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Volcanic Domes Associated with Au-Ag (Pb-Zn) Mineralization in the Shila-Paula Mining District: Arequipa - Peru

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Abstract

The objective of the present study is to promote the exploration of volcanic domes of rhyolitic to dacitic composition associated with Au-Ag (Pb-Zn) mineralization, mainly where there is little evidence of structures and especially where they do not report significant grades in gold, silver, lead or zinc; except in volatile elements, trace elements and rare earths, where it is often not given due importance.

The main lineaments of the Shila-Paula mining district are of an Andean NW-SE strike that generate E-W orientation tensions, with this system being the main one because it hosts known economic mineralization in the mining district. In addition, the important mineralized domes in the Shila-Paula mining district are related to hydrothermal alteration of the High Sulphidation (HS) type, with sub-outcropping structures of quartz-alunite composition, grading to argillic and finally distal to propylitic.

Keywords: *Domes, geochemistry, mineralization and hydrothermal alteration.*

I. INTRODUCTION

The study area is located within the Puquio-Caylloma silver-bearing belt, in the extreme southwest; it is also influenced by the Huayta and Chinchón calderas of 13 and 20 Ma respectively. Structurally, the area is influenced by large regional NW-SE Andean trend guidelines, with generally conjugate systems and where the movements appear to be essentially dextral, which have generated tensional fracturing with an E-W tendency. The latter system is the most important because it has known mineralization.

Likewise, in the area 3 main deformation zones can be distinguished, being the Coastal Batholith Emplacement Zone, Compressed Zone and Block Faulting Zone. (Caldas, J, 1993).

The mineralization of the district is probably related to domes of rhyolitic composition, located within the Huayta and Chinchón Calderas. In addition, the study area is characterized by 3 types of volcanic domes: first, domes without visible presence of structures on the surface, such as the so-called Kenko volcanic domes; second, domes with the presence of relevant mineralized structures in Au-Ag (Pb-Zn) on the surface,

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such as the Anchaca dome; and third, domes with the presence of sub-outcropping structures where there is no evidence of relevant economic mineralization. Example of a Scribe dome. In the present study, the third type will be referred to, due to the difficulties presented during the previous exploratory work carried out.

II. METHOD

The study was conducted in the Shila-Paula mining district that is located at the headwaters of the Colca River basin, in the upper parts of the sub-basin of the Miña and Sillque rivers. Politically, it is located in the communal lands of Chachas and Choco, which belong to the districts of Chachas and Choco, provinces of Castilla and Caylloma respectively, in the Region of Arequipa. It is located approximately 118 km as the crow flies northwest of the city of Arequipa, 41 km as the crow flies southwest of Caylloma.

The study methodology in this research is basic and observational in order to have knowledge about the influence of volcanic domes of rhyolitic to dacitic composition on mineralization.

They will also help us understand the evolution of volcanic domes and their subsequent deposition of mineralization as a result of magmatic activity during the Miocene-Pliocene in southern Peru. It is intended to carry out an experimental research, which will be of the exploratory type because the research problem is little known about the relationship of mineralization with volcanic domes. In addition, cross-sectional investigations of the descriptive type will be carried out, because all the geological, geochemical, structural features and hydrothermal alterations will be described, leading us to the discovery of new mineralized deposits related to domes.

2.1 Cabinet Stage

Collection and processing of all existing information of the mining district; Then, detailed work was scheduled such as: geological and structural mapping and hydrothermal alterations; Based on the interpretation of the results of the previous work, selective sampling was continued in channels of structures and in points on silicified bodies.

2.2 Quantification Stage

All the information obtained from the exploratory work carried out was processed, as a result graphs, diagrams and statistical tables were obtained from all the geological data; as well as, geochemical, structural and hydrothermal alteration plans, using geological software such as: Arcgist, Envi, SAS planet, IoGas, dip, etc., to perform the interpretations of the respective results.

