stole a piece of jewelry that was reported missing. Later, that particular piece was discovered at home proving the innocence of the victim. Asoke's father was aghast with remorse. Ignoring everybody's advice that a message recalling the concerned person for the job should suffice, he cycled several miles to his village, fetched him home, apologized and pleaded pardon publicly and reappointed him. It is in this moral ambience that Asoke grew up and he maintained high standards of ethics that drew admiration of all who knew him.

Owing to the transferable job of his father, Asoke had to change schools frequently. He finally matriculated from Dinajpur Zilla High School (currently in Bangladesh) in 1947 ranking 13th and he was awarded a first grade scholarship. Following the Intermediate Science (I Sc), he passed B Sc (Geology Honours) and M Sc (Geology) Examinations securing first class in all from Presidency College, Kolkata. For his excellent B Sc results he was awarded the Hindu College (predecessor of Presidency College) Foundation Scholarship. He topped the list of an outstanding batch of classmates in the M Sc Examination of the Calcutta University in 1954 earning the University Gold Medal. That his interests were many, beyond those of practically oriented good class-room boys, is evident from his own writings. He always accepted challenges rather than choosing easy routes. He wrote later that he chose Geology Honours in the B Sc course "not out of any particular fascination for the subject but in sheer frustration and anger having scored the lowest mark in it of all my subjects" (in the I Sc examination). For his college career he dutifully wrote



“The next seven years, distributed perhaps somewhat unevenly between classrooms, laboratories, and libraries on the one side and the Albert Hall Coffee House on the other (seven instead of the usual six years because I became discollegiate for inadequate attendance in pass course classes), passed like a dream”. And a dreamer he was for who else would bring out a pair of skinned chicken along with his papers in his classroom at Kharagpur simply because he forgot to visit home after shopping! Asoke was admitted to the Ph D in 1963 by IIT, Kharagpur. None of these distinctions and many others to follow ever bothered him as something special and he remained humble all his life.

After a short stint in the Geological Survey of India, Professor Mookherjee joined the Indian Institute of Technology, Kharagpur in 1956 as Lecturer in the Department of Geology and Geophysics. The same year he married Sumitra, daughter of the Late Jogendra Nath and Ashalata Bhattacharyya. Their only son, Kunal, born in 1959, was carefully and affectionately brought up inducting in him the value system that Asoke and Sumitra cherished. In this context the writer was a witness to a heated argument between the father and son in respect of the career that Kunal should choose in future. Kunal was in favour of a job relating to marketing, an idea vehemently opposed by his father who had the conviction that it will be a waste of the excellent academic training his son received. Kunal’s argument, to the contrary, was that his highly educated, widely respected and thoroughly academic father had to live frugally, cycling all the way to the Institute and elsewhere, whereas in the corporate sector one is normally endowed with easy affluence and a better standard of living. Asoke gave his opinion but did not insist on it. Kunal took his B Tech (Honours) degree in Electrical Engineering from IIT, Kharagpur in 1981 and is currently working as a senior executive in a German multinational company. He and his son Udayan remained closely attached to the family and Asoke enjoyed the company of his grandson more than anything in the world.

## PROFESSIONAL CAREER

The major period of the professional career of Professor Mookherjee was spent in the Indian Institute of Technology, Kharagpur. He joined as Lecturer in the Department of Geology and Geophysics in 1956, serving the Institute as Assistant Professor, Professor, Dean of Students and Dean of Academic Affairs. He was widely known for his erudition in different branches of Earth Sciences, with specialization in the field of Ore Geology. As a teacher and research guide he excelled in imbuing the scientific temper and the thirst for knowledge in his students, many of whom made an indelible mark in professional competence in later life. It is interesting to note that his classmate (Dr DK Ray) and a student (Dr SK Acharya) both rose to the position of Director General of the Geological Survey of India. Many of his students are serving as distinguished teachers in institutions of higher studies and research in India and abroad. His role as a model teacher was extended beyond the classrooms and



laboratory benches, cutting across faculties and age barriers. His honest and forthright approach won the students' confidence and he is remembered as one of the most successful Deans of Students Affairs, a duty he faithfully performed for three years. At the same time, his academic performance was so widely recognized that he was appointed Dean of Academic Affairs for another spell of three years, a position in which he equally excelled.

