Charles Solomon Pichamuthu

A tribute on his ninetieth birthday by *B. P. Radhakrishna*

The completion of ninety is an achievement—whether it be in the cricket field, in life's journey or in any type of human endeavour; it is a matter for congratulation. Our warm greetings go to Professor Charles Solomon Pichamuthu on this day (10 March 1990) when he crosses the ninetieth milestone on his life's journey. On this occasion it is worth recapitulating what he said about himself some fifteen years ago:

> I would like to thank God for all His mercies to me throughout these years. During a long scientific career of over 50 years I have met with obstacles and obstructions, frustrations and seeming failures; but sooner or later another door has opened through which I have been led on to further advancement. I do not attribute this to mere luck or chance, blind fate or predestination, but only to the grace of a benevolent providence.

This autobiographical reverie summarizes the life of Prof. Pichamuthu and highlights the attitude of mind that has guided his actions all these years. He has now reached the venerable age of 90 years with all his faculties intact and can look forward to crossing the century, creating one more record in his eventful career.

Early years

Charles Solomon Pichamuthu (affectionately called Charlie by his closest friends) was born in Dindigul on 10 March 1900, the eldest son of Shantappa Velliah (S.V.) Pichamuthu, the well-known headmaster of the Wesleyan Mission High School. Pichamuthu's early education was at the same school, where the teaching and training given were of a high order. The senior Pichamuthu was a great scholar in English as well as Tamil and a strict disciplinarian. He had a good library consisting of the choicest books in English literature, which became available to the young Pichamuthu for study. No wonder then that the young Pichamuthu stood first in all the examinations.

Pichamuthu joined the Central College, Bangalore, for higher studies in 1919. He owes his love of field work to his early training there under Professor P. Sampat Iyengar. Soon after graduation in 1921 he accepted the post of an assistant geologist in the state of Travancore. He enjoyed doing field work, living in a house-boat and travelling long distances over canals lined with lovely coconut palms. He remained in Travancore for six years (1921–1927), and when a post of assistant professor of geology at Central College, Bangalore, was advertised, he applied for it and got it, much to the annoyance of Sampat Iyengar, who had other ideas about filling the post.

Meanwhile Sampat Iyengar had

become director of the Mysore Geological Department. Being both professor at the College and head of the Survey, he introduced a scheme whereby there could be a healthy exchange of functions between members of the Survey and the College. A. M. Sen and B. Rama Rao of the Survey were drafted to give lectures at Central College, and Pichamuthu, now an assistant professor in the College, was taken to the Survey to study aspects of Mysore geology. It is to this happy circumstance that Pichamuthu owes his initiation to the geology of Mysore state. From that time onwards his interest in the subject never flagged and he was able to add substantially to our knowledge about the geology of the state.

Advanced training at Glasgow

Pichamuthu was ambitious and was not content at being a subordinate assistant professor. He had a great desire to go to one of the European universities for higher studies. After first considering the universities of Heidelberg and Geneva—he also suffered the injustice, later rectified, of being denied leave on unfair grounds—, Pichamuthu selected the University of Glasgow. There he came under the influence of two famous teachers of the day, Professor E. B. Bailey and G. W. Tyrell. Scottish geology was not much different from that of Peninsular India and field trips under the guidance of these two masters enabled Pichamuthu to see things in a new light.

In Glasgow, instead of selecting a local problem like most other students visiting the UK, Pichamuthu preferred to work on material brought from India. Quartzites, conglomerates and banded iron-formation of the Bababudan region, where he had worked earlier, had been regarded as originally igneous by the officers of the Mysore Geological Department. Pichamuthu, convinced of their sedimentary character, selected these rocks for detailed study. He contributed two papers, one on the Kaldurga conglomerate, and the other on the banded iron-formation of Bababudan. These are two of his best papers and opened up a new trend in the study of Precambrian sediments. B. Rama Rao, another indefatigable worker in Mysore geology, had, in the meantime, become director of the Mysore Geological Department. He, too, independently of Pichamuthu, had come to the conclusion, mainly as a result of close field studies, that many of the rocks included in the Dharwar Group were originally sedimentary in character and it was wrong to consider them as having had an igneous parentage. He presented a summary of his findings in his presidential address delivered before the Geology Section of the Indian Science Congress. In doing so, he failed to make a reference to the work of Pichamuthu. This was unfortunate and as a conse-

quence relations between the University Department of Geology and the Mysore Geological Department became strained.

