GUNDY LAKE ROAD PROJECT
Date: May 11th-12th (field acquisition) and 15th-16th (data analysis and report), 2015

OBJECTIVE

The next field school projects involve surveys in the Archean Superior Province of the Canadian Shield. The intent of the surveys is to focus on some of the most important methods for mineral exploration in the Precambrian shield: magnetics, electrical, and radiometric. The first project is on Gundy Lake Road, Ontario (Figure 1) and involves a survey of iron-rich metasedimentary rocks which form a magnetic and conductive target. This project will be followed immediately by a gravity and radiometric project on the Falcon Lake Intrusive Complex (FLIC) in easternmost Manitoba.

Figure 1. Location of Gundy Lake Road study area (Rosenthal 2008).

The Gundy Lake survey will be a relatively small scale survey over iron-rich metasedimentary rocks in the Lake of the Woods Greenstone Belt LWGB at the northern margin of the Wabigoon Subprovince of the Superior Province. The response of these rocks is visible on aeromagnetic surveys and in the present survey we wish to obtain more detailed information. The questions we will answer are:

1. What is the small-scale distribution (1-10 m scale) of the magnetization of the rocks?
2. What is the nature of the magnetization in these rocks?

3. What is the electrical resistivity response of these rocks, and is any enhanced conductivity spatially coincident with enhanced magnetization?

BACKGROUND GEOLOGY

Figure 2 shows the large scale divisions of the Archean Superior Province. The study area occurs within the Wabigoon subprovince near its margin with the Winnipeg River subprovince. The Winnipeg River Formation is made up of approximately 95% felsic and intermediate plutonic rocks with minor supracrustal rocks (Card & Poulsen 1998). The Wabigoon subprovince includes greenstone subdomains including the LWGB as well as a central plutonic domain. The supracrustal rocks range from ultramatic to felsic although they dominantly consist of tholeiitic to calc alkaline basalts (Card & Poulsen 1998).. The subprovince is characterized by lobate batholiths surrounded by volcanics which dip steeply away. The contact between these units is generally a zone of high strain. Metamorphism in the greenstone belts grades from greenschist in the middle to amphibolite at the boundaries (Card & Poulsen 1998).

