# Audit of resources and reserves

Pimenton Mine

V Region, Chile

Prepared for
Compañía Minera Pimentón
Subsidiary of
South American Gold and Copper Company Ltd.

Author of the Report

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# AUDIT OF RESOURCES_RESERVES IN PIMENTON MINE. OBSERVATIONS REGARDING THE CHANGES OF THE PIMENTON MINE PROJECT TECHNICAL REPORT (December 2009)

## 3. SUMMARY

## RESERVES

Compañía Minera Pimentón requested to Marco Alfaro, Ph. D. In Geostatistics, to revise and update the estimation of resources and reserves of the Pimenton mine, prepared by the team of the Mine, which is summerized in the following chart:

| Reserves | Proven | Probable | | Average width |
|---|---|---|---|---|
| Tons | 23831.7 | 68297.4 | | 0.86 meters |

Total Proven + Probable : 80483 tons

| Grades | Proven | Probable | | Average |
|---|---|---|---|---|
| Au g / t | 14.10 | 14.56 | | 14.44 |
| Cu % | 1.39 | 1.37 | | 1.37 |
| Au Eq g / t | 16.75 | 17.17 | | 17.06 |

The present estimation uses the same blocks, procedures and methodology which was applied in 2002 to arrive at the inventory of resources and reserves.

As in the original estimation, the proven blocks are derived from the measured resources, which are estimated with an extension of 5 meters upward and downward from a level, on which channel samples have been taken, every two meters along the vein. The probable blocks are derived from the indicated resources using 20 additional meters upward or downward of a measured block compared to the previous 15 meter projection used in 2002.

The measured grade is estimated from the sampled grades in the channel sample multiplied by the width of the vein.

The volumes are estimated by the traditional formula (width) * (length) * (height of the block), which are converted to metric tons by multiplying by a density of 3.0 tons/cubic meter.

The conversion of Resources (measured and indicated) to Mineral Reserves (proven and probable) is made by using a coefficient of recovery and a mining dilution of the resources.

The vein width is diluted to a minimum mining width of 80 centimeters.

**RESOURCES**

| | Tonnes | Au g/t | Cu% |
|---|---|---|---|
| **Inferred Class A** | **37,121** | **18.57** | **1.43** |
| **Inferred Class B** | **283,982** | **14.44** | **1.24** |

Class A Inferred refers to a 20 meter extension of the existing probable ore in the vertical sense, conditions allowing. It is given a fairly high probability of being converted to Probable classification in the future.

The Class B Inferred is the projection of the known veins down to below the 3185 level using a combination of existing drill holes and the reserve grades as a guide. The Class B uses the same parameters as the previous 2002 resource estimates but is modified by adding dilution to a minimum mining width of 80 cm from 55cm and using a SG of 3.0. Assuming the added 25cm of minimum width runs 0.5 g/t Au and 0.1% Cu

In order to fulfill the objectives of this Report, the Consultant carried out a visit to the Pimenton mine, on November 30, 2009. The mine, sample preparation and assay laboratory were reviewed as well as geological plans and sections of the principal veins.

The principal conclusion is that the Pimenton mine uses standard methodologies for the estimation of the narrow vein/high grade type gold deposits, conducive to reliable resources, which can be used in the mid to long-term mine planning.

Signature: Marco Antonio Alfaro

Mining Civil Engineer, University of Chile
Ph: D. on Geostatistics, Paris School of Mines
QP (Qualified Person) AusIMM, No. 229692

## 4. INTRODUCTION AND TERMS OF REFERENCE

a) Terms of Reference
- The format of this report complies with Form 43-101F1, part of Canadian National Instrument 43-101, Standard of Disclosure for Mineral Projects.

- The Pimenton Mine is owned by South American Gold and Copper Company Ltd. (SAGC), a company listed on the Toronto Stock Exchange.

- Compañía Minera Vizcachas and Compañía Minera Pimenton are subsidiary companies of SAGC.

- BTX is a company formed by M. Bernstein and D. Thomson, which identified Pimenton in the early 1980's, and later acquired control.

- ENAMI (Empresa Nacional de Minería) an enterprise owned by the government of Chile. ENAMI operates two custom copper smelters in Chile. One, Ventanas, is located about 192 kilometres from Pimenton.

- SERNAGEOMIN (National Mining Service). The entity that oversees mining activity in Chile, with particular emphasis on safety and permitting of projects.

- All monetary amounts are in US Dollars $, or Chilean Pesos CHP unless otherwise indicated.

- All measurements are in metric units unless otherwise indicated. The term tonne or tonnes refers to a metric tonne (1,000 kg or 2,205 lbs).

- Gold amounts may be referred to in terms of grams/tonne or in ounces.
(1 ounce troy = 31.1035 grams).

- Mining levels are named by approximate elevation in meters above sea level.

- Geographic locations are expressed in terms of the Universal Transverse Mercator (UTM) System, Band Nº 19, based on the CANOA Survey of 1956. All mining claim surveys in Chile are referred to this system of coordinates, which is linked to the Geodetic survey of Chile.

- Adits are mining tunnels driven from the surface usually with a slight grade (1%) towards the portal to drain water by gravity.

- Drifts are tunnels driven along a vein or mineralized structure.

- Crosscuts are tunnels driven in waste rock at oblique angles to the direction (strike) of mineralized veins.

- Raises are vertical openings, often driven between levels following a vein to prove continuity of the vein.

- Stopes are extraction openings formed by drilling, blasting and removing ore for recovery of valuable metals in process plants.

- Overhand stull stoping, is a system consisting or drilling and blasting a sequence of overhand cuts, removing the ore with scrapers or mechanical loaders and leaving behind “stulls” (timber) as supports for drilling and access.

- Cut-off Grade: the minimum metal content (or breakeven value), expressed in grams of gold per tonne, required to pay all costs of operation, including exploration, mining, processing, and delivery to market via smelting and refining. Copper assays are converted to gold equivalents by a formula, which considers relative metal prices, mill recoveries, and smelter terms.

**5. DISCLAIMER**

In the preparation of this report, the Qualified Person (QP) has relied on PA&H report dated 2003 report
on the general geology and description of the sampling procedures being applied as well as a review of the Ore Reserves by John Selters in 2005. This is in addition to discussions with supervisors. The QP has relied on the sample data and mine maps provided by SAGC.

Date : December 14, 2009 Marco Antonio Alfaro Sironvalle

## 6. DESCRIPTION OF PROPERTY

No change in this section from the 2002 Technical Report.

## 7. ACCESSES, WEATHER, LOCAL RESOURCES AND INFRASTRUCTURE

No change in this section from the 2002 Technical Report.

## 8. HISTORY

No change in this section from the 2002 Technical Report.

