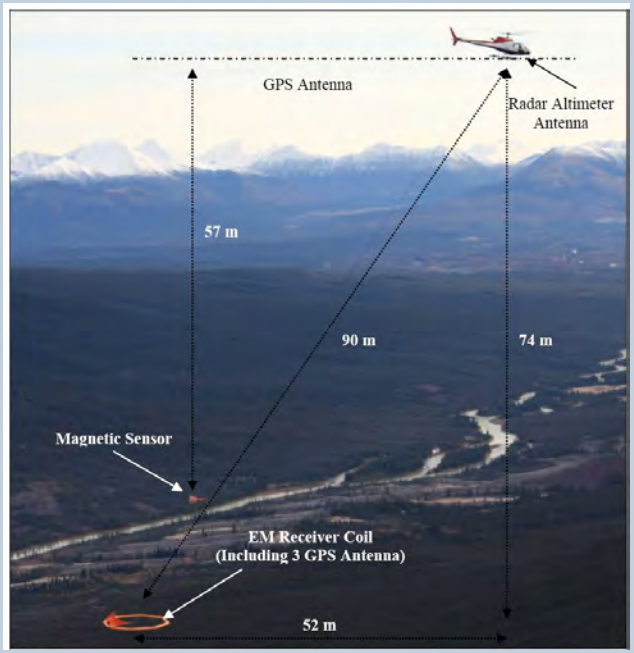
AFMAG FOR PORPHYRY COPPER DEPOSITS

Bingham Deposit

Utah

AFMAG & PCDs

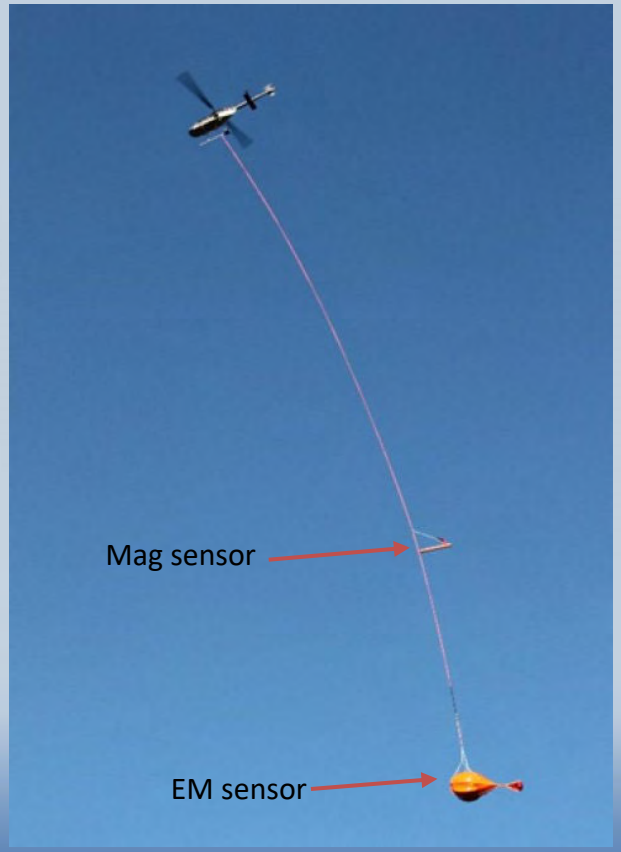
ZTEM



There are two commercial AFMAG systems in operation; ZTEM since 2008, offered by Geotech Ltd. and MMT, offered by Expert Geophysics since 2017.

ZTEM-Ground Sensors

MMT

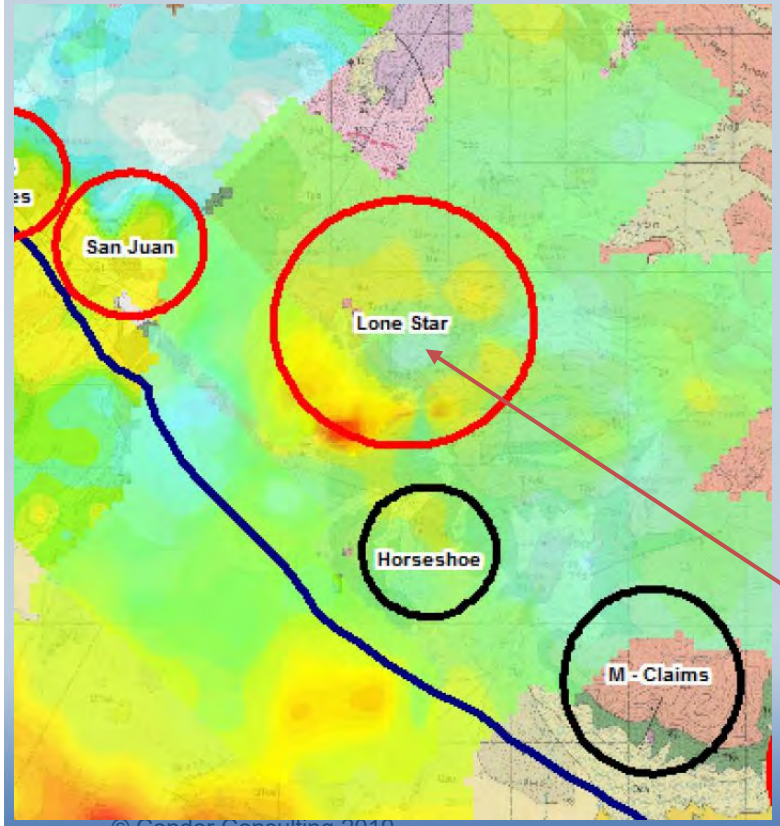


AFMAG & PCDs

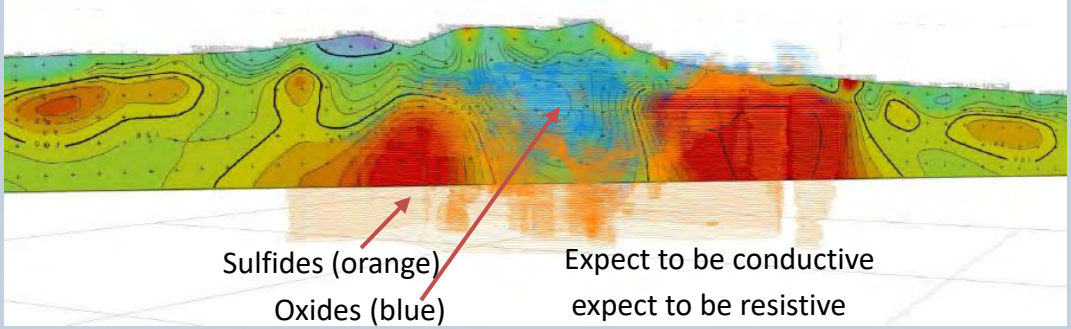
The nine examples of ZTEM over PCDs are presented (Condor currently has no MMT over a PCD). The adjacent table summarizes these outcomes.

Deposit	Mag	AFMAG-Linear	AFMAG-Circular	Comments
Lone Star-AZ	On gradient	TBD	Yes, according to the Lo and Zang paper (2008)	First ZTEM over PCD
Pebble-AK	On gradient	Bounding linears on either side of Pebble West	Circular feature (resistive center) over Pebble West	Intrusive bodies well mapped
Babine Lake-BC	high	Linears map structures and contacts quite well	Circular feature associated with mineralized intrusives; at low frequency resistive, high frequency conductive	Good correlation of structures inferred from DC resistivity and ZTEM linears
Kemess-BC	KN-high KS low	KN and KS associated with conductive linear trends	None apparent	Titan MT coverage over KN
Morrison-BC	high	Bounding linears with NW-SE trend adjacent to the strong of Morrison intrusives	Morrison intrusives form NW-SE trending low	Hearne Hill breccia, adjacent to Morrison is ZTEM conductive zone. Some MT coverage
Mt Milligan-BC	Subtle high on flank of larger high	Strong linears associated with contacts and faults	Discrete resistivity highs associated with separate intrusives	Quite complex patterns
Thompson Ck.-ID	Discrete low	A number of linears, thought to be contacts	Deposit is a discrete resistivity high	Fairly clear signature
EL Cobre-Panama	Blotchy mag highs associated with deposit	Major NW-SE faults do not shown in ZTEM	Various intrusive bodies show as discrete conductive bodies	Survey possibly too restricted spatially to adequately map mineral system
La Mina-Colombia	Two of three intrusives mag highs	Linears not well developed	Power line noise affects results but zones of resistivity highs noted	Intrusives are of limited aerial and depth extend.

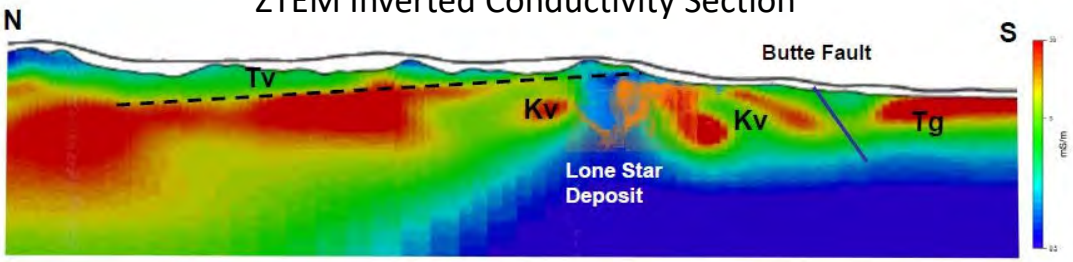
AFMAG & PCDs-Lone Star-AZ



DC Resistivity Section (2D inversion)



ZTEM Inverted Conductivity Section



M Thoman

AFMAG & PCDs-Lone Star-AZ

The first field work over PCDs was undertaken in 2008 in Arizona over the Lone Star deposit held by FMX (Phelps Dodge). This work showed that the large semi-circular intrusive bodies with moderate variations in bulk resistivity could be mapped with AFMAG, in this case ZTEM.