III. RESULTS

The Escribano dome is located 5 km SE of the Paula Mine, it is characterized by a strong aura of hydrothermal alteration, with the presence of sub-outcropping structures with quartz-alunite assembly; characterizing this leaflet of the high sulphurization type.

(See Plate 1).

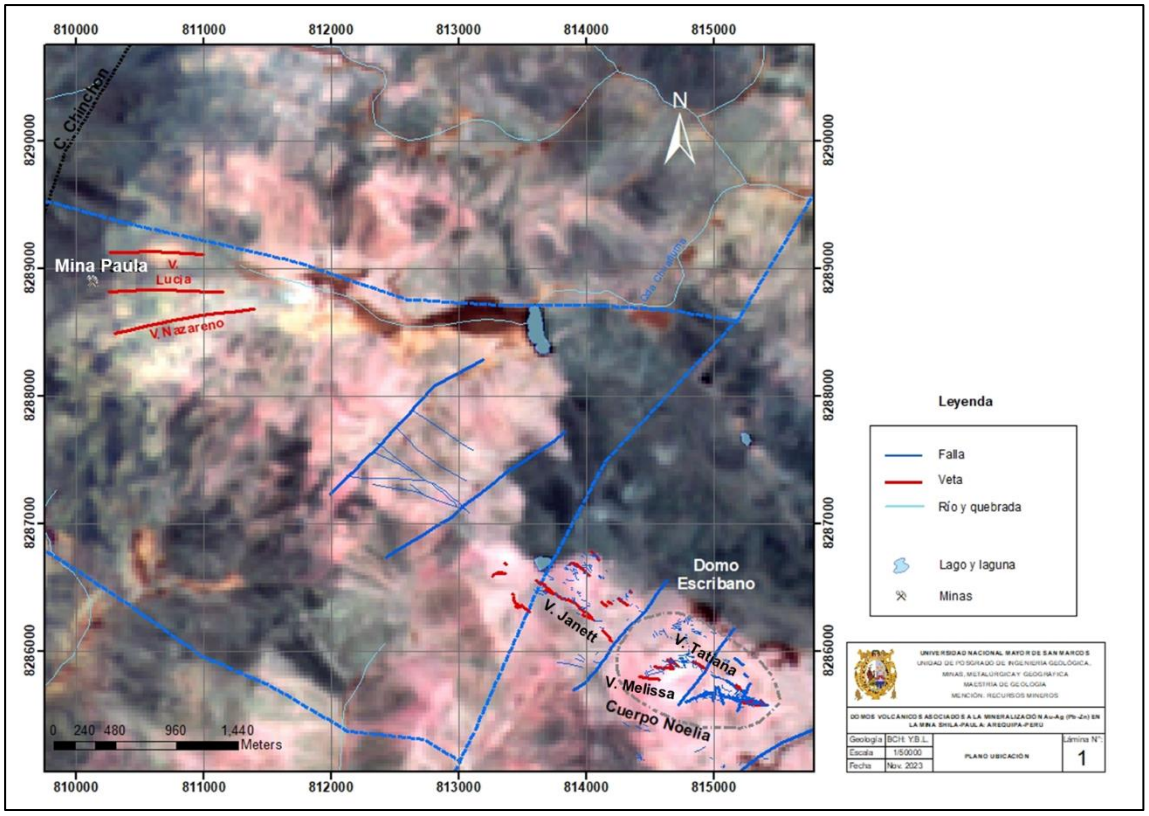
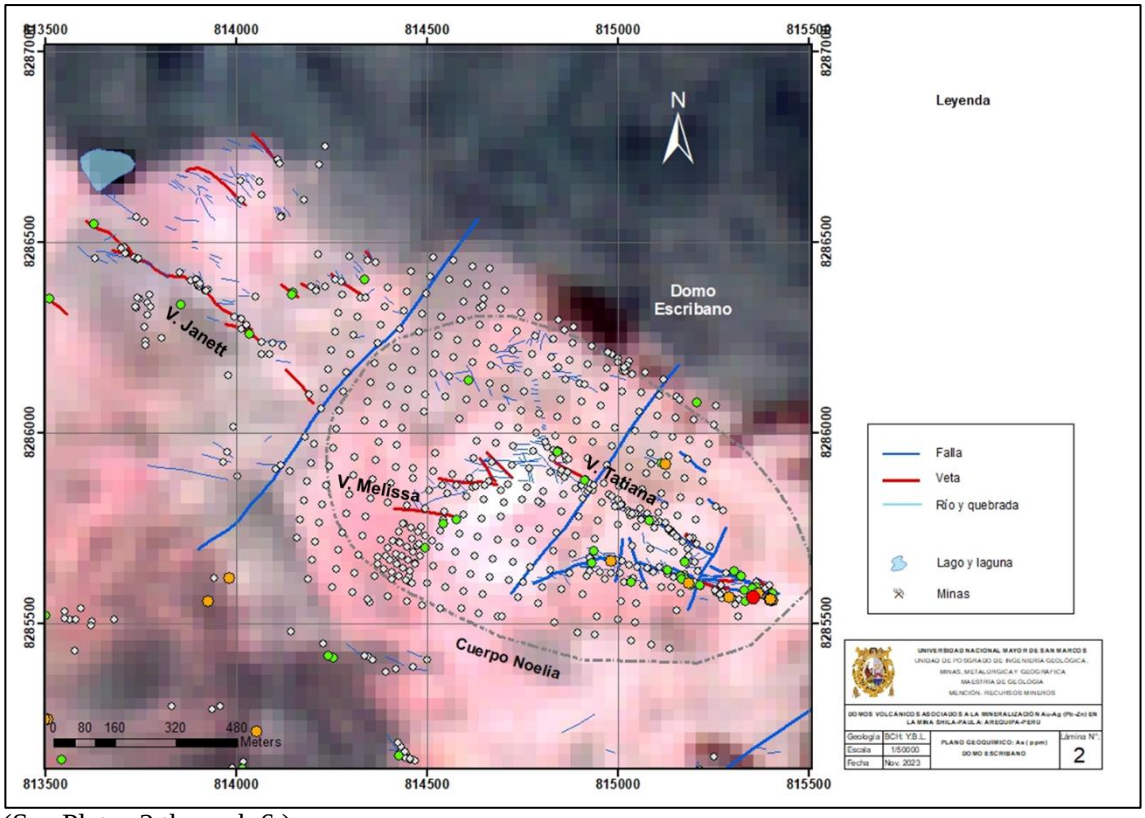


