*Elida RS, GIS and Field Geologic Mapping*

A preliminary proposal

By

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The proposed project aims to use Remote Sensing (RS), Geographic Information Systems (GIS) and fieldwork to shed some light on the nature of the Elida Copper Porphyry deposit. Specifically we would like to use RS-GIS to map, interpret and understand how copper is moving through the system while it is eroding.

To that end we will conduct Physiographic and Geologic Mapping of exposed surfaces in the area of the deposit. It will be attempted to map the following: (1) mineralogy: alteration, potassium influx, phylic, and argillic; (2) lithological units; (3) structural features at the outcrop level; and (4) weathered surfaces; and (5) lineaments and faults.

**Data**

This project will make use of acquired data as well as primary data collected in the field. The following data are considered:

- Geospatial Data:
  - Topographic Maps
  - Geologic Maps
  - Prospecting/Mining Exploration Data
  - Terrain (DEM) high resolution (LIDAR?)
  - Remote Sensing Images
  - High Resolution multispectral and hyperspectral
- Field Data
  - Ground Truth/Referencing and Sample Collection
  - Field Imaging: Ground photos, 'close'sensing
  - Field Mapping (Modern Plane Table Technique)

**Methods**

This study will build on methods used by others for similar purposes (Zhang, Kulon, Infrared Spectroscopy, Jensen's RS of the Env, plus articles) as well as incorporate our own techniques. For instance RS-GIS Icon Images developed by Pazner et al (see Appendix IV). *Lab methods* will involve digital image processing of high resolution multispectral and hyperspectral data. In addition, field samples will be analyzed. Additional lab techniques will involve: GIS Modeling Terrain Analysis and Visualization, and creation of Thematic Geologic Maps and Indices.

*Field methods* will include field imaging ("close sensing") and field spectroscopy. Appendix III is an example of Eyewear for real-time enhanced field geologic imaging (developed by Pazner). Ground Truth/Referencing and sample collection will take place at around July-August 2014. Additional instruments will be considered, e.g. ground penetration probes such as Ground Penetrating Radar (GPR). Field Geologic Mapping will be conducted using a modern (digital, GPS and image-based) plane table mapping technique (developed by Pazner).

**Timetable:**

*Dec 2013:* Site Orientation/Familiarization trip. Field imaging and sample collection, field mapping at the outcrop and smaller scale level (small features).

*Dec - August:* Data acquisition, processing and analysis (RS stage).

*August 2014:* Fieldwork: Ground Truth/Referencing and Sample Collection. Field Imaging: (Ground photos, 'close'sensing'). Field Geologic Mapping (Modern Plane Table Technique).

*Sept -December:* field data processing, integration, modeling and mapping (GIS stage).

*December 2014:* Results Assessment
Jan 2015-May 2015: Thesis and Report writing.

**Budget items:**

Graduate Research Assistant Salary
Field Travel Expenses
Workshops, short courses, interning (registration, travel, accommodation, per diem)
Data: maps, images, tasking satellites
Lab sample analysis
Instruments (Lab and Field, e.g. departmental field spectrometer, ground penetrating radar(?), other)
Computer hardware and software
Field equipment

Notes:

