POLYMETALLIC VEIN DEPOSITS AND OCCURRENCES CENTRAL CHUBUT PROVINCE ARGENTINA

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INTRODUCTION

The project area of central Chubut Province consists mainly of andesitic and basaltic rocks of Jurassic age that have undergone only very minor penetrative and/or thermal metamorphism. The andesites are underlain by a late Precambrian basement that is intruded by 200 Ma. granites that are not well exposed. The andesites are locally overlain by the Cretaceous Chubut Group molasse deposits (oil producer), Miocene rhyolites, and locally by plateau basalts that are younger than Miocene. The Jurassic volcanic rocks form 90 percent of the bedrock in the area.

Three types of deposits were selected for investigation by SEGEMAR; 1) Polymetallic Zn-Pb-Cu-Ag-+/- Au veins (Mina Angela area); 2) monomineralic barite and polymetallic Ba-Zn-Pb veins mainly occurring in widespread groups in the central part of the project area; and 3) quartz veins along the southern part of the project area near the highway from Paso de los Indios to Esquel (Figure 1).

FIELD OBSERVATIONS

Mina Angela Area

The mineralization in the Mina Angela area consists of the past producing Mina Angela base metal-silver-gold veins and a number of altered and mineralized zones in the immediate area including Minas Camilla, Sahuel and Cerro Bajo. The area us underlain by Jurassic andesites with the local occurrence of younger basalt, also of probable Jurassic age. These rocks are cut by rhyolite dykes of unknown affinity. The only other rhyolitic rocks in the area are the Pire Mahuida Formation of Miocene age.

a) Mina Angela: Mina Angela is developed on a series of sub parallel quartz-carbonate base metal veins that occur over a strike length of about 1.3 km and have been mined to a depth of about 200 metres. The area consists of a central vein-stockwork with veins extending both northeast and southwest from the central zone. On surface a sub parallel rhyolite dyke can be seen to pass from one side of the vein set to the other but the intersecting relationships can not be seen. According to mine geologist Oscar Garcia, the veins cut the rhyolite in the mine but the relationships are not easy to interpret suggesting that the two units may be cogenetic.

The host rocks for the veins are andesites, andesite volcanic breccias and diabase sills, with minor interflow waterlain sedimentary rocks derived from the andesites.

The veins are steeply dipping and complex in form. Discussions with Garcia indicated that the ore lenses are well zoned from copper-rich cores and Zn-Pb-rich margins. All of the vein material seen on dumps and the few exposures seen in the mine indicate that the veins are high level vein breccias. There is a considerable literature in Argentina on Mina Angela which has been only briefly reviewed.

Figure 1b) Mina Camilla: The Mina Camilla mineralization consists of two adjacent vertical vein and alteration zones striking northeast parallel to the Mina Angela trend. They have been mined over a length of 100 metres by means of an open cut/trench over a length of about 100 metres into the hillside. The zones, known as Clara Natividad and Veta Norte are similar pyritic and siliceous alteration zones with small quartz veins containing sphalerite and galena. The alteration is kaolin near surface, however at a depth of 5 metres or so the kaolin disappears and the alteration appears to be composed of chlorite and epidote, suggesting that the kaolinization is a meteoric effect.

c) Mina Sahuel: Mina Sahuel consists of two large trenches that were mined on a long alteration zone south of Mina Camilla. Mina Sahuel consists of a small open cut with several dumps that contain 2 types of material. One is a Mn-Fe wad oxide cap material that is alleged to be high in silver. The second is a silicified andesite that contains disseminated pyrite and traces of sphalerite and galena The silicification was traced as a narrow zone for about 100 metres along strike from the head of the pit.

Mina Sahuel Norte appears to be the continuation of the Sahuel occurrence and has been mined in a trench for a distance of about 300 metres along strike.

It consists of a narrow quartz vein in a wide (70 metre) pyritic siliceous alteration zone. On surface the vein/alteration zone contains a Mn-Fe oxide cap. The vein and wallrock contain minor sphalerite and galena.

d) Cerro Bajo alteration: The Cerro Bajo alteration zone forms a discrete topographic high that forms the highest point in the immediate Mina Angela area. It consists of a heavily silicified zone 300+/- metres in diameter in andesite with extensive kaolin and possibly minor sericite. Hematite is common as disseminated grains and staining joints and fractures. Within the alteration zone, 1 to 2 metre thick zones of more intense silicification containing some vuggy quartz contain disseminated minute hematite grains and stand out as ridges on the topographic high. They have the same strike as the Mina Angela veins. The alteration zone has been drilled to depths of several hundred metres without evidence of commercial mineralization. Disseminated pyrite is present at depth.

e) Note: In spite of the extensive mining of Camilla and Sahuel areas, and reported drilling of Cerro Bajo, no analyses of these areas were available to us. Mining was apparently for gold but the overall impression was that little gold was present tough this was based on hearsay.

f) Pire Mahuida rhyolites: The Pire Mahuida rhyolites of Miocene age outcrop about 10 to 15 kilometres north of Mina Angela. Since the Mina Angela veins are associated with rhyolites, it is important to know whether the Mina Angela rhyolite

Figure 1: Location map of mineral occurrences visited in central and northern Chubut Province.

dykes are related to the Pire Mahuida rhyolites or whether they are in fact older. Samples of both the Pire Mahuida and the Mina Angela rhyolites were collected for whole rock and REE analysis to assist in making this correlation.