Figure 1: Location plan of the Escribano dome.

Within the hydrothermal alteration zone, a series of siliceous alteration bodies have been recognized, highlighting the Noelia Bodies. Likewise, several structures have been mapped inside and outside this aforementioned body; the predominant orientation of these structures is NW-SE. The sampling reports low grades in gold and silver, while in some volatiles it reports interesting anomalies in tellurium, arsenic and mercury, which makes us suppose that this hydrothermal system is almost entirely preserved for gold mineralization at depth. Next, we will make a summary geological description of the main structures.

Noelia Body.- This siliceous body found inside the Escribano dome has dimensions of 800 x 250 m, with slight leaching and manifestations of silico-argillic microveins, with patinas of limonite and hematin. It has late quartz structures with a bearing coinciding with the major axis of the body (N 70° W), the main veins being Melissa and Tatiana. In this body, sporadic veins of white quartz to hyaline with a predominant N-S direction are also observed, with dissemination of fine pyrite. Sampling of the siliceous body with these veins did not report anomalies in gold, silver, copper, lead or zinc; except for anomalies up to 1528 ppb Te, 63 ppm Hg and anomalies in elements up to: 822 ppm V, 605 ppm Cr, 70 ppm Zr, 349 ppm Ni, 118 ppm Y, 5000 ppm Sr , 383 ppm La and others. Despite not being tested for Li and other important elements, the geochemical results report interesting anomalies in rare earths, which merit further research in the Miocene-Pliocene volcanic domes of southern Peru, to define whether volcanic domes of rhyolite, dacite are carriers of Li and other rare earth elements.



