Geochimica et Cosmochimica Acta Vol. 56, pp. 871–873

0016-7037/92/$5.00 + .00

The Taylor Colloquium: An introduction

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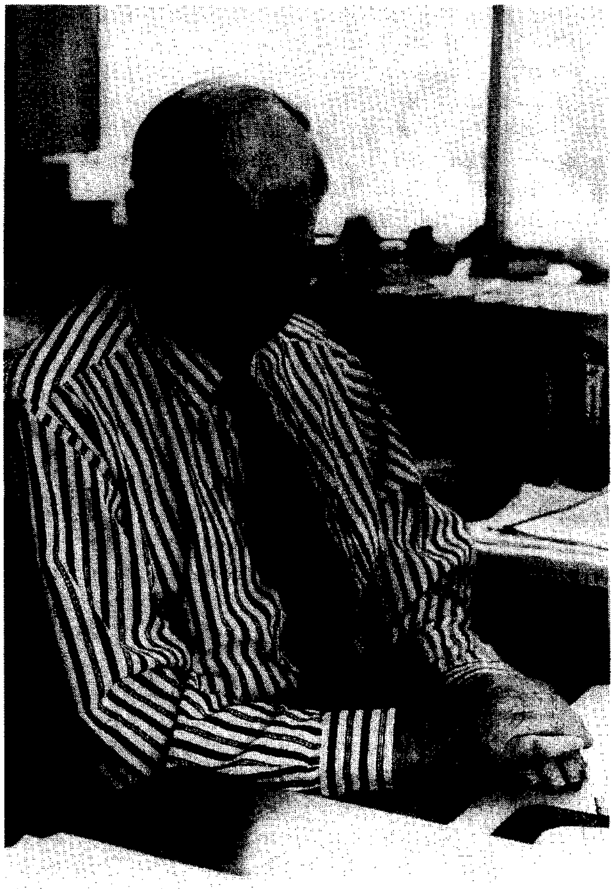
ROSS TAYLOR HAS been a preeminent geochemist for more than thirty-five years. For the past thirty years, he has been a dominating force in the field of trace element geochemistry. The year 1990 was an important benchmark for Ross on a number of counts. He celebrated his sixty-fifth birthday, and accordingly it marked his retirement as Professorial Fellow from the Research School of Earth Sciences (RSES) at The Australian National University. (He has now taken up residence across the road in the Research School of Physical Sciences.) In recognition, The Taylor Colloquium was held at RSES, in Canberra, on October 1–2, 1990. It was sponsored jointly by the International Union of Geological Sciences, The Geochemical Society, the Australian Academy of Sciences, and RSES. The meeting was organized by Roberta Rudnick, Malcolm McCulloch, and Dick Price in Canberra and by Scott McLennan in Stony Brook. More than fifty scientists from nine countries were in attendance, representing colleagues, friends, and former students.

Trying to develop a colloquium theme to reflect a career that has covered as much ground as that of Ross's was no mean feat. The "Origin and Evolution of Planetary Crusts" was finally selected as a subject that transgresses Ross's major research interests in the Earth, Moon, and other planets of the solar system. The colloquium was timely because of the continuing interest in crustal evolution and the growing interest in comparative planetology. It seems a relevant tribute to Ross that his influence can be seen in each and every paper.

A total of nineteen papers was delivered at the Taylor Colloquium over two days, including three papers co-authored by Ross himself. The papers being published here represent the research reported in many of these presentations, as well as additional papers from people who were unable to attend the conference. Many more added to the lively discussion and everyone involved helped to make the whole affair a successful one. Publication of such a proceeding through the journal *Geochimica et Cosmochimica Acta* is also an appropriate tribute. Ross has served (and continues to serve) as an associate editor for this journal since 1964, a record that is unlikely to be broken. He has developed close working relations with each of the journal's Executive Editors during that time. Ross's eighteen-year editorial association with another trace element geochemist, Denis Shaw, and the positive impact that this has had on geochemistry are especially noteworthy.

