VANCOUVER2012
4IPGC

GEOSCIENTISTS CANADA
GÉOSCIENTIFIQUES CANADA

4th International Professional Geology Conference

Delegate Program & Abstracts Volume

Earth Science – Global Practice

January 22-24, 2012

Vancouver, British Columbia, Canada

Renaissance Vancouver Harbourside Hotel

(Coinciding with AME BC's Mineral Exploration Roundup 2012)

Co-conveners

WWW.4IPGC.CA

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WELCOME AND ACKNOWLEDGEMENTS

On behalf of Geoscientists Canada, its member associations, our co-conveners, our sponsors and the several 4IPGC committees that contributed to the organization of this conference, I am pleased to welcome you to the 4th International Professional Geology Conference (4IPGC).

Professional Geoscientists form an international community that works to enhance life and contribute to each nation's economic resources, environment, health and protection of the public. The many roles and international demands on today's geoscientists led to the theme of this conference: Earth Science – Global Practice. We have attracted an exciting collection of talks over a broad range of topics that will be discussed during a half day Plenary Session and two days of Theme Sessions.

I firstly want to acknowledge and thank the Association of Mineral Exploration of British Columbia (AME BC) for our special arrangement enabling 4IPGC delegates to register and attend AME BC's Exploration Roundup conference, occurring at this time.

The organizers of 4IPGC hope to follow in the tradition of excellence set by the previous three meetings in: Alicante, Spain in 2000; London, England in 2004; and Flagstaff, USA in 2008. We have selected an outstanding geological location to present this event with expanded international participation and many complementary venues for you to experience.

Much effort has gone into preparing this conference. I especially want to thank: Geoscientists Canada past president James Moors Vice-Chair of the Organization Committee and Chair of the Sponsorship Committee; Oliver Bonham, CEO Geoscientists Canada; Peter Friz, Chair of the Technical Program Committee; Rakesh Kumar, staff and management of the Association of Professional Engineers and Geoscientists British Columbia; all our generous sponsors, our many committee members, and all others who worked so hard to make this happen. In addition, I want to recognize the organizations that are co-hosting 4IPGC: Geoscientists Canada, The American Institute of Professional Geologists (AIPG), The Australian Institute of Geoscientists (AIG), and The European Federation of Geologists (EFG).

We are delighted to have you in Vancouver and hope that this will be a memorable and enjoyable conference.

Bruce E. Broster, Ph.D., P.Geo.
Organizing Chair

MOT DE BIENVENUE ET REMERCIEMENTS

Au nom de Géoscientifiques Canada, ses associations membres, nos coorganisateurs, nos commanditaires et tous les comités de la Conférence 4CIGP qui ont travaillé et travaillent encore à son organisation et préparation, il me fait un immense plaisir de vous souhaiter la bienvenue à la 4ème Conférence internationale de la géologie professionnelle.

Les géoscientifiques professionnels constituent une communauté internationale qui s'est donnée comme mission d'améliorer la qualité de vie et d'aider au développement des ressources économiques, environnementales, de la santé et de la protection des citoyens pour chacune de ses nations. Ce sont les divers rôles que jouent aujourd'hui les géoscientifiques et les demandes internationales auxquelles ils doivent répondre qui nous ont menés au thème de la présente conférence : Sciences de la terre – Exercice à l'échelle mondiale. Nous avons obtenu des contributions fort intéressantes, couvrant une large sélection de sujets, qui seront présentées durant la demi-journée de l'Assemblée plénière et durant les deux jours des séances thématiques.

J'aimerais, tout d'abord, remercier l'Association des prospecteurs de minéraux de la Colombie-Britannique (AMEBC) d'avoir mis de l'avant un accord pour que les délégués de la 4CIGP puissent également s'inscrire et participer au Mineral Exploration Roundup 2012 (Rassemblement 2012 de praticiens de la prospection des minéraux) qui a lieu aux mêmes dates que la Conférence.

Nous, les organisateurs de la 4CIGP espérons bien être à la hauteur de la tradition d'excellence des trois conférences précédentes : celles d'Alicante, en Espagne, en l'an 2000; de Londres, en Angleterre en 2004; et, celle d'Arizona, aux États-Unis en 2008. Nous avons choisi un site géologique exceptionnel pour la tenue de la conférence, nous allons bénéficier d'une plus grande participation internationale et aurons pour vous d'autres sites à découvrir!

Je veux, ici, reconnaître tous les efforts qui ont été mis en œuvre pour préparer cette conférence. Tout spécialement, je veux remercier M. James Moors, président sortant de Géoscientifiques Canada; M. Oliver Bonham, vice-président du Comité d'organisation et président du comité des commandites; Peter Fritz, PDG de Géoscientifiques Canada;

Rakesh Kumar, président du comité des ateliers techniques; les membres du personnel et de l'administration de l'Association des ingénieurs professionnels et géoscientifiques de la Colombie-Britannique; tous nos généreux commanditaires; tous les membres de nos nombreux comités et, enfin, tous ceux et celles qui ont travaillé d'arrache-pied à l'organisation et à la préparation de cette Conférence. Je tiens aussi à remercier les organismes qui collaborent à la tenue de la 4CIGP : Géoscientifiques Canada; l'Institut américain des géoscientifiques professionnels (AIPG); l'Institut australien des géoscientifiques (AIG) et la Fédération européenne des géologues (EFG).

Bienvenue à Vancouver à vous tous ici présents! Nous vous souhaitons un agréable séjour et une conférence inoubliable.

Bien vôtre,

Bruce E. Broster, Ph.D., P.Geo.
Président du Comité d' organisation de la 4CIGP

COMMITTEES

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James Moors	(Vice Chair)	Canarc Resource Corp, Vancouver, BC
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Peter Friz		Hatch Ltd., Vancouver, BC
Kirk Hancock		BC Geological Survey, Victoria, BC
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Ruth Allington	(EFG)	GWP Consultants LLP, United Kingdom
Barbara Murphy	(AIPG)	Clear Creek Associates, Arizona, USA
Nieves Sánchez	(EFG)	Servicios y Estudios para la Navegación Aérea y la Seguridad Aeronáutica, Madrid, Spain
Isabel Fernandez	(EFG)	European Federation of Geologists, Brussels, Belgium
Andrew Waltho	(AIG)	Rio Tinto, Brisbane, Australia
Oliver Bonham		Geoscientists Canada, Burnaby, BC

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Oliver Bonham		Geoscientists Canada, Burnaby, BC
Rakesh Kumar		Geoscientists Canada, Burnaby, BC

CONVENERS

4IPGC Conference Conveners:

- European Federation of Geologists
- American Institute of Professional Geologists
- Australian Institute of Geoscientists
- Geoscientists Canada

CONTRIBUTING SPONSORS

The conference conveners wish to thank the following organizations that made financial contributions to offset 4IPGC conference expenses:

- Association for Mineral Exploration British Columbia
- Association of Professional Engineers and Geoscientists of British Columbia
- Association of Professional Engineers and Geoscientists of New Brunswick
- Association of Professional Engineers and Geoscientists of Saskatchewan
- Association of Professional Geoscientists of Ontario
- Canaccord Wealth Management
- Castillian Resources Corp.
- Endeavour Silver Corp.
- Entrée Gold Inc.
- Hatch Ltd.
- McMillan LLP.
- Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists
- Osisko Mining Corporation
- Professional Engineers and Geoscientists Newfoundland and Labrador
- The Association of Professional Engineers, Geologists, and Geophysicists of Alberta

GREETINGS FROM THE PRESIDENT – GEOSCIENTISTS CANADA

GEOSCIENTISTS GÉOSCIENTIFIQUES CANADA

Welcome

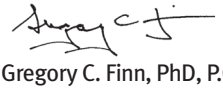
On behalf of Geoscientists Canada I wish to welcome delegates to Canada and specifically to Vancouver, British Columbia. Geoscientists Canada along with its international partners - The European Federation of Geologists, The American Institute of Professional Geologists and The Australian Institute of Geoscientists - is proud to serve as host for the 4th International Professional Geology Conference. The theme for the conference "Earth Science – Global Practice" is reflective of the very nature of the profession - geoscience is truly borderless and geoscientists have always thought globally, regardless of the nature of the work being undertaken.

Geoscientists Canada is the national council for professional geoscience whose members are the individual provincial and territorial bodies that regulate the profession in 11 out of the 13 jurisdictions in Canada. The mission of Geoscientists Canada is to protect the public through the development of consistent, high standards for licensure and practice of geoscience, facilitate national and international mobility, and promote the recognition of Canadian professional geoscience.

I would like to thank Bruce Broster, Chair of the Organizing Committee, who along with this committee has put together a very relevant, stimulating and informative program that reflects the true diversity of the profession, regardless of where you live or practice.

Once again enjoy your stay in Vancouver and I hope that you have an opportunity to see beyond the conference venue and get to experience all that the city and surrounding area has to offer.

I look forward to meeting you over the conference.



Gregory C. Finn, PhD, P.Geo
President, Geoscientists Canada

MOT DE BIENVENUE DU PRÉSIDENT – GÉOSCIENTIFIQUES CANADA

GEOSCIENTISTS CANADA
GÉOSCIENTIFIQUES CANADA

Bienvenue!

Chers délégués, au nom de Géoscientifiques Canada, il me fait un grand plaisir de vous souhaiter la bienvenue au Canada et plus spécifiquement à Vancouver, en Colombie-Britannique. L'organisme Géoscientifiques Canada ainsi que ses partenaires internationaux, notamment, la Fédération européenne des géologues, l'Institut américain des géoscientifiques professionnels et l'Institut australien des géoscientifiques, sont fiers d'être vos hôtes pendant cette 4ème Conférence internationale de la géologie professionnelle. Le thème de la conférence, « Sciences de la terre – Exercice à l'échelle mondiale » reflète bien la vraie nature de notre profession – la géoscience n'a aucune frontière territoriale et les géoscientifiques doivent toujours garder la perspective mondiale quelque soit la nature du projet en cours.

Géoscientifiques Canada est le conseil national de la géoscience professionnelle composé des organismes géoscientifiques provinciaux et territoriaux qui régulent la profession dans 11 des 13 juridictions canadiennes. La mission de Géoscientifiques Canada est de protéger les citoyens tout en travaillant à l'élaboration continue de normes concernant l'attribution du droit d'exercice et l'exercice même de la géoscience; à faciliter la mobilité nationale et internationale et à promouvoir la reconnaissance de la profession géoscientifique canadienne.

J'aimerais profiter de cette occasion pour remercier chaleureusement M. Bruce Broster, président du comité d'organisation de la Conférence, qui a réussi avec brio, avec les autres membres du comité, à préparer un programme informatif, pertinent et captivant qui reflète bien la vraie diversité de notre profession, quelque soit l'endroit où nous vivons ou où nous pratiquons notre profession.

Alors, encore une fois, je vous souhaite un magnifique séjour à Vancouver et j'espère que vous aurez l'occasion d'explorer au-delà du site de la conférence pour découvrir quelques unes des abondantes beautés de notre région.

Au plaisir de vous rencontrer tout au long de la conférence.

Gregory C. Finn, PhD, P.Geo
Président, Géoscientifiques Canada

4IPGC - Daily Events Schedule

Second Level – Renaissance Vancouver Harbourside Hotel

SUNDAY – January 22	MONDAY – January 23	TUESDAY – January 24
Registration desk open 1:00 - 7:00pm Second Level Foyer	Registration desk open 7:30am - 5:30pm Second Level Foyer	Registration desk open 7:30am - 10:20am Second Level Foyer
	8:30 - 9:40am Ballroom I *Opening Ceremony and Keynote Address*	8:20 - 10:00am Ballroom I Themes Session: *Practice skills, competencies and capacity for sustaining a global profession (Part I)*
	9:40-10:00am Second Level Foyer Coffee Break	10:00-10:20am Second Floor Foyer Coffee Break
	10:00am - 12:00pm Ballroom I Theme Session: *Securities Reporting - Global Perspective*	10:20am - 12:00pm Ballroom I Theme Session: *Practice skills, competencies and capacity for sustaining a global profession (Part 2)*
	12:00 - 1:20pm Ballroom II &III Global Practice Luncheon	12:00 - 1:00pm Ballroom II &III Networking Sandwich Lunch
	1:20-3:00pm Ballroom I Theme Session: *Geohazards - Keeping the Public Safe*	1:00-3:00pm Ballroom I Theme Session: *Geoscience in an Interdisciplinary World*
	3:00-3:20pm Second Level Foyer Coffee Break	3:00-3:20pm Second Level Foyer Coffee Break
3:00-5:00pm Ballroom III Plenary Session: *Governing a Globally Mobile Profession*	3:20-5:00pm Ballroom I Theme Session: *Geoscience Practice - Risk Manangement and Mitigation*	3:00-5:00pm Ballroom I Theme Session: *Serving Society - effective public engagement*
5:30-7:30pm Vista 360 *Delegates Welcoming Reception*	6:30-10:30pm Museum of Anthropology UBC *4IPGC Museum Banquet* (buses leaves hotel at 6:00pm - tickets required)	5:00 - 5:30pm Ballroom I *Key Messages Report and Closing Ceremony*

