Mineral Deposit Research Unit

Science. Exploration. Discovery.

Detecting and recovering porphyry and epithermal mineralization systems with broadband natural field airborne EM

(on examples of MobileMT data)

AUTHORS: Alexander Prikhodko

EVENT/DATE/LOCATION:
EM for Geologists / Nov 17 / SFU Downtown

ORGANIZING COMMITTEE

DMEC Decennial Mineral Exploration CONFERENCES

MDRU - Dr. Shaun Barker
DMEC - Ken Witherly
Technical Advisors - Scott Napier - MIRA, Geoff Plastow - SEEQUENT, Joel Jansen – Lundin Mining, BC Geophysical Society Liaison - Ross Polutnik

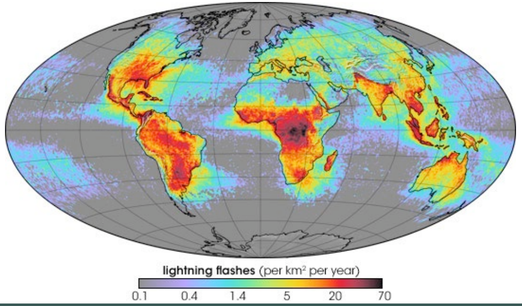
Presentation outline

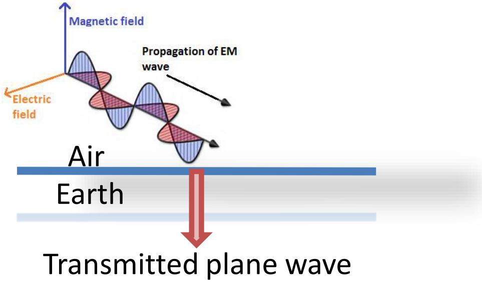
- Airborne AFMAG – MobileMT technology and its advantages
- MobileMT field case studies:
    - PNG Kainantu, epithermal and porphyry
    - Northern Chile, porphyry
    - Ecuador, (Panantza and San Carlos) porphyry
    - BC, Poplar porphyry
    - Central BC and Serbia, porphyry
    - Asia, epithermal

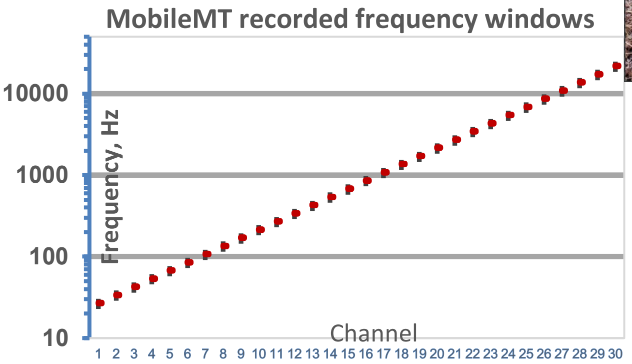
MobileMT – AFMAG technology

A typical lightning flash is **about 300 million Volts and about 30,000 Amps (weather.gov)**

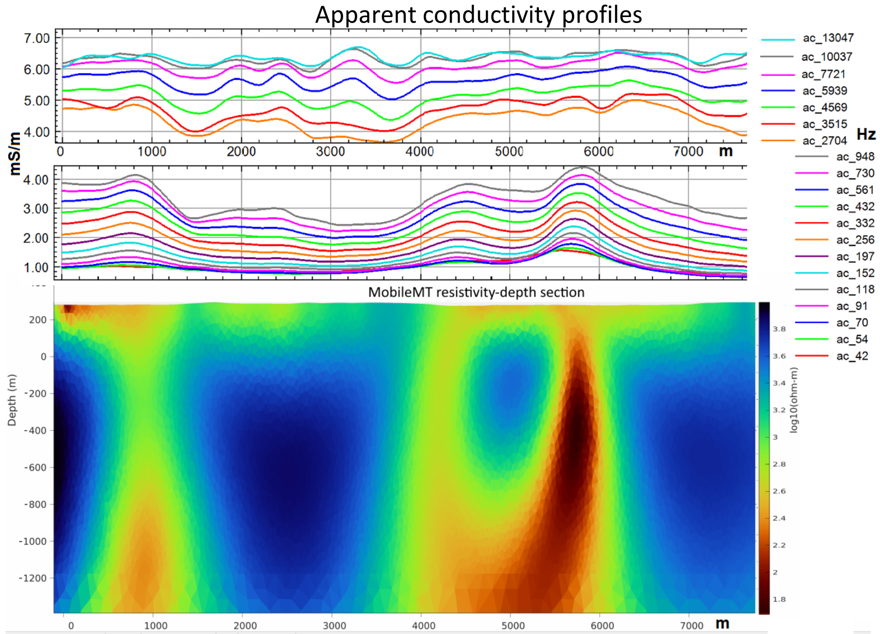
On Earth, the lightning frequency is **approximately 44 (± 5) times per second**, or nearly 1.4 billion flashes per year **(Lightning - Wikipedia)**

