



*Arora*



# ANANTHARAMAN PARAMESWARAN SUBRAMANIAM

(1921—1973)

Elected Fellow 1958

Indian geology suffered a serious loss at the sudden and untimely death of Dr. A.P. Subramaniam, one of the brightest and most promising geologists of his generation, at the young age of 52 years. Although he is no longer with us, the works he has left behind stand as enduring marks of his intellectual acumen and organisational ability.

## EARLY LIFE AND EDUCATION

Anantharaman Parameswaran Subramaniam was born on the 7th March in the year 1921 at Palghat in Kerala. We do not have much information about his early education or of the circumstance that led to his choosing geology as a major subject of study. He became a student of the Presidency College at Madras and graduated in the year 1940. He later moved to Varanasi for higher studies and obtained Masters Degree in geology from the Banaras Hindu University in the year 1942. The only avenue of employment for bright geologists in those days was the Geological Survey of India and soon after graduation Subramaniam joined that organisation as Geologist in 1943.

## SERVICE IN THE INDIAN GEOLOGICAL SURVEY

The southern region of the Survey had just then started functioning with headquarters at Madras and with Dr. M.S. Krishnan incharge. Subramaniam joined a select group of young geologists who were entrusted with the task of reexamination of the ground originally covered by Sir Thomas Holland in the early years of the present century. The interests of the Survey were economically oriented and it fell to the lot of Subramaniam to make a detailed study of the chromite occurrences in the Salem district of Tamil Nadu. He was thus first introduced to the study of what has come to be recognised as a classical example of Archaean layered igneous complex—the Sittampundi Complex. While in the southern region, he made a petrographic study of the alkaline rocks of Sivamalai, the results of which were published in the Proceedings of the Indian Academy of Sciences.

## ALUMNUS AT PRINCETON UNIVERSITY

This was the time when the Government of India was sending out bright students for advanced study in recognised universities abroad. Luckily for





Subramaniam, chance favoured his going to the celebrated University of Princeton whose geological department had acquired great fame through the researches of some of the most leading personalities in the field of geology of that time, like Professor Buddington, Professor Harry Hess and Professor Edward Sampson. Subramaniam soon became a favourite of all the three Professors. Under their guidance his intellect flowered and he was able to present a detailed and brilliant petrological study of the Sittampundi anorthosite-charnockite complex. Thanks to his work, this complex is now reckoned as one of the best studied metamorphosed layered complexes of Archaean age. This masterly account secured for Subramaniam the Ph.D. degree of the Princeton University in 1952. He returned to India soon after.

### SAMPSON, BUDDINGTON AND SUBRAMANIAM

It was at about this time, I had the good fortune of first coming into contact with Subramaniam. I was then a geologist working in the Department of Mines and Geology, Government of Mysore (now renamed Karnataka) and was engaged in the development of the chromite deposits at Byrapur in Hassan district. Edward Sampson, the well-known authority on chromite deposits had expressed a desire to see the chromite deposits of Byrapur and so Subramaniam brought the learned Professor to see the deposit. It was on that occasion I had the privilege of conducting both Professor Sampson and Subramaniam round the Byrapur chromite mines. Professor Sampson and Subramaniam appeared impressed with the large size of the high-grade chromite lens which we were then working by opencast methods. Later, when both Professor Sampson and Subramaniam came to Bangalore, we had arranged for a lecture by Professor Sampson in the Department of Mines and Geology. Professor Sampson spoke for just about an hour on his pet subject and held the audience spell bound. I recollect Subramaniam telling me after the lecture, that it was one of the shortest lectures which Professor Sampson had delivered, his normal lectures to students being of several hours duration!

My acquaintance with Subramaniam which started at that time became more intimate with the passage of time. Some of us had joined together and formed ourselves into an association called the "Mysore Geologists' Association". I was the Secretary of the Association and during the ten years or so of its existence, the Association brought out several useful publications including the one on 'The Charnockite Problem' by Professor Pichamuthu. It is pleasant to recall that the Princeton University was one of the earliest to show interest in the publications of this infant Association and patronized it by entering a subscription to the Bulletins of the Association. This was indeed a big boost to our fagging efforts at building the organisation. Professor Buddington, the well known authority on Adirondack ancrthosites also visited us about that time accompanied by Subramaniam. It was then I observed the great affection which Professor Buddington had for his brilliant pupil—Subramaniam.





