Competency Profile for Professional Geoscientists at Entry to Practice

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GEOSCIENTISTS CANADA®
GÉOSCIENTIFIQUES

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The opinions and intepretations in this document are those of the author and do not necessarily reflect those of Government of Canada

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The Practice of Professional Geoscience

The practice of professional geoscience is the performing of any activity that requires application of the principles of the geological sciences, and that concerns the safeguarding of public welfare, life, health, property, or economic interests, including but not limited to:

a) Investigations, interpretations, evaluations, consultations or management aimed at discovery or development of metallic or non-metallic minerals, rocks, nuclear or fossil fuels, precious stones and water resources;

b) Investigations, interpretations, evaluations, consultations, or management relating to geoscientific properties, conditions or processes that may affect the well-being of the general public, including those pertaining to preservation of the natural environment.

The practice of professional geoscience is regulated in most Canadian provinces and territories[1]. Geoscientists Canada is the national organization of the provincial / territorial regulatory bodies.

The Purpose of the Competency Profile

The competency profile is an important reference document for the geoscience profession, and may have many uses:

- Communicating to governments, employers, students and the general public about the work of professional geoscientists
- Informing the assessment of candidates for licensure[2]
- Creating stronger links between education and practice
- Assisting regulatory bodies to address issues such as continuing competence, practice guidelines and disciplinary matters

[1] Regulating provinces and territories may have unique and slightly differing legal definitions of professional geoscience; the definition appearing above is that of Geoscientists Canada.

[2] Licensure in professional geoscience is based upon completion of prescribed education and work experience. Since the mid-1990s most professional regulatory bodies in Canada have established competency-based standards for licensure, consistent with direction provided initially by the *Agreement on Internal Trade* (1994) and, more recently, by provincial Fairness Commissioners. Geoscientists Canada is working to provide additional tools to support the clarity and consistency of the licensing process.

Concepts and Definitions

Professional competence refers to the ability, in a given practice situation, to act in a safe, effective and ethical manner.

Competence is enabled by the ability to perform specific practice tasks with acceptable levels of proficiency. We define a competency as *the ability to perform a practice task with a specified level of proficiency*. Thus, competence is enabled by the possession of competencies.

The competencies constitute the array of abilities that the geoscientist brings to the workplace at entry to practice[3], and applies in the context of the situation at hand, using professional judgement. Competencies are not applied in isolation; they are an integrated set of abilities, each competency informing and qualifying the others.

The competencies cover a broad range of practice tasks, to ensure that geoscientists entering practice for the first time are equipped to work in a variety of common practice settings. Some competencies will not be relevant in certain practice settings.

The competencies describe practice tasks that are, in general, broad and complex. The performance of each competency requires the application of significant learning in one or more of the cognitive, psychomotor and affective domains[4].

At entry to practice, entry-level proficiency is required, as a minimum, in every competency applicable to the geoscientist's discipline and area of practice[5]. We define entry-level proficiency as follows:

Entry-level proficiency involves addressing commonly-occurring workplace situations without supervision or direction, within a reasonable timeframe, and achieving outcomes consistent with the generally-accepted standards of the profession. It includes the ability to recognize unusually complex workplace situations that are beyond the capacity of the entry-level geoscientist, and addressing them by seeking advice or consultation, by reviewing research literature, and / or by referral to a more experienced geoscientist.

[3] We define "entry to practice" as the point at which a geoscientist has completed the academic and supervised experience requirements of the regulatory body and is qualified to apply for the PGeo title and to work without supervision.

[4] We refer here to *Bloom's Taxonomy*, based upon the work of psychologist Benjamin Bloom in 1956, and many others who followed.

[5] For further information on the applicability of competencies by discipline and practice area, see the section below entitled Structure of the Competency Profile.

Scope of the Competencies

In Canada three distinct but related disciplines within professional geoscience are recognized: Geology, Environmental Geoscience and Geophysics. The document *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada*[6] (GKE) outlines education and work experience in each discipline that provide the necessary learning.

