

# **Dr Harsh K. Gupta**

(Career highlights in brief)

## **General**

Born on June 28, 1942, Dr Gupta had his education at the Indian School of Mines (B.Sc.(Hons), M.Sc. and A.I.S.M) and University of Roorkee (Ph.D.). He availed two years UNESCO fellowships for advanced studies at Tokyo. Dr Gupta has published over 130 research papers in International Journals, written 4 pioneering books published by Elsevier Scientific Publishing Company, Amsterdam and edited over 15 volumes. He has held senior responsible positions for the past 24 years, including Vice-Chancellor of Cochin University of Science & Technology; Director, National Geophysical Research Institute, Hyderabad; and Secretary to the Government of India for the Department of Ocean Development. Presently, Dr. Gupta is a Raja Ramanna Fellow at the National Geophysical Research Institute, and General President, Indian Science Congress 2007. Dr. Gupta has a unique combination of rich scientific research and science administration experience. He is internationally well connected and has been a Research Scientist, Professor and Visiting Professor at a number of Universities and Institutions abroad. He has been holding important international scientific positions and won several awards and recognitions. As the Leader of the III<sup>rd</sup> Indian Scientific Expedition to Antarctica, he has the distinction of establishing Indian Permanent Station at Antarctica during 1983-84 in a record time of an Antarctic summer. In the following, some details are provided:

## **Specialization**

Earth Sciences and their application to address problems of continents and oceans, administration of educational and scientific institutions.

## **Research**

Dr Harsh Gupta is among the most well known earth scientists in the world. During the 22<sup>nd</sup> International Union of Geology and Geophysics (IUGG) General Assembly held at Birmingham in 1999, he had the responsibility of convening a symposium on "Earthquake Precursors and Prediction". Incidentally, IUGG is the most important International Forum where around 5000 geophysicists and geodesists from all over the world meet once in four years. At the IUGG General Assembly (2003), he convened a symposium on 'Recent Destructive Earthquakes'; and at IGC 2004 a symposium on 'Stable Continental Region Earthquakes'.

In the following, some other facts are given:

Provided the first geophysical evidence for an enormously thick crust (65-70 km) below the Tibet Plateau and Himalayan region in 1967, found to be accurate as confirmed by detailed field seismic surveys conducted in 1980s.

Over the past 40 years, through detailed studies of earthquake focal mechanism, surface wave attenuation and other related work, threw much light on the geodynamic processes responsible for the high elevation of Tibet Plateau and tectonics of the Himalaya and nearby region.

Pioneered investigations of artificial reservoir induced earthquakes and developed criteria to discriminate reservoir induced earthquakes from normal earthquakes. These criteria are now internationally applied. Also developed procedures to estimate potential of occurrence of reservoir induced earthquakes at a given site. He discovered that reservoir induced earthquakes of magnitude  $\geq 5$  are generally preceded by a couple of  $M \geq 4$  earthquakes.

Completed a detailed study in 1986 of earthquake swarms and quiescence that precede major earthquakes in the northeast India region and concluded that major earthquakes are preceded by

well-defined swarms and quiescence. Also made a medium term forecast of a  $8 \pm \frac{1}{2}$  magnitude earthquake to occur in area bound by  $21^\circ\text{N}$  and  $25 \frac{1}{2}^\circ\text{N}$ , and  $93^\circ\text{E}$  and  $96^\circ\text{E}$  with a focal depth of  $100 \pm 40$  km before the end of 1990. This has come true.

Completed 'stress pattern' for the Himalayan and the Andaman-Nicobar Region as inferred from earthquake focal mechanism.

Dr Gupta has carried out detailed studies of Latur earthquake, one of the deadliest stable continental region earthquakes, and shown that fluids existing at shallow crustal depths played an important role in the genesis of Latur earthquake.

Dr. Gupta has developed the concept of spectral magnitudes and showed its application in learning about characteristics of seismic sources using broadband recordings. One latest application has been in characterizing the nuclear explosion.

