The Geologic and Geoanalytical Career of Professor Peter R. Hooper

The late Peter Ralph Hooper founded our lab, the "Peter Hooper Geoanalytical Lab" in the early 1970s. Peter was a very active geologist and geoanalyst, a strong believer in the utility of geochemical data tied to good field research. A complete list of his many publications can be found at the end of this document. The first part below deals with his early career in Antarctica and Wales and his analytical methods, the latter modified slightly but still in use in our lab today. The second and main part of the text deals with his geologic career, chiefly at WSU. If anyone has further information to offer we are happy to update this page.

Peter a few years before his retirement

Early career

Peter was born in Edinburgh, Scotland in 1931 but grew up both in Canada and Scotland where he finished his secondary schooling. His mother was one of the earliest women doctors to graduate from a Scottish university. His father owned a large farm in Alberta. Peter graduated in 1953 with a Geology degree from St Andrews University in Scotland (after acquiring US citizenship he carried as many as three passports and would select the most appropriate when traveling!). After graduation he and a few friends bought an old London taxi and drove it to the then recently opened Yugoslavia border. With many adventures the tour went as far as Dubrovnik on the Dalmatian coast, where they boarded the car on a ferry going

north to bypass the nearly impassable (by car) coastline, and then drove back to England from Split. Caroline, Peter's future wife, was among the party, and he proposed to her on their return.

A young Peter Hooper looking out of the taxi window in Yugoslavia in 1954.

Peter took a position with the British Antarctic Survey shortly after returning to England and set sail to Antarctica for three years. In the 1950s long distance communication was crude and the only contacts he had for the next three years were through letters. Peter had many an adventure in the Antarctic Peninsula, where he helped build and run a station on Anvers Island. Considering the crude state of their equipment and lack of communications it is quite amazing that he and his partners survived with no injuries. The primary forms of transportation were in small open boats on the water and by man hauling or dog sled on land. Peter and his group explored the island and wintered over twice in succession. Upon his return in 1957 he and Caroline were married and he wrote up his geologic work on the island for his PhD dissertation at the University of Birmingham (advisor: Ray Adie) and two publications (see references). Peter was awarded the Polar Medal by the Queen in 1958 for his achievements in the Antarctic, and a glacier, the Hooper glacier, was named for him in Anvers Island, Antarctica (64°44 S, -63°37 W or in decimal degrees 64.733 S, -63.617 W).

In 1959 Peter was offered a lecturer position in metamorphic and igneous petrology at the University of Swansea in Wales, where he spent 12 years. While at Swansea he became immersed in using the very new technique of XRF (see next section) as a rapid means to analyze rocks at the suggestion of his head of the department, Frank Rhodes, a micro-paleontologist. Peter explored the suitability of such equipment, which resulted in several publications in a completely new field. Because Peter was also quite experienced at travel in cold, rough terrain, and deeply interested in igneous petrology, he started a project to map the geology of

some of the islands and coastline of northern Norway, including those with some notable Caledonide age layered intrusions. That work led to several of his early publications (see references).

Peter came to Washington State University (Pullman, WA) for a sabbatical year in 1968 on a Fulbright Scholarship, teaching a variety of courses. He realized at a meeting on the Columbia River Basalts (CRB) at Cheney (WA) that the fundamental problem was how to distinguish one basalt flow from another – and he thought that XRF might provide the key. He returned to Wales, but was offered and accepted a full professorship in igneous petrology at WSU in 1971 to replace Professor Charles (Chuck) Campbell who had reached retirement. Peter clearly did not regret that decision.

X-Ray Fluorescence (XRF) methods for rock analysis and a bit of lab history

Peter was an early champion (Hooper and Atkins, 1969) of low dilution lithium borate fusion using graphite crucibles, the method we still employ. Most rock analysis was and is still done with platinum crucible high dilution fusions, with ratios of 5:1 or 10:1 of Li-borate flux:rock powder, whereas the low dilution fusion ratio is 2:1. Fusion destroys the mineral constituents of the rock and forms a glass pellet that is the ideal material for XRF analysis. The advantages of the low dilution method are: 1) only a single preparation is required to measure both major and trace elements, 2) corrections for inter-element absorption and enhancement can be made with no approximations, and 3) nearly any geologic material (not ores) can be usefully fused in inexpensive graphite crucibles.

