ANGOSTURA PROJECT, A High Sulfidation Gold-Silver Deposit located in the Santander Complex of North Eastern Colombia

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ABSTRACT

Precambrian gneisses of the Bucaramanga Group and Triassic-Jurassic porphyritic quartz monzonite and quartz diorite host the Angostura Deposit, located within the Eastern Cordillera of Colombia. Silicification, pyritization, sericitization, alunite and pyrophyllite and other alteration and indicator minerals suggest a high sulfidation origin for the structurally controlled hydrothermal mineralization. Gold – silver mineralization is mainly associated with tabular structures comprising silicification and pyrite in stockworks, stringers, breccias, and fault contact zones. Structure also plays an important role in concentration of gold and silver in high-grade shoots, which occur at intersections of veins and faults. The high-grade ore shoots host a large proportion of the economic mineralization.

Over 105,000 meters of diamond drilling in 340 holes has outlined a resource containing 3.5 million ounces of indicated and 4.5 million ounces of inferred ounces of gold.

Greystar is continuing with an extensive program of definition and delineation drilling, underground development and metallurgical work on the property.

Introduction

The Angostura project is located 370 km NE of Bogota in the municipality of California (northern area of the Santander Department). Access is provided by road from the city of Bucaramanga, the capital of Santander, 56 km to the SW of Angostura (Figure 1).

Gold mining in the district started in the pre-colonial times with the Chitareros Indians and continued during Spanish rule with mining high-grade veins and placers in the area. After independence and throughout the last century, precious metals were mined only at the small scale in the districts of Vetas and California.

Greystar started work on the property in 1995, and carried out exploration programs continuously until 2000. In June of 2003 Greystar reinitiated a major exploration program. Greystar has succeeded in expanding its property position and in making progress towards outlining a major gold deposit.

The property located between 2700 and 3400 m.a.s.l, has moderate temperatures, and precipitation averages between 600 and 700 mm. p.a. The average temperatures are about 13°C. The terrain is relatively rugged with light vegetation consisting of grasses and shrubs. There is significant growth of oak and eucalyptus trees in the lower elevations on the property.

Fig.1. Location

REGIONAL GEOLOGY

The tectonic and deformational history of the Eastern Cordillera is very complex and various plates are in complex interaction and magmatism associated, principally Caribean, Cocos, Nazca and South American plates from the Mesozoic throughout the Cenozoic.

At about the latitude of Bucaramanga the northernmost Andes bifurcate in two separate mountain ranges. The western branch of the Eastern Cordillera trends to the northwest towards Santa Marta and contains the Santander Massif in its southern part. The eastern branch maintains the NE trend forming the Sierra de Merida in Venezuela. Both mountain ranges mark the boundary of the triangle-shaped Maracaibo Block, which is characterized by tectonic escape towards the N (Taboada et al., 2000).

Regional faulting parallels the topographic fabric of the mountain ranges. The NNW trending crustal-scale Bucaramanga Fault, continuing from the city of Bucaramanga northwards to the Caribbean, defines a major break. Activity along the Bucaramanga Fault is considered to be complex with reverse movement as well as left-lateral shearing. More than 100 km of lateral displacement has been postulated for the Bucaramanga Fault (Taboada et al., 2000; Montes et al., 2004).

NE to NNE trending faults, such as the Rio Cucutilla Fault and Rio Surata Fault (Julvert et al., 1963) northeast of Bucaramanga, also show a combination of normal, reverse and right-lateral faulting. In particular the major Andean deformation phase (Miocene-Pliocene) had a strong influence on the activity along the major faults causing thrusting, increased uplift and strike-slip movement (Cooper et al. 1995).

