Fritz Geophysics

Lone Ranch Project,
Ferry County Washington,
Helicopter ElectroMagnetic, HEM,
Survey Interpretation

for ***Golden Oasis Exploration***

July 2007

Geophysics should <u>not</u> be "the tool of last resort".

Lone Ranch Project, Ferry County Washington, Helicopter ElectroMagnetic, HEM, Survey Interpretation

Summary

At the request of R. Kern, of Golden Oasis Exploration, I have designed, supervised, and completed an interpretation of a HEM survey over the Lone Ranch area in extreme northern Ferry County, Washington. The objectives of this survey and interpretation were to determine the geophysical signatures of host rocks, locate probable structures, and determine possible alteration and mineralization that may be associated with economic mineralization. The data base consisted of the HEM survey, flown by Fugro of Toronto, a preliminary geologic map, and an older USGS aeromagnetic data set. The expected target is mineralization in an exhalative layer with significant sulfides and pyrrhotite. This layer is expected to be the only low resistivity and highly magnetic unit in the section and is the target for the electromagnetic survey.

The mapped host rocks appear to have more magnetite than expected and have a very high resistivity. There are probably more late dikes in the area than previously known. The resistivity contrast between the hosts and the exhalative unit is large, from 100 to 1,000 times the low resistivities of less than 20 ohm-m in the exhalative. The area is interpreted to be extremely complex structurally. Almost all directions of the compass appear to be represented. The relative age of structures is interpreted to be from oldest to youngest, northerly, north-east and north-west, and finally easterly.

The very low resistivity unit interpreted from the HEM data shows a close correlation with the known exhalative unit. There is conservatively five kilometers of strike length of exhalative target interpreted from the HEM data with “hot spots” suggested by thicker – lower resistivity areas and the higher magnetic responses. Based on the geophysical data, lower measured resistivities would suggest a thicker or lower resistivity or both for the exhalative unit. This appears to be the only prioritizing method for selecting the target order.

No further geophysical work is recommended at this time. With the interpreted and mapped westerly dip, fences of angled drill holes to the east are recommended to test these targets. For the northern most flat lying, dip slope, Target 3, vertical holes should be satisfactory.

Conclusions and Recommendations

With the basic assumption that low resistivities are reflecting the mineralized exhalative unit, the HEM interpretation has defined extensive areas of possible economic targets within the survey area. The interpreted low resistivity zones follow the mapped geologic unit through most of the known mapped extent and extend the unit into additional areas. From the south central part of the survey the main unit appears to dip steeply to the west and flattens as it moves north across structures to a flat laying dip slope segment at the northern end of the survey. There is conservatively five kilometers of strike length of exhalative target interpreted from the HEM data with “hot spots” suggested by thicker – lower resistivity areas and the higher magnetic responses. Based on the geophysical data, lower measured resistivities would suggest a thicker or lower resistivity or both for the exhalative unit. This appears to be the only prioritizing method for selecting the target order.

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Introduction

At the request of Richard Kern, of Golden Oasis Exploration, I have designed, supervised, and completed an interpretation of a Helicopter ElectroMagnetic, HEM, survey over the Lone Ranch area in extreme northern Ferry County, Washington. The objectives of this survey and interpretation were to determine the geophysical signatures of host rocks, locate probable structures, and determine possible alteration and mineralization that may be associated with economic mineralization.

The HEM survey was completed by Fugro Airborne of Toronto, Ontario Canada. The data quality appears to be up to at least industry standards.

The interpretation and all of the data presentations are available as SURFER files and various bit maps. These can be used to produce plots to scale to overlay the existing data bases. The interpretation of the economic targets is included with this report on a standard letter size presentation at an unusual scale for use with this report. These are also available as bit maps to be reproduced at any scale.

Data Base

The HEM data were collected on 90 100m spaced EW lines and four NS tie lines using a six frequency, frequency domain EM system. The details of the equipment and survey procedures are included in the Fugro report and will not be repeated here. In addition, there were several discussions of the area geology and targets with R. Kern and H. Duerr. A brief geologic report with a preliminary geologic map was provided. The geologic map under lays the interpretation plot below. There is an existing USGS aeromagnetic survey of the area, but this survey used wide spaced flight lines and was not of use in the detailed HEM interpretation.

Expected Target Type

The expected target is known alteration and mineralization associated with an exhalative sedimentary unit within a series of phyllites. The exhalite horizon is known to contain significant sulfides from some drilling and surface geology. The geophysical target is expected to be considerably lower resistivities associated with the exhalative and sulfides. It is important to note that ***no other geologic unit*** is expected to have these low resistivities. An increased magnetic susceptibility may be useful as there is known pyrrhotite in the exhalative horizon. There are also some small dikes mapped in the area.