Peter was very interested in rapid methods of rock analysis, perhaps inspired by his PhD work with tedious wet chemical analysis of rocks from Antarctica. It took several months of skilled lab work to analyze (for major elements only) a dozen rocks in those days. His earliest XRF work (Hooper, 1964) described a rapid method of rock analysis using high dilution Pt crucible fusions, but he was impressed by experiments with low dilution done at Pomona College (Welday et al., 1964, Am. Mineralogist, v. 49, p. 889-903) and he decided to adopt that method for analysis of Columbia River basalts (Hooper and others, 1976). The initial method used a singly fused bead and was calibrated with eight basalt rocks that had been analyzed by the USGS. Later the method was slightly modified and the first fused pellet was reground to powder and refused to attain better homogeneity. Calibration of the instrument shifted to the use of a wider variety of rock standards to accommodate the demand for analysis of diverse rock types (Johnson, Hooper, and Conrey, 1999).

When Peter returned to Pullman as chair in 1971 he was given $25,000 to start a XRF lab in Morrill Hall. The money was used to acquire the basic rock grinding and fusing equipment needed to make fused pellets. We still use some of that gear, especially the custom-built rock chipper with hardened tool steel plates designed by Martin Williams of the WSU College of Sciences Tech Services. The fused pellets were shipped to Wales to run on the XRF at Swansea for the first few years. The Geology department moved into the newly built Webster building in 1974 and Peter installed the first XRF spectrometer in our lab in room 845 that same year, a "biologically automated" Philips 1410 X-ray fluorescence spectrometer. The peak and background angles and detector settings for each element were hand tuned and each sample bead was hand fed into the spectrometer. Several X-ray tubes were used to optimize signals for particular groups of elements, the tubes were constantly changed in and out. During the first years the machine was operated by Peter and his graduate students. But in 1978 Peter signed a contract to do work for the Rockwell Hanford Basalt (high level radioactive) Waste Isolation project (BWIP) and the work load picked up so that eventually the first technician, John Amistoso, and the first part-time bead lab workers, were hired. Ivan Herrick, a department technician, also helped with some of the early lab infra-structure, especially the installation of the first Apple IIe in the early 80s. Prior to that the matrix correction calculations were all done on the WSU mainframe, but with the advent of powerful personal computers the mathematics could be done in the lab. Amistoso was succeeded by Diane Johnson (Cornelius) in 1984, and Diane worked for 25 years, retiring in 2009. She and Peter made a great team and demand for the lab services grew steadily over the years.

We have few records of the period prior to 1978, but virtually every sample batch since has been recorded in logbooks that Peter started to keep track of the work for Rockwell. That work was lucrative and helped fund the purchase of a new Rigaku 3370 XRF spectrometer in 1986. The Rigaku was fully automated and thus relieved Diane and the graduate students from the drudgery of feeding and tuning the instrument. The Rigaku had a long life and served until 2004, when we acquired our current Thermo-ARL Advant'XP+ machine. By 2004 the XRF workload was more than one person could handle (approaching 5000 samples per year, now runs up to 6000 or more) so Rick Conrey (who was one of the heaviest users of the instrument) was hired to train under and help Diane, with a view to taking over operations when Diane retired. To keep up with the load as Diane was retiring Laureen Wagoner was also hired to handle many of the day-to-day chores. The preparation lab now employs 4-6 part time students at all times of the year. The XRF lab runs in conjunction with the ICP-MS lab Peter started in the mid

1980s (run by Charles Knaack; see below), many of our strengths come from comparisons of the data common to the two methods.

Peter provided $100,000 in funding for the first electron microprobe analyzer, a Cameca Camebax, in the Geology Dept at WSU in 1981, using money from the Rockwell contract. Energy dispersive capabilities were added using money from an agriculture faculty member who was studying the effects of Mt. St Helens ash on crops in eastern Washington. Peter had earlier hired Scotty Cornelius (now retired) to set up and run a thin section lab (Peter's students always examined a lot of thinly ground sections of rock with polarizing microscopes). Peter turned over operation of the microprobe to faculty member Nick Foit and Scotty, and Scotty ran the probe for 25 years, only stepping down after he had helped install and operate the new JEOL Hyperprobe that replaced the older Cameca.

In 1986 Peter headed the group that obtained the high precision Siemens D-500 X-ray diffractometer that we still operate these many years later. The same large grant (a combination of NSF, Murdock Foundation, and WSU money) also brought us our first ICP-MS instrument (and the Rigaku noted above), and the hiring of Charles Knaack, who still operates our now third generation ICP-MS instrument. When Peter retired in 2000, John Wolff stepped into his directorship and quickly added two additional ICP-MS instruments (a high precision ICP-MS and a multi-collector), a laser ablation sampler, and a micro-mill for isotopic and micro-analytic work. The reputation of the lab established under Peter's leadership was a key factor in acquiring these additional instruments.