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VANCOUVER HOTEL
HARBOURSIDE
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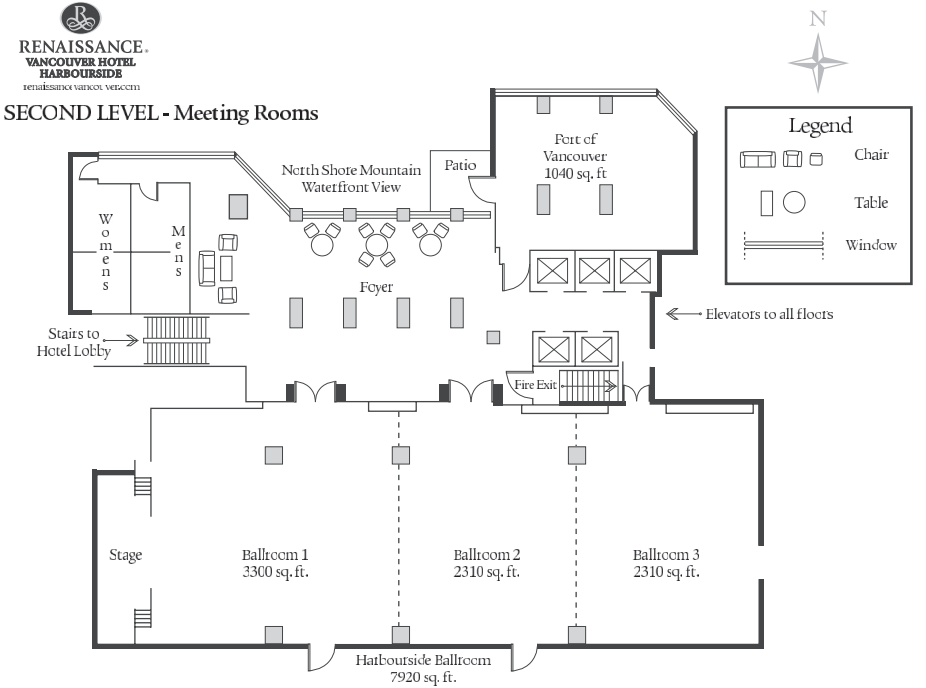
SECOND LEVEL - Meeting Rooms



PLENARY SESSION

Sunday, January 22 **3:00 - 5:00 pm** **Ballroom III**

Plenary Session - Governing a Globally Mobile Profession

Moderators: *Ruth Allington - European Federation of Geologists*
Oliver Bonham - Geoscientists Canada

The IPGC conferences are unique events that take place every 4 years. They bring together both practicing professional geoscientists and those involved in the operation of professional and regulatory bodies that govern the practice of geoscientists from across the world. The purpose of the plenary session at 4IPGC is to enable interchange and discussions and encourage collaboration on key issues involved in self-regulation around the world of a profession of global scope and which has a large proportion of practitioners who operate across both intranational and international borders. Using a moderated expert panel format, the session will cover a list of pre-determined topics. Discussion on each topic will be initiated by brief introductory remarks from a chosen panelist, following by comments from others on the panel and then discussion from the floor.

Panelists:
Andrew Waltho - Australian Institute of Geoscientists
Richard Spruill - Association of State Boards of Geology
Edmund Nickless - Geological Society of London
Barbara Murphy - American Institute of Professional Geologists
Greg Finn - Geoscientists Canada
Patrick Leahy - American Geosciences Institute

OPENING CEREMONY AND KEYNOTE ADDRESS

Monday, January 23	8:30 - 9:40 am	Ballroom I

Opening Ceremony and Keynote Address

Chair:	Oliver Bonham - Geoscientists Canada
8:30 - 8:35	**Opening and Welcome - Chair 4IPGC Organizing Committee** *Bruce Broster*
8:35 - 8:40	**Invited Welcoming Remarks - Past and Founding President Geoscientists Canada** *Gordon Williams*
8:40 - 8:50	**Invited Welcoming Remarks - President Canadian Federation Of Earth Sciences** *William Stiebel*
8:50 - 8:55	**Greetings and Welcome - President Geoscientists Canada** *Greg Finn*
8:55 - 9:40	**Keynote Address: Earth Science - Global Practice: Opportunities and Challenges Facing Professional Geoscientists** *Deborah McCombe*

KEYNOTE SPEAKER

Deborah McCombe, P.Geo.

Deborah McCombe, P.Geo., is Executive Vice President and Principal Geologist at Roscoe Postle and Associates Inc. (RPA) of Toronto.

Former president of the Association of Professional Geoscientists of Ontario and current Chair of CRIRSCO (Committee for Mineral Reserves International Reporting Standards), Ms. McCombe has over 30 years experience in exploration project management, reserve estimation, feasibility studies, due diligence and valuation studies on base metals, precious metals, and industrial mineral projects. She has worked in diverse geological settings in North and South America, Asia and Africa.[1]

Prior to joining RPA, Ms. McCombe was Chief Mining Consultant for the Ontario Securities Commission. She is the author of numerous articles and presentations focused on providing corporations and professionals alike with a better understanding of disclosure rules for mineral projects.

The keynote address at 4IPGC will allow Ms. McCombe to reflect on the work of professional geoscientists in all disciplines and bring the theme of the conference "Earth Science – Global Practice" into focus for delegates.

GLOBAL PRACTICE LUNCHEON

Monday, January 23	12:00 - 1:20 pm	Ballroom II & III

Global Practice Luncheon

Chair: *James Moors - Canarc Resource Corp*

- **Head Table**
- **Award Presentation**
- **Invited Luncheon Speaker - Jim Franklin**

NOTE: **Delegates are reminded that this is a ticketed event. All those who have registered as 4IPGC delegates have been provided with a complimentary lunch ticket as part of their delegate package. Luncheon tickets must be presented at the door.**

LUNCHEON SPEAKER

Jim Franklin, P.Geo.

Dr James M. (Jim) Franklin, PhD, FRSC, P. Geo, of Franklin Geoscience, is an exploration geologist focusing on the discovery of base metal, uranium and gold deposits.

After teaching at Lakehead University he joined the Geological Survey of Canada in 1975, where his research focused on Precambrian Shield metallogeny and modern and ancient VMS deposits. Later as Chief Geoscientist of the GSC, he coordinated its scientific program. Currently he is a director of three exploration companies and sits on numerous boards for professional and scientific groups. He is a Past President of both the Geological Association of Canada and the Society of Economic Geologists. He has received numerous awards, including GAC's Logan and Duncan R Derry medals. He is a Fellow of the Royal Society of Canada, and an Adjunct Professor at Queen's, Laurentian and Ottawa universities.

The title of Dr Franklin's luncheon presentation is:

FUTURE MINERAL RESOURCES DISCOVERIES: NEW KNOWLEDGE NEEDED FOR DISCOVERY

Monday, January 23 **10:00am - 12:00 noon** **Ballroom I**

Securities Reporting - Global Perspective

Chairs: *Andrew Waltho – Rio Tinto Exploration Pty Limited*
Patrick Stephenson – AMC Mining Consultants (Canada) Pty Ltd

This extended session covers topics related to public reporting by geoscientists in support of securities disclosures. Papers will address the challenges and risks that individual professionals face when reporting to clients and employers that are issuers of securities on stock exchanges. The session also includes papers addressing matters of importance to professional geoscientists acting as qualified or competent persons reporting under the CRIRSCO family of reserves/resources codes, NI 43-101, NI 51-101 in Canada, the JORC Code in Australia and other securities codes for minerals, oil and gas and other resources.

10:00 - 10:20	**Canadian and Australian Reporting Standards - Similarities and Differences** *Patrick Stephenson*
10:20 - 10:40	**The JORC Code in 2012** *Andrew Waltho*
10:40 - 11:00	**Horses for Courses: CRIRSCO Template and UN Framework Classification** *Ruth Allington*, Stephen Henley*
11:00 - 11:20	**Shortcomings of the CRIRSCO family of reporting codes** *David Abbott*
11:20 - 11:40	**Mineral disclosure in brine recovery projects** *James Whyte*
11:40 - 12:00	**Canadian Oil and Gas Evaluations Standards and Regulatory Disclosure** *David Elliott*

GEOHAZARDS - KEEPING THE PUBLIC SAFE

Monday, January 23 **1:20 - 3:00 pm** **Ballroom I**

Geohazards - Keeping the Public Safe

Chairs: *Bruce Broster – University of New Brunswick*
John Clague – Simon Fraser University, BC

Sound practices in all geohazards work is key to keeping the public safe. The papers in this session address professional practice topics and issues facing geoscientists whose practices encompass geological hazards of all forms, both natural and man-made. Talk topics include, the ways in which hazards are identified, risks are assessed and effects mitigated, as well as the way they are communicated to policy makers and the public.

1:20 - 1:40 **Earthquake Risk in British Columbia; The Lessons of the Chile, New Zealand and Japan Disasters**
John Clague

1:40 - 2:00 **Landslide Safety in British Columbia**
Pierre Friele

2:00 - 2:20 **Monitoring Ground Displacements with an Adaptive Multilooking InSAR Technique**
Bernhard Rabus, Jayson Eppler*

2:20 - 2:40 **Terrain Motion Measurements - Services to Society: Pangeo and Terrafirma projects**
Isabel Fernandez-Fuentes , David Norbury*

2:40 - 3:00 **Lessons learned from recent experiences of the Italian geologists in geohazard-related emergency activities**
Domenico Calcaterra, Gian Vito Graziano, Corrado Cencetti, Paride Antolini, Giovanni Calcagnì, Paolo Cappadona, Vittorio D' Oriano, Piero De Pari, Giorgio Di Bartolomeo, Eugenio Di Loreto, Piero Farabollini, Giuseppina Nocera, Michele Orifici, Sandro Rota.*

Monday, January 23 **3:20 - 5:00 pm** **Ballroom I**

Geoscience Practice – Risk Management and Mitigation

Chairs: *Peter Friz - Hatch Ltd.*
Glen Singleton - BC Hydro

This session addresses professional practice issues related to the application of risk management and mitigation. Much of professional geosciences practice involves the identification and assessment of hazards of all forms, that are naturally occurring or human-induced, to ensure protection of the public. Professional practitioners of geoscience must also deal with professional practice issues related to liability (technical, contractual, project management, and third party). The presentations in the session will focus on: Identifying the need for a national framework on practice guidelines to foster consistency and overall protection of the public; Ensuring graduating geoscientists have the appropriate core academic training to ensure public safety; Defining acceptable risk and risk tolerance; Developing of national best practices guidelines, by government agencies, to facilitate protection of the public; and, identifying geoscience project business risk liabilities and implementing professional and business practice mitigation strategies.

3:20 - 3:40	**Geoscience Professional Practice Guidelines – The development of a collective guidelines framework for the geoscience profession in Canada** *Oliver Bonham*, Gillian Daly, Ed Rodriguez*
3:40 - 4:00	**Some Perspectives on the Status of Geoscience Training for Environmental Geology** *Robert Stewart*
4:00 - 4:20	**Absolute Guarantees vs Acceptable Risks** *Anthony Deevy*
4:20 - 4:40	**A successful strategy for developing best practice "guidelines" for professional geoscientists** *Peter Bobrowsky*, Heather Crow, Rejean Couture, David Boteler*
4:40 - 5:00	**Risk Management and Professional Geoscience Practice** *William (Bill) Stiebel*

PRACTICE SKILLS, COMPETENCIES AND CAPACITY FOR SUSTAINING A GLOBAL PROFESSION – PART I

Tuesday, January 24 **8:20 - 10:00 am** **Ballroom I**

Practice Skills, Competencies and Capacity for Sustaining a Global Profession – Part I

Chairs: *Barbara Murphy - Clear Creek Associates*
Robert Font - Geoscience Data Management

This two-part session focuses on the broad issues of skills and competencies that professional geoscientists require and must develop further in order to undertake the work they do in a safe and professional manner, how our universities are preparing geology students for the workforce, the recruitment of younger geoscientists into the profession, professional ethics, competency profiles for geoscience work, continuing professional development and mentoring to meet professional standards, the role of professional societies and mutual recognition issues between regulatory jurisdictions, entry-level job to senior professional practice requirements and international comparisons, and human resources challenges and opportunities.

8:20 - 8:40	**Professional Renewal - A comprehensive, consultative and five year Program at Engineers and Geoscientists, British Columbia** *Derek Doyle*
8:40 - 9:00	**The Association of Professional Geoscientists of Ontario Registration Process and Continuing Professional Development Program - A Global Perspective** *Andrea Waldie*
9:00 - 9:20	**The National Association of State Boards of Geology (ASBOG®): History, Exams, Assessment and Professional Ethics** *John Williams*, Richard Spruill, Jeffery Randall, Jack Warner*
9:20 - 9:40	**Training Geologists in Spain: The Professional Point of View** *Manuel Reguiero*
9:40 - 10:00	**Competency profiles for Professional Geologists** *Alain Liard*

PRACTICE SKILLS, COMPETENCIES AND CAPACITY FOR SUSTAINING A GLOBAL PROFESSION – PART 2

Tuesday, January 24 **10:20 - 12:00 noon** **Ballroom I**

Practice Skills, Competencies and Capacity for Sustaining a Global Profession – Part 2

Chairs: *Barbara Murphy - Clear Creek Associates*
Robert Font - Geoscience Data Management

This two-part session focuses on the broad issues of skills and competencies that professional geoscientists require and must develop further in order to undertake the work they do in a safe and professional manner, how our universities are preparing geology students for the workforce, the recruitment of younger geoscientists into the profession, professional ethics, competency profiles for geoscience work, continuing professional development and mentoring to meet professional standards, the role of professional societies and mutual recognition issues between regulatory jurisdictions, entry-level job to senior professional practice requirements and international comparisons, and human resources challenges and opportunities.

10:20 - 10:40	**Emerging Risks to the Geoscience Workforce – Four Cornerstones of Ensuring a Sustainable Workforce** *Patrick Leahy*, Christopher Keane*
10:40 - 11:00	**From Possibilities to People: Human Resources Challenges and Opportunities for Knowledge Workers in Canadian Mineral Exploration** *Martha Roberts*, Courtnay Hughes*
11:00 - 11:20	**Qualification framework for higher education in geology - the EuroAges project** *Isabel Fernandez-Fuentes*, Eva Hartai*
11:20 - 11:40	**The Canadian picture: graduation, retention and job market needs in the Earth Sciences** *Greg Dipple*, Rob Raeside, Elisabeth Kosters, David Eaton*
11:40 - 12:00	**The post-university blues: practicing resource professionals need continuous mentoring** *Peter Laznicka*

Tuesday, January 24 **1:00 - 3:00 pm** **Ballroom I**

Geoscience in an Interdisciplinary World

Chairs: *Nieves Sánchez - Servicios y Estudios para la Navegación Aérea y la Seguridad Aeronáutica*
Peter Bobrowsky - Geological Survey of Canada

Geoscience practice involves collaboration with other professions (engineers, bankers, lawyers, analysts, regulators). Geoscience must also be underpinned by appropriate applied and academic research and by university teaching that makes explicit links to professional practice. Papers in this session address the issues and challenges of interdisciplinary practice and also of ensuring more effective communication and collaboration between professional geoscientists engaged in teaching and research and those applying geoscience in industry or public service. Talks also discuss organizational quality management and cover working examples of inter-disciplinary team work taken from difference sectors.

