NEW RICHES FROM OLD DATA; A REVALUATION OF LEGACY DATA FROM THE CASINO DEPOSIT, YUKON

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SUMMARY

The Casino porphyry deposit is situated in western Yukon, 380 km NW of Whitehorse. Casino was discovered in 1969 as a result of drilling a geochemical anomaly. Casino is unique in that it has a well-preserved weathering profile due to the lack of glaciation in the area. Since the deposits discovery, several aeromagnetic, aeroradiometric, IP and MT surveys have been carried out over the deposit. These surveys show some patterns considered typical of porphyry deposits but also some unusual responses attributed to the weathering profile. Deep IP and MT responses previously unrecognized were defined.

Key words: porphyry copper-gold, airborne magnetic, radiometric, IP and MT

INTRODUCTION

The Casino porphyry deposit is situated in western Yukon, 380 km NW of Whitehorse (Figure 1). Casino was discovered in 1969 as a result of drilling a geochemical anomaly. Since then numerous companies have undertaken extensive exploration work. Western Copper and Gold Corporation (WCG) currently owns Casino and is moving the project through permitting. A reserve of 965 million tonnes mill ore + 157 million tonnes heap leach (proven + probable), containing 4.5 billion lbs copper and 8.9 million oz gold has been published for the deposit.

While there are numerous porphyry deposits extending from Alaska through Canada and the US and down into northern Mexico, Casino is unique in that it has a well-preserved weathering profile due to the lack of glaciation in the area. Condor felt this made the deposit worthy of a more detailed assessment and in early 2017 with the cooperation of WCG, Condor began a systematic review of legacy geological and geophysical data acquired at Casino.

Of the available surveys, airborne magnetic and radiometric surveys carried out by the GSC were selected and of the ground surveys, a ground magnetic and IP survey from the late 1960s were utilized as well as a Titan IP-MT survey conducted in 2009. In addition, geological information was sourced from historical records and from WCG.

Earlier reporting by the GSC had noted a strong potassium response associated with Casino. This work also suggested that basic radioelement ratioing could help discriminate the altered intrusive rocks found at Casino from other barren potassium rich rocks in the area. An assessment of the magnetic results suggested that Casino was part of a larger magnetically-defined intrusive complex, although Casino itself is a relative magnetic low.

The first IP survey was only available as a single-layer image of resistivity and chargeability and with no details as to the parameters used. Based on what were considered reasonable assumptions of technology from that era, it was deemed likely the survey did not penetrate the upper oxidized zone which extends in places to over 100 m below ground surface.

The Titan data were re-processed with 2D and 3D codes. For the IP-resistivity results, the earlier assessment by the survey contractor appeared to be distracted by strong heterogeneity of response in the upper 200 m; Condor interpreted to be caused by the weathering profile. Large features at depth in both the resistivity and chargeability appear to be more primary features associated with the hypogene portion of the deposit. The MT results show a strong discrete response at depth. This is a new target previously unrecognized and deemed worthy of testing.

Figure 1: Location of Casino.

REGIONAL GEOLOGY, AIRBORNE MAGNETIC AND RADIOMETRIC SURVEYS

Geology & Magnetics-The district scale magnetics (GSC Open File 6254, 2009) shown in Figure 2 with the regional geology shows both clear positive correlations with the mapped geology but also some major inconsistences. The Dip Creek Fault is a pronounced magnetic low cutting through the Dawson Range Batholith. The Dawson Range Batholith shows a considerable variation in magnetic character, suggesting that either there are a number of unrecognized phases or different rock packages contained in the mapped unit. The metamorphic packages appear to show a consistent low magnetic response, as do two limited outcrops of rhyolite south of Casino. A zone of Mt Baker granodiorite in the SW part of the image shows magnetic highs at the two ends of an E-W elongate body. The Casino deposit appears to be hosted within a zone of elevated magnetic response designated the Casino Magnetic Zone (CMZ). This feature is elongate in an E-W direction (as are many of the discrete magnetic bodies) with a strike length of 8.5 km and a maximum N-S of about 5 km. The mapped geology does not capture this outline. The deposit itself shows moderate magnetic response adjacent to a low on its western side.

