

“Our primary focus is Energy Geoscience”

*An
interview
with
David Eaton*



David Eaton is Head of the Geoscience Department and a Professor of Geophysics at the University of Calgary. He joined the department in 2007, after spending nearly 11 years as a professor at the University of Western Ontario. Dave's industry experience started after a B.Sc. from Queens in 1984, and included Chevron, Home Oil, and Pulsonic before completing a M.Sc. and Ph.D. from the University of Calgary in 1988 and 1991.

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He worked one year in Plano, Texas with Arco Research and Technical Services, and three years with the Continental Geoscience Division of the Geological Survey of Canada, prior to returning to academia at UWO in 1997. His current research focuses on seismicity and structure of the Earth's lithosphere and core, and characterizing microseismic activity associated with carbon capture and storage and / or enhanced hydrocarbon recovery.

Dr. Eaton is an active volunteer, serving on the CSEG 2009 Microseismic Workshop Committee, and he previously initiated CSEG Superfund support for both a book and a K12 outreach project while at UWO. He is a past-president of the Canadian Geophysical Union, an associate editor for the Geological Society of America Bulletin and founding member of POLARIS (Portable Observatories for Lithospheric Analysis and Research Investigating Seismicity). Dave sat down for an interview with Satinder Chopra and Penny Colton in July 2009.

(Photos courtesy: Penny Colton)

S: *Let's begin by asking you about your educational background and experience.*

D: I received my Bachelor's Degree in 1984 from Queen's University. During my program I worked one summer with Chevron Canada Resources. Once I graduated from Queen's I worked in Calgary for a few years with Chevron, where I met my future wife. After a brief hiatus to do some world traveling, I returned to Calgary where I completed a Master's Degree with Fred Cook and went straight into a PhD. under the supervision of Rob Stewart. I completed my PhD in 1991 and was one of the first to graduate from the CREWES Project at the University of Calgary with a PhD.

S: *So, you did your B.Sc. from Queen's University and then came to U of C for your M.Sc. and Ph.D. How did you decide to come to Calgary?*

D: When I started my undergraduate degree at Queen's I wasn't sure exactly what I was going to do. I was interested in physics and chemistry, and I wanted to do some work that involved outdoor activities. I was lured into geophysics with the promise of jobs in Calgary and opportunities for outdoor recreation in the mountains, so I did end up switching majors into geophysics. At the time I started my undergraduate

degree it was well known that there were lots of jobs in geophysics in Calgary, but by the time I finished in 1984 things had changed quite dramatically. Fortunately, I still had a job to come to, giving me a chance to come and live in Calgary and experience the lifestyle here.

S: *You did an integrated geophysical study of Valhalla gneiss complex, SE BC for your M.Sc. thesis and then you worked on seismic migration/inversion for transversely isotropic elastic media for your Ph.D. thesis. Tell us how you developed these interests and how did you decide on taking up these topics.*

D: When I started my Master's program, the Department of Geology and Geophysics at the University of Calgary had just been awarded the Lithoprobe Seismic Processing Facility. Lithoprobe was really taking off as a big national project at this time, so I was very interested in getting involved. I had a chance to work with Dr. Fred Cook, who was a director of the LSPF. Through this, I had a wonderful opportunity to do some work in a beautiful part of British Columbia. I had the chance to go out there and collect rock samples and measure seismic velocities and densities, and work with gravity and magnetic data. Ultimately, I decided that this field was not what I wanted to leave my mark as a researcher. I

wanted to sink my teeth into something that was a little bit more theoretical and at about that time Rob Stewart joined the Department and kicked off the CREWES Project. I decided to join the CREWES and tackle something that I thought would provide a challenging theoretical problem to work on.

S: *Rob was also working at Chevron before he joined the University so you probably knew him from Chevron?*

D: I actually have known Rob in several capacities. In fact, we made a joke out of it when I came back a year and a half ago to be Head of the Department of Geoscience at U of C, because at that time I had known Rob as a colleague at Chevron and as my PhD supervisor at the University of Calgary. I then returned to 'supervise' him as Head of the Department.

S: *David let's ask you about your Chevron and Arco tenure, it was from 84 to 93 and you also pursued your M.Sc. and Ph.D. during this time, which is very creditable. You had a job and you were studying at the same time. Was that the case?*

D: Not exactly. I took several summer jobs during my time as a graduate student. I worked at Home Oil for one summer and I also worked at Pulsonic as a seismic processor, were

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I was trying so save some money for our move to Texas. I had a job offer to work at Arco immediately after I finished my PhD, so my wife and I with our two small children moved to Plano – a suburb of Dallas – and I worked at the Arco Research Centre.

