

CSAMT Case Study

Los Olivos Project, Valle de Olivos, Chihuahua

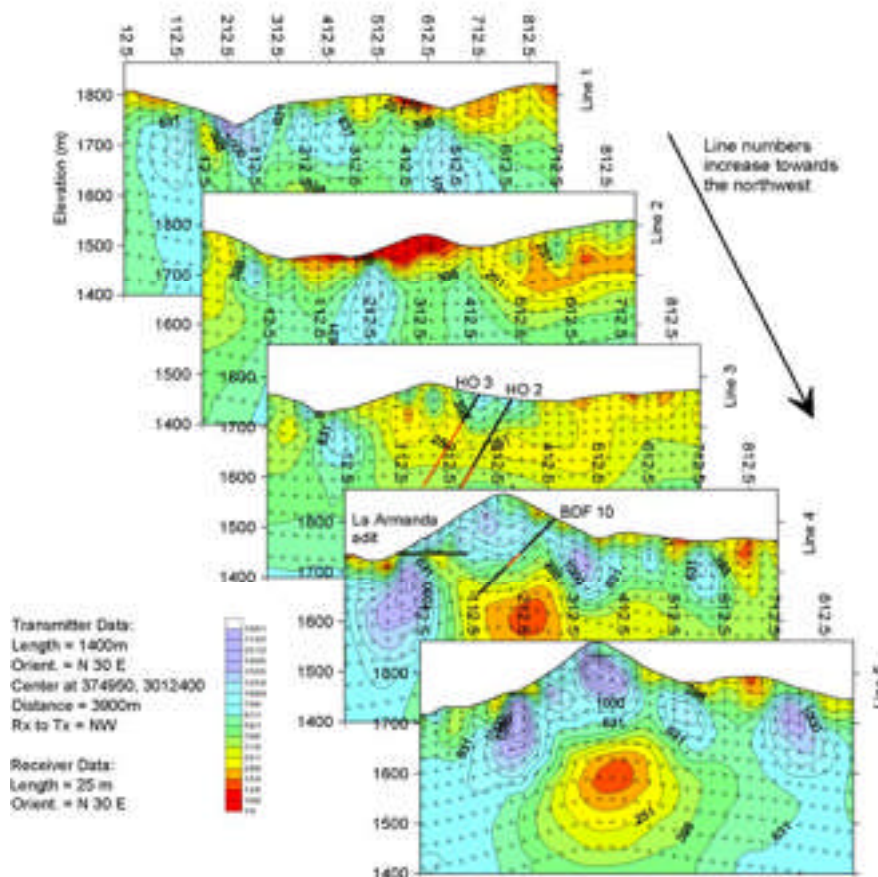


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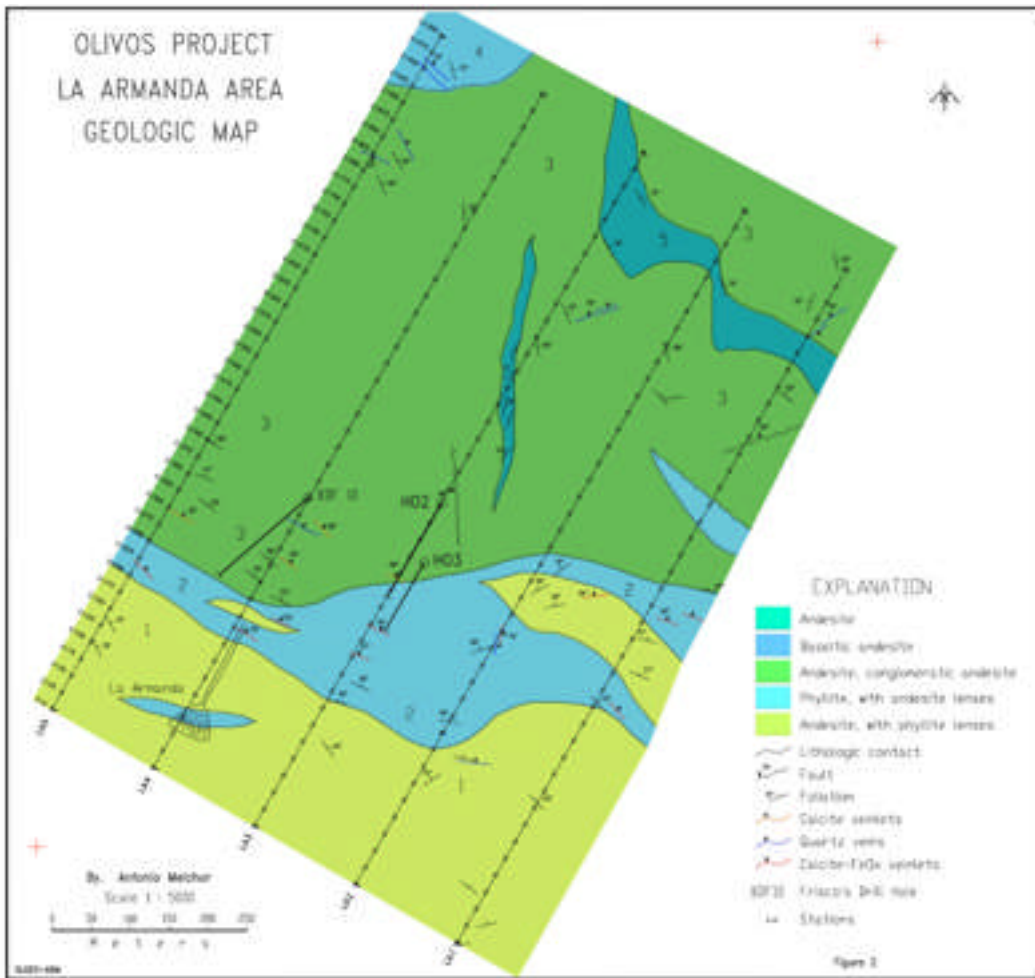
The Los Olivos Project is located 5 km east of Valle de Olivos near Hidalgo de Parral in the State of Chihuahua. During 1996 CSAMT data were collected along 5 lines forming the Olivos Grid. These data were acquired with the high-power (30 kW) Zonge International CSAMT system. La Parreña, S.A. de C.V. has released surface geology and drill hole results, including the Los Olivos CSAMT data. CSAMT is a high-resolution resistivity mapping technique that uses broadband electromagnetic signals for depth soundings.