The ground magnetic coverage is shown in Figure 3. This survey was produced by Cathro and Phillips (1970). Within the deposit, there is a discrete high magnetic response that closely correlates with the part of the Patton porphyry east of the Patton Fault. This suggests that there is vertical displacement with the magnetic feature coming from a deeper depth (based on Richards-2015). In an earlier geology map (Cathro and Phillips 1970), this unit is termed a 'magnetic latite porphyry'.

West of the Patton Fault, the Patton porphyry shows an elevated magnetic response but not as high as the part east of the Patton Fault. Elsewhere, the intrusion breccia and Dawson Range Intrusive are low magnetically.

Away from the deposit, there mapped geology is limited (see Phillips and Godwin 1970) and appears to be a variety of intrusive sub-types. West and north of the deposit there are a number of magnetic highs. Edges of a number of these features show some alignment with mapped faults.

The regional potassium response is shown in Figure 4. The Casino deposit shows a strong discrete potassium high that is limited to the footprint of the deposit. To the NW of Casino, there are a series of large highs that show some degree of alignment with the geology. A part of the Sulphur Ck. metamorphic package is a potassium high but when a un-named NE-SW fault is crossed (red double headed arrow), the radiometrics suggests there is an off-set to the NE which is not reflected in the geology. To the SE of Casino, a small block of Sulphur Ck. metamorphic rocks shows a strong potassium response coming from the northern part of the block and a low response on the southern side. In this environment, the effects of topography and the potentially thick residual (regolith) could have a strong impact on the radiometric response. At Casino, the oxide zone is up to 60 m thick, likely due to the high percentage of sulfides initially present. However, the strong potassium response over the deposit suggests almost an enrichment in potassium has taken place.

IP SURVEYS-SCINTREX AND TITAN

SCINTREX-Figure 5 shows the Scintrex IP results.

Chargeability-The results are 'suggestive' of a pyrite halo around the deposit but given the limits of the coverage and the thick oxide zone (over 100 m thick in places), this is speculative. More likely the character reflects changes in the leached cap/oxide zone, possibly clays or residual unweathered sulfides.

Resistivity-The resistivity results show a strong effect from the leached cap/oxide zone (Figure 8-geology section) expected to be of higher resistivity. However, the eastern part of the deposit shows as a resistivity low (<400 ohm-m). This could possibly be due to the survey at the base of Patton Hill responding to the supergene blanket which in that area is close to the surface This does not explain the low resistivity to the west and east of the deposit however. A zone of moderate resistivity extends to the NW from the deposit; the reason for this is unclear.

TITAN-The resistivity and chargeability in plan, section and 3D are shown in Figures 6-9.

Resistivity Depth Slices (Figure 6)-The shallow resistivity results (1200 and 1100 m amsl) show a complex set of highs and lows both inside and adjacent to the deposit. This is attributed to be due to a combination of the leached cap/oxide zone and structures; these are highlighted in the lower panel. The 900 m amsl image shows two strong conductive zones inside and adjacent to the deposit outline. The stronger of the features (highlighted in the lower panel) shows a close correlation with NE-SW and ~E-W structures. This feature persists to the deepest elevation slice (700 m amsl).

Chargeability Depth Slices (Figure 7)-The first two depth slices (1200 and 1100 m amsl) show a quite broken-up pattern with many small discrete highs being defined. When compared with the survey lines (not shown on these images) many of these small highs are located between lines and so are considered to have less reliability as they could be created as a result of the inversion modeling process. This is attributed to the response being derived largely from the oxide zone.

