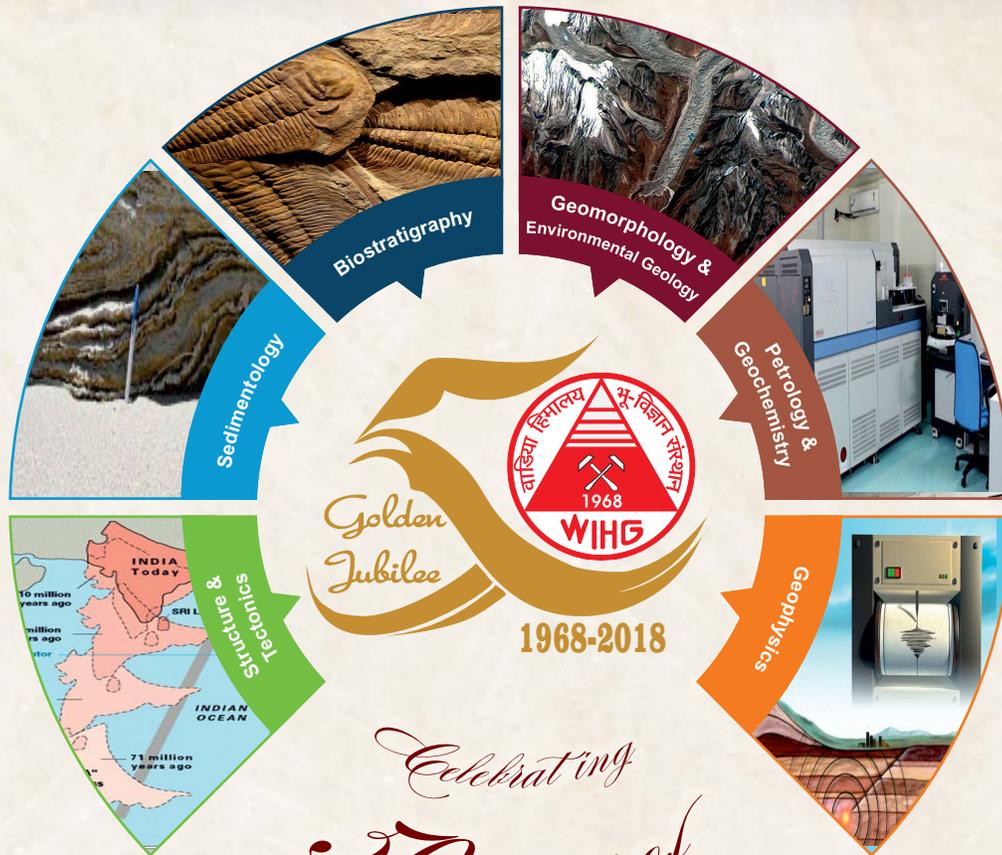


Reminiscences of Golden Days

(1968-2018)



*Celebrating
50 years of
Excellence in Himalayan Geology*

**Wadia Institute of Himalayan Geology
Dehradun**

Reminiscences **of Golden Days**

**50 years of Excellence in Himalayan Geology
(1968-2018)**



Compiled by

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Wadia Institute of Himalayan Geology
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29th June, 2018

Preface



Himalaya is the most spectacular continental geomorphic feature and is a classic case of crustal deformation involving continent-continent collision. The onset of the drift of Indian plate, its journey from break-up through drift to subduction and eventual collision involves deep continental processes, and deformation of rocks from surface to mantle of the earth. This largest relief on the earth became the reason of establishment of SW Indian Summer Monsoon and several of the large rivers like the Ganga, the Brahmaputra and the Indus. The continued rise of this collisional mountain chain controlled the evolution of the landscape at its periphery, the chemistry of the world oceans, and the growth and demise of several human societies through ages. Even today the interaction of the deep crustal and the surface processes at different time scales in the Himalaya control the pattern of natural hazards like the earthquakes, the floods and the landslides, where human interactions have increased the vulnerabilities both at social and economic fronts.

Therefore, the Himalaya is an ideal laboratory to understand (i) crustal deformation in collisional tectonic setting, (ii) rock deformation and metamorphism, (iii) landscape evolution, glaciers and mountain hydrology vis-à-vis climate and tectonics, (iv) modern and paleoseismicity, (v) Natural hazards and natural resources, and (vi) Impact of Himalaya on the evolution of modern human societies. Traditionally until 1968, the Geological Survey of India (GSI) and the Survey of India were involved in understanding these aspects but the task was too large to be managed. Thus an Institute (Institute of Himalayan Geology, later renamed Wadia Institute of Himalayan Geology after its founder Prof. DN Wadia) dedicated exclusively to the Himalayan studies was setup in the year 1968, where Prof. DN Wadia and several others played the role of visionaries. The Institute took responsibility of (i) training students and young researcher across the country in different aspects of Himalayan geology, (ii) providing state of art research and laboratory facilities to the nation, and (iii) publishing maps and research articles on Himalayan geology. The Wadia Institute has been on the leading front in the regional scale geological mapping of Himalaya, unravelling its metamorphic history, providing chronology and biotic constraints to the stratigraphy Quaternary geology and palaeoseismic studies. Overall it has helped the nation in creating a critical pool of manpower which could steer Himalayan Geology. In its journey to the Golden Jubilee from inception, the Institute has produced more than 200 research fellows, 105 Ph.Ds, numerous M.Sc. dissertations and published more than 2000 research articles. Additionally, the scientists of the Institute have authored more than 20 books, monographs, field guidebooks and maps. Importantly, WIHG has provided a platform to national and international community of Himalayan geologists by organizing more than 100 conferences and workshops, including a few in other Indian cities, and from time to time conducted major training programs to train young scientists, research scholars, faculty and officials. The Institute has also conducted or taken part in several expeditions to Himalaya, and two to Antarctica.

This compendium documents historical account of the inception, growth and activities of the Institute as well as musings and reminiscences from scientists and geologists who have been or are associated with it in different capacities.

A handwritten signature in black ink, appearing to read 'Meera Tiwari', with a horizontal line underneath.

Dr (Mrs) Meera Tiwari
Scientist 'G' & Director (Addl. Charge)

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D. N. Wadia

(1883-1969)

D.N. WADIA

A Biography

Professor Darashaw Noshewan Wadia was born on 23rd October 1883 at Surat. He came from a respectable family of ship-builders for the East India Company who had settled in and around Surat. His father, a Station Master, had a large family of nine children and was posted in a remote place which had hardly any educational institution. 'Dara', as he was affectionately called by the family, was sent to Surat for his early education. He spent these years under strict care and discipline of his maternal grandmother. He first studied in a private Gujarati school and then joined the Sir J.J. English School.

The Wadias moved to Baroda when young 'Dara' was twelve years old. Here he joined the Baroda High School. He was profoundly influenced by his eldest brother, the late M.N. Wadia, a reputed educationist of Baroda State, and under his personal care developed an abiding love of nature, devotion to knowledge and a zeal for learning.

In 1905, Prof. Wadia obtained his M.A. and B.Sc. degrees in arts and science with natural science, zoology and botany as his subjects from the Baroda College where he later served as a lecturer for some time. His interest in geology, so far a less taught subject in India, was kindled by the college Principal, Professor Adarjee M. Masani. He offered geology as one of the subjects for his Bachelor's degree even though Baroda College at that time did not have sufficient facilities for imparting education in geology. He graduated with credit mostly through self study and personal scholarship.

After obtaining his Bachelor's degree, Wadia was appointed a lecturer in the Prince of Wales College, Jammu in 1906. Jammu provided an ideal environment for his geological pursuits, and recognising his merit and capabilities, he was entrusted the task of organising the Department of Geology from its very inception. The Department gradually blossomed and developed facilities for full-fledged graduate and postgraduate courses. His command over English language was excellent and apart from Geology, he taught English also. He continued to teach in the College till 1921, when he accepted the post of Assistant Superintendent with the Geological Survey of India. During his tenure at Jammu, Prof. Wadia devoted many years for study of geological problems of the surrounding region. He mapped a chain of inliers of unfossiliferous carbonate 'his Great Limestone of Jammu' occurring within the Tertiary sediments. During his student days in Baroda College, Wadia was greatly influenced by Sri Aurobindo who was the Principal and taught classics and literature. It seems that Wadia's writing of science in literary style was due to influence of Sri Aurobindo's teaching. He would spend the greater part of his holidays from 1907 to 1920 towards the geological field work and during these years he collected plenty of material and evidence to frame some new ideas regarding the Himalaya. In 1919, he published his Book: "Geology of India" (Macmillan, London). This 536 pages text-book brought him fame both at home and abroad. During these years Wadia was fortunate to have worked under the able guidance of Charles Middlemiss, FRS, a great name in Indian Geology, who had been mapping the Kashmir region for over fifteen years. Due to his initiative, Wadia joined the Geological Survey of India.

Wadia's appointment as Assistant Superintendent in the Geological Survey of India at a relatively advanced age of 38, provided him with ample chances for carrying out geological researches on the Stratigraphy and Tectonics of the Northwestern Himalaya. With intense and detailed work in NW Punjab, Waziristan, Hazara and Kashmir, he was not only able to interpret the structure of this complex region, but also influenced the geological thinking in the country as a whole. His monumental work on structure of NW Syntaxis published in 1931 speaks eloquently of his scholarship wherein he proposed that the sharp 'hairpin' bend was not due to meeting of Himalaya and the Hindukush as summarised by Edward Suess but was due to bending of the

same mountain system around a pivot of the Indian shield. He was able to trace the lithotectonic belts from Kashmir through Hazara over 200 km.

Dr Wadia's other important and varied contributions included Geology of Poonch, Cambro-Trias sequence of NW Kashmir, volcanic rocks of Astor-Deosai and geology of Nanga Parbat. Wadia's contention for Joya Mair Dome in Jhelum District being suitable for oil field was proved many years later in 1944, when Attock Oil Company Ltd. struck oil and sent a congratulatory telegram to him while he was in Ceylon (Sri Lanka).

Dr Wadia was with the Geological Survey till 1938. During his tenure with the Survey, he spent his study leave in 1926-1927 at the British Museum working on vertebrate fossils collected from Potwar and Kashmir. He also visited geological institutions in Germany, Austria and Czechoslovakia and attended a course in Alpine Geology at the University of Geneva. His paper on the 'Syntaxis' of the Northwestern Himalayas', the acute arcuate knee bend of the entire Himalayan belt around a pivotal point of Nanga Parbat brought him both national and international fame. This was followed by his other monumental works on Ladakh, Nanga Parbat and Kashmir.

In 1935, Dr Wadia visited China, Japan and USA. In 1937, at the request of the International Geological Congress, Moscow, he contributed his famous paper on the "Tectonic Relations of the Himalayas with the North Indian Foreland".

Dr Wadia retired from the Geological Survey of India in 1938, when he was offered the post of Government Mineralogist in Ceylon (now Sri Lanka). He spent nearly six years intensively studying the geology of this island, considered by him as a graceful pendant of the Indian Peninsula. The results of his work have been published in many articles dealing with the mineralogy, structure and physiography of Sri Lanka.

Dr. Wadia was appointed Geological Adviser to the Government of India in 1944. In this capacity, he initiated and formulated a mineral policy for the country. Till that time India did not have any such policy. It is largely due to his efforts that the Government became aware of proper conservation and utilization of the country's mineral resources. In 1947, when the Indian Bureau of Mines was established, he was appointed the first Director. During these years, Atomic Energy had gained world-wide importance and the Atomic Energy Commission of the Government of India with a view to explore domestic resources of radioactive raw materials established its Atomic Minerals Division in 1949, and Dr. Wadia became its first Director. He continued to head this unit until his death on 15th June, 1969 after brief illness.

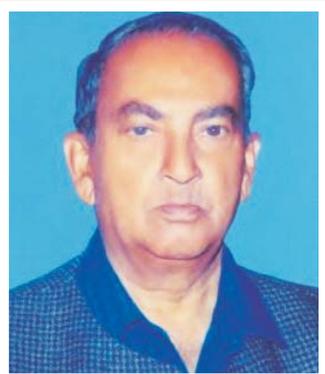
Wadia's love and devotion to the study of the Himalaya was unlimited. It was because of his initiative and efforts that the Institute of Himalayan Geology was established in 1968. The Institute was renamed as the Wadia Institute of Himalayan Geology (WIHG) in 1969- in his memory. He was also responsible for establishing the National Geophysical Research Institute (NGRI) at Hyderabad and the National Institute of Oceanography (NIO) in Panaji, Goa.

The genius and merit of Wadia found widespread recognition in the world. He was awarded the Honorary Doctorate of the Delhi University in 1947. The Royal Asiatic Society of Ceylon conferred upon him its Honorary Fellowship for his contributions to the Geology of Ceylon. He received the 'Back Award' of the Royal Geographical Society in 1934 and the 'Lyell Medal' of the Geological Society of London in 1943, for his paper on the "Syntaxis of the NW Himalayas – Its rocks, tectonics and orogeny". He was twice elected as the General President of the Indian Science Congress (1942 and 1943). He had subsequently been President of the National Institute of Sciences of India (now called the Indian National Science Academy or INSA) during 1945-46, Mining Geological and Metallurgical Institute of India in 1950, the Geological Mining and Metallurgical Society of India, Geological Society of India, Indian Society of Engineering Geology, Geographer's Association of India and Honorary Correspondent of the Geological Society of America. During the period, he also headed the Research Advisory Committees of many Scientific Institutions including the CSIR. He was Chairman of the Central Board of Geophysics of the Govt. of India during 1954-57 and the First President of Governing Body of the Institute of Himalayan Geology during 1968-69. He was elected a Fellow of the Royal Society of London in 1957.

The crowning honour of Dr Wadia's career came in 1963 when the Government of India made him the First National Professor in Geology. He presided over the XXII International Geological Congress held in New Delhi in December, 1964. He was also the recipient of the Meghnad Saha Medal of the Indian National Science Academy and P.N. Bose Memorial Medal of the Asiatic Society of Bengal. The Government of India had earlier honoured him with Padam Bhushan in 1958. Dr Wadia authored nearly one hundred original research papers, monographs, Records and Memoirs of the Geological Survey of India. Though very few of his publications have appeared in foreign journals, still the influence exercised by his writings in India and abroad is vast. His famous book 'Geology of India' has inspired many generations of students of geology, and would continue to do so in the coming years.

Dr Wadia always took pride in calling himself a pure Swadeshi product never having taken a degree from a foreign university. Only through his diligence and devotion he achieved what could rightly be described as scientific excellence. It is because of his achievements, authority of counsel and his personal charisma that he stood like a giant, who was revered and respected and dominated the academic and scientific scene in India for over half a century.

Past and Present Directors of the Wadia Institute of Himalayan Geology



Dr. S.C.D. Shah
(02.02.1978-31.05.1987)



Dr. V.C. Thakur
(13.10.1987-31.01.2000)



Dr. N.S. Viridi
(08.02.2000-30.06.2003)



Dr. B.R. Arora
(01.10.2003-31.10.2009)



Dr. Anil K. Gupta
(30.08.2010-28.08.2017)

Past and Present Scientists 'G' with Additional Charge of Director



Dr. A.C. Nanda
(30.06.2003-30.09.2003)



Dr. Ashok K. Dubey
(31.10.2009-30.08.2010)



Dr. Meera Tiwari
28.08.2017-present

Past & Present Presidents of the Governing Body of the Wadia Institute of Himalayan Geology

1. Prof. D.N. Wadia FRS : 1968-June 1969
2. Dr M.S. Krishnan FNI : 1969-1970
3. Prof. A.G. Jhingran FNI : 1970-July 1977
4. Shri S.P. Nautiyal : August 1977-March 1980
5. Prof. C. Karunakaran : April 1980-January 1982
6. Prof. R.C. Misra FNA : March 1982-September 1983
7. Prof. S.S. Merh FNA : 1985-1988
8. Dr Kurien Jacob : 1988-1991
9. Prof. K.B. Powar : 1991-1997
10. Prof. K.S. Valdiya FNA : 1997-2006
11. DST Secretary : 2006-2015
12. Prof. S.K. Tandon : 2015-present

Wadia Institute of Himalayan Geology

INCEPTION OF INSTITUTE - HISTORY

Himalaya being the tallest and most recent crustal structure is abode to several major rivers, along the course of which human civilizations flourished for ages. It was in the late 18th and early 19th century that the scientists, sages and philosophers realized the importance of Himalaya in the survival of mankind, its role in deciding the climate pattern and in building up the landscape of the surrounding regions. The Geological Survey of India and the Survey of India, the then nodal agencies to study various aspects of Himalaya, made notable contributions in the field of stratigraphy, palaeontology, glaciology, tectonics, geodesy, and seismology. Looking into the vastness of the subject and geographical extent of Himalaya, these organizations felt a need to widen the scope of Himalayan geology as a special subject of teaching and research. It was then, in June 1963, at Simla, that a Memorandum on this subject was submitted to Prof. Humayun Kabir, the then Minister for Scientific Research and Cultural Affairs by Prof. D.N. Wadia, FRS, the then National Professor of Geology and the Geological Adviser to the Government of India.

In pursuance of the suggestions made by Prof. Wadia in his Memorandum as well as the numerous meetings he had with a large section of scientists and administrators, the Scientific Advisory Committee to the Cabinet at their meeting held on 15th January 1965 recommended the establishment of a Central Institute of Himalayan Geology and related fields. In view of these recommendations, an ad-hoc committee consisting of 14 members, headed by Prof. D.N. Wadia, was set up by the Ministry of Education and Cultural Affairs on 13th December 1965. The Committee, had its first meeting at Lucknow on 25th December 1965, during the second Himalayan Geology Seminar at which the broad objectives and guidelines for the constitution of the proposed Institute were chalked out and a Sub-committee formed to work out the details. The Sub-committee submitted the draft constitution and an estimate of expenditure to the Government. The proposal was approved by the Government of India on 1st March 1968 and a sum of Rs. 11.22 lakh was sanctioned for the creation of an Institute during the 4th Plan period. On revision, this amount was raised to 20.6 lakh. The grant-in-aid was, however, to be released only when the Institute had been registered as a Society under the Societies Registration Act. Accordingly, the Memorandum of Association and Rules and Regulations of the Institute of Himalayan Geology Society were registered under the Societies Registration Act XXI of 1860 in Delhi on 29th June 1968. Below are the members who signed the Memorandum of Association of the Wadia Institute of Himalayan Geology.

Signatories of the Memorandum of Association:

1. Dr. D.N. Wadia,
National Professor of Geology, 10, King George Avenue, New Delhi
2. Dr. A.G. Jhingran,
Professor of Geology, Delhi University, Delhi-7
3. Dr. K. Jacob,
Deputy Co-ordinator, Dept of Airborne Mineral Surveys and Explorations, New Delhi
4. Dr. A.K. Dey,
Professor of Geology (Retd.), 54 Western Court, New Delhi
5. Dr. V.K. Verma,
Reader in Geology, Delhi University, Delhi-7
6. Dr. G.S. Roonwal,
Lecturer in Geology, Delhi University, New Delhi-7

7. Shri L.S. Chandrakant,
Head of the Bureau of Technical Education and Science, Ministry of Education, Government of India,
New Delhi

The Institute had its first Governing Body with Prof. D.N. Wadia as its President. Prof. A.G. Jhingran, the then Head of the Geology Department, Delhi University took over the charge as the Hon. Director in June 1969 and remained in this capacity till February 1976.

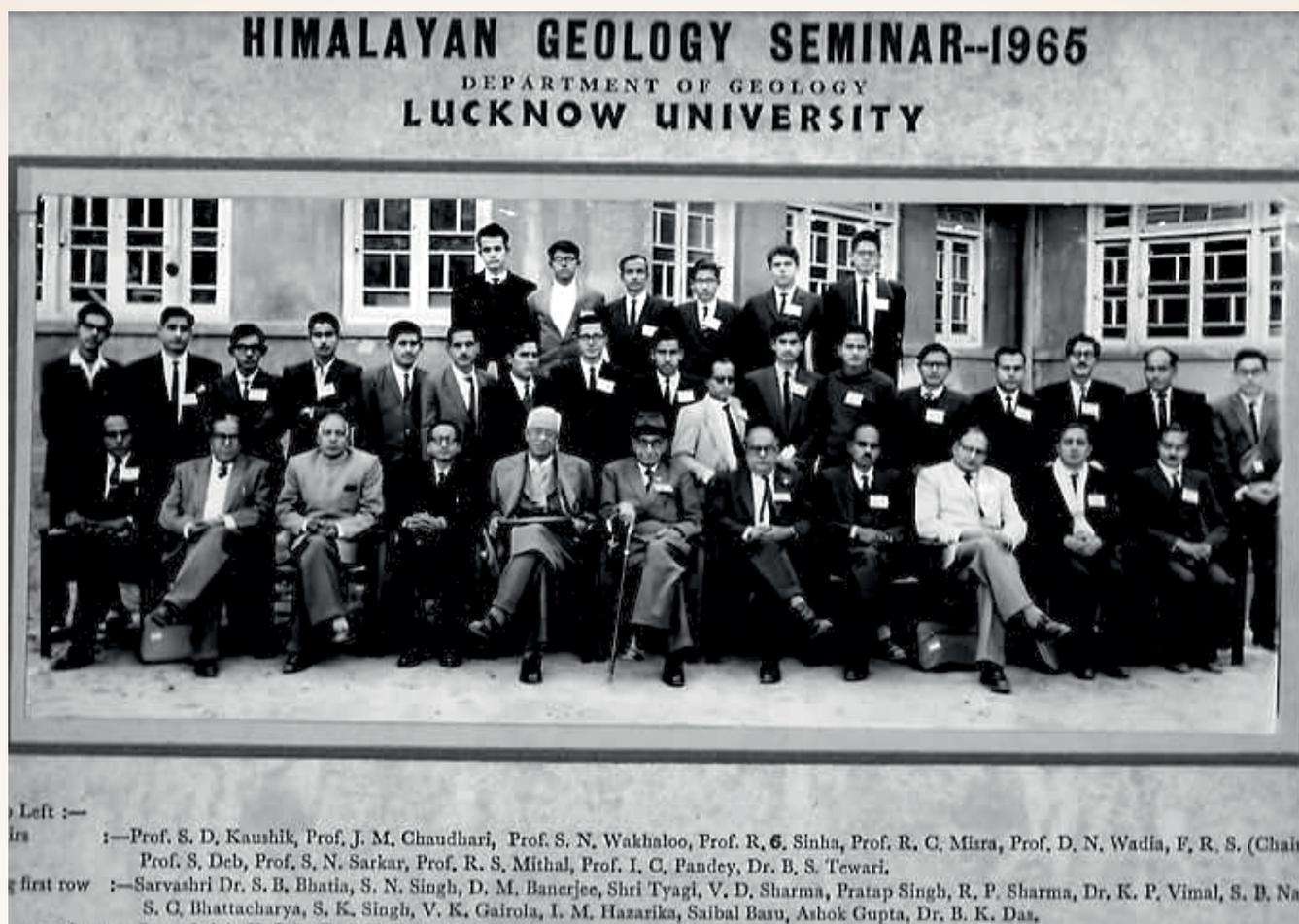
The Mandate

Wadia Institute is the only institute in the world dedicated to geoscientific research on the Himalaya. Our mandate is the application of emerging knowledge about the earth processes for fostering sustainable development and secured living in the Himalayan region. The primary focus is to study geodynamic evolution of the Himalaya besides its control on global climate, natural resources such as glaciers, surface and ground water. The major natural hazards, namely earthquakes and landslides in Himalaya are also being studied for the well-being of the mountainous population.

The Objectives

- To undertake, aid, promote, guide and coordinate researches in the geology of the Himalaya and foster a tradition of scholarship. Further, to carry out research towards development of new concepts and models concerning geodynamic evolution of the Himalaya through an integrated inter-disciplinary approach.
- To provide and promote effective linkage between various scientific and research organisations working in the country in the field of Himalayan Geology and related areas.
- To organise workshops, seminars, symposia and training programmes of specialised nature on topics related to the geology of the Himalaya and related orogenic belts.
- To serve as one of the National Reference Centres for the geology of the Himalaya and to provide high level consultancy services to the institutions, public agencies and industries.
- To collaborate with foreign research institutions and laboratories and other international organisations in the fields relevant to the objectives of the Institute, especially on problems calling for an application of new tools, methodologies and analytical techniques.
- To disseminate new knowledge and all information relating to geological and allied researches in the Himalaya through publication of monographs, research papers, maps, scientific reports, bibliographies, etc.
- To establish affiliation with recognised universities and institutions of higher learning for the purpose of enabling research scholars to register for post-graduate and research degrees.
- To inspire and to encourage young earth scientists in the study of the geology of the Himalaya.
- To institute a Wadia National Fellowship in Himalayan Geology for carrying out research work at the Institute.

The Institute had its humble beginning in two rooms of the Botany Department of Delhi University. Prof. K.S. Valdiya joined as the first scientist of the Institute in February 1970. Initially, the sphere of activities of the Institute was limited to awarding scholarships and grants to students and teachers from universities for doing research in the Himalaya. The Institute also started organising multi-institutional and multi-disciplinary expeditions to remote areas of Central Himalaya in Kumaon-Garhwal and eastern Himalaya in Arunachal Pradesh. The Himalayan Geology seminars organised by the Institute also became an annual feature and these provided a timely forum for Himalayan geologists from different organisations and universities in India and from abroad for presentation of their data and scientific interaction.



Himalayan Geology Seminar in 1965 when objectives and guidelines of the Institute were prepared

Unfortunately, the founder of the Institute, Prof. D.N. Wadia expired just one year after the inception of the Institute, i.e., in June 1969. It was then that the Institute of Himalayan Geology was renamed as the Wadia Institute of Himalayan Geology to honour Prof. D.N. Wadia for his contributions to the Geology of Himalaya as well as the efforts put in to bring the Institute to its existence.

First Governing body and Research Advisory Committee of the Institute

Members of the First Governing Body of the WIHG Society:

1. Dr. D.N. Wadia (President)
National Professor of Geology, 10, King George Avenue, New Delhi
2. Dr. W.D. West
Professor of Applied Geology, Sagar University, Sagar
3. Dr. I.C. Pandey
Professor of Geology, Panjab University, Chandigarh
4. Dr. R.C. Misra
Professor of Geology, Lucknow University, Lucknow
5. Dr. S. Deb
Professor of Geology, Jadavpur University, Calcutta
6. Dr. R.L. Singh
Professor of Geography, Banaras Hindu University, Varanasi

7. Dr. F. Ahmad
Professor of Geology, Aligarh Muslim University, Aligarh
8. Dr. S.P. Chatterjee
Professor of Geography, Calcutta University, Calcutta
9. Dr. A.G. Jhingran
Professor of Geology, Delhi University, Delhi-7
10. Shri. G. C. Chatterjee, (Member, ex-officio)
Director General, Geological Survey of India
11. Brig. J. S. Paintal, (Member, ex-officio)
Surveyor General, Survey of India
12. Dr. D.S. Kothari, (Member, ex-officio)
Chairman, University Grants Commission
13. Dr. M. S. Krishnan
Director, Geological Survey of India (Retd.)
14. Dr. Hari Narain
Director, National Geophysical Research Institute, Hyderabad
15. Shri L.S. Chandrakant (Member, ex-officio)
Head of the Bureau of Technical Education and Science, Ministry of Education, Government of India,
New Delhi
16. Director, Wadia Institute of Himalayan Geology Society, Delhi University, Delhi.

Members of First Research Advisory Committee Constituted in the Year 1982:

1. Prof. R.C. Mishra President (Chairman)
WIHG Dehradun
2. Prof. V.V. Shastri
Vice President, ONGC, Dehradun.
3. Prof. K.S. Valdiya
Kumaun University, Nainital
4. Dr. M. N. Qureshi
Director (ES) DST New Delhi
5. Dr. M. N. Bose
Director, BSIP, Lucknow
6. Prof. S. B. Bhatia
CAS Geology, Panjab University Chandigarh.
7. Prof. K. N. Khatri
Earth Science Department, Roorkee University, Roorkee
8. Dr. S. Varadrajn
Geology Department, Delhi University, Delhi.
9. Dr. S.C. D. Sah
Director, WIHG, Dehradun
10. Dr. V. C. Thakur
Deputy Director, WIHG, Dehradun.

In 1969, the Wadia Institute was transferred from the Ministry of Education to the newly created Department of Science and Technology. Till the end of 1975, the Institute did not have a permanent Director and even the scientific strength remained only upto 9. In February 1976, Dr. S.C.D. Shah was appointed the first full time Director and the Institute was shifted from Delhi to Dehradun. At Dehradun, the Institute functioned in rented buildings, first at 36 Teg Bahadur Road in Dalanwala, and later at 15 Municipal Road and 159, Vasant Vihar. In 1976, a 15 years' perspective plan for the development and organisation of the Institute was submitted to the Department of Science and Technology, and this plan also proposed that the Institute should have its own building complex and laboratory infrastructure. With the adherent efforts of Sh. S.P. Nautiyal, the then President of the Institute, a piece of land measuring 16.36 acres was acquired at General Mahadeo Singh Road in 1978. The construction of the Institute Complex started with the efforts put in by the President, the Director and Senior Scientists of the Institute who had carefully and meticulously prepared the plans for laboratories and infrastructural complex. The construction of the Office and Institute complex was finally completed by the end of 1982, and all the staff and infrastructure facilities were accordingly shifted from rented buildings to the new laboratory complex at 33, General Mahadeo Singh Road. On 23 October 1983, the institute celebrated birth centenary of its founder, Dr. D.N. Wadia. The Building and Laboratory Complex was formally inaugurated by Sh. K.R. Narayanan, the then Minister of State for Science and Technology, Government of India on 23rd July 1988.



A Commemorative postage stamp released on the Birth Centenary of Dr. D.N. Wadia on October 23, 1984

TIMELINE OF THE INSTITUTE'S INCEPTION & INFRASTRUCTURAL DEVELOPMENT

- June, 1963, Simla : A memorandum to form a Himalayan Geology Institute given to Minister.
- 15th January, 1965 : Scientific Advisory Committee to the Cabinet recommends the proposal.
- 13th December, 1965 : A committee was formed to formulate the objectives and guidelines for the Institute.
- 25th December, 1965 : Committee's first meeting held in Simla.

REMINISCENCES OF GOLDEN DAYS

- 1st March, 1968 : Proposal to form the Institute was formally approved by the Government.
- 29th June, 1968 : Institute of Himalayan Geology was registered as a society and certificate of registration was awarded. The Institute started functioning in the Botany Department of Delhi University.
- June 1970 : First Governing Body of the Institute was constituted.
- 1974-75 : Institute was shifted to a hired building in the vicinity of the Delhi University.
- 1976-77 : Research and Development plan of the Institute was formulated and submitted to the DST.
- 1976-77 : Institute started academic consultancy to various departments.
- 1977-78 : 16.25 Acres of land was purchased in Dehradun.
- 1978-79 : Six research groups were formed that continue to exist even today (2018).
- 1978-79 : Master Plan of Institute's present building complex at 33, General Mahadeo Singh Road, Dehradun was prepared.
- 1980 : Foundation of the new building was laid.
- 1982 : New building of the Institute was ready.
- 1983 : Celebrated Birth Centenary of Professor D.N. Wadia. Hon`ble Minister of State for Science & Technology Shri Shivraj V. Patil, released a commemorative stamp of Prof. D.N. Wadia.
- 1984 : All offices and laboratories of the Institute were shifted to the new building complex.
- 1988 : New Building and the Laboratory complex was formally inaugurated by Dr K.R.Naranayan, the then Minister of State for Science and Technology, Govt. of India and later President of India.



Prof. S.P. Nautiyal laying the foundation of the Institute building

The Institute has come a long way in its growth from a humble beginning in Delhi University to its present status of a full fledged national laboratory with well equipped laboratories and other infrastructural facilities for undertaking advanced level of research in the country. The Institute at present has on its roll 57 scientists, 63 technical, 52 administrative and supporting staff, and 14 contractual staff. The WIHG has now grown into a Centre that has attained both national and international recognition.

Areas of Research

The WIHG carries out basic research in Himalayan Geology and its related fields including geodynamic evolution, mountain building processes, geoenvironment and mineral resources. The research activities of the Institute are conducted through time-bound project mode and the areas of its multi-disciplinary research are organised into the following research groups :

1. Structural Geology and Tectonics
2. Petrology and Geochemistry
3. Biostratigraphy
4. Sedimentology
5. Geomorphology and Environmental Geology
6. Geophysics

The projects are conducted either area-wise specialization or in multi-area wise mode and also involving linkages with other laboratories and organisations in the country.

Research activities of the Institute are supported by specialised laboratories in each group. In addition to these, there is a Central Facility Laboratories system, which includes sophisticated analytical instrument facilities. The other support and logistic facilities include Thin Section Preparation, Photography, Cartography and Field Logistics.

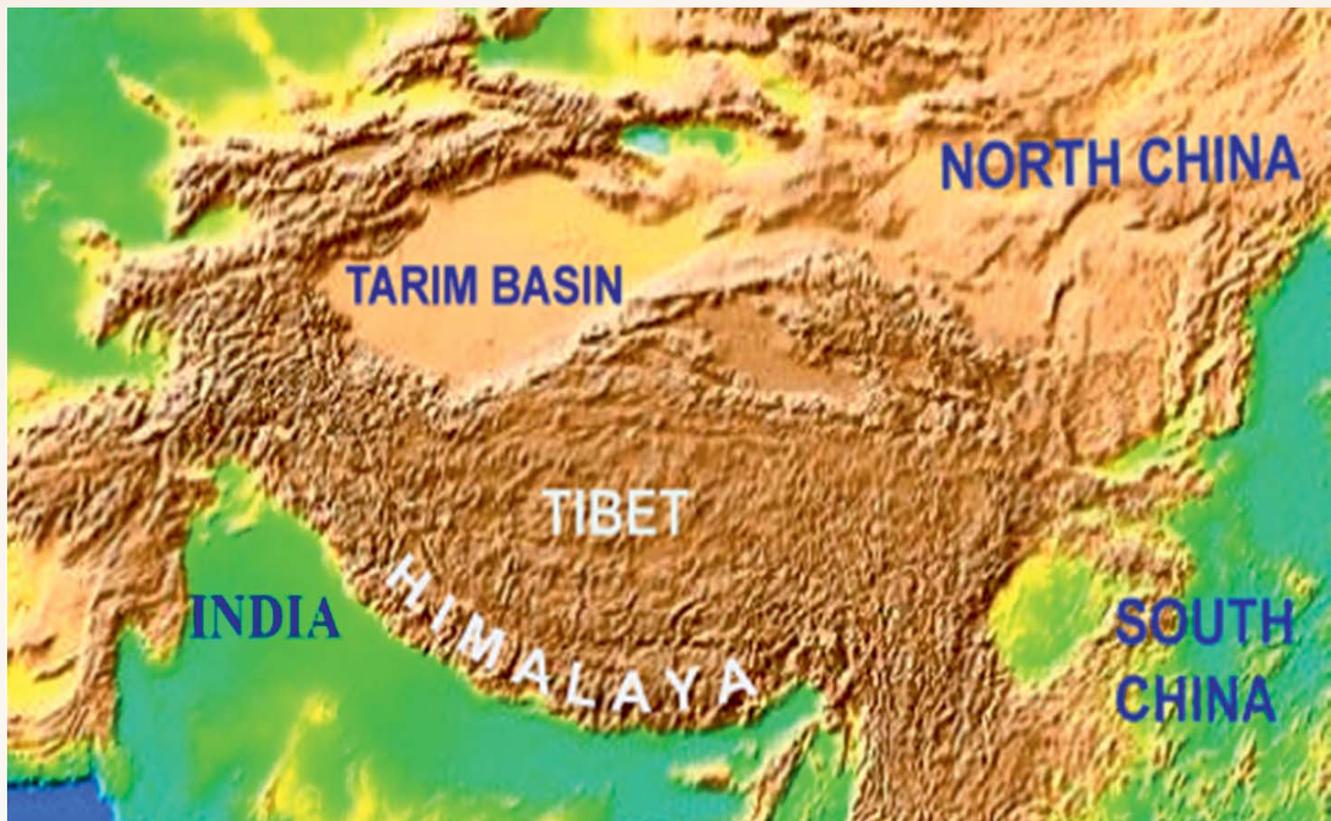
The fields of specialisation in each area of research are as follows :

1. *Structural Geology and Tectonics* – Kinematic analysis of structures in rocks, lineaments using remote sensing techniques, experimental structural geology, regional geology and tectonic analysis, neotectonics and active faults.
2. *Petrology and Geochemistry* – It includes petrology and geochemistry of magmatic (particularly granitoids and volcanics) and metamorphic rocks including geothermometry and geobarometry, ore-microscopy and fluid inclusion, fission track dating, petrological data base and application of computers in petrology.
3. *Biostratigraphy* – Invertebrate and vertebrate palaeontology, micro-palaeontology and palynology. Specialization in conodonts, ostracods, foraminifera, brachiopods and bivalves, early forms of life, stromatolites, algae, megavertebrates and microvertebrates.
4. *Sedimentology* – Clastic sediments particularly fluvial processes, carbonates, Quaternary and recent sediments and magnetostratigraphy.
5. *Geomorphology and Environmental Geology* – Geomorphological processes landforms analysis, palaeoclimatic studies, natural resources, landslides and glaciological studies.
6. *Geophysics* – Seismicity, seismotectonics and gravity studies.

MISSION PROJECTS

The Wadia Institute of Himalayan Geology plays a lead role in geological and geophysical investigations of the Himalaya. Scientists of the Institute work on basic as well as applied aspects and are actively involved in studying scientific issues related to the Himalayan evolution and geodynamics, to understand earthquake activity, glacial-monsoon linkages, climate-tectonic linkages, and study of the crust-mantle boundary across the India-Eurasia plate. The studies include geological mapping, structure and tectonics, petrology

and geochemistry, geochronology, sedimentology, geomorphology, palaeontology, glaciology, hydrological and geophysics. The Institute also offers expert advice on mitigation from climate and natural hazards.



The research activities of the Institute in the recent times are grouped into FIVE Thrust Area Themes (TAT) that are implemented as long-term and short-term projects. These include:

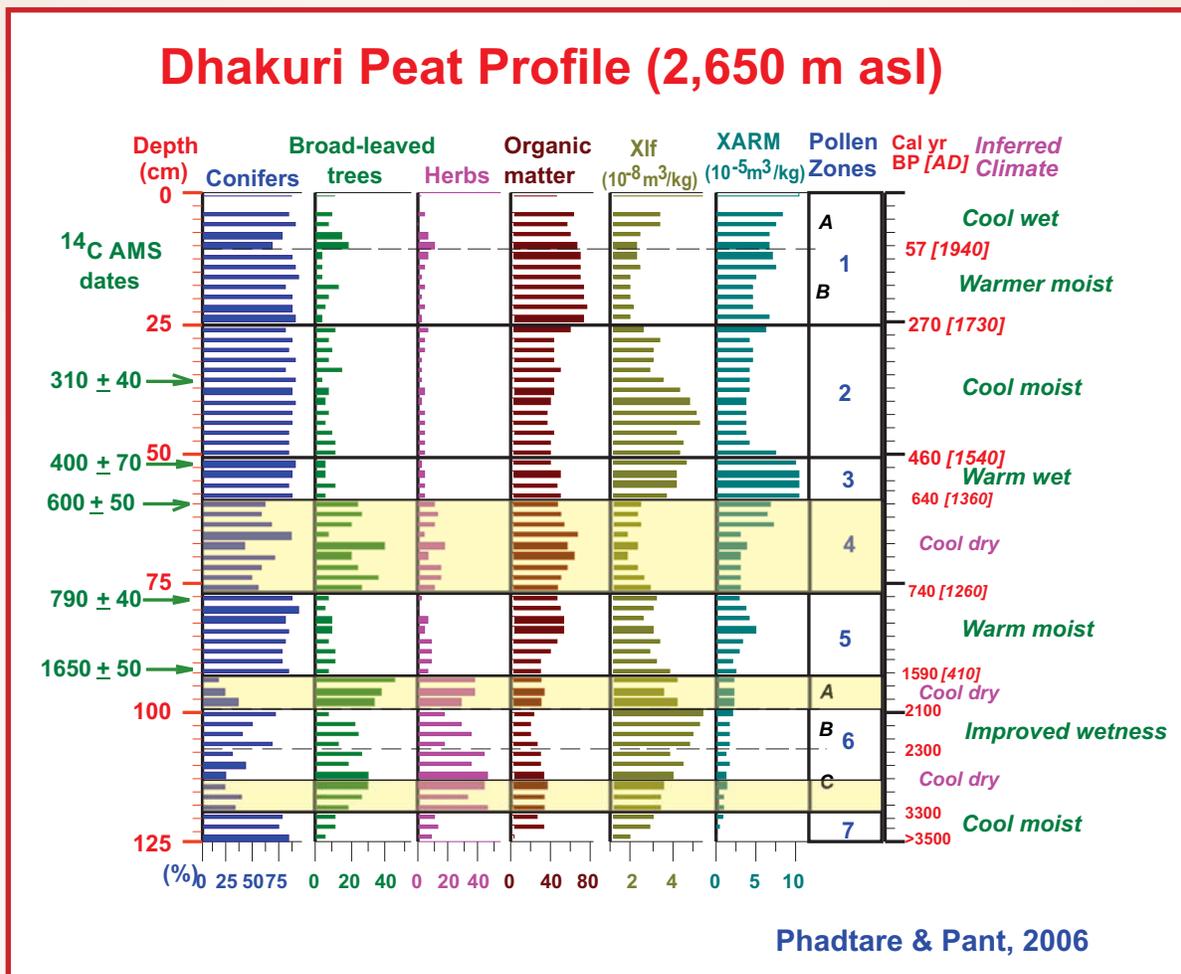
1. Geodynamic evolution of the Himalaya and adjoining mountains,
2. Indian monsoon-tectonics interaction and exhumation of the Himalaya,
3. Earthquake precursor studies and geo-hazard evaluation,
4. Biodiversity-environmental linkage, and
5. Himalayan glaciers, their role in Indian monsoon variability and hydrological changes in the Ganga Basin.

The broad goals of the Thrust Area Themes involve the development of new concepts and models for the geodynamic evolution of the Himalaya through an integrated interdisciplinary approach. The deformation, exhumation and erosion studies are carried out along with tectonic implications on biogeochemical cycles, floral-faunal extinction and their distribution and dispersal in time and space. The sedimentological and fossil records are also used as natural laboratory for testing the evolutionary innovation, diversification, extinction and environmental linkage to various bio-events. The earthquake precursor studies and geo-hazard evaluation involve the geophysical, remote sensing and geotechnical methods that help enhance the knowledge base on the various physical and geodynamic processes causing natural hazards and in implementing suitable mitigation measures. The program on Himalayan glaciers and sustainable natural resources involves the studies in the NW Himalaya on the processes of glacial dynamics and its interaction with global climate change, ore formation, and effect of anthropogenic emissions. Besides development of exploration strategies of natural resources, plan and coordinate research towards understanding physical processes causing natural disasters, evaluate their hazard potential and suggest remedial measures are other areas of interest.