Santana Barite Occurrence

The Santana barite occurrence consists if a swarm of 1 to 20 cm thick subvertical white to pink barite veins striking about 007° over a surface area of about 1 to 2 hectares. The veins cut hematized mafic volcanic breccia (Jurassic ?) and kaolinized rhyolite porphyry. A few hundred metres to he south east of the occurrence, rhyolite similar to the Pire Mahuida Formation is exposed in a small hill.

The barite occurs as coarse bladed crystals up to 4 cm in length. Some veinlets show symmetrical growth with colour banding parallel to vein walls indicating probable low temperature open space filling.

Alejandrito (Lagunita Salada) Barite Occurrence

The Alejandrito Barite vein consists of a 1 metre thick barite vein, striking 110° - 45° south, that is exposed over a length of about 100 metres. The stratigraphic profile at the vein is well exposed in the old workings and consists from footwall to hanging wall of highly sheared green altered andesite containing irregular patches of barite, 1 metre of massive barite, +/1 to 2 metres of sheared and altered mixed andesite and rhyolite, and fresh massive red rhyolite in the hangingwall.

Santa Maxima Barite-Sphalerite-Galena Occurrence

The Santa Maxima barite occurrence is one of the more interesting occurrences and provides excellent information on the possible age and origin of the deposit.

The Santa Maxima prospect consists of three vein structures cutting Jurassic andesite; one vein is exposed on the main valley floor, a second associated with intense shearing part way up a side valley and a third about 100 metres up the side valley from number 2.

The upper vein is most interesting. It consists of a 2 to 3 metre wide shear zone comprised of a 20 to 30 cm wide zone of more intense shearing with hematite-barite-galena along each margin and a central zone composed of diagonal gash veins also with hematite-barite and galena. The central vein consists of minor irregular 20 to 50 cm wide pods of barite on the west margin of a 50 metre-wide shear zone. The lower zone consists of barite with sphalerite and galena along a narrow sheared zone.

The geology of the site provides several constraints on the age and origin of the deposit as documented by Marcelo Marquez.

1) near the site of the occurrence in the access canyon, what appears to be the throat of a Jurassic volcano is exposed.. One hundred metre high cliffs provide an excellent cross section of andesite and andesite breccia intruded by swarms of andesite dykes. Outside the canyon, layered andesite flows appear to slope away from the centre of volcanic activity. At the Santa Maxima occurrence, the barite vein in the Jurassic volcanics can be seen to be truncated at the unconformity at the base of the Chubut Group molasse. The lowest beds of the Chubut Group are fossil fish bearing beds of Upper Jurassic age. The age of the deposits is therefore bracketed between the Jurassic age of the volcanics (undated) and the Upper Jurassic beds of the Chubut Group. This provides an excellent time line for comparison of lead isotope compositions.

El Mapuche Barite Mine

The El Mapuche mine is being operated from underground workings for the production of barite for drilling mud. The project foreman initially did not want to allow us access but finally did accompany us on a 1/2 hour visit over the surface.

The El Mapuche mine is developed on a 0.8 to 1.0 metre wide barite veins in Jurassic andesites. Two subparallel veins were observed on surface as open stopes. The attitude of the vein system is 300° - vertical . Alteration, mainly chloritic (greenish), is limited to a metre or so from the veins.

The barite is exceptionally clean with no indication of sulphides.

Del Mallon Barite-Galena-Sphalerite Occurrence

The Del Mallon occurrence lies on the edge of the Stella Maris vein system. It consists of a 25 metre long by 2 metre wide trench on a 1 metre wide barite vein that contains substantial amounts of galena and sphalerite. The attitude of the vein is 134° -

80° southwest. The GPS location is S43° 33' 20.9" and W69° 25' 06.8". The host rock is a Jurassic andesite that exhibits strong argillic alteration at the margins of the vein. This vein is more complex than those seen to date (other than Angela). A profile from wallrock to vein centre is as follows

1) fresh andesite
2) kaolinitized andesite
3) microcrystalline silica with low sulphide
4) crystalline silica with abundant galena and sphalerite
5) coarse barite with galena and less sphalerite. Some sections brecciated and healed by silica

Stella Maris Barite-Galena-Sphalerite Occurrence

The Stella Maris occurrence consists of a group of about 6 barite-base metal veins that have previously been mapped by Marcelo Marquez. Vein 1 occurs on a hillside near the top. The vein is about 1 metre wide and contains a complex assortment of lithologies. These include a siliceous zone in wallrock with hematite and galena, white siliceous material with barite blades and carbonate, and green altered andesite wallrock with barite blades and coarse galena cubes. GPS reading on the hilltop is S 43° 33' 31.7" W 69° 26' 07.7"

A quick visit was made to site 7 (Marquez Map) to collect a sample from a barite-galena-sphalerite vein.

Cañadon Bagual Galena-Sphalerite-Barite Occurrence

A 1.5 metre by 200 metre long Pb-Zn vein has been developed on 2 levels by means of adits. Barite, reported to occur in surface trenches was searched for but not found. Samples for characterization and isotopic analysis were collected from dumps below the level 2 adits. Samples collected contained galena and sphalerite +pyrite and chalcopyrite(?) in carbonate vein material of several generations, including grey, green, white and brown calcite.

Rio Chubut Media

A brief visit was made to this alteration zone on the west side of the Rio Chubut, opposite the Santa Maxima occurrence to collect a sample of gypsum for sulphur isotopic analysis.