Geophysically the oxide zone appears to have a high degree of heterogeneity which is giving the shallow parts of the model its complexity. The 900 m amsl depth slice is still 'complex' for both models but the anomalies are larger. This could be the level at which the supergene is the dominant geology. Again, while the geology suggests one unit, the geophysics suggests a considerable degree of heterogeneity. There is no coherent response associated with the deposit outline that suggests a staggered or gradational alteration envelope around the deposit. There is some character along the NE side in the 1100 and 900 m amsl levels that appear to coincide with the high in 1969 survey. In the final slice, 700 amsl, a deeper-seated feature is apparent. The results show a major high trend along the southern margin of the deposit. The chargeability model suggests that the depth of oxidation (sulfide destruction) is much deeper than assessed geologically.

Section L11200N (Figure 8)-The resistivity section appears to be better defining the oxide zone on this line but, as on L10900N, large parts of the supergene zone are also resistive. There are two 'knobs' of conductive rock noted; one at 610700E and another at 611250E. The resistivity 'topography' appears to reflect these 'knobs'. The chargeability shows the oxide zone as low and the supergene zone appears as a series of discrete chargeability highs. A major zone is located at 611000E and associated with the Casino microbreccia.

The Mag3D shows two depth limited highs; one at 610800E which correlates with the western contact between the microbreccia and granodiorite. The other high is located at 611180E and is associated with a shallow chargeability high and quartz monzonite. Note, there is quartz monzonite to the west associated with the Casino fault which does not show any magnetic response.

3D Display (Figure 9)**-** Panel 1 shows the chargeability isosurface (67 ms) and the MT isosurface (66 mS). Panel 2 has the DC resistivity isosurface (135 ohm-m) added as well. The deposit outline is also displayed. The trace of the IP and MT lies parallel to the southern edge of the deposit. The IP body lies along the deposit edge whereas the MT sits just to the south of the deposit edge. The resistivity body is shallower than either the IP or MT sources and extends well south of the southern edge of the deposit.

CONCLUSIONS

The Casino deposit shows some of the geophysical characteristics associated with porphyry copper deposits but as well shows a strong overprint caused by the preserved weathering profile. As well, deep chargeability and MT features were recognized which were unexpected but which could have important economic implications.

ACKNOWLEDGMENTS

Condor Consulting, Inc. wishes to thank WCG for the opportunity to present the outcomes shown here.

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Yukon Digital Bedrock Geology; January 2017 update