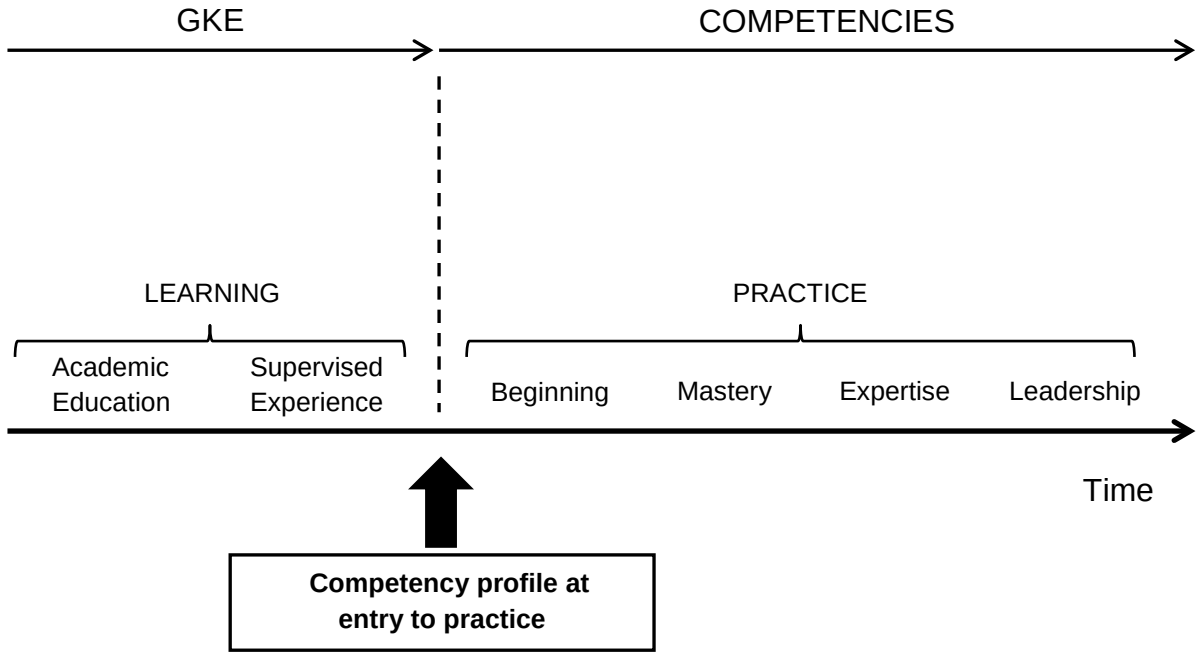
The competencies listed in the competency profile are the result of the ability to apply this learning in the workplace. They represent the full spectrum of abilities that are required, as a minimum, of professional geoscientists at their point of entry to practice.

Following commencement of practice, the geoscientist's competencies will evolve further. Competencies related to the practice area will increase in breadth and level of proficiency as a result of further experience and ongoing professional development. Proficiency in competencies that were present at entry to practice but which are not utilized in the practice area may decrease; over time, and without active use, such competencies may be lost.

The diagram on the following page illustrates the development of the geoscientist's career over time and the applicability of the competency profile.

[6] Geoscientists Canada, 2012

Career Development of the Geoscientist and Applicability of the Competency Profile



Development of the Competency Profile

The creation of the competency profile was an initiative of Geoscientists Canada within the Admissions Support Tools Project[7]. Proposed competencies were developed by a group of 9 subject matter experts encompassing the three geoscience disciplines, led by a consultant specializing in competency-based standards. Direction was provided by Geoscientist Canada's Competency Working Group, and the Canadian Geoscience Standards Board (CGSB).

Following agreement on the conceptual framework for the competency profile, competencies were drafted over a period of 8 months involving face-to-face meetings and distance-based communication. The group referred to numerous published standards for geoscience education and practice, both Canadian and international (see Appendix).

