Canadian Legends Series/Les Légendes Canadiennes

Series Introduction/ Introduction de la série

The CGS Heritage Committee, in conjunction with the CGS Education Committee, is starting a 'Canadian Legends Series' aimed at documenting wisdom gained by distinguished Canadian geotechnical professionals; both from their lives and their professional careers. The profiles in this series will be posted in the CGS Virtual Archives available at *http://www.cgs.ca/virtual_archives_legends.php* and, from time to time, will be published in Geotechnical News. It is hoped that the series will provide students and young professionals an opportunity to learn from some of the best minds in our field.

Profiles for Evert Hoek, Suzanne Lacasse and Norbert Morgenstern, obtained as a courtesy from the American Society of Civil Engineers' Geo-Institute's GeoStrata editors, have already been uploaded. In this issue of Geotechnical News, we are pleased to present the fourth profile, the first co-authored by an undergraduate student and her faculty advisor.

Le Comité sur le Patrimoine de la SCG, en partenariat avec le Comité sur l'éducation, débute une série d'articles intitulés «Les Légendes canadiennes» visant à documenter la sagesse acquise par des spécialistes canadiens de renom dans le domaine de la géotechnique à travers leur parcours personnel et professionnel. Les profils dressés dans le cadre de cette série seront disponibles dans les Archives virtuelles de la SCG à l'adresse suivante: *http://www.cgs.ca/virtual_archives_legends.php*. Ils seront également publiés occasionnellement dans Geotechnical News dans l'espoir d'inspirer les étudiants et les jeunes professionnels et de leur fournir une opportunité d'apprendre de certains des plus brillants esprits de l'industrie.

Les profils des Evert Hoek, Suzanne Lacasse et Norbert Morgenstern, offerts gracieusement par les éditeurs de GeoStrata, affilié au Geo-Institute de l'American Society of Civil Engineers, sont déjà disponibles en ligne. Dans la présente édition de Geotechnical News, nous sommes fiers de présenter un quatrième profil, préparé par une étudiante au baccalauréat et d'un membre de sa faculté d'ingénierie.

Interview with Canadian Legend: David M. Cruden, PhD, FEIC

This interview for the Canadian Legends Series (CLS) was conducted by Yiwen Zhang, Undergraduate Student, and Lijun Deng, Assistant Professor, Department of Civil & Environmental Engineering, University of Alberta. Lijun Deng is also a member of the CGS Heritage Committee.

For more than 30 years at the University of Alberta, David M. Cruden, Emeritus Professor of Civil & Environmental Engineering and of Earth & Atmospheric Sciences, taught and researched Engineering Geology and Terrain Analysis. Among other awards, David Cruden has been the recipient of the Legget Medal of the Canadian Geotechnical Society; the Varnes Medal of the International Consortium on Landslides; the Schuster Medal of the Canadian Geotechnical Society and Association of Engineering Geologists; and the Julian Smith Medal of the Engineering Institute of Canada.

David Cruden's former students remember him fondly as someone passionate about Engineering Geology, who was in his element during field trips and enjoyed quoting seemingly obscure scientists and philosophers.

Yiwen Zhang and Lijun Deng for the CLS: Could you tell us a little bit about your background?

David Cruden: I was born in Edmonton, not the city in Alberta but an area of north London, UK, and I've always been a big fan of the Tottenham Hotspur Football Club, the local club in the English Premier League.

After a degree in Geology from Oxford University, I moved to Canada. My family has a history of emigration to Canada, so it was not unusual for me to come to the University of Alberta for my Master's in Structural Geology. I then returned to England for my PhD in Rock Mechanics at Imperial College, University of London. After my PhD, I returned to Canada and did a postdoctoral fellowship at the Mining Research Labs at Elliot Lake, a uranium mining town about a 150 kilometres west of Sudbury, Ontario.

CLS: How did you decide to study Geology and when did you know you wanted to be an Engineering Geologist?

DMC: My parents are Scottish, one from Cruden Bay (north of Aberdeen) and one from the Highlands. Many of my holidays as a teenager were spent walking the hills of Scotland. Some founders of British geology, for example James Hutton, Charles Lyell, and Archibald Geikie (my favorite

Scottish Geologist), shaped the heroic age of British geology. Geology was very much a Scottish pursuit and so I decided to be a Geologist too. Walking around the British countryside appealed to me.

After my first degree and with my additional training in statistics during the first year of my PhD research, I realized that what I was doing was Engineering Geology. My research was associated with an inter-departmental rock mechanics project. Until then I considered myself a Structural Geologist.

CLS: What have been your research interests and have they changed over time?

DMC: In the late 1960s and early 1970s at Elliot Lake, I was interested in the deformation properties of rock materials; how a cylinder of rock put in a press under constant stress would deform—a creep test. We thought then that creep had three phases: a decelerating rate, a constant rate or steady-state, and an accelerating rate –the phase before failure. I discovered that there are only two phases of creep: decelerating and accelerating. This discovery was important at the time for underground nuclear waste disposal which requires caverns in a rock mass to last for thousands of years, not the usual design life for mines. If there was steady-state creep it would become very difficult to maintain a rock cavern for a very long period of time.

When I joined the faculty of the University of Alberta in 1971, the Federal government was funding a cooperative government / university / industry Pit Slope Research Program to help develop techniques for designing stable slopes in large open-pit mines. One task of the research was to investigate previous failures. John Krahn, a graduate student at the time, and I went to the Frank Slide, the 1903 rock slide over a coal mine in the Crowsnest Pass in southern Alberta. One question we had was how had mining within the toe of the slope influenced the stability? We were fascinated.