The first group of papers deals with the trace element and isotopic composition of sedimentary rocks. The subjects covered here are diverse. The first three papers are concerned with the chemical evolution of Precambrian seawater (Veizer, Clayton, and Hinton), rare earth element and Nd-isotopic evolution of sedimentary rocks as it relates to crustal evolution



Stuart Ross Taylor

(McLennan and Hemming), and utilizing major and trace element data to examine provenance relationships and tectonic history of Proterozoic sedimentary rocks from the Mount Isa region (Eriksson, Taylor, and Korsch). This group of papers reflects Ross's pioneering research on sedimentary geochemistry. As early as 1964, he recognized that REE abundances in sedimentary rocks could be used both to constrain the chemical composition of the continental crust and to trace its chemical evolution. The development of his ideas relating sedimentary compositions to crustal evolution can be traced in his papers with Petr Jakeš, Weldon Nance, Scott McLennan, and more recently Ken Eriksson. This research ultimately resulted in a book, co-authored with McLennan, *The Continental Crust: Its Composition and Evolution,* published in 1985 and already cited over 450 times.

Also included in this section are two papers that use high-resolution ion microprobe U-Pb dating of single zircons in sedimentary rocks. The first paper by Ireland examines the Phanerozoic tectonic development of New Zealand (the country of Ross's own provenance) and the second combines U-Pb zircon ages with Sm-Nd isotopic data to examine provenance relationships of Precambrian sedimentary rocks from the Amadeus Basin (Zhao, McCulloch, Bennett). Although Ross has been less directly involved in isotopic approaches, Malcolm McCulloch noted at the colloquium that the geochemical rationale of applying Nd isotopes to sedimentary rocks rests on a foundation set by Ross in his studies of REE distributions in sediments.

The second group of papers deals with another area that has been strongly influenced by Ross Taylor, that of island arc petrogenesis. Two papers examine the geochemical and isotopic composition (Price, McCulloch, Smith, Stewart) and experimental petrological relations (Nicholls, Oba, Conrad) of young island arc volcanic rocks from the North Island of New Zealand. The tectonic relations in this region remain among the most complex of any modern arcs. In the early days of plate tectonics, Ross recognized the importance of island arc processes in the formation and evolution of the continental crust, leading to the development, originally with Alan White, of the so-called "Andesite Model" for crustal composition. He further recognized the importance of collecting high-quality geochemical data for these rocks and set upon a major program of island arc geochemistry with Andy Duncan, Tony Ewart, Jim Gill, Mike Gorton, Mike Perfit, Alan White, and Dave Whitford. Virtually all of the fundamental problems of island arc petrogenesis that are now so vigorously argued, such as the role of the slab in island arc magmatism and the distribution of high field strength elements, were identified in these early studies.

The next group includes three papers that consider processes taking place deeper in the crust. The first two discuss possible reasons for the difficulties involved in the identification of restite in the lower crust. Rudnick proposes that restite may be sampled as undepleted granulites, and Kempton and Harmon, evaluating oxygen isotope data for granulite xenoliths, suggest that restite may be modified during basaltic underplating. Both papers stress the importance of basaltic underplating in crustal growth and evolution. Finally, He and Ar isotopic constraints on fluid migration between mantle and crust are discussed by Tolstikhin, Dokuchaeva, and Kamensky. Again, Ross's influence can be seen. The lower crust is not readily accessible to sampling and exposures of granulite terranes and the occurrences of granulite xenoliths provide less than a thorough sampling. Among the results of the models of crustal evolution that came from the studies of island arc volcanic rocks and sedimentary rocks were many predictions on the nature and composition of the lower continental crust, thus providing an impetus for further research. More recently, Ross has tackled this problem and has made important contributions towards understanding this complex region with Roberta Rudnick, Dick Arculus, and Malcolm McCulloch.

The final group of papers deals either directly or peripherally with the topic perhaps nearest and dearest to Ross's heart: the composition, origin, and evolution of the Moon. The first of these (McDonough, Sun, Ringwood, Jagoutz, and Hofmann) notes the similar relative crustal abundances of alkali elements in the Earth and Moon. Norman and Taylor examine the origin of lunar highland anorthositic clasts from an Apollo 16 breccia and evaluate the lunar differentiation history using Li/Yb systematics. The third paper in this group (Esat and Taylor) reports on Mg isotope fractionation in lunar soils and argues against the veracity of previous claims of isotope anomalies for O, Si, S, and K.