Cajon de Ginebre Quartz Veins

The Cajon de Ginebre Occurrence is a complex series of silicified zones and quartz veins that occur in andesite debris flows of Jurassic age. The silicified zones are 1 to 2 metres wide and weather high to form a jagged cocks comb. The zone examined was about 200 metres long but from a vantage point on a ridge, a reticulate network of similar veins could be seen a kilometer or so away. Other veins were pointed out lateral to the main system.

Within the vein investigated, it was difficult to distinguish between actual vein material and silicified wallrock. Within clean vein material, there were some open space fillings containing druzes of fluorite, quartz, adularia, and zeolite. Only traces of pyrite were present. The zones were somewhat sinuous with local areas of breccia healed by quartz and fluorite., Striations on the veins are subhorizontal. There is no indication of an intrusion in the area. About 10 chemical analyses of vein material give values near 0.5 ppm Au and 4 ppm Ag. These values are definitely anomalous. It would be definitely interesting to know the character of the samples analyzed, particularly with regard to sites where gold may have been removed by solution in the high-standing resistant weathering veins.

Pocitos de Quichairo Quartz Vein

The Pocitos de Quichairo vein forms a resistant weathering zone of massive „bull" quartz at least 25 metres wide along the crest of a ridge for more than a kilometer about 1 km south of highway 62 west of Paso de los Indios. The ground on both sides of the exposed vein is littered almost exclusively with bull quartz rubble for several hundred metres suggesting that the vein may be much wider than indicated by outcrop. The only impurities seen were minor carbonate and very minor iron oxide staining. Some vugs were seen at about 45 degrees to the strike. In the valley east of the main exposure of the vein, a possible horsetail or marginal zone of narrow veins (2 - 4 centimetres) could be seen intruding coarse siliceous grits.

RARE EARTH ELEMENT ANALYSES

A suite of rhyolite samples was collected for whole rock and rare earth element analyses to try and detrmine whether the Miocene Pire Mahuida alkaline rhyolites, which are exposed north and east of Mina Angela are of similar composition and affiliation to rhyolitic dykes that are found at Mina Angela and 70 km to the south at the Mina Alejandrito

Table 1: REE analyses for Pire mahuida rhyolite and rhyolite dykes at Mina Angela and Mina Alejandrito

	Ba	Th	Ta	La	Ce	Nd	Hf	Sm	Eu	Yb	Lu
Pire Mahuida	132.38	225.83	34.85	12.40	7.60	0.96	4.88	2.47	0.29	0.89	1.32
Pire Mahuida	80.48	180.00	18.18	17.00	9.47	1.78	3.41	3.50	0.69	1.05	1.21
Pire Mahuida	173.02	218.33	25.76	22.44	9.20	2.05	4.39	3.84	0.29	0.72	3.16
Alejandrito	157.94	207.50	7.58	28.08	11.20	1.37	5.85	4.60	1.27	1.70	2.35
Angela	61.90	75.00	2.27	9.68	2.67	1.64	0.98	0.91	0.29	0.33	1.10
Angela	152.54	47.50	4.55	9.56	5.87	1.51	1.95	1.18	0.39	0.23	0.62
Angela	196.83	67.50	8.33	12.40	4.67	1.10	2.93	1.37	0.39	0.30	1.69

barite vein. I have not received the whole rock analyses so that part of the correlation has not been completed. Rare earth element analyses (Table 1) were normalized against N-MORB analyses (Sun and McDonough, 1989). The resulting data (Figure 2) is interpreted to indicate the following;

1) The REE plot of rhyolite from the three locales forms a coherent and similar pattern and it is probable that the Pire Mahuida rhyolite flows and tuffs are of the same generation as the dykes at Mina Angela and Mina Alejandrito.

2) The magma from which the rhyolite formed is not the product of a magmatic differentiation process since the REE pattern shows no significant europium deviations.

3) The high Lu/Yb and La/Yb ratios are pressure controlled and indicate that the magma originated deep in the crust from high grade metamorphic rocks (Bea et al., 1997). This fact supports the interpretation of Pb isotopic ratios presented below.

LEAD ISOTOPE ANALYSES

Lead isotope analyses were carried out on galenas from a selection of veins from the central Chubut area (Table 2). The analyses were carried out by Geospec Laboratories Ltd, Edmonton, Canada. Their laboratory report is appended to this report giving analytical procedures and error limits associated with the data presented here. Graphical representation of the Pb isotope data data is in Figure 3.