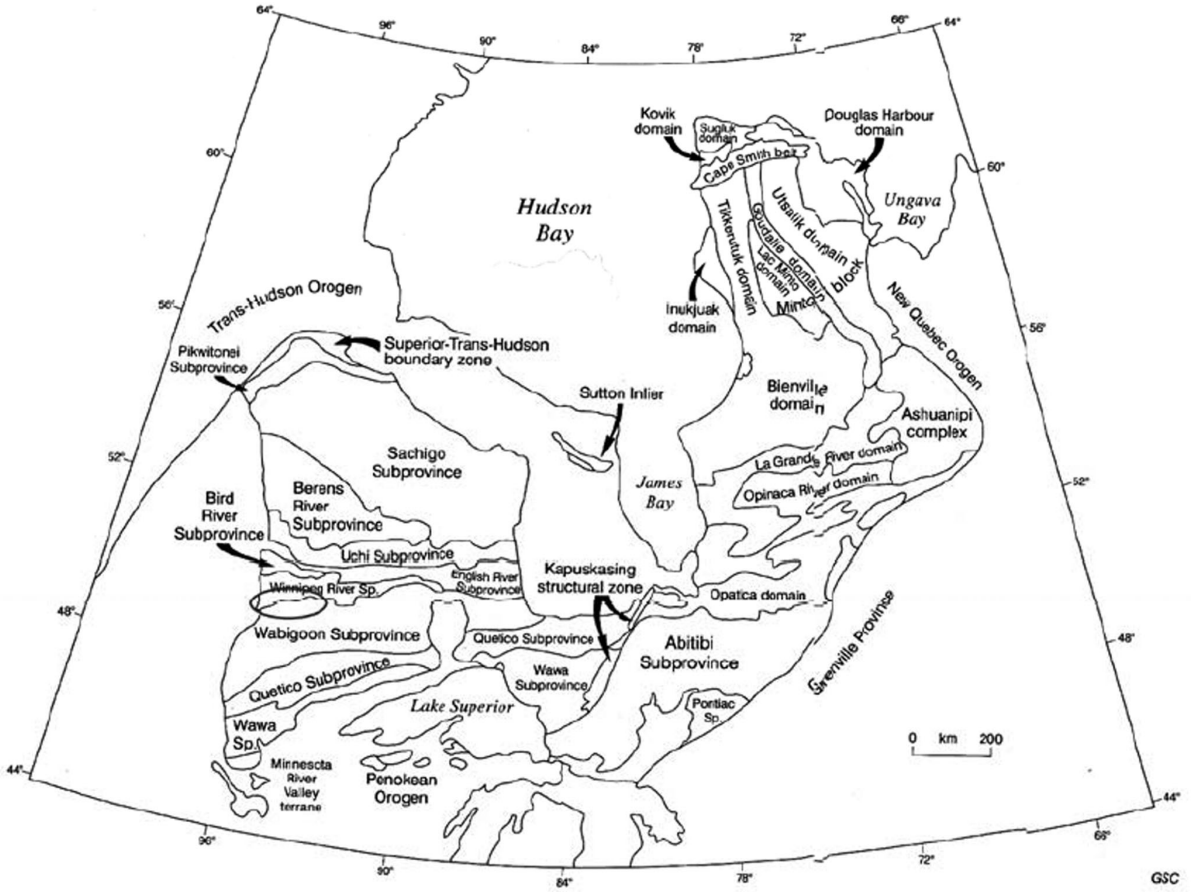

Figure 2. Large scale divisions of the Superior Province (Rosenthal 2008 as modified from Card & Poulsen 1998). Ellipse shows location of the study area.

The LWGB (Figure 3) comprises metamorphosed volcanic sequences, volcanic associated marine sediments and coarse-grained alluvial deposits (Ayer *et. al.* 1991). These sequences have been intruded by granitoid stocks. The study area lies at the boundary between the Wabigoon and Winnipeg River subprovinces which is a shear zone between the supracrustal rocks of the LWGB to the south and the felsic gneisses of the English River to the north (Figure 3, 4) (Card &

Poulsen 1998). Based on foliation within the shear zone, movement has been interpreted as nearly vertical (Cates 2001).

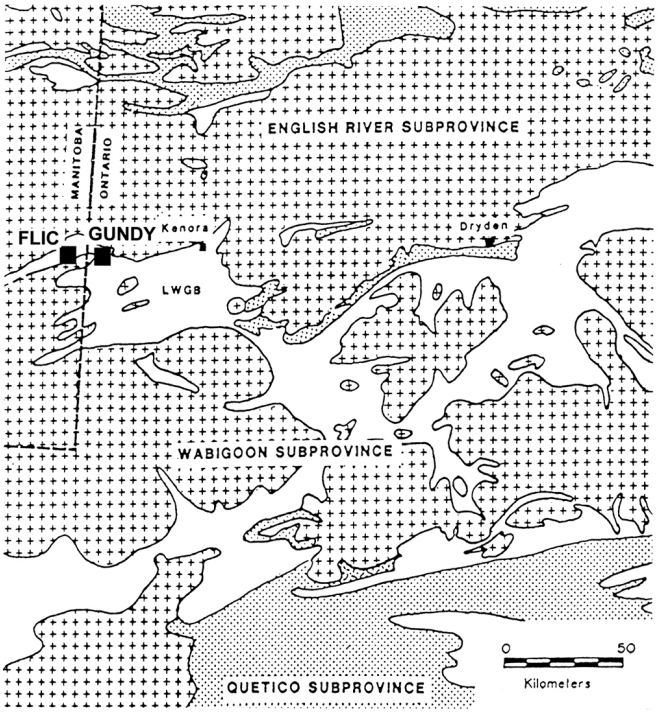

Figure 3. Regional geology map showing the location of the Gundy Lake Road and FLIC projects. Note the location of the Lake of the Woods Greenstone Belt (LWGB).