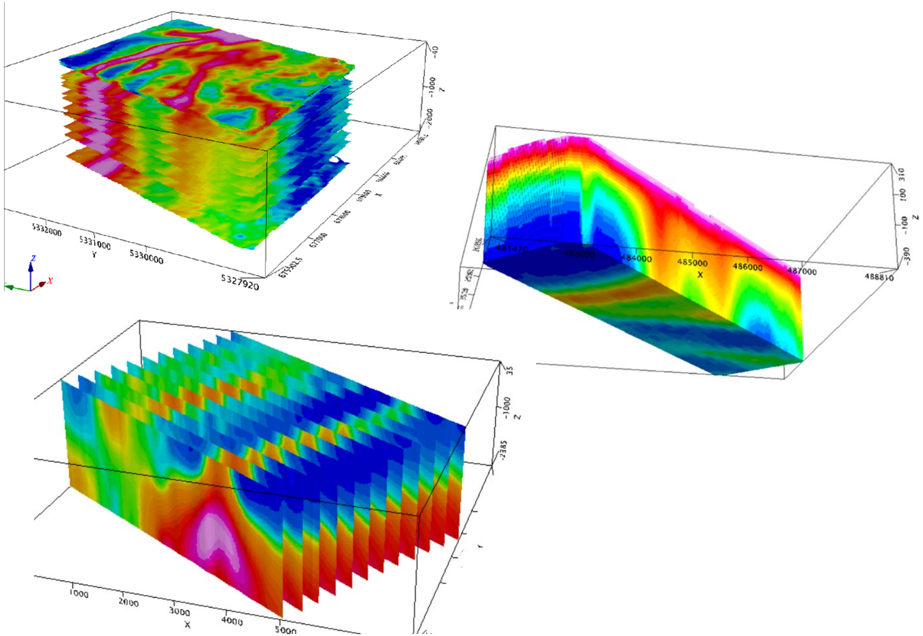




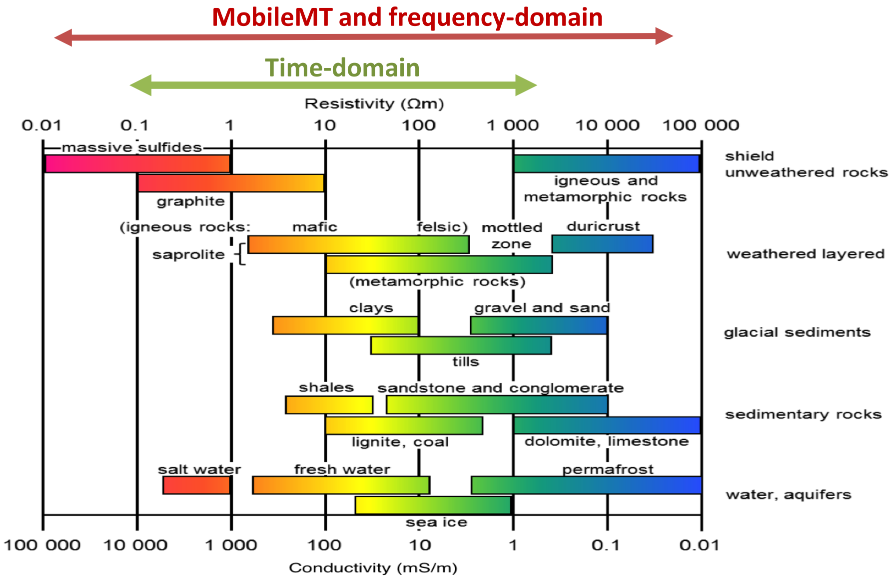


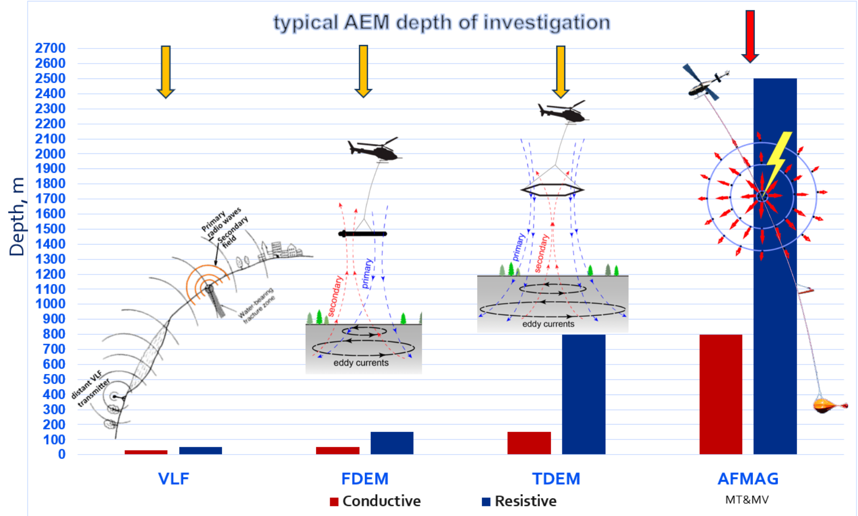
MobileMT resistivity-depth final products