S: *In-between you have also worked at the GSC?*

D: My work at the GSC followed my job as a research geophysicist at Arco in 1992-1993. When I went to Arco, close to a year had elapsed since my interview and things had changed dramatically. In 1991, when I interviewed for the position, the research lab in Plano was riding a high and many people were engaged in what I would label as curiosity-driven research. By the time I got there, corporate restructuring had occurred at the Research Lab. It didn't take me very long to realize that this was not really where I wanted to spend my career, so I ended up returning to Canada. I was offered a position at the Geological Survey of Canada in Ottawa – quite a change going from Texas. I spent three very enjoyable years at the GSC from 1993-1996, working in a research group that was directly involved with Lithoprobe Project. My work brought me back to Alberta quite a bit, because at this time Lithoprobe had an active project called Alberta Basement Transect which directly involved a few dozen oil and gas companies. Through this project, Lithoprobe collected about 2,000 km of seismic data during the

three years that I worked at the GSC. I had technical oversight over most of those contracts as the client representative (aka 'bird dog') for seismic acquisition programs in many parts of Alberta.

S: *Interestingly we interviewed Ron Clowes some time back and his interview is coming in the June'09 issue and now the September issue is going to have yours.*

P: *Ron Clowes gave the CSEG Distinguished Lecture at the CSEG AGM Luncheon in March 2009. Did you hear his talk?*

D: In fact, Ron came up to the University a few days after his CSEG luncheon presentation, so I had a chance to meet with him then.

P: *Ron showed many of those Lithoprobe sections in his Luncheon presentation, one including a couple of slides of the Alberta Transect – the slides are on the CSEG webcasts.*

D: Yes, that's right.

P: *Pretty impressive.*

D: Lithoprobe was an extraordinary project. Other projects of a similar nature have taken place in other countries, but I think that Lithoprobe set a standard that has yet to be surpassed. It was an interesting experience for me, being involved from the Government's side to set up contracts and work with acquisition

companies. During the three years I was involved, technology improvements were really impressive. Thanks to the Canadian seismic industry, the use of state-of-the-art technology was a big part of the reason why Lithoprobe was so successful. By working during summer months, Lithoprobe was also able to take advantage of off-season competitive rates and get more bang for the buck.

P: *Were there other geophysicists at the GSC at the time?*

D: Yes – I worked in the Seismology and Electromagnetism group within the Continental Geoscience Division at the GSC, a group of eight scientists, more or less evenly split between these two fields.

S: *So thereafter you took up teaching at the University?*

D: That's right.

S: *What made you choose teaching as a career?*

D: My father was a Professor of Chemistry at McMaster University, so I suppose that I always had a subconscious drive to be a Professor. So, while I really enjoyed being a research scientist in the Federal Government and met some great people and found the work to be both challenging and stimulating, at some level I wanted to teach as well. When I went to the University of Western Ontario in 1997, I truly wasn't out looking for a position

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anywhere – but a friend of mine from overseas e-mailed me and brought the advertised position to my attention. So, I threw my hat in the ring and ended up being offered a position there, in London, Ontario.

S: *When you look back on your career so far, what do you think have been some of the successful landmarks for you?*

D: Well, I guess looking back on my career I would have to attribute quite a bit of my academic success to a project in Canada, which is somewhat similar to Lithoprobe, called POLARIS. Like Lithoprobe, POLARIS is also a national project involving six Canadian Universities and several Government Agencies as well as support from a variety of different companies. POLARIS has installed about one hundred satellite telemetered broadband seismic stations across Canada. In terms of both exposure to the technology and the opportunity to supervise students this has been a great experience. POLARIS has brought me to the main area of research that I do right now, which is more related to earthquake seismology than things I was working on through my PhD. and after that.

S: *David tell us some of the memorable moments in your professional life and also a success story that you might share with us if the two are different.*

D: There are a lot of memorable moments, many of them centered around fieldwork or conferences, because those are always opportunities where I re-connect with people. In one of these instances, I was at the American Geophysical Union conference in San Francisco. At this time I was on a search committee at the University of Western Ontario for a new position there and so I was just checking to make sure that the job posting was up on an academic job posting board. I happened to notice that the University of Calgary was advertising for a Department Head and so jokingly I mentioned to my wife on the phone that night – you are

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not going to believe this but Calgary is looking for a new Department Head. Since my wife had long wished to return to Calgary to be closer to her family, that turned out to be one of those moments that changed my life.

S: *David, you have been here for more than one and a half years or two years now?*

D: Coming up on two years. I arrived in October 2007, so it will be two years this October.

