Sethunathasarma Krishnaswami (1945–2015)

S. Krishnaswami passed away on 20 July 2015. He was born on 21 May 1945 in Thiruvananthapuram. Swami, as he was popularly known, had his early education, including B Sc (chemistry) degree in 1963 from University College, Kerala University, Thiruvananthapuram. After attending the Atomic Energy Training School at BARC, Mumbai, Swami joined the Geophysics group of the Tata Institute of Fundamental Research (TIFR), Mumbai in 1964 and worked as a Research Associate until 1972. He obtained his Ph D degree from Bombay University in 1974. He later moved to Physical Research Laboratory (PRL), Ahmedabad in 1973 and served in various capacities. Swami was also a Visiting Scientist (1971–72) at the Scripps Institute of Oceanography, La Jolla, California, USA and at the Department of Geology and Geophysics (1976–77, 1986–87), Yale University, USA. He also served as a Dean from 1987 to 1993 and Acting Director (2004–05) at PRL. After his superannuation in May 2005, Swami continued his research work at PRL as INSA Senior Scientist and Honorary Scientist. He thus had a long association with PRL for over four decades.

Swami's research work primarily focused on the application of environmental radioactive and radiogenic isotopes to study the surface processes on Earth. His initial research work at Scripps Institution of Oceanography (San Diego, USA) was a benchmark study in the application of ^{210}Pb–^{226}Ra radioactive disequilibrium to infer that particle-associated scavenging process is ubiquitous in the deep sea. His postdoctoral research with K. K. Turekian (Yale University) and subsequent visits to Yale led to new results on the application of U–Th series nuclides for investigating various processes in aquatic systems. The use of uranium decay series nuclides in the study of Mt. St. Helens eruption in May 1980, and waters of hydrothermal vents and groundwaters of Connecticut, set a new measure of the utility of these nuclides in solving problems beside those usually associated with dating of events. Work on ^{210}Pb in studying water profiles from GEOSECS cruises added to studies that Swami was already engaged in with ^{230}Th. As quoted by Turekian, 'Swami's frequent visits and stay at Yale encompassed virtually all the research activities going on. When we became deeply involved in the study of osmium-187 variation with time in the ocean, Swami was in the thick of things and made sure that our chemistry was done properly. All the students at Yale profited mightily from Swami's frequent visits. He may have belonged to India but he was definitely an adopted son of Yale as well'.

Swami's subsequent sustained contributions in isotope geochemistry provided new approaches in making use of environmental radioactive and radiogenic tracers to understand and quantify various natural processes, such as sedimentation and particle mixing in lakes and coastal waters; growth history of marine and freshwater ferromanganese deposits; particle dynamics and solute–particle interactions; transport of pollutants in sea water and subsurface aquifers and chemical weathering processes and erosion in the Himalaya and Deccan traps and their influence on global change.

During the days when no radiometric method was available to date sediments deposited over the past one century, Swami had suggested and demonstrated the use of ^{210}Pb ($t_{1/2}$ = 22.3 yrs) as a tracer to establish the chronology of lake and near-coastal sediments. In later years, realizing the effect of sedimentation and particle mixing that occur in coastal waters, he made use of cosmogenic ^{7}Be and bomb-produced ^{239,240}Pu along with ^{210}Pb to decouple the two effects and assign ages to various layers in the sediment column. Swami also documented that subsurface aqueous systems are best suited to study the reactivity of several important radioisotopes of U–Th decay series and along with his students, made detailed measurements of ^{238}U–^{234}Th, ^{226}Ra–^{222}Rn–^{214}Pb–^{210}Pb and ^{228}Ra–^{224}Ra in groundwaters. These measurements showed that isotopes of Th, Ra and Pb are extremely reactive in subsurface aquifer environment and that nuclide removal onto particle surfaces is a reversible process and their rate constants for adsorption/desorption can be determined from the distribution of daughter–parent isotope pair.

Swami's research group achieved a major breakthrough by developing special filter matrix for collection of small quantities of suspended matter from surface and deep waters to understand the role of particles in controlling the distribution of radionuclides and trace elements in the ocean. It was shown that the concentration of radionuclides ^{210}Pb and ^{230}Th increases with depth on particles, which enables the estimation of particle settling rates (meters/day) through the sea-water column. Radioisotopes of varying half-lives (^{210}Pb, ^{231}Pa and ^{230}Th) were also measured at several cross-sections in manganese nodules whose orientations were known on the seafloor. This study confirmed the slow growth rates of the nodules and showed that manganese nodules grow at different rates on the bottom side facing the sediments and on the top side exposed to sea water.

In later years, Swami was engaged in studies on chemical weathering processes in the Himalaya and the impact of Himalayan Orogeny on the geochemical cycles of selected elements and isotopes in the ocean. His research work has shown that the Ganga/Brahmaputra rivers have considerably influenced the evolution of strontium isotopes and uranium concentration in the ocean since the Cenozoic era.

Post-superannuation, his main passion remained in discussing science with faculty members of the Geosciences Division at PRL and interacting with several graduate students of his own students. In a way, Swami was most fortunate to have spread his immense knowledge among

three successive generations of students at PRL. He had pioneered in several applications of radiogenic and cosmogenic radioisotopes and has left a long legacy of their use by the Earth sciences community. He has published more than 100 research papers in peer-reviewed journals, contributed reviews in books/encyclopaedia, edited special volumes of journals and also a book on *U–Th Series Nuclides in Aquatic Systems* (Elsevier publication).

Swami was a Fellow of the Geological Society of India, Indian Academy of Sciences, Indian National Science Academy, The National Academy of Sciences, India, The World Academy of Sciences, American Geophysical Union and Geochemical Society and European Association of Geochemistry. He was a recipient of the INSA Young Scientist Award (1975); Krishnan Medal (1981) and S.S. Bhatnagar Prize (1984). Swami was an Associate Editor of *Geochimica et Cosmochimica Acta*, and a Member of the Editorial Board of the *Journal of Earth Science*. He served as the Vice-President of IAPSO (International Association for the Physical Sciences of the Oceans); Vice-President of International SCOR (Scientific Committee on Oceanic Research); and Executive Member and Treasurer of IGBP (International Geosphere Biosphere Programme of ICSU). He was also INSA Council Member during 2002–04. He served as Chairman and Member of several National Committees of DST, CSIR and Ministry of Earth Sciences, Government of India.

Swami is survived by his wife, daughter, son and their spouses.

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