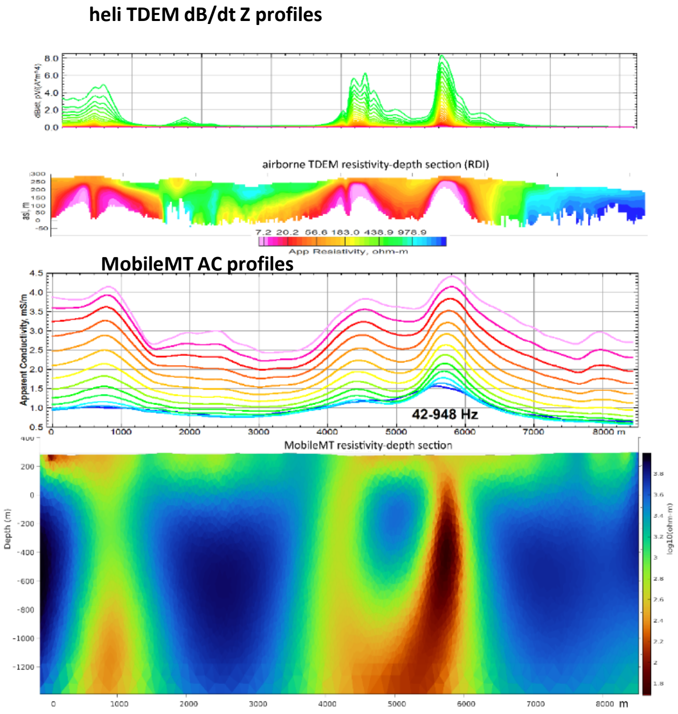
Airborne EM

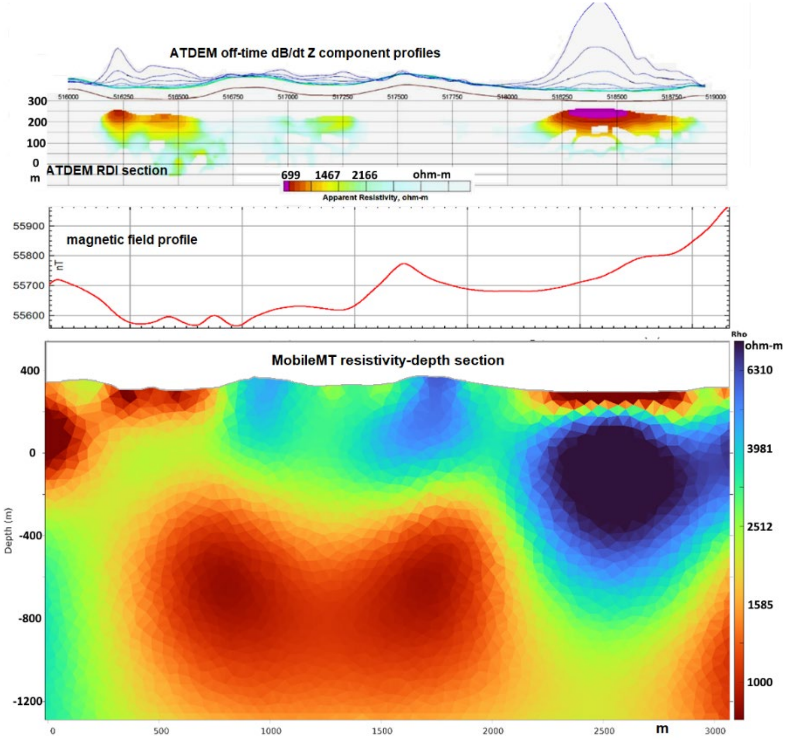




RANGE OF RESISTIVITY DETECTION AND DIFFERENTIATION

Direct comparison with airborne time-domain

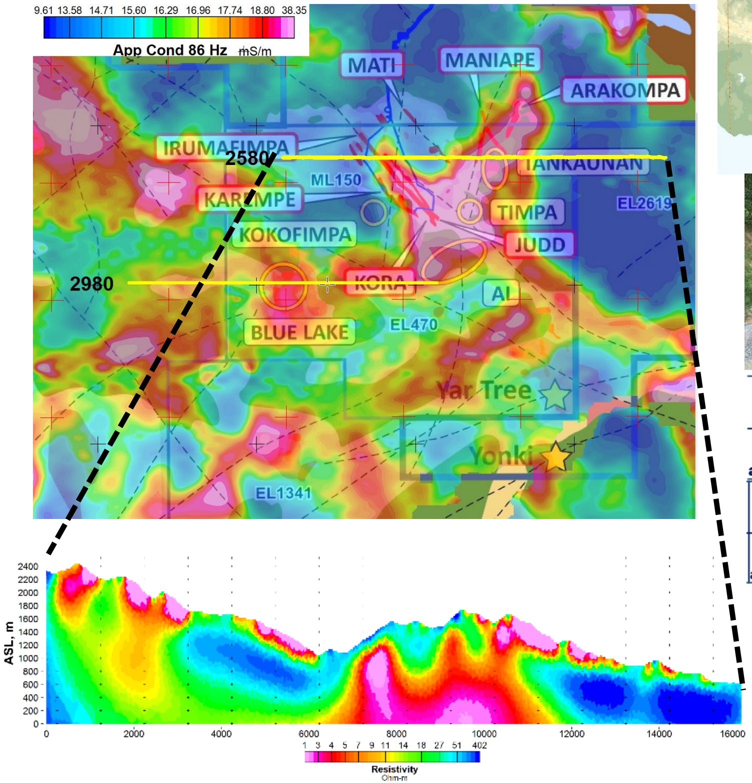




PNG, Kainantu Gold Mine

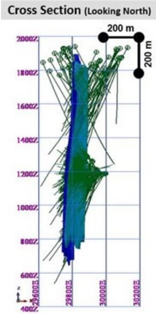
Au,Ag,Cu epithermal veins with less explored porphyry