Professor Mookherjee retired from IIT, Kharagpur in 1991 after thirty-five years of distinguished service. He was immediately offered the position of CSIR Emeritus Scientist and he chose the Department of Geological Sciences, Jadavpur University as the venue of work (1991-1996). In 1996 he was chosen as INSA Senior Scientist and he continued to work at Jadavpur University (1996-2001). During his stay at Jadavpur University for ten years, Professor Mookherjee's scholarship and quality of mind commanded high respect of students and teachers alike. His lectures on 'Introduction to Geology' to the new entrants fascinated one and all and have passed into a legend. During his stay at Jadavpur University he wrote the book 'Ore Genesis - A Holistic Approach' published by Allied Publishers, New Delhi in 1999.

### SCIENTIFIC CONTRIBUTIONS

Professor Asoke Mookherjee has been well known for his outstanding scientific contributions of lasting value spanning over four decades. From late 1950s onwards he has pioneered several modern lines of research in India that testify to his intellectual ability and drive. His major contributions can be summarized as follows: the earliest applications of trace element geochemistry to infer the source, origin, temperature of formation and the progressive changes in the composition of the ore-fluid; the first attempt to reconstruct the physicochemical ambience of mineralization quantitatively in terms of intrinsic parameters; to retrieve natural processes from 'frozen' records in minerals etc. All these publications have shown long 'half-lives'. His experimental demonstration of the efficacy of chloride complexing helped in resolving the then (1960s) vexing paradox of simultaneous transfer of metals and reduced S ions in the same ore fluid has been hailed as an outstanding contribution that has been exhaustively cited in text and reference books (Helgeson, Vlasov, Barnes). The first authentic documentation of sulfide melting at dyke contact also stands to his credit. Professor Mookherjee's research contributions on metamorphism of sulfide ores during the '60s and '70s are of such lasting value that these were chosen as the central theme of two international special publications during the late '80s (Ore Geology Reviews, 1987) and during the '90s (Mineralogical Magazine, 1993) in which virtually every paper discussed his work. His interpretations of ore textures through chemical mass balance and equilibrium considerations and the rationale of space-time convergence and exclusivity of mineralization in the context of regional metallogeny are equally important and are highly acclaimed. His series of publications on rare minerals from Rajpura-Dariba



deposits constitute a model example of systematic in-depth mineralogical investigation and a new mineral 'Rayite' (approved by International Mineralogical Association) was discovered by him and named after his teacher Professor Santosh Kumar Ray.

A major contribution of lasting value was a book 'Ore Genesis - A Holistic Approach', written by Professor Mookherjee and published by Allied Publishers, New Delhi in 1999. This publication has been hailed by the peers as the most comprehensive treatise on ore deposits that adequately filled a gap felt for a long time by ore geologists.

### **MEMBERSHIP, AWARDS AND HONOURS AND ASSOCIATION WITH NATIONAL AND INTERNATIONAL SOCIETIES**

Collecting academic laurels was of least priority in Professor Mookherjee's mind. The herculean task that was faced by one and all his admirers to get together the material in support of his nomination for any award is well known. Notwithstanding his allergy for any kind of advertisement and formal recognition, several awards were bestowed on him as his fame as an academician spread. Early in his professional career he received the Ridgefield Foundation Fellowship (USA) that enabled him to work with Professor HD Holland at Princeton University. The Asiatic Society, Bengal, awarded him NN Chatterjee Medal in 1964 for his contribution to Economic Geology. He was a recipient of the Post-doctoral Fellowship of the National Research Council, Canada (1966-1967). He was also endowed with the S Narayanaswami Award (1985) by the Geological Society of India (1985), IIT Silver Jubilee Research Award (1987), National Mineral Award, Government of India (1987-1988), Millennium Award, Indian Society of Applied Geochemists (2000), and the Darashaw Noshervanji Wadia Medal of INSA (2004). A Festschrift volume entitled 'Crustal Evolution and Metallogensis in the Northwestern Indian Shield' consisting of a seminar proceedings edited by Professor M Deb was dedicated to Professor Mookherjee on his 65th birthday.

Professor Mookherjee was a member of the Geoscience Advisory Board (1981) Govt. of Sri Lanka, and went to the USA and Germany in 1986 as Visiting Scientist of National Science Foundation and DFG respectively. He was chosen as a member of the delegation of the Indian National Science Academy to the 4th Indo-Soviet Joint Symposium on Earth Sciences organized by the USSR Academy of Sciences in Moscow in 1991. He served as Co-Chairman of the Working Group on Metallogeny of the International Association on the Genesis of Ore Deposits (IAGOD) during 2000-2004.