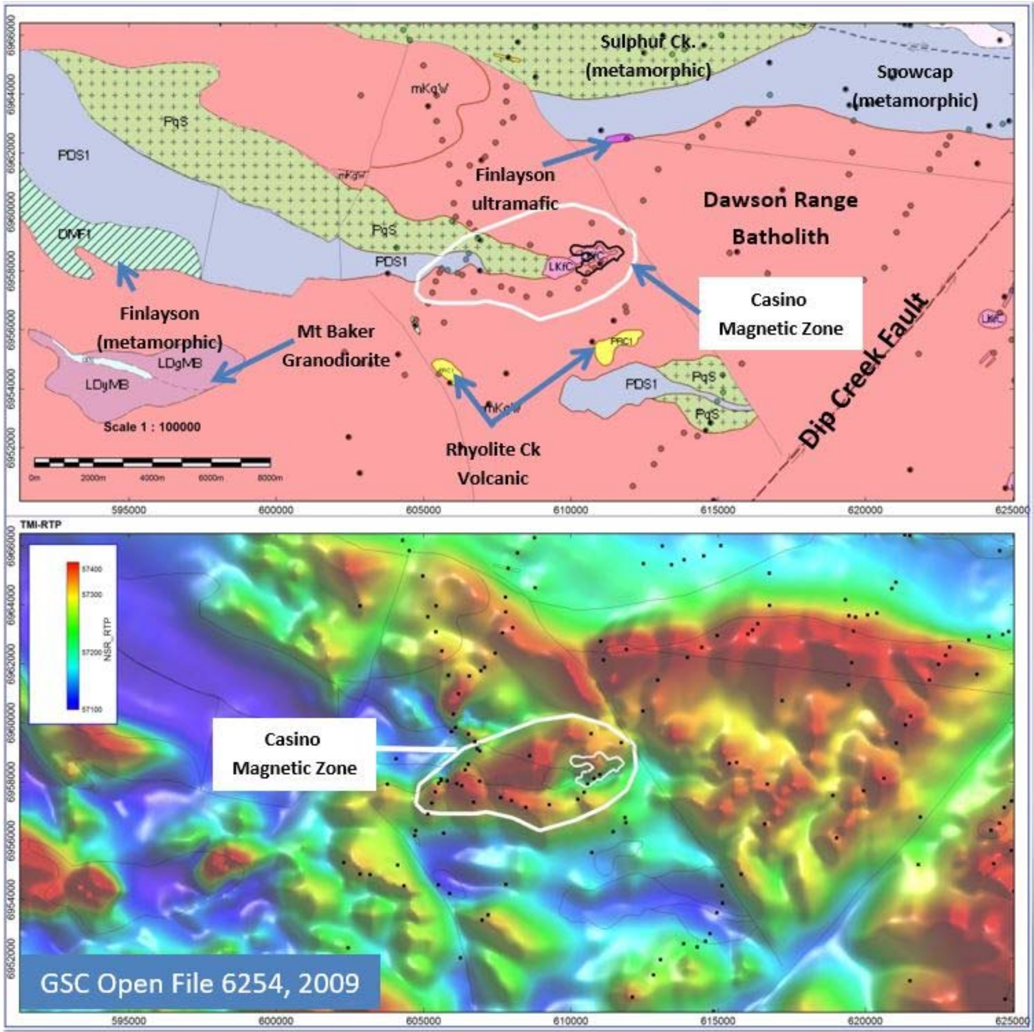

Figure 2; Geology and aeromagnetics over Casino.

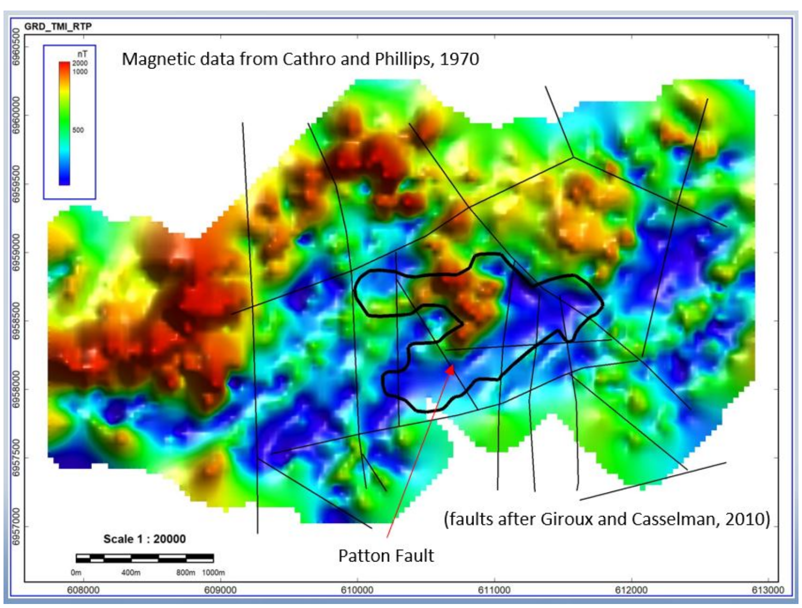

Figure 3: Ground magnetics. Black outline is Casino proposed pit.