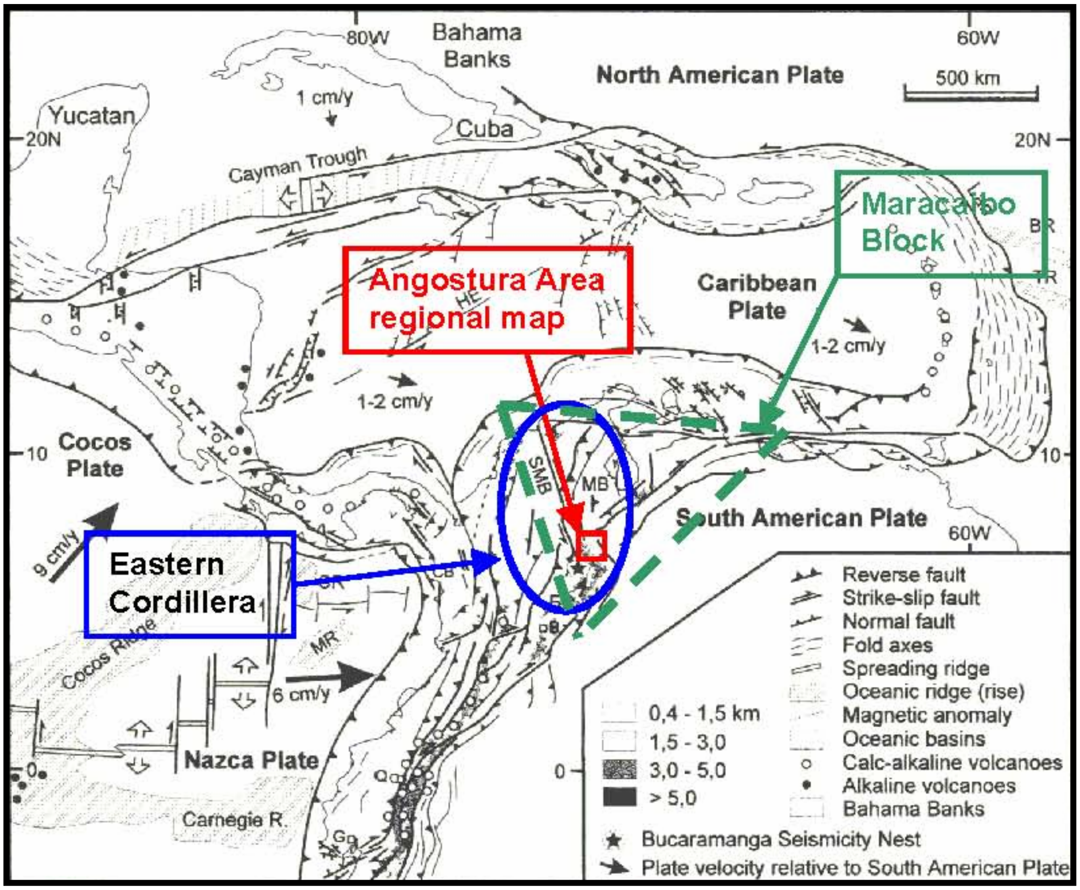

Fig. 2: REGIONAL TECTONIC MAP OF THE NORTHERNMOST ANDES AND THE CARIBBEAN REGION (Taboada et al., 2000)

The oldest rocks within the Santander Massif consist of Precambrian gneisses and schists of the Guyana Shield. These rocks were regionally metamorphosed to upper amphibolite grade during dynamo-thermal metamorphism and show polyphase ductile deformation. Younger rocks of Paleozoic and Mesozoic age occur in the region, but not in the immediate area of the deposit. Dioritic to granitic intrusive rocks (Santander Plutonic group; Ward et al., 1974) were emplaced into the Precambrian basement during Triassic to Jurassic times. Younger porphyritic rocks of probably Tertiary age are common in the immediate area of mineralization.

Property Geology

Porphyritic stocks and dykes of intermediate composition intrude the older basement gneisses and schists. Within the roof areas of larger intrusive bodies there are many xenoliths, inliers and roof pendants of both felsic and mafic gneisses.

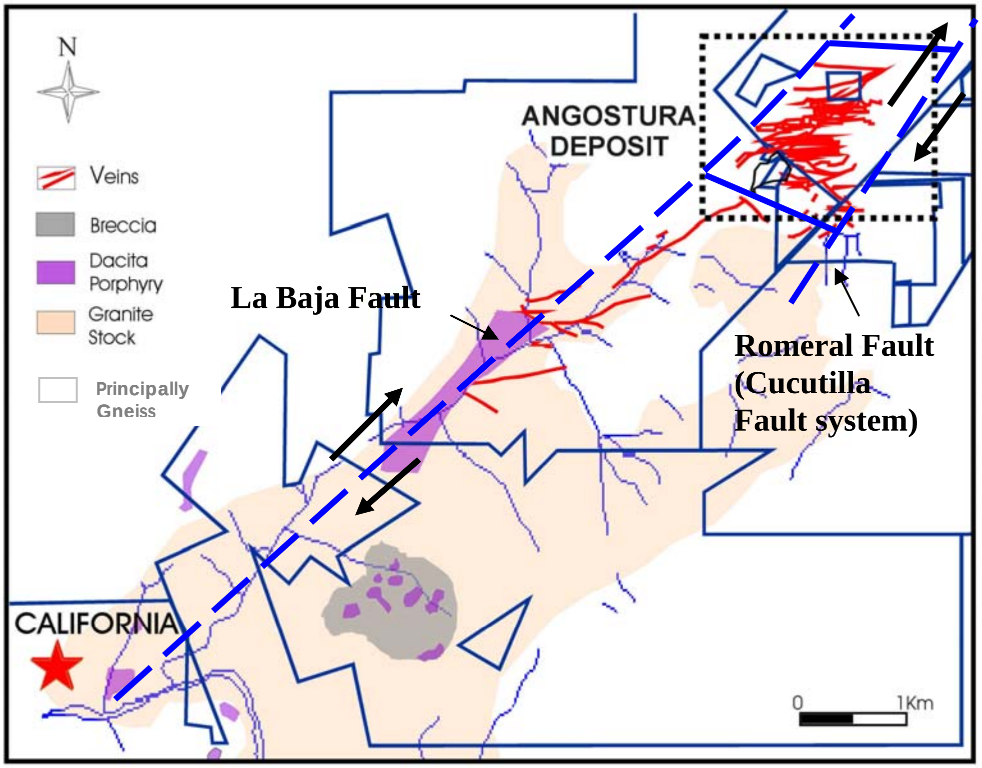

Fig. 3: Geology of the California Area

Ductile deformation with several stages of folding and shearing occurs throughout the entire Precambrian basement rocks. The exact age of ductile deformation (events) is not determined, but certainly is Pre-Cretaceaous. The structural anisotropy of the folded basement gneiss might have also influenced generation of later structures and subsequent ore-forming processes.

