A comparison between VTEM and AeroTEM III with examples from data collected in early 2008

Introduction

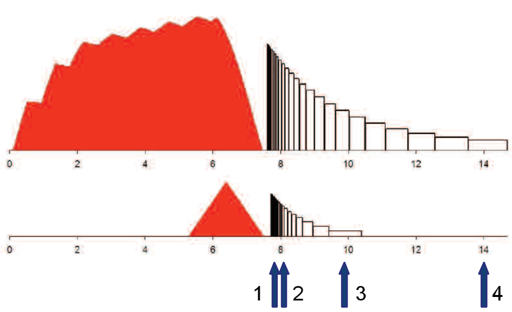
A comparison of survey data from the VTEM and AeroTEM III systems over the McFaud's Lake area (sometimes termed the "Ring of Fire area") of the Superior Province in Canada is presented.
Both VTEM and AeroTEM III flew the same area, 101 line-km with the same line spacing 100 m, and the same east – west line direction. The depth of the known conductors in the area is approximately 100 m (confirmed by drilling). The overburden thickness averages approximately 50 m.

System configuration

Table 1 shows the system configuration used for the survey and Figure 1 shows the shape of the transmitter pulse with the off-time gates. VTEM holds a clear advantage in base frequency, dipole moment, and transmitter pulse length. All of the above generate better signal to noise ratios and conductance discrimination. VTEM uses a long polygonal waveform pulse as opposed to a short triangular waveform pulse that all of the AeroTEM systems use. The VTEM waveform is more efficient at energizing the conductors. AeroTEM III system records both off-time and on-time channels, while VTEM system records B-Field data together with dB/dt data for off-time channels.

	VTEM	AeroTEM III
Transmitter loop diameter	26 m	10 m
Peak dipole moment	406,000 NIA	183,000 NIA
Transmitter peak current	190 A	250 A
Transmitter base frequency	30 Hz	90 Hz
Transmitter Pulse	Rectangular, 7.5 ms	Triangular, 2.2 ms
EM bird survey height	30 m	30 m

Table 1 – System configuration



VTEM
24 Off-time dB/dt Channels
24 Off-time B-field Channels

AeroTEM III
16 On-time Channels
17 Off-time Channels

Figure 1 – Transmitter pulses and time gates. The arrows 1 – 4 indicate the time gates used for the grids on the maps