1:00 - 1:20	**The Quest for Quality in Professional Practice** *Peter Mitchell*
1:20 - 1:40	**Renaissance and Rediscovery in Engineering Geology: The Search for its 21st Century Raison d'etre** *Robert Tepel*
1:40 - 2:00	**Research Collaborations for Water-Supply Planning in Illinois, United States** *Andrew Stumpf*
2:00 - 2:20	**Water Supply Planning: The Intersection of Politics, Regulation, Science and the Law. A Perspective from Virginia, USA** *Michael Lawless*
2:20 - 2:40	**The Kiggavik Project – Designing Uranium Development in Nunavut** *Frederic Guerin*
2:40 - 3:00	**The concept of sustainable development and the critical role of geoscientists in delivering it** *Ruth Allington*, Isabel Fernandez-Fuentes*

Tuesday, January 24 **3:20 - 5:00 pm** **Ballroom I**

Serving Society – Effective Public Engagement

Chairs: *Ruth Allington - GWP Consultants LLP*
Isabel Fernandez - European Federation of Geologists

Effective public engagement has long been recognized as a challenge for geoscientists. This session looks at the broad issue of public engagement in geoscience. Papers highlight contexts in which effective public engagement is important, including the work of networks for geoscience outreach, the public role of geological surveys and the duties of professional geoscientists to explain the value of earth materials and processes to the needs of society and to embrace principles of sustainable development in their day-to-day practice.

3:20 -3:40	**Canadian Geoscience Education Network: Challenges and Successes in Geoscience Outreach in Canada** *Kate MacLachlan*, Eileen van der Flier-Keller, Charly Bank, Kate Grapes-Yeo, Godfrey Nolan*
3:40 -4:00	**The Role of the Geological Surveys and Professional Bodies in Civil Protection** *Nieves Sánchez*
4:00 -4:20	**Public Engagement - the Elephant in the Room: A Critical Element for Unconventional Oil & Gas Development** *George Eynon*
4:20 - 4:40	**Vision for Earth Science in Bolivia** *Osvaldo Arce*
4:40 -5:00	**Ignorance Is Not Bliss** *William Siok*

KEY MESSAGES AND CLOSING CEREMONY

Tuesday, January 24	5:00 - 5:30 pm	Ballroom I

Key Messages Report and Closing Ceremony

Chair: *Bruce Broster - University of New Brunswick*

- Key Messages Report
- Closing Remarks
- Delegates Farewell

NOTE:

4IPGC delegates are reminded that the Exploration Roundup conference continues through Wednesday and Thursday (January 25 & 26), with a full technical program, exhibitor floor, networking luncheons and evening social events.

Tuesday night (January 24) at Roundup is "BC Night" which takes place 7-10pm in the Stanley Park Ballroom at the Westin Bayshore Hotel. Exploration Roundup conference badges must be worn.

See pages 24 & 25 for further details about the Roundup and where to pick up your Roundup badge.

4IPGC Museum Banquet

Monday January 23 6:30 – 10:30pm

The 4IPGC Museum Banquet is a cultural and social highlight of the conference, allowing 4IPGC delegates from around the globe to relax together at Canada's world famous Museum of Anthropology at the University of British Columbia.

Dine and explore the museum's renowned collections of totem poles and other dramatic aboriginal artwork of the coastal First Nations peoples.

This ticketed event will include cocktail reception, banquet, and guided tours of all the museum galleries, and return coach transport to the conference.

- **Buses for the 4IPGC Museum Banquet will leave the entrance to the Renaissance Vancouver Harbourside Hotel at 6:00pm. Tickets required.**
- **Return buses will leave the Museum of Anthropology at 10:30pm**

AME-BC MINERAL EXPLORATION ROUNDUP

Mineral Exploration Roundup 2012 takes place from Monday, January 23 to Thursday, January 26, at the Westin Bayshore Hotel (about 5 minutes walk from the 4IPGC Conference venue)

This year "the Roundup" is in its 29th year. It will once again bring together individuals and organizations representing all components of the global mineral exploration and mine development industries. The theme of Roundup 2012 is "Celebrating our First Century of Global Discovery" to coincide with AME BC's 100 year anniversary in 2012.

Roundup 2012 will be building on the excitement generated by a strong commodity market as well as the record attendance of 7,000 participants, from over 30 countries, at last year's event.

In addition to Technical Sessions, Roundup features: Field Trips, Short Courses, a Poster Session, a Core Shack, a Prospectors' Tent, and a Map Tent. There is also a large Trade Show, with over 240 exhibitors.

IMPORTANT NOTE:

- Because the Roundup convention has a tight security cordon, it will be necessary to have a valid Roundup delegate badge to enter Roundup. Your 4IPGC delegate badge alone will not guarantee access to Roundup.
- All delegates registered for 4IPGC were provided with a unique discount code, which allowed you to also pre-register for the Roundup at no extra cost.
- If you have pre-registered for Roundup, please go to Roundup Pre-Registration to pick up your Roundup badge.
- If you have not pre-registered for Roundup, please go to Roundup On-Site Registration for assistance with Roundup registration .

ROUNDUP DAILY EVENTS

	Jan 23	Jan 24	Jan 25	Jan 26
	MONDAY	**TUESDAY**	**WEDNESDAY**	**THURSDAY**
BREAKFAST EVENTS	CEO Breakfast		AME BC Health and Safety Awards Breakfast	
MORNING TECHNICAL SESSIONS	Official Opening followed by British Columbia, Alaska, Yukon, Quebec and Newfoundland Exploration Reviews	Public Geoscience: Preparing for the Next 100 Years	Advancing Your Exploration Project: Considerations for Environmental Assessment and Aboriginal Participation	International Exploration Successes
LUNCH EVENTS				
(Included with registration)	Baron of Beef Lunch			Beer and Sandwich Lunch
(Purchased tickets)	Old-Timer's Lunch	Finance Lunch	AME BC Lunch	AME BC/ CIM/MEG Lunch
AFTERNOON TECHNICAL SESSIONS	British Columbia's First 100 Years of Global Discovery	British Columbia, Yukon, and Alaska: Mineral Exploration and Mining Highlights	Canadian Exploration Highlights	Commodity Review: Balancing Demand, Growth, and Resurgent Recovery
Exhibit Hall, Core Shack, Map Tent, Prospectors Tent, Poster Session	10 AM – 5 PM	10 AM – 5 PM	10 AM – 5 PM	10 AM – 5 PM
Exhibit Hall Reception	4 – 5 PM	4 – 5 PM	4 – 5 PM	4 – 5 PM
EVENING EVENTS				
(Included with registration)	Yukon Night	BC Night	Alaska Night	
	7 – 10 PM	7 – 10 PM	7 – 10 PM	
(Purchased tickets)			AME BC Awards Dinner and Silent Auction.	
			6:30 - 11:30 PM	

STREET MAP - DIRECTIONS TO EXPLORATION ROUNDUP

VOLUME OF ABSTRACTS –

(LISTED BY PRESENTING SPEAKER NAME)

SHORTCOMINGS OF THE CRIRSCO FAMILY OF REPORTING CODES

David M. Abbott, Jr., Consulting Geologist, Denver, Colorado, USA

The CRIRSCO family of reporting codes have, in my view, some important short comings that should be recognized. First the sequence of the definition of terms proceeds step-wise from initial exploration to mineral reserve delineation when the true goal, particularly in the eyes of investors, is mineral reserves, the goal of the process. The SEC's definition of mineral reserves, "That part of a mineral deposit which could be economically and legally extracted or produced at the time of the reserve determination," focuses on the investor's goal, mineral reserves. I urge CRIRSCO family of reporting codes to incorporate the SEC's definition in their definitions. Second, the terms "resources" and "reserves" are too much alike, even for those whose native language is English. Furthermore, the mining industry uses these terms in opposite meaning to their standard definitions. Alternatives should be adopted to avoid the confusion. "Hopes" is suggested as an alternative to "resources." Hopes correctly characterizes the nature of mineral resource estimates. Third, the CRIRSCO family of reporting codes inherently implies that delineation of mineral resources/hopes must precede the delineation of reserves. This is not true for many deposits exploited by underground mining because their depths preclude delineation by surface drilling. These deposits are extended by driving underground workings in which (or from which) the sampling, etc. required to delineate mineral reserves occurs. As the analytical results of underground sampling are received, mine planning quickly determines whether the sampled volumes constitute ore or waste. A lengthy, intermediate period of mineral resource/hope delineation during which feasibility studies are conducted is not always required. In such cases, the mineral reserves are increased without the need for an intervening mineral resource/hopes estimation step. Finally, government agencies—geological surveys and bureaus of mines—should not use the terms used by the mining industry unless and until the requirements of the mining industry definitions are met. While the government agencies are legitimately asking questions about the types and locations of mineral occurrences that may be exploited at some time in the future, they should not confuse terminology and the public.

THE CONCEPT OF SUSTAINABLE DEVELOPMENT AND THE CRITICAL ROLE OF GEOSCIENTISTS IN DELIVERING IT

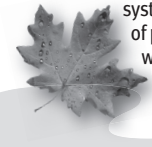
Ruth Allington, GWP Consultants LLP, United Kingdom; Isabel Fernandez-Fuentes, European Federation of Geologists, Belgium

The most widely accepted model of sustainable development has three pillars: Social, Economic, Environment. They are typically depicted as interlocking circles with 'sustainability' being at the triangular area in the centre where all three circles overlap. This illustration aims to illustrate the imperative of considering the three components both individually and collectively to achieve development which is viable, has an equitable impact on society and an acceptable impact on the environment (classically interpreted as the biosphere and, increasingly commonly in the late 20th and 21st centuries the atmosphere/ climate, but not normally the geosphere). This contribution will argue that attempting to achieve an optimal balance between the sustainability pillars in relation to an individual development project or the making of national or regional development plans is incomplete without consideration of the geosphere and therefore the input of geoscientists. The geosphere underlies and supports the biosphere and therefore an understanding of geology and natural processes is fundamental to environmental assessment. Society depends on manufactured goods and infrastructure made form raw materials that, if they cannot be grown, have to be mined. The economics of a development project or development plan are critically influenced by one or more of a range of 'geo' factors including ground conditions, availability and cost of raw materials, and impact and risk of natural hazards. It is no part of the authors' proposition that the contribution of geoscientists is the most important or predominant contribution to designing and delivering truly sustainable development. Rather that geoscientists have an essential role to play alongside other specialists in a collaborative environment where there is a common understanding of sustainable development objectives. It is not enough for geoscientists to be educated and trained to deliver technical and scientific excellence in narrow, well defined fields of practice; they also need to be educated and trained to contribute to multidisciplinary endeavours to deliver sustainable development. This paper will identify the ways in which geoscientists contribute most effectively, with others, to each of the sustainability pillars and therefore to planning and delivery of sustainable development. The contribution will be illustrated using case histories from the authors' own experience.

HORSES FOR COURSES: CRIRSCO TEMPLATE AND UN FRAMEWORK CLASSIFICATION

Ruth Allington, European Federation of Geologists; Stephen Henley, PERC and PERC representative to CRIRSCO, United Kingdom

There are two international systems for classifying and reporting mineral reserves and resources: that developed by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) and the United National Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC). Key definitions and terminology used for reporting solid mineral reserves and resources (and exploration results) within these two classification have been aligned with each other through extensive co- operative efforts between CRIRSCO and UNECE since the mid 1990s. The authors will argue that these two systems are not interchangeable and that neither provides a universal tool that can be applied to any situation where public reporting of mineral resources is necessary. In their opinion, any move to adoption of only one international system would be highly undesirable – the appropriate system should be chosen to match the objectives of the reporting in question. The various reporting standards now in use in most of the world's major mining capital markets are within the 'CRIRSCO family'. The classifications in the codes based on the CRIRSCO template are identical and their core definitions are all very similar. Most importantly they all have similar requirements for signoff by Competent Persons (known as Qualified Persons in Canada) who must have minimum relevant experience, professional qualifications, and accreditation through membership of an appropriate professional organisation or through an accepted licensing system. An underlying requirement of any estimates of mineral resources reported using a CRIRSCO-aligned reporting standard is that there must be "reasonable prospects for eventual economic extraction": in other words anything that is reported is interpreted as having some economic value. UNFC has been developed by UNECE (the United Nations Economic Commission for Europe) to encompass resources of both solid minerals and fluid hydrocarbons. With the participation of CRIRSCO and its hydrocarbon counterpart the Society of Petroleum Engineers (with the PRMS classification) a three-way mapping among the three different classifications has been achieved. The UNFC classification includes many more categories than either CRIRSCO or PRMS and is based on a three- dimensional classification by geological knowledge (4 levels), project feasibility (4 levels), and socio-economic viability (3 levels): a total of 48 categories, some of which may themselves be sub-divided. The UNFC does not include any concept of Competent Person - it is just a classification. The UNFC explicitly classifies only resources, and not mineable reserves. The authors consider that UNFC is the framework of choice for national or regional compilation of statistics in governmental, intergovernmental, and NGO planning and forecasting. However, whilst UNFC classified resources may be helpful in defining exploration targets or as base information for pre-feasibility or feasibility studies, the authors consider that UNFC is not a suitable framework for market and financial reporting of exploration results, mineral resource estimates, and mineral reserve estimates. The presentation will compare and contrast the UNFC and CRIRSCO systems, and identify and contrast the roles and responsibilities of professional geologists (and their professional bodies) when working under one system or the other, particularly in relation to protection of the public.