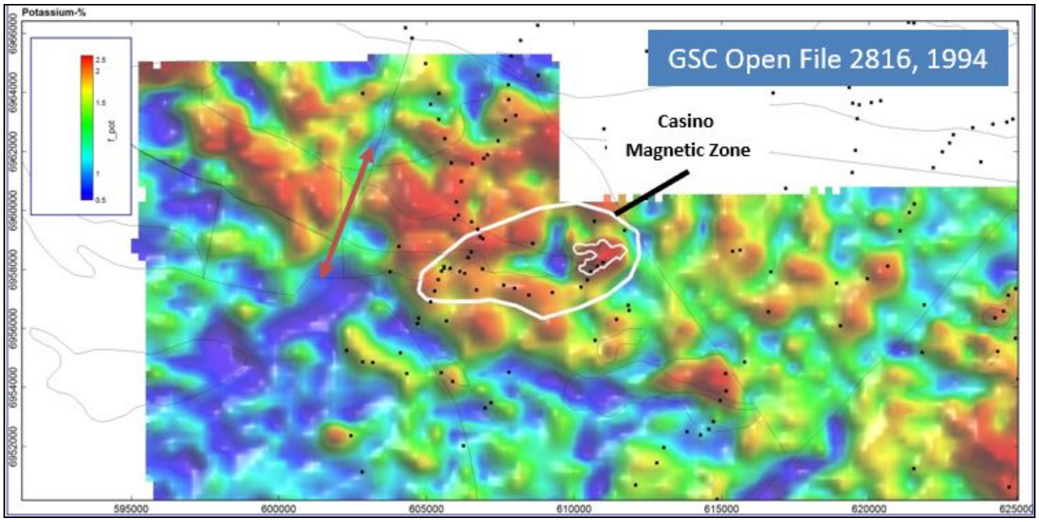

Figure 4:Aero radiometrics-Potassium %.

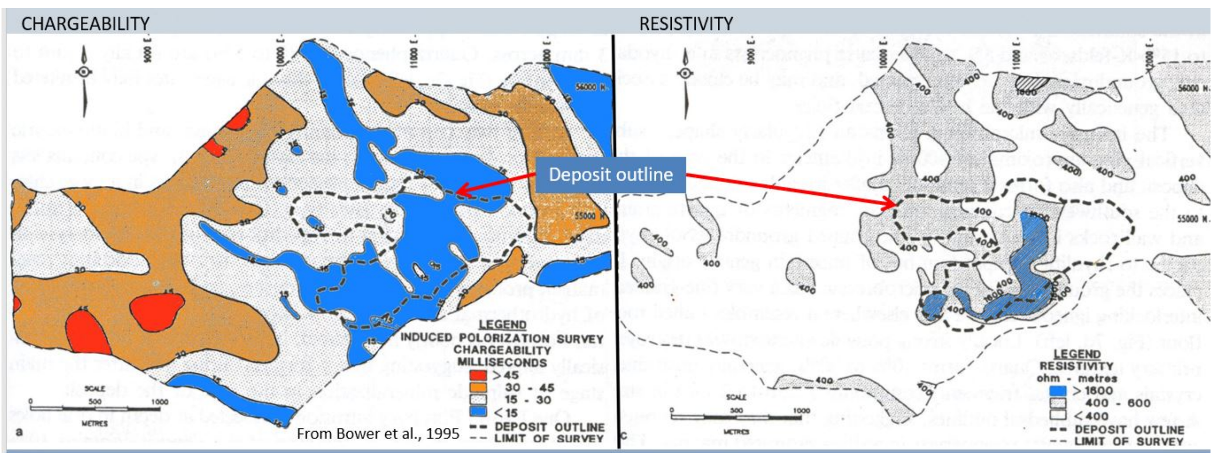

Figure 5: 1969 Scintrex time domain IP Survey.