Glasgow University awarded the D Sc degree to Pichamuthu for his work. At about the same time he was elected fellow of the Royal Society of Edinburgh.

Study of the Precambrian—Life-long odyssey

Pichamuthu returned to India in 1936 and started his field work with renewed vigour. Thus commenced his study of the Precambrian, which became for him a life-long journey of adventure. Pichamuthu was very fond of field work and felt that the field was the proper place to teach geology. He took parties of students again and again to the same outcrops, which he re-examined closely, and came out with new observations.

The ten-year period 1937–1947 was full of activity. In later years he used to recall this period as the Golden Age of the Geology Department at Central College. In 1947 he was chosen president of the Geology Section of the Indian Science Congress and gave a clear and coherent account of the Precambrian of Mysore state.

In 1948, on the retirement of B. Rama Rao, Pichamuthu had the good fortune of being selected director of the Mysore Geological Department. The administrators of those days had great foresight and chose the best candidates to head development departments. Pichamuthu discharged his duties as director with efficiency and enhanced the reputation of the Department. He had keen powers of observation and spotted features that others had overlooked. His recognition of graded bedding in quartzites, intra-formational folds in iron-formations, pillow structures in Archaean lava flows, association of pink granites and charnockites, and clouding of plagioclase in dyke rocks of the charnockite region are some instances of his special ability. He discussed the significance of these features in a number of short contributions. Speaking of his interest in Mysore geology he wrote:

> I was physically in this beautiful land which happens to be one of the oldest parts of the earth's crust, composed as it is of geological formations many of which are as old as 3000 million years. The study of these ancient rocks was thus a fascinating and exciting exploration into an inexhaustible past. It is difficult for a new geologist to realize the exhilaration of delving into the dawn of geological history and trying to reconstruct the conditions under which the Precambrian rocks of that period could possibly have been formed.

Mysore Geologists' Association

The Mysore Geologists' Association had come into existence in 1949 with Pichamuthu as its president. At the annual meetings of the Association, Pichamuthu would mix freely with others and make himself quite pleasant. He took great pains to prepare his presidential addresses and came out with brilliant summaries of problems of current geological interest. Two addresses, one on the 'Granite problem' at Kemmanagundi and the other on the 'Charnockite problem' at Shimsha, were later printed and widely circulated. These addresses, especially the latter, were welcomed by all the leading geologists of the day. His own professor, Sir Edward Bailey, called it 'a masterly review of the subject which would be of much use to geologists all over the world'. Prof. Arthur Holmes, voicing the views of petrologists, said, 'Books like yours, which summarize so adequately a definite field and bring the status of the problem right up-to-date, are of very special value.' This book, containing as it did a review of world-wide occurrences of granulitic rocks, soon became a valuable book of reference to the study of this important petrological problem.

The main contribution of Pichamuthu to the charnockite problem was his recognition of two types of charnockites, an older variety which was gneissic or granulitic and formed by regional metamorphism of pre-existing schists and gneisses, and a younger one which was coarse-grained and granitic and formed by anatexis.

Pichamuthu found evidence for the transformation of Peninsular gneiss to charnockite in a quarry at Kabbaldurga, and realizing the importance of his observation, communicated a paper to *Nature* with the title 'Charnockite in the making', and soon after followed it up with a more detailed paper, 'Transformation of Peninsular gneiss to charnockite', which was published in the *Journal of the Geological Society of India* (vol. 2, 1960, pp. 46–49). This was the starting point for research on this important topic. Kabbaldurga has since become world-famous. When, recently, a workshop was held in Bangalore on 'Deep continental crust of South India', the world leaders of earth science who had assembled on that occasion called on Pichamuthu at his residence to pay their tribute to an outstanding personality who had helped focus the attention of the world on an important aspect of the charnockite problem.