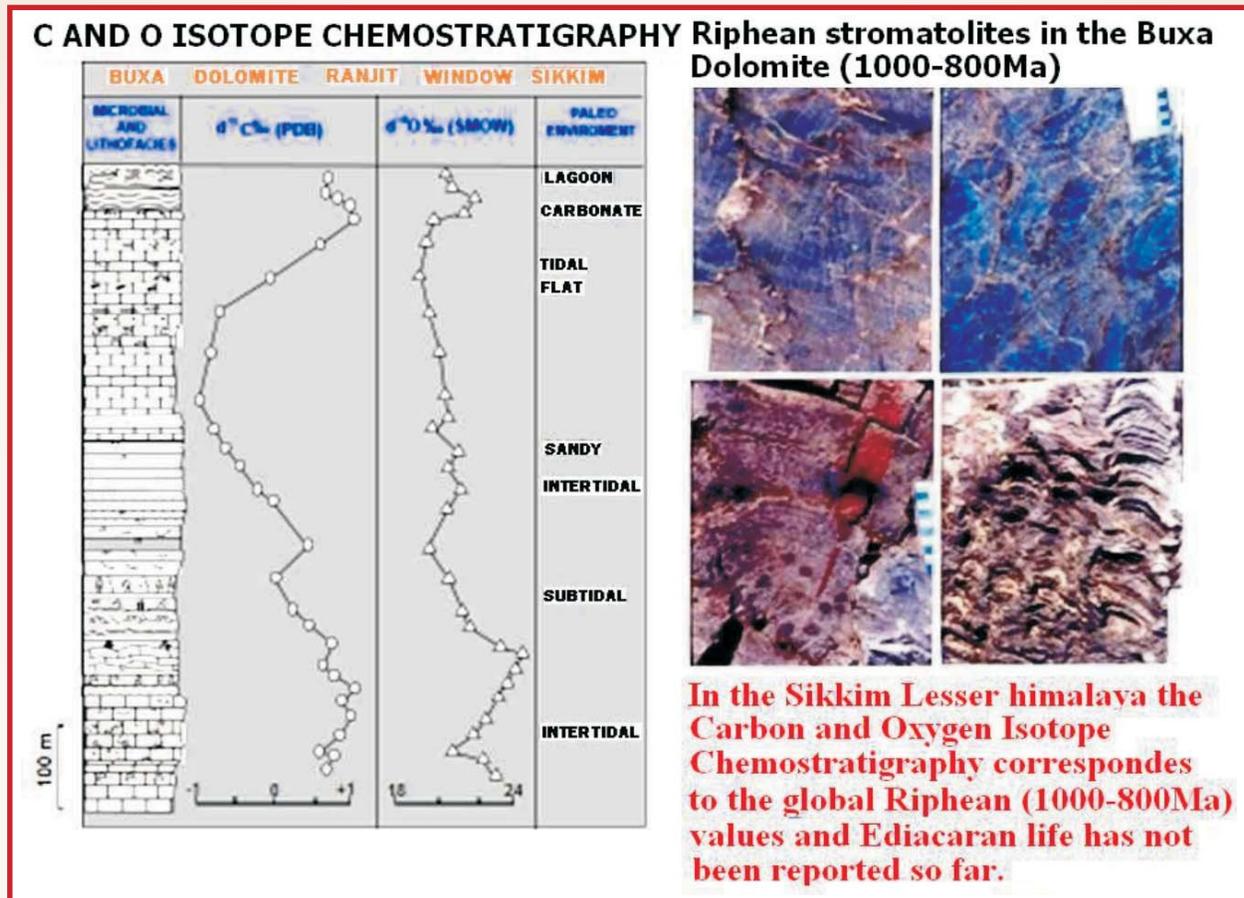
SOME HIGHLIGHTS

The multitude of data collated and synthesized by unstinted hard work of the WIHG scientists has greatly enhanced our knowledge on the geodynamic evolution of the Himalaya, in particular the processes and timing of subduction and exhumation in relation to India-Asia collision. Some salient achievements or highlights of the studies carried out by the Institute scientists are as follows:

- First ever passive seismology experiment around the Eastern Himalayan Syntaxis shows the presence of Moho at a depth of 47 km beneath Brahmaputra valley that gradually increases towards East and attains a depth of 62 km at the suture zone.
- Crustal thickness estimated using BBS in the NW Himalaya reveals gradual thickening of crust from ~46 km beneath the Sub-Himalaya to ~50 km beneath the Higher Himalaya and ~62 km in the Tethyan Himalaya. The Poisson's ratio measurements also show significant variation from south to north along the profile and are higher in the Tethyan Himalaya.
- The spatial variation in cooling ages, exhumation rates and seismicity of Kumaun-Garhwal region indicates that the Kumaun region as a single block, has undergone a rapid exhumation rate of ~4 m/Ma, and Garhwal region with a rate of ~1.5 m/Ma, a result of tectonic activity along the Main Central Thrust/Munsiari Thrust.
- Coesite and microdiamond were discovered in the Himalaya from the Tso-Morari Crystalline Complex, Ladakh, suggesting the derivation of material from depths greater than 120 km.
- The crustal growth in the Shyok-Darbuk corridor of the NE Ladakh can be explained by two stage melting processes involving the generation of orthogneiss with mafic enclaves (pre-collision), and temporal evolution towards increasingly more evolved felsic magmas during reworking processes (post-collision).
- For the first time 'plagiogranites', considered to be the end products of differentiation of tholeiitic magmas were reported to the north of Kyun Tso in the eastern Nidar Ophiolitic sequence.
- The pelitic rocks from Sutlej valley, NW Himalaya show peak P-T conditions of 9.1 kbar and 625°C respectively, suggesting exhumation from great crustal depth.
- 'Stannoidite' an unusual sulphide of Cu, Fe, Sn and Zn within chalcopyrite is reported for the first time in the eastern Kumaun region, which suggests the genesis of polymetallic sulphide mineralization due to cooling of high temperature and sulphur fugacity hydrothermal solution.
- Minamiite, a Ca-bearing hydrous sulphate mineral, is reported for the first time in India from the Deccan Volcanic Province at Matanumadh (Kachchh, Gujarat). This can serve as a potential Earth analogue for the Mars and the Martian conditions.
- Speleothem proxy records from Mawmluh Cave, Meghalaya reflect abrupt increase in the Indian Summer Monsoon strength during the Bølling-Allerød and early Holocene periods and pronounced weakening during the Heinrich and Younger Dryas cold events.
- The multi-parameter climate records from Dhakuri peat deposit in the Pindar Valley revealed four major (ca. 100 cal BC-100 cal AD, 285-360, 1250-1370 and 1570-1700 cal AD) and two minor (around 900 and 1750-1850 cal AD) dry climate events in Kumaun Himalaya.



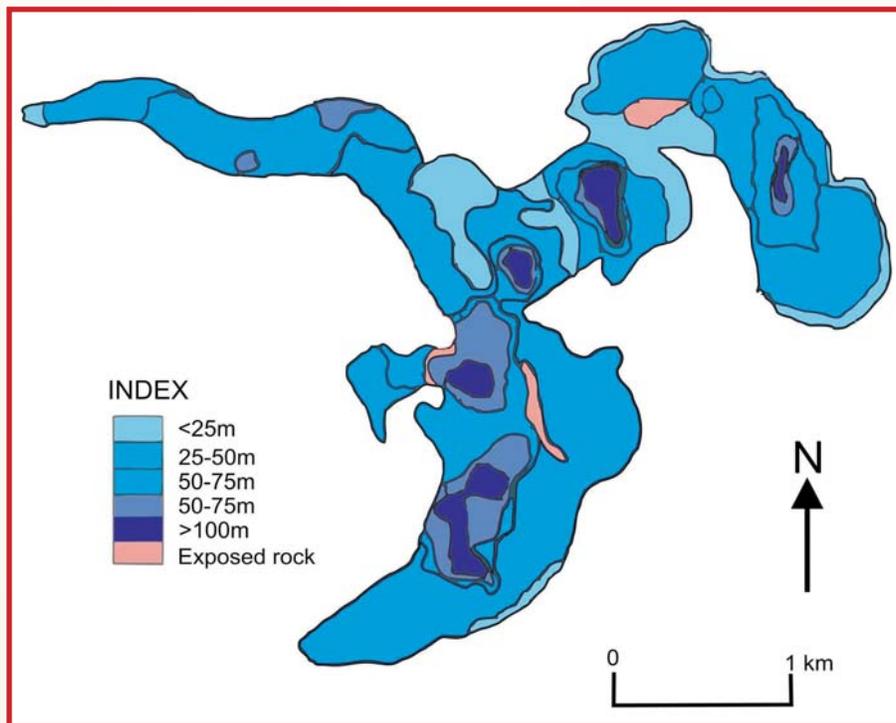
- The chronology of paleoflood deposits of the Himalaya established by OSL and ^{14}C AMS dating techniques, indicate: (i) The Alaknanda-Mandakini Rivers experienced large floods during the wet and warm Medieval Climate Anomaly; (ii) the Indus River experienced at least 14 large floods during the Holocene Climatic Optimum and magnetic susceptibility of flood sediments indicates that 10 out of 14 floods originated in the catchments draining the Ladakh Batholith; and (iii) the Brahmaputra River experienced a megaflood between 8 and 6 ka.
- The species *Alnus nepalensis* has been identified as a natural indicator for landslide prone areas. It is being used as a sampling tool for the generation of viable ecological model with geo-biodiversity and aspect management approach.
- The carbon isotope analyses ($\delta^{13}\text{C}$) of the representative samples of Almora graphite suggested that the graphite has crystallized from biogenic carbon during the metamorphism of the host sediments.
- The C and O isotopic analysis of Palaeocene algal-foraminiferal Lakadong Limestone from the Mawsynram section suggest a shallow marine environment of the deposition.
- A large number of Uvigerinid benthic foraminifera of upper bathyal environment in the Upper Disang (Middle to Late Eocene) of Nagaland suggests a possible source rock for hydrocarbon generation.
- The carbon and oxygen isotope chemostratigraphy of the Buxa Dolomite in the Western and Eastern Arunachal Lesser Himalaya are globally comparable with the Lower Permian Gondwana sedimentation in the Western and Eastern Gondwanaland.



- In the Cambrian successions of Parahio Valley (Spiti Basin) presence of ichnofossil assemblage and trilobite demarcate lower and middle Cambrian stratigraphic marker and indicate environmental transition from dysaerobic to aerobic.
- The identification and study of ancestral form of whales from a huge faunal collection from the Kalakot area, J&K demonstrate that whales evolved from an aquatic group of mammals living in freshwater bodies rather than on land, necessitating the revisions in the views held so far that whales had land-dwelling ancestors.
- Fossil bones and dentitions of primates and other mammals from Early Eocene Climatic Optimum show close similarity with contemporaneous fauna from Europe indicating faunal connection with that continent during the Early Eocene (~53 million year ago).
- A mineral map of the Uttarakhand is published depicting the occurrence of different minerals in various lithotectonic units.
- A systematic glacier lake inventory has been prepared from satellite images (2011-2013) for the Uttarakhand Himalaya. 1266 lakes were identified. This will help to understand the state and fate of glaciers, including the disaster potential (GLOF) in the region.
- The Institute was involved in the DST flagship programme to Map the Neighbourhood of Uttarakhand (MANU) for the Yamuna and the Bhagirathi valleys after the June 2013 Kedarnath disaster, in order to help in the sustainable development of the region.
- For the first time in the country, the tapping and using of the geothermal energy for room heating has been demonstrated in Chumathang region of Ladakh.
- Scientists carried out survey for the all-weather road connectivity between Manali and Leh, and other

sectors in the rugged Ladakh Himalaya for the Border Road Organisations (BRO).

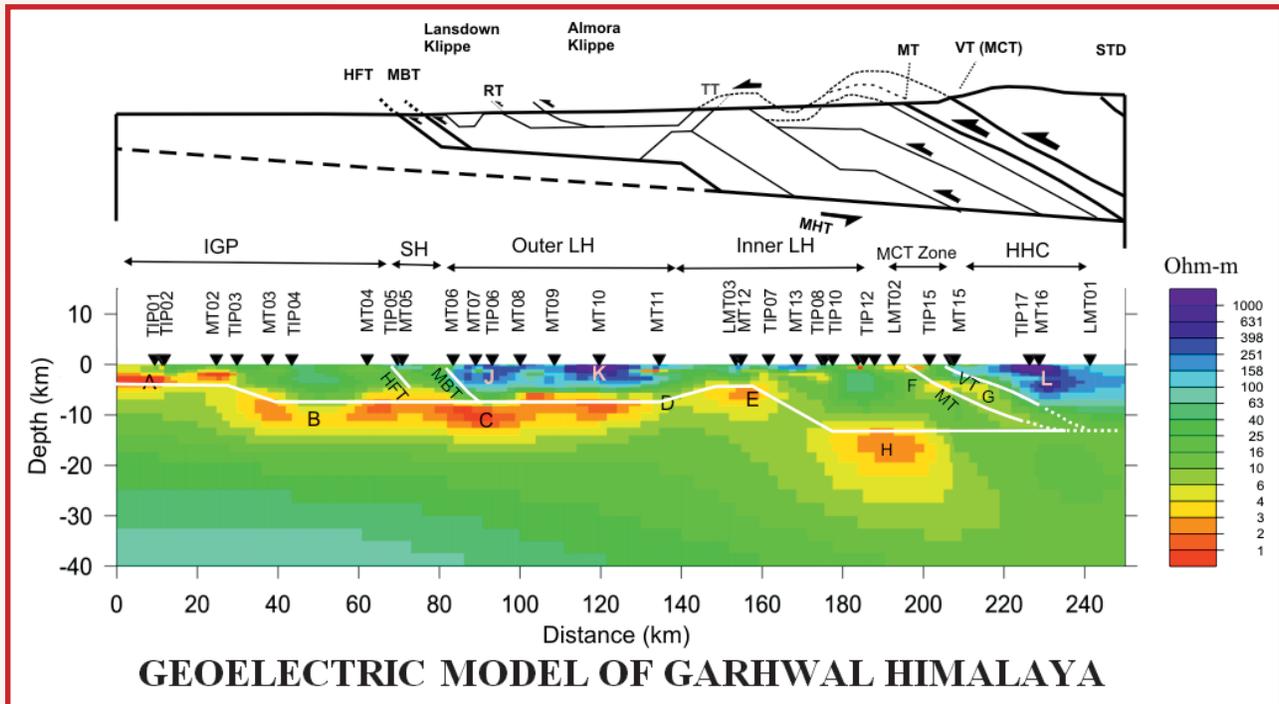
- Institute organized five days training programme for the officers of the Rail Vikas Nigam Ltd (RVNL) that has the responsibility of making 110 km rail route (mostly through tunnels) in the Himalayan terrain between Rishikesh and Karanprayag (Garhwal Himalaya).
- Survey was carried out for the district Administration of J&K after the 2014 flood to demarcate the safer areas for rehabilitating people in the Udhampur district.
- Institute has carried out field and analytical studies of the buried course of River Saraswati and found signature of existence of this river until ~1.7 kilo years before Present.
- A new program combining powerful InSAR and on-going GPS campaign surveys around the Tehri reservoir was taken up to better constrain the uplift/subsidence associated with annual loading/unloading of the reservoir.
- Glacier monitoring of Dokriani and Chorabari during 2010-2015 reveals the mean recession rate of the snout to be ~7 m/yr, and ~5-7 m/yr, respectively.
- Field evidences, on the basis of loops of lateral and terminal moraines suggest that there were four phases of advances and retreat of the Dokriani Bamak glacier over the last ~315 years.
- Colonization delay of *Rhizocarpon geographicum* species of lichen in the Gangotri glacier environment has been interpreted to be about 78 years for granite and between 50 and 78 years for the gneisses. The study of lichen help in establishing the absolute ages of the various terminal moraines of the Gangotri glacier, which in turn will help to ascertain its recession history.



Ice thickness map of Dokriani Glacier

- The frequency-dependent attenuation of P and S waves in the Garhwal Himalaya indicate that the Garhwal region falls under tectonically active areas of the world with dominance of scattering attenuation.
- A pronounced intra crustal low velocity layer with the depth range of ~10 to ~35 km is observed in all the seismic stations of the Ladakh region.

- Processing of repeat measurements over the GPS network revealed shortening of nearly 15 mm/yr within a 100 km narrow, arc-parallel zone, confined between the MBT and MCT.
- Electrical Resistivity Model across the Indus Suture of the NW Himalaya was obtained by the inversion of long period magnetotelluric data.



- Magnetotelluric studies in Bijnaur-Malari profile reveals mid-crustal ramp structure at shallow depths (10-15 km) which steeply dips beneath MCT zone upto a depth of 20 km.
- The ground motion estimation at different sites in Doon Valley, Uttarakhand, India was carried out using Horizontal to Vertical Spectral Ratio (HVSr) technique of Microtremor (Ground Ambient Noise). It was observed that the use of microtremor, constitutes an effective and inexpensive approach to site response and soft soil thickness estimation for preliminary microzonation results.
- Continuous radon monitoring in a 68 m deep borehole in the Garhwal Himalaya, and the abnormalities observed in radon emanation and other parameters in the borehole have shown to be precursory signature for the July 23, 2007 Kharsali earthquake of M4.9, that had an epicenter distance of 60 km.

PROMOTION OF RESEARCH AND HUMAN RESOURCE DEVELOPMENT

To promote geoscience research in the Himalaya, the Institute regularly organizes seminars, symposia and workshops on specialized themes related to Himalayan Geology. The Institute has organized a series of UNESCO sponsored regional training courses in ‘Structural Geology’ for Central and South Asian countries and three special courses in ‘Analytical Techniques and Data Interpretation in Petrology and Geochemistry’. It has also organized courses in paleoseismology and application of G.P.S. in crustal deformation. Young earth scientists attend the courses from India and abroad, especially from South Asia. The Institute scientists also conduct a training course in Geology for IFS probationers. To promote academic and scientific interaction, a number of Distinguished Scientists are invited to deliver special lectures regularly on National Science Day, Technology Day, Founder’s Day, Foundation Day and other days. As a part of research promotion the Institute organized international workshops such as the ‘30th Himalaya-Karakoram-Tibet (HKT)’ and ‘4th Third Pole Environment Workshop’. In the honour of doyens

of Geoscience, Institute has regular 'Lecture Series' such as 'D.N. Wadia Honorary Lecture', 'J.B. Auden Memorial Lecture', 'W.D. West Memorial Lecture' and 'S.P. Nautiyal Memorial Lecture'. These are organized by inviting eminent scientists from various organization to deliver the lecturers. The Institute also has bilateral exchange programs with Russia, USA and Hungary. The Institute scientists also participate in International Geological Correlation Programme (IGCP), International Lithosphere Programme (ILP), and International Geosphere Biosphere Programme (IGBP). Several programs have been initiated especially for young researchers. These include a protracted summer and winter training program and a large number of fellowships that lead to Ph.D. program as well as post-doctoral research. The Institute has been recognized as a Centre of excellence by a number of universities to guide research students for Ph.D. in Earth Sciences. Around 150 post-graduate students from different parts of the country are also given winter/summer training every year. Since 2016, the Institute organises every year National Geo-Research Scholars Meet to encourage young research students to present their research findings and provide a platform to them to develop and share new ideas on geoscience research.

AWARDS AND HONOURS

The Institute's scientists have achieved both National and International recognition through their excellence in research. Eight of its scientists have received National Mineral Award (Geosciences Award), while others have been elected Fellows of Indian Academy of Sciences. Scientists have also received awards like: L. Rama Rao Medal, M.S. Krishnan Gold Medal, K. Naha Award, S. S. Merh Award, C. Radhakrishna Murthy Medal, M.K. Ray Medal, Subba Rao Medal, Hari Narain Award, Electrotek and Geometrics Endowment Award, The Third World Academy of Sciences (TWAS) Prize, Young Research Award by Ministry of Mines, J.C. Bose National Fellowship, Doon Ratan Award, Uttarakhand Gaurav Award and also as 'Heroes of Environment' by Times Magazine,. The Institute's scientists have been holding positions not only in National Committees, but also in International Committees and Editorial Boards of several Indian and Foreign journals. Six books on Himalayan Geology by Institute scientists have been published by the international publishers.

COLLABORATIONS

To provide inter-linkage with sister institutions and share complimentary expertise in areas of overlapping interests, Institute has entered the MoU's at National level with Indian Institute of Remote Sensing (IIRS), Dehradun to understand the Geodynamics and Seismicity in the NW Himalaya, with Central Soil and Water Conservation Research Training Institute (CSWCRTI), Dehradun to carry out Hydrological investigations in the Himalaya, with National Geophysical Research Institute (NGRI), Hyderabad to understand the subsurface structure and Seismicity in the NW Himalaya, and also with BSIP, NRSA and CSIO. Institute has affiliation with IIT Roorkee, Kumaun, HNB Garhwal, Jammu, Doon, Graphic Era and other universities like UPES, Dehradun for Ph.D registration.

At International level it has collaborations with the University of Iceland, University of Akureyri (North Iceland) and the Icelandic Meteorological Office for Earthquake prediction and earthquake hazard mitigation in the Himalayan Region, with ISTERre, University of Savoie, France for the studies of Neotectonic activities, John Hopkins University, and Royal Belgian Institute of Natural Sciences for vertebrate palaeontological studies, an Indo-Norwegian bilateral exchange program to carryout studies on Geothermal Energy and Earthquake risk and assessment/slope stability, particularly in Mussoorie and Nainital townships.

LABORATORY FACILITIES

From time to time Institute took up priority-based programmes for setting up new as well as up-gradation of existing analytical laboratory facilities by introduction of new equipments. Institute is well equipped with

sophisticated analytical instrument facilities, which are run by competent scientists and technical staff. Laboratories provide facilities to research scientists of the Institute as well to researchers from the universities and other organizations from across the country. The laboratory facilities of the Institute are organised in two modes –

- (a) Central Facility Laboratories and,
- (b) Group Laboratories.

Central Facility Laboratories

Following are some important equipments, facilities available in the Institute:

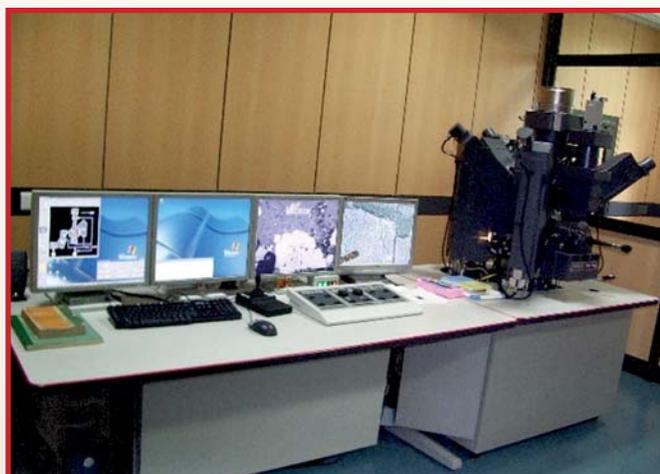
- LA-MC-ICP-MS (Thermo Scientific Neptune Plus) and Ultra clean chemistry lab for isotope geochemistry and geochronological dating of rocks.
- Stable Isotope Mass Spectrometer (Thermo Scientific Flash 2000 Isotope ratio MS) for stable isotopic studies.
- EPMA (CAMECA SX-100) for quantitative analysis of minerals and ores.
- ICP-MS (Perkin Elmer) for REE and trace elements analysis in ppb and ppt levels.
- XRF (Bruker S8 Tiger) for major and trace elemental analysis of rocks and soils.
- SEM with EDAX (Carl Zeiss EVO 40) to study the surface morphology of microfossils, minerals and ore minerals.



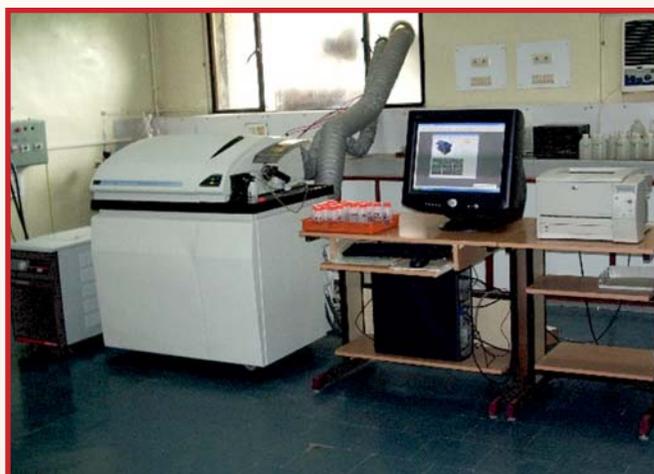
Thermo Scientific 'Neptune Plus' LA-MC-ICP MS



Thermo FLASH 2000 Isotope Ratio MS for Stable Isotopes



Cameca SX-100 EPMA



Perkin Elmer ICP-MS



XRF Bruker S8 Tiger



PANalytical X'Pert Pro*** XRD

- X-ray Diffractometer (PANalytical X'Pert Pro*** XRD) for identification of different phases of minerals and compounds.
- Raman Spectrometer (Horiba JY Labram HR) for mineral, fluid phase identification.
- Heating and cooling stage to carry out fluid inclusion studies for genesis of ore deposits and micro-thermometry.
- Fission Track Dating – for dating of minerals like apatite, zircon, etc.
- Ion Chromatograph (DIONEX DX - 500) for measurement of cations and anions mainly for water chemistry.
- TL/OSL instrument for dating Quaternary sediments.
- Particle Size Analyzer - Master Sizer - E (Malvern Instrument) - for determining particle size.
- Gravity meters, Global Positioning System (GPS) and Digital (Broad band) and Analog Seismic Recorders for studies related to crustal movement and earthquakes.
- Geo-technical laboratory for soils and rocks.
- Magnetostratigraphic Dating (Digital Spinner Magnetometer-DSM 2), Thermal Specimen Demagnetiser (TSD-2), Alternating Field Demagnetiser (Molspin) - to analyse the remnant magnetism in rocks.
- Remote Sensing Lab for active fault mapping and glaciological studies.
- Ground Penetration Radar (GPR), Automatic Weather Station (AWS), Differential Global Positioning System (DGPS) with data processing software, Total Station (ATR), Conventional Meteorological Observatory, Aethalometer and Laser Isotope Analyzer (LWIA) for Glaciological studies in the Himalaya.

Group Laboratories

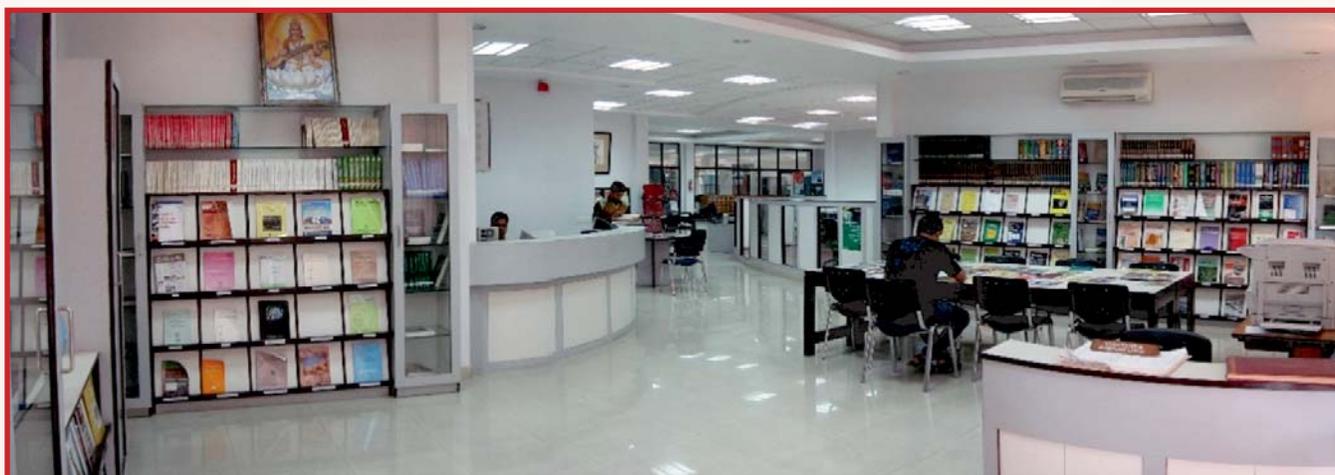
Each research group has its own specialised laboratories for undertaking analysis in their own field of research. The Group Laboratories include Palaeontology laboratories (Vertebrate Palaeontology, Invertebrate Palaeontology, Microscopy and Total Carbon, Palynology and Dendroclimatology laboratories), Sedimentology laboratory, Experimental Model Deformation lab, Optical laboratory, Fluid Inclusion Unit, Fission Track Dating laboratory and Seismology laboratory.

CONSULTANCY

Institute has provided consultancy services on geotechnical feasibility of micro-hydel projects to Himachal Pradesh and Uttarakhand, and landslides and their control, monitoring and management in Himachal Pradesh, Uttarakhand and Arunachal Pradesh. The Institute's experts provide a specialized consultancy service in site-selection for railways, bridges in the Himalayan terrain, deep tube-wells, multistoried building complexes, ropeways, transmission towers, control of landslides and road alignments including alignment of tunnels, site selection for barrages and power houses and environmental problems. The Institute has potential expertise of giving consultancy for small engineering related projects, drinking water and groundwater surveys. Also, through its laboratory infrastructure facilities, the Institute provides analytical services to researchers of universities and other organizations. Institute is also represented on major National committees, e.g., H.P.C. for preparation of Disaster management plans, Task forces for landslide zonation, Geotechnical investigations, etc.

LIBRARY, PUBLICATION AND DOCUMENTATION

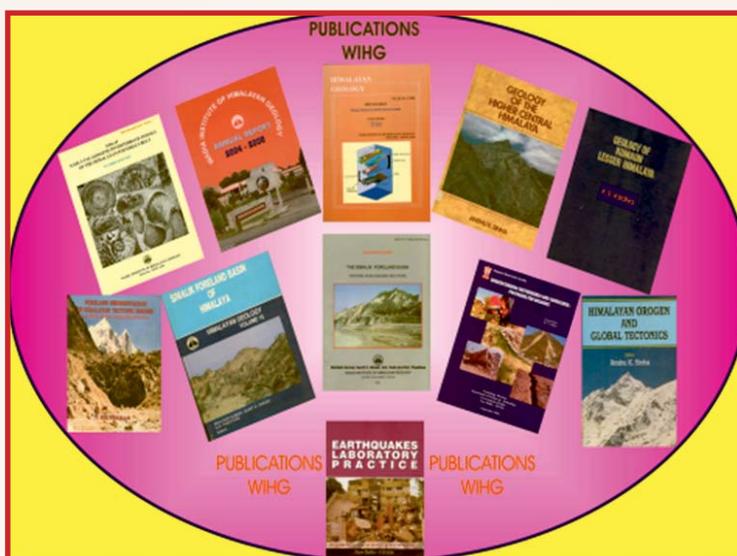
Swami Vivekanand Library of the Wadia Institute of Himalayan Geology is an exceptional Library of its kind, housing one of the finest collection of books, monographs, journals, e-books and others on the mountain building process, geological and geophysical phenomenon with special reference to the Himalaya. As of now the total collection of books in the Library crosses 32,000. The Library subscribes to 84 Foreign and 44 Indian journals. The personal collection of Prof. D.N. Wadia donated by Mrs. Mehr Wadia, is a valuable asset which contains old records and memoirs of the Geological Survey of India and some rare publications of the Geological Societies of London and America. The library also houses a large number of books and other publications donated by eminent geoscientists. The collection and services offered makes it one of the best libraries in the country in the field of Earth Sciences. The digitised articles were added to the Institutional Repository created using DSpace (OSS) for organizing and disseminating the research output of the Institute. The articles published by Institute scientists in various journals were also digitised. The Library has a small hub of computers for accessing the e-books and e-journals and Internet surfing and the other e-resources available, either subscribed by WIHG Library or made available through the National Knowledge Resource Consortium (NKRC). The Library has online access to numerous publishers who contribute more than four hundred journal titles, other than those subscribed by the Institute.



Panoramic view of the Institute Library

The Institute has Publication and Documentation facilities to bring out bibliographies, geoabstracts, monographs and field excursion guides. The Institute publishes a biannual Journal "Himalayan Geology", and till 2016 it has published 36 volumes. The publication and documentation section also brings out 'Annual Report' of the Institute both in Hindi and English, Annual Hindi magazine 'Ashmika', Quarterly

Newsletter 'BhugarbhVani', and 'Drishtikon' a half yearly newsletter of research scholars. The section also provides technical support to scientists, research scholars and other staff of the Institute.

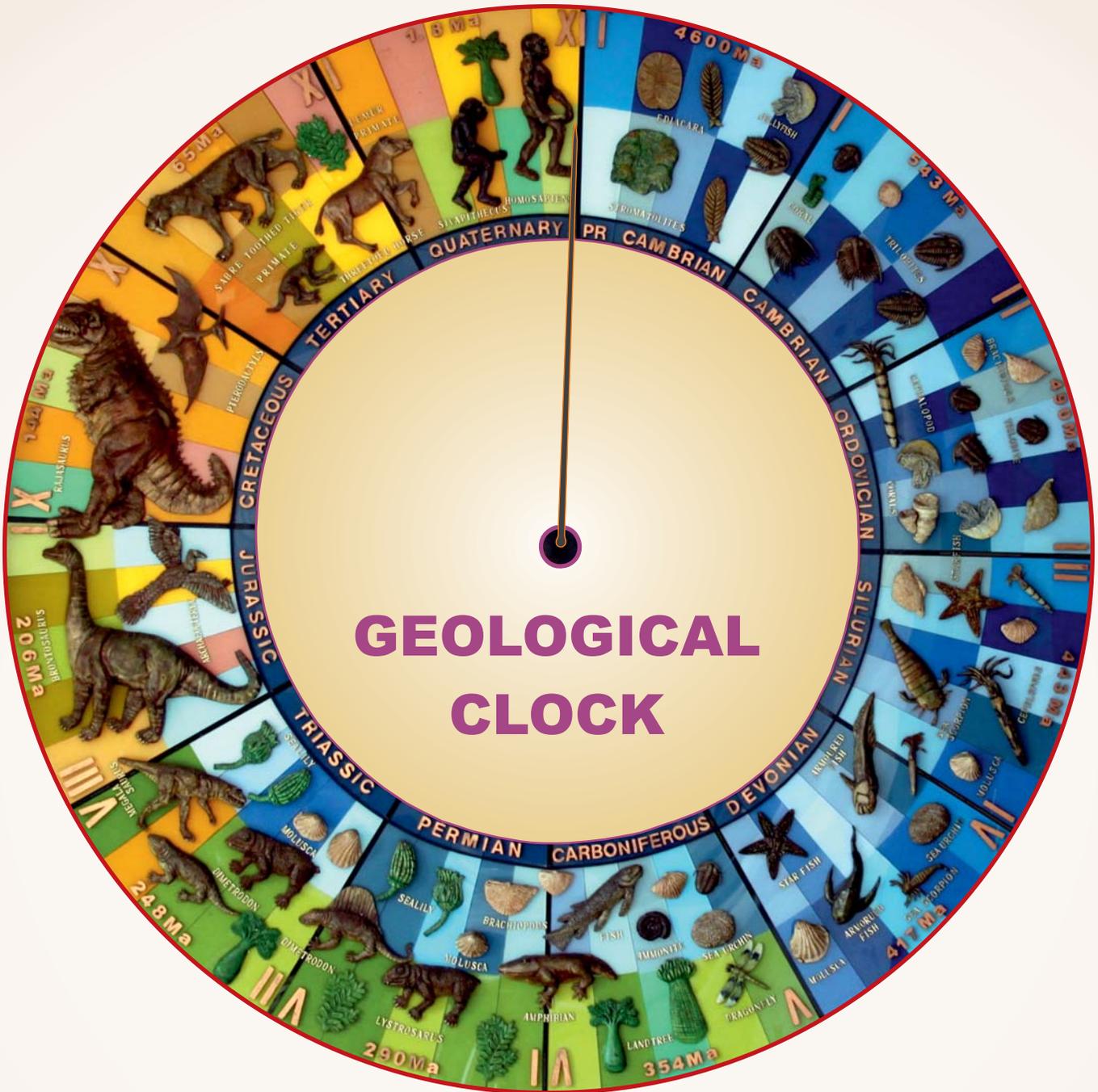


MUSEUM

One of the highlights of the Institute is S.P. Nautiyal Museum which is one of the best Earth Science Museums in India and is very popular among school children and university students. It is developed to educate students and general public about the role of Institute in Earth Sciences, and remains the main center of attraction for National and International visitors. The museum offers a glimpse of the mighty Himalaya, its origin, evolution in time and space, natural resources, life in the geological past, earthquakes, landslides and environmental aspects. It displays geological maps, charts, samples, models as well as various educational awareness exhibits including video films on Himalaya and general geology. The Museum remains open to the general public on all working days. The Museum is visited by more than 10,000 people each year from different parts of India and other countries. A model of extinct species of Giraffe prepared from waste material is kept for display in the WIHG lawn. The model not only provides interesting and important information regarding the extinct species of the Giraffe but also sends out message of saving the environment. The Museum keeps open days every year on National Science Day, Technology Day, International Museum Day, Environment Day; Foundation Day and on Founders Day. Besides this Science Quiz and Hindi essay competitions are being organised every year on the National Science Week. Brochures containing important information regarding the Institute activities, and the “Do's and Dont's” during and after earthquake are published in bilingual language (English and Hindi) and are provided free of cost to the visitors.



Partial view of the Institute Museum



'Geological Clock' is a projection of Earth's history of 4.5 billion years. It is a graphic aid that helps to visualize the geological past and lets us know as to what kind of organism appeared, dominated the earth or vanished from the earth and when.

Historical account of Institute's Research Activities

Dr. K.S. Valdiya, Dr. S.K. Tandon, Dr. V.C. Thakur and Dr. A.K. Jain were the first batch of scientists who started working on (i) Stratigraphy and Tectonics of Kumaon Lesser Himalaya, (ii) Stratigraphy and Tectonics of Arunachal Himalaya, (iii) Study of Dalhousie granite of Himachal Himalaya. Eleven research papers were published by Institute scientists in 1972-73 including one in Science. The work continued in similar directions with Dr. S.K. Shah and Dr. Anshu K. Sinha joining the team in 1973-74. The strength went upto 20 in 1977, which at present is 58.

Wadia Institute, since its inception, started organizing annual seminar of Himalayan Geology. In its fifth edition that was held at HNB Garhwal University during 29-31 October, 1974, the Institute played a decisive role in Standardisation of Nomenclature in Himalayan Geology. The meeting was attended by 20 scientists from different universities, Geological Survey of India, Oil and Natural Gas Commission (now Corporation) with the Director of Wadia Institute of Himalayan Geology as Chairman and Convenor of the meet organization.

During the year 1977 the Institute made significant discoveries of magnesite deposits in Kumaun Himalaya and ores of manganese, lead and copper were reported from Ladakh. High grade metamorphic rocks were discovered in Ladakh. Using fission track chronometers uplift and exhumation rates of Mandi granite in Sulej valley were reported. During the year 1976-77 Institute scientists started providing advisory services with the first report submitted on the structural problems in Giri Hydel Project (H.P. State Electricity Board), and a comprehensive report on ecological problems in high altitude lakes submitted to National Committee on Environmental Planning and Co-ordination and to Department of Science and Technology (DST). In the year 1978-79 Institute's research activities were organized into six groups (1) Structure and Tectonics, (2) Petrology and Mineralogy, (3) Biostratigraphy, (4) Sedimentology, (5) Geochemistry, and (6) Quaternary Geology-Geomorphology.

Mineral deposits in Nubra-Shyok, Kumaun-Garhwal, Arunachal Pradesh, with significant economic worth were identified in the year 1978-79 and the research team established the litho-tectonic set up of Shyok valley, Ladakh ranges, Indus Valley and Zaskar ranges. The same year the Government of India involved Wadia Institute as consulting institution on Himalayan Geology.

The major focus until 1977 was to build up stratigraphy and to understand tectonics of the Himalaya. It was in the year 1977-78 when Institute started three long term research projects: (i) LT-1 on Indus Suture Zone of Ladakh Himalaya, (ii) LT-2 on Higher and Tethys Himalaya of Garhwal and Kumaun, and (iii) LT-3 on Arunachal Himalaya. Around the same year a new thrust on Geomorphologic studies was made by initiating a project on Palaeoglaciaticion of Kashmir Himalaya and Kumaun Himalaya. In the year 1980-81 lab based modelling experiments to understand deformation kinematics in Himalaya was setup. In the subsequent year a major study on the faunal stratigraphy of Tethyan Himalaya was established and first record of Gauss-Matuyama boundary and biostratigraphic zonation was established in Indian Siwalik. In the year 1984 and later the institute was instrumental in proposing two stage collision model in the evolution of Himalaya where the Ophiolites component of the melange was identified as Tethyan oceanic crust. The Holocene of Karewas was elaborated. Precambrian-Cambrian stromatolite and colonial Archaeocyatha were reported from Mussoori Hills that helped in re-defining the stratigraphy of Himalaya. The first Geological traverse was made across the Chota Sigri Glacier. Stratigraphy and volcanics of the Indus Suture zone was established. Later in the year 1985, WIHG scientists highlighted the shortcomings of thin skinned tectonics in the evolution of Himalaya and detailed sedimentologic model of Siwalik succession was established. The Year 1989 saw establishing of geochronology of Rampur volcanics to 2.5 Ga using $^{144}\text{Nd}/^{145}\text{Nd}$ method, and using the Rb-Sr method Pc-C boundary was pin-pointed at 624 ± 10 Ma in Mussoorie hills. In the



2nd Seminar on Himalayan Geology, 28-30 September, 1967, Centre of Advanced Study in Geology, Panjab University, Chandigarh

- Chairs** : S.C.D. Sah, O.P. Varma, R.N. Lakhanpal, S.B. Bhatia, D.B. Sikka, Kedar Narain, A.G. Jhingran, Suraj Bhan (Vice Chancellor), I.C. Pandey, R.C. Misra, Y.L. Khullar, B.S. Tewari, M.N. Bose, Dipankar Niyogi, M.N. Mehrotra.
- 1st Row** : P.K. Mehta, C.P. Vohra, M.N. Saxena, G.S. Roonwal, S.C. Bhattacharya, B.K. Das, V. Raiverman, R.P. Rao, S.K. Shah, T.R. Bhatia, K.S. Raman, D.M. Banerjee, Ratesh Kumar, V.K. Gairola, Subhash Sharma, D.C. Gupta, V. Subramanian, A.D. Kharakwal.
- 2nd Row** : J.S. Jiwan, Surinder Kumar, D.K. Chaddha, P.K. Bose, B.C. Narula, G.L. Badam, N.S. Viridi, A.C. Nanda, P.K. Bisaria, D.S.K. Rao, Gurcharan Singh, Naresh Kochar, Anil Bhandari, A.M. Patwardhan, R.S. Chaudhury.

subsequent years, the intrusives in the Panjal traps were dated using Rb-Sr to 161 ± 5 Ma. Geomorphic and hydro-geological maps of Kangra and Doon valley, respectively were prepared. Soft bodied metazoans Ediacara were recorded from the Haimanta Group in the Pin Valley and the Pc-C boundary was demarcated in the Kunzum-La formation.

Seismic observatory at Dharamshala was established and in the year 1991 the Uttarkashi earthquake was successfully recorded and studied. In 1993, the fossil skull of *Rinoceros* (Rhinocerotid) was discovered from the Liyan formation of Ladakh. Petrography and Rb-Sr data of granitic intrusives into Wangtu gneiss suggested a large scale granitic magmatism at 1895 ± 64 Ma. The first compilation of the metabasic reference standard (MB-H) was established. An Early Vendian unconformity at ~ 650 My was characterized in the Tethyan Himalaya of Lahul-Spiti. Early Eocene Rodent record from Subathu of Himachal and J&K was established suggesting into-India hypothesis of evolution at ~ 55 Ma. Geochemical signatures of Zildat ophiolitic melange indicated Alkaline-sub Alkaline volcanic activity. Fluid inclusion study of rocks from Srimacher region of East Antarctica indicated three stages of fluid entrapment with various carbonic phases. Micro-structural and Quartz C-axis fabric studies carried out in MCT zone indicated combination of simple and pure shear deformation. In the year 1995, the oxygen and strontium isotopes of Deoban-Blaini-Krol Tal section showed precipitation of carbonate and phosphorite was influenced by microbiological processes. Ground Penetrating Radar survey conducted for the first time over Dokriani-Bamak glacier that estimated the thickness and volume of ice. A steep NW gradient of Bouguer gravity anomaly was observed in

Kiratpur-Keylong section indicating thickening of Indian Crust towards north. Age of Garbhyang Formation based on conodonts was placed at 480 My. Petro-mineralogic and magnetic fabric studies in the Upper Siwalik suggested uplift of Higher Himalayan Crystallines in Garhwal at 8.6 Ma. Thywali Gabroic body of Garhwal Himalaya was dated using whole rock Rb-Sr systematic to 1989 ± 117 Ma.