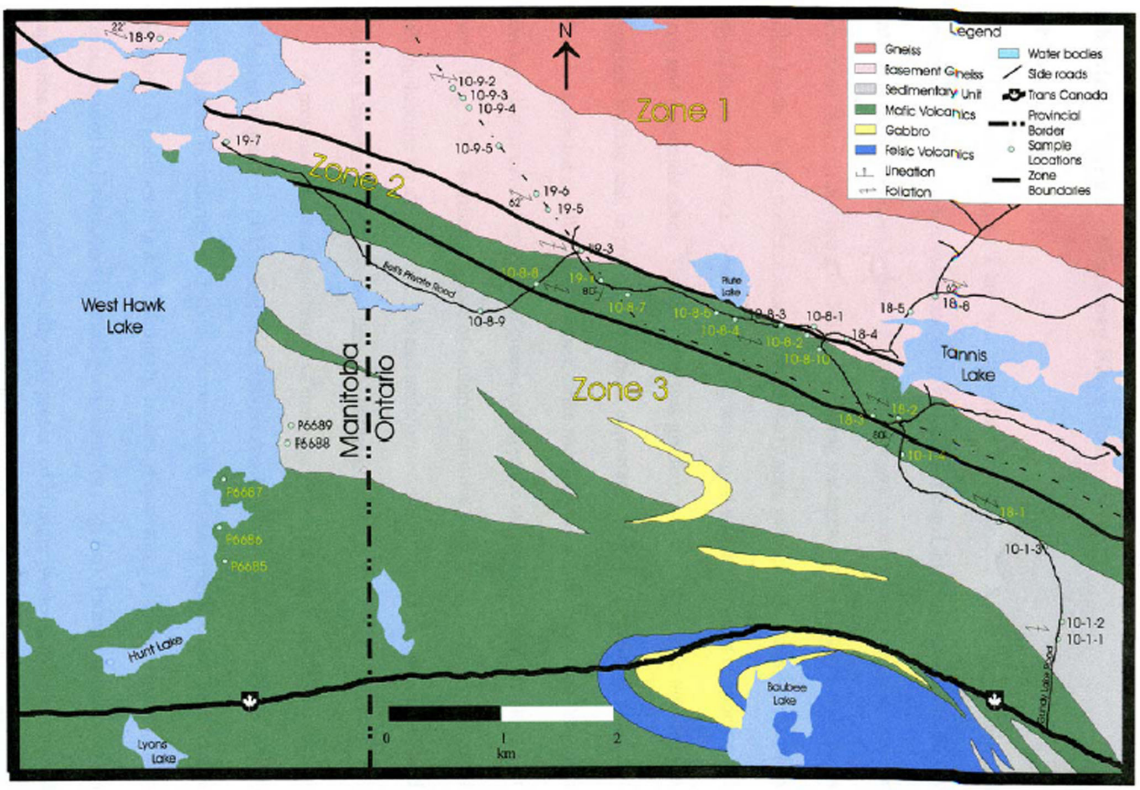

Figure 4. Local geology of the study area (Cates 2001).

Cates (2001) divided the local geology of the study area into three zones based on the petrology and metamorphic grade (Figure 4). Zone 1 is composed of rocks from the Winnipeg River Subprovince and comprises grey biotite gneisses intruded by pink granitoid rocks. Zone 2 in the shear zone itself and comprises both felsic rocks, amphibolite rocks and the Gundy Road Iron Formation. The entire shear zone is highly deformed and contains many mafic and felsic dikes which were intruded before the shearing. The intensity of the shearing increases towards the center of this zone (Cates 2001). Zone 3 is composed of mafic volcanic, sedimentary and granitoid intrusions of the LWGB. Bald (1981), described three iron formation members near the contact between the gneisses of the Winnipeg River and the Wabigoon supracrustal rocks. Because of poor surface exposure, she was not able to determine if individual iron formation members are continuous or if their form a number of discontinuous lenticular beds.