Presently, I am interested in the ground hazards affecting Canadian railways. From a risk management point of view, it is important to have access to a long history of hazards and descriptions of how they have been managed. However, over the course of my career, I have researched a variety of topics in Engineering Geology and Rock Mechanics, especially those related to landslides.

CLS: Has there been one project that you found particularly interesting?

David M. Cruden.

DMC: I have found all of my research projects interesting, however, one project stands out. In the early 1990s, the international landslide community began a worldwide project associated with UNESCO's International Decade for Natural Disaster Reduction. During the decade, that community formed a "Working Party on World Landslide Inventory". We asked the questions: how many landslides were there in the world, and how should we count them. I chaired a group of 52 Working Party members, from 33 countries. We put together publications on defining a landslide and naming its parts, and a number of publications on suggested methods for describing landslide activity, rate of movement, causes and remedial measures. We also produced the Multilingual Landslide Glossary of the terms we had defined to describe landslides.

CLS: You are well known for your landslide research. What are the biggest challenges in this field?

DMC: Landslide research is still young. Kinematics is one of the most difficult challenges. We have few observations of landslides moving rapidly, and it's difficult to carry out mechanical analysis without knowledge of the kinematics. Did the landslide move as one body, two bodies, or many bodies? Until you answer that question, your analysis may not be very useful or helpful. We need to have more observations from displacing masses to correctly model the mechanics.

CLS: How do you think Engineering Geology has evolved during the course of your career?

DMC: It really has changed an enormous amount since I started my career. As examples, when we resumed monitoring the Frank Slide in the 1970s, we used to have to climb Turtle Mountain to make observations and take measurements. Now there are sensors installed that can be queried over the internet, and as many observations as you need can be obtained without sweating. Or you can fly your drone over an area of interest—no need to walk there to see what is going on. We are replacing field observations with instruments and the data stream has become much larger and broader. We now have more data, which means better opportunities for better diagnoses and better outcomes.

What has not changed is the natural world's ability to surprise us. Kimberlites in Alberta? Late Cretaceous bentonite seams having local sources? Oil sand tailings containing swelling clays? These are "Black Swans", in Nassim Taleb's terminology, predictably unpredicted. We must learn to expect them.

CLS: What is the biggest shortcoming in Engineering Geology?

DMC: Let me start with an analogy. When there is an unexplained death, a post-mortem is legally required to find out the cause of death. So every time somebody dies, it's a learning opportunity for the medical profession. When we have large ground movements, we should carry out careful post-mortems, such as was conducted for the Mount Polley incident in central British Columbia in 2014. After the Frank Slide in 1903, two geologists from the Geological Survey of Canada were sent to investigate the site under instructions from the Canadian Department of Mines. Their report is still interesting and valuable.

CLS: How important do you think it is to have a graduate degree in the geotechnical field?

DMC: A successful professional career is quite possible without a graduate degree. The success depends on the professional's career path, projects the professional gets involved with, and the level and quality of supervision and mentorship the professional receives. Of those who do graduate studies, some carry straight on from their undergraduate to their graduate studies, such as myself, and others pursue graduate studies after working for a while.

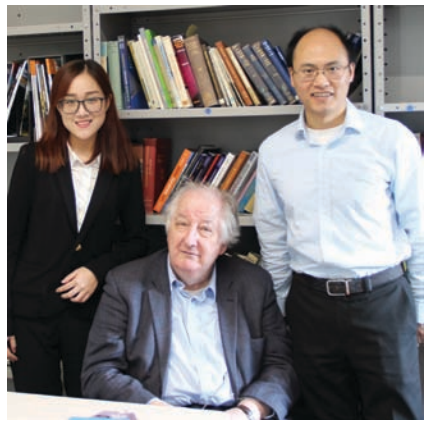
CLS: Closer to home, what do you think has been the most significant accomplishment of the UofA Geotechnical Group over the past few decades?

DMC: I'm sure each member of the Geotechnical Group would have a different answer. However, one accomplishment that I think unites us all is the training of many geotechnical professionals that have gone on to very successful careers in industry, academia and government, both in Canada and around the world. Many have become leaders in their fields.

CLS: Do you have any advice for young professionals?

DMC: Karl Popper's advice from his book Science: Conjectures and Refutations, was "Learn what people are discussing nowadays in science. Find out where difficulties arise, and take an interest in disagreements. These are the questions you should take up." This advice directed my early work and it still seems relevant today. Geotechnical professionals can find discussions in and around our technical societies. They should join those societies and join in the discussions.

The natural world is an important participant in discussions about ground movements. I've tried, with mixed success, to avoid commenting on a site that I haven't seen. If your opinion of a site is sought, ask to visit it. From the answer you get, at the least, you'll find out something about how your opinion will be valued.



Left to right: Yiwen Zhang, David Cruden and Lijun Deng.

CLS: David, thank you for your time and your insights.

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Women in Canadian Geotechnique Part 3 of 3

Andrea Lougheed

This is a contribution from the CGS Heritage Committee. Andrea Lougheed (BGC Engineering Inc.) is a member of this committee and its Task Force on Women in Canadian Geotechnique.

Introduction to Part 3 of the Series

Twelve 'Women in Canadian Geotechnique' were featured during the 71st Canadian Geotechnical Conference in Edmonton (GeoEdmonton 2018) where posters detailing their careers were displayed and a portion of the Heritage Luncheon was devoted to them. Parts 1 and 2 of this series were published in the September 2018 and March 2019 issues of Geotechnical News and profiled eight of the women: **Sue Aitken, Gail Atkinson, Anna Lankford Burwash, Heather Cross, Glynnis Horel, Suzanne Lacasse, Gretchen Minning** and **Danielle**