Faulting along the major NE trending structures, such as Cucutilla and Surata Faults, is considered to date back to the Mesozoic, as several of these faults also bound extensional basins with a marine transgressive sequence to the west and northwest of the Angostura area. The major deformational phase (Andean phase) caused reactivation of these structures as well as formation of new faults that linked existing fault systems. Compressional forces triggered fault development and enhanced fault activity. Movement along these NE trending faults is right-lateral.

At the Angostura project area two major right-lateral fault systems, the La Baja and the Romeral (Cucutilla) fault systems, form a dilational, right stepping, overlapping fault jog. The WNW trending Paez creek marks the southern limit, the northern limit has not been clearly defined so far, but several E-W trending structures exist that link both major strike-slip faults. Thus the fault jog can be described as a trapezoidal shaped block with a length of about 1,200 m in N-S and a width of 1,000 m in E-W direction.

In between the fault jog extensional structures with minor strike-slip components could develop. These structures predominantly strike E-W to NE-SW and NW-SE and show subvertical to steep dips. Strain analysis for the major faults and the mineralized second-order structures suggest a transition from a transpressional to a transtensional setting.

Throughout the Angostura area distinct structural zones can be delineated, which show predominance of certain structural styles. In the northernmost part (Cristo Rey and Veta de Barro) mineralized structures trend predominantly ESE-WNW. In the area of La Alta continuous ENE-WSW structures with a length of up to 1,000 m occur. The central Diamante zone contains predominantly E-W structures with lengths frequently in the 300 to 500 meter range. And the southern domain, referred to as the Vivito-Silencio area, contains more widely spaced E-W and also NW and WNW structures. N-S structures are locally present throughout all three areas, but the N-S drilling orientation is not appropriate to test these structures. A few of these N-S structures have been examined in underground workings where they have been found to be quite narrow (tens of centimeters), and limited to several tens of meters in length.

The fault-fracture system within the strike-slip fault jog controls hydrothermal alteration and subsequent precious metal mineralization. The relative age relationships between individual structures indicate that the formation of structures with either alteration only or with precious metal mineralization was very close in time. Structural fragmentation and displacement of individual mineralized structures by later faulting is absent. As a result mineralized structures are continuous longitudinally as well as vertically for several hundred up to 1000 meters.

Mineralized structures can be described as tabular structures of strong alteration that are parallel to subparallel to each other. Inside these trends individual smaller structures, such as quartz veins, veinlets and breccias occur with varying orientations. In particular the intersection of mineralized structures and deflections from E-W to NE-SW directions, causing steep rakes of ore bodies, host significant high-grade ore shoots.

There is also a preference of structures for different metal assemblages. Metal ratio plots have shown that the silver is preferentially controlled by NW structures with copper appearing more enriched in NE structures.

Mineralization and Alteration

Gold-silver mineralization is hosted by the basement gneiss, quartzmonzonite and quartzdiorite. A minor amount of the mineralization is hosted in older gneisses. Previous work in the adjacent areas by Nippon Mining suggested that some of the porphyries may be as young as Tertiary.

The tabular mineralized structures frequently are centered on a core of higher-grade brecciated silica structures with thicknesses from several centimeters to several meters. Quartz flooding envelops the breccias forming a silicified core to widespread sericite zone. Progressively weaker silicification and increase in sericite towards the external margins characterize these wide sericite haloes. Unmineralized argillaceous zones enveloping the structures, affect all of the country host rock.

The tabular mineralized structures are from 5 to over 50 meters in width, averaging 9 meters, with strike lengths from less than 100 meters to over 1000 meters (Figure. 4). The structures are developed to depths from less than 100 to over 500 meters (the maximum depth drilled).