This is thought to be due to the uniform excitation of the large geological structures by the natural fields.

Demonstration Survey

Encouraged by the results of the simulation results, a demonstration survey was conducted over two know porphyries in southwestern USA. The flight lines over simplified geology is shown in Figure 5.

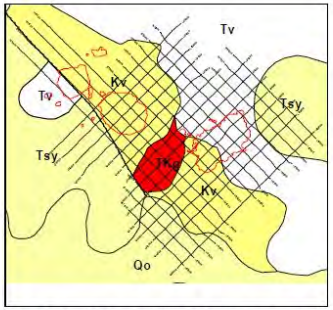


Figure 5 – simplified geology over the demonstration survey. Qo = Surficial Deposits (Holocene to mid Pleistocene), Tsy = Sedimentary Rocks (Pliocene to mid Miocene), Tv=Volcanic Rocks (Mid Miocene to Oligocene), TKg = Granitoid Rocks (Early Tertiary to Late Cretaceous), Kv = Volcanic Rocks (Late Cretaceous to early Tertiary).

Also shown in Figure 5 is the outline of the two porphyries covered by the survey.

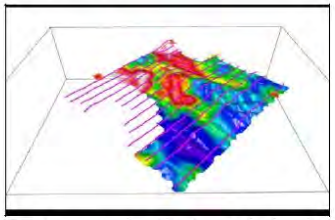


Figure 6 – perspective view of the phase rotated inphase in-line Tippers.

Figure 6 shows a perpective view of the phase rotated, in-line, 109 Hz real component of the tipper. Note that the data from the area to the southwest was contaminated by powerlines and was not useable. Only the northeast line data is presented. Note the half circular feature in the southwestern portion of the survey and the almost circular feature in the approximate middle of the survey.

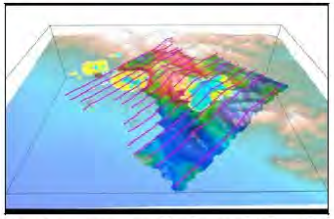


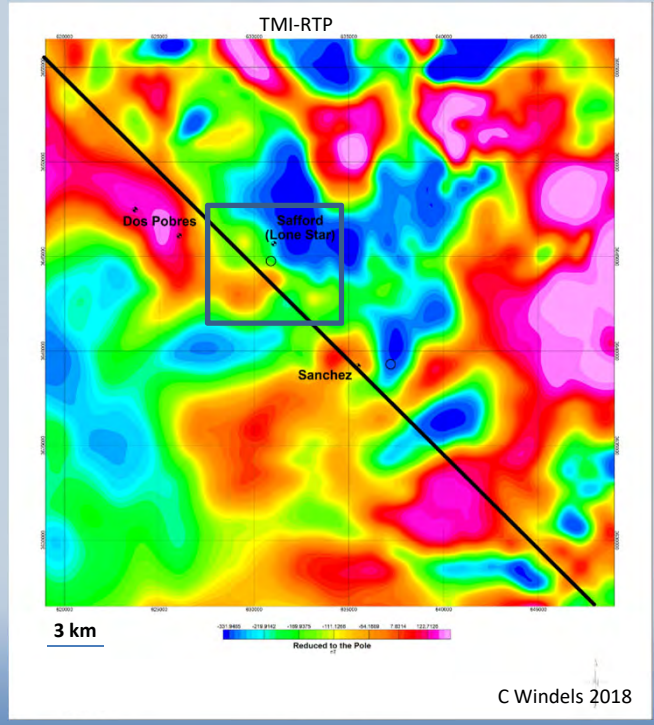
Figure 7 – perspective view of the phase rotated inphase in-line Tippers superimposed on topography and with the outlines of the porphyry mineralization and alteration (yellow) and intrusion (blue) superimposed.

Figure 7 has the outline of the alteration and mineralization of the porphyries shown in yellow, superimposed on the data. The visual correlation between the phase rotated Z-TEM highs, due to conductive features, and the outline of the alteration and mineralization is very compelling. Note that the survey results did not readily match with model results presented early. This is perhaps due to a lower erosional level of the porphyry system. Depending on the level of erosion, different alteration packages are exposed. A level or plan cut to the level below the low grade core will yield an alteration pattern in plan, that consists of annuli of different alteration. The resistivity response in this case would be an annulus of low resistivity surrounding a core of higher resistivity as more or less seen in the data.

Additional Numerical Simulation

Building on the knowledge gained, models were generated of various known world class deposits to determine the signature of these deposits so that similar targets can be recognized, to guide the exploration efforts, and to reduce the risk in exploration. Results from the Spence Deposit are shown.