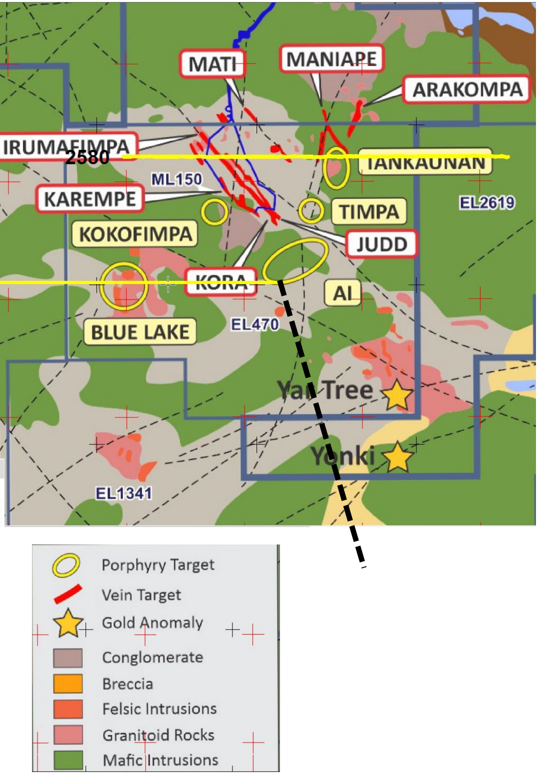
K92 MINING INC.



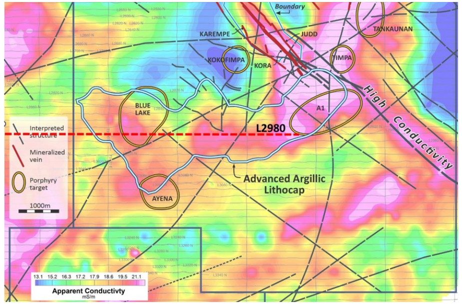
Kora	
indicated	inferred
2.1 moz	2.5 moz
at 9.2 g/t Au Eq	at 9.5 g/t AuEq

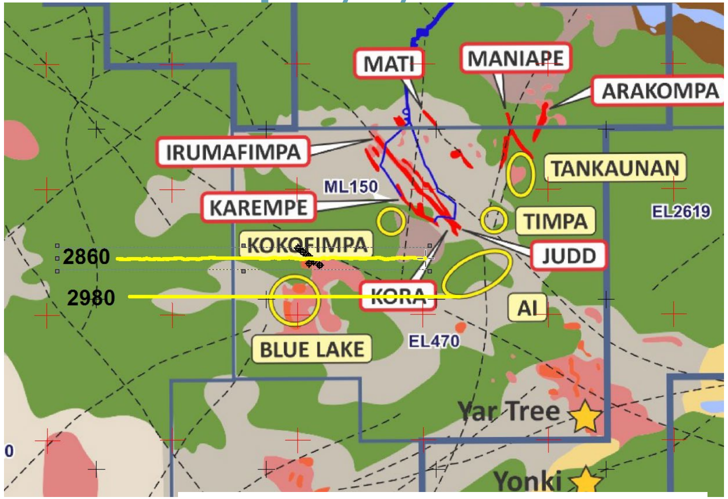
Irumafimba	
indicated	inferred
0.2 moz	0.2 moz
at 10.4 g/t AuEq	at 13.4 g/t AuEq