Gravity measurement and GPS data acquisition along the Kiratpur-Manali-Keylong-Tanglang La-Panamic was initiated. In the year 1997-98, institute scientists produced whole rock Sm-Nd isotope chronology of Mafic volcanic bodies of Garhwal-Kumaun region to 2.5 ± 0.08 Ga. Eclogite from Tso Moriri region yielded P-T history at 550°C at 14 Kb and occurrence of Methane in Nidar Ophiolite rocks was also reported. GPS measurement around Mohand indicated the movement of Indian Plate towards NE at an annual speed of 10-12 mm/year. Palynological studied from a well dated Alpine peat indicated reduced monsoon and arid climate at ~ 3500 yr BP. In the year 1998-99 Model age of the oceanic Island basalt of Indus and Shyok Suture Zone indicated first extraction of their protolith from Mantle at 675 and 475 Ma. Cosmogenic Exposure dating using ^{10}Be and ^{26}Al of rocks along the Indus River suggested bedrock incision rate of 1-2 mm/yr that initiated at 22-15 ka. Sedimentology and magnetostratigraphy of Siwalik in Kangra valley suggested that the deposition of Siwalik took place between 13-5 Ma. In the following years evidences of silica biomineralization and sponge spicules were reported from the Neoproterozoic of Gangolihat dolomite. Modeling results suggested crustal shortening of 22 % to 71.3% in foothills of NW Himalaya and GPS data suggested shortening of 15-20 mm/yr between HFT and craton. Pre-and-post earthquake studies were initiated using Radon measurements.

The year 2000 is known for its report of UHP metamorphism indicators in the coesite bearing eclogite rocks of Tso Moriri crystallines suggesting deep subduction of Indian Plate. Later a gabbro from the Nidar Ophiolite complex was dated to 140 Ma and geochemical isotopic data classified it as Marian type oceanic island arc sequence. In 2001, based on fossil discovery and magnetic polarity the chronology of Siwalik sequence of Himachal Pradesh (Kotla Khad section) was established between 11.1 and 6.1 Ma and 15 mm/yr of crustal shortening was reported between MCT and MBT of Garhwal Himalaya. Geochemical and fluid inclusion studies of Askot crystallines of Kumaun region indicated two stage development with early crystallized magmatic rocks undergoing assimilation of host rocks in later stage. Chert nodules from the Gangolihat Dolomite contained well preserved prokaryotic and eukaryotic originated walled and multicellular microfossils. The sedimentology of the Nagthat Formation suggested an overall shallow marine depositional setup. Deep teleseismic event recorded at Kothi area suggested that Moho depth ranges between 42-52 km whereas in the NE Himalaya it is 40 km and field survey could establish the stratigraphy of Eastern Aunachal. Sedimentologic study of Siwalik rocks suggested emergence of Chail thrust at ~ 10 Ma. Geoenvironmental data from Lullu valley suggested recurrence interval of flash floods to be three years since 1988 and using satellite data traces of new active faults were identified in the proximity of MBT and HFT in the NW Himalaya. Snout monitoring of Chorabari glacier indicated an alarming retreat of 5.29 m/yr. Magnetic fabric studies around Dehradun indicated change in stress directions from EW oriented to NS. Stratigraphic studies inferred a major Hiatus of ~ 1 Ga between Jaunsar/Damtha group and Mussoorie/Deoban Group of rocks and fossil discovery of ctenodactyloid rodent confirmed Early Miocene age of Dharmshala group. Study of earthquake of December 26, 2004 enhanced our understanding of interseismic strain accumulation in the Andaman arc. In the year 2005-06 the studies using Ar-Ar systematics in the Karakoram fault zone indicated that rocks exhumed to 8 km depth at ~ 8 Ma.

Discovery of Microdiamonds made from Tso Moriri complex supported earlier coesite based inferences of UHP metamorphism. Magnetostratigraphic studies identified 11 magnetopolarity events in Subathu Formation of Himachal Pradesh. In the year 2006-07 the newly acquired Magnetotelluric technique imaged the deeper structures of the collision zone and mapped the zone of partial melt inferred to be as channel flow. Raman Spectroscopy of rocks from Nidar Ophiolites identified the presence of hydrocarbons. Geochemical landscape of Ganga valley stream sediments suggested that radioactive elements of U, Th are enriched than the average crustal values. Record from Dakuri peat identified major climatic events of Medieval Climate Anomaly (MCA) and Little Ice Age (LIA) and Late Quaternary setup of Pinjaur Dun indicated two aggradation phases in the Late Pleistocene. The year 2007-08 marked 40th anniversary of the institute that

witnessed first ever passive seismology experiment conducted by WIHG. The results pointed towards 47 km crustal thickness in the eastern syntaxis in the Brahmaputra valley. Study of metamorphic mineralogy of Leo Pargil and Tso Moriri gneiss dome supported subduction related metamorphism but this took place at different rate and followed different exhumation path. Anisotropy of Magnetic Susceptibility (AMS) data from Munsiyari Thrust zone from Uttarkashi region suggested the thrust being locked. Discovery of Soft Sediment Deformation (SSD) structures in the Lesser Himalayan sequence indicated frequent seismic activity at ~1.8 Ga. Quaternary Landscape studies involving geomorphology, sedimentology and luminescence dating of terraces implied a wide spread valley aggradation in all the major river valleys across the Himalaya during Marine Isotope Stage (MIS)-3 and MIS-1. Similar inferences were drawn from Dun valleys as well. The major incision of rivers took place during the Early Holocene Climatic Optimum (11-9 ka). During the Late Pleistocene, the landscape buildup in Himalaya was largely controlled by monsoonal variations. Newly discovered fossils of Whales from Kalakot (J&K) demonstrated evolution of these whales from aquatic mammals which was contrary to the belief. Sulphide and Talc mineralization was reported from Chiplakot crystalline sequence. Geochemical studies on riverine sediments reported anthropological impacts on the hydrology of Pinjaur Dun. Recession rate of Gangotri glacier was reported to be alarming at 46 m/yr between 1962-90.

V-SAT connected 10 broad band seismic stations started adding new research dimensions by improving the positional accuracy of recorded earthquakes. Multi Parametric Geophysical Observatory (MPGO) recorded M 4.9 Kharsali earthquake and deeper geophysical probes kept on improving Moho depth, and structure of Decollement. Spiti and Yamuna valley exerted the control of major thrusts and faults in Himalaya over their initiation and recurrence. In the subsequent year dark organic matter in form of cellular and filamentous microfossils was reported from Neoproterozoic Buxa Dolomite of NE Himalaya. Recession of Dokriani glacier, between 1962-2008, took place at the rate of 17 m/yr and the year (2008-09) witnessed inauguration of the Centre for Glaciology and MPGO. This was 2009-10 when AMS studies helped in identifying co-seismic slip in the trench in soft sediment across HFT and in the same year a Ca-bearing hydrous sulphate mineral called Minamiite was reported for the first time from India in Deccan volcanic provinces and a rich fossil assemblage representing climate of Early Eocene Climatic Optimum were recovered from western India. Further research in Karakoram fault zone indicated rapid exhumation and cooling of fault related metamorphic rocks at ~10 Ma. A paleoclimate reconstruction using Pollen and elemental concentrations from a peat record from Chandra valley picked up a cold and dry Younger Dryas event and warming and wet Early Holocene Climatic Optimum. Oxygen isotope composition of fossil bones recovered from Himalayan foreland and western Peninsular India suggested monsoon like precipitation during Eocene-Oligocene period. Hydrochemistry of the Ganga River water from Haridwar and its vicinity indicated Carbonate weathering as prominent controlling Major Ion chemistry of waters. Coliform bacteria, *E. coli* and Nitrates showed anthropogenic signatures.

V-SAT connected seismic station till March 2011 recorded ~6000 earthquake events and their plot helped in understanding the sub-surface geometry of the Main Central Thrust (MCT). Geophysical studies in the year 2011-12 identified a mid-crustal ramp beneath the MCT in Garhwal Himalaya. AMS and Geochronology of Karakoram fault zone rocks suggested a non-coaxial deformation throughout the Cenozoic until ~13 Ma. Geomorphology, Sedimentology and Luminescence chronology indicated two phased filling of Soan Dun with first being >55-29 ka and second between 29-10 ka. Paleoseismic studies across the HFT near Kala Amb (HP) suggested an earthquake of M 7.6 between 34-17 ka and another earthquake of M 8.5 between 6-2 ka. A Long term slip along the HFT was estimated to be 3.59 ± 1.01 mm/yr since the Late Holocene. Earthquake observatories recorded two earthquake swarms across the MCT between April-May of 2009. Geochemical studies of Manipur Ophiolites indicated presence of refractory grade high-Al rich Chromites and metallurgical grade High-Cr Chromites and that these are derived from tholeiitic melt. Further in the year 2012-03, geophysical studies in the N-S transect in NW Himalaya implied crustal thickness of ~50 km beneath Lesser Himalaya that increases to 60 km beneath the Higher Himalaya and to 80 km beneath the eastern Ladakh. Structural mapping in the Chamba Thrust Sheet suggested the presence of a large scale Box-fold structure. Results from broad band seismometers suggested that most earthquakes in the Garhwal

Himalaya are located at a shallow depth of ~20 km. Late Quaternary studies along the Indus River suggested two phases of monsoon dominated aggradation since the past 50 ka and that the bedrock incision in the river's downstream was controlled by active deformation of north vergent Indus Molasse and rapid uplift in the NW Syntaxial zone. Tree ring based studies for the first time reported varying river discharge between AD 1295-2005 in the Kinnaur region. 2013 was the year of a major hydrological disaster in Himalaya. WIHG took a lead and mapped the disaster struck areas and provided an appraisal report to the Government.

A team of scientists investigated the Mandakini valley to understand the role of Lake outburst in Gandhi Sarovar compounding the disastrous impact of the flood on the landscape of the region. Besides this Earthquake data collected by the institute's seismic network also indicated swarm activity in the year. Fossil finds strengthened the know-how on the stratigraphy and depositional environment of various Blain-Krol sequence in Mussoorie and Garhwal syncline and Tethys sequence in Pin Valley and Karkra Formation of NW Himalaya. Further, Snow Avalanche inventory of Gangotri Glacier region was prepared that identified 24 avalanche sites in the region. In the subsequent years, geophysical investigation suggested an ongoing E-W extension in the Kinnaur region; Shergul blue schist being results of cold subduction; the age of Karakoram fault was estimated to be atleast 23 Ma and Zmithang thrust at ~7 Ma; outer Lesser Himalaya (OLH) and inner Lesser Himalaya (ILH) were demarcated on the basis of stratigraphic setting and provenance. Aeolian sediments of Ladakh were dated to 25-17 ka and 12-7 ka. Core sequence of Tso Moriri yielded a wet phase during 1650-1850 AD and its older Late Pleistocene record indicated a 1700 yrs cycle of monsoon variability. The year 2015-16 took an important step in mapping and inventory preparation of 1266 glacial lakes in Uttarakhand Himalaya. Groundwater heat source was tapped to heat a room in Ladakh. This technology was established by WIHG in collaboration with National Geotechnical Institute (NGI) of Norway. Geophysical studies revealed a prominent intra crustal low velocity zone beneath the Tethyan Himalaya. Receiver function analysis of teleseismic data helped in mapping the ramp-flat geometry beneath the Himachal Himalaya and implied diminishing ramp geometry. Geochronological studies using newly installed LA-MC-ICPMS suggested that Vaikrita thrust is the terrain boundary. Speleothem record from Mawmluh cave recorded YD and Heinrich events. The paleoflood records from the Ganga and Indus rivers suggest that floods in Himalaya are largely controlled by Indian Summer Monsoon.

WIHG reported occurrence of *Tianzhushania spinosa* from the Infra Krol Formation that helped in its global correlation with the Lower Doushantuo Formation of South China. Likewise, discovery of *Wengania* exquisite was reported from Birmania Formation implying Ediacaran age for the formation. Early Eocene hyaenodontid *Indohyaenodon raoi* was described from Cambay shales; *Elephas cf. namadicus* was reported from Late Pleistocene sediments of Ganga Plain. Glaciological studies investigated the role of debris cover on the melting and glacial retreat. Studies on Pensilungpa and Durung-Drung glaciers in Zaskar ranges reported retreat of 15 m/yr and 7 m/yr, respectively. Landslide susceptibility map of Mussoorie town-ship was prepared.

Most recently precursors of the global warming event PETM have been reported from the basal part of the Subathu Formation of type area in Himachal Pradesh. Apart from this new fossils of early Eocene Primates have been reported from the western India.

Infrastructural Growth of the Institute

Since the inauguration of Institute Building and Laboratory Complex at 33, General Mahadeo Singh Road (Dehradun) in 1988, a lot of new infrastructure has come over the years, e.g., the construction of 4th Block, WIHG Guest House, several blocks of residential quarters for scientists and staff, Director's Residence, and stores building, etc. Most of the laboratories and even scientists rooms have been renovated.

- 1997-98 Fourth Block of the Institute Building complex
- 2002-03 The Institute went for Local Area Network (LAN) and internet facility was provided to all scientists & main sections/labs.
Foundation laid for the Guest House-cum-Hostel of the Wadia Institute of Himalayan Geology.
- 2003-04 Inauguration of Institute Guest House by the DST Secretary.
- 2006-07 New Stores Building
- 2007-08 Staff Quarters
- 2010-11 Additional Staff Quarters
- 2011-12 Director's Residence
- 2012-13 Refurbishing of scientist's rooms



K.R. Narayanan, the then Hon'ble Minister of State for Science & Technology inaugurating the Building and laboratory Complex in 1988





Development of Laboratories

A beginning to develop various laboratories was made in 1977 when Institute purchased isodynamic separator, mettle balance, microscope, pH meter, oven for sedimentology and two advance microscopes for petrologic and biostratigraphic studies. An oscilloscope was purchased for geochemical analysis.

- 1978-79 : Saw a major growth in geochemical facilities when X-Ray Fluorescence (XRF) and Atomic Absorption and IR Spectrophotometer were purchased.
- 1982 : Wet Geochemical Laboratory, Energy Dispersive X-ray Spectrometer, Thin Section Laboratory, Structural Analysis Deformation Laboratory, X-ray Diffraction unit were incorporated.
- 1985 : 10 new equipments were installed, Lallcoste & Remberg Model D. microgal gravity meter, X-Y Plotter and Digitizer with WIPRO Series 286, Helicoders, Portable Seismograph, Digital Portable Kit, Field Printers, IGS-2 Proton Magnetometer, Freezing Stage and Petrographic Microscope, Zeiss Optical Microscope and Modi Xerox machine 1045.
- 1987 : A new laboratory for High Pressure and High Temperature studies has been established.
- 1988 : A new ICP-AES and Scanning Electron Microscopy (SEM 515 Philips) installed
- 1989-90 : XRF/ XRD/ SEM/ Wet Chemical Laboratory
- 1996-97 : Central recording Station of proposed Seismic-Array Telemetry at Naddi, Dharamshala, Himachal Pradesh provided good seismic data.
- 1997-98 : A luminescence Dating Lab was developed at the Institute for the dating of Quaternary sediments.
 DST identified the Institute to establish a National facility for Geotechnical investigations and training with special emphasis on landslides.
 New GPS and Digital seismographs were set up in H.P.
 The Remote Sensing Laboratory was strengthened with upgradation of existing image analyser and acquisition of new software and PC, etc.
- 1998-99 : The Arunachal Unit in the form of field station was inaugurated at Itanagar by Hon'ble Chief Minister of Arunachal Pradesh, Shri Gegong Apang.
- 2002-03 : The central facility of the Institute was upgraded by the purchase of New ICP-MS

instrument to carryout geochemical analysis.

Water Chemistry and Palaeomagnetic labs were upgraded.

A major analytical instrument i.e. ICP-MS (Perkin-Elmer ELAN-DRCe) was added to the Wet Chemical Laboratory.

- 2004-05 : A state-of-art Cameca-SX 100 Electron Probe Micro-Analyzer (EPMA) was established.
A new TL/OSL unit for dating the Quaternary sediments was added.
Advance rock magnetic system for characterizing the magnetic properties under high magnetic properties fields was added.
New generation of Scanning Electron Microscope (SEM) with Energy Dispersive X-Ray Analyser were added.
- 2006-07 : New Scanning Electron Microscope (Zeiss EVO-40 EP) with most advanced EDAX facility (Bruker LN2 free X-Flash 4010 SDD X-ray Detector) was installed in central facility replacing the old 'Phillips' Microscope (PSEM-515).
- 2008-09 : Opening of Centre for Glaciology (CFG); Multi-Parametric Geophysical Observatory at Ghuttu; Particle Size Analyser, Raman Probe, Laser Ablation attachment to ICP-MS, Automatic Sample Fusion Machine and 5 Units of Data Acquisition System for Broad Band Seismometers were added.
- 2009-10 : As a part of upgradation of laboratories, a new XRF (XRF-S8 Tiger) instrument was inducted in the Institute.
- 2010-11 : Stable Isotope Mass Spectrometer and new Luminescence Reader with single grain attachment were installed to existing analytical facilities.
- 2015-16 : LA-MC-ICP-MS was added to the existing facilities.

Library

A formal librarian was appointed in the year 1974-75 when the library received a major boost by adding 260 books and started subscribing to 32 National and International journals. In the year 1978-79 the library received Prof. D.N. Wadia's collection of 2000 books/journals and reprints. Today this library is nation's best in Earth Sciences with >10000 reference books; 2500 E-Books and it subscribes to >120 national and international journals and > 2500 books in Hindi literature. The stepwise growth of library can be followed as below:

- 1990-91 : The Library was provided with one IBM Compatible PC-AT 386 with 2Mb RAM, 80 Mb Hard Disk, one colour monitor and one 300 cps Dot Matrix Printer.
- 1991-92 : Computerisation of the library was completed.
- 1992-93 : The HIMGEO database was developed to store bibliography references on Himalayan Geology. Library computer PC-AT 386 was upgraded by providing one 300 Mb HD drive, and an uninterrupted power supply unit of 1.5 kva capacity with 30 minutes backup.
- 1993-94 : Report of HIMGEO Database was released on the occasion of Silver Jubilee celebration of the Institute. The database consists of 8422 Bibliography references on all aspects of Himalayan Geology for a period from 1816 till date.
- 1996-97 : The Library started subscribing two silver platter CD-ROM database, viz. GEOREF (1785-1996) from American Geological Institute, Washington, U.S.A. and GEOBASE (earth Disk, 1990-96) from Elsevier Science Ltd., Amsterdam.
- 1997-98 : A new database HIMDOC was created. The library started three important services viz., CD-ROM database, Associated Membership and Document delivery service.

Publication: Himalayan Geology (Journal)

Wadia Institute of Himalayan Geology has been publishing 'Himalayan Geology' volumes since 1971 and has published 16 volumes to date containing proceedings of the Himalayan Geology seminars. First issue of this (edited by A.G. Jhingran) was published in 1971 and was dedicated to the founder of the Institute, late Darashaw Nowsherwan Wadia, R.R.S., National Professor of Geology. In 1990, the Institute started publishing a separate publication called the 'Journal of Himalayan Geology' and published 6 volumes (Parts 1 & 2) biannually till 1995 (ISSN 0970-0951). In the year 1996, Institute decided to merge both these publications into one retaining the continuity of the 'Himalayan Geology' to be published as a journal. Therefore, the 'Journal of Himalayan Geology' was discontinued after volume 6 (1995) and 'Himalayan Geology' was made into regular publication as a journal. In this continuation volume 17 was published in 1996.

In 1997, Institute obtained the new ISSN No. (ISSN 0971-8966) for 'Himalayan Geology' and has been publishing the journal regularly. Since 2007, the journal is indexing regularly in Elsevier (Netherlands), Thomson Reuters (US) and Indian Citation Index (India) and obtained the SCI status with the Impact Factor: 0.125 in 2009. Current (2015/2016) Impact Factor of Himalayan Geology is 0.35.

Thirty eight volumes of 'Himalayan Geology' have been published till now. At present, Institute has registered 471 Life Time Subscribers under Life Time Subscriber Scheme for 'Himalayan Geology'.

Museum

Museum was arranged formally in 1976 when exhibits were gifted from Jammu University; rocks and fossils from Arunachal Himalaya were brought by Institute scientists and several paintings including Siwalik mammals and drifting continents were made and displayed. In the year 1978-79, for the first time, the museum took part in National Seminar on Resource Development and Environment in the Himalayan Region at Vigyan Bhawan, New Delhi. In the year 2002-03 the museum was dedicated to the memory of Prof. S.P. Nautiyal.



Museum as it began

Major Sponsored Projects

Seismicity and Seismotectonics of the Himalayan Region

Considering the vulnerability of north India, especially the Himalaya region, to earthquakes and associated hazards, DST has initiated a multi-institutional coordinated project to study the seismicity of the region in all its facts. Two areas, the North Western Himalaya (Kangra) and the North-East region have been identified for intensive work. The project is aimed at understanding the source mechanism of earthquakes, preparation of seismotectonic and risk analysis maps, developing models for the sub-surface geologic structure monitoring earthquake precursors and attempting earthquake prediction with a view to mitigate earthquake hazards. Leading institutions like IMD, GSI, WIHG, SOI, ONGC, IIG, Roorke University, etc. are participating in this programme.

The Department of Science & Technology implemented the North Western Himalaya study work in 1982, a major multi-disciplinary/multi-institutional project namely “**All India Coordinated project on the study of Seismicity and Seismotectonics of the Himalayan Region**” under Dr. Surendra Kumar, Scientist WIHG as Principal Investigator. During the 6th plan period a large number of seismological and geophysical observational programmes were taken up. The project continued in the 7th plan and was finally merged into the Geophysics Group of the Institute in the year 2000. The main objectives of this program were as follows:

1. Preparation of Neotectonic maps.
2. Isoseismal maps of individual shocks.
3. Geological and tectonic studies.
4. Aerial photo and satellite imagery studies.
5. Seismotectonic map of the region.
6. Historical and paleo-seismicity.

Permanent Observatories:

01.08.1985 : Established at Kothi (Manali); Helicorder 3 COM Long Period

26.07.1986 : Pakhi (Joshimath); Helicorder Vertical Short Period

01.11.1985 : WIHG (Dehradun); Wide Band Portacorder (Digital)

1985-1990 : Mobile observatories: 18 running in HP and UP (currently UK) analog stations

1990-2004 : Permanent observatories – 10 in HP and UK

2004-2007 : Added 10 BB Digital Reftec– in HP, Garhwal & Kumaun

2007-2012 : Added 10 BB Digital VSAT Real Time mode

2012-2017 : Added 10 BB and 5 Accelographs WIHG

Currently 43 Stations are running in Himalaya

Natural Resources Data Management System (NRDMS)

This project, taken up by the Institute in the year 1981 was sponsored by the DST, New Delhi. The project aimed at generating a Multi-disciplinary, computer compatible and spatially oriented database of Natural resources for modern management needs in Himalayan region. In the project the data was collected on Geomorphology, water bodies, rivers, mineral wealth and socio-economic factors at district level. These data were then transported to individual layers in GIS and analysed to provide feasibility for (i) rainwater harvesting, (ii) Landslide management, (iii) micro-hydel schemes, (iv) Flood Plain management, (v)

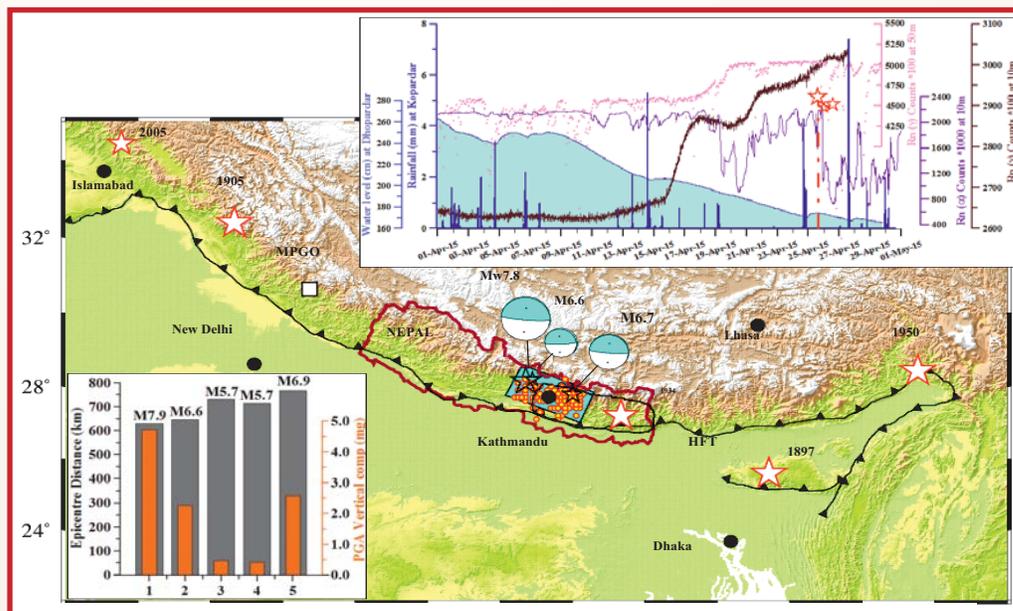
fisheries development, and (vi) National Parks management. This project was complete in the year 1993 with Dr. Devendra Pal as the team leader. Later this project was merged with the Institute.

Multi Parametric Geophysical Observatory, Ghuttu, Garhwal Himalaya

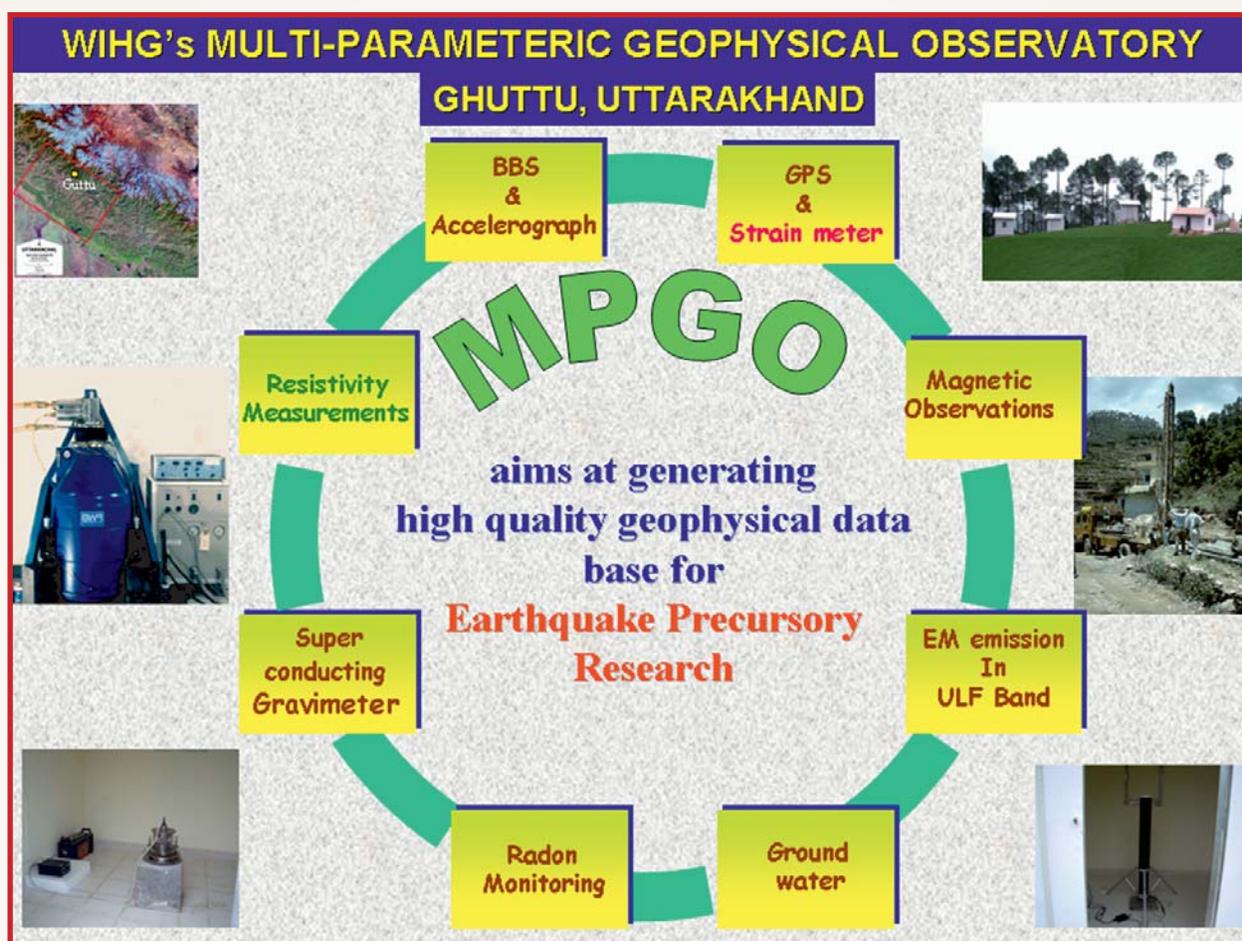
In 2006, WIHG established India's first Multi-Parameter Geophysical Observatory (MPGO) at Ghuttu, Garhwal Himalaya with a rationale to study earthquake precursors in an integrated manner. During the last 50 years, a variety of earthquake precursory signals have been reported in different parts of the world, notable among them are enhanced foreshocks, seismicity pattern, crustal deformation, changes in groundwater, thermal anomalies in surface temperature, and variation in radon/helium gas. Therefore, at MPGO, continuous data collection of a variety of parameters is performed with a great quest for earthquake precursors and their documentation. It is being performed in many seismically active zones of the world, in which five such observatories of India are located in Gujarat (Badargadh, Vamka, Desalpar), Shillong and Andaman-Nicobar Island. MPGO Ghuttu is located in a narrow belt of high Himalayan seismicity above the northern end of the locked part of the down dip portion of the under-thrusting Indian plate. The region is demarcated by a locking line where the up-dip edge slips aseismically along the Main Himalaya Thrust. The observatory is equipped with state-of-the art superconducting gravimeter (India's first), overhauser and fluxgate magnetometers, ULF band induction coil magnetometer, GPS, Broadband Seismograph, digital acclerograph, radon and water-level recorders. Therefore, it is designed to record precursory signals resulting from stress-induced changes in density, magnetization, resistivity, seismic wave velocity, fracture propagation, crustal deformation, electromagnetic and radon gas emission as well as fluctuations in hydrological parameters. The immediate priority for characterization of precursory signals is to develop data-adoptive techniques to estimate and eliminate the background variation caused by the hydrological, environmental and solar terrestrial dynamics related changes. A careful scrutiny of the MPGO data revealed prominent precursory signature in radon concentration (Figure below) and unambiguous co-seismic gravity jump related to the Mw 7.8 Gorkha Nepal earthquake of April 25, 2015. Similarly, radon fluxes show some definite trend that can be viewed as pre- and co-seismic changes related with the Mw 5.0 Kharsali and few other nearby earthquakes. Sudden anomalous changes of geomagnetic field intensity and dynamic waveform, lasting from several days before to a week after the earthquake, appear to be a manifestation of the thermal agitation on the magnetization of rocks around the source region of the earthquake. Few cases of unambiguous co-seismic gravity jump are perhaps related to the change in volumetric strain in the hypocenter zone. The dilatancy–diffusion model, based on the behaviour of crustal rocks under near-critical stress levels, remains the best working model to explain the existence of the reported precursors. The results obtained so far show that the multi-parameter approach crafted under the National Program on Earthquake

Precursors holds promise and long-term monitoring needs to be continued for statistical validation.

Location of MPGO Ghuttu and epicentres of Mw 7.8 Gorkha Nepal earthquake of April 25, 2015. **Inset (right):** The variation of soil radon using gamma probe (brown solid line), alpha probe (solid purple line), underground water radon through gamma



probe (pink dots), Rainfall (blue bars) and water level records in 68 m deep borehole (blue solid line) after Kumar et al. (2017). Inset (below) Peak Ground Acceleration (PGA) related to Mw 7.8 and large size aftershocks.

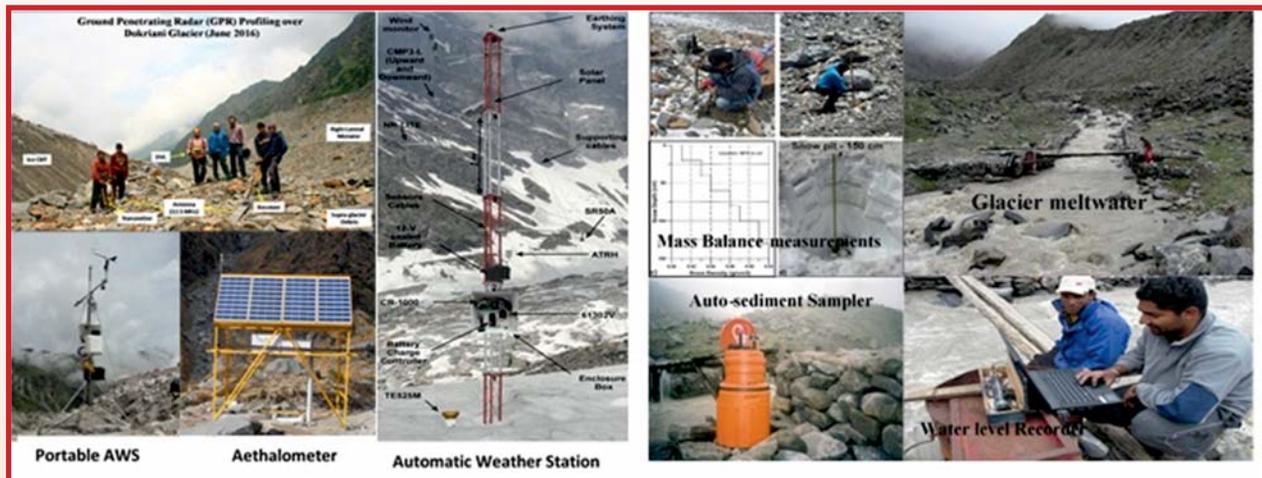


Multi-parameter equipment of MPGO, Ghuttu

Centre for Glaciology (CFG)

The glaciological studies on Himalayan glaciers were initiated at the WIHG in 1985 in a project mode under the 'Himalayan Glaciology Programme' of the Department of Science & Technology, Government of India. With the mandate of carrying out basic research in Cryosphere science and its societal application to the Himalaya, the Institute is associated with this programme for about thirty years from the year 1986. Since then the Institute has organised several glacier expeditions to various glaciers in the Himalaya. During the period several glaciers have been investigated for long term base and partly some of them are being monitoring regularly every year. Besides, extensive study in the glaciated terrain, the institute has also trained several manpower and carrying out specific research aspects through young research scholars. Considering the importance of studies on Himalayan cryospheric science, **Centre for Glaciology**' at Wadia Institute of Himalayan Geology, Dehradun was established by the DST, Government of India in July, 2009. The Centre for Glaciology is the first step forward in providing a platform for holistic approach to Himalayan cryosphere. The Centre has mounted a coordinated research initiative on the Himalayan glaciology to understand the effects of climate change on the glaciers and to develop strategies for climate change adaptability for sustaining Himalayan Eco-system. The Centre was setup with 19 manpower including- Scientists, Technical and supporting staff with an initial sanctioned budget of Rs.2366.18 Lakhs.

The Centre for Glaciology is engaged in long term glacier monitoring research programs in various aspects of Himalayan glaciology and also strengthened glacier monitoring networking, development of infrastructure and field facilities for long term glacier monitoring in context to climate change and its impact on glaciers health. Presently, the Centre is monitoring 08 glaciers, namely Gangotri & Dokriani in Bhagirathi River basin, Chorabari & Companion in Mandakini River basin; Dunagiri & Bagni in Dhauliganga River basin and Pindari & Kafni in Pindar River basin in Uttarakhand region of Central Himalaya. These glaciers have been developed/developing for the full flagship research stations having the facilities of various types of scientific equipments to collect the data throughout the year for understanding the effect of climate change on the glaciers health and water resources. The broad areas of research include the glacier dynamics, mass balance measurement, mountain hydro-meteorology, meltwater chemistry, isotopic characterization of glacier melt, precipitation (snow and rain), paleo-glaciology, paleo-climate glacial geomorphology and remote sensing based glacier studies. Beside that the Centre has developed the manpower and presently 18 employees including Scientists, Technical staffs and Research Scholars at different levels are working.

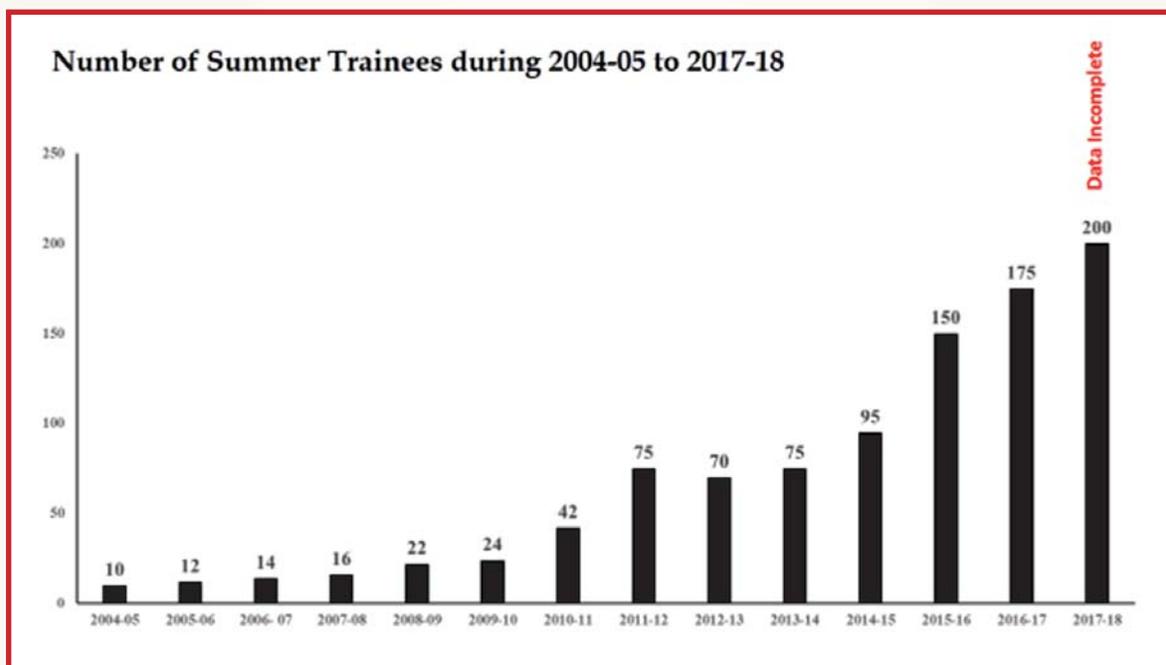


Objectives of CFG

- Institutionalize glaciological research in the country to provide holistic approach to Himalayan glaciology research.
- Establishment of Flagship Field Stations for multidisciplinary high quality data capture to establish inter-linkages of various forcing factors with glacier dynamics.
- Document glacial responses to palaeoclimatic variability through sediment records (moraine, glacial, fluvial and lacustrine), ice cores, peat logs, tree rings, etc.
- Create manpower through training programme in glaciology to fill voids of human resource in this specialized field.

Man Power Development

Recognizing the importance of Himalayan geology, the University Grants Commission in the year 1965 instituted 15 research fellowships that were meant for students pursuing research in Himalayan Geology. Later after the inception of Wadia Institute these fellowships were being disbursed from here. The fellowship allowed a fellow to get enrolled with any scientist/professor across the country and this continued until 2005. Since then the institute started its own research fellowships for students to work in its laboratories. As on today Wadia Institute hosts ~80 research scholars and Associates under different schemes. Institute also invites several summer interns on sponsored and self-sponsored basis and the number in the year 2017 reached ~150. The Institute took a nation-wide initiative in providing a platform, where young researchers can present their scientific results and interact with experts in form of National Geo-Research Scholars Meet. In the Year 2017 the institute organized the second edition of this program.



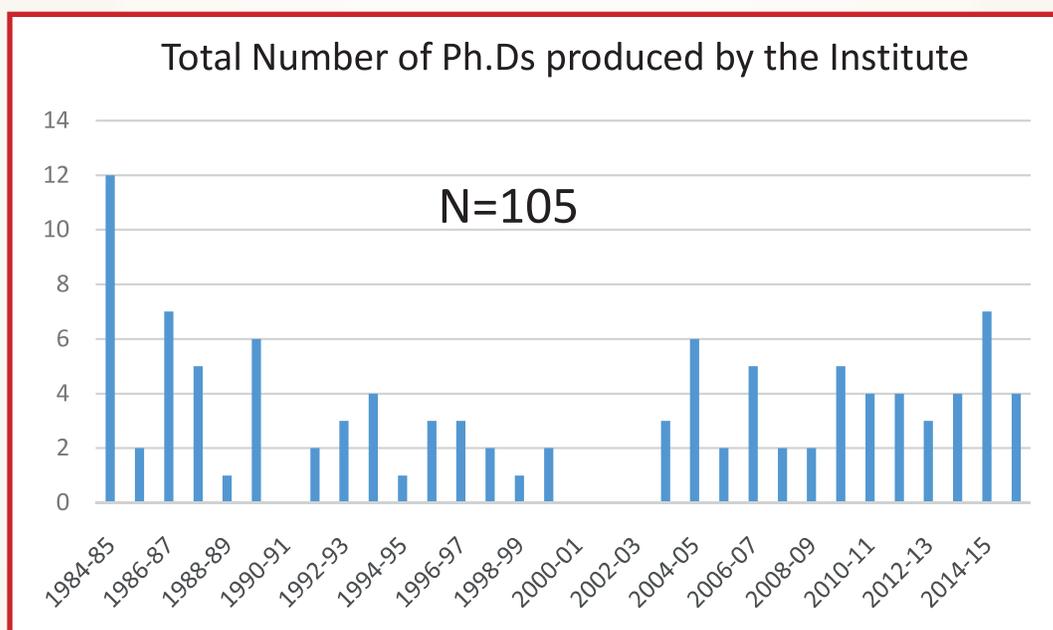
Besides, on regular basis, the Institute organizes training workshops, field courses, field workshops to generate man power in the field of Himalayan Geology. Few of the important ones (to the best of our knowledge) are listed below:

- 1985 : First regional Training Course in Structural Geology, sponsored by UNESCO and supported by DST.
- 1986 : Second regional Training Course in Structural Geology, sponsored by UNESCO and supported by DST.
- 1989 : Fourth regional Training Course in Structural Geology, sponsored by UNESCO and supported by DST.
- 1991 : Orientation course on Analytical Techniques and Data Interpretation in Petrology
- 1994 : Second Orientation Course on Analytical Techniques and Data Interpretation in Petrology.
- 1996 : Fourth SERC Winter School on Databases, Numerical Methods and Computer Modelling in

Modern Approach to Petrology.

- 1998 : Training Programme on structural mapping and interpretation and correlation of data, Organized for IBM.
- 2006 : National Field Workshop on Sub-Himalayan Palaeogene sediments in the context of India-Asia Collision.
- 2007 : Third SERC Module of Five year cycle of DST training program on crustal deformation and Tectonic Geomorphology
- 2009 : Fifth SERC Module of Five year cycle of DST training program on Crustal Deformation and Tectonic Geomorphology
- 2012 : Field workshop on Quaternary setup of Arid NW Himalaya: Main focus on Ladakh
- 2013 : WIHG Winter School in Geomathematics
- 2014 : Training program for Rail Vikas Nigam

Since 1985 WIHG has produced 105 Ph.D.s on problems ranging from metamorphism, structural deformation both at outcrop and regional scale, biostratigraphy, Quaternary Landscape evolution and palaeoclimate, Hydrogeology, natural hazards, paleoseismology and seismology. Below is a temporal distribution of doctoral awards from the WIHG.



Serving the Society through our Research Programs

The current Thrust Area Themes of research in the Institute are imprint projects which also address major societal needs. These issues are very important for all the Himalayan states and also hold special significance for the State of Uttarakhand where the Institute is housed.

Himalayan Glaciology Programme

Glaciers are perennial water resource in Mountain Rivers and are important for drinking water, agriculture productivity and hydropower generation. Presently FIVE glaciers namely, Dokriani, Chorabari, Gangotri, Pindari, and Dunagiri are being monitored to study various aspects like glacier dynamics, hydro-meteorology, snow ice melt-water chemistry, aerosol, snow covers changes. The above studies, are related to glacier retreat, inventory of lakes, paleofloods, Glacial Lake Outbursts Flood (GLOF), etc., assume utmost importance for mankind and the society.

