COMUNICACIONES N° 50 (1999): 109-115

GOLD EXPLORATION IN THE ANTENA DISTRICT, CENTRAL COASTAL CORDILLERA, CHILE: PARTIAL EXTRACTION TECHNIQUES

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KEY WORDS: *Gold, Exploration, Partial extraction geochemistry, central coastal Chile.*

INTRODUCTION

This paper presents the results of ongoing research and exploration in the Antena gold district, with emphasis on sampling and geochemical techniques used to locate primary sources for placer gold and definition of targets within hard rocks. The study area is located in the V region of Chile, approximately 100 Km NW of Santiago and only 18 Km SE of Valparaiso, at 250 m of mean altitude. This area has long been known for its placer gold deposits, worked ever since the Inca times, over 1 million ounces of extracted gold has historically been reported. The main placer gold deposits, worked periodically at small scale, are located within gravels along the Marga Marga and Las Palmas rivers.

GEOLOGICAL BACKGROUND AND MORPHOLOGY

In the district, Carboniferous - Triassic metapelites intruded by Late Jurassic biotite-amphibole tonalites and granites (162 - 150 Ma) crop out. These rocks are in turn intruded by greissen altered dioritic to felsic stocks and dikes. Faults, observed and inferred form a conjugate-shear set of N40°-60°W and N30°-50°E, and less prominent EW-trending faults.

Morphologically the district is characterized by low gentle hills disected by branch patterned drainage. The weathering profile is thick, with a ~60 m iron-rich deep red saprolite. Rock outcrops are rare and when present, are strongly weathered.

SAMPLING AND TARGET APPROXIMATION

Initial work began with widespread 2-3 Kg stream sediment and soil sampling. These samples were subject to Au analysis by atomic absortion spectrometry (Au-AAS) and 50 g fire assay (Au-FA). In addition, a small number of 1 cubic

meter stream sediment samples were taken for physical gold recovery by hand panning and by use of mechanical concentrators such as a Knelson and Gold Screw.

Gold concentrations in stream sediments and soils, analyzed by AAS and FA showed very low contrast and values that tended to be very close or within detection limits (Hurtado, 1999). Whereas, physical gold recovery gave excellent results, showing good contrast and outlining gold source streams. Follow up stream sediment and erosion channel sampling of anomalous streams, in conjunction with geophysical magnetic surveys lead to the determination of at least 5 target areas (Gato 1, 2 and 3, Zona 5 and Oso Grande), two of which were selected (Zona 5 and Oso Grande) for a grid of soil sampling for partial extraction analysis techniques.

Gold grain physical recovery outlined target areas without any indication as to source size and shape. Mean gold grain size (0.7 mm; Orellana, 1999) and gold grain morphology indicated a coarse and proximal gold source, not discernible at surface due to the occurrence of a deep saprolitic weathering profile. As the mean gold grain size imply large bulk sampling in order to minimize gold nugget effect in any follow up campaign, both, BLEG and MMI partial extraction techniques were tested for the fine definition of exploration targets.

In the Oso Grande zone a sample grid of 8 parallel lines with 50 m separation and 19 samples per line with 10 m sample intervals was taken. All 8 lines were sampled for MMI analysis, and 4 lines were sampled for BLEG analysis. In the Blanco 5 zone a sample grid of 9 parallel lines, at 3 to 5 samples each, with 50 m sample intervals, and 50 m line spacing was collected. Only BLEG analysis was used for these samples and results are reported in Jorquera (1999).

For the BLEG technique a 3 to 3.5 Kg sample was taken at an average depth of 30 to 50 cm, within the C-horizon. For the MMI technique, a 100 g subsample was separated from a 3 Kg sample, in many cases, from the original BLEG sample, and if not, from the same depth. BLEG samples were treated in GEOLAB/ALS, Santiago, whereas MMI samples were shipped to Australia for analysis.

