Welcome to...
Queen’s
Geological Engineering
Orientation Night
CLASS OF 2019

Dr. Georgia Fotopoulos, PEng
GEOENG Undergrad Advisor

Department of Geological Sciences and Geological Engineering
Miller Hall
What is Geological Engineering?

Geological Engineering is the practical application of the principles, concepts and techniques of the geological sciences to human needs.

Dr. John Hanes
A Geological Engineer combines:

- a knowledge of geological materials
- and earth engineering design principles

to create viable and *sustainable* projects
Geological Engineering and Sustainable Development

“development that satisfies present needs without compromising the needs of the future”
GEOLogical Engineering Prepares You for Many Career Paths and Job Opportunities…
Dr. Mark Diederichs, PEng
GEO-Design in Minex and Mining
GEO-Expertise for Oil and Gas (incl Geophys)
GEO-Technical Rock & Soil Engineering
GEO-Hazard Management
Office? Only if you want one!
Why Geological Engineering at Queens?

Well rounded education and skill set and confidence to go beyond ......
Preparing You For the World
Queen’s Undergrads and Grad Students
Working Everywhere
Jenn Day – Sci’11
My Geological Engineering Adventure (so far...)

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Why I took Geo... (and never looked back!)

2nd year Field Experience
After 2\textsuperscript{nd} year: Field Mapping - Geological Survey of Canada
Why I took Geo... (and never looked back!)

3rd and 4th year

1. Learn geological principles
2. Test rocks for engineering properties
3. Combine knowledge for design!
After 3rd year: Consulting - BGC Engineering

Geotechnical and Environmental Engineering
After 4th year:

Geologist – Barkerville Gold Mines

Gold!

Investigating rock for gold exploration

Rock Mechanics - MDENG

Investigating rock for mine construction and safety
After some great jobs........

Grad School =

Focussed Courses +
Exciting Research +
Hi Tech Tools
(Lab, Field, Software)
+ Travel.....
Canada, Switzerland,
France, Italy,
Greece, Austria,
Germany, Chile,
Brazil, USA.....
16.7m Diameter Tunnel Boring Machine
SPARVO, ITALY
This would EAT Miller Hall!
My Geo- Adventures so far:

TOPICS...

Mineral Exploration
Environmental Engineering
Underground Rock Mechanics
Mining Soil Mechanics
3D Laser Modelling
Pit Slope Stability
Deep Tunnelling

and

Nuclear Waste Storage

Can’t wait to see what’s next!
Mark Diederichs, PEng.  GeolEng Chair

The Program

MATH
GEOLOGY
CHEMISTRY
MECHANICS
PHYSICS
ECONOMICS
APPLIED SCIENCE
ENGINEERING ANALYSIS
DESIGN
The Program

Geological Characterization
Mineralogy
Petrology
Sediments

Engineering Economics

Techniques
Field Methods

Mathematical Tools
Diff-Eq's
Statistics

Design Concepts
Geo-Eng Analysis

Integration and Application
Engineering Design Project
Field School (Spring)

Fundamental Concepts
Mechanics
Earth Physics
Third & Fourth Year

Geological Analysis
- Structural
- Hydrological
- Geochemical

Geotechnical
- Soil and Rock Engineering

Quantitative Tools
- Numerical Models
- Terrain Analysis

Design Concepts
- Site Investigation
- Program Design

Integration and Application
- Field School (4th Year)

Applied GEO
- Geophysics
- Resource Engineering

Humanity - CE Electives

Specialty - TE Electives
4th Year
GEO-ENG DESIGN

INVESTIGATION AND MEASUREMENT

CREATIVITY
TEAMWORK

DESIGN of Geological Models

JUDGEMENT

ANALYSIS

DESIGN of Engineered Solutions

DESIGN of Analysis Protocols

DESIGN of Investigation Programs and Monitoring Systems

Queens Geological Engineering Program
Exploration Geology
Field Mapping with the Ontario Geological Survey
Madelein Sauve   Sci 17
Geotechnical Engineering
Soils & Earthworks
Ray Kennedy and Braeden Klassen
Geoscience and Engineering Labs

Dr. Kurt Kyser

Queen’s Facility for Isotope Research (QFIR)

Physical and chemical approaches to understanding the earth using the most advanced technologies

Research + Teaching + Student Projects
Queen’s Facility for Isotope Research (QFIR) Lab
$8 million very hi-tech lab
Dedicated to doing CSI on all natural systems!