## 9. GEOLOGIC SETTING

No change in this section from the 2002 Technical Report.

**10. DEPOSIT TYPES** No change in this section from the 2002 Technical Report.

## 11. MINERALIZATION

No change in this section from the 2002 Technical Report.

## 12. EXPLORATION

Within this Resource Estimate, the primary work has been the advance of a new adit to provide access to vein extensions below the Lucho/Leyton/Michelle area. The adit is oriented as a cross-cut to the vein systems and was started from a portal constructed at the 3375 elevation.

This adit has cut one new structure (Angeline) near the portal and at year-end 2008 had a total advance of 850 meters. 630 meters in the 3375 cross cut, 170 meters on the Lucho Structure and 80 meters on the Michele structure

## 13. DRILLING

With regard to the Pimenton Mine Resource estimate, there has been no change in this section from the 2002 Technical Report. No additional exploration drilling has been conducted in the Mine area per se. Although a new drill program was underway during the mine visit, the results will not be available in time for this review.

There has been additional drilling in connection with exploration of a bulk mineable porphyry target, which is outside the scope of this Audit.

## 14. SAMPLING METHOD AND APPROACH

The in-stope sampling methods are essentially the same as described in the 2002 Technical Report. In the stopes observed, the sample channels are being cut with impact hammers
(electric and/or pneumatic). The channels cross the vein structures at approximately 90 degrees to the dip. Approximately 5 kilos are taken from each sample. In the stopes, the channels are cut at 2.0 meter intervals (horizontal) along the stope face, and this sampling pattern is repeated after every fifth cut, which translates into a vertical spacing of approximatly 6 meters.
The channel locations are surveyed by instrument to locate all samples in 3-D UTM coordinates. This information is included in the computer database on Excel spreadsheets, for eventual three dimensional analysis in the Datamine software.

In the raises and drifts, the channels are cut across the vein and wall rock at intervals of 2.0 meters along the vein structure.

Each channel is normally segmented with three samples; one over the mineralized vein itself, and one sample from the lower grade wall-rock on either side (dilution material).

The cut sample material is collected on a canvas sheet and transferred to plastic bags which are tagged with a unique sample number and stapled. The sampling crew is led by a geologist and/or a experienced sample boss, who deliver the sample bags directly to the preparation laboratory at site.

As a control of “as-mined” grade during the extraction, each truckload or loader bucket of broken mineral coming from a given stope or workplace is sampled by taking one shovel full at random from the exposed content each load coming out of the mine portal. These samples are place in individual barrels marked for the active workplaces.

## 15. SAMPLE PREPARATION, ANALYSIS, SECURITY

Sample preparation and analysis is performed on site. The assay lab has been moved to a new site providing good opportunity to improve procedures and protocols.

## 16. DATA VERIFICATION

As the scope of this audit was defined as a review of the Resource and Reserve **estimate methodology**, no independent sampling or data verification was undertaken. The QP opinion is that not much would be accomplished by random independent sampling.

A review of the stope sampling records indicates that the primary high-grade vein structures have widths from 5 centimeters up to 70 centimeters with perhaps the most typical being 20 to 30 centimeters of sulfide vein. The sublevel sampling has in most cases verified the sampling of the actual vein width in the drifts below.

To date the ultimate check has been the payable amounts of gold and copper contained in the concentrates sold to Enami. The geologic staff and managers of Minera Pimenton are concerned about perfecting their sampling and volumetric measurement of materials mined and those amounts remaining in the Reserves.

The data base of duplicated grades of the “Lucho” for 2008 vein was revised, corresponding to the Pimenton Laboratory and to the ACT Laboratory in La Serena. The figures 1(a) and 1(b) show the results for the Au, in g/t and Cu in % (in green, the straight line y=x):

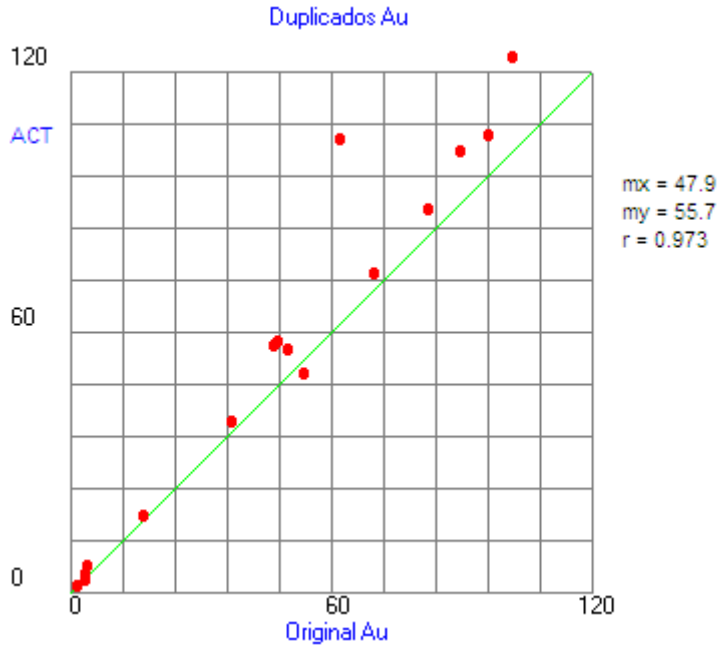


Figure 1(a): In the scatter, it is observed that the Laboratory ACT provides systematically higher grades than the Pimenton Laboratory; r is the correlation coefficient.

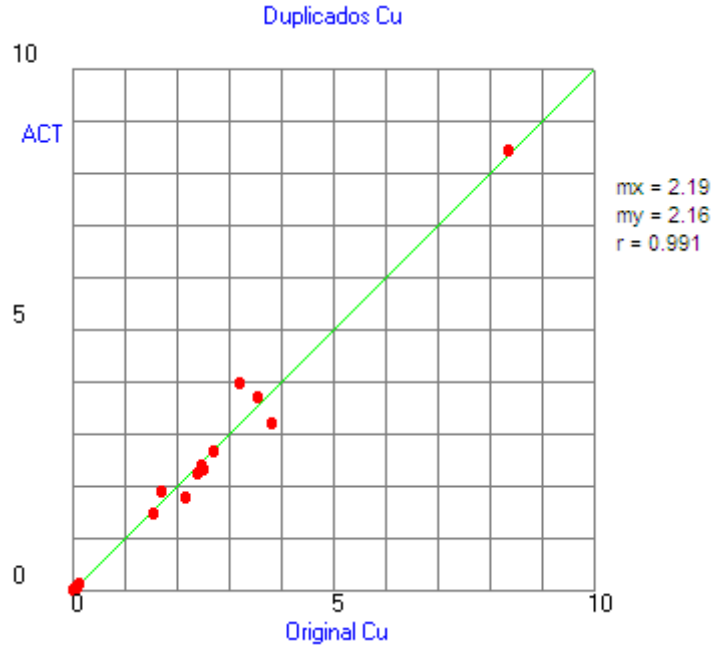


Figure 1(b): Scatter of copper grades; r is the correlation coefficient. Good results.

