Rengaswamy Ramesh (1956–2018)

Rengaswamy Ramesh was a man of extraordinary scientific latitude with countless important contributions to stable isotope geochemistry, palaeoclimatology, oceanography, biogeochemistry and solid earth studies. He was mentor to a long list of Master's and Ph D students, postdoctoral fellows and university teachers, and had inspired many young minds to take up science as a career. He was instrumental in shaping stable isotope research activities in numerous universities and institutions in India. He was extremely intelligent and a scholar in the true sense. He could solve cryptic crossword puzzles and differential equations with the same ease. He was versatile in his research and could plunge into any topic in physics or geosciences, far removed from his own expertise. He always believed that mathematics is the key ingredient of all scientific recipes and insisted on quantitative approach to understand natural processes. He was a teacher par excellence, who could explain the most difficult concepts of electrodynamics, stable isotope fractionation and error analysis lucidly to students of all ages. His lectures at Physical Research Laboratory (PRL), Ahmedabad and elsewhere were always packed to capacity. He had a child's enthusiasm to learn new things in science and life. He never accepted defeat and rarely allowed his own ignorance to deter him from achieving his goals. His immense contributions towards modernization of examination system in various government agencies would go a long way in helping the future generation of scientists, teachers and administrators in India. Here I recount my memories of this great academician.

Ramesh was born on 2 June 1956 in Alwarthirunagiri, Tamil Nadu and spent his childhood in the temple town Srirangam in Tiruchirappalli. He was the eldest amongst his siblings. He had his early education in various schools and colleges of Trichy. After completing M Sc in Physics from University of Madras in 1978, Ramesh joined PRL for his doctoral studies. He had the rare distinction of securing 100% marks in mathematics in all his board/university examinations, and received numerous scholarships and prizes from private, State and Central Government agencies for excelling in various examinations.

Ramesh's pursuits in scientific research began in 1979 under the supervision of K. Gopalan in the geocosmophysics group of PRL. Along with S. K. Bhattacharya, he set up a new stable isotope laboratory which went on to become the cradle of modern palaeoclimate research in India. He started his research career with stable isotopic studies of tree rings and demonstrated that isotopic ratios of H, C and O in cellulose of coniferous trees can be used as proxies of past variations in rainfall and temperature. Ramesh was trained by M. K. Hughes, M. J. DeNiro and Jim White in tree ring research and mass spectrometry. Devendra Lal was a constant source of inspiration for him since his initial years; in fact, he had imbibed some of Lal's traits in his research and supervision. Ramesh obtained his Ph D degree from Gujarat

University in 1984 and continued work in PRL as a postdoctoral fellow until he became a permanent faculty in 1987. He worked for brief periods in 1992 and 1994 as a visiting research associate at the Scripps Institution of Oceanography, San Diego, USA, under the mentorship of D. Lal. It was during these postdoc years that Ramesh mastered the skills of mathematical modelling that would allow him to get deep into geochemical and climate modelling in the future.

The most important contributions of Ramesh and his students have been in the fields of palaeoclimate studies and ocean biogeochemistry using stable C, O and N isotopes. He explored all possible archives of past climate records, in decadal to millennial timescales, such as tree rings, corals, speleothems, peat deposits, and both marine and lacustrine sediments. He collaborated with a large number of researchers across the country and worked in a variety of terrains starting from deep oceans to deserts through intertidal zones, mountain belts and caves. His four publications in *Nature*, one in *Science* and seven in *Geophysical Research Letters*, on Indian climate during the Quaternary highlight his outstanding contributions to the field. His attraction for oceans led him to work on nitrogen biogeochemistry of oceans. Using N isotopes as tracers, he quantified new and regenerated productions and various components of N and C cycling in the Arabian Sea, Bay of Bengal, equatorial Indian Ocean and Southern Ocean. Throughout his active research career Ramesh had led several research cruises, including one to the Southern Ocean. He had an instinctive ability not only to spot the most important problems in oceanography and climatology, for that matter in any other branch of geosciences, but also had ideas about how to solve them through theoretical and/or experimental means. This is the very reason why most of his Ph D students worked on very different projects.

Ramesh with his mathematical modelling skills contributed significantly to the fundamentals of stable isotope fractionation in nature. With his students he developed models to understand isotopic effects of crystallization from multicomponent sources, water–rock interaction, organic matter decomposition and diffusion processes in oceans/rocks/trees. Some of his other efforts include modelling of Sr isotopic evolution of sea water during the last 40 million years, estimation of new production in the oceans, air–sea exchange rates using radiocarbon in corals and trees, nutrient distributions and Ra transportation in the oceans. He and his collaborators initiated palaeoclimate modelling for the first time in India using global circulation models and experimental isotopic data from various archives. He provided a numerical code for error estimation in histogram plots and a MATLAB code for fitting weighted linear regression to bivariate data with correlated errors. Because of his resourcefulness he could venture into research in completely unrelated fields, such as mantle-derived carbonatites, river-water chemistry, weathering and erosion, feeding pattern of Asian elephants and soil carbon cycle.

Ramesh loved teaching. During the later part of his career he travelled a lot throughout the country delivering lectures on various aspects of geosciences, particularly on the applications of isotopes. He was a regular teacher at PRL for 'Statistics and error analysis' and 'Stable isotope geochemistry' for a long time. He also taught courses on 'Mathematical physics' and 'Electrodynamics'. For many years he successfully trained school students for International Earth Science Olympiad. Ramesh was the soul of Tuesday Seminars in PRL, he made the seminars lively with involved interactions. He loved to be questioned and sincerely believed that only through the act of questioning new ideas in science can develop. As a supervisor he was very demanding, and people working with him almost always found it difficult to cope up with his speed. As a person, he was kind to people, always had time to discuss and listen, and helped everyone from students to colleagues and support staff at PRL. He had remained a bachelor.

Ramesh was a true home-grown scientist. All his work was done in India. He had an illustrious academic career decorated with recognitions from multiple organizations from India and abroad. He had published over 200 research articles and edited a couple of books. He was recipient of the Shanti Swarup Bhatnagar Prize and a fellow of all the three Science Academies of India and the The World Academy of Sciences (TWAS), Trieste, Italy. He was also a recipient of the TWAS prize and lifetime achievement award from the Indian Space Research Organization (ISRO). He was one of the contributors to the reports of the Intergovernmental Panel on Climate Change (IPCC) that was awarded the Nobel Peace Prize in 2007. He served as a member of numerous national and international scientific bodies and review/planning committees.

Ramesh could read, write and speak in multiple languages apart from English and Tamil. His knowledge of French and German was admirable. His proficiency in Hindi and Urdu was extraordinary considering the fact that he came from the southern part of the country. He always stood first in all Hindi competitions organized in PRL, as part of the promotion of the official language, whenever he participated. He was also awarded by various organizations for his excellence in Hindi. His fluency in Urdu had developed out of his love for Ghazals. He was a passionate listener of Hindustani and Carnatic classical music, and was a regular visitor to the Saptak music festivals in Ahmedabad.

After his superannuation from PRL in 2016, Ramesh had moved to the National Institute of Science Education and Research, Bhubaneswar as a Senior Professor and was entrusted with the establishment of an Earth and Planetary Science Department. However, this mission of his remained unaccomplished because of his untimely passing away in Mumbai on 2 April 2018.

JYOTIRANJAN S. RAY

Physical Research Laboratory,
Navrangpura,
Ahmedabad 380 009, India
e-mail: jsray@prl.res.in