Himalayan Springs/Groundwater studies

The surface and subsurface water resources including the springs and potable water resources are crucial in the highly populous Himalayan terrain and require special attention. Similarly, understanding the hydrogeological control on the springs is important to estimate the occurrence and movement of groundwater in the hilly aquifers. WIHG research programmes are addressing the evolution of Himalayan hydrological system towards its conservation and sustainability.

Slope Stability/Landslides and Geotechnical studies

Identifying unstable slopes, their causes and consequences is one of the focused areas of our research. Standardizing the approach for their assessment and mitigation is beneficial for the planners and decision makers for sustainability and developmental activities in the Himalaya. The Institute, therefore, has established a laboratory for testing geotechnical parameters of rocks for engineering and hazard zonation projects. It has progressively developed expertise in slope instability and landslide studies. The landslide inventory and hazard zonation was carried out in the Satluj valley of Himachal Pradesh and in selected pilgrimage routes of Uttarakhand. Monitoring of landslides in parts of northeast Himalaya also falls in our activities. Besides this, Institute is involved in understanding Himalaya and how climate and tectonic of the region are interacting to shape the landscape and rocks of the region. Institute is engaged in understanding the modern extreme hydrological hazards and their past variability.

Study of paleo-earthquakes to identify vulnerable areas for future earthquakes - Mapping and understanding the active fault and paleo-earthquakes in different segments of Himalaya could be useful for recognition of earthquake prone areas. In this context, selected studies have been carried out in the foothills of northwest and northeast Himalaya in the past few years.

Seismic Zonation mapping in cities

The seismic zonation map data is very important to know damage prone areas useful in buildings, bridges, tunnels, canals, high power transmission lines, etc. The Institute so far has carried out seismic zonation mapping in selected cities such as parts of Jammu, Kangra, Dehradun and parts of Delhi.

Earthquake Awareness Program

The Institute implemented a Himalayan School Earthquake Learning Programme (HIMSELP). As a part of this initiative a network of seismic stations are installed in various schools of Uttaranchal and Himachal Pradesh to inculcate the culture of seismological data acquisition and introduce teaching of basic principles of physics and earthquake sciences. The goal of the HIMSELP is to create fruitful links between research institutions, colleges/secondary schools and public at large. More recently, the Institute demonstrated the

seismograph and organized mock drill as part of preparedness for earthquake to the students and teachers in some schools of Uttarakhand.

Study of Strategic and Industrial minerals in Himalaya

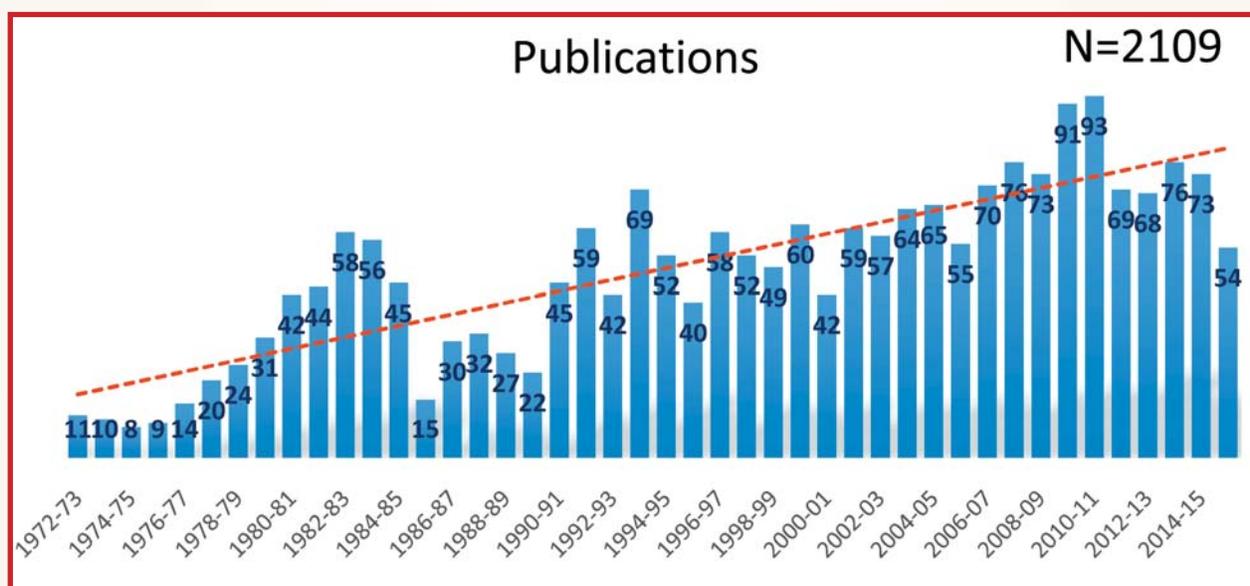
Institute is studying the origin, evolution and distribution of the metallic and non-metallic minerals in parts of Himalaya, not only to understand mineral occurrences in the Himalaya but also to delineate the processes that operated during the Himalayan orogeny. The Institute has reported new mineral locations as well as new minerals of genetic significance.

Scientific Expeditions

- 1973-74 Expedition to Malla Johar with Dr S.K. Shah as the team leader.
- June, 1976 Expedition to Tethyan Himalaya and Kali valley of Kumaun region, team leader Dr S.P. Jain, Panjab University, Chandigarh.
- July, 1976 Expedition to Ladakh with Dr N.S. Mathur as the team leader and to Malla Johar with Dr A.K. Sinha as the team leader.
- 1978-79 Expedition to Nubra-Shyok valley.
- 1986 Institute Scientist Late Dr B.K. Choudhary participated in a mountaineering expedition to the Kedarnath Dome led by the first Indian Woman Everester, Miss Bachendari Pal.
- 1988 Expeditions to the Great Himalaya between Kishtwar in the Chandra valley to Padum in the Zaskar valley.
- 1990-91 Under the Glaciology programme of the DST, an expedition team was organised and sent by the institute to different glaciers in the Garhwal Himalaya with an objective to choose a glacier for carrying out glaciological studies.
- Expedition to Eastern Karakoram in 1991 (Dr Hakim Rai, Dr K.S. Bist and Dr K.P. Juyal)
- 1992-93 Institute scientist Dr D.R. Rao participated in the 12th Antarctic expedition in 1993.
- Expedition to Eastern Karakoram in 1993 (Dr Hakim Rai, Dr T.N. Bagati, Dr Rohtash Kumar and Dr K.P. Juyal)
- 1996 Expedition to Shyok and Nubra Valleys in 1996 (Dr B.N. Tiwari, Dr Kishor Kumar and Dr K.P. Juyal).
- 2000-01 A three member team of WIHG (Dr J.T. Gergan, Dr D.P. Dobhal, and Dr Renoj Thhayyan) participated in the XX Expedition to Antarctica and carried out Ground Penetrating Radar (GPR) survey for measuring the ice thickness in Schirmarcher Region.

Publications

The Institute since its inception has published 2109 articles in books and journals of national and international repute like Nature, Science, Scientific Reports, Geology, Earth and Planetray Science; Geological Society of London; Bull. Geological Society of America, Lithos, Lithosphere, Paleo-3, Journal of Paleontological Society of India, Journal of Vertebrate Paleontology, Journal of Paleontology, Acta Paleontologica Polonica, Geobios, Paleontologic Z., Palaeoworld, Journal of Asian Earth Sciences, Journal of Human Evolution, Quaternary Science Reviews; Journal of Quaternary Science, Journal of Structural Geology, Journal of Metamorphic Petrology; The Holocene; Quaternary research; Geomorphology; Journal of Geophysical Research; Geophysical Research Letters; Journal Geological Society of India; Current Science; Journal Earth System Science; Proceeding of National Academy of Sciences; Contributions to Mineralogy and Petrology; Geological Magazine; Bulletin of Seismological Society of America; Geophysical Journal International; International Journal Earth Sciences; Seismological research letters; Natural Hazards; GCA, G-cube, etc. The details of these can be found in institute's annual reports of the respective years and below is a graphic presentation of the number of research articles published by institute annually.



Maps and Books

1. Valdiya, K.S. (1980). *Geology of Kumaun Lesser Himalaya*. Wadia Institute of Himalayan Geology.
2. Thakur, VC and Sharma, K.K. (1983). *Geology of Indus Suture Zone of Ladakh*. Wadia Institute of Himalayan Geology, Dehradun.
3. Sinha, A.K. (1989). *Geology of the higher Central Himalaya*. John Wiley & Sons.
4. Thakur, V.C. (1992). *Geology of western Himalaya*. Pergamon Press.
5. Philip, G., Kulkarni, A.V. and Thakur, V.C. (1996). *Glacier Atlas of Satluj Basin using Remote Sensing techniques*. (This is an Atlas first of its kind prepared based on satellite data on 1:50,000 scale pertaining to Himalaya). Submitted to Dept. of Science & Technology, Govt. of India, New Delhi.
6. Earthquake hazards in the Himalayan foot hills of NW India. Indo-US Collaborative Project: 1999.

7. Bhattacharya, A. and Philip, G. (2001). *An Atlas on Landslide Hazard Zonation Mapping Using Remote Sensing and GIS Techniques* National Remote Sensing Agency, Department of Space, Hyderabad.
8. Sah, M.P., Philip, G. and Mool, P.K. (2005). *Inventory of Glaciers and Glacial Lakes and the Identification of Potential Glacial Lake Outburst Floods (GLOFs) Affected by Global Warming in the Mountains of Uttarakhand Himalaya*. International Centre for Integrated Mountain Development, Nepal.
9. Dubey, A.K. (2014). *Understanding an orogenic belt*. Springer, Heidelberg, New York, Dordrecht, London.
10. Bhambri, R., Mehta, M., Dobhal, D.P. and Gupta, A.K. (2015). *Glacier Lake Inventory of Uttarakhand*. Wadia Institute of Himalayan Geology, Dehradun.

Edited Volumes

1. Thakur, V.C. and K.K. Sharma - *Geology of Indus Suture Zone of Ladakh (Series - D.N. Wadia Centenary Commemorative Volume)* 1983.
2. Thakur, V.C. Notes: - *Geological Excursion to Southern Tibet a Report* - 1984.
3. Tandon, S.K., Thakur, V.C., Nanda, A.C., Azmi, R.J., Bagati, T.N., Tewari, V.C., Kumar, Rohtash - *Excursion Guide-Himalayan Sequence of Dehra Dun-Mussoorie Sector*-1988.
4. Sharma, K.K. - *Geology and Geodynamics Evolution of the Himalaya Collision zone* – 1991.
5. Kumar, Rohtash, Ghosh, S.K., Viridi, N.S., Phadtare, N.R. - *Excursion Guide: The Siwalik Foreland Basin (Dehra Dun-Nahan Sector)*-1991.
6. Thakur, V.C. - *Geology of Western Himalaya, Vol. 19*. Pergamon Press, 1992.
7. Srivastava, R.A.K. and Dubey A.K., V.P. Singh - *Himalayan Geology, Vol. 14*, 1993.
8. Nanda, A.C. and Dubey A.K. - *Himalayan Geology, Vol. 16*, 1995.
9. Thakur, V.C. - *Landslide Hazard Management and Control in India* – 1996.
10. Nanda, A.C., Kumar, K.- *Excursion Guide on the Himalaya Foreland Basin (Jammu-Kalakot-Udhampur Sector)*. Wadia Institute of Himalayan Geology, Dehradun– 1999.
11. Mathur, N.S. and Juyal, K.P. - *Atlas of Early Palaeogene Invertebrate Fossils of the Himalayan* – 2000.
12. Kumar, K. and Sahni, A. – *Himalayan Foreland basin with special reference to pre-Siwalik Tertiaries*. *Himalayan Geology*, 21 (1-2) - 2002.
13. Mazari, R.K., Viridi, N.S., Philip, G.- *Excursion Guide - Environmental geomorphology and active fault tectonics of Paonta Sahib-Sataun-Renuka area, District Sirmaur, Himachal Pradesh*- 2002.
14. Sah, M., Philip, G., Mool, P.K., Bajracharya, S. and Shrestha, B. - *Uttarakhand Himalaya India: Inventory of Glaciers and Glacial Lakes and identification of potential glacial lake outburst floods (GLOFs)*. Report – 2005.
15. Kumar, K. and Loyal, R.S. - *Excursion Guide On Sub-Himalayan Palaeogene Succession Of Shimla Hills (Subathu-Dagshai-Kasauli formations in Stratotype Area, Solan District, Himachal Pradesh)* - 2006.
16. Thakur, V.C., Kumar, Rohtash, Ghosh, S.K.- *Field Excursion Guide: Himalayan Succession of the Dehra Dun - Mussoorie Sector* - 2011.
17. Tewari, V.C. – *Stromatolites* – 2011, Springer.
18. Mukherjee, S., Mukherjee, B. K. and Thiede, R. C. – *Geosciences of the Himalaya-Karakoram-Tibet orogen*. *International Journal of Earth Sciences*, Vol. 102, Issue 7, 2013.
19. Dubey, A.K. - *Understanding an Orogenic Belt: Structural Evolution of the Himalaya* - 2014.

20. Mukherjee, S. Carosi, R., Van Der Beek, P., Mukherjee, B.K., Robinson, D. M. - "Tectonics of the Himalaya: an introduction". Geological Society London Special Publication No. 412.1–2015.
21. Parcha, S.K., Thakkar, M.G., Thakur, V.C., Juyal, N. - Field Excursion Guide Sedimentation, Tectonics and Quaternary Landforms of Zaskar Valley (25th August to 8th September 2015)–2015.
22. Bhambari, Rakesh, Mehta, Manish, Dobhal, D.P., Gupta, Anil K. - Glacier Lake Inventory Uttarakhand –2015.
23. Nanda, A.C. - Siwalik Mammalian Faunas of the Himalayan Foothills - 2015.
24. Srivastava, Pradeep, and Singh, Vimal, Quaternary of Himalaya, Geomorphology, Special Issue Publication, Guest Editor–2017.

Maps

1. Thakur and B.S. Rawat, 1980. Geological Map of Western Himalaya.
2. Bartarya, S.K., 1995. Hydrogeology and Water Resources of Intermontane, Doon valley, Jour. Him. Geol., 6(2), 17-28.
3. Bartarya, S.K., Philip, G., Sah, M.P. and Mazari, R.K. 2004. Groundwater Prospect Mapping in parts of Himachal Pradesh, Under Rajeev Gandhi Drinking Water Mission, Submitted to NRSA, Dept. of Space. Hyderabad Govt. of India. (20 sheets at 1:50,000 scale).

Excursion Guides

1. Rohtash Kumar et al. - The Siwalik Foreland Basin (Dehradun-Nahan Sector). Wadia Institute of Himalayan Geology, Dehradun -1991.
2. Nanda, A.C., Kumar, K.- Excursion Guide on the Himalaya Foreland Basin (Jammu-Kalakot-Udhampur Sector). Wadia Institute of Himalayan Geology, Dehradun– 1999.
3. Kumar, K. and Loyal, R.S. - Excursion Guide On Sub-Himalayan Palaeogene Succession of Shimla Hills (Subathu-Dagshai-Kasauli formations in Stratotype Area, Solan District, Himachal Pradesh) - 2006.
4. Jayangondaperumal, R., Thakur, V.C., and Tiwari, M. -Himalayan Frontal Folds-Thrusts Belts–2015.
5. Bhakuni, S.S., Koushik Sen, Thakur, S.S., Rawat, G., Mukherjee, P.K., Tiwari, M. Rishikesh-Joshimath-Malari Transect (Garhwal Himalaya)–2015.

Monographs

1. Atlas of Early Palaeogene Invertebrate fossils of the Himalayan Foothills belt, 2000.
N.S. Mathur & K.P. Juyal
2. Siwalik Mammalian Faunas of the Himalayan Foothills: with reference to bichronology, linkages and migration, 2015.
A.C. Nanda
3. Lithostratigraphy, Biostratigraphy and Palaeogeography of the eastern Karakoram, India, 2018.
K.P. Juyal

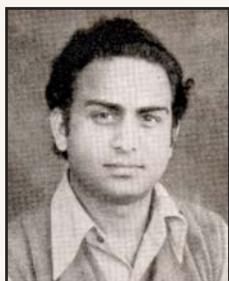
Awards and Honours (1970-2018)

- ‘Padma Shri Award’ of the Government of India
 - Dr V.C. Thakur 2018.
- ‘National Mineral Award’ of the Ministry of Steel and Mines, Government of India
 - Dr V.C. Thakur 1983-84.
 - Dr A.K. Sinha and Dr N.S. Viridi 1984-85
 - Dr Kewal Krishan Sharma 1986-87
 - Dr M.I. Bhat 1991-92.
 - Dr B.R. Arora 2002
 - Dr A.K. Dubey 2004
 - Dr Rohtash Kumar, Dr Sumit K. Ghosh and Dr S.J. Sangode 2005
 - Dr V.M. Choubey 2007
 - Dr Pradeep Srivastava 2011 (National Geoscience Award)
 - Dr A.K. Mahajan 2018 (National Geoscience Award)
- Dr V.C. Thakur elected as fellow of National Academy of Sciences, Bangalore in 1992.
- Dr Rajesh Sharma and Dr H.K. Sachan received ‘M.K. Ray Memorial Medal 1999’ on the occasion of 75th Annual General Meeting of the Geological, Mining and Metallurgical Society of India for the Paper entitled ‘A Study of Sulphide Mineralisation of Buniyar Area (J&K): evidences for Genesis and Evolution of Ores’.
- Dr G. Philip was conferred with the Indian National Remote Sensing Award in 2002.
- Letter of appreciation from the Department of Science and Technology to Dr Barun K. Mukherjee on the discovery of Coesite in Tso Moriri Crystallines.
- Dr S.J. Sangode received ‘C. Radhakrishnamurthy Award’ in 2005 from the Geological Society of India, Bangalore.
- Dr Rajesh Sharma was honoured with ‘Smt. Ketharju Venkata Subbamma- Sri Subba Rao Medal’ for the year 2006 for his contribution to geochemical and fluid inclusion studies of Ore-Minerals.
- Dr D.P. Dobhal was recognized as “Heroes of the Environment” by the prestigious Times magazine.
- Dr Pradeep Srivastava received ‘G.K. Gilbert Award’ for Excellence in Geomorphological Research from American Association of Geographers, United States in the year of 2007.
- Dr Pradeep Srivastava received Most Cited Paper Award (2004-2007) from the scientific journal Palaeogeography, Paleoecology and Paleoclimatology of Elsevier (2007).
- Geological Society of India on its Golden Jubilee Celebration Facilitated Dr B.R. Arora for his contribution to Geosciences (2008-09).
- Indian Geophysical Union bestowed Electrotek and Geometrics Endowment Award on Dr B.R. Arora (2008-09).
- Dr B.R. Arora was awarded the coveted “Hari Narain Award” (2009-10), by the Council of the Geological Society of India in recognition of his valuable contribution in the field of Indian Geophysics.

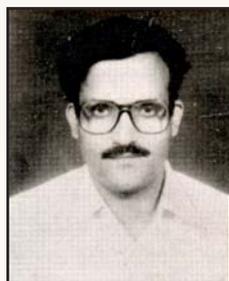
- Prof. A.K. Gupta, Director was selected for the ‘Third World Academy of Science’ (TWAS) Prize 2010 for his fundamental contribution to the study of Indian monsoon variability.
- Dr Pradeep Srivastava was awarded the “S.S. Merh Award 2010” for his contribution in the field of Quaternary Geology.
- Dr R. J. Perumal was awarded as ‘Professur Invitee-2010’ to University of Savoie, LGCA, CNRS Laboratory, Cambrey, France.
- Prof. A.K. Gupta was elected as Fellow of the Indian National Science Academy (INSA), New Delhi in 2011-12.
- Prof. A.K. Gupta was awarded J.C. Bose National Fellowship for his fundamental contribution to the study of Indian monsoon variability.
- Dr Pradeep Srivastava was awarded ‘M.S. Krishnan Gold Medal’ from the Indian Geophysical Union in 2011-12.
- Dr Kaushik Sen was conferred with ‘K Naha Award’ by the Geological Society of India, Bangalore in 2012-13.
- Dr P.K. Mukherjee received “M. Sita Devi & Rama Rao Medal-2014” from the Indian Society of Applied Geochemist, Hyderabad for his contribution in Analytical Geochemistry.
- Dr Devajit Hazarika received ‘Indian Society of Earthquake Science (ISES) Merit Award’ for young Scientist-2015’.
- Dr R. Jayangondaperumal received “S.S. Merh Award” from the Geological Society of India for his contributions to Quaternary Geology in 2016

SORROW POINTS

- Sad Demise of four member of the Institute, on 27th August 1984 :Tragic death of four members of the Institute, Dr A.K. Khanna (Scientist), Dr P.C. Pant (Scientist), Mr Kundan Singh (Driver) and Mr Kunwar Singh Rawat (Field Attendant) who met with fatal accident on 27th August 1984 while proceeding for geological expedition to Lahaul-Spiti region.
- Dr K.S. Bist on 17th June 2008
- Dr K.K. Purohit on 2nd November, 2012
- Dr B.K. Choudhary on 18th March, 2014



Ashok Kumar Khanna
(1951-1984)



Pramod Chandra Pant
(1954-1984)



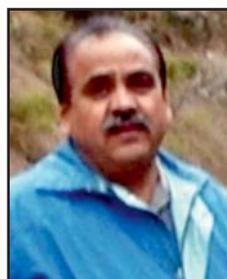
Kundan Singh
(1945-1984)



Kunwar Singh Rawat
(1959-1984)



Kuldeep Singh Bist
(1951-2008)



Kishore Kumar Purohit
(1954-2012)



Barun Kanti Choudhury
(1955-2014)

Past and Present Staff of the WIHG

(*Compiled from Annual Reports of WIHG)

PAST SCIENTIFIC STAFF

1. Dr. S. C.D. Sah
2. Dr. K.S. Valdiya
3. Dr. S.K. Tandon
4. Dr. A.K. Jain
5. Dr. V.C. Thakur
6. Dr. P.K. Verma
7. Dr. N.S. Mathur
8. Dr. Devendra Pal
9. Dr. K.K. Sharma
10. Dr. A.C. Nanda
11. Dr. A.K. Sinha
12. Dr. N.S. Viridi
13. Dr. Surendar Kumar
14. Dr. G.C.S. Gaur
15. Dr. Trilochan Singh
16. Dr. R.A.K. Srivastava
17. Dr. R.J. Azmi
18. Dr. T.N. Bagati
19. Dr. K.R. Gupta
20. Dr. K.S. Bisht
21. Dr. B.K. Choudhary
22. Dr. R.C. Mehrotra
23. Dr. Hakim Rai
24. Dr. R.K. Mazari
25. Dr. J.T. Gergan
26. Dr. N.C. Mehrotra
27. Dr. R.S. Rawat
28. Dr. A.K. Khanna
29. Dr. P.C. Pant
30. Dr. M.S. Rathi
31. Dr. K.S. Bisht
32. Dr. V.C. Tewari
33. Dr. N.S. Gururajan
34. Dr. A.K. Dubey
35. Dr. G.D. Gupta
36. Shri R.R. Patil
37. Dr. M.I. Bhat
38. Dr. B.R. Yadav
39. Shri Rajeev Banga
40. Dr. D.K. Misra
41. Dr. R.K. Chaujar
42. Dr. Keser Singh
43. Dr. S.K. Paul
44. Dr. V.M. Choubey
45. Dr. N.R. Phadatare
46. Dr. B.N. Tiwari
47. Dr. Talat Ahmad
48. Dr. Rohtash Kumar
49. Dr. S.K. Ghosh
50. Dr. P.P. Khanna
51. Dr. M.P. Sah
52. Dr. N.K. Saini
53. Dr. Neeta Sehgal
54. Dr. T.N. Johar
55. Dr. K.P. Juyal
56. Dr. K.K. Purohit
57. Dr. B.K. Nayak
58. Dr. Rafikul Islam
59. Mr. B.S. Rawat
60. Dr. P.K. Mukherjee
61. Dr. S.J. Sangode
62. Dr. P. Banerjee
63. Dr. S.K. Parcha
64. Dr. V.K. Saini
65. Mr. V. Sriram
66. Dr. Bhagwat Sharma
67. Dr. N. Siva Siddaiah
68. Dr. Kamal
69. Dr. A.K. Mundepi
70. Dr. B.R. Arora
71. Dr. Renoj J. Thayyen
72. Dr. A.K. Gupta
73. Dr. R.K. Singh
74. Dr. Indu Shekar

PAST TECHNICAL STAFF

1. Shri V.P. Singh
2. Shri Saeed Ahmed
3. Vajendra Joshi
4. Mrs. S.K. Sharma
5. Mrs. Abha S. Kumar
6. Shri J.J. Sharma
7. Shri M.M.S. Rawat
8. Shri B.B. Sharma
9. Shri A.K. Pandit
10. Shri D.P. Thapliyal
11. Shri K.R. Rao
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38. Shri Kedar Singh
39. Shri Jaya Nand Khanduri
40. Shri Ansuya Prasad
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| | 72. Shri D.P. Chowdhury |
| | 73. Mrs. Sharda |
| | 74. Shri Roshan Lal Raina |

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43. Shri Bhagat Singh

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| | 19. Dr. Suresh N. |

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8. Shri Vijay Singh
9. Shri Rudhra Chetri
10. Shri Laxman S. Bhandari
11. Shri Pradeep Kumar
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13. Shri Ummed Singh

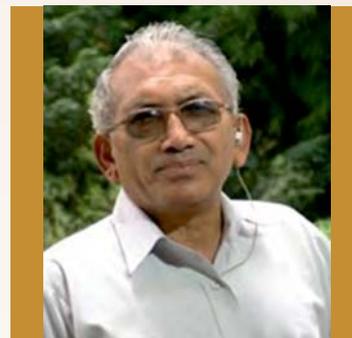
**Any omissions are inadvertent and regretted*

** Not necessarily in order of seniority*

Reminiscences

K. S. VALDIYA

Jawaharlal Nehru Centre for Advanced Scientific Research Bengaluru
Former, Additional Director & Former Chairman Governing Body, WIHG
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As I Remember

It was June 1963 at Shimla in Himachal Pradesh. National Prof. D.N. Wadia, the giant amongst the geologists had organized a two - day seminar in Grand Hotel. The meet was sponsored by the Education Ministry, Government of India, and the scholarly minister Professor Humayun Kabir inaugurated it. Among the participants were Prof. W.D. West from Sagar University, Prof. R.C. Misra from Lucknow University, Prof. I.C. Pandey from Panjab University, Prof. S. Deb from Jadavpur University, Shree Dashazara from Geological Survey of India, Kolkata and Shree B.N. Raina from the Himalayan Geology Division of the Geological Survey of India at Lucknow. I had gifted a group photograph of the participants to Dr S.C.D. Sah, then the Director of Wadia Intitute. It used to be on the wall in the Director's office. I was the youngest of the forty-fifty participants and nervously read my paper, spelling out as usual my rebellious thoughts on the stratigraphy of the Lesser Himalaya. Pointing to the large gap encompassing the Himalaya in the geological map of India. When Dr Wadia suggested the idea of having an institute devoted exclusively to all-encompassing comprehensive studies of the Himalaya, there was almost unanimous endorsement. However, the Geological Survey of India officials had serious reservations. The Minister Professor Humayun Kabir approved the proposal for establishment of an Institute under the umbrella of Education Ministry.

In the second seminar held in the Geology Department of Lucknow University in 1965, Prof. R.C. Misra was entrusted with the responsibility of preparing the draft of the memorandum of association under Society Registration Act for the institution to be named Institute of Himalayan Geology. Shree Girjesh Chandra, then a lecturer at Lucknow University, greatly helped Prof. Misra to come out with the draft that eventually formed the core of the constitution of the Institute. There was the general feeling that this Institute would be located at Lucknow. However, when Dr A.G. Jhingran, ex-director-general of Geological Survey of India, took over the charge as Professor and Head of the newly established Geology Department in Delhi University, the Institute of the Himalayan Geology was housed in 1½ rooms loaned by the Botany Department of the University. Prof. D.N. Wadia became President and Honorary Director and Professor Jhingran the Honorary Secretary of the Society.

Very soon tragedy befell on the infant institution; Dr Wadia passed away in 1969 without translating in to reality his magnificent dream. Dr M.S. Krishnan assumed charge as the next President; and Professor Jhingran was made the Honorary Director. At that point in early February, I joined the Institute as its first scientist. In the meeting of the Governing Body chaired by Dr Krishnan, the Institute was rechristened “Wadia Institute of Himalayan Geology”. That was in February 1970. Tragedy struck once again; Dr Krishnan breathed his last. Professor Jhingran took over as President in addition to his charge of Honorary Director.

Under the expert and sagacious guidance of Prof. Jhingran, I started from the scratch to work the nitty-gritty of the Institution, building -- acquiring topographical maps, equipments, field gears, advertising searching an appointing scientist, awarding and monitoring scholarship to the research students at different universities and making comprehensive research and development Five Year Plan. Among the earliest to join as scientists are Dr V.C. Thakur from Panjab University, Dr A.K. Jain from Roorkee University and Dr S.K. Shah from Jammu University.

The highlights of our preliminary efforts were annual seminars on Himalayan Geology, beginning in 1971. All active workers, including struggling research students involved in the study of Himalaya and also who were keenly interested in new developments, used to participate in large numbers. They came from across India and from abroad. These seminars used to be serious but festive events in which the participants bonded themselves in lasting friendship.

Apart from organizing the seminars, the responsibility of editing the massive proceedings of the seminars fell on me. For six years I toiled and burned midnight oil to bring out the annual volumes of Himalayan Geology (volume 1-6) then very keenly sought after publication of Wadia Institute of Himalayan Geology.

Despite multiple administrative and managerial tasks, I used to go up to the mountains of Uttarakhand for four to five months in a year -- in two installments - in autumns and in springs. I cannot forget the enriching joy and sublime ecstasy of working as a lone adventurer along the untravelled and less travelled paths traversing the formidable mountains, whispering jungles, smiling fields, lonely long stretches, roaring rivers and vibrant villages. I became an inseparable part of the land I studied and of the people I mingled with.



GEOLOGICAL SOCIETY OF INDIA

Prof. Harsh K. Gupta
President



Message

Dr. Darashaw Noshewan Wadia FRS, National Professor of Geology and Geological Adviser to the Government of India's Department of Atomic Energy, in his Presidential address to the International Geological Congress held at Delhi in 1964 gave an over view of the progress made in different disciplines of Geology including geodetic and gravimetric principles involved in causing the uplift of the Himalaya. His tireless work on stratigraphy of Himalaya and underlining the need to have a dedicated institution, laid the foundation of the Institute of Himalayan Geology in June 1968. It was rightly renamed as the Wadia Institute of Himalayan Geology and shifted to Dehradun in 1974. Over the past 50 years the Institute has made very significant contributions in mapping difficult terrains of north-east and north-west Himalaya, setting up state of art analytical facilities, developing an excellent network of seismic stations and also setting up India's first multi-parametric laboratory to study earthquake precursors. The Institute has been created with an excellent publication record. This all has been possible with untiring efforts of entire scientific manpower and successive Directors of the Institute.

On the occasion of the Golden Jubilee Celebration of WIHG, I wish to compliment the entire staff of WIHG and wish them continued success.

Harsh K. Gupta

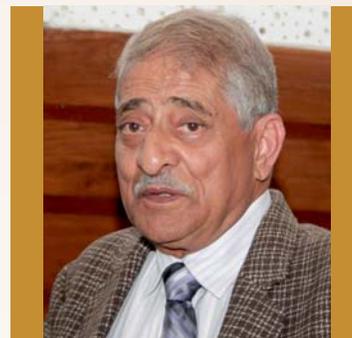
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Immediate Past President, International Union of Geodesy and Geophysics
Member, Atomic Energy Regulatory Board
 Formerly : **Secretary to Govt. of India, Department of Ocean Development**
Vice-Chancellor, Cochin University of Science & Technology
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S. K. SHAH

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Wadia Institute of Himalayan Geology – reminiscences

Though I spent most of my professional time on the teaching staff of the University of Jammu, I always considered Wadia Institute of Himalayan Geology (WIHG) as my second Karma Bhumi. This is because I have been associated with it in one form or another right from the time when the idea of this institute was conceived in a seminar in Lucknow under the patronage of Dr D.N. Wadia himself. I have since closely watched its metamorphosis into a premier institute of international standing through half a century with a sense of satisfaction and pride. That is why I am delighted to reminisce on my association which has always been a pleasant one and continues to be so.

In the initial years the concept of WIHG was in a fluid state. All their activity comprised conduct of annual seminars on recent advances in Himalayan Geology and publishing these papers in an annual volume. I made it a point to attend all these seminars and contribute whenever possible. This became an important forum for all active Himalayan workers to meet, exchange ideas and remain abreast with the latest advances. The other activity consisted of providing modest field grants to university teachers (who were always short of funds) for research work. I was among some of the earliest teachers to partake of this facility. The skeleton staff comprised three scientists, a so called Senior Scientific Officer (SSO, a post almost equivalent to a Reader in a University) and some clerical staff. The Head of the Department of Geology of University of Delhi was the Honorary Director of the Institute.

In 1971 WIHG started conducting research expeditions in Higher Himalaya through participation of active researchers from other organizations. I had the privilege to lead second such expedition in 1973 to Kumaun Himalaya (Niti Pass, Girthi Ganga Section, Rimkhim, Malla Johar region). The other members of this expedition comprised V.K. Gairola (BHU), Surendra Kumar (Lucknow University) and A.K. Sinha (WIHG). While we were still in the field, WIHG conducted interviews for the newly created posts of SSOs. I was selected in absentia since I was away and I came to know of it only on return. Eventually I joined WIHG as a regular staff member. The scientific staff at that point of time comprised three scientists (A.K. Jain, S.K. Tandon and V.C. Thakur), myself, Deputy Director (K.S. Valdiya) in addition to Honorary Director (A.G. Jhingran).

WIHG at this time was placed in an annexe of the Department of Botany of University of Delhi who had kindly allowed the Department of Geology (which did not have much of a building then) to house the Institute staff. The Deputy Director was provided a small cubicle but the rest of us were all sitting in a bigish room where we made cubicle like enclosures by arranging almirahs in a particular fashion.

WIHG as an organization then was primarily field oriented and during my stay there I led the third expedition to Himalaya comprising entirely the institute staff. I also conducted fieldwork in Arunachal Pradesh. While there were ample facilities for fieldwork there was no facility for any laboratory follow up. I remember how many visits I had to make to Jammu for laboratory and library work during my one year stay at the Institute. I also missed my teaching though I volunteered to conduct some classes in the Geology Department of Delhi University. Eventually I found that without a laboratory back up I would not be able to do full justice to all the data that was generated in the field. With a heavy heart I went back to University of Jammu but I continued my association with the Institute and the scientist friends.

After being on the regular staff for a brief period I was a frequent visitor when the Institute was shifted to a rented building in Delhi and finally to Dehradun. Now the Institute had a full-fledged Director (S.C.D. Sah) and a bigger building. It also purchased land for building its own campus. During this period I had some active scientific collaboration with the Institute and two of the scholars who worked with me were funded by the Institute. I had also some joint projects with the Institute scientists through the courtesy of the then President of the Governing Body S.P. Nautiyal and the Director S.C.D. Sah.

As the Institute shifted to its newly constructed campus, it had a rapid expansion of staff and laboratory facilities. Soon it became a reverse traffic for me. While being on the staff of WIHG I would make frequent visits to Jammu for laboratory work; now I started making frequent visits to Dehradun for facilities that did not exist in Jammu.

In succeeding years my association with the Institute was through being a member of the Research Advisory Committee (RAC) where I had a lot of interaction with the scientists of various generations. I had occasion to discuss the different projects with them and getting their inputs and offering suggestions. Academically this was one of the most interesting periods of my association with WIHG that was also a learning process for me.

I also had two terms as a member of the Governing Body (GB) of the Institute where I got involved in policy making and functioning of the organization. It was a prolonged phase of knowing the nitty-gritty of how a research organization functions and what are the problems involved. It was also an opportunity to understand and handle the individual idiosyncrasies that one encounters in dealing with different persons. In the first term I was a member of Grievance Committee where we discussed and tried to solve the problems of scientists. I realized that the scientists have their own kind of problems where human emotions are deeply involved and they are not necessarily down to earth pragmatic realists as is the common belief about them. During the second term I was deeply involved with making a vision paper for the Institute that would form the basis of the future direction of expansion and research.

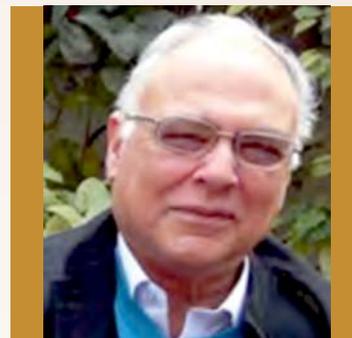
I had always an enjoyable association and interaction with all persons concerning the Institute, including my peers, my colleagues, fellow scientists of all generations and even non-technical staff. Among the peers I was beholden to all Presidents of the GB including A.G. Jhingran, S.P. Nautiyal, R.C. Misra, S.S. Merh, K. Jacob and of course K.S. Valdiya. I had cordial relations with all Directors, namely S.C.D. Sah, V.C. Thakur, N.S. Viridi, B.R. Arora, A.K. Gupta and in-charge Directors A.C. Nanda and A.K. Dubey. I have known the present in-charge Director Meera Tiwari from her student days when I had the occasion to conduct some classroom lectures to cover their syllabus in Kumaun University, Nainital, since they did not have a specialist teacher in Palaeontology at that point of time.

I have forgotten the number of times I was a member of the selection Committee for appointment and promotion of scientists, but I remember each scientist who appeared before me and his specialization. Occasionally I had an opportunity to see their progress and to find if we had really made a right choice.

WIHG has given me a lot of courtesy, consideration and assistance at all times and I am thankful to all concerned. I am not sure if I have been able to recompense all that but I have always tried my best to do so. While reminiscing on my association with WIHG I often wonder if I am a “living fossil” of that organization. If it is so then it puts me in illustrious company of some remarkable people and I am glad to be among them.

S. K. TANDON

Former Scientist & Present Chairman, Governing Body
 WIHG, Dehradun
 sktand@rediffmail.com



Reminiscences of the Wadia Institute of Himalayan Geology - The beginnings and early days in Delhi

Reminiscing the recent past is of common occurrence for multiple reasons; however reminiscing the distant past from fifty years yester is quite uncommon as memories get overprinted by many younger events. The Wadia Institute of Himalayan Geology, known as the Institute of Himalayan Geology at the time of its establishment, is now celebrating its Golden Jubilee. This then is the occasion when one has been called upon to reminisce from that deep past- the past of those founding years by some of us who were associated with the Institute in that phase of its history, and by some stroke of fortune continue to be associated with it fifty years later, to this day.

Following the submission of my doctoral thesis in July 1971 to the University of Delhi, I joined the WIHG as a Scientific Officer along with Dr A.K. Jain who came from the erstwhile University of Roorkee. Earlier, Dr K.S. Valdiya had given up his teaching position at the Udaipur University to join the Institute as a Senior Scientific Officer/Deputy Director. The beginnings of the Institute were humble- some minimum space had been squeezed out for the Institute out of the meagre space that had been allocated to the Department of Geology of the University of Delhi. Professor A.G. Jhingran, a leading figure in the domain of geological sciences headed the Department of Geology and he was also the Honorary Director of the Institute. Dr D.N. Wadia, National Professor of Geology, Dr M.S. Krishnan, and Dr W.D. West who was at the University of Sagar were the father figures in the geological sciences in those times and were involved in giving shape to seeding the core activities of the Institute. They clearly envisaged a synergistic existence for the Institute; synergy between the Institute, the academic departments where Himalayan geosciences was being pursued as well as with the professional geoscientists of the Geological Survey of India, ONGC, and the AMD.

We sought inspiration from the monumental contributions of the doyens of geology mentioned above, and strove to do our bit to unravel the complex geology of the far flung areas of the Himalaya. Professor Jhingran encouraged his younger colleagues to begin to explore the little known tracts of Arunachal Pradesh (then NEFA), Tethyan zone of Kumaun and Garhwal, and the suture zones of Ladakh. I would like to recall that the resources were meagre; there was only one field vehicle in the early days which was driven by the very resourceful Puran Singh.

Despite the limited resources, enthusiasm ran high in those of us who were part of the Institute in those early days- this list included K.S. Valdiya, A.K. Jain, V.C. Thakur, A.K. Sinha, as well as S.K. Shah and Late R.P. Sharma for brief periods. Expeditions to various parts of the Himalaya and the annual Himalayan Geology seminar became a part of the calendar of the Institute providing the much required boost to Himalayan Geology that Prof. D.N. Wadia had envisioned as a founding father. From the annual Himalayan Geology seminars, which also 'travelled' to various Himalayan destinations such as Srinagar (Garhwal) and Dehradun for a few years, came the tradition of producing the Himalayan Geology volumes that contained the proceedings of these seminars. Over the years this seminar series became an important literature resource for those embarking upon research careers in the area of Himalayan Geosciences.

The mid-seventies of the previous century saw more expansion in the scientific strength of the Institute. Quite a few scientists including A.C. Nanda, D. Pal, K.K. Sharma, T.N. Bagati, N.S. Mathur, Surender

Kumar joined during the last phase before the Institute shifted to Dehradun. India was going through the political turmoil of the Emergency, and Delhi was being decongested. Toward the end of 1975, Dr S.C.D. Sah, a well-known Palynologist from the BSIP was appointed as the Director of the Institute. In February, 1976 the Institute moved from the University of Delhi to a rented premises in Dehradun. It was sheer coincidence that I was entrusted with the task of organizing the first phase of the shifting along with A.C. Nanda, K.K. Sharma, and D. Pal. Relocation of the Institute also brought some upheaval in its wake- Dr K.S. Valdiya left to establish the Department of Geology at the Kumaun University, Naini Tal, Dr A.K. Jain had already chosen to return to the University of Roorkee, and I joined the University of Delhi in August 1976.

The Wadia Institute took rebirth in Dehradun under the dynamic and effective leadership of Shri S.P. Nautiyal who succeeded Professor A.G. Jhingran as President. He was ably assisted in the daunting task of building the Institute in Dehradun from 'ground zero' by Dr S.C.D. Sah, the Director and Dr V.C. Thakur as the Deputy Director. A new era then began in the life of the Institute- a journey of remarkable progress bringing it to what it is today- a landmark scientific institution both in the nation as well as in the scientific landscape of Dehradun and its environs.

Over the past four decades, I have been associated with the Institute in several capacities- as Member and Chairperson of the RAC, member of the Governing Body chaired by Prof. K.S. Valdiya, member of a review committee for WIHG, and more recently as Chairperson of the GB over the last year and a half. I have also had the privilege of delivering the W.D. West Memorial Lecture, the Foundation Day, and Science Day lectures at the Institute.

My association with the WIHG has been truly multi-dimensional, travelling all the way through multiple roles- from that of an early career scientist to the Chairman of the Governing Body of the Wadia Institute. I feel privileged by the richness of this association; the Institute provided me a platform on multiple occasions for intellectual growth, field exposure to the far-flung areas of Arunachal Pradesh and the Tethyan Zone of the Kumaun Himalaya, opportunities for collaborative research and for learned interactions with several colleagues from many disciplines of the geosciences.

I sincerely wish the WIHG an even more glorious journey from here on to its Platinum Jubilee and subsequently to its Centenary Year fifty years hence, and share my sense of great pride for having had the opportunity to be associated with it in many ways over the past five decades.

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Into the Memory Lane: My Destiny at the WIHG

In the National Seminar on Himalayan Geology, 1965, a 20-year old boy travelled to Lucknow with his Ph.D. Supervisor Prof. R.S. Mittal in cold winter from Roorkee, knowing little that that this seminar will change his destiny forever. I was attracted to the fascination of the Himalaya, to start with first field trip in Srinagar, Garhwal in the summers of 1965. With very little support I hired one Nepali porter and a cook and went out for the field trip across the River Alaknanda after its crossing by boat. Those were the days that only two road sections were available on either side of the selected area, which was to be covered on foot. It was done by week-long traverses when I had to fill-in ration and then back on the bridle paths. Due to paucity, sample collection was in small pieces, enough to make thin sections. However, the first effort was laughed at in the Department.