The above results show that the procedures of the Pimenton Laboratory for gold grades need to be studied and improved.

**Specific gravity.**

Specific gravity used in Pimentón mine is equal to 3.0 ton / $m^3$. The measures in November 2009 justifies this value. The scatter is in figure 1(c):

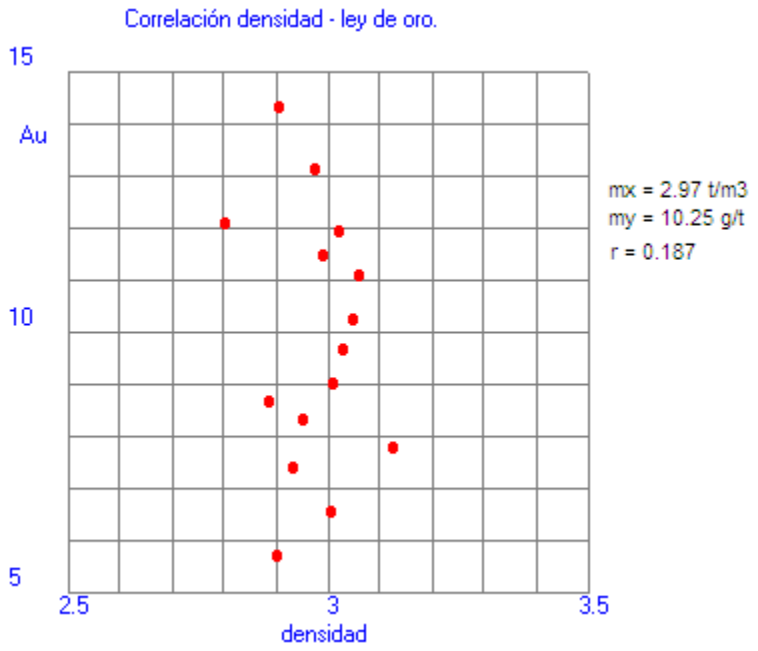


Figure 1(c): Scatter of Density-Au grades. There are no correlation between Au grades and Density.

The figure 1(d) shows the histogram of specific gravity data and the gaussian model fit:

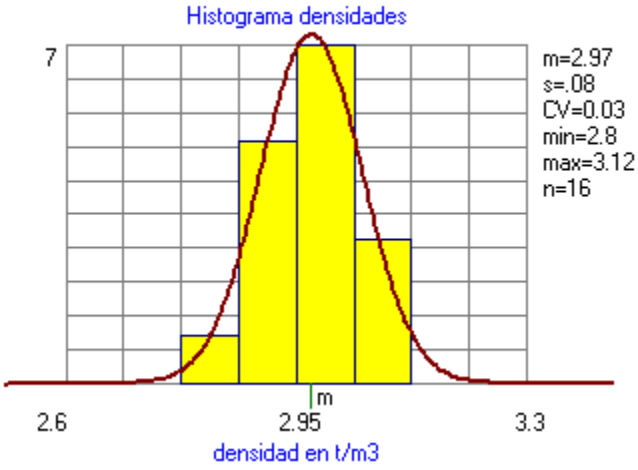


Figura 1(d): Histogram of specific gravity.

## 17. VARIOGRAMS

A representative zone of the deposit was chosen, which appears in figure 2(a) and 2(b) in a projection in plant and profile (in red, the Au laws higher than 7 gr/ton and in blue, the lower ones).

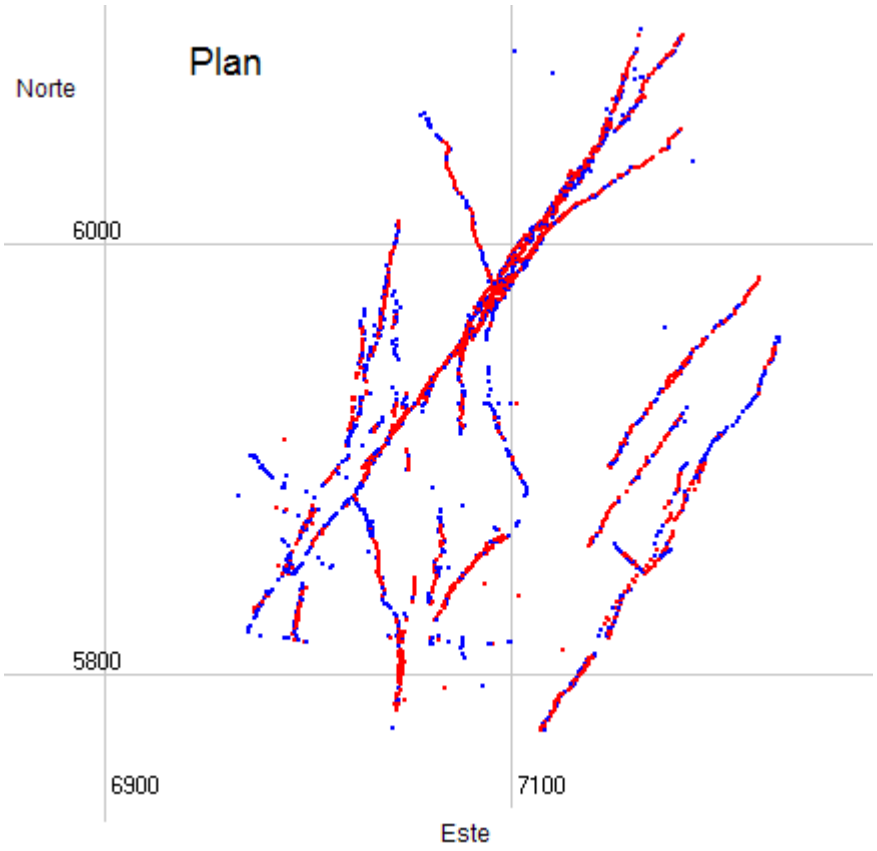


Figura 2(a): Plan view.