The proposed competencies were reviewed by the Geoscientists Canada's constituent associations (the provincial / territorial regulatory bodies) and then subject to a public consultation process within the profession. Established geoscience groups and

[7] The Admissions Support Tools (AST) Project will assist the regulatory bodies in assessing candidates for licensure, focusing initially on internationally-trained geoscientists. The AST Project has been funded by the Government of Canada's Foreign Credential Recognition Program.

organizations were asked for input, and practicing geoscientists across the country were surveyed to assess the relevance of the proposed competencies to current practice.

In June 2014 consultation data was reviewed by the subject matter experts, the Working Group and representatives of the constituent associations; competencies were adjusted where appropriate, and the final competency profile was reviewed by CGSB prior to acceptance.

Structure of the Competency Profile

The competency profile contains 5 sections:

1. Competencies applicable to all geoscientists

The 68 competencies in this section are organized under the following headings:

1. Scientific method
2. General geoscience
3. Communication & reporting
4. Information technology
5. Organization & management
6. Professionalism
7. Professional development
8. Ethics

These competencies apply to geoscientists irrespective of discipline and area of practice.

2. Competencies applicable to geoscientists working in the discipline of geology

The 16 competencies in this section are organized under the following headings and apply to geoscientists working within the discipline of geology:

1. Planning
2. Acquisition
3. Interpretation
4. Integration

3. Competencies applicable to geoscientists working in the discipline of environmental geoscience

The 19 competencies in this section are organized under the following headings and apply to geoscientists working within the discipline of environmental geoscience:

1. Planning
2. Acquisition
3. Interpretation
4. Integration

4. Competencies applicable to geoscientists working in the discipline of geophysics

The14 competencies in this section are organized under the following headings and apply to geoscientists working within the discipline of geophysics:

1. Planning
2. Acquisition
3. Processing
4. Interpretation
5. Integration

5. Competencies applicable to the geoscientist's area of practice

Prior to entering practice, geoscientists are required to have undertaken acceptable education and supervised geoscience work experience related to at least one established area of practice within their discipline. There are great many areas of practice within the geoscience profession. Some examples are:

Within geology	Within environmental geoscience	Within geophysics
➢ Mineral exploration ➢ Petroleum geology ➢ Survey mapping	➢ Groundwater assessment ➢ Geohazards investigation	➢ Oil and gas exploration geophysics ➢ Mineral exploration geophysics

Section 5 provides a generic approach reflecting this diversity. The 5 competencies in this section are demanding: they reflect the expectation that at entry to practice a geoscientist should have abilities in their area of practice in addition to those in their discipline generally.

GEOSCIENCE COMPETENCY PROFILE

1. Competencies applicable to all geoscientists	
1.1 Scientific method	
1.1.1	Apply scientific methodologies.
1.1.2	Apply concepts and principles of mathematics and statistics.
1.1.3	Apply concepts and principles of physics and chemistry.
1.1.4	Access and search scientific literature.
1.1.5	Recognize uncertainty, ambiguity and limits to knowledge.
1.1.6	Apply principles of quality assurance and quality control (QA / QC).
1.1.7	Undertake reasonable investigation and due diligence.
1.1.8	Use peer review processes.
1.2 General geoscience	
1.2.1	Recognize the essential features, processes, materials, history and development of the Earth and life on the Earth.
1.2.2	Recognize the complexities and interactions of geology and of geological processes in space and time.
1.2.3	Recognize the complexities and limitations of geoscience studies carried out in the field, the laboratory and the office.
1.2.4	Recognize the diversity of working environments within geoscience practice.
1.2.5	Apply locational tools and principles to georeference data.
1.2.6	Identify common rocks, their mineral compositions and characteristics.
1.2.7	Identify common rock and sediment sequences, associations and genesis.
1.2.8	Identify lithological assemblages, positions, age relationships and provenance.
1.2.9	Select and apply stratigraphic nomenclature and establish correlations.
1.2.10	Recognize fluid flow in geologic settings.
1.2.11	Identify surficial landforms, materials and processes.
1.2.12	Identify structural features and relationships.
1.2.13	Recognize geologic hazards.
1.2.14	Recognize geophysical methods, their applications and limitations.
1.2.15	Recognize geochemical methods, their applications and limitations.
1.2.16	Use devices and instruments specific to geoscience.
1.2.17	Analyze and interpret geoscientific data, maps, sections, and reports.
1.2.18	Prepare logs, sections, maps, and other graphics derived from geoscientific investigations.
1.2.19	Apply geoscience principles and modelling to identify solutions, interpretations or targets.
1.3 Communication and reporting	
1.3.1	Communicate clearly both orally and in writing.
1.3.2	Use graphic aids to assist communication.
1.3.3	Use language and communication style appropriate to purpose and audience.
1.3.4	Use standard geoscience terminology.
1.3.5	Prepare technical reports.
1.3.6	Develop and deliver presentations.