Recently (May 2006) Dr. Gupta made a successful short-term forecast of an M 4 earthquake in the Koyna region in India. The forecast made in May 16 and communicated to Current Science & Geological Society of India said *"On the basis of the data available from 7 seismic stations operating in the Koyna region, we have identified a nucleation, which started on May 12<sup>th</sup>, 2006. This may lead to the occurrence of an M~4 earthquake in the next 15 days. This shallow earthquake (focal depth less than 8 km) will occur within a radius of 10 km centered at  $17.1^\circ\text{N}$ ,  $73.8^\circ\text{E}$ . On the basis of our previous experience of studying nucleation-preceding earthquakes in the Koyna region, we expect this earthquake to occur over the next 15 days time (till 31<sup>st</sup> May, 2006), with a 50% probability"*. An earthquake of M 4.2 occurred on May 21<sup>st</sup>, 2006 with in specified parameters.

## **Research Related with Ocean Science**

Dr Harsh Gupta has been very deeply involved with investigations related to oceans. Early in his career during 1964-65 he participated in the India Ocean Expedition Programme where joint expeditions were undertaken in the Arabian Sea by the German research vessel Meteor and Indian research vessel Kistna. In 1968 he carried out very detailed investigations of regional crustal structure of the Bay of Bengal and Arabian Sea using the state-of-the-art surface wave dispersion techniques. Later, as the Director, Centre for Earth Science Studies (1982-87), Trivandrum, he pioneered efforts to generate wave atlas of the west coast of India. Detailed work on placer deposits on the west coast was also carried out.

He was the Leader of the 3<sup>rd</sup> Indian Scientific Expedition to Antarctica (1983-84) which established a permanent base for India in a record time. This station fulfilled a very urgent scientific requirement of the country.

In the recent years, at the National Geophysical Research Institute, he initiated a very detailed work on Gas Hydrates in the Exclusive Economic Zone of India. Sponsored by the Gas Authority of India Limited, a comprehensive report has been prepared under his leadership entitled "Gas Hydrate Exploration along the Continental Margins of India – Evaluation of Available Geophysical and Geological Data". Another landmark work has been the analysis of 80,000 line km of single channel seismic data in the Indian Exclusive Economic Zone to identify locations where bottom simulating reflectors occur. This has been extremely helpful in identifying zones of gas hydrate occurrences.

One of the major requirements in Antarctica has been the setting up of a permanent seismic station as well as permanent GPS station. Under Dr Gupta's stewardship these two major objectives were achieved during 1996-97 and 1997-98. India now boasts of one of the best state-of-the-art GPS station and a digital seismic data acquisition system in Antarctica.

At the Department of Ocean Development, he has implemented several new programmes, such as, scientific work necessary for submitting India's claims on Legal Continental Shelf where India may gain 1.5 million sq. km of additional ocean area over and above the 2 million sq. km Exclusive Economic Zone (EEZ); detailed bathymetry surveys in the entire EEZ of India; building of an Indo-Russian Gas Hydrate Centre at Chennai; acquisition of new research vessels; and latest being putting India on the global map by designing an Early Warning System for Oceanogenic Hazards (Tsunami and Storm Surges) for India, as well as successful commissioning of a 1 million litre per day Low Temperature Thermal Desalination Plant at Kavaratti, Lakshadweep Islands.

## **Publications**

### **Books Authored**

- (1) Gupta, H.K. and B.K. Rastogi (1976). "Dams and Earthquakes", Elsevier Scientific Publishing Company, Amsterdam, 229 p. (Translated into Russian in 1979 and Chinese in 1980).
- (2) Gupta, H.K. (1980). "Geothermal Resources: An Energy Alternative". Elsevier Scientific Publishing Company, Amsterdam, 227 p.
- (3) Gupta, H.K. (1992). "Reservoir Induced Earthquakes", Elsevier Scientific Publishing Company, Amsterdam, 364 p.
- (4) Gupta, H.K. and Sukanta Roy (2006). "Geothermal Energy: An Alternative Resource for the 21<sup>st</sup> Century", Elsevier Scientific Publishing Company, Amsterdam, 306 p.