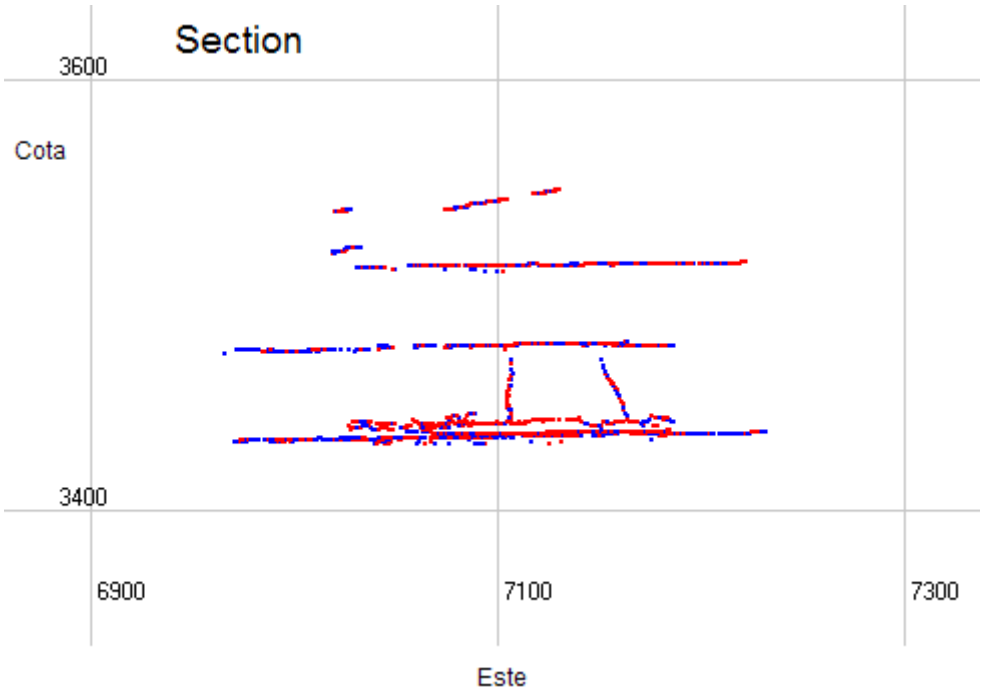


Figura 2(b): Profile view.

In this zone the **variograms** of the Au variable were calculated according to the direction of the veins (azimuth of the rank of 30º) and in the vertical direction. The figures 3(a) and 3(b) show the results:

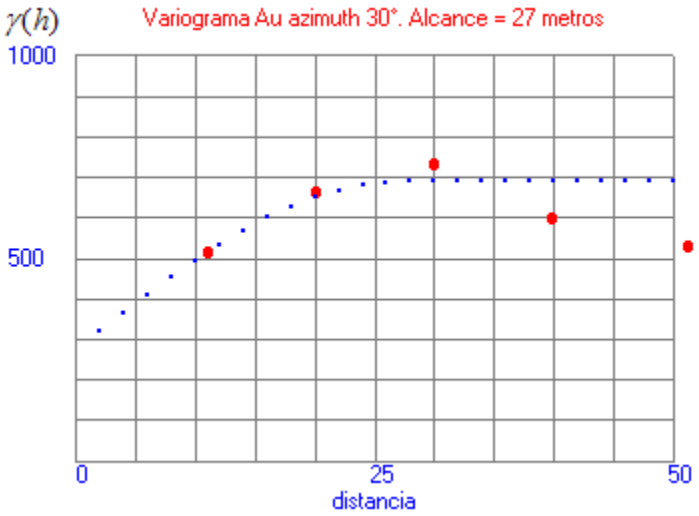


Figure 3(a): Variogram azimuth 30°, Au.

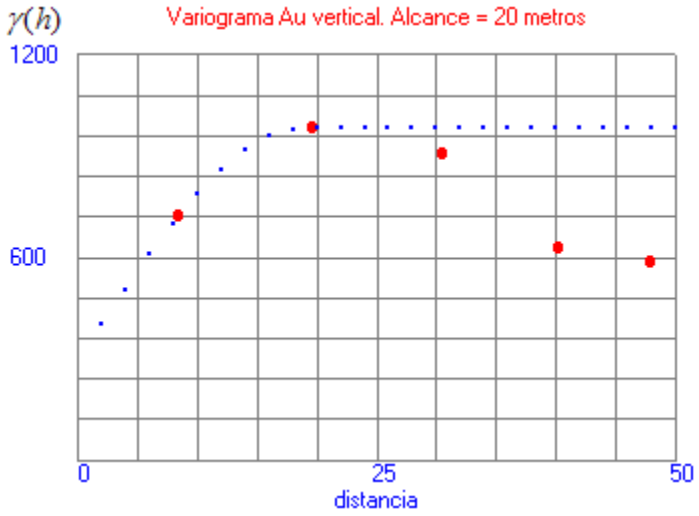


Figure 3(b): Variogram vertical, Au.

We can observe ranges between 20 and 27 meters and the presence of a pit effect, which is normal in this type of deposits. It is necessary to have more information, but this result shows that the categorization critieria used by Pimenton (± 5 meters Proven and ± 20 meters Probable) is very acceptable. The figure 4 shows a section of the new reserves on the Lucho vein (measured=red, indicated=blue, inferred "A"=green). The figura 4(b) shows the Carmela vein:

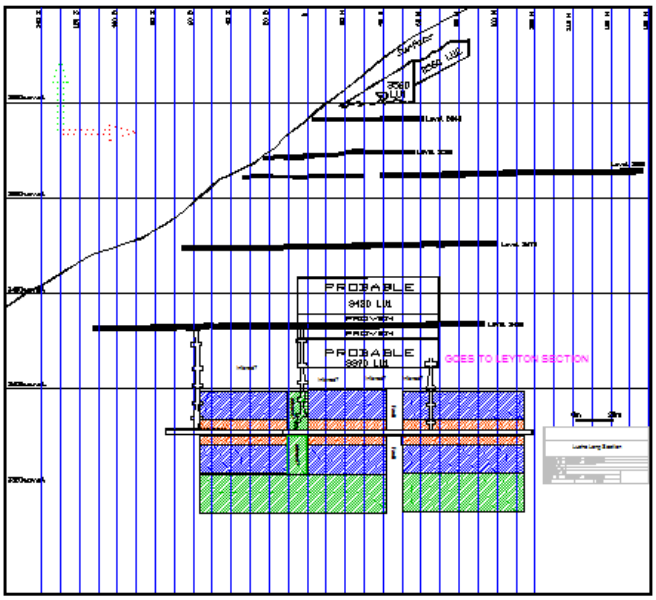


Figure 4(a): Categorization of the resources of the Lucho vein.