(See Plates 2 through 6.)

Figure 2: Structural and geochemical plan of As.

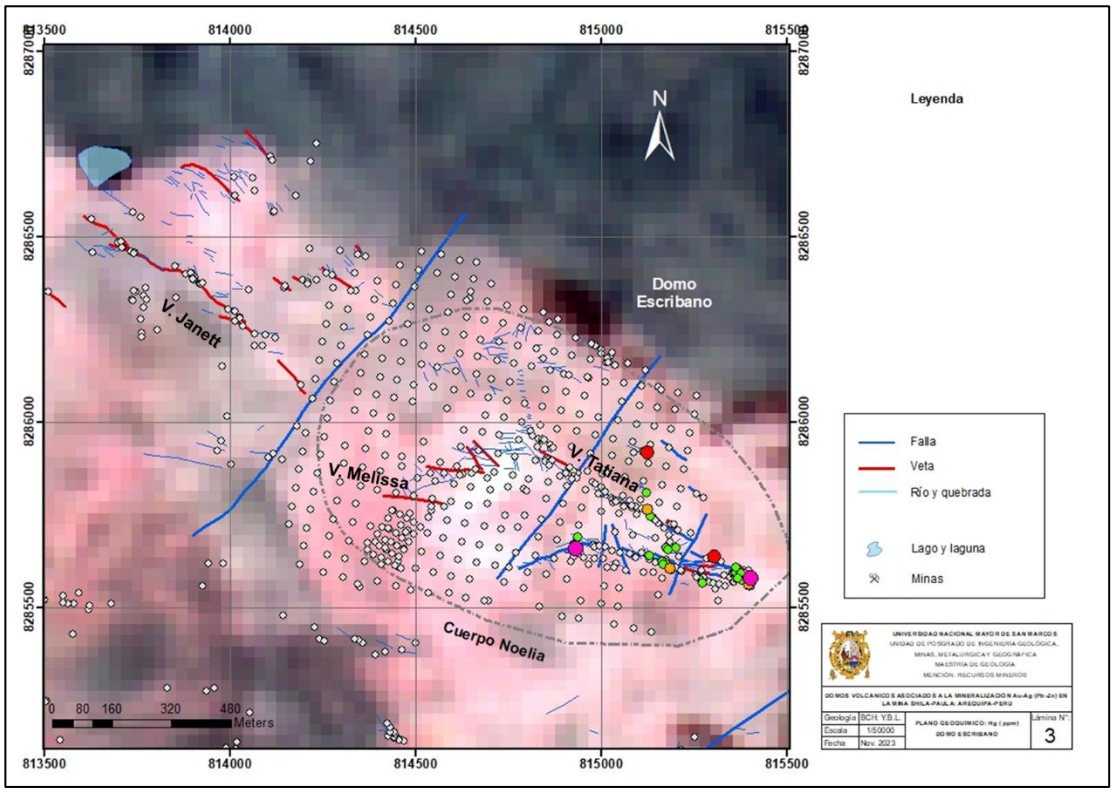


Figure 3: Structural and geochemical plan of Hg.