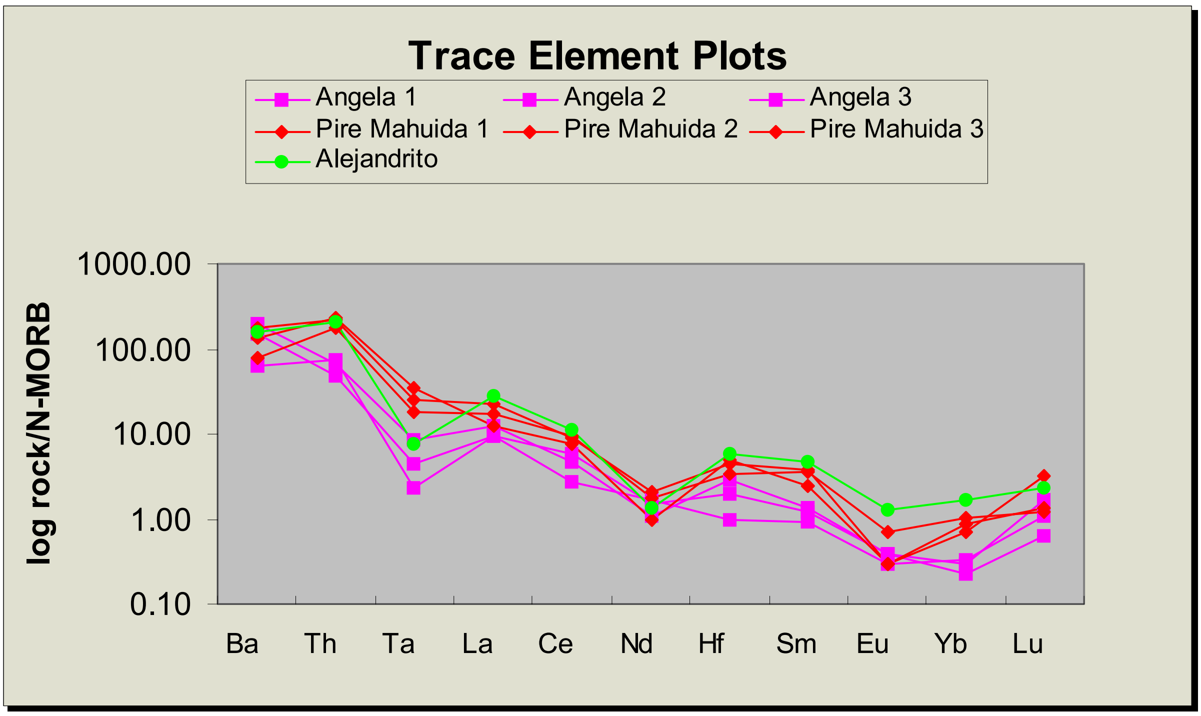


Figure 2: N-MORB normalized REE plot for Pire Mahuida rhyolite and rhyolite dykes from Mina Angela and Mina Alejandrito.

Table 2: Pb isotope ratios for galenas from central Chubut veins (analyses by Geospec Consultants Ltd).

Sample #	Occurrence	Pb 206/204	Pb 207/204	Pb 208/204
MacFarlane, 1990	Angela	18.035	15.593	38.193
PC 013	Angela Camilla	18.064	15.585	38.130
PC 035	Angela UG Susana Beatriz	18.025	15.584	38.117
PC 048	Alejandrita	18.443	15.625	38.409
PC 052	Santa Maxima	18.316	15.602	38.323
PC 062	Del Mallon	18.319	15.618	38.369
PC 062-repeat	Del Mallon	18.318	15.616	38.375
PC068	Cañadon Baguel	18.360	15.616	38.373
Stella Maris	Stella Maris	18.316	15.601	38.344
Stella Maris-repeat	Stella Maris	18.310	15.607	38.351

Both diagrams in Figure 3 show that the Mina Angela veins clearly have a different Pb isotopic signature than the central Chubut barite- base metal veins to the south. They plot in the upper crustal domain but near the orogene evolution curve possibly indicating a small component of mantle-derived lead in the galenas. The barite-base metal veins from central Chubut plot on the 400 my tie line but occur in rocks of Middle Jurassic age (~175 my). Interestingly, the Rio Oro veins plot farther up the 400 my tie line suggesting they are part of the same population of galenas but from a slightly more radiogenic source. The combination of a dominantly upper crustal compositions and approximate galena age older than the age of the host rocks indicates that the lead was derived from an basement beneath the Lonco Trapial andesitic volcanics in which the veins occur. That basement could be Lower Paleozoic or older in age.

The Mina Angela galenas are significantly less radiogenic than the galenas from the central Chubut veins and plot as a fairly tight group just above the orogene at approximately

Figure 3650 my along the reference curve of Zartman and Doe (1981). This data would seem to indicate that the lead originated in a basement terrane that is either somewhat older that the source for the central Chubut veins or that the Mina Angela veins are much older than the barite-base metal veins.. It would seem to preclude an origin related to the Pire Mahuida alkali rhyolites, since it would be expected that a genetic association with a K-rich intrusion and high metamorphic grade source area would result in much more radiogenic galenas.

The relationships of the galena compositions documented here is very interesting and a more extensive study may provide invaluable information on the origin of the mineral deposits in Patagonia and the relationship to the tectonic evolution of the area.

SULPHUR ISOTOPE ANALYSES

A very small suite of sulphur isotopic analyses was carried out in the laboratories of the Instituto de Geochronologia y Geologia Isotopico in Buenos Aires. The originally proposed 36 analyses was considered a reasonable orientation study. The 14 analyses completed provide only a glimpse into the genesis of these deposits. With so few analyses and a tendency for sulphur isotopes to form rather scattered populations in some circumstances, it is not possible to say that any of the analyses obtained is representative. It is hoped that the resources can be found to complete the program of sulphur isotopic analyses as originally proposed. I believe that a comprehensive study could provide comprehensive information on the origin and potential of these veins..

The sulphur isotopic analyses received are documented in Table 3 and illustrated in Figure 4.

The gamble in carrying out isotopic analyses on such a small population of samples from many veins is with the hope that the analyses provide a coherent pattern. In these samples, they do not, and as a result not a great deal can be said about their significance.

As was seen in the lead isotope data, the sulphur isotope data seems to indicate that the Mina Angela sulphur isotope compositions form a different population from the central Chubut occurrences farther south. The 5 analyses performed have a composition that approximates that of sulphides derived from a deep mantle derived source or from a deep crustal source approximating similar values.