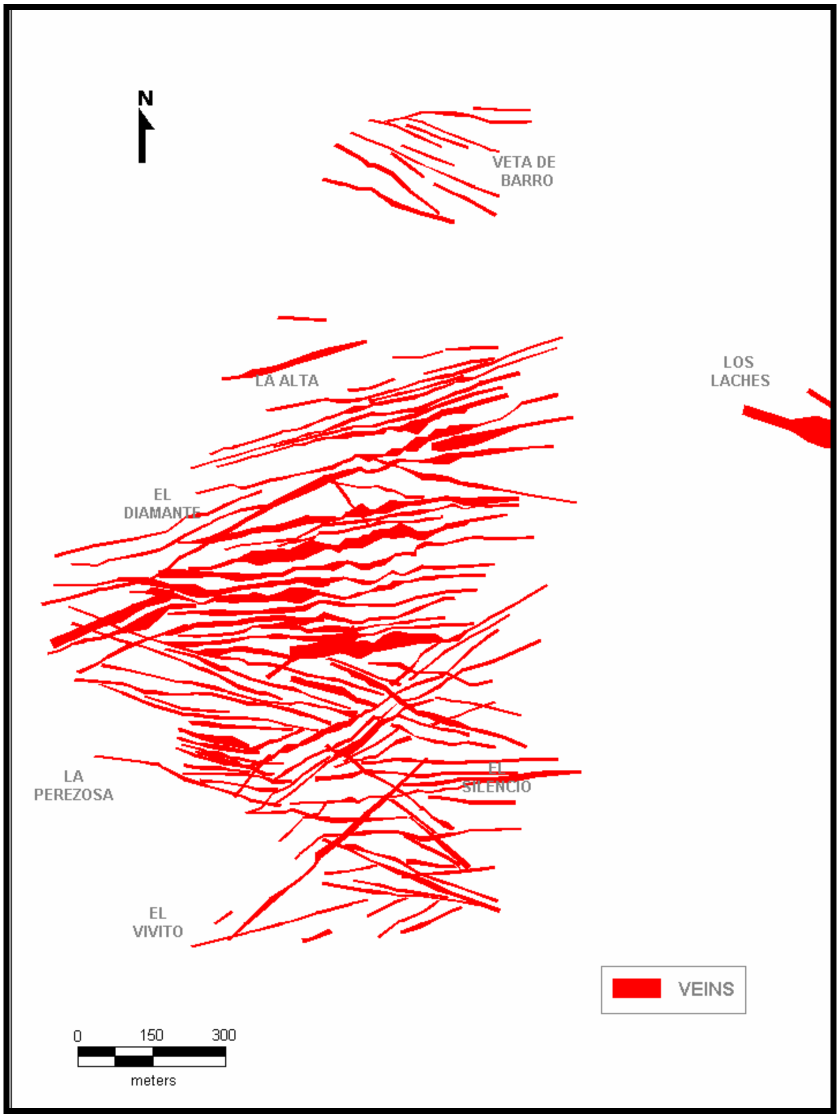

Fig. 4: Distribution of gold bearing structures at Angostura

Within the vein like structures there are strongly isotropic steeply plunging ore shoots. These shoots with vertical dimensions exceeding horizontal strike dimension by up to one order of magnitude, are localized on the loci of intercepts between veins and veins and veins and faults.

The plunge lines of the intercepts are the sites of Au enrichment reflecting increased porosity and permeability. Figures 6 and 7 illustrate the systematic pattern of high-grade ore shoots at vein – vein intercepts.

High-grade structures consist of multiphase hydrothermal and tectonic breccias with varying amounts of sulfides. From < 1% to >2 % coarse pyrite occurs in all structures, increasing sympathetically with grade. The coarse pyrite is paragenetically early. Fine, dark pyrite, and marcasite, is associated with higher gold grades in all alteration assemblages.

High-grade structures can form the cores, or occur on the hanging and/or footwall of the weakly mineralized tabular structures. The high-grade structures, which are less than 10% by volume of the ore, are relatively narrow, but persistent along strike and in the vertical direction.

Oxidation in the structures is highly variable and varies from several meters to several hundred meters, although more commonly it is 70 to 90 meters. Oxidation depth is a function of rock type, topography, alteration and structural preparation.

Large disseminated mineralized bodies occur in areas of intense ground preparation, which seems to occur where intense NW fracturing overlaps the E-W and NE fracture zones.

Mineralization has been tested over a vertical distance exceeding 1000 meters by drilling, and the occurrence of structures in known artesanal workings; however, the bottom of the system has never been determined. Elsewhere in the region, mineralization does occur at much lower elevation than has been tested by Greystar on the Angostura Property, for example important mineralization is outcroping next to the Town of California, located at 2,250 meters over sea level.