For this CSAMT case study, the Zonge SCS2D inversion code has been used to model these CSAMT data. The SCS2D inversion is a two-dimensional (2-D) finite element solution that not only models flat-lying geology and high-angle contacts, but also resistivity changes associated with topography. The modeled results for each modeled line is presented as a smoothly contoured modeled resistivity depth section. The modeled results for all 5 lines are shown as stacked depth sections viewed to the northwest, but displayed in reverse order with Lines 4 and 5 shown in the forefront.

2-D Smooth-Model Resistivity Inversion, Scalar CSAMT Data

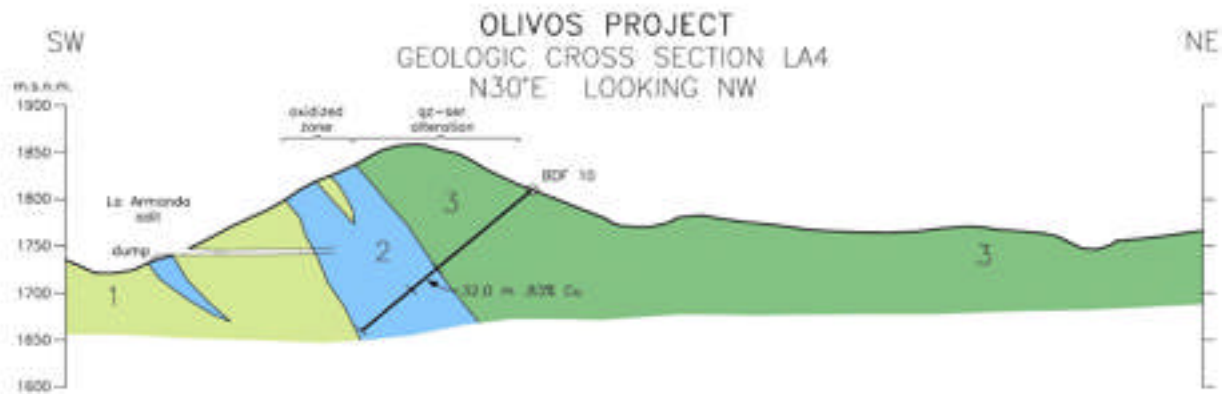
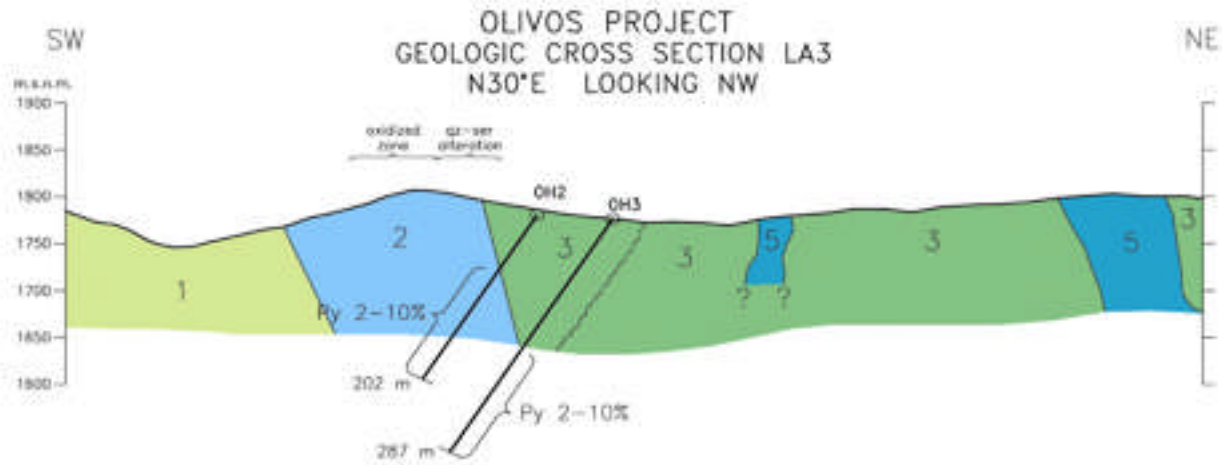