Realizing that it would be extremely difficult to complete the work I shifted to Uttarkashi District where lot of new roads were constructed and facilities were much better. I still preserve my geological map (used again in May 2017), which was prepared on an ammonia print, since we were not permitted to carry toposheets. Many research scholars were faced with such difficulties since xeroxing did not evolve in small cities, but it was exciting to work with full zeal. I still remember to have slept for six months on the floor of my departmental room during winter with heater on.

1969 saw completion of my Ph. D. thesis, with great difficulty! Who did not have that time!! And then what! With the Senior fellowship in hand I survived another two years without job.

It was only in early 1971 (I think) that I got an opportunity to present my work as the very first paper in the National Seminar on Himalayan Geology in Delhi. And I was so nervous to face such big audience. BUT my presentation was excellent with lots of congratulations to follow. Late Prof. A.G. Jhingran could spot me, and I was offered my first job in the Institute of Himalayan Geology, Delhi as Scientific Officer. I joined the post in August, 1971.

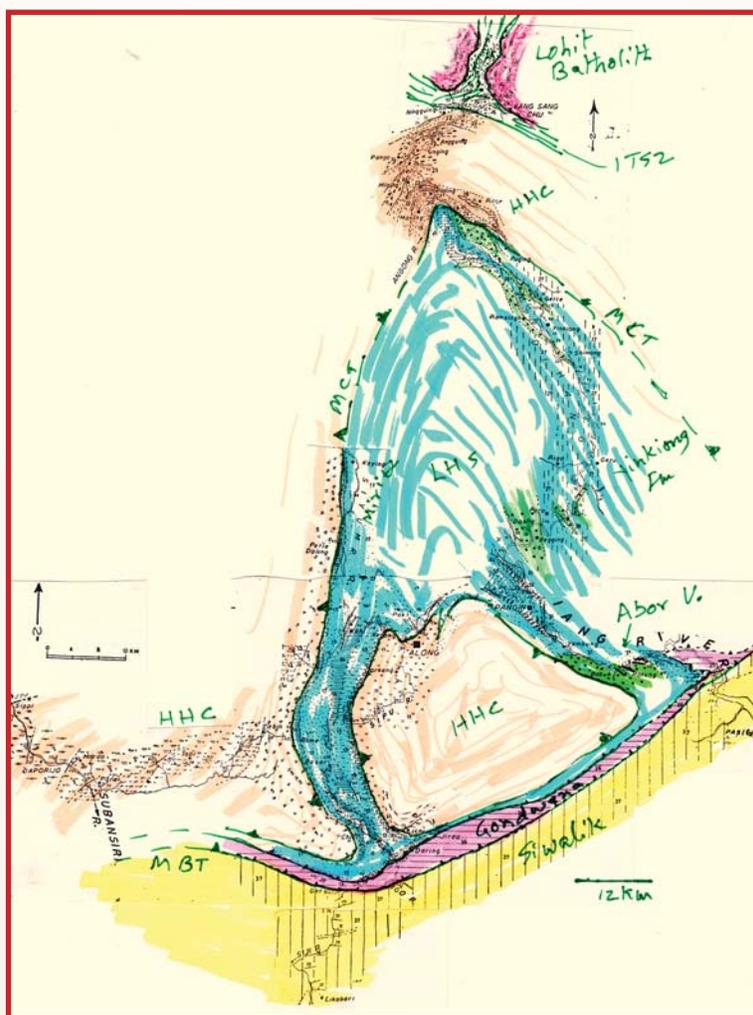
Two rooms in the Botany Department was our working space with one/two microscopes. One small room was occupied by Dr K.S. Valdiya, while some of us with research scholars were put in a big hall that was partitioned by steel almeries.

Initial thinking in the Institute was to carryout extensive mapping of the Himalaya, with Valdiya doing the Garhwal and Kumaun. New Scientists (myself and S.K. Tandon who joined later) were assigned Arunachal Pradesh. That is how my future was shaped with the Arunachal Himalaya about which everyone was ignorant about its geology, geography and people. We were told that man hunting was still prevalent in the interiors. The first trip was done by Institute jeep (converted into van) in winter 1971 to Siyum, Siang, Subabsiri and Kameng Districts, with two research scholars to be trained by us (one of them became the scientist in the Institute). We travelled to Dibrugarh by road in 4 days (about 2000 km) and crossed Brahmaputra River by ferry to reach Likabari on the other bank. Legally, petrol was available only in the plains and one has to travel 150 km to fill in the tank (we had special powers to buy petrol from local market). Puran Singh was an excellent driver and cook, and could save our lives on the road from Kaying to Along due to break failure on very steep descent. It was mostly dense forest with under-developed markets. Bamboo forest and under foliage made the field work extremely difficult except the road sections.

The Second 1972 Expedition to Arunachal was better planned with long road travel from Delhi to Dibrugarh. This time V.C. Thakur was with me and we crossed the Brahmaputra from Dibrugarh to Pasighat (about 12 hours on ferry) and travelled all the way to Yinkiong along the Siang River. Further north, it involved 14-day trekking to Tuting on left bank and return from the other bank. Fascinating geology was before us since we could cross all the tectonic units of the Arunachal Himalaya, including the Siwaliks and the Gondwanas in the foothills, the NW-SE trending Abor-Miri association of the Lesser Himalaya, the Higher Himalayan Crystallines (HHC) near the Eastern Himalayan Syntaxis, the Indus Tsangpo Suture Zone near Tuting and the Trans-Himalayan Batholith further north towards Tibet. Return was through Mishmi Hills where we could observe truncation of whole of Siwaliks and Lesser Himalayan Sequence; the HHC almost juxtaposing against the Brahmaputra Alluvium. A very exciting tectonic setting, indeed! We could thus trace extension and orthogonality of all tectonic units from main NE-SW trending units to NW-SE in Mishmi Hills.

1974 was again the turning point in my career when I started feeling frustrated in the Institute with no career enhancement; not realizing and unaware of the fact that it was going for big expansion. As one of its early and few scientist my journey ended in October, 1974 when I shifted to the University of Roorkee as Lecturer.

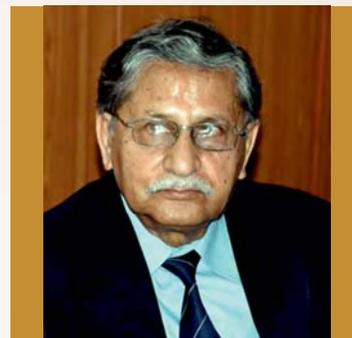
Neither the Institute nor Arunachal died in me with this changeover. Future saw more interaction and scientific contributions, as Arunachal remained my first priority. I returned to the WIHG as INSA Senior Scientist during 2011-12, while Arunachal produced one Ph.D. on Fission Track, etc. One never knows what next in my travel time!!!



First Map of NE Himalaya (Siang Antiform) produced by Dr A.K. Jain in 1974

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**Remembering the Past: Some musings**

In early 1965, an idea was mooted in the geological circle to propose an institute which will exclusively focus on the geology of the Himalaya. A meeting of the stalwarts like W.D. West, Dipankar Neogy, R.C. Misra, A.G. Jhingran, R.C. Sinha, I.C. Pandey, S. Deb, M.K. Hazra, R.S. Mittal, Rajnath, R.H. Rasul and several other geoscientists was held in Shimla under the chairmanship of the National Professor D.N. Wadia. In that meeting it was recorded that a major part of the Himalaya had not been mapped by the GSI by that time and therefore, the first priority will have to be given to prepare maps of the unmapped topographical sheets on 1 inch scale (50 thousand sheets were then not available). The lead was taken by Prof. R.C. Misra at Lucknow University where K.S. Valdiya had already earned recognition as a Himalayan geologist through his stellar performance at the last IGC held in Delhi. Most north Indian Universities were then asked to enrol young enthusiastic students to select their research problems in the Himalayan terrain and by default prepare a geological map of the study area. Prakash Dixit in Banaras, R.P. Sharma, Surendra Kumar and Dhiraj Banerjee in Lucknow, Phani Chattopadhaya in Jadavpur, Subhash Mukherje in Aligarh, Arvind Jain in Roorkee, S.K. Singh in Chandigarh and a few others (some names I have forgotten) were involved in this program with special funding from the Government of India (I do not remember which Ministry it was then, perhaps Ministry of Education). At that time CSIR JRF used to get 300/-pm +1000/-contingency. In contrast, we were paid 400/- of fellowship and 1500/- contingency. This was considered quite substantial and prestigious at that time. Together, over a period of three years, several parts of Kumaun, Garhwal, Himachal and Sikkim were mapped and a number of Ph.D. theses were submitted. While the work by the young researchers were in progress, the First Seminar on Himalayan Geology was organized by the Lucknow University in the winters of 1965 which was presided over by Prof. D.N. Wadia. All the young researchers got the opportunity to present research papers for the first time.

After this Seminar at Lucknow, it was more or less informally decided that the proposed institute will be housed in the Geology Department of the Lucknow University and the land behind the Geology Department will be given for the construction of the new Institute. This proposal was strongly supported by A.G. Jhingran who was then Director General of Geological Survey and also had the plan of settling in Lucknow after retirement from GSI. At this time, the process of writing the Constitution of the Institute of Himalayan Geology (as it was called then) was initiated. Prof. Misra handed over this job to one of the faculty members Girjesh Chandra who was good in drafting. RP Sharma and myself were asked by Prof. Misra to assist Girjesh Chandra on day- to-day basis. It took several months to prepare the Draft Constitution (which I believe may have changed over the years) which was subsequently vetted by several senior geoscientists including K.S. Valdiya who had by then returned from USA where he had gone under Fullbright fellowship. It was informally recorded that R.C. Misra will be the Honorary Director, K.S. Valdiya will take over as the Deputy Director, P.C. Dixit, D.M. Banerjee, R.P. Sharma and P.B. Chatterjee will be posted as Field Supervisors in Kumaun, Himachal, Garhwal and Sikkim. There was no official notification but this was the arrangement being planned at the incipient stage of Institute formation. We the Field Supervisors were expected to remain stationed in their respective regional huts at least 6 months in a year like GSI officers.

The above mentioned plan was shattered with A.G. Jhingran joining the Delhi University as the first Professor of Geology in November 1966 after his retirement from GSI. The proposal to establish the

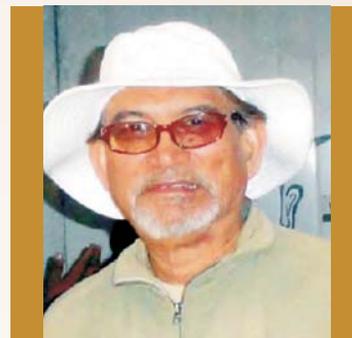
Himalayan Institute was reconsidered and it was finally decided to house it in two rooms of Botany Department loaned to Geology Department of Delhi University. This proposal had the blessings of D.N. Wadia who was also stationed in Delhi and wanted to remain in touch with its day-to-day development. It survived in DU campus for a number of years. K.S. Valdiya was the first scientist to be appointed as Senior Scientific Officer in January 1970. Exactly at the same time I joined DU as a lecturer. A.K. Jain was the first Junior Scientific Officer to be appointed. In subsequent years Vikram Thakur was appointed as JSO while R.P. Sharma joined as second Senior Scientific Officer which he resigned to take up NORAD fellowship in Norway. A.K. Sinha and S.K. Shah were later additions to the scientific cadre of the Institute. All the Institute scientists took part in teaching in the Department and members of the teaching faculty made use of the Institute's facilities without any restriction. The Seminar of the newly formed Institute of Himalayan Geology was held in DU campus in 1970 with Minister of Steel and Mines gracing the occasion. The entire arrangement of the first seminar was made by four of us; Valdiya, Jain, Roonwal and myself, working day and night.

In 1971, the first expedition to Tethys Himalaya was organized by the Institute. The six member team comprising K.S. Valdiya (Leader), K.B. Powar (Metamorphic/Igneous Petrologist) V.J. Gupta (Paleontologist), D.M. Banerjee (Sedimentologist and Regional Geologist), R. Venkatachalam (Geophysicists), R.K. Khanna (Army Engineers Corp) went up to Lipu Lekh Pass trekking on the famous Kailash-Mansarovar route.

The Institute was renamed as Wadia Institute after the sad demise of Prof. Wadia. It was also decided to shift the Institute to a place where large piece of land was made available. There was considerable dithering on this score and sites in Delhi, Meerut and Roorkee were explored. Finally, it was shifted to Dehradun on the intervention of S.P. Nautiyal who was then a member of the Governing Body of the Institute.

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**Reminiscences of my journey with Wadia Institute**

The Wadia Institute has come a long way from Grant - in - aid institute when started in Delhi University to a full-fledged national laboratory. In its earlier days, it organised Himalayan Geology seminars, multi - institutional expeditions to remote areas, published Himalayan Geology volumes, and awarded research fellowships and teacher -grantee aid to university faculty to undertake field work. With its shifting from Delhi to Dehradun in 1976 and appointment of the full time Director, Dr S.C.D. Sah, the Wadia institute started taking shape of an earth science research institute. As a directive of the Department of Science and Technology, a small group of scientists, under the benevolent guidance of the Director, prepared the document of ten years plan giving the institutional framework, identified thrust areas of research, research projects with long and short term objectives, and budgetary provision. This document laid the foundation for the growth of the institute. The credit for acquiring of land and construction of the institute building goes to Shri S.P. Nautiyal, President of the Governing body. He used to sit with the group of scientists and the architect that gave rise to the layout of laboratories, scientist rooms, library, museum and auditorium. Among the major research programmes initiated were the Indus Suture of Ladakh, Tethyan zone of Spiti, Siwalik foreland basin, Lesser Himalayan bio-stratigraphy, regional framework and tectonics of Arunachal Himalaya. The projects were formulated and executed with multidisciplinary approach. In sixties of Ladakh, Spiti and Arunachal, the infrastructure were not well developed in those areas. There was no petrol pump, no garage, no good bazaar in Leh. There was no Manali - Leh road, and for every emergency we had to send the vehicle to Srinagar. However , we were fortunate to have an official arrangement through Ministry of Defence, under which army assistance to civilian, we used to get fuel, ration, vehicle maintenance and stay facility from army units posted in Ladakh, we used to take traverses off the road lasting one to three weeks hiring ponies and labour and camping on the ground. Through these efforts we were able to generate the first order data of terra incognita areas of Ladakh and Karakoram that came out in the form of a monograph. Similarly through such field expeditions, another monograph on the Higher and Tethys Himalaya of Kumaun- Garhwal was published. Another aspect of fieldwork in Arunachal was that the field parties travelled by road, It took them 4-5 days drive by the institute vehicle one way to reach the field area. During this time, one of the major discovery of lower Cambrian conodonts was made by the Wadia scientist that changed the biostratigraphic chronological sequence of the Lesser Himalaya from the Mesozoic to the lower Cambrian - Precambrian.

By the time of retirement of Dr S.C.D. Sah came, the basic laboratory facilities and infrastructure had been developed in the institute for carrying out research in the Himalaya. As I took over as Director in 1987, one of my main aim was to develop rare earth geochemistry, radiometric dating, electron micro- probe for mineral chemistry facilities, for it was becoming difficult for the hard rock geologists to publish papers in good international journals without generating data in these fields. I was successful in creating ICPMS facility but failed in others because of financial constraint. In addition, I initiated to develop new frontier of research in areas of geodesy (GPS), seismicity, paleoseismology, model deformation in structural geology, magnetostratigraphy dating, glaciology, and natural resources data management collaborating with national programmes of the DST. The convergence and slip rate of northwest Himalaya was computed first time through GPS measurements that gave rise to concept of locked zone consistent with the central Himalaya. A

seismological network of stations was established in Kangra – Chamba region to record microseismicity, with the creation of a central recording set up at Naddi in Dharamsala. A permanent field station was set up at the base of Dhokriani-Bamak glacier in Garhwal to monitor the retreat of the glacier. This monitoring continued for more than 10 years. The data generated in this station later captured the attention of the global climate change community, and in October 29, 2007 issue of Times magazine, the scientist producing the data featured as one of the HEROES of the environment among world personalities like Gorbachev, AL Gore and Prince Charles. The Natural Resources Data Management System center was established at Pauri Garhwal, This center continued for nearly ten years, providing administrative support though generation of data for ongoing developmental projects. In capability building, the institute organised several training courses in upgrading skills and updating knowledge in earth science related activities. We also organised 4 UNESCO regional training courses in structural Geology for international and home participants. To run the institute and all these programmes, the administration played the crucial role. I used to have regular meetings once in a while face to face of the Registrar and Finance officer with the Group Heads to sort out the problems of the scientists in pursuing their research. One weakness I found in our system, as that I used to quote, how come that foreigners come in large teams from different institutions and with multidisciplinary approach produce benchmark papers on Himalaya. I used to find difficulty to build such teams probably due to individualistic personalities. But there was a cohesive group of Central facilities labs that provided analytical facilities not only to the scientist of the institute but for large numbers of researchers from the universities. Finally I presume that I had two successful tenures as Director. However all these endeavours would not have been possible without the full support of the DST, my colleagues in the Institute and mentors.

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I joined the Wadia Institute of Himalayan Geology in the year 1973. In the beginning, we were in two small rooms in the Botany Department of Delhi University. Professor A.G. Jhingran was our Honorary Director. Rooms were shared by Dr K.S. Valdiya, Dr V.C. Thakur and myself. We did expeditions and field work in Malla Johar and in the Higher Central Himalaya of Kumaon and Garhwal regions close to the Indo-Tibetan border. There we discovered a deposit of high grade Barite in the Girthi Ganga Valley (Please see the chapter in my monograph “Geology of Higher Central Himalaya”) published by John Wiley and Sons in London.

Subsequently we worked in Lahaul Spiti and Ladakh regions and published important papers with research scholars.

We also published for International Geological Correlation Programme (IGCP), UNESCO, and International Lithosphere Programme.

Finally, I was invited by the Friendship University, Moscow, to submit Doctor of Science to be honoured as Professor. With the growth of WIHG some of us were bestowed with National Mineral Award by the Government of India.

We moved to our new campus (present premises) in the year 1983.

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I joined the Wadia Institute as Scientist 'C' in March 1977, when the Institute was housed in a rented building at 15, Municipal Road. In 1977, Prof. S.P. Nautiyal was appointed as the Chairman Governing Body succeeding Prof. A.G. Jhingran who was also the Honorary Director till 1976, when Dr. S.C.D. Sah was appointed a regular Director. When I joined there were only 11 scientists. Prof. Nautiyal initiated the long term planning with new Governing Body and involving the senior scientists. The first systematic annual report was prepared by me and I reported the activities as per major projects, viz., Indus Suture Zone, the Tethyan sequence of Lahaul Spiti, Lesser Himalaya and outer Himalaya, Siwaliks and Lower Tertiaries. My first assignment was in the Indus Suture Zone of Ladakh. We started mapping in SE Ladakh jointly with Drs V.C. Thakur and S. Kumar. Earlier experience of work on a suture zone in Central Anglesey, North Wales, my Ph.D. from University of Leeds, UK, and having worked in Ladakh in 1970-71 helped to bring out interesting and exciting new results viz. discovery of Permian fossils in metamorphics of Tso Morari complex (Thaglang La Formation) as well as high pressure metamorphic assemblages in the ultramafics of SE Ladakh. Other teams worked in different parts of the suture zone in Indus and Shyok valleys and mapped virgin terrains to bring out new data and proposed evolutionary models and the occurrence of paired metamorphic belts in the Indus suture zone in the Himalaya.

As an initiative of Prof. Nautiyal we purchased a plot of land at GMS Road and planned the construction of new complex. We shifted to the new complex in 1982-83 and organized various laboratories, library and museum, etc. The research activities were now organized under various research groups. The Institute also had its first review committee in 1981 and new directions were given to the Himalayan research, new projects were launched and more scientists were recruited. Prof. K.S. Valdiya joined the Institute as Additional Director and organized Engineering Geology and Environmental geology studies. We started providing consultancy about hydel projects, building foundations, ropeways (e.g. Joshimath ropeway 1983-84) and tubewells in the Doon valley.

On 23rd October, 1983, we celebrated the Birth centenary of Dr D.N. Wadia in the library as the auditorium was still under construction. Mrs Mehr Wadia wife of Dr D.N. Wadia was our chief guest. Prof. Peter Molnar and Dr S.K. Mukherjee, DG GSI were the honoured guest speakers. Govt. of India also issued a commemorative postal stamp to mark the occasion

The research contributions of this Institute were now recognized nationally and internationally. Prestigious National Mineral Awards were won by Dr V.C. Thakur (1983-84), myself and Dr A.K. Sinha (1984-85).

The Institute also had some tragic moments. We lost two brilliant palaeontologists Dr. A.K. Khanna and Dr P.C. Pant on their way to Spiti for fieldwork. The vehicle driven by Shri Kundan Singh fell in the Satluj gorge at Taranda. All the occupants—two scientists, the driver and an attendant Shri Kunwar Singh Rawat died on the spot. My duty was to recover the bodies and bring them to Dehradun. It was really a traumatic experience in August, 1984.

Till 1987, the Institute was observing neither the Foundation Day (29th June) nor the D.N. Wadia Birthday (23rd October). It was during the chairmanship of Dr Kurien Jacob that on a suggestion and a note prepared by me for the G.B., the proposal to celebrate the Foundation day and Founder's day was accepted. In July 1988, Dr K.R. Narayanan, then the Minister of State for S & T and subsequently the President of India was

our chief guest and inaugurated the Building and Laboratory Complex. We also started a series of special lectures in honour of Dr D.N. Wadia, Dr J.B. Auden, etc.

It was during the chairmanship of Prof. K.B. Powar that we celebrated the Silver Jubilee of WIHG on 29th June, 1993, unfortunately on a low key and without much fanfare and any high dignitary as the chief guest.

We also initiated studies on landslide hazard zonation and documentation of major slope failures and cloud bursts in the western Himalaya. New labs were established in the newly constructed 4th block which now housed the Geophysics and Geomorphology groups. The seismic network and GPS studies were started with full fervour. We also started studies on active faults and neotectonic activities under Indo-US project with the Oregon State University U.S.A. jointly with Prof. R.S. Yeats. First training course in Palaeoseismology was organized with participation of experts from USA, Japan, New Zealand and India. This laid the foundation of palaeoseismological studies throughout the country by scientists thus trained and working in other Institutes.

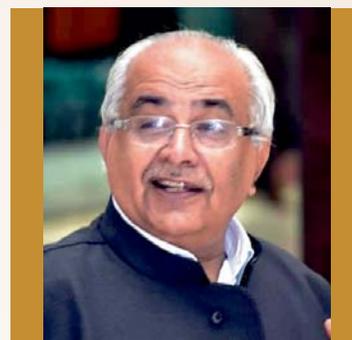
I took over as Acting Director of WIHG on 1st February, 2000. My tenure as Director up to 30th June, 2003 was very eventful. We had the 2nd DST Review Committee in 2002, the Raj Bhasha Committee in 1982 and the Parliamentary Standing Committee on Science and Technology in June 2003. It was a result of recommendations of the Review Committee that the budgetary allocation for the 10th Plan was enhanced and we were thus able to expand our activities. All the Foundation and Founder's days were celebrated with high dignitaries, including Prof. V.S. Ramamurthy, Prof. R.A. Mashelkar, Dr V.S. Rajan, Dr P. Nag, Dr J.C. Pant and Dr Kelkar, etc. Being the Director, I was also a member of the high power committee of the Govt. of India on preparation of Disaster Management plans for the whole country. The recommendations of the committee led to the establishment of Dept. of Disaster Management and Disaster Management Task Force under the Ministry of Home Affairs, Govt. of India. We also constructed our new Guest House within the Institute and some staff quarters. Some labs were renovated and TL/OSL, GPS and Paleomagnetic lab, etc. were strengthened.

I am very fortunate to have spent nine years (2003-2012) after my superannuation as the PI and Emeritus Scientist of two DST sponsored projects. These were very productive years and resulted in new data on active faults and neotectonic activities in the Western Outer and the Lesser Himalaya in Himachal Pradesh and Uttarakhand. This further helped in undertaking palaeoseismological studies by other colleagues in the subsequent years.

Before I close, I would like to share that someone asked about my email id having the name 'Wadia' (nsvwadia99@yahoo.co.in) even after my retirement. I feel we shall always be a part of the Wadia Institute —Jeevan Ke Sath Bhee aur Jeevan Ke Baad Bhee. We have lived to see the Institute through tough times but hope that the future of this Centre of Excellence for studying the unique creation of nature on this planet "the Himalaya" is bright. I wish the Scientists and other staff of the Institute best of coming years so that they can take the Institute to greater heights. GOD BLESS THE WADIA FAMILY.

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**Reminiscences of Wadia Institute of Himalayan Geology: An Introspection***Moments are more important than things*

The magic words “Wadia Institute of Himalayan Geology’ whenever ring my ears, my head bows in gratitude to Professor D.N. Wadia, Doyen of Indian Geology, who was visionary and instrumental in conceptualising the need of establishing an independent Institute dedicated to do advance research on the Himalayan Geology and related fields. This in a unique Institute anywhere on the globe dedicated to unveiling the evolution and geodynamic mysteries involved in the orogeny of the mountain chain resulting from continent-continent collision. My reminiscences with the Institute go back to more than 25 years; first, the Institute facilitated implementation of my field experiments in the Himalaya far from Indian Institute of Geomagnetism, Mumbai. Second, more direct interface when I had the opportunity to serve as a Director of this esteemed Institute during 2003-2009.

A glimpse into the past makes me recognise that the year 1976 was significant as a decision was made to shift the Institute to Dehradun, gateway to the Himalaya. By 1983, new mega building, most modern analytical laboratories and field monitoring networks were established. With the full scale divisional structuring in place, multidisciplinary research on frontline themes were initiated. Hence in the evolution history of the Institute, year 1983 is remembered as a year of rebirth. Discovery of ultrahigh pressure rocks with P-T-t path helped to constrain the process and timing of the subduction of the leading edge of the Tethys ocean floor going down to a depth of 100-120 km. Studies on the pre- and post-orogenic sediments from the Himalayan terrains have enabled to identify stratigraphic gaps and to place chronological constraints on the basin evolution. Discovery of Tiny Shelly Fossil from the Lower Vindhyan of Son Valley, central India which necessitated a major age-revision has withstood the test of time. The institute made important strides in the detection of economically viable magnesite deposits in Kumaun Himalaya, and ores of manganese, lead and copper in high grade metamorphic rocks in Ladakh. Such milestone discoveries had transformed the WIHG as nationally/internationally acclaimed Centre of Excellence in the Geological Studies.

These success stories of the past have always guided the path of future and opened new gateways to induct new disciplines to address new emerging science issues. Introduction of powerful geophysical techniques, imaging crustal structures and state of material, are increasingly supplementing the geological studies. Imaging of the collision zone in terms of electrical resistivity has located the extensive partial melt zone beneath Ladakh batholith at mid-crustal depth (25-35 km). Southward extrusion of the molten material supports the role of channel flow model in explaining the puzzle of inverse metamorphism in the Higher Himalaya. Similarly, passive seismic and magneto-telluric (MT) studies undertaken in Uttarakhand Himalaya have unambiguously imaged the top of the down-going Indian plate (MHT) as a positive velocity/high resistivity north-east dipping interface with a steep ramp at the transition from the Lesser to the Higher Himalaya. Another significant finding is that the MHT is capped by a thin fluid-filled high conductivity layer. Incorporation of mechanical weakening and rheological influence of fluids has been successful in explaining several facet of earthquake occurrences emerging from ever increasing seismic monitoring.

- The mechanical weakening effect of fluids counteracts the fault-normal stresses, facilitating thrust-type earthquakes on the single plane, shown by the GPS data as the locked segment of the MHT.

- The high conductance of the ramp symbolizes block of low shear strength and thus, serves as repository of high degree of strain, which under the deviatoric stresses releases strain into the brittle crust to generate small but more frequent earthquakes in the Himalayan Seismic belt (HSB), which is found to be no more than 30 km wide.
- Infiltration of the over pressurised fluids accompanying seismic pumping/stress transfer help to view fault and shear zones, like the MCT, as locale of micro-seismicity and accounts for the occasional occurrence of seismic swarms.

The seismotectonic model developed is fully validated by the recent Mw7.8 Gorkha earthquake of April 25, 2015. Later was a classic case of unzipping of the locked MHT whereas the largest aftershock of Mw7.3 was a consequence of the propagation of high pore-pressure fluids along the out-of-sequence thrust. Given these successes, the current focus has shifted to Kangra-Sutlej valley in western Himalaya, Sikkim Himalaya and across the Eastern Himalayan syntaxes.

Given that earthquake occurrences result in diverse natural hazards, a major science priority is to provide a safe habitat and possibly giving real time warning are the keystone for societal science. Noting that no individual earthquake precursor is still deterministic for real-time short-time prediction, Multi Parameter Geophysical Observatory (MPGO) is established at Ghuttu. Here, instead of individualistic approach, 11 precursory signals are being monitored simultaneously with a purpose that their cross-validation and synthetic value may pave way for real-time forecast of the earthquake. The MPGO is equipped to monitor stress-induced changes in magnetization, resistivity, density, elastic failure, deformation, radon and electromagnetic emission together with water table fluctuations due to the opening of micro-cracks during the earthquake preparatory cycles. Unlike weather patterns, even moderate magnitude earthquakes have long term return cycle, the efforts have to continue for long term before we taste success.

In alternative strategies to co-live with the constant threat of devastating earthquakes, two inter-linked studies were initiated. Under the first study, a mega project entitled “**HIMalayan School Earthquake Learning Program –HIMSELP**” was undertaken to educate school children to the various terminologies used to define source parameters of earthquake as well drill practices what to do and what not to do during earthquake occurrences. Second component deals with preparation of micro-zonation map depicting realistic scenario of earthquake shaking by estimating peak ground acceleration, attenuation/amplification of propagating seismic waves, thickness of near-surface sedimentary column, etc. First-order micro-zonation maps for Dehradun, Jammu and Chandigarh are already completed to design earthquake resistance buildings.

I have enjoyed every moment of my association with the Institute. My interactions with host ministry, Department of Sciences & Technology, Uttarakhand State authorities and range of experts both at home and abroad are treasures, which I shall cherish for the rest of my life. Dedicated scientists of WIHG are ready to undertake research in fresh challenging areas. I am sure that journey ahead will yield more valuable results. I wish each and every member of the WIHG all the best in their future endeavours.

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My Reminiscences of long journey with WIHG

Generally, many people at the age of 76 develop tendency to forget, even “what they ate in the morning breakfast or where did they keep their wallet”. To recapitulate the events of past 52 years is difficult but in case of Wadia Institute of Himalayan Geology, being so close to my heart and the next door neighbour, memories start flashing from the inception and creation of the Institute, through its 50 years long growth history.

I first heard about the coming up of an Institute on Himalayan Geology, in 1967 from an eminent Himalayan Geologist Dr D.N. Wadia during his visit to Jaduguda Uranium Mine, Singhbhum, Bihar. It was during a get together of the AMD Scientists that Dr Wadia explained his vision of the Institute. A long cherished desire of Dr D.N. Wadia (FRS), to create a Research Institute for studies on Himalayan Geology got fulfilled on 29th June, 1968. I was a witness to the inauguration and start of the Institute of Himalayan Geology in one room of the Botany Department of the Delhi University, under the Honorary Directorship of Prof. A.G. Jhingran (the then Head of the Geology Department of DU).

It was in 1967, when I got a Research Fellowship of McMaster University, Canada. As an AMD Scientist, I had to take permission from Dr D.N. Wadia, who was then an Advisor and was also heading the AMD after the accidental death of its Director, Dr Ghosh. On the sincere advice of Dr Wadia, I registered for Ph.D. in DU, while working in AMD. The topic of my research was “Atomic minerals bearing granites and pegmatites of Bhilwara District of Rajasthan”, under the supervision of Prof. A.G. Jhingran and the National Professor Dr D.N. Wadia as internal AMD supervisor. Since then my proximity to Dr Wadia and his wife Mrs Mehr Wadia, increased and I could visit his official residence and consult his personal library. It was this family closeness that I could persuade Mrs Mehr Wadia to donate Prof Wadia’s personal belongings like library, samples, his official bag, field diaries, maps, work sheets, medals, photographs, etc. to the WIHG.

From 1968 to 1973 WIHG continued research in the Himalaya on expedition basis. Himalayan Geology researchers from various universities were involved with the initial geological studies in remote areas. Drs K.S. Valdiya, S.K. Tandon, A.K. Jain, S.K. Shah, V.C. Thakur, A.K. Sinha, formed the appointed scientific team of the WIHG. It was unfortunate that most of them deserted the Institute at different stages and joined/ returned to their respective universities for better career prospects.

A steady growth of scientists started in WIHG with the appointment of four scientists (A.C. Nanda, D. Pal, N.S. Mathur, K.K. Sharma) with different specializations in 1974. With 8 years of research experience in AMD using sophisticated laboratory facilities and necessary infrastructure for field work in Himalayas, I landed in WIHG having one moderate type binocular microscope and one jeep for field work for 8 scientists. Anyhow, trying to readjust to new circumstances, a local shifting of a part of the Institute to a rented building in Tagore Park, Teg Bahadur Road, Dehradun was done in 1975. With my experience of laboratory based research in AMD, the seeding of the laboratories, library, photography lab, store, etc. was initiated at new campus of the WIHG.

After violent and devastating Kinnaur earthquake of 6.8 magnitude on 19 January, 1975 (causing 47 casualties, landslides, rock falls, avalanches and major damage to the Hindustan-Tibet Road), a field work was planned for me by Prof. Jhingran in the upper Satluj-Spiti Valley, the remotest part of the Kinnaur

region of Himachal Pradesh. Normally field work in such remote areas is done on well planned and well-funded expedition basis, but because of the emergent situation and with limited resources, I had to take this challenge. Dr K.S. Valdiya and I started for Kinnaur in one Jeep with trailer driven by calm and good driver Shri Puran Singh. As per the program, I was dropped at Akpa village and Dr. Valdiya proceeded with the jeep for field work in Kumaun.

How I survived, few months hard field work using small, crowded and stinking government transport, local trucks and defense vehicles, was a rare and unforgettable experience for me. Based on the best possible field and limited petrological data from remote area of Kinnaur Himalayas, I was invited with local hospitality to participate and present my paper “A Contribution to the geology of Satluj Valley, Kinnaur, Himachal Pradesh, India.” in CNRS International Symposium on Ecology and Geology of the Himalaya, Paris in 1976. Post-Symposium Geological Field Excursion to Franco-Italian Alps and visits to the Institute of Dolomieu, University of Grenoble, CNRS Centre for Researches in Petrography and Geochemistry, Nancy, Laboratories Rene Bornes du Centre de Spectrometric Nuclear et de Spectrometric du Masse, Orsay and Paris University, provided unlimited gain in knowledge which I could use during Himalayan researches and development of petrological, geochemical and geochronological laboratory infrastructures in WIHG. I hope younger generation of scientists will learn a lesson to take challenges, work hard and optimize the first available opportunity like a dare devil.

After my France visit, I changed my strategy to generate required petrological, geochemical, geochronologic and isotopic data for better understanding of petrogenesis and geodynamics of the Himalaya. Collaboration with eminent Indian and foreign scientists was established and project funds were used for the researches in Himalaya and its possible southern extension with Bundelkhand craton. Collaborations with PRL, Ahmedabad included, Dr K. Gopalan, Dr S. Krishnaswami, M.M. Sarin, Dr R. Ramesh, Dr Goswami and above all their teacher Prof. D. Lal (FRS). It was a great experience to do field work with Prof. Devender Lal for cosmogenic studies and with Dr Krishnaswami and his students for water isotopic chemistry along the Bhagirathi River starting from Rishikesh to Gangotri. Other collaborations included scientists from BARC, TIFR, AMD, IIT Powai, NGRI, BSIP, GSI, State University of San Diego, Scripps Inst. of Oceanography, University of California, and University of St. Andrews.

The period between 1975 to 1981 marked an important stage in the scientific and material growth of the WIHG: Dr S.C.D. Sah joined the WIHG as its first full time Director, WIHG was shifted to rented buildings in different premises in Delhi and Dehradun, and construction of permanent campus for WIHG in Dehradun. Various activities in WIHG during this period included i) Initial research planning, establishing research groups, searching and selecting suitable equipment and appointment of research specific scientific, technical, supporting and administrative staff, ii) Conducting field studies, collection of field data and samples through Expeditions and individual field work in remote and inaccessible regions of Kinnaur, Spiti, Zaskar, Ladakh, Karakorum, Kumaun, Garhwal, Sikkim, Arunachal Pradesh, Nagaland, etc., iii) Generation of laboratory based research data using/borrowing facilities of national and international universities and research institutions, and iv) Presenting research results in national and international seminars and conferences to project WIHG as a growing research institute for Himalayan geological studies.

Allocation of budgeted funds by DST were limited and largely consumed in construction of the Institute Building. This was also the period of material growth of the WIHG, in terms of converting the paper drawn laboratory based research institute building to its actual shape, necessitating mid-term corrections. Late Prof. S.P. Nautiyal as the Chairman of the WIHG and a large number of nationally and internationally eminent university professors and researchers, played a vital role in shaping the WIHG at its permanent Campus at Dehradun.

My continued interest in fission track studies on terrestrial rocks gave me an opportunity to participate in First International Workshop on Fission Track Dating (1980) in Italy. This workshop was the turning point in the standardization of FT technique by introducing mineral dosimeters in place of glass dosimeters, used since discovery of the FT dating technique.

An opportunity under the British Council Fellowship during 1983-84 was used to carry out XRF analyses of Ladakh samples at University of St. Andrews, attend short basic course on computers, field excursions to Scottish Highlands and lectures projecting the research activities of WIHG. This trip was extended to visit Geophysical Laboratory of the Carnegie Institute, Washington on the invitation of Dr H.S. Yoder and Dr F. Chayas for discussions on Igneous Rock Data Base being prepared under IGCP-163-IGBA project.

The hard work and the quality of researches by the WIHG scientists, was recognized on national and international level with various Prestigious Awards. It was a matter of great satisfaction and pride for all the scientists and other support staff of WIHG, when a survey report on the status of researches in National Earth Sciences Organizations was published in 1996. WIHG with a small strength of scientists was at the second place, after well-established GSI, having a large number of Earth Scientists and a century old history. For me and a team of scientists of the Petrology and Geochemistry Group, it was a matter of great satisfaction to find that in terms of subject wise research contributions, petrology and Geochemistry was judged as the best.

It is needless to mention that the strong foundation of WIHG was laid down by a small group of Scientists and Research Scholars under the Directorship of Dr S.C.D. Sah. The dedicated team of scientists started retiring with Dr Sah first to go in May, 1987, followed gradually by others. It was the vision of this team that the next generation of scientists could take the WIHG to its present position.

After 16 years of retirement I feel very happy when I visit the WIHG and see the fluid inclusion, geochemical, geochronology, isotopic labs with all the modern facilities which me and my colleague scientists had visualized, started and processed during our active service. In fact during our researches in Himalaya, we had been running after such facilities in other institutes. Sometimes I wish to have been born 16 years later and joined the WIHG with present laboratory infrastructures. I wish the young generation of WIHG to work hard like a dare devil and avail these modern facilities to take the Institute to new heights.

A. C. NANDA

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I joined the Wadia Institute on Oct. 11, 1974 as a Scientific Officer (now called Scientist 'B'). As stated in my appointment letter, my monthly salary then was Rs. 749/- only and I was indeed lucky as I was looking for a research job. Prof. A.G. Jhingran, Honorary Director handed me over my appointment letter personally at Chandigarh. Prior to joining the Institute, I was working as a Teaching Assistant in Geology Department, Panjab University. Even at that time Wadia Institute was a pioneer research institute, although it was not having its own building then, and Delhi University provided three rooms, which housed Director Wing, Administrative room and one small room for scientists. However, I was told to sit in a newly acquired building in residential area at 174, Tagore Park. Dr K.S. Valdiya, Deputy Director sat in the same building and there were 4-5 rooms for scientists. The drawing room was converted into library and at a later stage its kitchen at first floor was converted into Photography Lab. However, there was no photographer at that time. As the Director and administrative staff were sitting in Delhi University, for small work, everyone including Deputy Director used to walk down to the University. Tagore Park building was about 4 km away from the Delhi University. Despite various shortcomings, working environment was very good and there was a close cooperation between the scientific, technical and administrative staff. Everybody was determined to work hard to develop the institute. As there was limited staff, scientists were sharing various responsibilities. In the absence of a documentation officer, scientists were doing all jobs concerning the publications. Seminars were always arranged on grand scale and participation was tremendous. Himalayan Geology seminar proceedings were extremely popular and these were in great demand and first two volumes were reprinted to meet the demand. At that time facilities were less, but staff was concerned about the development of the institute. I was sitting in Tagore Park building from Oct., 1974 to March 1976, but no room was allotted to me. With great enthusiasm, I carried out my work from the library. At that time, there was no photographer or draftsman and typists were limited for office work only. However, scientists were able to publish good papers, which gave much needed recognition to institute. Initially, there was one vehicle with Delhi office, and field work by scientists was carried by public transport. Prof. Jhingran, retired Director General of Geological Survey of India, was very particular about the use of Hindi in official life. He published a Hindi journal "Bho Vigyan" and this was always published in time. He preferred to call all staff by their first names as it used to give personal touch. Most of time, we called each other by first name.

After the appointment of Dr S.C.D. Sah as Director in February 1976, Government decided to shift the Institute to Dehradun. Staff was not keen to shift as everybody was habitual of the fast life of Delhi. A small bungalow at 36 Teg Bahadur Road, Dalanwala, was taken on rent. Sometime in April 1976 we shifted completely to Dehradun. As I can recollect, Dr S.K. Tandon was shifting in-charge and was assisted by Dr K.K. Sharma and myself. At that time, I was the junior most scientist of the Institute. At Dehradun, we were receiving truck loads of almirahs, furniture, books, rock and fossil specimens, etc. from Delhi. Scientific and administrative staff unpacked the wooden boxes and other material and arranged the things in proper order. At that time, we lived and worked in trust and not even a single item was found missing. Rather, the staff coming from Delhi was thankful to the shifting team for unpacking and arranging the various items in proper order. The major problem that we encountered at Teg Bahadur Road building was of snakes. Every day these were sighted and sometimes three snakes were seen in a single day! As Teg Bahadur Road building was small, an adjoining building was also occupied. In the drawing room of second building, a nucleus of museum was established.

In 1978, Institute shifted to 15, Municipal Road building, which was more spacious than the two buildings at Teg Bahadur Road. In addition to library and museum, Optical and Geochemical labs were established. Now the Institute was fairly well established and working facilities were improved. Vehicles were provided to scientists for field works and considerable technical and office staff was added. Institute shifted to its permanent site in 1983-1984 and tremendous progress in every sphere has been made since then.

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**My stepping into the Wadia Institute**

My research career commenced with the finding of fresh water gastropods in the youngest beds (“Subathu-Dagshai passage beds”) of the dominantly shallow water marine early Palaeogene Subathu Formation of the Simla Hills. I continued biostratigraphic investigations on this lithounit and completed my Ph.D. work under the supervision of Prof. S.B. Bhatia, a very eminent geologist at the Panjab University, Chandigarh. Thereafter, I joined the Directorate of Mines and Geology, Rajasthan, where I worked for four to five years (1970-74) on some of the geological aspects in the Sirohi District and was also imparted training in base metal (mainly Pb, Zn and Cu) investigations by late Shri RL Surana.

In August 1974, I joined the much celebrated Wadia Institute at Delhi, where I was inspired by the great visionary Prof. A.G. Jhingran, doyen of Geology Dr K.S. Valdiya, Dr V.C. Thakur, Dr S.K. Tandon, Dr A.K. Sinha and Dr A.K. Jain. As I had already worked on the Subathu Formation of the Simla Hills, Dr Valdiya advised me to extend my studies to the Garhwal region.