BLEG AND MMI TECHNIQUES

Partial extraction techniques such as BLEG and MMI were applied strictly for the purpose of target definition. Road trenching and geophysical interpretations evidenced structurally controlled mineralization related to dike swarms, but these are imposible to define at surface due to the deep saprolitic weathering profile. BLEG and MMI were tested for their capability of fine target definition, with very encouraging results. Figure 1 and 2 show MMI and BLEG response ratio profiles for the Oso Grande area, and figure 3 shows a plan view of BLEG data interpretation and possible sources at depth in the Blanco 5 area. In both cases,

data interpretation indicates the possible existence of subvertical elongated precious metals mineralized ore bodies, within geophysically interpreted structures and surface observed greissenized dike swarms. In the case of the Oso Grande target, a well defined 200 m long, 30 m wide anomaly is inferred, and in the case of Blanco 5, four main anomalies of 50 to 250 m long and 30 to 50 m wide are inferred.

The anomalous targets in the Oso Grande zone are characterized by base metal-rich haloes and central peak precious metals response ratio anomalies. BLEG results in both Oso Grande and Blanco 5 are somewhat more diffuse than MMI, but contrast is still distinguisheable. MMI data show similar results and haloes, but contrast tends to be tightly constrained indicating a better target definition. Preliminary estimates indicate a geological potential of 700,000 oz. Au (Hurtado, 1999) for five targets.

CONCLUSIONS

Results of ongoing research and exploration indicate good potential for primary mineralization in the Antena district, well known for its placer gold deposits. Basic geochemical and geophysical exploration leading to the discovery of five targets areas within a thick saprolitic weathering profile showed active stream sediment and gold nugget recovery as the best broad target approximation tool. Geophysics proved very useful in the definition of structures in each selected area, and both BLEG and MMI proved as good target definition tools.

ACKNOWLEDGEMENTS

The research was supported by the Grant FONDEF 1033 from CONICYT, Chile, and was developed by the Department of Geology, University of Chile, in collaboration with IRD (France) and Compañía Minera Vizcachas.

REFERENCES

Hurtado, R., 1999. Estudio geológico-geoquímico en el Distrito Minero Antena, Cordillera de la Costa, V región, Chile: Un caso de exploración geológica-geoquímica en zonas cubiertas. Unp. M.Sc. Thesis, Department of Geology, University of Chile, 89 pp.

Jorquera, R., 1999. Geoquímica tradicional y BLEG aplicadas en la exploración de zonas cubiertas: Zona 5, Distrito Minero Antena, V región. Unpub. Thesis, Department of Geology, University of Chile, 69 pp.

Orellana, R., 1999. Morfología y geoquímica de partículas de oro en ambiente supérgeno (Región de Valparaiso, costa) y geoquímica de partículas de oro en depositos epitermales y pórfidos de oro. Unpub. M.Sc. Thesis, Department of Geology, University of Chile, 126 pp.