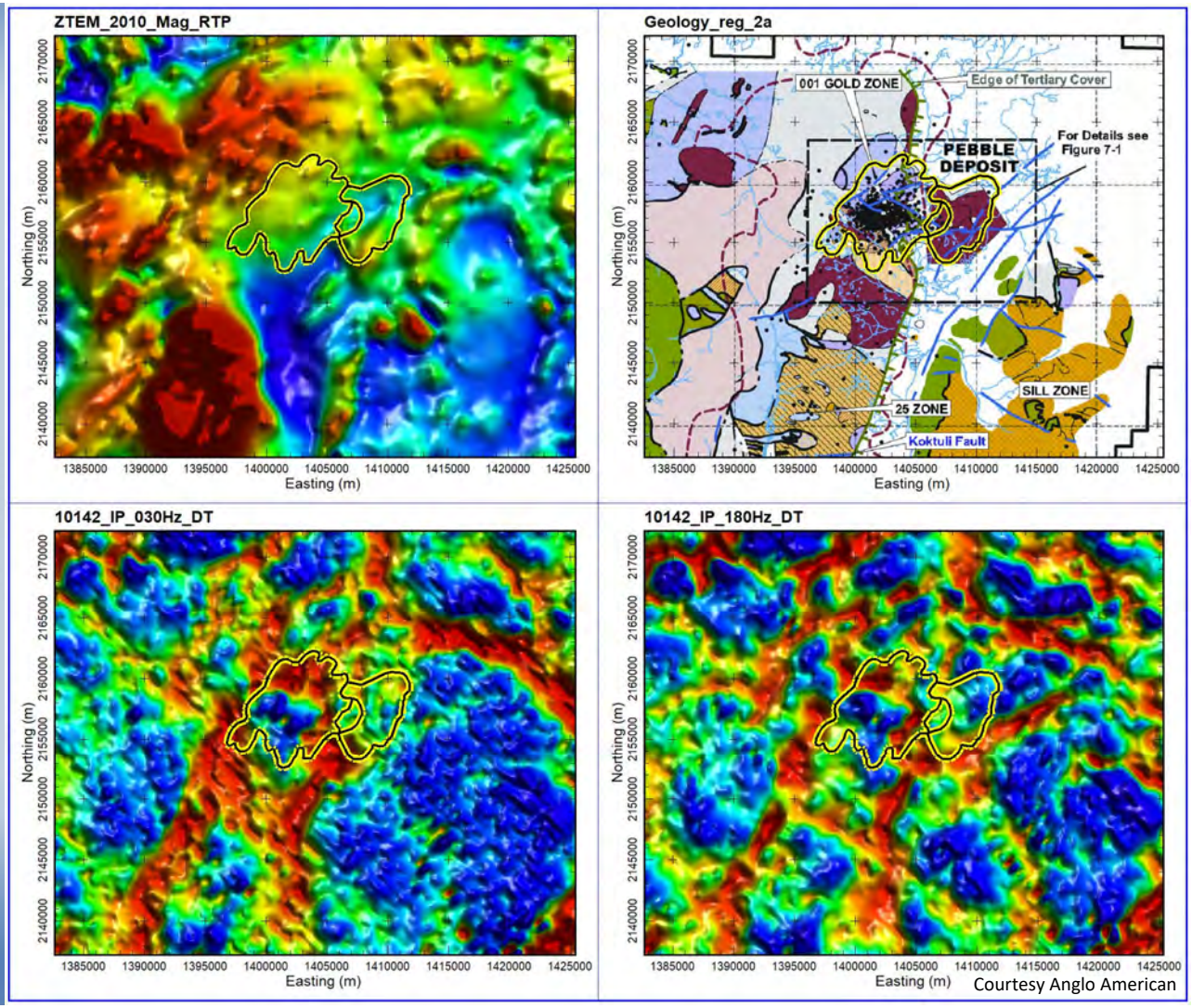
Lo and Zang 2008



C Windels 2018

AFMAG & PCDs-Pebble, AK

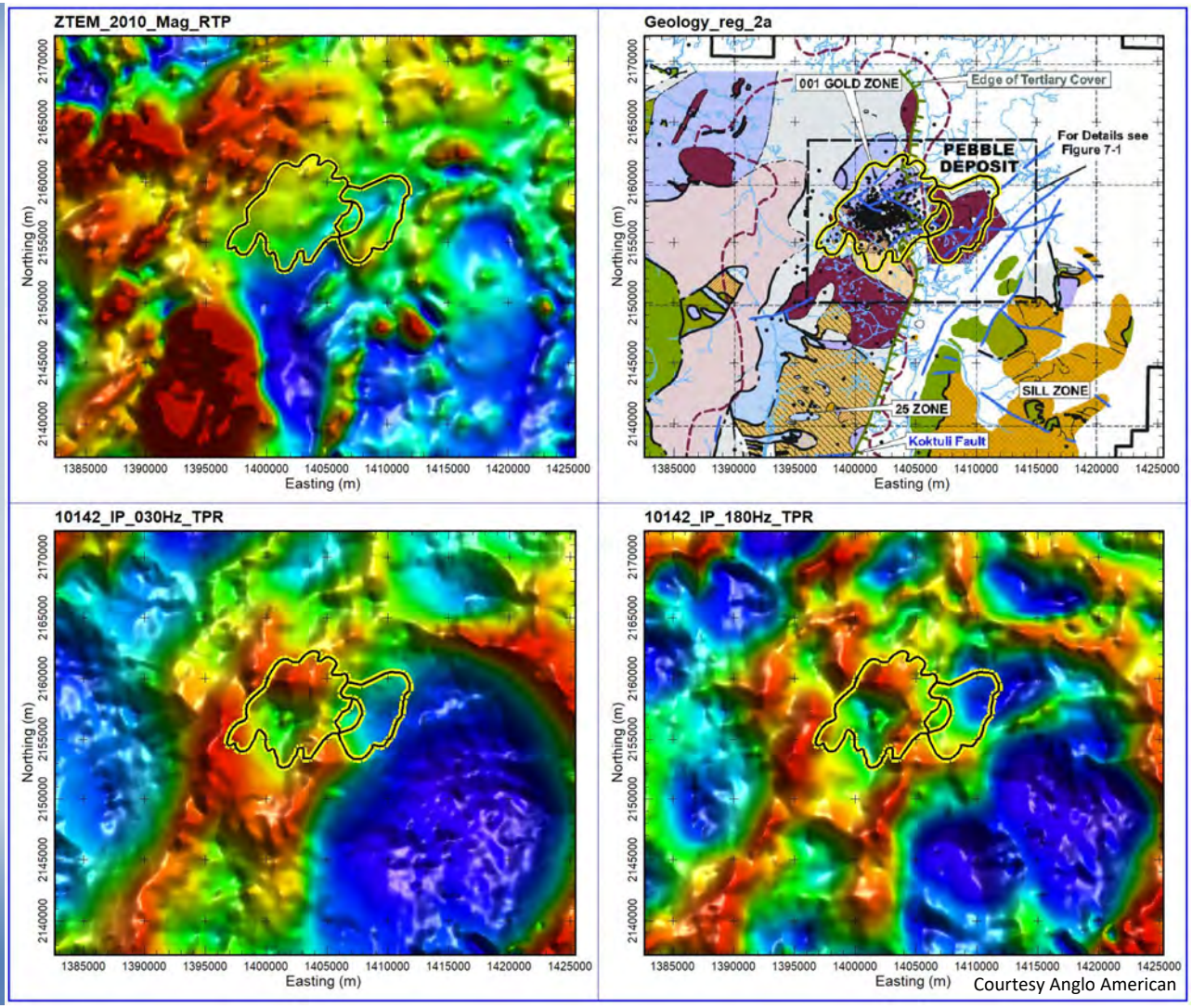
The deposit sits on a low gradient magnetic shelf. The DT shows similar results to the TPR.



Courtesy Anglo American

AFMAG & PCDs-Pebble, AK

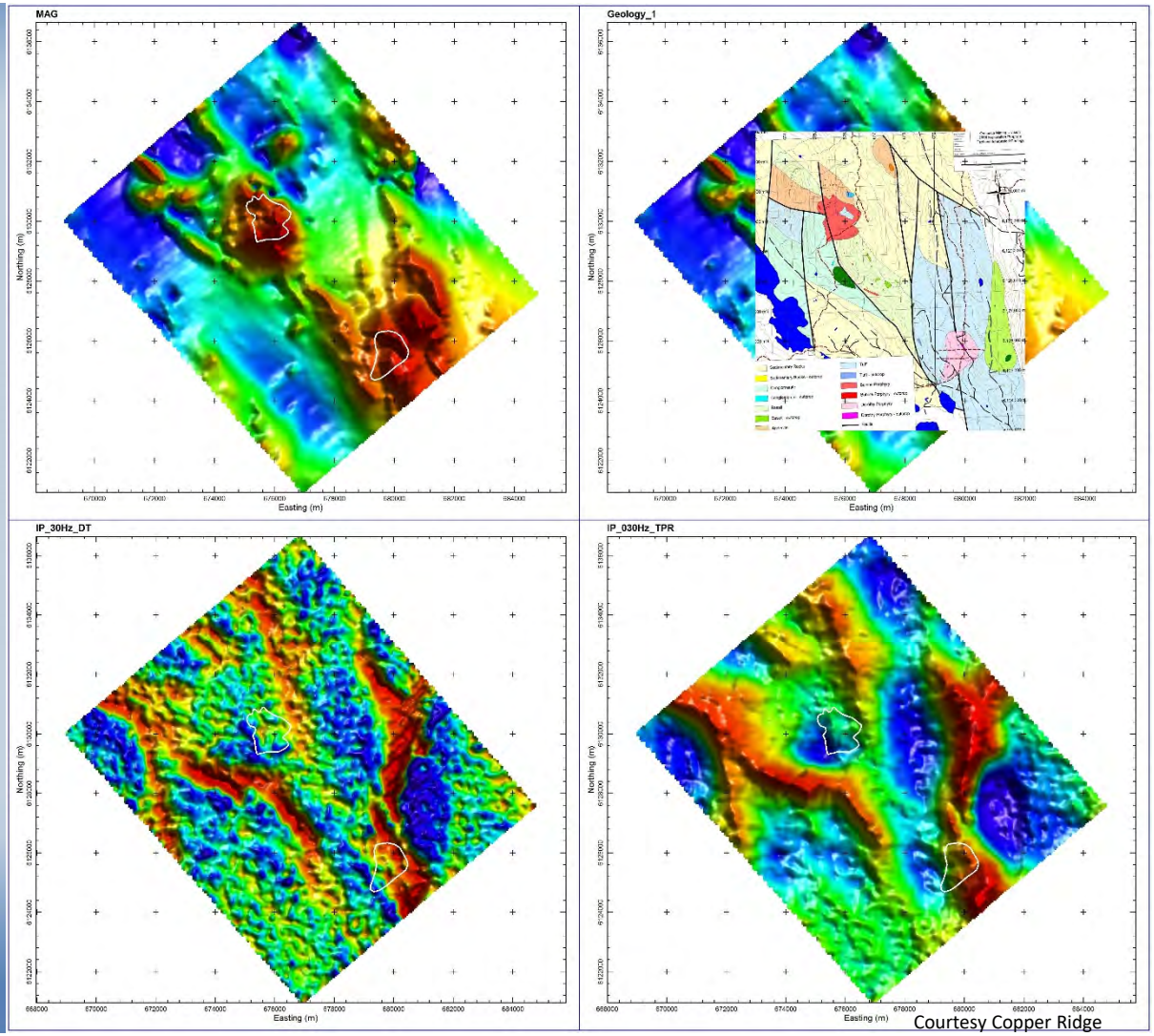
The TPR shows a discrete resistivity high associated with the Pebble West deposit. As well a number of structures are apparent. The 180 Hz TPR shows more detail than the 30 Hz TPR in the large resistive zones surrounding the deposit.