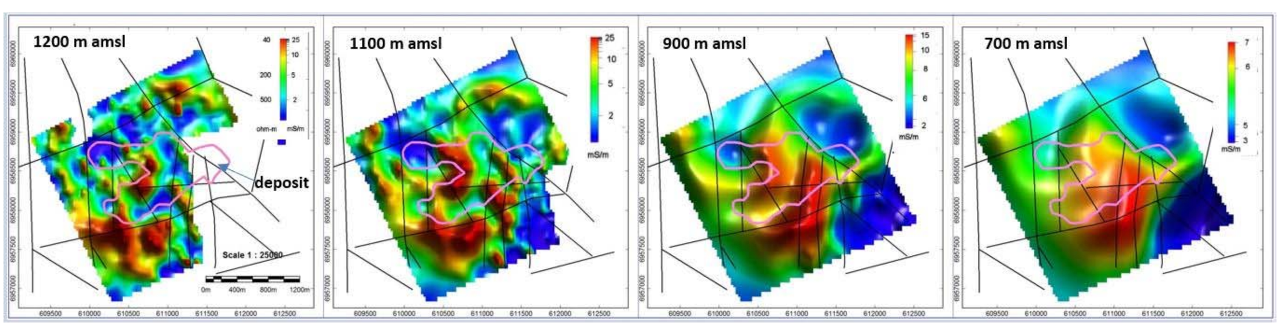

Figure 6: Titan Resistivity Depth Slices.

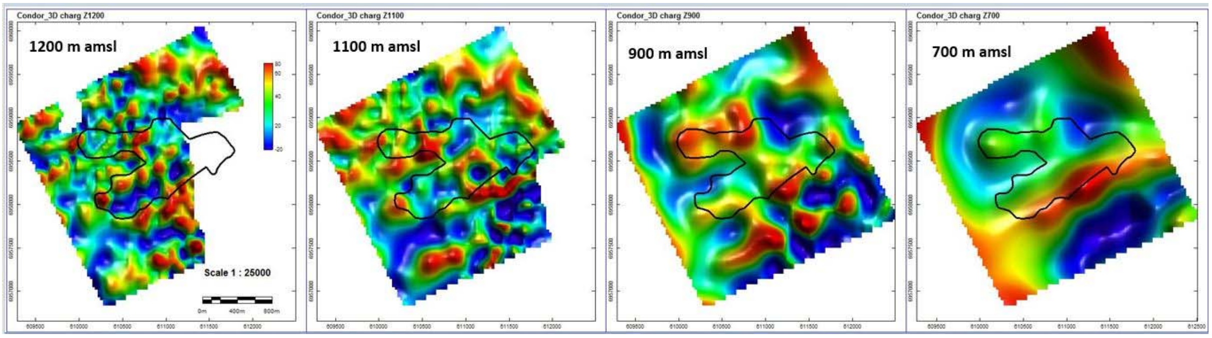

Figure 7: Titan Chargeability Depth Slices.