Host Rock Physical Properties

The first part of the interpretation process is the definition of the various host rock responses. In general, mineralization and alteration are areas that are different than the host rocks enclosing them. Consequently, defining the host response is necessary to determine the changes caused by possible alteration and mineralization.

From the description of the known rock types the magnetic expressions were expected to be limited to small dikes and possible erratically distributed pyrrhotite in the host and exhalative horizon. It was a surprise to see many magnetic features with high to moderate amplitudes and normal and reversed magnetic remnance. It is not clear what the sources are for the magnetic expressions, based on the existing geologic mapping and the HEM data. There are several interpreted dike like magnetic sources, with several interpreted to be much larger than mapped geologically, and a series of smaller dike like expressions along interpreted structures, but other than these there must be more pyrrhotite or magnetite in the sedimentary section.

The resistivity of the general host rock is very high, from greater than 1,000 ohm-m to above 5,000 ohm-m. In contrast, the apparent resistivity of the sulfide rich exhalative horizon is very low, generally less than 100 ohm-m and often about 20 ohm-m. The intrinsic resistivity is very difficult to measure as the thickness of the unit appears to be small. EM systems often can only measure the conductivity-thickness product effectively for steeply dipping sources. In the north end of this survey the low resistivity unit appears to be reasonably flat lying with measured resistivities of less than 10 ohm-m.

Structures

Almost all of the main compass directions appear to have some evidence of structural breaks. Perhaps the most important features are interpreted to define a set of wedge shaped blocks defined by north-easterly, north-westerly, northerly, and easterly structures. These wedges can be seen best on the processed magnetic data as in the first vertical derivative and curvature plots in the SURFER files. While the wedges appear to be defined by the NW and NE structures within the wedges, the main direction appears to be northerly.

Perhaps the most recent and one of the best defined structures is the easterly direction which appears to be filled by probable late dikes. One of the best of these is interpreted to be the location of the eastern end of North Fork Creek, in the center of the survey.

The relative age of structures is interpreted to be from oldest to youngest, northerly, north-east and north-west, and finally easterly. The figure below shows the complicated structural interpretation from the magnetic and resistivity data.

Priority Target Selection

The basic assumption of the interpretation of the HEM data and the definition of the geologic targets is that the exhalative horizon is of a considerably lower resistivity than the host rocks. The resistivity contrast may be up to 1000 times, but is at least 100 times between the host resistivities and the exhalative unit. Consequently, mapping the low resistivity zones becomes the basis for target selection.

The mapped exhalative zone is known from limited drilling and difficult geologic surface mapping. The preliminary geologic map showed a thin, discontinuous band of exhalative extending from near the south end of the survey area through to near the northern end. Fortunately, the low resistivity zones defined by the HEM data are nearly coincident with parts of the mapped unit and extend the unit into unknown areas.

The figure below shows the contoured resistivities for the 1500 Hz coplanar coil orientation. This is one of the lower frequencies for this system with the coplanar orientation better suited to define resistivities rather than detect vertical sources. For this system, the lower the frequency the deeper the penetration at a given frequency. The 1,500 Hz frequency is probably penetrating to about 70 to 100m in the high resistivity host, but less in the lower resistivity areas. The less than 100 ohm-m contours shown probably define the exhalative target as well as any other presentation.