### **Others**

Over 150 papers in scientific journals of international repute. Details are given in Annexure-I.

SCIENCE/NATURE	5
BULLETIN OF SEISMOLOGICAL SOCIETY OF AMERICA	25
TECTONOPHYSICS	12
OTHER INTERNATIONAL JOURNALS	39
INDIAN JOURNALS	57

### **Volumes Edited**

- Tectonophysics	3
- I.G.U.	2
- A.G.U.	1
- Current Science	2
- Inter Union Commission on Geodynamics	1
- Department of Ocean Development (GOI)	1
- Physics of the Earth and Planetary Interior	1
- Geological Society of India	3
- Pure & Applied Geophysics	1
- INSA Proceedings	2

## **Positions held**

Currently, Dr. Gupta is Raja Ramanna Fellow at the National Geophysical Research Institute, Hyderabad, and also the General President, Indian Science Congress 2007. Among the important positions held earlier include Director, Centre for Earth Science Studies, Trivandrum (1982-87); Vice-Chancellor, Cochin University of Science & Technology, Cochin (1987-90); Adviser, Department of Science and Technology, Government of India, New Delhi (1990-92); Director, National Geophysical Research Institute, Hyderabad (1992-2001); and Secretary to the Government of India, Department of Ocean Development (2001-2005). Earlier, he was a Research Scientist at the University of Texas at Dallas (1972-77) and has been an Adjunct Professor during 1977 through 2000.

## **Institution Building**

Dr Gupta has been involved from a very young age in senior administrative positions of institution building. He built Centre for Earth Science Studies at Trivandrum from a scratch. This included development of a whole campus in a short time of two years (1984-86). He also had the responsibility of building Indian Scientific Station in Antarctica which he did with distinction and completed all the tasks in a record time of one Antarctic summer (1983-84). In his capacity as Vice-Chancellor of Cochin University of Science and Technology (at the age of 45 years he was the youngest Vice-Chancellor in the country), among several things, he created DRDO – Cochin University of Science & Technology, Computer Centre equipped with the then latest available computers for joint research projects. He also hosted the Science Congress in January 1990, the first Science Congress in Kerala, which, people still remember as one of the best conducted Science Congress meetings. At DST, during his stay of two years (1990-92) he initiated many new programmes including consolidating DST inputs on IGBP projects.

During 1992-2001, Dr Gupta was the Director at the National Geophysical Research Institute (NGRI), Hyderabad. NGRI has risen to the position of one of the top few CSIR laboratories. From a meager rupees one crore external cash flow during 1993-94, it has grown to 11 crores during 1996-97 and the same level is maintained since then. NGRI won the prestigious Technology Prize for Business Development and Technology Marketing during 1997. At NGRI, Dr Gupta has revolutionized application of earth sciences to the basic needs of the country. This has included delineation of Mesozoic sediments (which could be petroliferous) under Deccan Trap cover, and a new chapter has been opened in looking for Gas Hydrates in offshore region of India. NGRI has also significantly contributed in water resource finding, rain water harvesting and water pollution related studies as well as ways and means of assessing and safeguarding against earthquake hazards.

## **International Associations**

Dr Gupta has been very active internationally. He is currently a Bureau Member of the International Union of Geodesy and Geophysics (IUGG), and Member of the Committee on Scientific Planning and Review of ICSU. Earlier he has been Councillor of the International Union of Geological Sciences (IUGS); the Chairman of the Steering Committee of Global Seismic Hazard Assessment Programme (a UN initiative); Chairman of IASPEI/UNESCO/ICL Working Group on Seismology and Related Sciences in Africa, as well as Bureau Member and Chairman of several Committees of the International Lithosphere Programme. He was the Founder President of Asian Seismological Commission. Dr. Gupta is currently a Member of the CSPR/ICSU as well as Member, ICSU Planning Group on Natural and Human-induced Hazards and Disasters. He has convened several international symposia at IUGG, IASPEI and IGU Assemblies. During January 1998, he convened a Chapman Conference on “Stable Continental Region Earthquakes” at NGRI, Hyderabad, this being the first Chapman Conference ever held in Asia.