1.4 Information technology	
1.4.1	Use common communication devices.
1.4.2	Use common computers, software and peripheral devices.
1.4.3	Use databases to manage geoscience information.
1.4.4	Ensure secure data management.
1.5 Organization and management	
1.5.1	Plan and organize activities.
1.5.2	Use time management skills.
1.5.3	Apply basic knowledge of proposal preparation and agreement management.
1.5.4	Provide direction to others.
1.5.5	Organize logistical support for field activities.
1.5.6	Maintain complete and secure records of work.
1.5.7	Apply basic knowledge of budgetary management.
1.5.8	Apply basic knowledge of risk management.
1.6 Professionalism	
1.6.1	Comply with relevant legislation, regulations and statutory reporting requirements.
1.6.2	Practice within the bounds of one's expertise and limitations.
1.6.3	Maintain awareness of best practices and guidelines.
1.6.4	Seek advice or assistance where necessary.
1.6.5	Act with flexibility in dealing with new and changing situations.
1.6.6	Treat others with respect and fairness.
1.6.7	Apply basic conflict resolution strategies.
1.6.8	Share geoscience information to assist the learning of others.
1.6.9	Work in a multidisciplinary team environment.
1.6.10	Represent the profession in a responsible manner.
1.6.11	Recognize the impact of geoscience practice on clients, society and the natural environment.
1.7 Professional development	
1.7.1	Maintain awareness of societal issues affecting geoscience practice.
1.7.2	Maintain awareness of emerging technical / scientific issues affecting field of practice.
1.7.3	Enhance knowledge and skills related to field of practice.
1.7.4	Self-evaluate performance, and set goals for improvement.
1.8 Ethics	
1.8.1	Comply with relevant codes of ethics.
1.8.2	Recognize obligations and responsibilities to society, to clients and to employers.
1.8.3	Practice in a manner that is non-prejudicial.
1.8.4	Respect confidentiality of information.
1.8.5	Recognize potential, perceived and real conflicts of interest.
1.8.6	Act with concern for the natural environment.
1.8.7	Identify and address health and safety concerns encountered in practice.
1.8.8	Accept accountability for decisions and actions.

2. Competencies applicable to geoscientists working in the discipline of geology	
2.1 Planning	
2.1.1	Compile and incorporate existing geoscience information.
2.1.2	Design field programs applicable to purpose of investigation and site conditions.
2.2 Acquisition	
2.2.1	Implement mapping programs.
2.2.2	Incorporate geophysical and remote sensing methods.
2.2.3	Implement sampling programs.
2.2.4	Incorporate drilling programs.
2.2.5	Implement logging programs.
2.2.6	Select appropriate laboratory analyses.
2.2.7	Address uncertainties and limitations in data.
2.3 Interpretation	
2.3.1	Determine and interpret rock and sediment sequences, associations and genesis.
2.3.2	Determine and interpret lithological assemblages, provenance, age and spatial relationships.
2.3.3	Determine and interpret surficial landforms, materials and processes.
2.3.4	Determine and interpret structural features and relationships.
2.3.5	Evaluate data consistent with purpose of investigation.
2.3.6	Evaluate data to construct models.
2.4 Integration	
2.4.1	Formulate conclusions and recommendations.