American diary

Pichamuthu was selected in 1953 under the leadership exchange programme of the US Government to tour the United States. He made the maximum use of the opportunity and formed many lasting friendships. On his return journey, he visited London and Glasgow and called on Arthur Holmes, Edward Bailey and G. W. Tyrell. As he progressed on his grand tour through the United States he put down in writing all he saw of that country. The letters he wrote were later published in the Information Circular of the Mysore Geologists' Association under the title 'My American diary' and were avidly read by all members of the Association.

Retirement and after

In 1955, on completion of 55 years, he retired from government service, although still hale and healthy and very fit for further years of work. Thanks to the interest that Arthur Holmes took in him, he was invited to accept the post of a professor of geology at the University of Malaya in Singapore. He spent the next four years in Singapore organizing a new department.

In 1963, on the death of Prof. C. Mahadevan of the Andhra University, the vacant post of professor of geology was offered to Pichamuthu. He moved over to Waltair (Visakhapatnam) and spent the next two years there. By now he had become an international figure known for his many contributions to the Precambrian of India. His wide knowledge of geological literature, his power of logical deduction, and his ability to express his thoughts clearly and succinctly enabled him to bring clarity where there was confusion before.

Professor Rankama had embarked on

an ambitious project of covering the Precambrian of the world in a series of several volumes. He naturally chose Pichamuthu to write the section on India and Ceylon. This was a rare honour. Pichamuthu executed the task with his usual thoroughness. This account of the Precambrian of India is frequently quoted, being one of the very few comprehensive accounts of the Indian Precambrian.

In 1972 Pichamuthu was elected president of the Geological Society of India, an organization he had helped to found fourteen years earlier. He remained its president till 1984, when failing health made him give up the post. He had steered the Society through a difficult period and had the satisfaction of seeing it grow in stature. When he was still president, the Society celebrated its silver jubilee in 1984. Pichamuthu himself had reached the age of 84 years by then. In 1988 the D. N. Wadia Medal of the Indian National Science Academy was presented to him in recognition of his significant contributions to the Precambrian geology of India.

Admirable qualities

Pichamuthu possessed many admirable qualities. These gained for him a very large circle of friends in all walks of life. His interests were not confined to geology alone. He was a great lover of cricket and a good player of chess. He was an active member of the YMCA and took part in all sports activities.

What struck anyone who came in close contact with Pichamuthu was his studiousness and methodical habits. He lived all his life learning. Each paper that he wrote was drafted after a patient search for all sources of knowledge on that particular subject. He would take copious notes and arrange them systematically and it was only after this patient and long-drawn-out exercise that he started building the structure of the paper, in logical sequence. It was Pichamuthu who started the practice of conscientious listing of the sources of information, a practice which had not been strictly followed by the earlier geologists of Mysore. He did fair justice to the work of those who preceded him. He was also tenacious and would not let go of a problem easily. He would go back to it again and again, wrestle with it to gain insight. It is this ability that made his writing lucid and attractive.

He was not a religious man in the conventional sense, but was a true believer in a supreme authority guiding the destiny of man. The Bible was his constant companion and he derived inspiration and solace from it. He was religious in his own special way.

> When the great scorer comes
> To mark against your name,
> He cares not whether you won or lost
> But how you played the game.

Pichamuthu, a born cricketer, has played the game exceedingly well. He is ninety and is not out. Let us all wish that he will continue to play the game and step into the twentyfirst century with all his senses intact.

B. P. Radhakrishna is editor, Journal of the Geological Society of India. This tribute is a condensed version of the one published in Granulites of South India (Geological Society of India Memoir 17, Pichamuthu Volume, 1990).