## PETROLOGIST AT CALCUTTA

Subramaniam became the petrologist of the Geological Survey of India in 1956 and in that capacity thoroughly reorganized that section. When I visited Calcutta for the first time in 1956 Subramaniam took me round the laboratory which was kept in a very trim condition and explained the details of research going on under his direction. His work then consisted of a restudy of the charnockite rocks from the type area which had not been examined in depth since the time of Holland.

## WITH TILLEY AT CAMBRIDGE

While he was engaged in these studies, he was once again lucky in getting a bursary award from the Royal Society of London which enabled him to work under the celebrated Professor Tilley at the University of Cambridge. Tilley was an institution by himself and was held in great esteem by his students for his industry and erudition, and the deep love he had for rocks. Subramaniam's stay at the Mineralogy and Petrology laboratories of the University of Cambridge under the guidance of such a master as Tilley proved very fruitful, bringing forth two important studies, one on the charnockites of the type area Madras, which was published in the *American Journal of Science* (1959) and another jointly with R.A. Howie on the paragenesis of garnet in charnockite, enderbite and related granulites, published in the *Mineralogical Magazine* in 1957. He continued his study of pyroxene and garnets from charnockites and came out with another important paper entitled "pyroxenes and garnets from charnockites and associated granulites" which was published by the Geological Society of America and included in the *Buddington Commemoration Volume* in 1962. It was during his stay at Cambridge he reexamined the thin sections of calciphyres from Nanjangud described by B. Rama Rao as containing rare assemblage of carbonate-silicate minerals and feldspathoids. He could find no evidence of feldspathoids or the existence of the paragenesis characteristic of Sanidine facies. Although reluctant to contradict the findings of Rama Rao, he was prevailed upon by Tilley to publish the results of his study. A detailed paper on the mineralogy and petrology of calciphyres of Nanjangud appeared in the *Geological Magazine*, London, in 1956.

## REVIEW OF THE CHARNOCKITE PROBLEM

Subramaniam's contributions to the elucidation of the charnockite problem, especially on the mineralogical, petrological and geochemical aspects are considerable. His review first presented in 1959 and later updated and published in 1967 in *Dansk Geol., Forem., Meddl.* has remained a classic and is frequently referred to by all workers engaged in the study of granulites.





## HIS REDEFINITION OF CHARNOCKITE

He redefined the term "charnockite" and "charnockite gneiss" of Holland and pointed out that the 'Acid' division of Holland composed of alaskites, birkremites, enderbites and hypersthene-quartz syenites was the true charnockite forming an igneous suite which had undergone metamorphic reconstitution and recrystallization with concomitant changes in mineralogy, such as unmixing of perthites and formation of garnet. The pyroxene granulite and lenses of norite of the 'Basic' division of Holland were considered by Subramaniam to be syntectonic slices which were unrelated to the real charnockite. The 'Intermediate' variety was classed as a hybrid resulting from the partial assimilation and incorporation of the older pyroxene granulites in the charnockitic magma. The leptynites of Holland, according to him, were the migmatized or recrystallized khondalites (quartz-feldspar-garnet-sillimanite gneisses) occurring in the basement and stratified with the pyroxene granulites. In support of the above conclusions, Subramaniam marshalled a wealth of mineralogical, petrological and chemical data.

He conceived of the charnockite suite of rocks as having crystallized under conditions of granulite facies. Subsequently, together with the other basement rocks they were subjected to high-grade regional metamorphism and later retrograde metamorphism with the formation of transitional types along certain segments.

## WORK IN MAHARASHTRA-GUJARAT CIRCLE

In 1960 he was posted to Poona as the Superintending Geologist of the Maharashtra-Gujarat Circle of the Geological Survey. He now turned his attention to the study of Deccan Traps, especially the mineral deposits associated with the traps. It was about this time, the only important commercial source of fluorite came to be discovered at Amba Dongar in Gujarat. Subramaniam presented a detailed description of the fluorspar mineralisation in a paper submitted to *Nature* in 1963. The unique features of this Amba Dongar fluorspar deposit was further examined and detailed in a paper included in the volume brought out in honour of Dr. Krishnan. The Amba Dongar fluorspar deposit represents the first recorded occurrence of a large mineral deposit whose genesis is directly attributable to Deccan volcanism. He also envisaged the possibility of basaltic magma containing mineralizing solutions with a variety of elements which could get deposited in a suitable host rock. This suggestion requires to be followed up by a careful examination of loci of volcanic emanations within the Deccan trap region, especially zones of explosive and fumarolic activity. Here I must state about his firm conviction that carbonatite did not exist. Because of this he failed to recognize the carbonatite character of the pipe rock at Amba Dongar. This was a mistake as later work proved. His conviction of the non-existence of carbonatite magma was so firm that he refused even to carry out tests for trace