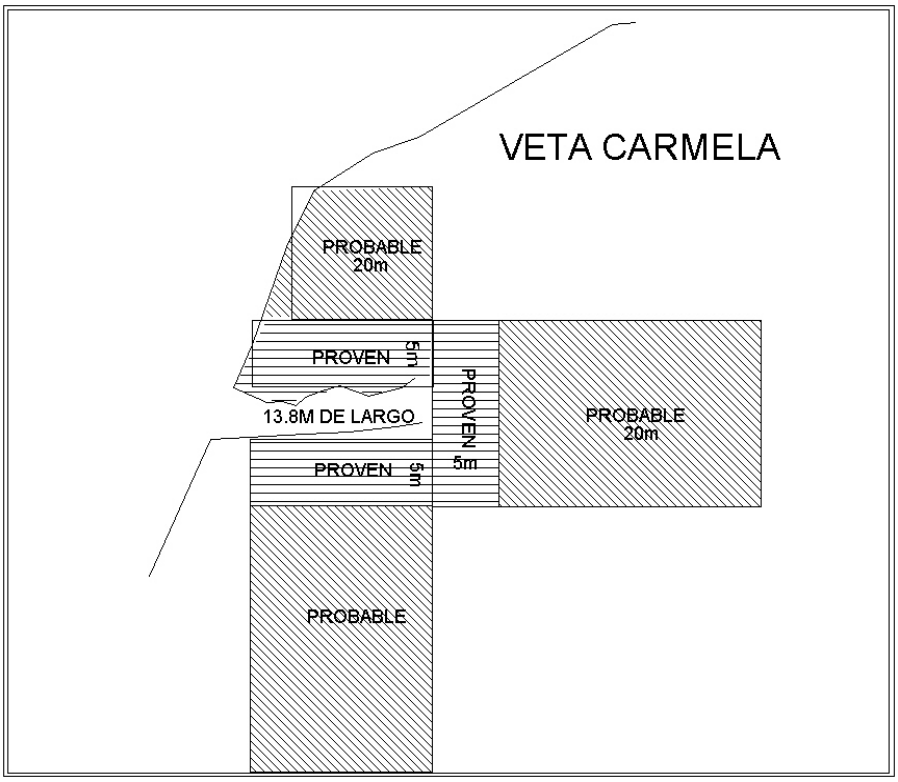


Figure 4(b): Categorization of the resources of the Carmela Vein.

Any future diamond drilling for reserves at Pimenton would use a grid spacing of less than 27 meters in the strike of the vein and 20 meters in the dip of the vein.

## 18. ADJACENT PROPERTIES

No change in this section from the 2002 Technical Report**.** There are no significant changes in nearby or adjacent properties which have relevance to high-grade narrow vein mineral resources which are the subject of this audit.

## 19. MINERAL PROCESSING AND METALLURGICAL TESTING

The basic parameters of mineral processing assumptions have been confirmed by the operations data and concentrate sales during the second half of 2004. However, full confidence in these performance figures will only be possible with improved systems of measuring tonnage input (by accurate belt scale) and grades of gold and copper in the plant heads, tails, and concentrates (automatic sampling systems), the latter of which has now been installed.

Mill Recoveries are reported at 93% and 91% for Gold and Copper respectively, versus the 91 % projected in the 2002 Technical Report. These recoveries are tied back to the concentrate sales figures.

The Knelson gravity concentrator has been installed for direct recovery of 50 to 60% of the gold and the mill capacity has been firmed up to over 200 tonnes per day by refinements to the secondary crushing system. and implementation of concentrate regrinding to improve the copper grade of the concentrate. Refinements to the milling operation yet to be completed include improved sampling systems, improved accuracy of the belt scale.

## 20. MINERAL RESOURCE AND RESERVE ESTIMATES

The estimate uses the same reserve blocks, procedures, and methodology which were applied in June 2002 and march 2005 to arrive at the Mineral Reserve for restarting the Pimenton Mine, the main changes are the following: Specific gravity is changed from 2.75 to 3.0 ton / $m^3$ and the Probable category is extended from 15 meters to 20 meters due to more information.

A major supposition of the past estimate was the vertical continuity of the vein thickness and grades between the levels, which needed to be proved by driving raises.

Raises driven from the levels were reported to have generally confirmed the vertical continuity of the veins between 3375 level and 3540 level, improving the confidence level of the estimate. However, some of the sample data on those raises was not available, and has not been incorporated in the estimate as of December 15, 2008.

In some cases, probable reserve blocks might have been upgraded to proven status by the completion of raises. In that sense, continuing with the prior block classification is prudent though somewhat conservative. Other raises encountered vein splits, vein thinning and lean zones which had to be left as pillars.

Sampling data being taken as the stopes move upwards has been incorporated in the Datamine model with 3-D coordinates established by instrument survey. However, this data is not yet being fully incorporated in the modeling and projection of mineral reserves.

The mill-head sample is now being tested for specific gravity every shift; results shown in Attachment H give an average of 2.95 tonnes per cubic meter.

For the 2008 Mineral Reserve estimate 3.0 tonnes per cubic meter was used since average S.G of 2.95 included low grade development muck.

Cutoff Grade

The Cutoff Grade assumed for Blocks included the Mineral Reserve estimate is 6.81 grams of Gold (Au Eq) per tonne. This is based on the estimate that a unit cost of $ 152 per ton of ore mined can be achieved at an operating rate of 4500 tons milled per month.

Au Eq is calculated using 1000 US$/ ounce of gold, and a copper price of US$ 2.80 per pound. Using these prices, corrected for mill and smelter recovery factors, the Gold equivalent grade is calculated as follows: 1 % Cu = 1.91 grams gold

AuEq (grams)= Au grade (gpt) + 1.91 * Cu grade (% Cu T).

The concept of Cutoff grade is complex at the moment because of number of variables which are not yet well established:

• The cost per tonne of ore is distorted by uncapitalized expenses related to plant modifications incurred during the startup period and substantial repair costs to mine equipment.

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• The cost per tonne is extremely sensitive to the rate of milling. This is because a high portion of the current costs are effectively fixed costs ( month to month). In terms of mining/milling costs, going from 2500 tpm to 4500 tpm can be done with a few more drillers and additional consumables.

Furthermore, while the matter of mine dilution is of concern, the fact that excess mill capacity is available makes taking the additional dilution rock through the mill possible with little increase in the overall monthly cost. The key point is to assure getting the planned amount gold from the “reserve tonnage” processed.

The following charts show the Pimenton reserves, whose summary is at the beginning of this report, for the Manterola, Michelle, Leyton and Lucho veins:

## 21. CONCLUSIONS

The most important conclusions derived from the study are:

The calculation methods for the estimation of reserves are consistent with the ones carried out in previous years (2002, 2005, 2008). More information has been aggregated, incorporating it where necessary. It can be concluded that the methodology used by Pimenton corresponds to standards of high grade gold mining in narrow veins.

At the present time, the density used is of 3.0 ton//$m^3$.