The magnetic effects of the iron rich rocks are visible on the contours of the data (Figure 5). Rosenthal (2006) collected magnetic and TEM data on nine profiles crossing the iron rich rocks.

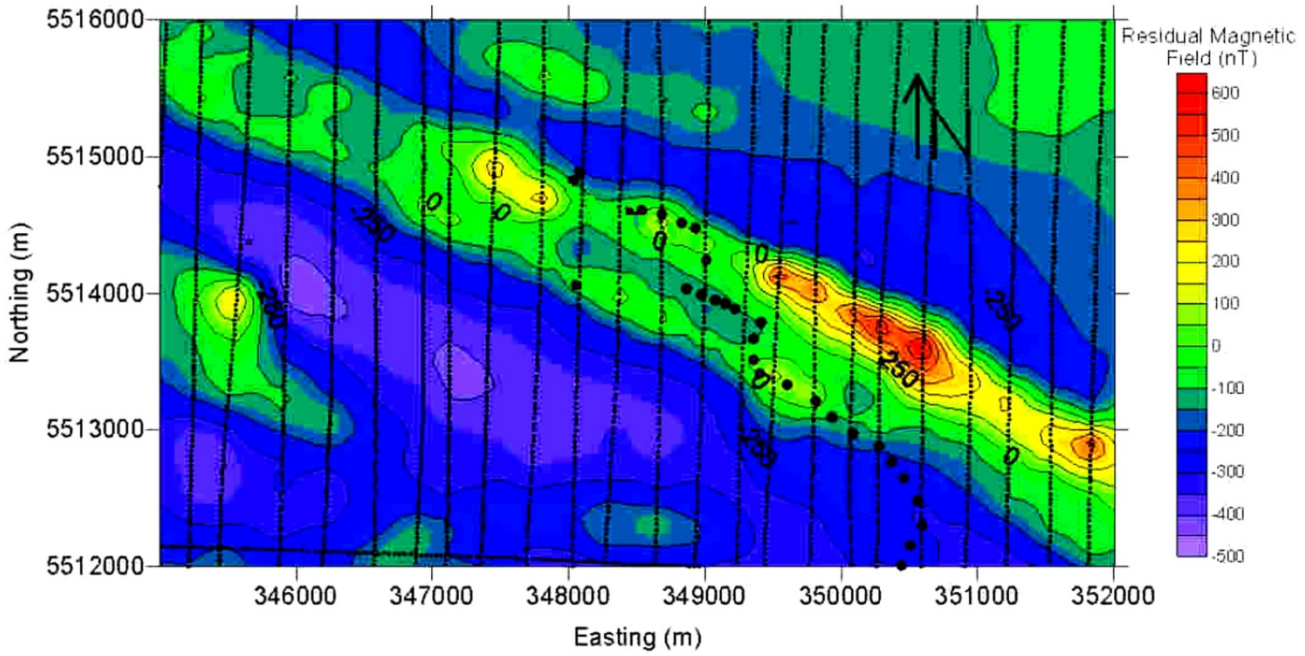

Figure 5. Interpolated aeromagnetic map of the Gundy Lake area (Rosenthal 2008). The magnetic effects of the iron rich rocks are visible on the contours of the data. The degree of resolution of the aeromagnetic data is shown by the spacing of the individual flight lines. The black dots are the GPS points recorded along Gundy and Bell roads.