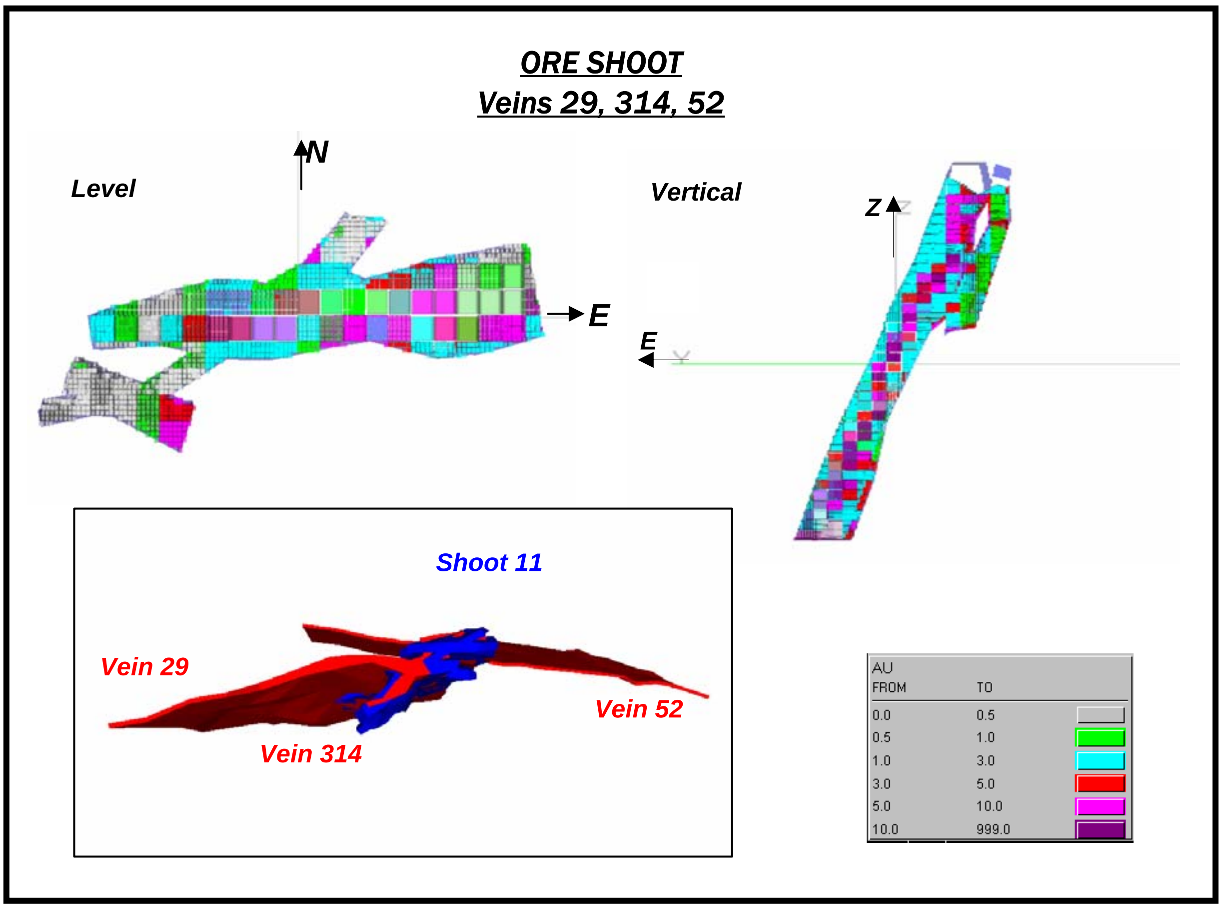

Fig. 6: Formation of ore shoots where intercepted by veins 29, 314 and 52

Within the tabular in places vein like mineralized structures a large proportion of the total resources are contained in higher-grade shoots that form within flexures or at loci of intersection of structures. The large amount of contained ounces in these shoots prompted Greystar to take a much closer look at the geology of the deposit in 1999 and 2000 to verify the model and determine the predictability of the location of shoots. Greystar carried out surface and underground sampling and mapping programs, and additional sampling of surface exposures and shallow workings in areas of targets predicted by the model. Total samples from shallow workings and surface channel and chip samples now number 4,149 and this information was incorporated into the modeling. A review of untested structural "look alike" targets was achieved by examining vein relationships in three dimensions using the resource data vein models in combination with surface geological information. The extensive structural studies and modeling have yielded an understanding of the controls of the high-grade ore shoots. The shoots are localized along the intercept axis occurring at the loci of vein–vein and vein-fault/fracture intercepts (Figures 8, 9). It was determined that to date less than half of potential sites were tested by past drilling. These prime targets are within the existing vein like structures where further exploration and definition drilling is planned. Significant improvement of the project's size, grade, and viability can be expected if these targets show mineralization to the degree of their analogs.

