

## My Journey in Earth Sciences and Creation of Physics Department in Guru Nanak Dev University, Amritsar

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Before venturing into Earth Sciences (Geochronology, Geochemistry and Geophysics), I tried my luck for a while to enter the domain of radiation biology. For this purpose, I participated in a four weeks Summer School organised in April, 1974 by the doyen of Biophysics, G.N. Ramachandran, who was a hot candidate for Nobel Prize in Physics those days in Indian Institute of Science, Bangalore. I found Biology and Biochemistry contents of the course a hard nut to crack. I collaborated with Dr. Bhagat Singh of Botany Department in Punjabi University, Patiala and undertook to investigate the chromosome aberrations in barley seeds exposed to neutron and gamma radiations. We wrote a joint project for funding by the CSIR (*Council for Scientific and Industrial Research*) which was not approved; hence my honeymoon with radiation biology was short-lived.

When emergency was imposed by Indian Prime Minister, Indira Gandhi, on June 25, 1975, I was visiting Delhi University to carry on investigations of Deuteron exposed nuclear emulsion plates. On the way back, I happened to visit Prof. K.K. Nagpal's Geochronology Laboratory in Kurukshetra University, Kurukshetra (KUK). Prof. Nagpal had shifted from Particle Physics to Geophysics recently and I found this route a viable choice for me. I knew that my training in microscopy in Paris will prove handy and useful, in the new field of my choice, to study fossil and induced fission tracks. During this visit, I was shown the fission tracks of Uranium in muscovite mica sheets etched in HF acid by M.K. Nagpal, a research scholar of Prof. Nagpal. It looked so simple and interesting that I decided to make an immediate shift to this field of Geochronology.

### FISSION TRACK (F.T.) DATING OF ROCKS

Fortunately, I was lucky that CSIR, New Delhi, sanctioned me a research project "*Dating of Rocks*" with some basic grant for equipment and posts of two Junior Research Fellows (JRFs). It was a great morale booster for me as I was the first teacher in Punjabi University, Patiala who was sanctioned two major projects by CSIR and UGC (University Grants Commission), respectively. Sohan Lal Koul and Surinder Singh Parmar joined as JRFs in my project in 1975. In fact, Mr. Koul started working without fellowship by end of 1974 and he got training to etch mineral samples in KUK for a few days. My Geochronology laboratory became functional at a cost of Rs. 2500 only before the CSIR project was sanctioned in 1975. We needed one student microscope, a bottle of HF acid, an etch-bath, a sharp razor blade, and a few strips of mica sheet. Microscope was already available and a bottle of 48% HF was purchased from Ambala Cantt. @ Rs. 40 only. Prof. A.K. Prasad of Geology Department, PU Chandigarh, supplied us muscovite and biotite samples of Bihar pegmatite belt. Before end of 1975, we published five research papers on dating of pegmatite samples, a great achievement indeed.

Our major problem was supply of mineral and rock samples. Our scholars had no training in geological field work; hence we had to depend upon supply from Geology Departments of neighbouring universities or Geological Survey of India (GSI). On return from Paris, I was appointed as the '*Tour Incharge*' of Physics Department. It gave us opportunity to collect samples from the areas visited by us. During one such tour to Kathmandu, Sohan Koul collected mineral samples of Himalayas in abundance for dating. We found that

Himalayan orogeny was the youngest among the mountain ranges of India. But, our geologist friends were not happy with our results. We were told that Himalayas had suffered reverse metamorphism and its geochronology is complex and complicated to interpret. Anyway, we discontinued our studies and shifted our focus to dating of minerals of Indian pegmatites, found in abundance in most of the states in India. In addition to muscovite mica, biotite and phlogopite, we ventured to date apatite, garnet, zircon, quartz and some other minerals. Surinder Singh and later on his scholar, Amanjit Singh Sandhu, created a record number of publications in area of Geochronology using fission track dating.

During Oct. 1977, ICTP (International Centre for Theoretical Physics) Trieste (Italy) organised a School on Physics of Earth of ten weeks duration. This was first of its kind outside the area of Theoretical Physics in ICTP. I was keen to participate in this School so that I can venture into inter-disciplinary areas of Earth Sciences with full blast. Prof. A.H. Cook of Cambridge University was Director of this School with other eminent lecturers from Russia, Japan and Canada. Since, our research group in PU Patiala was well established in Geochronology, my selection to this School became an easy affair. The various topics of Physics of Earth were covered exhaustively but my favourite topics were geochronology, seismology and earthquake studies. I never knew that one day my training will be helpful in Earthquake prediction studies using Radon and Helium as precursors. Prof. T. Rikitake from Earthquake Research Institute, Tokyo University, Japan and Prof. V. Keilis-Borok of Moscow were our most sought after Lecturers in this School.