Extraction line for oxygen in rocks and minerals

inductively-coupled plasma for element and isotopic analysis

selFrag - high voltage pulse fragmentor
Our Philosophy: Hands On Training In all Labs

Learning to identify minerals using microscopes:
2nd and 3rd year geomaterials

Determining the structure of materials using X-Ray Diffraction
2nd and 3rd year structural design
Electron microbeam techniques
Composition of Earth materials at all levels
3rd / 4th year projects
Timing is everything in Earth science
From Yesterday to 4 Billion Years Ago – we can tell

• **Dating rocks and minerals using laser** – 4th year projects

Zircon grain: U-Pb and Pb-Pb ICP-MS

Femto Second Laser Ablation System
Undergraduate Projects in the Geochemistry Lab

Find and remediate ore deposits:
*Sustain standard of living with minimal environmental impact*

Isotopes in rocks, minerals, gases, water, organic matter
*How do earth systems work?*

Timing of events recorded in rocks:
*What is the history of the Earth?*

Changing environmental patterns:
*How are humans affecting the environment and how components move from the geosphere into the biosphere*
FIELD EDUCATION

Ellen Handyside Sci ’17
and Callum Walter Sci ‘16
FIELD SCHOOL

Ellen Handyside
Sci ‘17

work hard
play hard
World's oldest fossil forest
Fourth Year Engineering Field Education
Callum Walter Sci ‘16
Fourth Year Field School
Northern Ontario Mine Sites
Production, Ground Control
and Environmental

Underground
Rock Engineering
Engineering Geology and Rock Engineering

How to determine the mechanical properties of nature for engineering design?
Scans and Analysis for Underground Rock Engineering
Computational Geomechanics: 2-D, 3-D Geotechnical Analysis
Rockfalls and Game Engines?
Rockfall Simulation
Simone Markus, Sci 16
Geotechnical Engineering Intern at Shell Canada

Fort McMurray, Alberta
Slope stability, water pressure monitoring, mine and tailings inspections
Slope stability, water pressure monitoring, mine and tailings inspections
Shell Christmas Party

Calgary Stampede

Jasper

Working in Oil and Gas
→ Travel!
→ Friends!
→ Fun!
Calgary, Alberta
- Consulting company
- Oil facilities design
Weyburn, Saskatchewan
- Injections student
- Enhanced CO₂ oil recovery
Lloydminster, Alberta/Saskatchewan

- Production operator
- Conventional heavy oil

Canadian Natural
Rock-Fall Analysis

Energy (kJ) vs Time (s)

Velocity (m/s) vs Time (s)
Field Work
Grad School Work Geo-Modelling
Geophysics@Queen’s

Dr. Alexander Braun

- 249 Geophysical Characterization of the Earth
- 319 - Applied Geophysics
- 419 - Geophysics Field School (Renfrew, 10 days)
- 439 - Advanced Applied Geophysics
- Some special studies courses, Exploration Seismology, Imperial Oil Barrel Competition

Your Career in Geophysics and Engineering
Geophysics: Equipment, Software and Toys

Seismic Survey

Remote Sensing by UAV (x3)

Geophysics software donations for student use valued at $196 million.
Geophysics: Equipment, Software and Toys

Resistivity/IP Survey

Ground Penetrating Radar

Electro-Magnetics

Magnetometry
Why do Geophysics?

Mineral Exploration
Geotechnical
Environmental
Oil and gas
Archaeology
Space
IT

Dynami Graphics Inc
Geophysics@Queens welcomes you to ...

Explore, Understand and Engineer our Planet from Global to Nano Scales...

