Ashkin was a nature enthusiast and was very fond of different types of flora and fauna. He bought a huge plot of land in New Jersey to have a proper garden. This interest of Ashkin inculcated a strong inclination towards nature in his son, Michael's mind. Michael went on to become a well-known American artist and is a Professor and chair of the Department of Art in the College of Architecture, Art and Planning at Cornell University. Michael Ashkin accepted the 2018 Nobel Prize in Sweden on behalf of his father in the Nobel Prize Ceremony held by the Royal Swedish Academy of Sciences.

Ashkin was elected as a member of the US National Academy of Engineering in 1984 and the US National Academy of Sciences in 1996. He was a fellow of the Optical Society of America (OSA), the American Physical Society (APS), the Society of Photographic Instrumentation Engineers (SPIE), and the American Association for the Advancement of Science (AAAS). He was also inducted as a 'Life Fellow' of the Institute of Electrical and Electronics Engineers (IEEE). In 1987, he received the Quantum Electronics Award from IEEE. He received the Charles and Tones Award from the OSA in 1988. OSA also conferred on him the Frederic Ives Medal/ Jarus W. Quinn Award in 1998. Ashkin was inducted into the American Optical Society, the Institute of Electrical and Electronic Engineers, and the American Association for the Advancement of Science. In 2013, he was also inducted into the American National Inventor's 'Hall of Fame'. Ashkin was also elected fellow of the American Physical Society (APS). He was a recipient of the Keithley Award of APS in 2003. He also received the prestigious Harvey Prize of Technion – the Israel Institute of Technology in 2004.

Ironically, Ashkin mentioned in one of his interviews that he never took any formal courses on optics, neither at Columbia University nor at Cornell University. After 40 years of an extensive, and productive research career in AT&T Bell Labs, Ashkin retired; but he never stopped working. He was gifted some equipment from Bell Labs on his retirement and continued research in the basement of his residence. Research in the very last leg of his illustrative career as a world-class scientist and innovator involved manipulating light with reflective concentrator tubes to produce affordable solar power. He could not be present at the Nobel Prize ceremony in Sweden due to health reasons. In the many invited lectures that he delivered after receiving the Nobel Prize, Ashkin mentioned that he believed in the fact that harnessing and utilizing solar power would shape the world's future and sustenance.

Ashkin died on 21 September 2020 at the age of 98, in his residence at Rumson, New Jersey. He is survived by his wife, three children, five grandchildren, and two great-grandchildren.

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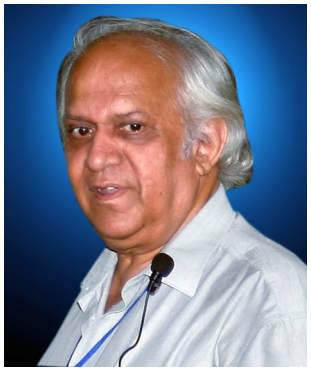
Indra Bir Singh (1943–2021)

The sad demise of Professor Indra Bir Singh in the early hours of 11 February 2021 stunned the entire geological community in India and abroad. Indra Bir was proud of his alma mater Lucknow University which provided him the platform to contribute to various aspects of Earth Sciences. With his death, the world has lost an internationally well recognized geologist with broad interests in Earth Sciences. He is survived by his wife Janak and two sons Shwetabh and Arunabh, both working abroad.

Indra Bir was born in Lucknow on 8 July 1943 in the western UP family of Chaudhri Atar Singh and Ram Kumari. He had his early schooling in a neighbourhood school – Mansa Din Shukla Inter College and attended the Govt Jubilee Inter College for High School (class X) examination. He joined Intermediate Course in Lucknow Christian College in 1956. His collegemates included some of the later year highly successful geoscientists like Nirankar Prasad (Canadian



Geological Survey), Sayyed Abbas Jafar (Aligarh Muslim University, Birbal Sahni Institute of Palaeobotany and ONGC), Satya Prakash Rastog (GSI) and Avinash Chandra (Director General of Hydrocarbons). I happened to be his class fellow as well in Class XI. Two of his close class friends at the college became leading oncologists in US (Manatosh Banerjee) and top orthopaedic surgeon of India (D. K. Taneja).

Indra Bir studied Geology in Lucknow University and obtained M.Sc. (Spl) degree in 1962. He joined Oil and Natural Gas Commission. He worked in Director's Cell briefly under B. G. Deshpande where he had the company of Aditya Chaubey, Laxman Singh, Bindesh Srivastava and Avinash Chandra, who in later years earned considerable laurels in the field of petroleum exploration. In 1963, he left for higher studies in the Technical University, Stuttgart. He worked under the supervision of Aldinge

and obtained Doctoral degree in 1966 for his work on the Geology of Harz Mountains. After obtaining Doctoral degree, Indra Bir worked with Thomas Barth for over an year as post-Doctoral Fellow in the University of Oslo, Norway. During this one year, Indra Bir equipped himself with the nuances of hard rock petrology and geochemistry which he had missed during his Stuttgart days. He worked on the Proterozoic quartzite of Telemark area in the south-eastern part of Norway and published several significant papers on sedimentation.