In 1975, I was deputed by Prof. A.G. Jhingran to undertake one year training at the Indian Photo Interpretation Institute (now Indian Institute of Remote Sensing) at Dehradun. Subsequently, in 1976 the Wadia Institute was shifted to Dehradun. Dr S.C.D. Sah, the first Director of the Institute formulated five research groups comprising various disciplines of Geology. I was happy to be associated with the Biostratigraphy Group and had a very cordial relationship not only with the scientists and staff of the group but also with those of other groups. Dr Sah and subsequent Directors (Dr V.C. Thakur, Dr N.S. Viridi, Dr B.R. Arora and Dr Anil K. Gupta), as well as learned members of RAC and GB were instrumental in expanding the Institute and its infrastructure, including, labs, museum and guest house. This facilitated carrying out advanced research not only by the scientists of our Institute but also of other organizations, making the Wadia Institute a very reputed geological organization.

In order to understand the geodynamic evolution of the Himalaya, several multidisciplinary projects and expeditions, including those in the difficult and inhospitable terrains, were organized by the Institute. I was lucky to participate in Ladakh Expeditions commencing in 1976 along with Dr Devendra Pal, Dr K.K. Sharma, and Dr Surendra Kumar and subsequently with Dr J.T. Gergan, Dr K.P. Juyal, Dr Rohtash Kumar, Dr Kishor Kumar and Dr N.S. Siddaiah. I carried out biostratigraphic investigations mainly on the Cretaceous-Eocene succession not only in the Indus Suture Zone but also in the Tethyan Zone and the Himalayan foothills.

Discussions with Dr Thakur, Dr Sinha, Dr Viridi, Dr Devendra Pal, Dr Hakim Rai and several others greatly helped in understanding evolution of the Himalaya. The results of these studies were published in the form of several papers and a monograph of the Wadia Institute.

I was always supported by my colleagues Dr A.C. Nanda, Dr R.J. Azmi, Dr B.N. Tiwari, Dr Meera Tiwari, Dr Kishor Kumar, Dr S.K. Parcha, Dr R.K. Sehgal and Dr Kapesa Lokho, among others, in discussions on my research activities as well as in smooth functioning of various labs of the Biostratigraphy Group. I carry with me pleasant memories and very cordial relations with all colleagues of scientific, technical and administrative sections of the Institute who invariably stood by me at every step.

Sudden and untimely demise of Dr A.K. Khanna, Dr P.C. Pant, Shri Kundan Singh (Driver) and Shri K.S. Rawat (Field Attendant) in a fatal accident on August 27, 1984 on way to Lahul-Spiti deprived us the company of these young, enthusiastic and promising family members. They will be remembered for times to come.

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**Major scientific contributions using Geochemistry at WIHG**

Geochemical and isotopic studies of the Precambrian mafic magmatic rocks from the Lesser Himalaya helped in understanding the Precambrian lithospheric extension and opening of Lesser Himalayan rift basins (Ahmad and Bhat 1987; Ahmad and Tarney 1991; Ahmad 2008) and those from the northern India shield (Aravalli and Central India regions: Ahmad and Rajamain, 1991; Ahmad and Tarney 1994; Kumar and Ahmad 2007; Ahmad and Jayananda 2008; Ahmad et al. 2008a,b,c; 2009). Similar studies on the Cretaceous magmatic rock of the Indus and Shyok Suture Zones, Ladakh helped in understanding of the closure of the Neo-Tethyan Ocean by northward subduction of the Neo-Tethyan ocean floor under the Eurasian plate (Ahmad et al., 1996, 1998, 2005; 2008).

Nd-isotopic profiling across major structural /metamorphic units indicate that the Vaikrita Thrust is the 'real' Main Central Thrust (MCT). Nd model ages and epsilon Nd values indicate that the high grade Vaikrita Group rocks have much younger mantle extraction ages compared to the Lesser Himalayan sequences. Thus the Vaikrita Group is not the basement for the Lesser Himalayan sequences, rather the former could be basement for the Tethyan Sedimentary Sequences (Ahmad et al., 1999, 2000).

Separated zircon crystals from Ladakh and Karakoram batholiths display zoned zircon crystals typically observed in igneous rocks. U-Pb zircon SHRIMP ages obtained for the Khardun La and Chang La top samples is circa 58 Ma. A Karakoram Batholith sample near Tangste Gompa gives an age of circa 32 Ma. One zircon grain from this sample gave a late Permian age, and this may indicate the involvement of older crust in the batholith. One leucocratic granitic dyke sheet sampled between Darbuk and Shyok villages has a mixture of zircon crystals that gave a range of ages between 15 Ma and 97 Ma. Several grains gave ages ranging between 250 – 970 Ma. These older ages may indicate that older crust was involved in the generation of part of the Karakoram Batholith (possibly the southern portion of the Tibetan slab?). Recent suggestions that collision was as late as 35 Ma may need serious consideration in the light of magmatic zircon ages of 32-36 Ma by Prof. Ahmad and his co-workers from ANU (Ahmad et al. 2008).

Recent and ongoing studies by Prof. Ahmad in the Central Indian Tectonic Zone indicate major role of bi-modal volcanism during Proterozoic Crustal evolution in the Central Indian Shield (Ahmad et al., 2009). Sm-Nd and U-Pb zircon age data from the Amgaon-Tirodi basement rocks indicate first extraction of the crust from mantle started during Archean (~3100 Ma) and the first remobilized granitic melt were generated during early Proterozoic (~2400Ma).

अशोक दुबे

भूतपूर्व वैज्ञानिक जी० व निदेशक (अतिरिक्त प्रभार)
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अतीत की सुनहरी यादें

याद का फिर कोई दरवाजा खुला आखिर—ए—शब
दिल में बिखरी हुई खुशबू—ए—कबा आखिर—ए—शब

याद का एक दरवाजा धीरे—धीरे खुल रहा है। सामने वाडिया संस्थान है जैसे मेरा इंतजार करता हुआ। मैं इसमें प्रविष्ट होता हूँ कुछ देने के लिये और बहुत लेने के लिये। यहां की यादें ही तो मेरे जीवन का संबल हैं।

यादों का हुजूम मेरे आसपास है
मैं बीते वाक्यात् का एहसानमंद हूँ।

समझ नहीं आता ये सिलसिला कहां से प्रारंभ करू। शायद इंग्लैण्ड से करना बेहतर होगा जहां सन् 1974 से 1976 तक मैं पी०एच०डी० कर रहा था। मेरे सुपरवाइजर प्रोफेसर जॉन रेमसे थे, जिनके साथ डा० वी०सी० ठाकुर पहले पी०एच०डी० कर चुके थे। डा० विरदी मुझसे सीनियर थे और उनकी मदद और सलाह मुझे हमेशा मिलती रही। मुझे याद है जब इंग्लैण्ड की मे मैं इंग्लैण्ड का पहला फील्डवर्क करने गया था तब डा० विरदी ने ही अपना ब्रंटन कंपास मुझे उधार दिया था। पी०एच०डी० के पश्चात् जब मैं भारत लौटा तो मुझे ज्ञात था कि डा० ठाकुर और डा० विरदी वाडिया संस्थान में ही कार्यरत हैं। मगर संयोग कुछ ऐसा रहा कि मैं रुड़की विश्वविद्यालय के भूगर्भ विभाग में मिलने गया तो वहां प्रोफेसर वी०के०गौड़ से मुलाकात हुई और उस दिन शाम छः बजे उन्होंने अगले दिन प्रातः विभाग में एक लेक्चरर के पद पर ज्वाइन करने का प्रस्ताव दिया। प्रारंभ में यह नियुक्ति तीन माह की होनी थी और इस दौरान पोस्ट विज्ञापित करने की बात थी। उस समय प्रोफेसर आर०एस० मित्तल यूनिवर्सिटी के कुलपति थे इसलिए बिना किसी परेशानी के मैं रुड़की में जम गया। मेरा समय भी बड़े अच्छे से गुजर रहा था।

इधर वाडिया संस्थान में डा० ठाकुर एक मॉडल विरूपण की प्रयोगशाला स्थापित करना चाह रहे थे। रुड़की में तीन वर्ष गुजारने के पश्चात् मुझे महसूस हो रहा था कि यहां शोध के लिये समय निकालना जरा मुश्किल काम है इसलिए मैं वाडिया संस्थान आ गया।

रुड़की में तो विश्वविद्यालय का मकान था इसलिए देहरादून में सबसे पहले रुकने का कोई ठिकाना ढूंढने की चिन्ता थी। रुड़की में जब मैंने जिक्र किया तो वहां के एक शोध छात्र ने मुझे सलाह दी कि जाकर सीधे डा० राठी के कमरे में रुक जाना। उन्हें जानने वाले और न जानने वाले सब वहीं रुका करते थे। तो इस तरह डा० राठी का घर था बेघरों का ठिकाना। देहरादून पहुंचने पर निदेशक से मिलने से पहले मुझे डा० राठी से मिलने की चिन्ता थी। खैर, उनसे मुलाकात हुई और संयोग से उस समय उनके घर के पास ही एक मकान किराए के लिये खाली था। उस मकान के एक हिस्से में रफी (डा० रफीकुल इस्लाम) रहा करता था। डा० राठी ने इसी घर में मेरा इंतजाम करवा दिया। इस तरह मैं और रफी वर्षों तक एक ही घर में रहे।

ऑफिस के 15 म्यूनिसिपल रोड वाले दफ्तर में मेरी भी कुर्सी मिल गई और डा० ठाकुर के विशेष सहयोग से प्रयोगशाला जमाने में भी कोई रुकावट नहीं आई। परेशानी सिर्फ यह थी कि स्टोर और निदेशक का ऑफिस वसंत विहार में था इसलिए लगातार आना—जाना चलता रहता था।

डा० एस०सी०डी० शाह उस समय निदेशक हुआ करते थे। उनकी तरह सीधा—सादा और सज्जन अधिकारी मैंने अपनी जिन्दगी में दूसरा नहीं देखा। निदेशक के तो पचासों जिम्मेदारी के काम होते हैं मगर इसके बावजूद हमें कभी भी उनसे मिलने का समय नहीं लेना होता था। जब आवश्यकता हो आप उनके ऑफिस में जाकर मुलाकात कर सकते थे। दूसरी महत्वपूर्ण बात! मुलाकात से पहले कभी यह डर नहीं था कि वह क्या कहेंगे या क्या करेंगे। उनका इतना पॉजिटिव एटिट्यूड

होता था कि उन्होंने कभी भी निराश करके मुझे अपने ऑफिस से नहीं लौटाया। जो मैंने चाहा मुझे हमेशा मिला। उनके और डॉ० ठाकुर के बीच कुछ इस तरह का सामंजस्य था कि हमें शोधकार्य में या फील्ड वर्क में कभी कोई परेशानी नहीं हुई। ग्रुप में अपने सहयोगियों के साथ हमने यूनेस्को और दूसरे कई प्रायोजित ट्रेनिंग प्रोग्राम करवाए जिनमें हमें कार्य करने की पूरी स्वतंत्रता थी और इसीलिये यह प्रोग्राम काफी सफल रहे।

इधर मेरे प्रयोग ठीक चल रहे थे और शोध पत्र भी लगातार आ रहे थे। एक दिन अचानक एटलांटा के प्रोफेसर जार्ज डेविस का पत्र मिला। वह एक पाठ्य पुस्तक लिख रहें थे जिसमें मेरे कार्य का जिक्र और कुछ प्रयोग के कुछ चित्र शामिल करना चाहते थे। किसी पाठ्य पुस्तक में चूंकि मेरा काम पहली बार आना था इसलिए मैं काफी उत्साहित था। म्यूनिसिपल रोड के दफ्तर में ही एक छोटा सा कार्यक्रम था जिसमें मैं अपने प्रयोगों के चित्र प्रिंट किया करता था। शाम पांच बजे मैं घर पहुंचा, चाय पी। मदद के लिये श्रीमती जी को साथ लिया और रात तक फोटो प्रिंट किये गए। शायद मुझे लग रहा था कि देर होने पर प्रोफेसर डेविस अपना इरादा न बदल दें। अगले ही दिन उन्हें फोटो पोस्ट किये गए। मेरा यह उत्साह या उत्तेजना कम होते होते उस समय पूरी तरह खत्म हो गई जब डॉ० एम०एम० कुरैशी से मैंने उसका जिक्र किया। डॉ० कुरैशी उस समय डी०एस०टी० में एडवाइजर की पोस्ट संभाले हुए थे। डॉ० कुरैशी ने मुझे ध्यान से देखा और हिदायत बरतने को कहा, "सो व्हाट?"

डॉ० शाह के पश्चात् डॉ० ठाकुर निदशक बने। इससे किसी को आश्चर्य नहीं हुआ क्योंकि यह तो होना ही था। संस्थान के रिसर्च एण्ड प्लानिंग सेल के प्रमुख होने के नाते शोध संबंधी अधिकांश निर्णय डॉ० ठाकुर द्वारा ही लिये जाते थे इसलिए ज्यादा फेर-बदल की गुंजाइस नहीं थी। डॉ० ठाकुर से मैंने अपने जीवन में बहुत कुछ सीखा संस्थान के सर्वोच्च अधिकारी होने के बावजूद उन्होंने कभी भी अपनी राय या सोच थोपनी नहीं चाही। जो भी उनकी सलाह होती थी उसे बड़े धीरे से और समझाते हुए उन्होंने दी। बीच में एक समय यह भी था जब मैं प्लेट टेक्टॉनिक्स के खिलाफ अपने पर्वों में लिख रहा था। वह चाहते तो बेशक मेरे इस काम में रोक लगा सकते थे मगर उन्होंने सिर्फ धीरे से मुझे सलाह दी कि इस तरह का काम करने से बहुत कुछ हासिल नहीं होने वाला। उनकी सलाह मानने में मैंने शायद देर लगा दी। थोड़ा पहले मान लिया होता तो इसमें मेरी ही भलाई होनी थी।

डॉ० विरदी और डॉ० नंदा चूंकि संस्थान के ही सदस्य थे और वह सब की काबिलियत और नाकाबिलियत जानते थे इसलिए उनके समय संस्थान निर्बाधता से चलता रहा। डॉ० बी०आर० अरोड़ा के आने पर थोड़ी धुकधुकी थी कि अब क्या होने वाला है? मगर डॉ० अरोड़ा के व्यक्तित्व की विशेषता थी कि वाडिया संस्थान को वह बहुत जल्दी समझ गए। आदमी की पहचान उनसे बेहतर और उनसे जल्द शायद ही कोई कर सकता है। उनकी इसी क्वालिटी से वह एक अच्छी टीम बनाने में सफल होते हैं और कचरे को किनारे कर देते हैं। उनकी एक और विशेषता है, बड़ी सोच, बड़ी प्लेनिंग और उसे सफलतापूर्वक संचालित करना। यह उनके प्रयासों का ही परिणाम था कि एम०पी०जी०ओ० और ग्लेशियोलॉजी सेंटर संस्थान में आए।

संस्थान के विभिन्न निदेशकों को सफलता मिली मगर यह तभी संभव हो पाया जब संस्थान के कर्मचारियों और प्रशासनिक अधिकारियों का उन्हें भरपूर सहयोग मिला। ऐसे तो सभी कर्मचारी धन्यवाद के पात्र हैं मगर फिर भी श्री० नायर, श्री बर्थवाल, श्री दिनेश चन्द्रा, श्री हरीश चन्द्रा, श्री माहटा और श्री विश्वास का उल्लेख नितांत आवश्यक है। यह सब उनके अथक प्रयासों का परिणाम है कि संस्थान इतनी ऊँचाइयों तक पहुंचा है।

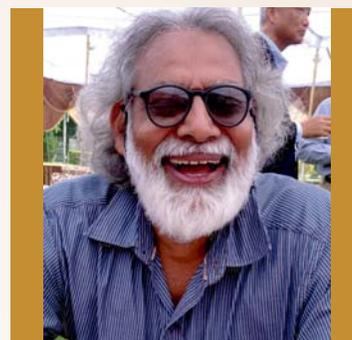
अंत में मगर सबसे महत्वपूर्ण उल्लेख तो डॉ० एम०आई० भट्ट का है। हम दोनों का साथ कुछ इस तरह रहा जैसे चंदन और पानी। चंदन वह थे और पानी मैं। वह न सिर्फ एक अच्छे सहयोगी रहे वरन उससे अच्छे मित्र रहे। हमने कई फील्ड ट्रिप साथ किये और कई शोध-पत्र साथ लिखे। पढ़ने वालों को वह पेपर पसंद आए हों या न आए हों, हो सकता है कुछ लोग नाराज भी हुए हों मगर हमने अपने दिल की भडास निकाल ही ली। रोज सुबह ऑफिस में अपने कमरे में जाने से पहले वह मेरे कमरे में आते थे। रात में जो विचार उनके दिल में आते थे उस पर डिस्कशन होता था और चाय के बाद उनका कमरा खुलता था। उनके श्रीनगर जाने का मुझ पर गहरा सदमा लगा मगर शायद यही उनके लिये बेहतर था। बस हमारे कुछ स्वप्न अधूरे से रह गए।

अतीत हमेशा सुखद होता है। कवि हरिवंश रॉय बच्चन के शब्दों में "अब न रहे वो पीने वाल अब न रही वो मधुशाला"

फिर भी मैं जानता हूँ संस्थान उन्नति करता रहेगा। इस सुखद भविष्य के लिये मैं अपनी शुभकामनाएं देता हूँ। अगले पचास वर्षों में यह और अधिक ऊँचाइयों तक पहुंचेगा और इसकी अंतर्राष्ट्रीय ख्याति में और चार चाँद लगेंगे।

R. J. AZMI

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My Unforgettable Moments of WIHG.....

My Selection to Wadia as Scientist 'B' - a Big Surprise to me!

My selection in 1977 as Scientist 'B' in WIHG at Dehradun was a big surprise to me—neither I had sufficient experience of working in the Himalaya, nor made any remarkable contribution in the Himalayan Geology. I had just a brief exposure of the beautiful Kashmir Valley during preparation of my M.Sc. dissertation on the Permo-Triassic successions in 1971 and had published a small note on the first record of the fusulinid foraminifer from the Permian *Gangomopteris* Beds of Zewan Spur, near Pampore (Srinagar). Further, my specialization during Ph.D. Thesis in BHU was on the marine Neogene foraminiferal micropaleontology of the Andaman – Nicobar Islands. The only favourable point was that I had learnt the micropaleontological techniques which could help a lot in recovering the microfossils from the apparently 'unfossiliferous' Himalayan formations which, in turn, would help in unravelling its stratigraphic complexities. With all these things in mind and, to be honest, after reading a paper written by Dr V.C. Thakur on 'Problems of Himalayan Geology', I was quite motivated and had courage to face the interview with a focus on the 'Stratigraphy of the Spiti Valley'. My text-book knowledge had convinced me that the Spiti Basin is an ideal fossiliferous sedimentary basin with several type localities of the Precambrian to Cretaceous 'Formations' of the Tethyan realm that can be seen in a short distance bird's eye view. Interview went great and soon I was told by my Supervisor Prof. MS Srinivasan that I have been selected. I joined the Institute on 26th December, 1977.

It was a matter of great pleasure that we were given freedom to form a team out of the freshly recruited scientists to initiate a project on the 'Spiti Basin'. The only suspicion that how my qualification would work in Spiti was instantly overcome by the visionary Director Dr S.C.D. Sah, who without taking any time suggested me to work on 'conodonts' that he could visualize would be very useful for the Biostratigraphy of the Tethyan Himalaya. His further advice to meet his friend Prof. R.K. Goel at the University of Roorkee who had recently published a monumental paper on the Lower Triassic conodonts of Spiti (1977) was also of paramount importance. Indeed, meeting with Prof. Goel was the moment of immense pleasure and most rewarding. He offered his whole hearted support and displayed his collection of Spiti conodont material for my observations. This was the auspicious beginning of my conodont research in the Himalaya, which undoubtedly proved revolutionary in the Lesser Himalayan Stratigraphy.

Soon after joining the Institute, the First Expedition to the Spiti Valley was launched in July 1978 for a period of about two and half months. Endless excitement prevailed among the members of the team that comprised myself, Dr T.N. Bagati and Dr Ashok K. Khanna with ancillary staff of Shri Diwan Singh (Driver) and Shri Kunwar Singh Rawat (Field Attendant).

Unlike today's Spiti Valley as a famous tourist destination in the tribal belt of Himachal Pradesh, four decades ago approach to the valley was quite difficult and very different in the sense that expeditions like ours had to strictly depend on their own logistics (transport, food, camping, etc.). Obtaining Inner Line Permits for visiting the tribal belt of Spiti valley from the HP Government offices was necessary for all individuals within the restricted period of three months between 15 July to 15 October. The route of our First Spiti Expedition (1978) was via Rohtang Pass – Kunzum La through the bouldary road along the glaciated

Chandra Valley crossing numerous glacial fed nalas. The main hurdle we had to face was the vehicular movement beyond the Batal Bridge while negotiating through the serpentine road for crossing the Kunzum La when we experienced intermittent engine failure of our vehicle. Diwan Singh's all efforts failed and we were just short of about 1.5 km to reach the Kunzum La Top (15,060 feet). In the growing darkness and the powerful icy winds, we urgently required a shelter in the non-windy zone. Pushing the vehicle with trailer for nearly a kilometer was the only option that we did and took a sigh of relief. Our emergency camping site was the roadside on way to Kunzum La where pitching of tents was done swiftly with the help of camp torches. We were all exhausted, but had lavish 'dinner' of egg omelette-bread with hot tea. We managed to reach Kaza, the District HQ of Spiti after two days with great difficulty.

Exciting and Sad Moments of Spiti Expeditions:

It is very sad to mention here that during the Fourth Spiti Expedition (1984), we lost four members of the expedition as the vehicle plunged into the Sutlej River near Sungra in Kinnaur District of Himachal Pradesh while advancing towards the Spiti Valley. Among the lives lost were the two very enthusiastic young scientists Dr. Ashok K. Khanna and Dr P.C. Pant and two very active supporting staff members Shri Kundan Singh (Driver) and Shri Kunwar Singh Rawat (Field Attendant) – RIP.

Prof. S. P. Nautiyal – As President, a Lively Human Being and a Career Booster :

In December 1981 when 4th International Field Workshop and Seminar of IGCP Project 156 on Phosphorite was organized by the GSI in Dehradun with a focus on the Tal Phosphorite of Mussoorie. Incidentally, I was completely unaware of any such event in Dehradun. But Mr. S.P. Nautiyal was there as a dignitary who noticed my name often cropping up during the deliberation because of our recent discovery of Cambrian conodonts from the Lower Tal Phosphorites of Maldeota PPCL Mine. He even had tried to convey me through some one that I should come and meet him because International experts wanted to discuss about our Tal conodont discovery. Just one day before the last day of the meeting someone in the Institute asked me, *'If am aware of any such meeting on Mussoorie Phosphrite. Tomorrow is the last day in the Madhuban Hotel'*. Next day in the morning I went straight to conference hall of Madhuban Hotel. Sitting on the dais with six other dignitaries Mr. Nautiyal directed me to come to him. He whispered, *'Where were you? We were looking for you all these days!'* He introduced me to a foreigner sitting next to him, *"He is Dr Azmi"*. *"Oh, pleased to meet you, I'm John Shergold. You know Prof. Müller is here! Please be seated, we are going to start"* (Prof. Shergold was the Chairman of the IGCP Project 156 on Phosphorite). To my surprise, he made the opening announcement, *"We are happy that today Dr Azmi is with us. We would like to hear him about his discovery of the Cambrian Conodonts from the Lower Tal Phosphorites"*. Although I was unprepared for any such eventuality, I spoke for a few minutes followed by comments of the world renowned conodont expert Prof Klaus Müller from Bonn (then W. Germany). Looking the photo plate in my paper he commented, *"I can see that there are typical well preserved Cambrian conodonts with deep inner cavities. I have no doubt their being of Cambrian age."* This statement of Prof. Müller helped setting a milder tone in deliberations by those who all the time had advocated for the Cretaceous/Permian age for the Tal Phosphorites. In this very hall a year ago I had presented this paper in the XI Himalayan Geology Seminar (1980) and then no heed was given to my presentation. Rather some discouraging remarks were passed in view of the deeply held Cretaceous age for the Tal



Prof. Muller with Dr R.J. Azmi and Dr T.N. Bagati

Formation. Only one encouraging remark was by Late Prof. S.K. Singh of Lucknow University when he stressed, “Azmi has presented an important data which should be seriously looked into rather than brushing it aside”.

The IGCP 156 event of Madhuban Hotel is such a memorable one where late Prof. S.P. Nautiyal had played a very vital role that boosted my scientific career, particularly for an invitation for 3 months visit to Prof. Muller’s Lab in Bonn in 1982 under DAAD Fellowship and then for another two year visit to his lab when I got Humboldt Fellowship in 1985. The outcome of the Tal Cambrian conodont discovery was such a great one that the Blaini-Krol-Tal succession which was entrenched in the geological literature as of Permo-Carboniferous to Cretaceous age for more than a century became one of the best globally known latest Precambrian–Early Cambrian succession where Blaini became one of the best examples of the “Snowball Earth” Marinoan Glaciation (650 Ma) and Lower Tal Phosphorite for delineating the Precambrian/Cambrian Boundary (542 Ma) with its very rich content of the ‘Earliest Skeletal Fossils’ including the best preserved earliest Protoconodonts with their natural clusters. This landmark contribution became a matter of pride for the Wadia Institute of Himalayan Geology.

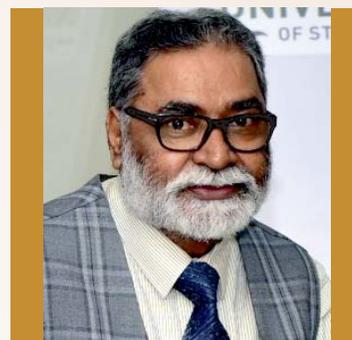
Post-1998: Decade of Glory, Defamation and Excitement:

My discovery of Lower Cambrian Small Shelly Fossils from the Rohtas Formation of the Lower Vindhyan in October 1998 (JGSI) once again received global attention. This time it was because I advocated for a far younger age for the Vindhyan of the central India bringing it equivalent to the Blaini-Krol-Tal (latest Precambrian – Early Cambrian) of the Lesser Himalaya and the Marwar Supergroup of the Trans-Aravalli Vindhyan, against the generally accepted view of its Mesoproterozoic age which was based mainly on the Riphean age stromatolites and radiometric dates. Coincidentally, in the same month of October 1998, the renowned German Paleontologist Prof. Adolf Seilacher had also made a startling claim of twice deeper origin of the multicellular animals (1.1 Billion Year Old) based on the accepted Mesoproterozoic age of the Lower Vindhyan where he had evidence of some traces fossils from the Churhat Sandstone of Son Valley (Science) which lies immediately below my SSF bearing Lower Vindhyan Rohtas Limestone. Discussions on both fossil discoveries went on in National and International forums for nearly a decade, initially with lot of applause but later doubts were raised on their biogenicity. Particularly for my SSF discovery, charges were levelled to the extent of ‘fraud’ in the media in 2002 by none other than the DG GSI, Dr S.K. Acharyya, as the microfossils, according to their report, were not recovered in situ. This act of doubting my scientific integrity was very depressing and was a testing period of my research career. However, with my strong scientific convictions and vigor to work more, and of course, with the moral support of my fellow colleagues I could overpower the situation soon. By September 2004, after successful completion of Ph.D. thesis of Mr Deepak Joshi on the Vindhyan Biostratigraphy under the supervision of Late Prof. S.S. Srivastava (IIT Roorkee) and myself things changed a lot that also generated judicious confidence in the new Director Prof. B.R. Arora. However, revelation by Prof. Stefan Bengtson of the Swedish Museum of Natural History on the microfossils recovered through his own collected Lower Vindhyan samples made substantial difference when he sent a report to me for official use and subsequently also published an abstract of his findings in 2007 GSA Denver Annual Meeting mentioning “The occurrence of Lower Vindhyan fossils resembling forms known from the Ediacaran – Cambrian rocks is confirmed: Annulated tubes, calcified cyanobacteria, embryo-like spheroidal fossils with polygonal surface structure, as well as “quilted-pneus’ similar to that found in Ediacaran deposits”. This report and the report Prof. Bengtson had earlier sent for official use enormously helped in regaining my lost scientific credibility and in stabilizing myself in the ongoing debate on the age of Vindhyan.

Acknowledgement: Upon successful completion of the glorious 50 Years of WIHG, we must sincerely acknowledge the untiring timely efforts of the Duo Late Prof. Nautiyal as President and Dr Sah as Director of the WIHG for bringing the Institute from Delhi to Dehradun and for providing a permanent campus. With long and sustained efforts of all the contemporary Directors, Scientists and the Administrative staff, the Wadia Institute has now grown into an important global centre for the geoscience research in the Himalaya. In the “Golden Jubilee Year”, I wish and pray for a vibrant all round growth and fame of the Wadia Institute of Himalayan Geology!!!

TRILOCHAN SINGH

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My Professional Journey in the Wadia Institute

It was July 1971, when I first heard the name of Wadia Institute of Himalayan Geology (WIHG). After passing my M.Sc. in Geology from Lucknow University I was getting prepared for research. I distinctly remember that Prof R.C. Misra, the then HoD of the Geology Department, called me in his office and asked if I wish to take up a position of JRF in the WIHG. He said, “before you give me your consent let me tell that you will have to go to Delhi and to work in NEFA region”. He horrified me by narrating NEFA as high hilly terrain with dense forest and heavy rains. He further alarmed me by saying, “although it is dangerous and risky, but if you have to die you may die in Hazrat Ganj, here in Lucknow itself”. Without being afraid and out of excitement, I gave my consent immediately. He then said, “No, go to your home and ask your parents, if they allow you to work in NEFA”, giving emphasis on the word ‘NEFA’. My father permitted, but my mother was a bit reluctant. Somehow, I could convince her. Next day I told Prof Mishra about the same. He then asked me to write an application and fill the prescribed form, which he later took with him to the next meeting of the Governing Body of the WIHG, of which he was a member.

I may add here that the Lucknow experienced heavy flood in the first week of September 1971, and so the University was closed. After the flood, when I visited the department, there was an offer letter from the WIHG, but the date to join had passed. I then requested the Director, WIHG to extend the date to join the Institute. After getting the approval, I joined the Wadia Institute of Himalayan Geology on 1st October 1971, under the NEFA Project, and became the first in-house Research Scholar of the Institute.

To initiate the NEFA Project, it was planned to undertake the reconnaissance field trip under the leadership of Prof A.K. Jain. Everything was planned and all preparations were carried out to start our train journey on 11th Nov 1971. Unfortunately, the Indo-Pakistan War was declared, and we had to cancel this trip. It, however, gave me the chance to be a part of the Organizing Team to host the 1st National Seminar of the WIHG at Delhi in Dec. 1971. As a Research Scholar, I got an opportunity to meet the legendary Professors, Scientists, Scholars and Geologists from all parts of the nation in this seminar.

After the cease fire, once again the field trip was planned and this time in the Institute’s vehicle. In the meantime, one of my batch-mates, Mr Shive Kumar Misra, also joined the NEFA Project. My first field trip from WIHG commenced on 4th Feb 1972, under the leadership of Dr A.K. Jain, accompanied by Dr S.K. Tandon and my colleague Shive Kumar Misra, Shri Krishan Lal, bearer and Shri Puran Singh, Driver. This trip lasted for 91 days (4th Feb to 5th May 1972).

Later, in 1974 the Institute shifted from Delhi University to an independent hired building in Tagore Park in Delhi itself. In Nov 1975, Dr S.C.D. Sah joined as the first Director of the WIHG. By 1976, many other scientists joined the Institute, and the designation of the scientific staff was changed from Scientific Officer to Scientist, with grading as Scientist B, C, E1, E2, F and G, as per seniority.

In the meantime, the Governing Body of the institute headed by Prof A.G. Jhingran was looking for a land in Delhi for permanent building of the Institute. But the Central Government never wanted any new Institution in Delhi, and gave option to choose from Lucknow, Varanasi, Chandigarh, Roorkee or Dehradun. The government, however, was keen that the Institute, as the name Himalayan Institute, should be in the Himalayan region, and thus suggested Dehradun. Moreover, there are several scientific Institutions

stationed at Dehradun for interaction. Finally, the Wadia Institute was shifted from Delhi to Dehradun in Feb 1976. Initially it was in a rented building on 36, Teg Bahadur Road, then shifted to a leased building on 15, Municipal Road, and finally got its own building at the present location in 1981.

After submission of my Ph.D. Thesis in 1976, I formally joined the Institute as Scientist 'B' on 19th Feb 1977. Continuing to explore the erstwhile NEFA, now named as Arunachal Pradesh, I took up my First Field Trip as a regular Scientist of the Institute on 22nd Feb 1977 along with Dr Surendra Kumar for 75 days. Subsequently, I went to Arunachal Pradesh for field work for 60 to 120 days almost every year till 1988, when the Institute shifted its focus to the NW Himalaya. Thereafter, I started exploring the NW Himalaya, covering Kashmir, Ladakh, and Lahaul & Spiti. Intermittently, I also took small field trips in Himachal, Garhwal and Kumaun Himalaya. In May 1995, I was asked to handle the on-going Deptt. of Sci. & Tech. sponsored NRDMS Project of the Pauri District as its PI, which was completed in May 1997.

In 1997, the Governing Body lead by Prof K.S. Valdiya re-launched research activities in Arunachal Himalaya, and entrusted me with two major tasks, one to initiate the Eastern Arunachal Himalaya Research Program (EAHRP) as its Coordinator, and second to coordinate in organizing annual seminars/workshops of the Institute in other cities, which were so far being conducted in the Institute itself. Under this program, I coordinated two Workshops in 1998, one at Jammu University in March, and the other at Dibrugarh University in December.

Around the same time, I got deeply involved in establishing the 'North East Unit' of the Institute at Itanagar in Arunachal Pradesh. This was inaugurated by the State Chief Minister on 15th Dec 1998. This Unit was later renamed as 'Arunachal Unit'. I was designated as the Scientist In-charge of this Unit, and I formally took over the charge at Itanagar on 1st Feb 1999. It became a turning point in my professional career.

In Dec 1999, a Scientist of Regional Research Laboratory (RRL), now renamed as North Eastern Institute of Science & Technology (NEIST), forecasted occurrence of a major Earthquake in NE Region, which created a panic in entire NE Region. Being the In-charge of the NE Unit of the Himalayan Institute, all eyes were on me. I contacted the Director at the HQs, but in vain. Then, I had to study hard to learn about the earthquakes - why, when and where, so as to prepare myself to create awareness amongst the masses regarding the earthquake hazards and their mitigation strategies by providing integrated knowledge about preparedness, rescue, relief, rehabilitation, etc. It helped the common man to come out of psycho-fear and panic that was created by prediction of a major earthquake in the region. People do realize the importance of type of buildings required in Arunachal Pradesh. The subject of retrofitting of weak buildings was of much interest, which was new to the common man.

In 2001, the then His Excellency the Governor of Arunachal Pradesh, Shri Arvind Dave ji, took keen interest in the activities of the Arunachal Unit of the Institute. He even visited the Institute at Dehradun on 11-12 April 2001. He was highly impressed with the activities of the Institute and desired that the Institute could help the State, particularly in the field of Natural Hazards, through its Arunachal Unit at Itanagar.

I rendered dedicated services to discharge administrative and technical duties in the capacity of the Scientist In-charge, and successfully made the Unit functional for NINE long years with meagre facilities and staff. I would ever remain grateful to Prof K.S. Valdiya ji for his blessings and moral support at all times. I would also like to mention here the names of two personalities who not only ameliorated in shaping up my professional career but also helped in smooth running of the Arunachal Unit at Itanagar. It included Dr G.D. Gupta, the then Advisor, DST; and Shri K.D. Singh IFS, the then Special Secretary to the Chief Minister of Arunachal Pradesh.

Finally, it was in Feb 2008 that I opted voluntary retirement. I was quite hopeful to have a graceful retirement from Dehradun, but neither I was transferred nor called back at HQ, instead I was given retirement from Itanagar itself. It was painful for me as I never expected that the Institute, to which I served from the infancy of my professional career for 31 long years, will ignore my dedication and affection for the Institute. I have seen the Institute growing from just 3 to a strength of 62 scientists over the years. I still have my sentimental attachment with the Institute. I wish that the Institute flourishes further and attains a rank amongst the best International Institutes.

R. S. RAWAT

Former Scientist 'F' &
Head, Petrology & Geochemistry Group, WIHG, Dehradun

**WIHG : a brief account of its growth**

I have witnessed the growth of this Institute from its inception in Delhi University to its present set up at Dehradun. As a person, who witnessed its ups and downs first as a closely interlinked student at Dept. of Geology, Delhi University from 1969 to 1978 and later as a Wadia Scientist from May 1978 to March 2013; and even after my retirement while staying at Dehradun itself. I can say, for about 50 years I have seen the activities of the Wadia Institute in person and thus can provide a brief account of this Institute.

We are well aware that this premier Institute to study the complex Himalayan Geology was established on 29th June 1968 under the Ministry of Education and Culture, Govt. of India at Delhi University with humble resources, with the then name **Institute of Himalayan Geology** having the cadre posts as per Govt. of India norms, i.e., Scientific Officers, etc. It started functioning from two rooms of Botany Dept. and one room of Dept. of Geology, Delhi University with Prof A.G. Jhingran as its Honorary Director, a couple of Scientific Officers, one Assistant Administrative Officer, and 3-4 supporting staff. Later on 3-4 more scientists with Prof K.S. Valdiya being the Senior most joined and a building was rented at Tagore Park near Delhi University till shifting to Dehradun in early 1976.

During 1975-1977 many Institutes were asked to move out of Delhi, and ours was one of them. Under the changed circumstances, WIHG organised its Annual 6th Himalayan Geology Seminar at KDMIPE (ONGC) in October 1975 so that the idea can be formulated, where the Institute can be established at DEHRADUN (I presented my first Paper in this very seminar on Amritpur granite with mathematical approach). Prior to this seminar, Dr S.C.D. Sah was selected as first director of this Institute and was quite vocal in the seminar, although he joined the Institute a bit later, just before its shifting to Dehradun in Feb. 1976.

In the meantime, a very dynamic man, famous for establishing Institutions in India (MECL & ONGC, etc.) Prof. S.P. Nautiyal became the President of the Governing Body of WIHG in 1977 and made drastic changes in its working--first and foremost he visualised own building of the Institute, purchased the land for the same. During his tenure, the Institute progressed fast in matters of staff and facilities and the cadre post names were changed from Scientific Officers to Scientists and Administrative Officer to Registrar-as per norms of Autonomous Institutes in India.

During the occupancy of Municipal Road office, on 20th Sept. 1977 about 10-12 scientists were selected including me but I was not allowed to join without a Ph.D., although many Scientists prior and after me were allowed. I joined the Institute in May 1978. As the staff was increasing, a need was felt to have more space and hence the administrative staff and a few Scientists were shifted to 159-Vasant Vihar Office with the Director – Dr Sah, although at Municipal Road office-some labs and library were under Dr V C Thakur (Deputy Director) as overall incharge. My labs were at Municipal road but I was deputed as Officer on Special Duty with Prof Nautiyal to help him in the day today official work, regarding building construction progress as well as to prepare three projects on Nepal Himalaya for which Dr Thakur and myself were deputed as Indian Representatives to discuss with Nepalese Authorities at Kathmandu in Nov. 1979.

The foundation stone of the WIHG building complex was laid on 10th Sept 1978 by Prof Nautiyal and Dr Sah. The work was progressing very well, however with change of Governing Body in Sept 1980 and

joining of Dr Valdiya in the beginning of 1980 as Additional Director for six months things slowed down.

Dr Sah's tenure was good for building activity. This period was also very good for me as I developed an Experimental Petrology Lab in 1986-1987 and Dr Sah was very happy to see the synthetically grown quartz crystal by three different techniques in my lab—just a few days prior to his retirement on 31st May 1987.

In June 1987, Dr V.C. Thakur took over the charge of the Director of the Institute and his tenure from June 1987 to Jan. 2000 was the golden era of Wadia Institute of Himalayan Geology in every sphere-in research publications, training programmes (man power development in nation- I organised two advance analytical courses in 1991 and 1994), development of new advance labs – Fluid inclusions Lab, Fission track lab, Experimental structural lab, Rock mechanics Lab, XRD, XRF, SEM, ICPMS, AAS, Experimental High P-T Lab besides many other facilities and a very informative museum and computerised library. The achievements of Dr Thakur's tenure were also highlighted in a movie telecasted nationally by DD1 in 1992 and subsequently by Current Science Journal. The DST also highlighted the discovery of kermasite in its Annual Report for 1991- 1992, besides first time report of fluorite in Mandi granite, Himachal and High P-T minerals from Ladakh. During his tenure maximum number of Scientists were awarded for their scientific contributions, etc.

In the past a lot of emphasis was given to mapping and geology of remote Ladakh and NEFA but later other areas also received due attention- particularly natural resources (I developed a model on the role of fluids in magmatism, metamorphism, tectonism, sedimentation vis-à-vis mineralisation and I applied the experimental data with the field data and was able to search new mineralised zones in Himachal and Uttaranchal). The Institute also developed expertise in Earthquake studies, Glaciology (thanks to Dr J.T. Gergan-an unsung hero of this field, the person who made the blue print for DST on glacial studies in India), seismotectonics, Quaternary studies, Environmental studies, besides the routine geological studies and consultancy, etc., and advance analytical procedures of petrology and geochemistry, including rock standards from Himalaya.

I hope in future, the incumbent Directors will lead the Institute from the front and our Wadia Institute will shine in the country for which we will have pride to be associated at any stage at any time- past, present and in future.

On the occasion of Golden Jubilee of WIHG on 29th June 2018, I extend my sincere gratitude to the staff with whom I worked, for the faith they had in me and wish all the best for their future in their profession as well as in the family to achieve new horizons. Please be bold enough to point out all wrongdoings and be kind to your juniors; then only you will be a truly happy person in life and God will give you his blessings.

JAI HIND – JAI BHARAT

SUMIT K. GHOSH

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My days in Wadia Institute of Himalayan Geology, Dehradun

After a short stint of nearly a year in the Geological Survey of India, I joined the esteemed Wadia Institute of Himalayan Geology, Dehradun in October 1984 as a Scientist. I feel lucky to join the WIHG. During graduation, my dream was to become a scientist by profession and place of job to be at Dehradun. With the blessing of god, both of my ambitions got fulfilled. Though happy, but at the same time scared for taking the challenging research job in a complicated and youngest orogen- Himalaya. Till then, my research work was mainly confined to the peninsular region- as my M.Sc. and Ph.D. dissertation work was in the Kolhan Basin of the Singhbhum Craton. I therefore, had very little exposure to Himalaya terrain (limited during my M.Sc. field trip).

I superannuated as a Scientist G in 2015, spanning nearly three decades of association and many things have happened during this time span and for me it is difficult to summarise. However, I have tried to retrieve from my mental hard disc.

My research journey in the WIHG started from the then Biostratigraphy and Sedimentology Group (in subsequent years a full-fledged Sedimentology Group was created). I am fortunate to get a chance for heading the group (one of the accomplished groups of the WIHG) and superannuated from the same group, I still feel delighted for it.

During my initial phase, I was fortunate to have a caring director- Dr S.C.D. Sah, who gave us the liberty to work as per our wish. My research assignment was in the Lesser Himalayan siliciclastics of the Garhwal-Kumaun Sectors. During my early phase of field work, I always remember the help of Dr R.J. Azmi and Dr M.N. Joshi (DBS College Dehradun) for introducing to me the different lithounits of the Mussoorie syncline. I learned various facets of Himalayan Geology from Dr N.S. Viridi. My area of research confines mainly within the Lesser Himalaya. During 1991, area of research had a shift from Proterozoic Lesser Himalayan sedimentary succession to Cenozoic Himalayan Foreland basin.

Since 1984 till my superannuation, I had the opportunity to work with four notable and worth mentioning directors (4D) Dr S.C.D. Sah, Dr V.C. Thakur, Dr N.S. Viridi and Dr B.R. Arora. I must acknowledge that my journey with these 4D has been smooth and academically enriching.

The proud three-some team of myself, Drs Rohtash Kumar and S.J. Sangode (presently Professor in Geology, Pune University, Pune, happens to be our colleagues) had great time working together. This formidable team also won the prestigious National Mineral Award of the Govt. of India in 2005 as a first ever team award from the WIHG. I had a golden time with our young and budding researchers--Dr Subhojit Sinha (CU), Yogesh Roy (NCAOR), Sharat Dutta (GSI), Shyam Singh (GSI), Poonam Jalal (KU) and many dissertation and summer interns of various universities and Institutions. During this period, I also progressed academically, to a large extent. I am happy to share that many researchers have completed their Ph.D. and M.Sc. dissertation work under my supervision. During our days, the WIHG was like a home for us and its staff as family members. Even after my superannuation, I still enjoy the association of our active scientists- Drs Pradeep Srivastava, Anil Kumar, Som Dutt and many others.

