In an effort to provide as many opportunities as possible, priority will be given to those who have not already received funding for a Faculty of Arts & Science international opportunity including 398 REP, ICM, CFHU or DIIIF – (Some exceptions may apply, please inquire for details). All proposals involving undergraduate student travel must include the full participation of a faculty member with a continuous undergraduate appointment to the Faculty of Arts & Science (St. George). All student participants must be current Arts & Science (St. George) undergraduate students in good standing and be enrolled in an academic program at the time the proposed activity takes place.

PART I

Last Name: Bank  First Name: Carl-Georg (Charly)  Title: Associate Professor

Sponsoring department: Earth Sciences

UTOR Email Address: charly.bank@utoronto.ca

Part II – Project Summary

Project title and a brief description of your proposed project: Seismic Tomography and Ground-Penetrating Radar to Map Sediment Stratigraphy and Thickness at Kathu Pan, South Africa

ESS 398H0F L0101

marking scheme:
10% pre-departure assignment (background on methods and site)
20% contribution to field work
30% written field notes and documentation
10% interim report (due at end of fieldwork)
30% final report (due late September)

This proposal builds on Charly's previous successful collaboration with Prof. Michael Chazan (ANT) in South Africa - funded by the REP program in summer 2014 - which resulted in an undergraduate thesis project and a peer-reviewed publication with that former undergraduate team member as first author (Papadimitrios, Bank, Chazan, Walker: Paleotopography of a stone-age archaeological site in South Africa from ground-penetrating radar and magnetometry, accepted for publication in the South African Journal of Science, 2018).

For 2019 we are planning to work on another site about 3 km away. This site is a dried lake which contains a rich archaeological and environmental record over the past 150,000 years. The geophysics
A team will collect two kinds of data:

1. Ground-penetrating radar (GPR) with a 400 MHz antenna will be able to differentiate the upper 3 to 4 m. This corresponds to a depth for which PhD candidate Vasa Lukich has produced detailed sedimentological descriptions of layers at three sinkholes in the pan. The radar profiles should be able to confirm her correlations between those and extend the stratigraphy towards the center of the pan.

2. Seismic tomography will collect body and surface waves to map depth to bedrock and indicate the type of bedrock. A magnetic survey we conducted in 2014 in this area shows a curved magnetic anomaly; this result will help us set up seismic lines.

Two people are necessary to run a survey (either magnetic or GPR), but setting up and moving a seismic line is very work intensive and best done by a team of four. By taking along three students we can efficiently set up a seismic line, and then split into two pairs to collect GPR and seismic data concurrently.

Total number of undergraduate students participating: 3

Location of activity (city and country): Kathu, Northern Cape Province, South Africa

Dates of activity: 15 June to 08 July 2019

Role of faculty supervisor:
I will be preparing the students for the trip (providing readings, answering questions, discussing ground rules, field safety) and assist them to get ready (e.g., packing list, introduction to equipment). At the site I will train students in diligent data collection protocols and trouble-shoot when problems arise. Students will be rotating with the tasks, which means that they will also be working with me one-on-one collecting some of the data since much of the time we will be working in pairs. We will remain within sight and hearing of one another, and also close (within 1 km) of the archaeological team.

PART III – Details of Proposed Activity

Description of proposed activity:
Kathu Pan is a stone-age archaeological site, it also maintains a nearly uninterrupted record of Holocene and Pleistocene (1o abut 150 ka) environmental conditions at the southern reaches of the Kalahari desert. Our project will help understand both aspects. By running seismic and radar surveys you will determine the depth to the bedrock and map out layers within the sediments. A network of profiles will allow you to create a 3D image of the subsurface and help connect the isolated profiles investigated by other researchers we are collaborating with. A successful team member will be curious about geophysics, archaeology, and sedimentology, and interested in learning from other researchers and students.

Planned academic outcomes:

Vasa Lukich, a PhD student jointly supervised by Professors Chazan (ANT) and Cowling (ESS), has analysed sediment samples from different sinkholes at the site and interpreted them in terms of past environmental conditions. Our project will aid in correlating between her vertical profiles. Charly's goal is for this project to culminate in an undergraduate thesis project, a conference presentation by the student author, and a journal publication with student co-authors.
Building student oral and written communication skills is an important goal of the department's programmes. This project will require students to communicate on site with one another and with the team of Canadian and South African scientists and students led by Prof. Chazan. They will compose a report and I anticipate that, similar to previous projects, one student will present our results at an international research conference.

Providing experiential learning opportunities for undergraduate students is a stated goal of the Faculty, and the project is designed as cooperation between the ESS and ANT departments.

**How will students be selected to participate in the proposed project?**

*Please list any prerequisites, specific conditions or other relevant information.*

Students should have completed 200-level courses in ESS (including ESS241 Geologic Structures, ESS262 Earth System Processes) and ideally would have background in sedimentology (ESS311) and geophysics (JGA305). Alternatively they are enrolled in the Archaeology program and have a strong interest in science, including geophysical methods. Students should be aware that we will be sharing accommodations, preparing meals together, and working in a warm and dry environment. If more then three students apply, Charly will conduct more thorough interviews to select a team based on interest, career aspirations, and background (for example if a student has never been able to travel abroad this could be a factor). The ideal team would represent a tiny cross-section of the diversity among FAS students.

**Indigenous Consultation:**  N/A

**How does this project meet the requirements of the REP Program?**

The proposed project adheres to all points listed on the website http://www.artsci.utoronto.ca/international-programs/faculty/applications-international-programs/research-excursions

1. continuously supervised practical experience off-campus for two or more students
2. "supervised" and connected to Charly's research
3. linked to an ongoing archaeological project in South Africa
4. project runs in summer, report will be due end of September
5. students not yet selected
6. students will not be paid, but earn H credit
7. proposal has ESS designator
8. only student expenses listed, other expenses (faculty travel and living expenses, shipping of equipment, custom fees) carried by faculty member grant

**Does this project require ethics approval?**  x no

*All undergraduate students, graduate students, and faculty taking part in international opportunities must meet the UofT Safety Aboard guidelines as noted on the Safety Abroad website: http://www.studentlife.utoronto.ca/cie/safety-abroad in order to participate. Support will*
be provided by the Professional and International Programs (PIP) office at Woodsworth College to ensure safety abroad requirements are met.

**PART IV – Itinerary**

**Brief Itinerary (list dates and daily activity):**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Location</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 June</td>
<td>Toronto</td>
<td>depart for Cape Town</td>
</tr>
<tr>
<td>16-18 June</td>
<td>Cape Town</td>
<td>late arrival, drive to Kathu w/ 2 overnight stays</td>
</tr>
<tr>
<td>19 June to 02 July</td>
<td>Kathu</td>
<td>field work</td>
</tr>
<tr>
<td>03/04 July</td>
<td>Kathu</td>
<td>drive to Kathu w/ overnight stay</td>
</tr>
<tr>
<td>05/06 July</td>
<td>Cape Town</td>
<td>sightseeing, finish interim report</td>
</tr>
<tr>
<td>07/08 July</td>
<td>Cape Town</td>
<td>flight Cape Town - Toronto</td>
</tr>
</tbody>
</table>