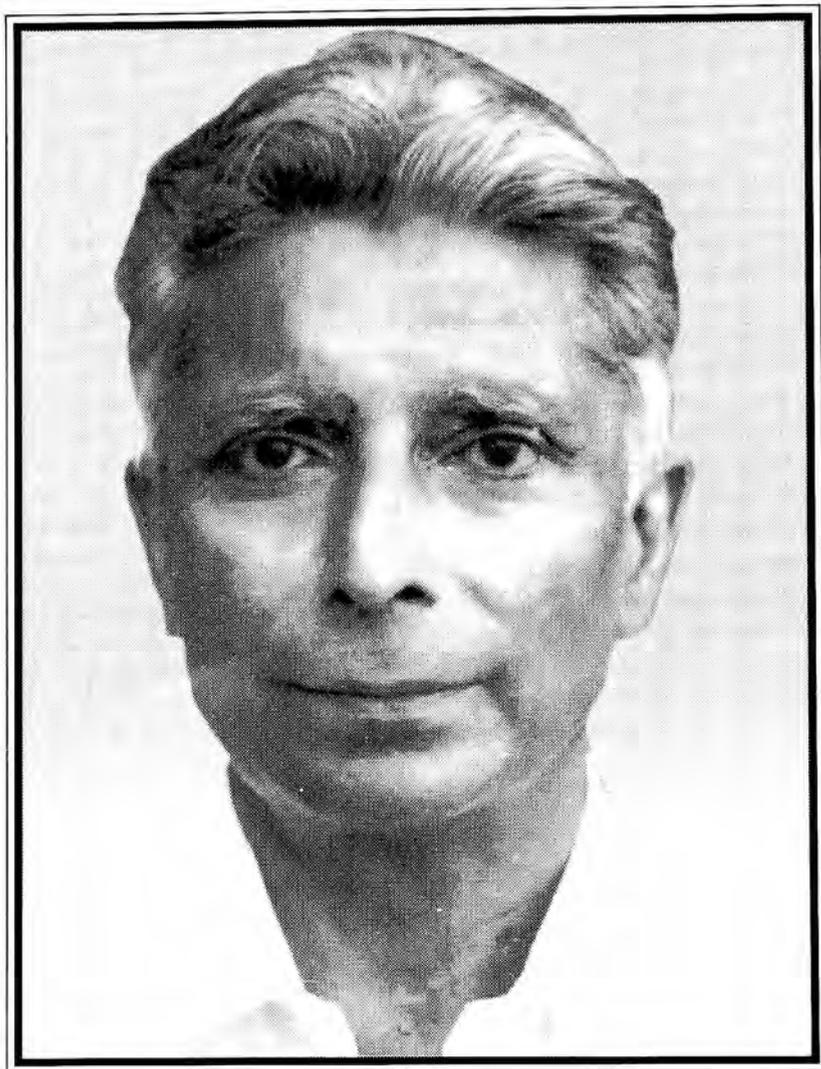


# AMALENDU ROY

(1 January 1924 – 23 December 2005)

*Biog. Mem. Fell. INSA, N. Delhi* **31** 141-156 (2007)





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## **AMALENDU ROY**

(1924-2005)

**Elected Fellow 1984**

“Rough sea makes an able sailor,” could be an apt description of Amalendu Roy who in his long and illustrious journey, instead of taking the known path, chose to discover new routes and in the process left a blazing trail behind him. A passionate and dedicated scientist, to Roy geophysics was much more than just a profession from 9 in the morning to 5.30 in the evening; it was his life. He lived and dreamt in the maze of geophysics. An eager learner throughout his proactive life, on discussion table Roy would plead to others with a genial smile that often originated from his bright eyes, “Say not yes; please argue with me, differ from me and prove me wrong so that I share your knowledge and learn new things”. Roy was an institution in himself. He was a lighthouse to guide and show the path to new generations of geophysicists in India and abroad.