The ranges of the variograms for gold are higher than 20 meters.

The laboratory produces gold grades lower than the ACT laboratory in La Serena. The analysis of copper grades are better than in 2008.

## 22. RECOMMENDATIONS

The most important recommendations are:

To continue with the geostatistic analysis to obtain more reliable variograms. The present variograms determined in this study show that the range of the projection is in the order of 20 meters in the vertical sense, therefore the categorization of Pimenton Mine is conservative.

To do a detailed study of the laboratory procedures for preparation and analyisis and improve the present situation, which in the case of gold, has a conservative bias (with a relative error of 18%).

In the case of copper grades, the results are better (a relative error os 9%)..

Review the sampling method by chip sampling, using duplicate channels at several points of one vein.

## 23. REFERENCES


- Due Diligence on Restart of the Pimenton Mine, Central Chile. Pincock Allen & Holt, 2003
- Audit of Mineral Reserve Estimate Pimenton Mine. John J. Selters, 2005
- Audit of Mineral Reserve Estimate Pimenton Mine. John J. Selters, 2002
- Audit of resources and reserves Pimenton Mine, Marco Alfaro, 2008.

## CERTIFICATE OF QUALIFIED PERSONS

I, Marco Antonio Alfaro Sironvalle, do hereby certify that:

1. I am a Mining Civil Engineer, Ph. D. in Geostatistics with Tecniterrae Ltda. Consultores Mineros, at Waterloo 529, Las Condes, Santiago, Chile;

2. the technical report to which this certificate applies is entitled "*Audit of Resources and Reserves, Pimenton Mine, V Region, Chile"* dated December 2009 (the "Technical Report") prepared for Compania Minera Pimenton, a subsidiary of South American Gold and Copper Company Limited (the "Issuer");

3. I have a degree in Mining Civil Engineering from the University of Chile, obtained in 1971. I have a Doctorate from the Paris School of Mines. I have worked since 1971 in resource estimation and reserves. Included in my past experience are the following:

   (a) Reserves Superintendent, Codeico Chuquicamata Mine;

   (b) Senior Mining Engineer, BHP Consulting, Santiago Office;

   (c) Principal Geostatistician, SRK Consulting Santiago, Chile;

   (d) Director Resources-Reserves, Metalica Consultores; and

   (e) I am a registered engineer in the Institute of Mining Engineers of Chile and in the Australasian Institute of Mining & Metallurgy, QP by the AusIMM, with the number 229692.

   I am a "qualified person" for purposes of National Instrument 43-101 - *Standards of Disclosure for Mineral Projects* ("NI 43-101");

4. my most recent personal inspection of the property that is the subject of the Technical Report was when I visited such property for a period of one day on November 30, 2009;

5. I am responsible for all aspects of the Technical Report;

6. I have not had any prior involvement with the property that is the subject of the Technical Report. I am independent of the Issuer as described in section 1.4 of NI 43-101;

7. I have checked the calculation of the resources and reserves of the property that is the subject of the Technical Report since October 2008;

8. I have read NI 43-101 and the Technical Report has been prepared in compliance with NI 43-101; and

9. as of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

**DATED** the 14th day of December, 2009.

*"Marco Antonio Alfaro Sironvalle"*

**MARCO ANTONIO ALFARO SIRONVALLE**

**RESUMEN DE CURRICULUM VITAE**

**I. Nombre: Marco Antonio Alfaro Sironvalle**

Titulo: Ingeniero Civil de Minas, Universidad de Chile, 1971.
Ingeniero Matemático, Universidad de Chile, 1972.
Grado: Docteur en Sciences et Techniques Minières, Ecole Nationale Supérieure des Mines de París, Francia, 1979.
Fecha de nacimiento: 29 Abril 1947
Estado Civil: casado.

**II. Experiencia Profesional:**

1971-1972 Investigador en el Departamento de Ingeniería de Minas de la Universidad de Chile.

1973-1974 Investigador en el Centre de Géostatistique de Fontainebleau, Ecole des Mines de París, Francia.

1975-1979 Jefe de Proyectos de Evaluación de Yacimientos en el Centro de Cálculo de la Escuela Superior de Ingenieros de Minas de Madrid, España.

1980-1986 Director del Departamento de Ingeniería de Minas de la Universidad de Chile.

1987-1989 Jefe de Proyectos, División Minas, Centro de Investigación Minera y Metalúrgica CIMM.

1990-1992 Superintendente de Reservas, Subgerencia de Planificación Mina, Codelco Chile, División Chuquicamata.

1995-1995 Senior Mining Consultant. BHP Engineering, Santiago Office, Chile.

Junio 92- Consultor Independiente, Gerente de Tecniterrae Ltda. Asesor permanente de las Empresas Mineras siguientes:

- Soquimich
- Somich
- Cimin.
- SQM Nitratos.
- Compañía Minera Los Pelambres.

- Compañía de Carbones de Chile, Cocar.
- Compañía Minera Can-Can.
- Compañía Minera Cerro Negro.
- Compañía Minera Mantos de Oro.
- Codelco Chile, División Chuquicamata.
- Codelco Chile, División E1 Teniente.
- Codelco Chile, División E1 Salvador.
- Carolina de Michilla.

Agosto 99- Junio 2003: Ingeniero de Minas Senior. Modular Mining Systems.
Julio 2003-: Consultor privado.
Enero 2004-Septiembre 2006: Jefe de Proyecto, Consultor Asociado, Metálica Consultores.
Septiembre 2006- Febrero 2008: Principal Geostatistician. SRK, Santiago Office.
Febrero 2008 – Director Recursos Reservas, Metálica Consultores.

**III. Experiencia Docente:**

1. Profesor de Geoestadística, Departamento de Ingeniería de Minas de la Universidad de Chile, 1979 a 1997.

2. Profesor de Evaluación de Yacimientos en el Departamento de Ingeniería en Minas de la Universidad de Santiago, 1987-1989, 1999 a la fecha.

3. Profesor de Evaluación de Yacimientos en el Departamento de Ingeniería de Minas de la Universidad de Antofagasta, 1983-1986.

4. Profesor de Informática Geológica y Minera en el Programa de Doctorado en la Escuela de Minas de Madrid, 1975 - 1979.

5. Profesor de Probabilidades y Procesos Estocásticos en la Escuela de Ingeniería de la Universidad de Chile, 1979-1989, 1996- a la fecha.

6. Profesor de Inferencia Estadística en la Escuela de Ingeniería de la Universidad de Chile, 1979-1989, 1996- a la fecha.

7. Profesor de Estadística Aplicada y de Teoría de las Probabilidades. Facultad de Ingeniería Universidad de los Andes, 2004 a la fecha.