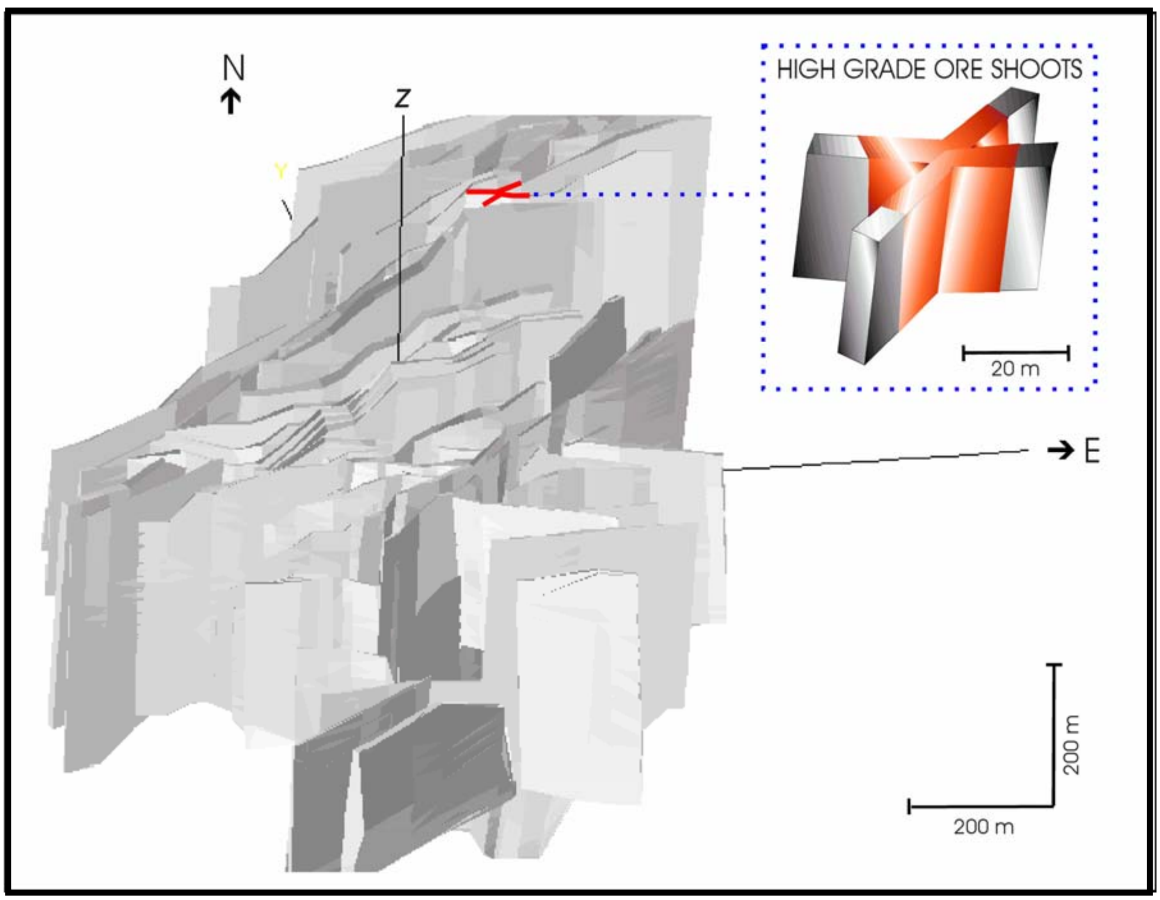

Fig. 7 Isometric projection of structures in the Angostura Deposit

Alteration and Ore Mineralogy

Alteration is centered on zones of faulting, fracturing and within host rock; nearly all the intrusive rocks are completely altered. Alteration assemblages are a result of progressive alteration of intrusive rocks resulting in various combinations of clay, clay - sericite, sericite, sericite-silica and silica with strong silicification is at the core of minerallized structures and subordinate but locally significant amounts of alunite. Pyrophyllite has been observed in the Veta de Barro area, on the westernmost limit of the system. Where affected by hydrothermal alteration, gneisses show various stages of retrograde alteration with saussarization of feldspars and propylitic alteration occurring in the periphery and various degrees of silicification with sericitization and chloritization of felsic and mafic gneisses respectively.

Pyrite is the main visual indicator of gold mineralization. Pyrite occurs as clusters and as fracture 'in-fills' in quartz and ranges in size from 2 microns to over 200 microns in diameter. Marcasite, occurring as fine dark sulfides is common and may be more closely related to the gold event. In thin section marcasite has been observed forming the matrix or cement around pyrite. The marcasite appears paragenetically younger than pyrite. Also a pyrite-pyrrhotite gel (melnikovite pyrite) is found to occur microscopically. Chalcopyrite is the main copper

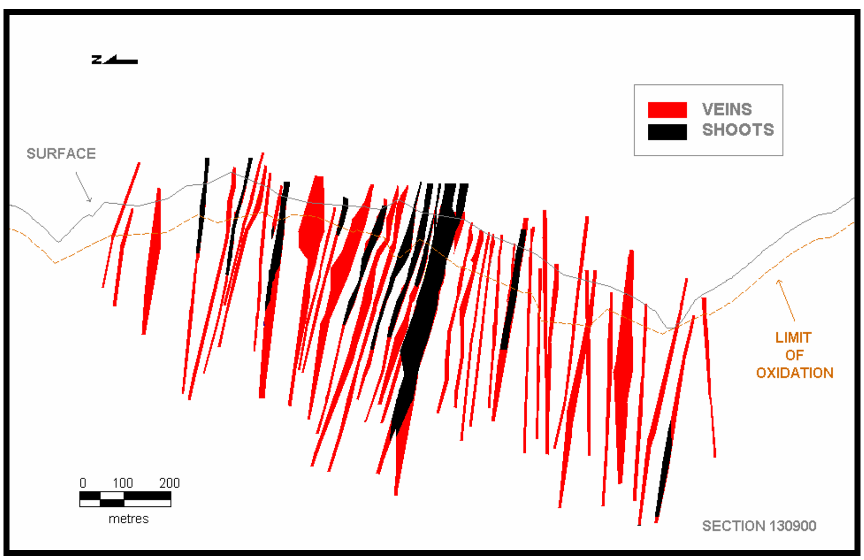

Fig 8. Distribution of tabular structures and location of higher grade shoots . Vertical Section.