In summary, Peter's strategy for obtaining rapid high quality analyses of thousands of rock samples using XRF and ICP-MS methods was just what was needed to study the geology of the Pacific NW and elsewhere both then and now. He strongly emphasized the need for good analytical data to be closely tied to solid fieldwork. He was keenly interested in petrology and realized the necessity of using the electron microprobe to analyze minerals and glasses within rocks to acquire data vital to any petrologic interpretation.

Career at Washington State University

As noted above, Peter came on a Fulbright Scholarship to WSU during 1968 from the University of Swansea. He was intrigued by the vast pile of Columbia River basalt (CRB), which was largely unknown. He realized that his XRF capability could be put to good use to rapidly characterize individual flows and

formations within the basalt pile, and he started a research campaign with Phil Rosenberg, now emeritus professor. The department had struggled during the late 1960s, especially in 1967 when many of the graduate students left in the midst of a semester and the dean took over the chairmanship of the department. Peter was well liked by his new colleagues, and they offered him the post of departmental chair. He accepted the offer and he and Caroline came to Pullman in 1971. Peter served as chair until 1976, calming the rough waters that the department had encountered. The department changed dramatically during Peter's tenure, as several members of the faculty retired. The atmosphere improved greatly also due to Peter's diplomacy, and he passed on the chair position to Frank Scott.

Upon arrival at WSU Peter immediately began working on the stratigraphy and petrology of the CRB with the aid of a successful NSF grant. The vast majority of his first graduate students (listed below) were involved in that project and in the development of the XRF analytical capabilities. Many of these students were part of the early "Basalt Research Group" that heavily utilized the XRF. The first two graduate student members were Wally Kleck and Greg Holden, who both helped set up some of the basic lab equipment. Other members of that group included Barbara Siems and Jeff Brown, both of whom were advised by James Crosby at the Water Resources Center. The first CRB work by Peter and his students was focused on the Snake and Salmon River canyons that offered excellent exposures and complete sections of the basalt pile. The early micro-analytical work was done with the electron microprobe run by Charlie Knowles at the University of Idaho. The Water Resources Center group worked on drill cores, chiefly from municipal water wells, from across eastern Washington.

Early CRB and XRF grad students chaired by Peter:
Gregory Holden, MS, 1974 (retired faculty from Colorado School of Mines)
Karen Summers, MS, 1975
Wallace Kleck, PhD, 1976 (long career teaching at CA community colleges)
Vic Camp, PhD, 1976 (instructor at San Diego State University)
Terry Lee Taylor, MS, 1976
Catherine Sundstrom Bard, MS, 1977
Steve Reidel, PhD, 1978 (retired from Battelle to WSU Tri-Cities)
Michael Shubat, MS, 1979

The work of Peter and his graduate students led to the publication of many of the now classic papers dealing with CRB stratigraphy and petrology (see references below). Peter also applied his interest in structural geology from his earlier work in Norway to the young structures and tectonics that have developed

since the CRBs were emplaced. And he pursued the use of paleomagnetic signatures as a means of further understanding the basalt stratigraphy and age, as well as the post-emplacement structural deformation. Peter bought a diamond drilling kit for collecting paleomagnetic cores and many of his students will well remember being flogged from outcrop to outcrop from literally sunrise to sunset! The number of CRB theses declined during the 80s and 90s as Peter developed interests in the geology of NE Washington and other flood basalt provinces around the world. But several students listed below continued to pursue CRB or CRB-related projects with Peter's help. In the 80s and 90s Peter worked in collaboration with personnel from the US Geological Survey, especially Don Swanson and Jim Evans, and also with support from the State of Washington Department of Natural Resources. The focus of the detailed work shifted to NE Oregon and SE Washington, and reconnaissance maps of the entire Columbia Plateau were put together. Much of that work was summarized in the well known GSA Special Paper published in 1989. A 20 years on summary of research on the CRB has been recently published, edited again by Peter's former student Steve Reidel. Peter also developed collaborations with Chris Hawkesworth, then at Open University in the UK, Gordon Goles at the University of Oregon, and Bob Duncan at Oregon State University (OSU). Peter arranged trades of analytical data in those days, students who needed age dates could trade XRF and/or ICP-MS work at WSU for radiometric age dates with students at OSU who needed such data. And students who required isotopic data could trade with Richard Lambert's students at the University of Alberta, or visit the lab there to do the measurements themselves.

Bart Martin, MS, 1984 (faculty at Ohio Wesleyan University)
Michael Bailey, MS, 1986
Michael Bailey, PhD, 1988 (US Corps of Engineers)
Steve Kuehn, MS, 1995 (research faculty, Concord University)
Stan Sobczyk, PhD, 1994 (Environmental Restoration, Nez Perce tribe)
Benjamin Binger, MS, 1997
Two students from those years who never finished theses but contributed solid work should also be mentioned: Beth Gillespie and Bea Johnston.