elements in the laboratory when a suspected specimen from Karnataka was brought to him for confirmation. Such failings are not unusual even in scientists of high repute. Subramaniam was no exception.

### BAUXITE DEPOSITS OF WESTERN GHATS

While in charge of the Maharashtra Circle, he gave special attention to the study of bauxite deposits of the Western Ghats close to Belgaum, which later enabled the establishment of an aluminium smelter industry at that place. He had an uncanny instinct for identifying talent and gathered round him a group of youngsters of exceptional ability who are now occupying responsible positions in the Survey. He motivated them to pursue worthy endeavours. He was never too busy to give advice to those who went to him. "A.P." as he was affectionately known had the ability to motivate his coworkers to great heights of achievement and excellence by his own example and by taking keen interest in the work of his junior colleagues and by helping them out in their personal problems in an unobtrusive manner. He made all those who came in contact with him share his vision and had the tenacity to translate it into reality.

### ADVANCING FRONTIERS IN GEOLOGY AND GEOPHYSICS

In 1964, he edited along with S. Balakrishna a volume entitled "Advancing Frontiers in Geology and Geophysics" in honour of Dr. M. S. Krishnan, the well-known geologist of India, on his 65th birthday. His knowledge and acquaintance with a large number of distinguished scientists in India and abroad enabled him to collect quite a number of valuable articles for this volume covering a wide spectrum of earth science. He held Dr. Krishnan (who also happened to be his father-in-law) in great esteem and spoke highly of his work and attainments whenever opportunity occurred. The bringing together of so many good contributions to honour a scientist of the eminence of Dr. Krishnan must have given him great satisfaction. Dr. Krishnan likewise had a high opinion of his son-in-law and it will not be incorrect to say that Dr. Krishnan helped to mould the character of his young pupil in various ways and launched him on his distinguished career.

### DEPUTY COORDINATOR, AIRBORNE MINERAL SURVEYS AND EXPLORATION

In 1964, the Government of India decided to start a new department for carrying out Airborne Mineral Surveys and Exploration (AMSE). The organisation of the work of this new department was entrusted to Dr. Kurien Jacob, formerly of the Geological Survey. Dr. Jacob who knew Subramaniam very well wanted to enlist his services for building up the new department, but this was not possible immediately. A little later his wish was fulfilled and Subramaniam came to be appointed as Officer





on Special Duty in the department of Airborne Mineral Surveys and Exploration. In 1969, when Dr. Jacob relinquished his post as Deputy Coordinator, Subramaniam succeeded him and continued in that post till death snatched him away while still in service. Subramaniam developed the new AMSE organisation with unstinted energy and great dedication on the sound foundations laid by his predecessor. Subramaniam realised the importance of prompt and reliable laboratory support to ongoing mineral investigation programmes and organised the AMSE laboratories to a high degree of sophistication and productivity. He was instrumental in securing for the AMSE under Australian and West German bilateral assistance programmes atomic absorption spectrophotometer units, X-ray fluorescence/diffraction facilities and a large repro-camera for map reproduction.

In my capacity as Director of Mines and Geology, Government of Karnataka, I had opportunities of visiting Delhi at frequent intervals. I always made it a point to call on Subramaniam whenever I was in Delhi and spent a few hours with him. Our talks mainly centred around steps to improve the quality of the Journal of the Geological Society of India. He had developed a particular love for the Journal and was full of suggestions.