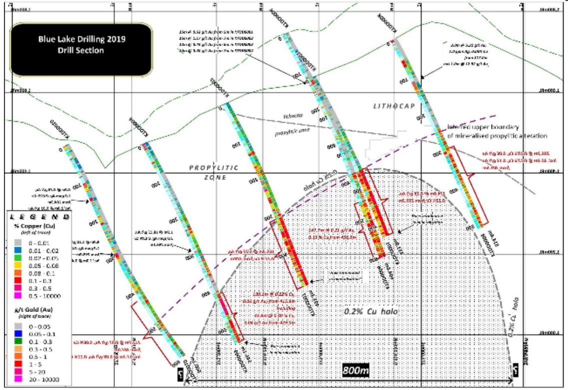


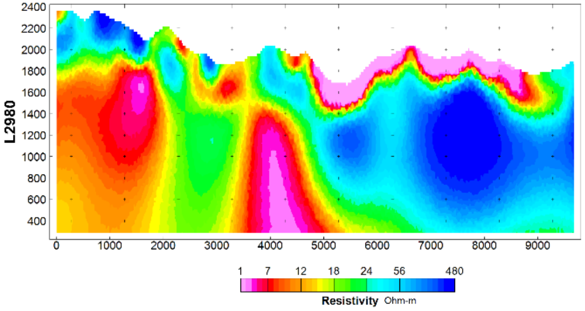


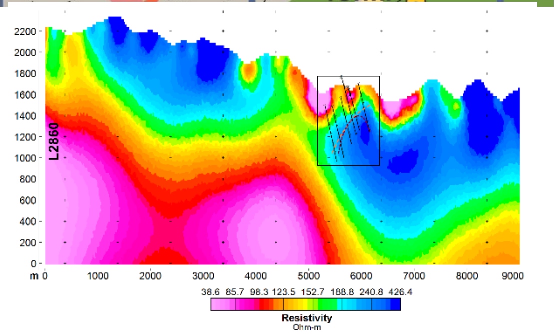
Kainantu. Blue Lake Porphyry

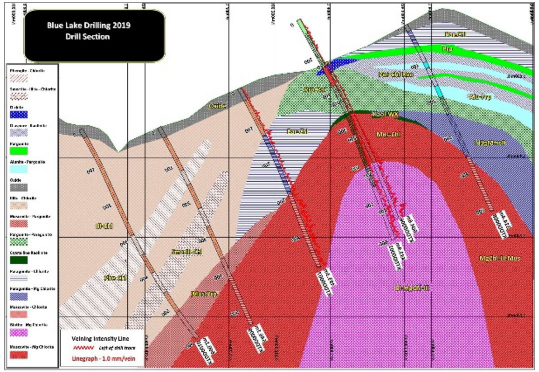




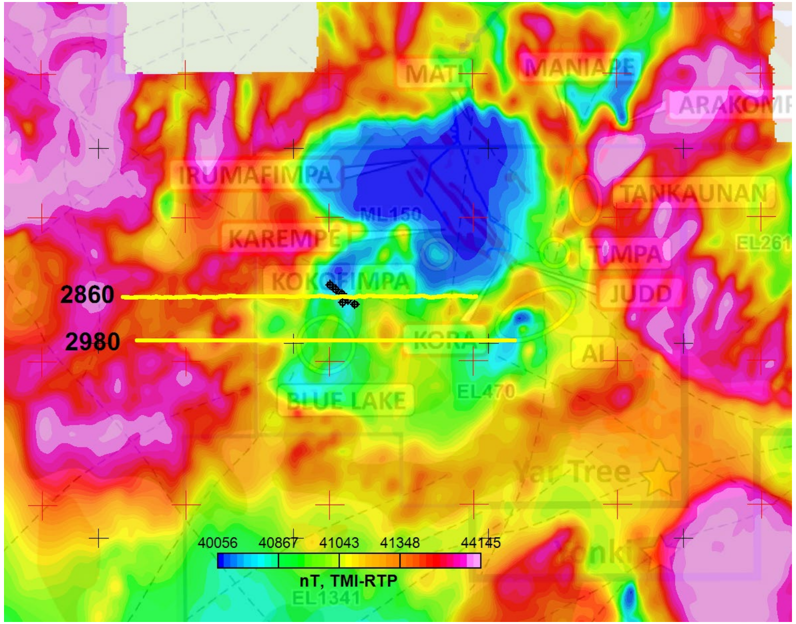






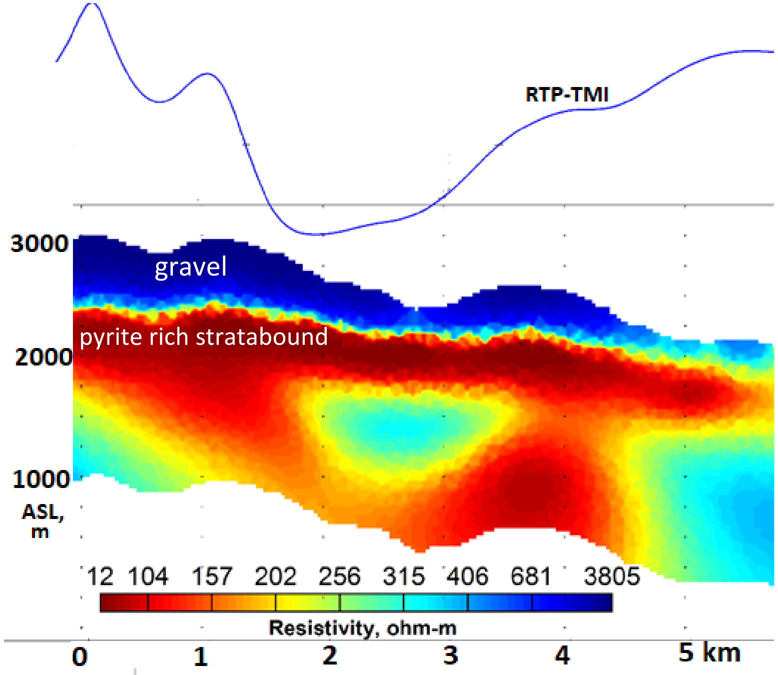


Kainantu, magnetic field

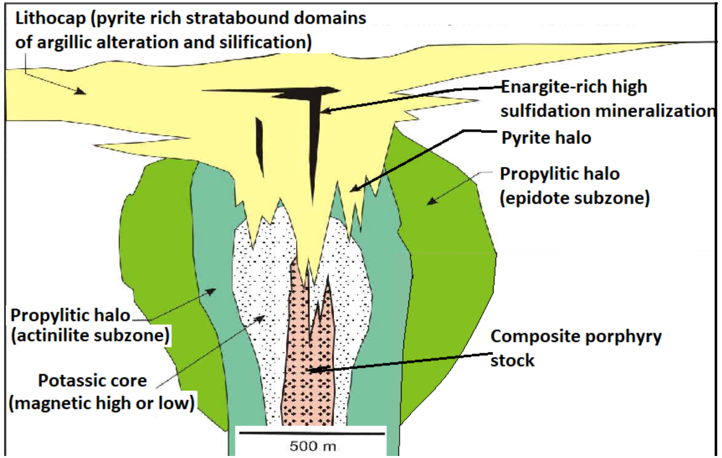


Northern Chile – Porphyry system