In addition to my training in Physics of Earth (Geophysics), I was lucky on two other counts. I knew Prof. Abdus Salam, Nobel Laureate in Physics, was the Director of ICTP. But I never dreamt that our casual meeting during the inaugural session of this School will turn into an everlasting friendship between two Punjabi scientists. The other count was equally interesting. In those days, participants in ICTP organised Schools were financially supported

and allowed to visit other Laboratories in Europe for advanced training in their research areas of interest. I took advantage of this facility to visit Institute de Physique du Globe (Paris Institute of Earth Physics) in Paris and Institute of Geophysics of Graz University, Austria. At both these places, I was invited by Prof. C.J. Allegre and Prof. H. Moritz, respectively, for future collaboration. Before return to India, I made a trip to Tunisia to meet my friend, Moncef Fekih, of Paris university days. I had to catch my return Air India flight from Rome (Italy) which gave me an opportunity to visit the historic city of Rome and its environs. I also visited Prof. L. Tommassino's laboratory situated in the outskirts of Rome city to learn about the techniques of Spark counting of tracks and ECE (Electro-chemical Etch) cell fabrication.

### **A NEW EXPERIENCE OF LIFE: CREATION OF PHYSICS DEPARTMENT IN GNDU**

A turning point came in my scientific journey on July 10, 1979. I left Punjabi University Patiala after serving it for 14 years to set up a new department of Physics in Guru Nanak Dev University (GNDU), Amritsar. It was a great challenge in my life to create a new department. I had to start from a scratch so far as research facilities were concerned. The teaching of Physics was going on at B.Sc. (Hons.) subsidiary level in Chemistry Department, but Physics Block was being used for administrative purposes as Registrar office cum University Library. We started B.Sc. (Hons.) class in Physics Block by securing possession of three rooms, one for my office, the other for the class room and another for the laboratory. Before leaving Patiala, I was sanctioned a Project "Radon and Thoron Estimation in Soil and Water" by CSIR, New Delhi. The Head Physics at PU Patiala, being my former teacher from AMU Aligarh, allowed me the liberty of transfer of my project funds and the equipment to GNDU, Amritsar without any fuss under CSIR rules.

I was the youngest Head of a Department in GNDU and considered to be naive for administration. My training in research took place in Europe and I was not well versed with the tactics of dealing with my bosses in

university hierarchy. Frankly speaking, I did not subscribe to hero worship, better known as chamchagiri in Indian parlance. The red tape of Indian bureaucracy is well known. I was wondering why a clerk or an Assistant Registrar commands more authority in pushing files than a university Professor in India. The files were cleared by the Vice Chancellor only after Registrar office approves the application of Professor or Head of the Department. I cannot believe that this is the British legacy as claimed by our politicians. It is unique to Indian democracy which breeds corruption and inefficiency. All my dynamism and motivation to put the department on a fast track suffered due to this bureaucratic system in vogue. It was like a mental torture and my social behaviour changed a lot due to these irritants. However, I kept my cool despite many hurdles created by the university administration. To keep me under bureaucratic tags, a high powered committee was constituted to supervise my activities concerning purchase of equipment for our laboratories.

Despite these handicaps, we made progress in both teaching and research. We introduced Berkeley Physics Series in B.Sc. (Hons.). Research projects were introduced in M.Sc. program. There was a pressing demand for introduction of M.Phil. for College teachers who were seeking eligibility under new UGC rules. During 1979-1983, we had started B.Sc. (Hons.), M.Sc. (Hons.), M.Sc. (Pass) and M.Phil. programs, in addition to catering for Chemistry, Biology and Electronics Departments, supported by a teaching faculty of just eight. The decade of 1983-1993 was horrible for Punjab and our University due to the rise of militancy in Punjab. Amritsar city and Golden temple proved to be its epicentre. The University functioning was affected and our teaching programs got derailed due to local disturbances. Our faculty from other states started moving to safe havens and their replacement became difficult. At this stage, we had to make compromises by recruiting our own Ph.D. qualified candidates to vacant faculty positions. This led to inbreeding and lowering of standards in academia but there was no way out. We could pull on well in experimental physics, but our theoretical branch suffered a lot during this period of turbulence.

All my efforts failed to attract some talented faculty from outside the Punjab state.