It was at about this time, a decision had been taken to move the AMSE out of Delhi and shift it to Bangalore. This was welcome news to me, as this change would have enabled Subramaniam to play a more active role in the affairs of the Geological Society of which he was a member on the Council. He visited Bangalore on several occasions and kept in close touch with me. I remember the last occasion when he came to Bangalore was to attend a seminar which the Society had organized on 'Norms in Mineral Exploration'. He was the moving spirit behind the seminar and in spite of his ill health made the trip to Bangalore and exerted himself in organizing it. I became anxious about his health but he laughed it off as a joke and insisted on sitting right through the seminar taking active part in its deliberations. He was endowed with a rare sense of humour and it was always a pleasure and privilege to spend some time with him. That was the last occasion I saw him. Few days later the tragic and unbelievable news came that he had passed away in Delhi on 22nd April 1973 at the All India Institute of Medical Sciences.

### PERSONAL TRAITS AND CHARACTER

Little acts of consideration and humaneness endeared him to many of the younger group. When a scientist reported to duty on transfer/appointment, Subramaniam would make enquiries about the journey, whether a transport was sent to the station. He invariably extended help in arranging a temporary place of stay till the new entrant found his moorings. While visiting remote field-camps, very often A.P. would carry with him vegetables and sundry material for the camp kitchen. He was a rare combination of all that is best and of lasting value in our culture and tradition, being





the same time modern and progressive in his ideas about organising and carrying out scientific work. He had immense faith in the abilities of the Indian geoscientists when properly motivated, and attempted to provide a congenial atmosphere for scientific work wherever he held responsible positions.

A man of strong impulses A.P. either liked or disliked any proposition or individual. He could not suffer hypocrites. This particular trait earned him as many admirers as detractors.

Because of his intellectual eminence and infinite capacity for hard work, he became an active member of several International Sub-Commissions. As member of the Commission on the Cartography of Metamorphic Facies Belts he had compiled a valuable text on Metamorphic Belts of India and was anxious to get it published. I had volunteered to include it as a special volume of the Society. Before he could revise it and give it a final form he was no more. His attitude to life had been "give me work while I live; may God grant me life while there is work to do". He refused to live in the past and to the last moment of his life, he exulted in the present with all its transient sweetness, trials and challenges.

### MEMBERSHIP OF LEARNED SOCIETIES

Subramaniam was a member of many learned Societies—the Geological Society of London, the Indian National Science Academy, Delhi, the Indian Academy of Sciences, Bangalore, the Geological Society of India, the Geological Society of Australia, the Geological Society of Japan, the Mineralogical Society of America, the Mineralogical Society of Britain and the Society of Economic Geologists, U.S.A. He served on the Council of the Geological Society of India for a number of years. He was a member of the Working Group on the Nomenclature of Charnockites under the IUGS and of the Working Group on International Commission for Geodynamics and was also Chairman of the Indian National Committee for IUGG.

His published papers were not many, but the few that he wrote are classics in their respective fields and have a distinct stamp of their own containing a wealth of mineralogical, petrographical and chemical data.

Great things were expected of him. He had reached a stage and position where he could have guided research of a high order. He had looked forward to take an active part in cultural and scientific activities in Bangalore. His colleagues had already shifted to Bangalore and he was to follow in a few weeks' time. But fate willed it otherwise and he was snatched from our midst suddenly by the cruel hand of death on 22nd April 1973. He was a lover of classical Hindustani music and, I understand, would sit throughout the night till the early hours of the morning





enjoying the concerts of well-known artists. He was equally at home with Carnatic music and he used to play for his own pleasure a string instrument (Dilruba).

He was a sports lover and his love for the game of cricket was only matched by his strong love for geology. He was also a great cook! His colleague in the Survey, Sri Swami Nath recalls the many occasions when he was fed by Subramaniam with food prepared by himself. Even to this day he remembers with relish the dish of Brussels Sprouts prepared in the Palghat style with a dash of pepper, served during one of his visits to Subramaniam.

The eldest daughter of Dr. M.S. Krishnan, Srimati Akhilandeswari was his wife. She was a worthy companion to Subramaniam and had distinguished herself by translating the concise version of the text book of her father on the 'Geology of India' to Hindi. In times of stress his wife sustained him by her love and devotion and self-abnegation. She totally subordinated her personality to that of her husband. Subramaniam left behind two sons, Ramesh, an engineer settled in USA, and Krishna Prasad, a doctor working at the All India Institute of Medical Sciences, Delhi.

B. P. RADHAKRISHNA

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