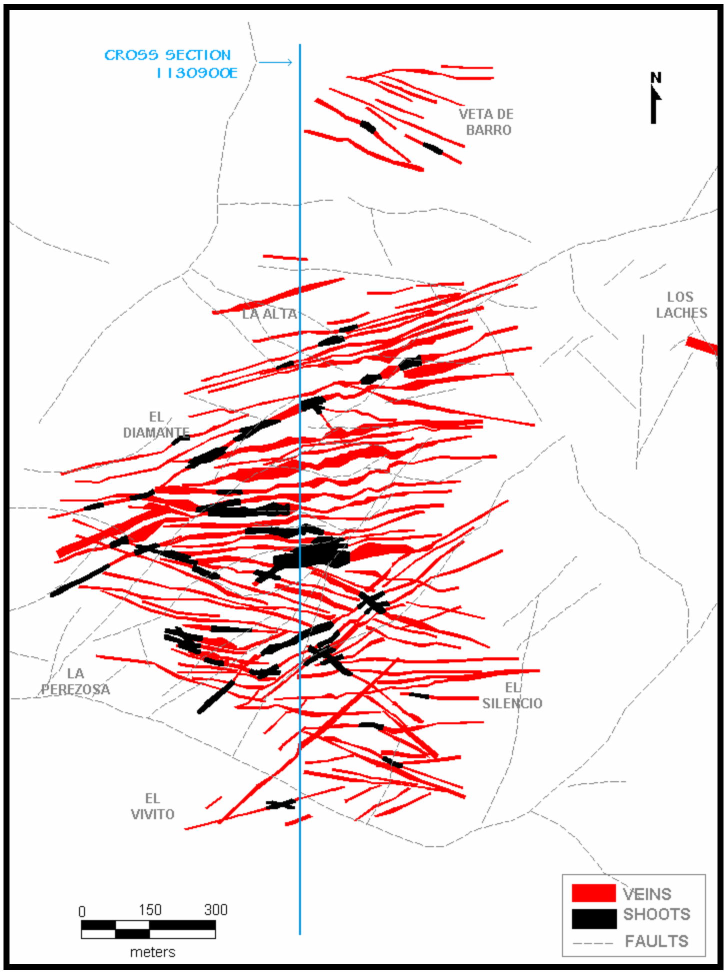

Fig 9. Plan View of distribution of tabular structures and location of higher grade shoots

mineral occurring in trace amounts. Digenite after chalcopyrite and chalcocite also occurs quite frequently, and enargite has also been observed in drill core.

Gold occurs mainly in the native form within pyrite and marcasite. Apart from occasional visible gold, petrographic studies identified gold in the native form, as Au-Ag tellurides (sylvanite and krennerite) and Bi-Tellurides that form as rims on pyrite (Fig. 10) and quartz grains and as inter-granular threads and pockets within such grains and locally in tellurides (Vancouver Petrographics Ltd. 1998). Particle size of the gold grains is from 5-180 microns. Tetrahedrite occurs frequently as minor quantities with chalcopyrite. Native gold is often associated with tetrahedrite. Where found together, the tetrahedrite and gold grains occur as pockets within pyrite aggregates. Native gold occurs with intergrown tetrahedrite molded on pyrite grains, or in silica matrix, as inclusions with native Te and Au tellurides in chalcopyrite and pyrite, or in matrix of tetrahedrite or as native gold in opalized rock matrix independent of pyrite.

Silver occurs as argentite and acanthite as well as tellurides in the primary zone and as soluble minerals such as cerargyrite within the zones of supergene enrichment. Galena and sphalerite grains are observed as isolated grains. Sphalerite occurs sparsely showing a pale color that indicates a light iron variety, which is more characteristic of high sulfidation systems, unlike the dark high iron variety that is characteristic of a low sulfidation environment. Mo is very anomalous throughout the deposit and also has a good correlation with gold mineralization.

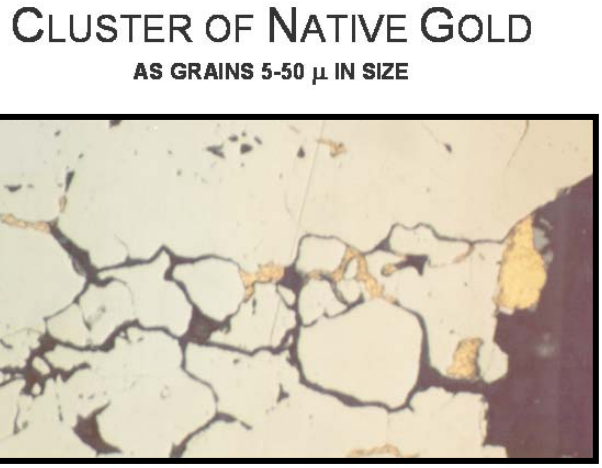

Fig. 9: Native gold grains along pyrite grain boundaries

Alumino-phosphate minerals have also been observed in a number of thin sections. Geochemically Au shows a very strong correlation with Ag and Fe, and a moderately strong correlation with Cu, Bi, As, Te, and moderate correlation with Mo, Pb, and Zn. Au shows a positive correlation with P. There is a strong negative correlation between Au and K, Na, and Ca. Apart from Au, Ag and Fe, all the other trace metals are only of geochemical interest.

A limited amount of fluid inclusion work was done on three specimens from the deposit (Albinson 1999). An early stage of pre-sulfide and pre-gold coarse crystalline quartz exhibits abundant populations of predominantly secondary planes of fluid inclusion assemblages with coexisting two-phase liquid/vapor, and vapor rich inclusions. The coexistence of both types of inclusions is considered evidence that boiling occurred in the fluids (Bodnar, et al., 1985). Growth zones with primary fluid inclusions, which are typical of low sulfidation-environment, are conspicuously absent in this stage. Fluid inclusion assemblages with consistent temperatures of homogenization were measured in the two-phase inclusions, and exhibit a 300°C to 370 °C range with salinities between 5.8 to 13 weight percent NaCl equivalent. Under hydrostatic pressure conditions this data suggests that the deposit may have formed at a depth range between 1000 and 2000 meter below the paleo-water table (Albinson 1999), suggesting that the Angostura deposit is an example of a high-sulfidation system formed at somewhat greater depths than the typical high-sulfidation deposits. This may also explain the greater influence of structure on the distribution and the great vertical development of mineralization. Later ore-stage quartz is either fine grained crystalline and contains no measurable fluid inclusion populations, or is coarsely crystalline and exhibits scarce growth zones with primary fluid inclusions, which exhibit lower temperatures of homogenization (237° C to 249° C) and salinities (4.3 to 6.7 weight % NaCl equivalent). Although scarce fluid inclusion data is available from ore-stage material. These numbers suggest mineralization could be related to more dilute lower-temperature fluids.