..and have the time of your life!

Chen et al., 2012

magnetotactic bacterium
Natalie Blacklock  Sci ’15

Geophysics Field School
Renfrew, ON
Geophysics in Exploration
Canadian Malartic Mine, QC
The 3 R’s of Queen’s Geological Engineering

Georgia Fotopoulos, PEng

Reputation
Sought after by Industry
Salaries Start at $50K to $100K

Queen’s is one of Top 2 Geo-Schools in the country (Maclean’s)

Responsibility
Student involvement in all aspects of the department

Recognition
Leads to PENG License
+ can also lead to PGEO
One More R

RELEVANCE

4th Year Design Projects:

Meeting Industry and Public Needs
Site Investigation Design
Geological Model Design

Escher et al., 1994
Analysis Program Design
Final Project Design
Summer in the Department
Eleanor McAuley and Katie Irwin
Summer in the Department

Lab Work
Summer in the Department
Design Work
Katie Irwin  SCI’15
MASc Geological Engineering and Geophysics
Academic Summers
BISC British Archeology Field School
Second Year Geo

Why We Chose Geo

- Love for the Outdoors
- Passion For The Environment
- Everything Starts With the Earth

You will look cool!

Presented By:
Connor Meeks
Olivia Wojcieszynski
Intro to GeoEng (GEOE281)
Field Trip
Help is Always Near!

Small Class Size
Friendly Upper Years
Amazing Professors

Family Field Fun
Alumni and Careers

Geological Engineering at Queen's is a well-established, highly regarded, thriving and dynamic program with a long tradition of excellence.

We take great pride in our strong alumni presence in Canadian and international industry and across the R&D spectrum.

Here is just a sample.....
Marlène Villeneuve
GEO BSc Eng 2002  GEO PhD 2008

Now: Professor Engineering Geology, New Zealand

3 yrs Tunnelling Engineer
California and Australia

Tunnelling with a 10m Boring Machine
2km under the Swiss Alps (her PhD)
Rick Wasfy
GEO BSc Eng  2004

SPECIALIZED TECH INC.
Gas Well Desanding Services

2011 - Calgary

Tour d’Afrique – 2010 –
Cairo to Cape Town

Lead Engineer
“Investing in Queen’s is truly investing in the future leaders of the 21st century…and that is, no doubt, a high return, compounding investment worth making.”
Drew Feustel
PhD  Queen’s Geophysics, 1995

NASA ASTRONAUT
MISSION SPECIALIST

NASA
IMAX HUBBLE 3D
esg solutions
EXXON Mobil
Danielle Delaloye,
GEO BSc 2009
MASc 2012
Matt Lato  
(GEO BSc Eng 2006; PhD 2010)  
Now Senior Engineer
Victoria Sterritt
GEO BSc Eng 2004

Senior Project Geophysicist for TECK

Masters of Economic Geology, UBC, 2006
MBA, Queen’s 2015

Returned to Teck, ...
.....first week back!
Geoffrey Ballard
B.Sc.Eng, 1956
Inventor of the Ballard hydrogen fuel cell
One of MacLean’s magazine’s 50 Canadians to watch in 2003

Geological Engineering was important to my success because:

It taught me to make good decisions based on fragmentary and scattered data - A highly prized ability in business.
Fun

The Miller Club

Undergraduate Society for Geological Sciences and Geological Engineers

Jess Andrew (Sci ‘16) President

Academics

Teams
Sports!!!!
Gronch!!!
Even More Fun!
What Else We Do...

For the Department:

• Curriculum Committee
• Promotion and Tenure Committee
• BED Fund Representative
• Alumni & Industry Reps

For the Students:

• Bus to PDAC
• Geo-Help Centre
• Beers with Profs
• Networking/Resume Workshops
• 4th Year Dinner
• Engineering Wine and Cheese
• And MANY more!
JOIN US NOW FOR SNACKS, REFRESHMENTS AND DISCUSSION DOWN THE HALL IN THE READING ROOM
We’ll be there to answer any questions you may have!