He was synonymous with discipline, hard work, honesty, integrity and modesty. Such was his reputation that from 1964 till he took up UNESCO Professor’s position in Nigeria in 1980, his modest office room at National Geophysical Research Institute (NGRI), Hyderabad was a veritable pilgrimage for eminent earth scientists from across the country, his former colleagues in Geological Survey of India (GSI), IIT, Kharagpur, Oil and Natural Gas Commission (ONGC), Oil India Ltd., admiring scientists and faculty members of University departments. While visiting India many overseas geophysicists made NGRI a destination to meet and exchange views with this erudite scholar.

### **BIRTH AND EARLY EDUCATION**

Amalendu Roy was born on January 1, 1924 in Narayangunj (now in Bangladesh) to late Sri Abani Kanto and (Srimati) Hem Nalini Roy. He was the third of the family of four, two brothers including him and two sisters. He had early education in Narayangunj. A bright student, he was awarded Four letters and a Star for his outstanding performance in Matriculation (1939). He moved to Jagannath Intermediate college in Dacca and completed I Sc in 1941 standing first in order of merit. He was on the move again, this time to Presidency college, Calcutta (now Kolkata) to complete B Sc (Hons) in Physics in 1944.



## POST GRADUATION AND DOCTORAL WORK

The presence of Professor Satyen Bose, the eminent physicist, in Dacca University attracted many young students to join the Dept. of Physics there. It was no exception for a brilliant student like Roy. He completed M Sc in 1946. As with many young people those days in 1940s, the financial circumstances compelled him to join the Geological Survey of India (GSI) in 1947. Since the main stream of GSI was geology, Roy studied B Sc (Geology) in Presidency College, Calcutta in 1949. A rare endeavour to serve GSI better! However, his desires of higher education materialized when he was deputed by GSI to Colorado School of Mines, USA to pursue MS (Exploration Geophysics) as Government of India overseas scholar during 1949-52.

Roy's dreams of earning a doctoral degree were fulfilled at IIT, Kharagpur in 1960. His research guide at IIT was the versatile mathematician, Professor BR Seth, FNA (*Biographical Memoirs of INSA Fellows*, 1990, Vol. 14, p.140).

## ACADEMIC AND PROFESSIONAL CAREER

### Geological Survey of India, Calcutta

Roy was outstanding in his academic and professional life. He served with distinction the GSI from 1947 through 1954. GSI provided a strong platform to young Roy to understand geological field problems dealing with minerals, groundwater and engineering, and to develop the insight to mount geophysical field surveys. Precision in data collection, accuracy in data reduction and interpretation and taking utmost care of the geophysical equipments were Roy's hallmark that remained throughout his career. Erstwhile colleagues in GSI held him with great respect for his untiring hard work, intelligence and fellow feeling.

### IIT, Kharagpur

Once the department of Geology and Geophysics was formed at IIT, Kharagpur many eminent teachers and scientists were invited to join the department. Roy accepted the invitation and moved to Kharagpur in 1954. This is the place where Roy blossomed and Amalendu Roy as he is known to the geophysics world today was born. Roy spent seven years at IIT, taught geophysics with extraordinary brilliance, conducted model studies, field surveys and theoretical research, and provided excellent guidance to post graduate students, who in later years gained name and fame at home and abroad; some of these outstanding alumni; to name a few, are Dr SP Srivastava, Professors Subir Banerjee, Ravi Ravindra, Deepak Choudhury, Dr Sudhir Jain, Dr SK Acharya, Professors HP Patra, BK Sahu, BC Roymahasay, PS Naidu, Mathuresh Poddar. He commanded great respect from his colleagues and students, turned the department into a temple of learning and placed it on the world



of geophysics by publishing research articles with far-reaching results in leading quick succession journals like *Geophysics*, *Geophysical Prospecting* and *Geoexploration* (later renamed as *Appl Geophys*).