S: *Tell us about the Department of Geoscience at the U of C, what programs that are offered now in terms of the type of research being carried out, what sets it apart from other Universities and what is it that attracts students to come to the University of Calgary and things like that.*

D: Since I joined the Department we've adopted a mission statement that defines us as a department that specializes in Energy Geoscience, using that term in a very broad sense. Of course it encompasses oil and gas exploration, but the intent is to encompass other aspects of Energy Geoscience as well, such as Uranium and unconventional gas. For example, we recently appointed a new Chair in unconventional gas. Another of the real strengths of the Department is Exploration Geophysics. Groups like the CREWES Project which have attained world class status. There are also outstanding researchers in various aspects of Environmental Geochemistry, near-surface geophysics, basin studies and paleontology. I could go on and on, but in various different ways all of these different areas of research contribute to this overall thrust.

One aspect of our Department which is distinct is that we are by far the largest in Canada, measured by student enrolment. The Department has grown dramatically in the last four or five years and now we train about 15% of all the geoscientists in Canada at both the Undergraduate and the Graduate level. Currently,

there are about 480 Undergraduate students and 170 Graduate students in Geoscience programs.

The Department has added twelve new faculty members in the last few years to try to accommodate this growth. As a result, there are a lot of new faces, together with a lot of energy and dynamism, which is a wonderful environment to work in. Our growth has come with a number of challenges that put strains in the system, such as finding lecture rooms that are big enough and the extra workload for all staff. Overall, we are extremely happy and proud of the growth that's happened there and we are trying to accommodate all of the challenges that come along with it.

The reason that the University has done so well in student enrolment numbers clearly has a lot to do with the oil industry. Over the past few years, there has been considerable growth in employment here, and that's attracted people. I believe that the Department has tried to become more in tune with the industry. That philosophy has really paid dividends.

Calgary is also blessed with being very close to the mountains and having lots of opportunities for doing fieldwork in glorious locations. We also have strategic ties with organizations like the Geological Survey of Canada. So there are quite a number of reasons why Calgary is so well suited to Geoscience within the University. The Department actually features quite prominently, even in things like the University's Strategic plan. You don't find that in many Universities – in most places Geology and Geophysics are obscure disciplines, whereas at the University of Calgary they are actually very prominent.

S: *What are any special goals or challenges in your position as the Head of the Geoscience Department?*

D: As Head of the Department, I would like to develop further involvement with the CSEG. The University is constructing a Down-Town Campus which will be located about two blocks from the CSEG office. The Department has proposed to offer a



variety of professional development training at the Down-Town Campus. We are currently in the process of developing plans to offer Graduate level courses there in a modular format. I would like to work with the CSEG and the CSPG to see how it might be possible to integrate these plans with professional training efforts that those societies have.

P: *I remember that in the 80s and 90s some of the University of Calgary graduate level courses were offered in the evening and taken by a fair amount of industry participation. Is that currently in practice or an option for the Down-Town Campus?*

D: What we would like to do is to make it straight forward and easy for people who are working down-town to attend graduate level courses at the University. We hope to package it in such a way that you don't have to be registered as a grad student to take these short course modules. That's where I think that working with CSEG and CSPG would work really well. Until very recently, the Geoscience Professional Development Centre offered this type of training on campus, with partial support from the CSEG. We are essentially planning to move that function to the Down-Town Campus.

P: I took perhaps four of those grad courses over the years. An APEGGA member could enroll as an unclassified student and take graduate courses for credit without submitting transcripts; that was an Alberta type, geoscience solution for professional development.

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- D: A big factor in our plans is to make the courses that we offer fit nicely into APEGGA guidelines.
- S: *Okay, coming back to the challenges that you mentioned, would there be anything else that you would like to add to that? I think you had addressed part of it?*
- D: My impression is that decades ago, being a Head of a Department was kind of a part-time activity. The administrative challenges and logistics seemed to have really grown, so it is a very challenging position to run a large, diverse department and maneuver it through all the different changes that take place at the University as well as within the community. I am still teaching and doing research, so in a sense I have three jobs.
- P: *What role has the CSEG played in your career accomplishments? I recall CSEG funding a book and geophone setups in schools? I can't remember all the details – perhaps you can tell that story.*
- D: When I was at the University of Western Ontario I applied twice for funding from the CSEG Superfund. I received funding for a project called SHAKE, which stands for Students Having Awareness and Knowledge of Earthquakes. Through that project we installed a simple seismometer at five High Schools in the area around London. We used instruments manufactured by a company in California, called Personal Seismographs, which connect to a PC using a serial cable. The accompanying software reproduces what you might see if you are looking at an earthquake drum recorder. The setup provides a great interactive educational tool for young school groups. By projecting the monitor output and asking all of the students to jump, they can make their own earthquake. These units are sold in California and allow members of the public to monitor local earthquake activity from their basement.
- I also got funding from the CSEG Superfund for a book which we published through the SEG.
- S: *That was a book on hard rock seismic exploration...?*
- D: Yes it's called Hard Rock Seismic Exploration. The book is a compilation of a number of different studies, many of which I was involved with when I was at the Geological Survey of Canada. The published studies are all aimed at trying to adapt seismic methods to mineral exploration problems. I was very grateful to the CSEG for providing the seed money that allowed the project to take place.