VISION FOR EARTH SCIENCES IN BOLIVIA

Osvaldo Arce, Bolivian Geological Society, La Paz, Bolivia

The Bolivian Geological Society (Colegio de Geólogos de Bolivia) jointly with the Bolivian Geological Survey (Sergeotecmin) and the Department of Geological Sciences of the San Andres University in La Paz are promoting research programmes in Earth Sciences. These programmes are expected to provide both short term and longer term solutions for a continuum of earth science development, promote productive activity of exploration and development of Bolivia's natural resources, and promote development of scientific knowlege. The objective is to build strong in-country expertise in the Earth Sciences to enable sustainable and environmentally responsible development of natural resources for the benefit of Bolivian society Studies in Earth Sciences in Bolivia need to undergo major changes. The current emphasis is to substantiate the classical approaches of exploration, description and data gathering through quantitative methods of data processing and interpretation of processes and event. The Earth Science research should evolve from a subject of individual inquiry to larger programmes involving geoscientists with complementary expertise and capabilities. Thus, the research programmes in geosciences should become more multi-disciplinary and more multi-institutional as well as make full use of available technology. A major impetus for this shift comes not only from the need to understand and better quantify the spatial and temporal evolution of the lithosphere, with emphasis on the Bolivian segment, but also from the recognition that such knowledge could form the basis for identifying new mineral deposits and promoting the sustainable development of our natural resources. In addition, the recurrence of natural hazards has reinforced the need to learn more about the mechanics of these phenomena and to develop predictive modeling capabilities to prevent tragedies. The emerging challenges will involve, on a continual basis, appropriate human resource development in terms of skills and expertise, as well as facilities and infrastructure. The direct interface of the Earth Science programmes with exploration/exploitation of both renewable and non-renewable natural resources such as energy, groundwater and minerals calls for a much closer tie-in of the programmes between our society, universities, industry and concerned government departments.

A SUCCESSFUL STRATEGY FOR DEVELOPING BEST PRACTICE "GUIDELINES" FOR PROFESSIONAL GEOSCIENTISTS

Peter Bobrowsky, Geological Survey of Canada; Heather Crow, Geological Survey of Canada; Rejean Couture, Geological Survey of Canada; David Boteler, Geological Survey of Canada

Professionals in all disciplines frequently rely on specialized documentation that provides examples of "best practice" for its practitioners. Occasionally such documents are prescriptive, regulatory and obligatory in the legal sense, but more frequently they are timely and extensive compilations (guidelines) by the peer community that illustrate current philosophies of practice, successful examples of application and consensus opinions on various methods and techniques relevant to the discipline in question. Professional geologists, geotechnical engineers and others in Canada will soon have access to a series of national hazard related "guidelines" to be issued by the Government of Canada that address hazard topics affecting the health and safety of Canadians. The aim of each volume is to provide a state of the art synthesis of the particular hazard including, where applicable, lexicons of specialized terminology, reviews of methods and techniques for hazard identification and monitoring, analyses of the contributing and triggering factors, descriptions of mitigative options and many other aspects. Specialists at the Geological Survey of Canada are now coordinating contributions from respective Canadian experts representing government, academia and the private sector as advisors, editors, authors and reviewers to the various volume chapters. Specifically, the Geological Survey of Canada will be publishing the following Canadian volumes: 1) Technical Guidelines for Canadian Landslide Hazards; 2) Guidelines for Shear Wave Investigations for Seismic Site Characterization in Canada; 3) Space Environment Effects on Satellites; 4) Geomagnetic Effects on Power Systems; 5) Geomagnetic Effects on Pipelines; 6) Ionospheric Effects on Radio Communications. The significance and role of adequate representation by the professional community practicing in various sectors, importance of collaboration and dialogue, need for endorsement by learned societies and other lessons learned in this exercise will be outlined and reviewed in this presentation. The guidelines effort by the GSC provides an excellent example of a successful program and strategy that best serves both the professional geoscience community and the public at large on a number of geo-issues of value to all.

GEOSCIENCE PROFESSIONAL PRACTICE GUIDELINES – THE DEVELOPMENT OF A COLLECTIVE GUIDELINES FRAMEWORK FOR THE GEOSCIENCE PROFESSION IN CANADA

Oliver Bonham, Geoscientists Canada; Gillian Daly, Golder Associates; Edmund Rodrigues, URS Corp

Geoscience is a regulated profession in all but one province and one territory in Canada through license-to-practice legislation which places each individual P.Geo. under a Code of Ethics and makes them directly accountable to the public for the work they perform. While a number of the regulatory bodies in Canada have developed, and continue to develop, excellent geoscience professional practice guidelines, it had long been recognized that a national framework on guidelines could foster consistency and thus greater overall protection of the public. Work, facilitated by Geoscientists Canada, to develop a guidelines framework took 19 months (June 2009 – Dec 2010) and received funding assistance from the Government of Canada's Labour Mobility Program, administered by Human Resources and Skills Development Canada. All 10 of the regulatory bodies in Canada were engaged in finalizing the framework, with 7 directly involved in its development, through active participation on the project's national steering committee. The framework describes the purpose of practice guidelines and the challenges associated with both developing and maintaining such documents. It then sets out collectively-agreed to principles concerning: 1) indentifying the need for guidelines for different types of practice; 2) the process and methodology that should be followed in preparing guidelines and 3) the structure and components of a typical practice guideline. In Canada, practice guidelines need to be specific to a particular province or territory, because of the jurisdictional nature of geoscience licensure. The framework secures this need for guideline variances arising from differing local regulatory requirements. At the same time, it recognizes that all guidelines should reflect the reliance on the scientific principles and the methods, and should carry similar expectations around independent professional judgment – the universal underpinnings on which sound geoscience practice is based, and that apply equally regardless of jurisdiction. This paper will be the story of a project. It will describe the work that was undertaken to understand and address the challenge, and achieve consensus. It will also briefly introduce the framework itself and reflect on its subsequent use.

LESSONS LEARNED FROM RECENT EXPERIENCES OF THE ITALIAN GEOLOGISTS IN GEOHAZARD-RELATED EMERGENCY ACTIVITIES

Domenico Calcaterra*, Gian Vito Graziano, Corrado Cencetti, Paride Antolini, Giovanni Calcagnì, Paolo Cappadona, Vittorio D'Oriano, Piero De Pari, Giorgio Di Bartolomeo, Eugenio Di Loreto, Piero Farabollini, Giuseppina Nocera, Michele Orifici, Sandro Rota - Consiglio Nazionale Geologi, Rome, Italy

Because of its geological and geomorphological structure, Italy has a long history of geohazards and related disasters. Earthquakes, volcanic eruptions, landslides, floods systematically cause extensive damage, both to human life and property. The toll of these disasters tend to dramatically increase also as an effect of the intense, recent urbanization of at-risk areas. Due to the persistent risk posed by the various kinds of geohazards, in the last decades some national and regional laws have been approved giving a relevant impulse to the organization and development of the Civil Protection National Service, as well as of other public agencies whose aim is the prediction and the prevention of natural risks. In this framework the Italian geologists offered their valuable experience in a number of catastrophic events: Umbria- Marche 1997 (earthquake), Sarno 1998 (landslides), island of Stromboli 2002 (landslide-related tsunami), Calabria 2008-2009 (landslides and floods), Messina 2009 (landslides and floods), L'Aquila and Abruzzo 2009 (earthquake) are only the major events of a longer series of tragic episodes where the contribution of the geoscientists from all the working areas (professionals, universities and research centres, public administrations) greatly helped in facing not only the post-disaster management but also many other activities covering all stages of prevision, prevention, rescue and reconstruction. As to further enforce the role of geoscientists, the newly elected Italian Council of Geologists (Consiglio Nazionale dei Geologi) has recently signed a protocol with the Civil Protection Department, whose main aim is to favour the participation of the professional geologists to the various phases of future emergencies related to geohazards. The protocol includes the implementation of a variety of activities such as promotion and diffusion of best practice standards, training and formation of professionals, dissemination of technical and scientific information to citizens. This presentation will illustrate the present-day situation in Italy on the above issues and delineate the possible future scenarios regarding the prediction and prevention of geohazards and the policy for disaster management.

EARTHQUAKE RISK IN BRITISH COLUMBIA; THE LESSONS OF THE CHILE, NEW ZEALAND, AND JAPAN DISASTERS

John Clague, Centre for Natural Hazard Research, Simon Fraser University Burnaby, BC Canada

The west coast of British Columbia (BC) is located at the boundaries of three lithospheric plates and is the most seismically active region in Canada. More than 3 million people, about 10 percent of the country's population, live on the south coast of BC, within an area that experiences infrequent, but large (M7-7.5) crustal earthquakes and rare, giant (M9+) subduction earthquakes. Although this reality is appreciated by government officials and the public, and actions have been taken to reduce risk, much remains to be done to prepare for inevitable large earthquakes. Three earthquake disasters in the past two years in other developed countries situated on the Pacific Ring of Fire illustrate the scope of the problem and challenges we face: the Chile subduction earthquake (M8.8) in February 2010; the Christchurch crustal earthquake (M6.3) in February 2011; and the Tohoku (Japan) subduction earthquake (M9.0) in March 2011. Chile, New Zealand, and Japan have modern building codes with stringent seismic provisions, yet the earthquake damage in each case was extreme and the loss of life high. These earthquakes provide valuable lessons for BC because they happened in tectonic settings similar to that in BC and because they impacted modern cities with infrastructure similar to that of Vancouver and Victoria. In this talk, I review the three earthquakes and their impacts, and explore the lessons they offer.

ABSOLUTE GUARANTEES VS ACCEPTABLE RISK

Anthony J. Deevy, A.J. DEEVY & Co. CONSULTING GEOLOGISTS, Waterford, Ireland

Permitting for industrial development is often fraught with objectors looking for absolute guarantees that no harm will result from the development, as was expressed in the case of bringing the Corrib gas ashore in the West of Ireland. Absolute guarantees are only a pipe dream in a world where the only certainties are death and taxes. There is always some level of risk.

There are natural hazards: storms, earthquakes, volcanoes etc., bacteria and viruses. One can take precautions to avoid these by choosing where one lives and with whom one associates. Mitigating measures like safer buildings, storm defences, immunization can all be taken but risk cannot be eliminated.

There are voluntary hazards: vehicular and air transport, alcohol consumption, smoking, skiing etc. Casualties do occur but society is prepared to a greater or lesser extent to accept the associated risks, most of which are controlled by legislation. There is an outright ban on some of the voluntary hazards in some cultures, e.g. alcohol in Muslim Countries.

There are industrial hazards: people work underground, at heights during construction, on farms and fishing commercially. People also work on oil rigs and with electricity and hazardous chemicals etc. Injuries and deaths occur, which in many cases are followed by investigations and recommendations. Occasionally new legislation is introduced. Industrial Companies - Du Pont being a leader - set goals of zero accidents and more recently – zero harm. One of their Principles of Effective Safety Management is that “all injuries and occupational illnesses can be prevented”.

However, realistically, a goal of zero accidents or zero harm is merely aspirational for many organisations engaged in work activities.

There are emotive hazards. These can be perceived as very real but may be irrational. The very mention of radiation, asbestos, cyanide, arsenic etc. can arouse fear in people which is often totally out of proportion to the real dangers involved. Sometimes the motivation and/or vested interests of those high-lighting the hazards is open to question. However these are all naturally occurring substances and no amount of legislation will eliminate them. Similar to hazardous chemicals, proper use of these substances is imperative.

In summary, to live on this planet we have to accept risks. But what is an acceptable risk? A possible definition of acceptable risk is: where the perceived benefits considerably outweigh the hazards. This definition by its very nature is subjective. And who is the arbiter? The answer to this question was probably quite simple in the days of absolute monarchies and dictators. Better decisions should be possible in current times of informed democracies, but evidence would suggest that elected representatives are often followers of public sentiment (rational or otherwise), rather than leaders with vision.

The planet is constantly evolving. The fossil record has shown that animals and plants, who failed to adapt to change, perished. Exposure to risk, natural and manmade has always been part of human existence. Risk tolerance remains a matter of opinion.

THE CANADIAN PICTURE: GRADUATION, RETENTION AND JOB MARKET NEEDS IN THE EARTH SCIENCES

Greg Dipple, Rob Raeside, David E Eaton, Council of Chairs of Canadian Earth Science Departments / CCCESD; Elisabeth C. Kosters, Canadian Federation of Earth Sciences (CFES), Wolfville, Nova Scotia

About forty university departments in Canada offer degree programs in earth sciences and related fields. Most of these departments participate in CCCESD (http://cccesd.acadiau.ca/), which has collected a number of vital statistics since 1974. About 5,000 students are currently enrolled in these programs, at least 75% in BSc programs. The enrolment figures are typical cyclical nature, with peaks in the early 1980`s and late 1990`s. Graduation figures and graduation-to-enrolment proportions suggest that retention is about 90%, although this figure must be somewhat flattered by students entering these programs laterally after their second year. The percentage of women students in all BSc programs combined has remained more or less constant at ca. 40% during the last 15 years (since when data are available), but the percentage of women students in MSc and PhD programs has risen significantly from less than 30% and less than 15% to about 40% and 35% respectively during that same period. The number of faculty has risen from about 450 to about 550. The job market in Canada is largely resource-driven, with expected growth in the mining and environmental sectors outpacing those in petroleum, government and academia. The mining and environmental job opportunities are coupled, as the mining sector increasingly employs environmental specialists. The aging petroleum industry infrastructure in western Canada also requires increasing numbers of environmental graduates. A Canadian Federation of Earth Sciences (CFES) employer survey in 2007 showed that all Canadian sectors are aging, the environmental sector the least so, suggesting – not surprisingly – that the next generation is more motivated for environmental careers than for careers in resource extraction. The Canadian petroleum sector recruits largely BSc-level graduates. An industry downturn in the petroleum sector may thus be more calamitous for workers, as they have fewer qualifications when looking for other possibilities during such an economic period. A different employment challenge is offered by the Canadian mining industry, which employs at least twice as many temporary workers than any of the other sectors. Summer employment is and always has been an important 'foot in the door'. Recruitment for summer jobs in the private sector is poorly coordinated as companies see this as a competition for hiring the best and the brightest with an eye on future staff and thus do not cooperate in campus tours. This is perceived as a problem by students and has resulted in an increasing uptake in co-op programs where universities assist in the coordination of placements. Field-based summer jobs, largely concentrated within mining and environmental companies and government geological surveys,are valuable sources of field experience, although in some years these are limited by the economic state, thereby limiting exposure to field work for students in those years largely to university Earth Science programs Canada's demographics in combination with the expected need for new hires make it clear that the country cannot rely on intensification of recruitment of 18-yr olds alone and must turn to immigration. The Canadian government has recently relaxed immigration requirements for a number of professions.