Novel and innovative concepts like "Interpretation of self potential data for tabular bodies (1959)", "Optical analogue of gravity and magnetic fields (1959)", "A simple integral transform and its applications to some problems of geophysical interpretation (1962)" and "Ambiguity in geophysical interpretation (1962)" took geophysics by storm and Roy had quietly sown the seeds of quality research in geophysics that inspired a whole generation of researchers in India.

Complimenting his students at IIT, he admitted candidly at NGRI later, "The search for answers to the intelligent questions put by the students at Kharagpur formed life-long research topics for me. Some I have solved, and for some I am still on the look out for suitable answers". Roy loved IIT life so much that whenever any former colleague, young student or anybody else for that matter from Kharagpur visited him at NGRI, he used to get nostalgic, rewind his memories and go back to those youthful days.

In reciprocation, Professors Ashok Mukherjee, K Naha, SVLN Rao, Sisir Sen, TK Bhattacharya, HP Patra, SH Rao, KK Roy and others always wished to have a glimpse of Roy, feel his warmth and take his blessings. He spoke with a voice that was measured, moist with love and resonated with affection. Chain smokers Ashoke Mukherjee, SVLN Rao and SH Rao, when offered cigarettes (Roy smoked only once at 9.30 in the morning and once again at 3.30 pm in the afternoon after a cup of tea), would jump up on their feet and with folded hands admit, " Sir, agreed we do smoke, but never in your presence !" What respect he enjoyed from his erstwhile colleagues ! Scenes such as these, to which I was often a witness, brought tears in my eyes.

## **Oil and Natural Gas Commission**

After spending seven fruitful years at IIT Kharagpur and forming a broad pyramidal foundation for the department and for himself, Roy moved to Oil and Natural Gas Commission (ONGC) at Dehradun. His personality and dedication brought him once again to the centre stage. Commission's chairman, Dr BS Negi, Institute of Petroleum Exploration (IPE, renamed later as KDMIPE) director, Dr Hari Narain, eminent geophysicists SN Sengupta and AN Dutta along with Roy formed the core group for India's hydrocarbon exploration. Roy's interests took him to drilling sites, though not required of a geophysicist and administrator of his status, in different parts of the country where he spent nights after nights recording and analyzing the core samples. It was here that Roy was intimately associated with oil exploration techniques, which stood good for him to obtain startling results in well-logging methods later in 1970s in NGRI.



Roy brought in a new work culture at ONGC, and inspired his colleagues, young and old, to develop deeper understanding in oil exploration. As deputy director of IPE he trained all the young crop of earth scientists of ONGC.

### **National Geophysical Research Institute**

Declining the directorship at IPE, Roy joined the newly established NGRI at the invitation of Dr Hari Narain (who had earlier moved from ONGC as NGRI director) as its deputy director, and headed the Exploration Geophysics Division. Soon it became a very strong research group dealing with potential fields, electrical and electromagnetics and seismics along with mineral and groundwater exploration. Successes in field surveys include exploration of chromite at Sukinda belt in Orissa for Tisco, mica for CVC Mining Co. in Gudur, AP, base metals in Rajasthan and location of numerous sites for groundwater in AP, Karnatak, Tamil Nadu, Orissa and Maharashtra. The Exploration Geophysics Group at NGRI turned into a role model for other groups at NGRI, research centres and university departments in other parts of India. The young researchers and scientists in this division worked with dedication and sincerity more to keep up Roy's reputation than for their own career development that came along in any case.

Besides building up the institute at its nascent stage, Roy spent sixteen very fruitful years at NGRI in conducting and guiding research that, besides putting him as one of the most leading geophysicists in the world, put the institute and our country on the world map of geophysics. At NGRI, he perfected the theory and application of continuation technique to potential and electromagnetic fields, depth of investigation of electric and electromagnetic fields and new results in well-logging. Development of two-electrode array, concept of gradational variation of electrical resistivity with depth, innovative techniques to compute magnetic fields and confirmation of several theories through careful resistivity model experiments are some of the research areas where he opened new avenues and created new frontiers. He gave equal importance to theory, model studies and field investigations.