Ross Taylor's "love affair" with the Moon is matched only by that of the late Harold Urey himself. In fact, when Urey visited and lectured at Oxford during the mid-1950s, he provided a strong influence on Ross. Ross saw great promise in the newly developing field of cosmochemistry and never looked back. A watershed in his career came in 1969 when during a visit to the Lunar Science Institute, arranged by Robin Brett, Ross was invited to take over the emission spectrographic facilities in the Lunar Receiving Laboratory. Within a pressure-cooker atmosphere, he produced high-quality elemental data on the first returned lunar samples and has been a central figure in lunar studies ever since. He has called this his "most important and critical work." Over the years much more was to come from his studies of lunar rocks and amongst his most important contributions were his models of lunar evolution, developed with Petr Jakeš, and the history of the lunar highland crust developed with Ted Bence. The breadth of his vision of the moon is unsurpassed and has been captured in his immensely successful books: *Lunar Science: A Post Apollo View* (1975) and *Planetary Science: A Lunar Perspective* (1982). His vision continues to expand and a third book in this series, *Solar System Evolution: A New Perspective*, will be published soon.

The final paper (Koeberl) provides an exhaustive data set for Muong Nong tektites and discusses their origin as a splash product from a single meteorite impact on the earth. A study of tektites provides a fitting end to this series of papers. To a large degree, Ross cut his cosmochemical teeth on tektite research. Before the lunar landings many thought these glassy objects came from the moon and so they were central to much of the discussion in cosmochemistry. Ross first developed the emission spectrographic technique (and later the spark source mass spectrographic method) to its ultimate precision in generating high-quality data for tektites, especially during the 1960s. He has published more than thirty papers on this subject and from an early date championed the now accepted terrestrial origin as a splash product from meteorite impact. A great deal of our understanding of volatility effects on element distribution during high-energy events originates from studies on tektites.

The papers in this volume provide a summary of the breadth of Ross Taylor's accomplishments, but the overview would not be complete without some further additions. His contributions to analytical geochemistry have been great. Over the years he has set up four influential trace element laboratories at Oxford (1954), Cape Town (1958), Canberra (1961), and Houston (1969). During the 1950s and 1960s, when most geochemists really struggled to obtain high precision, the data from these labs were always of the highest quality and have stood the test of time. Ross also pioneered the difficult but highly versatile spark source mass spectrometry technique for trace element analyses, and his lab in Canberra was one of the first to apply ICP-AES as a low-level, high-precision geochemical technique. His studies on trace element distributions in feldspars, completed some thirty years ago with Knut Heier are still frequently cited. In the field of meteoritics (Ross recently served as President of the Meteoritical Society), characterization of REE anomalies in inclusions of Allende meteorite (with Brian Mason) and descriptions of Mg isotope anomalies (with Tezer Esat) stand out. He has also made important contributions to our understanding of the geochemistry of metamorphic rocks, granites, and basalts. In all he has written over 200 scientific publications including five books (a sixth is in press) and has had substantial collaborations with over thirty scientists. He has received a D.Sc. from Oxford and his honors include a fellowship in the Australian Academy of Science and an honorary fellowship in the Royal Society of New Zealand. Most recently, he was awarded the Norman L. Bowen Award (1988) from the American Geophysical Union.

Many people have influenced Ross's scientific career and in turn, his mark in geochemistry can be seen on four continents. The early influence of his Ph.D. supervisor Brian Mason (whose own studies under V. M. Goldschmidt were interrupted by war) kindled his interest in geochemistry. Collaborations with Dick Leninger (Indiana) and later Louis Ahrens (Oxford, Cape Town) helped to mark the path in analytical geochemistry. John Jaeger convinced Ross to join the then young earth science group at ANU, where his career has flourished. Among those who were his students are Tony Erlank and Peter Kolbe (at Cape Town), Jim Gill, Mike Gorton, Dave Whitford, Weldon Nance, Scott McLennan, and Roberta Rudnick (all at Canberra).

A list of research projects, collaborators, honors, and publications provides a tangible measure of a scientist's influence. There are also intangible measures of influence, and in Ross Taylor's case these are perhaps equally important. His opinion and counsel are routinely sought by colleagues within his discipline and by those from other fields. At the Research School of Earth Sciences, he was always ready to provide advice, assistance or simply a sympathetic ear for anyone with a scientific, personal, or "political" problem. Perhaps his greatest attribute is the remarkable intellectual environment that he creates around himself. This comes from his scientific integrity, creativity and rigor, his near encyclopedic knowledge, his cultural élan, and his basic high regard for other people.