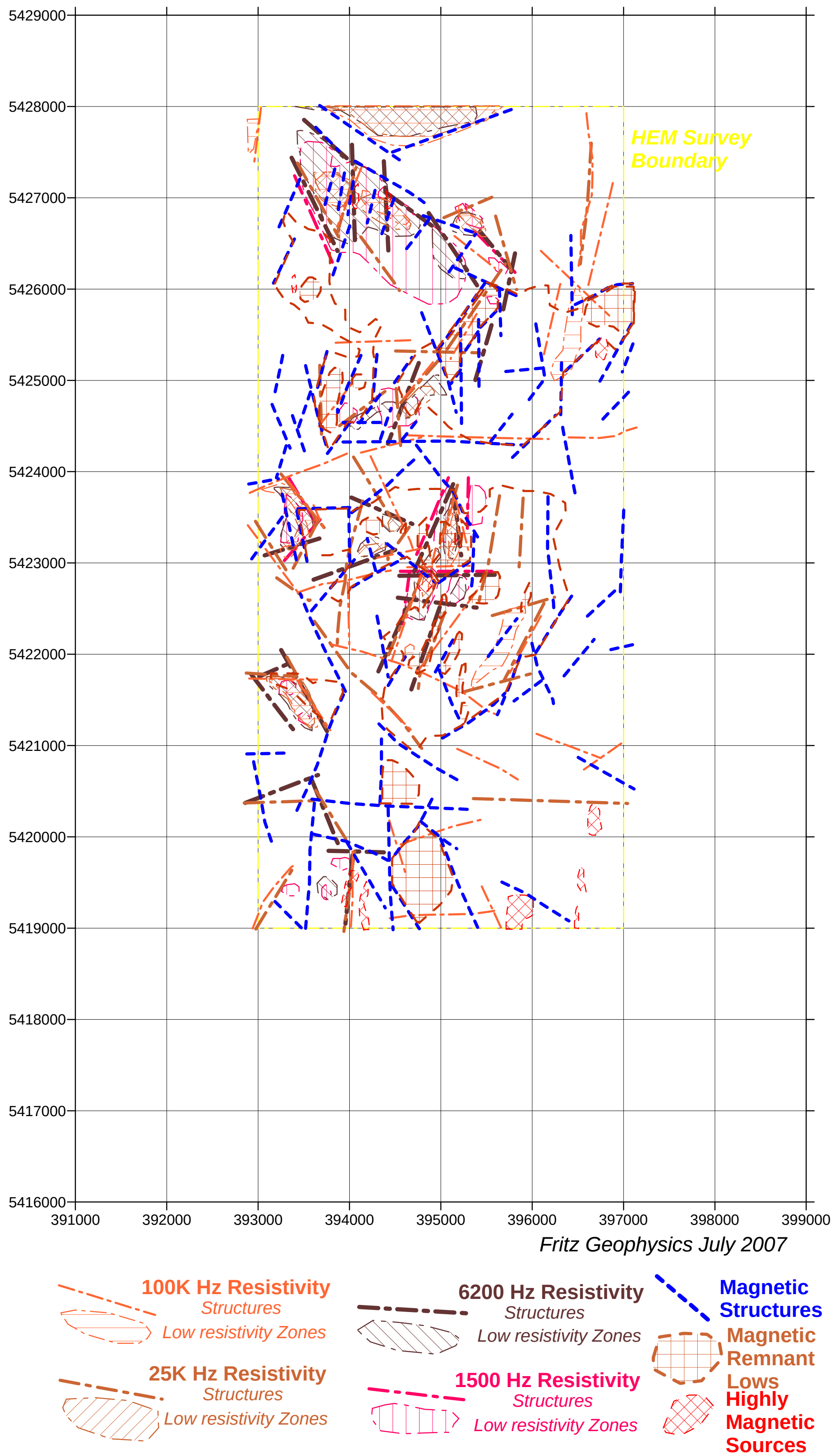
As indicated on the figure, the low resistivity horizon appears to pinch and swell along the strike length and appears to change dip considerably from the center of the area to the north. These changes appear to be related to the wedges, described above, mainly interpreted from the magnetic data, and the later easterly structures. In the south central wedge the low resistivity unit appears to have a steep westerly dip. There may be a second possible exhalative unit to the east of the main zone as indicated by another set of low resistivities. North, across the easterly dike filled structure, into the northern wedge, the low resistivity unit is moved to the west and appears to be thinner and have a somewhat flatter dip. At the northern end of this wedge the low resistivities are interpreted to be reasonable flat lying. In this area the topographic surface is reasonably flat and slopes to the north-west. The interpreted low resistivity unit appears to underlay this surface at a reasonably consistent depth, i.e. this is a dip slope. The depth to the unit is about 25 to 50m in this area. The northern edge of the low resistivities is truncated by the sharp slope change to the north, into Canada. If there were outcrop, there may be exposures of this unit on the northern slope.

The magnetic expressions show a considerable variation along the low resistivity unit. There are extreme magnetic highs and areas of probable remnant lows, also suggesting a magnetic source. This type of expression would be consistent with higher volume percent of pyrrhotite. Pyrrhotite is known to have an extremely erratic magnetic response. However, the more magnetic areas may suggest stronger sulfide mineralization and possible higher economic grades.