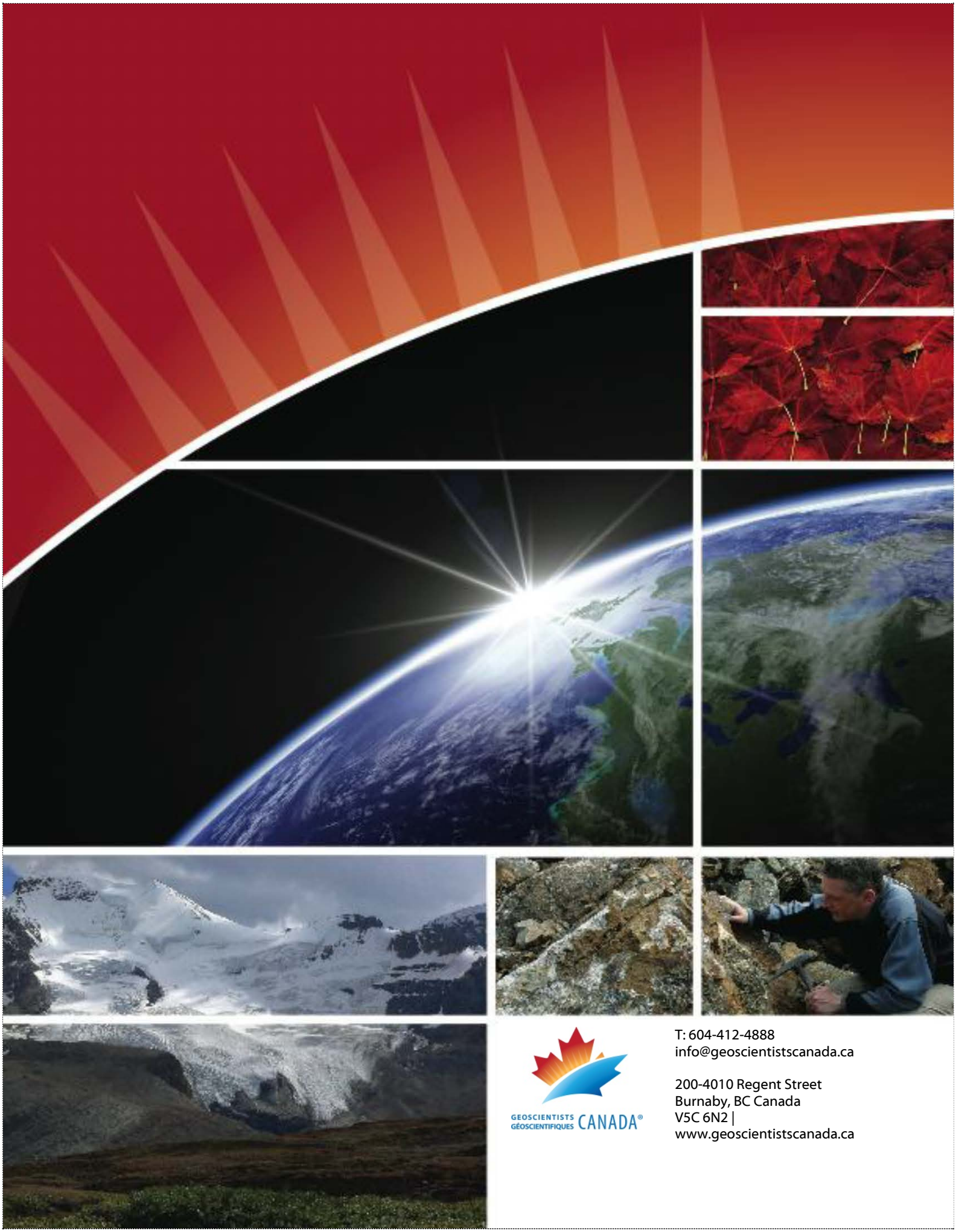
3. Competencies applicable to geoscientists working in the discipline of environmental geoscience	
3.1 Planning	
3.1.1	Compile and incorporate relevant existing information.
3.1.2	Design field programs applicable to purpose of investigation and site conditions.
3.2 Acquisition	
3.2.1	Implement sampling programs.
3.2.2	Incorporate geophysical and remote sensing methods.
3.2.3	Incorporate drilling methods.
3.2.4	Implement logging methods.
3.2.5	Prepare field maps.
3.2.6	Select appropriate laboratory analyses.
3.2.7	Address uncertainties and limitations in data.
3.3 Interpretation	
3.3.1	Determine and interpret rock and sediment properties, sequences, associations and genesis.
3.3.2	Determine and interpret lithological assemblages, positions, age relationships and provenance.
3.3.3	Determine and interpret surficial landforms, materials and processes.
3.3.4	Determine and interpret structural features and relationships.
3.3.5	Determine and interpret the physical and chemical characteristics of relevant materials.
3.3.6	Determine and interpret geologic and environmental hazards.
3.3.7	Evaluate data to construct models.
3.4 Integration	
3.4.1	Formulate conclusions and recommendations.