Compared to Lines 2 and 3, a difference is observed on the modeled 2-D depth sections for Lines 4 and 5 to the northwest. A deep conductive zone is noted between stations 310 and 460. The Geologic Map and the Geologic Section for Line 3 suggest that high-angle andesite dikes and fault-like features are aligned sub-parallel to Lines 2 and 3. Drill hole HO2, located near station 455 on Line 3, encounters sulfide mineralization in a moderately resistive zone at a depth of 135 meters. Drill hole HO3, located off-line south towards Line 2, crosses sulfide mineralization at a depth of 60 meters. The 2-D modeled depth section for Line 3 clearly shows a conductive zone associated with pyrite mineralization, intersected by drill hole HO3. Although pyrite mineralization identified by drill hole HO2 is located 75 meters deeper, this deeper mineralization is located just 20 m north of drill hole HO3. This suggests a plunging zone of mineralization between drill holes HO2 and HO3 (this identified as a northeast conductive trend defined by Lines 2 and 3 on the 1700 m elevation plan-view plot).



Mineralized sulfides are the primary target at Los Olivos. Over 100 meters of 2 to 10 percent pyrite were identified in drill hole H02 and H03 on Line 3. Copper is identified along a 30-meter intercept crossed by drill hole BDF10 on Line 4. Sulfides appear to be associated with the phyllite rock located between the andesites to the southwest and conglomeratic andesites to the northeast. Quartz-sericite alteration is found in the vicinity of the phyllite and conglomeratic andesite contact. Metallic-luster sulfides in excess of 4 or 5 percent can be highly conductive. Sericite-based alteration is expected to be moderately conductive.

The modeled 2-D depth sections for Lines 4 and 5 show a much deeper conductive zone below depths of 125 m (see the 1600 m elevation plan-view plot). On Line 4, drill hole BDF10 locates mineralized sulfides at 125 m. This mineralization is located below the peak beneath station 310 and appears controlled by the contact between resistive hanging wall and conductive foot wall rocks. The resistive hanging wall rock is conglomeratic andesite, possibly silicified. The conductive foot wall rock may be quartz-sericite alteration associated with underlying phyllite rock.



