University of Western Ontario – Department of Earth Sciences

Earth Science 4451Y: Geophysical Field School

(Offered together with GP 9509A):

Course Description

This course is a 10-day Geophysical field school held in the vicinity of Calabogie, Ontario in late August and early September, providing an introduction to geophysical techniques used in exploration for mineral deposits and hydrocarbons, as well as those used in geotechnical and environmental studies. This course is jointly run by the University of Western Ontario (UWO) and Queen's University.

This course meets the CCPG knowledge requirements for Field Techniques (Geophysics) for Registration as a Professional Geophysicist. Techniques covered will include gravity, magnetic, seismic and electromagnetic field methods. Data acquisition and basic data processing and interpretation will be covered, together with an introduction to data analysis using specialized software. Each geophysical method will be introduced in classroom lectures, with accompanying outdoor practical lab sessions. The course will culminate in a detailed survey design, execution, and interpretation for two field sites (Admaston & Calabogie).

This course is an intensive upper year field course and will progress at a rapid pace with 14 hour workdays being standard for much of the course.

Instructors

UWO: Laura Sanchez lsanche@uwo.ca , Queen's: Gabe Walton 7ggw@queensu.ca

UWO TA: Jessica Stromberg jstromb@uwo.ca , Quenn's : TBA

Field trip (absence from Campus)

The course takes place during a mandatory ten day field school in the Calabogie and Admaston areas south and west of Ottawa. We depart on Thursday, August 29st, 2013, and we will drive back Sunday, Sept 8th, 2013.

Field Safety

Students are expected to be familiar with and comply with the University Off-Campus Activity Safety Policies. You will be required to sign a safety form prior to departure for the field school. No specialized safety training is required prior to participation in the course.

Equipment

Students will make use of geophysical equipment belonging to UWO and Queen's, and may further be using equipment loaned to us by local geophysical companies. Some of this equipment is expensive. Students are expected to treat all equipment with care.

Expected Learning Outcomes: Students completing the course will be capable of performing the following tasks:

- Survey Execution – Collecting data using various instrumentation
- Survey Design – Making decisions on which techniques to use and on how surveys should be setup
- Data Processing & Interpretation – Drawing meaningful conclusions from field data
- Communication – Effectively documenting work completed and results

Note that these learning outcomes are not mutually exclusive (i.e. the experience you gain with survey execution will help you make informed decisions about survey design).

The table below breaks each learning outcome into three different levels of competency. Students are generally expected to engage with the course content at an "intermediate" level.

Learning Area	**Level**		
	Basic	**Intermediate**	**Advanced**
(1) Survey Execution	Operate basic instrumentation	Anticipate potential limitations of instrumentation based on site/job characteristics	Overcome instrument limitations in novel situations (troubleshooting)
(2) Survey Design	Explain the physical principles of the instrumentation	Student can apply a knowledge of survey logistics and instrumentation principles in designing an effective survey plan	-
(3) Data Processing & Interpretation	Use software to process data	Interpret how processing choices influence results	Critically analyze an interpretation of data for potential issues/inconsistencies

(4) Communication	Differentiate between correct and incorrect terminology	Effectively communicate orally and through written materials, using proper terminology	-

Evaluation:

10% Two written reports on field testing of geophysical instruments
10% Field work design at Calabogie and Admaston field sites (group effort).
25% Participation & Professionalism
10% Final oral presentation
15% Oral exam
20% Final fieldwork report (one field site)
10% Executive summary (second field site)

Evaluation Details

1. Individual reports on field testing of instruments (x2)

Learning Objectives Assessed: 3,4

The objective is produce a report on the proper functioning of each instrument, and to make recommendations for field procedures to be used during the Calabogie and Admaston field trip. The field test data should be quantitatively compared with expected geology and anomalies in the area to document the correct instrument response. Students will write one report for each of the first two field testing days:

Report 1: Magnetics or EM

Report 2: Seismic Refraction or Resistivity

These reports will be written individually, although collaboration with others on maps and data plotting is encouraged. Following the initial submission of each report, there will be an opportunity for peer review prior to the final submission to the instructors for marking.

The field tests must be fully documented, all data must be reduced and quantitative interpretations and/or conclusions must accompany the reports. A *brief* discussion of the instruments used (name and model), where and why the exercise was done, and how the data were collected is required. Conclusions should be written with regard to the functioning of the instrument and any recommended field procedures to be used.

Field test reports are to be approximately 1000 words. Excessive length will be penalized (up to 10% mark reduction, depending on severity)! The field data should be clearly represented in the

form of graphs, figures or tables, as appropriate. Base maps need to be detailed, legible and should clearly show the location of each survey, as well as be annotated with any anomalies located. Maps must have a legend, a scale and a North arrow.

You can format your reports in any logical manner that you deem appropriate. A *possible* format for the field test reports is:

Objectives: Discussion of where and why survey was performed

Instruments: Instruments used, operating principles and what exactly is measured (be brief)

Procedure: Brief review of survey procedure (specific to each geophysical method), including setup

Results: Show and describe your primary data (graphs, images, etc). Brief discussion of results, addressing sources and magnitude of errors and limitations

Data analysis and interpretation: This is where you describe what you think your data mean (refer back to the objectives)

Conclusions and recommendations: This section should be very brief for these reports (1 paragraph).

Bibliography: Include a correctly formatted reference to the manual, and any other material you used.

Appendicies (as needed): For large volumes of data that cannot be effectively displayed in the report body.

Standards/Assessment of reports: Professional standards in written work are critical in this course.