In veins that contain both sulphides and sulphates, the problem of interpretation is more complex. In sulphide only systems there is isotopic partitioning between individual sulphide minerals but the difference between individual minerals, say sphalerite and galena is commonly only a few per mil. In sulphate-sulphide systems, the partitioning can be

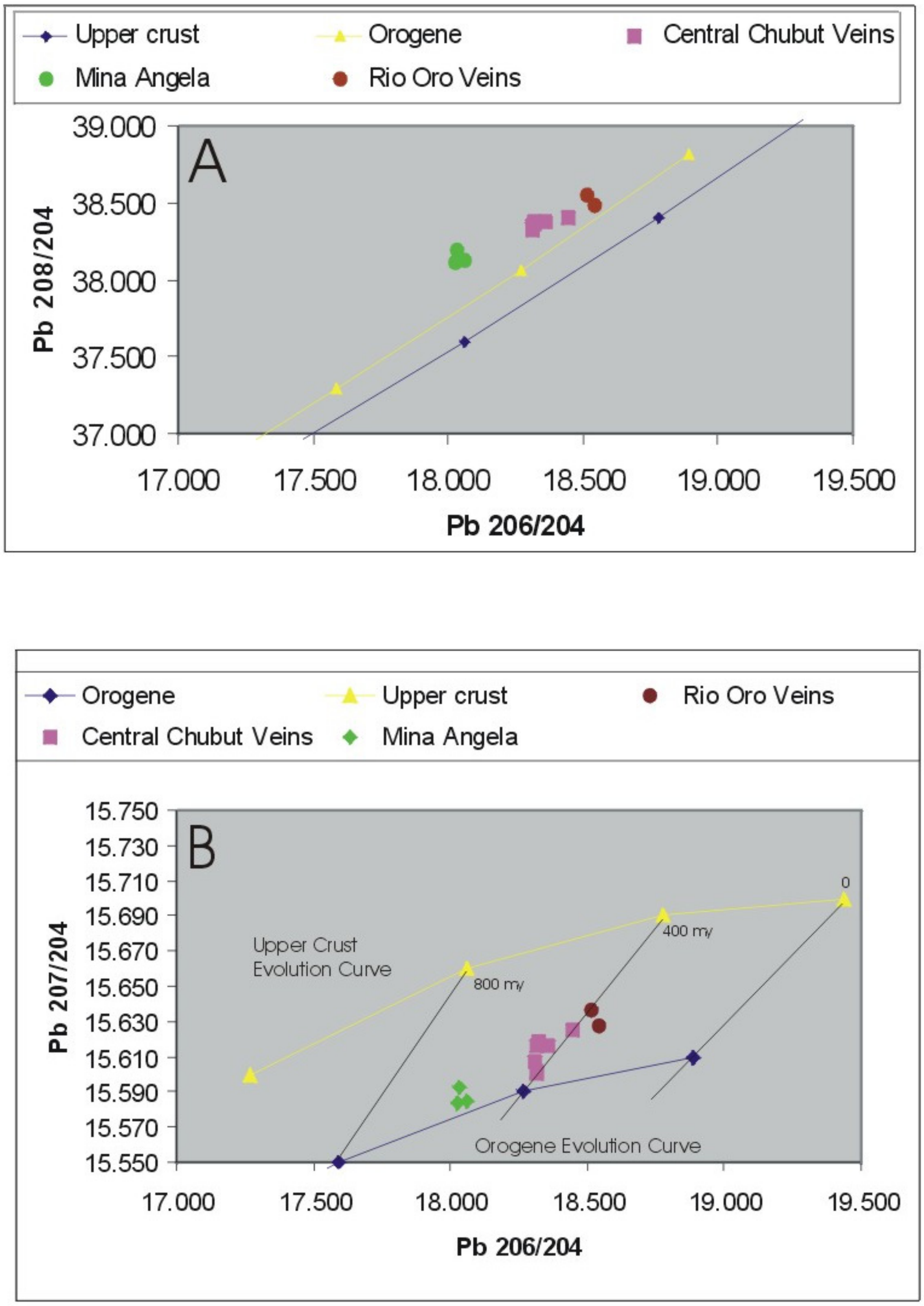
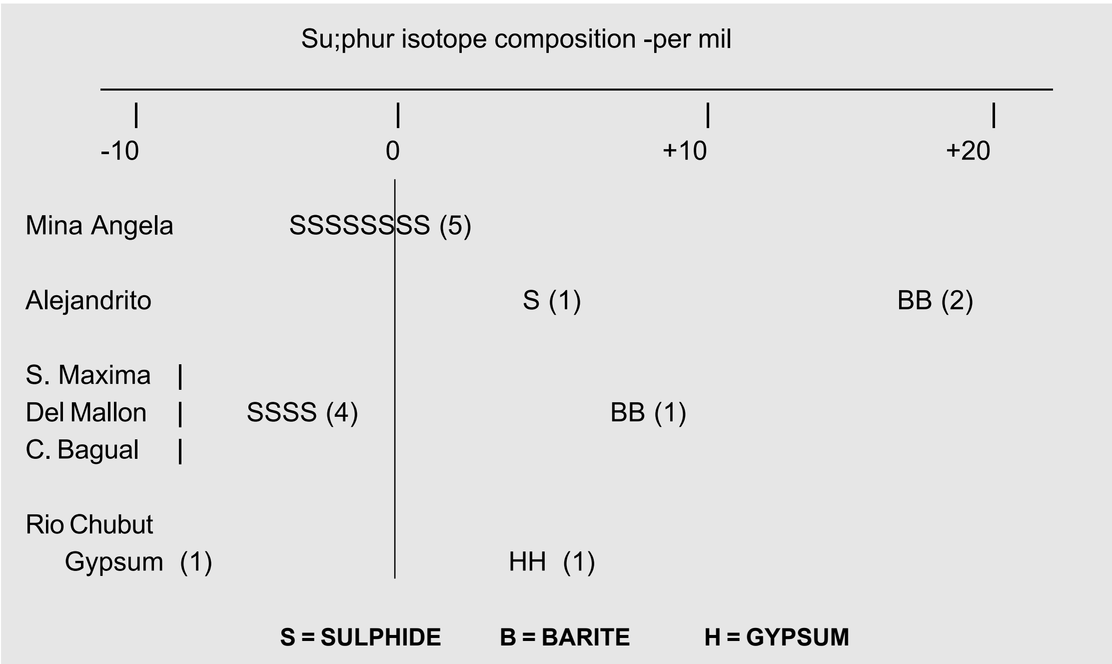