SURVEY METHODS

The field work will be conducted as three groups of four students. Data collection will be focused on two parallel profiles crossing the site, separated by about 100 m. Each group will collect: in-line EM31 (vertical-dipole and horizontal-dipole, quad and in-phase), in-line EMP-400 (vertical-dipole and horizontal-dipole, quadrature and in-phase), in-line EM34 (vertical-dipole and horizontal-dipole), TEM (profiling mode), magnetic and magnetic gradient (with base station), radiometric, and magnetic susceptibility data on one profile. In order to investigate the anisotropy of the responses additional EMP-400 and EM31 data should be collected at an appropriate station spacing over magnetic/conductive target regions with instruments oriented perpendicular to the

survey line. Station spacing for the surveys will be established by each group with final approval from an instructor. The susceptibility and radiometric data can be collected on outcrops occurring on or near the line and should be tied to a geological examination and description of the outcrops along the line.

EM data only will be collected along additional profiles between or near the main profiles on a cooperative basis as time permits. Each group should include at least one additional profile of in-line **EMP-400, EM31**, and **EM34** data. A dipole-dipole **DC resistivity** and possibly IP sounding should be completed along the road crossing any points where magnetic or conductive targets cross the road. Additional walking mode **magnetic** data should be collected over the whole survey area, and **magnetic susceptibility** measurements should be taken on outcrop.

Both groups should prepare a sketch map of the area showing the road position and both surveys lines. Azimuths and **GPS** locations of important features should be measured and recorded. Dips and strikes of representative beds should be measured.

EQUIPMENT

We will need the equipment for each of the methods listed above, as well as **gravity, radiometrics,** and **elevation** equipment for the FLIC project. **GPR** may be taken on FLIC if there is sufficient space for the equipment, It is your responsibility to see that all necessary parts are present and packed organize yourselves to do this efficiently! Remember to include spare batteries and relevant *battery chargers*, as this is a multi-day project. Everyone should have a safety vest.

GROUPS

The groups are listed below, along with pairs for advanced data analysis and report writing.

Group 1		Group 2		Group 3	
Neil	1a	Amandeep	2a	Qaisar	3a
Shehryar		Gafaar		Easton	
Sodiq	1b	Steve	2b	Kevin	3b
Harsimran		Yana		Tony	

ACCOMMODATION DETAILS

Accommodation for the Gundy and FLIC projects will be at Star Lake Field Camp on Sunday through Tuesday nights. The emergency contact number will again be Andrew's cell phone, 204-997-9204, although because of coverage it may also be useful to use the main Department of Geological Sciences number 204-474-9371.

- Bedding. Students will be assigned to a bunk room. Beds and mattresses are available but it will be necessary for students to bring a sleeping bag (or alternative bedding), pillow, towel, and soap etc in addition to the usual field equipment.
- Meals. All meals except lunch on the first day will be provided, but you must be on time for them. Breakfast is at 7 AM and dinner is at 6 PM. You can prepare a cut lunch form appropriate materials provided at breakfast time. The tap water at Star Lake is poor so drinking water will be provided. You will need to bring a water bottle. Alternatively if the weather is cold you may like to bring a thermos for coffee or tea. There will be pop or juice boxes available for lunch but the number of these that can be taken each day is limited.
- Showers. The field school has showers but you will be rationed to one short to moderate length shower a day.

• Camp Protocol. You are expected to follow the camp protocol that is designed to facilitate the coexistence of a relatively large number of people in a small space. It is not a boot camp but following a few easy rules will make things a lot more pleasant for everyone.

- If in doubt about whether you should or can do something, ask.
- Everyone (including instructors) will be rostered on to help with dishes and clean-up.
- At the end of our stay it is necessary to sweep and clean out bunk-rooms and the geophysics trailer.
- Everyone should be respectful of others. There should be no loud noise after 11 PM in order to allow those who prefer/need to sleep to do so.
- Be respectful of the protocol at meals. Ask if seconds are allowed unless it has otherwise become clear. Clear off your dishes promptly once you are finished eating.
- We expect a professional attitude to alcohol. Only beer and wine are permitted. There must be no alcohol in the field and no excessive drinking during geophysical work at the field station. Hangovers will not form an acceptable reason for poor performance or attitude to the geophysical work. We will not transport alcoholic drinks from Winnipeg to Star lake but you will have the opportunity to buy them at West Hawk Lake.
- Remember that a component of field marks for the Gundy and FLIC projects depends on reasonable compliance with these guidelines.