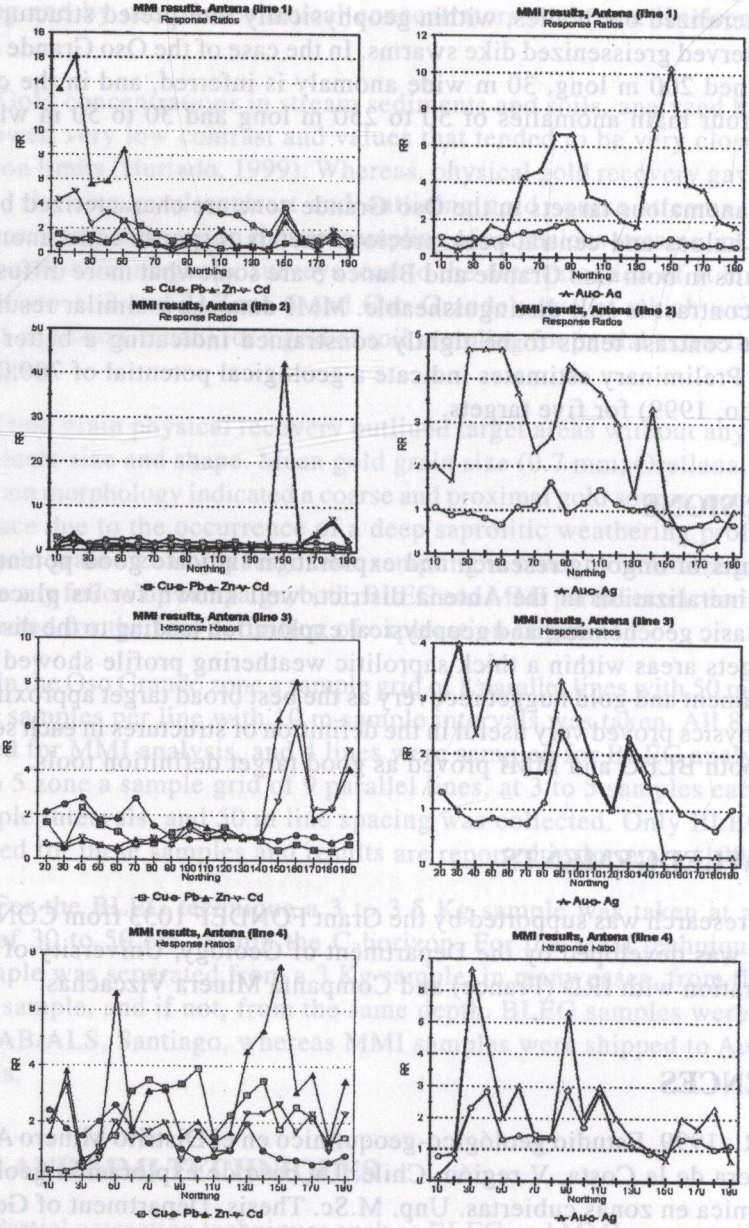

Figure 1a.- MMi Response Ratio profiles for the Oso Grande Target.