Peter's interest in other flood basalt provinces led to several trips to India and South Africa to study the Deccan and Karroo basalts. The work in India was done in collaboration with two colleagues in England, Nick Walsh and Bob Beckinsale, and several colleagues in India, especially KV Subbarao. The work in southern Africa was supported by two colleagues, Andy Duncan and Goonie Marsh, at universities in South Africa. Peter was concerned with the education of under-represented students in South African universities, so he regularly donated

scholarship funds for that purpose. Two students at WSU completed dissertations based upon their work with Peter:

John Beane, PhD, 1988 (Deccan) (Maine Dept of Environmental Protection)
Jakub Rehacek, PhD, 1995 (Karroo)

John Beane's paper on the Deccan is probably one of the most cited in the Deccan literature because it deals with the basic stratigraphy so well exposed in the Western Ghats of India. Peter and Jakub Rehacek's work on the Karroo is also widely cited. Peter's international renown led to his being asked to write the chapter on flood basalt volcanism for the Encyclopedia of Volcanoes. He also took the lead in the debate over plume versus non-plume origins for flood basalt provinces, arguing strongly in favor of the mantle plume hypothesis.

Peter's other interests were many, and he advised many graduate students who did diverse projects. The common theme of these theses was that they required considerable field and analytical work, the two components that Peter believed to be fundamental to geologic research. Peter, in conjunction with John Watkinson, our structural geologist, and David Gaylord, our sedimentologist, developed a long-standing interest in the complex geology of NE Washington. That interest was deepened by the work of the following graduate students chaired by Peter:

Donatus Orazulike, PhD, 1982 (faculty in his home country of Nigeria)
Diane Carlson, PhD, 1984 (retired faculty from Cal State Sacramento)
Grace McCarley Holder, MS, 1985
Wade Holder, PhD, 1986
Grace McCarley Holder, PhD, 1990 (Great Basin Unified Air Pollution Control District)
Charles Knaack, MS, 1991 (ICP-MS supervisor, Peter Hooper Geoanalytical Lab)
Laureen Wagoner, MS, 1992 (XRF technician, Peter Hooper Geoanalytical Lab)
George Morris, PhD, 1996 (Swedish Geological Survey)

This work led to the publication of several papers (including several by Grace and Wade Holder) dealing with fundamental aspects of the Cretaceous and Eocene geology of NE Washington.

Peter also developed an interest in the geology of accreted terrane rocks, probably because they underlie much of the CRB and could serve as the potential

contaminants of the CRB magmas. That work was done in NE Oregon and included the following graduate students:

Greg Caffrey, MS, 1982
James Scrivner, MS, 1983
Michael Houseman, MS, 1983
John Beane, MS, 1984

Peter was also interested in the Cenozoic volcanic rocks of NE Oregon that both preceded and post-dated the CRB eruptions. Several graduate students working on these rocks completed degrees under his supervision:

John Reef, MS, 1983
David Bailey, PhD, 1990 (faculty at Hamilton College)
Sandra Lillegren, MS, 1992 (Environmental Restoration, Nez Perce tribe)
Kevin Urbanczyk, PhD, 1994 (chair in Geology at Sul Ross State University)

Peter also sponsored several students who brought their own ideas for projects with them. Those students did projects from the Cascade Range of Washington and Oregon to Nevada and elsewhere and include:

George LeBret, MS, 1976
George Nieman, MS, 1980
Vic Swan, PhD, 1980 (worked in IT at WSU for many years)
Richard Conrey, PhD, 1991 (former XRF lab supervisor at the Peter Hooper Geoanalytical Lab)

All told Peter served as graduate committee chair to 16 PhD and 20 Masters students. He was a very versatile, understanding and demanding advisor! If the students needed pushing he provided the push, but if they were doing well on their own he allowed them to pursue their interests at their own pace. No matter how hard he was on the students he always seemed to have their best interests at heart; he realized much better than they the importance of just getting started with the writing and pushing it through to completion. Nine of Peter's students continued on with academic careers in teaching and research, and three former students currently or recently helped operate the laboratory he founded.

The retirement years in England

Peter and Caroline retired to England, to a house they had built on the river Thames at Whitchurch. Peter enjoyed gardening in the local allotment, collecting maps, playing real tennis (the original game), and rowing a restored classic Thames skiff. He became Professor Emeritus at WSU and worked on several papers chiefly dealing with his long-standing interests in the CRB and the Deccan and other flood basalt provinces. He kept in touch with many colleagues around the world and was a Visiting Research Professor at the nearby Open University. He always was interested in how the GeoAnalytical Lab was faring and the new analytical methods. His death in 2012 was sudden and unexpected, and he will be sorely missed.

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