From metallurgy to managing a nuclear reactor

C. V. Sundaram, born on 7 November 1929, had his academic training in chemistry at the Presidency College, Madras from where he took his BSc (Hons) in 1949. He then did his DIISc (Met) at the Indian Institute of Science, Bangalore, and joined the Department of Atomic Energy and started his research in chemical metallurgy with the late Brahm Prakash.

When Brahm Prakash moved over to Bombay to head the Metallurgical Research Programme on nuclear materials, Sundaram also joined him in the research studies on the extractive metallurgy of these materials. Their collaboration efforts spanning over two decades have witnessed momentous contributions not only in the field of nuclear metallurgy but in the whole gamut of metallurgical research in the country. If it is Brahm Prakash who laid the firm foundation for nuclear metallurgy in the country, it can be said of Sundaram that he, along with several other distinguished metallurgists of the DAE, have provided an enduring structure to it. They have secured a proud place for the nation among the leading nations in nuclear metallurgy in the world.

Sundaram's contributions in fundamental and applied metallurgy are wide and varied. Under his leadership, a host of technologies ranging from hydro-, pyro-, pyrovacuum- and electro-metallurgy and several modern metal refining techniques like CVD, PVD and EB melting have been developed for almost all the metals in the reactive and refractory metals group. Many of these processes are now being commercially practised in the country. To cite a few instances, zirconium sponge plant, zirconium powder plant, tantalum powder plant, beryllium plant and production facilities for boron carbide/boral are all in regular operations in different parts of the country. Titanium production technology was first tested on a pilot scale at the NFC, Hyderabad and based on this a 100-T demonstration plant was set up and operated at the DMRL, Hyderabad.

Sundaram served BARC till 1982 when he shifted his activities to Kalpakkam, where he took charge as Director, IGCAR. Here, under his leadership the commissioning of the first experimental fast breeder reactor (FBTR) was completed and it was put into operation in 1985.

Sundaram is also associated with the Indian Institute of Metals for well over three decades and has rendered yeoman service to this premier metallurgical institute in several capacities. Beginning as an ordinary member, he rose to become the Chief Editor of the *Trans IIM*, Chairman of the Materials Science Division and was elected President for the year 1981–82. He has since been conferred Honorary Membership of the Institute. He is also a Fellow of both the Indian Academy of Sciences and the

Indian National Science Academy. He is the Chief Editor of a very recent journal, *Metals, Materials and Processes*, launched last year from India.

For a person who has made such varied and outstanding contributions, it is only but natural that recognition and awards come his way. Sundaram has received numerous awards—Kamani Gold Medal (1966), Binani Gold Medal (1968), NMD Award (1970), Vasvik Award (1979), Platinum Jubilee Award of the IISc (1984), IIM Platinum Award (1985), Sanjay Gandhi Award (1985), S. H. Zaheer Medal (1986) and Padma Bhushan (1986).

Sundaram retired from IGCAR in November last year after an illustrious and meritorious professional career spanning a little over three decades. He is presently a consultant to the Nuclear Fuel Complex, Hyderabad (DAE), of which he was one of the chief architects. He had been chosen by the Indian Physics Association as one of the DAE–CV Raman lecturers for 1989. These are lectures addressed to undergraduates and given by scientists who have made outstanding research contributions and are also known for their communication skills.

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Foreign academies honour Indian scientists

V. L. Chopra, Biotechnology Centre, Indian Agricultural Research Institute, New Delhi, and Gurdev S. Khush, Plant Breeding Department, International Rice Research Institute, Manila, have been elected to the fellowship of the Third World Academy of Sciences, Trieste, Italy. Khush has also been elected Foreign Associate of the US National Academy of Sciences. Chopra has been associated with wheat breeding work leading to the development and release of many disease-resistant and high-yielding wheat varieties. Khush is a well-known cytogeneticist and rice breeder. Sixty-five high-yielding varieties of rice developed under his leadership are grown all over the world. He was a recipient of the Borlaug Award in 1977. In 1987 he shared the Japan Prize with Henry Beachell.

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