Courtesy Anglo American

AFMAG & PCDs-Babine Deposit, BC

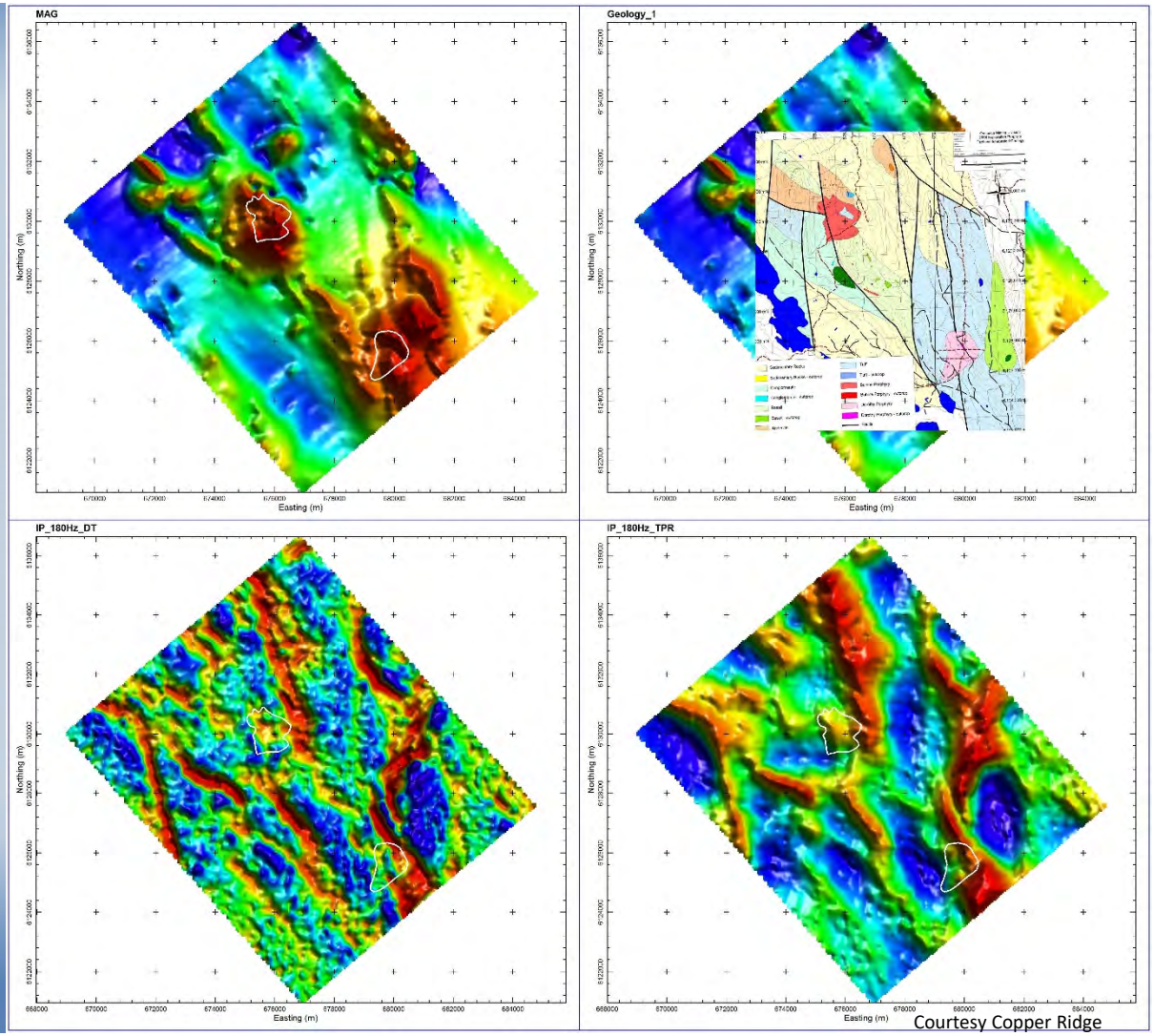
There are two intrusive bodies at Babine; the Nak (northern body) and Dorothy. Both bodies show a coincident magnetic high as well. The DT results are somewhat noisy but the TPR 30 Hz shows roughly circular resistive zones where the intrusives are outline. Major linear highs in both the DT and TRP images correlate with mapped structures that also appear in the IP-resistivity results.



Courtesy Copper Ridge

AFMAG & PCDs-Babine Deposit, BC

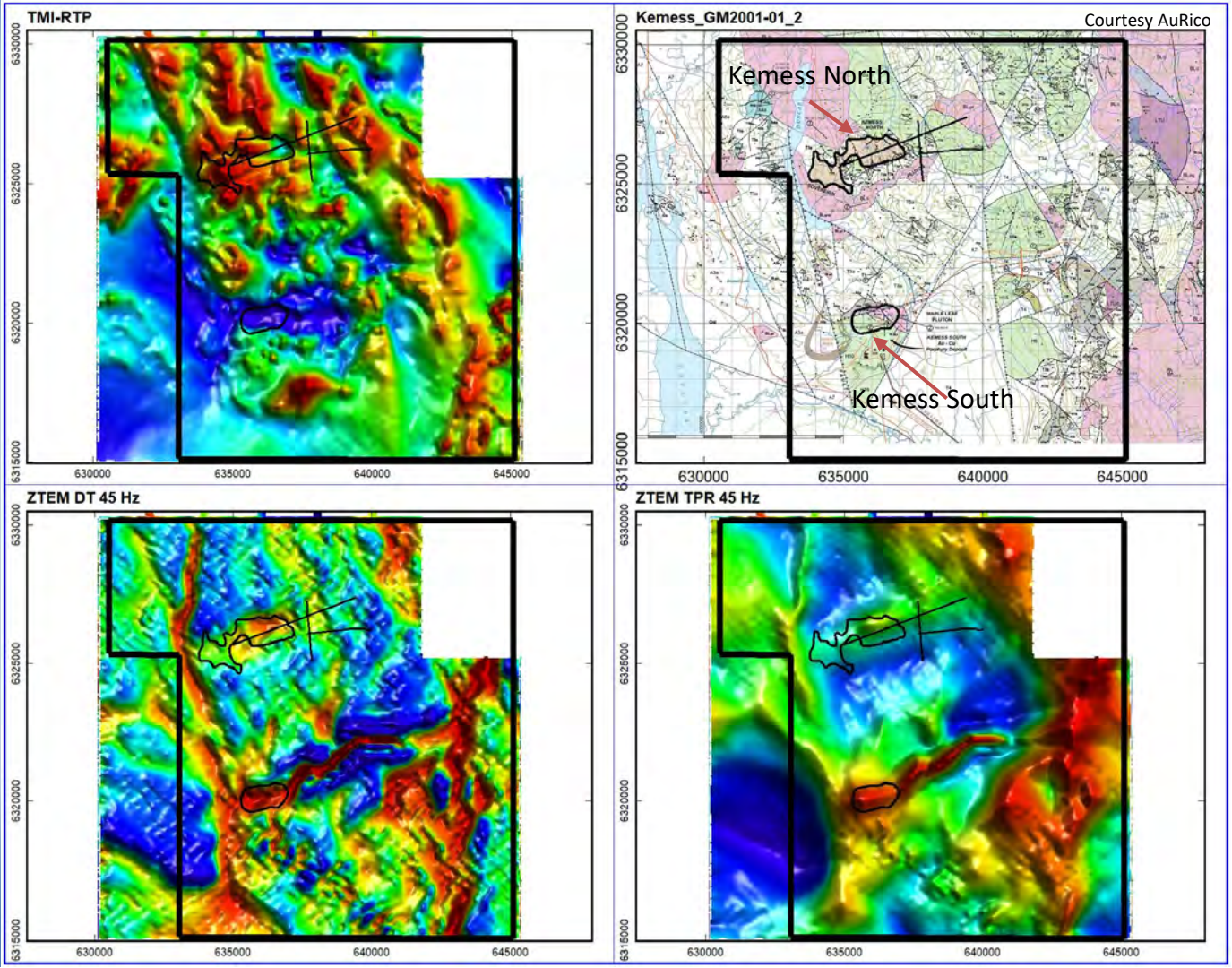
The higher frequency DT and TPR show the core of the Nak and Dorothy to be conductive. Linear highs show the structures in the area to be extensive and complex.



Courtesy Copper Ridge

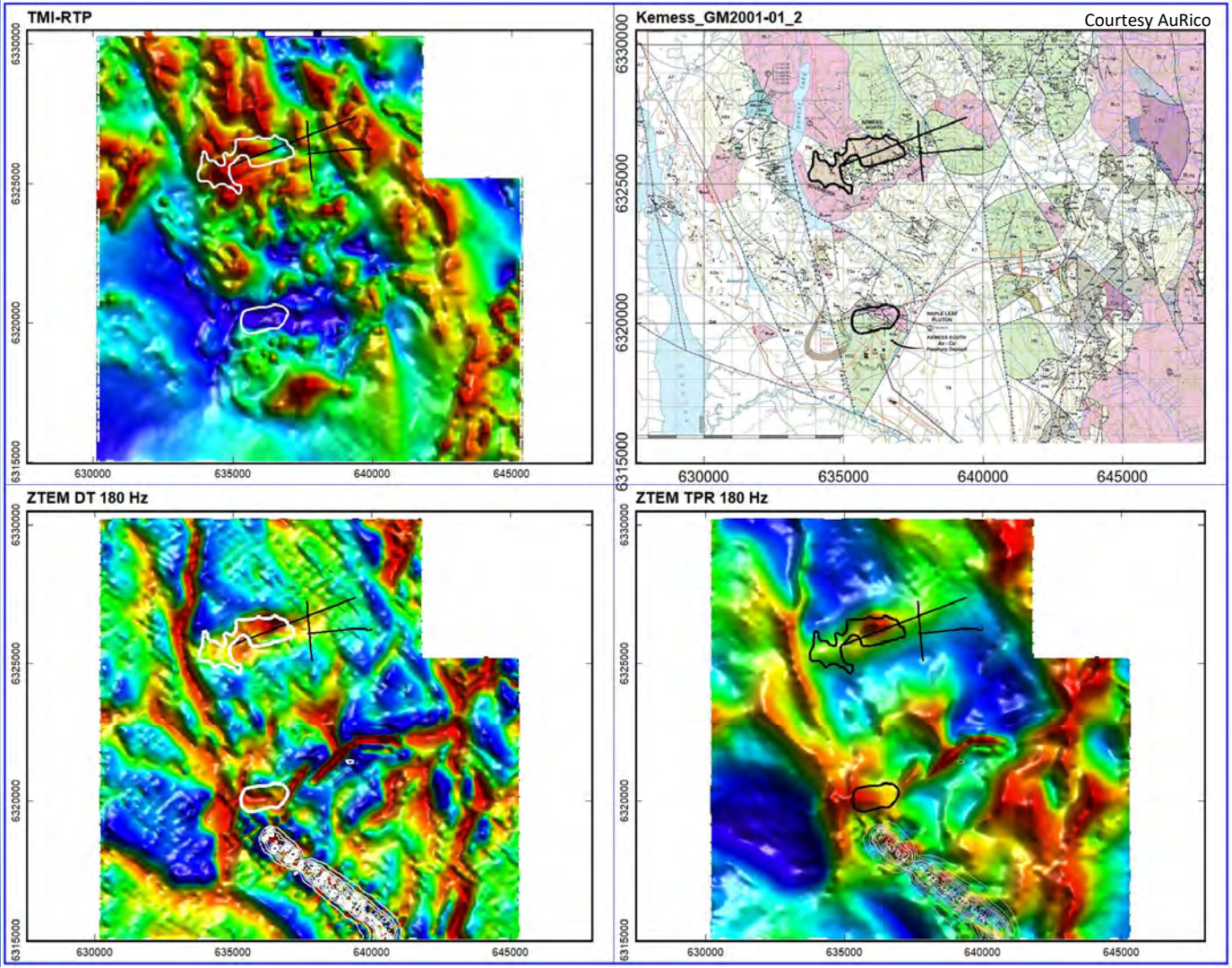
AFMAG & PCDs-Kemess, BC

The Kemess situation is different in that the mineralized intrusive is associated with a conductive feature rather than resistive one. As well for Kemess South, the deposit appears almost to be part of a conduit or channel that trends ENE from the NW trending Duncan Fault.