## **Science Communication**

Dr. Gupta has been extensively involved with science communication and popularization. He has given numerous talks on Earthquakes and what can be done about it, at different forums in India

and abroad. He was the Chairman of the Steering Committee of the recently concluded Global Seismic Hazards Assessment Programme, one of the programmes initiated by U.N. for International Decade of Natural Disaster Reduction (IDNDR), where over 500 scientists worked globally from 1992 to 2001 to prepare, for the first time, a global map of Earthquake Hazard. He has convened several interesting workshops and symposiums, which produced excellent volumes. In 1999, he convened, on behalf of Indian National Science Academy (INSA), a unique symposium on "Deccan Heritage" with specialists on Deccan Bio-diversity, Earth Sciences and Culture which resulted in a volume "Deccan Heritage" published by University Press. He convened a symposium on Water Resources and their Management at INSA (March 12, 2001), which was attended by a large scientific community. Recently, Dr. Gupta convened a Seminar on 'Key Issues in Ocean Sciences in 21<sup>st</sup> Century' at INSA on 9<sup>th</sup> March, 2002.

## Special Assignments

Dr Gupta has been the visiting Professor at University of Paris Sud, Paris, France, University of Texas at Dallas, USA and at the University of Hamburg, Germany. He has been also a visiting Scientist at US Geological Survey and Adviser/Consultant to UNESCO, IAEA and Commonwealth Science Council on several occasions.

## Honours and Awards

Fellow	Indian National Science Academy
Fellow	Third World Academy of Sciences, Italy
Fellow	National Academy of Sciences, India.

### Dr Gupta has won several awards. To mention a few:

1977	Indian School of Mines Golden Jubilee "Outstanding Alumni" Award
1978	Krishna Gold Medal of the Indian Geophysical Union
1983	Shanti Swarup Bhatnagar Prize for Science & Technology in Earth Sciences
1985	USSR Academy of Sciences "100 Years of International Geophysics" Memorial Medal
1989	The first "Dr Anil Kumar Ganguli" Memorial Oration Award, BARC, Bombay
1991	National Mineral Award, Government of India
1993	The Department of Atomic Energy, Government of India "C.V. Raman Lectureship".
1995	Indian Science Congress Association Jubilee Lecture
1995	CSIR Technology Prize for Business Development and Technology Marketing
1997-98	Ninth Professor K.P. Rode Memorial Lecture of the Indian Science Congress Association
1998	Second Outstanding performance Award by the 11 <sup>th</sup> International Kharazmi Festival of Iranian Research Organization for Science and Technology, Teheran, Iran
1998	Indian Geophysical Union Decennial Award
1999	Federation of Indian Chambers of Commerce and Industry, New Delhi, Award for Physical Sciences, 1998-99
1999	IGU Millennium Award
2000	Indian Society of Applied Geochemists Millennium Award
2001	Vikram Sarabhai Memorial Lecture, Department of Space
2001	First Dr. H.N. Siddiquie Memorial Lecture, Indian Geophysical Union
2002	22 <sup>nd</sup> G.P. Chatterjee Memorial Award, Indian Science Congress Association
2003	Jawaharlal Nehru Visiting Fellowship 2003, Indian National Science Academy
2003	The 4 <sup>th</sup> Prof. C. Karunakaran Endowment Lecture
2003	Bruun Memorial Lecture, 22 <sup>nd</sup> session of the Assembly of International Oceanographic Commission, Paris.
2003	National Mineral Award for Excellence-2002

2004 Prof. K. Naha Memorial Medal (2004) of INSA  
2004 Sir Alladi Krishnaswamy Aiyer Endowment Lecture 2004  
2005 Prof. J.B. Auden Memorial Lecture 2005  
2005 Prof. M. Kurup Memorial Lecture 2005  
2005 Prof. Y. Nayudamma Memorial Lecture 2005  
2006 '*Padmashri*', Government of India