Data Comparison – Grids

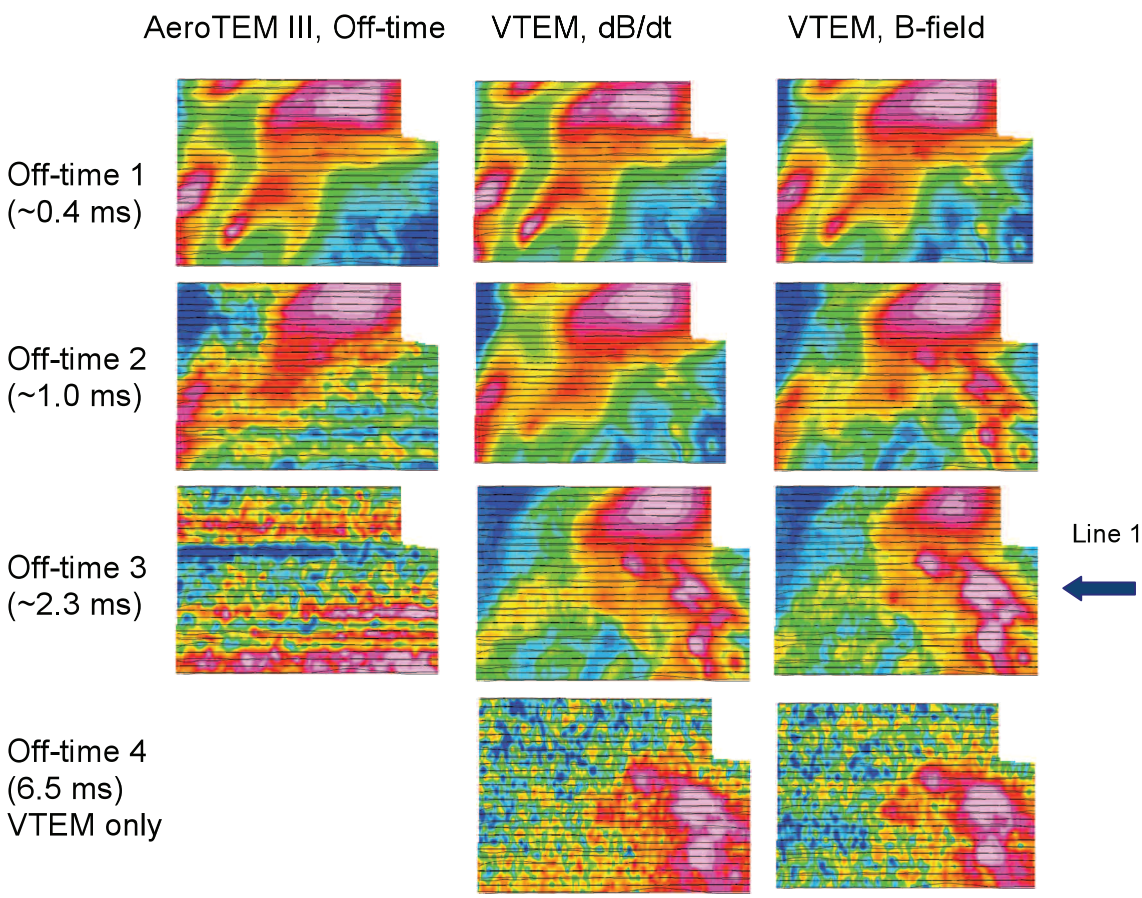


Figure 2 – EM time gate grids

Figure 2 shows the gridded EM channel data of the two systems. The early time EM response in the area is basically due to the conductive overburden. The main trend of the early time features is NE-SW (across the NW-SE magnetic trend of the basement – Figure 3). The early time grids (off-time 1, ~ 0.4 ms) for both AeroTEM III data and the VTEM data are essentially the same. The VTEM late time data, especially B-field, clearly shows the location and the structure of the basement conductors in the SE part of the map (trending NW-SE along with the magnetic trend). The AeroTEM III late time data becomes too noisy to successfully detect the basement conductors.

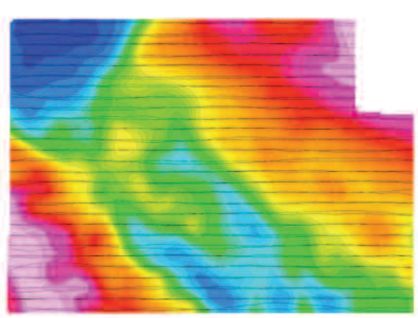


Figure 3 - Total field magnetic grid

The magnetic data presented in Figure 3 shows that the basement magnetic futures in the area are trending NW-SE.

Data Comparison – Profiles

Figure 4 is the profile data of both the AreoTEM III data and VTEM data over the same line (Line 1 indicated in Figure 2). Inspection of the two sets of the plots show that VTEM hold a commanding advantage in signal to noise ratio. Also note that the spatial resolution of VTEM is clearly superior. Spatial resolution is important as the VTEM noise has a much higher spatial frequency than the bedrock response. This makes for easier visual signal to noise separation for interpretation. The wavelength of the noise on the AeroTEM III data is long, showing either receiver motion noise or the effects of heavy-handed filtering. The AeroTEM III noise is in the same wavelength as the valid EM anomalies, further decreasing the ability to interpret the data.