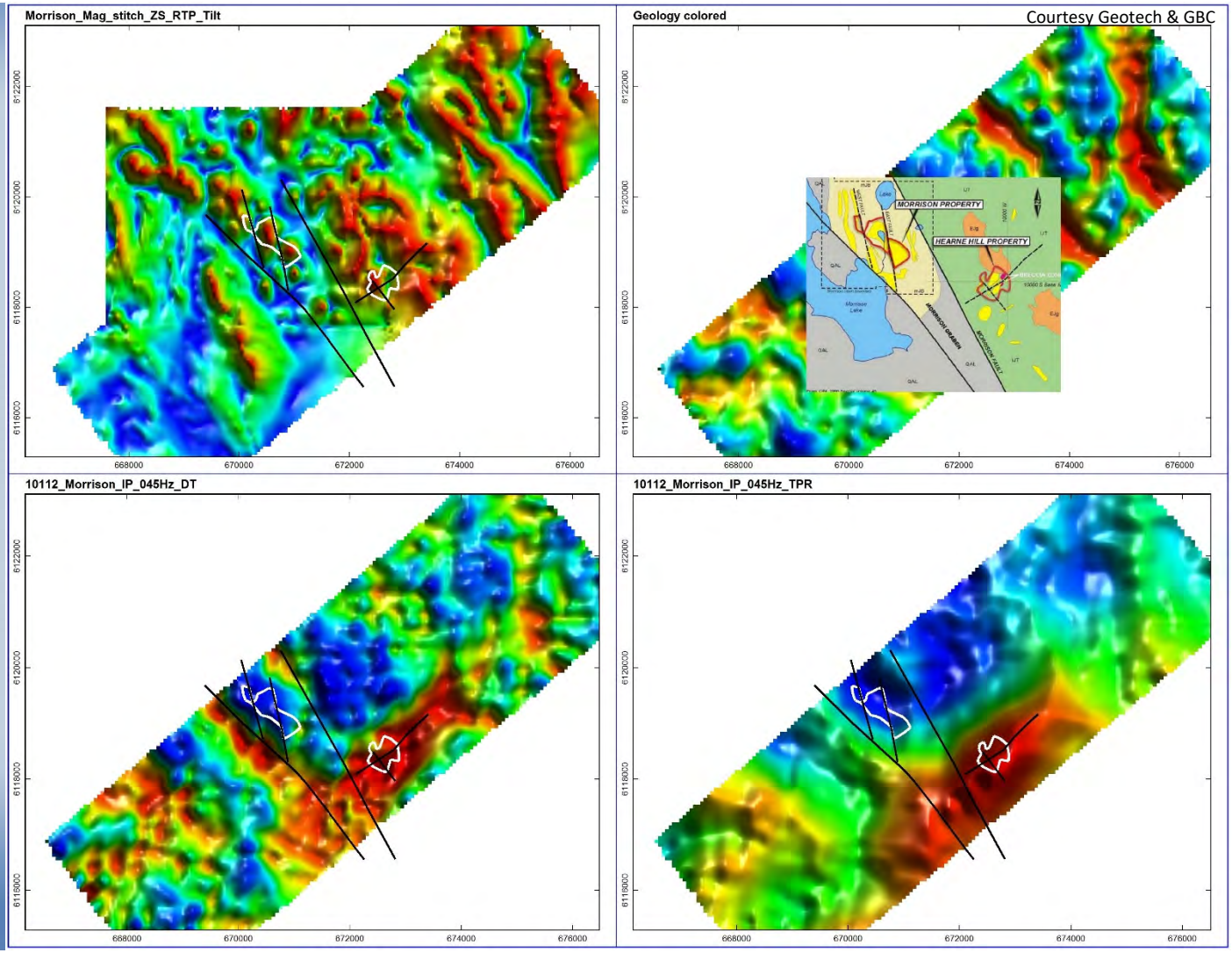
AFMAG & PCDs-Kemess, BC

The TPR response for 180 Hz shows a discrete conductive zone at the east end of the Kemess North pit outline. This is believed to correlate an earlier defined DIGHEM conductor that is attributed to vein sulfides and supergene mineralization.



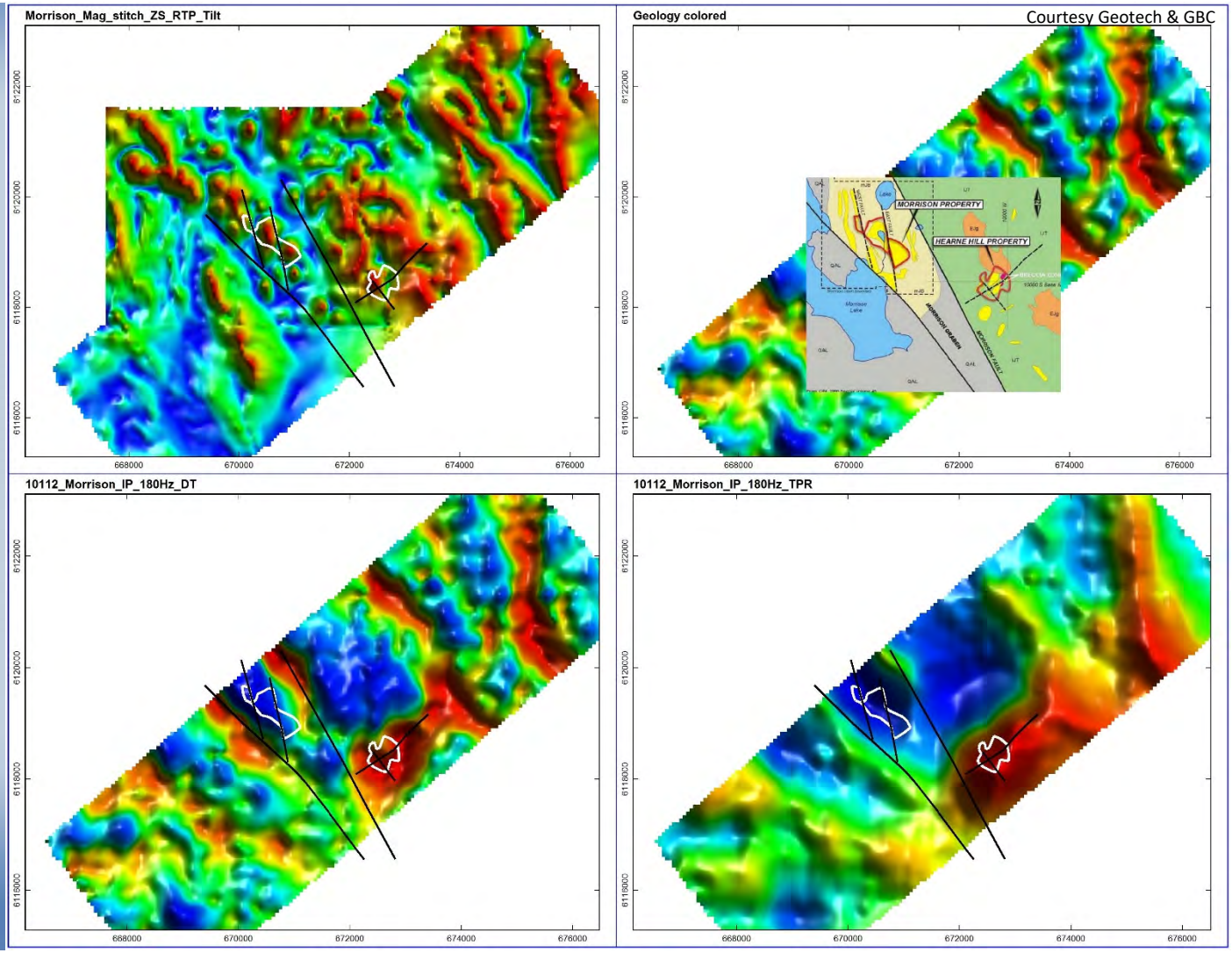
AFMAG & PCDs-Morrison, BC

The mineralized intrusive is broken up into a number of discrete bodies which shows up well in the magnetic results. The overall deposit area on the 45 Hz images shows as a resistivity high, bounded by two NW-trending conductive linears. A major orthogonal NE-trending thick conductive zone is as well apparent and this hosts the Hearne Hill breccia pipe.