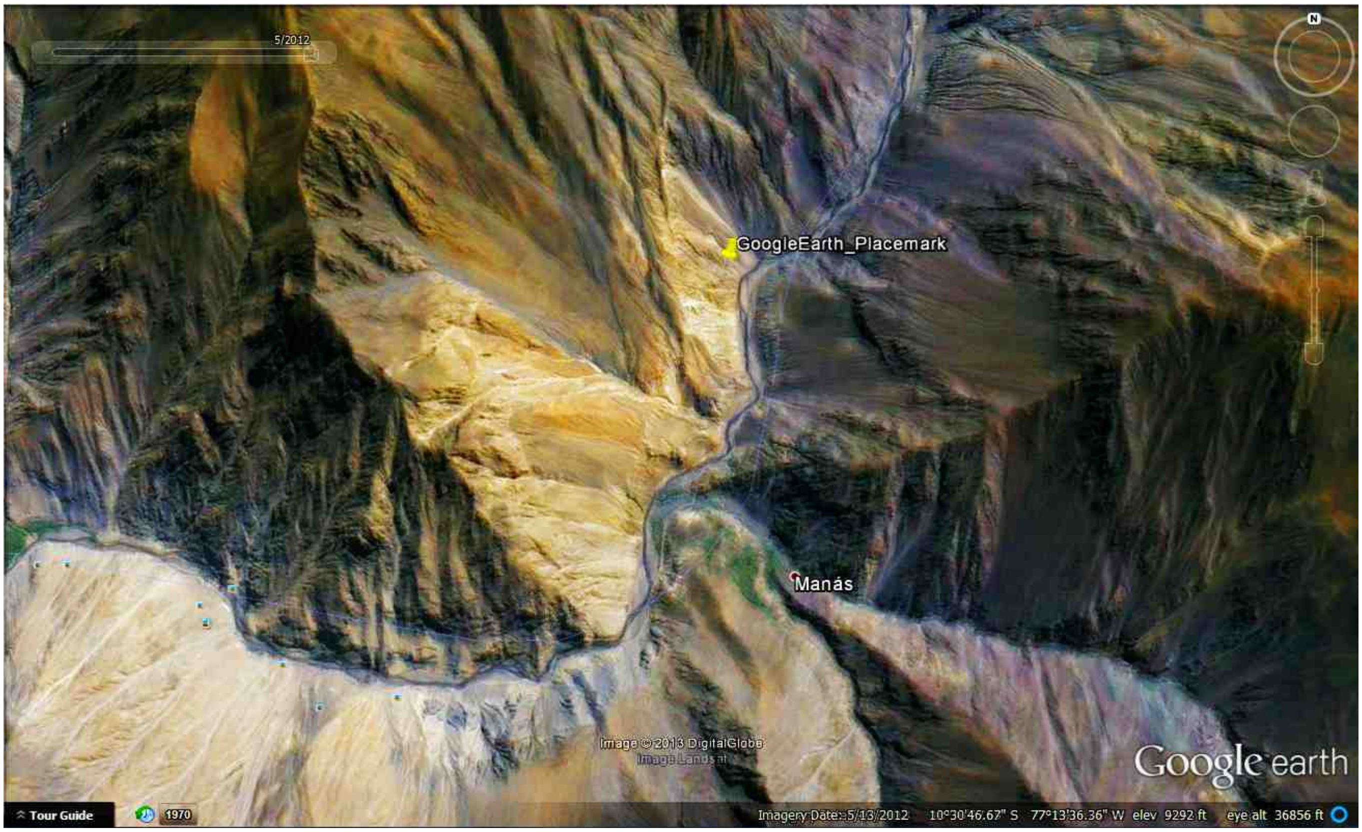
a. MITACS Accelerate Internship for 4 months, 15K (7.5 matched funding from government and from the company. Min 10K for the Student.
b. For research grants via Western U. need to factor in 40% overhead.
c. Travel expenses to include transport (and insurance) of professional equipment.

Appendices

I. Google Earth Image (w/caption)
II. Field Images (enhanced)
III. Example of Field Imaging (ROSIP)
IV. Example of Alteration Mineral Pattern Image

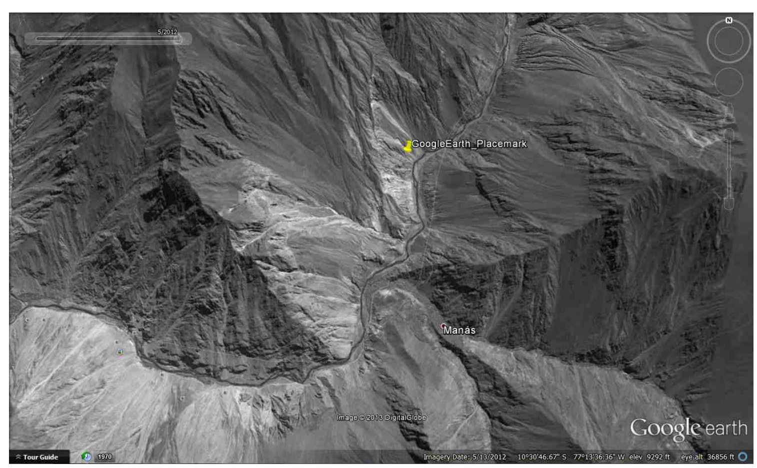
Appendix I: (a) Fused Google Earth Image. (b) Low resolution color Google Earth image pan-sharpened using (c) high resolution 'historic' B&W image.