Metallurgy and Resource Evaluation

Metallurgical work comprising bottle roll and column tests was carried out by METCON in 1998 on a 640-kg sample from the newly completed 200-meter Fuego Verde Adit driven to intersect higher-grade structures by Greystar.

The results of the 1998 metallurgical work suggest good leaching characteristics of the sulfide and oxide mineralization. Extraction rates of 75-80 % were shown to be achievable in the column tests.

In early 2005 bench scale column tests performed on three samples from the La Perezosa tunnel showed extraction of approximately 60 % of the gold from samples that were of sub cut-off grade material.

The most recent resource evaluation was done by Greystar under supervision of Snowden in March 2005. Every mineralized structure was modeled as a wire-frame object and the resources were calculated within each individual structure using DATAMINE software. Ore shoots within each structure were analyzed individually for correlations that characterize each individual structure. Grade cutting was done separately on each ore shoot based on grade distribution in adjacent drill holes. This last study gave a total mineral resource of 199 million metric tons having a grade of 1.25 gm Au/t with a cut off grade of 0.4 gm. Au/t in oxide zone and 0.55 Au/t in sulphide zone. Snowden Mining Industry Consultants Inc reviewed the methodology.

Table 1: Angostura Project Resource Summary of March 2005

	Indicated Mineral Resources				**Inferred Mineral Resources**			
	Tonnes	**Au (g/t)**	**Au (oz)**	**Ag (g/t)**	**Tonnes**	**Au (g/t)**	**Au (oz)**	**Ag (g/t)**
Oxide Zone (CoG 0.40 g/t)								
Shoots	3.645.000	2,24	262.000	8,7	5.395.000	2,21	383.000	7,9
Veins	19.278.000	0,95	587.000	5,6	10.540.000	1,08	365.000	5,1
Disseminated					5.775.000	0,64	120.000	3,4
Sub Total Oxide Zone	**22.923.000**	**1,15**	**849.000**	**6,1**	**21.710.000**	**1,24**	**867.000**	**5,3**
Sulphide Zone (CoG 0.55 g/t)								
Shoots	9.467.000	2,1	640.000	6,2	16.993.000	2,00	1.093.000	7,1
Veins	54.871.000	1,11	1.956.000	4,6	61.250.000	1,14	2.246.000	4,2
Disseminated					11.560.000	0,85	315.000	2,7
Sub Total Sulphide Zone	**64.338.000**	**1,26**	**2.596.000**	**4,8**	**89.803.000**	**1,27**	**3.654.000**	**4,6**
TOTAL Oxide & Sulphide Zones	**87.261.000**	**1,23**	**3.445.000**	**5,2**	**111.513.000**	**1,26**	**4.521.000**	**4,7**

Of the above resource base 83 % of the contained ounces are hosted within the 119 well-defined mineralized structures, 74 shoots and the remainder occur in disseminated mineralization. The tabular structures have widths from five meters to over 50 meters, averaging about 9 meters (Figure 4).

Environmental Studies and Permitting

Mining and exploration in Colombia is subject to environmental laws and regulations put in place by the Ministry of the Environment under law 99/93.

All of Greystar's concessions are fully compliant with the environmental legislation for both mining and exploration activities. The concessions have environmental approvals, environmental management plans or environmental licenses according to the particular situation. Currently Greystar is applying for a unified environmental license (Licencia Ambiental Conjunta) for all the titles from the Ministry of Environment and some base line studies are in proccess.

Community and Social Issues

Greystar has made community relations a very important part of its daily activities and has undertaken a number of community programs. These programs touch upon education, health care and support of community events.

Greystar has engaged Colombian specialists in the field of socio-environment planning to draw up an action plans and define programs for community relations. At the same time a Social Worker carried out a social baseline studies that will be incorporated into the long-term action plan.

Greystar operates a community liaison office in California to facilitate community contacts. A more in depth description of Greystar's social program can be found in the publication by Felder (2004).

Discussion and Conclusion

The Angostura deposit is an important high sulfidation gold discovery in a part of the South American Cordillera hitherto unknown for deposits of this type and size. The California District, within which the Angostura deposit is located, has attracted several mining and exploration companies since the nineteen forties. The social and security issues that have plagued Colombia since the nineteen fifties has discouraged many mining and exploration companies from pursuing exploration of these highly prospective areas. The persistence by Greystar and its staff under these circumstances has been rewarded with the discovery of a significant gold deposit.

At Angostura the strong structural control of mineralization resulted in the distribution of the majority of the contained ounces in a large number of vein like structures and shoots.

Although not unique in these types of deposits, it is nevertheless significant that a large proportion of the ounces are hosted in high-grade shoots within tabular structures.

Analysis of geological results and structural modeling has also demonstrated that there is potential for additional high-grade ore shoots within the presently known mineralized structures. Delineating these structures should result in an increase of overall grade and contained ounces.

The California and the neighboring Vetas Districts have mineralization extending over many square kilometers, pointing to tremendous exploration potential for the region as a whole.

The discovery of an important gold deposit in the Eastern Cordillera of Northeastern Colombia is of great significance to explorationists since this port of the Northern Andes has not been known for giant gold deposits.

Acknowledgements

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