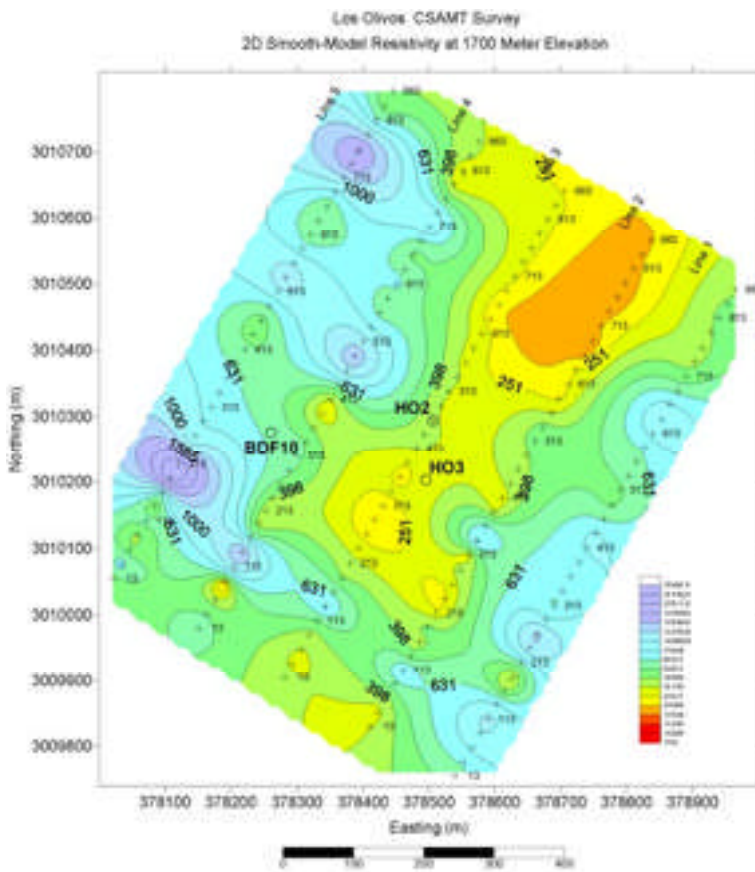
EXPLANATION

- Andesite dike
- Basaltic andesite
- Andesite, conglomeratic andesite
- Phyllite, with andesite lenses
- Andesite, with phyllite lenses

- Lithologic contact
- Fault
- BDF 10 Old diamond Frisco Hole

By: Antonio Melchor

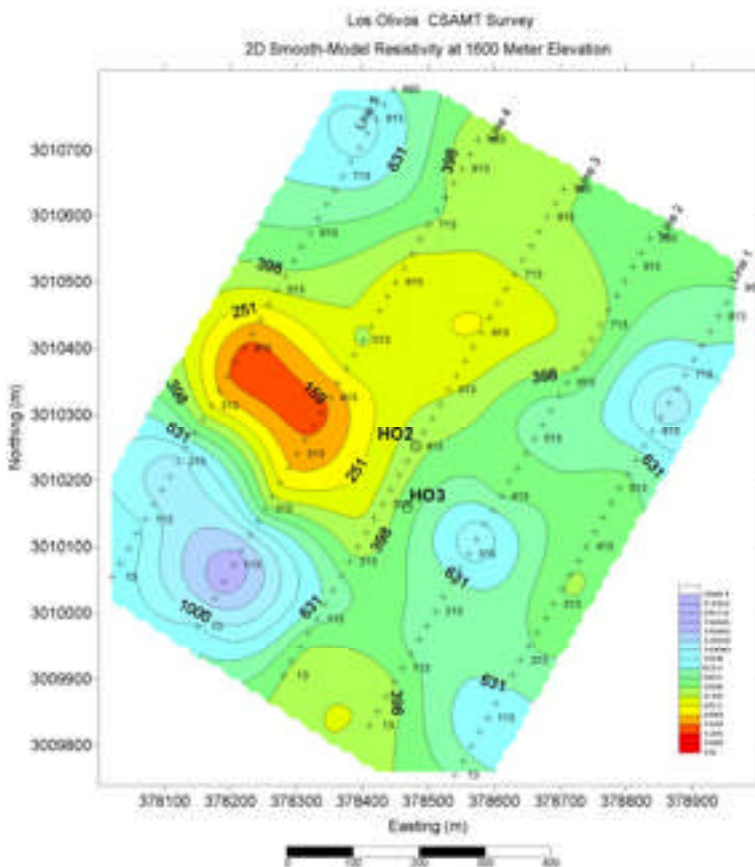




The 2-D smooth-model inversion of the CSAMT data collected at Los Olivos clearly identifies important geologic changes. Metallic-luster sulfide mineralization and sericite alteration are both identified as conductive sources. Sulfide mineralization has been identified in three drill holes completed at Los Olivos. It is possible that near-surface detail has been obscured by silicification, such as contacts between andesites and phyllites crossed by Lines 4 and 5. Of particular interest is the conductive zone located at an elevation of 1600 m between stations 310 and 460 and the northeast conductive trend observed at an elevation of 1700 m. While drilling at BDF 10 located copper associated with the hanging wall contact at an elevation of 1700 m below station 310 on Line 4, the lower conductive zone at the 1600 m elevation does not appear to have been fully tested.

The La Amanda adit crosses through a near-surface conductive contact between a phyllite lens and unaltered andesite. The tunnel passes through the andesite and terminates in moderately resistive oxidized phyllite rock. These charges are clearly observed on the 2-D smooth-model inversion for Line 4.

Of particular interest is that the 2-D inversions appear to have eliminated conductive features associated with topography, specifically the high ridge crossed by Lines 4 and 5. The modeled conductive zones are associated with geology, not topography. The Zonge 2-D smooth-model software, combined with the 1996 Los Olivos CSAMT data, certainly demonstrates the high-resolution resistivity detail typical of this electromagnetic technique.



Zonge International

3322 E. Ft Lowell Rd, Tucson, AZ 85716 USA

Tel: (520) 327-5501 Fax: (520) 325-1588

Email: zonge@zonge.com