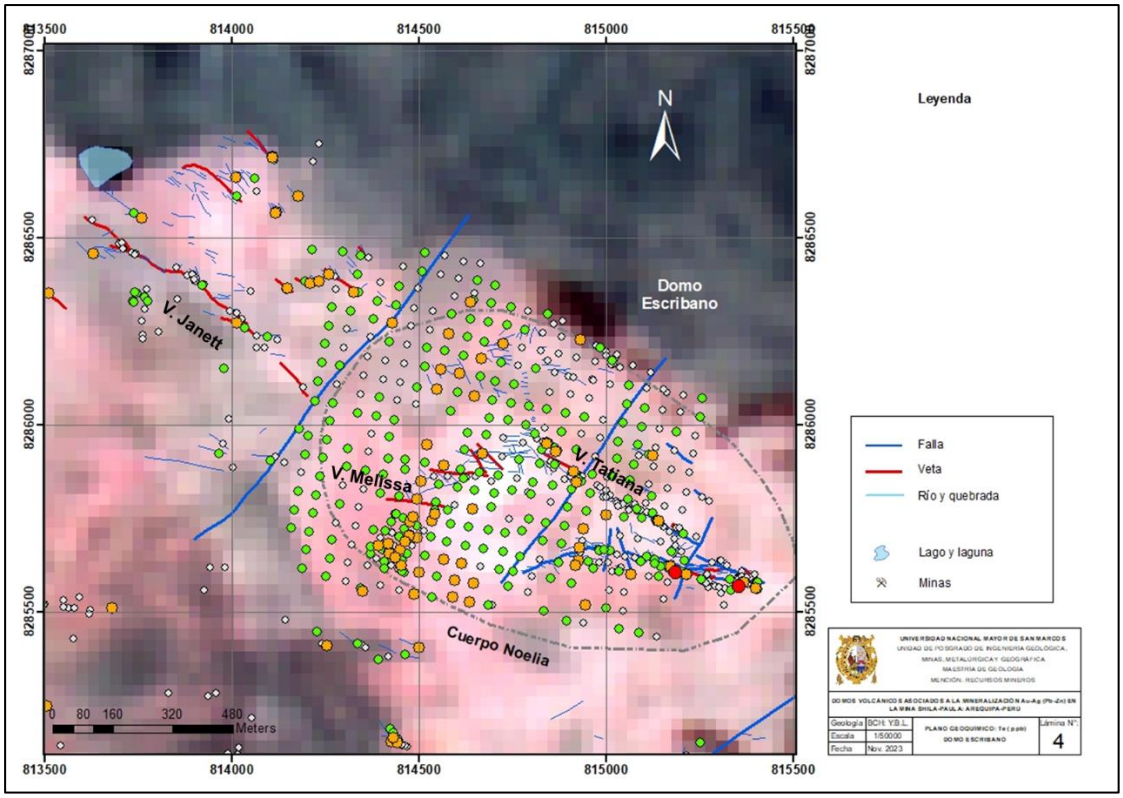


Figure 4: Structural and geochemical plan of Te.