### **Contributions to NGRI's Development**

His very presence in NGRI created a thrilling environment not only for those who were in his group, but for every other scientist; it was like field at a distance due to a magnet. Everyone like me although not directly associated with Roy, recalls Dr SVS Sarma, former head of magnetotelluric group at NGRI, was equally inspired to work hard and do good research. The institute library geared up to procure good books and good journals (NGRI library till today is considered by many as the best of its kind in earth sciences), the maps and drawing section tightened its belt to get all the toposheets, aerial photos, draughting tables and equipments, and under



watchful eyes eager-to-learn technical officers like P Krishnaswamy, PJ Vijayanandam and M Jayarama Rao produced line drawings and contour maps of such high standard (pre-computer era) that even researchers and officers not belonging to NGRI traveled miles to get their figures drawn to meet the international standards. Under his vigilant eyes, MM Hussaini and M Prakasha Rao did not miss a coma or a semicolon in preparing his scientific articles and numerous lecture notes. Much before the ISO movement in India, NGRI had set its high standards; much of its credit goes to Roy. Even the drivers felt it a privilege to take him to GSI, Osmania University or Defence Laboratory (where most of Roy's computations were carried out under direct supervision of senior officers like Lt. Col. A Balasubramanian and Dr K Sarveshwara Rao. During my deputation IIT, Bombay (1978-83), Dr KS Rao, then a faculty there, fondly remembered Roy and described how Roy helped him to achieve precision and novelty in computations.

All the Divisional Heads at NGRI – gravity and magnetics, airborne surveys, heat flow and paleomagnetism, instrumentations, seismology, theoretical geophysics, geochemistry, considered it a privilege to discuss the research results with Roy before communicating them for publication. Roy provided unbiased, encouraging and constructive views for the benefit of all, especially for young researchers.

### **A COLLEAGUE AND A FRIEND**

No body was an assistant to Roy. All were his colleagues. He was an intense man and his relationship with colleagues, too, was intense. He held institute director Dr Hari Narain, Professors TC Bagchi and late PK Bhattacharya of IIT Kharagpur, late LN Kailasam and PM Mathew of GSI, late BS Negi, late Dr. MN Ghosh, late SN Sengupta and late AK Dutta of ONGC, late Professor SN Sarkar and Professor Jagdeo Singh of Dhanbad, late Professor HS Rathor of BHU, late Professor Sundara Rama Rao of AU, Waltair, Professor VK Gaur and many other eminent earth scientists in high esteem. While senior colleagues at NGRI like late Dr S Balakrishna, late Dr MN Qureshy, Professor RK Verma, Dr PV Sankar Narayana, Professor D Guptasarma looked up to him as a friend, to younger generation scientists like late Dr PA Paul, late Dr N Krishna Brahmam, late Dr A Appa Rao, Dr HK Gupta, Professor BB Bhattacharya, Dr Mathuresh Poddar and to freshers like us he was a guide, a teacher and a source of inspiration. From mid-sixties to mid-seventies NGRI was a well-knit institute and there was a scientific romance in its youthful environment.

### **A SENSITIVE HUMAN BEING**

He was very sensitive and was deeply affected by the turn of events, such as the passing away of younger colleagues. In a letter dated December 31, 1989 he wrote to me, "Your silence should have told me something, but I was not listening. So many



of them jumped the queue - Rajni (Dr Rajnikant Verma), Rakesh (Dr Rakesh Kumar) and now Sheel (Dr Sheel Chand Jain). It is just not fair. What does one say or do at such moments ? With 66 years behind me, I feel stupid. In another letter of July 12, 2003, Roy lamented, "Dr Appa Rao's and Dr Kaila's passing away is shocking. I wonder what happened to them; they were still young".