MobileMT resistivity section over a porphyry system under gravel resistive and lithocap conductive overburdens

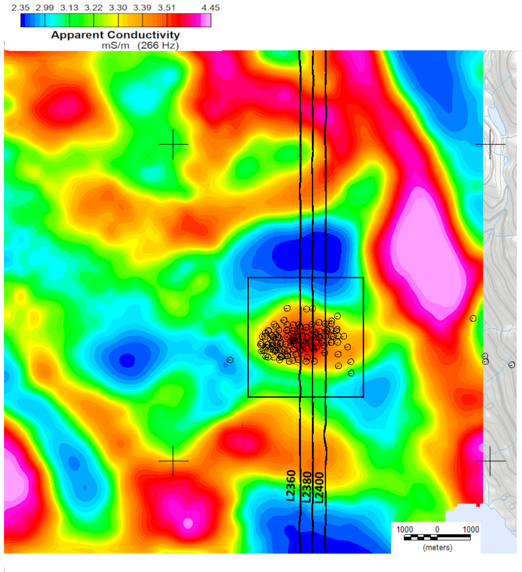


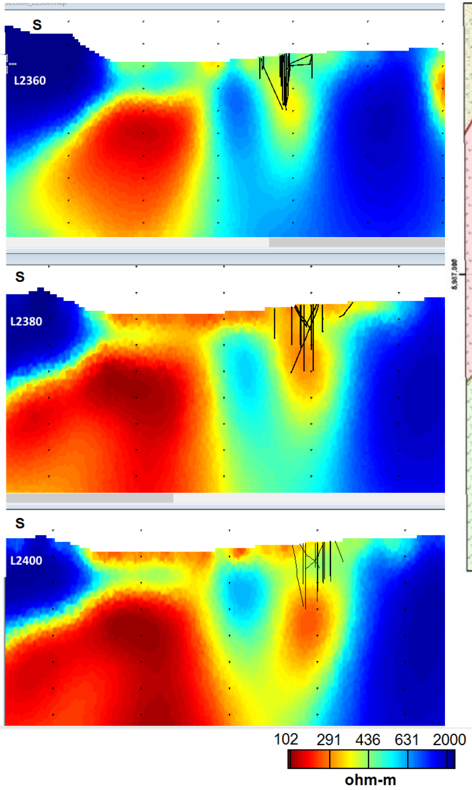
Schematic illustration of alteration zoning and overprinting relationships in a calc-alkalic porphyry system

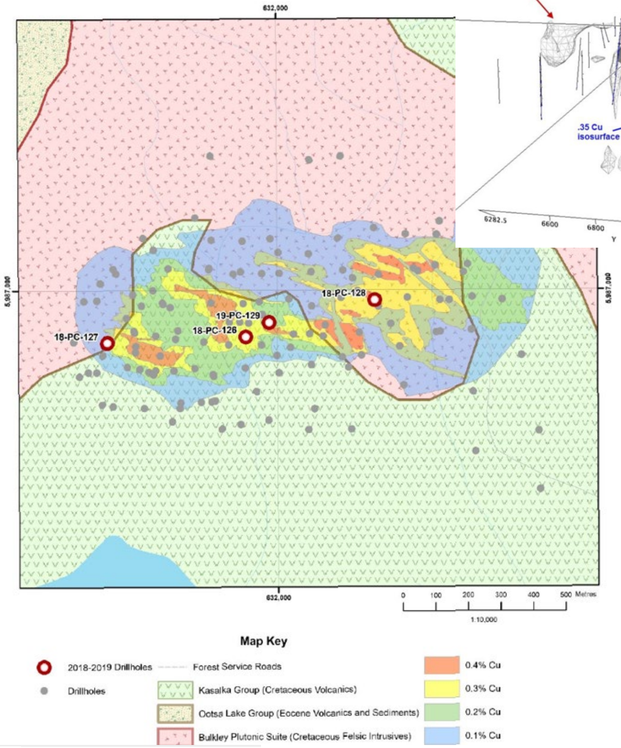


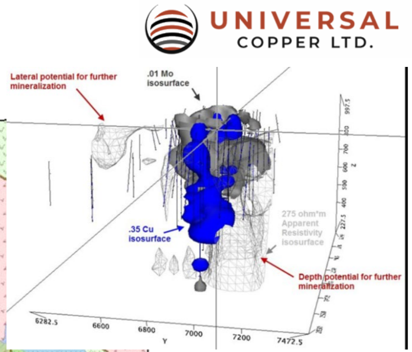
after Holliday et al., 2007

Poplar Cu-Mo porphyry deposit (BC, Canada)