PROFESSIONAL RENEWAL-A COMPREHENSIVE, CONSULTATIVE AND FIVE YEAR PROGRAM AT ENGINEERS AND GEOSCIENTISTS, BRITISH COLUMBIA

Derek V. Doyle, Association of Professional Engineers and Geoscientists of British Columbia, Burnaby, BC

Ten characteristics of a self-regulating profession were established by the Council of both elected members (13) and government appointees (4). A broad based Professional Renewal Task Force was established with a supporting conference of members. Terms of Reference, support staff and a budget were established for the work, scheduled over a two-year period. The Task Force was chaired by one of the government appointees to Council to indicate that the driving force was "upholding and protecting the public interest" and to avoid any sense of personal interests of the members of the professions or turf protection. Following a broad based survey of the members where 5400 members of the total membership of 24,000 participated, research and input from other associations and governments, the task force identified eight topics for attention. These were as follows: public interest and code of ethics; registration; practice standards and guidelines; continuing professional development; practice review; enforcement; investigation and discipline; and compliance management. The task force brought forward 38 recommendations to Council for the renewal of programs and processes. Council approved the 38 recommendations and added the staff and financial resources of $1.4 million to achieve implementation over five years. At the end of Year Two (June 30/11), 34% of the recommendations have been completed and a further 11% are near completion (80% or higher). Some matters could be implemented by changes in policy, some necessitate changes to Bylaws that require ratification by 66% of the voting members and others required legislative changes which are under consideration by the provincial government of British Columbia. On average, the 38 recommendations are 72% complete and staff and resources have been committed to continue implementation on a priority basis. The renewal program is under budget and ahead of schedule.

CANADIAN OIL AND GAS EVALUATION STANDARDS AND REGULATORY DISCLOSURE

David C. Elliott, Alberta Securities Commission, Calgary, Alberta

Canada has been a producer of oil and gas for many years and is the largest supplier of oil and gas to its neighbour, the USA. Historically, most of the production has been from "conventional" sources, but production of "unconventional" oil and gas has increased significantly, the best known being bitumen from the oil sands. Oil and gas activities represent a major portion of the activity in the Canadian securities markets, with more oil and gas companies on the Canadian exchanges than in any other country. Guidelines for the evaluation of oil and gas resources were published by the Society of Petroleum Evaluation Engineers (Calgary) in 2002, as the Canadian Oil and Gas Evaluation Handbook (COGEH), which, with subsequent expansions and revisions is now in three volumes. COGEH is incorporated in Canadian securities legislation on the disclosure of oil and gas activities, National Instrument 51- 101, as the required standard for resource evaluation. The talk will describe COGEH and National Instrument 51-101. Issues arising from developments in the industry, such as the growth of shale gas activity, will also be discussed, as will a current initiative to examine the possibility of merging the COGEH standards and guidance with those of the SPE/AAPG/WPC/SPEE Petroleum Resource Management System (PRMS). The United Nations Framework Classification (UNFC) of resources, which covers both solid minerals and hydrocarbons, will also be described.

PUBLIC ENGAGEMENT - THE ELEPHANT IN THE ROOM: A CRITICAL ELEMENT FOR UNCONVENTIONAL OIL & GAS DEVELOPMENT

George Eynon, Energy Resources Conservation Board, Calgary, Alberta

Throughout its almost 75-year history Alberta's Energy Resources Conservation Board (ERCB) has regulated conventional oil and gas development. More recently Alberta has been developing its unconventional resources—in situ bitumen, tight oil, tight gas, deep- or basin-centred gas, coalbed methane (CBM), shale gas, and in situ coal gasification. The nature of these resources, and the technologies needed to recover them, are shaping how the ERCB regulates their development in non-conventional ways.

Over the past decade the ERCB created new regulatory structures—development entities for CBM and Deep Basin gas; control wells for CBM; commingling of production streams from coal-sand sequences—to more effectively manage development of some of those unconventional resources.

However, the competing interests of rural agricultural operations, municipal and rural districts, ex-urban residential development, and the oil & gas sector's operations are real. It is extremely important for local operators to work with each other and with the local communities to provide a consistent message and approach and to identify opportunities to minimize the impact of development on the landscape. Consistent messaging about the impacts of play-based unconventional resources on the community over the longer term will create smoother (and less costly) operations.

The ERCB recently released a regulatory framework to manage unconventional oil & gas plays—Unconventional Resources Regulatory Framework—that is currently out for stakeholder comment. As Professional Geoscientists we have an obligation to members of the public who might be impacted by our projects to explain the life-cycle of the development, not just the initial activity (the first well). Further, we must manage the impacts on the region with the local authorities. This principle of public engagement is the cornerstone of the ERCB's new unconventional regulatory framework.

FUTURE MINERAL RESOURCES DISCOVERIES: NEW KNOWLEDGE NEEDED FOR DISCOVERY

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Future discoveries require innovative exploration. The demand for both conventional and high-technology metals will increase rapidly as China and India attain higher living standards. New discoveries must be underpinned by expanded investment by both governments and industry in all aspects of resource development, including geoscience that underpins discovery, advanced remote sensing methods, and more efficient and environmentally responsible resource recovery technologies. Well-validated, quantitatively qualifiable criteria for all deposit types, can be used to rapidly assess ore potential using modern-quality digital geological maps, at least at a broad scale. Three-dimensional rendering techniques used for deep imaging of the earth, including both high-resolution seismic and cosmic particles as energy sources are now being adapted to explore in shallow crystalline terrains. Advanced ultra-sensitive geochemical methods using gases, organic compounds, soil, plants and rocks are providing much improved vectors to ore. New field-based analytical methods enable mapping of most elements, as well as a wide spectrum of minerals. Developing quantitative models of ore-forming processes that can be applied at all scales will ensure the supply of metals needed for the rapidly developing nations, and for improved quality of life everywhere. We must obtain new knowledge from the broad range of scientific disciplines, well beyond conventional ore-deposits geoscience. New "low impact" mining and extractive technologies will also draw on geoscience information. Canada and Australia lead the world in exploration and mining research. For example, the Canadian Mining Innovation Council's efforts to raise Canadian R&D capacity through new public-private partnerships are focussed not only on developing new knowledge and technology, but also on increasing the supply of highly qualified people for all aspects of our industry. We must encourage new students to gain the education needed to join our professions in order to meet the challenges of ensuring a robust future supply of metals and minerals.

LANDSLIDE SAFETY IN BRITISH COLUMBIA

Pierre Friele, Cordilleran Geoscience, Squamish, BC

Keeping the public safe is the first principle within APEGBCs code of ethics. Yet, public safety is not the sole responsibility of professionals. Safety is never absolute; there is always some level of risk. In this regard, policy makers play a critical role in defining safety, thereby enabling risk management. However, with two notable exceptions, among local governments in BC there is no landslide safety policy. This talk outlines through an example from professional practice how this situation is failing the public in British Columbia. At the root of the problem is the provincial government's unwillingness to define landslide safety. In 2008 a scientific paper was published that assessed landslide hazard at Mount Meager and the risk affecting Pemberton Valley 32-75km downstream. In the absence of local or provincial guidelines, the estimated risk was evaluated against international standards and found to be unacceptable. Spurred by ethics, the authors informed the local authorities. By August 2010, no meaningful action had been initiated by local governments. On August 6, 2010 one of the largest landslides in Canadian history occurred at Mount Meager, and the associated outburst flood hazard resulted in an overnight evacuation of 1500 people. The event emphasized the risk described in 2008. The sole response of the regional district was to post the scientific paper on their website, with no explanation or discussion of the implications of the risk. Apparently, without an adopted level of landslide safety there is nothing forcing the local government to act. In British Columbia legislation requires approving officers to request risk assessment where there are perceived hazards affecting a proposed development. Depending on the location and nature of a project, the approving agency might be a municipality (n=160), a regional district (n=28) or the Ministry of Transportation and Infrastructure (MoTI). In many cases, a proposal falls under more than one jurisdiction. In lieu of consistent policy, problems may arise. Referring to the Pemberton example, in 2009 MoTI issued a policy document stating the "Approving Officer may refuse a subdivision where new building sites are proposed within an identified hazard zone including the run-out zone of 1:10,000 year life-threatening events." According to the findings of the 2008 paper, in areas within MoTI jurisdiction within the Pemberton Valley, no new subdivision would be allowed. In this light, one would think the regional district's inaction is untenable. The public suffers by an inability to act in full awareness of identified risks, which could ultimately lead to financial or lethal consequences. When the responsibility for defining landslide safety rests at the level of local government several issues may exist: a lack of technical expertise, a lack of financial resources, or a conflict of interest between the need for taxation revenue and the potential for land use restriction. Between agencies there may be different standards adopted, and this may lead to confusion. These issues affect the practice of landslide risk management throughout BC. What is needed is landslide safety policy adopted at the Provincial level.

TERRAIN MOTION MEASUREMENTS – SERVICES TO SOCIETY: PANGEO AND TERRAFIRMA PROJECTS

Isabel Fernandez Fuentes, David Norbury, European Federation of Geologists, Brussels, Belgium

This paper outlines how InSar is increasingly being used in a variety of technical contexts that contribute to public safety. Two projects in Europe serve as examples that demonstrate the reliable and useful services to society through assessment of InSar measurements of terrain motion. The Terrafirma project aims to implement an operational pan-European ground motion information service in support of policies aimed at protecting the citizen against natural and anthropogenic ground motion hazards. The technology used is based on using Persistent Scatterer Interferometry (PSI) to detect and monitor terrain motions. PSI InSar compares the phase difference between tens or hundreds of radar scenes to derive the measurement of terrain motion and is a non invasive survey method able to measure millimetric motions over wide areas in both urban and non-urban environments. A substantial global archive of scenes exists dating back to 1991. In the current stages, key user segments were identified which are interested in the particular products from the service portfolio. This segmentation into themes is made according to the motivation behind these users of Terrafirma as follows: • Hydrogeology: with sub- themes of Groundwater management, and abandoned or inactive Mines. • Tectonics: with sub- themes of Crustal block boundaries and Vulnerability maps • Flood: with sub-themes of Flood risk maps and Flood defence monitoring • Wide Area mapping: with sub-themes of widely acceptable and interpretable subsidence maps which are scalable and compatible with other products. The PanGeo project is a service proposed to enable free and open access to geohazard information to be achieved by the generation of a validated Geohazard Data Layer and Geohazard Summary for 52 of the largest towns listed in the GMES Urban Atlas. Upon user enquiry, a PanGeo web-portal will automatically integrate the geohazard data with the Urban Atlas to highlight the polygons influenced. The datasets will be discoverable, accessible and useable via a distributed web-map system as built and demonstrated by OneGeology Europe (www.onegeology-europe.eu). The key users of PanGeo are anticipated as: • Local Authority planners and regulators who are concerned with managing development risk, • National geological surveys and geoscience institutes who are obliged to collect geohazard data for public benefit, • Policy-makers concerned with assessing and comparing European geological risk, much as the Urban Atlas data is used to compare the land cover or use status of European towns. Products will be made by integrating interpreted InSAR terrain-motion data, geological information and the land cover and land use data contained within the Urban Atlas. Integration, interpretation and validation of key features observed will be made by the national Geological Survey. It is planned to deliver the service for two Urban Atlas towns in each country of the EU, 52 towns in total, representing 13% of the total EU urban population. The presentation will outline the background to these projects and provide examples of improvement in public safety.

QUALIFICATION FRAMEWORK FOR HIGHER EDUCATION IN GEOLOGY - THE EUROAGES PROJECT

Isabel Fernandez Fuentes, European Federation of Geologists; Eva Hartai, European Federation of Geologists, Brussels, Belgium

The EuroAges (European Accredited Geological Study Programmes) is a European pilot project in the context of the European Qualifications Framework (EQF), Lifelong Learning Programme. The project was carried out during the period of January 2009 to January 2011. It aims at developing Europe-wide applicable quality standards and criteria for the assessment of higher education programs in geology in the context of the Bologna Process.

The project leader was ASIIN Consult GmbH, a German accreditation agency. Combining the common interests and individual strengths of ASIIN, The European Federation of Geologists, the Spanish Official Professional Association of Geologists, the Hungarian Geological Society and the Geology Section of the Swedish Association of Scientists, the EuroAges project has provided important reference documents as: mapping the structure of geology study-programs across Europe; the existing qualification framework, including a set of learning outcomes which graduates of first and second cycle degree programmes are expected to achieve; learning outcomes and skill levels for qualification as a professional geologist; and accreditation criteria & procedures.

The mapping of the existing qualifications for geology supported the increased transparency of earth sciences qualifications across Europe and therefore facilitates the improved academic and professional mobility across Europe. The document includes reports on 27 countries with information about the implementation of Bologna process, education in geology programs and structure, learning outcomes, professional pre-requisites, and accreditation systems.

The standards and criteria intend to provide means for reviewing the quality of higher education geology qualifications in the European higher education area, in a way that encourages the dissemination of good practice and a culture of continuous improvement of geology programmes. Given the great diversity of geology education across Europe, the attempt to create framework standards comprising all areas of the geology discipline appears ambitious. The EuroAges intends to provide an overarching reference point for the variety of geology programmes. In order to allow for possible inclusion of existing geology specialisations within European higher education institutions, the framework was formulated in rather general terms.