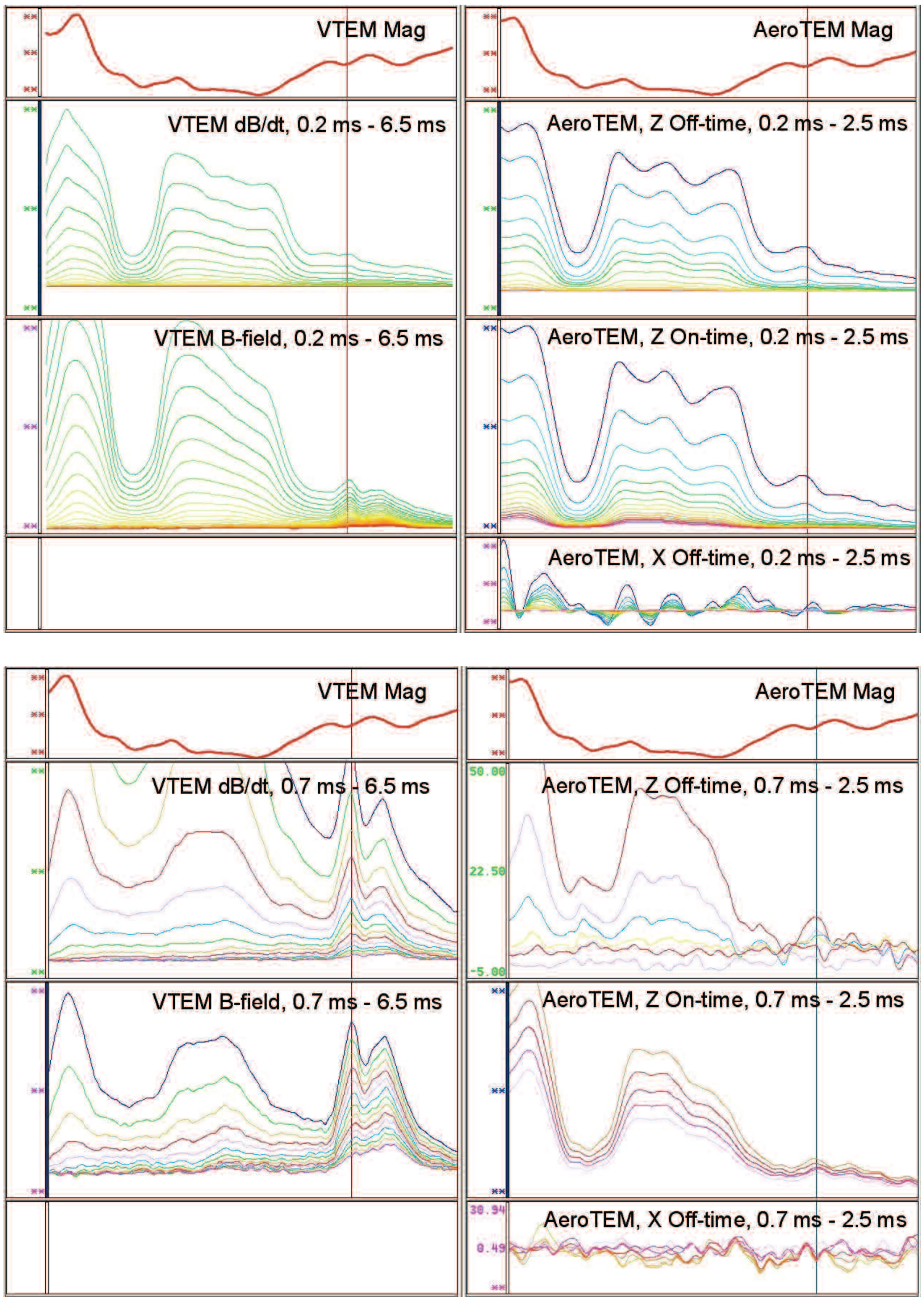


Figure 4 – EM profiles

Time Constant Comparisons

Figure 5 shows the amplitude versus time plots of the VTEM dB/dt,VTEM B-Field, AeroTEM III Zon and AeroTEM Zoff data over the peak of the anomaly detected by both systems. The VTEM decay curve varies smoothly showing good signal to noise. The AeroTEM III decay plots decay smoothly only for the early time channels. At late channels, the noise in the system is seen as single point changes in the slope. The time constant estimate is 12.6 milliseconds with the VTEM B-Field at late time. Using the AeroTEM III data, a reliable time constant estimate is approximately 5 milliseconds obtained from averaged mid to late times. VTEM has a longer measurement time and transmitter pulse which allows for the resolution of high conductance targets.

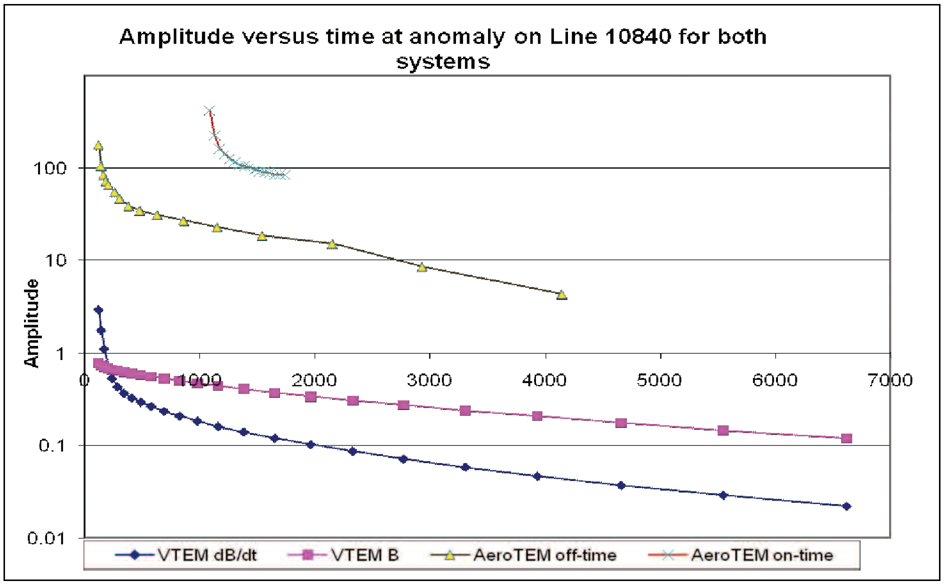


Figure 5 - Amplitude versus time plots of the VTEM dB/dt, B-Field, AeroTEM III Zon and Zoff responses on L10840

Conclusions

The comparison of the two systems using actual survey data collected over the same area shows that VTEM outperforms AeroTEM III in terms of signal-to-noise and conductance discrimination. VTEM's long duty cycle allowed it to detect conductive structures in the deeper basement that are un-resolvable in the AeroTEM IIII data. The much better signal to noise ratio also means that VTEM will detect both smaller more subtle variations in geology as well as targets at greater depths.

VTEM

Hi Resolution - Deep Penetration