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I am also involved with the CSEG right now because I am on the Organizing Committee for a Workshop on microseismic methods.

S: *David, tell us about the different types of problems in Geophysics that you have worked on, briefly, and what areas of Geophysics interests you most and why.*

D: I enjoy doing work in the field and that's been a feature of a lot of my research throughout my career, whether it's staying involved in Lithoprobe Vibroseis surveys or setting up my own stations to record teleseismic earthquakes. I also like to write my own computer code so I do a lot of work in trying to adapt and improve algorithms.

I am currently in the process of implementing a large project funded by the province and the Canada Foundation for Innovation. I am installing nine broadband seismic stations around Alberta, which we'll be connecting to the Internet and using to record local microearthquakes as well as to explore deep in the earth using teleseismic observations. Coupled with that, I am engaged in some new work on microseismic. Today, in fact, I am purchasing a micro seismic data acquisition system which includes a borehole and surface geophone arrays. This system will be the first of its kind at a Canadian University so it will allow me to participate in microseismic monitoring studies. I hope that this will give me the chance to apply skills

that I developed in looking at earthquake related studies to new problems at the reservoir scale.

S: *Very interesting. I noticed that you have an impressive list of publications, quite an elaborate set and I notice that you are teaching and your focus is more on, as you mentioned, global or applied or theoretical seismology, is that right?*

D: Yes, that's correct.

S: *Doing earthquakes and continental dynamics and so on? I think we know research at the U of C has focused more on problems of an applied nature, i.e. focusing more on oil and gas exploration. So I am wondering; if you could give us an idea about the direction in which research is going to go under your leadership?*

D: I will talk first about my vision for the Department and research directions for the Department.

I already mentioned that we are rallying under the umbrella of Energy Geoscience in various different facets. Some new specific areas where the Department would like to develop research strength are in carbon capture and storage and in Arctic Geoscience. I see those as two areas where there are tremendous opportunities. I think both of these areas will allow us to continue to work very closely with industry and societies like the CSEG as well as open up opportunities for doing more fundamental research. For my own research, I am working to develop a very vigorous component of microseismic monitoring since this dovetails very well with my other interests and earthquake seismology. One of the things I hope to achieve as Department Head is to invigorate research productivity as it is measured in the academic world. The old adage of 'publish or perish' is still very much a factor in Academia right now. A challenge for an academic department, especially one with big applied science profile, is to keep teaching and research activities relevant and applied, but still be in a position to demonstrate productivity

in terms of peer-reviewed publications. I am trying to ensure that it happens in our Department.

S: *What is your impression about the important developments that people can expect in Geosciences, something like the 3D adoption in the 1980s is now routine?*

D: Well, I think anyone's crystal ball, looking at the future, is always a bit cloudy. One lesson that I have learned in my career is that Geosciences are important across very broad range of applications. I think that application of Geoscience to environmental problems and resource exploration will continue to see growth. For example, as oil and gas resources become more scarce and more valuable as time goes on and it is not getting any easier to find – so technology is going to have to keep up. I think a University Department has to stay abreast of the latest technology such as time-lapse, 4D, seismology applied for reservoir studies as well as carbon capture and storage. Marine applications of geophysics will grow, with more work using ocean-bottom cables and recording in marine environments. Seismic anisotropy remains an area which is still not entirely understood, and there is a huge scope for doing more work. Generally speaking, however, I think more and more it is important to work with other disciplines. Geophysicists will need to work with reservoir engineers, geologists and graduates from the business school, economics, etc. We are trying to open our minds and create programs that will give those kinds of multidisciplinary opportunities to students.

S: *David I noticed that you have been quite active in publishing as I mentioned in the previous question also. Apart from the journal publication and the presentations that you made at the conventions or professional meetings you published a couple of books also?*

D: No, just one.

S: *I was going to ask you for the benefit of our readers, tell us about*

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your approach towards all this – publishing and books and all that.