Using these data the selection of a drill target should be based on the lowest resistivities. As above, an EM system can usually only define the conductivity-thickness product. Consequently, the lower the mapped resistivity should suggest either a lower resistivity or a thicker section or both. In all cases this could be the best indicator of mineralization. Since all of the geology and geophysical data suggest a westerly dip, fences of angle drill holes to the east are recommended to test the low resistivity targets. For the flat dip, dip slope, part of the target to the north, vertical holes may be satisfactory. The three target areas selected on the figure are only numbered from the best known geologically to the least known. Prioritization of drill targets should be based on the measured resistivity values as described above and any other additional information.

There are other scattered low resistivity zones, apparently restricted to the wedge features up section from the main low resistivity responses in the central area. These responses are smaller than the main unit and may be of interest if the main targets prove economic.

Lone Ranch WA HEM Interpretation



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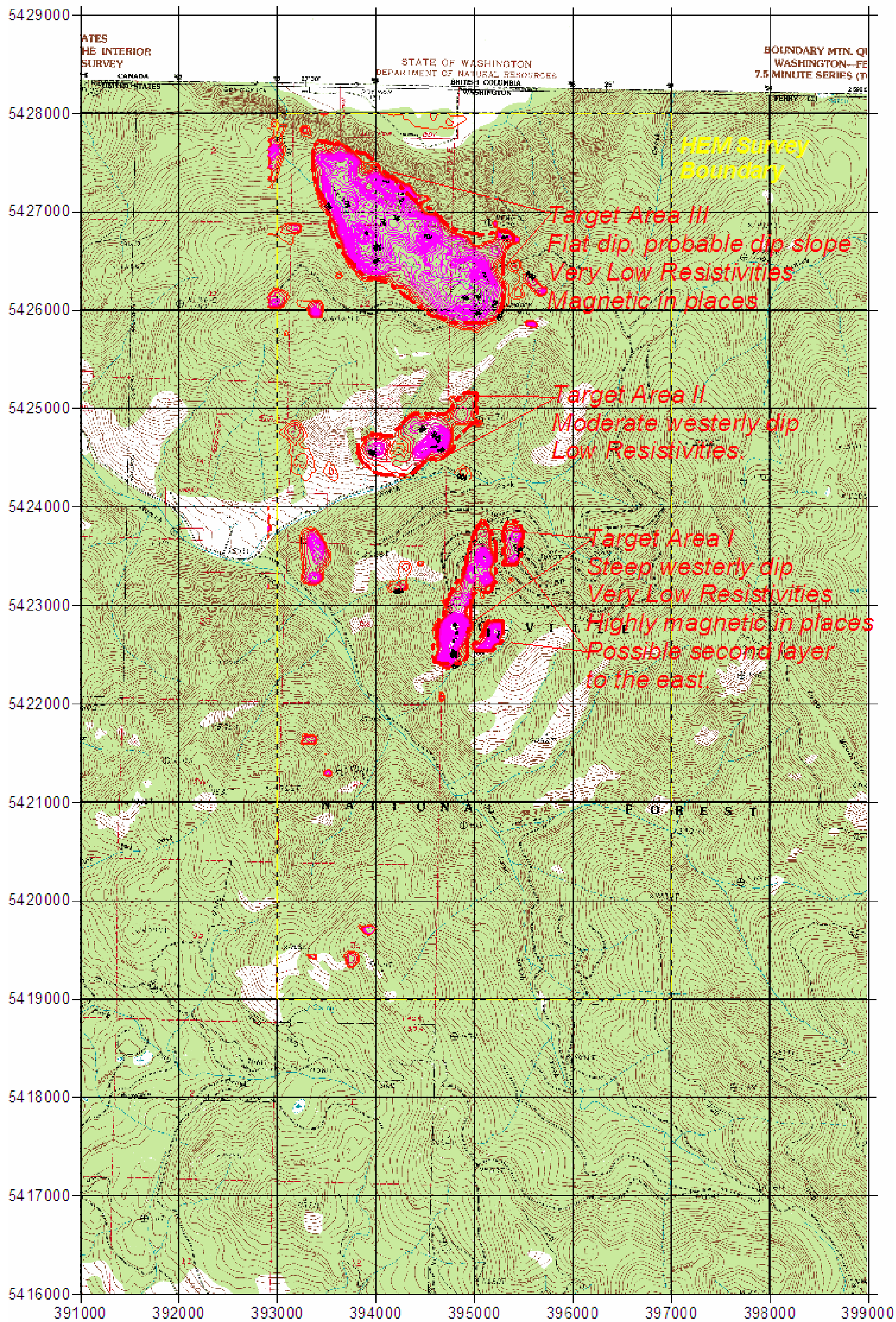

CP 1500Hz Resistivity
< 100 ohm-m log ci

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