8. Profesor de Probabilidades en la Escuela de Economía de la Universidad de Chile, 1985-1986.

9. Profesor Auxiliar de Probabilidades en la Ecole des Mines de París, Francia, 1973-1974.

10. Profesor de Evaluación de Recursos Mineros, Universidad de Concepción, Carrera de Geología, 2006- a la fecha.

11. Profesor del postítulo “Certificación y Valorización de Activos Mineros”, Pontificia Universidad Católica de Valparaiso, 2005- a la fecha

12. Profesor de diversos cursos de formación continuada para las Empresas o Instituciones siguientes:

- Disputada de las Condes, Areas E1 Soldado y Los Bronces.
- Codelco Chile, Divisiones Teniente, Andina, Salvador.
- Codelco Chile, División Chuquicamata.
- Compañía Minera E1 Indio.
- Instituto de Ingenieros de Minas de Chile.
- Comisi6n Chilena de Energía Nuclear.
- Carolina de Michilla.
- Soquimich.
- Cominco Resources.
- San Vicente de Morococha, Perú.
- Ingemmet, Lima, Perú.
- Instituto de Investigaciones Mineras y Metalúrgicas, San Juan, Argentina
- Comibol, La Paz, Bolivia.
- Fundaci6n G6mez Pardo, Madrid, España.
- Mina Aguilar, Argentina
- Universidad de Santander, Bucaramanga, Colombia.
- Compañía Minera Cerro Negro
- Instituto de Ingenieros de Minas del Perú
- Compañía Minera Mantos de Oro
- Universidad Nacional Antonio Basadre, Tacna, Perú.
- Colegio de Ingenieros de Chile, Antofagasta.
- INTEC Chile.
- Mina Cerro Matoso, Nickel, Colombia.
- Mina Cerrejón, carbón, Colombia.
- Instituto de Ingenieros de Minas del Perú.
- Modular Mining Systems.
- Mina Cerro Vanguardia.
- Xstrata Lomas Bayas.

**IV. Publicaciones:**

Variadas Publicaciones en el área de Evaluación de Yacimientos, Economía Minera, Investigaci6n Operativa, Computación Aplicada a la Minería, Simulación, Planificación Minera, Estadística Aplicada, Muestreo de Minerales.
Más de 300 Informes Técnicos para diferentes Empresas Mineras.
Cuatro libros publicados.

**V. Yacimientos Estudiados.**

Ha participado en estudios de reservas aplicados a diversos yacimientos, entre los cuales se puede citar:

- Sidi Hajaj, Fosfatos, Marruecos.
- Saelices El Chico, Uranio, España.
- Puentes de García Rodriguez, Carb6n, ENDESA España.
- Cuenca Carbonífera del Guadiato, ENADIMSA España.
- Yacimiento de la Viezca (Flúor), Fluoruros del Norte España.
- Minas del Marquesado (Hierro), Granada, España.
- Minas de Rio Tinto: Cerro Colorado y Masa San Dionisio (Cobre), España.

- Chuquicamata, cobre y arsénico.
- Mina Sur, Chuquicamata, Extensi6n Norte y Extensi6n Sur.
- Mansa Mina, Chuquicamata.
- Chuqui Norte (Radomiro Tomic), Chuquicamata.
- E1 Abra, Chuquicamata.
- El Teniente, Codelco Chile.
- Mina Lince, Carolina de Michilla.
- Mantos Blancos, Anglo American.
- Oficina Pedro de Valdivia, Soquimich.
- Oficina Maria Elena, Soquimich.
- Oficina Pampa Yumbes.
- Oficina Colupo.
- Oficina Yolanda.
- Oficina Mapocho.
- Oficina Ossa.
- Oficina Puelma.
- Oficina Lagunas.
- Oficina Victoria.
- Oficina Pampa Carmen.
- Pampa del Soronal, Pampa Hermosa y Pampa Fortuna.
- Oficina Aguas Blancas
- Oficina Pampa Blanca.
- Pampa Lenka
- Pampa Carbonatos
- Pampa Donato
- Pampa Tocomar
- Salar de Atacama
- Salar de Ascotán ( Ulexitas ).
- Mina Can-Can (Oro).
- Mina Salvador.
- Mina Damiana.
- Mina Altamira.
- Mina Campamento Antiguo.
- Andacollo Oro.
- Mina Tres Perlas.
- Mina Marte, Anglo American.
- Mina Manto Verde, Anglo American.
- Mina Santo Domingo.
- Mina E1 Bolsico.
- Distrito Minero E1 Salar, Arica.
- Mina Rosario de Rengo.
- Andina, Sur Sur, Don Luis y Don Luchito, Codelco.
- Mina Algarrobo (Hierro).
- Mina Los Colorados (Hierro).
- E1 Bronce de Petorca (Oro).
- Mina Faride (Oro).
- E1 Soldado, Disputada de las Condes.
- Los Bronces, Disputada de las Condes.
- Mina Cerro Negro (Cobre).
- Mina Pirquitas, Compañía Minera Cerro Negro.

- La Coipa, Farellón Bajo y Coipa Norte, Mantos de Oro.
- Mina Chimberos, Mantos de Oro.
- Mina Tamaya (Oro).
- E1 Indio, Proyecto Nevada (Oro).
- Cerro Navío, calizas.
- Cerro Verde, (Cobre), Perú.
- Tintaya, (Cobre), Perú.
- Proyecto aurífero E1 Choco, Promiven, Venezuela.
- Placeres auríferos Chaipi, Perú.
- Proyecto San Antonio, Codelco Chile.
- E1 Bronce de Atacama (Cobre), Cominor.
- Manto Agua de la Falda (Oro), Homestake.
- La Granja, Cambior (Cobre), Perú..
- Proyecto aurífero Gaby, Ecuador.
- Proyecto Gaby (Cobre), Codelco Chile.
- Torta de Ripios Mina Sur y Chuquicamata.
- Mina Lota (Carbón), Enacar.
- Mina La Chulita (Carbón), Enacar.
- Mina Zaldívar (Cobre).
- Botadero 57 (Cobre), Chuquicamata.
- Mina Carola (Cobre).
- Oxidos del Norte (Cobre), Chuquicamata.
- Proyecto Antucoya (Cobre), Soquimich.
- Tranque Talabre (Cobre), Chuquicamata.
- Tranques Cauquenes y Barahona (Cobre), El Teniente.
- Tranque Cerro Negro (Cobre).
- Proyecto E1 Tesoro (Cobre).
- Minera Tocopilla (Cobre).
- Mina Las Luces, Taltal
- Mina Sauce, Las Cenizas (Cobre).
- Mina Alhué (Oro).
- Mina Lomas Bayas (Cobre).
- Mina Mantos de la Luna (Cobre, Titanio).
- Mina Freirina (Titanio)
- Mina Centenario (Cobre)
- Mina Chimborazo (Cobre)
- Mina Japonesa (Hierro)
- Mina Boquerón Chañar (Hierro)
- Cerro Matoso (Nickel, Colombia).
- Consorcio Minero Horizonte (Oro, Perú)
- Proyectos Alemao, Cristalino, Igarapé, “118”, Encantado, C.V.R.D. (Cobre, Brasil)
- Cerro Vanguardia (Oro, Argentina)
- Mina El Toqui (oro, plomo, zinc)
- Mina Carmen de Andacollo (cobre)
- Mina El Mochito, Honduras (plomo, zinc).
- Mina Tayahua, Mexico (cobre).
- Proyecto Trafigura, Cu, Perú.
- Mina Tayoltita (oro, Mexico)
- Minas de Ocampo (oro, México)
- Proyecto Franke, Cu, Chile