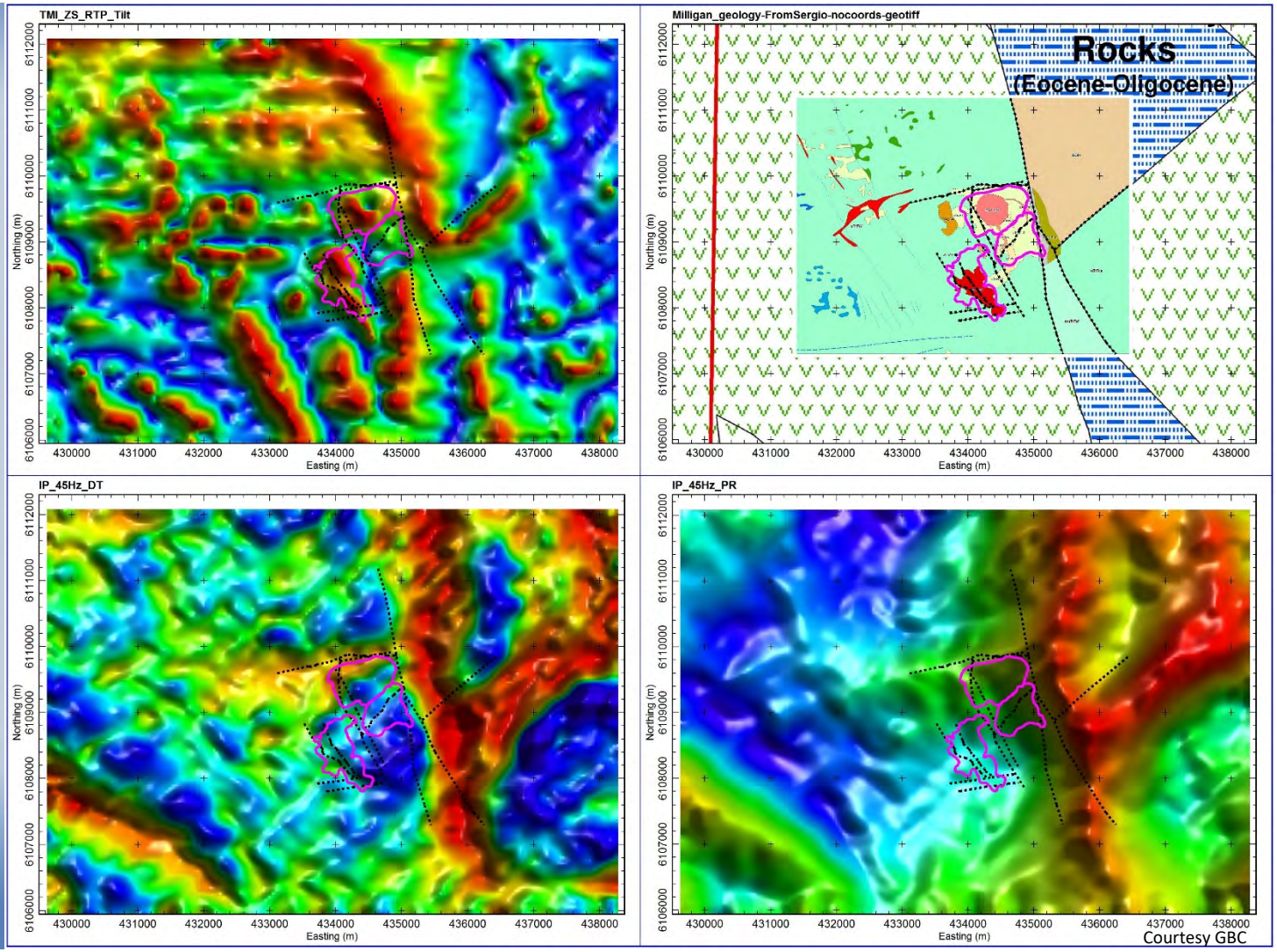
AFMAG & PCDs-Morrison, BC

While the NW-trending linears are less intense for 180 Hz images.



AFMAG & PCDs-Mt. Milligan, BC

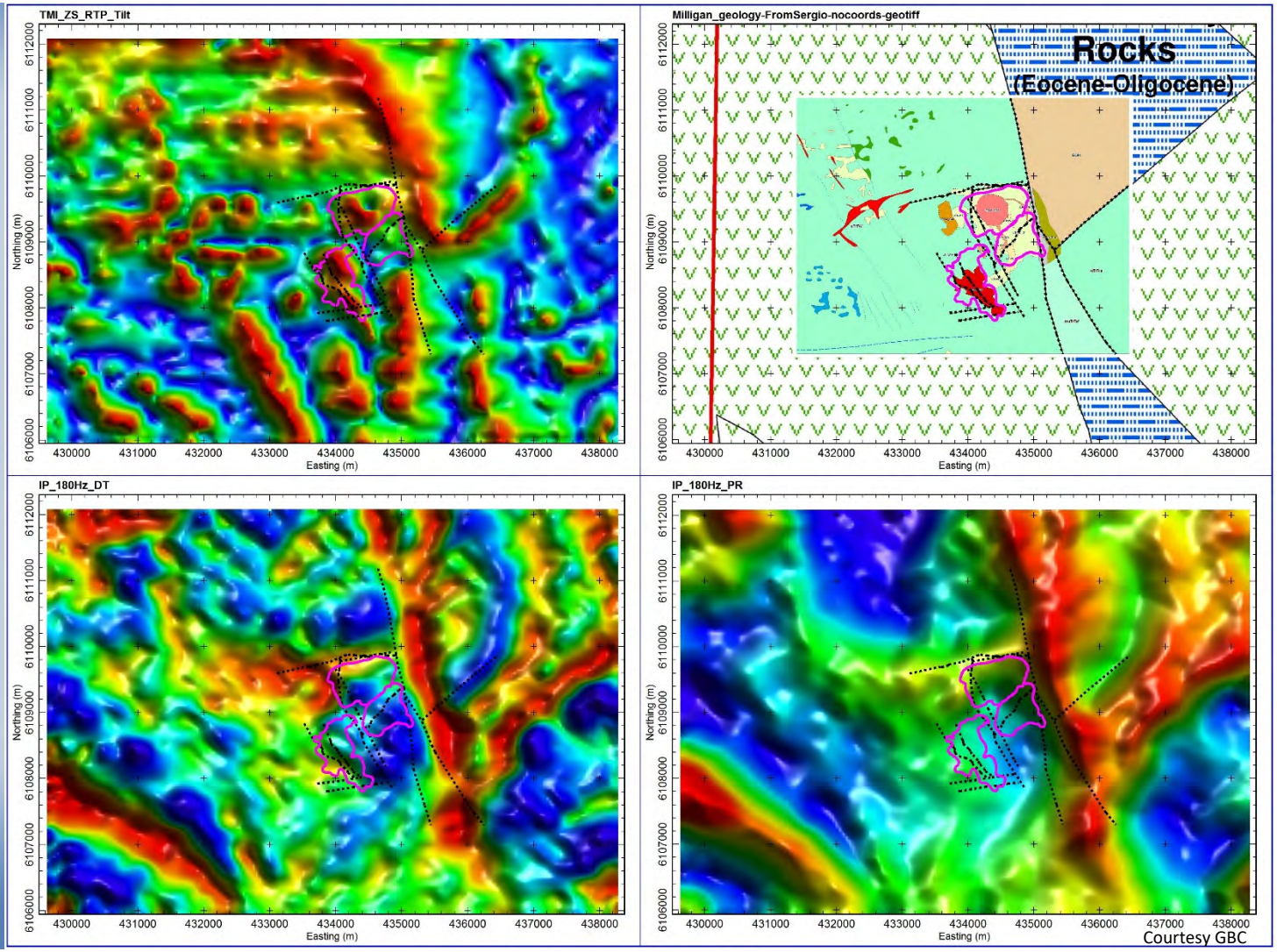
The TMI-Tilt shows the various mineralized intrusives are locally magnetic. The 45 Hz DT shows the deposit area to be a roughly conformable circular resistivity zone. A number of structures as well show up as linear features.