### **A ROLE MODEL AND FRIEND OF YOUNG GENERATION**

At this point may I take some liberty (may be forgiven by the readers) to add a couple of personal things in order to project Roy from a different perspective. Roy was more than the head of exploration group for me. He initiated my research career at NGRI. His association was so motivating that he led me to take up challenges after challenges, and taught me not to be a mere follower, but to be one to create followers. True to his prophetic words, together we could develop new concepts that were accepted the world over in different fields of geophysics – groundwater and mineral exploration, electrical and electromagnetic methods and potential fields.

Roy stood dignified and tall. He was quick to acknowledge talent and generous in praises. He wrote with great style, and spoke so elegantly by choosing appropriate words and modulating his voice with pauses and measured meters that one can mentally place a coma, a semi-colon, a colon or an exclamation in his crispy sentences. He remained honest to the core as a scientist and as a human being. During his long and distinguished service Roy had interviewed and assessed many candidates for junior and very senior positions in NGRI, GSI, Oil India Ltd., ONGC, Central Groundwater Board, Universities etc. He was quick to recognize the talent, strange it may appear, he never asked the candidate on the topics of his own research. He would quickly look into the papers, reports and thesis of the candidate and ask simple, yet witty questions. Besides giving useful hints, he used to be extremely attentive to hear the answers. An intelligent answer will never miss Roy's attention, nor will he hide his satisfaction. A lively wit was his most notable trait. Once selected by Roy, the candidates gained so much confidence that they continued to perform well throughout their life and eventually become assets to their organizations !

### **AUTHORSHIP IN SCIENTIFIC COMMUNICATIONS**

Authorship grabbing is a national as well as international issue that has marred scientific temper to a great extent. Roy, on the other hand, was clearly above this unfortunate malady. In my first meeting he declared, "My job requirement is to guide and conduct research: I am paid by the Government to guide, therefore, no claim for authorship; I shall author a paper only when I conduct my own research. In a joint-work I shall be a second author, only if my contribution exceeds more than



50%." Such clear and noble thoughts have immensely inspired me. In one instance of a field-related case study, he cabled to the editor of *Geophysical Prospecting* to delete his name from the corrected galley !

### A MAN OF CONVICTION

Roy was a man of conviction. He never backed out from the scientific facts that he established or propounded. In scientific communications he remained tough and never reconciled to any changes that he thought unjust. In a manuscript to *Geophysics* in 1969, the reviewer tried to correct his English. Pointing out the numerous mistakes the reviewer has committed in trying to correct the manuscript, Roy pleaded with the editor that the reviewer's job was to look into the correctness – technical and scientific, of the paper and not merely grammar. The editor accepted the manuscript in its original form. After several rounds of conflicting comments of five reviewers the editor of *Geophysical Prospecting* asked Roy whether he would like his paper to be published, to which he wrote a two-word reply, "Please publish". The paper on New Results in Well logging appeared in its original form in 1975. AA Fitch, for a series of books on geophysics that he edited, solicited a paper by Roy on well-logging. Roy did oblige him, but when suggested to bring in some modifications in the manuscript that were not to his liking, he wrote to Fitch, "Please publish or return the manuscript". Fitch published it without any changes. The high noon of his research came when a series of papers on the current pattern and potential distribution in the ground provided new insight into the interpretation of well-logging data that forced the well-log giant Schlumberger Company to withdraw their most popular 'Well Log Document No 8' from circulation. No mean achievement, indeed !

### OVERSEAS ASSIGNMENTS

Roy was essentially a strong nationalist and turned down the invitation as early as in 1963 to join the University of Minnesota as an Associate Professor. However, for short period of six months (August 1973-February 1974) he was UNESCO consultant at Federal University of Bahia, Brazil.