- Your reports are expected to be clearly written to a high standard.
- Figures are expected to be of a high quality, numbered and captioned below, and *included* within the text.
- You must refer to each Figure at least once in the text to provide context.
- Maps are essential: they must be legible, with a legend, scale, North arrow etc.
- Appendices are allowed for presentation of large volumes of data, but must be summarized within the text.
- A bibliography is always required, and correct (APA) referencing style is expected.
- Any formulas are to be treated as a part of the text, and punctuated accordingly *and numbered*.
- Formulas must be either derived or properly referenced, and any previous results (mathematical, geophysical, or geological) must be referenced.
- Reports must be double spaced

2. Design proposal for fieldwork at the Calabogie and Admaston sites

Learning Objectives Assessed: 2,4

Students will be split into a number of teams. Each team will then be asked to give two short (~5 minute) presentations outlining their proposed survey design (one presentation for each site).

The proposals should consist of at least:

- Geological/geophysical summary for the area (in the context of your chosen methods)
- Proposed instrumentation and line locations
- Proposed survey parameters for each instrument
- A preliminary itinerary with instrument use planned as well as time/manpower requirements for each survey.

The designs will be evaluated both on their technical soundness and their logistical feasibility (i.e. is there too much or too little work for the amount of people, time, and instrumentation that we have?).

Consider the survey design proposal as a competition between rival consulting firms fighting for the business of the instructors. Following the selection of the best design for each site by the instructors, the entire student team will finalize their design (making adjustments as appropriate) and assign tasks to each individual.

3. Participation and Professionalism

Learning Outcomes Assessed: 1

The importance of participation and professionalism in this course cannot be understated. This mark will be qualitatively assigned based on a qualitative assessment by the instructors of your professionalism, as well as your achievement of learning outcome number 1 (i.e. your conduct in the field). This mark will be based on the following factors:

- Enthusiasm and efficiency in completing field work
- Quality of peer feedback provided for initial field reports
- Involvement in keeping equipment organized and in good condition
- Quality (detail, organization, legibility) of field notes (to be checked by the instructors)
- Participation in a variety of different data collection activities (i.e. not doing resistivity for 3 of the 4 main field days)

4. Final oral presentations

Learning Objectives Assessed: 3,4

All students writing their final report on a given site will work together in a group to put together an oral presentation. Based on their data processing work and interpretations, each student will contribute to the presentation (a few slides, less than five minutes). This presentation will be evaluated as a team mark for both communication and technical merit.

These are presentations to management on the success (or otherwise) of the field excursion. Both presentations should include a site introduction, visual summaries of the data collected (maps, representative profiles), a preliminary evaluation of the data, and recommendations for future work (if necessary).

5. Oral Exam

Learning Objectives Assessed: 1,2,3,4

Each student will have an individual meeting with one more instructors. Questions assessing any of the learning outcomes specified above may be asked during this meeting.

6. Final Fieldwork Report

Learning Objectives Assessed: 3,4

One final report is required (for either Admaston or Calabogie). Each student must prepare their report individually, although students are encouraged to organize the tasks of data processing, and data modelling in such a way as to equalize the workload amongst themselves. Nevertheless, *all written work submitted will be considered to be the independent work of the student who submits it.*

Reports should contain approximately 4000 words. Insufficient or excessive length will be penalized (again, up to 10% mark reduction, depending on severity). It is suggested your reports follow this format:

Abstract
Table of contents
Introduction
Geological setting
Geophysical survey methods
Data reduction
Integrated interpretation
Conclusions / recommendations
Bibliography
Appendices

Figures should appear within the body of the text. Appendices may be used to present large volumes of data without interrupting the flow of the report. In the past students have jointly compiled and submitted a single appendix containing all relevant field data. This is acceptable and encouraged, but each individual report must be properly illustrated with figures from this appendix when making reference, e.g. to a particular interpretation.

7. Executive Summary

Learning Objectives Assessed: 3,4

Students will (individually) write an executive summary (less than two pages) on the work performed at the site for which they did not write their final report. This executive summary will be heavily based on shared data, processing results, and to some extent, the interpretations presented by the other group in their final oral presentation. The executive summary should show an understanding of the results obtained and should ideally contain some original interpretations.

SCHEDULE:

Date	Activities
Thursday, August 29th, 2013	Arrival at BW Renfrew Course Intro Safety Briefing Intro to Gravity/Mag Report Explanation Intro to EM
Friday, August 30th, 2013	Mag, EM, and Gravity Field Tests Intro to Geosoft and mag processing Intro to Resistivity/IP **Report 1 (due midnight)**
Saturday, August 31st, 2013	Introduction to Seismic Refraction Report 1 Peer Editing & Resistivity/IP Field Tests **Report 1 – Final (due 2:00 pm)** RES/IP Processing & Refraction Field Tests

	Refraction Processing
	Report 2 (due midnight)
	Intro to Seismic Reflection
	Peer Editing & Walkaway Noise Test
Sunday, September 1st, 2013	**Report 2 – Final (due 2:30 pm)**
	Intro to reflection processing
	Intro to field sites
	Survey Design and Presentations
Monday, September 2nd, 2013	Admaston Day 1
Tuesday, September 3rd, 2013	Admaston Day 2
Wednesday, September 4th, 2013	Calabogie Day 1
Thursday, September 5th, 2013	Calabogie Day 2
Friday, September 6th, 2013	Processing, writing final reports
	Oral exams throughout
Saturday, September 7th, 2013	**Reports and presentations due at 3 pm**
	Executive summary due at 9 pm
Sunday, September 8th, 2013	Travel

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed.

In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see: http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here: https://studentservices.uwo.ca/secure/medical_document.pdf

Accessibility Statement: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x.82147 for any specific question regarding an accommodation.