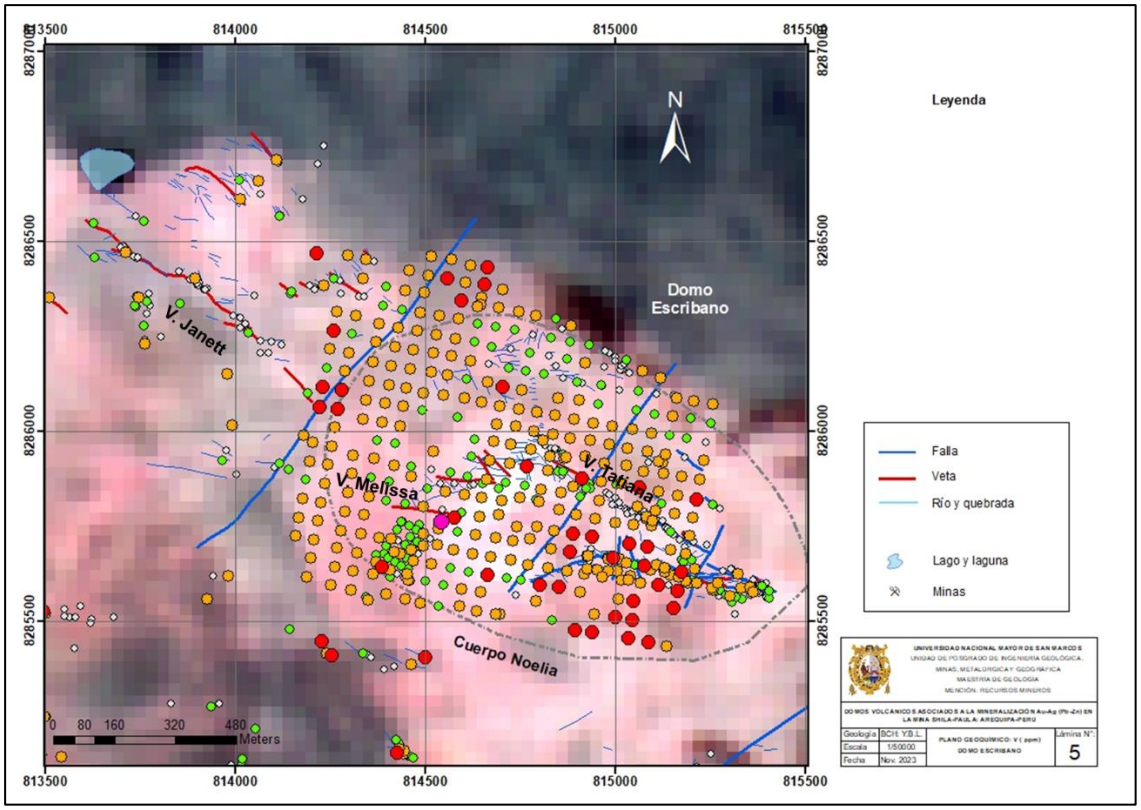


Figure 5: Structural and geochemical plan of V.