His style of study of sedimentary structures in the Telemark region attracted the attention of H. E. Reineck who invited him in early 1969 to join his research group as *Mitarbieter* (co-worker) in the Seckenberg Oceanographic Institute at Willhelmshaven in north Germany. Indra Bir virtually submerged himself in the studies of shallow water tidal flats in the north coast of Germany where he studied *in situ* formation of sedimentary structures, recorded variations in the tidal strength from morning till night. Months of such observations were used by him and his colleagues to prepare depositional models. He used to say that it was real fun and educative to see the sand grains dancing to the tune of the tidal waves and modify their behaviour with changing hydrological and micro-morpho-tectonic domains. A prolonged experience of working on modern sea coast gave Indra Bir the confidence and armed him with expert knowledge that helped him to interpret geological events precisely in the ancient rock records. He became expert in accurately defining the marine shallow facies.

H. E. Reineck and he jointly wrote a book *Depositional Sedimentary Environment*, published by Springer Verlag in 1973. This book was warmly welcomed by the geological community and became a hot selling book all over the world. The second revised and enlarged edition was printed in 1980. For a long period of time, this book remained a 'bible' for the clastic sedimentologists especially petroleum geologists, until newer books arrived in the market. The book was simultaneously translated and made available in Russia and China.

On return to India, Indra Bir joined Lucknow University in 1972 as a Lecturer. He became Reader in 1984 and Professor in 1986. Between 1995 and 2003 he served as the Head of the Department of Geology and Dean of Science Faculty of Lucknow University. He spent two years as Alexander von Humboldt Fellow (1978–1979) in different German Universities. Between 1984 and 1986 he was Visiting Professor at the Louisiana State University, Baton Rouge, USA as temporary replacement for a well-known sedimentologist Arnold Bouma. His departmental colleagues in Louisiana, Barun Sengupta and Paul Aharon had great regard for him. He spent nearly two years (1998 and 1999) as full Professor teaching at the University of Erlangen-Nuremberg, Germany.

In 1995, he was elected to the Fellowship of Indian National Science Academy. In 1996 he received the L. Rama Rao Birth Centenary Award of the Geological Society of India. He was presented the National Award for Excellence in Earth System Science by the Ministry of Mines, Government of India in 2014. In 2020, he received Special Commendation from the Governor of UP for his contributions to the academic and corporate life of Lucknow University at the Centenary Celebration of Lucknow University. He also served as INSA Senior Scientist (2008–2013) and INSA Honorary Scientist (2013–2016).

Indra Bir retired from University service in 2006, without showing any change in his work routine and academic engagements. He acquired an iconic image of an individualist and a bold thinker with an intuitive mind. His most significant contribution to the Indian Geology was complete demolition of the age old idea of Mesozoic age of Lesser Himalayan sedimentary rocks. His studies proved that a major part of the Lesser Himalayan rocks are Precambrian and not Paleo-Mesozoic as recoded in earlier geology text books. His scientific contributions touched the entire spectrum of Indian stratigraphy from Precambrian to Meghalayan. Providing a brand new idea of the depositional history of the Ganga Plain sediments and modelling landform development is a prominent feather to his cap. His geo-archeological work includes discovering ancient potteries, evidence of domestication of elephants on extensive grasslands with rice cultivated since 8,500 years BP. His interpretation of the sediments of the Karewa basin in the Kashmir valley, remains unique till date. He proposed a completely new depositional model for the Bhuj Formation in Kachchh (Kutch), Gujarat, which led to major revisions in the palaeogeographic models of the western Indian sedimentary basins. Facies models prepared for the Vindhyan basin sedimentary succession and Lameta sediments, although criticized by some workers in later years, add up to the list of his scientific contributions. He wrote another significant book *Delta Sedimentation: East Coast of India* co-authored by A. S. R. Swamy. This book serves as a reference book for the oil exploration companies. Indra Bir often participated in some activities of UNESCO's International Geological (now Geosciences) Programmes and was on the Advisory Board of the Directorate General of Hydrocarbons (DGH).

Indra Bir was simple in his attire, connoisseur of classical music and good food. He had pleasant demeanor, sharp mind full of novel ideas. He was an excellent teacher and touched the lives of his students in a special way. All his students carry a part of his personality as well as carry on his legacy. Above all, he was a great humanitarian and an excellent compassionate friend.

He had a stocky build and robust health. But during the last couple of years he had to compromise and remain low due to unforeseen illness. Even during these bleak days, as and when he felt better, he used to invite his old colleagues to his home, often discussed the finer details of a paper that he was preparing for submission.

Indra Bir Singh will remain irreplaceable in Indian geological domain for a long time to come.

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