Figure 3: Pb 208/204 vs Pb 206/204 (A) and Pb 207/204 vs Pb 206/204 (B) diagrams for galenas from the Central Chubut veins. The Pb 207/204 diagram (B) contains tie lines joining the 0 my, 400 my and 800 my ages on the upper crustal and orogene curves of Zartman and Doe (1981).

very large as is seen in the results seen above with 10 to 20 per mil difference between sulphide and sulphate minerals. There are several mechanisms that may apply to this data and a detailed interpretation is not reasonable with the limited data. However under hydrothermal regimens where there is little change in isotopic composition in the transition from dissolved to precipitated sulphate (eg. barite), and sulphides contain substantially lower values, it would seem that there are three groups of sulphide occurrences represented by the sulphide-only Mina Angela, Barite only occurrences such as Alejandrito, and the mixed barite-sulphide occurrences represented by Santa Maxima, Del mallon, Stella Maris and Cañadon Bagual. The heavy Alejandrito sulphate must certainly have a strong element of sediment-derived seawater sulphate and the barite-base metal occurrences may have a mixed sulphate source.

Table 3: Sulphur isotope analyses on sulphide and sulphate minerals from the central Chubut base metal veins.

Sample #	Occurrence	Type	Pyrite	Galena	Sphalerite	Barite	Gypsum
PC002	Mina Angela	Zn-Pb Veins			-2.9		
PC004	Mina Angela	Zn-Pb Veins	-0.6	-3.1			
PC010	Mina Angela	Zn-Pb Veins			-6.3		
PC024	Mina Sahuel	Pyritic Alteration	1.4				
PC047	Alejandrito Ba	Ba vein tr galena				17.8	
PC048	Alejandrito Ba	Ba vein tr galena		1.3		16	
PC052	Santa Maxima	Ba Vein with Galena + Sphalerite	-7.4				
PC063	Del Mallon	Ba-Zn-Pb vein		-8.7		6.3	
PC067	Stella Maris	Zn-Pb-Cu vein			-8.8		
PC068	Cañadon Bagual	Zn-Pb vein		-5.1			
PC071	Rio Chubut medio	Hydrothermal gypsum					1.5



DISCUSSION AND RECOMMENDATIONS

Base metal Veins

Mina Angela is an important occurrence with the former presence of a small tonnage of base metal mineralization and at least four zones of large, widely distributed hydrothermal alteration. The remaining central Chubut barite +/- base metal vein occurrences visited are smaller and are probably not of immediate economic importance. Further study of the veins may reveal criteria that permit more insight into the possible potential of these vein systems.

The REE, lead isotope and sulphur isotope analyses provide a few constraints and have enhanced the knowledge of the veins. The REE data confirm that the Tertiary Pire Mahuida volcanic rocks and the dykes at Mina Angela and Mina Alejandrito may be related, and that the magma originated in a deep crustal metamorphic basement.. This casts doubt on the relationship between the Alejandrito group of veins and those farther to the south. The Alejandito vein appears to have altered the Mesozoic dyke rocks whereas the Santa Maxima vein is truncated by Upper Jurassic sedimentary rocks and therefore appears to predate them. This may indicate several periods of vein emplacement over 175 my of geological time.

The lead isotopic analyses indicate that the galenas from Mina Angela and the barite - base metal veins are clearly 2 separate groups of veins and that the barite - base metal veins may have similarities in metal source and age of intrusion to the Rio Oro veins in Santa Cruz Province.. Their Pb isotopic composition is much less radiogenic than is anticipated for Jurassic and younger veins indicating different deep crustal lead sources or different ages of formation (Early Paleozoic or older) for Mina Angela and the barite-base metal veins. The primitive nature of the Pb composition of the galenas also seems to preclude an origin related to Pire Mahuida alkali rhyolite volcanism (K-rich)(Lizuain,A. 1995), and would be expected to result in the addition of significant radiogenic lead to the galena. This does not appear to have been the case.

Any further work must be governed by the priorities of SEGEMAR. If consideration is given to further work on the Chubut vein systems. This study appears to provide some direction to possible future studies that may have merit and assist in the metallogenic evaluation of the vein groups. Activities that should be considered in any future study include the following.

- Basic data on all occurrences of all types should be compiled in a single file to permit classification of the deposits and to control the direction of sampling and field work.

- Geological mapping of vein districts not mapped should be up completed where necessary and mapping in the Mina Angela area should be upgraded considering that in our 2 day visit we discovered 2 unmapped lithologies.