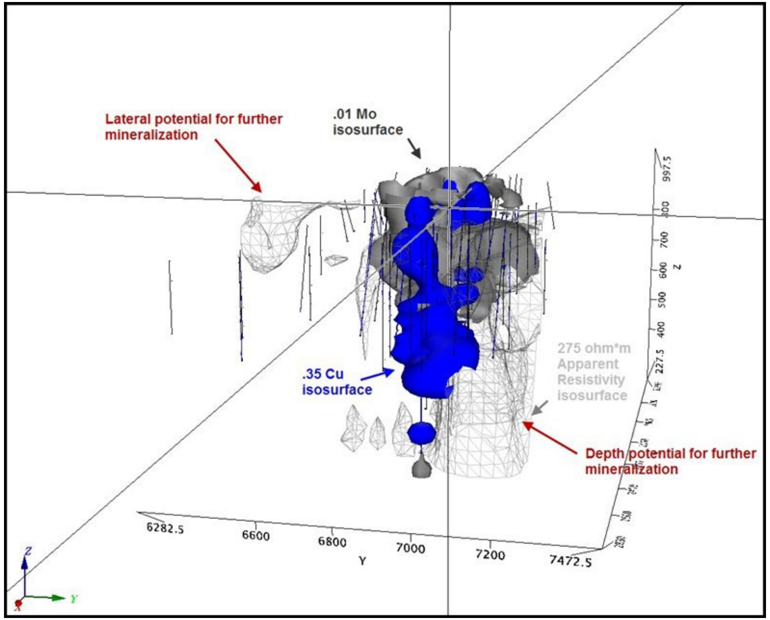








Poplar Deposit, ground IP and Cu isosurface



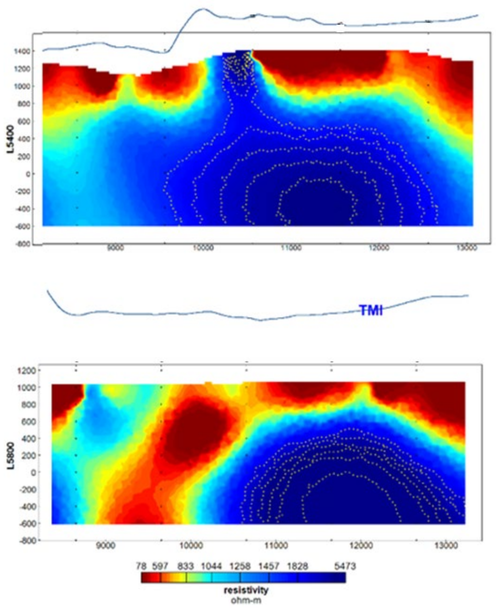
With its well-developed pyrite halo, the Poplar Deposit responds well to the Induced Polarization method of geophysical surveying. Surveys performed from 1974-1976 (Witherly, 1974, Bowen 1975, 1976) effectively mapped the phyllic (quartz-sericite-pyrite) alteration zone, and served to direct the diamond drilling during the nineteen seventies and eighties.

Similarity of alkalic porphyries in different regions

Central British Columbia

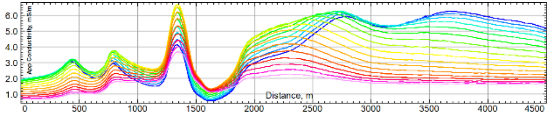
alkalic porphyry copper-gold deposits region

MobileMT Resistivity sections

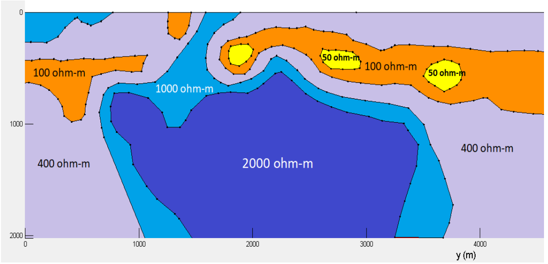


Serbia, Bor

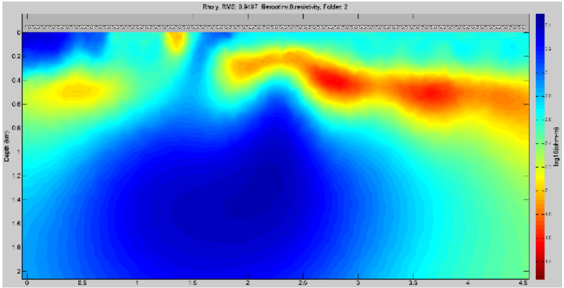
calc-alkalic porphyry copper deposit region (forward modeling)



Calculated apparent conductivity profiles from the model (26-1000 Hz)



