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APPLICATIONS OF LASER-ABLATION ICP-MS ANALYSIS: A TRIBUTE TO HENRY P. LONGERICH

PREFACE

The first eight articles in this issue of *The Canadian Mineralogist* have been contributed to celebrate the career achievements of Henry P. Longerich, Professor Emeritus at Memorial University of Newfoundland (MUN), in furthering geochemical analysis using inductively coupled plasma – mass spectrometry (ICP-MS).

Henry Perry Longerich was born in Du Quoin, Illinois, in 1940. He studied chemistry at Millikin University, Illinois, before undertaking a Ph.D. in analytical chemistry at Indiana University. He held the position of assistant professor in chemistry at the University of Alaska for five years before taking up a postdoctoral fellowship at Dalhousie University in Halifax in 1972. He moved to Memorial in 1974 as a research associate in the Institute for Research in Human Abilities. Fortunately, in 1978, he applied for a vacant assistant professorship in the Department of Earth Sciences, where for 25 years he has plied his trade as one of the world's premier analytical geochemists.

At Memorial, Henry was made responsible for the analytical facilities within the Department of Earth Sciences. He applied his expertise to the maintenance and development of the electron microprobe, thermal ionization mass spectrometer, and X-ray fluorescence facilities. The pivotal year in Henry's career was 1984. It was then that he attended the American Society for Mass Spectrometry meeting in Boston, where he was introduced to the then infant technique of ICP-MS. That technique, which combines the ionizing power of an inductively coupled plasma with the detection capability of a quadrupole mass spectrometer, was then unproven. However, Henry grasped immediately the extraordinary potential of a multi-element technique,

which combined parts-per-billion detection limits with spectral simplicity, in the determination of low-level concentrations of geologically important elements, such as the rare-earth and platinum-group elements. He convinced many of his colleagues that ICP-MS would be the technique of the future for elemental and isotope analysis, and persuaded one colleague, Dave Strong, to develop what proved to be a successful NSERC (Natural Sciences and Engineering Research Council of Canada) application for a SCIEX ICP-MS instrument, one of the first of its kind in Canada.

The following years were ones of discovery as the more unruly characteristics of the new analytical technology, in particular a low tolerance of dissolved solids, severe mass-dependent drift and matrix effects, polyatomic spectroscopic interferences, and memory effects, became apparent. Hours were spent poring over LOTUS spreadsheets full of seemingly bemusing data, after which Henry would pass judgement, and a new experiment or two would ensue. The problem was progressively and generally addressed. Through this patient, methodical approach, Henry and his colleagues made major contributions to the understanding of the ICP-MS, developing protocols to combat its problems and to apply its strengths. Foremost among its strengths was the method's ability to determine the concentrations of forty or so trace elements in a single aliquot of a solution of dissolved rock. This proved to be a boon particularly for igneous geochemistry. As this and other unique applications were developed, including those with uses in the environmental sciences, the services of the Memorial ICP-MS laboratory were sought by researchers across Canada and abroad. With further

NSERC funding, the lab added a second ICP–MS instrument, a VG PQII+S, which, for reasons that baffle even Henry, is perhaps the most sensitive PQII ever built and, to this day, one of the most sensitive ICP–MS instruments in operation. Through Henry’s leadership, MUN’s laboratory became recognized by NSERC as a National Facility for ICP–MS analysis.

In 1989, exercising vision ahead of his time, Henry realized that the recently demonstrated combination of laser-ablation sampling with ICP–MS detection might be developed for spatially resolved, *in situ* analysis of minerals in petrographic sections. With ongoing support from NSERC, he built the first laser-ablation system designed specifically for *in situ* sampling of minerals for ICP–MS analysis. Over the following years, Henry and his group developed operating and calibration protocols that are now used worldwide, and made hardware developments, including laser samplers based on 266 nm and then 213 nm laser systems, which have in turn become the industry standards. These exciting new developments encouraged young researchers from all over the world to join the MUN group. Most of them have gone on to set up leading laboratories of their own. Training these “students” in the science of LA–ICP–MS analysis is an achievement that makes Henry justly proud.

Applications of LA–ICP–MS have truly revolutionized the Earth sciences. This was the subject of a technical session held in Henry’s honor at the annual joint Geological Association of Canada – Mineralogical Association of Canada meeting in St. John’s in 2001. Most papers in this collection grew from that meeting and attest to the variety of geological applications now being attempted using LA–ICP–MS.

Henry took early “retirement” in 1996, and has since been teaching chemistry at various institutions across Canada, while maintaining an active research program at Memorial. In particular, he has continued work on his long-standing interests in the geochemical fingerprinting of wines, low-level concentrations of platinum-group elements, and elemental fractionation during laser ablation.

The success of Henry and his group in developing ICP–MS and LA–ICP–MS was founded to a large extent on Henry’s vision. However, he also brought to the group a deep toolbox of theoretical and practical analytical knowledge that was largely lacking amongst his geologist colleagues. He also brought himself to the group, a man of fundamental decency who treated all his coworkers, colleagues, students and the technicians in the machine shop with respect and kindness, and was given unfailing loyalty in return. Those who worked with Henry wanted to give him their best, and usually did, in many cases producing some truly exciting scientific work.

Henry has been an excellent teacher of his craft and a mentor to his students, postdoctoral fellows and close

associates. Generous with his insights, he loves to be challenged and to argue his case. His unflappable and patient approach in the face of seemingly uninterpretable data, instrumental problems and pressure to produce, is a rare quality and a valuable lesson for any analyst. Graduate students at Memorial lucky enough to have taken his course on Analytical Methods were rewarded with a deep understanding and respect for the power and limitations of chemical analysis.

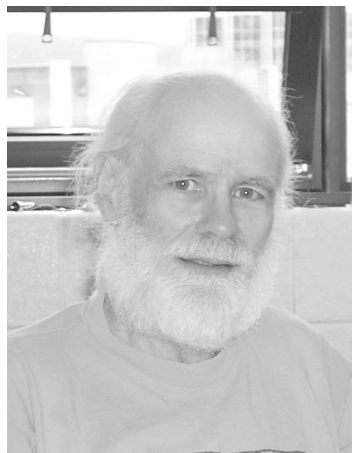
Most important for Henry is the fact that, in ICP–MS, he was involved in a fascinating science, a science that is now being furthered all over the world by students and postdoctoral fellows that learned their trade under his tutelage.

The undersigned guest editors thank all the contributing authors for their interesting, thought-provoking articles, and all the reviewers who took time out of their busy schedules to provide constructive criticism. Their collective efforts have led to a wonderful tribute to a unique scientist.

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