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A Tribute to Eric Raymond (Lou) Vance: Ceramic Materials Physicist and Nuclear Wasteform Expert – 15th November, 1942 – 7th March, 2019

This special issue of the *Journal of the American Ceramic Society* is a tribute to the life and work of Eric Raymond Vance. He was known to most of his friends and colleagues from his youth not as “Eric” or “Raymond” but “Lou” (taken from the name of his father “Albert Louis Vance”). His distinguished career perhaps began from his secondary school days at Stawell High School (now known as Stawell Secondary College), in the small town of Stawell, Victoria, Australia. Stawell is most well known for the annual “Stawell Gift”, a professional foot race which began in 1878 at the end of the gold rush in that area of Victoria, as the “Easter Gift” of £24 (several thousands in today’s dollars) conducted by the Stawell Athletic Club and raced every year since, except for the years during World War II.

Lou was born in Ararat, Victoria, but during his childhood the family moved to Stawell where his father established a pharmacy business. From his commencement at Stawell High School, it was very soon apparent that Lou was a person of exceptional abilities. He had a remarkable capacity for scholastic achievement, exhibiting from the early years, sharp insight, industry and unusual inventiveness. He scored outstanding results at all levels through these years, culminating in First-Class Honours in all subjects and four General

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Exhibitions in his Matriculation in 1959. To this day, the College considers Eric Raymond Vance to have been one of its most talented students.

Following a B.Sc. from The University of Melbourne, Lou graduated with a Ph.D. in Physics from Monash University in 1968, with a thesis entitled “A Study of Gamma Manganese and Some of its Alloys” for which he researched under the supervision of the late Associate Professor Jack Smith. He then held research positions around the world, summarised as follows:

1968-1969 Australian Atomic Energy Commission, (now Australian Nuclear Science and Technology Organisation (ANSTO)), Sydney, during which time he not only published the papers from his thesis but continued to undertake neutron scattering studies on metal alloys and oxides;

1969-1972 University College, London, England, where he was a Research Associate in the group of Dr Judith Milledge, researching irradiation effects on minerals, and in particular diamonds;

1972-1977 Research School of Physical Sciences, Australian National University, Canberra, Australia, where he was a Post-Doctoral Fellow in the Department chaired by Professor Alan Runciman, and which for Lou was a particularly productive period in his research on irradiation effects in various materials;

1977-1978 University College, London, a return to the research on irradiation effects in minerals in the group of Dr Judith Milledge;

1978-1979 Research Associate, Georgia State University, Atlanta, Georgia, U.S.A., Lou’s first experience of research in the U.S.A., which not only involved his introduction to positron annihilation, a technique which he would use on projects later in his career, but also a return to manganese alloy research;¹

1979-1982 Senior Research Associate, Materials Research Laboratory, Pennsylvania State University, State College, Pennsylvania, U.S.A., a most productive time in his research career, during which he worked in the group of the late Professor Rustum Roy and which gave him his initial introduction to nuclear wastefrom technology;

1982-1987 Research Scientist, Atomic Energy of Canada Ltd., Pinawa, Manitoba, Canada, involving studies of sphene-glass ceramics for high-level nuclear waste and spent fuel;

1987-2019 ANSTO, Sydney, recruited specifically to undertake research on Synroc but, in typical “Lou Vance style”, not limited to this topic.

In 2007, Lou received a Leverhulme Fellowship which enabled him to work with Professor Ian Farnan in Earth Sciences at Cambridge University in 2008. He was later made a Life Member of Clare Hall.

Lou's research embraced many different areas of the physics of materials, and included not only ceramics, but studies of magnetism in metallic alloys, neutron irradiation effects in diamonds and other minerals, properties of glass ceramics and geopolymers. Surprisingly, his first ever refereed publication was not on his own PhD thesis topic but on what was then (1968) considered to be "a high-temperature superconducting material", the A15-structure compound, V_3Si .² Lou briefly returned to research on superconducting materials, following the discovery of the high- T_c ceramics,³ for which Lou's expertise in ceramic processing appealed to his collaborators.