**(a)**

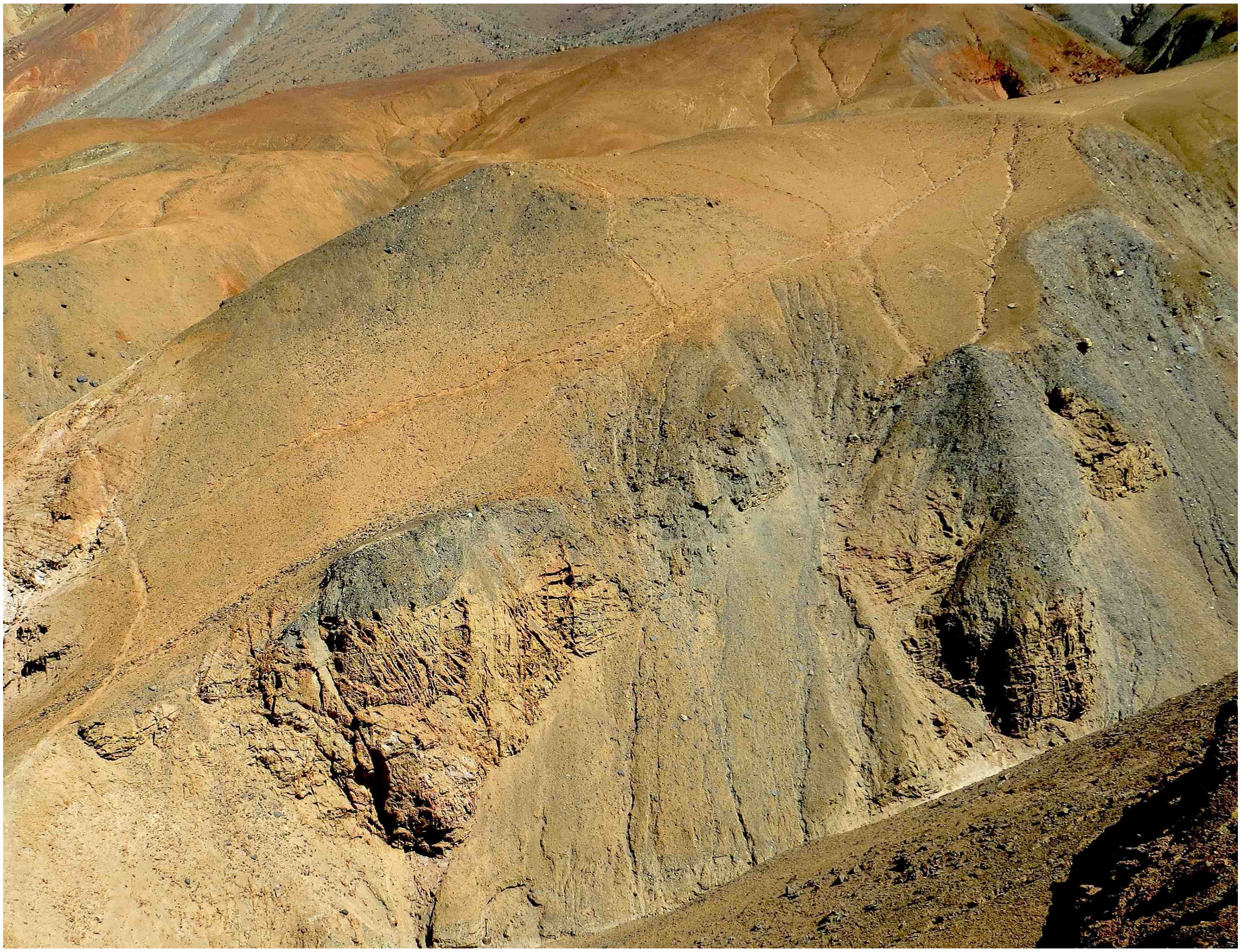



**(b )**


**(c)**



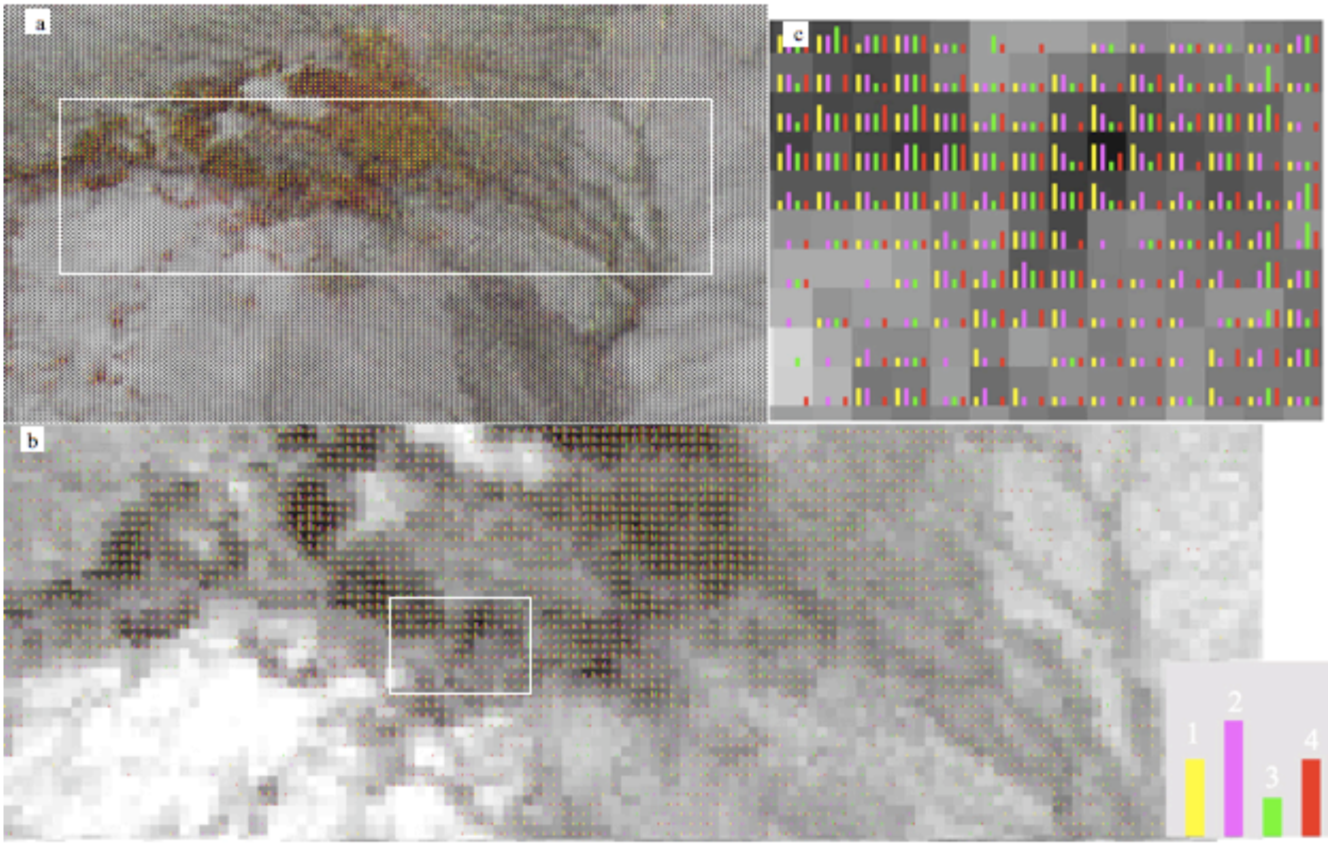
Appendix II:  Three enhanced field photographs (taken by Manuel Montoya?)




09/04/2013

Appendix III: Example of Right-On-Site Field Imaging and Enhancement using Eyewear (Goggles)

Appendix IV: Example of Alteration Mineral Pattern Image




Portion of Color-coded bar-chart icon imagemap for visualizing mineral abundance in the study area
(a: macro-level view; b: meso-level view; c: micro-level view); 1: alunite; 2: kaolinite; 3: montorillonite; 4: muscovite