THE KIGGAVIK PROJECT – DESIGNING URANIUM DEVELOPMENT IN NUNAVUT

Frederic Guerin, Nicola Banton, Barry McCallum, AREVA Resources Canada, Saskatoon, Saskatchewan

The Kiggavik Project is a proposed uranium ore mining and milling operation located in the Kivalliq region of Nunavut approximately 80 km west of the community of Baker Lake. Mineral resources are estimated at approximately 51,000 tonnes uranium (133 million lbs U_3O_8) at an average grade of 0.46% uranium. The mandate of the Project team has been to identify through feasibility and environmental assessment work a means "to develop and operate the Kiggavik Project in an environmentally, socially and economically sustainable manner, and to provide a base for development of other potential deposits in future". According to this mandate, public engagement work has been on-going since 2006 through a community liaison office, visits to Saskatchewan uranium mines, meetings and presentations to stakeholder groups, public information sessions and by communication tools including a project blog. In 2007 exploration and field work resumed at the Project properties. The Kiggavik Project has been assessed and certified as meeting the requirements of ISO 14001:2004 and OHSAS 18001:2007 under the scope "Uranium exploration and development in Canada". Engineering, environmental and geosciences related activities have been conducted to support a feasibility study and the formal Environmental Impact Assessment regulatory process, which is on-going. This paper presents key Project components that have been designed to account for specific environmental constraints and/or public concerns. This includes the design of tailings management facilities in permafrost, the development of a mill process to minimize fresh water usage and the logistics strategies for both Project supplies and product transportation.

WATER SUPPLY PLANNING: THE INTERSECTION OF POLITICS, REGULATION, SCIENCE AND THE LAW. A PERSPECTIVE FROM VIRGINIA, USA.

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Virginia experienced a significant drought between 1999 and 2002. As a result of that drought legislation was passed requiring all localities to prepare a water supply plan. The purpose of each plan is to evaluate current water sources and demand, and to project the adequacy of those sources to meet increased demand over a 50-year planning period. The plans are required to address private water supplies as well as municipal water supplies, including individual residential wells, agricultural uses and small, private community water systems. While many of the urban areas of Virginia use surface water sources, the more rural areas rely largely on groundwater sources. Data for quantifying groundwater resources is lacking in many areas of the state. Therefore it is only possible to estimate current use and identify data gaps with regard to evaluating the impact of that use on the resources. Groundwater withdrawal permits are only required in the Coastal Plain portion of the state, so the regulatory mechanism to manage groundwater resources is not available across a majority of the state. The information contained in the local and regional water supply plans is required by regulation to be compiled into a State Water Resources Plan. An advisory committee has been formed to determine the contents of the State Plan, and evaluate the role of the Department of Environmental Quality in identifying and mediating potential conflicts over water resources. A regional approach to planning has been encouraged to promote cooperative management of water resources, although this approach continues to focus on political, rather than hydrologic, boundaries. Politics has entered the water supply planning process as the elected leaders in the United States (US) continue to seek ways to cut expenditures. The premier example of successful regional water supply management in the eastern US is the Interstate Commission on the Potomac River Basin (ICPRB) established by the US Congress in 1940. The ICPRB assists with managing water resources in the greater Washington, DC area; the watershed covers several states and the area continues to grow in population. Virginia is considering leaving the ICPRB in order to save an estimated US$150,000 per year. Virginia water law complicates management of water resources. Water allocations for several of the larger cities in the state date from the 17th century, and addressing these resources in the context of the 21st century will prove politically and legally challenging. The water supply planning regulation will likely be the catalyst to bring politics, regulation, science and the law together to successfully manage Virginia's water resources. One challenge is to prominently involve science in the decision-making process.

THE POST-UNIVERSITY BLUES: PRACTICING RESOURCE PROFESSIONALS NEED CONTINUOUS MENTORING

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In today's parlance university graduates are an "intellectual product". In contrast with other products that receive continuous update and servicing like computer software, the manufacturer of graduates, the university, does nothing. Those lucky graduates who joined an enlightened and progressive, mostly large mining company, receive continuous on-the- job mentoring. Those who join, or establish, small local outfits have nowhere to go. Some of the occasional conferences contain practically useful components like core sheds, short courses targeted on working professionals, useful field trips but these venues are opportunistic, costly and irregular. After a burst of euphoria and conference enlightenment comes a long gestation period of tedia. Nowhere to turn to human- administered learning, inspiration and experience. Before the mass electronization of our lives some practical thinkers recognized this problem and did something about it. Professor Eric Rudd with several co- workers and industry, government assistance, established the Australian Mineral Foundation (AMF) in Adelaide, Australia, in 1973. A purpose-designed building on government-granted land contained a library dedicated to mineral resources; an effective international bookshop; information- retrieval and bibliographic service; and, best of all, a program of no-nonsense courses, workshops and conferences dedicated to continuous education of professionals: over 800 such venues during the AMF tenure of 28 years. Corporate libraries still cherish the blue binders of practical course notes. AMF was sustained by its mostly corporate membership, was predictable and accessible, always there. Unfortunately it went out of business at the end of 2001. The government did nothing to help. Shortly before its demise AMF was joined by Data Metallogenica (DM), an expert system targeted on mineral explorers and based on a large, broadly versed collection of miniaturized geological samples from mineral deposits of the world. The sample sets in uniform order, permanently attached to aluminum plates, constituted a "rock library", Lithotheque. With the parallel collection of hand samples, Macrotheque, it was easy to get, under a single roof, a "hands-on" information on the IOCG, or Carlin type, or whatever. DM has survived the AMF demise and became the property of Amira International in Melbourne that continues the www.datametallogenica.com. website, although the physical collection is presently inaccessible. This restricts growth and prevents update. The Lithotheque-style of assembly and presentation of information via actual geological materials that do not change with concepts is popular with the exploration community. It is also cheap and easy to establish, especially in countries without resources to engage in frontier research. I have proposed (Episodes, v. 32, No.4, December 2009) an international adoption of the Lithotheque system by geological organizations worldwide, whereas each country/organization would own their physical collection, then share its photoimages with the rest of the world, via internet. This could become a seed for the next, practical, user-friendly centre of post-university education to come to life somewhere in the world. Many retired exploration geologists would love to volunteer as resident mentors, to pas their accumulated knowledge on the young generation, if there were a place to do so.

EMERGING RISKS TO THE GEOSCIENCE WORKFORCE – FOUR CORNERSTONES OF ENSURING A SUSTAINABLE WORKFORCE

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The great demographic shift underway in many developed nations is impacting the geosciences extraordinarily hard. We examine the situation in the United States as an example of how there are four clear overarching issues to establishing a sustainable geosciences workforce: (1) Capacity of the Educational Sector, (2) the fundamentals of meeting future demand, (3) the issue of graduate quality, and (4) the emerging challenge of sustaining the capacity building of future geoscientist generations. The United States currently hosts about half of all geoscientists globally (about 400,000) and is facing the imminent, and in the case of the Federal geosciences workforce, attrition of the Baby Boom generation geoscientists. This demographic shift is impacting all parts of the geosciences and when coupled by internal shifts in the geosciences on subdisciplinary thrusts, the match between the skill portfolio of new graduates is not necessarily well-aligned with the exiting skills of retirees. In particular, the US faces the challenge of, based on current demand, attrition, and graduation rates of being short nearly 150,000 geoscientists by 2021. At the same time, the educational community is seeing the retirement of faculty that are leading into constrained ability to educate students in a number of topics, especially those in the resourcesectors. Given current funding trends and priorities, this phenomenon is likely to be in a feedback loop and will complicate the broad skill portfolio of the future geosciences. We also examine the issues of global migration and how it does not appear to be nearly as important to addressing the challenges as assumed by many. In addition, the prospective future geosciences majors appear to be of lesser quality than even 5 years ago based on test scores, yet we will also present several broad strategies and cautionary tales that can help the US, and likely the global, geosciences community to ensure a stable and effective future.

COMPETENCY PROFILES FOR PROFESSIONAL GEOLOGISTS

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Background: Any person meeting set requirements, including holding an accredited degree or its equivalent and having minimum certified relevant professional experience, is eligible for registration as a Professional Geologist in Quebec. These requirements or qualifications are written into regulations which reflect a long established practice of relying on degrees and peer review to grant professional registration. Except for accreditation of degrees, the same framework prevails throughout Canada. Legislation governing these practices seldom provides other details on required competencies. Nevertheless, the primary role of a regulator in the registration process is to ascertain the competency of persons allowed to practice a regulated profession. The traditional approach to assessing candidates for registration is being challenged on two fronts:

a) The growing need to recruit new practitioners of varying background from outside Canada strains the limits of existing assessment tools,

b) The rapid evolution of professional practice and public pressures for greater accountability lead to renewed interest in effective competency.

Also, international agreements on labour mobility put more emphasis on competencies with respect to the practice and favor multiple paths to competency as opposed to strict reliance on academic degrees.

Competency profile Initiative: In February 2011, with support from the Ministère de l'immigration et des communautés culturelles du Québec, the Ordre des géologues du Québec proceeded to develop competency profiles for professional geologists. Competency is defined in relation to the actual practice as the ability to perform the require tasks in respect to established criteria. The competency profiles to result from this initiative will form the basis for the production of tools for assessing the qualifications of new entrants to the profession, i.e., typically a person with 3-6 years of experience after a university degree.

Generally accepted protocols for developing competency profiles were followed in this project. For the purpose of the project, the professional practice of geology was subdivided into three areas based largely on the fact that practitioners in each of these areas tend to share common work environments or silos. These areas are: 1. Resource geology (i. e., geology applied to exploration and extraction of mineral and energy resources and states land management); 2. Engineering and environmental geology (i. e., geology applied to foundations, construction materials, natural hazards, dewatering, groundwater supply and protection, site assessment and rehabilitation); 3. Geophysics and remote sensing (i. e., geophysical surveys and remote sensing with their interpretation applied to multiple purposes). In each of these areas, professional practice was defined to consist of six to seven main tasks with 3 to 5 contingent tasks. Significant commonality was found in many of the tasks in each area with significant differences with respect to technical aspects and conditions of performance for some tasks. Required knowledge and skills for each task were defined in summary fashion. Though academic training is essential to preparing future professional geologists, it is also evident that a significant proportion of the required knowledge and skills is acquired outside an academic environment through practice. The project will be presented with an overview of outcomes and future work.

CANADIAN GEOSCIENCE EDUCATION NETWORK: CHALLENGES AND SUCCESSES IN GEOSCIENCE OUTREACH IN CANADA

Kate MacLachlan, Association of Prefessional Engineers and Geoscientists of Saskatchewan; Eileen van der Flier-Keller, School of Earth and Ocean Sciences, University of Victoria, BC Canada; Charly Bank,Department of Geology, University of Toronto; Kate Grapes-Yeo, Geoscience Education Consultant; Godfey Nowlan, Geological Survey of Canada

The Canadian Geoscience Education Network (CGEN) is the outreach and education arm of the Canadian Federation of Earth Scientists (CFES), an organization that brings together 14 affiliated member societies representing about 20,000 Earth scientists in Canada. CGEN is a grassroots group of over 400 geoscientists and educators from all sectors across Canada, who seek to promote Earth Science education and outreach. CGEN stimulates and coordinates the development of outreach activities that increase public awareness and appreciation of Earth Science. The organization raises funds to support many of these activities and promotes Earth Science teaching at all levels of school and university. CGEN provides a key forum for Earth scientists and educators to network and exchange ideas and information with respect to Earth Science outreach. CGEN hosts a number of core projects including; EdGEO, Earth Science Careers website, Geoscape Canada, What on Earth, and Friends of Canadian Geoheritage, which can be accessed via www.geoscience.ca/cgen/. CGEN members are also involved with many outreach and awareness projects often linked to major events such as the International Year of Planet Earth book "4 Billion Years and Counting" or more regional events such as the BC Year of Science. We will highlight some of the challenges as well as keys to the success of recent initiatives from across the country, including various examples of CGEN outreach activities. Another successful model for geoscience outreach in Canada is exemplified by Mineral Resources Education Program of BC and Prospectors and Developers Association of Canada (PDAC) Mining Matters.

EARTH SCIENCE – GLOBAL PRACTICE – OPPORTUNITIES AND CHALLENGES FACING PROFESSIONAL GEOSCIENTISTS

Deborah A. McCombe, Executive Vice President and Principal Geologist, Roscoe Postle Associates Inc., Toronto, Ontario

Professional geoscientists practising throughout the globe face many similar challenges and many opportunities to improve standards of practice. Mobility, either inter-provincially, in countries such as Canada, or across international borders, has been improving in recent years. However, there is still a lack of clarity and knowledge concerning temporary and incidental practice. Geoscience regulators or similar organizations globally, are adopting more consistent background and experience requirements when individuals apply to become a practicing member of a professional association or organization. In Canada, a minimum of four years of geoscience work experience is required for a professional geoscientist to legally practise geoscience and to be able to make appropriate professional geoscience decisions which will protect the public and the environment.

Professional geoscientists have taken a leading role in the development of standards and industry best practices. Standards for the disclosure of mineral resources and mineral reserves, such as the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards and the Joint Ore Reserves Committee (JORC) Code in Australasia are two examples. The Committee for Mineral Reserves International Reporting Standards (CRIRSCO) comprised of members from Canada, South Africa, Europe, Australasia, Chile, USA, and most recently Russia all have similar codes and have developed the CRIRSCO template for reporting of mineral resources and mineral reserves. This template is a guideline for countries developing their own reporting standards.