Professor Mookherjee was elected a Fellow of the Indian National Science Academy in 1981, Indian Academy of Sciences in 1990 and the National Academy of Sciences (India) in 1994. He also served as Vice President (1999-2000) and Editor



(2000 - ) of the West Bengal Academy of Science and Technology. His erudition was naturally utilized by his choice as S. Ray Memorial Lecturer, Presidency College, Kolkata (1984), UGC National Lecturer (1986) and the 6th NN Chatterjee Memorial Lecturer of Geological, Mining and Metallurgical Society of India (1988).

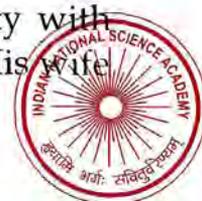
### EXTRA CURRICULAR ACTIVITIES

For Professor Asoke Mookherjee, the life of an academic is only fulfilled by his overall social commitments. His avid interests in cultural and sociological aspects, both within and outside the campus, his strong conviction on justice for all and his wit to make all laugh, often at his own expense, earned him lifelong friends and admirers all over the country and beyond. He was a dedicated Bridge player winning many local tournaments. His love for literary works and passion for poetry was evident during even mundane discussions. He excelled in recitation and in debates. An audio cassette "Nana Ranger Rabindra Nath" assembled his recitation of some selected poems of the great poet and humanist (brought out by STM Cassette Co., Kolkata, 2002).

Apart from his cultural interest, Professor Mookherjee maintained an abiding commitment to the dissemination of science and the scientific temper among the vast uninitiated populace. He wrote many articles on popular science, often with strong criticisms of pseudoscience that pushes the minds of common people to the middle ages. Many of these were published in well known dailies and their thought-provoking and topical character induced their publication as a book entitled "Indian Society & Science: Viewed From the Interface" in 2005 by New Age Publishers, Kolkata. The book includes chapters on: Science Literacy; Science, Anti-Science, Pseudoscience; Contemporary Science; Waning Public Trust on Science?; Large Dams and Transgenic Plants; Spaceship Earth and Global Village; Shrunken Infancy and Erased Childhood; Science and Technology Research; Reminiscences of a Geologist. This collection of articles should serve the purpose of removing dogmas such as illogical faith in astrological predictions, reconciliation with supernatural powers and non-analytical education system that afflict most of the common masses in India and many other places in the world.

### LAST DAYS

During routine investigations for apparently minor maladies, it was diagnosed in 2003 that Professor Mookherjee was suffering from lung cancer. Overcoming the stunned initial reactions, Asoke and his immediate family put up a brave front. Prolonged treatment followed in Kolkata and Mumbai. Friends and relatives visited as usual and the 'adda's, the discussions, were lively as ever; a gossamer veil of anxiety and sorrow hung but was never recognized. Asoke faced the reality with courage and analysed his afflictions with the detachment of a true scientist. His wife



Sumitra, an admirable lady, quietly carried the entire responsibility of a loving partner and confidante, along with the usual household chores, and much else. Asoke named her "Dashabhuja" meaning Goddess Durga who could perform several duties at a time. His son Kunal, brother Alope, sister Alpana and the larger family on Asoke's and Sumitra's side extended all support. His numerous students and friends were always eager to support him in this difficult time. This certainly encouraged Asoke to fight the battle to the last.

Meanwhile, the Indian National Science Academy selected Professor Mookherjee for the prestigious award of DN Wadia Medal for 2004 in recognition of his outstanding contributions to the field of Earth Sciences. During the award ceremony he was expected to deliver a lecture though there was no real compulsion. But as usual, he accepted this challenge also, delivering the lecture on "Relationship between 'reserve' and 'Clarke value' of ore metals - A mirage?" barely three months after he underwent a radical surgery involving removal of one afflicted lung. The lecture was brilliant as always, the mind ruling over body. During the journey back home he laughingly said, with perhaps a tinge of sorrow, that this was possibly his last public lecture!

After a brief period of relative stability, Professor Mookherjee's health started deteriorating towards the end of 2005. In spite of the best medical attention and palliative treatment, his suffering escalated day by day. But even in worst of times the sharpness of his mind never faded. Barely a few days away from death he referred the attending physicians to a recent article in *Nature* (quoting the volume and number), which could help them to provide relief to his struggle to breathe. The amazed doctors froze in pathetic silence. He passed away on the 15th February, 2006, leaving behind his family, a host of friends and students and the scientific fraternity to mourn his loss.

### ACKNOWLEDGEMENTS

I am grateful to INSA for offering me the chance of putting on record the multifaceted character of Professor Asoke Mookherjee, a rare intellectual and a socially committed person. In this effort, I had the privilege of receiving full support from his family, particularly his wife Sumitra and son Kunal and his student Professor Biswajit Mishra in the collection of material.