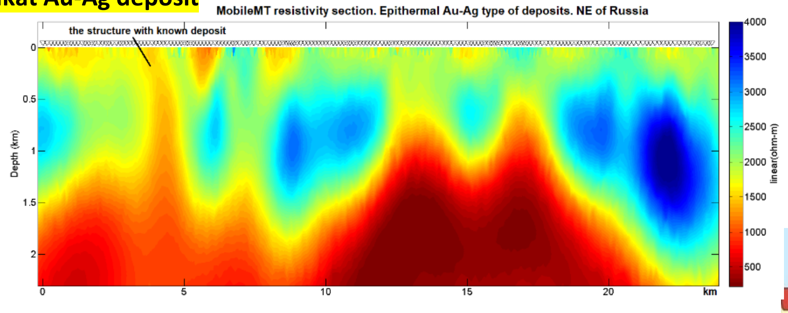
Resistivity-depth model

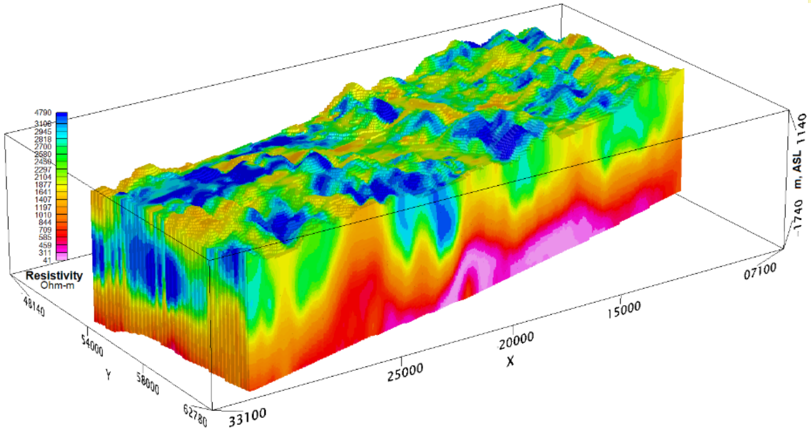


Resistivity section (non-constrained inversion of the calculated apparent conductivities)

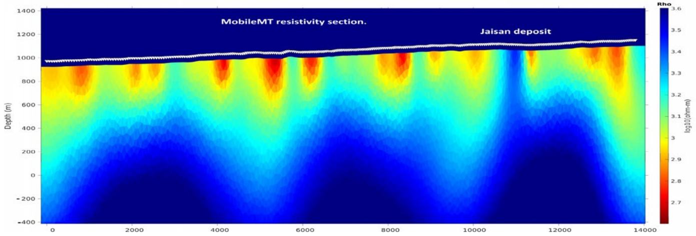
Epithermal mineralization systems

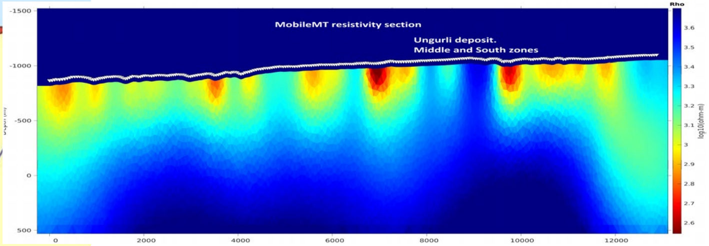
Dukat Au-Ag deposit

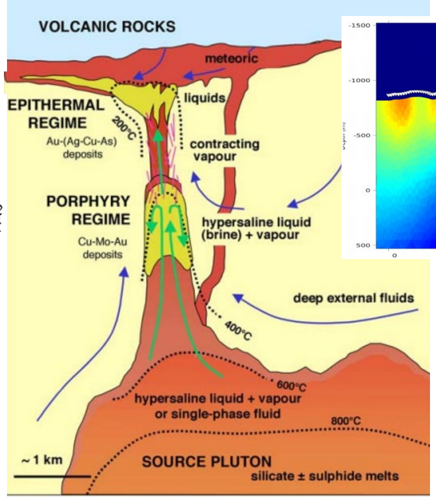




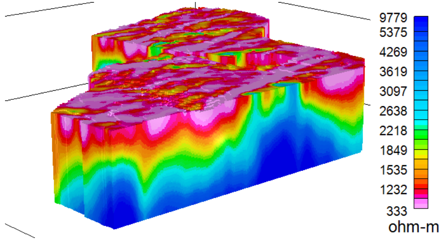
Jaisan and Ungurli Cu-Mo-Ag deposits (Kazakhstan)







Christoph A. Heinrich, 2005



Conclusions

Resistivity, having a dual nature (electronic and ionic), is a parameter capable of describing the geoelectric complexity of porphyry and epithermal mineralization systems;

Choosing the right EM measuring method/system is critical for exploration. It should cover a suitable depth range (not for potential mining but for exploration purposes), detect variations in a wide resistivity range, including very resistive, and be sensitive to different geometries of geoelectrical structures;

The same type of mineralization, even having the same genetic model, in different places petrophysically can differ significantly. There is no universal geoelectrical model characterized by absolute resistivity values for practical usage as a reference.

Understanding the geological and structural (exploration) models of mineralization systems in an explored region is key for geoelectrical image interpretation and targeting purposes.

Juliane Hübert et. al, 2016