With geoscientists busy travel schedules it can be a challenge to become familiar with the various standards of practice as well as local regulations. Nonetheless, adherence to environmental, social, regulatory and other standards, wherever we practice as professional geoscientists, enhances the public's confidence in the information geoscientists provide and the reputation of our profession. Protection of the public is a fundamental principal of being a professional geoscientist. With an increasing number of geoscientists working on projects in remote locations of the world it can be challenging for professional associations to communicate with their members and, if necessary, apply disciplinary measures when required. Establishing communication channels among international professional associations would be an initial step to mitigate this challenge. Currently, there is an abundance of international projects that require the skills of professional geoscientists; however, there is a shortage of trained professionals. It is essential that we educate and encourage students to consider one of the fields of geosciences as a career. Ongoing communication at both high school and university levels will help to guarantee a steady stream of future professionals in the geosciences industry.

In summary, there are a number of opportunities and challenges that face professional geoscientists practising globally. Enhanced communication on an individual basis and among professional associations will improve our ability to work globally, and increased education about the importance of geoscience as a profession will attract the new generation of geoscientists to our industry.

THE QUEST FOR QUALITY IN PROFESSIONAL PRACTICE

Peter R. Mitchell, Association of Professional Engineers and Geoscientists of British Columbia, Burnaby, BC.

The Association of Professional Engineers and Geoscientists of BC (APEGBC) is the body which has the legislated authority to regulate the practice of professional geoscience and engineering in British Columbia. After completing a successful pilot program APEGBC is proceeding with the implementation of a voluntary program which addresses Organizational Quality Management (OQM) in professional geoscience practice . Recognizing the significant influence that organizations employing geoscientists have on the practice of the profession, the program aims to improve quality management in professional practice at an organizational level. APEGBC is proposing to make this self-funded program available on a voluntary basis to all organizations providing professional geoscience services. As a result of the success of the pilot program, in December 2010, APEGBC Council approved the establishment of the Organizational Quality Management (OQM) Committee. The OQM Committee is tasked with implementing the APEGBC-administered voluntary OQM Program. The goal of the APEGBC OQM Program is to assist organizations involved in the provision of services involving the practice of professional geoscience to improve or introduce in-house quality management procedures that systematically address the following specific practice obligations their geoscience employees have under the Engineers and Geoscientists Act and the Association bylaws: • Application of the relevant APEGBC technical practice guidelines; • Retention of complete project documentation; • Documented checking of geoscience work using a written quality control process; • Authentication of geoscience documents using the professional seal of a geoscientist; • Application within the organization of "direct supervision" as defined in the Act when delegating professional geoscience activities to non geoscientists ; and • Documented field reviews of projects which require the implementation of technical recommendations involving the application of professional geoscience. The program being developed would see APEGBC issuing an OQM certification to participating organizations that have voluntarily implemented policies and procedures consistent with the quality management requirements of the Act and bylaws of the Association or adapted existing in-house policies and procedures to align with these requirements. Participating organizations would have a number of options to achieve certification. The OQM program is aimed at assisting organizations in providing direct support to employees who are APEGBC members or licensees so that they can better meet their quality management requirements under the Act and bylaws; and making it easier to educate Geoscientists-in-Training (GIT) about these requirements. It is also intended to foster high standards of quality management in professional practice and help to build consistency throughout an organization's operations. APEGBC has prepared a draft OQM Manual and is looking at implementation in Spring 2012.

MONITORING GROUND DISPLACEMENTS WITH AN ADAPTIVE MULTILOOKING INSAR TECHNIQUE

Bernhard Rabus, Simon Fraser University, Canada;
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Increasing populations and economic development worldwide has led to vastly expanded construction of tunnels, highways, bridges, and utility lines over past decades. Monitoring the stability and safety of this accumulated infrastructure in regard to aging, as well as its interaction with surficial geology and natural hazards presents a formidable problem that will become ever more pressing in the future. Surface displacement time series measured with spaceborne InSAR data at monthly intervals and few meters spatial resolution can provide reliable reconnaissance of infrastructure stability with comprehensive spatial coverage. This frees now overwhelmed ground-based monitoring to the complementary tasks of very high temporal resolution monitoring of acutely dangerous conditions previously identified by the InSAR method. InSAR and ground-based methods can be tightly integrated with available environmental proxy data and modeling of structures and ground motion to derive future infrastructure risk maps. To achieve the high spatial resolution necessary to derive risk maps for a wide range of terrain from uni-dimensionally small artificial structures such as bridges to natural slopes and embankments we have developed a novel InSAR method that exploits both persistent point scatterers (PS) as well as coherent distributed scatterers (DS) such as areas of pavement or partially vegetated terrain. The new method, Homogenous Distributed Scatterer (HDS)-InSAR identifies HDS candidates by using adaptive multilooking of statistically homogenous pixel neighborhoods combined with a coherence threshold of the differential phase of each neighborhood with respect to its surroundings. HDS-InSAR preserves PS and forms a direct generalization to our proven DualScale- PSI method. We use both parametric and non-parametric tests for an optimum definition of the adaptive neighborhoods. Final selection of HDS is done via temporal coherence thresholding on the HDS candidates. The density of HDS exceeds that of PS by more than an order of magnitude often providing essentially continuous coverage over bridges, road lanes. HDS-InSAR solves and corrects for temperature dilation in addition to topographic height for each HDS. We illustrate the performance of our new HDS-InSAR method compared to DualScale-PSI using displacement results from the Palabora open mine, in South Africa displaying the history of a collapsing slope of the former open pit, as well as the urban area of Vancouver, Canada revealing interesting ground instabilities some of which are associated with the large construction activities in the run-up to the 2010 Olympics.

TRAINING GEOLOGISTS IN SPAIN: THE PROFESSIONAL POINT OF VIEW

Manuel Regueiro y González-Barros, Spanish Official Association of Professional Geologists, Madrid, Spain

Spain has recently implanted in all university studies the Bolonia agreement. The overall European idea and the basic principles to apply were quite impressive: an unified system of academic titles with a similar structure in length and with similar professional skills and competences to be acquired in that period. In summary the product will be more or less homogeneous throughout Europe, no matter the career or the country of origin. But it looks now that the devil is in the details and the real put in practice of the system has been terrible nightmare for the Universities and the professors. In geology we do not yet have the resulting graduate of the new process, so we must wait and see, but some voices are already alerting that the lack of funds might turn the bright idea in a fused lamp. This paper presents the current situation of the training of geologists in Spain as resulting from the works developed during the execution of the EuroAges project carried out by several EFG organizations, including the EFG itself, and the model the ICOG suggest to train the Spanish geologists of the 21st century

FROM POSSIBILITIES TO PEOPLE: HUMAN RESOURCES CHALLENGES AND OPPORTUNITIES FOR KNOWLEDGE WORKERS IN CANADIAN MINERAL EXPLORATION

Martha Roberts, Mining Industry Human Resource Council; Courtnay Hughes, Mining Industry Human Resources Council, Ottawa, Ontario

Knowledge workers are essential in Canadian mineral exploration. Over 75 per cent of the mineral exploration workforce in Canada is comprised of knowledge workers (i.e., highly educated and skilled). The increased use of technology and the need to stay ahead in a global market mean that knowledge workers are now crucial to the future prosperity of the sector. In the summer of 2011, MiHR released the results of two intensive research studies; one reported the human resource challenges and opportunities for knowledge workers in the Canadian exploration and mining industry, and the reported on the labour market and HR issues facing the Canadian exploration sector. This presentation will discuss findings from a cross-study analysis of knowledge workers in Canadian mineral exploration. For this research over 900 industry stakeholders participated in intensive consultation sessions through focus groups, interviews, questionnaires, round tables, and labour market research activities. Several overlapping issues were identified in a detailed analysis of the labour market issues and HR needs for knowledge workers in mineral exploration. Overall the knowledge worker segment of the exploration sector is aging; thought of as relatively unappealing to women at the mid-point of their career; and is lacking opportunities for training and development of students in relevant job- ready skills sets. Discussions will highlight knowledge transfer and leadership strains facing the sector; the causes and solutions for mid-career attrition of women in mineral exploration; opportunities for training and support for students in gaining field work and on-the- job experience in the sector; and the need to raise awareness and prepare the Aboriginal workforce for knowledge worker roles.

THE ROLE OF THE GEOLOGICAL SURVEYS AND PROFESSIONAL BODIES IN CIVIL PROTECTION

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Nowadays, our society is living a new stage because globalization has produced many changes in different issues such as communications. Social perception of catastrophic events is changing because now we can feel a disaster occurring very far from our home, as something which can be suffered by ourselves. Natural disasters produce significant damage and the world is acting as a spectator, demanding information and explanations about the role of the people in each case - civic education is a very important issue in a range of emergency scenarios. Geological surveys and professional associations will have to adapt their goals to this new social requirement and they should play an active role for all the phases in the management of emergencies and inside the civil protection system. The World Conference on Disaster Reduction held in Japan in 2005, concluded with the Hyogo Declaration, establishing a new framework for action "Building the resilience of nations and communities to disasters". The priorities are: (1) Governance action; (2) Risk knowledge; (3) Social prevention culture; (4) Reduction of underlying risks; (5) Disaster preparedness for effective response. Indicators and analysis are necessary to evaluate the weaknesses of the system, the actions in progress, the results and the culture for prevention as a basis of an efficient forward model. Geological institutions can help to develop resilience through a range of actions: (1) requesting the implementation of policies that consider the natural processes as an integral part of the territory; (2) communicating and education concerning natural processes to society, with didactic materials aimed at many different groups (children, students, citizens in general, politicians, decision makers...); (3) creating specialized groups to take part in interventions to assess the situation during and after the emergency and plan responses; (4) preparing reports with evolving indicators to alert about inadequate tendencies; (5) speak out about situations which give rise to unacceptable risks for populations; (6) create a global corporate network dedicated to risk and disaster prevention as a public value. All institutions should develop a strategy for disaster reduction in a document to reflect the public compromise for this issue.

IGNORANCE IS NOT BLISS

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Professional geoscience organizations in the US, Canada, and Europe endeavor to appeal to students through various outreach activities. Most geoscience organizations in our respective national organizations dedicate resources for student scholarships, student meeting registrations, student travel assistance, incentives to participate in organizational activities, and for organizational officers to address student and faculty groups. Cooperative programs and collaboration between national societies such as the Canadian Council of Professional Geoscientists, the European Federation of Geologists, the American Institute of Professional Geologists, the American Geosciences Institute, and others reveals many shared frustrations regarding the diminishing interest shown by geoscience students in professional societies and the services available through them. A significant obstacle to greater success in recruiting geoscience students to the professional societies is a general lack of faculty interest in non-learned societies as proper organizations for establishing professional credentials. Experience shows that both faculty and student groups are enlightened when given specific information (particularly in a seminar setting) about licensure, post-graduate continuing education, career opportunities, employment websites for the geosciences, the advantages of professional society membership, and other compelling perspectives. One key to greater impact upon the student and faculty geoscience population is slogging through university bureaucracies to arrange seminar opportunities with geosciences students and faculties. Oftentimes faculty are more amazed by a glimpse of the applied world of geosciences than the students they ostensibly have responsibility to mentor.

CANADIAN AND AUSTRALIAN PUBLIC REPORTING STANDARDS – SIMILARITIES AND DIFFERENCES.

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Canada and Australia have the most widely recognised and adopted public reporting standards for mineral exploration results, mineral resources and mineral (ore) reserves in the world. The standards are encapsulated in National Instrument 43-101 (Canada) and the JORC Code (Australia). Each of these is supported by other standards, guidelines and enforcement mechanisms in their respective jurisdictions that ensure the proper functioning of market- related public reporting on mineral assets. Both NI 43-101 and the JORC Code are "CRIRSCO"-type reporting standards, that is, they are Principles-based standards that emphasize the importance of Transparency, Materiality and Competence, whilst providing direction and guidance on public reporting of mineral assets. One of the key aspects is the requirement for such public reports to be based on work undertaken by an appropriately qualified and experienced person ("Qualified" or "Competent Person"), who can be held to account for his or her actions through membership of a recognized professional association. While NI 43- 101 and the JORC Code are essentially similar in virtually all important aspects, there are some differences both between the standards themselves and between the reporting environments in Canada and Australia. It is important for companies and persons active in both jurisdictions to be aware of these differences.

SOME PERSPECTIVES ON THE STATUS OF GEOSCIENCE TRAINING FOR ENVIRONMENTAL GEOLOGY

Robert A. Stewart, ARCADIS US Inc.,
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After the United States enacted the Superfund law and Resource Conservation and Recovery Act (RCRA) in 1980, societal concerns about human effects upon the global environment increased dramatically, and academic geology programs became increasingly interdisciplinary. This change accompanied a concurrent shift in employment opportunities for geologists, away from traditional employers (mining, petroleum), and toward the environmental field (regulatory agencies, private consulting).

This shift has also seen the traditional geology major and its core of fundamental courses evolve to include a variety of environmental geoscience programs. Such programs are often diluted into a major field of study consisting of mostly introductory courses distributed over too many departments, with too little geoscience training at the advanced level. And, to the further detriment of the students, the quality and quantity of geology courses may be insufficient for professional certification or licensure. A few specific and recurring examples of de-emphasis or apparent disinterest in traditional training support these general concerns. Structural geology and field school, long considered cornerstones of traditional geology degrees, are either skipped, not offered or have become electives. As field training slips, students lose skills in air photo interpretation, photo-documentation and surveying essential to environmental investigations, especially those that do not require more sophisticated forms of data acquisition and management. Appreciation of surficial geology, and specifically geomorphology, glacial geology and anthropogenic soil appears to be lacking. Ore deposits and petroleum geology are also not typical options for environmental science degrees, even though the implicit and explicit concepts in both courses are important to understand the nature of background levels of metals in rock and soil, stratigraphic and structural controls on contaminant transport, and water-rock-microbe interactions.

These examples underscore the importance of fundamental geology courses to environmental geoscience education. Inadequate training can lead to flawed work, resulting in wasted resources, litigation, and job loss.

Some factors responsible for the de-emphasis of, and/or lack of interest in traditional geology courses include lack of mentoring opportunities for students, faculty inexperience beyond academia and indifference to post-graduate employment; limited internal and external funding opportunities for geoscience programs, and limitations inherent in small departments.