- Augment lead isotopic studies by increasing the number of analyses. New sampling should ensure representative sampling from 3 groups of veins: the Mina Angela veins, the polymetallic veins, and barite-dominant veins. Additionally, to try and confirm sources of metal, sampling and analysis of possible basement rocks and the Pire Mahuida rhyolites, the Jurassic host rocks, and other igneous rocks for lead isotopic composition would assist in determining the source of metals and possible mobilizing intrusive phases to assist in modeling these deposits.

- Augment the sulphur isotopic studies in a similar manner and including isotopic compositions of sulphides in various host rocks, possible associated intrusions.

Quartz vein systems

The Cajon de Ginebra and Pocitos de Quichairo quartz veins are different types of systems and will be discussed separately

The **Cajon de Ginebra** vein system shows many of the characteristics of low sulphidation epithermal mineralization. These include the presence of vuggy textures, adularia and fluorite in the absence of significant sulphide mineralization. These types of veins can be highly zoned with regard to their Au content and the fact that the few samples analyzed were reported to contain up to 0.5 ppm Au and 4 ppm Ag is very significant. Although individual veins are not thick, the veins are long and several systems occur in the vicinity of the vein observed.

It is recommended that the **Cajon de Ginebra** veins be mapped in detail to include such features as vein mineralogy and structural orientation (strike and dip) to permit definition of vein orientations and mineral zoning with elements of regional geology. They should also be modeled chemically with extensive lithochemical sampling (more than100 samples) to define both horizontal and vertical (relative to topography) variations in gold content and associated elements. Such a project may generate significant gold values which would stimulate greater interest by mineral exploration companies. Great care should be taken to sample as low as possible in the vein outcrop and channel samples from contact to contact (Including contact and a few centimetres of wallrock) are preferred.

The **Pocitos de Quichairo** quartz vein is impressive in its size and the apparent purity of the bulk vein material, seeming to be composed of virtually 100 % quartz. In an area close to a source of energy this would be a significant source of SiO_2 for a glass industry. I recommend a baseline mapping project to define the geology of the Pocitos de Quichairo vein and other associated vein. This mapping program should define variations in host rock, associated structure and variations in vein type. Sampling should be carried out for chemical analysis to cover the possibility of both an industrial SiO_2 resource and the possibility of a gold enriched phase of the quartz vein. I have not seen Cerro Vanguardia and can not draw comparisons but SEGMAR should use its knowledge of Cerro Vanguardia as a component of the evaluation of Pocitos de Quichairo quartz vein. Perhaps 50 selected hand samples and channel samples would do for a preliminary look.

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Table 4: Samples collected from Central Chubut polymetallic veins Of the recommended analyses, only the Pb isotope, REE, and 14 sulphur isotope analyses were received. This report would have benefited from the additional analyses.

Sample Number	Vein Name	Description	Whole Rock analysis	Trace Element analysis	Pb Isotope	S Isotope	REE
SFB97-PC001A	Mina Angela	Andesite with 10% py					
SFB97-PC001B	Mina Angela	Sphalerite-hematite veinlet					
SFB97-PC002	Mina Angela	sphalerite-galena-pyrite		1		3	
SFB97-PC003	Mina Angela	Chalcopyrite vein		1			
SFB97-PC004	Mina Angela	Py-cpy-sph-gn		1		3	
SFB97-PC005	Mina Angela	galena green sphalerite		1	1		
SFB97-PC006	Mina Angela	altered andesite with pyrite					
SFB97-PC007	Mina Angela						
SFB97-PC008	Mina Angela	chalcopyrite-sphalerite		1			
SFB97-PC009	Mina Angela	galena-rich Platifera shaft		1	1		
SFB97-PC010	Mina Angela	Sphalerite-rich Platifera shaft		1		3	
SFB97-PC011	Mina Camilla south	silicified with pyrite		1			
SFB97-PC012	Mina Camilla north	pyrite rich sample		1		1	
SFB97-PC013	Mina Camilla	quartz with galena-py-cpy					
SFB97-PC014	Mina Camilla	qtz-sph-gal					
SFB97-PC015	Mina Camilla	kaolin					
SFB97-PC016	Mina Camilla	rhyolite for adularia					
SFB97-PC017	Mina Sahuel	Mn- Ag-wad		1			
SFB97-PC018	Mina Sahuel	Mn Ag-wad		1			
SFB97-PC019	Mina Sahuel	Mn-wad					
SFB97-PC020	Mina Sahuel	silicified andesite with pyrite		1			
SFB97-PC021	Mina Sahuel	silicified rk with boxwork + py-sph.		1			
SFB97-PC022	Mina Sahuel N.	altered andesite + pyrite	1	1			
SFB97-PC023	Mina Sahuel N.	altered andesite + pyrite	1	1		1	
SFB97-PC024	Mina Sahuel N.	altered andesite + pyrite	1	1		1	
SFB97-PC025	Mina Sahuel N.	altered andesite + pyrite		1		1	
SFB97-PC026	Mina Sahuel N.	pyritic alteration		1		1	
SFB97-PC027	Mina Sahuel N.	galena			1		
SFB97-PC028	Mina Sahuel N.	altered andesite					
SFB97-PC029	Mina Sahuel N.	quartz-Mn material					
SFB97-PC030	Cerro Bajo	silicified andesite + hematite					
SFB97-PC031	Cerro Bajo	kaolin + silica					
SFB97-PC032	Mina Angela	rhyolite	1				REE
SFB97-PC033	Mina Angela	coarse grained mafic dyke					
SFB97-PC034	Mina Angela	rhyolite	1				REE
SFB97-PC035	Mina Angela	galena - mine					