Courtesy GBC

AFMAG & PCDs-Mt. Milligan, BC

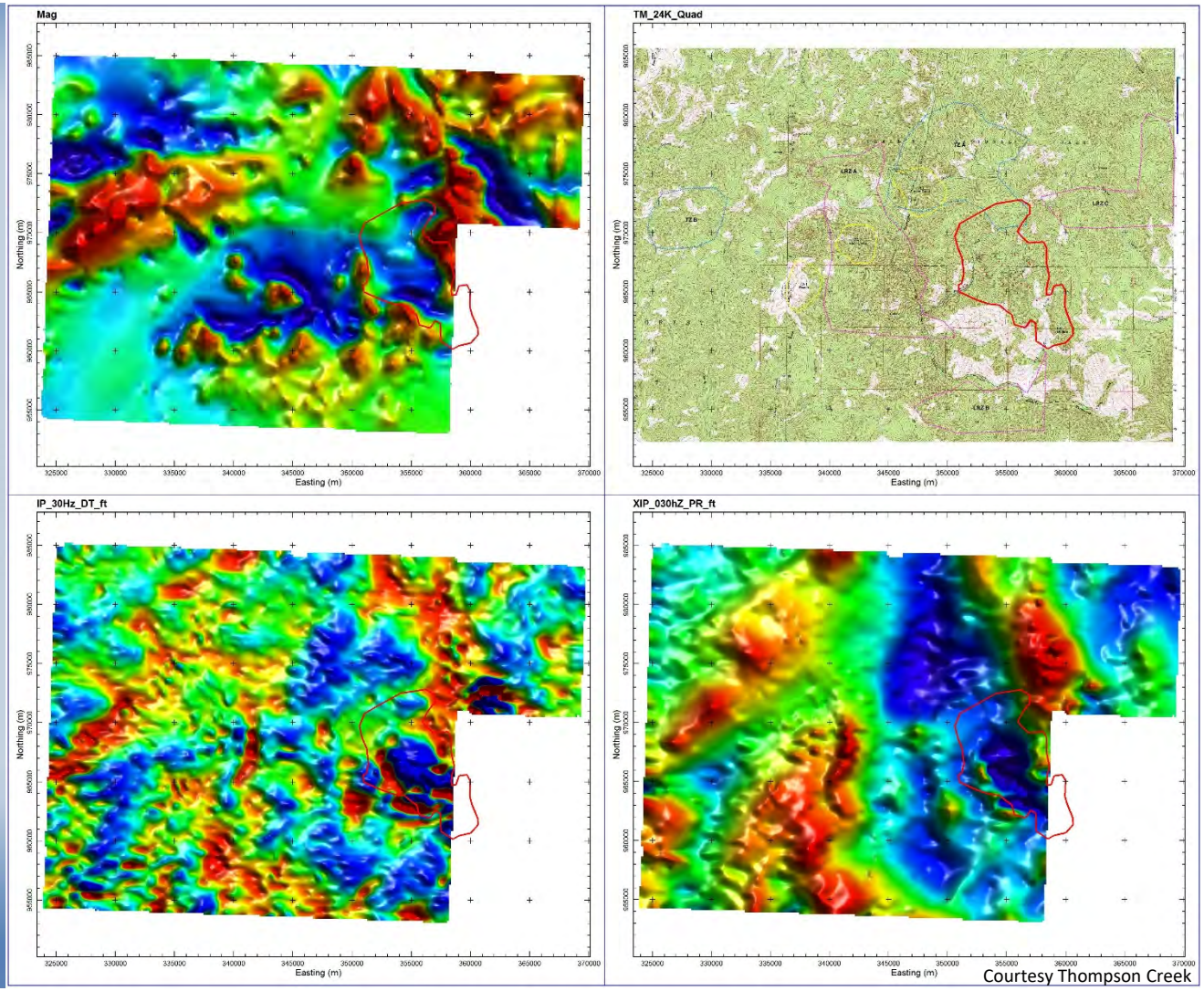
The 180 Hz results are quite similar to the 45 Hz patterns but smoother.



Courtesy GBC

AFMAG & PCDs-Thompson Ck, ID

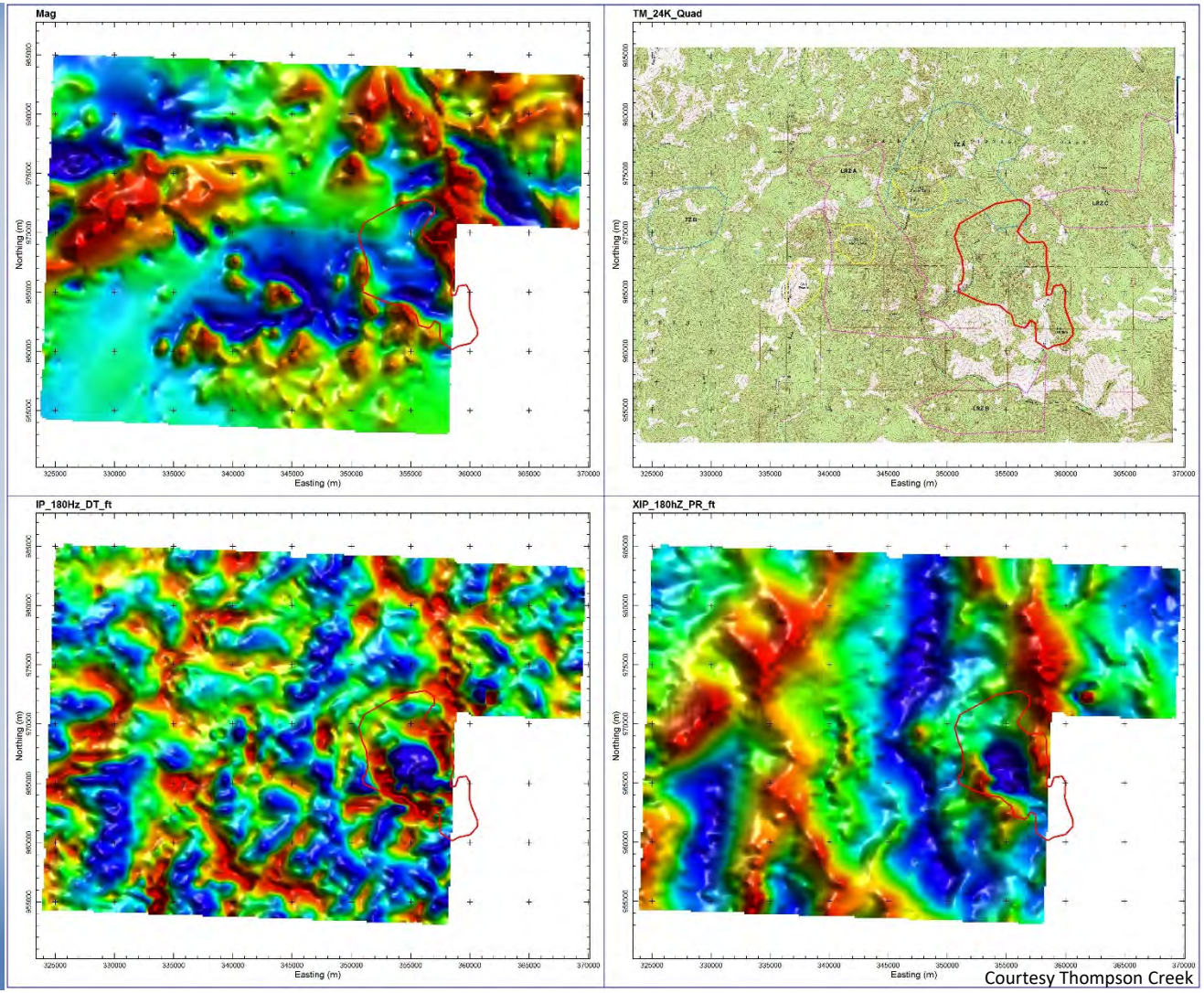
The main intrusive body is a magnetic low. Within the outline of the mineralized intrusive, there is a strong discrete resistive zone.



Courtesy Thompson Creek

AFMAG & PCDs-Thompson Ck, ID

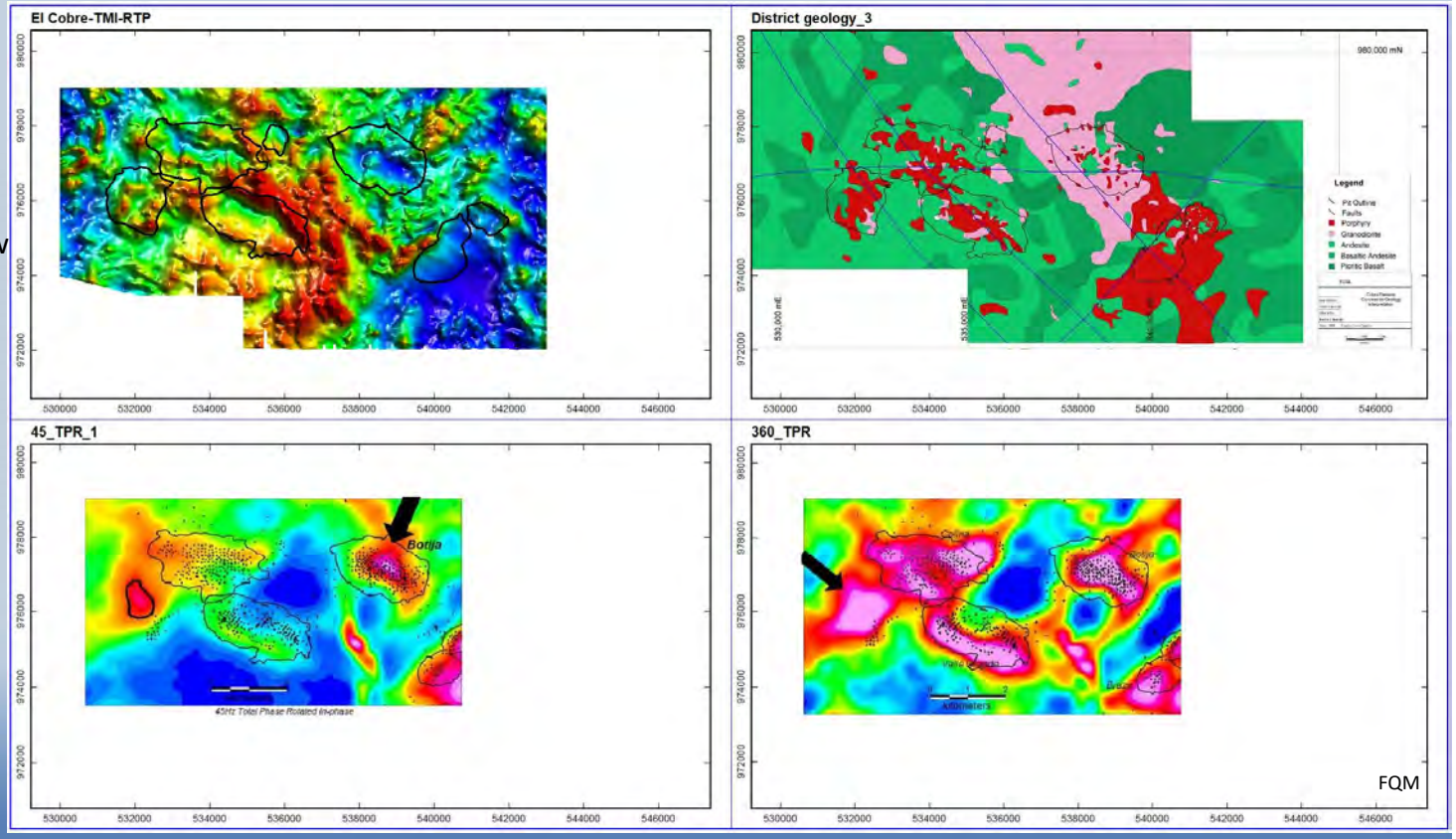
The 180 Hz images show more continuity of the linear features (contacts/structures).