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## BIBLIOGRAPHY

## (a) Books

- 1999 Ore Genesis – A Holistic Approach Allied Publishers, New Delhi 657 pp
- 2005 Indian Society and Science – Viewed From The Interface, New Age Publishers Pvt Ltd, Kolkata 102 pp

## (b) Research Papers

- 1955 Manganiferous micas of Madhya Pradesh and their origin *Sci and Culture* **21** 380-381
- 1958 Paragenesis of the manganese minerals associated with the gonditic rocks near Khapa Nagpur District Quart *Journ Geol Min Meta Soc India* **30** 33-36
- 1959 (With SAHU KC) Microhardness of the Plagioclase series *Amer Mineral* **45** 742-744
- 1961 Distribution of minor elements in the gonditic manganese ore and its geochemical significance *Econ Geol* **56** 723-729
- 1962 Certain aspects of the geochemistry of cadmium *Geochim Cosmochim Acta* **26** 351-360
- (With NAHA K) Kolar gold field India: A discussion *Econ Geol* **57** 262-265
- 1964 Distribution of radioactivity in the Mosabani copper mine Bihar, India: A discussion *Econ Geol* **59** 501-502
- The geology of the Zawar lead-zinc mine Rajasthan, India *Econ Geol* **59** 656-677
- Thermal metamorphism of sulfide minerals at Zawar mine Rajasthan, India *Econ Geol* **59** 498-501
- Regional structural framework of the lead-zinc deposit at Zawar Rajasthan, India *Journ Geol Soc India* **6** 67-80
- Genetic interpretations of the temperature-independent hypogene ore body zoning *Proc 8th Commonwealth Min Meta Congress* **6**
- 1968 The Zawar lead-zinc deposits: a reply *Econ Geol* **63** 721-727
- (With SUFFEL GG) Massive sulfide – late diabase relationships: Horne mine Quebec Genetic and chronological implications *Canad Journ Earth Sci* **5** 421-432
- Dykes sulfide deposits and regional metamorphism: criteria for determining their time relationship *Miner Deposita* **5** 120-144
- (With DUTTA NK) Evidence of incipient melting of sulfides at Geco mine Maitausadge *Canada Econ Geol* **65** 237-238
- “Metamorphic” and “Metamorphosed” sulfide deposits *Econ Geol* **65** 886-889
- Geophysical Education and Opportunity in India: A Discussion *Geoexploration* **9** 237-238
- Deformation of Pyrite: A Discussion *Econ Geol* **66** 200
- 1976 Ores and Metamorphism Temporal and Genetic Relationships In Wolf KH (Ed) Handbook of Stratabound and Stratiform Ore Deposits Elsevier Amsterdam **vol 4** 203-260 pp
- 1977 (With TENGINKAI SG) A study of the oxidized zone in the Rakha Chapri block of the Singhbhum copper belt *Indian Journ Earth Sci S Ray Volume* **143-156**