He left NGRI and served the Dept of Geology, Ibadan, Nigeria as a UNESCO Professor during 1979-82 followed by another tenure as Visiting Professor at Dept of Geology, Univ of Ife, Ile-Ife, Nigeria. He retired in 1984.

### OVERSEAS ADMIRERS

Not only in India, Roy was held in high esteem and had many overseas admirers. Professor DS Parasnis, well known for his excellent books on applied geophysics, was so enamoured by Roy's personality and work that he named his son Amalendu Parasnis. When I was introduced in October 1969 as a research fellow from India to



Professor P Meiser, Head of International Geohydrological Programme at Federal Institute of Geoscientific Research at Hanover, Professor Meiser enquired if I knew Professor Amalendu Roy. Amazed by his clear pronunciation of Amalendu, I replied that I worked with him. "You are fortunate", he smiled. Surprise to come. He got up, opened his cupboard, took out a silver-bound document and said, " Reprint of Roy's paper. A treasure. It has provided me bread and butter all these years." Meiser's words created a rare turbulence of thrill in me. Standing to deliver a keynote address on electromagnetic migration to an international gathering in Moscow, Professor Michael Zhnadov said, " All that I am going to say today is, in essence, based on the theory and concept of the continuation of electromagnetic fields by the Indian geophysicist, Professor Amalendu Roy." (The wordings are not exact, the theme is). The lone Indian in the audience to have the hair-raising excitement by this pronouncement was Professor RGS Sastry of Roorkee University (now renamed IIT, Roorkee). Professor Hinze of Purdue University, USA who used Roy's material for several years in the course he taught at Purdue, was eloquent in his tribute, "Roy deserves to be recognized for his notable accomplishments. He was an outstanding geophysicist who made many important contributions to our sciences".

## AWARDS AND HONOURS

Shy by nature, Roy felt uncomfortable to hear words of praise. He did not even reveal his great achievements to his family members; daughter Parama and son Sujoy often came to know about him from their friends. He was a member of SEG, EAEG and regional editor of *Geoexploration* (now *Applied Geophysics*). He was the recipient of Decennial Award (1976) of Indian Geophysical Union, the Millennium Award (2001) Association of Exploration Geophysicists and was elected Fellow of INSA (1983).

## LIFE IN AUSTERITY

Roy lived a simple and austere life. He never gave an impression that he stood head and shoulder above others. He became deeply religious (not dogmatic) early in 1970s and continued till end. After the retirement in 1984 from the Dept of Geology, Univ of Ife-Ife, Nigeria Roy gave up geophysics altogether and followed a path of spiritualism, first in Ramakrishna Mission, Hyderabad and then at Maitri Ashram on the banks of the river Ganga in the Varanasi. Here, he took pleasure in teaching arithmetic and physics to the students in the ashram school, and in dispensing homeopathy medicines in the Ashram clinic.

After a couple of years he joined his family in Hyderabad to look after his ailing wife. After her sudden demise in late nineties, he moved to his nephew's place in



Calcutta and from there to USA to live with his daughter. However, once again he came back to Maitri Ashram in Varanasi.

### THE TWILIGHT

Mrs Ramola Roy, MA (English), predeceased her husband. A symbol of affection and love, a genial smile always decorated her face. Two children – Dr Sujoy Roy is a practicing physician in UK and daughter Parama is a Professor of English in University of California, Riverside Campus, USA. It so happened that Parama along with her husband, Bharat, an eminent economist, visited her father at Varanasi, where Roy stayed in Maitri Ashram and spent ten days with him before flying back to USA. After returning to Riverside Parama wrote to me, “Baba is physically frail. His situation is painful to watch; and I hope he does not have much more suffering days ahead of him.” True to his nature, Roy did not let his daughter down, and passed away exactly ten days after. True, he was ageing, but not getting old. His end was sudden. He passed away in the early hours of December 23, 2005 in Maitri Ashram in Varanasi. Daughter Parama and son-in-law Bharat flew down from USA to perform the last rites on the banks of the holy Ganges; thus came the end of an epoch.