During my three decades at WIHG there has been phenomenal growth in terms of upgradation of various

facilities- from a moderate to state of the art laboratory and library (in India, perhaps the best facilities available under one roof). In addition, various other amenities created include guest house, staff quarters, director's bungalow, new building blocks for stores and scientists.

Additional work, other than the research activities, entrusted to me from time to time includes Garden setting, Laboratory and Library upgradation and Vigilance, etc., which I enjoyed thoroughly and learnt many things out of it.

I am fortunate enough to participate in both the Silver (1993) and Golden (2018) jubilee Events of the WIHG.

The Journey never ends, and I always wish to contribute to WIHG in whatever way it may be possible even after my superannuation particularly in motivating our budding researchers. I consider myself fortunate for having such an opportunity to work in the WIHG's unmatched environment and will never forget my memories of WIHG.

RAFIQUL ISLAM

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Reminiscing my experiences with Wadia Institute

In the year 1979, when I was a Research Scholar in the Department of Geology, AMU, Aligarh, someone from outside the Department delivered a talk on 'Himalayan Geology' which attracted me towards Himalaya. After sometime there was an advertisement for the post of JRF in the Wadia Institute of Himalayan Geology and I applied for the same and got selected as a JRF in a research project called "Geochemical mapping along Main Central Thrust" and my journey in the Himalaya started from there on. After joining the Institute, I met my fellow colleagues Late K.K. Purohit, Amar Nath, R.P. Singh, P. Sahajpal, M.N. Qidwai and Sagari Das. Our first field trip was to Kedar Nath valley, a tremendous journey, that I experienced for the first time.

I started my Ph.D. work under Dr V.C. Thakur in 1981, in Bhilangna valley of Garhwal Himalaya. Those days roads were not smooth in the Garhwal Himalaya, as are today. Usually, I used to take two days to reach Bhilangna valley after having a halt at Tehri town. During that time most of the roads were unmetalled. In 1985, I joined the Zaskar Project and carried out field work in Kishtwar window along with late Dr B.K. Chaudhury and B.S. Rawat. We saw a lot of new things and had new ideas. Subsequently, another field work was carried out in the Zaskar valley in Ladakh with Dr Thakur, Dr Mathur and B.S. Rawat. I have vivid memories of that trip as I saw many new things such as new lithology, new structures, etc. Finally, I completed my Ph.D. in 1986 and subsequently joined the Wadia Institute main stream in 1988. My initial project was in Ladakh, jointly with Dr Hakim Rai, where I was amazed to see the ophiolitic melange, a series of rocks in a single suite. During those two months I could travel from Dras to Nyoma and Tangtse, etc. At the end of our field trip we were trapped in heavy snow fall, but quite luckily somehow we managed to reach Srinagar because we were on main track, at Sakti, a village close to Chang La pass. However, we were blocked again for 10 days because Srinagar-Jammu highway was cut off due to heavy snowfall. A solid experience and struggle.

My next project was on Pan- African granite magmatism in Northwestern Himalaya, which gave me ample opportunity to see several granite bodies of 500 Ma ages in Himachal Pradesh and Ladakh Himalaya, specially the Tso-Morari, Zaskar and Nimaling granites. Working with these Pan-African events was a wonderful experience and also rewarding in terms of understanding and publications.

After this project, I went back to Ladakh, along with Dr Talat Ahmad to concentrate on plutonic and volcanic rocks of Trans Himalaya. We could do some good work and make good publications.

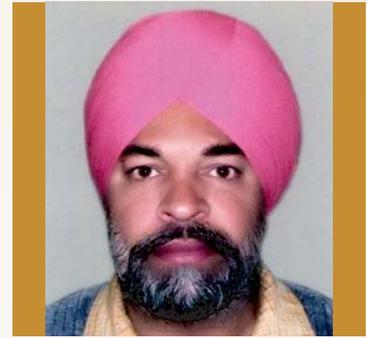
Finally, again I went back to study the Lesser Himalaya, a journey with Dr. Pradeep Srivastava, Dr S.K. Ghosh and Dr S. Vyshnavi, studying weathering in older rocks to Quaternary sediments for my final destination.

My journey in the Himalaya has been wonderful—experienced lots of new things and got new ideas. Of course, Wadia Institute of Himalayan Geology gave me a solid platform where I could perform well in my scientific endeavours. Till date I make it a point to come to the Institute on every occasion and am always very happy to participate. I wish many more new researches in the Institute since it houses many world class instruments and is one of the best Laboratories in the country.

My very best wishes to the Institute leadership, Scientists, young researchers and the staff on Golden Jubilee.

KESER SINGH

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My journey with the Wadia Institute started sometime in 1976-77 when a common friend suggested me to meet the then Director, Dr S.C.D. Sah. Being unemployed and with no choice, one day I went to seek an appointment with the Director at 15 Municipal Road. All fear went away as soon as I met Dr Sah. He introduced me to Dr V.C. Thakur and advised me to pursue a carrier in research. Within a short span of time JRF was awarded to me to start the Ph.D. work but not before I cleared a test on Folding and Fracturing of Rocks from a book by John G. Ramsay.

My Ph.D. topic was Quantification of deformation pattern across a part of Chamba region, Himachal Pradesh. The first field work was done using public transport and it took me two days to reach Chamba during the summer of 1977. One can realise the difficulty in carrying out field work in those days using public transport. Two months of field work in a rugged terrain with unmetalled roads and along the valleys without a path was completed with difficulty. I still remember about a bare footed local porter who assisted me in one such valley, which usually remains covered with snow. One can imagine the plight of that porter, but to my surprise his response was -- it is a routine for them to move barefooted on snow throughout the day.

Four years of the extensive field work supported by laboratory work enabled me to complete my Ph.D. thesis in 1981. Nowadays there are softwares to calculate the finite strain, but in those days all calculation and plotting were done manually. The strain ellipsoids were also drawn manually on the geological map. I have still preserved not only those maps but also their ammonia prints. Finally in 1983, the Ph.D. was awarded to me. It may be added that the thesis was typed on ordinary typewriter, as at that time neither photocopying nor computers were available as today. I took my first job as a Senior Scientific Assistant in the Institute in the year 1981. Later in 1984, I joined as a Scientist 'B' in the Institute.

Working under various projects submitted as per office guide lines, a comprehensive geological map of Chamba and adjoining Kishtwar, Pangi and Lahaul regions was prepared with an interpretation different than the existing ones at that time. Beside research, I was a teaching faculty for 4th UNESCO Regional Training Course in structural geology for International and national participants.

I participated in a comprehensive project on evolution of the Main Central Thrust (MCT) and was assigned areas around Yamuna and Tons valleys. Work on Quantifying and analysing the deformation pattern across the MCT was successfully completed.

I was also a member of a team for field work around Tso Morari area of Ladakh. Looking at sky in the night was an unforgettable experience. Many thanks to the WIHG and to all my colleagues, and especially to my mentor Dr V.C. Thakur.

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“If you don’t evolve, you perish”

– Charles Darwin

10th July, 1984, I still remember the rainy day, when I joined the Wadia Institute of Himalayan Geology as Scientist 'B'. Being a resident of Nainital for the last 25 odd years, I felt unusually warm in Dehradun, while everyone around me seemed to be quite comfortable.

As I entered the gates of WIHG for the first time, the first thing I did was to leave my identity of being a female gender (often considered a weaker gender) and embraced the identity of being only a geologist, an identity I still identify myself with.

Dr S.C.D. Sah, the then Director of the Institute, was a fatherly figure who welcomed me to this vast ocean and made me aware that I needed to be ready for all kinds of tides. It was him who taught me the important lesson of humility. I learnt that a scientist must never be proud. Because once you let the pride take over you, you stop learning. And you can learn only when you keep that childlike enthusiasm alive in you. You need to be humble always and be aware of the fact that you never know enough! There’s still a lot to be discovered.

I was asked to join the Biostratigraphy Group. Dr N.S. Mathur was the head of our group. I found him as a very simple person, and I still stick to my first impression. The first project I was given was “Biostratigraphy of Blaini-Krol-Tal with special reference to Precambrian- Cambrian boundary”. Dr R.J. Azmi was PI of the project. That time, Dr Azmi was on top of his fame for his discovery of Small-shelly fossils from Precambrian-Cambrian boundary. I worked with him for more than 15 years. Dr Azmi helped me a lot during the field work and told how to deal with microfossils. He taught me the nuances of field work. In search of early life, I travelled from Solan to Nainital in the Outer Lesser Himalaya and from Deoban to Pithoragarh in the Inner Lesser Himalaya. I travelled to Kashmir Tethys Himalaya from where I discovered Precambrian-Cambrian small shelly fossils for the first time. Field work in Lesser Himalaya led me to discovery of very peculiar early Ediacaran microfossils. My search of early life is still going on. A lot is to be done.

Now back to my memories, I was the only lady scientist in the Institute for the next 20 years. And, the journey was not at all easy. But no one said that it was going to be easy! This journey was my choice and I had to nurture my dream. Every person in this world, who has done something worthwhile, has nurtured his dream like his baby. My dream, my passion was to delve in the ocean of science and make some worthwhile contribution to it. It was not easy, but it was simple. Simple, because I was blissfully unaware about the laws and fundamentals of work life politics; ignorance was bliss in this case. And, at every step in my journey, I did what was necessary, what was possible, and suddenly, I was doing the impossible! Most often, we are so busy thinking about the useless easy shortcuts to success, that we forget the simple path: the path of honest hard work.

My life as a geologist was like swimming in ocean. As if I had come from the small lake of Nainital into this giant ocean. Sometimes, it happens that even the sewage of the city is drained into the ocean; this did not mean that I stopped swimming. I kept swimming, but I always kept my head high: because lowering my head would force me to gulp that dirty water! So my rule was: keep swimming, don’t gulp. The only common rule for all tides was: never go with the flow, as only the dead go with the tide.

By God’s grace, now that I have been given the charge of the Director, I aim to take the prestige of this institute as high as the Himalaya, just as our predecessors dreamt it to be.

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**Reminiscing my tryst with Geology and the Wadia Institute**

I first came to know about Geology as a subject when I passed my Intermediate Examination back in 1974 and was looking for a suitable college where I could get admission in B.Sc. My eldest brother told me about it emphasizing that if I study Geology it may be easier for me to get a job. I happily agreed to his suggestion. Although I was an average student till 12th, Geology raised my overall interest in studies, and my doing well in B.Sc. and M.Sc. (to everyone's surprise!) incited me to go on, and pursue Ph.D. in Geology. While doing M.Sc. from the Lucknow University, I was particularly impressed by Dr Ashok Sahni who taught me Vertebrate Palaeontology. His subject interested me greatly also because I had a special liking for Biology from the beginning and had studied Zoology and Botany even in B.Sc. So I requested him to guide me and applied for a CSIR fellowship to work under him in early 1979. Soon after, I was sent on my first post-M.Sc. field trip with Dr B.N. Tiwari in the UP Siwaliks around Kalagarh, the area which was assigned to him for his Ph.D. by Dr Sahni. So this was a trip for my field training. Apart from learning methodology for spotting vertebrate fossils in field and excavating them safely we returned with a small but good collection of fossils. Within a few months of my joining, Dr Sahni moved to Panjab University (PU) as a Professor. Even though I had no fellowship then (mid-1979), I also decided to move literally along with him to PU, where I was soon welcomed by a regret letter from the CSIR. This did not deter me much, and instead of Ph.D., I decided to enrol for M.Phil. (one year degree) under Prof. Ashok Sahni with the idea that if I do not get a fellowship even next year I will stop at M.Phil., otherwise I will continue for Ph.D. Pursuing M.Phil. or Ph.D. without a fellowship and far away from home was a tall order and a bold decision on my part. But my family as well as my supervisor Prof. Sahni supported me in this. In fact, Prof. Sahni even paid for some of my early field trips undertaken from the PU. Luckily, I got the CSIR fellowship next year (Rs 400/- per month, big money then!), and by mid-1983 I had M.Phil. as well as Ph.D. degrees with specialization in vertebrate paleontology of Paleogene Subathu succession of the NW sub-Himalaya.

I came to know about the Wadia Institute in 1981 from a friend who was also working for a Ph.D. at the PU but with a WIHG fellowship. In early 1983 (post-Ph.D. thesis submission) responding to a WIHG advert for Scientist 'B' positions, I applied. Around the same time, I was awarded a PDF of the Smithsonian Institution, Washington, DC so I went to USA for a year (1983-84) to work on Eocene whales, and missed the Interview at the WIHG. This was when Drs Rohtash Kumar, S.K. Ghosh, N.R. Phadtare, Meera Tiwari and BN Tiwari were inducted in the Institute. I did not opt to extend my stay in the US, and just before completion of my tenure of PDF there, I applied for the CSIR's Pool Scientist scheme with Lucknow University as my first choice and WIHG the second. As I returned to India in October 1984, the CSIR's Pool Scientist award (for 02 years) came, wherein I was advised to join the Wadia Institute.

I joined the WIHG on 31st Jan, 1985 as a Pool Scientist of CSIR. In the later part of 1985, there was another advert for Scientist 'B' positions in WIHG and I applied again. Armed with a Ph.D., a PDF from the Smithsonian Institution and a few good papers, I was bubbling with confidence that I will surely get through. The level of my confidence was so high that I use to tell one of my WIHG friends, who was also a candidate aspiring to be upgraded to a scientists' position in WIHG, to try next time with better preparation. The interview that happened in January 1986 went very well. However, as the luck would have it, and to my utter shock and disbelief, my friend was through and I was left out. This result pushed me down so much that it

became unbearable for a while, so I took off and rushed to my home in Lucknow to get some solace. Whatever be the cause, I somehow can't remain upset for a long time, so I returned soon and engrossed myself into work. Later, in December 1986 my diligence and hard work paid off and, based on the same interview of 17 January 1986, I was offered the position of a Scientist 'B' in WIHG. I joined it happily on 26th December, 1986 and have stuck to the Wadia Institute since then, never looking back, left or right.

Based on my specialization and interest, I was placed in the then Biostratigraphy & Sedimentology Group under the headship of Dr N.S. Mathur with a note that I shall also render my services to the museum. From 1987 to 2005, I was involved in the projects mostly on the Himalayan Foreland Basin and the Ladakh Molasse Group with focus on the Paleogene succession of the NW sub-Himalaya in the company of Drs N.S. Mathur, A.C. Nanda, Rohtash Kumar, S.K. Ghosh, B.N. Tiwari and K.P. Juyal. During my long stint in the WIHG, I went on numerous long, not-so long, and short field trips in the sub-Himalaya of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Uttar Pradesh. Work in these areas resulted in many good publications, including a couple of field guide books and an edited volume.

My first opportunity to visit Ladakh came in the year 1992, when Dr A.C. Nanda, Dr B.N. Tiwari and I set out on a ~45 day field trip in Kargil-Leh-Nyoma-Liyan areas. This trip was quite productive and Dr B.N. Tiwari and I followed it up with another in 1996. Further trips to Ladakh and Zaskar were undertaken in 2003 (with Drs N.S. Mathur and K.P. Juyal for a DST project) and in 2008 and 2009 (for a collaborative project with BSIP scientists). In between, I went on a ~45 day trip to Arunachal Pradesh to explore the Paleogene and younger successions for recovery of vertebrate fossils. This was the time when a unit of the WIHG was set up in Itanagar (Arunachal Pradesh). During this trip of 1998, Dr R.K. Sehgal and I worked in areas like Likabali, Geku, Yinkiong, Dalbuing, Siang and Pasighat, etc. However, this trip did not yield the desired results so we did not follow it on.

During 2008 and 2009, I also made a couple of trips to Meghalaya to investigate the K/T boundary sections (e.g., Um Sohryngkew River section) from the vertebrate paleontological view point and to also look for the potential of recovering dinosaur fossils, especially in the Dirang area. These trips were undertaken with Dr V.C. Tewari and Dr Kapasa Lokho. Although these trips resulted in a few good papers, the rather low potential, especially for vertebrates, deterred me from going there again.

While continuing my ongoing work on the Paleogene of NW sub-Himalaya, in early 2006, I decided to extend my work to some of the late Paleocene and early Eocene sections of Gujarat and Rajasthan in western India. This was done especially to look for the land vertebrates and because continental beds of this age were not available in the Himalaya. Since the initial results were very encouraging and fruitful, the RAC allowed me to include these areas and sections in my regular Institute project. Subsequently, I shifted my focus to localities in western India because the productive sites there were mostly in the open cast lignite mines which are not static and get excavated and filled up rather fast so any work and especially fossil collection has to be done within limited time, which required full focus. To optimize the output from these "mines of fossils" I involved myself in informal collaboration with a team including Dr Ashok Sahni and Dr R.S. Rana, and continuously got excellent results. We documented the oldest Cenozoic vertebrate fauna from western India comprising diverse land mammals and other vertebrates, including snakes, lizards, frogs and birds based on their exceptionally well preserved dentitions as well as post-cranial elements in a series of papers in reputed journals. The fauna unexpectedly revealed affinities with European and American forms in a pre-collision scenario. It improved our understanding of Eocene mammal faunas and their relationships to a great extent.

The success story of western India prompted me to return to Himalaya and take a fresh look at the early Eocene part of the Subathu succession for any short continental phases, and luckily we succeeded in finding some early Eocene rodents from a thin horizon in the lower middle part of the Subathu Formation (older red beds) of the type area in Himachal Pradesh. This horizon has the potential to yield varied early Eocene land mammal remains. So the work has to go on in the Paleocene-Eocene successions of the NW sub-Himalaya as well as western India.

During my tenure at the Wadia Institute I was given the responsibility of organizing a Workshop on

Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries at the Jammu University in March 1998, a DST sponsored National Field workshop on Sub-Himalayan Paleogene in the context of India-Asia collision in March 2006, 78th Annual Meeting of Indian Academy of Sciences in November 2012, 4th Third Pole Environment Workshop in April 2013, and 24th Indian Colloquium on Micropalaeontology and Stratigraphy in November 2013. Apart from this I was entrusted with many other important responsibilities from time to time, which I happily fulfilled to the best of my ability. I particularly enjoyed my role in the publication of “Himalayan Geology”—a biannual research journal of the WIHG from 2002 to 2016, first as its Assistant Editor and then as Editor.

Over the years, I have amassed the best collection of fossils of Eocene land mammals from the Subathu succession, a part of which is on display in the WIHG museum. My collection of fossils also includes Eocene cetaceans (whales) from Kachchh and early Eocene vertebrates from the NW sub-Himalaya as well as western India all of which are now stored in the WIHG. During my tenure in the WIHG, I guided four Ph.D. students, namely Rahul Srivastava, Shashi Kad, Arunkumar Rangnathan and Smita Gupta all of whom have contributed to my forward journey in the Institute. It is greatly satisfying to share that I could publish the results of my work in most of the major International journals on Paleontology as well as in lead journals like Nature and Nature Communications.

The Wadia Institute has given me all that I deserved and desired and I am fully satisfied with my fruitful innings here, which will come to an end on 30th September 2018. I consider myself lucky to have been associated with this unique and glorious Institute for such a long time and be a witness to its Silver as well as Golden Jubilee celebrations. During all these years, I received full support from all the Directors and colleagues, and especially from my group-mates and some great friends. I wish and pray that our great Wadia Institute attains greater heights in times to come. I also wish a great journey forward to all my younger colleagues in the WIHG!!

Long live Wadia Institute, Long live fellow Wadiaites!!!

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**Reminiscences from the treasure of past...**

I can easily recollect the day when I came for the Interview in Wadia Institute from Lansdowne. While waiting for my turn and walking in the front lounge, a senior and alluring person who was passing through came to me asking what I was doing. When I informed that I started my career as faculty in a Government Degree College, he continued with questions on Geology of Lansdowne, and finally extended his good wishes. Later, I was introduced with this great personality Prof. I.C. Pandey, who inspired the generations. I also had occasion of some interaction with Prof. S.P. Nautiyal, another doyen of Geology.

I could earlier get two opportunities of visiting Wadia Institute at 15 Municipal Road, when I was in M.Sc. in 1982 and had brief talks with Drs K.K. Sharma, R.R. Patil, Late Drs K.R. Gupta and B.K. Chaudhary. The visits were enthralling as a Geology student. I was shown a small room telling me that the instrument kept there was highly sophisticated. It was a Leitz Orthoplan microscope equipped with U-stage and a point counter. I am lucky to experience the growth of Wadia Institute since 1984, and many times have shared the inception of present state of art laboratories. I feel there was continuum in the laboratory development, however, Institute entered into a new era after the creation of the EPMA lab. Later, the instruments, which used to be dreams earlier, were added and I was often involved in laboratory development. The idea to compete with the frontline Himalayan scientists is now possible and only requires some passion.

When I joined the Wadia Institute there was a tea stall adjacent to the gate and there were a couple of chowkidars as security persons. But the Institute used to be like a family sharing happiness and pain with each other. Dr S.C.D. Sah was not only the Director of the Institute but he was also like an esteemed elderly person of the family. Conventionally, the appreciations received by seniors particularly by the Directors have been motivating and the stress and strain were not accumulating much.

My first field work was in the Chamoli district, and during long field stays it was not uncommon to visit local post office for letters. The problems we faced in field seasons, are now cherished memories. In one such event, bats inside an old mine suddenly started flying over our heads as we entered the narrow shaft. I have visited more than 100 mineral locations in Himalaya with various colleagues mainly including Drs D.R. Rao, R.S. Rawat and B.K. Nayak, and with my Ph.D. students. Some of the ore locations are highly prospective if we consider the grade and genesis. Operating mines of Industrial minerals are scattered in pockets but can be more organised with rigorous monitoring. Since the mineralization sites are mostly off the roads, it is always helpful to interact with the local people. I found that the questions of the students also stimulate thinking and generate new ideas. The project formulation in the Institute requires better brain storming sessions, and open and suggestive discussions. Within and across laboratory discussions are warranted. In an attempt that I remember, nearly all the scientists of Petrology group agreed to work on one single problem with multiple proxies and approach, but somehow it could never be finalized due to reasons not known to me.

I am fortunate to have the opportunities of multiple roles in the Institute, and representing the Institute in some important National forums. I always tried to keep the Institute's flag high. One of the most wonderful experience was presenting the Institute proposal for organisation of 30th HKT in the WIHG, at Lucca, Italy, which was a successful attempt. We were well prepared and took with us some attractive pamphlets inviting

International community for the next meeting. Organisation of 4th TPE and 30th HKT were amazing as coordinator. It was just incredible to have with us honourable President of a partner country in the Institute for more than 24 hours. On the other hand, I recollect the words of Honourable Minister of State for Science & Technology in 30th HKT program, saying that I have come to see what is important about this event that about sixty participants from world's leading Universities are here. The field work of Rishikesh – Malari section in this HKT was so well demonstrated that I will always have appreciation for my colleagues involved therein. Alongside, I feel why not we organise such illustrative field visits for our upcoming generation of students and new scientists. A field training to most beginners would be useful. I am grateful to the Directors in the Institute for trust they have shown in me by assigning some of the most important responsibilities. I enjoyed working with wonderful colleagues for which I remain thankful to them.

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At the onset let me take this opportunity to extend my hearty greetings to the WIHG fraternity on the eve of the Golden Jubilee. It indeed gives me enormous pleasure to narrate the turn of events leading to my association with this Institute. To start with, before joining Wadia Institute I did get an in-house exposure at NGRI, Hyderabad, wherein I carried out my Ph.D. work. It was in 1987, December 1st week when I saw an advertisement offering Scientists 'B' posts at Wadia Institute, and no doubt that advertisement was a turning point in my life. I applied for the scientists post, and little did I imagine that I will be selected. It was a dream come true for me to get a chance to work in the prestigious Institute like Wadia Institute. I stepped into the beautiful campus of Wadia Institute on April 15, 1988 and joined a research group working on petrological and geochemical studies of rocks. A group which is not only agile but full of nice people. I remained in this group till date and am fortunate enough to reach upto Scientist 'G' level by getting timely promotions at each level.

Soon after joining the Institute as a part of my assigned project I got an opportunity to go on a long field trip in parts of Sutluj valley and Ladakh region, and for a person like me who is from south India it was a fascinating experience to go around these places and know about the Himalaya. During my long stay of 30 years in WIHG I had also carried out many field works in parts of Uttarakhand, J&K and Himachal Pradesh. The greatest opportunity the Institute provided me is by giving me a chance to be a Member representing the Institute in the XII Antarctica Scientific Expedition of 1992-93. Certainly it was a great experience for me to work in Antarctica region, and publish some good papers both in National and International Journals.

I shared the responsibility of being in-charge of labs like VG-354 Mass Spectrometer and Electron Probe Micro Analyser for their regular operation and maintenance. I had also undergone application training of EPMA in their factory at France. During my research career, I had the privilege of being author of several National and International publications. To mention some, I have publications in journals like Journal of Petrology, Gondwana Research, Royal Society of Edinburg, Computer & Geosciences, Island Arc, Mineralogy & Petrology, Geochemical Journal, Journal Geological Society of India, Current Science, etc.

On the other hand, I am also fortunate enough to serve the Institute in the capacity of Technical Secretary to Director since 2001. As Technical Secretary during these more than 17 years, I tried my best to be adaptive and flexible in facing the challenges at difficult times, while being very cordial and kind with my fellow staff members. I had also shouldered the responsibility of Member Secretary of Research Advisory Committee for one term of three years. Apart from this, I served the Institute in various capacities as Member/Chairman in Committees such as Library, Purchase, Technical evaluation, Screening, Seminar Organizing, etc.

The working environment of the Institute is very good, people are good and I had great job satisfaction in serving this Institute since 1988. The working environment is good not only in office, the family relations of staff outside the office are also very cordial and people are very helpful to each other. The families developed great bonding and friendship among each other, and periodically have get-togethers on the occasion of festivals and other family functions.

In the end, I pray for more and more achievements of this premiere Institute in the areas of research on Earth System Sciences in the Himalayan region, and also to reach to greater heights in years to come. I shower my good wishes to the staff of the Institute for future success in achieving their vision and goals. Last but not the

least, the days I spent in Wadia Institute and in Dehradun are amazing and I will be cherishing the fond reminiscences of the Institution for all it has given me for rest of my life. I am once again thankful for getting this opportunity to share few of my feelings through this 'Golden Jubilee Reminiscence' publication brought out by the Institute.

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**WIHG....my Institute**

The images of the Himalaya show a highly magnificent, attractive and challenging range, despite all this, I was far from attracted by it owing to unexplainable inhibitions. I was told by some of my friends about the hostile environment, inaccessibility and the adventures involved to reach this arduous and highly challenging mountain belt. The institute in Dehradun with an isolated road and the trailer attached field party jeeps looming with the uncertainty of their return added to my fear and thus a long list of reasons which did not allow me to take up Himalayan geology as my career. I considered myself a misfit. Nevertheless, I casually responded to the WIHG's job advertisement just to gain experience to face an interview board. It was a cold winter morning of 21st Decemebr 1989, when I reached the Wadia Institute to appear for the interview towards the selection for the post of Scientist-B. The winter rain further dropped the temperatures to an already cold day. However, the impressive building blocks designed to be laterally off-setting and the museum was the main attraction I didn't miss. The warm welcoming Board found me intellectually fit to join this institute. I had very little knowledge of the Institute then.

While I did have few other job offers simultaneously with me, it was Dr. V.C. Thakur, the Director then, who advised me to join the Institute as it offered 'Himalayan freedom' to labour on any topic of my research interest in any part of the Himalaya. Coincidentally for my subject of interest, I found Himalaya to be the ideal candidate to employ satellite remote sensing techniques and I gladly accepted the offer.

When I joined the Institute, I was asked to share my sitting area with one of my senior colleagues due to lack of office space. Sharing was not a palatable formula as he had been all alone and enjoying a single seated office room. My entry to that room, I remember, seemingly triggered discomfort and generated cold war. I have to admit, it was a 'low angle reverse fault' experience. Nevertheless the 'fault scarps' got degraded with time and 'sub-aerial erosional processes'. The differences dissolved eventually as we were working on entirely different themes. Today every new induction in the Institute has the privilege to enjoy their privacy in a single seated office room. It only goes to show that my Institute has grown further over the period of time.

First experiences teach you the most. All the excitement of my maiden field trip to the Himalaya, in the Doon valley, along with Dr. Rohtash Kumar in search of a fault identified on the satellite data dipped! The fault trace was explicitly clear on the satellite image in the Upper Siwalik which extended into the Doon gravels. However, we failed to recognise the fault in the field, which had displaced the boulder bed in the thick jungles of the Rajaji National Park. We got completely lost. I found myself as an isolated boulder with no bearing within the Upper Siwalik boulder conglomerates. My enthusiasm faded. That initial failure taught me to see through the riddles in the Himalaya. The first seminar I attended in WIHG on Himalayan Geology in 1990 challenged me to work further on this restless mountain chain and the Director constantly motivated and encouraged me to use the aerospace data to understand various facets of Himalaya.

My first trip to the Nubra valley in the Trans Himalayan range in 1996 along with Dr. T.N. Jowhar took 5 days. It was a jeep journey with a trailer attached. That drive involved halts at Pang, Upshi, and the field camp at Saboo village in Leh before crossing the Kardung-La and finally to the Panamik village. This field trip helped me comprehend the painstaking efforts of a geologist who inevitably needed to have immense

team spirit to work in very tough terrain. Late Mr. Vijay Pal was a skilled driver who displayed his expertise in tracing roads in the unrecognisable road routes of the Himalaya. Interestingly, for an expert like him, as usual Mr. Vijay Pal remained silent throughout the journey and interacted with us only when he needed to refuel the tank. I imagine he found peace in the silence of the jeep to find his way into and out of this majestic yet mysterious mountain range.

My first glacier expedition in 1998 to the Shaune Garang glacier in the Baspa valley was another challenging task. This shed light to a new world of my experience to the Himalayan glaciers. Over the past many years I have undertaken several field trips in the Himalaya, assisted by most of the drivers of the Institute. At this juncture, I must attest that the drivers recruited by WIHG were and are highly skilled and well trained to successfully manoeuvre the vehicle in isolated places and routes of the uneven terrain of the Himalaya.

I observed myself growing with time as the institute grew. My seniors were highly supportive in smoothly carrying out the field work and other assignments. The entry and the entrance of the Institute frequently changed as and when the Directors changed. Renovation of labs, rooms and modernisation gave a major facelift to the Institute. However, I strongly believe that the mind-set needed change in pace with outward ornamentation. The Institute has successfully passed through the thick and thin clouds and the vision documents lost its sight to accomplish the missions. May be individual achievements were preferred to institutional achievements. Needless to mention, I have also found that over the period of many years an institute that was close knit as a family has grown apart. There was a time when most of the researchers were mindful about their own work and always had each other's back in the times of need. Those times seem quite long ago.

Above all this, I know for fact that I owe much to my Institute. The institute did not withhold any good thing to me so as to discontinue my growth. I am proud to be among the WIHG fraternity. This unique institute has got a Himalayan heart to accommodate researchers and staff from all parts of the country. The glory of the Institute will continue to shine when one owns-up his responsibility, accountability with all honesty and sincerity. This Institute has been able to celebrate its Golden Jubilee only through honest and sincere employees who untiringly held the torch high. My Institute needs more such dedicated people to take up successive efforts to the successful growth in the years to come.

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After completing my Ph.D. on Geohydrological studies of springs and landslide and erosion aspects of a Himalayan basin from the Geology Department, Kumaun University, Nainital, I preferred to join the Wadia Institute over the CBRI Roorkee in July 1988, to work in the Himalaya and contribute to Environmental Geology of Himalaya particularly on springs, groundwater and landslide related research. This was a career choice I opted for. The day I entered the Institute, intuitively I knew that I had reached a threshold of my journey of research. It was a dream world of knowledge, scientific endeavour and academic brilliance. Scientists from diverse disciplinary backgrounds and from different parts of the country found a loving and caring environment in this Institute.

It was the research environment, family culture (Wadia family), and support of my senior colleagues in the Institute that I could carry out contemporary research and publish good research papers some of which were later adjudged best papers in the Institute in the years 1989, 1994, 2003 and 2004. It was the Wadia Institute which provided me a platform to successfully compete for BOYSCAST Fellowship in LGGE, Grenoble, France where I could learn techniques of glaciology and ice core research.

Although, initially it was difficult to work in the absence of laboratory and field instruments related to hydrogeology and landslides, I got an opportunity to develop them gradually with the support of our Directors. Growing up in WIHG since late eighties and introducing groundwater and landslide related research in the Institute, which was in infancy in Himalaya at that time, brought unfathomable joys of research. It gives me satisfaction that our past Directors Dr V.C. Thakur, Dr N.S. Virdi and Dr B.R. Arora reposed their faith in me and projected me as a spokesperson for water related issues in all the national and state fora and in organising seminars/workshops related to water and environment in 1995 and 2007. Further, the work on hydrogeology of Himalayan springs which I initiated with my thesis in 1984 now has many followers, including NGO's, who are carrying it forward not only for studying the behaviour of springs but also for their rejuvenation. With the support of Dr Thakur and Dr Virdi during their respective tenures, I was able to give new dimension to landslide research in the Institute particularly related to landslide hazard zonation and data based landslide research. The fruits of that work are now being reaped in WIHG and I feel happy that the momentum is being carried forward.

At a later stage of my career in the Institute my Ph.D students, namely Kanchan Bahukhandi, Mala Bhat, Sameer Tiwari, Subhra Sharma and Divya Thakur helped me in pursuing cutting edge research. The journey of research could not have been possible without helping attitude of drivers such as Shri Deewan Singh, R.S. Yadav, Shyam Singh, field assistants like Shri Pratap Singh, and administrative and technical staff of the WIHG family.

The face of research had changed over a period of time in the Institute and not only did we have the opportunity to watch the change in research methodologies from field based to laboratory based but we also became part of the new methodology and instrumentation. I am also fortunate to develop water chemistry laboratory with top class instruments in water analysis that kept me glued in. It gave me a deep sense of satisfaction and pride when recently (2017) I became a member of a report drafting committee of DST from WIHG to frame policy document for the rejuvenation of drying up of Himalayan springs for NITI AAYOG – a matter which I first raised in 1984 and then in subsequent years. The report has been placed before the PMO for further action.

With a lot of pride and satisfaction on research atmosphere in WIHG, lately it started coming in my thoughts that career progression is slow in WIHG as compared to universities. Whenever an opportunity came to me to express an opinion I did express it without thinking about consequences or bothering about who is sitting next or opposite to me, and I have suffered consequences of that. I also now realise that some prejudice has crept in our promotion policy and research environment is becoming more bureaucratic which is not a healthy practice for Institute's growth. This has given me a lesson that one has to be careful in navigating his way through the tricky moments in office. Another lesson for me from the Institute is that "nothing in life comes easy, and more often than not, achievement comes at the end of a long period of preparation and hard work".

I have always had it in my head that I wanted to write about my journey in the Wadia Institute. I felt I have to reflect, if only for my family (Wadia family) as much as for anyone else. My research journey in the Wadia Institute started really well and I feel that given the exposure of all the research undertaken, writing a book to encapsulate this knowledge and experience would be the thing to do. As of now it is in my head and only time will tell when it will come true. I also feel that the time is ripe enough for the Institute to reorient its structure and research programs foreseeing 10-20 years of research goals and introduce decentralization and accountability.

The foundation day is always celebrated with lots of enthusiasm and I am fortunate to be part of both Silver Jubilee in 1993 and this year's Golden Jubilee. I am also fortunate that my superannuation is coinciding with Golden Jubilee foundation day on 29th June 2018.

K. P. JUYAL

Former Scientist 'E'
WIHG Dehradun

**Some remembrances of high altitude field work**

I joined the WIHG in the year 1978 as a Technical Assistant in the Biostratigraphy Group. Later in February 1986, I was appointed as a regular Scientist 'B' in the same group. In 1988, I completed my Ph.D. thesis on Faunal communities and biostratigraphy of the Subathu Formation of the western Lesser Himalaya under the supervision of Dr N.S. Mathur, the then head of the Biostratigraphy Group. During my tenure in the Wadia Institute I worked on Cretaceous-Paleogene successions of the Himalayan foothill belt, Spiti, Zaskar Shyok valley as well as the Indus Suture Zone. I also participated in a couple of expeditions to eastern Karakoram (1991 and 1993) where I worked on Devonian-early Cretaceous sediments. Apart from publishing several research papers, I published two monographs, one entitled "Atlas of Early Palaeogene Invertebrate fossils of the Himalayan foothills belt" (co-authored with Dr N.S. Mathur and published in 2000) and the other entitled "Lithostratigraphy, Biostratigraphy and Palaeogeography of the eastern Karakoram, India" (published in 2018). I superannuated from the WIHG in the year 2001.

Geology is a field science and a geologist learns more in the lap of mother earth than in the class room. To understand the earth in detail, a geologist carries out geological field work. During the field work geologist visits remote and difficult areas, like forests, barren lands, deserts, hills, valleys, high altitude rugged areas, lakes and glaciers, etc. and faces many difficulties. Being a Himalayan geologist I got the opportunities to carry out geological investigations in the Hiamalayan region and faced many unpredictable incidences during field work. Although I remember several such incidents that occurred during my field work in the Tethyan belt of Garhwal and Zaskar regions, I am mentioning here below two unforgettable ones.

On October 5, 1998, a field party consisting of Dr S.K. Parcha and myself, driver Shri Surjan Singh and two CDLs Shri Bipin Thapa and Shri Arbind Kumar, left for field work in the Tethyan Higher Himalayan belt, namely, Lapthal, Sangcha Malla localities including Butchadhura Pass (India – China border). After one day stay in Srinagar (Garhwal) the party reached Joshimath on October 6. At Joshimath after completing the official formal, like obtaining inner line permit and other logistic requirements we left on 7th October and drove along Dhauli river valley for Malari (61 km. from Joshimath) which is situated at the confluence of rivers Dhauli Ganga and Girthi Ganga. First field work was carried out along Dhauli Ganga. In the Dhauli River valley, there are several villages, namely Bompa, Chhinka, Gamsali and Niti, etc., where central crystallines are exposed. In the Girthi Ganga Valley there are no villages after Malari. After one day stay at Sumana along Girthi valley our party left for Lapthal on 12th October. Our main focus of investigation was Cretaceous sequence and therefore, we started out field work from Bulchadhura Pass (> 17000 ft.) and moved downwards to Sangcha Malla, where these sequence are well exposed. We worked in this area for two days (13-14 Oct.) camping for one day at Sangcha Malla and next day we shifted to Lapthal. The weather was clear during these two days and there were no indication of bad weather but on 14th October all of a sudden the weather changed. It became very windy and there was heavy snow fall in the night which continued for six days from 15th to 20th October. At Lapthal our field party took shelter in the ITBP camp. Besides the Assistant Commandant there were a few Jawans, 43 horses (for transportation) and 58 goats (for food in winters) in the camp.

The continuous snow fall covered the mountains totally with 8-10 ft. thick sheet of snow. It also covered the grass in the surrounding hills which was source of food for the animals. As a result of this hungry animals

cried day and night for the want of grass. The challenging task before the ITBP was to manage the after-effects of the tragedy in the camp and surrounding areas. The first thing that the ITBP officer did was to try his best to save the life of horses and goats by giving them food item, i.e. pulses and rice from the stock in the camp regularly. Now the prime challenge was to save the human life after this disaster. The area was in the grip of flood, bridges over the rivers were badly damaged, path ways were covered with snow, communication system had totally failed in the area, and temperature was too low, and there was risk of avalanches. More than 35 people lost their lives around Lapthat due to avalanche and low temperature. Many of ITBP Jawans were doing their duties in the forward posts of higher altitudes in border area. In the Lapthal Camp the day temperature reached minus 4-5° degrees. The snow fall also reduced the oxygen level resulting in lack of appetite. We too suffered from high altitude sickness, had chest pain, weak metabolism and sleepless nights.

Fortunately, the wireless system of ITBP was working and I sent a wireless message to the Director WIHG through ITBP HQ at Seemadwar in Dehradun. Ultimately the Institute managed to send a helicopter on 23.10.1998. ITBP officer received the message to guide the helicopter in landing because there was thick snow cover. But the helicopter could not land and took a position 2–3 ft above the ground, so that we could board. We reached Dehradun safely on 23 Oct. evening. Our men Sh. Thapa and Arvind Kumar could return only after four months when the snow melted and path ways became clear. We thank our brave paramilitary force, ITBP who saved the field party by providing help as well as our Institute Authority for taking care.

The second incident happened in Zanskar region, when a young horse lost its life. It was on 30th July, 1992 when our field party comprising Dr N.S. Mathur and myself, two students, Shri Anand Mohan Srivastava and Shri Dharmendra Singh Bist, field assistant Shri Puran Chandra Pande and driver Shri Chandra Pal left for 52 days field work in the Zanskar region. As usual the field party reached Leh after four days and it took another day from Leh to Bodhkharbu. In Bodhkharbu on 5th August we did field work around nearby areas and arranged mules and started on foot in the interior, rugged Zanskar mountains. I remember field party camped at several places in Kanji Nala, Chomo Nala, etc. and then we shifted our camp to Dumbar locality, where some villages were located near the camp and hence some local villagers use to visit our camp. Many young boys were fascinated to see our camp life. The field work around Dumbar was completed and we were planning to shift to another area. The new area was much different from Dumbar.

For the new area we had to arrange more horses. One young boy, named Nurbu, who used to visit our camp offered his horse for field party. But when the boy asked for permission from his grandfather he refused. The boy ignored his grandfather's advice and became the part of our expedition with his nine year young horse. The field party next day after closing the camp started journey for the new area. We had to cross the Shillakong La (Pass), which was very near from Dumber. Around this pass limestone is exposed and the path is narrow and zig-zag with steep slope. There was a cliff on the southern side, where the horses have to negotiate the pass. We walked slowly and carried out our field work around the hill. Nurbu's young horse with two field kit bags on its back was leading and was to cross the pass first. Unfortunately, while negotiating the pass it lost its balance and fell down on the steep limestone slope into a ~500 feet deep gorge. The horse suffered back bone injury and could not stand and the next day it died. Our sleeping bags and other belongings got scattered on the steep slope and could not be retrieved. This unpleasant incident posed many problems, i.e. our field work suffered badly, Nurbu and his family demanded the cost of horse as compensation and many other problems, we lost some of our field gear.

To meet out such challenges during the field work one has no other option but to face them bravely. In this case we had to alter the rest of our field schedule to work in the other areas and also we had to pay handsomely to the horse owner to avoid any tension with the locals.

VIKRAM GUPTA

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My association with the Wadia Institute of Himalayan Geology

On the occasion of the Golden Jubilee celebration of the Wadia Institute, I am happy to pen-down my journey right from the idea of landing up in the Wadia Institute to the present.

It was way back in 1987, during graduation from the Panjab University, Chandigarh, we were visiting Dehradun - Mussoori for the geological field study tour. It happened that on way back to Chandigarh, we stayed in Dehradun and thus visited the Wadia Institute. It was a holiday that day, nevertheless we entered the premises of the Institute and walked through the corridors of the first and second blocks of the building. I felt lucky and proud to have visited the Institute housing Scientists of varying disciplines, as I was already enthralled by the 'Scientist' designation. On the second occasion in 1989, while doing M.Phil. from the same university, I visited Spiti region for fieldwork and there I was greatly fascinated by the camping sites of scientists of the Wadia Institute at Kaza and at the base camp of the Chotta Shigri glacier.

It was perhaps the visit to the Wadia Institute and my later chance meeting with some of its scientists in the field camps in the interior of the Himalaya in late eighties that generated a keen desire in my mind to sail my life as a Wadia Scientist.