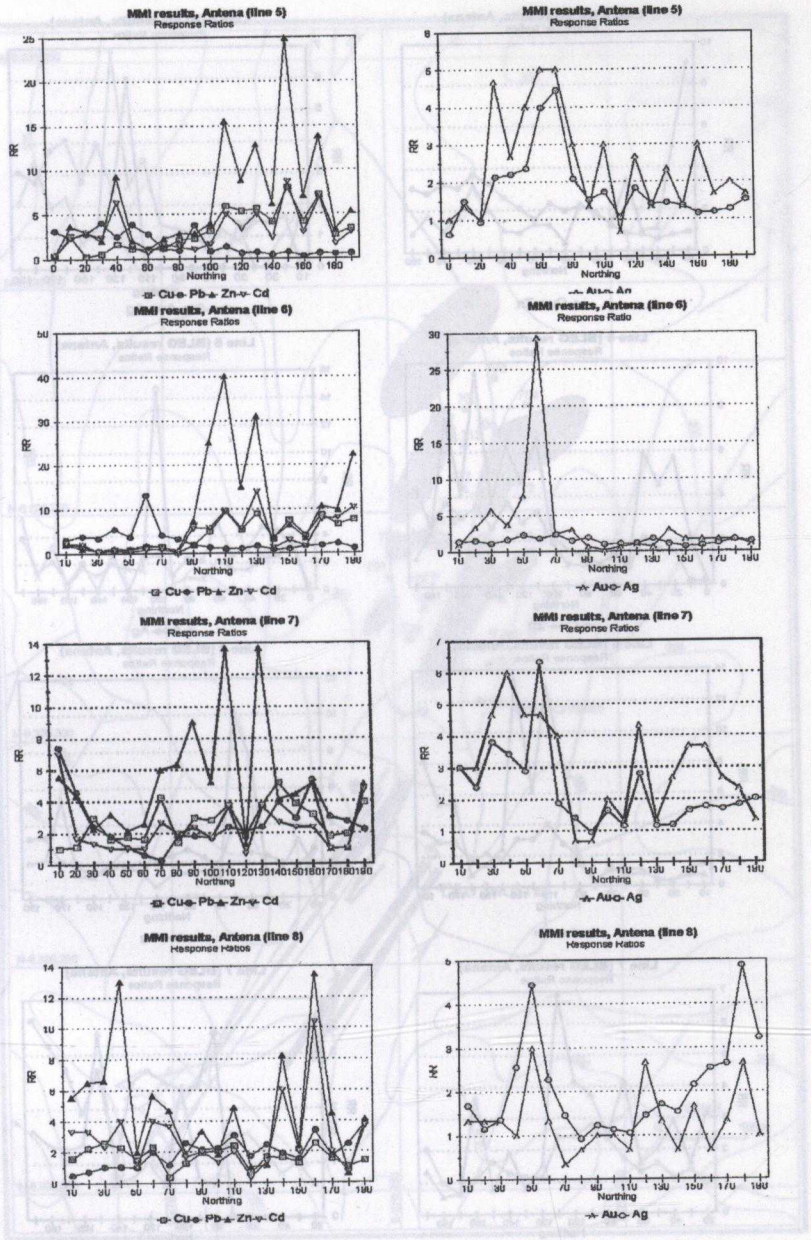

Figure 1b.- MMi Response Ratio profiles for the Oso Grande Target.

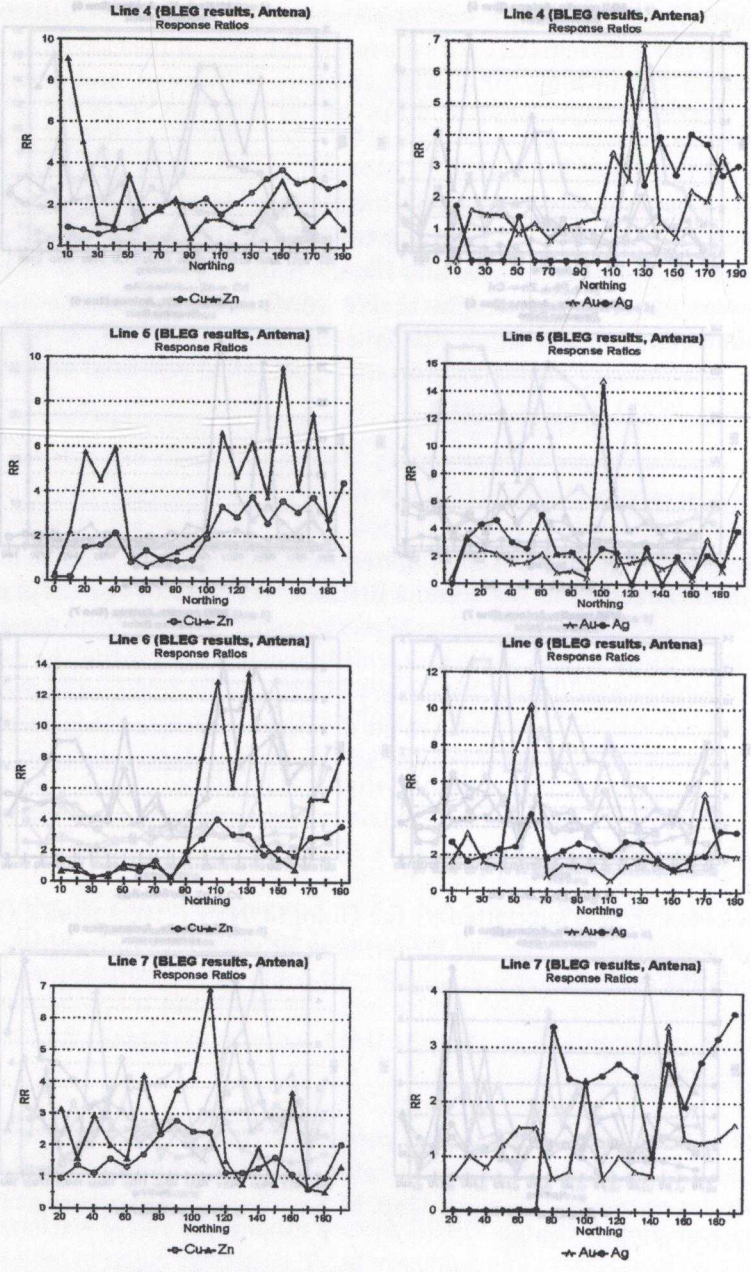

Figure 2.- BLEG Response Ratio Profiles for the Oso Grande Target.