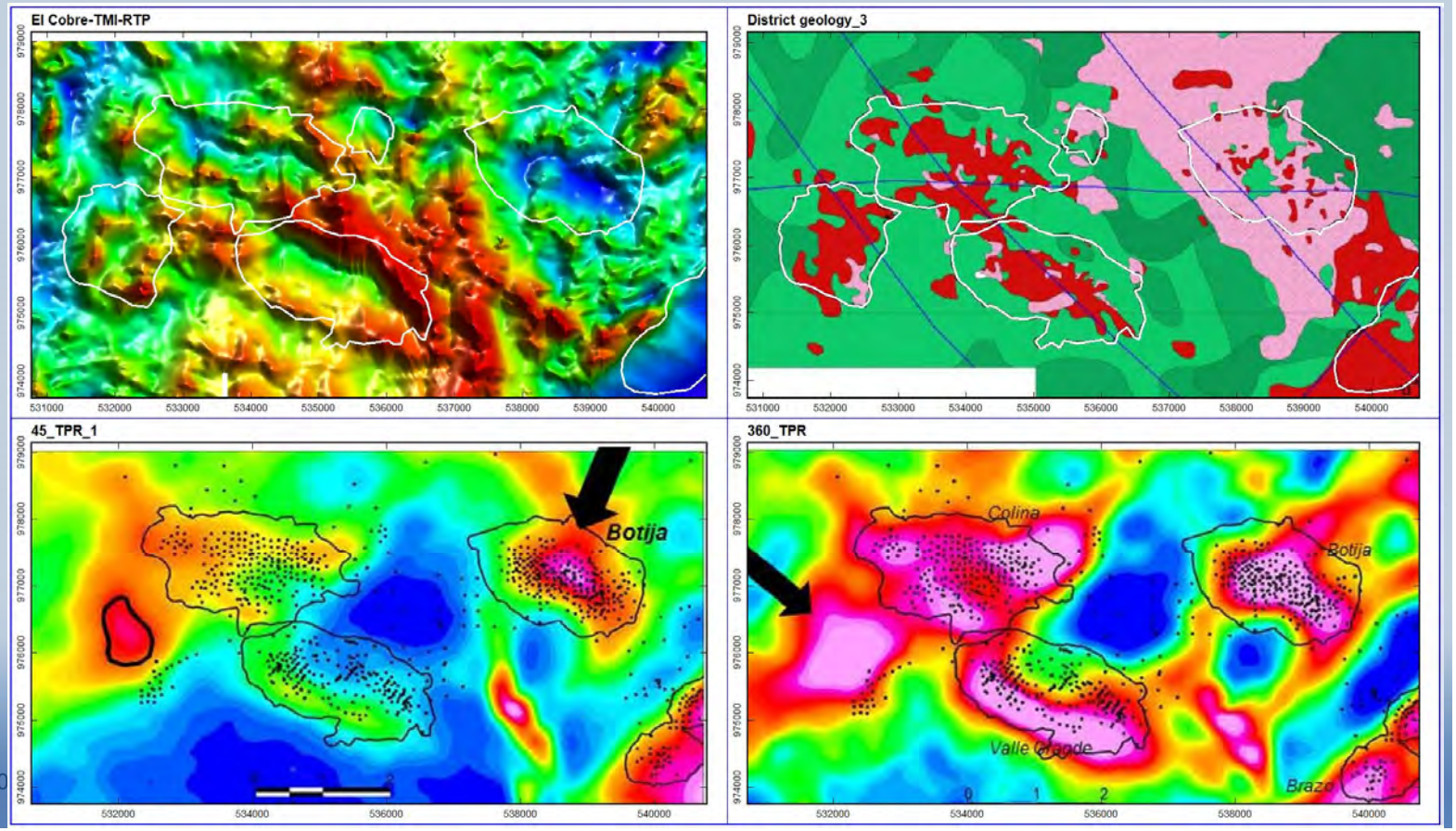
Courtesy Thompson Creek

AFMAG & PCDs-EL Cobre-Panama

The magnetic patterns associated with the mineralized intrusives is irregular. The available ZTEM show the mineralized zones are conductive. Little evidence of structures is apparent in the results.

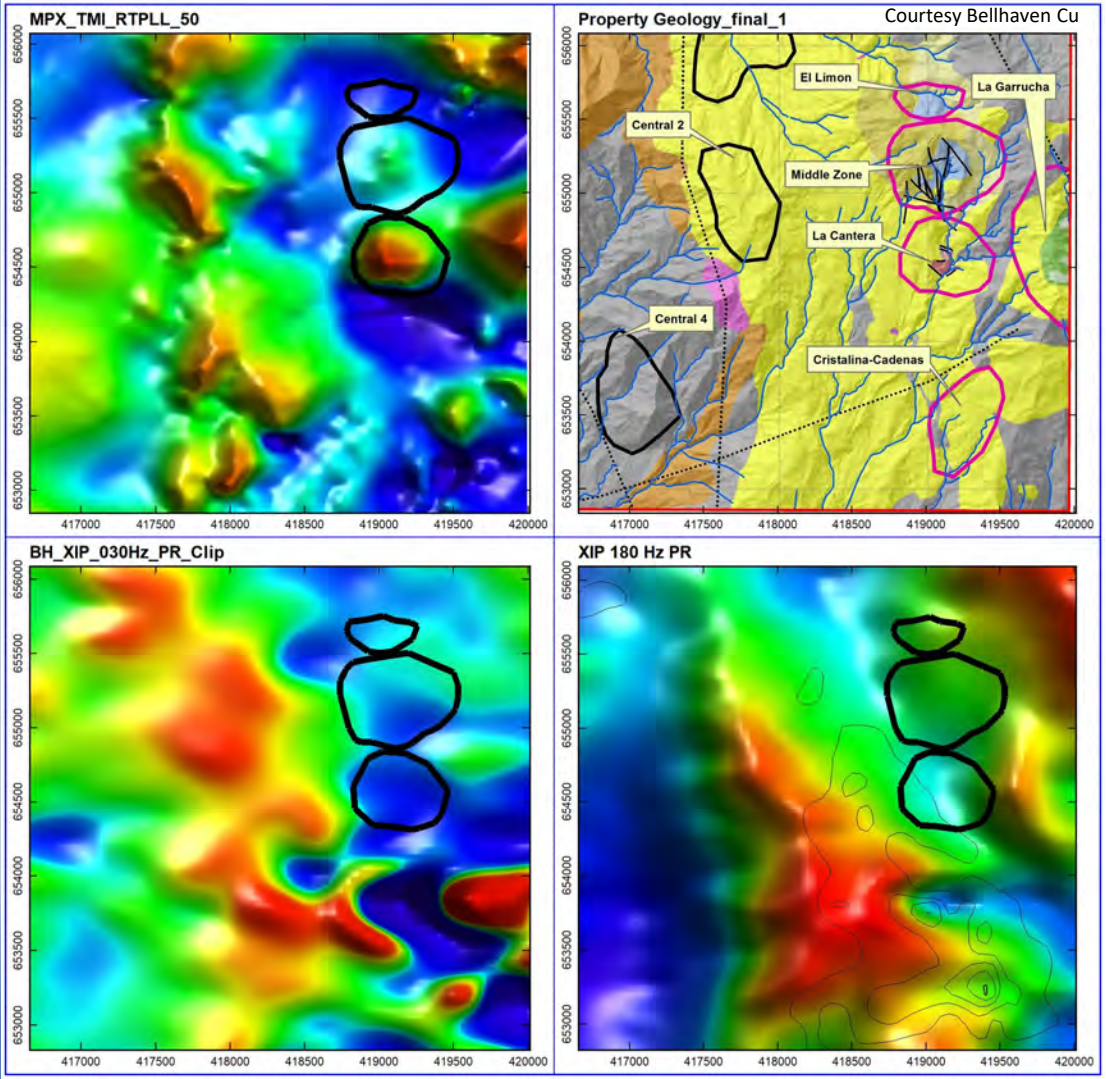


AFMAG & PCDs-EL Cobre-Panama



AFMAG & PCDs-La Minas-Colombia

Of the three main intrusives, two show a discrete magnetic high response. The 30 Hz TPR show some zones of high resistivity associated with the intrusives; power lines responses hinder the quality of the results.



AFMAG & PCDs-La Minas-Colombia