RISK MANAGEMENT AND PROFESSIONAL GEOSCIENCE PRACTICE

William (Bill) H. Stiebel, Canadian Federation of Earth Sciences (CFES), Halifax, Nova Scotia

This presentation will focus on some of the potential liability issues that could occur in professional geosciences practice and the risk management measures professional geoscientists can utilize use to manage, eliminate, reduce or transfer risk associated with the work undertaken. There are many different types of risk that can affect a project and which could result in potential liability to the geoscientist practitioner. It is always best to understand and identify the potential risks at the initial proposal stages of a project, and put in place the mechanisms needed to manage these risks . This seminar presentation will provide an overview of typical geosciences projects business risks and potential liabilities, such as contractual, technical, project management and third party, and discuss good professional and business practices that can be used to mitigate these risks and reduce the potential of assuming unmanageable professional liability.

RESEARCH COLLABORATIONS FOR WATER-SUPPLY PLANNING IN ILLINOIS, UNITED STATES

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In the State of Illinois, United States, the Illinois State Geological Survey (ISGS) has been the primary source for earth science information and data since its inception in 1905. The ISGS, a division of the Prairie Research Institute (PRI) at the University of Illinois Urbana-Champaign is sought out by federal and state agencies, private consultants, mineral exploration companies, county and municipal governments, and the public for results of basic and applied earth science research to address issues pertaining to groundwater supply, carbon sequestration, engineering geology, coal and petroleum geology, industrial minerals, and environmental remediation. Since placement of the ISGS wholly within the University in 2008, opportunities for collaborative research have flourished, which have contributed to greater cross-disciplinary liaisons with partners on-campus and at external institutions. The PRI leverages its state appropriation to secure additional research funding that in turn helps to create, attract, and support billions of dollars of economic activity for the state. Many citizens in Illinois rely on groundwater for their water supply. Two divisions of the PRI, the ISGS and the Illinois State Water Survey (ISWS), specifically, have been engaged in collaborative research projects in suburban Chicago area and downstate Illinois to provide technical information and advisement on the availability of groundwater. These projects have involved the development of cross-disciplinary research partnerships between universities, private industry, local governments, and the public, which have been instrumental in leveraging the available resources, sharing of proprietary data, and dissemination of earth science information to policy-makers and stakeholders. A number of research partnerships are engaged in studies of the Mahomet Aquifer, the primary water source for nearly 1 million people in central Illinois. Geoscientists at the PRI conduct the basic research, which in turn supports the additional, applied studies undertaken in collaboration with external partners. One example of these partnerships is a recently completed multi-year study of the aquifer system in the Champaign-Urbana area that was funded by the local water company. Geoscientists at the PRI also serve as technical advisors to quasi-governmental organizations in the region whose missions are to develop long-range water-supply management plans and provide support, assistance and advisement to engage public and private bodies involved in the stewardship and provision of water resources.

RENAISSANCE AND REDISCOVERY IN ENGINEERING GEOLOGY: THE SEARCH FOR ITS 21ST CENTURY RAISON D'ÊTRE

Robert E. Tepel, California State Mining and Geology Board, San Jose, CA, USA

Engineering Geology is a small discipline within the geological profession. Estimates of the percent of geologists in the United States practicing it are typically in the low single digits; the same is likely elsewhere. Yet engineering geology has great world-wide influence because of its often critical input into civil engineering practice. From its beginnings in North America and Europe, the subsuming of engineering geology practice into civil engineering practice made the goal of identifying the societal worth of Engineering Geology either unnecessary (in the minds of some) or elusive (in the minds of others). The resulting lack of raison d'être led to confusion within the geological profession, and within the discipline of Engineering Geology, over 1) the role and relationships of engineering geology in the profession of geology, and 2) the value of engineering geology practice to society. Only in the last decade have engineering geologists world-wide made significant progress toward understanding the fundamental nature of their discipline and its value to society. This paper summarizes the development of Engineering Geology and shows how late 20th century changes in its application, workplace setting, and societal practice setting, resulted in a new concept of the core value of engineering geology practice to society, synthesized here from the ideas of many. The unique and distinguishing core work process of Engineering Geology (and corresponding work product of the same name) is The Engineering Geology Site Characterization, also known as the Geological (Site) Model or Total Geological Model, which defines all of the geologic conditions, on-site, off-site, near and far, that will or could affect people, their property, and their institutions as they use their natural and built environments. Viewed through the prism of wealth, the practice outputs of Economic Geology and Engineering Geology stand in strong contrast. Economic geologists create wealth through the discovery and exploitation of mineral resources; engineering geologists protect wealth and health through the discovery and explanation of geologic factors and conditions (geohazards) that affect, or might affect, people, their structures, and their institutions. Geohazards evaluation fits naturally into engineering geology practice because pro-active treatment of geohazards commonly requires civil engineering practice. While considerable engineering geology practice remains integrated into civil engineering practice, the development of professional licensure allowed engineering geologists to practice geology before the public independent of the engineering office. Practice emphasis grew to encompass geohazards that concerned individual, corporate, and government clients who want to understand and manage geologically-sourced risks. With the practice authority legally conferred by licensure, engineering geologists can stop thinking of engineering geology practice as geology performed under the direction of engineers for engineering projects, and start thinking of engineering geology practice as the discovery, and communication of information about, geologically-sourced risks that affect, or might affect, people and their institutions as they use, and interact with, their natural and built environments. This newly discovered raison d'être is exactly what engineering geologists of the 19th and 20th centuries were doing for their engineer employers (they just did not think of their practice that way).

THE ASSOCIATION OF PROFESSIONAL GEOSCIENTISTS OF ONTARIO REGISTRATION PROCESS AND CONTINUING PROFESSIONAL DEVELOPMENT PROGRAM - A GLOBAL PERSPECTIVE

Andrea Waldie, Association of Professional Geoscientists of Ontario, Toronto, Ontario

The Professional Geoscientists Act, 2000 received Royal Assent on June 23, 2000 and established the Association of Professional Geoscientists of Ontario (APGO). APGO governs the practice of professional geoscience in Ontario and reports to the Minister of Northern Development, Mines and Forestry. The legislation protects the public and investors by establishing a regulated association of geoscientists with the power to admit only qualified persons, to encourage continuing professional competence, to discipline members for professional misconduct and to prevent unqualified individuals from practising. The Association has been registering qualified individuals as professional geoscientists since 2002. Since the Act and its regulations are relatively new, these pieces of legislation take into consideration the current global nature of the profession of geoscience. The Registration Regulation (O.Reg. 59/01) and APGO procedures are inclusive in nature and provide clear processes for the recognition of international credentials and work experience. As well, the Association encourages continuing professional competence of its members through the Continuing Professional Development program, available to members online wherever internet access is available. This presentation will discuss APGO's registration requirements and process designed to facilitate the admittance of internationally trained applicants in to the profession; and will provide a brief overview of the online CPD program module.

THE JORC CODE IN 2012

Andrew Waltho, Australian Institute of Geoscientists (AIG), Perth, WA, Australia

When first introduced in 1989, the JORC Code (JORC) became a widely recognised standard of best practice for mineral resource and ore reserve reporting based on extensive discussion of standards in the Australian exploration and mining community since the late 1960's. Like many standards, JORC attempted to redress examples of inappropriate reporting of resources and reserves by a small number of companies. The current version, adopted in 2004, represents the fifth revision of JORC since its adoption. The three parent bodies of the Joint Ore Reserves Committee are the Australasian Institute of Mining and Metallurgy (AusIMM), Australian Institute of Geoscientists (AIG) and the Minerals Council of Australia (MCA). All three parents are professional or industry representative bodies, with no role in securities market regulation. The Australian Securities Exchange (ASX) was, until 2010, responsible for markets regulation but this responsibility became contentious when ASX became a publicly listed company with shares traded in its own market. Regulatory responsibilities were consequently transferred to the Australian Securities and Investment Commission (ASIC), a Commonwealth government authority, responsible for corporate regulation in Australia. Compliance with the JORC Code is explicitly required of by ASX Listing Rules. Since the last revision of JORC in 2004, there have been a number of specific interpretations of how the code should be applied issued by ASX as "Company Updates". This process effectively blurred the distinction between JORC, as a set of principles of professional practice by Competent Persons engaged in resource and reserve reporting, and the ASX Listing Rules which govern the practices of companies. There is a strong argument that the two sets of regulations, JORC and the Listing Rules, are better applied to Competent Persons and listed companies respectively, delivering clearer distinction between differing responsibilities, like that achieved by reference to the CIM Guidelines in NI 43-101. The consolidation of regulatory responsibilities within ASIC also creates an opportunity for the reach of JORC to extend to all Australian businesses, not just listed entities, that could benefit from clearer delineation of what is required of both Competent Persons and companies. There are a number of areas where experience suggests that JORC could be improved, particularly in reporting of exploration targets and definition of what should be considered a resource. What minerals are covered by JORC could also be reviewed, particularly in relation to coal seam gas and in-situ coal gasification products which tend to be reported using petroleum sector reporting criteria even though coal is covered by JORC. Report structure is also frequently discussed. NI 43-101 is frequently criticised for being prescriptive, but clearly does not prescribe how Competent Persons should undertake resource and reserve estimates, which is the key concern and where competence is most critical. The underlying concepts of transparent and material reporting by Competent Persons remain the core strength of JORC which may actually be enhanced by reversing some of the post-2004 updates to the current code and more clearly delineating the respective duties of Competent Persons and companies in the next update.

MINERAL DISCLOSURE IN BRINE RECOVERY PROJECTS

James Whyte, Ontario Securities Commission; Craig Waldie, Ontario Securities Commission, Toronto, Ontario

About 2009, expectations of a high demand for lithium impelled exploration companies to invest in lithium projects. Some were hard-rock pegmatites with lithium mineralization, but others were a geological type not foreseen by securities rules: the mineral-brine resources of sedimentary basins in arid areas. NI 43 101 Standards of Disclosure for Mineral Projects and Canadian Institute of Mining and Metallurgy mineral resource and reserve definitions had originally been drafted with hard-rock mineral resources in mind. Disclosure requirements, NI 43 101s technical report form, and CIM definitions did not accommodate a resource that existed in liquid state in sedimentary aquifers. But it appeared that market participants saw mineral brines as a mineral resource and expected similar disclosure rules and definitions to apply to them. The Ontario Securities Commissions Staff Notice 43 704 Mineral Brine Projects and National Instrument 43 101 provides companies and their qualified persons with guidance on our interpretation of NI 43 101 and CIM Definitions, and how those rules and guidelines apply to mineral brine projects. Staff of the Commission have taken the view that mineral brine projects fit the definition of "mineral project" in NI 43 101, and that the public interest is served by having brine projects subject to NI 43 101. The Staff Notice also expresses the view that companies and qualified persons can reasonably interpret the CIM definitions of "mineral resource" and "mineral reserve" to include mineral brines. Disclosure of mineral-brine resources and reserves should still conform to Parts 2 and 3 of NI 43 101, including the rule s requirement to express resource and reserve figures as a quantity and grade, and its requirement to disclose key assumptions and parameters that define the mineral resource or reserve. Technical reports on mineral-brine projects need to discuss aspects of the project that apply particularly to mineral brines. These obviously include hydrogeological information like porosity, permeability, and the geometry of the aquifer, but the report should also discuss matters like climate and surface- water balance and the kind of mineral tenure that can be exerted on a brine resource. For advanced properties, the technical reports section on mining methods is the place to cover proposed well field designs, expected pumping rates, and predicted production over time. Qualified persons should be hydrogeologists or engineers, and should have an adequate level of experience relevant to brine projects.

THE NATIONAL ASSOCIATION OF STATE BOARDS OF GEOLOGY (ASBOG®): HISTORY, EXAMS, ASSESSMENT, AND PROFESSIONAL ETHICS

John W. Williams, Richard Spruill, Jeffery Randall, Jack Warner - National Association of State Boards of Geology (ASBOG®) Columbia, South Carolina, USA

The activities of the National Association of State Boards of Geology (ASBOG®), conceived of in 1988 and formally organized in 1990 by the south-eastern states (GA, FL, SC, NC, TN, VA, AR) to facilitate the licensing of professional geologists, include:

1. developing and administering national licensing examinations (currently formatted as separate multiple-choice fundamentals and practice examinations),
2. seeking to bring compatibility to the procedures used in various states in the licensing process,
3. collecting and providing information for the approximately forty-thousand registrants within the 30 states and Puerto Rico who are members of ASBOG®,
4. developing and maintaining relationships with foreign countries and organizations such as Canada, China, European Federation, etc. with programs and interests in professional geological licensing, and
5. providing information on candidates' performance on examinations to their respective academic institutions to assist in curriculum development.

Professional ethics is one of the issues that ASBOG® considers of critical importance in the professional practice of geology. To promote and implement consideration of professional ethics, the following activities have been completed or are continuing:

1. code of ethics for the membership of ASBOG® (adopted),
2. guidelines for the enforcement of the ASBOG® code of ethics (adopted),
3. establishment of ASBOG® internal structure, staffed with appropriate personnel to enforce code of ethics (completed),
4. creation of draft code of ethics for potential adoption by member state boards (implemented and under state boards consideration),
5. facilitation of ASBOG® member participation in workshops on professional geological ethics (continuing activity),
6. collection and publication of information on activities of individual boards and professional ethics (continuing activity),
7. periodic survey of the geological profession to determine importance placed on professional ethics by practicing geologists (continuing - first survey 2005, second 2010)
    a. 2005 – statistical data support finding that practicing, licensed geologists in Canada and the United States attach significant importance to professional ethics,
    b. 2010 - statistical analysis of more than three thousand responses from licensed, practicing geologists in United States and Canada as to frequency and seriousness of thirteen commonly encountered professional ethical issues such as conflict of interest, failure to disclose regulatory violations, plagiarism, practicing outside area of competence, practicing without a license, etc.
8. inclusion of professional ethics questions on the fundamental and practice ASBOG® examinations (continuing activity).

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