PRELIMINARY SCHEDULE

The following schedule may be modified by weather and other factors.

Monday 11th May

8:30	Arrive at Department and pack vehicles. **Bring your lunch and drinking water.**
9:00	Depart Winnipeg.
11:30	Arrive at site and plan surveys
12:00	Lunch
12:30-16:30	Geophysical measurements.
16:30	Travel to Star Lake stopping at West Hawk Lake.
17:00	Unpack geophysical equipment: put batteries on charge.
17:30	Move personal gear to two bunk rooms (students)
18:00	Dinner
19:30	Data entry. Planning of next day's survey.
21:30	Free time

Tuesday 12th May

07:00	Breakfast
08:30	Depart Star Lake for Gundy Lake Road.
09:00-12:00	Geophysical measurements.
12:00-12:45	Lunch.
12:30-17:00	Geophysical measurements.
17:00	Travel to Star Lake stopping at West Hawk Lake.
17:30	Unpack geophysical equipment: put batteries on charge.
18:00	Dinner
19:30	Data entry. Planning of next day's surveys (Gundy and FLIC).
21:30	Free time

Wednesday 13th May

07:00	Breakfast
08:30	Depart Star Lake for Gundy Lake Road.
09:00-12:00	Geophysical measurements.
12:00	Depart for FLIC Project

12:00-12:30	Lunch
12:30-17:00	Geophysical measurements.
17:00	Travel to Star Lake stopping at store and/or beer outlet at West Hawk Lake.
17:30	Unpack geophysical equipment: put batteries on charge.
18:00	Dinner
19:30	Data entry. Planning of next day's (FLIC) survey.
21:30	Free time

Thursday 14th May

07:00	Breakfast
08:30	Depart Star Lake for FLIC.
09:00-12:00	Geophysical measurements.
12:00-12:30	Lunch
12:30-17:00	Geophysical measurements.
17:00	Return to field station for dinner. Some data entry may be done at this time
18:00	Dinner
19:30	Return to Winnipeg.
21:30	Unpack vans & organize equipment

DATA ANALYSIS

Data analysis and reporting for the Gundy Project will be done before that for the FLIC project and is due at **10 PM on Saturday 16th May 2014.** The data archiving and data reduction will be done for their profiles by each group. This work includes reducing each set of data to a final form that can be plotted as a profile or contoured. The full data set will then be made available to both groups. Advanced analysis including integration of data from both groups and magnetic modelling will be done by partners; reports will be in pairs as well (one report per pair).

REFERENCES

Ayer, J.A., Johns, G.W. and Blackburn, C.E., 1991. Archean volcanology and sedimentology of the Lake of the Woods the classic Keewatin greenstone belt; *Geological Association of Canada*, fieldtrip guidebook B2, May 29 June 2, GAC/MAC/SEG joint annual meeting, Toronto, Ontario, p. 1-12.

Bald R.C., 1981. Petrogenesis of Early Archean, Gneissic Tnalite-Granodiorite from the English River Subproovince, Gundy Lake Area, Northwestern Ontario, Msc. Thesis, University of Manitoba 117 pp.

Card K. and Poulsen K.H., 1998. Geology and mineral deposits of the Superior Province of the Canadian Shield,*in Geology of North America Series*, ed. Lucas, S B; St Onge, M R, p.15-204.

Cates N, L., 2001. Characterization of the boundary between the Winnipeg River and the Wabigoon subprovinces of the Superior Province, Gundy Lake, northwestern Ontario, Msc Thesis, University of Manitoba.

Rosenthal, L. 2008. Electrical and magnetic responses of iron formations in the Gundy Lake Road area, Lake of the Woods Greenstone Belt. B.Sc. (Hons.) Thesis, U. Manitoba, Winnipeg, Canada.