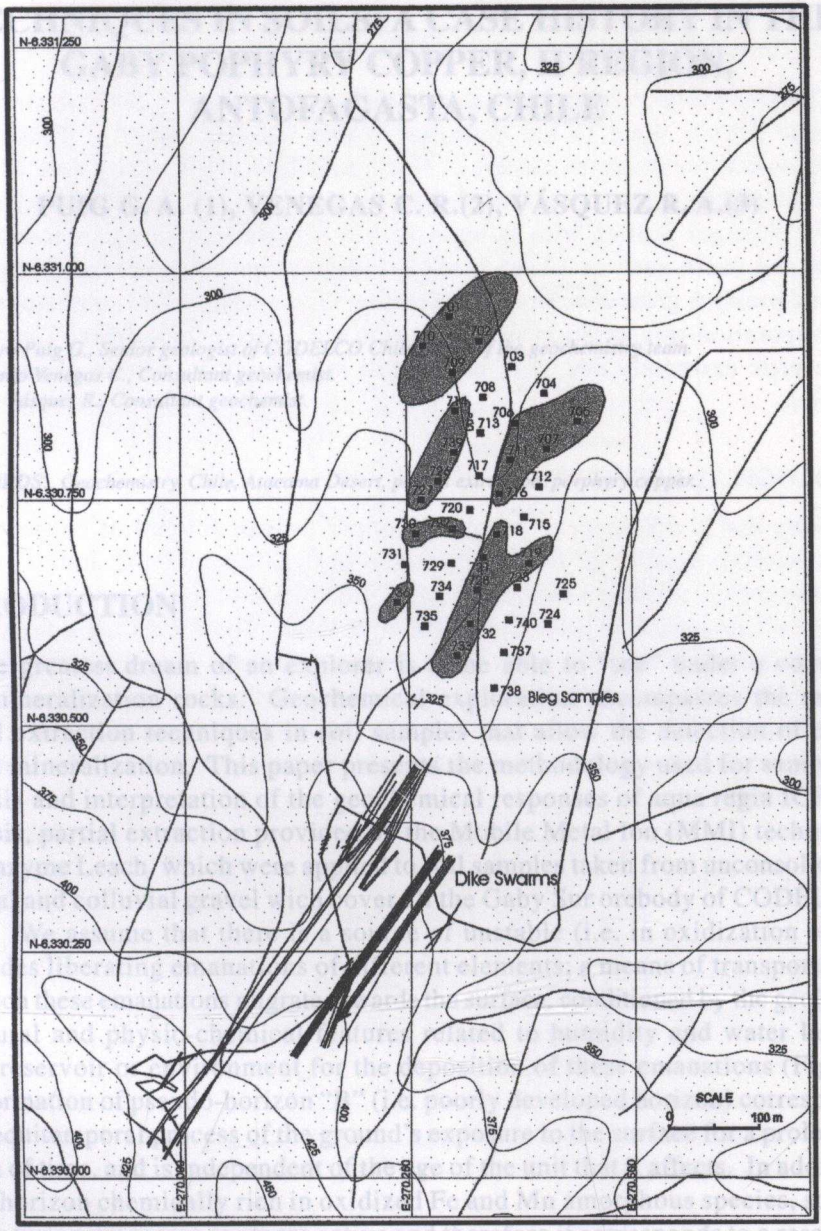

Figure 3.- BLEG data interpretation plan view showing possible ore bodies at depth in the Blanco 5 Target.