But, as indicated above, Lou's recruitment to ANSTO followed the invention of Synroc, in the 1970s, by the late Professor Ted Ringwood of the Australian National University.⁴ Synroc, a synthetic ceramic composite based on natural mineral phases for safely locking away various radioactive elements, subsequently occupied much of the research effort for Lou and his ANSTO colleagues for the remainder of his life. Drawing on his knowledge of wasteform technology from his research in Canada, and enthusiastically applying this to the Synroc program, Lou progressed within ANSTO, being promoted to Senior Research Scientist in 1987 and to Chief Research Scientist in 2001.

He was author or co-author to almost 400 articles in international journals or conference proceedings including 23 papers in the *Journal of the American Ceramic Society*. His most cited publication⁵ has 684 citations, according to *Web of Science* at the date of preparation of this Editorial and six of his publications have been cited in excess of 100 times. He was also co-author on three patents. He was a Fellow of the American Ceramic Society, the Australian Institute of Physics, the Australian Academy of Technological Sciences and Engineering and the Australian Ceramic Society. Lou was also an Academician of the World Academy of Ceramics, a long-time member of the Materials Research Society and a member of the Australian Nuclear Association. He held editorial and advisory board roles for the *Journal of the American Ceramic Society*, the *Journal of the Australian Ceramic Society*, the *Journal of Nuclear Materials*, and the *Journal of Nuclear Science and Technology*. Lou also served on numerous international ceramic conference organising committees and was a frequent session

chair at radioactive waste immobilisation symposia. He was the lead organiser for the symposium on radioactive waste immobilisation at PacRim 6 (Maui, 2005) and technical organiser of the Austceram arm for Materials Australia/Austceram 07 (Sydney, 2007). He was also co-technical organiser for PacRim 9 (Cairns, 2011) and the Materials Research Society's "Scientific Basis for Nuclear Waste Management" Symposium held in Sydney in 2017.

In 2018, Lou was awarded the prestigious ANSTO CEO Award, jointly with the late Dr Mark Reinhard, for his sustained research contribution. It is a measure of his scientific leadership and achievements within the Synroc program, that a first-of-a-kind, industrial-scale, Synroc waste treatment facility is currently under construction on the ANSTO site at Lucas Heights, south of Sydney. This project will see the Synroc technology become an industrial reality. The innovative facility will treat the nuclear waste from ANSTO's molybdenum-99 nuclear medicine production and Lou was the design engineer for the wasteform that will be produced. His work was absolutely critical to the success of this high-profile project and it is somewhat comforting to think that ANSTO will be producing Lou's wasteform product for the next (at least) 40 years. Lou leaves behind a legacy in terms of his science but also his attitude and approach to life. His many colleagues and collaborators take his knowledge and his discoveries forward but much more than that, we will forever remember his warmth, his generosity, his humour, and his humility.

In his spare time, Lou was a most competitive sportsman. While in his youth he excelled in cricket, Australian rules football, tennis and golf, he continued to play the last two sports competitively well beyond his young days. Indeed, he continued to play competitive tennis until just a few months prior to his death. He was also a devoted family man and is survived by his wife, Jan, of almost 50 years, their two children, Julia and Michael and four grandchildren, Ben and Anna, Lucy and Sophie.

We acknowledge the American Ceramic Society for agreeing to this Special Issue as a tribute to the life and work of Lou Vance. In planning this issue, we have attempted to represent some of the fields of research which occupied Lou's career, by inviting key authors from amongst his many collaborators, to prepare and submit a manuscript. These manuscripts were required to be on original research and they have been subjected to the same standards of peer-review that applies to all publications in the *Journal of the American Ceramic Society*.

We have also included a review article, “Synroc Technology: Perspectives and Current Status”, summarising the current status of Synroc technology and which has been prepared by some of Lou’s ANSTO colleagues, something which seemed to be most appropriate.

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6th May, 2020

Figure Captions:

Figure 1. Lou in front of the ANSTO Synroc Demonstration Plant. (Image courtesy of Gerry Triani, ANSTO, 2018.)



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