- Proyecto Santa Luz (oro, Brasil).
- Mina La Chapada (oro y cobre, Brasil)
- Mina Pimentón (oro)
- etc.

**VI. Otros Antecedentes:**

1. Miembro del Comité Editorial de la Revista "Mathematical Geology", 1980-1996.

2. Miembro del Comité de Becas de la International Association for Mathematical Geology, 1988-1992.

3. Secretario Ejecutivo de la International Geostatistical Association, (Presidente: Georges Matheron), 1988-1992.

4. Miembro del Consejo Directivo del Centro de Investigación Minera y Metalúrgica CIMM, años 1992-1994, 2003-2004.

5. Presidente del Instituto de Ingenieros de Minas de Chile, períodos 1995-1996, 2002-2003. Vice-Presidente del Instituto de Ingenieros de Minas de Chile, Período 1994-1995. Director del Instituto de Ingenieros de Minas de Chile, Periodos 1991 – 1993.

6. Miembro del Consejo del Departamento de Ingeniería de Minas de la Universidad de Chile, 1992-1995.

7. Representante en Chile del CESMAT ( Centre d'Etudes Supérieures en Matières Primes ), 1982 a 1985.

8. Miembro del Groupe de Reflexion Linking Financial Analysis to Ore Reserve Evaluation. Escuela de Minas de París, 1988-1994.

9. Miembro del Consejo (por votación) de la International Association for Mathematical Geology, 1992-1996.

10. Presidente de la Asociación de Académicos de la Facultad de Ciencias Físicas y Matemáticas de la Universidad de Chile, 1986.

11. Profesor guía de Tesis de Doctorado en la Escuela de Minas de París, Centre de Geologie de l'Ingénieur, 1993 a la fecha. Rapporteur de Tesis, Centre de Géostatistique, 2004.

12. Premio al Profesional Distinguido, Instituto de Ingenieros de Minas de Chile, año 1993.

13. Miembro del Comité para otorgar el "IAMG President's Prize", International Association for Mathematical Geology, 1994.

14. Organización de cursos de Formación continuada, con los especialistas siguientes:
    Dr. Dominique Bongarçon, Muestreo de Minerales.
    Dr. Pierre Maurice Gy, Muestreo de Minerales.
    Dr. Kadri Dagdelen, Leyes de corte óptimas.
    Dr. Christián Lantúejoul, Simulación de leyes.

15. Investigador en Proyecto Fondef acerca del modelamiento matemático del flujo gravitacional en minería por hundimiento de bloques.

16. En Modular Mining Systems construyó el software "HistoFit" de tratamiento de variables del despacho de camiones en operaciones mineras.

17. Co-chairman del Congreso MassMin. Santiago, Chile, 2003.

18. Premio "Alexander Sutulov", distinción otorgada por el Ministerio de Minería de Chile, 2007.

19. "Qualified Person", QP, AusIMM, No. 229692.

**VI. Publicaciones más importantes.**

| | |
|---|---|
| M. Alfaro, Ch. Huijbregts | Simulation of a Sedimentary Deposit. APCOM, Denver USA, 1974. |
| M. Alfaro, F. Míguez | Optimal Interpolation using Transitive Methods. First International Congress on Geostatistics, Frascati, Italia, 1975. |
| M. Alfaro | The method of random coins. Solution of the problem of the simulation of a random function in the plane. Mathematical Geology, Vol 12, 1980. |
| M. Alfaro | Statistical Inference of the semivariogram and the quadratic model. Second International Congress on Geostatistics, San Francisco USA, 1984. |
| M. Alfaro | Introducción Practica a la Geoestadística. Escuela Superior de Ingenieros de Minas de Madrid, 1974. |
| M. Alfaro | Introducción a la Geoestadística Operativa. Escuela Superior de Ingenieros de Minas de Madrid, 1975. |
| M. Alfaro | Etude de la Robustesse des Simulations des Fonctions Aléatoires. Tesis de Doctorado, Escuela de Minas de París 1979, Director de Tesis: Georges Matheron. |
| M. Alfaro | Introducción al Muestreo Minero. Prefacio por P. Gy y D. Bongarcon. Instituto de Ingenieros de Minas de Chile, 2002. |
| M. Alfaro, J. Saavedra | Predictive models for gravitational flow. MassMin2004, Santiago, Chile, 2003. |
| M. Alfaro | Introducción a la Teoría de las Funciones Aleatorias. Depto. De Matemáticas, U. de Chile, 2005. |
| M. Alfaro | Estimación de Recursos Mineros. Depto. Ingeniería en Minas, Universidad de Santiago, 2006. |
| M. Alfaro | Calculation of the error in mining plans. Meeting of SRK Resources, Dublin, Irlanda, 2007. |
| M. Alfaro | Microergodicity and Geostatistical Simulations. Geostat2008, Santiago Chile, 2008. |

En la página WEB del Centro de Geoestadística de la escuela de Minas de París, se pueden encontrar y bajar algunas publicaciones de M. Alfaro (www.cg.ensmp.fr/bibliotheque):

a) Etude de la Robustesse des simulations des fonctions aléatoires, 1979. Tesis de doctorado caligráfica.
b) Nouveaux Résultats sur la vitesse des calculs géostatistiques, 1991.
c) La Teoría de La Variables Regionalizadas y sus aplicaciones (por G. Matheron, traducción al español por M. Alfaro, 2005).
d) Curso de Geoestadística (por G. Matheron, traducción al español por M. Alfaro, 2005)
e) Evaluación de Recursos Mineros, 2007.
f) La Teoría de las Variables Regionalizadas y su Estimación (por G. Matheron, traducción al español por M. Alfaro, 2008)
g) Estimar y Elegir (por G. Matheron, traducción al español por M. Alfaro, 2008).