### TRIBUTES TO ROY

On hearing the passing away of Roy, Dr Vijay P Dimri, Director, NGRI held a special condolence meeting and described him to be rarest among the rare personalities, who chose altogether a different path to lead his life after superannuation. Apart from being a great teacher of geophysics in India, he left an indelible mark with his high quality research.” A large number of scientists that included Professor D Guptasarma, Dr HK Gupta, Dr DC Mishra, Dr D Atchuta Rao, Dr R Umamaheswara Rao, among others and Dr PD Venkateswaralu of GSI paid glorious tribute vividly remembering the high standard set by him first as deputy director and then as acting Director of the Institute.

When the correspondent contacted Professor KK Roy, formerly with IIT, Kharagpur and now an emeritus scientist at Jadavpur University, his immediate reaction was, “We deeply mourn the sad demise of Professor Amalendu Roy, one of the great teachers of geophysics in India. His contribution to geophysics through his research will be remembered by us for many more years to come.” Professor Kabir Roychoudhury, now at Utrecht University, The Netherlands, expressed his deep sorrow, “Yes, very sad, in deed. A range of emotions and memories swept through me and my wife, Anita. A giant among the geophysicists, a wonderful teacher, a stern task master ... a rasogolla-distributing deputy director during the holi celebrations, and finally, a mellowed elder (almost like a brother). Sure, he had



weaknesses; somehow it made him more human ... and accessible. Hope, NGRI will remember him in a suitable way. May his soul rest in peace”.

G VENKATARAMAN

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### Unpublished Technical Reports

1. Resistivity surveys for locating Gondwana Sedimentary Basins near Kamptee, C.P.
2. Magnetic survey for Manganese Ore at Tirodi, C.P.
3. Resistivity survey for groundwater in Deccan Trap area near Dhond, Bombay



4. Determination of depths to bedrock for road or dam alignment on riverbeds at Kopargaon, Jalgaon and other sites, C.P.
5. Gravity and magnetic survey for Manganese ore at Mansar, C.P.
6. Gravity and Magnetic surveys over Gondwana Basins near Durgapur, West Bengal.
7. Single-electrode well-logging for groundwater in Punjab and U.P.
8. About 15-20 reports on the gravity-cum-magnetic, seismic and electro-logging field surveys carried out in Oil & Natural Gas Commission
9. Geophysical prospecting for Copper deposits in Khetri Copper Belt, Rajasthan.
10. Geophysical prospecting for Baryte at Phutana, District Chanda, Maharashtra.
11. Geophysical prospecting for Base metals at Donger Maunda and Gayapani, District Nagpur, Maharashtra.
12. Geophysical prospecting for Base Metals at Gayapani, Pular and Parsori, District Nagpur, Maharashtra.
13. Magnetic survey for Iron ore in Panchmahal and Baroda districts, Gujarat
14. Resistivity survey for depth to basement near Qutub Minar, Delhi.
- 15-24 Resistivity surveys for Groundwater at Ghatkesar, Dt. Hyderabad; Medchal, Dt. Hyderabad; Shakkarnagar, Dt. Nizamabad; MERADO site at Adyar (Madras); Astrophysical observatory site at Kavalur (Madras); Bellapalli, Dt. Guntur; Chagallu and Jangareddigudem, Dt. West Godavari; Gaganpahad, Dt. Hyderabad; Balmany Coffee Estates, Coorg and Suntikoppa and Margolly Coffee Estates, Coorg.

In addition, some on-the-spot locations for water wells were given for several clients.

25. Seismic measurements for determination of relative effectiveness of two different explosives in seismic prospecting.
26. Resistivity measurements for location of abandoned coal mine boundaries.
27. Experimental geophysical surveys for Bauxite at Amarkantak, M.P.