D: I tell my students and that at the end of one's academic career, your legacy really is your publications. Publishing one's work is truly an integral part of scientific research, which is not complete until it is exposed to scrutiny by scientific peers and placed in a format where it is accessible to other people and other groups. I place a lot of value on dissemination of scientific results in a high-impact venue. Publishing in an industry-friendly format, like the RECORDER, or the Leading Edge, makes it more accessible to people in the industry, whereas other journals such as Geophysics may have a bit more academic impact. Books end up in libraries and arguably have a longer shelf life.

I have a presentation that I occasionally give to my group at the University called "How to Publish a Paper". When I was invited to China in 2005 to visit Jihlin University, I discovered after I got there that in exchange for funding my trip they expected me to give a whole series of seminars which I hadn't prepared. I ended up presenting whatever I had on my computer and most of them were greeted with polite sort of sleepy response. When I presented –"How to Publish a Scientific Paper" it attracted hundreds of people from across campus and it was a huge success at the University that I was visiting. So I think people want to know about that.

S: *As you mentioned, you worked in industry, you worked at the GSC, now you are teaching. What has been your own philosophy for career growth, and what personal and professional goals are you working towards now?*

D: I guess my philosophy has really been to try to pursue my passion and my interests. That has taken me to different places and slightly different career paths, but I have been in Academia now for about a dozen years, so that's where I am now and where I will continue.

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I am looking forward once my term, as Department Head is finished to really getting back to research. I've got a lot of new ideas that I'd like to pursue. I feel that I've got a really strong and active group and I found it very exciting and stimulating to see opportunities to interact with industry.

S: *So these are your aspirations for the future?*

D: Yes.

S: *Good, we'll go on to the next question. I would like to ask you about your impression of the current state of research in the Canadian Universities in general and then with the respect to Geosciences in particular. So you might like to include in terms of the funding that is required, the problem for research, or dearth or abundance of students and things like that.*

D: Well I think that on the whole Canadian Universities are doing

reasonably well. I think they are going through a period of transition right now, since many Canadian Universities experienced a lot of growth in the late 60s and early 1970s. The resulting demographics mean that there is a lot of retirement happening at Universities, leading to a healthy period of reinvention. Universities are also increasingly expected to demonstrate their relevance to society, so one of my philosophies as a scientist is that it's very important to expose scientific work to the public, not only through peer reviewed publications but also through media interviews. I believe that scientists have an obligation to inform the public about what it is we are doing and why it is important and relevant, since ultimately Universities and Government Laboratories are funded by the taxpayer. To some extent, the Geosciences at Canadian Universities are struggling right now. I think there is a declining interest in our society in physical science and I think that's unfortunate. There is a misperception by High School students about what careers are out there and what it's really all about to be a scientist.

S: *The Outreach Program of CSEG aims towards increasing that awareness amongst students.*

Let's talk to you about some of the new technology ideas that you are experiencing, you have mentioned microseismic applications in one of the questions, would you like to share something more about that?

D: The lines are being blurred between different disciplines and I think Universities are going to have to keep up with those changes and adapt. We need to look for ways to bring Geology and Geophysics closer together. I think students who are able to master both are at a distinct advantage. I think that, in some cases, students of Geology may require a bit

more exposure to mathematically based work. For students of Geophysics it's very important to better understand geological processes.

S: *David let me ask you about your other interests apart from the science that you practice all the time. What other interests do you have? Cycling I know for sure.*

D: I guess fitness in general. I like to do all kinds of outdoor activities, so cycling and running – when my knee is behaving itself – hiking in the mountains, camping, canoeing, those sorts of activities are all passions of mine.

S: *Finally I would like to ask you about your message for young entrants to Geosciences. What are the most rewarding aspects of taking up a career in Geoscience?*

D: Geoscience has a tremendous amount to offer to students. For one, it can provide opportunities to apply knowledge of other fields like Physics and Biology. As a science, it is easy to grasp the relevance and the applications of Geoscience, and I think that's what makes it exciting. It also is a scientific discipline that offers tremendous opportunities for students to travel to exotic locations, both for fieldwork and collaboration with colleagues. Geoscience remains an exciting and appealing discipline for students to take. I embrace and encourage every opportunity we have to develop interactions with industry but I like to communicate the message that that's not all that we do. For example, there are tremendous opportunities for fundamental advances in Arctic and environmental applications.

S: *Was there any question that you expected me to ask and I didn't touch upon it?*

D: I can't think of anything else myself.

S: *Thank you very much for giving us this time for sitting and chatting with us; it has been a great pleasure.*

D: Well, it's my pleasure. **R**