Though I happily began my research journey at the Panjab University (PU), the revelation and the following controversy about the Fossil Fraud in the University around the same time forced me to quit research at the University. Initially, I was quite disappointed about quitting my research at PU, but eventually it turned out to be a blessing in disguise because soon after in 1991 I got an opportunity to start working as a Research Fellow at the Wadia Institute. I still remember that almost immediately after joining the Institute, I visited Kinnaur and Spiti regions of Himachal Pradesh with three Senior Scientists of the Institute and got good field training. Time sailed through, and then my supervisor asked me to present the results of research in a seminar that was being organized in the Institute. During those days, research fellows did not have any training even about in-house seminars, and here I was asked to present my work in front of distinguished audience. Obviously, the task was challenging for me, but I accepted the same. I completed my Ph.D. under the supervision of Dr N.S. Viridi in 1996.

Those were the days, when research students working in the Institute could themselves realize as to how difficult it was to become a scientist. To have any chance of success as an applicant for scientist's position in the Institute one had to have doctorate degree and not just thesis submitted, besides some publications. This was the time when there was complete ban on fresh recruitments. I therefore decided to leave the country in 1996 and take up a Teaching-cum-Research positions abroad.

However, I did not miss the very first opportunity to return back to homeland and my beloved Institute as a Scientist, though this was the toughest decision of my life because I had to quit a lucrative job in the foreign land. So my journey in the Institute as a Scientist started in Feb 2003. I was really happy and thankful to the peers who had shown confidence in me and advised me to lead the research projects on landslides and related mass movement activities. Since these geomorphic activities greatly affect the public life at large, the Institute's partnership with public and government sector started immediately after the occurrence of Varunavat Parvat landslide in September 2004 that endangered the entire Uttarkashi township in the Garhwal Himalaya. Over the years, such partnerships have grown to the extent that Institute's presence is

greatly felt in any developmental and planning related issues in the Himalayan terrain, be it in the NGT, the state and central governments or in public and private enterprises.

During this journey, a paradigm shift from mostly field related studies to more lab focused studies in the Institute has been witnessed. This, over the years, has led to setting up of state-of-the-art laboratory facilities. On the other hand, number of field based researchers has declined.

Geologists usually experience some great, very exciting or challenging and memorable moments during their field trips when they have to face challenges of life and very tough time in the field. I remember the toughest time for me was when I was carrying out the feasibility study for an hydroelectric project in the Higher Himalaya, and we lost one of our Senior scientists in the field due to the cardiac arrest. At that point of time, I realized how even small and seemingly insignificant mistakes or precautions could take or save your life in the field.

I wish that one day our Institute becomes a centre of eminence for providing all the geological inputs for planning and development in the hilly regions. Though we have leaped a step forward in this direction, there still is a long way to go.

PRADEEP SRIVASTAVA

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Having worked on the Quaternary Geology of the Ganga Plain, I never imagined that I would get a chance to traverse Himalaya and serve the Wadia Institute of Himalayan Geology. I fondly remember the summer of the year 2005, sitting in my lab in the University of Georgia, USA when I got the offer letter to join the Institute as a Scientist 'C'. I accepted the offer whole heartedly and joyfully joined the Institute on 12th September, 2005.

Being quite naive in the Geology of Himalaya I started discussing the subject rigorously with seniors like Dr Rohtash Kumar, Dr R. Islam and Dr S.K. Ghosh, to name a few, and took on to the first fieldwork in Alaknanda Valley with Dr R. Islam within 60 days of my joining. Given my training in sedimentology with Prof. I.B. Singh, and in Luminescence dating with Prof. Ashok Singhvi and my own interest in Quaternary Sedimentology I was associated with the Sedimentology Group of the Institute. Prof. B.R. Arora, the then Director of the Institute encouraged me and supported me to double the capacity of Luminescence Dating Laboratory which already existed in the Institute. This came as a big backing and responsibility as well and I feel satisfied, that, as on date the lab works 24x7. I was lucky to have a sincere student in Yogesh Ray with whom while working in various valleys of Himalayan southern front I took on a project to understand the Quaternary landscape of the Himalaya and its bearing on tectonics and climate. The results were exciting and for the first time we were able to put forth a hypothesis that terraces in Himalaya can also be formed under the forcing which is solely influenced by variations in the SW Indian Monsoon as against the established thought with tectonics as driver.

Alongside, seniors like Dr D.K. Mishra and Dr S.S. Bhakuni I got a chance to work and publish on the Brahmaputra River Valley, NE Himalaya as well. The research got boost and encouragement when our publications out of these researches were adjudged best papers of the Institute consecutively for three years from 2008 to 2010. Yogesh Ray, besides Ph.D. degree, was bestowed with the Young Researcher Award by the Ministry of Mines. In the subsequent years, I was joined by Anil Kumar, who is now my young colleague in the Institute. We worked in drier part of Himalaya, in Ladakh and published several articles on the evolution of the Indus River. I was overjoyed by the thought that our group became the first in the country who worked, published and supervised Ph.D's on all the three major rivers of India, the Ganga, the Brahmaputra and the Indus. The journey includes my subsequent students like Shipra Chaudhary, Deepti Sharma and Rupa Ghosh. On the administrative front, the Institute showed confidence in me as soon as my association began. This helped in improving my decision making capabilities, learning from the mistakes. Specifically, I loved working for the Academic Program Committee that deals with expanding student's affairs of the Institute. I feel indebted to the way Wadia Institute accepted me and supported me in all my endeavours in the Himalaya and elsewhere. I enjoyed rock solid support from all my seniors, young colleagues, laboratory personnel and my friends that helped boost my confidence and career progression. I am happy that I could bring accolades like, the M.S. Krishnan Gold Medal, S.S. Merh Award and the National Geoscience award for my organization and myself. The Institute is celebrating its Golden Jubilee and again it comes with a renewed sense of responsibility that our youthfulness has to be transformed into more mature outcomes. With all new blood in the form of students, I wish to keep contributing, that too in a way that springs up the group and the Institute, all together, to the next level of excellence.

AJAY PAUL

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Yes..... I was excited to join Wadia. Although, I had a letter from BHU as well, but It was my choice to work here. Joined the Geophysics group and found the live atmosphere everywhere. Be it in academics or social aspect, got mixed up in the Wadia family in a well homogenised way. Initially I started working on the seismological data from the institute's instruments but it was a big moment for me when I initiated the linking of Wadia to the national seismological scenario consisting of India Metereolgy Department (IMD) and Tsunami Early Warning System (INCOIS).

After working here for few years I felt a change in my stature in Earth Science fraternity as I got respect in meetings and lectures outside just because of my association with WIHG. And now I owe a responsibility to carry forward the name and fame to a higher level.

BARUN K. MUKHERJEE

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I have been interested in Geology, particularly in mineralogy as I liked seeing rock wafers through microscope from my university days. I became fascinated exploring minute details of rocks during my graduation time (1991-1993) in the Department of Geology, Banaras Hindu University, Varanasi. This was introduced by Mr Kedar Banerjee, a senior Laboratory In-charge of the Geology Department. I really enjoyed learning the subject in detail, and did my Masters in Geology. Subsequently, in 1998, I initiated my Ph.D. research on “Origin of magnesite deposit in Pithoragarh” under the supervision of Prof H.P. Sengupta. It was a tough time to pursue research work without any fellowship. By the time I planned my first field work, I got to know, that the Wadia Institute of Himalayan Geology, Dehradun advertised a post of Project Fellow under a DST sponsored project of Dr H.K. Sachan. I figured out that this temporary employment would allow me to complete my Ph.D. work in Pithoragarh magnesite.

I joined the Wadia Institute on 7th January 2000 on the advice of Prof H.B. Srivastava. After joining the Wadia, I carried out two field works- one in Pithoragarh and another in Western Ladakh. As a part of the project objectives, I worked in the Zildat Fault and collected rock samples from the Indus Suture Zone (ISZ). After completion of field work, I was asked to prepare petrography notes on collected samples; this was an easy task for me. Being alone in the Institute at that time, I could fully devote my time on this. Surprisingly, I found myself in difficulty, when I failed to recognise a quartz-type mineral in a high-grade metamorphic rock. I suspected about the mineral coesite, but was scared to speak out. I was a novice, and decided to get it verified by the renowned metamorphic petrologist, Prof. R.K. Lal (Geology Department, BHU). I showed him the rock slide, he asked me to explain the optical characters of the mineral. I was much scared, and responded slowly: “high relief, dusky and polycrystalline quartz occurring as inclusions within garnet... coesite??” He was mute for several minutes, then complimented on my new finding! He also suggested to confirm this. With this motivation I returned back to Dehradun and approached the then Director, Dr N.S. Viridi, and requested him to send rock slide for further characterisation using Raman spectroscopy. He agreed readily and the slide was sent to Tokyo Institute of Technology, Japan, which confirmed my suspicion. It was the first UHP mineral recognised from the ISZ. It signifies deep subduction of Indian plate beneath the Eurasian plate. Since then I started receiving appreciation and criticisms both. Meanwhile, I was called to attend a meeting by Prof K.R. Gupta, Advisor Dept. of Science and Technology, Govt. of India. There I was handed an appreciation letter from the Ministry of Science and Technology, Govt. of India. The Appreciation letter dated 1st May 2001 says “(Barun K. Mukherjee) he became first person in India, who discovered ultra-high pressure mineral-coesite, which will have substantial impact on understanding the geodynamic evolution of Himalayan region”. The finding was also referred in DST’s reports. From there I believe, my research got momentum and I was on roll. I received several foreign travel grants for Switzerland, France, and Cambridge and received many invitations in Govt. meetings to present my new finding from the Himalaya. Thereafter, I decided to pursue thesis work in UHP metamorphism of the ISZ rock and dropped the idea to complete thesis work on Pithoragarh magnesite.

In mid-2001, I enrolled for Ph.D. at Garhwal University. In the beginning of Nov. 2002, I got an unpleasant news that Garhwal University is likely to change its Ph.D. ordinance by end December of 2002. So I decided to write my thesis within 40 days. However, submission of thesis within 18 month of Ph.D. registration required a special permission from the Vice Chancellor (VC) Garhwal University. I met the VC through Dr M.P.S. Bisht of Garhwal University. My discussion with the VC lasted 17 minutes, and he permitted me

to submit my Ph.D. thesis. The Thesis was submitted on 26th Dec 2002 and awarded in 2003. Simultaneously I published a couple of research articles in reputed Journals. In mid-2004, I was called for a Scientist 'B' Position in the Wadia Institute. Around the same time I was awarded 2 yrs JSPS postdoctoral fellowship at Tokyo Institute of Technology, Japan. At the interview, the position of Scientist B, was almost offered, but the committee advised me to avail the JSPS fellowship. I followed the advice and went to Japan for two years and incidentally we discovered microdiamond from the Himalaya.

On 25th Dec 2006 I completed the JSPS PDF and on 8th January 2007 I Joined the Wadia Institute as Scientist 'B' and am presently working as Scientist 'D'. I have completed 11 yrs of my scientific job. My focus is now on the collisional dynamics of the Himalaya including fore as well as back-arc material present in the form of ophiolitic sequences, melange and gneissic domes. I am keen towards the deep Earth studies and evolution of ultrahigh-pressure rocks of continental affinities, their origin, rock-fluid interaction and rate of exhumation. Studies integrate a variety of research methods: field geology, mineralogy, metamorphic petrology, surface and subsurface inclusion mineralogy, mineral chemistry, fluid inclusion and geochronology.

I have guided two Ph.D. students, Souvik Das and Koushick Sen, and presently I have two Ph.D. students working under my guidance: Manas M and Tania Saha. I have guided one Master's Thesis and more than 20 summer trainees. I have convened a couple of sessions in EGU Vienna. I have published several research articles in top ranked Earth Science Journals including Geology, EPSL, Lithosphere, Structural Geology, European Journal of Mineralogy, International Geology Review, Geological Magazine, Geological Society of London, International Journal of Earth Sciences, and in national Journals like Current Science, Journal of Geological Society of India, and have been conferred with best research paper awards in 2003, 2007 and 2009. I have co-edited two International themed volumes, one in the International Journal of Earth Sciences and another in the Geological Society of London. I actively participated in preparing the "vision document 20-20" and "Golden Jubilee Compendium" for the Wadia Institute of Himalayan Geology.

Looking back at my journey through research, it has been rather interesting and surprising at every step. It has driven me to take up challenges and venture new ideas, thanks to moral support especially from my wife Tamanna and other family members.

Since graduation, I was imaginative, and it has been very rewarding. I have had the opportunity to work with the cutting-edge technologies at the Wadia Institute of Himalayan Geology, Dehradun that sharpened my intellectual skills.

R. K. SEHGAL

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Several of my colleagues have shared their sweet memories of the WIHG in this compendium. My reminiscences during the 30 years long service at WIHG are both sweet and sour. I joined the WIHG first in the year 1988 as a Technical Assistant. In the early years of my service, I qualified the written examinations for class one positions of several prestigious organisations like ONGC, Atomic Mineral Division and Coal India Limited, but literally failed in all the interviews.

As a Technical assistant I was posted in the Museum of WIHG. As a team member I worked hard to expand and give a facelift to the Museum. In a few years, the Museum became very popular and presently it is one of the best Earth Science Museums in the country. Along with my museum duties, I simultaneously enrolled for Ph.D. under the able guidance of Dr A.C. Nanda. My research problem was on Siwalik biostratigraphy, and a part of my research area lies in District Udhampur (J & K), and it was very difficult to carry out the field work due to prevailing terror activities in the region. Due to this it took me almost seven years to submit my Ph.D. thesis. Prof. S.K. Tandon and Late Dr K.R. Gupta were examiners of my thesis. During my tenure in the Museum, I got several opportunities to organize mega outdoor exhibitions, a few among these are: Exhibition in Parliament Annexe; India Gate Lawns; Delhi University; National Science Museum; Raj Bhavan of Uttarakhand; Parade Ground and ITBP headquarters, Dehradun and many more. In 1998, WIHG opened a small Center at Itanagar, ('NE Unit') and an inaugural exhibition was organized on this occasion. This center is now closed.

Besides my museum duties, I continued my research work as per my potential. I appeared for several interviews (five to six times) for a scientific position in WIHG but all in vain. I did a lot of field work during my service period right from the NW Himalaya (Leh and Kargil area with Dr A.C. Nanda and Dr Rohtash Kumar) to the NE Himalaya (with Dr Kishor Kumar). The most difficult field work was in Kargil area, where we encountered more bullets and bomb shells than fossils.

With successive assessment promotions, I reached the post of Senior Technical Officer in July 2011. Then suddenly destiny felt pity on me, and I was selected as a Scientist 'C' in the Institute in July 2011. Since then I am working on the biostratigraphy of the Himalayan Foreland Basin, and hope to achieve good results in the rest of my service tenure.

The best part of my journey, I think is that I was able to make several good friends and no foe thus far.

मंजु पंत

सहायक वित्त एवं लेखा अधिकारी
वाडिया संस्थान, देहरादून



बेपरवाह सी जिन्दगी कैसे कुछ पलों में बिखर जाती है। इसी बिखरी जिन्दगी को समेटने के लिए 16 मार्च 1985 को वाडिया संस्थान में ज्वाइन करने के बाद मैंने इस सफर की शुरुआत की। आज सिर्फ अपनी बात कहना चाहती हूँ। मन बहुत बहुत डर और उदासी से भरा हुआ था। पता नहीं था इस सफर का कोई साथी होगा कि नहीं। कई तरह की आशकाएँ थीं मन में। लगा था कि ये यात्रा तो बहुत लम्बी है, अकेली कैसे तय करूंगी। हां तो एक बहुत बड़ी चिन्ता मन में लिए हुए भाई के साथ जब इस संस्थान में पहली बार मैंने प्रवेश किया तो लगा कि मैं कहीं खो न जाऊँ। जिस विषय में कभी सोचा ही नहीं था वहीं मुंह बाए सामने खड़ा था। रमन सर उस समय के सहायक प्रशासनिक अधिकारी ने मुझे स्थापना अनुभाग में ज्वाइन करवाया था। उनकी भाषा सुनकर मैं थोड़ा डर सी गई थी। दक्षिण भारतीय होने के कारण उनकी भाषा में कुछ अलग सा लहजा आता था। आफिस के बारे में कुछ पता ही नहीं था। शुरु में लगा मैं कैसे कर पाऊंगी, पर मेरी सकारात्मक सोच ने मुझे आगे बढ़ने का हौसला दिया। सबसे बड़ा योगदान उस समय के लोगों का था, जिन्होंने हमें हाथों हाथ लेकर हर कदम पर हमारा साथ देकर हमारा हौसला बढ़ाया। हमें उदासियों से लड़ने की ताकत दी और जीवन में आगे बढ़ने की प्रेरणा भी। तभी तो मैं धीरे-धीरे उस लंबे सफर पर चल पड़ी आप सबके साथ, आप सबकी उंगली पकड़कर। जो डर, आशंका मन में थी वह कुछ ही समय में गायब हो गई। खालीपल से भरे दिल में एक उम्मीद ने जन्म ले लिया। हिम्मत आ गई कुछ कर गुजरने की।

धीरे-धीरे कुछ न आते हुए भी मैंने सबके सहयोग से काम करना शुरु किया। अब कुछ-कुछ समझ आने लगा था। मुझे आज भी याद है जब मैंने पहली बार स्टैंसिल काटने के बारे में सुना था तो मुझे लगा ये कौन सा बड़ा काम है। मुझे स्टैंसिल और कैंची दे दें, मैं ही काट दूंगी, पर झिझक के मारे किसी को बोल नहीं पा रही थी। बाद में मुझे पता लगा कि स्टैंसिल काटना क्या होता है। मुझे अपनी सोच पर बड़ी हंसी आयी और आज भी आती है। नवंबर 1988 में मेरा स्थानांतरण लेखा अनुभाग में कर दिया गया था। वहां के लाल हरे पैन से बड़ा डर लगता था। डेबिट क्रेडिट क्या होता है पता ही नहीं था, पर तब के सभी अधिकारियों और सहकर्मियों के सहयोग से मैंने काम सीख लिया और आज भी अपने उच्च अधिकारियों एवं सहकर्मियों से मुझे बहुत कुछ सीखने को मिलता है। अब मुझमें आत्मविश्वास भी आ गया था। काम करने का जज्बा था और माहौल भी बहुत अच्छा था। 15 वर्ष बाद 2004 में फिर स्थापना अनुभाग में और 7½ वर्ष बाद 2011 में सहायक वित्त एवं लेखा अधिकारी के पद पर लेखा अनुभाग में स्थानांतरित हुई। जिसने कभी सोचा ही ना हो नौकरी करने का वो इन्हीं दो अनुभागों में कार्य करते हुए आज 33 साल बाद आपके सामने है, आप सभी के सहयोग से ही तो। आज मैं सोचती हूँ तो लगता है कैसे इतना लंबा सफर कुछ पलों में ही गुजर गया, जहां मैं डर रही थी कि कोई हमसफर होगा कि नहीं वहां इतने साथी और इतने हाथ आगे बढ़े हमारे लिए कि फिर कुछ भी सोचने की जरूरत कहाँ थी। ऐसा नहीं कि बुरा दौर नहीं आया पर वो इतने लंबे अंतराल में बहुत थोड़ा सा था, कुछ पलों का ही, फिर मैं क्यों उन थोड़े से पलों को याद करूँ जब कि मेरे पास बहुत सी अच्छी यादें और अच्छे साथी हैं याद करने को। कई बार दिल में खयाल आता है कि यदि ये नौकरी नहीं होती तो क्या होता, पर ईश्वर ने यही रास्ता मेरे लिए सोचा था। बहुत सारी खट्टी मीठी यादें मेरे इस संस्थान की हमेशा मेरे दिल में रहेंगी, जो वजह हैं मेरे बहुत कठिन दिनों को इतने खुशनुमा बनाने की। मैं कहना चाहती हूँ हां मैं अपने संस्थान को बहुत प्यार करती हूँ। मैंने भरपूर कोशिश की है कि मैं अपना सर्वोत्तम योगदान दे पाऊँ अपने इस संस्थान के लिए।

इक लंबा सा सफर कैसे पलों में कट गया, उदासी का आलम हौसलों में बदल गया,
आप सभी थे साथी इस सफर के, इस साथ से जीवन ही बदल गया।

A. C. NANDA

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 WIHG, Dehradun
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**Birth of S.P. Nautiyal Museum**

When I joined the WIHG in 1974 in Delhi Prof A.G. Jhingran Honorary Director of the Institute wanted me to collect the vertebrate fossils and set the museum of the Institute. In my first field visit in 1975, I was able to collect significant number of Siwalik vertebrates. Both scientific and administrative staff was thrilled to see the collection. Even Governing Body members were shown the collection and they also expressed their desire to have a museum on Himalayan Geology and Natural History. However, there was no space available at Delhi University or Tagore Park. We moved to Dehradun in early 1977 and two residential buildings were hired for the Institute at Teg Bahadur Road. Dr S.C.D. Sah, the first Director of the Institute, asked me to develop the museum in the drawing room of one building. However, funds were not available for furniture and initially specimens were displayed on the floor. Later two working benches with storage space were provided. Soon, scientists spared more specimens and even started bringing specimens from field especially for the museum. The area of Teg Bahadur Road was deserted at that time and in summers and rainy seasons, snakes used to roam in the lawns of both the buildings. However, Institute activities were carried out normally. In 1978, the Institute was shifted to 15, Municipal Road building and we had more space there. Again in the drawing room of the building, museum was established. Mineral, rock and fossil specimens were displayed even in walled showcases and almirahs. Vertical space of walls was used and a few pinup boards were put on walls. Field photographs, charts and maps were displayed showing the research work of scientists. Specimens were properly labelled and arranged in systematically way. A small but effective museum came into existence. Very soon, it caught the attention of local schools and students of Marshall's school were the first to visit the museum. It was a great day in the history of museum and students and teachers were given guided tour and it generated considerable interest. Very soon, students of other schools in the vicinity of Municipal Road started visiting.

The permanent complex of the Institute came into existence in 1983-84 at GMS Road, where sufficient space was provided for a full-fledged museum. Museum was shifted to the present two storied complex. However, we did not have sufficient specimens and exhibits to display then, and only half of the ground floor was used initially. A few showcases of two different types were added and pinup boards were installed to display charts, maps and photographs. The prime aim of the museum was to spread education to students and reflect the research activities of the Institute. Keeping this in mind, the showcases were designed. Some showcases had hidden lights and wooden planks to enable notes-writing while others were made fully of glass except their wooden base. These were used for the display of large specimens and kept in the central part of museum. Local visitors and media, who came to attend the Institute functions such as Foundation Day, National Science Day, Hindi Day, etc., provided considerable publicity to the Institute and its museum. The students, teachers and general public started coming to the museum. At that time, limestone mining was in full swing in Mussoorie Hills and two exhibits dealing with "Impact of Man on Environment" and "Alaknanda Valley tragedy of 1970" were put up. The first exhibit was on the hazards of mining. These exhibits were self-explanatory and detailed descriptions with photographs and maps were provided to make them more educative. Mining lobby was upset with these exhibits, particularly with one on mining hazards. However, we continued to educate the general public and ultimately Supreme Court put a ban on mining. Despite this, funds were scarce and museum was in great need of showcases. Scientists then used to bring

specimens in large wooden boxes. These were emptied, covered with brown papers and used in displaying specimens. A few large specimens were cut and polished for display.

There was great curiosity in general public about the activities of the Institute. An exhibit with thread and pins was prepared in which mineral discoveries and achievements of Institute were shown and displayed just outside the museum entrance. Later, activities of research groups were also displayed. We celebrated the first National Science Day (NSD) in 1987 in grand style, inviting various educational institutions. In subsequent years, we even arranged Science and Hindi essays competitions. This caught the attention of various schools of adjoining areas such as Mussoorie, Roorkee and Vikas Nagar. They took active part in NSD celebrations. On this day, Institute observed open day when labs were also kept open for visitors. On this day students and visitors came in thousands. Sometimes, the lawns and open space of Institute were fully occupied as people waited for their turn to see the museum. Now, student parties and tourists come to visit the museum from all over India.

Suddenly, we observed an increase in the visits of foreign tourists. On enquiry, we found that museum was listed in International guide books for India and it was recommended to visit the museum as tourist and educative place. Museum staff was jubilant. Afterwards any article published on tourism at least in India, WIHG museum found mention. Tourists and scientists from various countries, including Afghanistan, Argentina, Austria, Australia, Bangladesh, Brazil, Canada, China, Czech Republic, England, France, Germany, Holland, Hungary, Iran, Israel, Italy, Japan, Malaysia, Nepal, Nigeria, New Zealand, Norway, Pakistan, Poland, Sri Lanka, Switzerland, United Kingdom, UAE., USA., USSR, Vietnam, and Yugoslavia have visited the museum over the years.

Mrs. Mehr Wadia, wife of Late Dr D.N. Wadia, donated the personal library and precious and semiprecious mineral collection, 120 mm slides, field diaries, medals, awards and honours of Prof. Wadia to the Institute. Apart from the National Science Day, other open days celebrated by museum include Technology Day on May 11, World Environment Day on June 6, Foundation Day and Founder's Day, which fall on June 29 and Oct. 23 every year. On these occasions mineral collections, medals, awards and honours of Prof. Wadia are especially displayed. WIHG museum has collections from several Institutes including Jammu University, Birbal Sahni Institute of Palaeosciences and Geological Survey of India, etc. After Latur Earthquake in year 1993, Department of Science and Technology asked the Institute to arrange an exhibition on Earthquakes to educate the legislatures. During this exhibition, museum released its first educative brochure entitled "Personal Protection in Earthquakes". The brochure highlighted the precautions, before, during and after an earthquake. The Parliament committee appreciated the brochure and subsequently, it was widely distributed.

As museum gained recognition, more popular exhibits such as on Earthquakes, Origin and Evolution of Life, Landslides, Glaciers, Nehru: Science, Geology and Himalaya, Life and Works of Prof. D.N. Wadia were added. These exhibits influenced the educational institutions and students greatly. Students did project work on these themes. In addition, an audio and video section was established and educative scientific movies were shown to visitors, particularly students. During summer vacations, museum remained busy with students and staff helped them to complete their projects. A pictorial exhibit depicting the past memories of the Institute was also displayed. Additional minerals, rocks, fossils and building stones of Himalaya were displayed. Polished sections of the large rock specimens were also displayed and soon these became a centre of attraction. Additional plant, invertebrate and vertebrate fossils were displayed. Siwalik vertebrates remained the star attraction and visitors spent maximum time in Siwalik gallery. A model of an extinct elephant, *Stegodon insignis* was kept near the entrance of museum as front piece. It was the most popular models among young students and children. Governing Body of the Institute in 2003 named the museum as "S.P. Nautiyal Museum" after Late Shri S.P. Nautiyal, Ex. President of the WIHG Governing Body. The credit to develop the museum does not go to any single individual. It was a team work and scientific, technical and administrative staff contributed, appreciated and encouraged the museum staff. The museum saw speedy growth during the tenures of Dr S.C.D. Sah and Dr V.C. Thakur (both Ex Directors). Both did a lot for the museum and it was their interest, appreciation and encouragements that a museum on Himalayan Geology and Earth Sciences came into existence and attained International listing. Shri A.K.

Pandit, Artist cum Modeller attached to the museum, prepared various Siwalik mammals models and landscapes. Later Dr S.K. Parcha and Dr R.K. Sehgal joined the museum and helped in its development. Governing Body of the Institute acknowledged my efforts and in 2003 gave me an additional designation of ‘Curator’ and gave monthly special pay for my contribution. This is the story of the museum, which started with a few specimens, which were displayed on the floor. I retired in 2005 and until that date we did not spend much money on museum. Most of the exhibits and paintings were prepared by staff, who were more concerned for the development rather than their comforts. We strongly believed that museum is an educative place and not a place with luxury decoration. Thus, without liberal funds it was established and received appreciations from students, teachers, visiting scientific staff, politicians, and national and international visitors. This museum is renovated now and most of old furniture has been replaced it is now fully air-conditioned.

Memories
at a glance



Dr D.N. Wadia with Dr S. Radhakrishnan, President of India



Dr D.N. Wadia with memento



Dr D.N. Wadia discussing geology



Dr D.N. Wadia with others



Staff of WIHG performing Bhumi Puja for Institute Building in 1979



Completed WIHG Building Complex in 1983-84



Shri K.R Narayanan, the then MoS for Science & Tech. inaugurating WIHG Complex in 1988



Staff of WIHG performing Bhumi Puja for 4th Block of Institute



Prof. A.G. Jhingran, Honorary Director, WIHG with WIHG scientists, VI Himalayan Geology Seminar, 1975



Sh S.P. Nautiyal at WIHG building site, 23rd Oct., 1979



Dr A. Gansser, VIII Him. Geol. Sem., 25th Oct., 1977



Sh S.P. Nautiyal with Dr A. Gansser and others



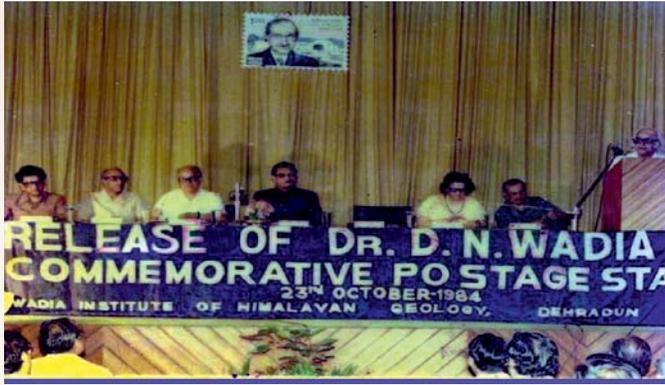
Sh S.P. Nautiyal at WIHG building site, 23rd Oct., 1979



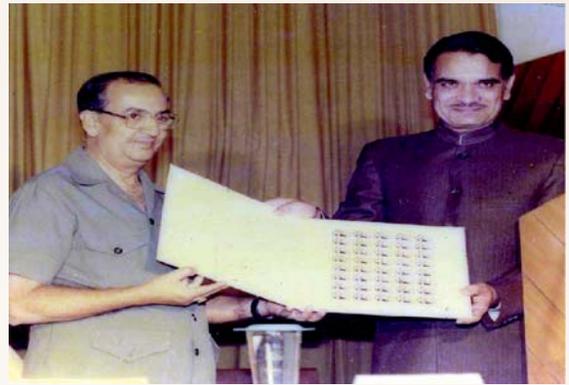
Dr S.C.D. Sah Director WIHG with scientists



Field Excursion, Girthi Ganga Valley, 1973



Sh Shivraj Patil (MoS, DST) & Sh V.N. Gadgil (MoS, Comm.) releasing stamp on Dr Wadia, 1984



Sh Shivraj Patil (MoS, DST) and Dr S.C.D. Sah with Postage stamp Album, 23 Oct., 1984



Dr S. Vardarajan, Secretary, DST, during Wadia Centenary celebration, 23 Oct., 1983



Dr S.Z. Qasim Member Planning Comm. with Drs V.C. Thakur & A.K. Sinha, 1993



Sh Vasant Gowariker Secretary, DST releasing Himalayan Geology volume, 29th June, 1990



Sh Vasant Gowariker Secretary, DST in Palaeontology Laboratory, 29th June, 1990



Inspecting the site for 4th Block of building complex

REMINISCENCES OF GOLDEN DAYS



Dr V.S. Ramamurthy, Sec. DST, 9th Feb., 2003



Sh Sharad Pawar, Ex-CM of Maharashtra 12th Sept., 2001



Dr R.A. Mashelkar, DG, CSIR, 23rd Oct., 2001



Prof. Yashpal Former Chairman, UGC, 24th Feb., 1995



Dr M.G.K. Menon, Secretary DST



Dr V.C. Thakur with dignitary



Group with Sh S.P. Nautital, Dr C.P. Vohra, Dr K.N. Khatri, Dr K.B. Powar & others

REMINISCENCES OF GOLDEN DAYS



Sh S.N. Talukdar Former Member (Expl), ONGC



Dr K.S. Valdiya, Sust. Develop. Doon Valley, June 1995



Dr K. Chandra Former Director ONGC, 29th June, 1995



Dr S.K. Joshi Ex-DG CSIR, 23rd Oct., 2003



Field Excursion in Shimla Hills, VIII Himalayan Geology Seminar, 27th Oct., 1977



Dr C.N.R. Rao releasing Bibliography of Himalayan Geology, 30th Sept., 1988



Sh P. Chavan MoS Sci. & Tech. inaugurating the Centre for Glaciology, 4th July, 2009



Sh V. Singh Hon. CM of H.P at Naddi Observatory, H.P.



Sh Y.S. Choudhary MoS Sci. & Tech. inaugurating a lab



Sh Olafur Ragnar, President of Iceland, 1st April, 2013



Sh S.J. Reddy MoS & T during 4th Third Pole Workshop



Chief Guest, Guest of Honour & delegates of 4th Third Pole Env. Workshop at WIHG, 1st April, 2013

REMINISCENCES OF GOLDEN DAYS



Dr Jayant Narlikar (IUCAA, Pune), 23rd Oct., 1999



Dr S.B. Bhatia and Dr N.S. Viridi



Dr P. Rama Rao Sec. DST, Dr K.B. Powar 29th June, 1991



Dr Kurien Jacob Chairman GB with Dr V.C. Thakur



Dr K.S. Valdiya with Sh N.D. Tiwari



Dr T. Ramasamy with former Directors of WIHG



Dr R.S. Mittal with Dr K.B. Powar, Dr I.C. Pandey, Dr N.S. Viridi, Dr A.K. Sinha and others



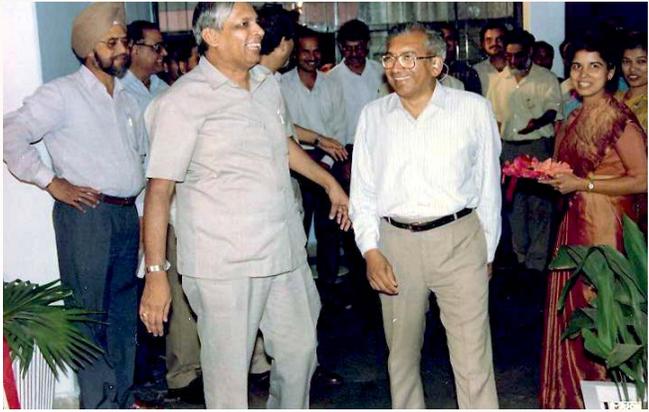
Silver Jubilee Foundation Day, 29th June, 1993



Dr V.C. Thakur & Dr H.C. Visvesvaraya VC Roorkee Univ



Dr V.C. Thakur with Dr R.S. Mittal, 29th June, 1993



Dr K.B. Powar Chairman GB WIHG & Dr K.S. Valdiya



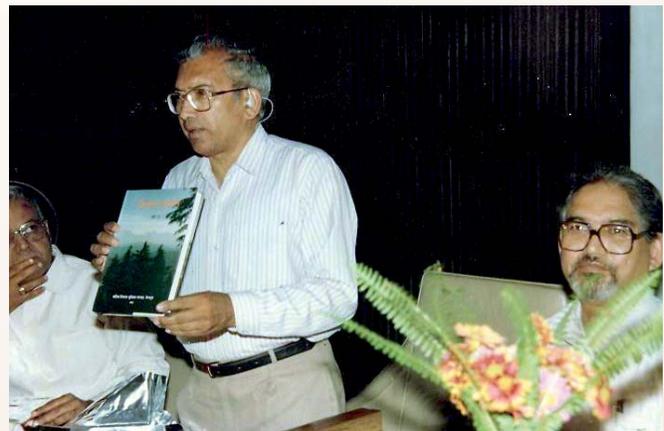
Dr K.B. Powar with chief guest Dr Visvesvaraya



Dr K.S. Valdiya releasing a volume, 29th June, 1993



Distinguished Audience, 29th June, 1993



Dr K.S. Valdiya releasing Himalayan Geology volume

REMINISCENCES OF GOLDEN DAYS



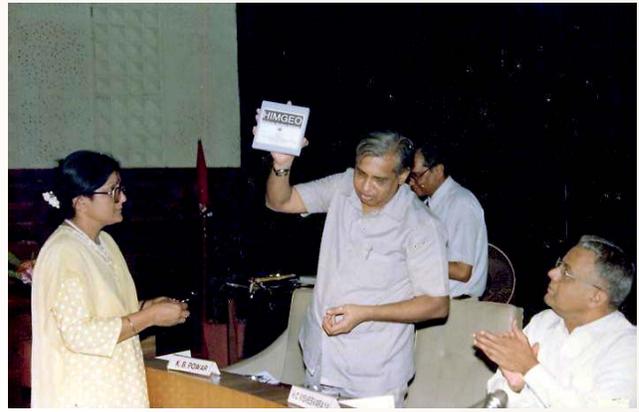
Silver Jubilee Foundation Day, 29th June, 1993



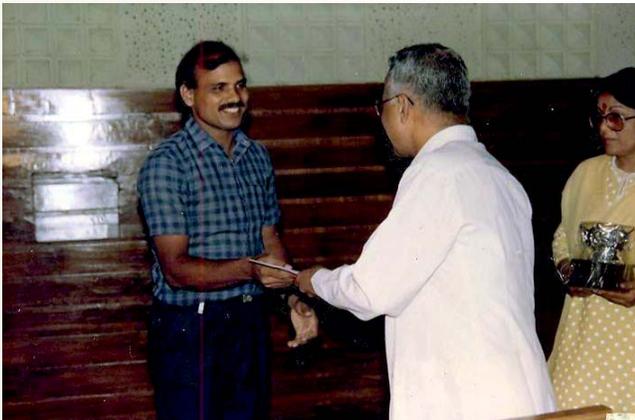
Saraswati Vandana, 29th June, 1993



Dr H.C. Visvesvaraya VC Roorkee Univ., 29th June, 1993



Dr K.B. Powar releasing Him Geol CD, 29th June, 1993



Best paper Award to Dr K Kumar, 29th June, 1993



Director's Award to Dr KK Purohit, 29th June, 1993



Drs T. Singh, M.P. Sah, K.S. Bist & RAK Srivastava, 1993



Dr K.B. Powar Chair GB with chief Guest, 29th June, 1993

REMINISCENCES OF GOLDEN DAYS



Members of 1st Expedition to Arunachal Pradesh with Dr A.G. Jhingran, 4th Feb., 1972



Post-seminar field excursion



Dr M.P. Darkatch Director UNESCO, Struct. Geol. Training Course, 3rd April, 1985



Mrs Mehr Wadia (w/o Dr D.N. Wadia), 23rd Oct., 1983



Farewell to Dr S.C.D. Sah Director WIHG, 31st May, 1987



Farewell to Dr V.C. Thakur Director WIHG, 31st January, 2000



Field camp in Himalaya



Dr A.K. Sinha in field (Malla Johar), 1979



Field Expedition to Eastern Karakoram



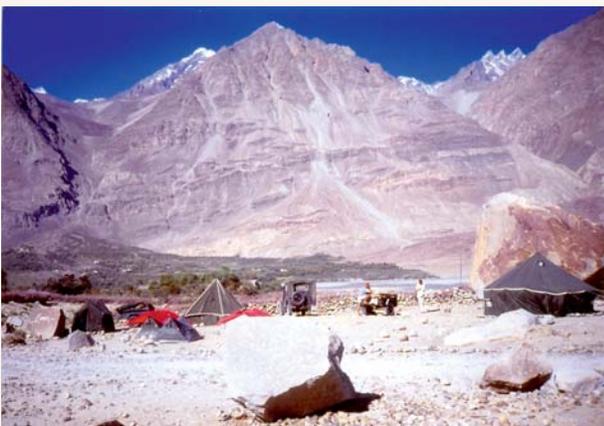
Sh S.P. Nautiyal with Drs Mathur & Juyal, Renuka Lake



Dr K.P. Juyal in Eastern Karakoram



Field Parties at Saboo camp site, Leh, Ladakh, 1996



Field Camp site



Crossing the river using ropes and basket

REMINISCENCES OF GOLDEN DAYS



Dr R.C. Misra Former Chair GB WIHG, 29th June, 1989



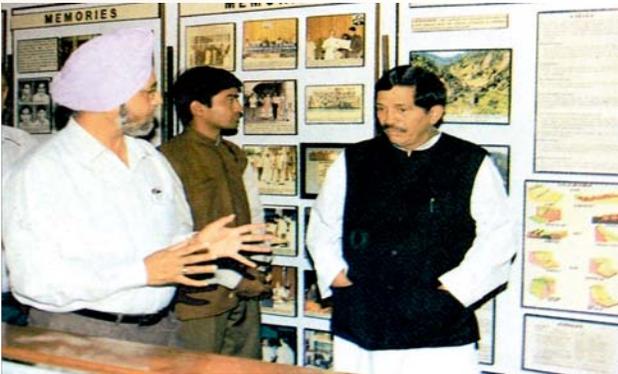
Dr H.C. Visvesvaraya, VC Roorkee Univ. 29th June, 1993



Inauguration of NE Unit of WIHG at Itanagar
by Hon. CM of Arunachal Pradesh, 1998



Dr S.K. Joshi Ex-DG, CSIR dedicating the Museum
to Sh S.P. Nautiyal



Sh B.S. Rawat, MoS for Sci. & Tech., 4th April, 2002



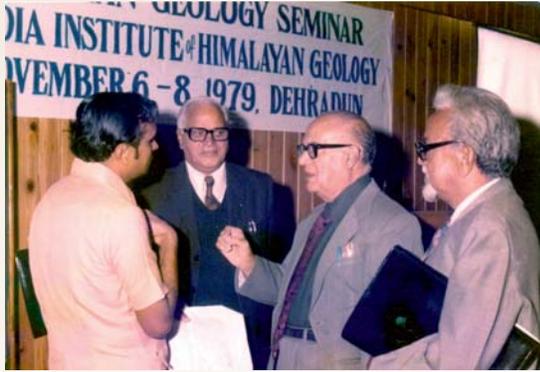
Dr Prem Vrat Director, IIT Roorkee



Dr V.S. Ramamurthy Sec. DST, laying Foundation
stone of WIHG Guest House, 2003



Dr J.N. Goswami, Director PRL Ahmedabad,
National Technology Day 11th May, 2009



Sh S.P. Nautiyal with Dr I.C. Pandey, 1979



Dr V.C. Thakur in field near Maldeota



Dr Ashok Sahni and Dr I.C. Pandey



Field excursion, XV ICMS, Dehradun, 1996



Delegates of the XV Indian Colloquium on Micropaleontology & Stratigraphy (ICMS), Dehradun, 1996



Under Construction-4th Block of WIHG building complex, 1997



XXIV ICMS, WIHG Dehradun, Nov. 2013



Workshop on Landslides, Way Forward WIHG, Sept. 2013



Curtain Raiser, India Intl. Sci. Festival, WIHG, Nov., 2016



Intellects Meet, India Intl. Sci. Festival, Nov., 2016



Sem., Development of Water Resources, WIHG, 2006



Disaster management Workshop, WIHG, Dec. 2004



Release of Vision Document of WIHG by Sci. Adv. Dr R.Chidambaram & T. Ramasamy Sec. DST



30th HKT Workshop, WIHG, Oct., 2015



Sh S.P. Nautiyal & Dr K.B. Powar



Sh R. Pokhriyal, Dr H.K. Gupta, B.R. Arora releasing a book



Sh V.R. Deshmukh, Dr A. Sahni releasing Abst. vol. 2011



Smt. M. Alva Hon. Governor of Uttarakhand



Dr M. Tiwari at the time of taking charge from Dr A.K. Gupta, 31st August, 2017



Dr K.K. Pal Hon. Governor of Uttarakhand, Golden Jubilee Seminar, WIHG, 16th May, 2018



Dr K.K. Pal Hon. Governor of Uttarakhand inaugurating the Golden Jubilee Seminar, May, 2018



Parliamentary Standing Comm. on Sci. & Tech. visit to WIHG, 2nd June, 2018



Dr T. Ramasamy Secretary DST inaugurating the WIHG Stores building, 2006



Dr T. Ramasamy and Dr B.R. Arora in EPMA Laboratory



Dr V. Ramamurthy inaugurating the EPMA Lab, 2006



Farewell to Dr Devendra Pal, Scientist, GEG Group



Parliamentary standing committee visit to WIHG, June 2003



Dr V.C. Thakur former Director WIHG receiving the Padma Shri Award of the Government of India from Honorable President of India Sh. Ram Nath Kovind, April, 2018



Dr A.K. Dubey former Scientist 'G' WIHG receiving the National Geoscience Award of the Government of India, 2004



Dr Pradeep Srivastava Scientist 'E' WIHG receiving the National Geoscience Award of the Government of India, 2011



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