4. Competencies applicable to geoscientists working in the discipline of geophysics	
4.1 Planning	
4.1.1	Compile and evaluate existing geoscience information.
4.1.2	Design data acquisition programs considering geological models, acquisition environment and objectives of study.
4.2 Acquisition	
4.2.1	Implement geophysical data acquisition.
4.2.2	Address uncertainties, ambiguities, limitations and pitfalls in geophysical data acquisition.
4.3 Processing	
4.3.1	Plan processing flow of geophysical data considering geological model, acquisition environment and objectives of study.
4.3.2	Address uncertainties, ambiguities, limitations and pitfalls in geophysical processing.
4.4 Interpretation	
4.4.1	Evaluate results and recommend further acquisition or processing as appropriate.
4.4.2	Perform geophysical modelling.
4.4.3	Evaluate and visualise multiple attribute data sets.
4.4.4	Display geophysical data in geological context.
4.4.5	Interpret geophysical data considering geological model, acquisition environment and objectives of study.
4.4.6	Interpret dimensions and physical properties of targets.
4.4.7	Address uncertainties, ambiguities, limitations and pitfalls in geophysical interpretation.
4.5 Integration	
4.5.1	Formulate conclusions and recommendations.

5. Competencies applicable to the geoscientist's area of practice	
5.1	Apply a comprehensive and systematic understanding of current knowledge to practice activities.
5.2	Apply a comprehensive knowledge of current methods used to undertake investigation.
5.3	Critically evaluate models.
5.4	Seek and apply knowledge to address multifaceted problems in familiar and unfamiliar contexts.
5.5	Recognize the complexity of knowledge, as well as contributions from other geoscience areas of practice and other professions.

Appendix: Principal Reference Documents for Development of the Competency Profile

- *Benchmark for Earth Sciences, Environmental Sciences and Environmental Studies*, Quality Assurance Agency for Higher Education (UK), 2007
- *Core Engineering Competencies*, Engineers Canada, 2012
- *Entry-to-Practice Competencies for Geoscience in Canada? - A Concept Study*, Geoscientists Canada, 2007
- *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada*, Geoscientists Canada, 2012
- *Guidance Note for Validation as a Chartered Geologist or Chartered Scientist*, The Geological Society, The Science Council (UK), 2011
- *Initial Competencies Compendium for Geologists from Quebec* (English translation), Ordre des géologues du Québec, 2012
- *Ministerial Statement on Quality Assurance of Degree Education in Canada*, Council of Ministers of Education, 2007
- *Qualification Framework and Accreditation Criteria for Geology Study-Programmes in Europe*, Euro-Ages (EU), 2010
- *Tasks of a Professional Geologist*, National Association of State Boards of Geology (USA), 2004
- *Critical Needs for the Twenty-first Century: The Role of the Geosciences*, American Geosciences Institute (USA), 2012
- *The UK Quality Code for Higher Education*, Quality Assurance Agency for Higher Education (UK), 2011



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