- 1978 (With MUKHOPADHYAY D) "Rock Ball" texture from Saladipura pyrite-pyrrhotite ore body Khetri Copper belt *India Neues Jahrbuch Min Mh* **133**
- 1979 (With BASU K and SANYAL S) Montobasite and metatriplite from zoned pegmatites of Govindpal MP *Indian Earth Sci* **6** 191-199
- (With PHILLIP R) Distribution of copper, cobalt and nickel in ores and host rocks Ingladhal Karnataka India *Miner Deposita* **14** 33-35
- 1980 (With BASU K, BORTNIKOV N and MOZGOVA N) Rare minerals from Rajpura-Dariba Rajasthan India I Owheeite *Journ Geol Soc India* **21** 417-424
- 1981 (With RAO CN) Pyritized ooids stringed ooids and 'reticulate' tubular structures from within black shales at Amjhor Bihar India *Sed Geol* **28** 63-73
- (With BASU K, BORTNIKOV N, MOZGOVA N and TSEPIN AI) Rare minerals from Rajpura-Dariba Rajasthan India II Intermetallic compound  $Ag_{74.2}Au_{16.4}Hg_{9.4}$  *Neues Jahrbuch Min Abh* **141** 217-223
- (With BASU K, BORTNIKOV N, MOZGOVA N and TSEPIN AI) Rare minerals from Rajpura-Dariba Rajasthan India III Plumbian tetrahedrite *Neues Jahrbuch Min Abh* **141** 280-281
- (With BASU K, BORTNIKOV N, MISHRA B, MOZGOVA N and TSEPIN AI) Unusual geochemical and mineralogical features of the Rajpura-Dariba polymetallic deposit Rajasthan India *Proc 4th Indo-Soviet Symp Earth Sci Moscow*
- 1982 (With NAHA K and BASU K) Deformational structures in the Rajpura-Dariba area Rajasthan, India and their significance In Sychanthavong SPA (Ed) *Crustal Evolution and Orogeny* Oxford and IBH Publ Co Pvt Ltd 275-291 pp
- (With MISHRA B) Preliminary studies on fluid inclusion geothermometry of quartz-sulfide veins from Zawar area Rajasthan using a heating stage with canthol strips *Proc Fluid Incl Workshop IIT Bombay* 20-30
- 1983 (With BASU K, BORTNIKOV N, MOZGOVA N, SIVTISOV AV, TSEPIN AI and VYALSOV LN) Rare minerals from Rajpura-Dariba Rajasthan, India IV A new Pb-Ag-Ti-Sb sulphosalt rayite *Neues Jahrbuch Min Mh* **7** 296-304
- (With MISHRA B) On the reaction rim texture galena + tetrahedrite + chalcopyrite + bournonite *Journ Geol Soc India* **24** 588-593
- 1984 (With BASU K, BORTNIKOV N, MOZGOVA N, SIVTISOV AV, TSEPIN AI and VRUBLEVSKAJA ZA) Rare minerals from Rajpura-Dariba, Rajasthan, India: the first recorded occurrence of a manganoan fahlore *Neues Jahrbuch Min Abh* **149** 105-112
- (With BASU K, BORTNIKOV N, MOZGOVA N and TSEPIN AI) Significance of transformation textures in fahlores from Rajpura-Dariba polymetallic deposit Rajasthan, India *Neues Jahrbuch Min Abh* **149** 143-161
- (With MISHRA B) 'Derived' and observed sulfosalt-sulphide phase assemblages compared - a case study from Rajpura-Dariba, India *Miner Deposita* **19** 112-117
- (With MOZGOVA N, GOLOVANOVA TI and MISHRA B) Rare minerals from Rajpura-Dariba India VI Thalcusite its geochemical significance *Neues Jahrbuch Min Mh* **10** 444-454
- (With MISHRA B) Analytical formation of phase equilibria in two observed sulfide-sulfosalt assemblages in Rajpura-Dariba polymetallic deposit Rajasthan, India *Econ Geol* **81** 627-679



- (With TENGINKAI SG) Unusual geochemical features of the oxidised zone at Chapri block in the Singhbhum copper belt of India *Chem Geol* **60** 51-62
- Influence of tectonic settings on the structure and distribution of ore deposits In Saha AK (Ed ) Geological Evolution of Peninsular India Hindustan Publishing Company New Delhi 150-159 PP
- (With MISHRA B) Geothermometry based on fractionation of Mn and Cd between coexisting sphalerite and galena from some carbonate-hosted sulfide deposits in India *Miner Deposita* **23** 179-185
- Chemical and structural correlation problem of rayite *Neues Jahrbuch Min Abh* **160** 20-33
- Ore genesis today: Plutonism and neptunism stand reconciled and vindicated *Indian Journ Geol* **61** 73-92
- (With PANIGRAHI MK) Ore mineralogy and fluid inclusion characteristics of different ore associations from Malanjhand copper deposit MP *India Journ Geol Soc India* **37** 239-256
- (With MISHRA B) Tetrahedrite mineral chemistry and metal zoning A thermodynamic assessment from Rajpura-Dariba polymetallic deposit India *Econ Geol* **86** 1529-1538
- (With MOZGOVA N, BORODAEV YS, EFIMOV AV and GANDHI SM) Rare minerals from Rajpura-Dariba Rajasthan, India *VII Reniereite Minera Petrol* **46** 55-65
- Metallogeny – the search for a rationale behind space-time selectivity of ore deposits formation *Curr Sci* **63** 173- 180
- (With PANIGRAHI MK, PANTALU GVC and GOPALAN K) Granitoids around the Malanjhand copper deposits: Types and age relationship *Proc Ind Acad Sci (Earth Planet Sci Ser)* **102** 399-413
- (With PANIGRAHI MK) Reserve base in relation to crustal abundance of metals: another look *Journ Geochem Explor* **51** 1-9
- 1996 (With PANIGRAHI MK) The Malanjhand copper (+molybdenum) deposit India: Mineralization from a low-temperature ore-fluid of granitoid affiliation *Mineral Deposita* **32** 133-148
- 2000 Crustal fluids and formation of mineral deposits 5<sup>th</sup> Foundation Lecture: The Indian Geological Congress 19 pp