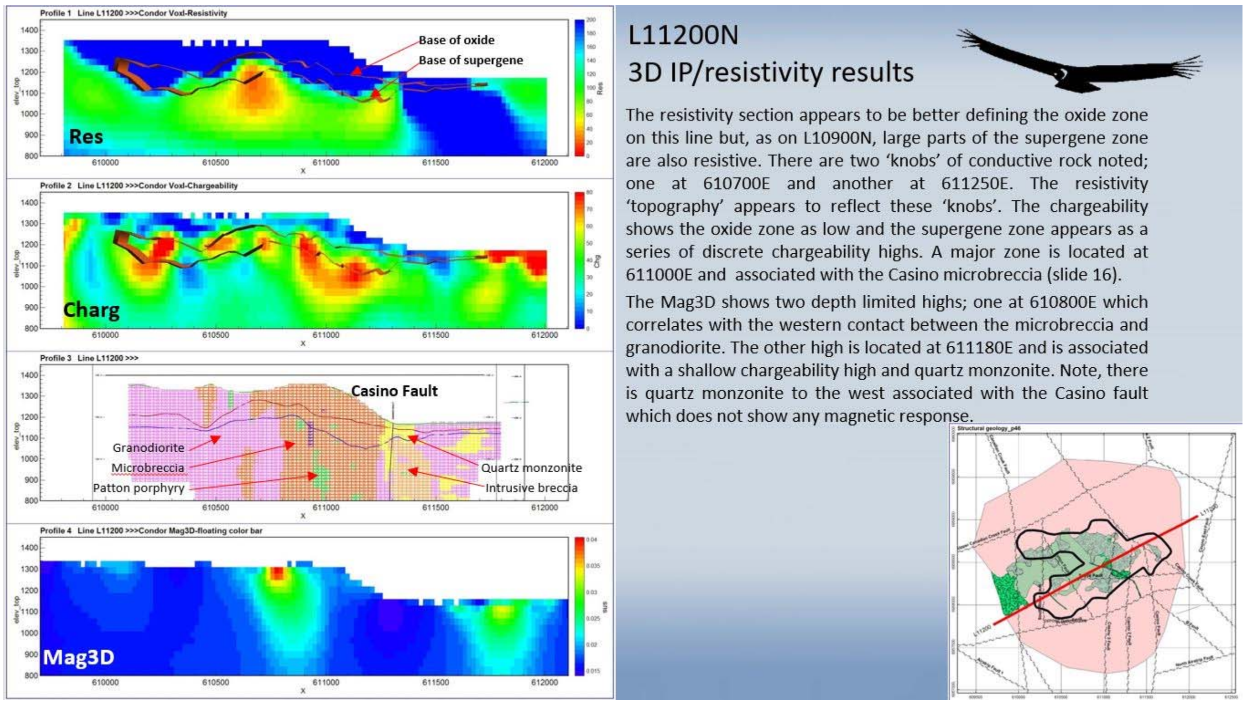

Figure 8: IP section for L11200N + Mag3D.

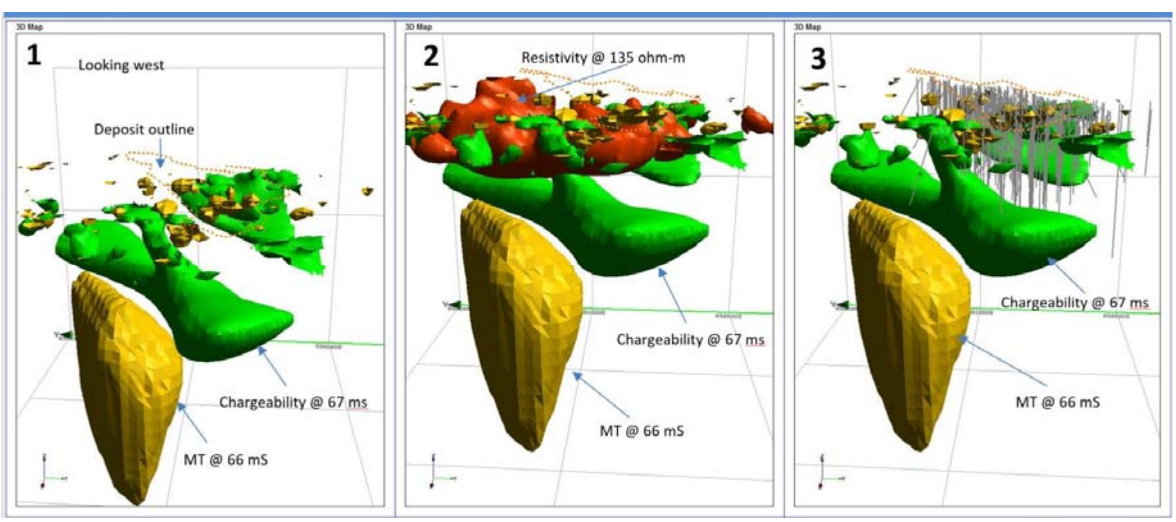

Figure 9: 3D Views of MT, IP and Resistivity Models.