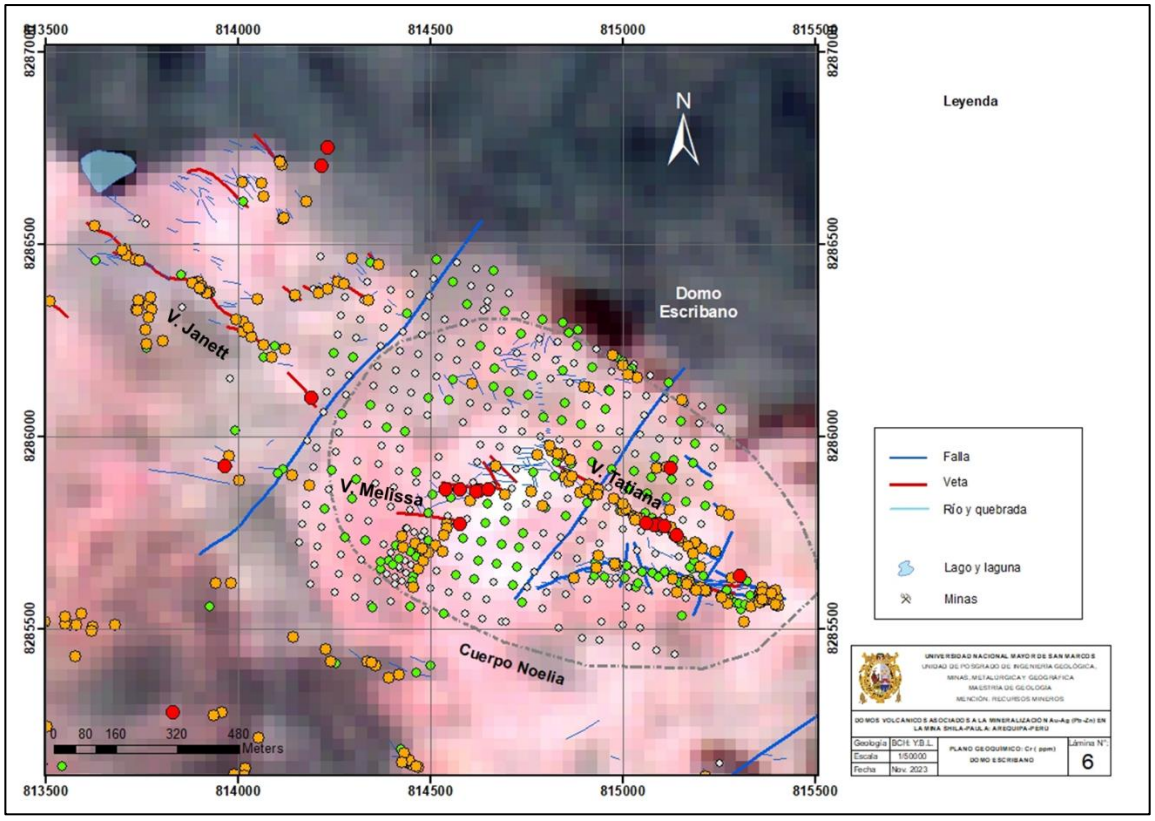


Figure 6: Structural and geochemical plan of Cr.

Melissa Vein.- Outcrops approximately 200 m, is lost at both ends due to coverage, bearing N 64º W, dipping between 77º and 81º S, of variable width between 0.20 and 0.80 m. The filling is white to hyaline quartz, with dissemination of fine pyrite, sericite, jarosite, hematite and kaolin. The sampling carried out did not report anomalies in gold or silver, except for 5,175 ppb Te, 267 ppm As and 867 ppm Ba. (See Plates 2 through 6.)

Veta Tatiana.- Outcrops approximately 140 m, is lost at both ends due to coverage, bearing N 62º W, dipping between 85º and 88º S, with variable width between 0.50 and 1.20 m. The filling is white to hyaline quartz, with crystallized quartz drusen, bands of gray silica, with dissemination of fine pyrite, sericite, jarosite and hematite. The sampling carried out did not report anomalies in gold or silver, except for 1,290 ppb Te and 1,254 ppm Ba. (See Plates 2 through 6.)

Janett Vein: It is located to the northwest of the Noelia Body, outcrops approximately 200 m, is lost by cover, heading N 50º W, dipping 80º to the S, with widths varying between 1.00 and 2.00 m. The fill is 30% white to hyaline quartz, altered rock, banded with the presence of gray silica, dots of alunite, with little diffusion of fine pyrite, dots of sericite and kaolin, patinas of jarosite and hematite. Eighteen samples were taken, and there were no anomalies in gold or silver, except for 1,488 ppb Te and 1,800 ppm Ba. (See Plates 2 through 6.)

IV. DISCUSSION

In previous work carried out by Barrera, Y., (2007) refers to the rhyolitic domes of composition and rhyolitic ignimbritic tufs are part of the Kenko volcanics, which was called at that time as a continuation of previous reports. Now, in my opinion, volcanic domes should not be considered within the Kenko volcanoes, in any case they should have another name.

It was also mentioned that the favorable mineralization in the mining district is the E-W tensional mineralization; however, the main structures present within the Escribano dome are on average N70°W, where these structures present a favorable geochemistry in volatile elements with great possibilities of hosting economic mineralization at depth.

V. CONCLUSIONS

Mineralization in the Shila-Paula mining district is related to domes of rhyolitic composition and intrusive bodies of dioritic to andesitic composition, located inside and outside the Huayta and Chinchón calderas.

The Escribano dome configures a high sulphidation system, with structures and bodies with mineralogical assembly of quartz-alunite, anomalous in Te, As and Hg, which need to be explored in detail.

The distribution of Te associated with As at the district level is very marked in most mineralized areas; whose anomalies range from 500 to 5,000 ppm; likewise, Te is associated with the presence of Au, so it should be considered as a guide in the search for Au.

Volcanic domes associated with Au-Ag (Pb-Zn) mineralization are related to hydrothermal alteration mainly of the high sulphidation (HS) type.

Domes of rhyolitic composition, even dacitic in the Shila-Paula mining district, can not only be explored by Au, Ag, Pb, Zn and Cu; but also by rare earths and others, which is evidenced in the geochemical sampling mentioned above.

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