Before the end of 1990, Physics department was running four M.Sc. programs. We started M.Sc. Applied Geophysics and M.Sc. Energy Sciences simultaneously without making full preparations for creating infrastructure. These courses had to be closed down after a few years when job market was not favourable to run these programs. During 1991-1993, I was assigned the duties of Dean Academics and Students Welfare (DASW) of GNDU, which was a heavy duty job. The university was provided liberal grants by Ministry of Human Resource Development (MHRD) through its agency university grants commission (UGC) to start job-oriented courses in the University. The implicit purpose was to wean away young unemployed youth from terrorist activities. We started M.Sc. Applied Physics and many other courses under Applied Science Faculty. I was instrumental in designing course contents and creating infrastructure in the capacity of DASW with the support of Senior Academics, like Prof. Harjit Singh of Chemistry department. Our Physics faculty strength grew from 8 in 1983 to 22 in 1993 when I exited the office of Deanship.

## **MY RESEARCH COLLABORATIONS AND CONFERENCE PARTICIPATIONS**

Coming back to the activities of my research group after my brief stint of Deanship, our progress was not hampered due to circumstances prevailing in Punjab but the entry of students from other universities became restricted in research. I had half a dozen research students under my supervision. We were lucky to be awarded research projects from various funding agencies, namely UGC, CSIR, DST (Department of Science and Technology), DAE (Department of Atomic Energy) and MEF (Ministry of Environment and Forests). Before my retirement in 2002, I had served as Principal Investigator of 16 major research projects in India. We had entered into collaboration with some Universities and Research Laboratories in India and Germany, for example, KUK in India and GSI (Helmholtzzentrum für Schwerionenforschung: Helmholtz Centre for

Heavy Ion Research), Darmstadt in Germany. It gave me an ample opportunity to travel to Europe for user committee meetings and presenting our research papers at International conferences globally.

My first participation in an International conference took place in Acapulco in Mexico in Sept. 1983. Prof. G. Espinosa was organiser of this 12th SSNTD (Solid State Nuclear Track Detector) Conference in Acapulco, a beautiful holiday resort on Pacific coast. It was my longest journey of 32 hours by air in life with five stopovers between New Delhi and Acapulco. I was dead tired and scared too on reaching Mexico City during midnight. On the whole, it was a memorable conference as I chanced to meet many stalwarts in SSNTD area of research, namely, S.A. Durrani (UK), R.L. Fleischer (USA), R. Brandt (Germany), L. Tommassino (Italy), G. Somogyi (Hungary) and S.L. Guo (China). In fact, Prof. Guo was my room-mate during this Conference. I chaired a session at Acapulco Conference and presented our Single Activation Energy Model of radiation damage annealing in SSNTDs. Later on, I found a group in Australia claimed priority for this model but our paper appeared in the proceedings of 12th SSNTD Conference

in 1983; while they published their paper in Nuclear Tracks in 1984.

Thirteenth SSNTD Conference was organised by Prof. Tommassino in Rome during September 1985. In Acapulco, hardly 80 participants attended but in Rome there were nearly 250 delegates from 40 countries. International Nuclear Track Society (INTS) was set up in Rome to hold these conferences in future. I was elected as Indian representative of INTS at Rome. It was decided to hold the 14th SSNTD Conference at Lahore in Pakistan which was organised by Prof. H.A. Khan in 1988. It proved to be a blessing in disguise for our group as we presented 20 papers which was the highest number from any group in India or abroad. Our contribution was almost the same as from the whole of Pakistan, the host country. Our team enjoyed the hospitality of my friend of Paris days, Dr Asgar Ali, in Lahore. We were offered official facility to visit Nankana Sahib, the birthplace of Guru Nanak, after the conference. The advantage of these SSNTD Conferences was three-fold: (i) meeting old friends, (ii) exchange of ideas, and (iii) training of fresh researchers in the art of presenting papers.



Author H.S. Virk (2nd right) with Nobel Laureates: Prof. Abdus Salam (1st right), Peter Higgs (4th right), Leon M. Lederman (5th right) in ICTP, Trieste, Italy (1987)

My long-lasting friendship with Prof. Abdus Salam proved to be another blessing. Our department was affiliated with ICTP, Trieste for training of our faculty. Almost all our teachers and some of our research scholars visited ICTP to participate in Workshops or other programs of their interest. A centre of Promotion of Science was set up in GNDU Amritsar with funding from ICTP to popularize Science teaching in rural areas of Punjab. The book "Ideals and Realities" by Abdus Salam was translated by me into Punjabi language under the title "Adarsh Ate Haqiqat". I had the privilege of serving as Senior Associate of ICTP for five years (1990–95) and visiting several countries under TWAS (Third World Academy of Sciences) Fellowship program. My most memorable visits were to Iran, China and Malaysia. These visits gave me an opportunity to contribute in building up research centres in developing countries and exchange of ideas of mutual interest.

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### List of Papers in Earth Sciences and Related areas (Copies available on [www.researchgate.net/profile/Hardev\\_Virk/publications](http://www.researchgate.net/profile/Hardev_Virk/publications))

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