SFB97-PC036	Mina Angela	rhyolite	1				REE
SFB97-PC037	Pirce Mahuida	rhyolite	1				REE
SFB97-PC038	Pirce Mahuida	rhyolite	1				REE
SFB97-PC039	Pirce Mahuida	rhyolite	1				REE
SFB97-PC040	Santana Ba	barite				1	
SFB97-PC041	Santana Ba	altered rhyolite					
SFB97-PC042	Santana Ba	breccia with barite- calcite matrix					
SFB97-PC043	Santana Ba	hematitic scinter with barite vein					
SFB97-PC044	Santana Ba	rhyolite from hill					
SFB97-PC045							
SFB97-PC045A	Alejandrito Ba	altered andesite					
SFB97-PC046	Alejandrito Ba	altered red rhyolite with adularia					
SFB97-PC047	Alejandrito Ba	submassive barite with fluorite?				1	
SFB97-PC048	Alejandrito Ba	Barite with trace galena			1	2	
SFB97-PC049	Alejandrito Ba	fresh red rhyolite	1				REE
SFB97-PC050	Santa Maxima Ba-Pb-Zn	hematite-barite-galena		1			
SFB97-PC051	Santa Maxima Ba-Pb-Zn	galena-sphalerite					
SFB97-PC052	Santa Maxima Ba-Pb-Zn	hematite-barite- galena-sphalerite		1		3	
SFB97-PC053	Santa Maxima Ba-Pb-Zn	altered andesite					
SFB97-PC054	Santa Maxima Ba-Pb-Zn	galena			1		
SFB97-PC055A	Santa Maxima Ba-Pb-Zn	aphanitic andesite					
SFB97-PC055	Santa Maxima Ba-Pb-Zn	barite				1	
SFB97-PC056	Santa Maxima Ba-Pb-Zn	galena				1	
SFB97-PC057	Mapucha Ba	massive barite-calcite					
SFB97-PC058	Mapucha Ba	massive barite	1	1		1	
SFB97-PC059	Mapucha Ba	fresh andesite					
SFB97-PC060	Mapucha Ba	altered andesite					
SFB97-PC061	Del Mallon Ba-Pb-Zn	kaolinized andesite porphyry					
SFB97-PC062	Del Mallon Ba-Pb-Zn	microcrystalline quartz with sphalerite and galena		1			
SFB97-PC063	Del Mallon Ba-Pb-Zn	coarse barite blades with galena and brown carbonate				3	
SFB97-PC064	Del Mallon Ba-Pb-Zn	Barite-galena-sph frags? In breccia? Cemented by quartz		1	1	3	
SFB97-PC065	Stella Maris Ba-Pb-Zn	green carbonate? galena-barite					
SFB97-PC066	Stella Maris Ba-Pb-Zn						

SFB97-PC067	Stella Maris Ba-Pb-Zn	barite-sphalerite-galena		1	1	3
SFB97-PC068	Canyadon Bagual Pb-Zn	galena-rich + pyrite		1	1	2
SFB97-PC069	Canyadon Bagual Pb-Zn	similar+green alteration and sphalerite				
SFB97-PC070	Canyadon Bagual Pb-Zn	orange mineral for I.D.				
SFB97-PC071	Rio Chubut Medio	gypsum				1
SFB97-PC072	Cajon de Ginebre	Fluorite druze	1	1		
SFB97-PC073	Cajon de Ginebre	Silicified wallrock	1	1		
SFB97-PC074	Cajon de Ginebre	Silicified wallrock	1	1		
SFB97-PC075	Cajon de Ginebre	Pyrite nodule				
SFB97-PC076	Cajon de Ginebre Adularia-zeolite					
SFB97-PC077	Pocitos de Quichairo	Bull quartz	1	1		
SFB97-PC078	Pocitos de Quichairo	Bull quartz	1	1		
SFB97-PC079	Pocitos de Quichairo	Bull quartz	1	1		
SFB97-PC080	Pocitos de Quichairo	Bull quartz	1	1		
Future Samples	Cajon de Ginebra			100		
Future Samples	Pocitos de Quichara			50		
TOTAL		**18**	**183**	**8**	**36**	**7**

1. Detailed examination of samples to be shipped for analysis may result in a slightly different selection than those indicated above.
2. Whole rock analysis means analysis for Si)2, Al2O3, Total Fe as Fe2O3, MgO, CaO, Na2O, K2O, TiO2, Cr2O3, P2O5, LOI, and including the imobile traces Ba, Nb, Rb, Sr, Y, Zr such as X-ray Assay Lab package XRF102.
3. Trace element analysis indicates thae following minimum suite of elements Au as XRAL FA30/1, Ag, Cd, Co, Pb, Cu, Mo, Ni, Zn, Sb, As, Sn, W as in XRAL ICP80. It would be useful to run a selection of these samples for HG as XRAL by method CHM-20.
4. REE analyses by ICPMS such as XRAL ICPMS-17.
5. Samples for the Cajon de Ginebra and Pocitos de Quichairo occurrences should in general only be analysed for Au but a selection representing perhaps 25% of the samples collexted should undergo complete analysis for characterization of the occurrences as low-sulphidation epithermal.

SEGEMAR
SERVICIO GEOLÓGICO
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SECRETARÍA DE ENERGÍA Y MINERÍA

Buenos Aires, 2001

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POLYMETALLIC VEIN DEPOSITS AND OCCURRENCES CENTRAL CHUBUT PROVINCE ARGENTINA

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